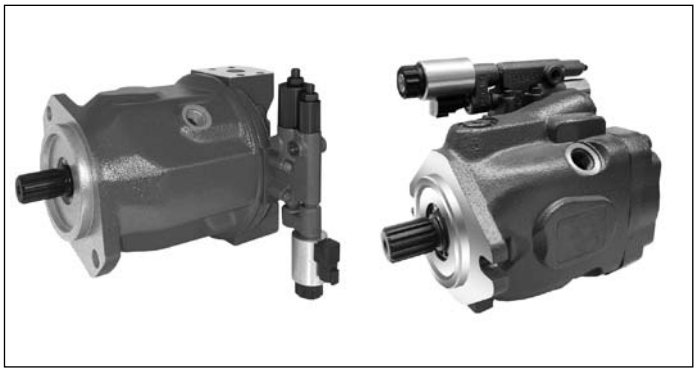
Axial piston variable pump A10V(S)O, A10VO Series 3x and 5x with electro-proportional EF differential pressure control

RE 92709
Edition: 12.2015
Replaces: 05.2004



Series 31 and 32
- Sizes 18 to 180
- Nominal pressure/maximum pressure 280 / 350 bar
- Open circuit

Series 52 and 53
- Sizes 18 to 100
- Nominal pressure/maximum pressure 250 / 315 bar
- Open circuit

Features
- Electro-proportional differential pressure control by a current signal
- High precision
- Safe function in the event of a power failure, e.g. supply of braking and steering systems
- Use of standard proportional amplifiers possible
- Compact design

Application possibilities
- Variations in the fine control
- Control of the maximum flow
- Use for electronic load limiting control

Further information on the relevant products can be found in the data sheets:

A10V(S)O series 31	92701
A10VO series 32	92705
A10VO series 52/53	92703

Inhalt

Ordering code A10V(S)O series 31 (see also data sheet 92701)

01	02	03	04	05		06	07		08	09	10	11	12	13
	A10V(S)	**O**			**/**	**31**		**–**						**P**

Version

		18	28	45	71	100	140	
01	Standard version (without code)	●	●	●	●	●	●	
	High-speed version	–	–	●	●	●	●	**H**

Axial piston unit

02	Variable swashplate design, nominal pressure 280 bar, maximum pressure 350 bar	–	●	●	●	●	●	**A10V**
		●	–	–	–	–	–	**A10VS**

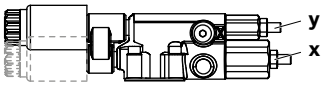
Operating mode

03	Pump, open circuit	**O**

Size (NG)

		18	28	45	71	100	140
04	Geometric displacement	**18**	**28**	**45**	**71**	**100**	**140**

Control device

										Controller axis	**x**	**y**
05	Differential pressure control, electrically variable, negative characteristic curve									**EF.**		
		Δp shifting Controller axis **y**	U = 12 V	●	●	●	●	●	●	**EF1**		
			U = 24 V	●	●	●	●	●	●	**EF2**		
		Δp shifting Controller axis **x**	U = 12 V	●	●	●	●	●	●	**EF6**		
			U = 24 V	●	●	●	●	●	●	**EF7**		
	Possible controller combinations[1]											
	Controller axis **x**	Controller axis **y**										
	Pressure controller[1]	Flow controller	X-T plugged **without** flushing function	●	●	●	●	●	●	**EF.**[1]	**D**	**C**
			X-T open **without** flushing function	●	●	●	●	●	●	**EF.**[1]	**D**	**F**
	Flow control X-T plugged **with** flushing function	Pressure controller remote controlled	X-T plugged **without** flushing function	●	●	●	●	●	●	**EF.**	**S**	**G**
	X-T open **without** flushing function			●	●	●	●	●	●	**EF.**	**F**	**G**

Series

		18	28	45	71	100	140	
06	Series 3, index 1							**31**

All other ordering code information for position 07 to 10 and 12 can be found in the data sheets 92701

Port plate		**Position**	**Fastening thread**							
11	Flange ports according to SAE J518	rear	metric	not for through drive	●	●	●	–	●	●	**11**
					–	–	–	●	–	–	**41**
			SAE		●	●	●	–	●	●	**61**
					–	–	–	●	–	–	**91**
		on the side opposite, top, bottom	metric		●	●	●	–	●	●	**12**
					–	–	–	●	–	–	**42**
			SAE		●	●	●	–	●	●	**62**
					–	–	–	●	–	–	**92**

Connector for solenoids

13	DEUTSCH molded connector, 2-pin, without suppressor diode	**P**

● = Available ○ = On request – = Not available

1) For controller combinations with pressure controller, differential pressure control can only take place in controller axis “y”. This is only possible with the combinations with EF1 and EF2.

Ordering code A10VO series 32 (see also data sheet 92705)

01	02	03	04		05	06		07	08	09	10	11	12
A10V	**O**			**/**	**32**		**–**						**P**

Axial piston unit

		45	71	100	140	180	
01	Variable swashplate design, nominal pressure 280 bar, maximum pressure 350 bar						**A10V**

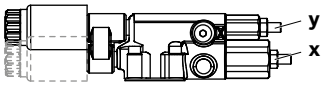
Operating mode

02	Pump, open circuit	**O**

Size (NG)

		45	71	100	140	180
03	Geometric displacement	**45**	**71**	**100**	**140**	**180**

Control device

											Controller axis	**x**	**y**
04	Differential pressure control, electrically variable, negative characteristic curve										**EF.**		
		Δp shifting controller axis **y**	U = 12 V	●	●	●	●	○	**EF1**		
			U = 24 V	●	●	●	●	○	**EF2**		
		Δp shifting Controller axis **x**	U = 12 V	●	●	●	●	○	**EF6**		
			U = 24 V	●	●	●	●	○	**EF7**		
	Possible controller combinations[1]												
	Controller axis **x**	Controller axis **y**											
	Pressure controller[1]	Flow controller	X-T plugged **without** flushing function	●	●	●	●	○	**EF.[1]**	**D**	**C**
			X-T open **without** flushing function	●	●	●	●	○	**EF.[1]**	**D**	**F**
	Flow control X-T plugged **with** flushing function	Pressure controller remote controlled	X-T plugged **without** flushing function	●	●	●	●	○	**EF.**	**S**	**G**
	Flow control X-T open **without** flushing function			●	●	●	●	○	**EF.**	**F**	**G**

Series

		45	71	100	140	180	
05	Series 3, index 2						**32**

All other ordering code information for position 06 to 09 and 11 can be found in the data sheets 92705

Port plate

		Position	**Fastening thread**							
10	Flange ports according to SAE J518	rear	metric	not for through drive	●	●	●	●	●	**11**
		at side opposite top, bottom	metric		●	●	●	●	–	**12**
			metric		–	–	–	–	●	**22**

Connector for solenoids

12	DEUTSCH molded connector, 2-pin, without suppressor diode	**P**

● = Available ○ = On request – = Not available

1) For controller combinations with pressure controller, differential pressure control can only take place in controller axis “y”. This is only possible with the combinations with EF1 and EF2.

Ordering code A10VO series 5x (see also data sheet 92703)

01	02	03	04		05	06		07	08	09	10	11	12
A10V	**O**			**/**	**5x**		**–**						**P**

Axial piston unit

		18	28	45	60	63	72	85	100	
01	Variable swashplate design, nominal pressure 250 bar, maximum pressure 315 bar	●	●	●	●	●	●	●	●	**A10V**

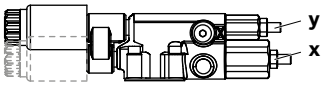
Operating mode

02	Pump, open circuit	**O**

Size (NG)

03	Geometric displacement	**18**	**28**	**45**	**60**	**63**	**72**	**85**	**100**

Control device

											Controller axis	**x**	**y**
04	Differential pressure control, electrically variable, negative characteristic curve										**EF.**		
		Δp shifting Controller axis **y**	U = 12 V	○	○	○	○	○	○	●	●	**EF1**		
			U = 24 V	○	○	○	○	○	○	●	●	**EF2**		
		Δp shifting Controller axis **x**	U = 12 V	○	○	○	○	○	○	●	●	**EF6**		
			U = 24 V	○	○	○	○	○	○	●	●	**EF7**		
	Possible controller combinations[1)]												
	Controller axis **x**	Controller axis **y**											
	Pressure controller[1)]	Flow controller	X-T plugged **without** flushing function	○	○	○	○	○	○	●	●	**EF.[1)]**	**D**	**C**
			X-T open **without** flushing function	○	○	○	○	○	○	●	●	**EF.[1)]**	**D**	**F**
	Flow controller	X-T plugged **with** flushing function	Pressure controller remote controlled	X-T plugged **without** flushing function	○	○	○	○	○	○	●	●	**EF.**	**S**	**G**
		X-T open **without** flushing function			○	○	○	○	○	○	●	●	**EF.**	**F**	**G**

Series

		18	28	45	60	63	72	85	100	
05	Series 5, index 2	–	●	●	●	–	–	●	–	**52**
	Series 5, index 3	●	●	●	–	●	●	●	●	**53**

All other ordering code information for position 06 to 11 can be found in the data sheets 92703

Connector for solenoids

12	DEUTSCH molded connector, 2-pin, without suppressor diode	**P**

● = Available ○ = On request – = Not available

1) For controller combinations with pressure controller, differential pressure control can only take place in controller axis “y”.
This is only possible with the combinations with EF1 and EF2.

EF – differential pressure control, electrically variable

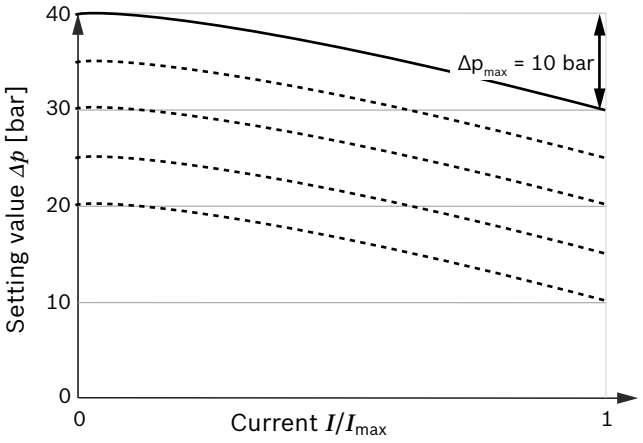
The differential pressure control is based on a pressure flow controller.
In combination with a pressure controller, it limits the maximum pressure at the pump outlet within the control range of the variable pump. The variable pump only supplies as much hydraulic fluid as is required by the consumers.
In combination with a remote controlled pressure controller DG, LS pressure limitation takes place via a separate pressure relief valve. More information can be found in data sheets 92701, 92703 and 92705.
In addition to the function of the pressure controller, a differential pressure is tapped off via an adjustable orifice (e.g. directional valve) which regulates the flow of the pump before and after the orifice. The pump flow is equal to the actual hydraulic fluid quantity required by the consumer.
With all controller combinations, the V_g reduction has priority.

- Basic position in depressurized state: $V_{g\,max}$.
- Setting range for pressure control series 3x
  25 to 280 bar.
  Standard is 280 bar.
- Setting range for pressure control series 5x
  35 to 250 bar.
  Standard is 250 bar.

The electrically variable differential pressure control can be used to reduce the differential pressure by a maximum of 10 bar. A PWM signal is used to control the electrically variable controller (solenoid).

- Setting range for differential pressure control:
  20 to 40 bar.
  Standard is 24 bar.
  If another setting is required, please state in plain text.

▼ **Characteristic curve EF**



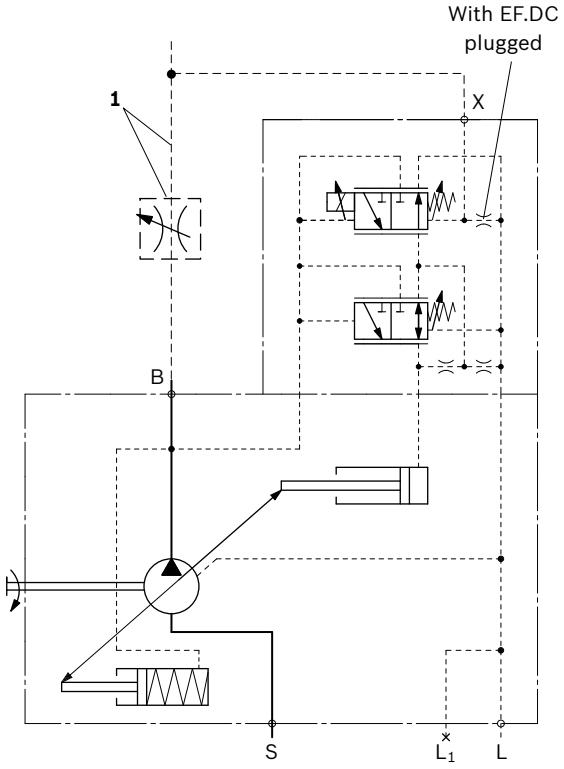
Unloading port **X** to the reservoir and with de-energized solenoid results in a zero stroke (“standby”) pressure which is about 1 to 2 bar higher than the defined differential pressure Δp. Other system influences are not taken into account.

Technical data, solenoids	EF1../EF6..	EF2../EF7..
Voltage	12 V (±20 %)	24 V (±20 %)
Control current		
Start of adjustment Δp_{max}	0 mA	0 mA
End of adjustment Δp_{min}	1200 mA	600 mA
Current limit	1.54 A	0.77 A
Nominal resistance (at 20 °C)	5.5 Ω	22.7 Ω
Dither frequency	100 to 200 Hz	100 to 200 Hz
Minimum working stroke of the dither within the control range[1)]	352 mA	176 mA
Duty cycle	100 %	100 %
Operating temperature range	-20 °C to +115 °C	
Type of protection: see connector version page 10		

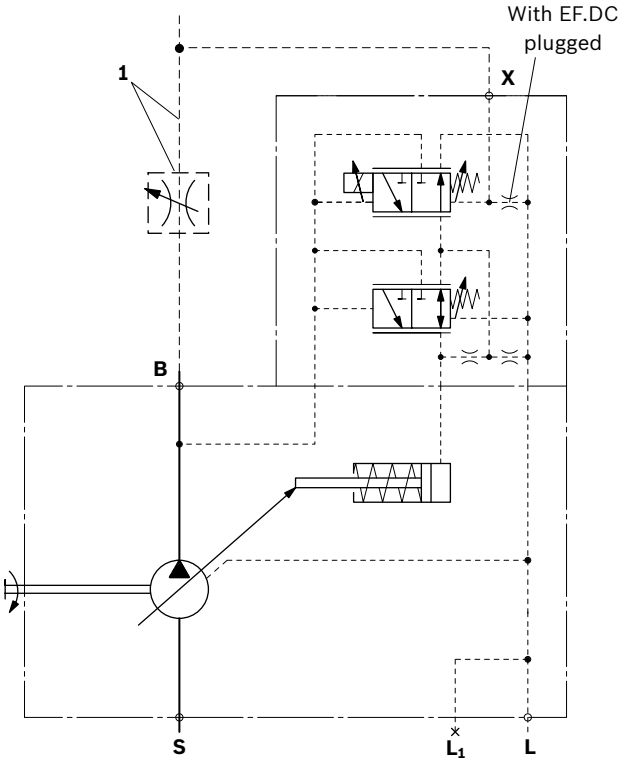
Project planning note
For a maximally energized valve, a minimum differential pressure Δp of 10 bar must be present.

1) ΔI = 44 % of the current difference within the control range, regardless of the mean value of the current

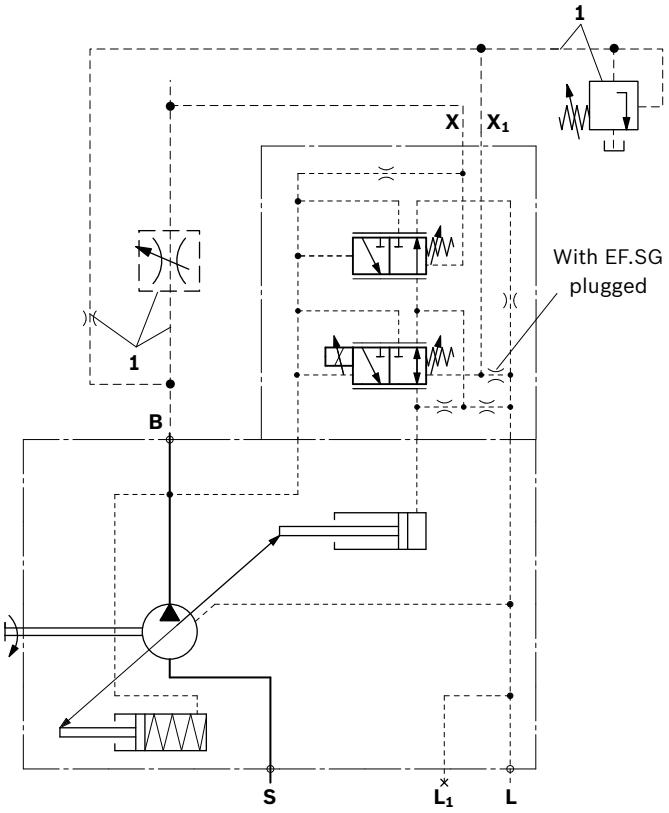
▼ **Circuit diagram EF.DF series 3x**



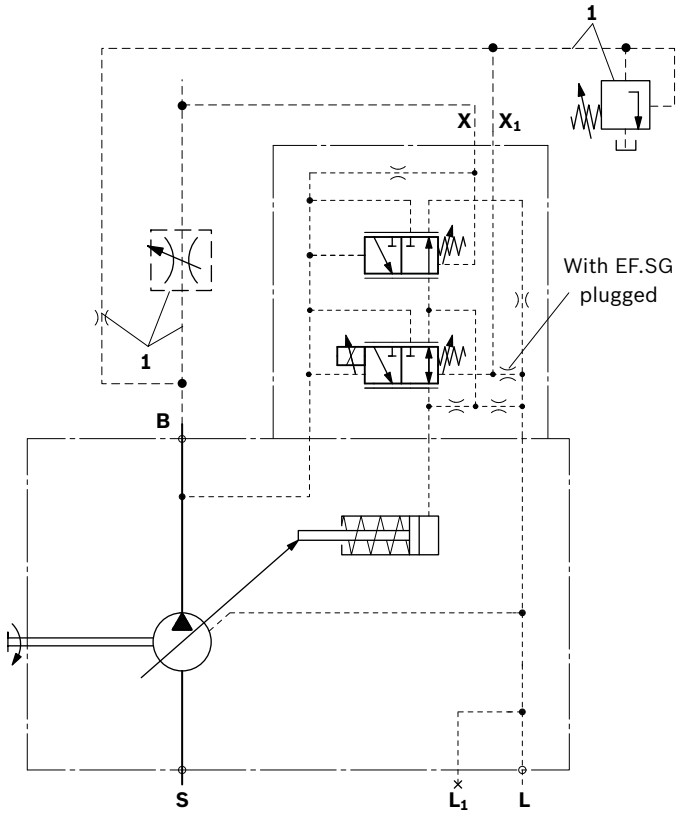
▼ **Circuit diagram EF.DF series 5x**



▼ **Circuit diagram EF.FG series 3x**



▼ **Circuit diagram EF.FG series 5x**



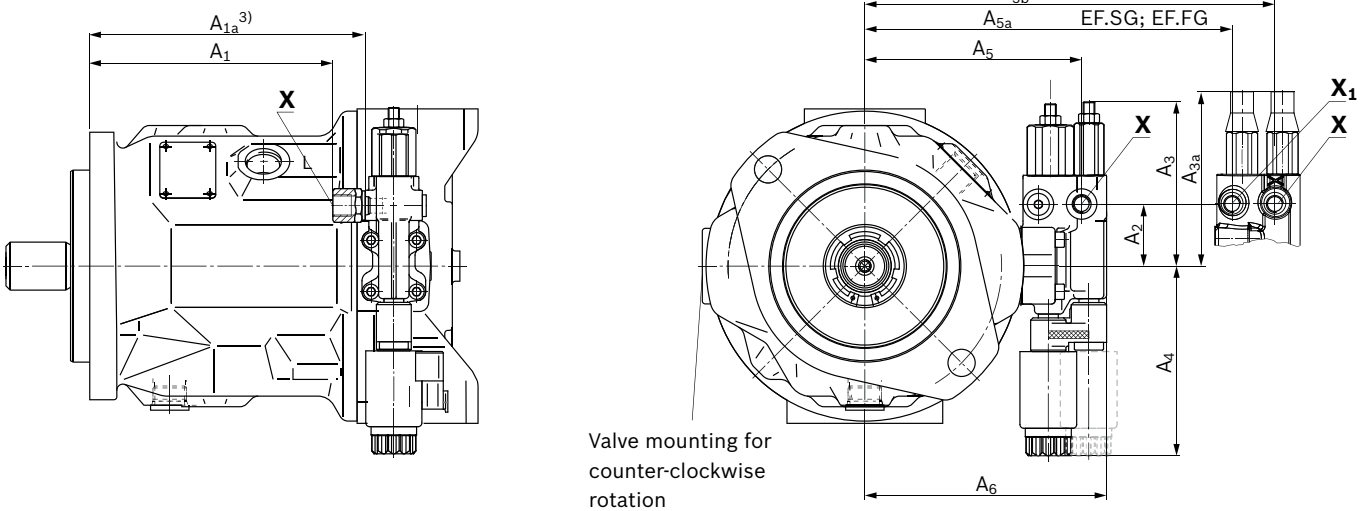
1 The metering orifice (control block) or pressure relief valve and the line is not included in the scope of delivery.

For ports, see Connection table series 31 and Connection table series 52/53 on page 9.

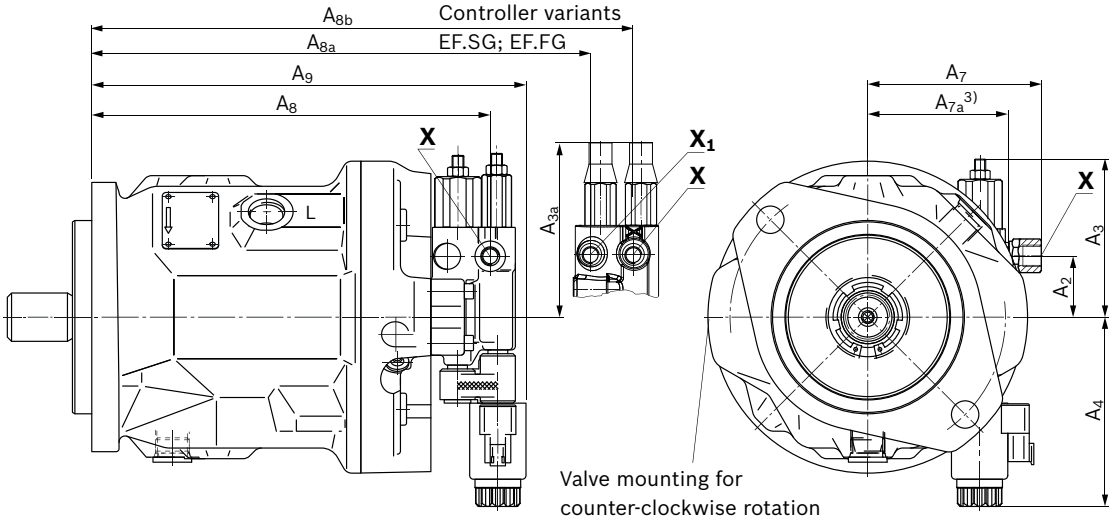
Dimensions A10 V(S)O series 31 and 32

Clockwise rotation (main dimensions of the variable pump and the technical data, see data sheet 92701, 92705)

▼ **Valve mounting with port plate 12/42/62/92**



▼ **Valve mounting with port plate 11/41/61/91**



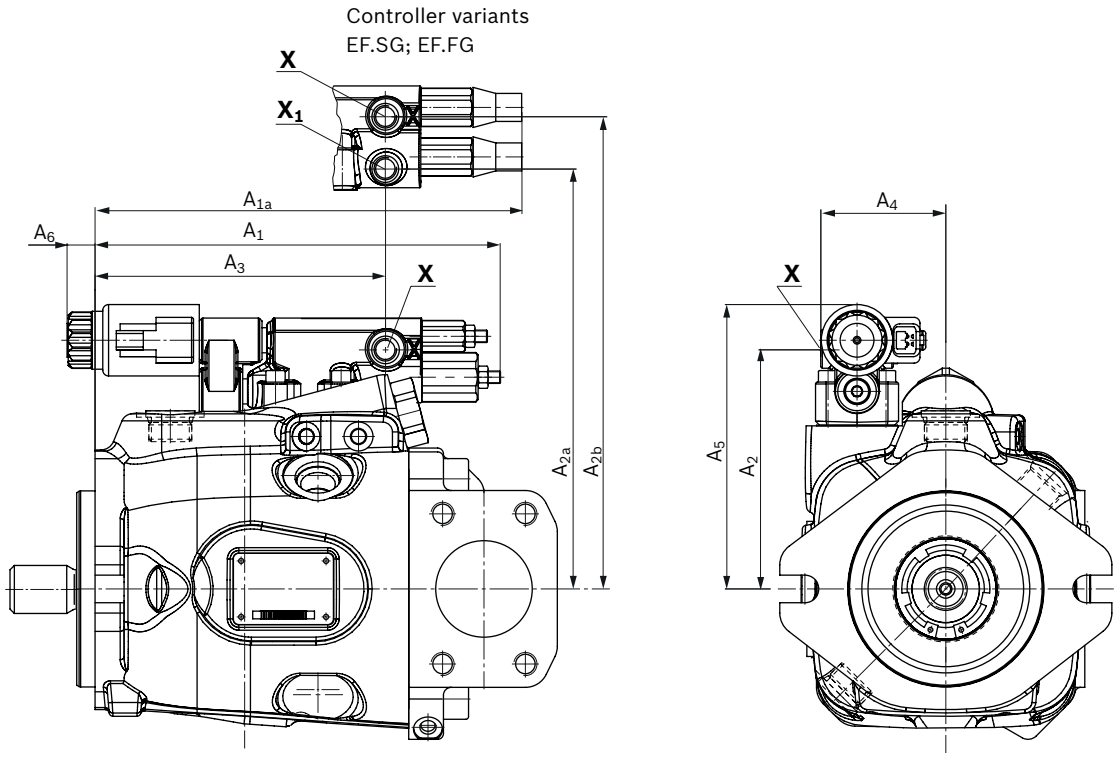
Size	A_1	A_{1a} [3]	A_2	A_3	A_{3a}	A_4	A_5	A_{5a}	A_{5b}	A_6	A_7	A_{7a} [3]	A_8	A_{8a}	A_{8b}	A_9
18	108	129	40	110	113	124	109	81	109	133	–	–	–	–	–	–
28	118	139	40	110	113	124	119	91	119	142	95	74	209	181	209	232
45	133	154	40	110	113	124	129	101	129	153	103	82	228	200	228	251
71	161	182	40	110	113	124	143	115	143	167	114	93	262	234	262	285
100	229	250	40	110	113	124	148	120	148	172	121	100	327	299	327	350
140[1]	233	254	29	99	102	136	163	135	163	187	on request					
140[2]	206	227	29	99	102	136	163	135	163	187						

For ports, see Connection table series 31 and 32 on page 9.

1) Dimensions of mounting flange C
2) Dimensions of mounting flange D
3) At port plates 61, 91 or 62, 92 series 31 see data sheet 92701.

Dimensions A10 VO series 52 and 53

Clockwise rotation (main dimensions of the variable pump and the technical data, see data sheet 92703)



Size	A_1	A_{1a}	A_2	A_{2a}	A_{2b}	A_3	A_4	A_5	A_6
18									
28									
45									
60					on request				
63									
72									
85[1)]	241.5	245	139.5	111.5	139.5	171.5	74	163	–
85[2)]	251.5	255	139.5	111.5	139.5	181.5	74	163	–
100	251.5	255	133	105	133	181.5	74	157	–

For ports, see Connection table series 52/53 on page 9.

1) Dimensions of mounting flange C
2) Dimensions of mounting flange D

Connection table series 31

Ports version metric		Standard	Size	$p_{max\ abs}$ [bar][2]	State
B	Working port (high-pressure series) Fastening thread[1]	SAE J518[3] DIN 13	See data sheet 92701	350	O
S	Suction port (standard pressure series) Fastening thread[1]	SAE J518[3] DIN 13		10	O
L	Drain port	DIN 3852		2	O[5]
L_1	Drain port	ISO 11926[4]		2	X[5]
X	Pilot pressure controller axis y	DIN 3852	M14 × 1.5; 12 deep	350	O
X_1	Pilot pressure controller axis x	DIN 3852	M14 × 1.5; 12 deep	350	O

Ports version SAE		Standard	Size	$p_{max\ abs}$ [bar][2]	State
B	Working port (high-pressure series) Fastening thread[1]	SAE J518 ASME B1.1	See data sheet 92701	350	O
S	Suction port (standard pressure series) Fastening thread[1]	SAE J518 ASME B1.1		10	O
L	Drain port	ISO 11926[4]		2	O[5]
L_1	Drain port	ISO 11926[4]		2	X[5]
X	Pilot pressure controller axis y	ISO 11926[4]	7/16-14UNC-2B; 11.5 deep	350	O
X_1	Pilot pressure controller axis x	ISO 11926[4]	7/16-14UNC-2B; 11.5 deep	350	O

Port plate assignment metric/SAE see Ordering code A10V(S)O series 31 (see also data sheet 92701) and position 11 on page 2

Connection table series 32

Ports		Standard	Size	$p_{max\ abs}$ [bar][2]	State
B	Working port (high-pressure series) Fastening thread[1]	SAE J518[3] DIN 13	See data sheet 92705	350	O
S	Suction port (standard pressure series) Fastening thread[1]	SAE J518[3] DIN 13		10	O
L	Drain port	ISO 11926[4]		2	O[5]
L_1	Drain port	ISO 11926[4]		2	X[5]
X	Pilot pressure controller axis y	ISO 11926[4]	7/16-14UNC-2B; 11.5 deep	350	O
X_1	Pilot pressure controller axis x	ISO 11926[4]	7/16-14UNC-2B; 11.5 deep	350	O

Connection table series 52/53

Ports		Standard	Size	$p_{max\ abs}$ [bar][2]	State
B	Working port (high-pressure series) Fastening thread[1]	SAE J518[3] DIN 13	See data sheet 92703	315	O
S	Suction port (standard pressure series) Fastening thread[1]	SAE J518[3] DIN 13		5	O
L	Drain port	ISO 11926[4]		2	O[5]
L_1, L_2[6]	Drain port	ISO 11926[4]		2	X[5]
X	Pilot pressure controller axis y	ISO 11926	7/16-20UNF-2B; 11.5 deep	315	O
X_1	Pilot pressure controller axis x	ISO 11926	7/16-20UNF-2B; 11.5 deep	315	O

1) Observe the instructions in the operating instructions concerning the maximum tightening torques.
2) Momentary pressure spikes may occur depending on the application. Keep this in mind when selecting measuring devices and fittings.
3) Metric fastening thread is a deviation from standard.
4) The spot face can be deeper than as specified in the standard.
5) Depending on the installation position, **L**, **L_1** or **L_2** must be connected (please refer to installation instructions in the relevant data sheets).
6) Only series 53
7) O = Must be connected (plugged when delivered)
X = Plugged (in normal operation)

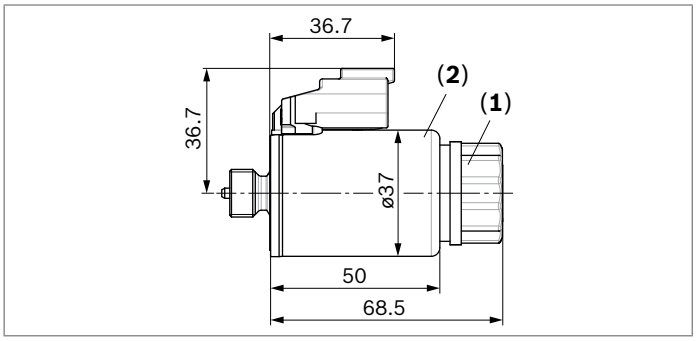
Connector for solenoids

DEUTSCH DT04-2P-EP04

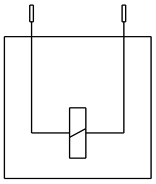
Molded connector, 2-pin, without bidirectional suppressor diode

The following type of protection ensues with a mounted mating connector:

- IP67 (DIN/EN 60529) and
- IP69K (DIN 40050-9)



▼ Switching symbol



Note

- If necessary, you can change the position of the connector by turning the solenoid.
- The procedure is defined in the general operating instructions 90300-B.

▼ Mating connector DEUTSCH DT06-2S-EP04

Consisting of	DT designation
1 housing	DT06-2S-EP04
1 wedge	W2S
2 sockets	0462-201-16141

The mating connector is not included in the scope of delivery. This can be supplied by Bosch Rexroth on request (material number R902601804).

Electronic controls

Control	Electronics function	Electronics		Data sheet
Electric pressure control	Controlled power outlet	RA	analog	95230
		RC4-5/30	digital	95205

Project planning notes

- The axial piston variable pump A10V(S)O with EF control is designed to be used in open circuit.
- The project planning, installation and commissioning of the axial piston unit require the involvement of qualified skilled personnel.
- Before using the axial piston unit, please read the corresponding instruction manual completely and thoroughly. If necessary, request it from Bosch Rexroth.
- Before finalizing your design, please request a binding installation drawing.
- The specified data and notes must be observed.
- Depending on the operating condition of the axial piston unit (working pressure, fluid temperature), the characteristic curve may shift.
- Preservation: Our axial piston units are supplied as standard with protection to preserve them for a maximum of 12 months. If longer preservative 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 variants of the product are approved for use in safety functions according to ISO 13849. Please consult the responsible contact person 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. When a direct current is applied, solenoids do not cause electromagnetic interference nor is their operation impaired by electromagnetic interference.
  Other behavior can result when a modulated direct current (e.g. PWM signal) is applied. Potential electromagnetic interference for persons (e.g. persons with a pacemaker) and other components must be tested by the machine manufacturer.
- Pressure controllers are not safeguards against pressure overload. Be sure to add a pressure relief valve to the hydraulic system.
- Working ports:
  - The ports and fastening threads are designed for the specified peak pressure. The machine or system manufacturer must ensure that the connecting elements and lines correspond to the specified operating conditions (pressure, flow, hydraulic fluid, temperature) with the necessary safety factors.
  - The working ports and function ports can only be used to accommodate hydraulic lines.

Safety instructions

- During and shortly after operation, there is a risk of burns on the axial piston unit and especially on the solenoids. Take appropriate safety measures (e.g. by wearing protective clothing).
- Moving parts in control and regulation systems (e.g. valve spools) may in certain circumstances become stuck in an undefined position due to contamination (e.g. contaminated hydraulic fluid, abrasion or residual dirt from components). As a result, the hydraulic fluid flow or torque build-up of the axial piston unit will no longer respond correctly to the operator's commands. Even the use of different filter cartridges (external or internal inlet filter) will not rule out a fault but merely reduce the risk. The machine/system manufacturer must check whether additional measures on the machine are required for the relevant application in order to bring the powered load into a safe position (e.g. safe stop) and ensure all appropriate measures are taken.

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