

# Pressure and flow control system

**RE 30027/06.04**  
Replaces: 05.02

1/14

## Type SYDFEC

Component series 2X



H6828/01

## Table of contents

Contents	Page
Features	1
Ordering code	2 and 3
Function, section	4
Schematic diagram	5 and 6
Technical data	7
Electrical connection	8
Block circuit diagram	9
Scope of functions, communication via CAN bus, closed control loop quality	10
Characteristic curves	11 and 12
Unit dimensions	12
Nameplate lettering (example)	13
Engineering notes	13

### Further information about this system:

– Component description of A10VSO pump	RE 92712 for size 18, RE 92711 for sizes 28 to 140
– Component description of VT-SWA-1-1X rotary angle sensor	RE 30268
– Component description of HM 12-1X / HM 13-1X pressure transducer	RE 29933
– Component description of HM16-1X pressure transducer	RE 30266
– Component description of VT-DFPE...-2X/... pilot valve	RE 29016
– Component description of SYDZ 0001-1X pump pre-load valve	RE 29255

### In addition, the following information about the SYDFEE system can be ordered:

– Sales information (engineering aids)	RE 30030-01-V
– Description of the CANopen interface	RE 30027-Z
– Engineering notes and commissioning instructions	RE 30027-B

## Features

The DFEC control is used for the electrohydraulic control of pressure and swivel angle of a variable displacement axial piston pump.

The SYDFEC.. closed-loop control system consists of the following components:

- A10VSO axial piston pump with built-on VT-DFPC...-2X/.. proportional valve as pilot valve
- The VT-DFPC..-2X/.. valve with integrated digital open and closed-loop control electronics with CANopen interface integrates the entire control functionality for the DFEC system
- The swivel angle is acquired by a VT-SWA-1-1X rotary angle sensor based on a Hall sensor
- Pump pre-load valve (optional)
- Pump combinations possible
- The HM16 pressure transducer (optional) for installation in the pump or the pre-load valve for direct connection to the control electronics. This provides a complete plug-in system.



## Ordering code

### Order example

1) **Order example of single pump**

SYDFEC-2X/100R-PPA12N00-0000-A0A0FLX

2) **Order example of pump combination**

Both type designations must be connected by "+" (material number of 1st pump + material number of 2nd pump)

SY2DFEC-2X/100-100/ R900709799 + R900709799

SY2DFEC-2X/100-100/ SYDFEC-2X/100R-PSA12KD5-0000-A0A0FLX + SYDFEC-2X/100R-PSA12KD5-0000-A0A0FLX

Double pump					
Size of front pump					
Size of rear pump					
Material number of front pump (or indication in clear text, if material number is not known)					
Material number of rear pump (or indication in clear text, if material number is not known))					

### Preferred types

#### Single pumps

Type	Material no.
SYDFEC-2X/018R-PSC12N00-0000-A0A0FLX	R900731028
SYDFEC-2X/028R-PPA12N00-0000-A0A0FLX	R900721765
SYDFEC-2X/045R-PPA12N00-0000-A0A0FLX	R900731026
SYDFEC-2X/071R-PPA12N00-0000-A0A0FLX	R900731027
SYDFEC-2X/100R-PPA12N00-0000-A0A0FLX	R900708502
SYDFEC-2X/140R-PPB12N00-0000-A0A0FLX	R900725946

#### Through-drive pumps for pump combination

Type	Material no.
SYDFEC-2X/028R-PRA12KD3-0000-A0A0FLX	R900709796
SYDFEC-2X/045R-PRA12KD3-0000-A0A0FLX	R900709797
SYDFEC-2X/071R-PRA12KD5-0000-A0A0FLX	R900709798
SYDFEC-2X/100R-PSA12KD5-0000-A0A0FLX	R900709799
SYDFEC-2X/140R-PSB12KD7-0000-A0A0FLX	R900709800

#### Through-drive (● = available)

			Size						
			18	28	45	71	100	140	
Without through-drive			●	●	●	●	●	●	N00
With through-drive for mounting an axial piston unit, a gear pump or a radial piston pump									
Mounting flange	Shaft/coupling (separate order)	for mounting:							
ISO 100, 2-hole	Splined shaft 7/8" 22-4 (SAE B)	A10VSO 28 (shaft S or R)	-	●	●	●	●	●	KD3
ISO 100, 2-hole	Splined shaft 1" 25-4 (SAE B-B)	A10VSO 45 (shaft S or R)	-	-	●	●	●	●	KD3
ISO 125, 2-hole	Splined shaft 1 1/4" 32-4 (SAE C)	A10VSO 71 (shaft S or R)	-	-	-	●	●	●	KD5
ISO 125, 2-hole	Splined shaft 1 1/2" 38-4 (SAE C-C)	A10VSO 100 (shaft S)	-	-	-	-	●	●	KD5
ISO 180, 4-hole	Splined shaft 1 3/4" 44-4 (SAE D)	A10VSO 140 (shaft S)	-	-	-	-	-	●	KD7
82-2 (SAE A, 2-hole)	Splined shaft 5/8" 16-4 (SAE A)	1PF2G2, PGF2	●	●	●	●	●	●	KC1
82-2 (SAE A, 2-hole)	Splined shaft 3/4" 19-4 (SAE A-B)	A10VSO 10, 18 (shaft S)	●	●	●	●	●	●	KC1
101-2 (SAE B)	Splined shaft 7/8" 22-4 (SAE B)	A10VO 28 (shaft S), PGF3	-	●	●	●	●	●	KC3
101-2 (SAE B)	Splined shaft 1" 25-4 (SAE B-B)	A10VO 45 (shaft S), PGH4	-	●	●	●	●	●	KC3
127-2 (SAE C)	Splined shaft 1 1/4" 32-4 (SAE C)	A10VO 71 (shaft S)	-	-	-	●	●	●	KC5
127-2 (SAE C)	Splined shaft 1 1/2" 38-4 (SAE C-C)	A10VO 100 (shaft S), PGH5	-	-	-	-	●	●	KC5

## Function, section

The pressure and swivel angle control of the A10VSO variable displacement pump within the SYDFEC system is provided by an electrically controlled proportional valve (2). The proportional valve determines the position of the swashplate (1) by means of the actuating piston (4). The displaced oil flow is proportional to the position of the swashplate. The counter-piston (3) that is pre-loaded by a spring (5) is continuously pressurised with pump pressure.

When the pump is not rotating and the actuating system is depressurised, the swashplate is held by a spring (5) in position + 100 %. When the pump is powered and the proportional solenoid (8) is de-energised, the system swivels to zero stroke pressure, since a spring (10) pushes the valve spool (9) to the neutral position and pump pressure  $p$  is therefore applied to the actuating piston (4) via valve port A. At 8 to 12 bar, a balance is reached between the pump pressure at the actuating piston and the spring force (5). This neutral position (= zero stroke operation) is taken, when, for example, the valve electronics is de-energised.

The proportional valve is controlled by digital electronics (11) integrated in the valve. This closed-loop control electronics processes all of the control signals required for operating the A10VSO variable displacement pump under closed-loop pressure and flow control.

The control electronics receives the command values for pressure and swivel angle as well as the power limit via the CAN bus (14). Optionally, the command values for pressure and swivel angle can each be fed forward via an analogue input or be changed over via 2 switching inputs. The HM16 pressure transducer is to be mounted to port P of the pump or, if an SYDZ pre-load valve is used, to port MP1, and connected to the M12 component socket (13). Alternatively, an external pressure transducer can be connected via the central plug (12). A position transducer with integrated electronics (7) on the pump acquires the actual swivel angle value. The acquired actual values are processed in the amplifier and compared with the selected command values.

A minimum value generator ensures that only that controller is active which is assigned to the desired working point. Here, one system variable (pressure, swivel angle or power) is exactly corrected, the other two variables are below the given command values. The output signal of the minimum value generator becomes the command value for the closed valve control loop.

The actual value of the valve spool position is acquired by an inductive position transducer (6). The output value of the valve position controller determines the current through the proportional valve (8) via the amplifier output stage. As soon as the working point is reached, the control spool (9) of the proportional valve is held in its central position.

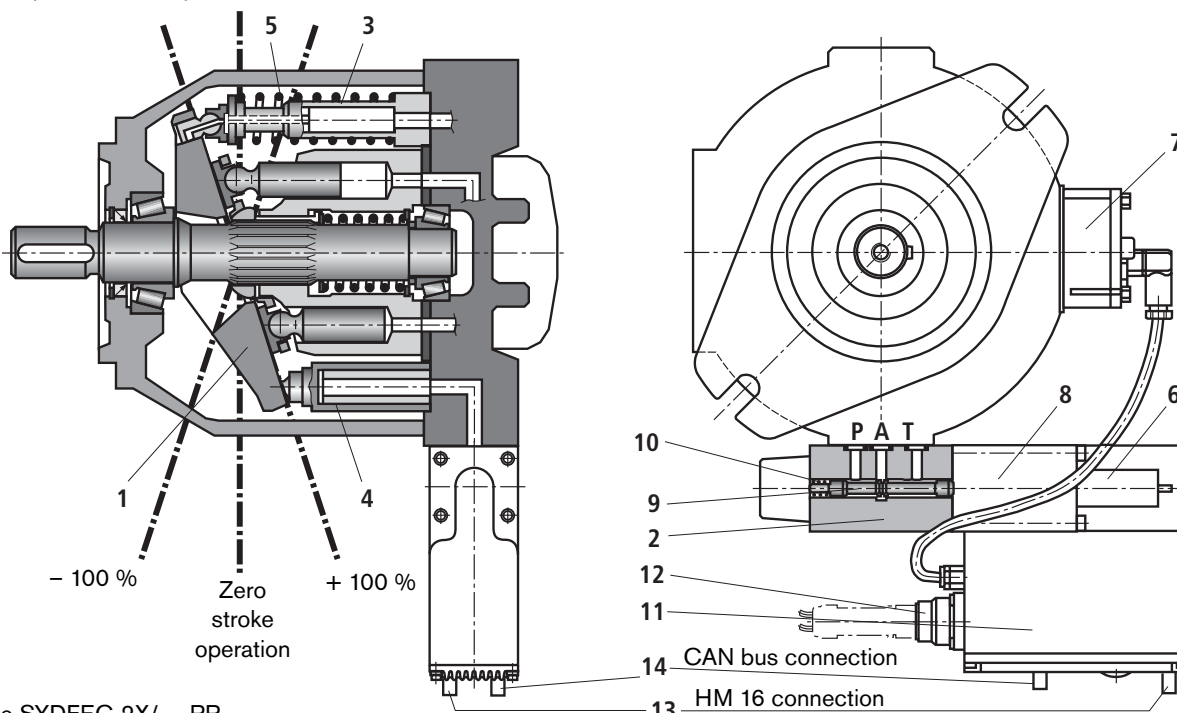
If the higher-level controllers demand an increase in the swivel angle (increase in flow), the valve spool (9) must be shifted from the central position (connection of actuating piston (4) A → T) until the swivel angle has reached the required value. Shifting the valve spool against the force of the spring (10) is achieved by increasing the electric current through the proportional solenoid (8).

The swivel angle is reduced (reduction in flow) by opening the connection of the actuating piston (4) from P → A.

### Actuating system supply

There are three possibilities of supplying the hydraulic control system of the pump with pilot oil:

1. Internal, without pre-load valve (only possible with system pressures > 20 bar)
2. Internal, with pre-load valve (system pressure 0 ... 100%)
3. External supply via shuttle valve – automatic change-over internal / external through shuttle valve sandwich plate (observe engineering notes!)



Type SYDFEC-2X/...-PP...






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

<b>General</b>							
Drive speed	n	See RE 92711 (sizes 28 – 140) and RE 92712 (size 18)					
Size	Size	18	28	45	71	100	140
Weight – Pump without thorough-drive, incl. high-response valve – additionally, pre-load valve – additionally, with ext. supply of actuating system	kg	14	17	23	35	47	62
	kg	3.3	3.3	3.3	6.3	6.3	6.3
	kg	2	2	2	2	2	2
<b>Hydraulic</b>							
Max. permissible operating pressure	$p_{\max}$	250 bar <sup>1)</sup> (280 bar after consultation)					
Required min. actuating pressure	$p_{\min}$	≥ 20 bar					
Hydraulic fluid temperature range	$\vartheta$	– 20 to + 70 °C					
Hydraulic fluid		Mineral oil (HL, HLP) to DIN 51524					
Fluid cleanliness		Max. permissible degree of contamination of the hydraulic fluid to NAS 1638 class 7 or 18/16/13 to ISO 4406 (for particle size 2/5/15 $\mu\text{m}$ )					
<b>Electrical</b>							
Operating voltage	$U_O$	24 VDC + 40 % – 5 %					
Operating range – Upper limit value – Lower limit value	$u_O(t)_{\max}$	35 V					
	$u_O(t)_{\min}$	21 V					
Current consumption (in steady-state control operation) – Nominal current – Maximum current	$I_{\text{nom}}$	0.6 A					
	$I_{\max}$	1.25 A					
Inputs – Actual pressure value (depending on actual value input, see ordering code) • Current input (ordering code C) • Voltage input (ordering code V) • Voltage input (ordering code D) • Voltage input (ordering code E) • Voltage input (ordering code F) – 2 analogue inputs – 2 digital inputs	$I_O$	4 to 20 mA; load $R_i = 100 \Omega$					
	$U_O$	0 to 10 V; $R_i = 220 \text{ k}\Omega$					
	$U_O$	0 to 5 V; $R_i = 110 \text{ k}\Omega$					
	$U_O$	1 to 10 V; $R_i = 220 \text{ k}\Omega$					
	$U_O$	0.5 to 5 V; $R_i = 110 \text{ k}\Omega$					
	$U_{\text{in } 1}$	0 to 10 V; $R_i = 220 \text{ k}\Omega$					
	$U_{\text{in } 2}$	–10 to 10 V; $R_i = 100 \text{ k}\Omega$					
	logic 0 (low)	≤ 8 V					
	logic 1 (high)	≥ 14 V					
	$R_e$	3 $\text{k}\Omega \pm 10 \%$					
Outputs: – 2 analogue outputs	$U_O$	± 10 V					
	$I_{\max}$	2 mA					
– Error message	low-active $U_a$	≥ $U_O - 5 \text{ V}$ ; 10 mA (short-circuit-proof); error: $U_O < 1 \text{ V}$					
CAN bus – Physical bus properties – Signal transmission – Bus plug – Protocol		ISO 11898-2/4V					
		Differential, two-wire cable					
		M12x1 plug, 5-pin					
		CANopen for Industrial Systems CiA Standard 301 Version 3.0					
Electrical connection		Plug-in connector, 12-pin, N11REFF, DIN 43 563 <sup>2)</sup>					
Permissible ambient temperature range	$\vartheta$	0 to 50 °C					
Storage temperature range	$\vartheta$	0 to 70 °C					
Type of protection to DIN 40 050		P 65 with plug-in connector mounted and locked					

<sup>1)</sup> For supplements, see sales information (engineering aids) RE 30 030-01-V

<sup>2)</sup> Separate order, see page 8 (electrical connection)

 **Note!** For details regarding **environment simulation tests** in the fields of EMC (electromagnetic compatibility), climate and mechanical stress, see RE 30 027-U (declaration on environmental compatibility).

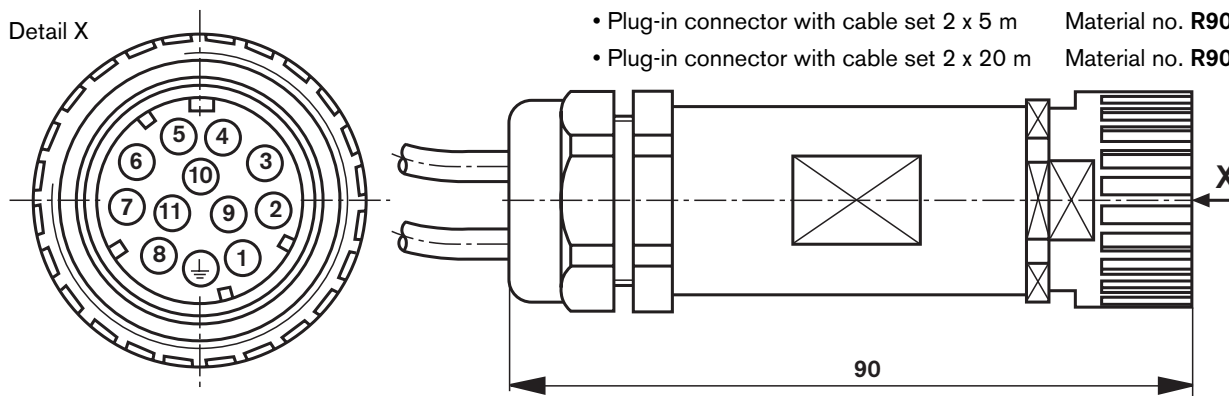
## Electrical connection

### Central connection

Plug-in connector to E DIN 43563-B (12-pin),

- Plug-in connector without cable (kit) Material no. **R900884671**
- Plug-in connector with cable set 2 x 5 m Material no. **R900032356**
- Plug-in connector with cable set 2 x 20 m Material no. **R900860399**

Detail X



**X1: Pin assignment of component plug or plug-in connector and cable set**

Pin	Assignment	Code
1	+ $U_O$	1
2	0 V $\triangle$ L0	2
PE	Ground	green/yellow
3	Fault	white
4	M0	yellow
5	$U_{in 2}$ (AI2)	green
6	$U_{out 2}$	violet
7	$U_{in 1}$ (AI1)	pink
8	$U_{out 1}$	red
9	Digital IN1 (DI1)	brown
10	Actual pressure value H	black
11	Actual pressure value L	blue
n.c.		grey

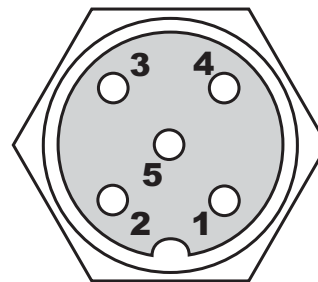
Supply cable  
3 x 1.0 mm<sup>2</sup>

Signal cable  
10 x 0.14 mm<sup>2</sup>;  
shielded  
(Shield must be connected at  
one end in the control cabinet!)

**X2: Connection of HM 16 pressure transducer and serial interface (RS232) (component socket M12x1)**

Pin	Assignment (DMU)	Pin	Assignment RS232
1	+ $U_O$	2	RxD (RS232)
3	Reference L0		
4	Signal	5	TxD (RS232)

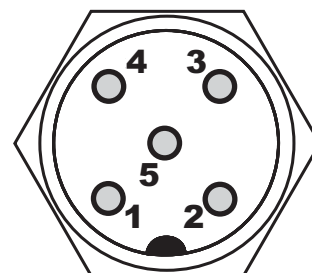
Top view of component socket



**X3: CAN bus connection and digital input 2 (DI2), shielded (component plug M12x1)**

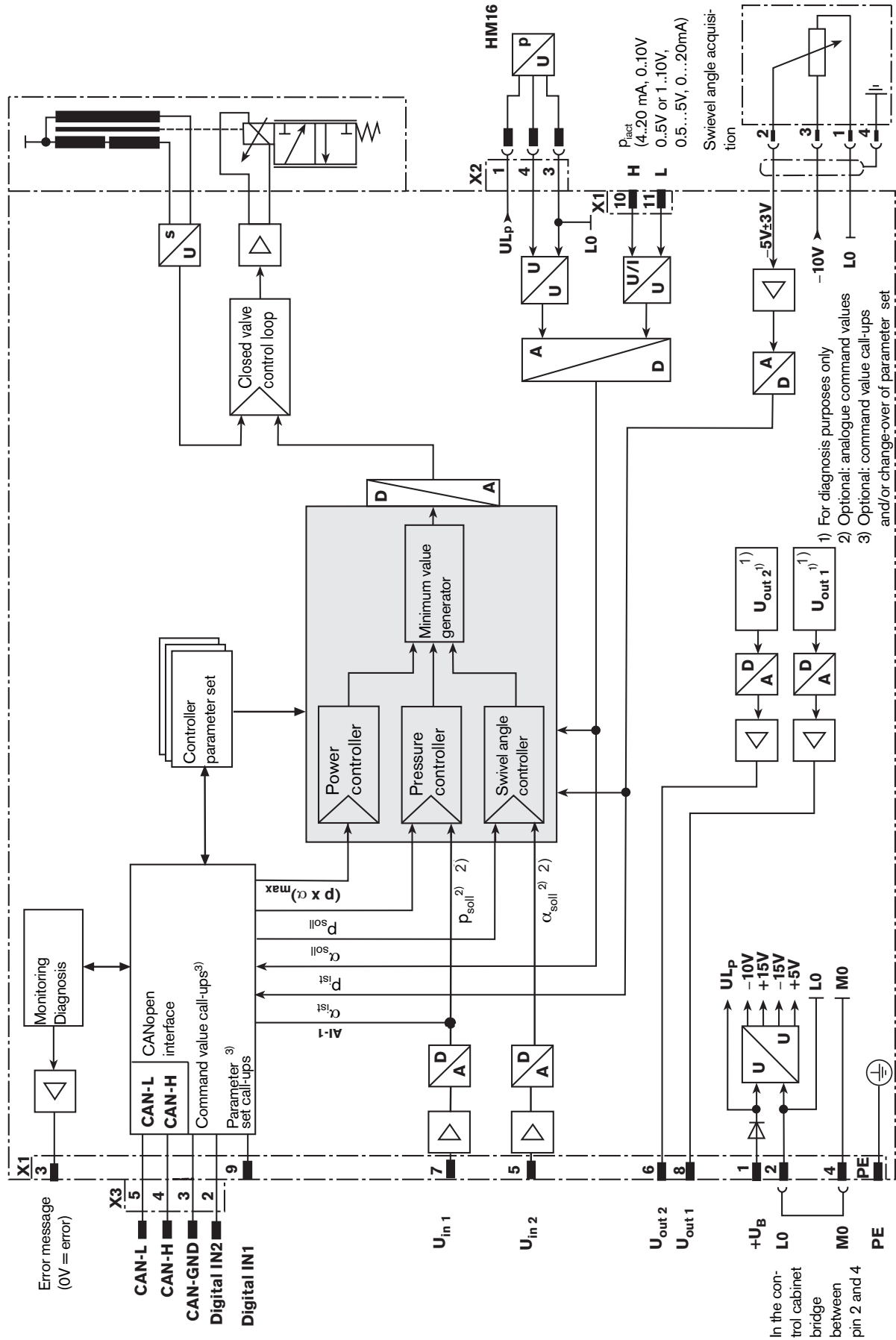
Pin	Assignment	Pin	Assignment
1	Reserved	3	CAN-GND
2	Digital IN2 (DI2)	4	CAN-High
		5	CAN-Low

Top view of component plug



Suitable connection plug for actual pressure value input for version F: Plug-in connector type M12x1 (shielded version)

Block circuit diagram / pin assignment of integrated electronics for SYDFEC



## Scope of functions

### Structure of the closed-loop control electronics

- Analogue valve position controller
- Digital swivel angle controller
- Digital pressure controller
- Digital power controller

### Controller parameter sets

16 controller parameter sets can be selected in real time via PDO (e.g. optimization to different oil volumes).

Default values are pre-assigned to these controller parameters, which can be adjusted by means of SDO or the PC software WIN PED®. It is possible to select 4 controller parameter sets via 2 switching inputs, if no CAN bus is used.

### Power limit

can be changed or switched off by means of SDO

### Leakage compensation

can be cut in or out by means of PDO, value can be configured (manual or automatic calibration)

### Pressure transducers

Up to 4 pressure transducers can be connected (fading function)

### Master/slave function

Direct connection of master and slave pump via CAN bus with PDO or analogue signals.

Stand-alone operation:

- Command values from the machine control

Master/slave operation:

- The master receives command values from the machine control and sends commands value to the slave
- The machine control does no longer send command values to the slave

The assignment of master and slave(s) can be optionally configured by means of SDO. Several master/slave groups are possible.

### Special function for change-over of injection process/ pack-and-hold pressure

Command values can be adjusted by means of SDO for pack-and-hold pressure.

### Automatic calibration functions

- Offset of the pressure transducer
- Valve characteristic curve correction
- Swivel angle zero point
- Swivel angle gain
- Leakage compensation

Corrective values can be called from the control.

### Monitoring functions

- CAN communication
- System deviation
- Cable break of valve, swivel angle transducer, pressure transducer
- Temperature
- Supply voltage

### Internal command value ramps

- Pressure
- Flow

## Communication via CAN bus

- Protocol according to CANopen (Communication for Industrial Systems CiA Standard 301 Version 3.0)
- Receipt of pressure and flow command values (PDO, real time)
- Sending of actual pressure and flow values (PDO, real time)
- Certain control options can be selected via the control byte (PDO)
- The status byte (PDO) shows the internal state of the DFEC
- Changes to settings via SDO

## Optional command value source: CAN bus, analogue signals, command value call-ups

The command values for pressure and flow can be fed forward from different command value sources:

- CAN bus (command values for pressure and flow via PDO)
- 2 analogue inputs (1 command value input each for pressure and flow)
- 2 switching inputs (4 command values each for pressure and flow)

**Control loop quality SYDFEC** (the given values are only valid in conjunction with components associated to the system according to the type code!)

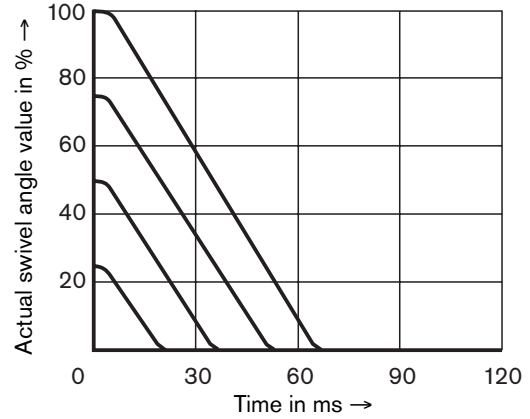
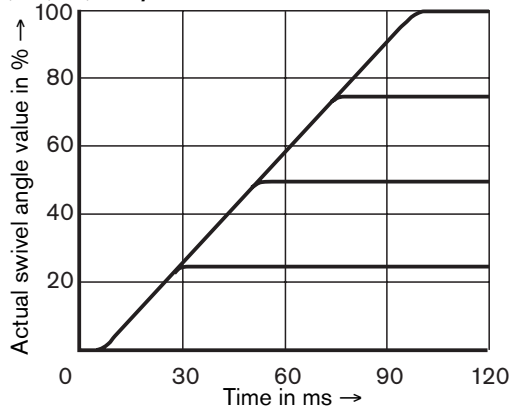
	Swivel angle control	Pressure control <sup>1)</sup>
Linearity tolerance	≤ 1.0 %	≤ 1.5 % (1% <sup>2)</sup> )
Temperature error	≤ 0.5 %/10 K	≤ 0.5 %/10 K
Hysteresis	≤ 0.2 %	≤ 0.2 %
Repeatability	≤ 0.2 %	≤ 0.2 %

<sup>1)</sup> Without consideration of pump pulsation

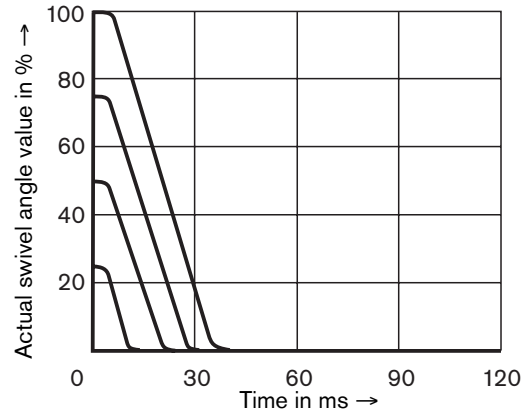
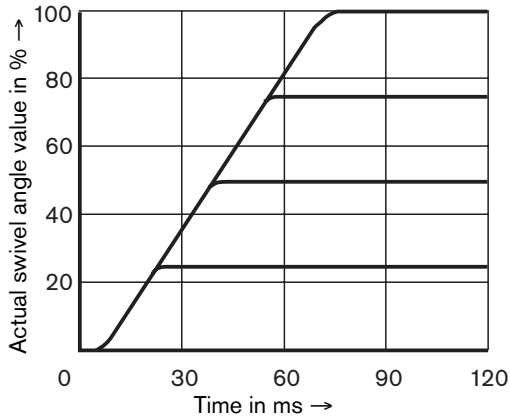
<sup>2)</sup> When using the integrated calibrating functions

**Transfer function for swivel angle command value step-change with 360° spool (version "A")**

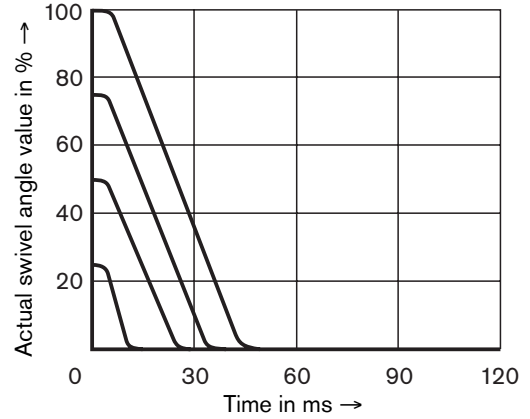
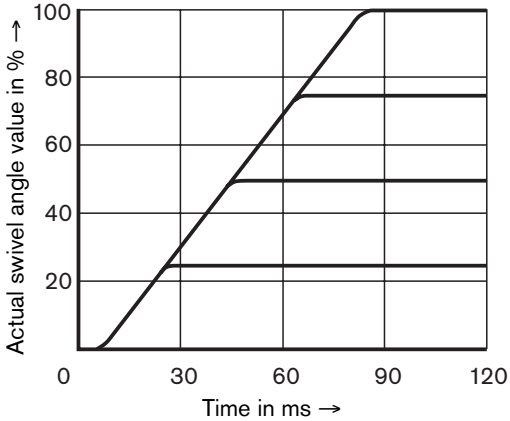
**Sizes 18, 28, 45, 71  $p = 20$  bar**



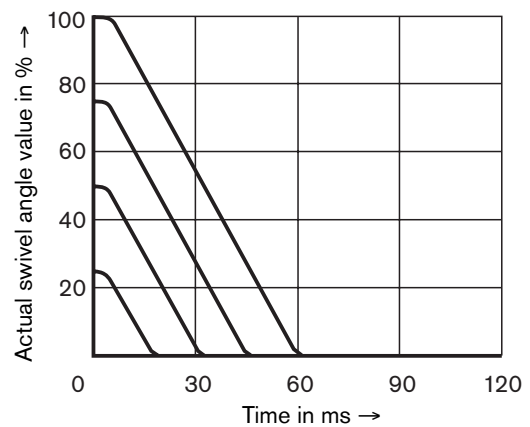
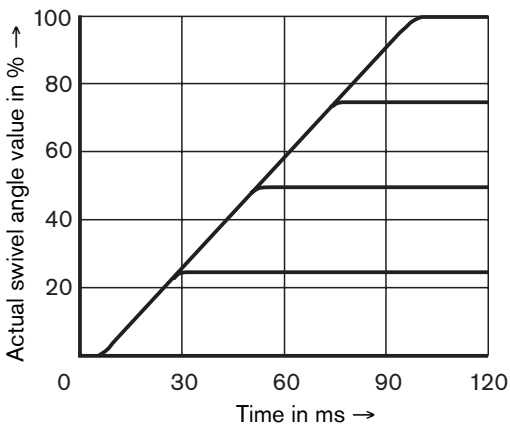
**Sizes 18, 28, 45, 71  $p = 50$  bar**



**Size 100  $p = 50$  bar**

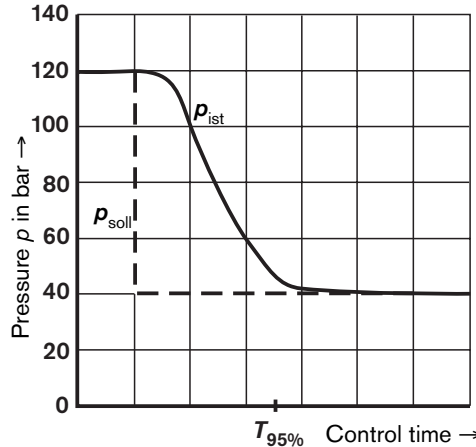
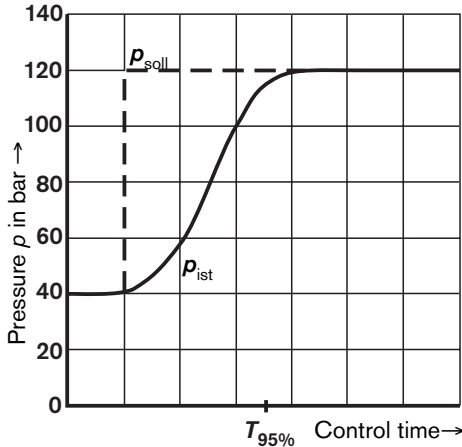


**Size 140  $p = 50$  bar**



### Transfer function for pressure command value step-change for SYDFEC with 360° spool (version "A")

The curve shapes and control times given here are achieved when the relevant standard parameter set is selected. With an optimised system, shorter times may be achieved.



$T_{95\%}$  in ms with a connected hydraulic fluid volume (lines and consumer)

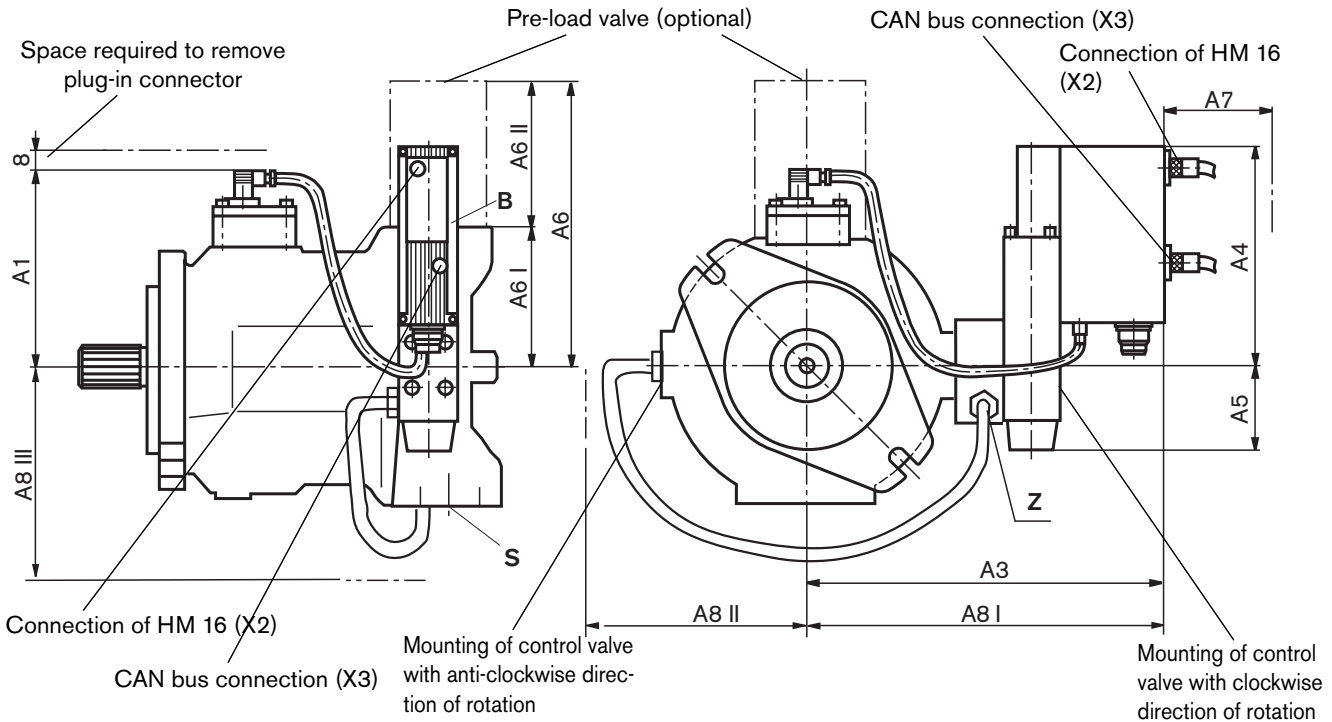
< 5 L	150 ms
5 – 10 L	200 ms
15 – 25 L	250 ms

For pressures up to 40 bar, the response time values are greater.

### Unit dimensions SYDFEC (in mm)

#### Sizes 18 to 140

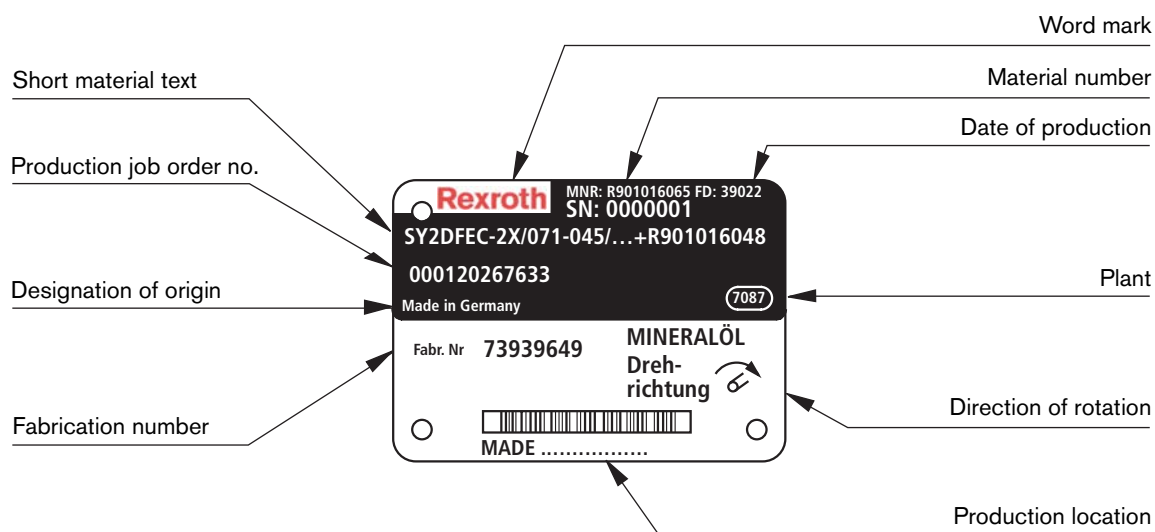
(Valve installation orientation "0"; shaft version "S"; without through-drive "N00")



Size	A1	A3	A4	A5	A6	A6 I	A6 II	A7	Pilot oil port "Z"		
									A8 I	A8 II	A8 III
18	120	198	158	63	178	63	115	60	233	125	100
28	128	208	158	63	195	80	115	60	243	135	115
45	134	218	158	63	205	90	115	60	253	145	125
71	146	232	158	63	254	104	150	60	267	159	150
100	151	237	158	63	247	100	147	60	272	164	150
140	162	250	143	78	257	110	147	60	285	182	150

Dimension A7 → installation space required for CAN bus plug-in connection and optional connection for HM16 pressure transducer

## Example of nameplate for an SY2DFEC pump combination



### Note!

Please have the material number and the fabrication number at hand in the case of queries with regard to the pump combination.

## Engineering notes

- Always shield command and actual value cables.
- The distance to aerial lines or radio equipment must be at least 1 m.
- Signal cables must not be installed near power cables.
- Supplementary notes on the SYDFEC control system can be found in RE 30 030-01-V.

## Notes

---

## Notes

---

Bosch Rexroth AG  
Industrial Hydraulics  
Zum Eisengießer 1  
97816 Lohr am Main, Germany  
Telefon +49 (0) 93 52 / 18-0  
Telefax +49 (0) 93 52 / 18-23 58  
documentation@boschrexroth.de  
www.boschrexroth.de

© All rights reserved by Bosch Rexroth AG, also in the case of patent applications. Any right of disposal such as right of copying or distribution lies with us.

The data specified only serves to describe the product. No statements concerning a certain condition or suitability for a certain application can be derived from our information. The details stated do not release you from the responsibility for carrying out your own assessment and verification. It must be remembered that our products are subject to a natural process of wear and ageing.

## Notes

---