

Control devices HM, HS5 and EO series 1X and 3x Americas



- ▶ Control and adjustment systems for the axial piston variable pumps (A)A4VSO, A4VBO, (A)A4VSG and (A)A4CSG
- ▶ Open and closed circuits

Features

- ▶ Electro-hydraulic control with proportional and control valve
- ▶ Digital electro-hydraulic control systems with amplifier or on-board electronics and IntraWorks freely programmable operating software (HS5 and HS5E)
- ▶ Control of swivel angle, pressure and torque limitation (HS5P)
- ▶ Control for speed variability with HS5 and HS5E.
- ▶ Mechanical $V_{g \min}$ and $V_{g \max}$ limitation
- ▶ Electric control for inside-reservoir installation under fluid (HS5M, EO2M)
- ▶ The special version enables overcenter and decompression via the pump.
- ▶ HS5(E)V, HS5(E)L with internal control pressure supply, as standard, including overcenter and decompression

Contents

Type code for A4VSO, A4VBO, A4VSG, A4CSG	2
HM1 / HM2 – Hydraulic, volume-dependent	6
HM2C – Proportional valve, position transducer	12
HS5(P) – electro-hydraulic control, control valve	16
HS5M – suitable for use under fluid	23
HS5V – Internal control pressure supply, open circuit	27
HS5L – Internal control pressure supply, closed circuit	29
HS5E(P) – Integrated digital electronics (OBE)	32
Electrical data of pilot control valve HS5E	35
Signals and pin assignment of the central connector	37
HS5EV(P) – Integrated digital electronics (OBE) and internal control pressure supply	43
HS5EL - Internal control pressure supply for A4CSG	47
HS5K / EO1K / EO2K – short circuit valve	49
EO1 / EO2 – control with proportional valve	53
EO2M – Suitable for use under fluid	62
Project planning notes	66
Installation instructions	66
Safety instructions	67
Related documentation	68

Type code for (A)A4VSO

01	02	03	04	05	06	07	08	09	10	11	12
	(A)A4VS(L)	O		/		-					

Hydraulic fluid

01	For details see data sheet 92050
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Axial piston unit

		40	71	125	180	250	355	500	750	1000	
02	Swashplate design, variable	•	•	•	•	•	•	-	-	-	AA4VS
	SAE version	•	•	•	•	•	•	-	-	-	AA4VS
	metric version	-	-	-	-	-	-	•	•	•	A4VS(L) ¹⁾

Operating mode

03	Pump, open circuit	O
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Size (NG)

04	Geometric displacement (values see data sheet 92050)	40	71	125	180	250	355	500	750	1000
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Control device

		40	71	125	180	250	355	500	750	1000	
05	Hydraulic control, depending on volume										
	minimum control pressure 290 psi (20 bar)	•	•	•	-	•	-	-	-	-	HM1
	minimum control pressure 725/1450/1800 psi (50/100/125 bar)	•	•	•	•	•	•	•	•	•	HM2
	Customer compact solution: electro-hydraulic control with proportional valve and with AWAX position transducer (prepared for customer-specific control system)	○	○	•	○	•	○	•	○	○	HM2C
	Digital, electro-hydraulic control, with control valve for electric displacement and pressure and torque limitation with VT-HPC-1-1X with external control pressure supply. For variable-speed drives (Sytronix), please order separate spare SD card, see (data sheet 30237)	•	•	•	•	•	•	•	•	•	HS5 ²⁾
	....and with pressure transducer HM20-2X/630-C-K35	•	•	•	•	•	•	•	•	•	HS5P ²⁾
	....suitable for use under fluid	•	•	•	•	•	•	•	•	•	HS5M ²⁾
	....with internal control pressure supply	•	•	•	•	•	•	-	-	-	HS5V ²⁾
	....and with pressure transducer HM20-2X/630-C-K35	•	•	•	•	•	•	-	-	-	HS5VP ²⁾
	Digital electro-hydraulic control system, with control valve with OBE for electric displacement and pressure control and torque limitation with external control pressure supply	•	•	•	•	•	•	•	○	○	HS5E ²⁾
	....and with pressure transducer HM20-2X/630-C-K35	•	•	•	•	•	•	•	○	○	HS5EP ²⁾
	....with internal control pressure supply	•	•	•	•	•	•	-	-	-	HS5EV ²⁾
	....and with pressure transducer HM20-2X/630-C-K35	•	•	•	•	•	•	-	-	-	HS5EVP ²⁾
	Analog, electro-hydraulic control, with proportional valve for electric displacement control with VT 5035-1X										
	....minimum control pressure 290 psi (20 bar)	•	•	•	-	•	-	-	-	-	EO1 ²⁾
	....and with short circuit valve	▲	▲	▲	-	▲	-	-	-	-	EO1K ²⁾
	....minimum control pressure 725/1450/1800 psi (50/100/125 bar)	•	•	•	•	•	•	•	•	•	EO2 ²⁾
	....suitable for use under fluid	•	•	•	•	•	•	•	•	•	EO2M
	....and with short circuit valve	▲	▲	▲	▲	▲	▲	▲	▲	▲	EO2K ²⁾

Series

		40	71	125	180	250	355	500	750	1000	
06	Series 1, index 0	•	•	-	-	-	-	-	-	-	10
	Series 3, index 0	-	-	•	•	•	•	•	•	•	30

Further details on positions 07 to 12 can be found in data sheet 92050 ((A)A4VSO)

• = Available ○ = On request - = Not available

1) Charge pump (L) only available with NG 750
 2) Operation with HF hydraulic fluids on request

Type code for A4VBO

01	02	03	04	05	06	07	08	09	10	11	12
		O			/		-				

Rotary group version

01	For details see data sheet 92122
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Axial piston unit

		71	125	250	450	
02	Swashplate design, variable, high-pressure unit up to 6500 psi (450 bar)	●	●	●	●	A4VB

Operating mode

03	Pump, open circuit	O
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Size (NG)

04	Geometric displacement (values see data sheet 92122)	71	125	250	450
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Control device

		71	125	250	450	
05	Customer compact solution: electro-hydraulic control with proportional valve and with AWAX - position transducer (prepared for customer-specific control system)	○	○	○	○	HM2C
	Digital, electro-hydraulic control, with control valve for electric displacement and pressure and torque limitation with VT-HPC-1-1X with external control pressure supply	●	●	●	●	HS5¹⁾
	...and with pressure transducer HM20-2X/630-C-K35	●	●	●	●	HS5P¹⁾
	...suitable for use under fluid	●	●	●	●	HS5M¹⁾
	...with internal control pressure supply	●	●	●	-	HS5V¹⁾
	...and with pressure transducer HM20-2X/630-C-K35	●	●	●	-	HS5VP¹⁾
	Digital electro-hydraulic control system, with control valve with OBE for electric displacement and pressure control and torque limitation with external control pressure supply	●	●	●	●	HS5E¹⁾
	...with internal control pressure supply	●	●	●	-	HS5EV¹⁾
	...and with pressure transducer HM20-2X/630-C-K35	●	●	●	-	HS5EVP

Series

06	Series 1, index 0	●	-	-	-	10
	Series 3, index 0	-	●	●	●	30

For details see data sheet 92122 (A4VBO)

07	Direction of rotation
08	Sealing material
09	Drive shaft
10	Mounting flange
11	Port plate for working lines
12	Through drive

● = Available ○ = On request - = Not available ▲ = Not for new projects

1) Operation with HF hydraulic fluids on request

Type code for A4VSG

01	02	03	04	05	06	07	08	09	10	11	12	13	14
	(A)A4VS	G			/		-						

Hydraulic fluid

01	For details see data sheet 92100
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Axial piston unit

		40	71	125	180	250	355	500	750	1000	
02	Swashplate design, variable	•	•	•	•	•	•	-	-	-	AA4VS
	SAE version	•	•	•	•	•	•	-	-	-	
	metric version	-	-	-	-	-	-	•	•	•	A4VS

Operating mode

03	Pump, closed circuit	G
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Size (NG)

04	Geometric displacement (values see data sheet 92100)	40	71	125	180	250	355	500	750	1000
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Control device

		40	71	125	180	250	355	500	750	1000	
05	Hydraulic control, depending on volume										
	minimum control pressure 290 psi (20 bar)	•	•	•	-	•	-	-	-	-	HM1
	minimum control pressure 725/1450/1800 psi (50/100/125 bar)	•	•	•	•	•	•	•	•	•	HM2
	Customer compact solution: electro-hydraulic control with proportional valve and with AWAX - position transducer (prepared for customer-specific control system)	○	○	•	○	•	○	•	○	○	HM2C
	Digital, electro-hydraulic control, with control valve for electric displacement and pressure and torque limitation with VT-HPC-1-1X with external control pressure supply	•	•	•	•	•	•	•	•	•	HS5¹⁾
	....with 2 pressure transducers HM20-2X/630-C-K35	•	•	•	•	•	•	•	•	•	HS5P¹⁾
	....with short circuit valve	•	•	•	•	•	•	•	•	•	HS5K¹⁾
	....with 2 pressure transducers HM20-2X/630-C-K35	•	•	•	•	•	•	•	•	•	HS5KP¹⁾
	....suitable for use under fluid	•	•	•	•	•	•	•	•	•	HS5M¹⁾
	Digital electro-hydraulic control system, with control valve with OBE for electric displacement and pressure control and torque limitation with external control pressure supply	•	•	•	•	•	•	•	•	•	HS5E¹⁾
	....and 2 pressure transducers HM20-2X/630-C-K35	•	•	•	•	•	•	•	•	•	HS5EP¹⁾
	....with short circuit valve	•	•	•	•	•	•	•	•	•	HS5EK¹⁾
	....and 2 pressure transducers HM20-2X/630-C-K35.	•	•	•	•	•	•	•	•	•	HS5EKP¹⁾
	Analog electro-hydraulic control, with proportional valve for electric displacement control with VT 5035-1X										
	....minimum control pressure 290 psi (20 bar)	•	•	•	-	•	-	-	-	-	EO1¹⁾
....and with short circuit valve	•	•	•	-	•	-	-	-	-	EO1K¹⁾	
....minimum control pressure 725/1450/1800 psi (50/100/125 bar)	•	•	•	•	•	•	•	•	•	EO2¹⁾	
....and with short circuit valve	•	•	•	•	•	•	•	•	•	EO2K¹⁾	

For details of positions 06 to 14 see data sheet 92100 ((A)A4VSG)

• = Available ○ = On request - = Not available ▲ = Not for new projects

1) Operation with HF hydraulic fluids on request

Type code for A4CSG

01	02	03	04	05	06	07	08	09	10	11	12	14
A4CS	G		/			-						

Axial piston unit

01	Swashplate design, variable	A4CS
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Operating mode

02	Pump, closed circuit	G
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Size (NG)

03	Geometric displacement (values see data sheet 92105)	250	355	500	750
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Control device

		250	355	500	750	
04	Hydraulic control, depending on quantity					
	Customer compact solution: electro-hydraulic control with proportional valve and with AWAX - position transducer (prepared for customer-specific control system)	●	○	●	○	HM2C
	Digital, electro-hydraulic control, with control valve for electric displacement and pressure and torque limitation with VT-HPC-1-1X with external control pressure supply For variable-speed drives (Sytronix), please order the required SD card separately, see (data sheet 30237)	●	●	●	●	HS5¹⁾
	...with 2 pressure transducers HM20-2X/630-C-K35	●	●	●	●	HS5P¹⁾
	...with short circuit valve	●	●	●	●	HS5K¹⁾
	...with 2 pressure transducers HM20-2X/630-C-K35	●	●	●	●	HS5KP¹⁾
	...with internal control pressure supply	●	●	●	●	HS5L¹⁾
	...with 2 pressure transducers HM20-2X/630-C-K35	●	●	●	●	HS5LP¹⁾
	Digital electro-hydraulic control system, with control valve with OBE for electric displacement and pressure control and torque limitation with external control pressure supply	●	●	●	●	HS5E¹⁾
	...with 2 pressure transducers HM20-2X/630-C-K35	●	●	●	●	HS5EP¹⁾
	...with internal control pressure supply	●	●	●	●	HS5EL¹⁾
	...and 2 pressure transducers HM20-2X/630-C-K35	●	●	●	●	HS5ELP¹⁾
	...with short circuit valve	●	●	●	●	HS5EK¹⁾
	...and 2 pressure transducers HM20-2X/630-C-K35	●	●	●	●	HS5EKP¹⁾
	Analog electro-hydraulic control, with proportional valve for electric displacement control with VT 5035-1X					
	...minimum control pressure 1450/1800 psi (100/125 bar)	●	●	●	●	EO2¹⁾
	...and with short circuit valve	●	●	▲	▲	EO2K¹⁾

For details of positions 05 to 14 see data sheet 92105 ((A)A4CSG)

● = Available ○ = On request - = Not available ▲ = Not for new projects

1) Operation with HF hydraulic fluids on request

HM1 / HM2 – Hydraulic control, volume-dependent

Type	NG	40	71	125	180	250	355	500	750	1000	
(A)A4VSO, (A)A4VSG		●	●	●	–	●	–	–	–	–	HM1
(A)A4VSO, (A)A4VSG		●	●	●	●	●	●	●	●	●	HM2

The control **HM1/2** sets the displacement of the pump depending on the control fluid quantity.

This control is used for 2-point circuit or as a base device for controls with proportional valves (additional electric feedback required), e.g. HS5, HS5E, E02, E01.

Spring-centering

The spring-centering of the stroking cylinder is standard. It is used for setting and adjustment in the depressurized neutral position, but without a defined reset during high-pressure operation.

Notice

- ▶ The spring feedback in the controller and pump control spring centering are no safety devices. The controller can stick in an undefined position due to internal contamination (contaminated hydraulic fluid, abrasion or residual contamination from system components). As a result, the flow in the axial piston unit will no longer respond correctly to the operator's specifications. Check whether the application on your machine requires additional safety measures to bring the driven consumer to a safe position (immediate stop).

Swivel angle limitation

Minimum and maximum swivel angle limitation is mechanically adjustable up to 50 % $V_{g \max}$. For size 500, $V_{g \min}$ is adjustable up to 50 % $V_{g \max}$ and $V_{g \max}$ up to 70 % $V_{g \max}$.

Notice

Setting with (A)A4VSO and A4VBO (open circuit):

- ▶ The $V_{g \max}$ stop is set to nominal $V_{g \max}$ as standard. Please specify different values in your order
- ▶ The $V_{g \min}$ stop is set to $V_g = 0$ gpm (0 l/min) with $P_{HD} = 290$ psi (20 bar) as standard. Other values should be specified when placing the order.

Setting with (A)A4VSG and (A)A4CSG (closed circuit):

- ▶ The $V_{g \max}$ stops are set on both sides to nominal $V_{g \max}$.

When ordering, please state other setting requests in plain text.

Two versions are available:

Type	Control pressure [psi (bar)]	Sizes
HM1	from 290 (20)	40, 71, 125 and 250 (see page 7)
HM2	from 725/1450/1800 (50/100/125)	40...1000 (see page 8)

HM2: To minimize the control fluid consumption, the stroking chambers are sealed in sizes 125 to 750.

▼ Flow direction in closed circuit

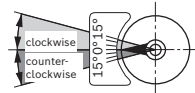
Direction of rotation		Swiveling range ¹⁾
clockwise	counter-clockwise	
B to A	A to B	clockwise
A to B	B to A	counter-clockwise

Overcenter with (A)A4VSO is available on request.

▼ Flow direction in open circuit

Direction of rotation		Swiveling range ¹⁾
clockwise	counter-clockwise	
S to B		counter-clockwise
	S to B	clockwise

1) See swivel angle indicator



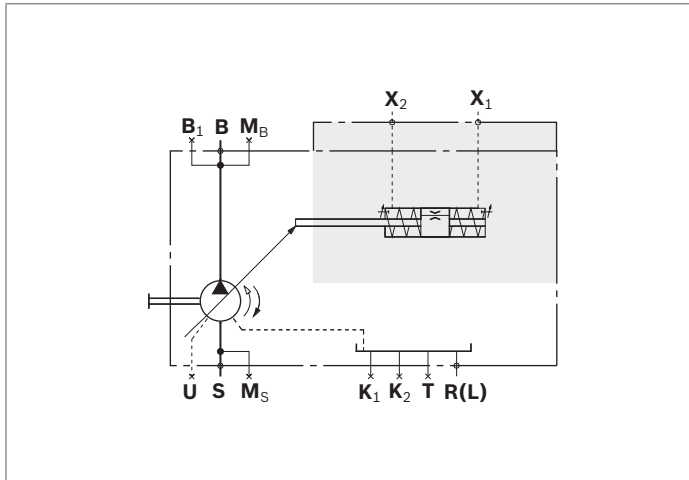
Technical data HM1

Size		NG	40	71	125	250
Control pressure (in X ₁ , X ₂)	p_{min}	psi (bar)	290 (20)	290 (20)	290 (20)	290 (20)
	p_{max}	psi (bar)	1450 (100)	1450 (100)	1450 (100)	1450 (100)
Control stroke	s_{max}	inch (mm)	0.56 (14.2)	0.67 (17.1)	0.81 (20.7)	1.02 (25.9)
Control area	A	inch ² (cm ²)	2.56 (16.6)	3.81 (24.6)	5.63 (36.3)	8.79 (56.7)
Control volume	$V_{S max}$	inch ³ (cm ³)	1.44 (23.6)	2.57 (42.1)	4.59 (75.2)	8.97 (147)
Weight: approx. (A4VSO...HM1...N00)	m	lbs (kg)	84 (38)	121 (55)	202 (92)	427 (194)

Circuit diagrams HM1

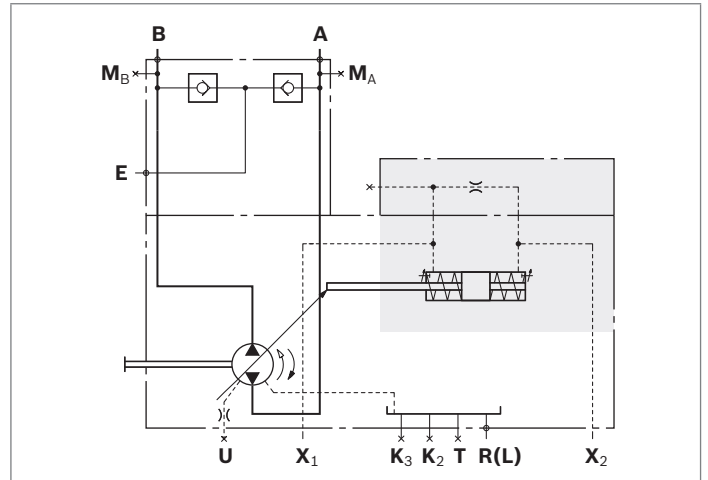
▼ **Sizes 40 and 71**

Example: open circuit (A)A4VSO



▼ **Sizes 125 and 250**

Example: closed circuit (A)A4VSG



Ports		with swivel direction
X ₁	Control pressure	counter-clockwise
X ₂	Control pressure	clockwise

Technical data HM2

For (A)A4CSG with HM2, the control pressure relief valve (see data sheet 92105, circuit diagram for version **F** with integrated boost pump) is not required and is replaced with a threaded plug.

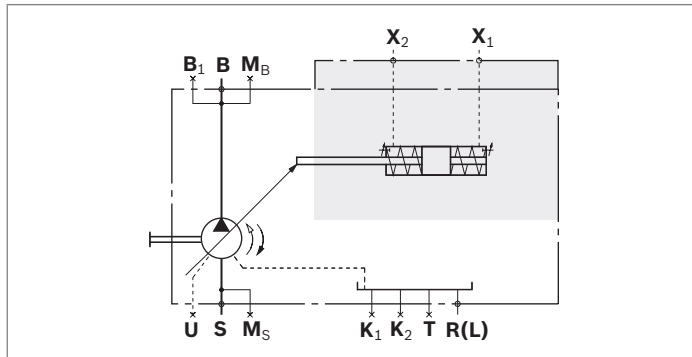
To minimize the control fluid consumption, the stroking chambers are sealed in sizes 125...1000 and can be bled via the ports **R₂...R₇**.

Size		NG	40	71	125	180	250	355	500	750	1000
Control pressure (in X₁ , X₂)	p_{min}	psi	725	725	725	1450	1450	1450	1800	1800	1800
		(bar)	(50)	(50)	(50)	(100)	(100)	(100)	(125)	(125)	(125)
	p_{max}	psi	5100	5100	5100	5100	5100	5100	5100	5100	5100
		(bar)	(350)	(350)	(350)	(350)	(350)	(350)	(350)	(350)	(350)	(350)
Control stroke	s_{max}	inch	0.56	0.67	0.81	0.81	1.02	1.02	1.28	1.46	1.63
		(mm)	(14.2)	(17.1)	(20.7)	(20.7)	(25.9)	(25.9)	(32.6)	(37.0)	(41.4)
Control area	A	inch ²	1.26	1.95	2.81	2.81	4.39	4.39	5.92	8.80	9.86
		(cm ²)	(8.1)	(12.6)	(18.1)	(18.1)	(28.3)	(28.3)	(38.2)	(56.8)	(63.6)
Control volume	$V_{S\ max}$	inch ³	0.70	1.31	2.29	2.29	4.47	4.47	7.60	12.80	16.10
		(cm ³)	(11.4)	(21.5)	(37.5)	(37.5)	(73.2)	(73.2)	(124.5)	(210)	(263.3)
Weight: approx. (A4VSO...HM2...N00)	m	lbs	84	121	203	234	428	472	721	1036	1323
		(kg)	(38)	(55)	(92)	(106)	(194)	(214)	(327)	(470)	(600)

Circuit diagrams HM2

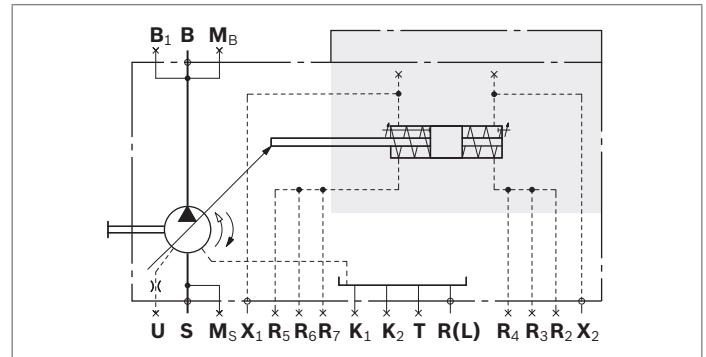
▼ **Sizes 40 and 71**

Example: open circuit (A)A4VSO



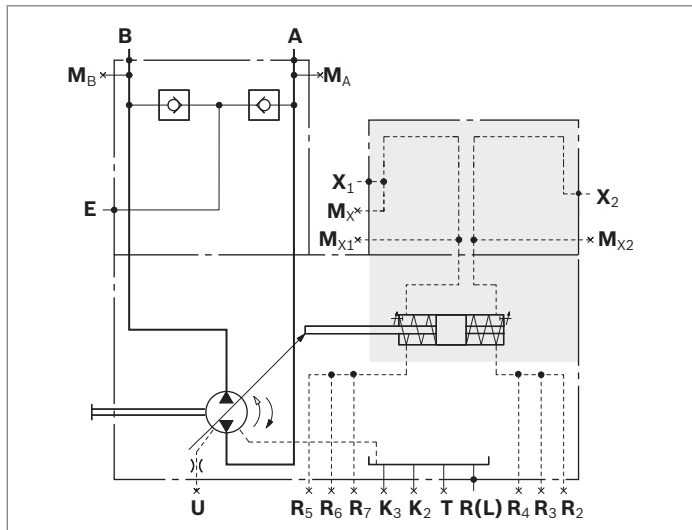
▼ **Sizes 125 to 355**

Example: open circuit (A)A4VSO



▼ **Sizes 500 to 1000**

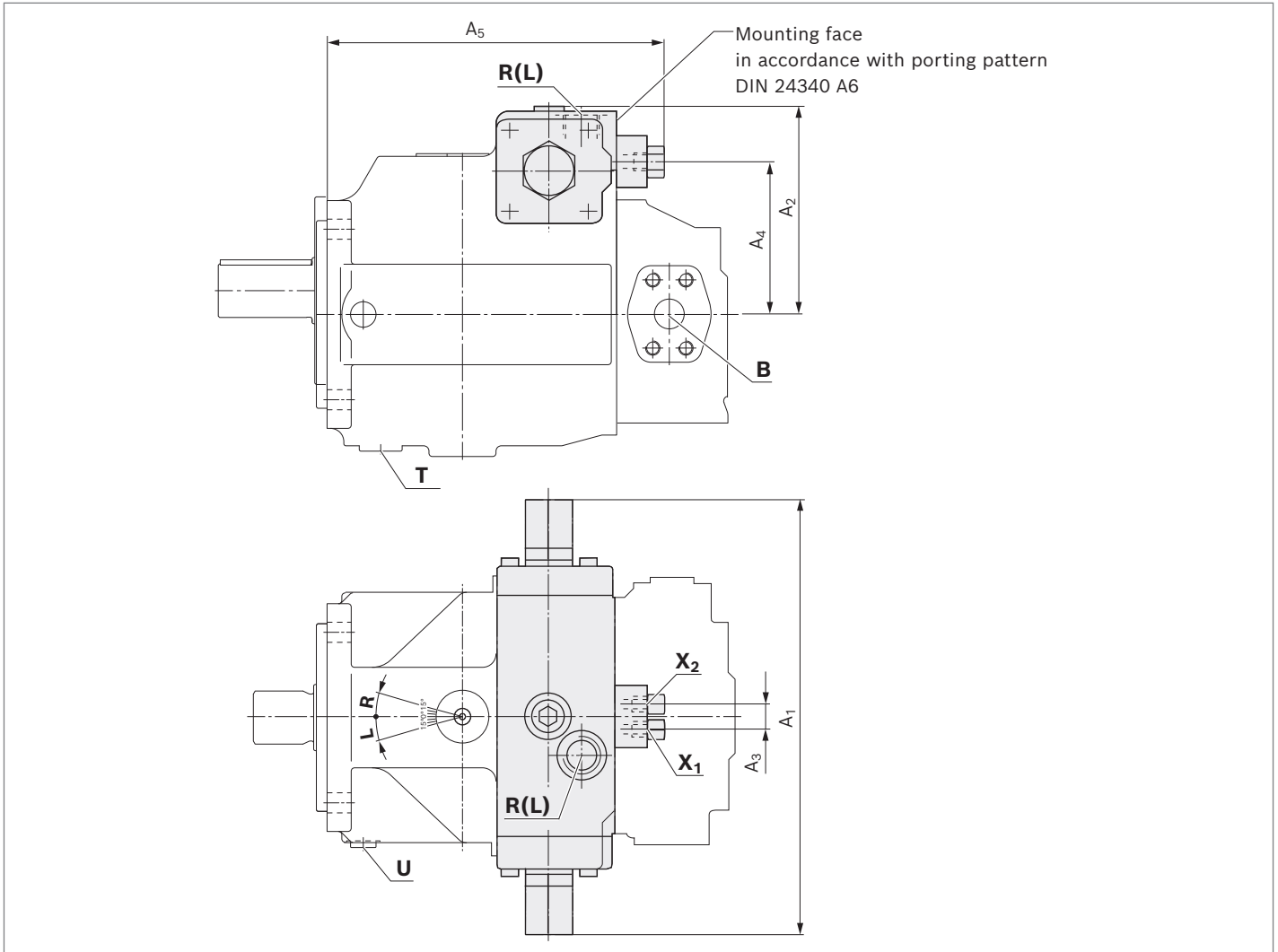
Example: closed circuit A4VSG



Ports	
X₁	Control pressure
X₂	Control pressure
M_x, M_{x1}, M_{x2}	Measuring ports control pressure
R₂ ... R₇	Air bleeding the stroking chamber

Dimensions HM1/HM2

▼ **(A)A4VSO and (A)A4VSG, size 40 and 71**



NG	A ₁	A ₂	A ₃	A ₄	A ₅	
40	11.65 (296)	5.35 (136)	0.94 (24)	4.02 (102)	9.76 (248)	For detailed dimensions and technical data for the variable pump, see data sheet 92050 ((A)A4VSO) or 92100 ((A)A4VSG)
71	13.07 (332)	6.18 (157)	1.10 (28)	4.72 (120)	10.90 (276)	

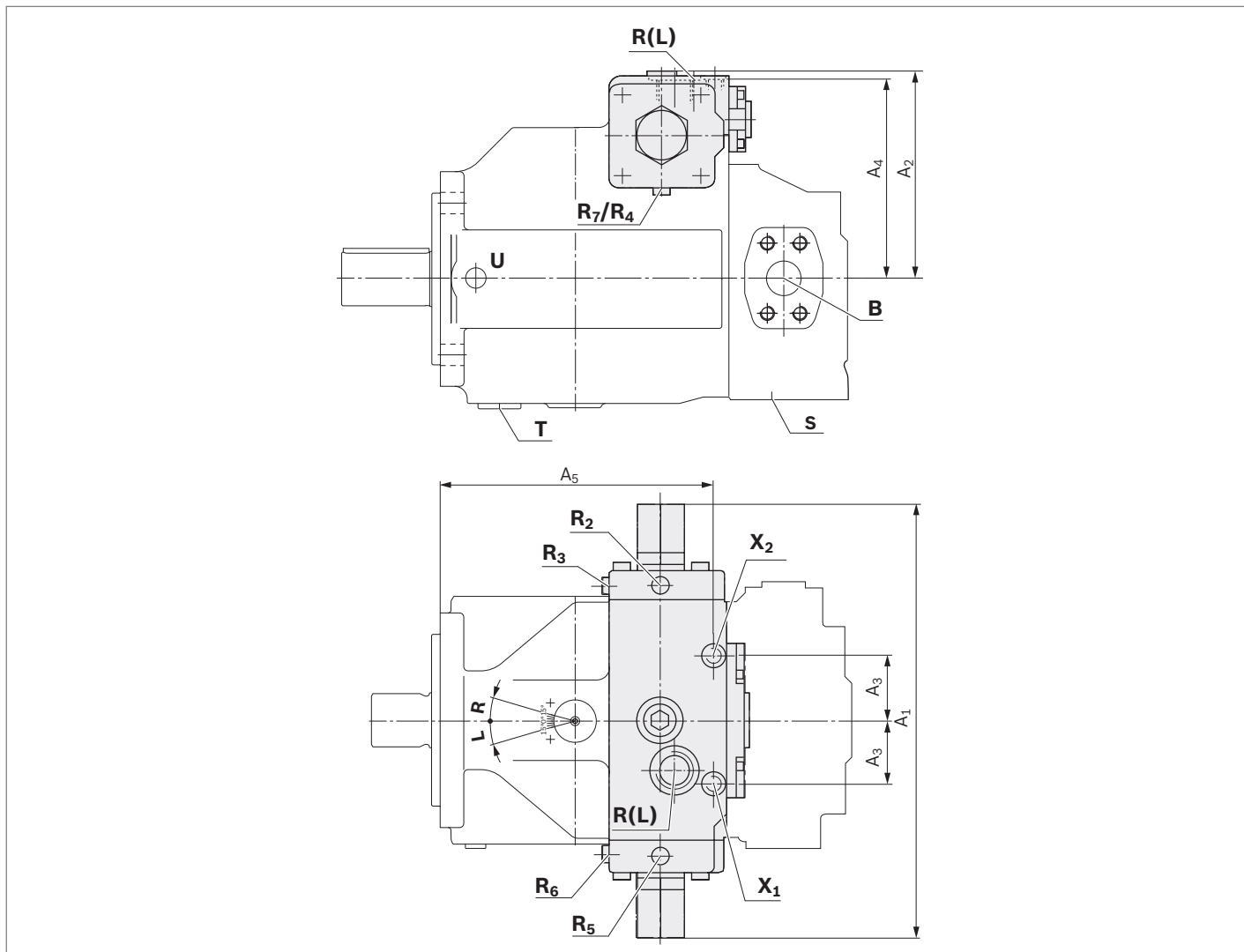
Ports		Standard	Size	p_{max} [psi (bar)] ¹⁾	State ²⁾
X ₁ , X ₂	Control pressure	ISO 11926	9/16-18UNF-2B; 0.51 (13) deep	1450 (100) (with HM1) 5100 (350) (with HM2)	O

1) Depending on the application, momentary pressure peaks can occur. Keep this in mind when selecting measuring devices and fittings.

2) O = Must be connected (plugged on delivery)
 X = Plugged (in normal operation)

Dimensions HM1/HM2

▼ **(A)A4VSO, (A)A4VSG and (A)A4CSG, sizes 125 to 355**



NG	A ₁	A ₂	A ₃	A ₄	A ₅	
125/180 ²⁾	5.83 (402)	7.52 (191)	2.64 (67)	7.34 (186.5)	9.88 (251)	For detailed dimensions and technical data for the variable pump, see data sheet 92050 ((A)A4VSO), 92100 ((A)A4VSG) or 92105 ((A)A4CSG)
250/355 ²⁾	19.09 (485)	9.37 (238)	2.80 (71)	9.17 (233)	12.24 (311)	

Ports	Standard	Size	p _{max} [psi (bar)] ¹⁾	State ³⁾	
X ₁ , X ₂	Control pressure	ISO 11926	9/16-18UNF-2B; 0.51 (13) deep (size 125 and 180)	1450 (100) (with HM1)	O
			3/4-16UNF-2B; 0.59 (15) deep (size 250 and 355)	5100 (350) (with HM2)	O
R ₂ ... R ₇	Air bleeding the stroking chamber	DIN 3852-1	M10 x 1; 0.31 (8) deep	5100 (350) (only with HM2)	X

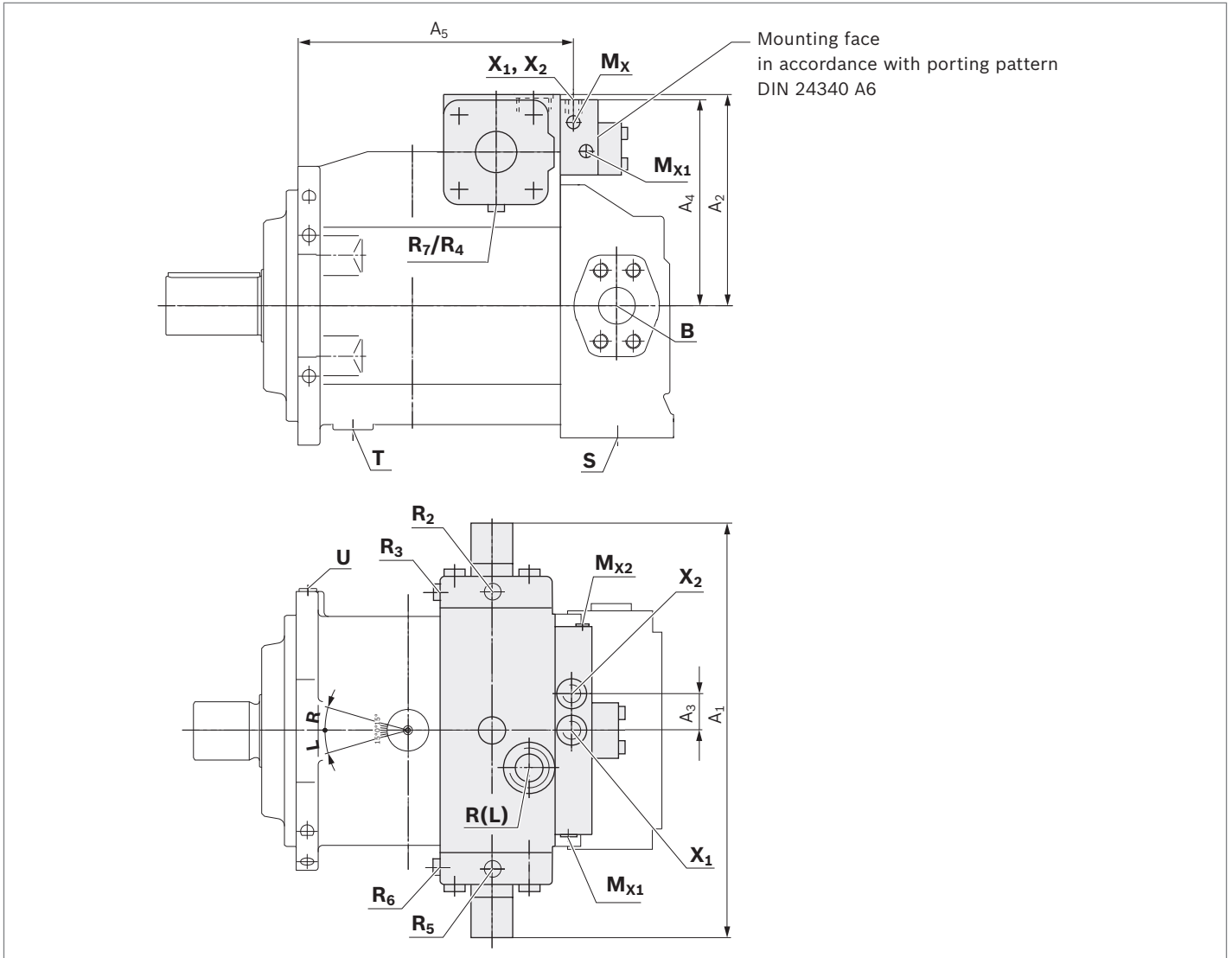
1) Depending on the application, momentary pressure peaks can occur. Keep this in mind when selecting measuring devices and fittings.

2) Size 180 and 355 only with HM2

3) O = Must be connected (plugged on delivery)
 X = Plugged (in normal operation)

Dimensions HM2

▼ **A4VSO, A4VSG and A4CSG, sizes 500 to 1000**



NG	A ₁	A ₂	A ₃	A ₄	A ₅	
500	21.58 (555)	11.14 (283)	1.97 (50)	10.79 (274)	15.28 (388)	For detailed dimensions and technical data for the variable pump, see data sheet 92050 (A4VSO), 92100 (A4VSG) or 92105 (A4CSG)
750	24.80 (630)	12.60 (320)	1.97 (50)	11.97 (304)	16.54 (420)	
1000	26.38 (670)	13.66 (347)	1.97 (50)	12.87 (327)	19.13 (486)	

Ports		Standard	Size ¹⁾	p _{max} [psi (bar)] ²⁾	State
X ₁ , X ₂	Control pressure	DIN 3852-1	M27 × 2; 0.63 (16) deep	5100 (350)	O
M _x , M _{x1} , M _{x2}	Control pressure measuring	DIN 3852-1	M14 × 1.5; 0.47 (12) deep	5100 (350)	X
R ₂ ... R ₇	Air bleeding the stroking chamber	DIN 3852-1	M14 × 1.5; 0.47 (12) deep	5100 (350)	X

1) Depending on the application, momentary pressure peaks can occur. Keep this in mind when selecting measuring devices and fittings.

2) O = Must be connected (plugged on delivery)
 X = Plugged (in normal operation)

HM2C – Customer solution with proportional valve, position transducer

Type	NG	40	71	125	180	250	355	450	500	750	1000
(A)A4VSO		○	○	●	○	●	○	–	●	○	○
A4VBO		–	○	○	–	○	–	○	–	–	–
(A)A4VSG		○	○	●	○	●	○	–	●	○	○
(A)A4CSG		–	–	–	–	●	○	–	●	○	–

The HM2C customer solution provides the base unit, sensors and actuators required for a control system. This means that a pump control system can be built up by the end users themselves for electronic volume, pressure and power control. Notice: No finished pump control electronics is available for the HM2C like for the HS5. The HM2C can be integrated freely in the control architecture of the plant operator machine with defined standard interfaces.

On the pump side, the base unit is equipped with:

- ▶ a proportional valve (including integrated valve amplifier)
- ▶ Swivel angle sensor

All components are already installed and piped up and only have to be connected with the on-site control. The HM2C control receives the setpoint value for the mounted proportional valve from the superordinate control in the form of an electric current signal.

Component	Designation	Material number
Valve	Sizes 40 to 180 4WREE6V08-2X/G24K31/F1V-989 Data sheet 29061	R901438013
	Sizes 250 to 1000 4WREE6V16-2X/G24K31/F1V-989 Data sheet 29061	R901377315
Swivel angle sensor	Standardized output signal 4 to 20 mA and 2 to 10 V	Depending on the size

The pump setting is recorded via the swivel angle sensor. These two parameters are therefore available to the superordinate control.

Example applications:

- ▶ The plant operator wants to retain his own machine control and integrate the pump control in it. This type of customer-specific solution can be set up with the HM2C and the Motion Logic Control (MLC) from Bosch Rexroth, for example. Together with a matching I/O axis module, a freely programmable control is available to the user.

The axis module and the MLC for actuating the HM2C control are not included in the HM2C scope of delivery.

Spring-centering

The spring-centering of the stroking cylinder is standard. It is used for setting and adjustment in the depressurized neutral position, but without a defined reset during high-pressure operation.

Notice

- ▶ The spring feedback in the controller and pump control spring centering are no safety devices. The controller can stick in an undefined position due to internal contamination (contaminated hydraulic fluid, abrasion or residual contamination from system components). As a result, the flow in the axial piston unit will no longer respond correctly to the operator's specifications. Check whether the application on your machine requires additional safety measures to bring the driven consumer to a safe position (immediate stop).

To minimize the control fluid consumption, the stroking chambers are sealed in sizes 125 to 1000 and can be bled via the ports R2 to R7.

Swivel angle limitation

Minimum and maximum swivel angle limitation is mechanically adjustable up to 50 % $V_{g \max}$. For size 500, $V_{g \min}$ is adjustable up to 50 % $V_{g \max}$ and $V_{g \max}$ up to 70 % $V_{g \max}$ (75 % with A4VBO 450).

Notice

Setting with (A)A4VSO (open circuit):

- ▶ The $V_{g \max}$ stop is set to nominal $V_{g \max}$ as standard. Please specify different values in your order
- ▶ The $V_{g \min}$ stop is set to $V_g = 0$ gpm (0 l/min) with $P_{HD} = 290$ psi (20 bar) as standard. Other values should be specified when placing the order.

When ordering, please state other setting requests in plain text.

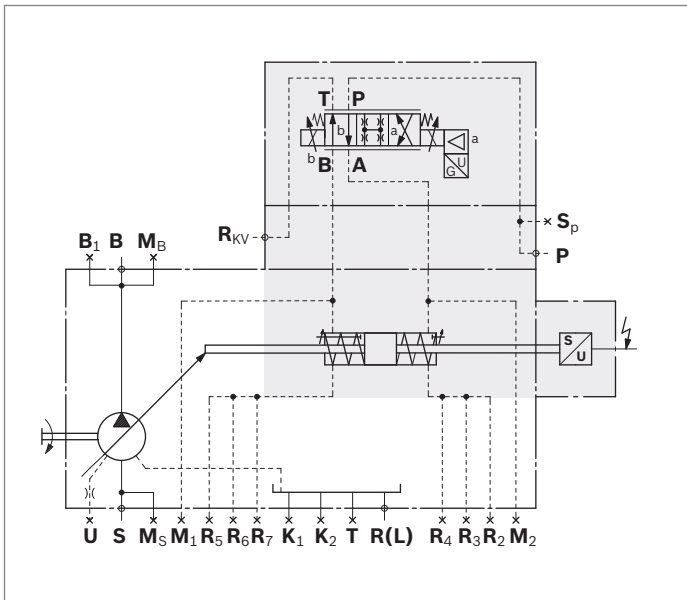
Technical data HM2C

Size		NG	125	250	500
Control pressure (in P)	p_{min}	psi	725	1450	1800
		(bar)	(50)	(100)	(125)
	p_{max}	psi	5100	5100	5100
		(bar)	(350)	(350)	(350)
Control stroke	s_{max}	inch	0.81	1.02	1.28
		(mm)	(20.7)	(25.9)	(32.6)
Control area	A	inch ²	2.81	4.29	5.92
		(cm ²)	(18.1)	(28.3)	(38.2)
Control volume	$V_{S max}$	inch ³	2.29	4.47	7.60
		(cm ³)	(37.5)	(73.2)	(124.5)
Weight: approx. (A4VSO...HM2...N00)	m	lbs	203	428	721
		(kg)	(92)	(194)	(327)

Circuit diagrams HM2C

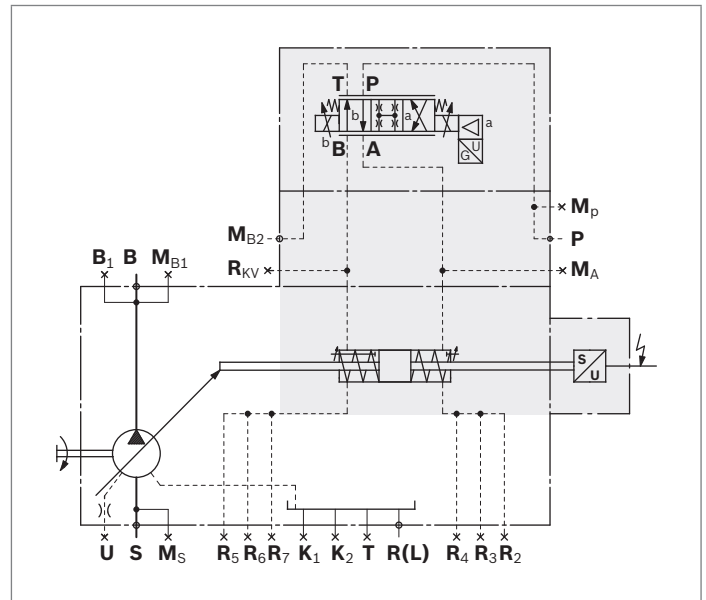
▼ **Sizes 125 to 250**

Example: open circuit (A)A4VSO HM2C



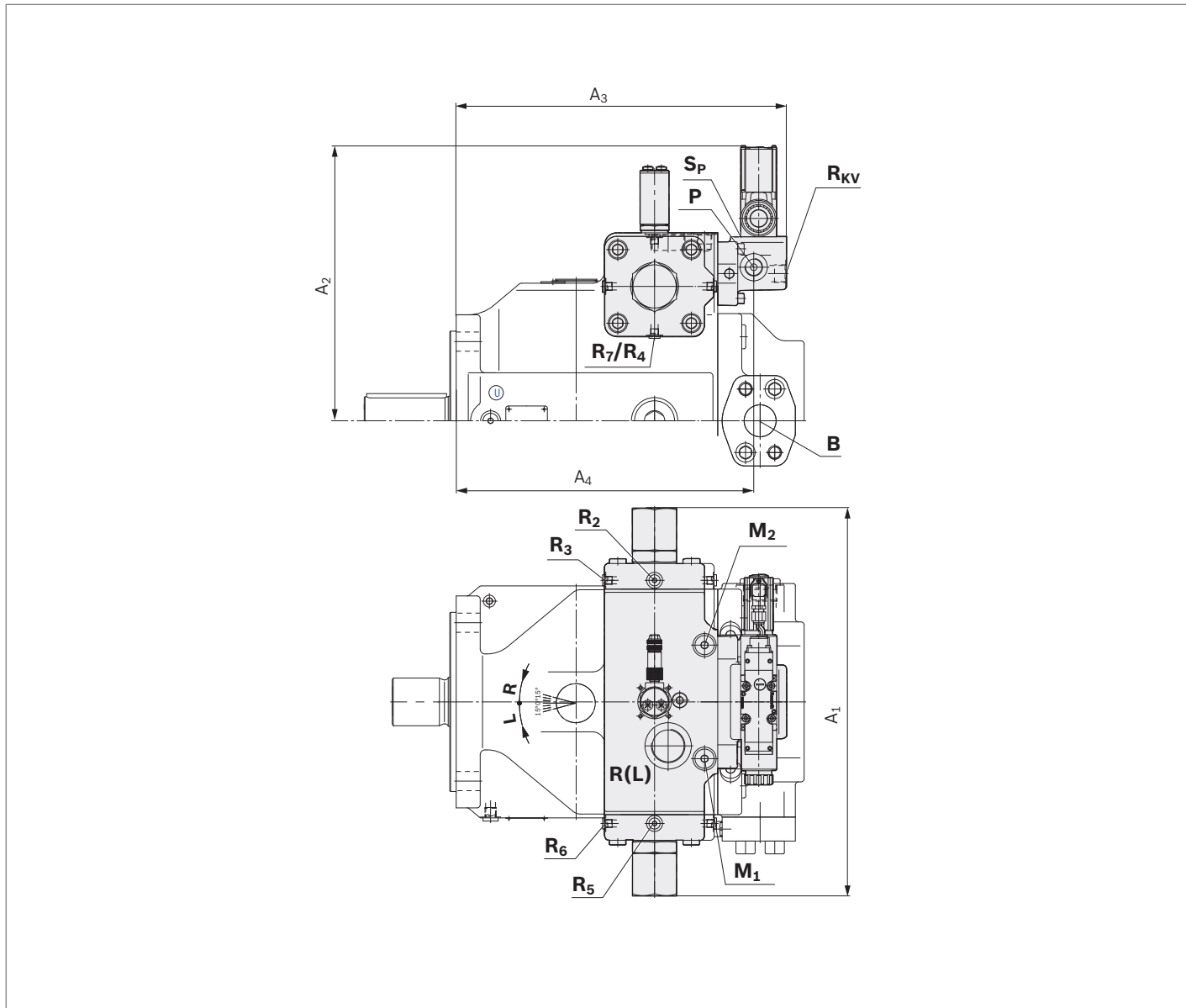
▼ **Size 500**

Example: open circuit A4VSO HM2C



Dimensions HM2C

▼ **(A)A4VSO, (A)A4VSG and (A)A4CSG, size 125, 250**



NG	A ₁	A ₂	A ₃	A ₄	
125	15.80 (401)	12.00 (304)	13.80 (350)	12.20 (309)	For detailed dimensions and technical data for the variable pump, see data sheet 92050 ((A)A4VSO), 92100 ((A)A4VSG) or 92105 ((A)A4CSG)
250	19.10 (485)	13.50 (344)	16.20 (412)	14.60 (372)	

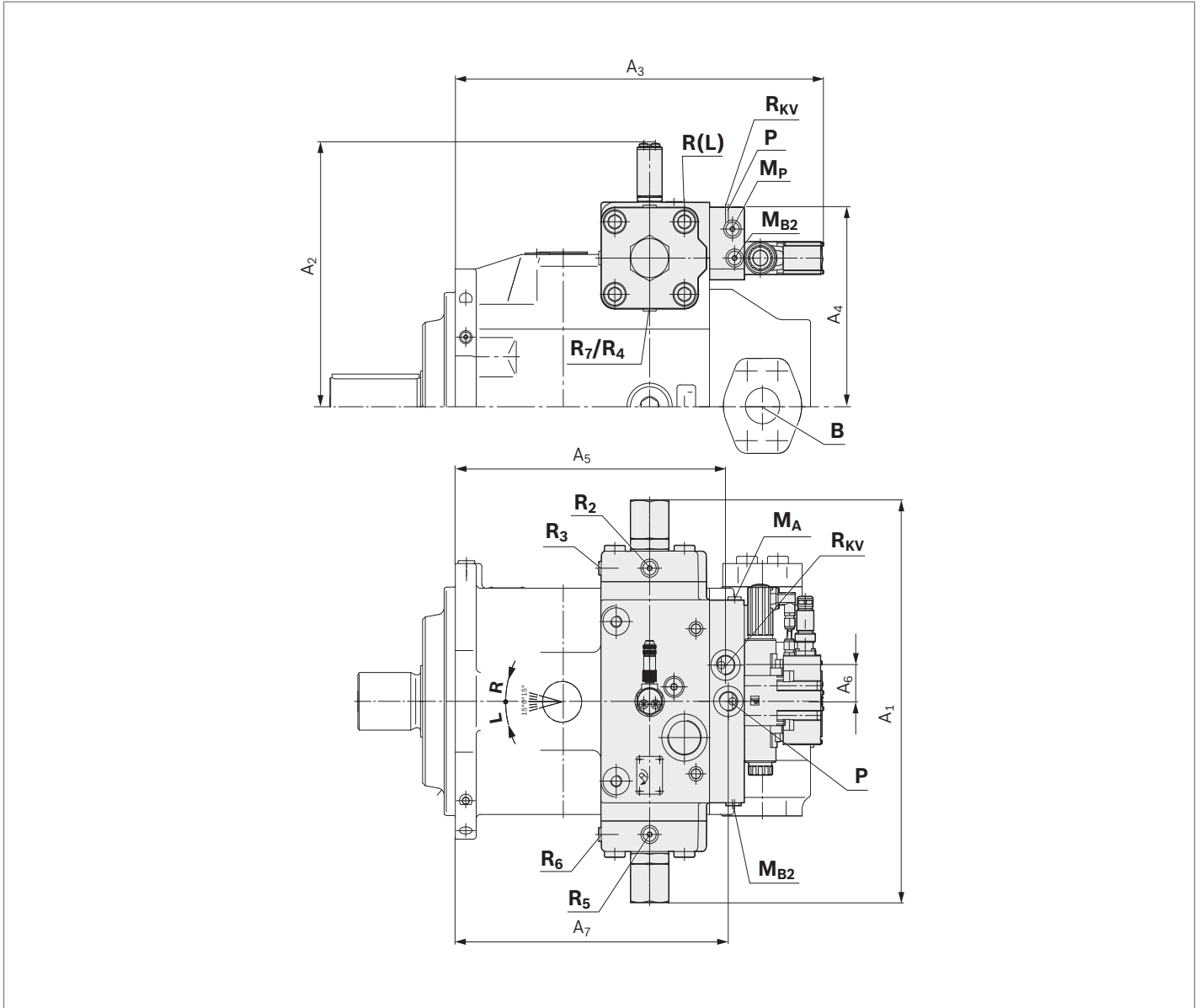
Ports	Standard	Size	p_{max} [psi (bar)] ¹⁾	State ²⁾
P, R_{KV}	Control pressure	DIN 3852-1 M22 × 2; 0.55 (14) deep	1450 (100)	O
M_x, M_{x1}, M_{x2}	Control pressure measuring	DIN 3852-1 M14 × 1.5; 0.47 (12) deep	4550 (315)	X
R₂ ... R₇	Air bleeding the stroking chamber	DIN 3852-1 M10 × 1; 0.31 (8) deep	4550 (315)	X

1) Depending on the application, momentary pressure peaks can occur. Keep this in mind when selecting measuring devices and fittings.

2) O = Must be connected (plugged on delivery)
 X = Plugged (in normal operation)

Dimensions HM2C

▼ **A4VSO, A4VSG and A4CSG, size 500**



NG	A ₁	A ₂	A ₃	A ₄	A ₅	A ₆	A ₇	
500	21.90 (555)	14.30 (363)	20.50 (520)	10.80 (274)	15.30 (388)	1.97 (50)	15.40 (392)	For detailed dimensions and technical data for the variable pump, see data sheet 92050 (A4VSO), 92100 (A4VSG) or 92105 (A4CSG)

Ports	Standard	Size	p _{max} [psi (bar)] ¹⁾	State ²⁾	
P, R_{KV}	Control pressure	DIN 3852-1	M27 × 2; 0.63 (16) deep	1450 (100)	O
M_X, M_{X1}, M_{X2}	Control pressure measuring	DIN 3852-1	M14 × 1.5; 0.47 (12) deep	4550 (315)	X
R₂ ... R₇	Air bleeding the stroking chamber	DIN 3852-1	M14 × 1.5; 0.47 (12) deep	4550 (315)	X

1) Depending on the application, momentary pressure peaks can occur. Keep this in mind when selecting measuring devices and fittings.

2) O = Must be connected (plugged on delivery)
 X = Plugged (in normal operation)

HS5(P) – electro-hydraulic control with control valve

Type	NG	40	71	125	180	250	355	450	500	750	1000	
(A)A4VSO, (A)A4VSG		●	●	●	●	●	●	–	●	●	●	HS5(P)
(A)A4CSG		–	–	–	–	●	●	–	●	●	–	
(A)A4VBO		–	●	●	–	●	–	●	–	–	–	

For electric displacement and pressure control as well as torque limitation with VT-HPC-1-1X with external control pressure supply

The control **HS5** sets the displacement of the pump with the mounted direct operated control valve proportional to the setpoint value.

The pump setting is reported by an inductive position transducer.

With **HS5P**, the mounted pressure transducer HM20 (see data sheet 30272) records the system pressure, with A4VSG and A4CSG, each pressure side is assigned a pressure transducer.

Together with the relevant control electronics VT-HPC-1-1X and the operating software IndraWorks, the user has a precise and freely parameterizable control, which offers a comfortable operating and diagnosis interface.

The digital control amplifier VT-HPC-1-1X for actuating the HS5 control is not included in the scope of delivery, please order separately in accordance with data sheet 30237.

The programming of the digital control electronics takes place via the Ethernet interface of the IndraWorks operating software.

Machine and system dynamics must be optimized by the system operator using the pressure control function.

Spring-centering

The spring-centering of the stroking cylinder is standard. It is used for setting and adjustment in the depressurized neutral position, but without a defined reset during high-pressure operation.

Notice

- ▶ The spring feedback in the controller and pump control spring centering are no safety devices. The controller can stick in an undefined position due to internal contamination (contaminated hydraulic fluid, abrasion or residual contamination from system components). As a result, the flow in the axial piston unit will no longer respond correctly to the operator's specifications. Check whether the application on your machine requires additional safety measures to bring the driven consumer to a safe position (immediate stop).

To minimize the control fluid consumption, the stroking chambers are sealed in sizes 125...1000 and can be bled via the ports **R₂** ... **R₇**.

Swivel angle limitation

Minimum and maximum swivel angle limitation is mechanically adjustable up to 50 % $V_{g \max}$. For size 500, $V_{g \min}$ is adjustable up to 50 % $V_{g \max}$ and $V_{g \max}$ up to 70 % $V_{g \max}$ (75 % with A4VBO 450).

Notice

Setting with (A)A4VSO (open circuit):

- ▶ The $V_{g \max}$ stop is set to nominal $V_{g \max}$ as standard. Please specify different values in your order
- ▶ The $V_{g \min}$ stop is set to nominal $V_g = 0$ gpm (0 l/min) with $P_{HD} = 290$ psi (20 bar) as standard. Other values should be specified when placing the order.

Setting with (A)A4VSG and (A)A4CSG (closed circuit):

- ▶ The $V_{g \max}$ stops are set on both sides to nominal $V_{g \max}$.

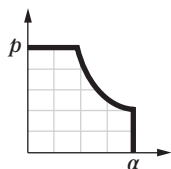
When ordering, please state other setting requests in plain text.

Optional:

- ▶ **HS5P** with one (open circuit) or two (closed circuit) pressure transducer(s) for pressure control and torque limitation
- ▶ Speed variation possible with SD card: VT-SD-HPC-HS5n.
For a description of the functionality, see pump control 30237-Z manual.

Technical data HS5(P)

Size		NG	40	71	125	180	250	355	450	500	750	1000	
Control pressure (in P)	(A)A4VSO, (A)A4VSG, (A)A4CSG	p_{\min}	psi (bar)	1450 (100)	1450 (100)	1450 (100)	1800 (125)	1800 (125)	1800 (125)	– (–)	2200 (150)	2200 (150)	2200 (150)
	A4VBO	p_{\min}	psi (bar)	– (–)	1900 (130)	1900 (130)	– (–)	– (–)	– (–)	2750 (190)	– (–)	– (–)	– (–)
		$p_{\max}^{1)}$	psi (bar)	5100 (350)	5100 (350)	5100 (350)	5100 (350)	5100 (350)	5100 (350)	5100 (350)	5100 (350)	5100 (350)	5100 (350)
Control stroke		s_{\max}	inch (mm)	0.56 (14.2)	0.67 (17.1)	0.81 (20.7)	0.81 (20.7)	1.02 (25.9)	1.09 (25.9)	1.28 (32.6)	1.28 (32.6)	1.46 (37.0)	1.63 (41.4)
Control area		A	inch ² (cm ²)	1.26 (8.1)	1.95 (12.6)	2.81 (18.1)	2.81 (18.1)	4.39 (28.3)	4.39 (28.3)	5.92 (38.2)	5.92 (38.2)	8.80 (56.8)	9.85 (63.6)
Control volume		$V_{S \max}$	inch ³ (cm ³)	0.70 (11.4)	1.31 (21.5)	2.29 (37.5)	2.29 (37.5)	4.47 (73.2)	4.47 (73.2)	7.60 (124.5)	7.60 (124.5)	12.81 (210)	16.06 (263.3)
Actuating time		$t_{\min}^{2)}$	s	0.04	0.06	0.09	0.09	0.12	0.12	0.15	0.15	0.2	0.25
Weight: approx. (A4VSO...HS5...N00)		m	lbs (kg)	92 (42)	130 (59)	216 (98)	247 (112)	441 (200)	485 (220)	734 (333)	734 (333)	1049 (476)	1336 (606)
Control loop performance hysteresis													≤ 0.2%
Repeat accuracy													≤ 0.2%
Linearity deviation swivel angle													≤ 1.0%
Linearity deviation pressure													≤ 1.5% of $p_{\max}^{3)}$

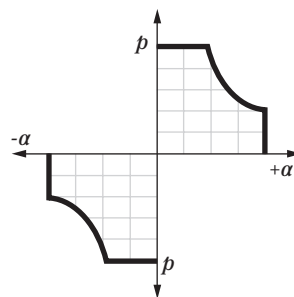
A4VSO – open circuit
▼ Characteristic curve


Basic setting for design without short circuit valve, de-energized proportional valve and connected control pressure: $V_{g \min}$ (see table).

▼ Flow direction S to B

Direction of rotation	Swiveling range ⁴⁾	Basic setting
clockwise	counter-clockwise	$V_{g \min}$ (counter-clockwise)
counter-clockwise	clockwise	$V_{g \min}$ (clockwise)

- 1) Due to the permissible data of the proportional valve
- 2) With minimum control pressure
- 3) Pressure transducer value

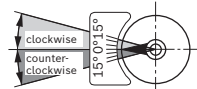
A4VSG and A4CSG – closed circuit
▼ Characteristic curve


Basic setting for design without short circuit valve, de-energized proportional valve and connected control pressure: $V_{g \max}$ (see table).

▼ Flow direction

Direction of rotation	Swiveling range ⁴⁾	Flow direction	Basic setting
clockwise	clockwise	B to A	$V_{g \max}$ clockwise
	counter-clockwise	A to B	
counter-clockwise	clockwise	A to B	$V_{g \max}$ counter-clockwise
	counter-clockwise	B to A	clockwise

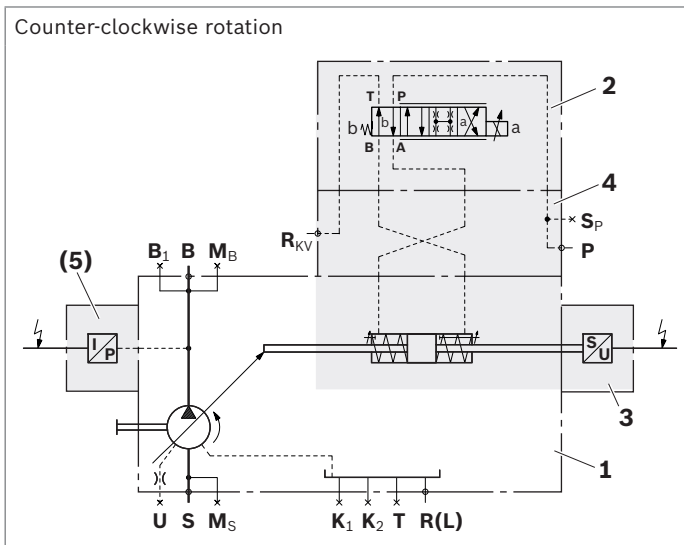
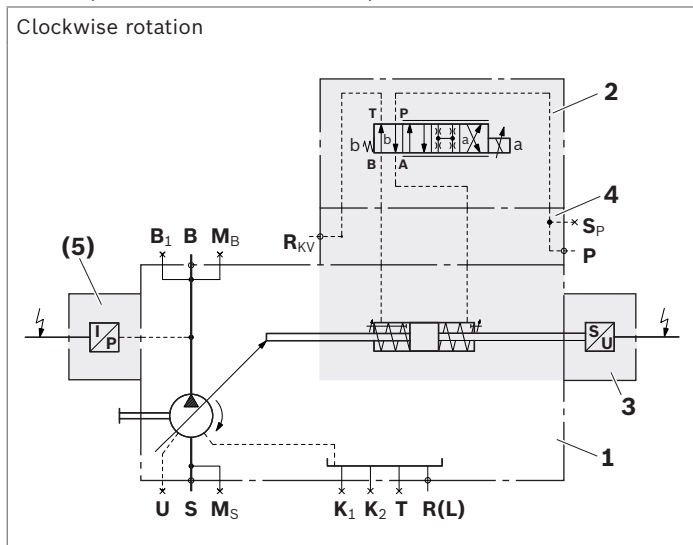
- 4) See swivel angle indicator



Circuit diagrams HS5(P)

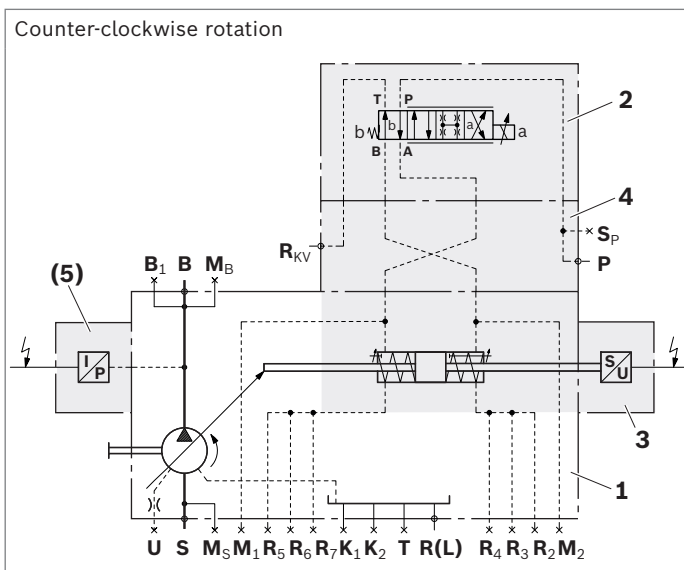
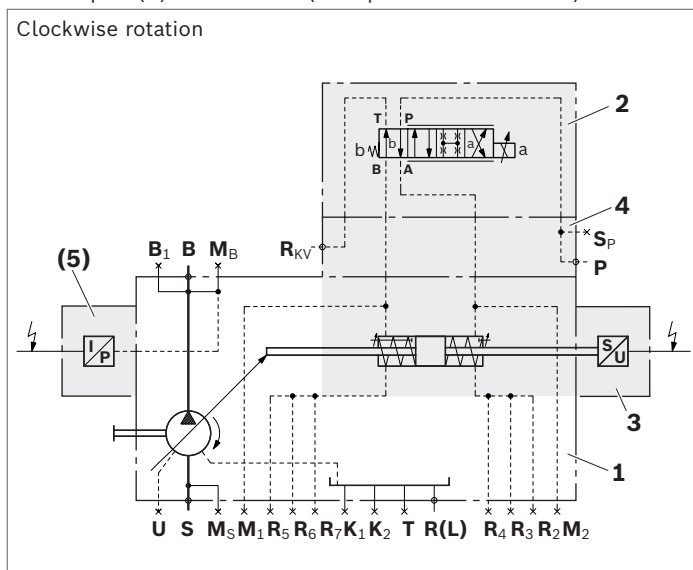
▼ **Sizes 40 and 71**

Example: (A)A4VSO HS5P (with pressure transducer)



▼ **Sizes 125 to 355**

Example: (A)A4VSO HS5P (with pressure transducer)



- 1 Pump with hydraulic control device
(A)A4VSO (see data sheet 92050), A4VBO (see data sheet 92122)
- 2 4/4 directional control valve (see data sheet 29027)

NG	Type
40 to 180	4WRPH6CA24L-2X/G24Z4/V-855
250 and 355	4WRPH6CA40L-2X/G24Z4/V-855

- 3 Inductive position transducer

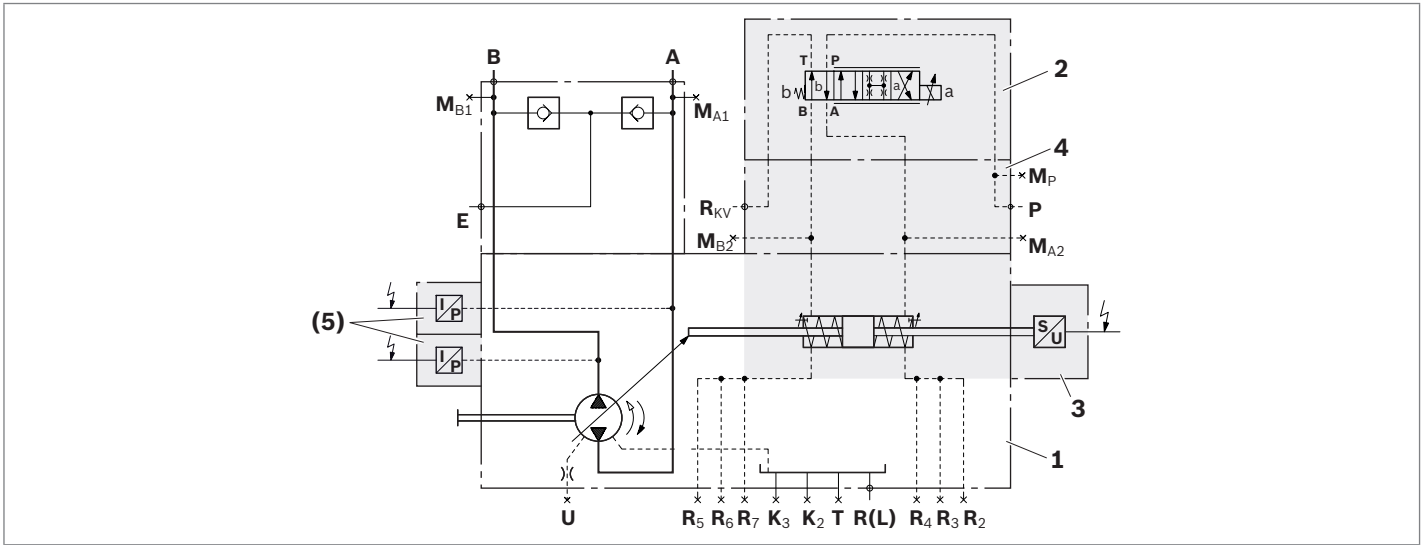
NG	Type
40, 125 and 180	AWAX004D03
71	AWAX004D02 with spacer
250, 355	AWAX004D02

with round connector 4-pin M12 × 1

- 4 Intermediate plate
- 5 **Only with HS5P:** Pressure transducer HM20-2X/630-C-K35 (see data sheet 30272) with intermediate flange, with (A)A4VSG and (A)A4CSG, each pressure side has 1 pressure transducer assigned and mounted

▼ **Sizes 500 to 1000**

Example: A4VSG HS5P (with pressure transducer)



- 1 Pump with hydraulic control device (A)A4VSG (see data sheet 92100)
- 2 4/4 directional control valve (see data sheet 29027)

NG	Type
500 to 1000	4WRPH6CA40L-2X/G24Z4/V-855

- 3 Inductive position transducer

NG	Type
500 to 1000	AWAX004D02

with round connector 4-pin M12 × 1

- 4 Intermediate plate

Only with HS5P: Pressure transducer HM20-2X/630-C-K35 (see data sheet 30272) with intermediate flange, with (A)A4VSG and (A)A4CSG, each pressure side has 1 pressure transducer assigned and mounted

Ports	
P	Control pressure
S_P	Control pressure accumulator
R_{KV}	Control fluid return flow
M...	Measuring ports control pressure
R₂ ... R₇	Air bleeding the stroking chamber

Dimensions HS5(P)

▼ **Size 40 and 71; example: (A)A4VSO HS5P with pressure transducer in B** (clockwise rotation with; counter-clockwise without HM20)

With (A)A4VSO and A4VBO counter-clockwise and clockwise rotation, partly different components and dimensions.
 With (A)A4VSG, the dimensions "L" apply for both directions of rotation.

▼ **Clockwise rotation**
 A_7 to mounting face
 A_4 to mounting face

▼ **Counter-clockwise rotation**
 A_{7L} to mounting face
 A_{4L} to mounting face

With pressure transducer, position 5: Intermediate flange with through holes (dimensions dependent on NG) for mounting bolts (for fastening threads, see relevant pump data sheet)

Transport lock

(5) Valve mounting with (A)A4VSG
 (A)A4VSO for **clockwise rotation**
 A4VBO for **clockwise rotation**

▼ Detail W clockwise rotation

▼ Detail W counter-clockwise rotation

Valve mounting with (A)A4VSO, A4VBO for **counter-clockwise rotation**

For key, see page 19
 For dimensions and technical data for the variable pump, see data sheets 92050 ((A)A4VSO), 92122 (A4VBO) or 92100 ((A)A4VSG)

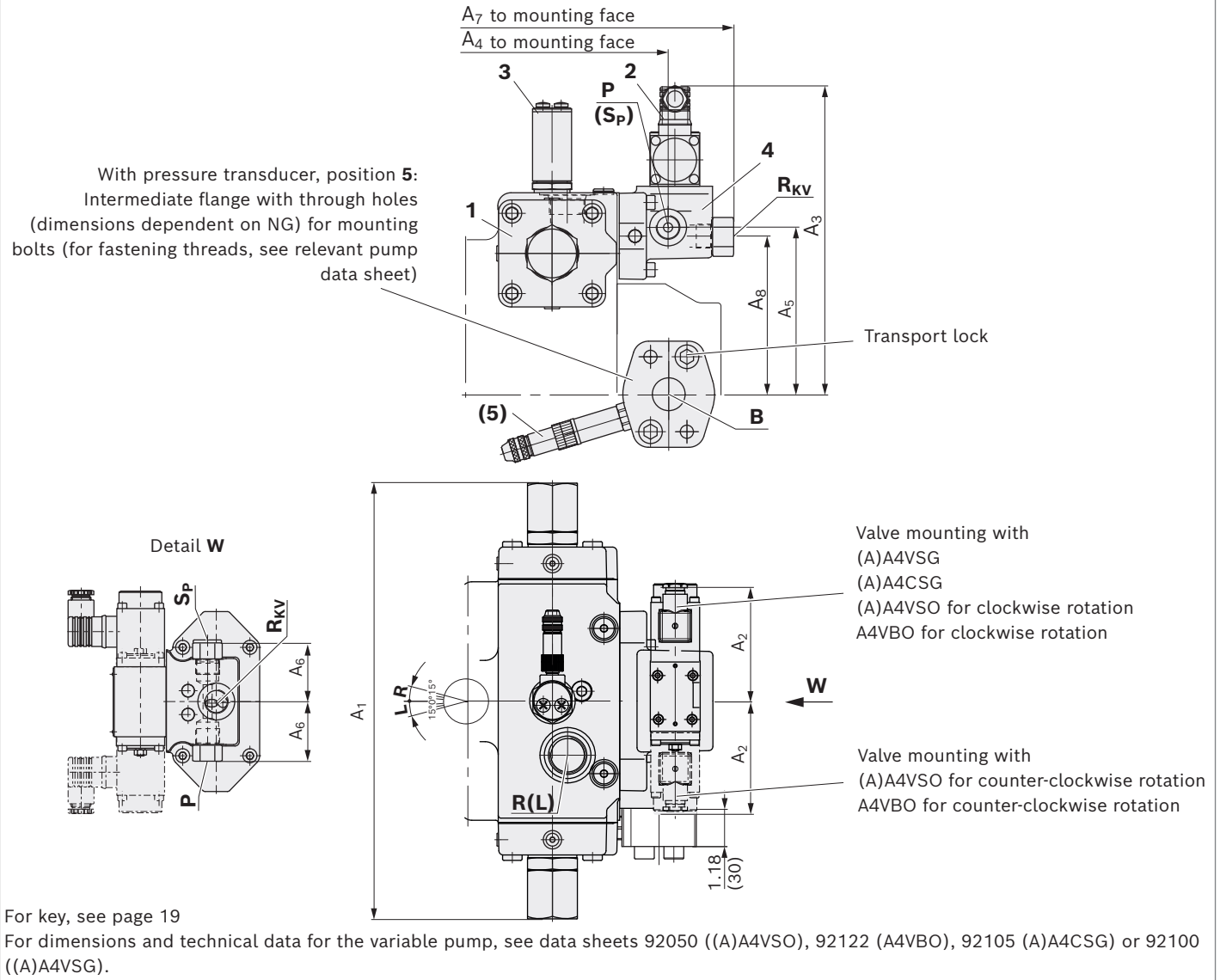
NG	A ₁	A ₂	A _{2L}	A ₃	A _{3L}	A ₄	A _{4L}	A ₅	A _{5L}	A _{6(L)}	A ₇	A _{7L}	A ₈	A _{8L}	A ₉	A _{9L}	A _{10(L)}
40	11.65 (296)	4.34 (110.3)	4.09 (104)	9.88 (251)	9.13 (232)	8.74 (222)	9.04 (229.5)	4.25 (108)	4.21 (107)	2.87 (73)	11.97 (304)	9.96 (253)	5.04 (128)	3.70 (94)	1.18 (30)	0 (0)	3.35 (85)
71	13.07 (332)	4.14 (105.3)	4.22 (107.1)	10.55 (268)	9.80 (249)	9.80 (249)	10.10 (256.5)	4.84 (123)	4.80 (122)	3.11 (79)	13.03 (331)	11.2 (280)	5.63 (143)	4.29 (109)	1.18 (30)	0 (0)	3.11 (79)

Ports	Standard ¹⁾	Size	p_{max} [psi (bar)] ²⁾	State ³⁾	
P	Control pressure	ISO 11926	7/8-14UNF-2B; 0.67 (17) deep	4550 (315)	O
S_P	Control pressure accumulator	ISO 11926	7/8-14UNF-2B; 0.67 (17) deep	4550 (315)	X
R_{KV}	Control fluid return flow	ISO 11926	7/8-14UNF-2B; 0.67 (17) deep	3050 (210)	O

1) ISO 6149 with A4VBO 71
 2) Depending on the application, momentary pressure peaks can occur. Keep this in mind when selecting measuring devices and fittings.
 3) O = Must be connected (plugged on delivery)
 X = Plugged (in normal operation)

▼ **Size 125 to 355, example (A)A4VSO HS5P with a pressure transducer on port B**

With (A)A4VSO and A4VBO, the dimension A_4 is different for clockwise and counter-clockwise rotation.
 With (A)A4VSG and (A)A4CSG, dimension A_{4R} (clockwise) applies for both directions of rotation.



NG	A ₁	A ₃	A _{4R}	A _{4L}	A ₅	A ₆	A ₇	A ₈
125/180	15.83 (402)	11.30 (286)	12.20 (310)	12.54 (318.5)	6.14 (156)	2.76 (70)	15.09 (383)	5.83 (148)
250/355	19.09 (485)	12.70 (322)	14.65 (372)	14.98 (380.5)	7.56 (192)	2.76 (70)	17.52 (445)	7.24 (184)

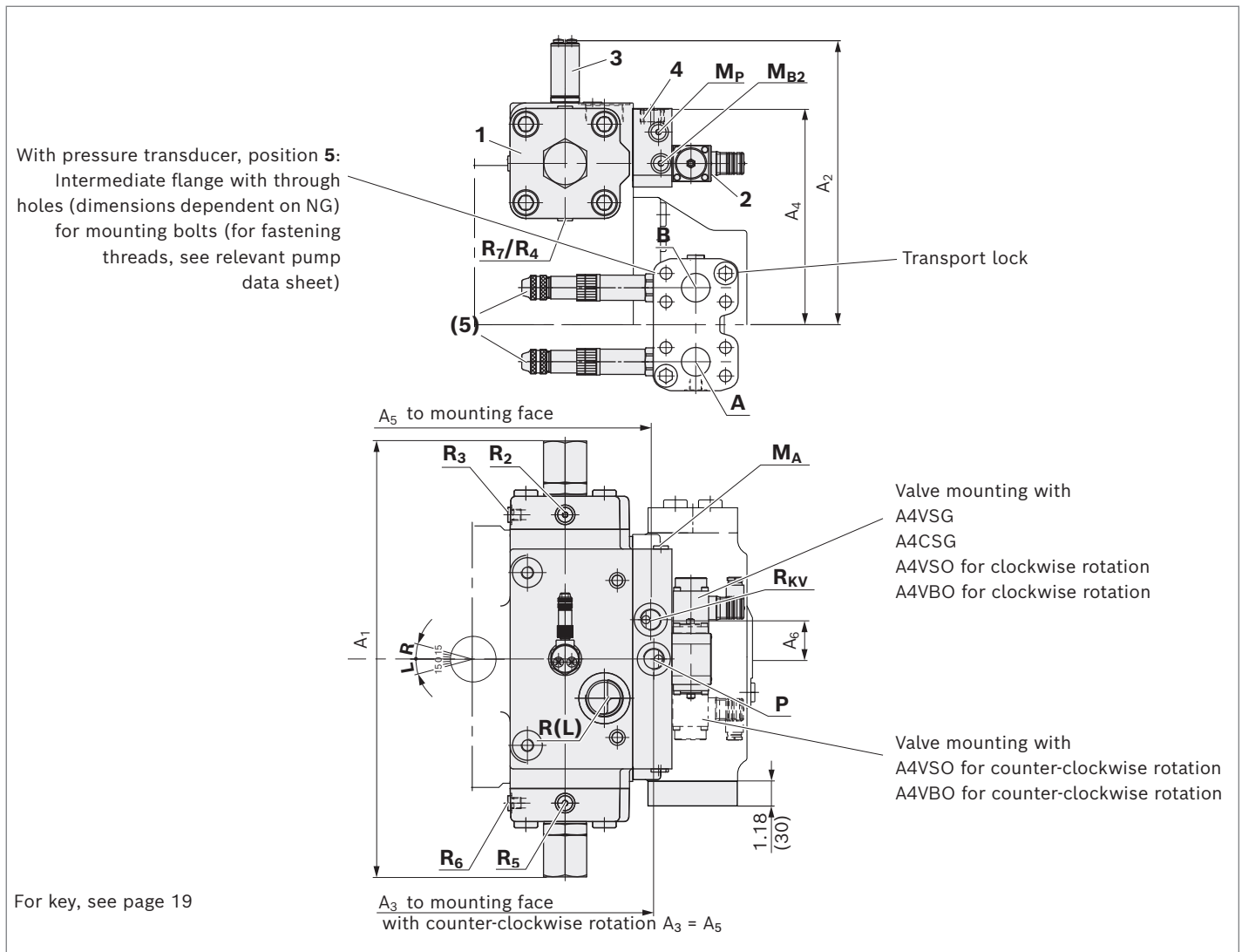
Ports	Standard	Size ¹⁾	p_{max} [psi (bar)] ²⁾	State ³⁾
P	Control pressure	ISO 11926	7/8-14UNF-2B; 0.67 (17) deep	4550 (315) O
S_p	Control pressure accumulator	ISO 11926	7/8-14UNF-2B; 0.67 (17) deep	4550 (315) X
R_{kv}	Control fluid return flow	ISO 11926	7/8-14UNF-2B; 0.67 (17) deep	3050 (210) O
M₁, M₂	Control pressure measuring	DIN 3852-1	M14 x 1.5; 0.47 (12) deep (NG 125 and 180) M18 x 1.5; 0.47 (12) deep (NG 250 and 355)	4550 (315) X 4550 (315) X
R₂ ... R₇	Air bleeding the stroking chamber	DIN 3852-1	M10 x 1; 0.31 (8) deep	4550 (315) X

1) ISO 6149 with A4VBO 125, M22 x 1.5; 0.55 (14) deep
 2) Depending on the application, momentary pressure peaks can occur. Keep this in mind when selecting measuring devices and fittings.

3) O = Must be connected (plugged on delivery)
 X = Plugged (in normal operation)

▼ **A4VSO, A4VBO, A4VSG and A4CSG, size 500 to 1000**

Example A4VSG HS5P with two pressure transducers on port **B**



NG	A ₁	A ₂	A ₃	A ₄	A ₅	A ₆	
500 (450 with A4VBO)	21.85 (555)	14.30 (363)	15.34 (392)	10.79 (274)	15.38 (388)	1.97 (50)	For detailed dimensions and technical data for the variable pump, see data sheet 92050 (A4VSO), 92122 (A4VBO), 92100 (A4VSG) or 92105 (A4CSG)
750	24.80 (630)	15.80 (402)	16.69 (424)	11.97 (304)	16.54 (420)	1.97 (50)	
1000	26.38 (670)	16.90 (429)	19.29 (490)	12.97 (327)	19.13 (486)	1.97 (50)	

Ports	Standard ¹⁾	Size	p_{max} [psi (bar)] ²⁾	State ³⁾
P	Control pressure	DIN 3852-1 M27 × 2; 0.63 (16) deep	4550 (315)	O
R_{KV}	Control fluid return flow	DIN 3852-1 M27 × 2; 0.63 (16) deep	1750 (120)	O
M_{A2}, M_{B2}, M_P	Control pressure measuring	DIN 3852-1 M14 × 1.5; 0.47 (12) deep	4550 (315)	X
R₂ ... R₇	Air bleeding the stroking chamber	DIN 3852-1 M14 × 1.5; 0.47 (12) deep	4550 (315)	X

1) ISO 6149 with A4VBO 71

2) Depending on the application, momentary pressure peaks can occur. Keep this in mind when selecting measuring devices and fittings.

3) O = Must be connected (plugged on delivery)

X = Plugged (in normal operation)

HS5M – suitable for use under fluid

Type	NG	40	71	125	180	250	355	450	500	750	1000	
(A)A4VSO, (A)A4VSG		●	●	●	●	●	●	–	●	●	●	HS5M
A4VBO		–	●	●	–	●	–	●	–	–	–	

The version **HS5M** corresponds to the HS5 design, but without proportional valve, but with pilot pressure ports **X₁** and **X₂**.

The proportional valve can be positioned separately in the system and piped up via the designated ports **X₁** and **X₂** of the pump.

The unit can be installed in the reservoir together with the directly mounted position transducer.

Approved for HLP fluids DIN 51524.

Recommendation

- ▶ Directional control valve 4WRPH6, see data sheet 29027
- ▶ Electronics VT-HPC-1-1X see data sheet 30237
- ▶ For cables, see data sheet 30237-B

Notice

Setting with (A)A4VSO (open circuit):

- ▶ The $V_{g \max}$ stop is set to nominal $V_{g \max}$ as standard. Please specify different values in your order
- ▶ The $V_{g \min}$ stop is set to nominal $V_g = 0$ gpm (0 l/min) with $P_{HD} = 290$ psi (20 bar) as standard. Other values should be specified when placing the order.

Setting with (A)A4VSG and (A)A4CSG (closed circuit):

- ▶ The $V_{g \max}$ stops are set on both sides to nominal $V_{g \max}$.

▼ Flow direction in closed circuit

Direction of rotation		Swiveling range ¹⁾
clockwise	counter-clockwise	
B to A	A to B	clockwise
A to B	B to A	counter-clockwise

▼ Flow direction in open circuit

Direction of rotation		Swiveling range ¹⁾
clockwise	counter-clockwise	
S to B		counter-clockwise
	S to B	clockwise

Technical data inductive position transducer AWAX

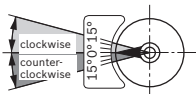
Temperature range	-13°F to +176°F (-25 °C to +80 °C) for AWAX004D02 and AWAX004D03
Type of protection	IPX7 DIN VDE 0470-EN 60529
Typical temperature drift	0.05% / K (based on the total output voltage swing)
Vibration resistance	10 g sine; 10 g noise; 15 g shock
Use under fluid	approved for HLPD 46 (with installed mating connector)
Sealing material	FKM

Technical data HS5M

Size		NG	40	71	125	180	250	355	500	750	1000
Control pressure (in X1, X2)	p_{\min}	psi	725	725	725	1450	1450	1450	1800	1800	180
		(bar)	(50)	(50)	(50)	(100)	(100)	(100)	(125)	(125)	(125)
	$p_{\max}^{2)}$	psi	5100	5100	5100	5100	5100	5100	5100	5100	5100
		(bar)	(350)	(350)	(350)	(350)	(350)	(350)	(350)	(350)	(350)
Control stroke from 0 cm ³ to $V_{g \max}$	s_{\max}	inch	0.56	0.67	0.81	0.81	1.02	1.02	1.28	1.46	1.63
		(mm)	(14.2)	(17.1)	(20.7)	(20.7)	(25.9)	(25.9)	(32.6)	(37.0)	(41.4)
Control area	A	inch ²	1.26	1.95	2.81	2.81	4.39	4.39	5.92	8.80	9.86
		(cm ²)	(8.1)	(12.6)	(18.1)	(18.1)	(28.3)	(28.3)	(38.2)	(56.8)	(63.6)
Control volume	$V_{S \max}$	inch ³	0.70	1.31	2.29	2.29	4.47	4.47	7.60	12.81	16.07
		(cm ³)	(11.4)	(21.5)	(37.5)	(37.5)	(73.2)	(73.2)	(124.5)	(210)	(263.3)
Weight: approx. (A4VSO...HS5M...N00)	m	lbs	84	121	202	233	427	471	719	1034	1320
		(kg)	(38)	(55)	(92)	(106)	(194)	(214)	(327)	(470)	(600)

1) See swivel angle indicator

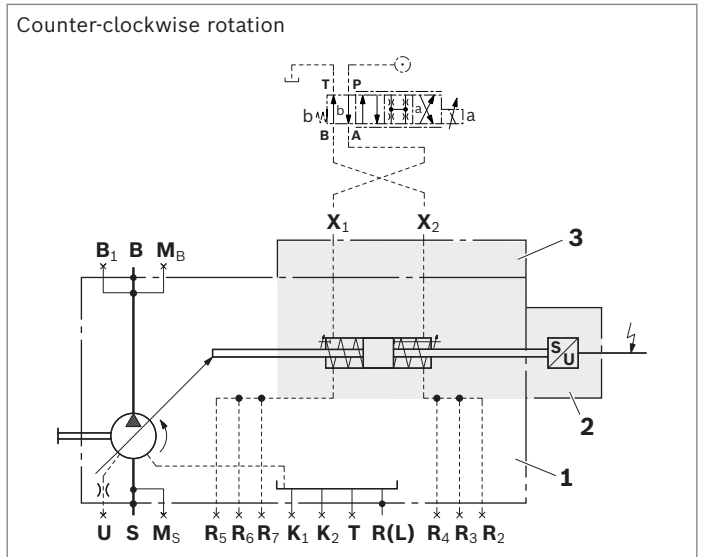
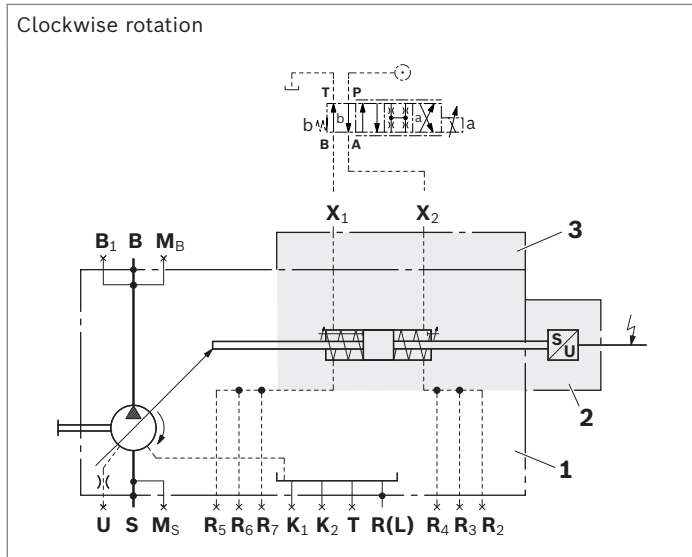
2) Observe any restrictions due to the proportional valve



Circuit diagrams HS5M

▼ **Size 40 to 1000 for (A)A4VSO and (A)A4VSG, size 250 to 750 for (A)A4CSG**

Example: (A)A4VSO...HS5M, size 125 to 1000



1 Pump with hydraulic control device (A)A4VSO
 (see data sheet 92050)

2 Inductive position transducer:

NG	Type
40, 125 and 180	AWAX004D03
71	AWAX004D02 with spacer
250 to 1000	AWAX004D02

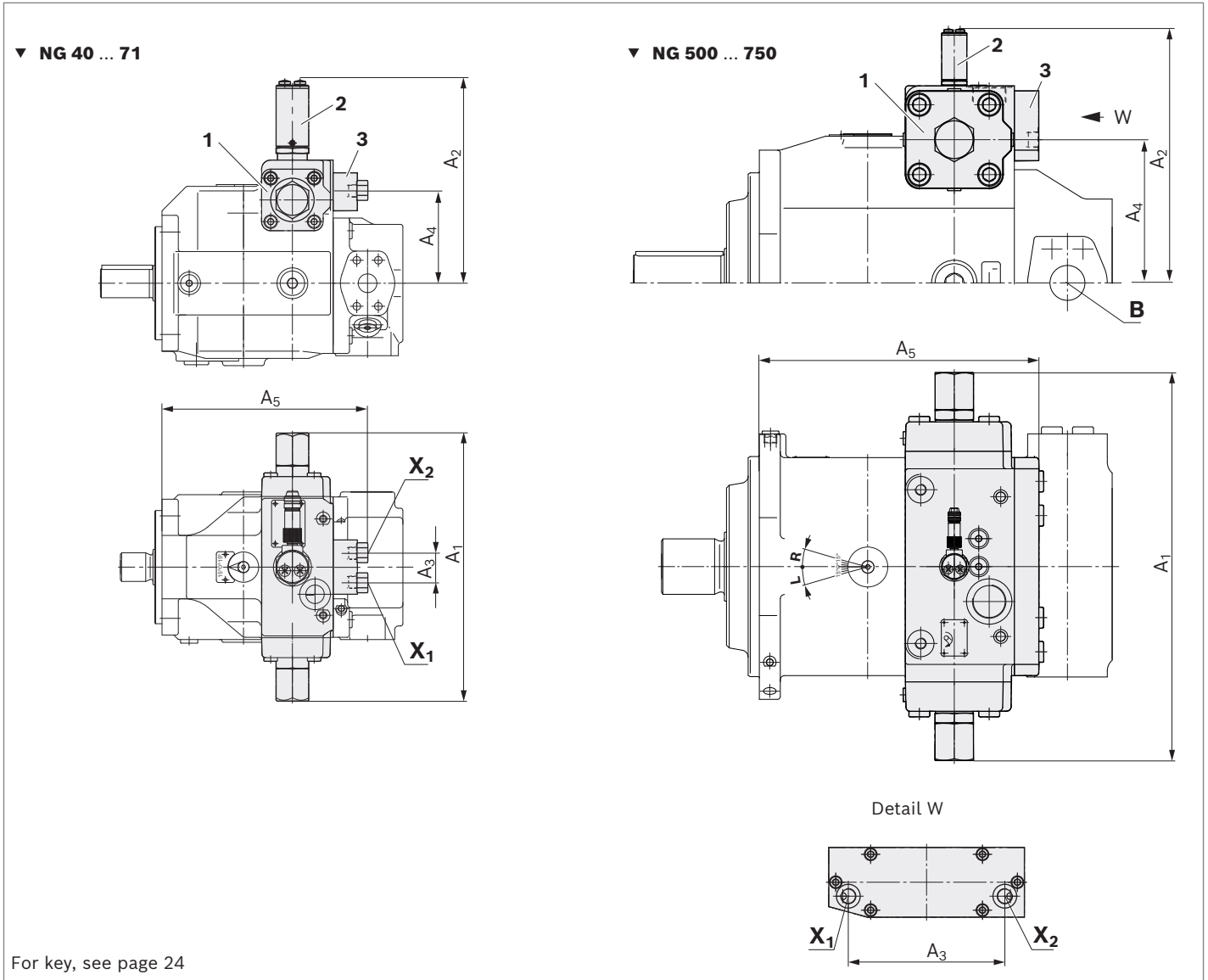
with round connector 4-pin M12 × 1

3 Port plate

Ports	
X ₁	Control pressure
X ₂	Control pressure
R ₂ ... R ₇	Air bleeding of stroking chamber (NG 125 to 1000)

Dimensions HS5M

▼ **(A)A4VSO, (A)A4VSG and (A)A4CSG, size 40, 71, 500 and 750**



NG	A ₁	A ₂	A ₃	A ₄	A ₅
40	11.65 (296)	8.81 (223.7)	1.10 (28)	4.09 (104)	9.49 (241)
71	13.07 (332)	9.57 (243)	1.10 (28)	4.72 (120)	10.59 (269)
500	21.85 (555)	14.30 (363)	8.82 (224)	8.07 (205)	15.71 (399)
750	24.80 (630)	15.75 (400)	8.82 (224)	9.25 (235)	16.97 (431)

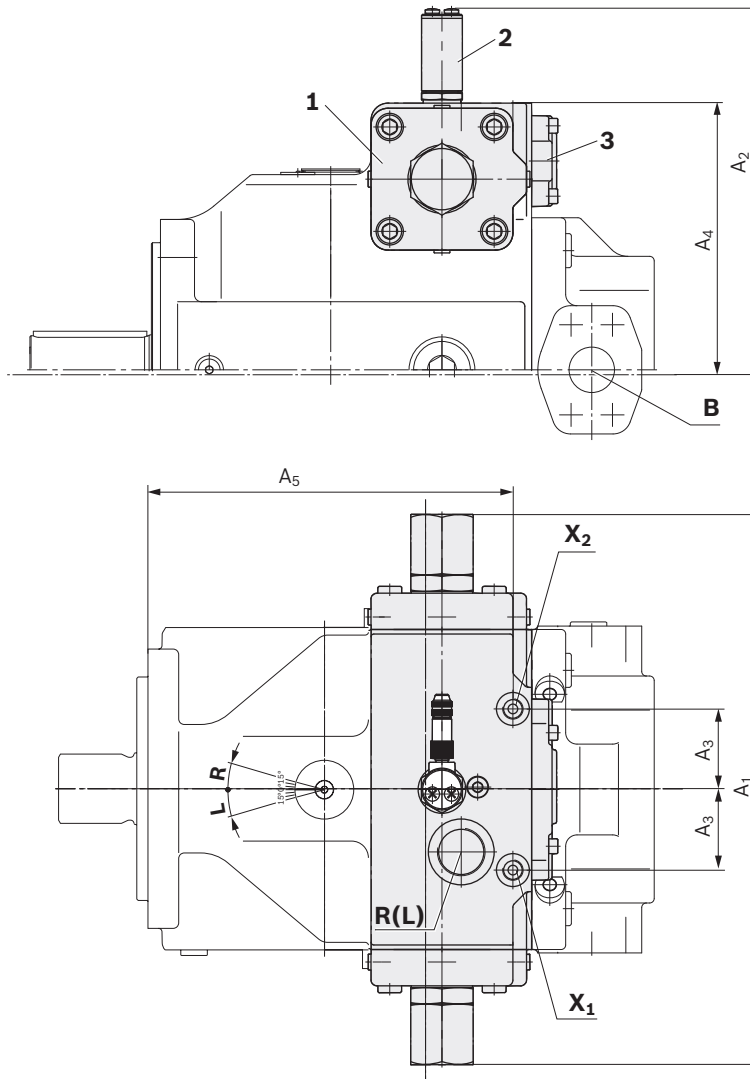
For detailed dimensions and technical data for the variable pump, see data sheet 92050 ((A)A4VSO), 92100 ((A)A4VSG) or 92105 ((A)A4CSG)

Ports	Standard	Size	p_{max} [psi (bar)] ¹⁾	State ²⁾	
X₁, X₂	Control pressure	ISO 11926 DIN 3852-1	9/16-18UNF-2B; 0.51 (13) deep (NG 40 and 71) M22 × 1.5; 0.55 (14) deep (NG 500)	5100 (350) 5100 (350)	O O

1) Depending on the application, momentary pressure peaks can occur. Keep this in mind when selecting measuring devices and fittings.

2) O = Must be connected (plugged on delivery)
 X = Plugged (in normal operation)

▼ **((A)A4VSO, (A)A4VSG and (A)A4CSG, sizes 125 to 355**



For key, see page 24

NG	A ₁	A ₂	A ₃	A ₄	A ₅
125/180	15.83 (402)	10.07 (272)	2.64 (67)	7.34 (186.5)	9.88 (251)
250/355	19.09 (485)	12.50 (318.2)	2.80 (71)	9.17 (233)	12.54 (310.5)

For detailed dimensions and technical data for the variable pump, see data sheet 92050 ((A)A4VSO), 92100 ((A)A4VSG) or 92105 ((A)A4CSG)

Ports	Standard	Size	p _{max} [psi (bar)] ¹⁾	State ²⁾	
X ₁ , X ₂	Control pressure	ISO 11926	9/16-18UNF-2B; 0.51 (13) deep (NG 125 and 180) 3/4-16UNF-2B; 0.59 (15) deep (NG 250 and 355)	5100 (350) 5100 (350)	O O

1) Depending on the application, momentary pressure peaks can occur. Keep this in mind when selecting measuring devices and fittings.

2) O = Must be connected (plugged on delivery)
 X = Plugged (in normal operation)

HS5V – control with internal control pressure supply for open circuit

Type	NG	40	71	125	180	250	355	450	500	750	1000	
A4VSO		●	●	●	●	●	●	–	–	–	–	HS5V
A4VBO		–	●	●	–	●	–	–	–	–	–	

The version **HS5V** corresponds to the HS5 design, but with internal control pressure supply, differential stroking pistons and depressurized basic setting $V_{g \max}$.

This removes the need for an external control pressure supply. The control pressure supply takes place directly from the high pressure.

With the electric motor switched off and actuator system depressurized, the pump swivels to maximum displacement ($V_{g \max}$) through spring force.

For reliable control, the system pressure must be at least 290 psi (20 bar).

If the pump is to be controlled below 290 psi (20 bar), a preload block is required for generating the required control power. You need to contact us for a specific application.

Basic position de-energized

With a de-energized proportional valve and plugged pump outlet, the pump switches to minimum pressure (87 to 145 psi (6 to 10 bar)).

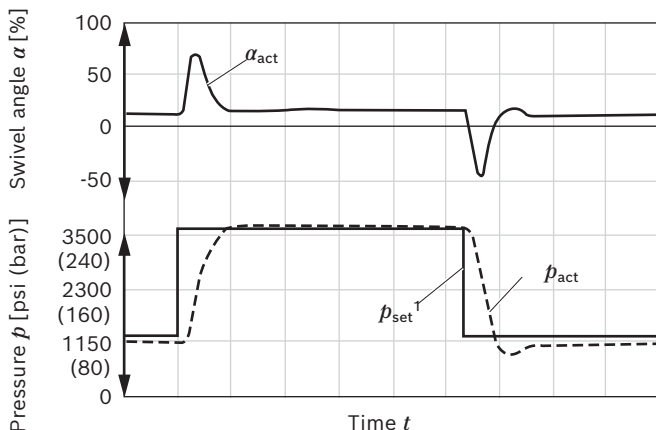
Electronics:

- ▶ VT-HPC-1-1X, see data sheet 30237

Swiveling range –100 % to +100 %

As a special feature, the pump can switch the conveying direction. This feature of switching over the neutral position enables a quick pressure reduction via the pump.

▼ Dynamic characteristic curve for pressure reduction via the pump



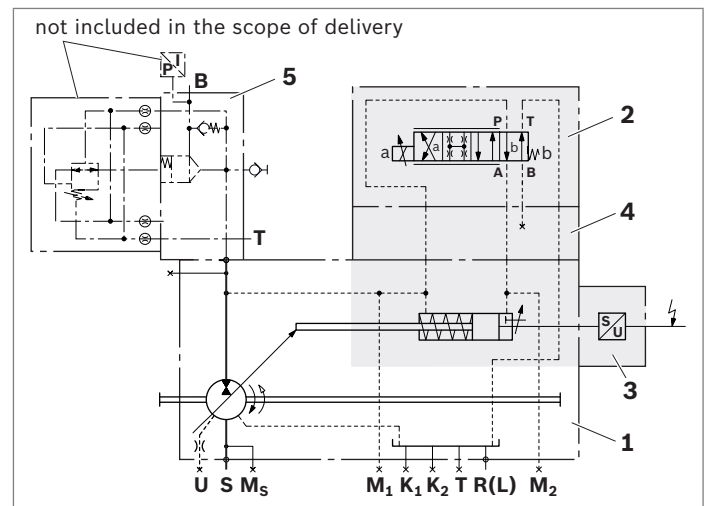
Technical data HS5V

Size	NG	40 to 355
Maximum working pressure $p_{\max}^{1)}$	psi (bar)	5100 (350)
Minimum working pressure p_{\min}	psi (bar)	290 (20)

Circuit diagram HS5V

▼ Sizes 250 and 355

Example: (A)A4VSO HS5V with preload block AGEV4-05728-AA/46



- 1 Pump with hydraulic control device (A)A4VSO (see data sheet 92050)
- 2 4/4 directional control valve (see data sheet 29027)

NG	Type
40 to 180	4WRPH6CA24L-2X/G24Z4/V-855
250 and 355	4WRPH6CA40L-2X/G24Z4/V-855

- 3 Inductive position transducer:

NG	Type
40, 125 and 180	AWAX004D03
71	AWAX004D02 and spacer
250 to 355	AWAX004D02

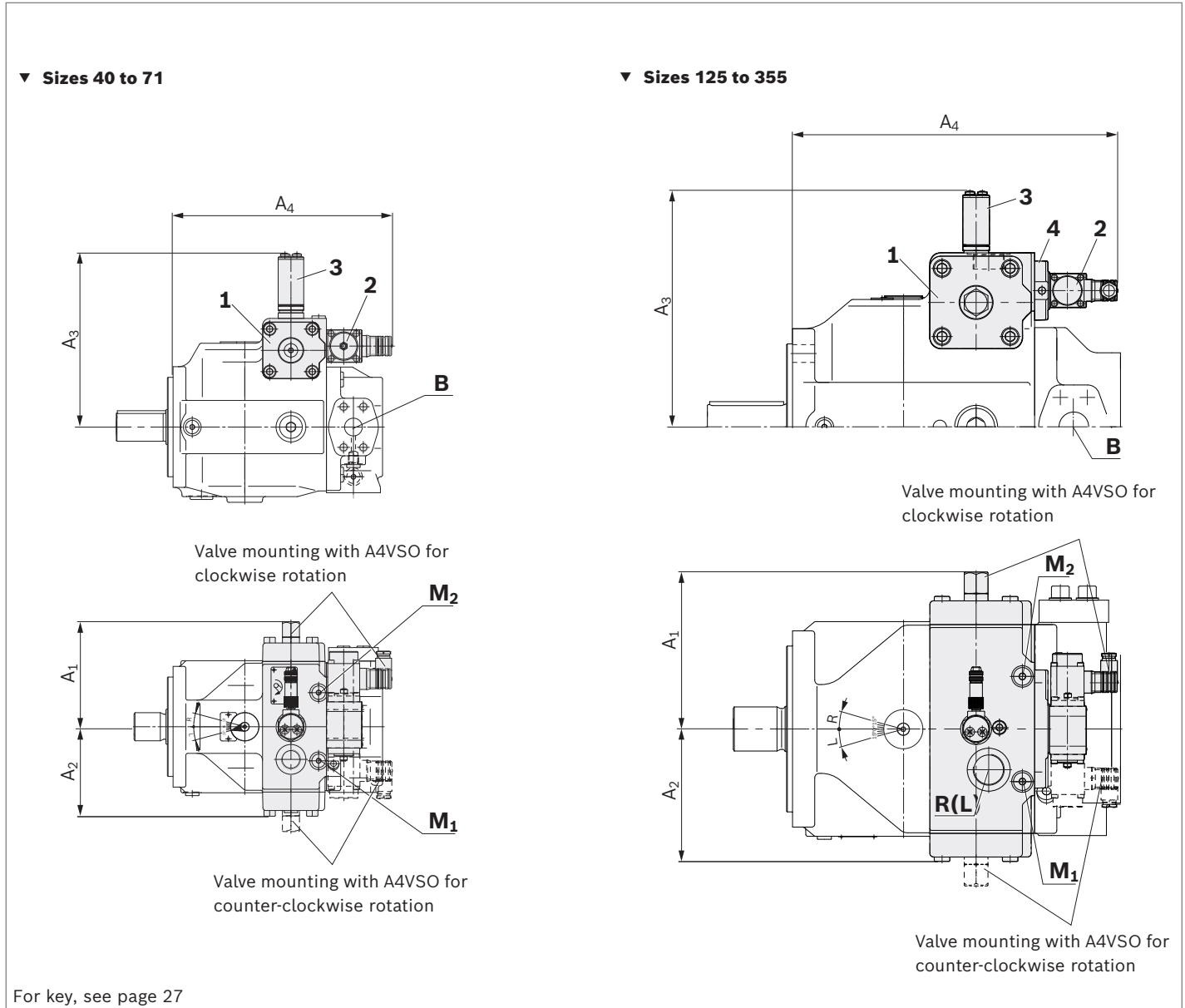
with round connector 4-pin M12 × 1

- 4 Intermediate plate
- 5 Preload block

1) Due to the permissible data of the proportional valve, higher pressures on request

Dimensions HS5V

▼ **(A)A4VSO, size 40 to 355**



NG	A ₁	A ₂	A ₃	A ₄	
40	5.12 (130)	4.09 (104)	8.82 (224)	11.06 (281)	
71	5.83 (148)	4.96 (126)	9.63 (244.7)	12.16 (309)	
125	6.97 (177)	5.79 (147)	10.70 (271)	14.80 (375)	For detailed dimensions and technical data of the variable pump, see data sheet 92050 ((A)A4VSO)
180	6.97 (177)	5.79 (147)	10.70 (271)	14.80 (375)	
250/355	8.35 (212)	7.05 (179)	12.17 (309)	17.05 (433)	

Ports	Standard	Size	p _{max} [psi (bar)] ¹⁾	State ²⁾
M ₁ , M ₂	Control pressure measuring DIN 3852-1	M14 × 1.5; 0.47 (12) deep (size 40 to 71) M18 × 1.5; 0.47 (12) deep (size 125 to 355)	4550 (315)	X

1) Depending on the application, momentary pressure peaks can occur. Keep this in mind when selecting measuring devices and fittings.

2) O = Must be connected (plugged on delivery)
 X = Plugged (in normal operation)

HS5L – control with internal control pressure supply for (A)A4CSG

Type	NG	250	355	500	750	
(A)A4CSG		•	•	•	•	HS5L

The **HS5L** variant corresponds to the HS5 version but with internal control pressure supply. With a rotating pump and not active control (valve de-energized), the pump swivels to $-V_{g\ max}$ by the boost pressure. The control pressure supply comes directly from the high pressure or boost pressure. This removes the need for an external control pressure supply. With the electric motor switched off and actuator system depressurized, the pump swivels to 0% swivel angle through spring-centering.

Notice

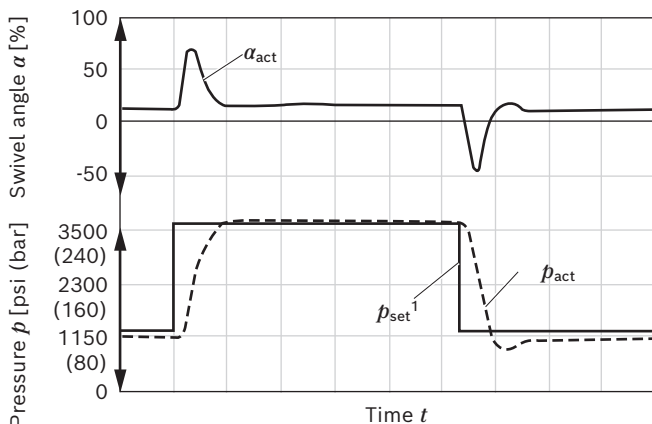
- ▶ The spring feedback in the controller and pump control spring centering are not safety devices. The controller can stick in an undefined position due to internal contamination (contaminated hydraulic fluid, abrasion or residual contamination from system components). As a result, the flow in the axial piston unit will no longer respond correctly to the operator's specifications. Check whether the application on your machine requires additional safety measures to bring the driven consumer to a safe position (immediate stop).

For safe control, the control pressure must be twice the boost pressure (for NG 355 +75 psi (+5 bar)). See also boost pressures in data sheet 92105.

Swiveling range -100 % to +100 %

As a special feature, the pump can switch the conveying direction. This feature of switching over the neutral position enables a quick pressure reduction via the pump.

▼ Dynamic characteristic curve for pressure reduction via the pump



1) Due to the permissible data of the proportional valve, higher pressures on request

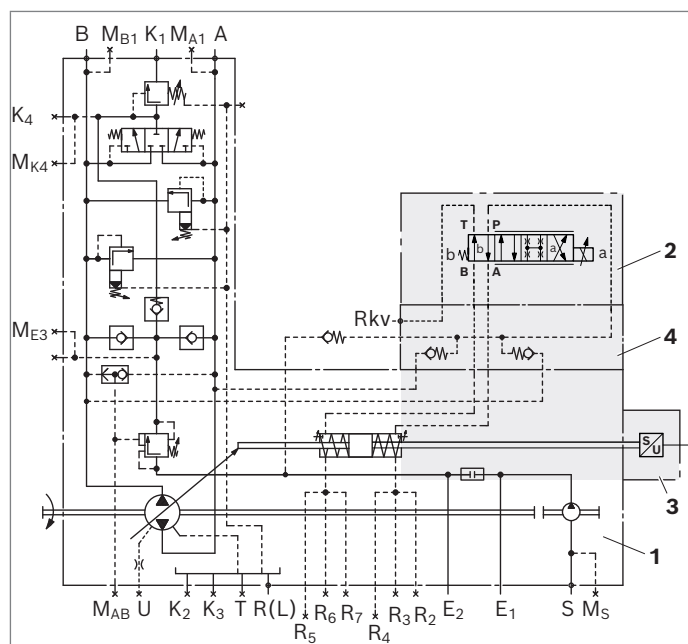
Technical data HS5L

Size	NG	250 to 750
Maximum working pressure	$p_{max}^{1)}$ psi (bar)	5100 (350)
Minimum working pressure	p_{min} psi (bar)	290 (20)
Minimum required control pressure	p_{min}	Double boost pressure +75 psi (+5 bar) for size 355

Circuit diagram HS5L

▼ Sizes 250 and 750

Example: (A)A4CSG 500HS5L



- 1 Pump with hydraulic control device (A)A4CSG (see data sheet 92105)
- 2 4/4 directional control valve (see data sheet 29027)

NG	Type
250 and 750	4WRPH6CA40L-2X/G24Z4/V-855

- 3 Inductive position transducer:

NG	Type
250 to 750	AWAX004D02

with round connector 4-pin M12 x 1

- 4 Intermediate plate

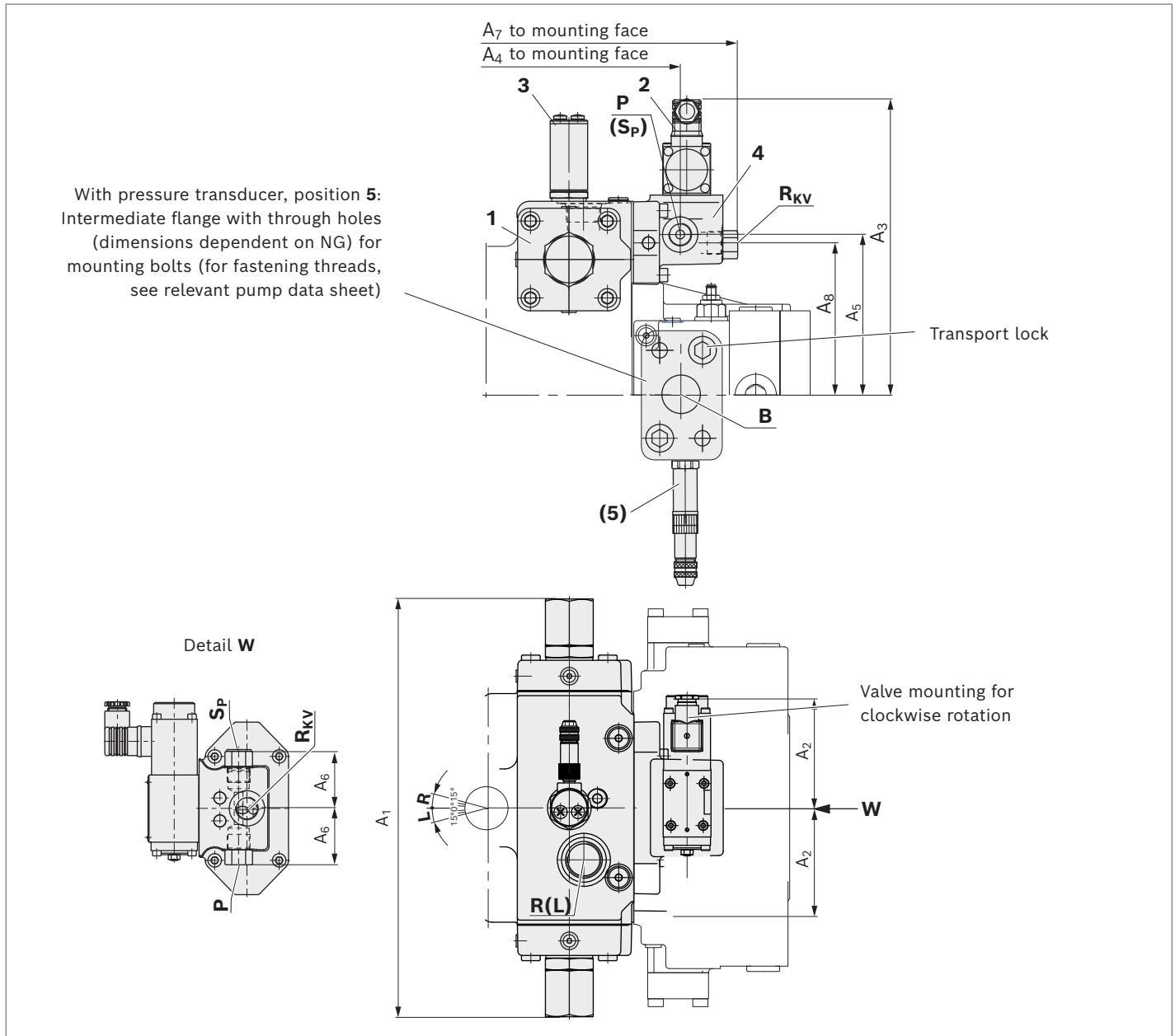
▼ Flow direction in closed circuit

Direction of rotation	Swiveling range	
clockwise	counter-clockwise	
B to A	A to B	clockwise
A to B	B to A	counter-clockwise

The diagram shows a 4/4 directional control valve with ports labeled B, MB1, K1, MA1, A. Arrows indicate flow directions: clockwise rotation corresponds to flow from B to A, and counter-clockwise rotation corresponds to flow from A to B. The swiveling range is indicated as 51°-15° clockwise and 15°-0° counter-clockwise.

Dimensions HS5L

▼ **Size 250 to 355, example (A)A4CSG HS5LP with two pressure transducers on port B and A**



NG	A ₁	A ₃	A ₄	A ₅	A ₆	A ₇	A ₈	
250/355	19.09	12.70	14.65	7.56	2.76	17.52	7.24	For detailed dimensions and technical data of the variable pump, see data sheet 92105 (A)A4CSG
	(485)	(322)	(372)	(192)	(70)	(445)	(184)	

Ports	Standard	Size	p_{max} [psi (bar)] ¹⁾	State ²⁾
P	Control pressure	ISO 11926	7/8-14UNF-2B; 0.67 (17) deep	4550 (315) O
Sp	Control pressure accumulator	ISO 11926	7/8-14UNF-2B; 0.67 (17) deep	4550 (315) X
R_{KV}	Control fluid return flow	ISO 11926	7/8-14UNF-2B; 0.67 (17) deep	3050 (210) O
M₁, M₂	Control pressure measuring	DIN 3852-1	M18 × 1.5; 12 deep	4550 (315) X
R₂ ... R₇	Air bleeding the stroking chamber	DIN 3852-1	M10 × 1; 8 deep	4550 (315) X

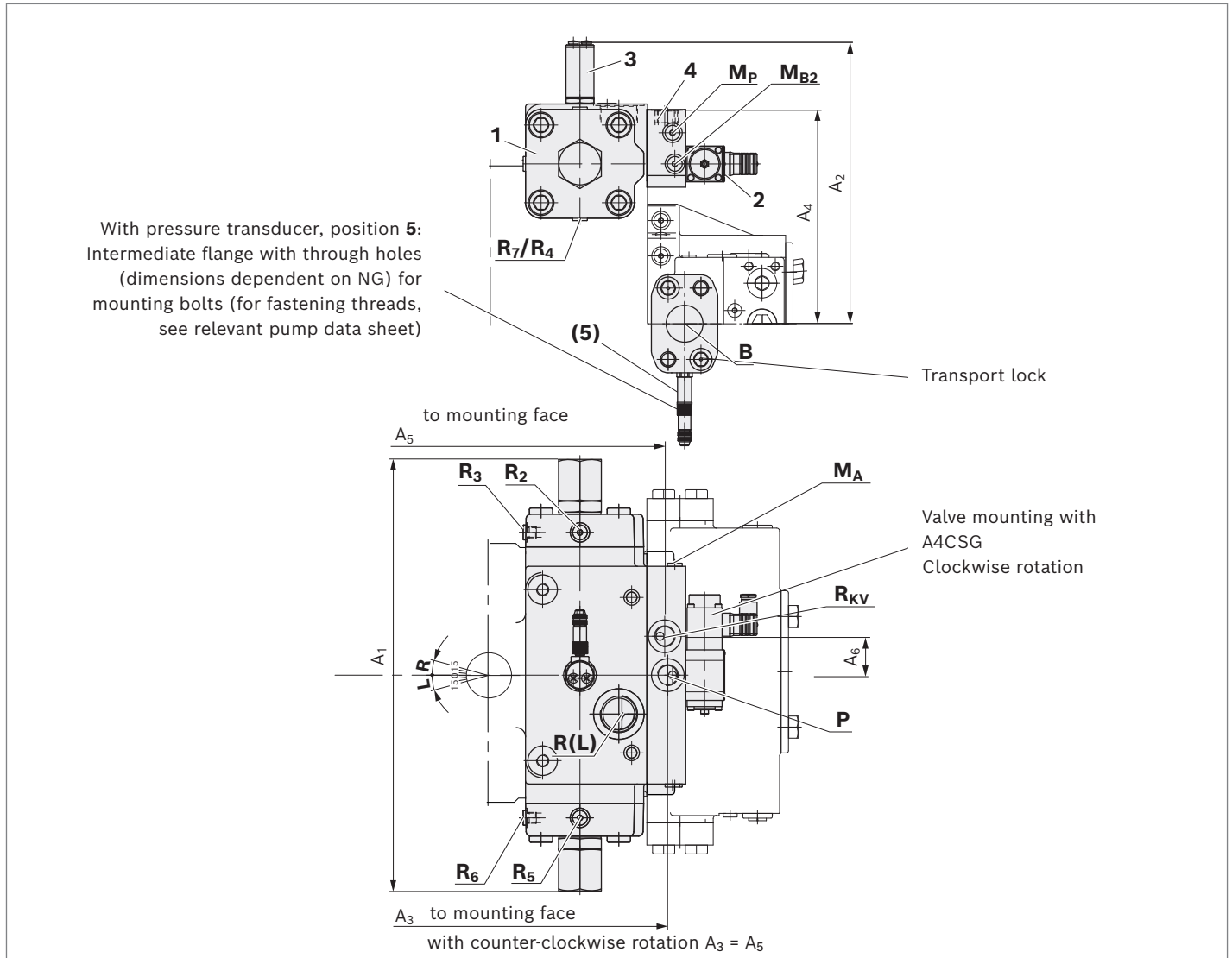
1) Depending on the application, momentary pressure peaks can occur. Keep this in mind when selecting measuring devices and fittings.

2) O = Must be connected (plugged on delivery)
 X = Plugged (in normal operation)

Dimensions HS5L

▼ **A4CSG, sizes 500 to 1000**

Example A4VSG HS5LP with two pressure transducers on ports **B** and **A**



NG	A ₁	A ₂	A ₃	A ₄	A ₅	A ₆	
500	21.85 (555)	14.30 (363)	15.34 (392)	10.79 (274)	15.38 (388)	1.97 (50)	For detailed dimensions and technical data of the variable pump, see data sheet 92105 (A4CSG)
750	24.80 (630)	15.80 (402)	16.69 (424)	11.97 (304)	16.54 (420)	1.97 (50)	

Ports	Standard ¹⁾	Size	p _{max} [bar] ¹⁾	State ²⁾
P	Control pressure	DIN 3852-1 M27 × 2; 0.63 (16) deep	4550 (315)	O
R_{KV}	Control fluid return flow	DIN 3852-1 M27 × 2; 0.63 (16) deep	1750 (120)	O
M_{A2}, M_{B2}, M_P	Control pressure measuring	DIN 3852-1 M14 × 1.5; 0.47 (12) deep	4550 (315)	X
R₂ ... R₇	Air bleeding the stroking chamber	DIN 3852-1 M14 × 1.5; 0.47 (12) deep	4550 (315)	X

1) Depending on the application, momentary pressure peaks can occur. Keep this in mind when selecting measuring devices and fittings.

2) O = Must be connected (plugged on delivery)
 X = Plugged (in normal operation)

HS5E(P) – control system with integrated digital electronics (OBE)

Type	NG	40	71	125	180	250	355	450	500	750	1000	
(A)A4VSO		●	●	●	●	●	●	–	●	○	○	HS5E(P)
(A)A4VSG		●	●	●	●	●	●	–	●	●	●	
(A)A4CSG		–	–	–	–	●	●	–	●	●	–	
A4VBO		–	●	●	–	●	–	●	–	–	–	

An axial piston variable pump with HS5E is a complete solution for an entire Bosch Rexroth pump control system for electro-hydraulic

- ▶ swivel angle control
 - ▶ Pressure control (optional HS5EP)
 - ▶ Torque limitation (optional HS5EP)
- and external control pressure supply.

The control system consists of the following components:

- ▶ (A)A4VSO, (A)A4VSG, (A)A4CSG or A4VBO axial piston variable pump
- ▶ Directional control valve with **On Board Electronics**
- ▶ Swivel angle sensor for detecting pump swivel angle
- ▶ Optional (HS5EP): one pressure transducer with (A)A4VSO or two pressure sensors with (A)A4VSG/(A)A4CSG

Machine and system dynamics must be optimized by the system operator using the pressure control function.

Spring-centering

Pump control spring centering comes standard. It is used for setting and adjustment in the depressurized neutral position, but without a defined reset during high-pressure operation. Spring centering is not a safety device.

To minimize the control fluid consumption, the stroking chambers are sealed in sizes 125 to 1000 and can be bled via the ports R2 to R7.

Swivel angle limitation

Minimum and maximum swivel angle limitation is mechanically adjustable up to 50 % $V_{g \max}$. For size 500, $V_{g \min}$ is adjustable up to 50 % $V_{g \max}$ and $V_{g \max}$ up to 70 % $V_{g \max}$.

Notice

Setting with (A)A4VSO (open circuit):

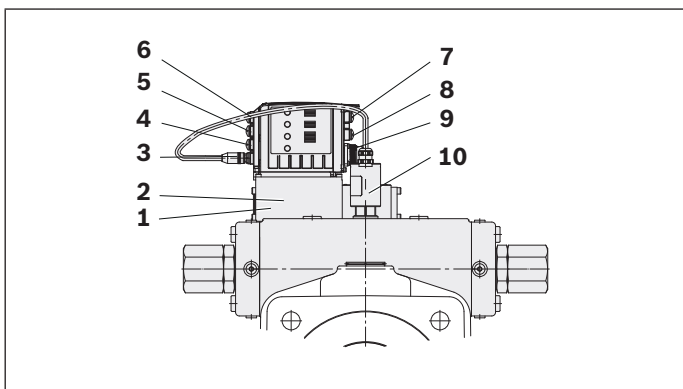
- ▶ The $V_{g \max}$ stop is set to nominal $V_{g \max}$ as standard. Please specify different values in your order
- ▶ The $V_{g \min}$ stop is set to $V_g = 0$ gpm (0 l/min) with $P_{HD} = 290$ psi (20 bar) as standard. Other values should be specified when placing the order.

Electrical control loop performance

	Swivel angle control	Pressure control ¹⁾
Linearity tolerance	≤ 1.0%	≤ 1.5% (≤ 1.0% ²⁾)
Temperature error	≤ 0.5% / 10 K	≤ 0.5% / 10 K
Hysteresis	≤ 0.2%	≤ 0.2%
Repeat accuracy	≤ 0.2%	≤ 0.2%

Connection

- ▶ 24 V voltage supply
- ▶ Ambient temperature -4 °F to +140 °F (-20 °C to +60 °C)
Hydraulic fluid temperature -4 °F to 158 °F (-20 °C to +70 °C)
- ▶ LED status indicator
- ▶ Interface for:
EtherNet/IP, Sercos III, EtherCAT,
ProfiNET RT connection

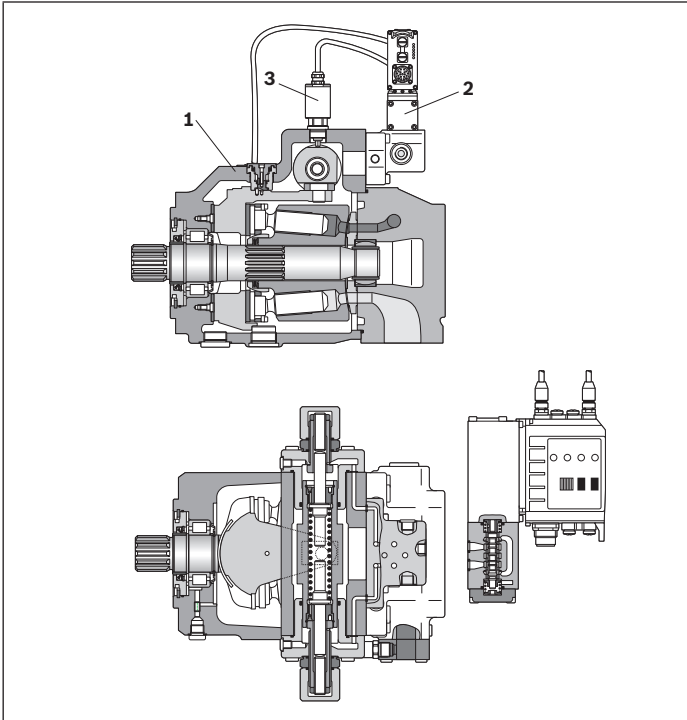


Example A4VS size 250

- | | |
|----|--|
| 1 | Proportional solenoid |
| 2 | Inductive position transducer for valve position |
| 3 | X8A actual swivel angle input |
| 4 | reserved, X2N |
| 5 | Configurable sensor interface X2M2 (Pressure sensor input) |
| 6 | Configurable sensor interface X2M1 (Pressure sensor input) |
| 7 | Multi-EtherNet interface X7E1 |
| 8 | Multi-EtherNet interface X7E2 |
| 9 | Plug-in connector XH4 |
| 10 | VT-SWA-LIN-G15 swivel angle sensor |

- 1) Without taking into account the pump pulsation
- 2) Using the integrated calibration function

Sectional view of (A)A4VSO ... HS5E(P)



- 1 Pump with hydraulic control device (A)A4VSO (see data sheet 92050)
- 2 HS5E pilot control valve

NG	Type
40 to 180	HS5E/6 CA 24L-2X/VH0/24MD7G
250 to 1000	HS5E/6 CA 40L-2X/VH0/24MD7G

- 3 Swivel angle sensor (see data sheet 30263):

NG	Type
40, 125 and 180	VT-SWA-LIN-1X/G15-1-C20
71	VT-SWA-LIN-1X/G15-2-C20
250 to 1000	VT-SWA-LIN-1X/G15-3-C20

with round connector 4-pin M12 × 1

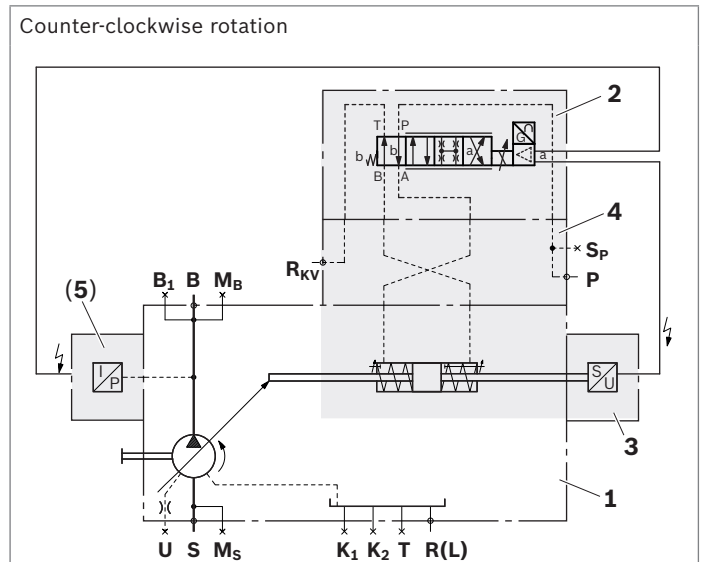
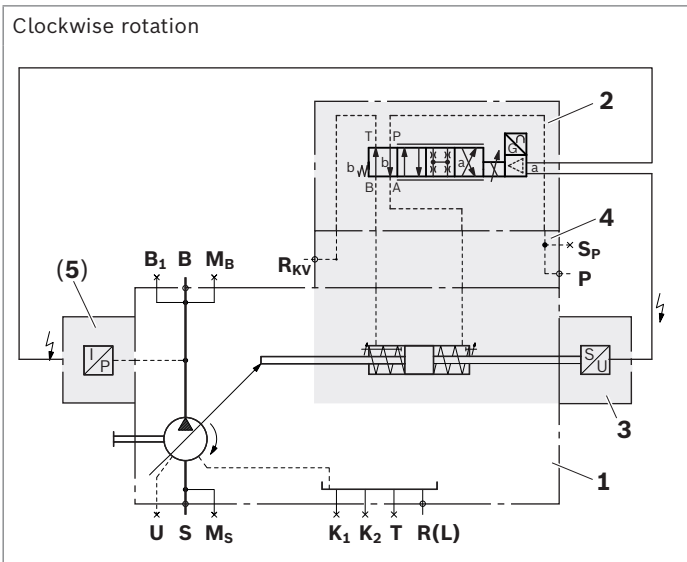
Optional:

- ▶ HS5EP with one or two pressure transducer(s) for pressure control and torque limitation
- ▶ HS5EL(P) with internal control fluid supply see HS5L
- ▶ HS5E(L)(V)(P) with speed variation (in preparation)

Circuit diagrams HS5EP

▼ **Sizes 40 and 71**

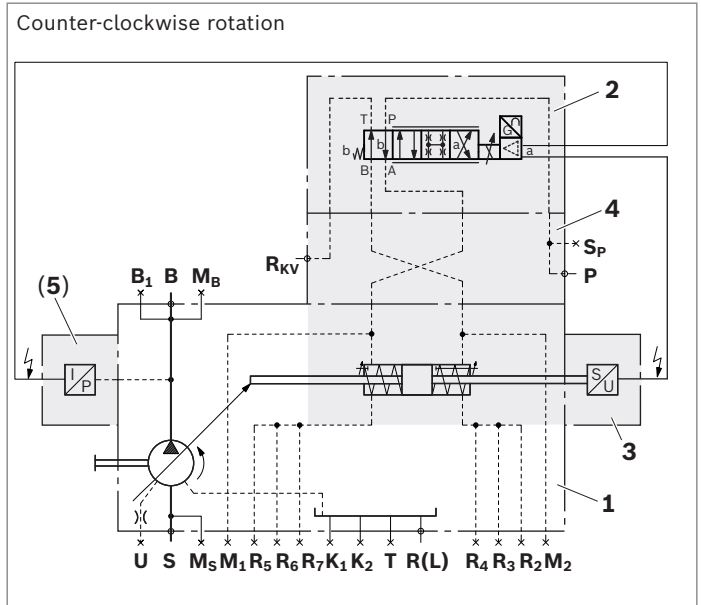
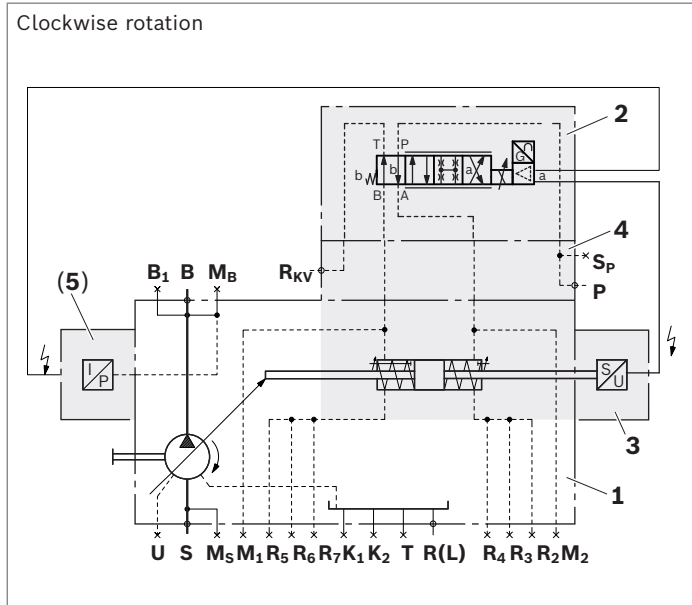
Example: (A)A4VSO...HS5EP (with pressure transducer)



Circuit diagrams HS5EP

▼ Sizes 125 to 500

Example: (A)A4VSO...HS5EP (with pressure transducer)



- 1 Pump with hydraulic control device
(A)A4VSO (see data sheet 92050), A4VBO
(see data sheet 92122)
- 2 Pilot control valve HS5E
- 3 Swivel angle sensor VT-SWA-LIN-1X/G15-...-C20
- 4 Intermediate plate
- 5 **Only with HS5EP:** Pressure transducer HM20-2X/630-C-K35
(see data sheet 30272) with intermediate flange, with (A)A4VSG
and (A)A4CSG, each pressure side has 1 pressure transducer
assigned and mounted

Connection table HS5E

Ports	
S	Suction port
B	Working port
P	Control pressure
S_P	Control pressure accumulator
R_{KV}	Control fluid return flow
M₁, M₂	Control pressure measuring
R₂ ... R₇	Air bleeding the stroking chamber
M_S	Suction pressure measuring
M_B	Measuring operating pressure
K₁, K₂	Flushing port
T	Drain port
R(L)	Fluid filling; air bleeding (drain port)
U	Flushing port
B₁	Additional connection

Electrical data of pilot control valve HS5E

Ambient and operating conditions

Characteristics		Values
Supply voltage ¹⁾	Nominal voltage	U_B 24 VDC
	Lower limit value	$U_B(t)_{min}$ 18 VDC
	Upper limit value	$U_B(t)_{max}$ 36 VDC
	maximum permissible residual ripple	2.5 Vss
Power consumption	maximum	P 40 W
Current consumption (in static control operation)	Rated current	I_{nom} 0.6 A
	Maximum current	I_{max} 2.3 A
Required external fuse protection		4 A, slow-blow
Ambient temperature range at the pump		-4 to +140 °F (-20 to +60 °C)
Storage temperature range pump/electronics	permissible	+32 to +158 °F (0 to +70 °C)
	Ideal storage temperature	+41 to +68 °F (+5 to +20 °C)
Hydraulic fluid temperature		-4 °F to +158 °F (-20 to +70 °C) (for detailed information see instruction manual 92076-01-B)
Cleanliness level of hydraulic fluid	according to ISO 4406 for particle size 4/6/14 µm	18/16/13

Environmentally acceptable systems for the areas of EMC, climate, and mechanical loading

Characteristics	Values
Mechanical loading: Sinus test according to DIN EN 60068-2-6	10 ... 2000 Hz / maximum 10g / 10 cycles / 3 axes
Mechanical loading: Noise check according to DIN EN 60068-2-64	20 ... 2000 Hz / 10g RMS / 30g peak / 30 min / 3 axes
Mechanical loading: Transport shock according to DIN EN 60068-2-27	15g / 11 ms / 3 axes
Electromagnetic compatibility (EMC)	
▶ EN 61000-6-2 / EN 61000-6-3	10 kV CD/15 kV AD with BWK B
– EN 61000-4-2 ESD	2 kV with BWK B
– EN 61000-4-4 burst	0.5 kV (sym./asym.) with BWK B
– EN 61000-4-5 surge	10 Veff (150 kHz ... 80 MHz)
– EN 61000-4-6 HF line-conducted	with BWK A
– EN 55016-2-1 radio interference voltage	0.15 ... 30 MHz, Class A, EN 55022
Maximum relative humidity (non-condensing)	95%
Design of electronics	Integrated on pilot valve (OBE)
Electrical connection	see following page 37
Type of protection according to EN 60529 (pump including pilot valve and sensors)	IP 65 with mounted and locked plug-in connectors

Notice

- ▶ The information about mechanical loading only refers to components containing electronics, i.e. the HS5E pilot control valve, HM20 and the VT-SWA-LIN.

¹⁾ Supply voltage is used directly for sensor connections **X2M1**, **X2M2**, and **X2N** (no internal voltage limitation)

Electrical features of inputs and outputs

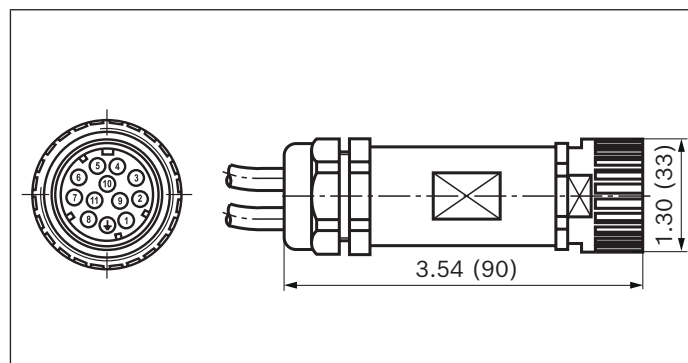
Ports		Values
Digital inputs XH4	Number	1 (+2 optional, configurable, if analog inputs are omitted)
	Low level	V -3 ... 5
	High level	V 15 ... U_B
	Current consumption at high level	mA < 1
	Reference potential	Pin 5
Digital Outputs XH4	Number	1
	Low level	V 0...3
	High level	V 15 ... U_B
	Current capacity	A 1.5 (short circuit resistant)
	Signal delay time	ms < 2 (depending on set scan time)
	Reference potential	GND
Analog inputs XH4	Number (current or voltage input parameterizable)	2 optional, configurable, if digital inputs are omitted
	AD resolution	Bit 12
	Voltage inputs (differential inputs)	
	– measuring range	V -10...+10
	– input resistance	k Ω 80 +10%
	– temperature drift	< 14 mV / 10 K
	Current inputs (reference to AGND)	
	– input current	mA 4 ... 20 (0 ... 20 physical)
	– input resistance	Ω 200, measuring resistor plus FET
	– temperature drift	< 25 μ A / 10 K
Analog outputs XH4	Number (current or voltage input parameterizable)	1
	AD resolution	Bit 10
	Voltage outputs	
	– output range	V -10 ... +10 (0 ... 10 by software)
	– minimum load impedance	k Ω 10
	– temperature drift	< 5 mV / 10 K
	Current outputs	
	– output range	mA 0 ... 20 (4 ... 20 by software)
– maximum ohmic resistance	Ω 200	
Analog sensors X2M1, X2M2	Number (current or voltage input configurable)	1 per connector
	Supply voltage	V 24 (same as supply voltage applied to XH4)
	Maximum supply current	mA 350 (total X2M1, X2M2 and X2N)
	AD resolution	Bit 12
	Voltage inputs	
	– measuring range	V 0 ... 20
	– input resistance	k Ω 200 +/-10 %
	– temperature drift	< 15 mV / 10 K
	Current inputs (reference to AGND)	
	– input current	mA 4...20 (0...20 physical)
– input resistance	Ω 200, measuring resistor plus PTC	
– temperature drift	< 10 μ A / 10 K	

XH4: Signals and pin assignment of the central connector

The following table shows the pin assignment of the central connector 11 + PE for pilot control valve HS5E. The "code" column refers to the cable kit that can be ordered as optional accessories.

(For cable sets, see instruction manual 92076-01-B chapter "Cable sets")

▼ XH4: Central connector



Pin	Signal	Description	Signal direction	Signal level	Code
1	+ U _B	Voltage supply	IN	+24 V	1
2	L0	Reference potential for voltage supply	-	-	2
⊕	Ground	Ground connection for the electronics	-	-	Yellow/ green
3	DO	Switching output 24 V, max. 1.5 A Factory setting: Error signal	OUT	Logical 24 V (Load I _{max} ≤ 50 mA)	white
4	M0	Reference potential for analog signals	-	-	yellow
5	AI 2	Analog input 2 (or digital input, configuration via software) factory setting: Swivel angle setpoint value standardized	IN	analog +/-10V (digital 24V)	green
6	AO 2	Analog output 2 factory setting: Swivel angle actual value standardized	OUT	+/- 10V or 0-20 mA (Load I _{max} ≤ 1 mA)	Violet
7	AI 1	Analog input 1 (or digital input, configuration via software) Factory setting: Pressure setpoint value standardized	IN	+/- 10 V or 24 V digital	Pink
8	AO 1	Analog output 1 factory setting: Actual pressure value standardized	OUT	+/- 10V or 0-20 mA (Load I _{max} ≤ 1 mA)	red
9	DI	Digital input (use can be freely configured) Factory setting: Error reset	IN	Logical 24 V	Brown
10	Actual pressure value High	Pressure sensor input: Signal level dependent on parameter setting.	IN	0-10 V, 0-20 mA (freely configurable)	Black
11	Actual pressure value Low	Reference potential for actual pressure value High (pin 10)	-	-	blue
n.c.					gray

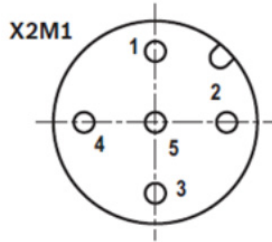
Notice

- ▶ Connect ports M0 and L0 in the control cabinet to prevent potential shifts.
- ▶ Signal lines (pin 3 to 11) must be shielded.
The shielding must be connected to the control on one side!

X2M1 and X2M2: Analog, configurable pressure sensor interface (coding A), M12, 5-pin, socket

Pin assignment of X2M1 and X2M2:

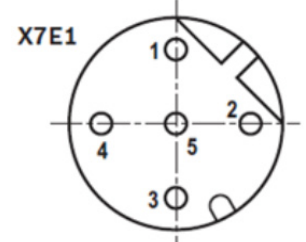
Pin	Assignment
1	+ 24 V voltage output (sensor supply) ¹⁾
2	Sensor signal input for current (4 ... 20 mA) ²⁾
3	GND
4	Sensor signal input voltage (0 ... 10V) ²⁾
5	Negative differential amplifier input to pin 4 (optional)



X7E1 and X7E2: Plug-in connector assignment for Ethernet interface (coding D), M12, 4-pin, socket

Pin assignment of X7E1 and X7E2:

Pin	Assignment
1	TxD +
2	RxD +
3	TxD -
4	RxD -
5	not assigned



- ▶ Use a shielded bus cable as the data cable. When doing this, the shield should be connected to the connector housing.
- ▶ Ethernet M12 connection cable, please contact Rexroth for the material number.

Voltage supply of the HS5E pilot control valve

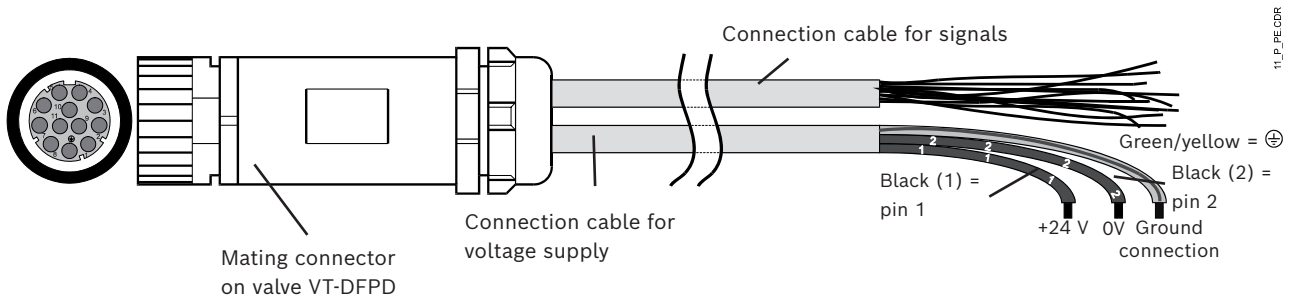
The HS5E pilot control valve is supplied with 24 V DC. If this system-side voltage supply is not present, you can use the VT-NE30-2X/ power supply unit according to data sheet 29929. You connect the 24 V of the power supply unit to connections 1 (+24 V) and 2 (L0) of the plug-in connector. With the available connection cable, this corresponds to the two black wires of the 0.0015 inch² (1 mm²) cross-section 3-pole cable. In this context, you must connect the wire labeled "1" to +24 V and the one labeled "2" to L0 (Ground). The yellow/green wire must be connected to ground.

Connecting the voltage supply of the HS5E pilot control valve Recommendation:

On the system-side, the voltage supply of the HS5E pilot control valve should be fuse-protected using a 4 A slow-blow fuse.

The HS5E pilot control valve does not have an enable input to block the function of the valve.

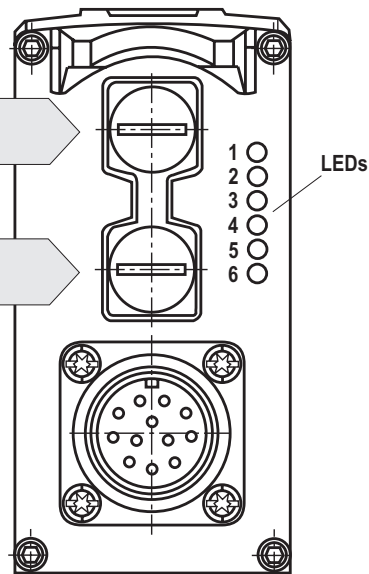
In the event of a fault, the drive enable should be canceled via fieldbus. All other safety-relevant intervention must be carried out by the higher-level control (e.g. drive motor OFF, close isolator valves, etc.)



1) Maximum load capacity 50 mA, voltage output same as connected voltage supply at input XH4.
 2) Only one signal input per interface can be configured

LED status indicators

LED	Interface	Sercos	EtherNET/IP	EtherCAT	PROFINET
1	X7E1	Activity	Activity	not used	Activity
2		Link	Link	Link/Activity	Link
3	Electronics- module	S	Network status	Network status	Network status
4		Module status	Module status	Module status	Module status
5	X7E2	Activity	Activity	not used	Activity
6		Link	Link	Link/Activity	Link



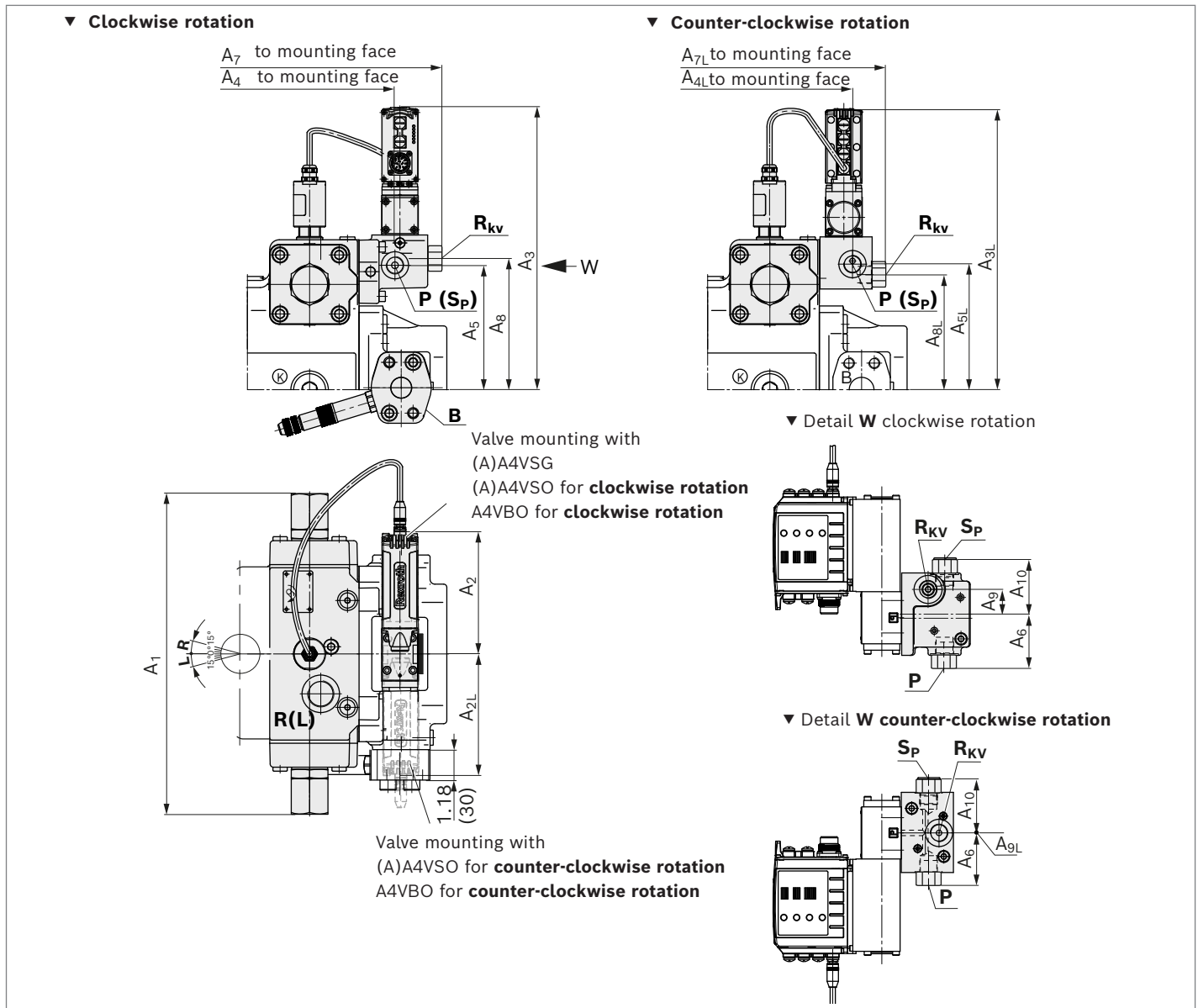
Indication of status LED

Module status LED (LED 4)	Indication status	Network status LED	Indication status
Off	No voltage supply	Off	No voltage supply
Green/red flashing	Self-test	Green	Operation
Green flashing	Drive ready for operation		
Green	in control		
Red flashing	Warning		
Red	Fault		

- ▶ LEDs 1, 2, 5, and 6 refer to interfaces "X7E1" and "X7E2"
 - Link: Cable is plugged in, connection has been established (lit up permanently)
 - Activity: Data has been sent/received (flashing)
 - Module status LEDs 3 and 4 refer to the electronics module
- For a detailed description of the diagnosis LEDs, refer to the functional description of the Rexroth HydraulicDrive.

Dimensions HS5E(P)

▼ **(A)A4VSO, size 40 to 71, example: (A)A4VSO HS5EP with pressure transducer in B** (clockwise rotation with; counter-clockwise without HM20)



NG	A ₁	A ₂	A _{2L}	A ₃	A _{3L}	A ₄	A _{4L}	A ₅	A _{5L}	A ₆	A ₇	A _{7L}	A ₈	A _{8L}	A ₉	A _{9L}	A ₁₀
40	11.65 (296)	6.46 (164)	6.53 (166)	12.59 (319.7)	11.85 (301)	8.74 (222)	9.04 (229.5)	4.25 (108)	4.21 (107)	3.11 (79)	11.97 (304)	11.18 (284)	5.04 (128)	3.70 (94)	1.18 (30)	0 (0)	3.11 (79)
71	13.07 (332)	6.27 (159.3)	6.34 (161)	13.19 (335)	12.52 (318)	9.80 (249)	10.10 (256.5)	4.84 (123)	4.80 (122)	3.13 (79.4)	13.03 (331)	12.24 (311)	5.63 (143)	4.29 (109)	1.18 (30)	0 (0)	3.17 (80.6)

For detailed dimensions and technical data of the variable pump, see data sheet 92050 ((A)A4VSO)

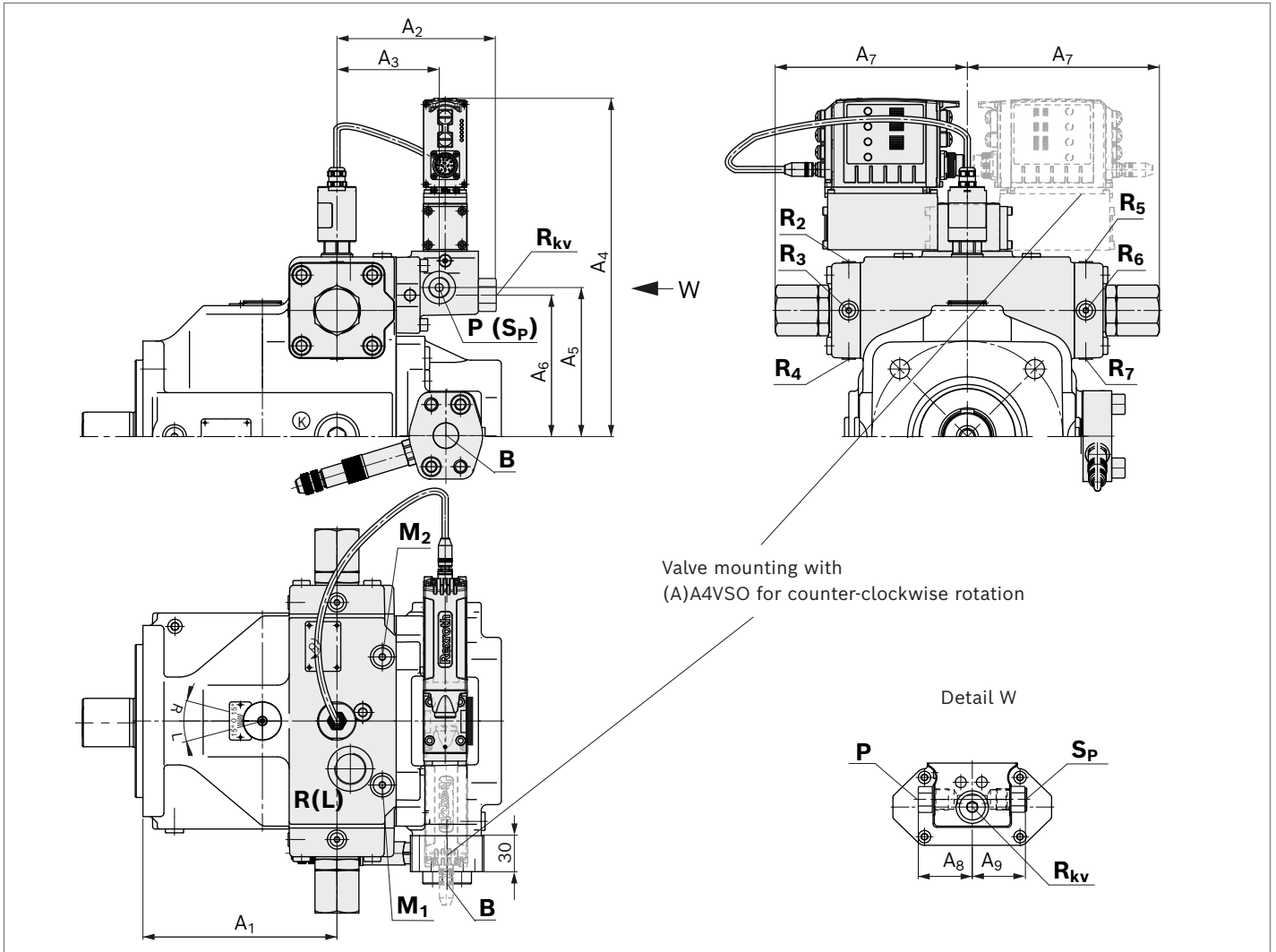
Ports	Standard	Size	p_{max} [psi (bar)] ¹⁾	State ²⁾	
P, SP	Control pressure	ISO 11926	7/8-14UNF-2B; 0.67 (17) deep	4550 (315)	O
R_{kv}	Control fluid return flow	ISO 11926	7/8-14UNF-2B; 0.67 (17) deep	1750 (120)	O

1) Depending on the application, momentary pressure peaks can occur. Keep this in mind when selecting measuring devices and fittings.

2) O = Must be connected (plugged on delivery)
X = Plugged (in normal operation)

Dimensions HS5E(P)

▼ (A)A4VSO, sizes 125 to 355



NG	A ₁	A ₂	A ₃	A ₄	A ₅	A ₆	A ₇	A ₈	A ₉
125	7.99 (203)	7.01 (178)	4.21 (107)	13.50 (343)	6.14 (156)	5.83 (148)	6.97 (177)	2.76 (70)	2.76 (70)
180	7.99 (203)	7.01 (178)	4.21 (107)	13.94 (354)	6.14 (156)	5.83 (148)	7.91 (201)	2.76 (70)	2.76 (70)
250/355	9.76 (248)	7.68 (195)	4.88 (124)	14.92 (379)	7.56 (192)	7.24 (184)	9.55 (242.5)	2.76 (70)	2.76 (70)

For detailed dimensions and technical data of the variable pump (A)A4VSO, see data sheet 92050

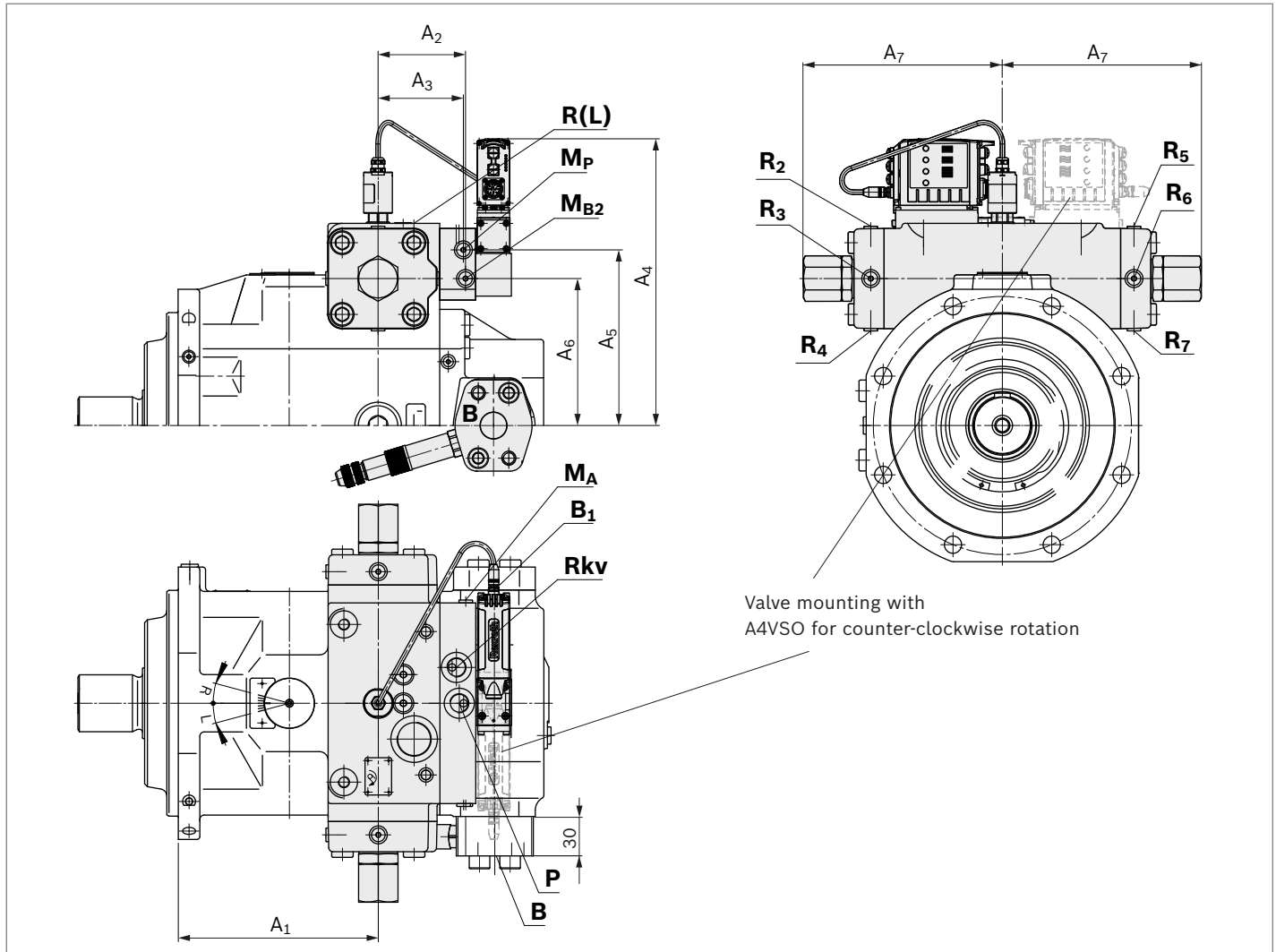
Ports	Standard	Size	p_{max} [psi (bar)] ¹⁾	State ²⁾	
M₁, M₂	Control pressure measuring	DIN 3852-1	M14 x 1.5; 0.47 (12) deep (NG 125 and 180) M18 x 1.5; 0.47 (12) deep (NG 250 and 355)	4550 (315)	X
P, SP	Control pressure	ISO 11926	7/8-14UNF-2B; 0.67 (17) deep	4550 (315)	O
R₂ ... R₇	Air bleeding the stroking chamber	DIN 3852-1	M14 x 1.5; 0.31 (8) deep	4550 (315)	X
R_{KV}	Control fluid return flow	ISO 11926	7/8-14UNF-2B; 0.67 (17) deep	1750 (120)	O

1) Depending on the application, momentary pressure peaks can occur. Keep this in mind when selecting measuring devices and fittings.

2) O = Must be connected (plugged on delivery)
 X = Plugged (in normal operation)

Dimensions HS5E(P)

▼ **A4VSO, size 500**



NG	A ₁	A ₂	A ₃	A ₄	A ₅	A ₆	A ₇	
500	10.98 (279)	4.80 (122)	4.68 (119)	15.75 (400)	9.65 (245)	8.07 (205)	10.93 (277.5)	For detailed dimensions and technical data of the variable pump, see data sheet 92050 (A4VSO)

Ports	Standard	Size	p_{max} [bar] ¹⁾	State ²⁾
M_{B1}	Control pressure measuring	DIN 3852-1	M18 × 1.5; 0.47 (12) deep	4550 (315) X
M_{B2}, M_A, M_P	Control pressure measuring	DIN 3852-1	M14 × 1.5; 0.47 (12) deep	4550 (315) X
P	Control pressure	DIN 3852-1	M27 × 2; 0.63 (16) deep	4550 (315) O
R₂ ... R₇	Air bleeding the stroking chamber	DIN 3852-1	M14 × 1.5; 0.47 (12) deep	4550 (315) X
R_{KV}	Control fluid return flow	DIN 3852-1	M27 × 2; 0.63 (16) deep	1750 (120) O

1) Depending on the application, momentary pressure peaks can occur. Keep this in mind when selecting measuring devices and fittings.

2) O = Must be connected (plugged on delivery)
 X = Plugged (in normal operation)

HS5EV(P) – control supply with integrated digital electronics (OBE) and internal control pressure supply

Type	NG	40	71	125	180	250	355	500	750	1000	
(A)A4VSO		•	•	•	•	•	•	–	–	–	HS5EV(P)
(A)A4VBO		–	•	•	–	•	–	–	–	–	

An axial piston variable pump with HS5E control system is a complete solution for an entire Bosch Rexroth pump control system for an electro-hydraulic

- ▶ swivel angle control
 - ▶ pressure control (optional HS5EVP)
 - ▶ torque limitation (optional HS5EVP)
- with internal control pressure supply.

The control system consists of the following components:

- ▶ (A)A4VSO or A4VBO axial piston variable pump
- ▶ Directional control valve with **On Board Electronics**
- ▶ Swivel angle sensor for detecting pump swivel angle
- ▶ Optional (HS5EVP): one pressure transducer with (A)A4VSO and A4VBO

Machine and system dynamics must be optimized by the system operator using the pressure control function.

In contrast to the HS5E control system, the HS5EV control system eliminates the need for an external control pressure supply. The control pressure supply takes place directly from the high pressure.

With the electric motor switched off and actuator system depressurized, the pump swivels to maximum displacement ($V_{g \max}$) through spring force.

For reliable control, the system pressure must be at least 290 psi (20 bar).

If the pump is to be controlled below 290 psi (20 bar), a preload block is required for generating the required control power. You need to contact us for a specific application.

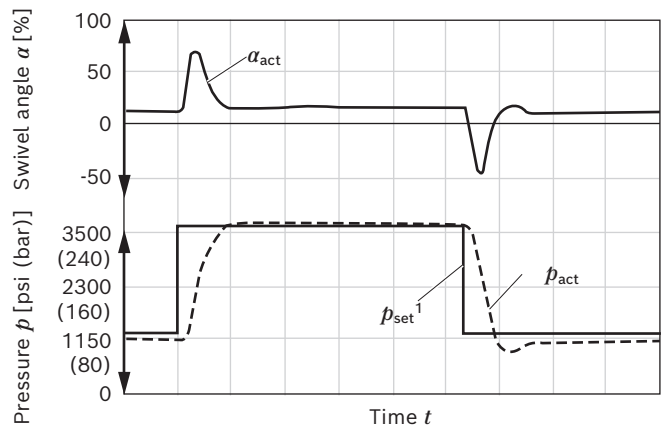
Property, basic position de-energized

With the proportional valve de-energized, the pump outlet plugged and the axial piston unit rotating, a minimum pressure (approx. 87 to 145 psi (6 to 10 bar)) settles.

Swiveling range –100 % to +100 %

As a special feature, the pump can switch the conveying direction. This feature of switching over the neutral position enables a quick pressure reduction via the pump.

▼ Dynamic characteristic curve for pressure reduction via the pump



Technical data: Working pressure HS5E control system

Size	NG	40 to 355
Maximum working pressure $p_{\max}^{1)}$	psi (bar)	5100 (350)
Minimum working pressure p_{\min}	psi (bar)	290 (20)

Electrical control loop performance

	Swivel angle control	Pressure control ¹⁾
Linearity tolerance	$\leq 1.0\%$	$\leq 1.5\%$ ($\leq 1.0\%^{2)}$)
Temperature error	$\leq 0.5\%$ / 10 K	$\leq 0.5\%$ / 10 K
Hysteresis	$\leq 0.2\%$	$\leq 0.2\%$
Repeat accuracy	$\leq 0.2\%$	$\leq 0.2\%$

Notice

- ▶ Information on electrical data and ambient and operating conditions of the pilot control valve as well as further information on the central connector can be found on page 35 and 37.

1) Without taking into account the pump pulsation

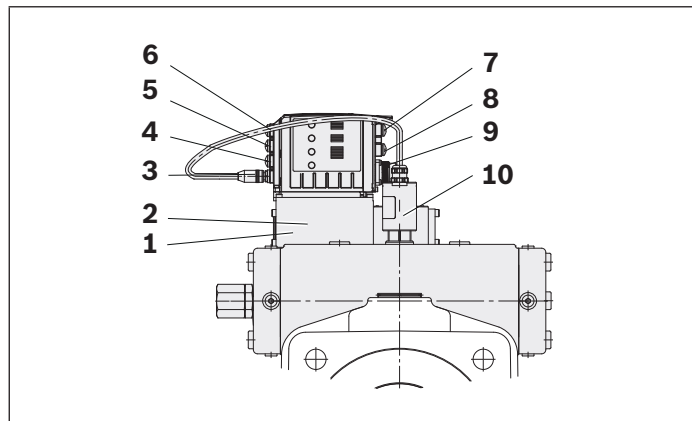
2) Using the integrated calibration function

HS5EV(P) – control supply with integrated digital electronics (OBE) and internal control pressure supply

Connection

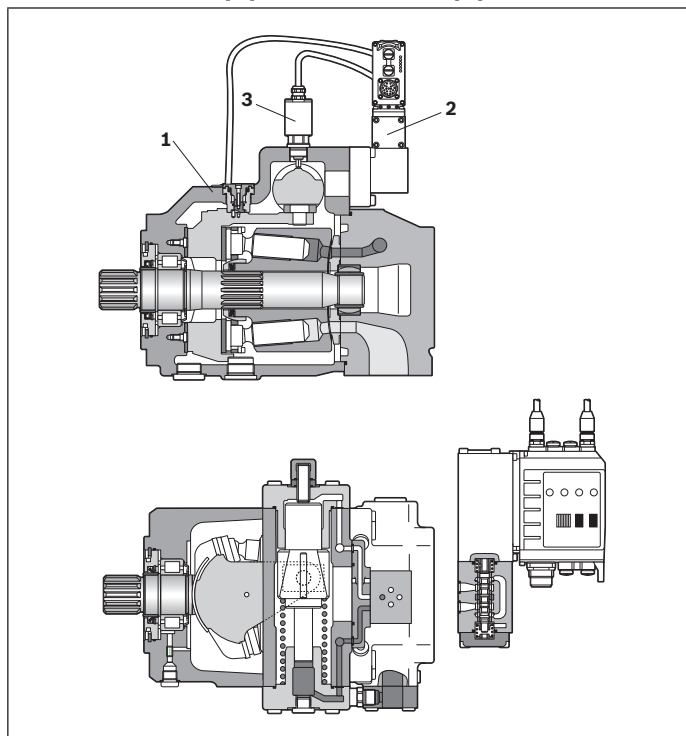
- ▶ 24 V voltage supply
- ▶ Ambient temperature -4 °F to 140 °F (-20 °C to +60 °C)
Hydraulic fluid temperature -4 °F to 158 °F (-20 °C to +70 °C)
- ▶ LED status indicator
- ▶ Interface for:
EtherNet/IP, Sercos III, EtherCAT, ProfiNET RT connection

For further technical information see HS5E



Example: (A)A4VSO size 250, clockwise rotation

- | | |
|----|---|
| 1 | Proportional solenoid |
| 2 | Inductive position transducer for valve position |
| 3 | X8A actual swivel angle input |
| 4 | reserved, X2N |
| 5 | Configurable sensor interface X2M2
(Pressure sensor input) |
| 6 | Configurable sensor interface X2M1
(Pressure sensor input) |
| 7 | Multi-EtherNet interface X7E1 |
| 8 | Multi-EtherNet interface X7E2 |
| 9 | Plug-in connector XH4 |
| 10 | VT-SWA-LIN-G15 swivel angle sensor |

Sectional view of (A)A4VSO...HS5EV(P)

- 1 Pump (A)A4VSO with hydraulic control device
(see data sheet 92050)
- 2 HS5E pilot control valve

NG	Type
40 to 180	HS5E/6 CA 24L-2X/VH0/24MD7G
250 and 355	HS5E/6 CA 40L-2X/VH0/24MD7G

- 3 Swivel angle sensor (see data sheet 30263):

NG	Type
40, 125 and 180	VT-SWA-LIN-1X/G15-1-C20
71	VT-SWA-LIN-1X/G15-2-C20
250 to 1000	VT-SWA-LIN-1X/G15-3-C20

with round connector 4-pin M12 × 1

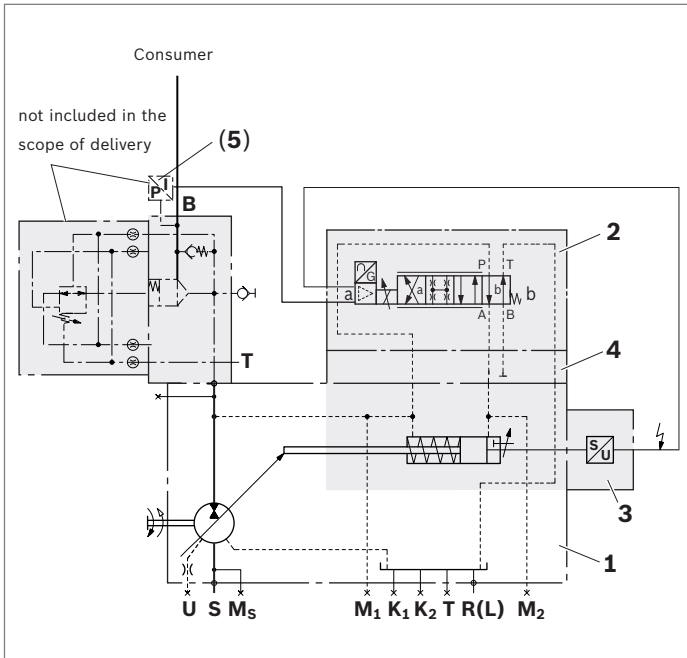
Optional:

- ▶ HS5EVP with a pressure transducer for pressure control and torque limitation

System circuit diagram HS5EVP

▼ **(A)A4VSO, size 40 to 355**

Example: (A)A4VSO 250HS5EVP with preload block AGEV



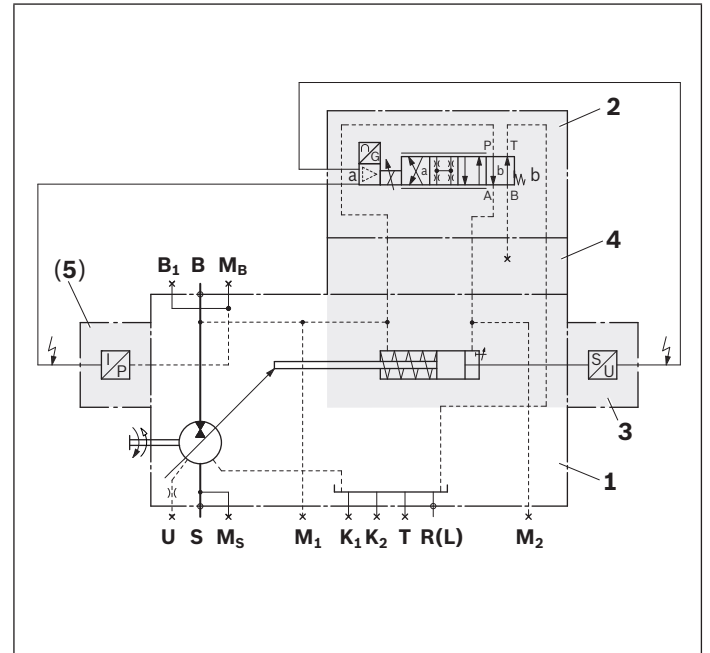
Ports

S	Suction port
B	Working port
M₁, M₂	Control pressure measuring
M_s	Suction pressure measuring
K₁, K₂	Flushing port
T	Drain port
R(L)	Fluid filling; air bleeding (drain port)
U	Flushing port

Circuit diagram HS5EVP

▼ **Sizes 40 to 355**

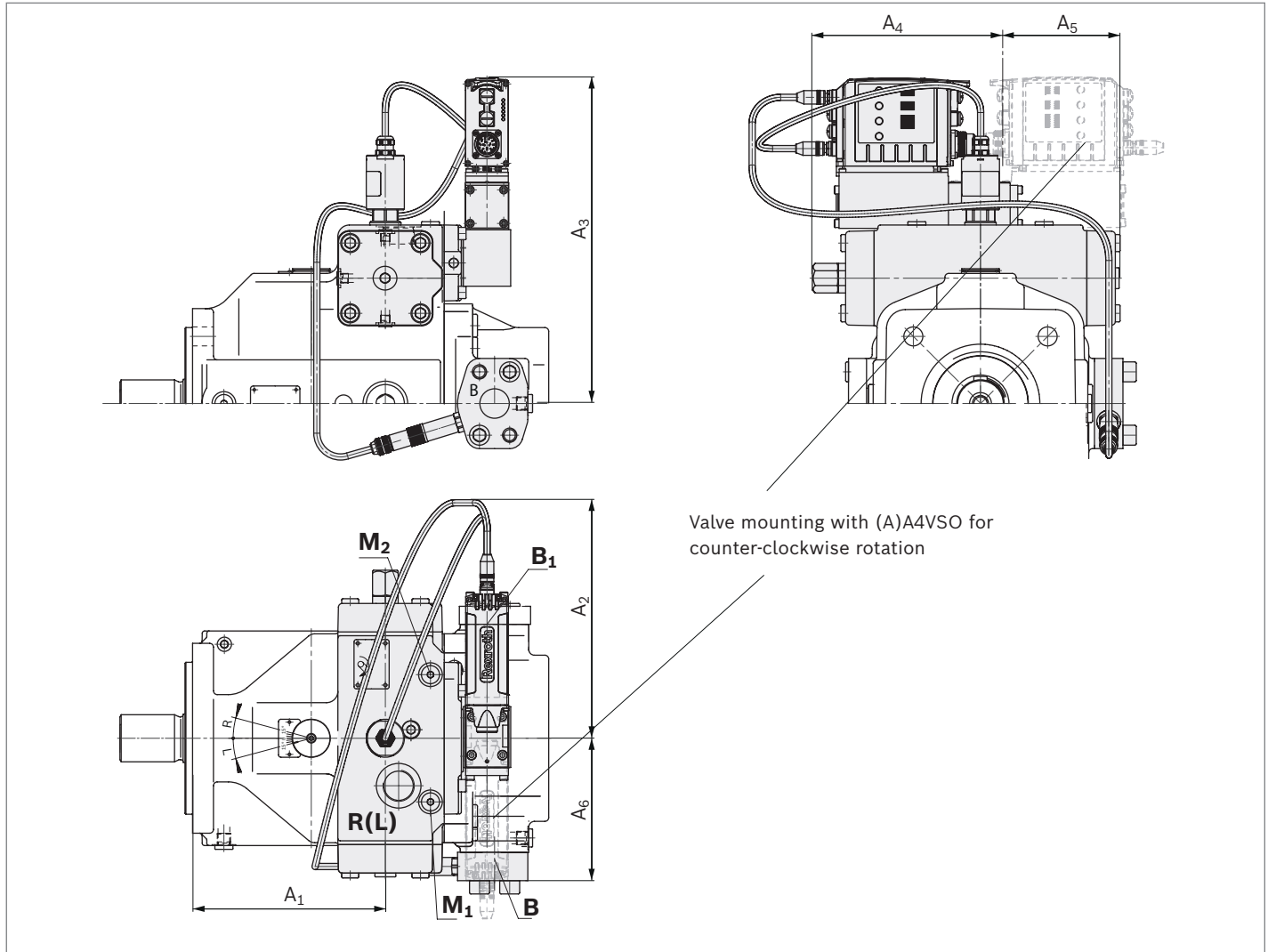
Example: (A)A4VSO...HS5EVP (with pressure transducer)



- 1 Pump with hydraulic control device (A)A4VSO (see data sheet 92050), A4VBO (see data sheet 92122)
- 2 Pilot control valve HS5E
- 3 Swivel angle sensor VT-SWA-LIN-1X/G15-...-C20
- 4 Intermediate plate
- 5 **Only with HS5EVP:** Pressure transducer HM20-2X/630-C-K35 (see data sheet 30272) with intermediate flange.

Dimensions HS5EVP

▼ **(A)A4VSO, sizes 40 to 355, clockwise rotation**



NG	A ₁	A ₂	A ₃	A ₄	A ₅	A ₆
40	5.67 (144)	11.10 (282)	11.55 (293.5)	5.12 (130)	4.09 (104)	4.72 (120)
71	6.54 (166)	9.92 (252)	12.16 (309)	15.83 (148)	4.96 (126)	4.82 (122.5)
125	7.99 (203)	9.88 (251)	13.50 (343)	6.97 (177)	5.79 (147)	5.61 (142.5)
180	7.99 (203)	9.84 (250)	13.50 (343)	6.97 (177)	5.79 (147)	5.91 (150)
250	9.76 (248)	9.76 (248)	14.92 (379)	8.39 (213)	7.05 (179)	6.85 (174)
355	9.76 (248)	9.76 (248)	14.92 (379)	8.39 (213)	7.05 (179)	7.01 (178)

For detailed dimensions and technical data of the variable pump (A)A4VSO, see data sheet 92050

Ports	Standard	Size	p_{max} [psi (bar)] ¹⁾	State ²⁾
M ₁ , M ₂	Control pressure measuring DIN 3852-1	M14 × 1.5; 0.47 (12) deep (NG 40 to 180) M18 × 1.5; 0.47 (12) deep (NG 250 and 355)	4550 (315)	X

1) Depending on the application, momentary pressure peaks can occur. Keep this in mind when selecting measuring devices and fittings.

2) O = Must be connected (plugged on delivery)
 X = Plugged (in normal operation)

HS5EL – control with internal control pressure supply for (A)A4CSG

Type	NG	250	355	500	750	
(A)A4CSG		●	●	●	●	HS5EL

The **HS5EL** variant corresponds to the HS5E version but with internal control pressure supply. With a rotating pump and not active control (valve de-energized), the pump swivels to $-V_{g\max}$ by the boost pressure.

The control pressure supply takes place directly from the high pressure or boost pressure. This removes the need for an external control pressure supply.

With the electric motor switched off and actuator system depressurized, the pump swivels to 0 swivel angle through spring-centering.

Notice

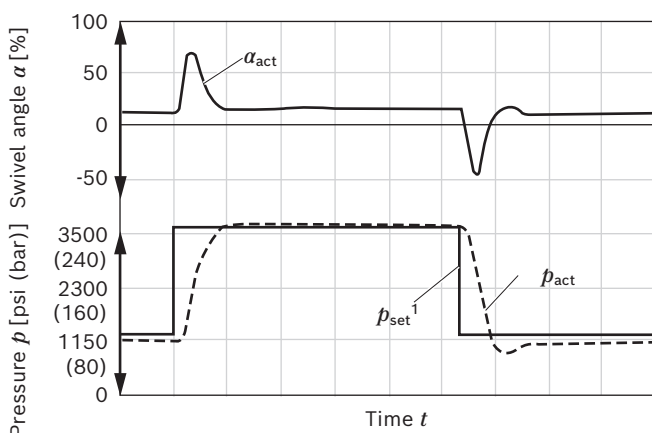
- ▶ The spring feedback in the controller and pump control spring centering are no safety devices. The controller can stick in an undefined position due to internal contamination (contaminated hydraulic fluid, abrasion or residual contamination from system components). As a result, the flow in the axial piston unit will no longer respond correctly to the operator's specifications. Check whether the application on your machine requires additional safety measures to bring the driven consumer to a safe position (immediate stop).

For safe control, the control pressure must be twice the boost pressure (for NG 355 +75 psi (+5 bar)). See also boost pressures in data sheet 92105.

Swiveling range -100 % to +100 %

As a special feature, the pump can switch the conveying direction. This feature of switching over the neutral position enables a quick pressure reduction via the pump.

▼ Dynamic characteristic curve for pressure reduction via the pump



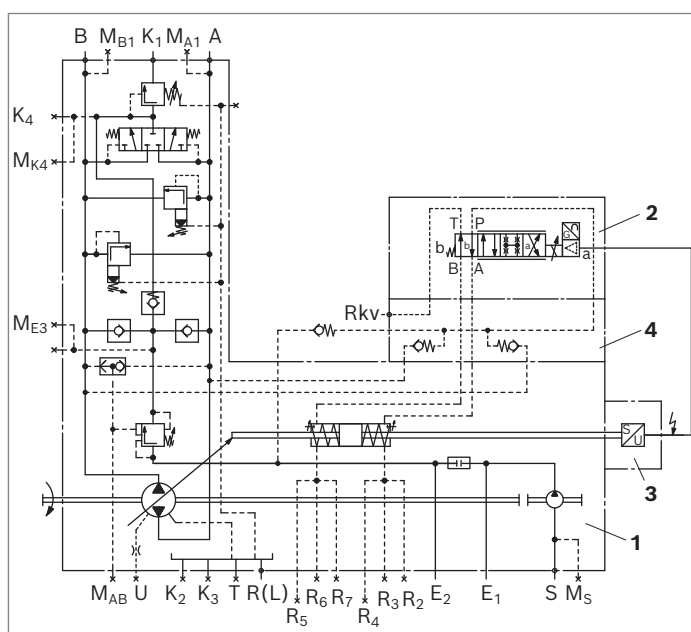
Technical data HS5EL

Size	NG	250 to 750
Maximum working pressure	$p_{\max}^{1)}$ psi	5100 (350) (bar)
Minimum working pressure	p_{\min} psi	290 (20) (bar)
Minimum required control pressure	p_{\min}	Double boost pressure +75 psi (+5 bar) for size 355

Circuit diagram HS5EL

▼ Sizes 250 to 750

Example: (A)A4CSG 250HS5EL



1 Pump with hydraulic control device A4CSG (see data sheet 92105)

2 HS5E pilot control valve

3 Swivel angle sensor (see data sheet 30263):

NG	Type
250 to 750	VT-SWA-LIN-1X/G15-3-C20

with round connector 4-pin M12 × 1

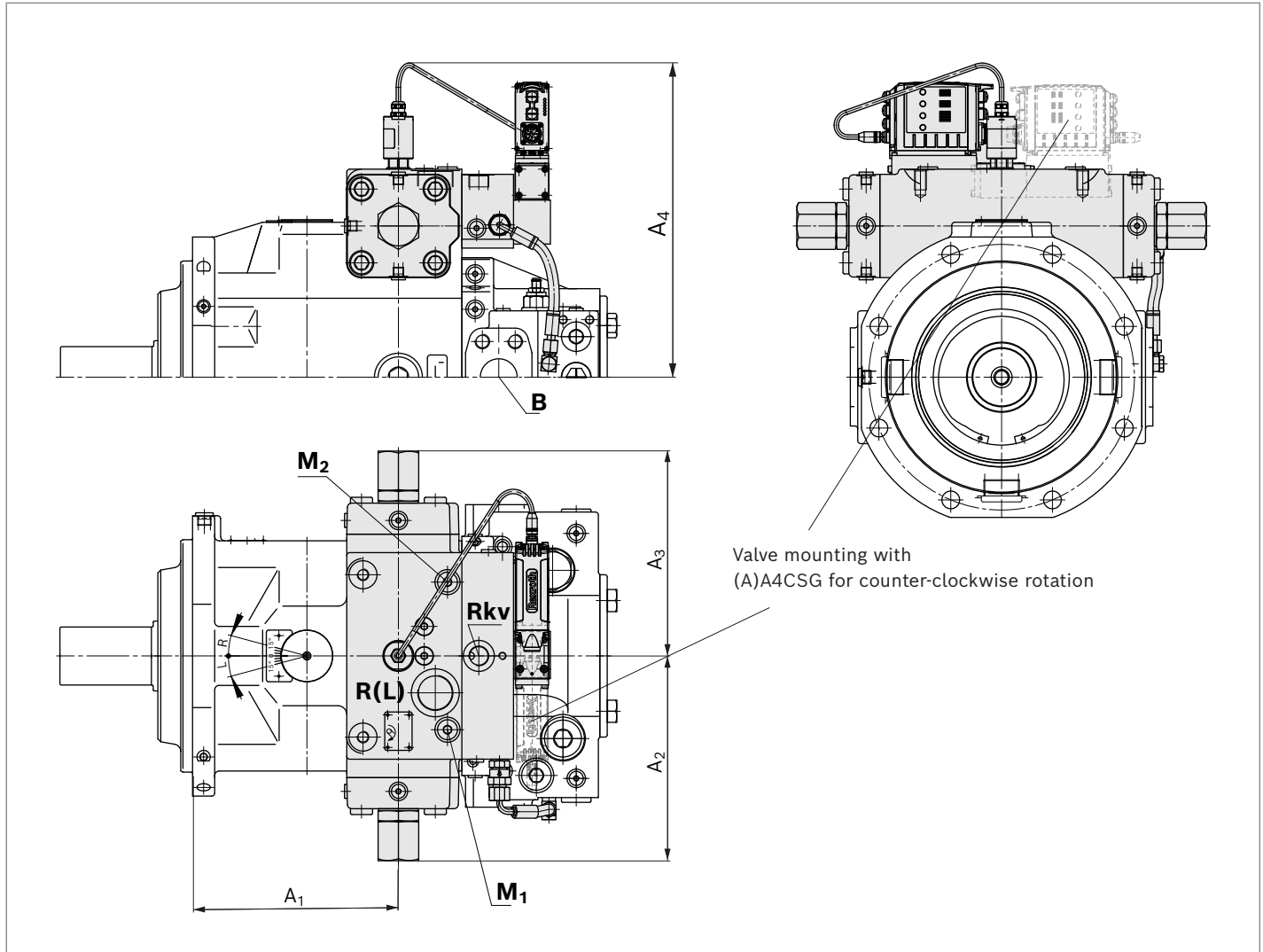
4 Intermediate plate

▼ Flow direction in closed circuit

Direction of rotation		Swiveling range
clockwise	counter-clockwise	
B to A	A to B	clockwise
A to B	B to A	counter-clockwise

Dimensions HS5EL

▼ **A4CSG, sizes 250 to 750, clockwise rotation**



NG	A ₁	A ₂	A ₃	A ₄	
250	9.76 (248)	9.55 (242.5)	9.55 (242.5)	15.35 (390)	
355	9.76 (248)	9.55 (242.5)	9.55 (242.5)	15.35 (390)	For detailed dimensions and technical data of the variable pump (A)A4CSG, see data sheet 92105
500	10.98 (279)	10.94 (278)	10.94 (278)	–	
750	10.98 (279)	10.94 (278)	10.94 (278)	–	

Ports	Standard	Size	p_{max} [psi (bar)] ¹⁾	State ²⁾
M ₁ , M ₂	Control pressure measuring	DIN 3852-1	M18 × 1.5; 0.47 (12) deep (NG 250 and 355)	4550 (315) X
M _{A2} , M _P			M14 × 1.5; 0.47 (12) deep (NG 500)	4550 (315) X

1) Depending on the application, momentary pressure peaks can occur. Keep this in mind when selecting measuring devices and fittings.

2) O = Must be connected (plugged on delivery)
 X = Plugged (in normal operation)

HS5K / EO1K / EO2K – short circuit valve

Type	NG	40	71	125	180	250	355	500	750	1000	
(A)A4VSG		●	●	●	●	●	●	●	●	●	HS5K
(A)A4CSG		–	–	–	–	●	●	●	●	–	
(A)A4VSG		●	●	●	–	●	–	–	–	–	EO1K
(A)A4CSG		●	●	●	●	●	●	◇ ²⁾	◇ ²⁾	◇ ²⁾	
		–	–	–	–	●	●	◇ ²⁾	◇ ²⁾	–	EO2K

A 4/2-way shut-off valve is installed between the proportional or control valve and the control device.

Notice

- ▶ The short circuit switching is used for setting and adjustment in depressurized neutral position, but with no defined reset during high-pressure operation
- ▶ The spring feedback in the controller and pump control spring centering are no safety devices. The controller can stick in an undefined position due to internal contamination (contaminated hydraulic fluid, abrasion or residual contamination from system components). As a result, the flow in the axial piston unit will no longer respond correctly to the operator's specifications. Check whether the application on your machine requires additional safety measures to bring the driven consumer to a safe position (immediate stop).
- ▶ With a de-energized short circuit valve, the proportional valve has no function due to the interrupted connection, i.e. the control does not follow the setpoint value.

Detailed information on EO1 and EO2 control is available from page 53.

● = **short circuit valve** (4/2-way shut-off valve)

Type Z4WE6E68-3X/EG24N9Z4/V¹⁾ (see data sheet 23193, please observe limits of performance).

◇ = **short circuit valve** (4/2-way shut-off valve)

Type Z4WEH10E68-4X/6EG24N9ETZ4/B10D3¹⁾ (see data sheet 24753).

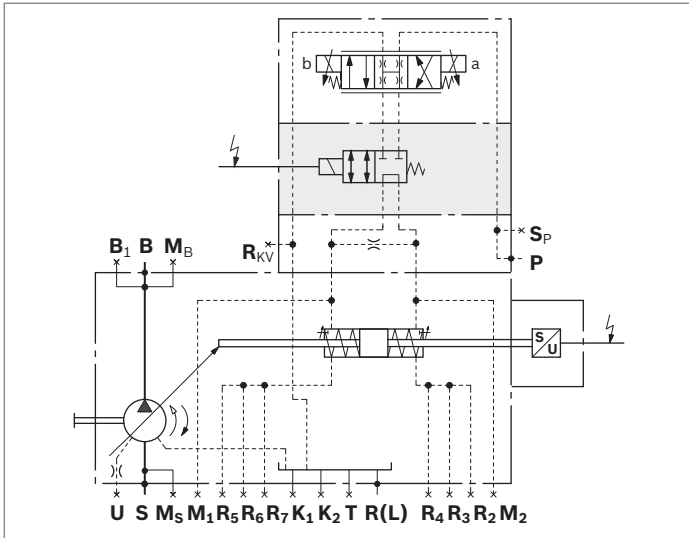
1) With plug-in connector according to DIN EN 175301-803 / ISO 4400 Cable gland M16 × 1.5 for cable diameters 0.18 to 0.39 inch (4.5 to 10 mm)

2) For circuit diagram and dimensions, see page 52

Circuit diagrams

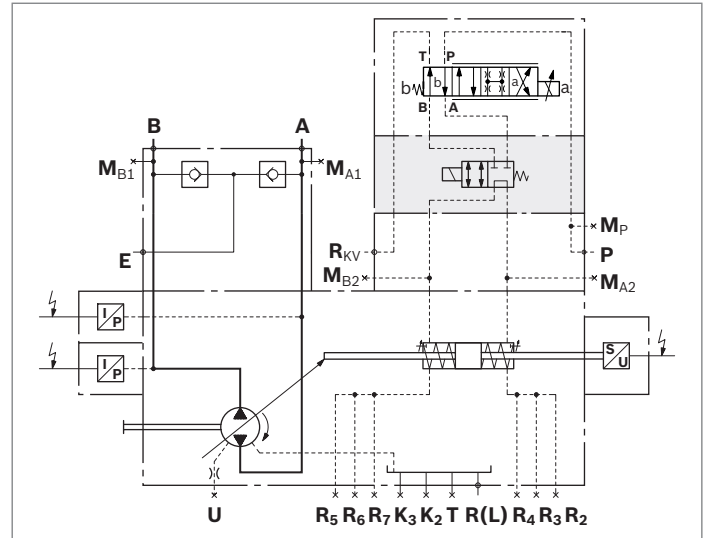
▼ **Sizes 125 to 355**

Example: open circuit (A)A4VSO **EO2K**



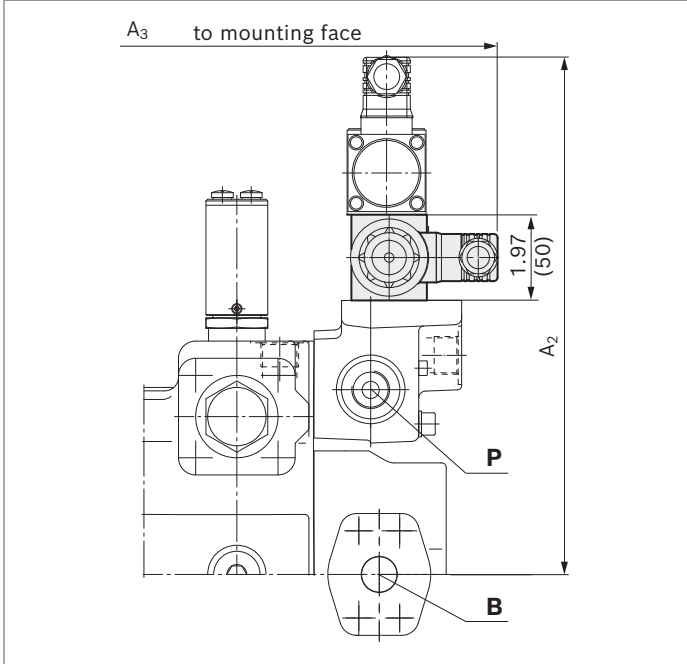
▼ **Sizes 500 to 1000**

Example: closed circuit A4VSG **HS5KP**

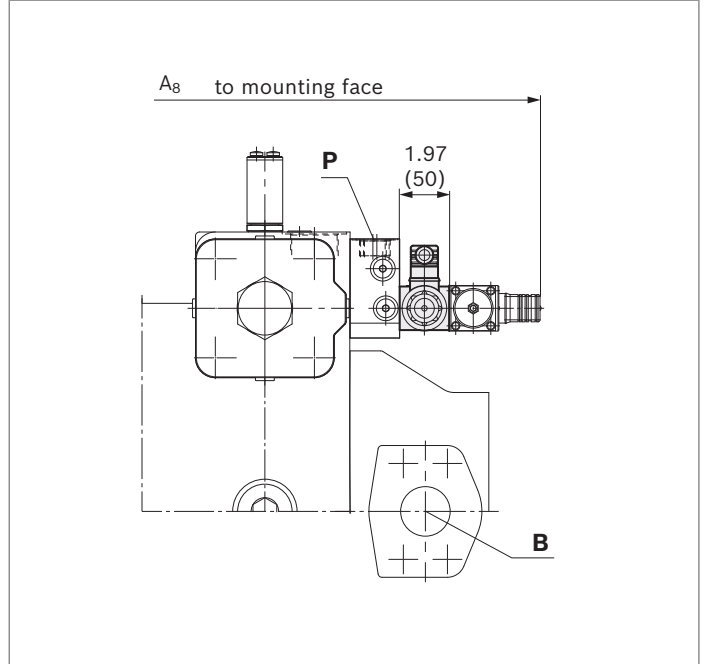


Dimensions

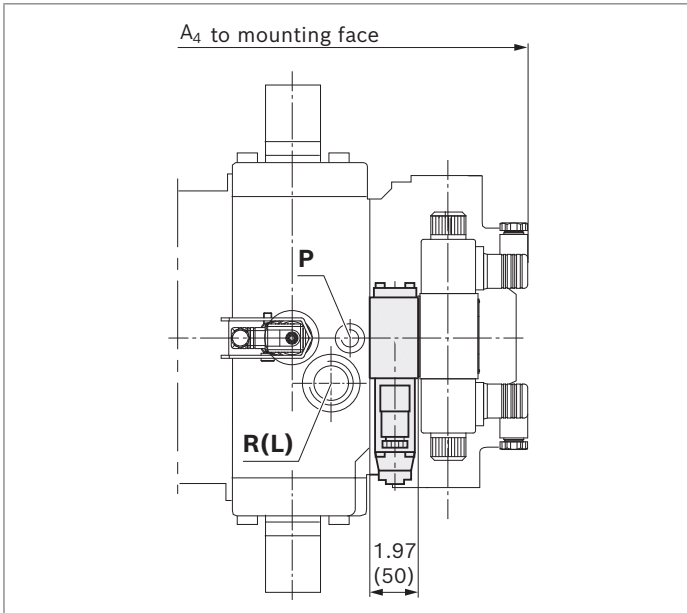
▼ **HS5K, size 40 to 355**



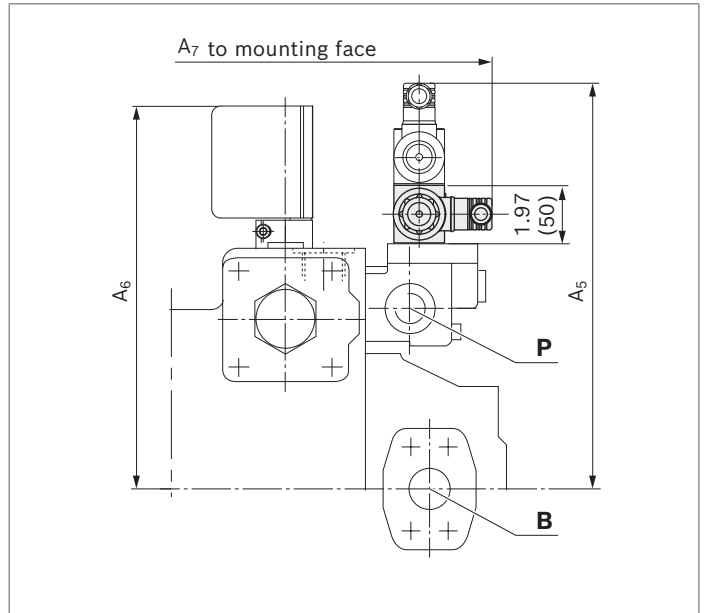
▼ **HS5K, sizes 500 to 1000**



▼ **EO1K, size 40 and 71**



▼ **EO1K, sizes 125 and 250**
EO2K, size 40 to 355

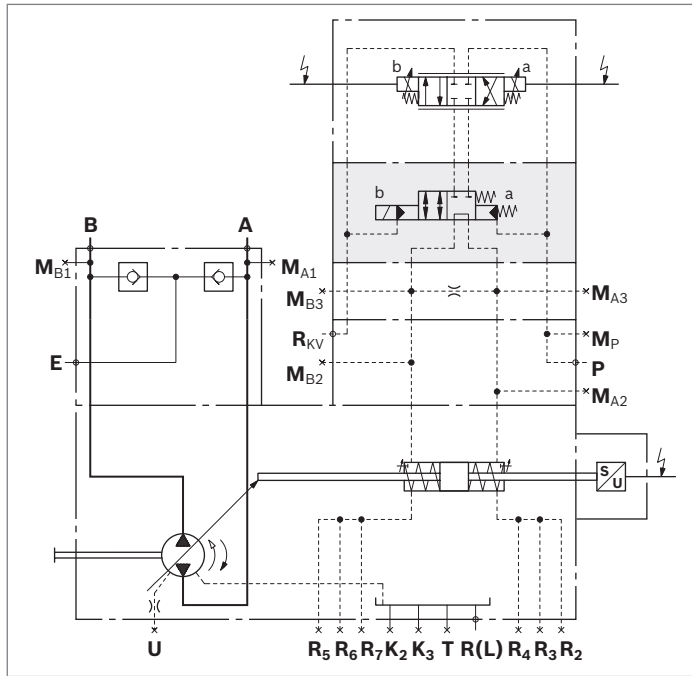


NG	A ₂	A ₃	A ₄	A ₅	A ₆	A ₇	A ₈
40	11.90 (301)	11.65 (296)	12.76 (324)	11.73 (298)	9.69 (246)	11.61 (295)	-
71	12.24 (311)	12.72 (323)	13.82 (351)	12.36 (314)	10.43 (265)	12.68 (322)	-
125 / 180	13.20 (336)	15.00 (381)	-	10.03 (331)	11.73 (298)	14.92 (379)	-
250 / 355	14.39 (365.5)	17.44 (443)	-	14.37 (365)	13.58 (345)	17.44 (443)	-
500	-	-	-	-	-	-	21.69 (551)
750	-	-	-	-	-	-	22.95 (583)
1000	-	-	-	-	-	-	25.55 (649)

Circuit diagram EO2K

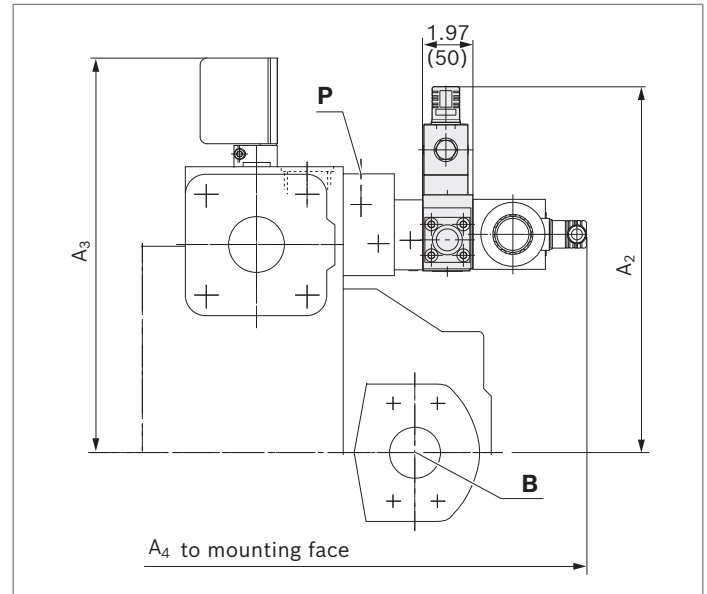
▼ **Sizes 500 to 1000**

Example: closed circuit A4VSG **EO2K**



Dimensions EO2K

▼ **Sizes 500 to 1000**



NG	A ₂	A ₃	A ₄
500	15.20 (386)	15.43 (392)	23.98 (609)
750	16.42 (417)	16.81 (427)	25.24 (641)
1000	17.28 (439)	17.95 (456)	27.83 (707)

EO1 / EO2 – control with proportional valve

Type	NG	40	71	125	180	250	355	500	750	1000	
(A)A4VSO, (A)A4VSG		•	•	•	–	•	–	–	–	–	EO1
		•	•	•	•	•	•	•	•	•	EO2
(A)A4CSG		–	–	–	–	•	•	•	•	–	

For electric displacement control with VT-5035-1X

The control **EO1/2** sets the displacement of the pump with the mounted direct operated proportional directional valve proportional to the setpoint value.

The pump setting is reported by an inductive position transducer.

Spring-centering

The spring-centering of the hydraulic stroking cylinder is standard. It is used for setting and adjustment in the depressurized neutral position, but without a defined reset during high-pressure operation.

Notice

- ▶ The spring feedback in the controller and pump control spring centering are no safety devices. The controller can stick in an undefined position due to internal contamination (contaminated hydraulic fluid, abrasion or residual contamination from system components). As a result, the flow in the axial piston unit will no longer respond correctly to the operator's specifications. Check whether the application on your machine requires additional safety measures to bring the driven consumer to a safe position (immediate stop).

Swivel angle limitation

Minimum and maximum swivel angle limitation is mechanically adjustable up to 50 % $V_{g \max}$. For size 500, $V_{g \min}$ is adjustable up to 50 % $V_{g \max}$ and $V_{g \max}$ up to 70 % $V_{g \max}$.

Notice

Setting with A4VSO (open circuit):

- ▶ The $V_{g \max}$ stop is set to nominal $V_{g \max}$ as standard. Please specify different values in your order
- ▶ The $V_{g \min}$ stop is set to nominal $V_g = 0$ gpm (0 l/min) with $P_{HD} = 290$ psi (20 bar) as standard. Other values should be specified when placing the order.

Setting with A4VSG and A4CSG (closed circuit):

- ▶ The $V_{g \max}$ stops are set on both sides to nominal $V_{g \max}$.

When ordering, please state other setting requests in plain text.

Electric amplifier

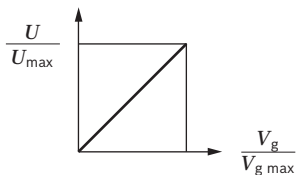
The electric amplifier VT 5035-1X for controlling the pump swivel angle is not included in the EO scope of delivery, please order separately in accordance with data sheet 29955.

Two versions are available:

Type	Control pressure [psi (bar)]	Sizes
EO1	from 290 (20)	40, 71, 125 and 250 (see from page 54)
EO2	from 725/1450/1800 (50/100/125)	40...1000 (see from page 56)

(A)A4VSO – open circuit

▼ **Characteristic curve**



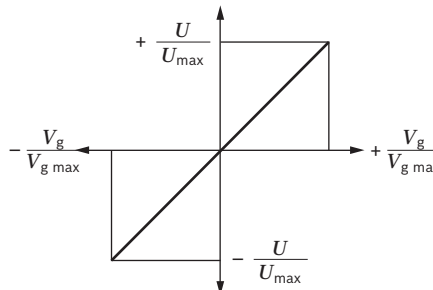
▼ **Flow direction S to B**

Direction of rotation	Swiveling range ¹⁾	Actuation of solenoid
clockwise	counter-clockwise	a
counter-clockwise	clockwise	b

Overcenter is available on request.

(A)A4VSG and (A)A4CSG – closed circuit

▼ **Characteristic curve**



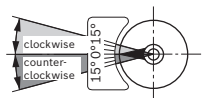
▼ **Flow direction**

Direction of rotation	Swiveling range ¹⁾	Flow direction	Actuation of solenoid
clockwise	clockwise	B to A	b
	counter-clockwise	A to B	a
counter-clockwise	clockwise	A to B	b
	counter-clockwise	B to A	a

Technical data EO1

Size		NG	40	71	125	250
Control pressure (in P)	p_{min}	psi (bar)	290 (20)	290 (20)	290 (20)	290 (20)
	p_{max}	psi (bar)	1450 (100)	1450 (100)	1450 (100)	1450 (100)
Control stroke	s_{max}	inch (mm)	0.56 (14.2)	0.67 (17.1)	0.81 (20.7)	1.02 (25.9)
Control area	A	inch ² (cm ²)	2.57 (16.6)	3.81 (24.6)	5.63 (36.6)	8.79 (56.7)
Control volume	$V_{S max}$	inch ³ (cm ³)	1.44 (23.6)	2.57 (42.1)	4.59 (75.2)	8.97 (147)
Setting time ²⁾	t_{min}	s	0.12	0.20	0.22	0.40
Weight: approx. (A4VSO...EO1...N00)	m	lbs (kg)	92 (42)	130 (59)	216 (98)	440 (200)
Maximum hysteresis ΔV_g ³⁾			$\leq \pm 2\%$ of $V_{g max}$			
Minimum repeatability ³⁾			$\leq \pm 1.5\%$ of $V_{g max}$			
Linearity deviation ³⁾			$\leq 2.5\%$ of $V_{g max}$			

1) Cf. Swivel angle indicator



2) With 725 psi (50 bar) control pressure

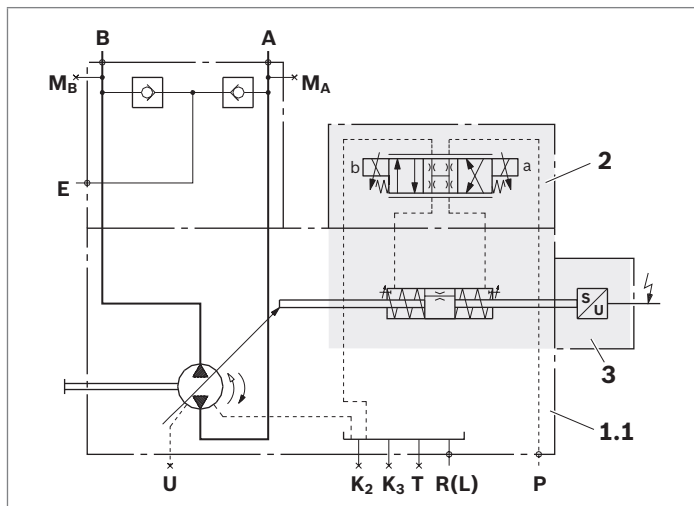
3) Values are valid for a constant operating temperature of 122 °F (50 °C)

EO1 circuit diagrams

The control fluid to be supplied externally on port **P** is drained internally via the drain port **R(L)** of the pump.

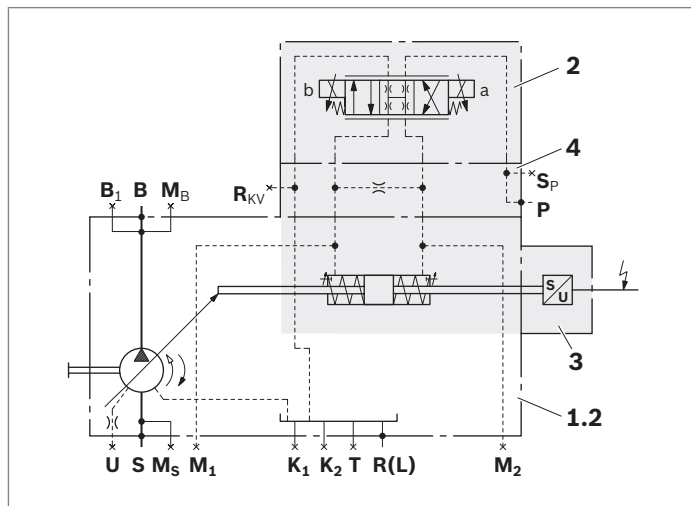
▼ Sizes 40 and 71

Example: closed circuit (A)A4VSG



▼ Sizes 125 to 355

Example: open circuit (A)A4VSO



- 1 Pump with hydraulic control device
- 1.1 (A)A4VSG (see data sheet 92100)
- 1.2 (A)A4VSO (see data sheet 92050)
- 2 4/3-way proportional valve (see data sheet 29055)

NG	Type ¹⁾
40 and 71	4WRA6V15-2X/G24N9K4/V-589
125 and 250	4WRA6V30-2X/G24N9K4/V-589

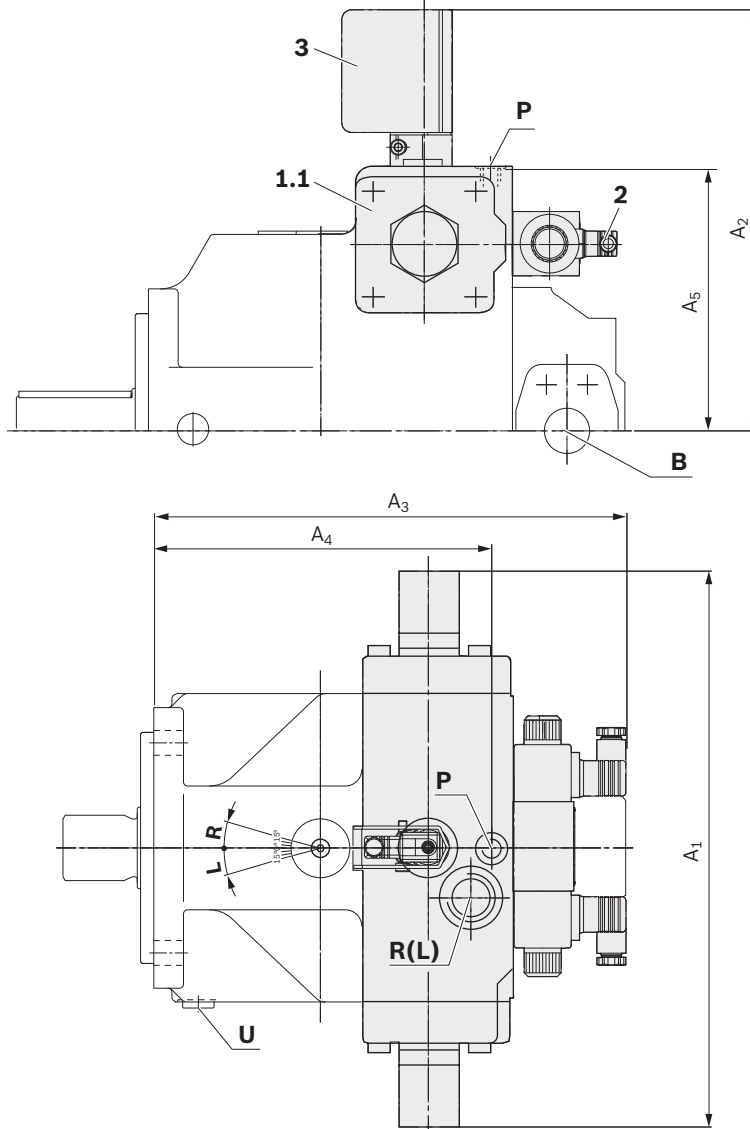
- 3 Inductive position transducer AWXX004D02¹⁾
- 4 Flow control plate

Ports	
P	Control pressure
S_P	Control pressure accumulator
R_{KV}	Control fluid return flow
M₁, M₂	Measuring ports control pressure

1) Solenoids with plug-in connector according to DIN EN 175.301-803 / ISO 4400 Cable gland M16 × 1.5 for cable diameters 0.18 to 0.39 inch (4.5 to 10 mm)

Dimensions EO1

▼ **A4VSO and A4VSG, size 40 and 71**



For key, see page 55

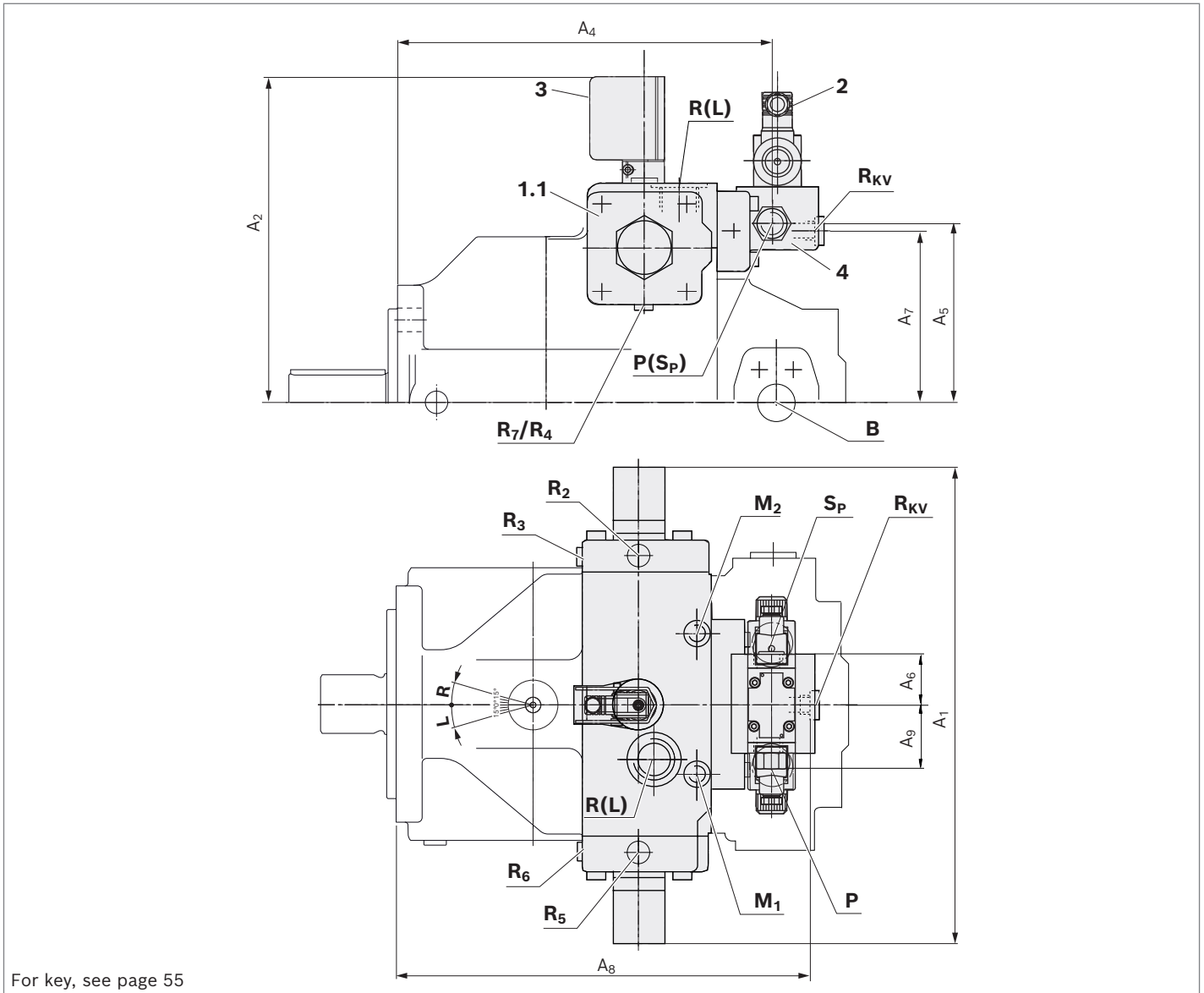
NG	A ₁	A ₂	A ₃	A ₄	A ₅	
40	11.65 (296)	9.69 (246)	10.98 (279)	7.01 (178)	5.31 (135)	For detailed dimensions and technical data for the variable pump, see data sheet 92050 ((A)A4VSO) or 92100 ((A)A4VSG)
71	13.07 (332)	10.43 (265)	12.05 (306)	8.07 (205)	5.98 (152)	

Ports	Standard	Size ¹⁾	p _{max} [psi (bar)] ²⁾	State	
P	Control pressure	ISO 11926	9/16-18UNF-2B; 0.47 (12) deep	1450 (100)	O

1) Depending on the application, momentary pressure peaks can occur. Keep this in mind when selecting measuring devices and fittings.

2) O = Must be connected (plugged on delivery)
X = Plugged (in normal operation)

▼ **A4VSO and A4VSG, size 125 and 250**



NG	A ₁	A ₂	A ₄	A ₅	A ₆	A ₇	A ₈	A ₉
125	15.83 (402)	11.73 (298)	12.28 (312)	6.14 (156)	1.54 (39)	5.83 (148)	13.86 (352)	2.76 (70)
250	19.03 (485)	13.58 (345)	14.65 (372)	7.56 (192)	1.54 (39)	7.24 (184)	16.22 (412)	2.76 (70)

For detailed dimensions and technical data for the variable pump, see data sheet 92050 ((A) A4VSO) or 92100 ((A)A4VSG)

Ports	Standard	Size	p_{max} [psi (bar)] ¹⁾	State ²⁾
P	ISO 11926	7/8-14UNF-2B; 0.67 (17) deep	1450 (100)	O
S_p	DIN 3852-1	M22 × 1.5; 0.55 (14) deep	1450 (100)	X
R_{KV}	DIN 3852-1	M22 × 1.5; 0.55 (14) deep	60 (4)	O
M₁, M₂	ISO 11926	9/16-18UNF-2B; 0.5 (13) deep (NG 125) 3/4-16UNF-2B; 0.59 (15) deep (NG 250)	1450 (100) 1450 (100)	X X
R₂ ... R₇	DIN 3852-1	M10 × 1; 0.31 (8) deep	1450 (100)	X

1) Depending on the application, momentary pressure peaks can occur. Keep this in mind when selecting measuring devices and fittings.

2) O= Must be connected (plugged on delivery)
 X = Plugged (in normal operation)

Technical data EO2

Size		NG	40	71	125	180	250	355	500	750	1000
Control pressure (in P)	p_{\min}	psi	725	725	725	1450	1450	1450	1850	1850	1850
		bar	(50)	(50)	(50)	(100)	(100)	(100)	(125)	(125)	(125)
	$p_{\max}^{1)}$	psi	4550	4550	4550	4550	4550	4550	4550	4550	4550
		bar	(315)	(315)	(315)	(315)	(315)	(315)	(315)	(315)	(315)	(315)
Control stroke	s_{\max}	inch	0.56	0.67	0.81	0.81	1.02	1.02	1.28	1.46	1.63
		mm	(14.2)	(17.1)	(20.7)	(20.7)	(25.9)	(25.9)	(32.6)	(37.0)	(41.4)
Control area	A	inch ²	1.26	1.95	2.81	2.81	4.39	4.39	5.92	8.80	9.63
		cm ²	(8.1)	(12.6)	(18.1)	(18.1)	(28.3)	(28.3)	(38.2)	(56.8)	(63.6)
Control volume	$V_{S \max}$	inch ³	0.70	1.31	2.29	2.29	4.47	4.47	7.60	12.81	16.07
		cm ³	(11.4)	(21.5)	(37.5)	(37.5)	(73.2)	(73.2)	(124.5)	(210)	(263.3)
Setting time ²⁾	t_{\min}	s	0.1	0.12	0.2	0.2	0.25	0.25	0.3	³⁾	³⁾
Weight: approx. (A4VSO...EO2...N00)	m	lbs	92	130	216	269	440	484	744	1058	1344
		kg	(42)	(59)	(98)	(122)	(200)	(220)	(338)	(481)	(611)
Maximum hysteresis $\Delta V_g^{4)}$											$\leq \pm 2\%$ of $V_{g \max}$
Minimum repeatability ⁴⁾											$\leq \pm 1.5\%$ of $V_{g \max}$
Linearity deviation ⁴⁾											$\leq 2.5\%$ of $V_{g \max}$

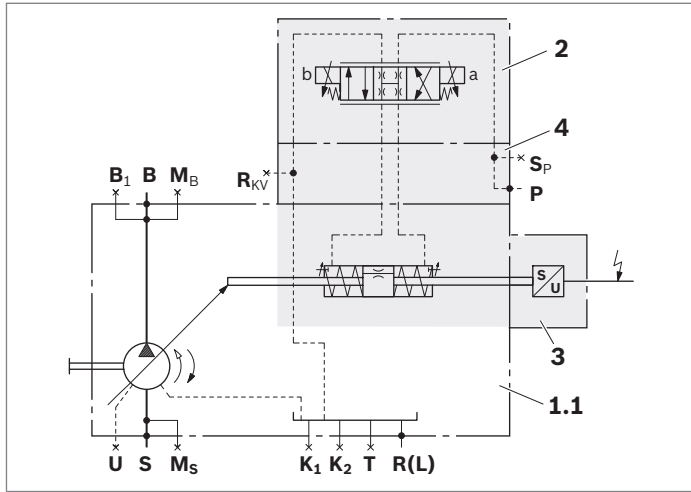
1) Due to the permissible data of the proportional valve
2) With minimum control pressure
3) Values are valid for a constant operating temperature of 122 °F (50 °C)
4) On request

Circuit diagrams EO2 – size 40 to 355

The control fluid to be supplied externally on port **P** is drained internally via the drain port **R(L)** of the pump. For (A)A4CSG with EO2, the control pressure relief valve is not required and is replaced with a threaded plug. To minimize the control fluid consumption, the stroking chambers are sealed in sizes 125...355 and can be bled via the ports **R₂** to **R₇**.

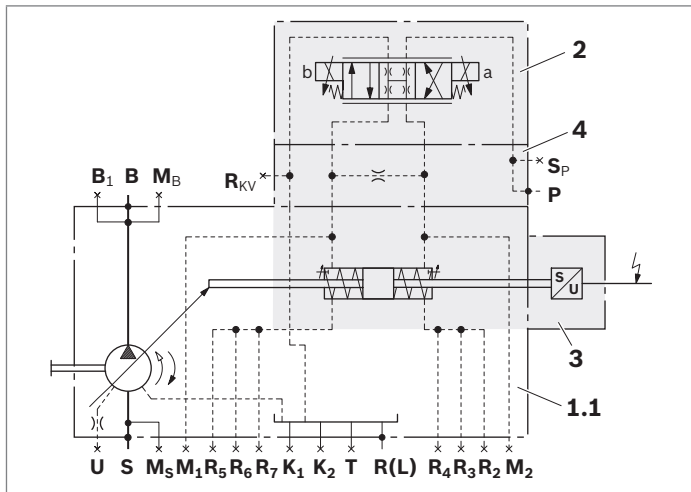
▼ **Sizes 40 and 71**

Example: open circuit (A)A4VSO



▼ **Sizes 125 to 355**

Example: open circuit (A)A4VSO



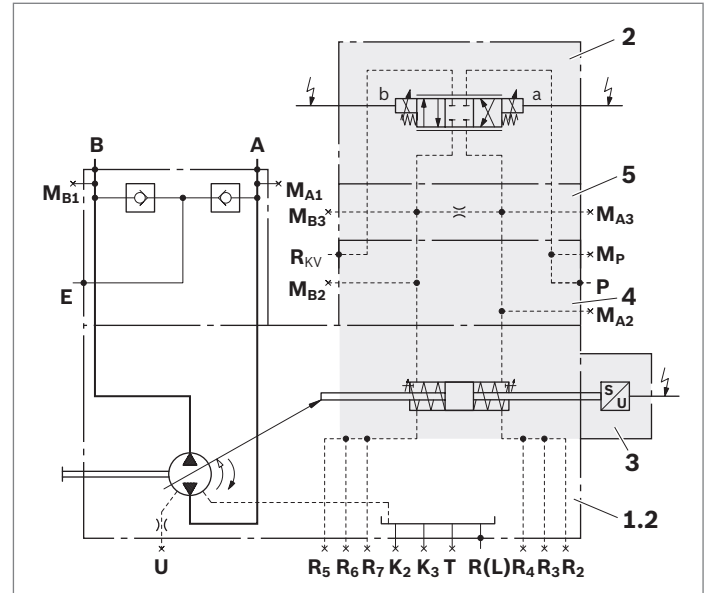
Circuit diagram EO2 – size 500 to 1000

The control fluid to be supplied externally on port **P** is drained via the port **R_{KV}** to be connected externally to the reservoir.

For A4CSG with EO2, the control pressure relief valve is not required and is replaced with a threaded plug. To minimize the control fluid consumption, the stroking chambers are sealed and can be bled via the ports **R₂** to **R₇**.

▼ **Sizes 500 to 1000**

Example: closed circuit A4VSG



- 1 Pump with hydraulic control device
- 1.1 (A)A4VSO (see data sheet 92050)
- 1.2 (A)A4VSG (see data sheet 92100)
- 2 4/3-way proportional valve (see data sheet 29055 or 29061)

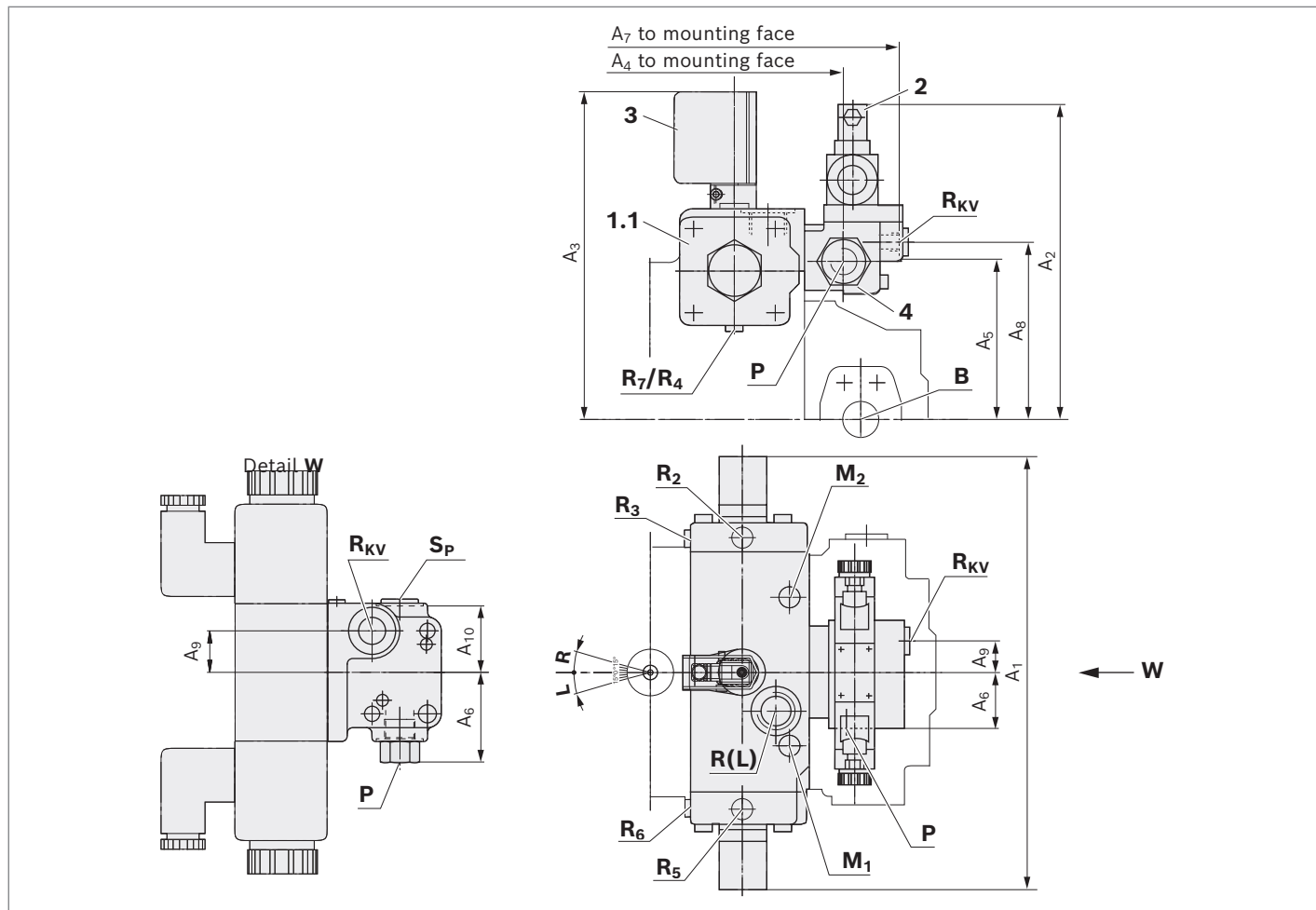
NG	Type ¹⁾
40 and 71	4WRA6V15-2X/G24N9K4/V-589
125 to 355	4WRA6V30-2X/G24N9K4/V-589
500 to 1000	4WRE10E25-2X/24K4/V-93

- 3 Inductive position transducer AWXX004D02¹⁾
- 4 Intermediate plate
- 5 Flow control plate

Solenoids with plug-in connector according to DIN EN 175.301-803 / ISO 4400 Cable gland M16 × 1.5 for cable diameters 0.18 to 0.39 inch (4.5 to 10 mm)

Dimensions EO2

▼ **A4VSO, A4VSG and A4CSG, size 40 to 355**



For key, see page 59

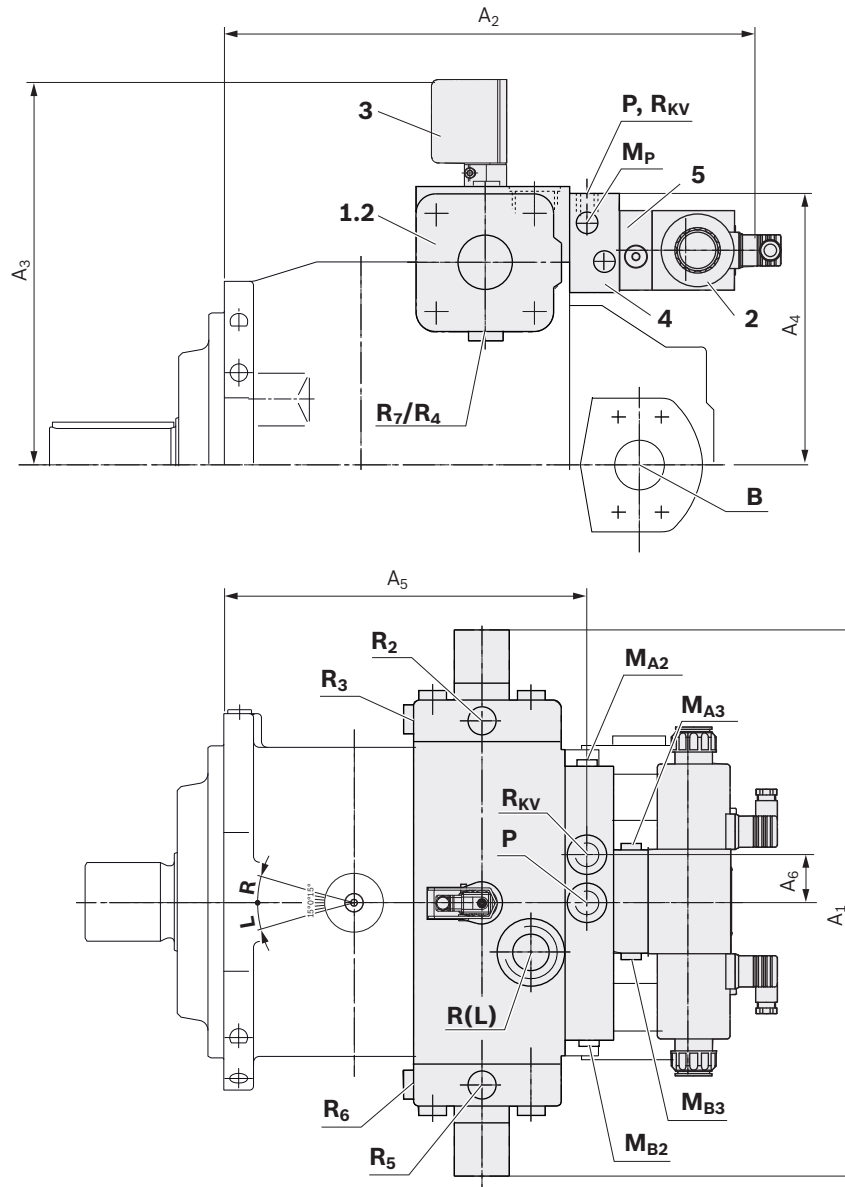
NG	A ₁	A ₂	A ₃	A ₄	A ₅	A ₆	A ₇	A ₈	A ₉	A ₁₀	
40	11.65 (296)	9.76 (248)	9.69 (246)	8.74 (222)	4.25 (108)	2.91 (74)	10.75 (273)	5.04 (128)	1.38 (35)	2.09 (53)	For detailed dimensions and technical data for the variable pump, see data sheet 92050 ((A)A4VSO), 92100 ((A)A4VSG) or 92105 ((A)A4CSG)
71	13.07 (332)	11.39 (264)	10.43 (265)	9.80 (249)	4.84 (123)	3.11 (79)	11.81 (300)	5.63 (143)	1.18 (30)	1.89 (48)	
125/180	15.83 (402)	11.06 (281)	11.73 (298)	12.20 (310)	6.14 (156)	2.76 (70)	13.78 (350)	5.83 (148)	0 (0)	1.54 (39)	
250/355	19.09 (485)	12.48 (317)	13.58 (345)	14.65 (372)	7.56 (192)	2.76 (70)	16.22 (412)	7.24 (184)	0 (0)	1.54 (39)	

Ports	Standard	Size	p_{max} [psi (bar)] ¹⁾	State ²⁾
P	Control pressure	ISO 19926 7/8-14UNf-2B; 0.67 (17) deep	4550 (315)	O
Sp	Control pressure accumulator	DIN 3852-1 M22 × 1.5; 0.55 (14) deep	4550 (315)	X
Rkv	Control fluid return flow	DIN 3852-1 M22 × 1.5; 0.55 (14) deep	3050 (210)	X
M₁, M₂	Control pressure measuring	DIN 3852-1 M14 × 1.5; 0.47 (12) deep (NG 125 and 180) M18 × 1.5; 0.47 (12) deep (NG 250 and 355)	4550 (315) 4550 (315)	X X
R₂ ... R₇	Air bleeding the stroking chamber	DIN 3852-1 M10 × 1; 0.31 (8) deep (NG 125 to 355)	4550 (315)	X

1) Depending on the application, momentary pressure peaks can occur. Keep this in mind when selecting measuring devices and fittings.

2) O = Must be connected (plugged on delivery)
X = Plugged (in normal operation)

▼ **A4VSO, A4VSG and A4CSG, sizes 500 to 1000**



For key, see page 59

NG	A ₁	A ₂	A ₃	A ₄	A ₅	A ₆	
500	21.85 (555)	22.01 (559)	15.43 (392)	10.79 (274)	15.28 (388)	1.97 (50)	For detailed dimensions and technical data for the variable pump, see data sheet 92050 (A4VSO), 92100 (A4VSG) or 92105 (A4CSG)
750	24.80 (630)	23.27 (591)	16.81 (427)	11.97 (304)	16.54 (420)	1.97 (50)	
1000	26.38 (670)	25.87 (657)	17.95 (456)	12.87 (327)	19.13 (486)	1.97 (50)	

Ports		Standard	Size ¹⁾	p _{max} [psi (bar)] ²⁾	State
P	Control pressure	DIN 3852-1	M27 × 2; 0.63 (16) deep	4550 (315)	O
R _{KV}	Control fluid return flow	DIN 3852-1	M27 × 2; 0.63 (16) deep	3050 (210)	O
M _P , M _{A2} , M _{B2}	Control pressure measuring	DIN 3852-1	M14 × 1.5; 0.47 (12) deep	4550 (315)	X
M _{A3} , M _{B3}	Control pressure measuring	DIN 3852-1	G 1/4 in	4550 (315)	X
R ₂ ... R ₇	Air bleeding the stroking chamber	DIN 3852-1	M14 × 1.5; 0.47 (12) deep	4550 (315)	X

1) Depending on the application, momentary pressure peaks can occur. Keep this in mind when selecting measuring devices and fittings.

2) O = Must be connected (plugged on delivery)
 X = Plugged (in normal operation)

EO2M – Suitable for use under fluid

Type	NG	40	71	125	180	250	355	500	750	1000	
A4VSO		•	•	•	•	•	•	•	•	•	EO2M

The **EO2M** variant corresponds to the EO2 version, but without proportional valve, but with pilot pressure ports **X₁** and **X₂**.

The proportional valve can be positioned separately in the system and piped up via the designated ports **X₁** and **X₂** of

the pump.

The unit can be installed in the reservoir together with the directly mounted position transducer.

Approved for HLP fluids DIN 51524.

Technical data EO2M

Size		NG	40	71	125	180	250	355	500	750	1000	
Control pressure (in P)	p_{\min}	psi	725	725	725	1450	1450	1450	1850	1850	1850	
		bar	(50)	(50)	(50)	(100)	(100)	(100)	(125)	(125)	(125)	
	$p_{\max}^{1)}$	psi	4550	4550	4550	4550	4550	4550	4550	4550	4550	4550
		bar	(315)	(315)	(315)	(315)	(315)	(315)	(315)	(315)	(315)	(315)
Control stroke	s_{\max}	inch	0.56	0.67	0.81	0.81	1.02	1.02	1.28	1.46	1.63	
		mm	(14.2)	(17.1)	(20.7)	(20.7)	(25.9)	(25.9)	(32.6)	(37.0)	(41.4)	
Control area	A	inch ²	1.26	1.95	2.81	2.81	4.39	4.39	5.92	8.80	9.63	
		cm ²	(8.1)	(12.6)	(18.1)	(18.1)	(28.3)	(28.3)	(38.2)	(56.8)	(63.6)	
Control volume	$V_{S \max}$	inch ³	0.70	1.31	2.29	2.29	4.47	4.47	7.60	12.81	16.07	
		cm ³	(11.4)	(21.5)	(37.5)	(37.5)	(73.2)	(73.2)	(124.5)	(210)	(263.3)	
Setting time ²⁾	t_{\min}	s	0.1	0.12	0.2	0.2	0.25	0.25	0.3	³⁾	³⁾	
Weight: approx. (A4VSO...EO2...N00)	m	lbs	92	130	216	269	440	484	744	1058	1344	
		kg	(42)	(59)	(98)	(122)	(200)	(220)	(338)	(481)	(611)	
Maximum hysteresis $\Delta V_g^{4)}$											$\leq \pm 2\%$ of $V_{g \max}$	
Minimum repeatability ⁴⁾											$\leq \pm 1.5\%$ of $V_{g \max}$	
Linearity deviation ⁴⁾											$\leq 2.5\%$ of $V_{g \max}$	

1) Due to the permissible data of the proportional valve

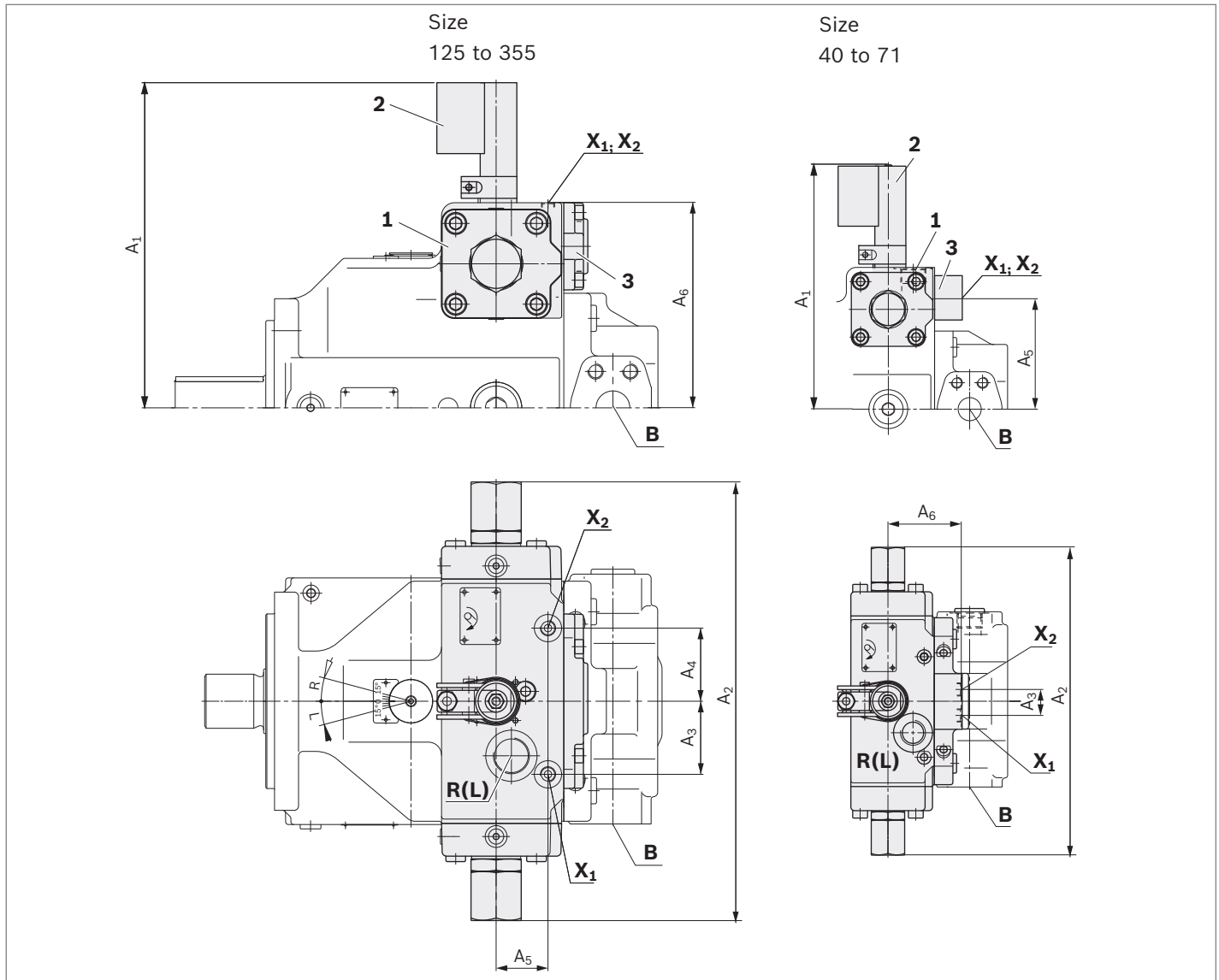
2) With minimum control pressure

3) Values are valid for a constant operating temperature of 122 °F (50 °C)

4) On request

Dimensions EO2M

▼ **(A)A4VSO, size 40 to 355**



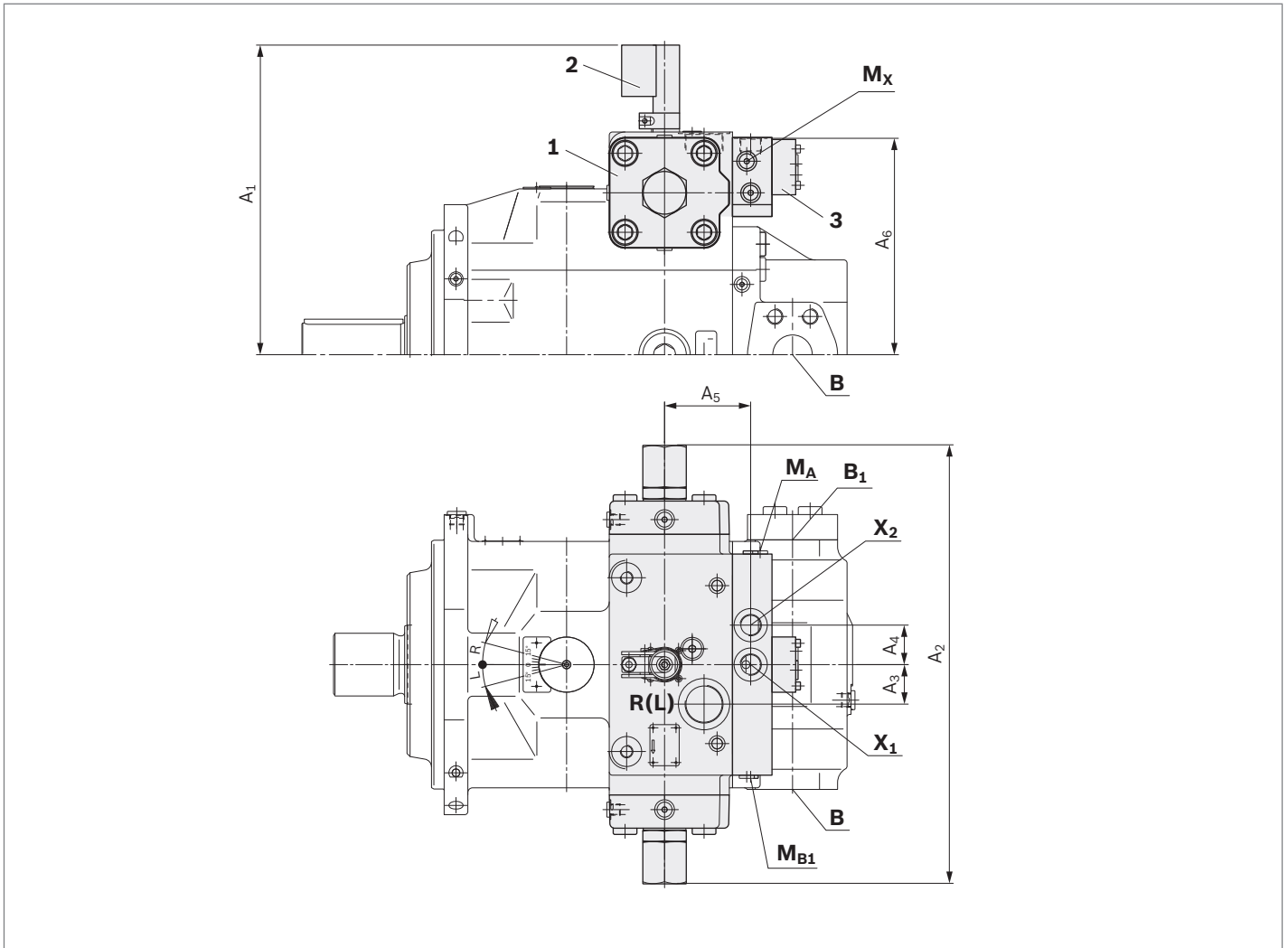
NG	A ₁	A ₂	A ₃	A ₄	A ₅	A ₆	
40/71	10.41 (264.5)	13.07 (332)	1.10 (28)	–	4.70 (119.5)	3.11 (79)	For detailed dimensions and technical data for the variable pump, see data sheet 92050 (A4VSO)
125/180	11.73 (298)	15.83 (402)	2.64 (67)	2.64 (67)	1.87 (47.5)	7.34 (186.5)	
250/355	13.58 (345)	19.09 (485)	2.80 (71)	2.80 (71)	2.46 (62.5)	9.17 (233)	

Ports	Standard	Size	p_{max} [psi (bar)] ¹⁾	State ²⁾	
X₁, X₂	Pilot pressure	DIN 3852-1	M14 x 1.5; 0.47 (12) deep (NG 40 and 180)	4550 (315)	O
			M18 x 1.5; 0.47 (12) deep (NG 250 and 355)	4550 (315)	O

1) Depending on the application, momentary pressure peaks can occur. Keep this in mind when selecting measuring devices and fittings.

2) O = Must be connected (plugged on delivery)
X = Plugged (in normal operation)

▼ **A4VSO, sizes 500 to 750**



NG	A ₁	A ₂	A ₃	A ₄	A ₅	A ₆	
500	15.43 (392)	21.85 (555)	1.97 (50)	1.97 (50)	4.29 (109)	10.79 (274)	For detailed dimensions and technical data for the variable pump, see data sheet 92050 (A4VSO)
750	16.81 (427)	24.80 (630)	1.97 (50)	1.97 (50)	4.69 (119)	11.97 (304)	

Ports		Standard	Size	p_{max} [psi (bar)] ¹⁾	State ²⁾
X ₁ , X ₂	Pilot pressure	DIN 3852-1	M27 × 2; 0.63 (16) deep	4550 (315)	O
M _A , M _{B1} , M _X	Control pressure measuring	DIN 3852-1	M14 × 1.5; 0.47 (12) deep (NG 500)	4550 (315)	X

1) Depending on the application, momentary pressure peaks can occur. Keep this in mind when selecting measuring devices and fittings.

2) O = Must be connected (plugged on delivery)
X = Plugged (in normal operation)

Project planning notes

- ▶ The control devices HM, HS5 and EO are designed for use in the open circuit ((A)A4VSO, A4VBO) or closed circuit ((A)A4VSG, (A)A4CSG) depending on the pump.
- ▶ Project planning, installation and commissioning of the axial piston units requires the involvement of skilled personnel.
- ▶ Before using the axial piston unit, please read the corresponding instruction manual completely and thoroughly. If necessary, this can be requested from Bosch Rexroth.
- ▶ Before finalizing your design, request a binding installation drawing. If you need a 3D installation model, please consult the responsible contact person at Bosch Rexroth .
- ▶ The specified data and notes contained herein must be observed.
More information on the products can be found in the data sheets listed on page 1.
- ▶ Depending on the operating conditions of the axial piston unit (working pressure, fluid temperature), the characteristic curve may shift.
- ▶ The characteristic curve may also shift due to the dither frequency or control electronics.
- ▶ Preservation: Our axial piston units are supplied as standard with preservation protection for a maximum of 12 months. If longer preservation protection is required (maximum 24 months), please specify this in plain text when placing your order. The preservation periods apply under optimal storage conditions, details of which can be found in the data sheet 90312 or the instruction manual.
- ▶ Not all versions of the product are approved for use in a safety function according to ISO 13849. Please consult the proper contact at Bosch Rexroth if you require reliability parameters (e.g. $MTTF_d$) for functional safety.
- ▶ Depending on the type of control used, electromagnetic effects can be produced when using solenoids. Use of the recommended direct current (DC) on the electromagnet does not produce any electromagnetic interference (EMI) nor is the electromagnet influenced by EMI. A possible electromagnetic interference (EMI) exists if the solenoid is supplied with modulated direct current (e.g. PWM signal). The machine manufacturer should conduct appropriate tests and take appropriate measures to ensure that other components or operators (e.g. with a pacemaker) are not affected by this potentiality.

- ▶ Pressure controllers are not safeguards against pressure overload. Be sure to add a pressure relief valve to the hydraulic system.
- ▶ For drives that are operated for a long period of time with constant rotational speed, the natural frequency of the hydraulic system can be stimulated by the excitation frequency of the pump (rotational speed frequency x 9). This can be prevented with suitably designed hydraulic lines.
- ▶ Please note the details regarding the tightening torques of port threads and other threaded joints in the instruction manual.
- ▶ The ports and fastening threads are designed for the p_{max} permissible pressures of the respective ports, see the connection tables. The machine or system manufacturer must ensure that the connecting elements and lines correspond to the specified application conditions (pressure, flow, hydraulic fluid, temperature) with the necessary safety factors.
- ▶ The working ports and function ports are only intended to accommodate hydraulic lines.

Installation instructions

The installation instructions for the relevant variable pump apply:

- ▶ (A)A4VSO, data sheet 92050
- ▶ A4VBO, data sheet 92122
- ▶ (A)A4VSG, data sheet 92100
- ▶ (A)A4CSG, data sheet 92105

Only the controls **HM1**, **HM2** and **HS5M** are suitable for use under fluid.

Safety instructions

- ▶ During and shortly after operation, there is a risk of getting burnt on the axial piston unit and especially on the solenoids. Take the appropriate safety measures (e.g. by wearing protective clothing).
- ▶ Moving parts in control equipment (e.g. valve spools) can, under certain circumstances, get stuck in position as a result of contamination (e.g. contaminated hydraulic fluid, abrasion, or residual dirt from components). As a result, the hydraulic fluid flow and the build-up of torque in the axial piston unit can no longer respond correctly to the operator's specifications. Even the use of various filter elements (external or internal flow filtration) will not rule out a fault but merely reduce the risk. The machine/system manufacturer should test whether additional measures are required on the machine for the relevant application in order to bring the driven consumer into a safe position (e.g. safe stop) and make sure any measures are properly implemented.

Related documentation

Product-specific documentation

Document type	Title	Document number
Data sheet	Axial piston variable pump (A)A4VSO series 1x and 3x	92050
	Axial piston variable pump (A)A4VSG series 1x and 3x	92100
	Axial piston variable pump (A)A4CSG series 3x	92105
	Axial piston variable pump A4VBO series 1x and 3x	92122
Instruction manuals	Axial piston variable pump A4VSO series 1x and 3x	92050-01-B
	Axial piston variable pump A4VSG series 1x and 3x	92100-01-B
	Axial piston variable pump A4CSG series 3x	92105-01-B
	Axial piston variable pump A4VBO series 1x and 3x	92122-01-B
	Control system HS5E(V)(L) for Axial piston variable pump A4VSO, A4VBO, A4VSG and A4CSG	92076-01-B
	VT-HPC-1-1X Digital control electronics for axial piston pumps	30237-B

Documentation for control valves and control electronics

Control	Title	Document number
HM2C	4/2 and 4/3 proportional directional valves direct operated, with electric position feedback, without/with integrated electronics (OBE)	29061
HS5.../HS5M/HS5V/HS5L	Pressure transducer for hydraulic applications; type HM20	30272
	Digital control electronics for axial piston pumps; type VT-HPC	30237
	Directional control valves, direct operated, without electric position feedback; type 4WRPH	29027
HS5E.../HS5EV/HS5EL	Swivel angle sensor; type ASSEMBLY KIT VT-SWA-LIN	30263
	Compact power supply units VT-NE30, unit series 2X, VT-NE31, unit series 1X	29929
	Directional spool valves, direct operated, with solenoid actuation; type Z4WE	23193
	4/2 and 4/3 directional shut-off valves, internally pilot operated, externally pilot operated; type Z4WEH and Z4WH	24753
	Electric amplifier for 1/8 flow adjuster with proportional valves; type VT 5035	29955
	Electric amplifiers; type VT-VSPA1-5...-1X/V0/RTP	29055

Documentation for hydraulic fluids

Document type	Title	Document number
Data sheet	Hydraulic fluids based on mineral oils and related hydrocarbons	90220
	Environmentally acceptable hydraulic fluids	90221
	Bosch Rexroth Fluid Rating List for Rexroth hydraulic components (pumps and motors)	90245

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