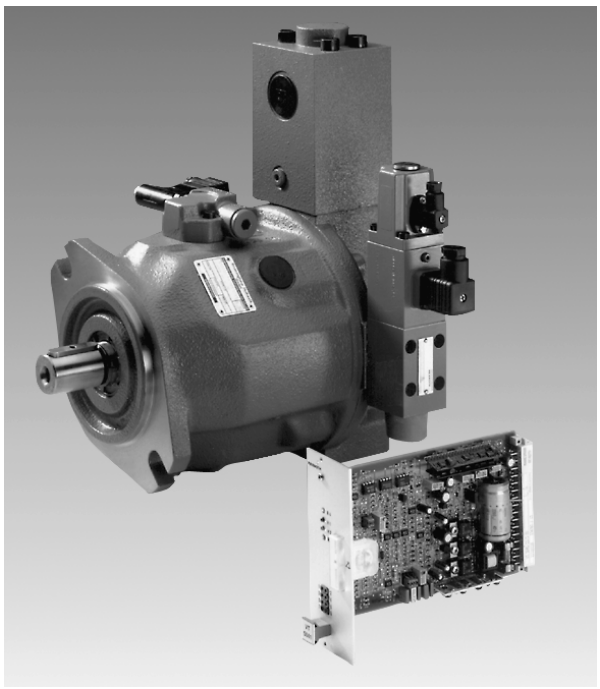
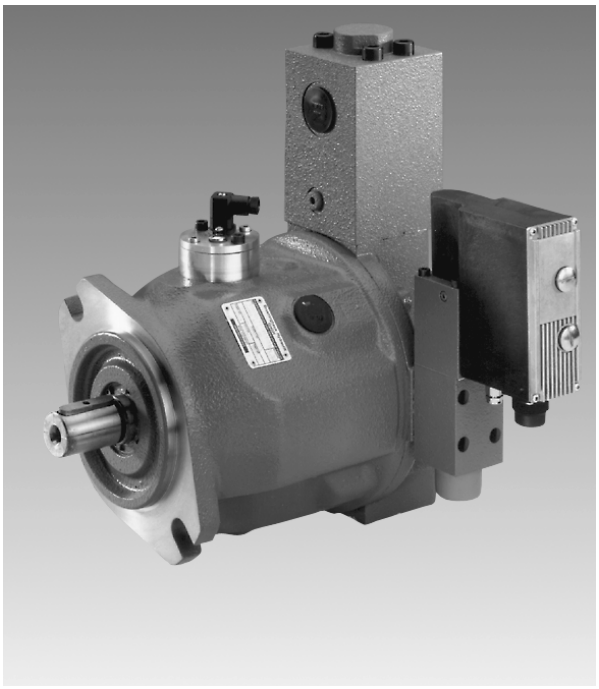
MANNESMANN REXROTH

Electrical Closed Loop Control Systems DFE1, DFEE, and FE1 for the Control of AA10VSO Variable Displacement Axial Piston Pumps

RA
30 022/12.97
Metric
Replaces: 03.96



H/A 5342/96
Type DFE1 pump with VT 5041 controller, bolt-on SYDZ valve, and pressure transducer.



H/A 5312/95
Type DFEE type pump with bolt-on SYDZ valve and pressure transducer.

DFE1 controls are used for the electro-hydraulic closed loop control of pressure and swivel angle of variable displacement axial piston pumps.

DFE1 closed loop control system consists of the following components:

– AA10VSO axial piston pump with built-on STW 0063 proportional valve includes inductive position transducer for sensing the swivel angle and valve position (for detailed information regarding the pump, see RA 92 711)
– STC pressure transducer for sensing the system pressure
– VT 5041 amplifier card for the control of all electrical functions required for the DFE1 control
– Optional pump preload valve – SYDZ

In terms of function, DFEE closed loop control system corresponds to DFE1 system, but includes open and closed loop control electronics, which are integrated into the pump mounted proportional valve. The VT 5041 external control electronics are therefore not required

With this version containing integral electronics, the inductive swivel angle transducer is replaced by a transducer on the basis of a Hall-effect sensor.

Table of contents

Functional description, section

The closed loop control of pressure and swivel angle of AA10 VSO...DFE. variable displacement pumps is via an electrically controlled proportional valve (2). The proportional valve determines the position of the swashplate (1) via the control pistons (3 and 4). The displaced flow is proportional to the position of the swashplate. The control spool (3), which is preloaded by a spring (5), is permanently subjected to the pump pressure.

While the pump not rotating and the control system is pressureless , the swashplate is held in position + 100 % by the spring (5). With a driven pump and a de-energized proportional solenoid (8) the system regulates to zero stroke pressure as the valve spool (9) is pushed to the right by the spring (10) and therefore the pump pressure is applied to the control piston (4) via valve port A. A balance between the pump pressure and the spring force (5) is achieved between 8 to 12 bar. This basic setting is taken on with inactive closed loop control electronics (e.g. controller not enabled).

The closed loop control electronics consist of a pressure, a swivel angle and a valve spool position controller. The actual pressure value is sensed by means of a pressure transducer. The position of the swashplate is sensed using the swivel angle transducer (7).

The corresponding controllers compare the two actual values with the command values. Any detected control deviations are processed further in the controllers and then passed on to a minimum value generator. With the minimum value generator it is ensured that the controller associated to the working point is active.

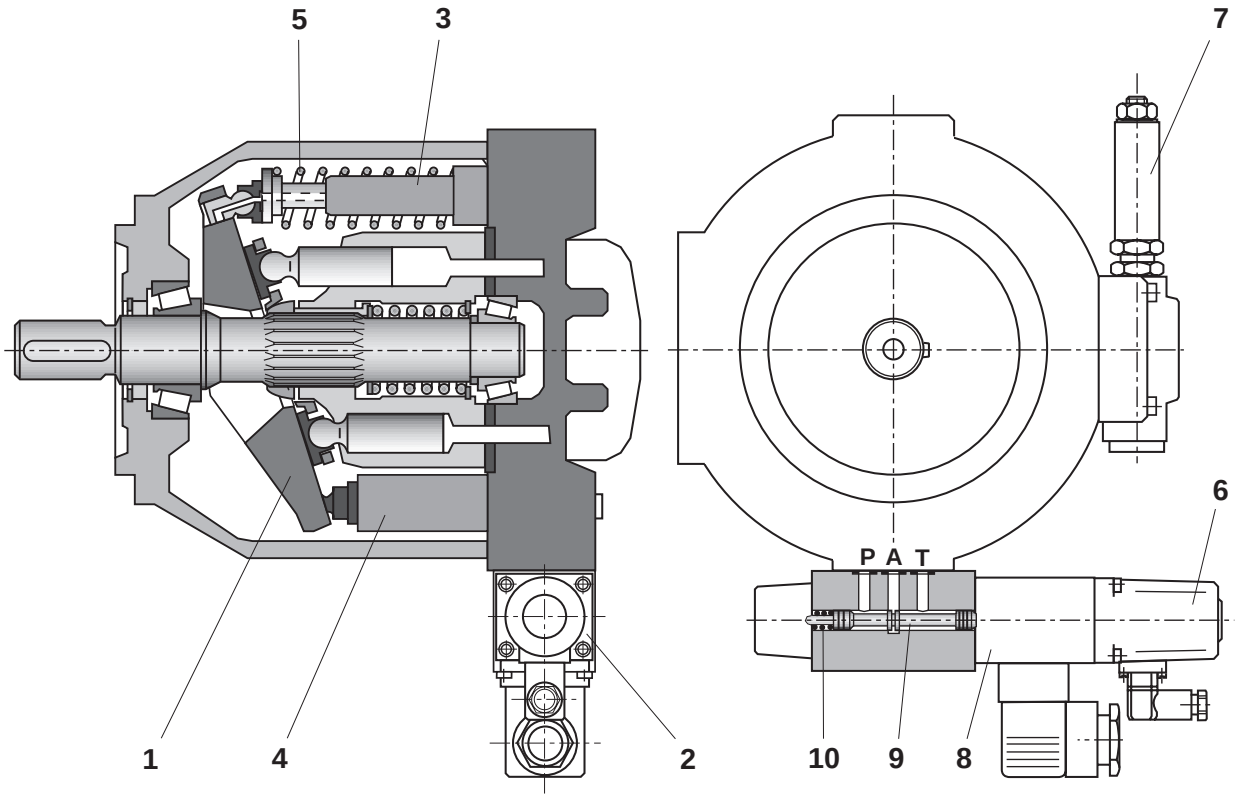
The actual value of the valve spool position is picked up by an inductive position transducer (6). The output value of the valve position controller determines the current through the proportional solenoid (8) via the amplifier output stage. In the static condition (pressure command value equals actual pressure value or swivel angle command value equals actual swivel angle value) the control spool (9) of the proportional valve is in its central position.

If the higher-level controllers demand an increase of the swivel angle (increase in flow), the valve spool (9) must be moved from the central position to the left (connection of the control piston (4) via valve port A to tank) until the swivel angle has reached the required value. The movement of the valve spool against the force of the spring (10) is achieved by increasing the electric current through the proportional solenoid (8) accordingly.

To reduce the flow the control piston (4) must be connected to the P port of the valve. A reduction of the solenoid current causes the valve spool (9) to move to the right.

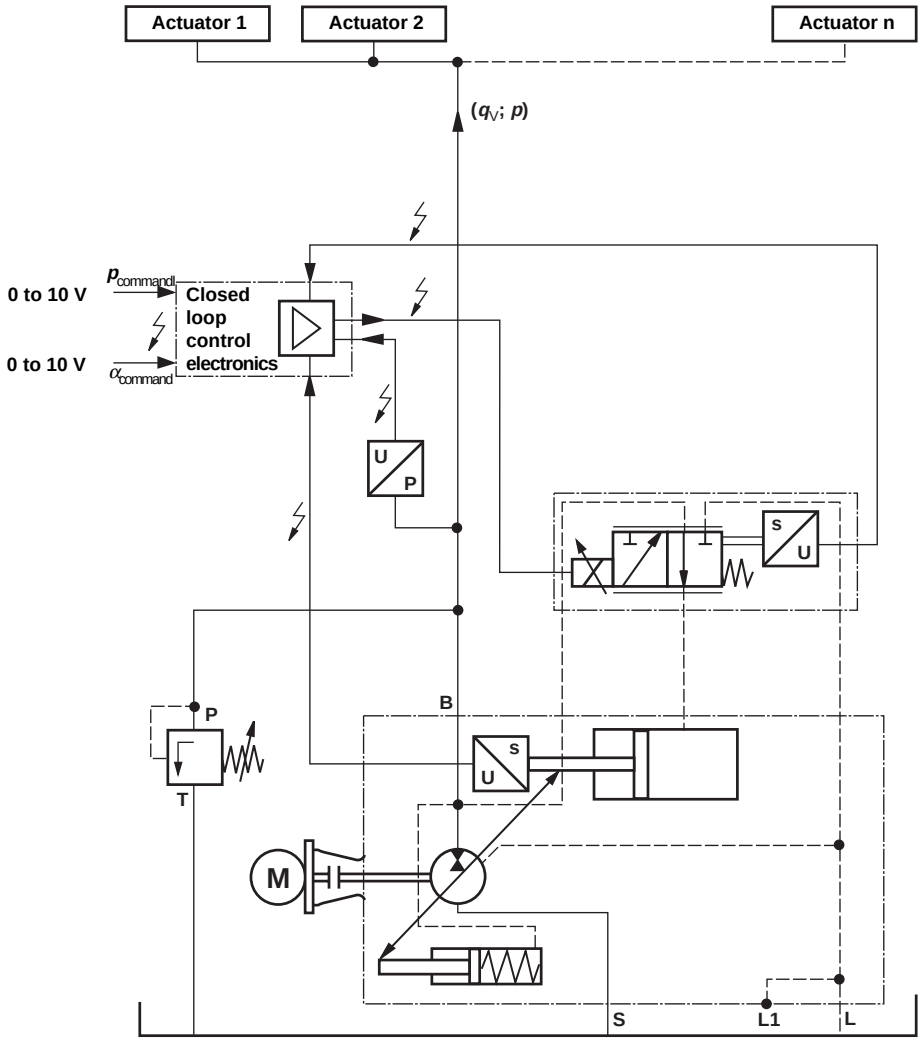
The proportional valve (2) requires closed loop control electronics which realize all the electrical functions for the operation of the variable displacement pump with DFE. control. For the DFE1 system version VT 5041 amplifier cards are provided for this purpose; the DFEE system version comes with integral open and closed loop control electronics.

Note: The system must be bled during commissioning.



DFE1 system

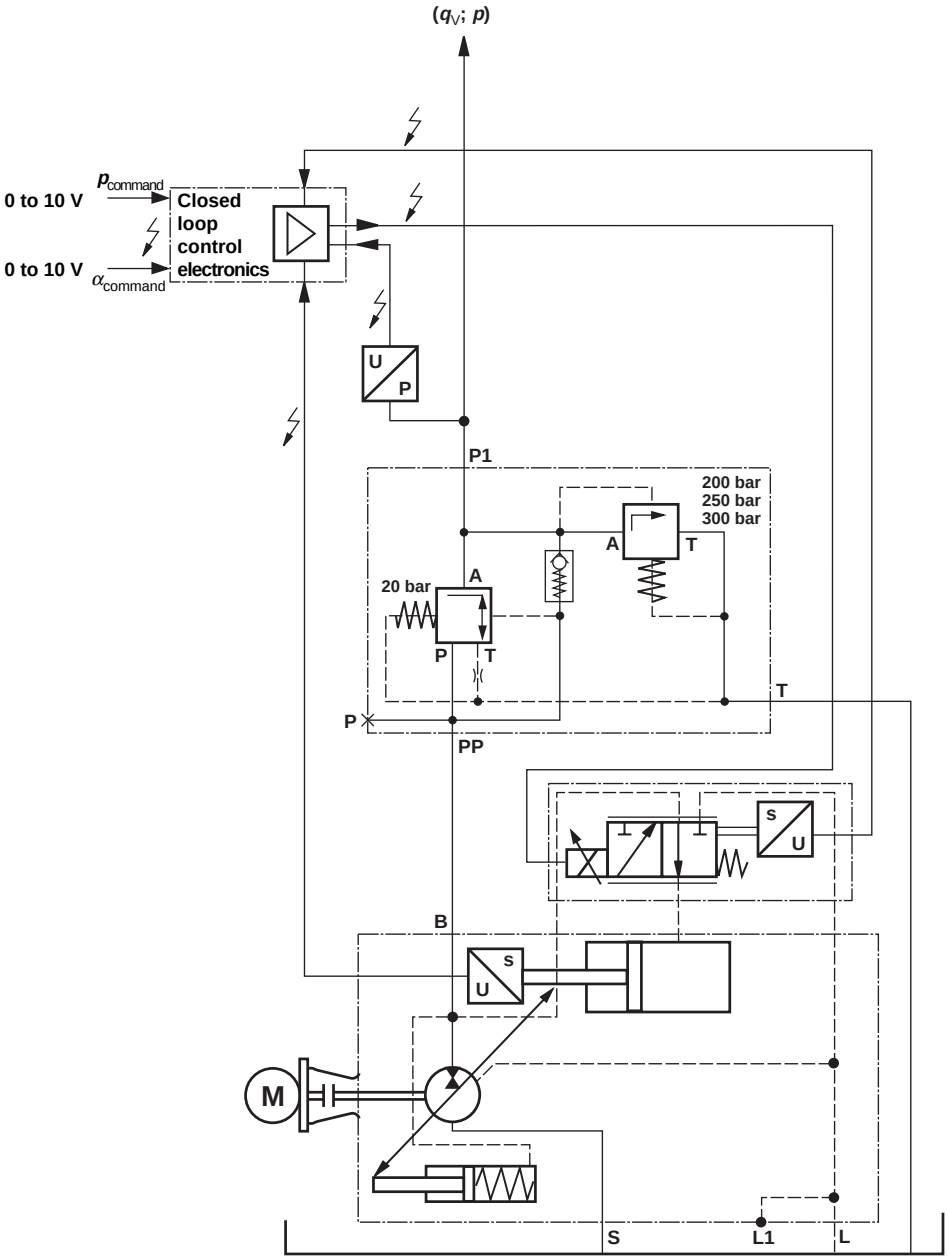
DFE. control with internal supply to the control system



Note:

With this circuit variant, the minimum system pressure is 12 bar. When the flow must be controllable at a working pressure of less than 12 bar or when a pressure must be controlled at < 12 bar, this is possible by using a preload valve or connecting an external supply to the control system.

DFE. control with preload valve

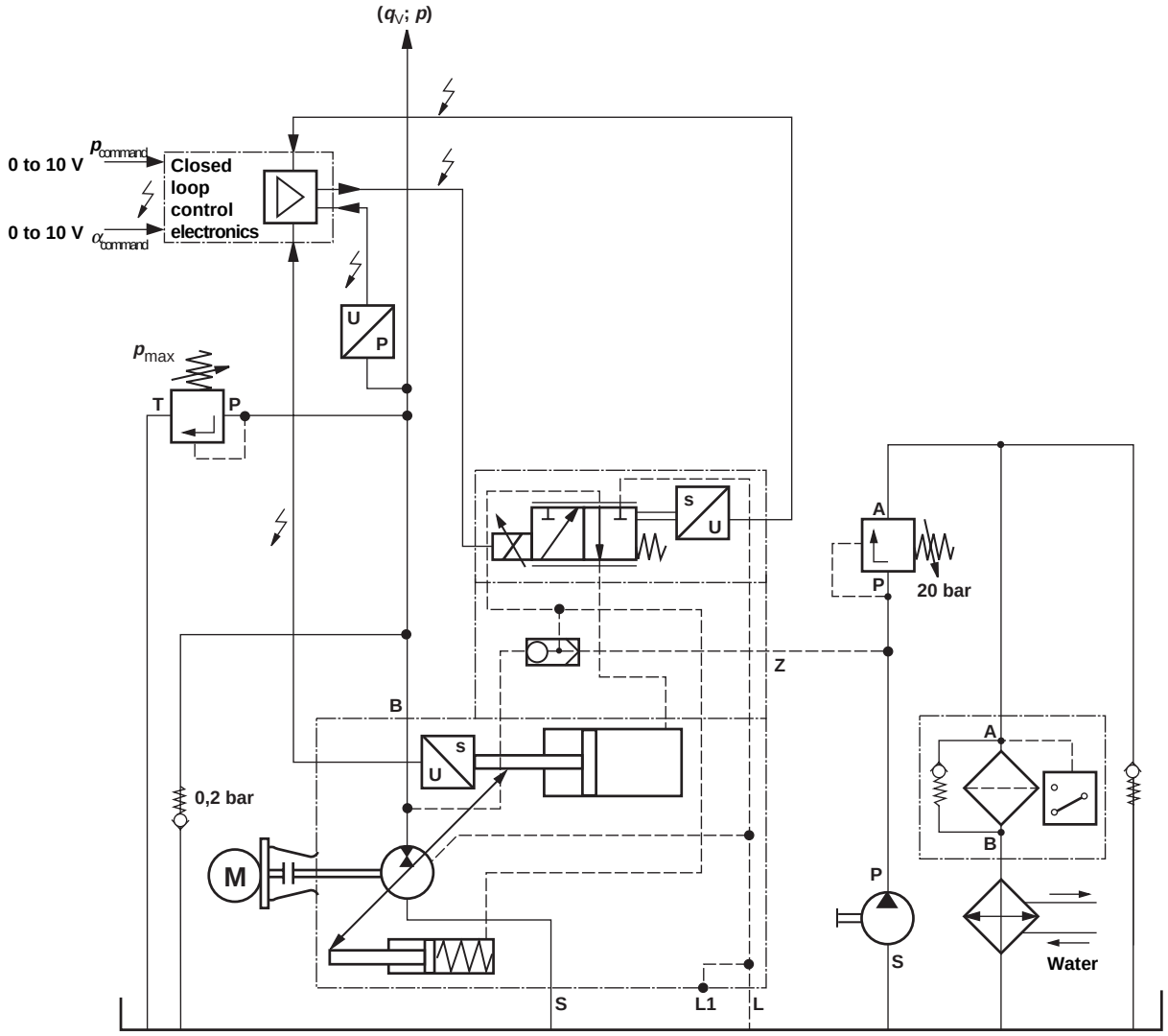


For technical details and ordering code of the preload valve, see page 23.

DFE. control with external supply to the control system

If the system comprises a further pump apart from the pump for DFE. control, the external supply to the control system is ideal. The pump with the higher pressure supplies the control system via a shuttle valve.

The pressure of the pump for external supply must be approx. 20 bar (if required, a pressure reducing valve should be installed). A must is the use of a pressure relief/anti-cavitation valve (check valve with 0.2 bar spring) in order to avoid cavitation in the case of malfunction.



Note when ordering the pump:

With external supply to the control system, version **SO 479** (for sizes 18 to 71) or **SO 487** (for sizes 100 and 140) must be ordered.

CAUTION!!

- With externally supplied control systems the safety function, which swivels the pump to zero stroke when the output stage of the controller card is de-energized, is no longer available.
- With de-energized output stage of the controller card, the swashplate of the control pump is pushed against the negative stop by external pressure (100 % displacement from the system to the tank).
- When a fault is detected (even if the controller is not enabled) the output stage is switched off. With an active fault message, it is absolutely necessary that the machine controls respond (e.g. drive motor of the pump must be switched off, the external supply to the control system must be interrupted).
- Command values for pressure and flow must always be greater than zero as due to drift or inaccurate setting there is no exact "zero" pressure or "zero" swivel angle value. Thus, command value signals equal zero or slightly greater than zero can lead to cavitation in the worst case. (always: $p_{command} \geq 3$ bar, $\alpha_{command} \geq 5$ %)
- The actual value must not be smaller than 10 bar for longer than 10 minutes to ensure lubrication.

Ordering code

AA10VSO			DFE1	/	31	R	-	P	K	C	62	N00	2

Fluid

Mineral oil (no code)	

Axial piston unit

Swashplate design, variable displace open circuit, industrial SAE version	**AA10VSO**

Size

Displacement V_g	in³/rev	cm³/rev
	1.10	**18**
	1.71	**28**
	2.75	**45**
	4.33	**71**
	6.10	**100**
	8.54	**140**

Control type

Proportional pressure and flow control	**DFE1**

Series

	31

Direction of rotation

Viewed on shaft end	Right hand, clockwise	**R**
	Left hand, counter-clockwise	**L**

Seals

Buna-N (NBR per DIN ISO 1629); shaft seal FPM (fluorocarbon)	**P**

Shaft end

SAE-keyed shaft	**K**
SAE-splined shaft	**S**

Mounting flange

SAE 2-hole flange mounting flange	**C**
SAE 4-hole flange mounting flange, size 140 only	**D**

Service ports

		28	48	71	100	140	
Ports A/B	Opposite side ports, SAE flange, standard series, UNC mounting screws (Code 61)	●	●	–	●	●	**62**
	Opposite side ports, SAE flange, standard series, B port size 1", UNC mounting screws (Code 61)	–	–	●	–	–	**92**

Thru-drive

No thru-drive	**N00**
With thru-drive; for details see RA 92 711	**KXX**

SYDZ sequence valve option

Without sequence valve	**omit**
With sequence and relief valve, pressure limitation up to 2900 psi (200 bar)*	**1**
With sequence and relief valve, pressure limitation up to 3600 psi (250 bar)*	**2**
With sequence and relief valve, pressure limitation up to 4350 psi (300 bar)*	**3**

*State settings in clear text when ordering.

● = available
– = not available

Ordering code

AA10VSO		DFEE		/	31	R	-	P	K	C	62	N00	2	C	2

Fluid

Mineral oil (no code)	

Axial piston unit

Swashplate design, variable displace open circuit, industrial SAE version	**AA10VSO**

Size

Displacement V_g	in³/rev	cm³/rev
	1.10	**18**
	1.71	**28**
	2.75	**45**
	4.33	**71**
	6.10	**100**
	8.54	**140**

Control type

Proportional pressure and flow control	**DFEE**

Additiona functions

Electronics without additional functions	**omit**
Electronics with power limitation as additional functions	**3**

Series

	31

Direction of rotation

Viewed on shaft end	Right hand, clockwise	**R**
	Left hand, counter-clockwise	**L**

Seals

Buna-N (NBR per DIN ISO 1629); shaft seal FPM (fluorocarbon)	**P**

Shaft end

SAE-keyed shaft	**K**
SAE-splined shaft	**S**

Mounting flange

SAE 2-hole flange mounting flange	**C**
SAE 4-hole flange mounting flange, size 140 only	**D**

Service ports

		28	48	71	100	140	
Ports A/B	Opposite side ports, SAE flange, standard series, UNC mounting screws (Code 61)	●	●	–	●	●	**62**
	Opposite side ports, SAE flange, standard series, B port size 1", UNC mounting screws (Code 61)	–	–	●	–	–	**92**

Thru-drive

No thru-drive	**N00**
With thru-drive; for details see RA 92 711	**KXX**

SYDZ sequence valve option

Without sequence valve	**omit**
With sequence and relief valve, pressure limitation up to 2900 psi (200 bar)*	**1**
With sequence and relief valve, pressure limitation up to 3600 psi (250 bar)*	**2**
With sequence and relief valve, pressure limitation up to 4350 psi (300 bar)*	**3**

Pressure transducer input value (pactual)

Current input 4 to 20 mA	**C**
Voltage input 0–10 Volts	**V**
Voltage input 1–10 Volts	**E**

Special options

Without connecting cable	**1**
Connector with cable 5 meter (15 ft) long	**2**
Connector with cable 10 meter (30 ft.) long	**3**
Connector with cable 20 meter (60 ft) long	**4**

*State settings in clear text when ordering.

Technical data DFE1 (for applications outside these parameters, please consult us!)

Technical data – hydraulic

AA10VSO variable displacement pump		
Maximum permissible operating pressure	p_{max}	250 bar
Required minimum control pressure	p_{min}	20 bar
Drive speed	n	1500 or 1800 min^{-1}
Fluid temperature range	t	– 20 to + 70 °C, preferably 45 to 50 °C
Ambient temperature range	t	– 20 to + 70 °C

The operation of the system at pressures and temperatures higher than the values above will result in a shorter service life and stability problems.

Further information: see data sheet RE 92 711

Technical data – electrical

Proportional valve			
Type of voltage			DC
Power		P_{max}	19 W
Power requirement		I_{max}	2.5 A
Control current		I	approx. 1.25 A
Solenoid coil resistance	– cold value at 20 °C	R	2 Ω
	– max. warm value	R	3 Ω
Duty cycle	– with amplifier in closed loop operation		100 %
	– proportional solenoid at I_{max}		40 %
Electrical connection			Plug-in connection 2-pin + PE/Pg11 to DIN 43 650
Type of protection			IP 65 to DIN 40 050
Valve spool position transducer			
Measuring system			Differential transformer
Control stroke			± 0.6 mm
Linearity tolerance			≤ 1 %
Carrier frequency		f	5 kHz
Coil resistance (at 20 °C)	– between connection 1 and 2		113 Ω
	– between connection 3 and 4		101 Ω
Electrical connection			Connector G4W1F / socket G4A5M
Type of protection			IP 65 nach DIN 40 050
Swivel angle transducer			
Measuring system			Differential throttle
Control stroke			± 4 mm
Linearity tolerance			≤ 1.5 %
Carrier frequency		f	5 kHz
Coil resistance (at 20 °C)	– between connection 1 and 2		32 Ω
	– between connection 2 and ⏚		46 Ω
	– between connection 1 and ⏚		32 Ω
Electrical connection			Plug-in connection to DIN 43 65, form B
Type of protection			IP 65 to DIN 40 050
Control electronics			VT 5041amplifier in Euro-card format (see pages 17 to 20)

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

Technical data – hydraulic

AA10VSO variable displacement pump		
Maximum permissible operating pressure	p_{max}	250 bar
Required minimum control pressure	p_{min}	20 bar
Drive speed	n	1500 or 1800 min^{-1}
Fluid temperature range	t	– 20 to + 70 °C, preferably 45 to 50 °C
Ambient temperature range	t	0 to 60 °C

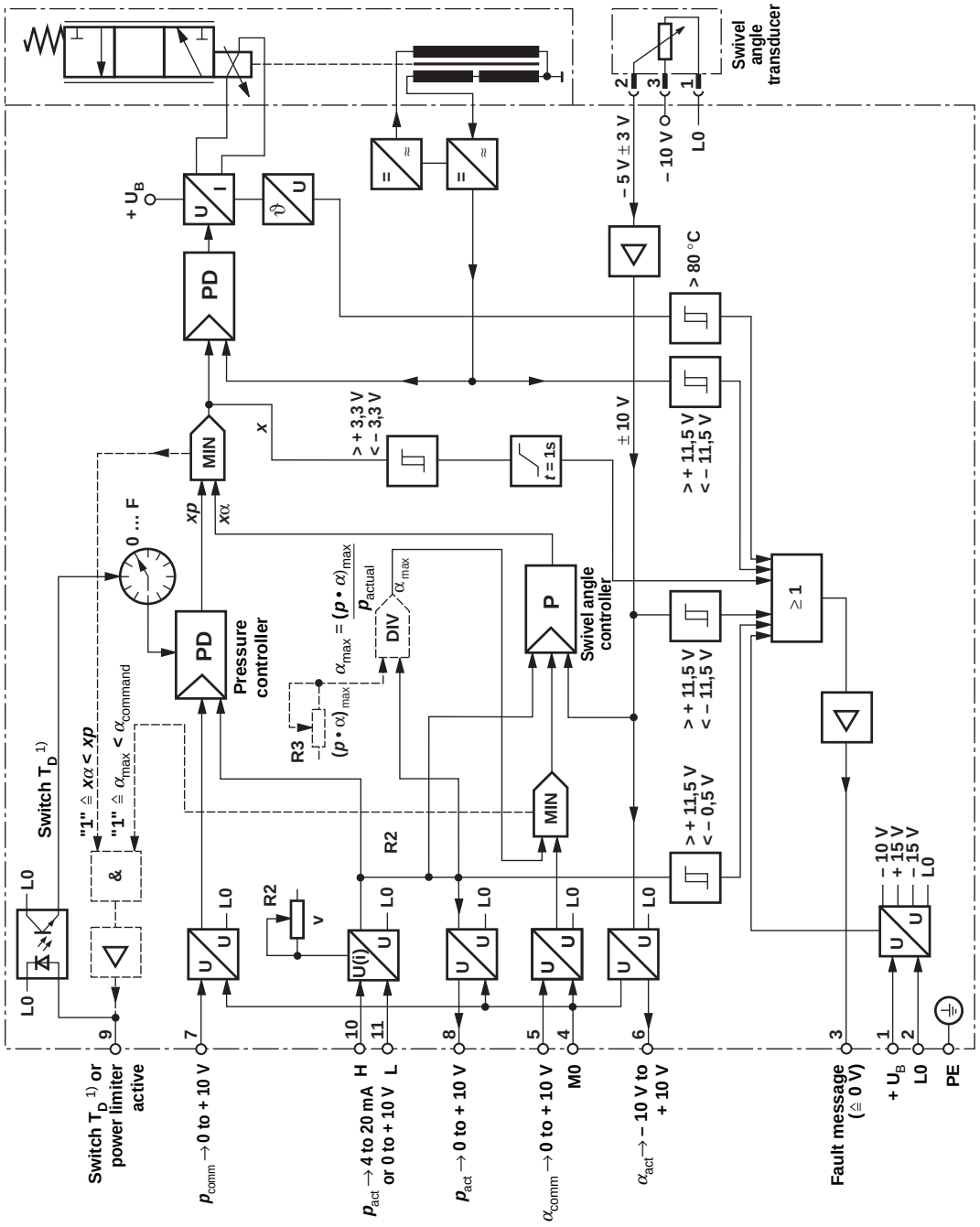
The operation of the system at pressures and temperatures higher than the values above will result in a shorter service life and stability problems.

Further information: see data sheet RA 92 711

Technical data – electrical

Integral electronics		
Operating voltage	U_B	24 VDC + 40 % – 5 %
Operating range		
– Upper limiting value	$u_B(t)_{max}$	35 V
– Lower limiting value	$u_B(t)_{min}$	21 V
Power requirement (in static closed loop control operation)		
– Nominal current	I_{nom}	0.6 A
– Maximum current	I_{max}	1.25 A
Inputs		
– Command values (pressure and swivel angle)	U_e	0 to 10 V; R_E = 100 kΩ
– Switch T_D (only with ordering code **1** w/o additional functions)		
• "Off"	U_e	< 0.6 V
• "On"	U_e	> 21 V
– Actual pressure value (depending on the actual pressure input, see ordering code)		
• Current input (ordering code **C**)	I_e	4 to 20 mA; load R_B = 100 Ω
• Voltage input (ordering code **V**)	U_e	0 to 10 V; R_E = 100 kΩ
Outputs		
– Actual values		
• Pressure	U_a	0 to 10 V
• Swivel angle	U_a	± 10 V
– Fault message → L-active	U_a	≥ U_B – 5 V; 10 mA (short-circuit proof); error: U_a < 1 V
– Power limitation → H-active (only with ordering code **3** with additional function)	U_a	≥ U_B – 5 V; 10 mA (short-circuit proof); inactive: U_a < 1 V
Type of connection		Connector 11-pin + PE, N11REFF, DIN 43 563
Permissible operating temperature range	t	0 to 60 °C
Storage temperature range	t	0 to 70 °C
Electromagnetic compatibility		Severity 4 to prEN 50 082 part 2
Shock		15 g / 11 ms to IEC 68-2 part 27
Resistance to vibration		20 g / 20 to 2000 Hz to IEC 68-2 part 36
Type of protection		IP 65 to DIN 40 050
Swivel angle transducer		
Measuring system		Hall sensor
Measuring range (swivel angle)	α	± 18 °
Output actual swivel angle value	U_a	– 5 V ± 3 V
Electrical connection		Connector G4W1F / socket G4A5M
Permissible operating temperature range	t	0 to 60 °C
Storage temperature range	t	0 to 70 °C
Electromagnetic compatibility		Severity 4 to prEN 50 082 part 2
Shock		15 g / 11 ms to IEC 68-2 part 27
Resistance to vibration		20 g / 20 to 2000 Hz to IEC 68-2 part 36
Type of protection		IP 65 to DIN 40 050

Block circuit diagram / pin allocation of integral electronics for DFEE (type VT-DFP)



– – – Only for version with additional function of power limitation (ordering code **3**)

1) Switch T_D only for version without additional functions (ordering code **1**)

Connecting cable with connector

(with ordering code **C** included in the scope of supply)

Length of the connecting cable: 5 m (2 lines)

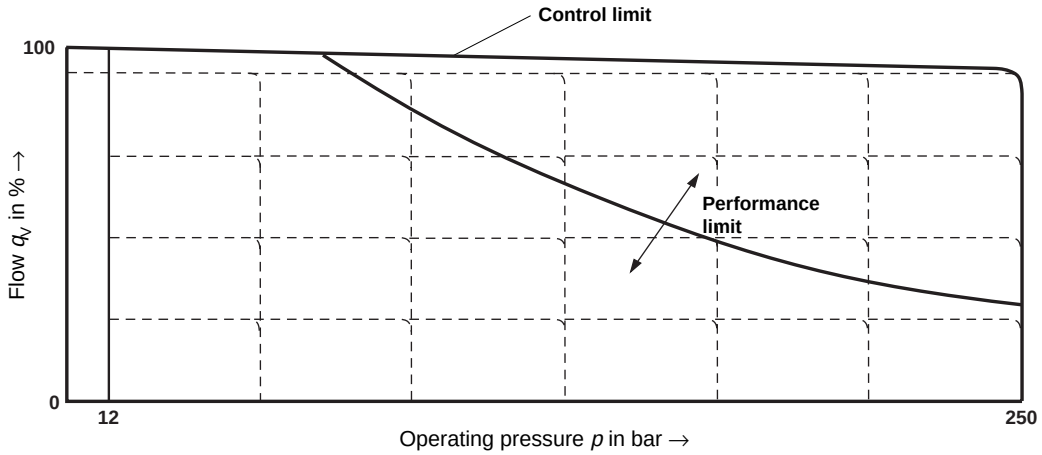
Connector: 11-pin + PE

Pin	Signal	Code	
1	+ U_B	1	Supply cable 3 x 1.0 mm²
2	0 V ≙ L0	2	
PE	Ground	green/yellow	
3	Fault	beige	Signal cable 10 x 0.14 mm²
4	M0	yellow	
5	α_{comm}	green	
6	α_{act}	violet	
7	p_{comm}	pink	
8	p_{act}	orange	
9	Switch T_D or power limitation	brown	
10	Actual pressure value H	black	
11	Actual pressure value L	blue	

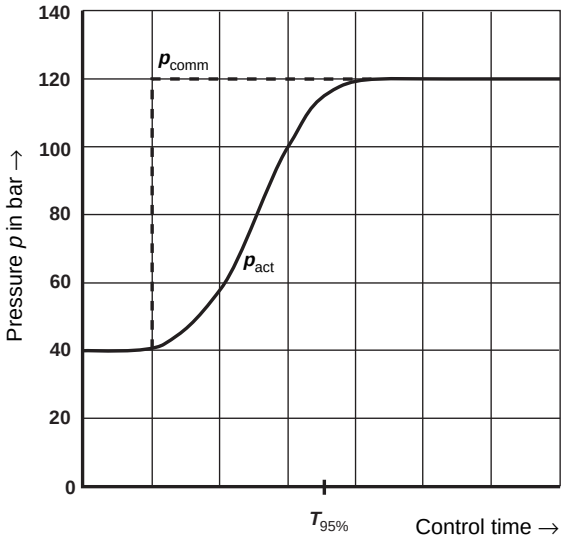
Control loop quality DFE1 and DFEE

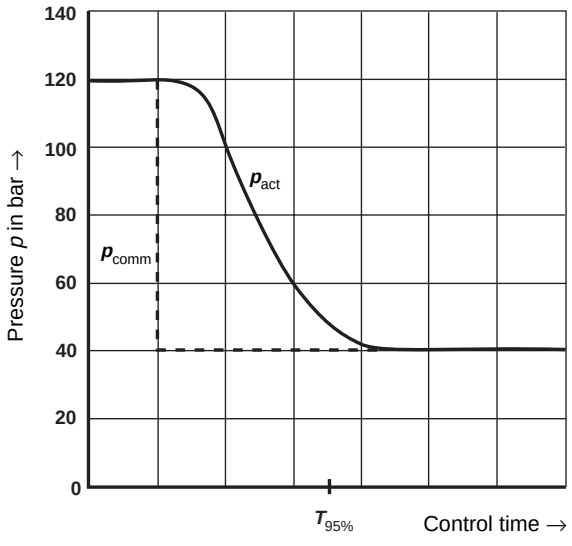
	Closed loop swivel angle control	Closed loop pressure control
Linearity tolerance	≤ 1.0 %	≤ 1.5 %
Temperature drift	≤ 0.5 %/10 K	≤ 0.5 %/10 K
Hysteresis	≤ 0.2 %	≤ 0.2 %
Repeatability	≤ 0.2 %	≤ 0.2 %

Static characteristic curve DFE1 and DFEE



Transient function with pressure command value step-change DFE1 and DFEE

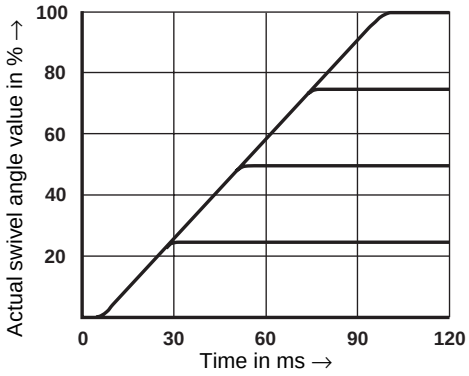


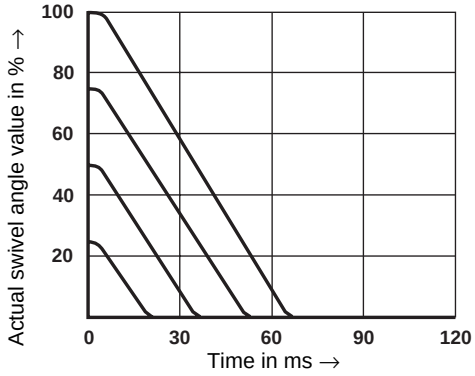


The above characteristic curve forms and control times can only be achieved with an optimized pressure controller (for DFE,1 see setting of the jumper on page 13; for DFEE, see setting of the coding switches on page 14).
For pressures of 0 to 20 bar and when using a preload valve, the values for the response times are higher.

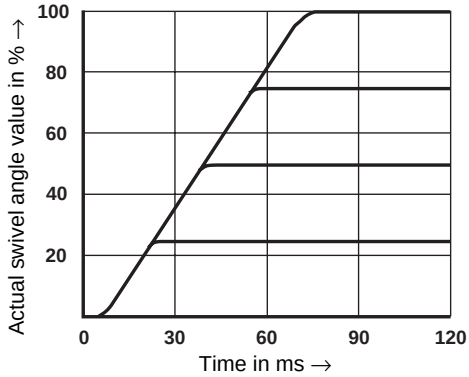
Transient functions with swivel angle command value step-change DFE1 and DFEE

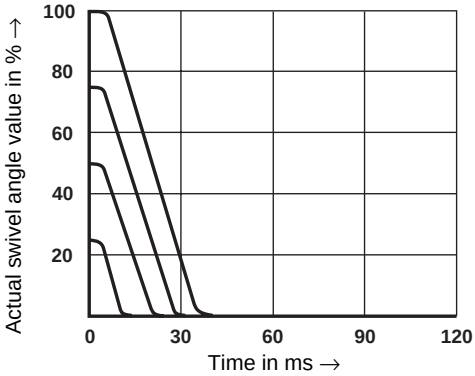
Size 18, 28, 45, 71 p = 20 bar



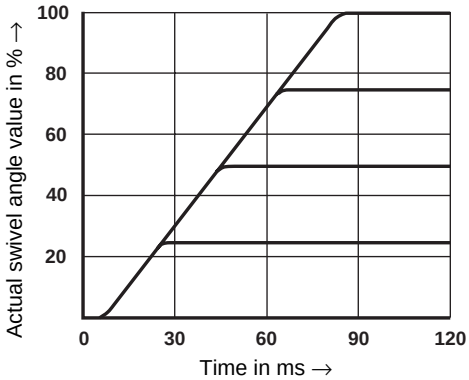


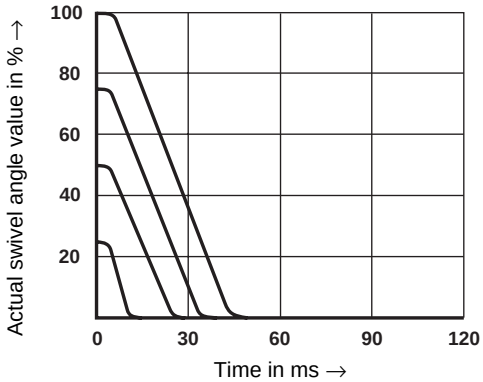
Size 18, 28, 45, 71 p = 50 bar



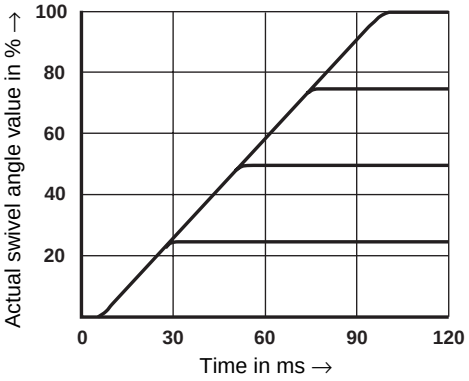


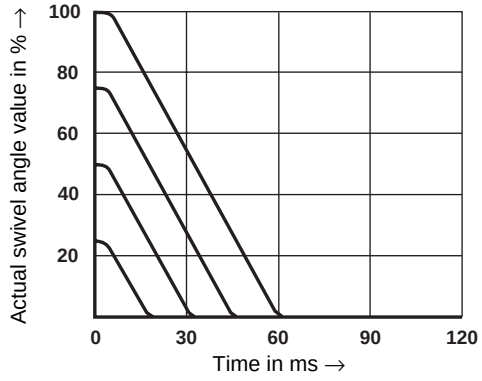
Size 100 p = 50 bar





Size 140 p = 50 bar





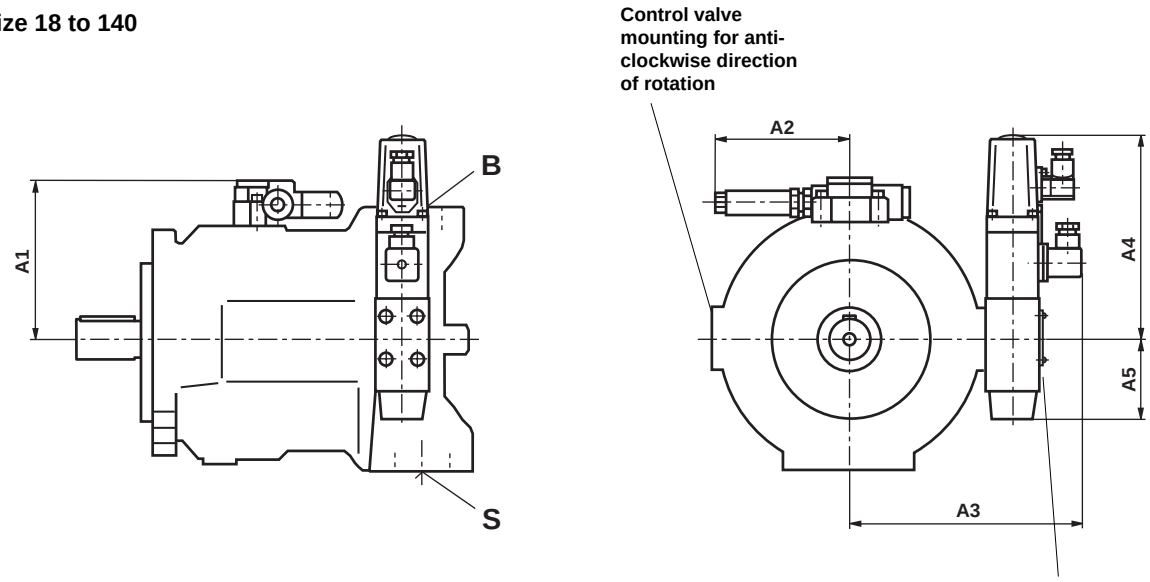
Optimization of the pressure controller for DFE1 (setting of the jumpers)

Connected hydraulic fluid volume (in L) (lines and actuators)	Jumper setting (on VT 5041-2X) J3	J4	J5	$T_{95\%}$ (in ms)
≤ 5	off	off	off	150
7.5	off	on	off	200
10	on	on	off	200
15	on	off	on	250
20	off	on	on	250
25	on	on	on	250

Larger fluid volumes on request.

Unit dimensions DFE1 (Dimensions in mm)

Size 18 to 140



Size	A1	A2	A3	A4	A5
18	98	107	161	158	63
28	106	107	171	158	63
45	112	107	181	158	63
71	124	107	195	158	63
100	129	107	200	158	63
140	140	107	238	143	78

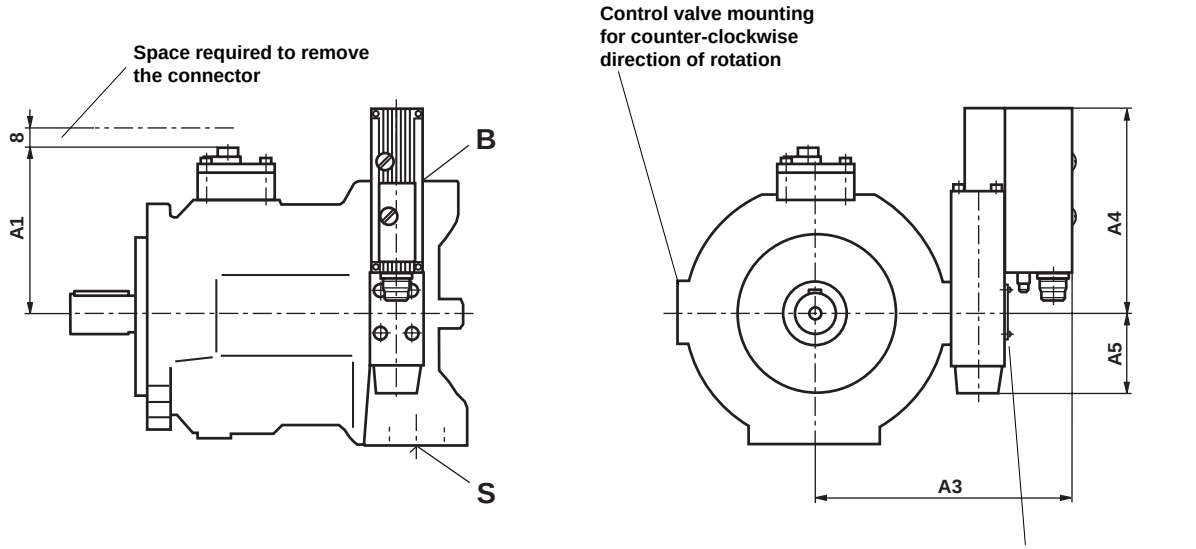
Optimization of the pressure controller for DFEE (position of the coding switches)

Connected hydraulic fluid volume (in L) (lines and actuators)	Position switch settings for switch T_D Off	for switch T_D On	$T_{95\%}$ (in ms)
≤ 5	0; 8	–	150
6.25	1; 9	–	150
7,5	2; A	0	200
10	3; B	1	200
12.5	4; C	2; 8	200
15	5; D	3; 9	250
20	6; E	4; A	250
25	7; F	5; B	250
30	–	6; C	250
35	–	7; D	300
40	–	E	300
45	–	F	300

Larger fluid volumes on request.

Unit dimensions DFEE (Dimensions in mm)

Size 18 to 140



Size	A1	A3	A4	A5
18	120	168	158	63
28	128	208	158	63
45	134	218	158	63
71	146	232	158	63
100	151	237	158	63
140	162	275	143	78

A10VSO variable displacement axial piston pump

Ordering code (only in connection with **DFE1** when ordering the pump separately!)

A10VS	O		DFE1/	3X	–	P	K		62			

Axial piston unit

Type of operation (pump, open circuit)

Size 18 = **18**
Size 28 = **28**
Size 45 = **45**
Size 71 = **71**
Size 100 = **100**
Size 140 = **140**

Control option

Series

Direction of rotation
Clockwise = **R**
Counter-clockwise = **L**

NBR seals (FPM shaft seal) = **P**

Cylindrical shaft end with keyed shaft = **K**

Connection flange
SAE 2-hole (sizes 18, 28, 45, 71, 100) = **C**
SAE 4-hole (sizes 140) = **D**

Ports for service lines
Pressure port B, Suction port S: SAE opposite sides, connection thread UNC

Through-drive			**18**	**28**	**45**	**71**	**100**	**140**	
Without through-drive			•	•	•	•	•	•	**= N00**
With through-drive for the connection of an axial piston unit, a gear pump or a radial piston pump									
Connection flange	Shaft	For the connection of:							
82-2 (SAE A)	19-4 (SAE A-B, 3/4")	A10VSO 18	•	•	•	•	•		**= K52**
ISO 100, 2-hole	22-4 (SAE B, 7/8")	AA10VSO 28	•	•	•	•	•		**= K03**
ISO 100, 2-hole	25-4 (SAE B-B, 1")	AA10VSO 45	–	•	•	•	•		**= K05**
ISO 125, 2-hole	32-4 (SAE C, 1 1/4")	AA10VSO 71	–	–	•	•	•		**= K08**
ISO 125, 2-hole	38-4 (SAE C-C, 1 1/2")	AA10VSO 100	–	–	–	•	•		**= K38**
ISO 180, 4-hole	44-4, (SAE D,1 3/4")	AA10VSO 140	–	–	–	–	•		**= K21**
82-2 (SAE A)	16-4 (SAE A, 5/8")	G2/GC2/GC3-1X	•	•	•	•	•		**= K01**
101-2 (SAE B)	22-4 (SAE B, 7/8")	G3	•	•	•	•	•		**= K02**
101-2 (SAE B)	25-4(SAE B-B, 1")	GC4-1X	–	•	•	•	•		**= K04**
101-2 (SAE B)	32-4 (SAE C, 1 1/4")	GC5-1X	–	•	•	•	•		**= K06**
127-2 (SAE C)	38-4 (SAE C-C, 1 1/2")	GC6-1X	–	–	•	•	•		**= K24**
Metric 4-hole, centr. Ø 63	Keyed shaft Ø 25	R4	•	•	•	•	•		**= K57**
Connection of a combination pump **(not A10)**									see page 16

A10 combination pump
Connection of an A10 combination pump (the size is determined by the through-drive of the DFE1 pump) = **-A10**
Without A10 combination pump = **No code**

Controller of A10 combination pump
DR controller = **DR**
DRG controller = **DRG**
DFR controller = **DFR**
DFR1 controller = **DFR1**

AA10VSO variable displacement axial piston pump

Ordering code for auxiliary pump (supplement to ordering codes on pages 6, 7 or 15)

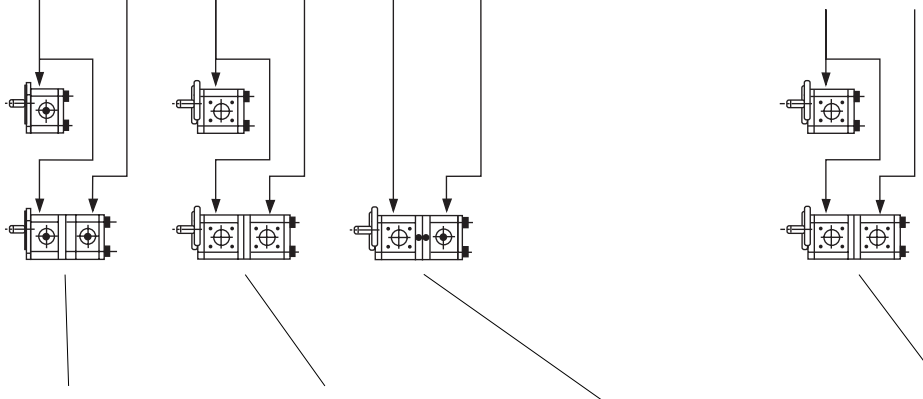
AA10VS	O	71	DFE1/	3X	R	–	P	K	C	62	

see ordering code on page 15

GXX	KXX (see page 15)	LXX	N00 (see page 15)	PXX	UXX	VXX	WXX	YXX
G2	With through-drive no integrated auxiliary pump	G3	No through-drive no integrated auxiliary pump	G3+G2	GC2/3	GC4	GC5	GC6

Comes with through-drive type:

GX_1X_2				LX_1X_2				PX_1X_2				UX_1X_2				VX_1X_2				WX_1X_2				YX_1X_2			
Pump 1		Pump 2		Pump 1		Pump 2		Pump 1		Pump 2		Pump 1		Pump 2		Pump 1		Pump 2		Pump 1		Pump 2		Pump 1		Pump 2	
X_1	NG	X_2	NG	X_1	NG	X_2	NG	X_1	NG	X_2	NG	X_1	NG	X_2	NG	X_1	NG	X_2	NG	X_1	NG	X_2	NG	X_1	NG	X_2	NG
		0	—			**0**	—							**0**	—			**0**	—			**0**	—			**0**	—
1	004	**1**	004	**1**	020	**1**	020	**1**	020	**1**	004	**5**	006	**1**	006	**5**	020	**1**	008	**5**	040	**1**	008	**1**	080	**1**	008
2	005	**2**	005	**2**	023	**2**	023	**2**	023	**2**	005	**6**	008	**2**	008	**6**	025	**2**	010	**6**	050	**2**	010	**2**	100	**2**	010
3	008	**3**	008	**3**	026	**3**	026	**3**	026	**3**	008	**7**	010	**3**	010	**7**	032	**3**	013	**7**	064	**3**	013	**3**	125	**3**	016
4	011	**4**	011	**4**	029	**4**	029	**4**	029	**4**	011	**8**	013	**4**	013			**4**	016			**4**	016			**4**	025
5	014	**5**	014	**5**	032	**5**	032	**5**	032	**5**	014	**9**	016	**5**	016			**5**	020			**5**	020			**5**	040
6	016	**6**	016	**6**	038	**6**	038	**6**	038	**6**	016							**6**	025			**6**	025			**6**	064
7	019	**7**	019					**7**	019									**7**	032			**7**	032			**7**	080
8	022	**8**	022					**8**	022													**8**	040			**8**	100
																						9	050			**9**	125



Single pump:
1PF2G2-4X/XXXRR20MRS250

Double pump:
1PF2G2-4X/XXXRR20MRK
+ 1PF2G2-4X/XXXRN20MDLS252

Single pump:
1PF2G3-3X/XXXRD07MBS250

Double pump:
1PF2G3-3X/XXXRD07MBK
+ 1PF2G3-3X/XXXRN07MHLS252

Double pump:
1PF2G3-3X/XXXRD20MBK
+ 1PF2G2-4X/XXXRN20MHLS252

Single pump:
1PF2GCX-1X/XXXRR07MU2-A304

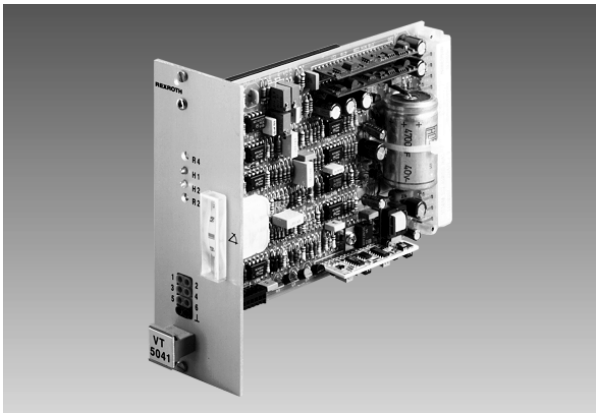
Double pump:
1PF2GCX-1X/XXXRR47MU2-A304
+ 1PF2GCX-1X/XXXRF47MK0

External control electronics for DFE1: VT 5041 amplifier, series 2X

VT 5041 amplifiers are used to control AA10VSO...DFE1 axial piston units with a proportional valve. The amplifiers provide all the functions which are required to operate the AA10VSO...DFE1, i.e. closed loop pressure and swivel angle control according to given command values.
The controller circuit can be adjusted to a certain hydraulic fluid volume (actuator plus lines).

Features:

- Differential input
- Switched mode power supply ± 15 V ± 3 %
- Two oscillators and two demodulators for inductive sensing of position and swivel angle
- Pressure controller
- Swivel angle controller
- Valve spool position controller
- Minimum value generator
- Power limiter (only with VT 5041-2X/3)
- Self-pulsing output stage
- Reverse voltage protection
- Display unit for actual swivel angle value on front panel (only with VT 5041-2X/3)
- LEDs on front panel:
  - H1 = fault message
  - H2 = power



H/A 3445/92
VT 5041-2X/3...

Suitable card holder:

- VT 3002-2X/32; see RA 29 928 (single card holder, without power pack)

Power pack:

- VT 19 083-1X; see RA 29 929 (NE30 power pack; 115/230 VAC – 24 VDC; 70 VA)

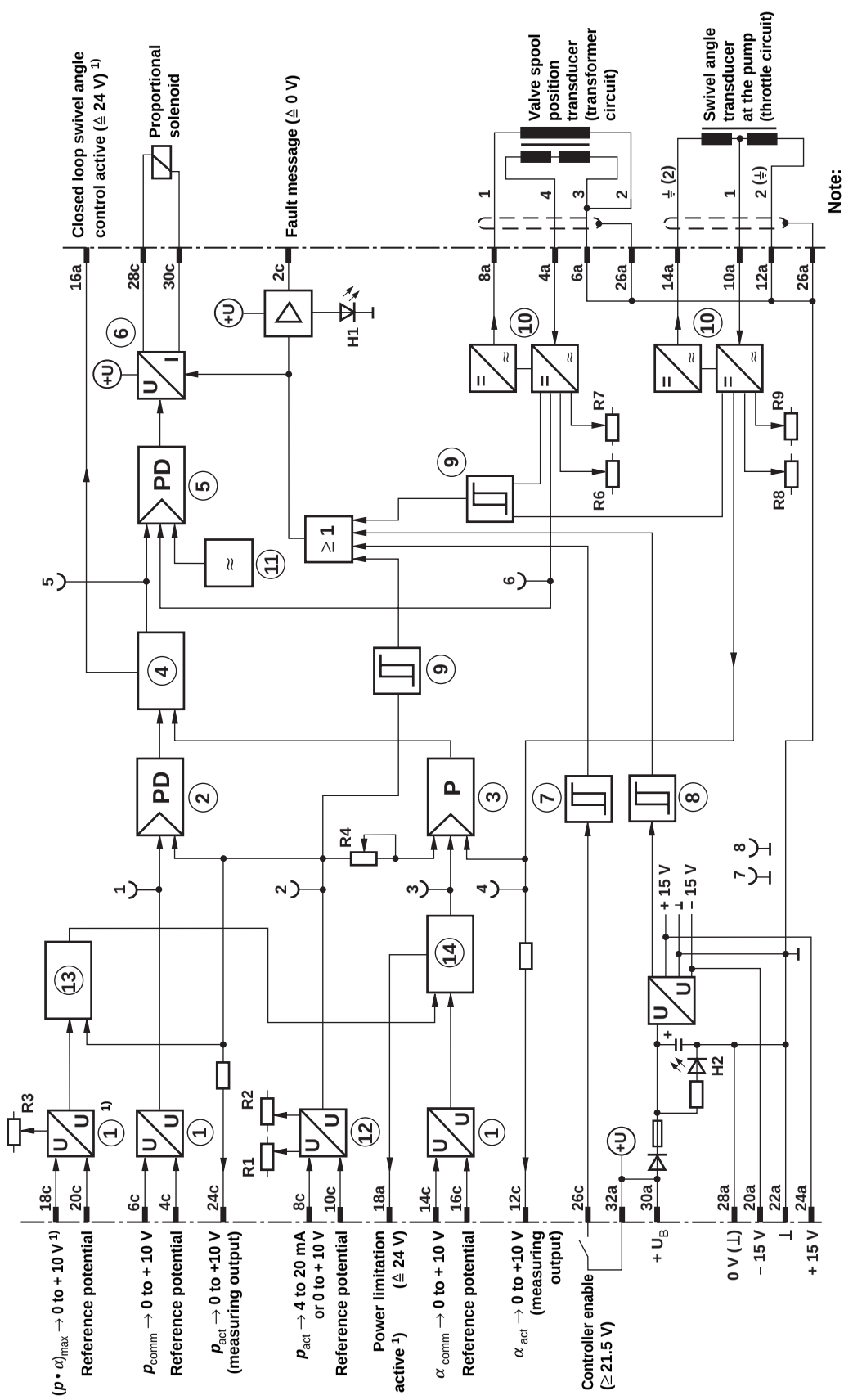
Technical data (for applications outside these parameters, please consult us!)

Operating voltage	U_B	24 V DC
– Upper limiting value	$U_B(t)_{max}$	35 V DC (instantaneous value)
– Lower limiting value	$U_B(t)_{min}$	21 V DC (instantaneous value)
Power requirement	$U_{nominal}$	600 mA (I_{max} = 1.25 A)
Nominal resistancee of the solenoid (20 °C)	R	2 Ω
Oscillator frequency:		
– Valve feedback	f	approx. 5 kHz
– Swivel angle feedback	f	approx. 5 kHz
Position transducer type:		
– Pump (throttle circuit)		IW 9
– Valve (transformer circuit)		DK2
Inputs:		
– Command values (pressure, swivel angle)	U_e	0 to 10 V (R_e= 100 kΩ)
– Actual value (pressure) VT 5041-2X/.V.	U_e	0 to 10 V (R_e= 100 kΩ)
VT 5041-2X/.C.	I_e	4 to 20 mA (R_e= 500 Ω)
– Power signal $(p \bullet \alpha)_{comm}$ [1]	U_e	0 to 10 V (R_e= 100 kΩ)
– Controller enable	U	> 21 V
Outputs:		
– Solenoid current	I_{max}	2.5 A
– Actual values (pressure, swivel angle)	U_a	0 to 10 V
– Fault message (L-active)	U_a	≥ U_B – 5 V; 10 mA (short-circuit proof); error: U_a < 1 V
– Auxiliary voltages	U	± 15 V ± 3 %; 10 mA
– Closed-loop swivel angle control, swivel angle comm. value active [1]	U	+ 24 V
Fuse protection (internal)	I_S	1.6 A T
Type of connection		32-pin blade connector, DIN 41 612, form D
Card dimensions		Euro-card 100 x 160 mm, DIN 41 494
Front panel dimensions		
– Height:		3 HE (128.4 mm)
– Width conductor side VT 5041-2X/1..		1 TE (5.08 mm)
VT 5041-2X/3..		3 TE
– Width component side VT 5041-2X/1..		5 TE
VT 5041-2X/3..		7 TE
Permissible ambient temperature	t	0 to 50 °C
Storage temperature	t	– 20 to + 70 °C
Weight VT 5041-2X/1..	m	0.19 kg
VT 5041-2X/3..	m	0.21 kg

[1] only with VT 5041-2X/3..

External control electronics for DFE1: VT 5041 amplifier, series 2X

Block circuit diagram / pin allocation



Note:
The connection of the position transducer in throttle circuit is valid for clockwise rotation of the pump ("(") anti-clockwise rotation of the pump).

1 Differential amplifier
2 Pressure controller
3 Swivel angle controller
4 Minimum value generator
5 Valve position controller
6 Current output stage
7 Output stage enable
8 Monitoring of power supply symmetrics
9 Cable break detection
10 Oscillator/demodulator
11 Dither generator
12 Input amplifier
13 Divider 1)
14 Minimum value generator 1)

H1 Fault display
H2 Power
R1, R6, R8 Zero point
R2, R7, R9 Amplitude
R3 Constant maximum power preselection 1)
R4 Leakage compensation

1) only with VT 5041-2X/3..

External control electronics for DFE1: VT 5041 amplifier, series 2X

Functional description

The amplifier card has one input each for the pressure and swivel angle command value (1). The actual pressure value is picked up by a pressure transducer. A position transducer at the pump senses the actual swivel angle value. The recorded actual values are processed in the electrical amplifier (10 and 12) and compared with the command values. The controllers (2 and 3) create a signal from the resulting control deviations. The minimum value generator (4) ensures that always the control loop associated to the working point is active. The output signal of the minimum value generator (4) becomes the command value for the valve control loop. A dither signal of the dither generator (11) is superimposed on the valve command value, which causes a continuous oscillation of the valve spool.
The actual valve value is picked up using an inductive position transducer. An oscillator/demodulator circuit (10) provides conditioning of the signal. The control deviation is determined and further processed in the valve controller (5). The output signal of the valve controller (5) forms the command value for the self-pulsing current output stage (6), which controls the proportional solenoid of the high-response control valve.

The amplifier card is provided with a fault message output, to which a voltage of 0 V is applied in the case of a failure. At the same time LED "H1" lights up and the output stage is de-energized. A fault message is triggered off by cable break or when the ranges of the position measuring systems (9) are exceeded, by break of the pressure cell cable (only VT 5041-2X/.C.) or by a wrong voltage supply (8). A non-granted enable is also registered as fault by the enable detector (7).
The closed swivel angle control loop also provides, as an additional function, the possibility of compensating for pump leakage. The swivel angle command value is offset in dependence upon pressure with a value which corresponds to the leakage.
Amplifiers of type VT 5041-2X/3.. offer the possibility of power limitation. The limiting value for power ($p \bullet \alpha$) can be preselected externally or via a potentiometer and is divided by the actual pressure value (15). The resulting swivel angle command value is compared with the preselected swivel angle command value. The smaller value is connected to the swivel angle controller (3) via a minimum value generator (14).

Projecting / maintenance instructions / Caution

- The amplifier card may only be plugged or unplugged when the system is switched off!
- Measurements on the card may only be taken using instruments with R_i > 100 kΩ!
- Command values may only be switched via relays having gold contacts (small voltges, small currents)!
- The ground of the inductive position transducer must **not** be connected to the 0V operating voltage!
- Always shield command and actual value cables; leaving the shielding on one end open, connect the shielding to 0V operating voltage on the card side!
- Recommendation: 1. Also shield solenoid cables (one end to 0 V)!
  2. For lengths up to 50 m use cable type LiYCY 1.5 mm^2, for greater lengths, please consult us!
- The distance to aerial lines or radio sources must be at least 1 m!
- Do not lay solenoid and signal cables near power cables!
- **Attention:** When using **differential inputs both inputs** must always be switched on or off **simultaneously**!

Ordering code (only for separate order of the amplifier card!)

VT 5041	–	2X/	–	0		*

Series 20 to 29 (20 to 29: technical data and pin allocation unchanged) **= 2X**

Amplifier without additional functions **= 1**
Amplifier with additional functions **= 3**

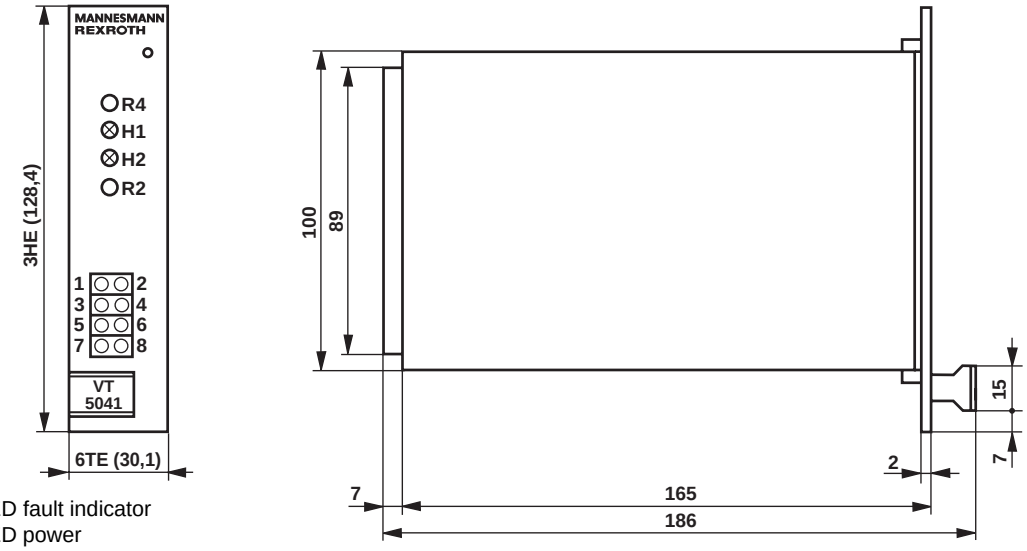
Further details in clear text

V = Voltage input p_{act}= 0 to 10 V
C = Current input p_{act}= 4 to 20 mA

Recommendation : Current input **C**

External control electronics for DFE1: VT 5041 amplifier, series 2X

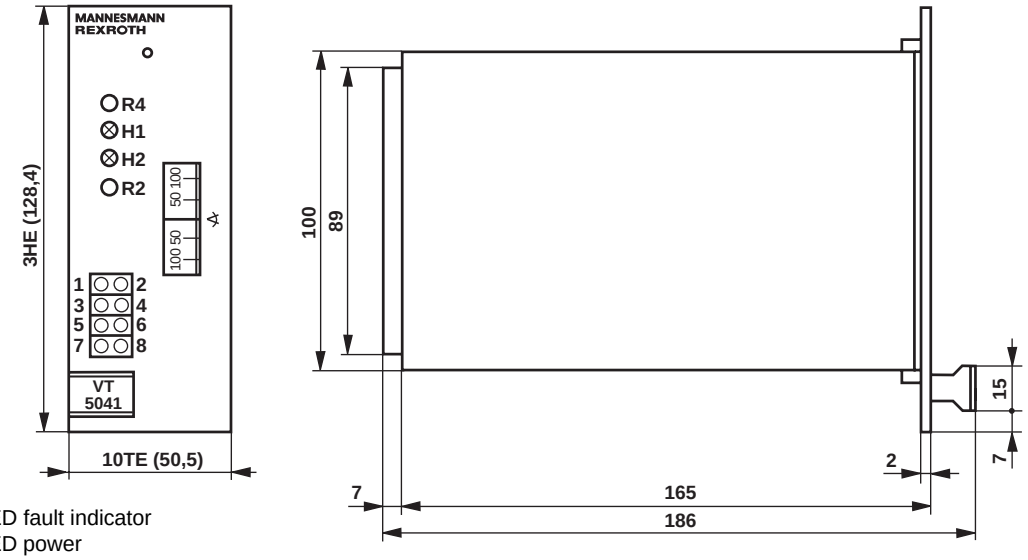
Unit dimensions VT 5041-2X/1... (Dimensions in mm)



H1: LED fault indicator
H2: LED power
R2: Amplitude balance p_{act} (pressure transducer)
R4: Leakage compensation

Measuring socket 1: p_{comm}	+ 10 V ≙ 100 %
Measuring socket 2: p_{act}	+ 10 V ≙ 100 %
Measuring socket 3: α_{comm}	– 10 V ≙ 100 %
Measuring socket 4: α_{act}	+ 10 V ≙ 100 %
Measuring socket 5: Valve command value	– 10 V ≙ 100 %
Measuring socket 6: Actual valve value	+ 10 V ≙ 100 %
Measuring socket 7: Ground	
Measuring socket 8: Ground	

Unit dimensions VT 5041-2X/3... (Dimensions in mm)



H1: LED fault indicator
H2: LED power
R2: Amplitude balance p_{act} (pressure transducer)
R4: Leakage compensation

Measuring socket 1: p_{comm}	+ 10 V ≙ 100 %
Measuring socket 2: p_{act}	+ 10 V ≙ 100 %
Measuring socket 3: α_{Soll}	– 10 V ≙ 100 %
Measuring socket 4: α_{act}	+ 10 V ≙ 100 %
Measuring socket 5: Valve command value	– 10 V ≙ 100 %
Measuring socket 6: Actual valve value	+ 10 V ≙ 100 %
Measuring socket 7: Ground	
Measuring socket 8: Ground	

Pressure Transducer Model ST for Static and Dynamic Measurement of Pressures in Liquids and Gases

- Good long term stability and repeatability
- Integral amplifier for 10 V and 4 to 20 mA outputs
- Single ended supply voltage
- Welded stainless steel construction
- Hermetically sealed at electrical termination
- Shunt for simplified calibration, on voltage models
- Female SAE-4 port for reliable, leak-free connections
- Quick disconnect, 6-pin connector included

Pressure transducer model ST

Functional description

Pressure transducers model ST are suitable for demanding applications. Using a bonded strain gage and all welded stainless steel construction, the transducer is designed for harsh environments and a wide range of operating fluids. The transducer features a calibrated integral amplifier. The 10 V models have a shunt available for easy system calibration. On these models, installing a jumper between pins D and E will simulate an 80% pressure. The 4 to 20 mA transmitters are a two-wire configuration, without shunt. Mating electrical connectors are always included unless specified in clear text.

Pin	5 V & 10 V transducers only	STB
A	(+) Supply 15 to 26 VDC	(STB)
B	(–) Supply return] Note 1	
C	(–) Output common] Note 1	
D	(+) Output 0 to 5 V / 0 to 10 V	
E	Shunt Cal 1 (80%)	
F	Shunt Cal 2	

Note 1: B and C internally connected

Pin	4 – 20 mA transmitters only	STC
A	(+) Supply 15 to 40 VDC	
B	No connection	
C	No connection	
D	(–) Output 4 to 20 mA	
E	Case ground	
F	No connection	

Ordering code

ST	A	5000 –	1X	*

Pressure transducer

Output signal

0 to 10 VDC **= B**

4 to 20 mA **= C**

Pressure range

5000 = 0 – 5000 PSIG

3000 = 0 – 3000 PSIG

2000 = 0 – 2000 PSIG

Series

Further details to be written in clear text

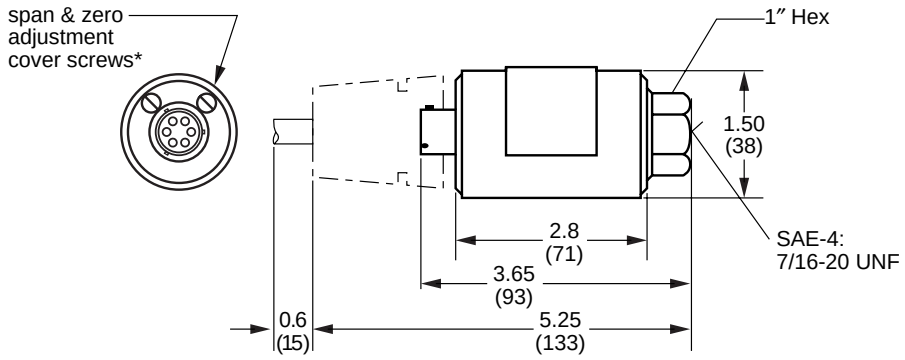
Transducer includes mating electrical plug PT06A-10-6S (US00 882 836)

Other pressure ranges are available. Consult us for delivery.

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

Pressure range, max		PSIG (bar)	5000 (345) 3000 (207) 2000 (138)
Overload			
– Safe		% of FS	50
– Burst		% of FS	300
Port connection (female)			SAE-4; 17/16-20 UNF
Wetted parts			17-4 PH stainless
Case			Stainless steel
Weight		lbs (kg)	0.74 (0.34)
Electrical termination			PT-1H-10-6P or equivalent
Mating elec. plug (included)			PT06A-10-6S or equivalent
Ambient temperature		°F (°C)	0 to 185 (–18 to 85)
Compensated temperature range		°F (°C)	60 to 160 (16 to 71)
Temperature effect			
– Zero, max.		% of FS / °F	0.01
– Span, max.		% reading / °F	0.015
Accuracy (full scale)			
– 5 V / 10 V transducers		%	±0.5
– 4 – 20 mA transmitters		%	±0.2 preferred
Resolution			infinite
Excitation (supply voltage)			
– 10 V transducers	(STB)	VDC	15 to 26
– 4 – 20 mA transmitters	(STC)	VDC	15 to 40 preferred
Maximum current			
10 V transducers		mA	25
Output signal		VDC	0 to 10
		(2-wire) mA	4 to 20
Calibration range		%	approx. ±10

Unit dimensions: dimensions in inches (millimeters)



* Factory set during calibration. No adjustment required.

Pump preload valve type SYDZ 0001

Application:

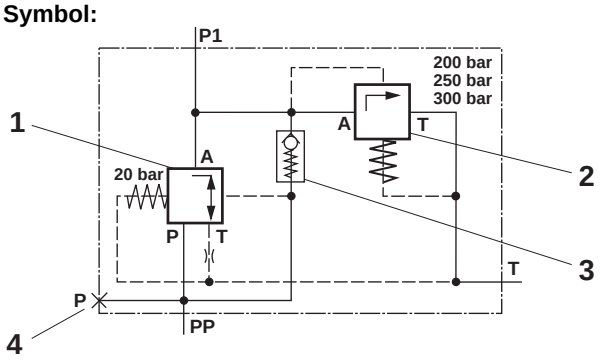
SYDZ 0001 pump preload valves are used when the flow from AA10VSO variable displacement pumps must be controllable at operating pressures lower than 12 bar and only internal pilot oil is available for adjustment.
In this case the valve is mounted directly onto the SAE pressure port of the AA10VSO variable displacement pump (see RA 92 711 and RA 92 712).

Functional description:

The preload function is only effective within the pressure range of up to 20 bar. If the operating pressure in Port P1 exceeds 30 bar, the preload valve is fully open. In order to limit the maximum pressure, a factory-preset pressure relief valve is integrated into the preload valve (see ordering code). In addition, an integrated check valve allows the pressure to be controlled in the range < 20 bar.

Note: The system must be bled during commissioning, prior to startup.

Symbol:



1 Preload valve
2 Pressure relief valve
3 Check valve
4 Bleed screw

Ordering code (only for separate order of the preload valve!)

SYDZ 0001 – 1X/		M	*

Series 10 to 19 (10 to 19: unchanged installation and connection dimensions) **= 1X**

Pressure limitation 200 bar **= 200**
Pressure limitation 250 bar **= 250**
Pressure limitation 300 bar **= 300**

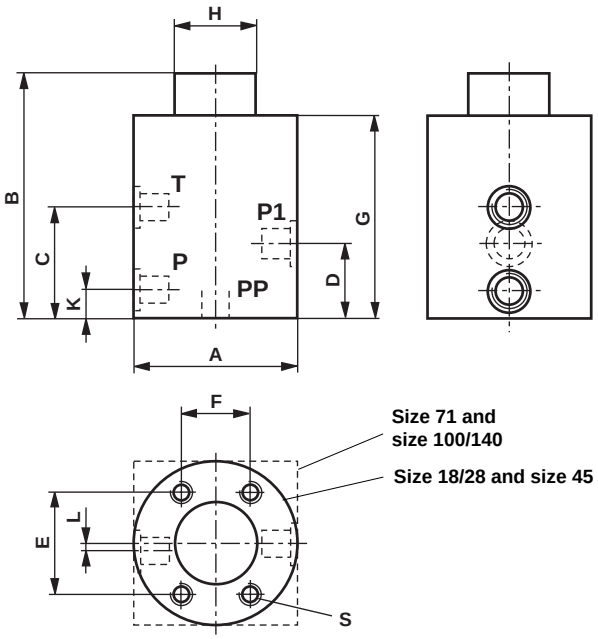
Pump type and size:

A10VSO size 18/28 **= V028**
A10VSO size 45 **= V045**
A10VSO size 71 **= V071**
A10VSO size 100/140 **= V140**

Further details in clear text

M = NBR seals, suitable for use with mineral oil (HL, HLP) to DIN 51 524

Unit dimensions: dimensions in inches (millimeters)



	Size 18/28	Size 45	Size 71	Size 100/140
A	Ø 75	Ø 80	□ 85	□ 85
B	115	115	150	147
C	60.5	60.5	94	91
D	30	33	56	56.5
E	47.6	52.4	58.7	66.7
F	22.2	26.2	30.2	31.8
G	104	104	134	131
H	Ø 34	Ø 34	Ø 45	Ø 45
K	14	15	24	24
L	0	0	4.5	4.5
PP	SAE 3/4"	SAE 1"	SAE 1 1/4"	SAE 1 1/4"
P1	G 1/2	G 3/4	G 1	SAE 1 1/4"
P	M8 x 1	M8 x 1	G 1/8	G 1/8
T	G 3/8	G 3/8	G 3/4	G 3/4
S	M10 x 120 DIN 912-10.9	M10 x 120 DIN 912-10.9	M10 x 150 DIN 912-10.9	M14 x 150 DIN 912-10.9

Tightening torques for valve fixing screws
M10: M_A = 75 Nm
M14: M_A = 205 Nm

System variant: FE1 electrical closed loop control system

FE1 closed loop control systems can be used where only the function of closed loop swivel angle control is required.

For this system variant, the technical data of the SYDFE1 control are valid, but the following deviations have to be taken into account:

1. Pump

The AA10VSO…FE1 pump cannot swivel into the negative direction of displacement.

2. Amplifier card

For the FE1 closed loop control, two variants of the VT 5041 amplifier card are available.

Variant 1: VT 5041-2X/10 V

Variant 2: VT 13 945 A
(with approximate command value ramp of ca. 6.5 s)

When connecting the card it is absolutely necessary to observe the pin allocation for both cards on page 22!
For further information, see pages 14,16 and 17.

3. Pressure transducer omitted

4. Preload valve as with DFE1 control

Ordering code

AA10VSO		FE1		/	31	R	-	P	K	C	62	N00	2

Fluid

Mineral oil (no code)	

Axial piston unit

Swashplate design, variable displace open circuit, industrial SAE version	**AA10VSO**

Size

Displacement V_g	in³/rev	cm³/rev
	1.10	**18**
	1.71	**28**
	2.75	**45**
	4.33	**71**
	6.10	**100**
	8.54	**140**

Control type

Proportional pressure and flow control	**FE1**

Series

	31

Direction of rotation

Viewed on shaft end	Right hand, clockwise	**R**
	Left hand, counter-clockwise	**L**

Seals

Buna-N (NBR per DIN ISO 1629); shaft seal FPM (fluorocarbon)	**P**

Shaft end

SAE-keyed shaft	**K**
SAE-splined shaft	**S**

Mounting flange

SAE 2-hole flange mounting flange	**C**
SAE 4-hole flange mounting flange, size 140 only	**D**

Service ports

		28	48	71	100	140	
Ports A/B	Opposite side ports, SAE flange, standard series, UNC mounting screws (Code 61)	●	●	–	●	●	**62**
	Opposite side ports, SAE flange, standard series, B port size 1", UNC mounting screws (Code 61)	–	–	●	–	–	**92**

Thru-drive

No thru-drive	**N00**
With thru-drive; for details see RA 92 711	**KXX**

SYDZ sequence valve option

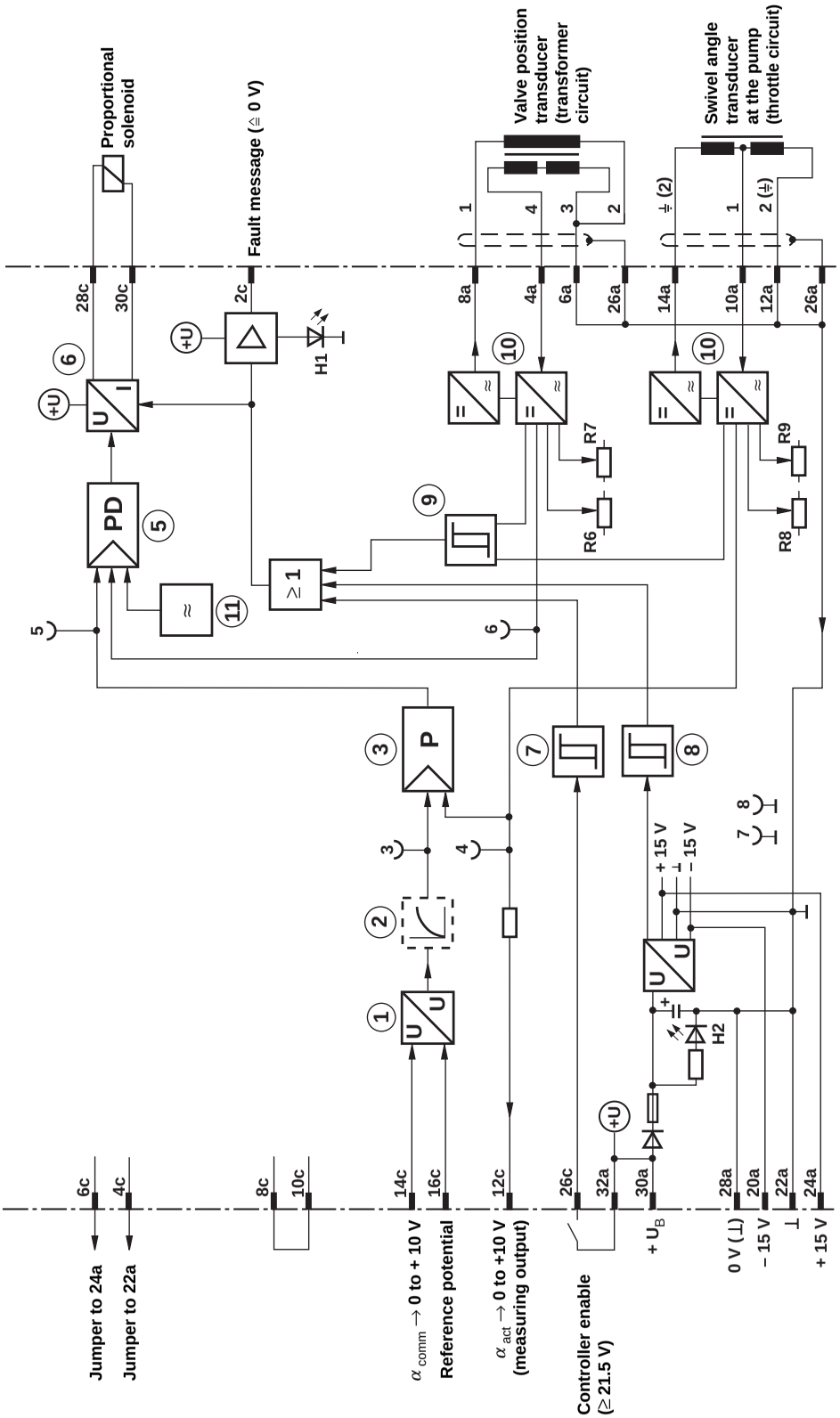
Without sequence valve	**omit**
With sequence and relief valve, pressure limitation up to 2900 psi (200 bar)*	**1**
With sequence and relief valve, pressure limitation up to 3600 psi (250 bar)*	**2**
With sequence and relief valve, pressure limitation up to 4350 psi (300 bar)*	**3**

*State settings in clear text when ordering.

● = available
– = not available

System variant: FE1 electrical closed loop control system

Block circuit diagram / pin allocation:
VT 5041 amplifier card (connection for FE1) and VT 13 945 A



Note:
Connection of the position transducer in throttle circuit is valid for clockwise direction of rotation of the pump ("( )"for anti-clockwise rotation).

H1 Fault indicator
H2 Power
R6, R8 Zero point
R7, R9 Amplitude

1 Differential amplifier
2 Command value delay (only with VT 13945 A)
3 Swivel angle controller
5 Valve position controller
6 Current output stage
7 Output stage enable
8 Monitoring of power supply balance
9 Cable break detection
10 Oscillator/demodulator
11 Dither generator

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