

# Sytronix – variable-speed pump drives

Energy-efficient | Powerful | Cost-effective







Sytronix variable-speed pump drives change the game with hydraulic systems and offer new opportunities for innovative designs. Energy-efficient solutions using components matched to the application and an in-depth knowledge of the technology are key.

Investment in energy saving technology using Bosch Rexroth hydraulics can provide fast returns, with energy savings up to 80%.

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## **Sytronix – energy-efficient variable-speed pump systems**

Sytronix system overview	6
Sytronix selection guide	8
Sytronix system key	9

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## **Sytronix FcP variable-speed pump drives**

FcP 7010	15
FcP 5010	20

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## **Sytronix SvP variable-speed pump drives**

SvP 7010	28
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## **Sytronix DFE variable-speed pump drives**

DFE 7010	36
DFE 5010	39

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## **Sytronix individual solutions**

8 steps for a system solution	43
Selection guides	45

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## **Components and modules**

Motor-pump-assemblies	47
Drives	54
Motors	63
Pumps	68
Accessories	76

# Sytronix – energy-efficient variable-speed pump systems

Older machine designs focused on systems that had the capacity to deliver maximum performance, even though it might have only been for a fraction of the total cycle. Today there is a greater emphasis on reducing energy consumption and noise emissions. Higher energy prices and workplace environmental requirements have engineers rethinking their designs.

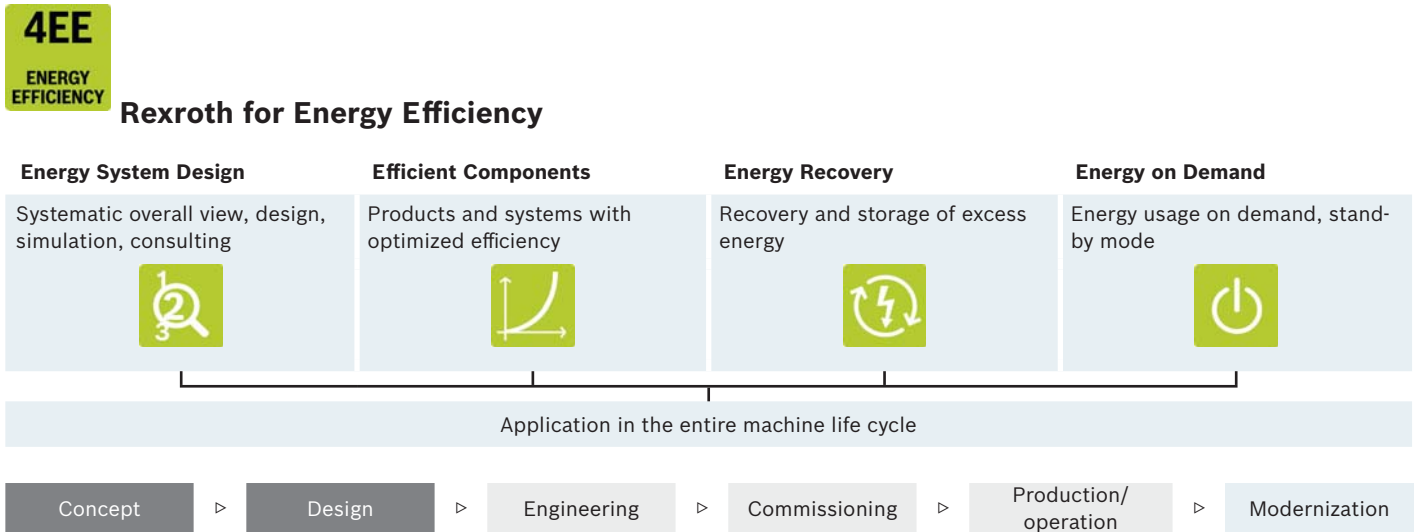
Using Sytronix (smart interplay of hydraulics and electronics) variable-speed pump drives can address these issues by combining the advantages of Bosch Rexroth technologies: reliability of high-performance hydraulics and energy-efficiency and dynamics of high-performance drives and electronics.

Sytronix drives combine matched electric motors, hydraulic pumps, and VFDs (variable frequency drives), which has the potential of significant energy savings and a considerable reduction in noise emissions at a cost that provides an attractive return on investment.

## Energy on Demand – powerful hydraulics, intelligent control

By integrating the advantages of hydraulics with the control intelligence of electrical drives, motor speeds can be continually adjusted to match the machine’s requirements. The drive speed of the pump can be lowered to an energy-efficient, quiet level when the process requires less than full performance. By having a major portion of the machine cycle time matched to the part-load requirement, energy is saved and noise is reduced.

Sytronix systems are part of Bosch Rexroth’s **4EE strategy** for system energy reduction.



## Sytronix: efficient and versatile

To meet the requirements of pump drive systems – Sytronix systems can provide a number of key advantages:

- ▶ Energy savings of up to 80%
- ▶ Reduction in noise emissions by up to 20 dB (A)
- ▶ Lower investment and reduced operating costs



## Sytronix advantages

### Reduced energy consumption

Energy savings of up to 80% decrease operating costs and reduce CO2 emissions.

### Lower noise emission

Sytronix drives can reduce the noise emission of the hydraulic power unit up to 20 dB (A). Meeting stringent noise specifications in certain market areas is easier and may be accomplished with noise control measures.

### Easier installation and commissioning

Pre-configured Sytronix hydraulic pump drives and assemblies utilize matched components to provide complete pump drive systems. This results in short installation and commissioning times. Rexroth offers more than 100 drive configurations in three different performance classes.

### Easier cooling

By lowering the average pump drive speed, variable-speed pump drives can significantly reduce generated heat, minimizing the cost and energy required to cool the hydraulic system.

### Lower space requirements

Using Sytronix drives can lower space requirements for the hydraulic system:

- ▶ Compact design
- ▶ Simpler valve technology and reduced requirements for control electronics
- ▶ Reduced hydraulic fluid volume resulting in smaller reservoir requirements
- ▶ Reduction in space for cooling due to reduced heat loads and elimination of most noise containment hardware

### More reliable operation

- ▶ Integrated system design using proven hydraulic and electrical components
- ▶ Condition monitoring and diagnosis available in the drive control electronics

### Retrofit design assistance

Rexroth can provide customers with support throughout the retrofitting process, from planning to assembly to on-site commissioning.

### Compliance with regulatory requirements

Sytronix variable-speed pump drives can assist with compliance for noise control (EU Directive 2003/10/EC) and electric motor energy efficiency (EU Regulation (EC) no. 640/2009).

## Application areas

- ▶ **Wood and paper processing machines**
- ▶ **Plastics processing machines**
- ▶ **Die-casting machines**
- ▶ **Presses**
- ▶ **Machine tools**
- ▶ **Metallurgy**

# Sytronix system overview

## Scalable power and functionality

Sytronix variable-speed pump drives offer a comprehensive range of pumps, controllers, motors and software to suit a wide spectrum of applications. Rexroth provides machine manufacturers support during project planning, utilizing simulation models for system design and component selection. Scalability of performance and function allows for an optimal choice of system components.

When using a cascade system, multiple Sytronix drives can work together to efficiently generate the flow rate required for the process.

Sytronix systems are available as pre-configured systems or as individually configured components.

## Always the right Sytronix system

Rexroth offers variable-speed pump drives in three performance classes:

### Basic Dynamics

#### **Sytronix FcP – frequency-controlled pump drive**

FcP systems are suitable for standard applications with constant pressure control, for open hydraulic systems up to 90 kW. Typical applications are machine tool systems, as well as auxiliary axis movements in different applications such as presses.

### High Dynamics

#### **Sytronix SvP – servo variable pump drive**

SvP systems use the high dynamics of synchronous permanent magnet motors to achieve significant energy savings. Capabilities include axis control functions in both open and closed hydraulic circuits requiring high dynamic performance, as well as advanced electrical and electrohydraulic control. Plastics processing machines and presses are key sectors for this technology.

### High Power and Dynamics

#### **Sytronix DFE – variable-speed drive utilizing a pump with electronic pressure and flow control**

DFE systems are suited for high performance applications requiring a favorable price-performance ratio. These systems utilize variable displacement piston pumps and are especially suited for retrofit installations in existing systems. Capable of axis control functions, these drives offer high performance in open hydraulic circuits, and can be used in machines with multiple hydraulic functions.

The Sytronix house

# Sytronix

Variable-Speed Pump Drives

## Preconfigured sets

### Sytronix FcP



Drives for pressure control

- Pressure and flow control

### Sytronix SvP



Drives for axis control

- Pressure and flow control
- Force and velocity control
- Positioning

### Sytronix DFE



Drives for axis control

- Pressure and flow control utilizing variable displacement pumps
- Power control

Basic Dynamics

High Dynamics

High Dynamics & High Power

## Individual Sytronix Solutions

Customizable solutions from Rexroth electric and hydraulic program



- Communication via Ethernet and other fieldbuses
- Master/Slave operation
- Cascaded pumps
- Safety on Board
- Custom system functions





# Sytronix selection guide

Requirements			Effective performance		
			80 kW	90 kW	315 kW*
Open and closed-loop axis control	Closed hydraulic circuit		SvP 7010	DFE 5010 / 7010	
	Open hydraulic circuit	One hydraulic circuit in the machine			
			Multiple hydraulic circuits in the machine		
Constant pressure system	Open hydraulic circuit		FcP 5010 / 7010		

\* Higher power range on request

The Sytronix selection guide shows the Rexroth Sytronix product family.

## Open and closed-loop axis control

- For closed hydraulic circuits, Sytronix SvP speed-variable drives offer high dynamics and comprehensive electrical and electrohydraulic control options. In open hydraulic circuits, the Sytronix DFE system, utilizing electronic pump control of pressure/flow (p/Q), is an alternative option. DFE-based hydraulic drives offer an addition to the performance portfolio and are suitable for machines with multiple hydraulic circuits.
- In cascade systems, multiple Sytronix drives work together to efficiently generate the flow rate required for the process.

## Constant pressure systems

- For constant pressure systems, cost-effective Sytronix FcP drives using VFD driven asynchronous motors are suitable for conventional drives up to 90 kW.

## Two options for Sytronix systems

After choosing the appropriate product family using the selection guide, there are two options for the pump system to fit the requirements:

- **Pre-configured system sets** from the product families of FcP, SvP or DFE using the selection guides (see next page).
- Assembly of **individual systems** by combining modules and components using application guidelines and system requirements. This can be done in collaboration with Rexroth applications specialists, for example for Sytronix systems with pump types that are not yet available in the sets (see „Sytronix individual solutions“ on page 42).

Sets will be available starting in October 2013. Please contact your Bosch Rexroth for questions regarding availability.



# Sytronix system key

1	2	3	4	5	6	7	8	9	10	11	12	13	14
SYT	-			-		-					-		-

Example

SYT	-	DFE	50	10	-	D10	xxx	-	S	-	FC2	N	A	xxx	-	FV	xxx	-	NNNN
-----	---	-----	----	----	---	-----	-----	---	---	---	-----	---	---	-----	---	----	-----	---	------

	Description	Pos.	Designation	Entry
System	Product line	01	Sytronix	SYT
	Product family	02	SvP FcP DFE	SVP FCP DFE
	Series	03	Rexroth Fv = 50 IndraDrive Hxx = 70	50 70
	Generation	04	10	10
Pump	Pump technology	05	PGH PGM PGF A10 A4 DFE-A10 DFE-A4	PGH PGM PGF A10 A04 D10 D04
	System flow	06	l/min	xxx
	Coupling	07	Direct Standard	D S
Motor/system pressure/controller	Motor technology	08	Servo = MSK Asynchronous = MOT-FC IE2 Servo asynchronous = MAD	MSK FC2 MAD
	Rated speed	09	1500 2000 3000	F H N
	Motor cooling	10	Forced-ventilated (IC 416) Self-ventilated (IC 411) Liquid-cooled Convection	A S L N
	Nominal pressure Motor-pump unit	11	bar	xxx
	Controller	12	Rexroth Frequency Converter Fv IndraDrive HCS IndraDrive HMV/HMS	FV HC HM
	Performance overload	13	%	xxx
	Implementation	14		NNNN

## Selecting pre-configured systems

Use the following selection guides for each product family to determine your options based on the following three parameters.

## Three steps for choosing a Sytronix system

1. **Select a flow**
2. **Select a system pressure**
3. **Select a performance level**

The Sytronix system key guides the user to a system selection. For a definition of the Sytronix system key, please see page 9.

### Steps 1 + 2

Selection guide for flow, system pressure, and controller (e.g. Sytronix FcP 5010 with PGF)

Pumps					Motors							P <sub>nom</sub> [kW] n <sub>max</sub> [rpm]
n <sub>max</sub> = 3600 rpm					MOT-FC IC411 (self-ventilated)							
Type	NG	p <sub>cont</sub> [bar]	p <sub>max</sub> [bar]	Q* [l/min]	1.5	2.2	3	4	5.5	7.5	11	
					4200	4000	4000	4000	4000	4000	3800	
p <sub>cont.**</sub> [bar]												
PGF2	006	210	250	23	67	98	135					
PGF2	008	210	250	29	53	78	107	139				
PGF2	011	210	250	39	40	58	80	104	144			
PGF2	013	210	250	47	33	48	66	86	119			
PGF2	016	210	250	57	27	40	55	71	99	135		
PGF2	019	210	250	68	23	34	47	61	84	114		
PGF2	022	180	210	66	20	29	40	52	72	98	144	
K [%]												
Controller	Rexroth FV FVCA01.1	1K50	118		118							
		2K20	162		162	120						
		4K00										
		5K50					164	127				
		7K50						165	118			
		11K0							155	113		
		15K0								160	114	
										1157		

### Selection example for system key

SYT-FCP5010-PGF **\*\*\*** -S-FC2FS **\*\*\*** -FV **\*\*\*** -NNNN -----> SYT-FCP5010-PGF **047** -S-FC2FS **086** -FV **127** -NNNN

■ = Preferred systems

\* The maximum permissible speeds of the overall system resulting from the concerned motors and pumps were used to calculate the cell values. The flow was calculated without the degree of efficiency.

\*\*The effective pressure was calculated without the degree of efficiency.

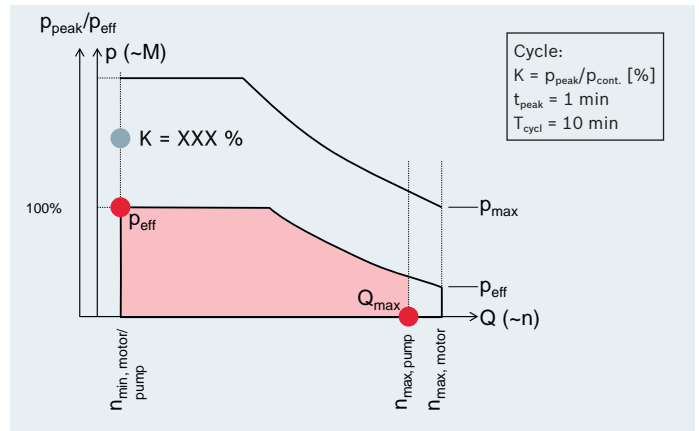
### Step 3

The performance of your pump system is determined by the peak load that can be obtained in intermittent operation, without damage to the pump drive system. It is defined as  $p_{\text{peak}}/p_{\text{cont.}}$  and described as the factor K in %.

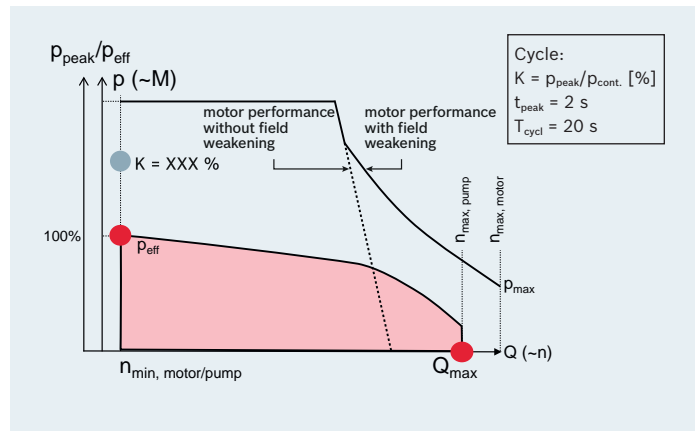
The individual pump-motor combinations determine the characteristic curves for the appropriate Sytronix system.

## Sytronix selection guides for individually configured system components

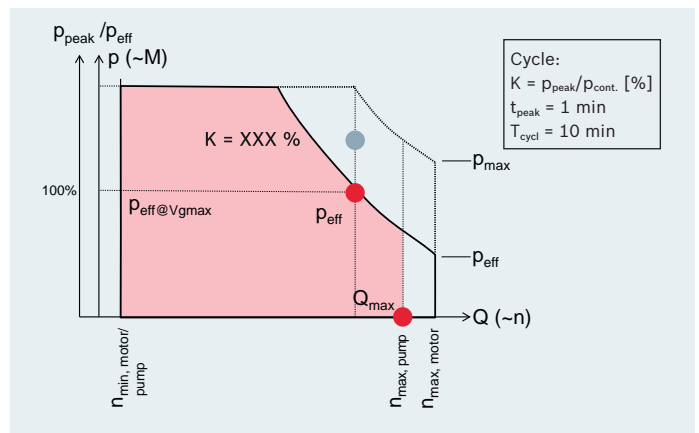
To configure a Sytronix system, all required components are available separately (see „Components and modules“ on page 46). Bosch Rexroth specialists can provide support for the selection process. Steps and selection guides are described in the section “Individual solutions” (see page 42).



Performance curve, example FcP 5010 – forced-ventilated, constant pump



Performance curve, example SvP 7010 – forced-ventilated, constant pump



Performance curve, example DFE 5010 – self-ventilated, variable pump

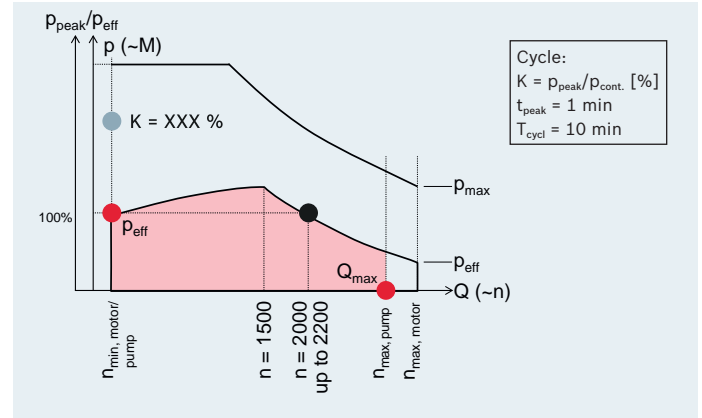
## Sytronix configuration guide for constant pressure systems, e.g. FcP 5010 solutions

Using a self-ventilated motor (designation: IC411) and a constant pump allows the system to maintain the system pressure  $p_{cont.}$  indicated in the selection guides beyond the nominal motor speed of 1500 rpm, up to a constant speed of approximately 2000 – 2200 rpm. With a PGF2 013 internal gear pump, the corresponding flow is calculated (without the degree of efficiency) as follows:  $Q = (n \cdot V) / 1000$  -->  $Q = (2200 \text{ rpm} \cdot 13 \text{ cm}^3) / 1000$  -->  $Q = 28.6 \text{ l/min}$ . E. g. at a  $p_{cont.}$  of 86 bar as indicated in the selection guide for a PGF2 013, this pressure can be held constant at a flow of 28.6 l/min.

The flow value of 47 l/min specified in the selection guide always refers to the maximum possible speed of either the hydraulic pump  $n_{max, pump}$  or asynchronous motor  $n_{max, motor}$ . This flow value of 47 l/min can only be achieved temporarily at reduced pressure.

The minimum speeds for the hydraulic pump  $n_{min, pump}$  and asynchronous motor  $n_{min, motor}$  depend on the selected Sytronix system and the system pressure. For FcP and DFE applications, the minimum speed depends on the pressure and is typically more than 100 rpm. For SvP applications, the speed can significantly be less than 100 rpm for a temporary period.

You can use the SytronixSize design tool to perform detailed calculations for your application.



Configuration curve, example FcP 5010 – self-ventilated, constant pump, constant pressure system

# Sytronix FcP variable-speed pump drives

## FcP system sets

Sytronix FcP (**f**requency **c**ontrolled **p**ump drive) systems consist of a motor-pump assembly with a standard asynchronous motor and a VFD with control electronics. With regard to dynamics, accuracy and functionality, the FcP product family covers standard performance hydraulic drives and is suitable in the following applications:

- ▶ Constant pressure systems up to 90 kW
- ▶ Applications with controlled volume flow profile or where alternating p/Q control is required
- ▶ Open hydraulic circuits
- ▶ Single quadrant operation

Starting with the basic FcP system, a PGF family internal gear pump is used for pressure and flow control. For higher pressure and performance, the PGH internal gear pump is utilized, as well as A10 and A4 axial piston variable displacement pumps. When used at high pressures, utilizing variable displacement piston pumps helps to reduce the torque on the electric motor so that a smaller drive can be selected.

FcP 5010 and FcP 7010 utilize different VFD drive electronics. Differences include the type and scope of communication and bus interfaces, as well as additional functionality and user interfaces.

## Components

- ▶ Hydraulic pump
- ▶ Electric motor
- ▶ VFD with control electronics
- ▶ Pressure transducer

## Applications

The FcP systems are energy-efficient variable-speed pump drives for constant pressure systems (e.g. machine tools) with open hydraulic circuits as well as in systems for pressure supply for auxiliary axis movements, such as in presses and metallurgy.

## Sytronix FcP systems

Sytronix FcP key advantages:

- Cost-effective, energy-efficient drive
- Intuitive, easy, manual parameterization
- Optional additional control features



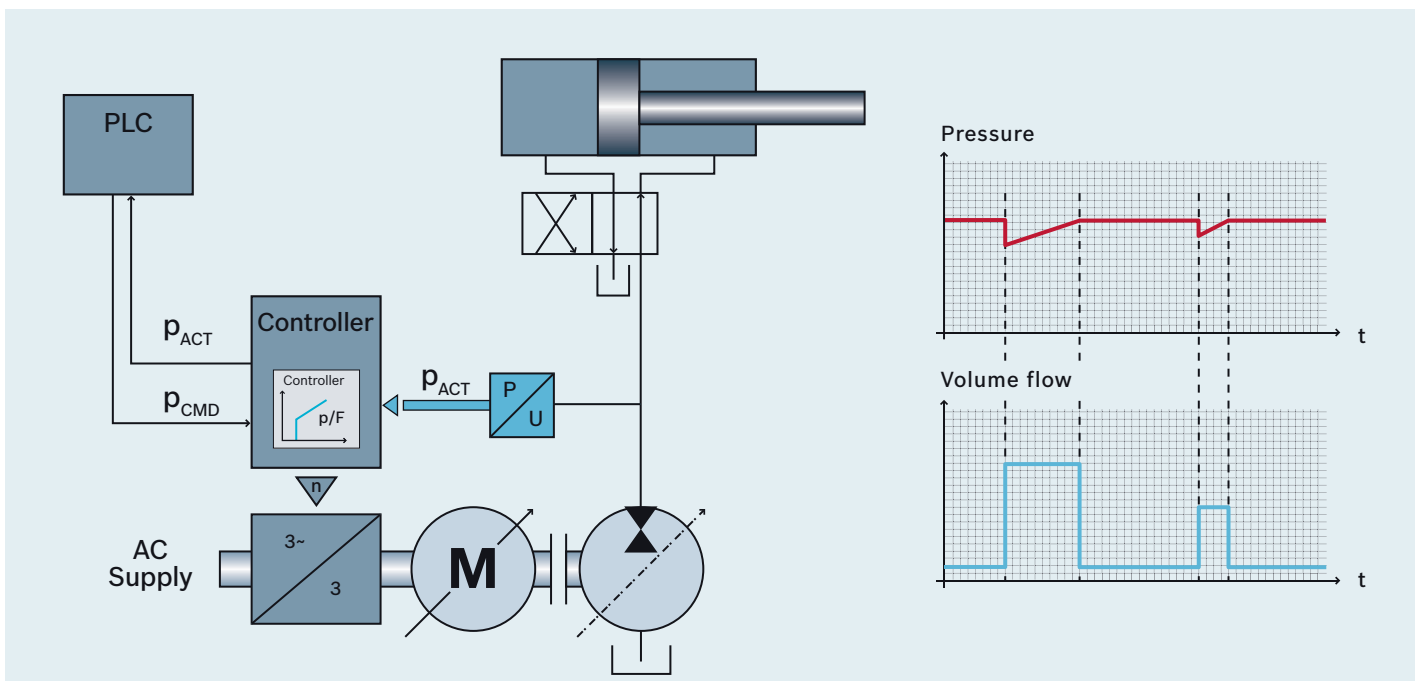
### Function

In constant pressure systems, the drive controls the motor speed to maintain constant system pressure. This is accomplished by modulating the flow to provide constant system pressure independent of the flow demand.

Use of additional hydraulic accumulators ensures fast pressure requirements in smaller systems. Conventional directional valves control the flow direction and determine the direction of travel of the hydraulic actuator.

The desired pressure setting is determined by the machine control and used as a command value to the VFD. The VFD control compares the command value with the actual value measured by a pressure transducer and adjusts the motor speed accordingly.

FcP block diagram



# FcP 7010

## Features

- ▶ Performance up to 90 kW effective
- ▶ Support for most industry standard buses: CANopen, PROFIBUS, sercos, EtherNet/IP, ProfiNet, and EtherCAT.
- ▶ Drive-integrated PLC for enhanced capabilities, based on IEC-61131
- ▶ Double quadrant operation
- ▶ “Safety on Board”, auto-tuning, pump protection, multi-Ethernet communication, condition monitoring

## Components

- ▶ MOT-FC motor with forced or self-ventilation
- ▶ Pump types PGF, PGH, A10VZO-EZ4, and A4VSO-EZ
- ▶ IndraDrive controller
- ▶ Scalable Basic, Advanced controller

## Applications

- ▶ Similar to the FcP 5010 series, typical uses are in constant pressure systems for open hydraulic circuits and controlled axis movement. In addition, the FcP 7010 using the IndraDrive controller provides further functional control features.
- ▶ Systems up to 20 kW commonly used in machine tools
- ▶ Systems up to 630 kW found in axis control in the metallurgy and press industries. In these fields axial piston pumps optimized for higher system pressure operation are typically used.





## FcP 7010 with PGH

## Selection guide for Sytronix FcP 7010 with PGH

Pumps <sup>1)</sup> n <sub>max</sub> = 3000 rpm					Motors <sup>1)</sup>																
Type	NG	p <sub>cont</sub> [bar]	p <sub>max</sub> [bar]	Q [l/min]	MOT-FC IC411 (self-ventilated)								MOT-FC IC416 (forced-ventilated)								P <sub>nom</sub> [kW] n <sub>max</sub> [rpm]
					1.5	2.2	3	4	5.5	7.5	11	15	18.5	22	30	37	45	55	75	90	
					4200	4000	4000	4000	4000	4000	3800	3800	3800	3800	3800	3800	2800	2800	2800	2800	
p <sub>eff</sub> [bar]																					
PGH2	005	315	350	15	87	128	176	229													
	006	315	350	18	73	106	147	191	264												
	008	315	350	24	54	80	110	143	198	269											
PGH3	011	315	350	33	40	58	80	104	144	196	288										
	013	315	350	39	33	49	68	88	122	166	244										
	016	315	350	48	27	40	55	71	99	135	198	269									
PGH4	020	315	350	60	22	32	44	57	79	108	158	216									
	025	315	350	75	17	26	35	46	63	86	127	172	302								
	032	315	350	96		20	27	36	49	67	99	135	236	281							
	040	315	350	120		16	22	29	40	54	79	108	188	225	305						
	050	250	310	150			18	23	32	43	63	86	151	180	244						
PGH5	063	315	350	189/176*				18	25	34	50	68	120	143	193	237*	289*				
	080	315	350	240/224*					20	27	40	54	94	112	152	187*	228*	278*			
	100	315	350	300/280*				16	22	32	43	63	75	90	122	150*	182*	222*	303*		
	125	315	350	375/350*					17	25	34	54	60	72	98	120*	146*	178*	243*	292*	
	160	210	260	480/448*						20	27	47	56	76	93*	114*	139*	190*			
	200	170	210	600/560*						16	22	38	45	61	75*	91*	111*	152*			
	250	135	170	750/700*							17	30	36	49	60*	73*	89*	121*			

\* Flow limited by the maximum motor speed

					K [%]														
Controller	Rexroth IndraDrive C	HCS01.1E	-W0008	79															
			-W0018	224	165	125													
			-W0028			189	146	105											
			-W0054				191	140	100										
		HCS02.1E	-W0070					187	133	100									
		HCS03.1E	-W0070						161	132	113								
			-W0100								183	135	109						
			-W0150									176	142	117					
			-W0210											179	146	112			
		HCS04.2E	-W0350														189	158	
			-W0420															192	

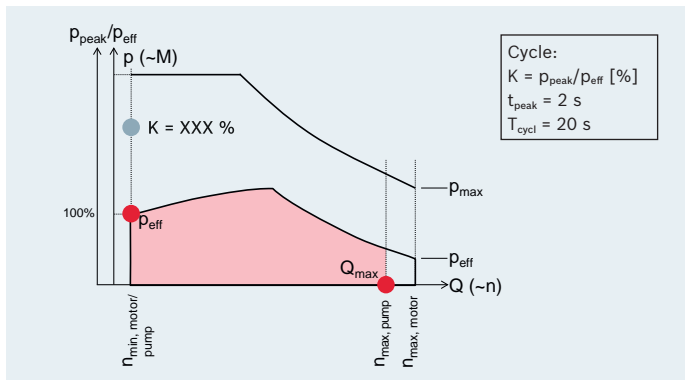
<sup>1)</sup> The pump and motor can also be ordered separately as motor-pump-assembly MPE (see „Motor-pump-assemblies“ starting on page 47)

Note: For a detailed explanation of the tables, see page 10

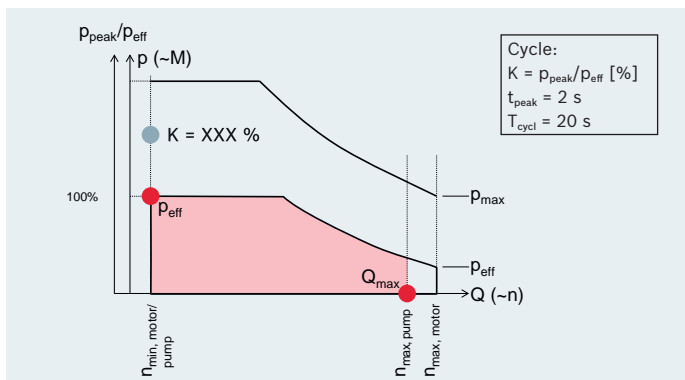
## Selection example for system key

SYT-FCP7010-PGH **\*\*\*** -S-FC2FS **\*\*\*** -HC **\*\*\*** -NNNN -----> SYT-FCP7010-PGH **075** -S-FC2FS **127** -HC **100** -NNNN

**1** **2** **3** **1** **2** **3**



Performance curve for FcP 7010 – self-ventilated with constant internal gear pump



Performance curve for FcP 7010 – forced-ventilated with constant internal gear pump

#### Detailed component information:

Motors: see „Motors“ starting on page 63

Pumps: data sheets 10227, 10223

Controller: catalog R999000018 (DE), R999000019 (EN)

FcP 7010 with A10VZO-EZ4

Selection guide for Sytronix FcP 7010 with A10VZO-EZ4

Pumps <sup>1)</sup>						Motors <sup>1)</sup>																
						MOT-FC IC411 (self-ventilated)																
Type	NG	p <sub>cont</sub> [bar]	p <sub>max</sub> [bar]	n <sub>max</sub> [rpm]	Q [l/min]	1.5	2.2	3	4	5.5	7.5	11	15	18.5	22	30	37	45	55	75	90	P <sub>nom</sub> [kW]
						4200	4000	4000	4000	4000	4000	3800	3800	3800	3800	3800	2800	2800	2800	2800	2800	n <sub>max</sub> [rpm]
						p <sub>eff</sub> [bar]																
A10VZO-EZ4	010	250	315	3600	37	59	87	120	156	215												
	018	280	350	3300	59	35	51	70	91	126	171											
	028	280	350	3000	84	22	33	45	58	81	110	162	220									
	045	280	350	3000	135/126*		20	28	36	50	68	101	137	168	200							
	071	280	350	2550	181			18	23	32	43	64	87	106	126	171	210	256				
	100	280	350	2300	230					23	31	45	62	75	90	122	150	182	222			
	140	280	350	2200	308					16	22	32	44	54	64	87	107	130	159	217	260	
	180	280	350	1800	324						17	25	34	42	50	68	83	101	124	169	202	

\* Flow limited by the maximum motor speed

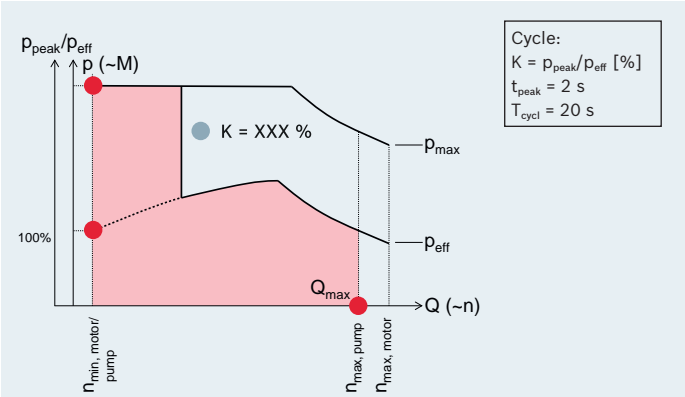
				K [%]																		
Controller	Rexroth IndraDrive C	HCS01.1E	-W0008	79																		
			-W0018	224	165	125																
			-W0028			189	146	105														
			-W0054					191	140	100												
		HCS02.1E	-W0070						187	133	100											
			-W0070							161	132	113										
		HCS03.1E	-W0100								183	135	109									
			-W0150									176	142	117								
		HCS04.2E	-W0210											179	146	112						
			-W0350														189	158				
			-W0420																192			

<sup>1)</sup> The pump and motor can also be ordered separately as motor-pump-assembly MPE (see „Motor-pump-assemblies“ starting on page 47)  
Note: For a detailed explanation of the tables, see page 10

Selection example for system key

SYT-FCP7010-A10 **\*\*\*** -S-FC2FS **\*\*\*** -HC **\*\*\*** -NNNN -----> SYT-FCP7010-A10 **084** -S-FC2FS **110** -HC **140** -NNNN

**Detailed component information:**  
Motors: see „Motors“ starting on page 63  
Pumps: data sheet 91485  
Controller: catalog R999000241 (DE), R999000242 (EN)



Performance curve for FcP 7010 – self-ventilated with axial piston pump with two-point adjustment

## FcP 7010 with A4VSO-EZ

## Selection guide for Sytronix FcP 7010 with A4VSO-EZ

Pumps <sup>1)</sup>						Motors <sup>1)</sup>								P <sub>nom</sub> [kW] n <sub>max</sub> [rpm]
						MOT-FC IC411 (self-ventilated)								
Type	NG	p <sub>cont</sub> [bar]	p <sub>max</sub> [bar]	n <sub>max</sub> [rpm]	Q [l/min]	18.5	22	30	37	45	55	75	90	
						3800	3800	3800	2800	2800	2800	2800	2800	
						p <sub>eff</sub> [bar]								
A4VSO-EZ	040	350	400	2600	104	188	225	305						
	071	350	400	2200	156	106	127	172	211	257	313			
	125	350	400	1800	225	60	72	98	120	146	178	234	292	
	180	350	400	1800	324			68	83	101	124	169	202	
	250	350	400	1900	475				60	73	89	121	146	
	355	350	400	1700	603					51	63	85	103	
	500	350	400	1500	750							61	73	
						K [%]								
Controller	Rexroth IndraDrive C	HCS03.1E	-W0070 -W0100 -W0150 -W0210	132 113 183 135 109 176 142 117 179 146 112										
				HCS04.2E	-W0350 -W0420									

<sup>1)</sup> The pump and motor can also be ordered separately as motor-pump-assembly MPE (see „Motor-pump-assemblies“ starting on page 47)

Note: For a detailed explanation of the tables, see page 10

## Selection example for system key

SYT-FCP7010-A04 **\*\*\*** -S-FC2FS **\*\*\*** -HC **\*\*\*** -NNNN -----> SYT-FCP7010-A04 **156** -S-FC2FS **211** -HC **142** -NNNN

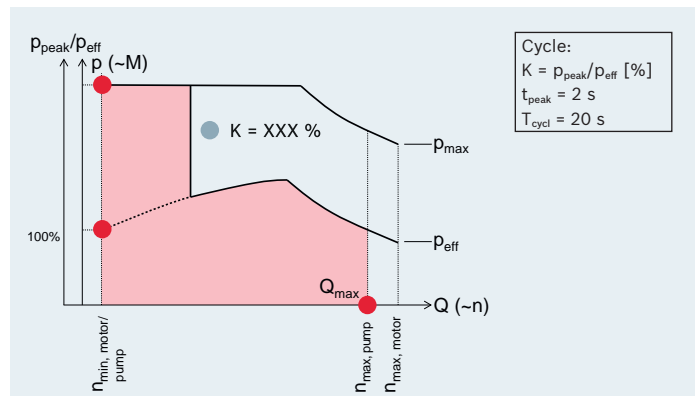
## Detailed component information:

Motors: see „Motors“ starting on page 63

Pumps: data sheet 92050

Controller: catalog R999000241 (DE), R999000242 (EN)

Performance curve for FcP 7010 –  
self-ventilated with axial piston pump with two-point adjustment



# FcP 5010

## Features

- ▶ Performance up to 90 kW effective
- ▶ FcP 5010 based on the Rexroth Fv VFD offering standard control features and analog and PROFIBUS interfaces. Simple on-board configuration using the interface control panel.
- ▶ Double quadrant operation
- ▶ Pump protection

## Components

- ▶ MOT-FC motor with forced or self-ventilation
- ▶ Pump types PGF, PGH, A10VZO-EZ4, and A4VSO-EZ
- ▶ Rexroth Fv FVCA01.1 control

## Applications

- ▶ Suitable for use in open hydraulic circuits for central pressure supply in assemblies with multiple axes: i.e. constant pressure systems. FcP is an energy-saving solution and can reduce hydraulic energy consumption by 30 to 70%, depending on the operational cycle. Typically a smaller displacement pump can be used and cooling requirements are reduced for the same hydraulic output.
- ▶ Systems up to 20 kW commonly used in machine tools
- ▶ Systems from 20 to 90 kW found in axis control in the metallurgy and press industries. In these fields axial piston pumps optimized for higher system pressure operation are typically used.



## FcP 5010 with PGF

## Selection guide for Sytronix FcP 5010 with PGF

Pumps <sup>1)</sup> n <sub>max</sub> = 3600 rpm					Motors <sup>1)</sup>							P <sub>nom</sub> [kW] n <sub>max</sub> [rpm]
Type	NG	p <sub>cont</sub> [bar]	p <sub>max</sub> [bar]	Q [l/min]	MOT-FC IC411 (self-ventilated)							
					1.5	2.2	3	4	5.5	7.5	11	
					4200	4000	4000	4000	4000	4000	3800	
					p <sub>eff</sub> [bar]							
PGF2	006	210	250	23	67	98	135					
PGF2	008	210	250	29	53	78	107	139				
PGF2	011	210	250	39	40	58	80	104	144			
PGF2	013	210	250	47	33	48	66	86	119			
PGF2	016	210	250	57	27	40	55	71	99	135		
PGF2	019	210	250	68	23	34	47	61	84	114		
PGF2 <sup>2)</sup>	022	180	210	66	20	29	40	52	72	98	144	
					K [%]							
Controller	Rexroth Fv FVCA01.1	1K50			118							
		2K20			162							
		4K00				120						
		5K50					164					
		7K50						127	118			
		11K0						165	155			
		15K0								113		
									160	114		
										157		

<sup>1)</sup> The pump and motor can also be ordered separately as motor-pump-assembly MPE (see „Motor-pump-assemblies“ starting on page 47)

<sup>2)</sup> 3000 rpm

Note: For a detailed explanation of the tables, see page 10

## Selection example for system key

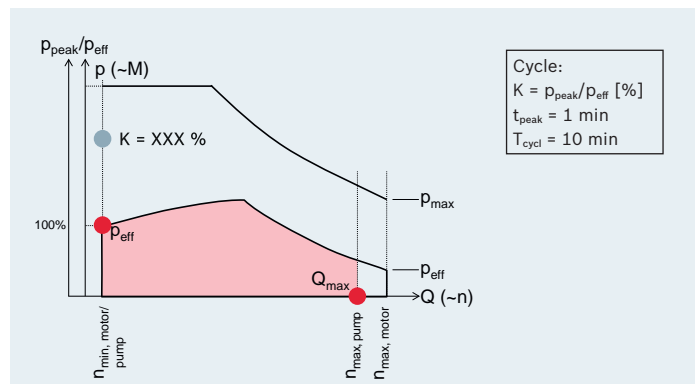
SYT-FCP5010-PGF **\*\*\*** -S-FC2FS **\*\*\*** -FV **\*\*\*** -NNNN -----> SYT-FCP5010-PGF **047** -S-FC2FS **086** -FV **127** -NNNN

## Detailed component information:

Motors: see „Motors“ starting on page 63

Pumps: data sheet 10213

Controller: catalog R912004739



Performance curve for FcP 5010 – self-ventilated

## FcP 5010 with PGH

## Selection guide for Sytronix FcP 5010 with PGH

Pumps <sup>1)</sup> n <sub>max</sub> = 3000 rpm					Motors <sup>1)</sup>																P <sub>nom</sub> [kW] n <sub>max</sub> [rpm]	
Type	NG	p <sub>cont</sub> [bar]	p <sub>max</sub> [bar]	Q [l/min]	MOT-FC IC411 (self-ventilated)								MOT-FC IC416 (forced-ventilated)									
					1.5	2.2	3	4	5.5	7.5	11	15	18.5	22	30	37	45	55	75	90		
					4200	4000	4000	4000	4000	4000	3800	3800	3800	3800	3800	3800	2800	2800	2800	2800		2800
										p <sub>eff</sub> [bar]												
PGH2	005	315	350	15	87	128	176	229														
	006	315	350	18	73	106	147	191	264													
	008	315	350	24	54	80	110	143	198	269												
PGH3	011	315	350	33	40	58	80	104	144	196	288											
	013	315	350	39	33	49	68	88	122	166	244											
	016	315	350	48	27	40	55	71	99	135	198	269										
PGH4	020	315	350	60	22	32	44	57	79	108	158	216										
	025	315	350	75	17	26	35	46	63	86	127	172	302									
	032	315	350	96		20	27	36	49	67	99	135	236	281								
	040	315	350	120		16	22	29	40	54	79	108	188	225	305							
	050	250	310	150			18	23	32	43	63	86	151	180	244							
PGH5	063	315	350	189/176*			18	25	34	50	68		120	143	193	237*	289*					
	080	315	350	240/224*				20	27	40	54		94	112	152	187*	228*	278*				
	100	315	350	300/280*				16	22	32	43		75	90	122	150*	182*	222*	303*			
	125	315	350	375/350*					17	25	34		60	72	98	120*	146*	178*	243*	292*		
	160	210	260	480/448*						20	27		47	56	76	93*	114*	139*	190*			
	200	170	210	600/560*						16	22		38	45	61	75*	91*	111*	152*			
	250	135	170	750/700*							17		30	36	49	60*	73*	89*	121*			
					K [%]																	
Controller	Rexroth Fv FVCA01.1	1K50			118																	
		2K20			162	120																
		4K00					164	127														
		5K50					165	118														
		7K50						155	113													
		11K0							160	114												
		15K0								157	118											
		18K5								186	139	115										
		22K0									157	129	110									
		30K0										176	150	111								
		37K0											188	139	112							
		45K0												176	142	117						
		55K0													164	136	111					
		75K0														188	154	117				
		90K0															185	141	117			

<sup>1)</sup> The pump and motor can also be ordered separately as motor-pump-assembly MPE (see „Motor-pump-assemblies“ starting on page 47)

\* Flow limited by the maximum motor speed

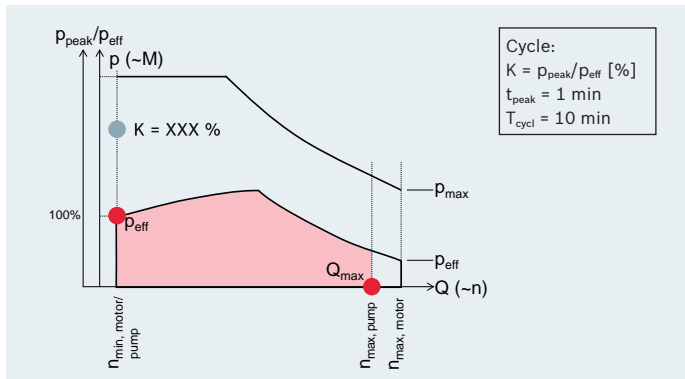
Note: For a detailed explanation of the tables, see page 10

## Selection example for system key

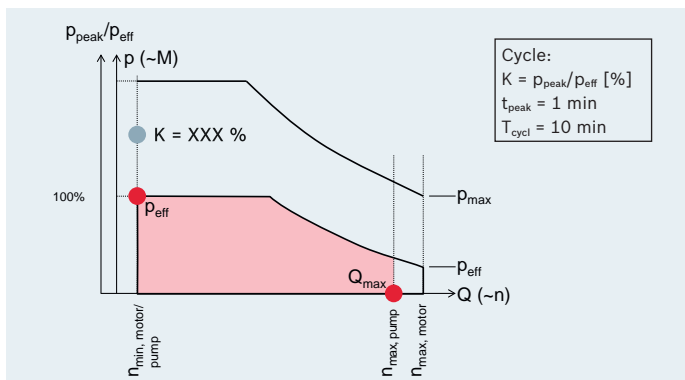
SYT-FCP5010-PGH **\*\*\*** -S-FC2FS **\*\*\*** -FV **\*\*\*** -NNNN -----> SYT-FCP5010-PGH **075** -S-FC2FS **127** -FV **114** -NNNN

**1** **2** **3** **1** **2** **3**





Performance curve for FcP 5010 – self-ventilated with constant internal gear pump



Performance curve for FcP 5010 – forced-ventilated with constant internal gear pump

**Detailed component information:**

Motors: see „Motors“ starting on page 63

Pumps: data sheets 10227, 10223

Controller: catalog R912004739

FcP 5010 with A10VZO-EZ4

Selection guide for Sytronix FcP 5010 with A10VZO-EZ4

Pumps <sup>1)</sup>						Motors <sup>1)</sup>																	
						MOT-FC IC411 (self-ventilated)																	
Type	NG	p <sub>cont</sub> [bar]	p <sub>max</sub> [bar]	n <sub>max</sub> [rpm]	Q [l/min]	1.5	2.2	3	4	5.5	7.5	11	15	18.5	22	30	37	45	55	75	90	P <sub>nom</sub> [kW]	n <sub>max</sub> [rpm]
						p <sub>eff</sub> [bar]																	
A10VZO-EZ4	010	250	315	3600	37	59	87	120	156	215													
	018	280	350	3300	59	35	51	70	91	126	171												
	028	280	350	3000	84	22	33	45	58	81	110	162	220										
	045	280	350	3000	135/126*		20	28	36	50	68	101	137	168	200								
	071	280	350	2550	181			18	23	32	43	64	87	106	126	171	210	256					
	100	280	350	2300	230					23	31	45	62	75	90	122	150	182	222				
	140	280	350	2200	308					16	22	32	44	54	64	87	107	130	159	217	260		
	180	280	350	1800	324						17	25	34	42	50	68	83	101	124	169	202		
						K [%]																	
Controller	Rexroth Fv FVCA01.1	1K50	118																				
		2K20	162	120																			
		4K00			164	127																	
		5K50				165	118																
		7K50					155	113															
		11K0						160	114														
		15K0							157	118													
		18K5								186	139	115											
		22K0									157	129	110										
		30K0										176	150	111									
		37K0											188	139	112								
		45K0												176	142	117							
		55K0													164	136	111						
		75K0														188	154	117					
		90K0															185	141	117				

<sup>1)</sup> The pump and motor can also be ordered separately as motor-pump-assembly MPE (see „Motor-pump-assemblies“ starting on page 47)

\* Flow limited by the maximum motor speed

Note: For a detailed explanation of the tables, see page 10

Selection example for system key

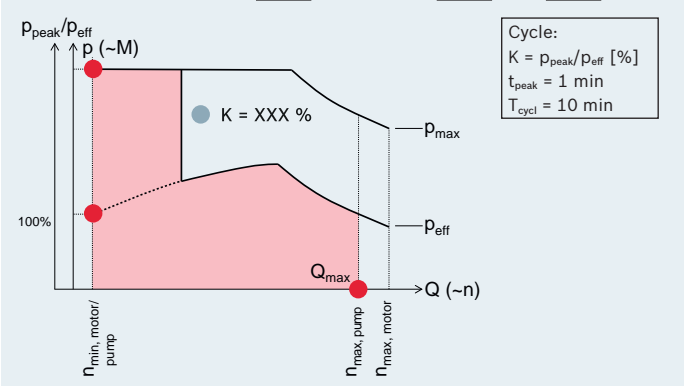
SYT-FCP5010-A10 **\*\*\*** -S-FC2FS **\*\*\*** -FV **\*\*\*** -NNNN -----> SYT-FCP5010-A10 **084** -S-FC2FS **110** -FV **113** -NNNN

**Detailed component information:**

Motors: see „Motors“ starting on page 63

Pumps: data sheet 91485

Controller: catalog R912004739



# FcP 5010 with A4VSO-EZ

## Selection guide for Sytronix FcP 5010 with A4VSO-EZ

Pumps <sup>1)</sup>						Motors <sup>1)</sup>								P <sub>nom</sub> [kW] n <sub>max</sub> [rpm]
						MOT-FC IC411 (self-ventilated)								
Type	NG	p <sub>cont</sub> [bar]	p <sub>max</sub> [bar]	n <sub>max</sub> [rpm]	Q [l/min]	18.5	22	30	37	45	55	75	90	
						3800	3800	3800	2800	2800	2800	2800	2800	
						p <sub>eff</sub> [bar]								
A4VSO-EZ	040	350	400	2600	104	188	225	305						
	071	350	400	2200	156	106	127	172	211	257	313			
	125	350	400	1800	225	60	72	98	120	146	178	234	292	
	180	350	400	1800	324			68	83	101	124	169	202	
	250	350	400	1900	475				60	73	89	121	146	
	355	350	400	1700	603					51	63	85	103	
	500	350	400	1500	750							61	73	
						K [%]								
Controller	Rexroth Fv FVCA01.1	18K5				115								
		22K0				129	110							
		30K0				176	150	111						
		37K0					188	139	112					
		45K0						176	142	117				
		55K0							164	136	111			
		75K0								188	154	117		
		90K0									185	141	117	

<sup>1)</sup> The pump and motor can also be ordered separately as motor-pump-assembly MPE (see „Motor-pump-assemblies“ starting on page 47)

Note: For a detailed explanation of the tables, see page 10

## Selection example for system key

SYT-FCP5010-A04 **\*\*\*** -S-FC2FS **\*\*\*** -FV **\*\*\*** -NNNN -----> SYT-FCP5010-A04 **225** -S-FC2FS **178** -FV **154** -NNNN

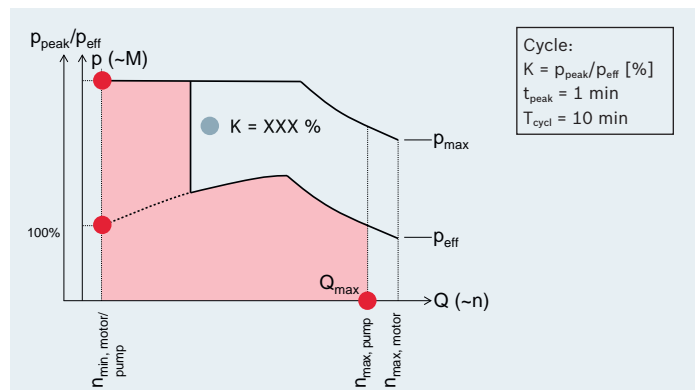
### Detailed component information:

Motors: see „Motors“ starting on page 63

Pumps: data sheet 92050

Controller: catalog R912004739

Performance curve for FcP 5010 –  
self-ventilated with axial piston pump with two-point adjustment



# Sytronix SvP variable-speed pump drives

## SvP system

Sytronix SvP (**s**ervo **v**ariable **p**ump drive) systems consist of a motor-pump assembly driven by a permanent magnet synchronous servo motor and servo controller.

In the family of Sytronix variable-speed pump drives, the Sytronix SvP offers the highest dynamic performance and control accuracy. SvP systems provide the broadest range of control functionality, from pressure and force control to flow and speed control to position control and alternating control.

The controller is part of Rexroth's proven IndraDrive family using the IndraWorks engineering tool as the interface. In addition to traditional hydraulic control functionality, the SvP system provides further functions of pressure ripple compensation, energy monitoring, productivity and condition monitoring, as well as maintenance and troubleshooting aids.

The SvP system can be configured for required communication interfaces by exchanging the CSH controller. The command and actual values of pressure, flow and position can then be commanded and monitored by a high level machine control system using either an analog interface or industry standard bus interfaces. The SvP provides easy and flexible integration into machine control systems.

## Components

- ▶ Hydraulic pump
- ▶ Synchronous servo motor
- ▶ IndraDrive servo controller
- ▶ Pressure transducer

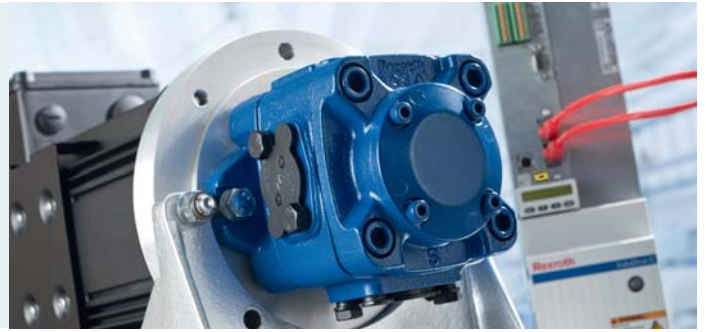
## Applications

The system is suitable for use in either open or closed hydraulic systems controlling hydraulic axes.

## Sytronix SvP systems

Sytronix SvP features key functions:

- ▶ High efficiency servo motors with a level of standard and direct pump mount versions
- ▶ High dynamics and control accuracy
- ▶ Broad range of control functionality

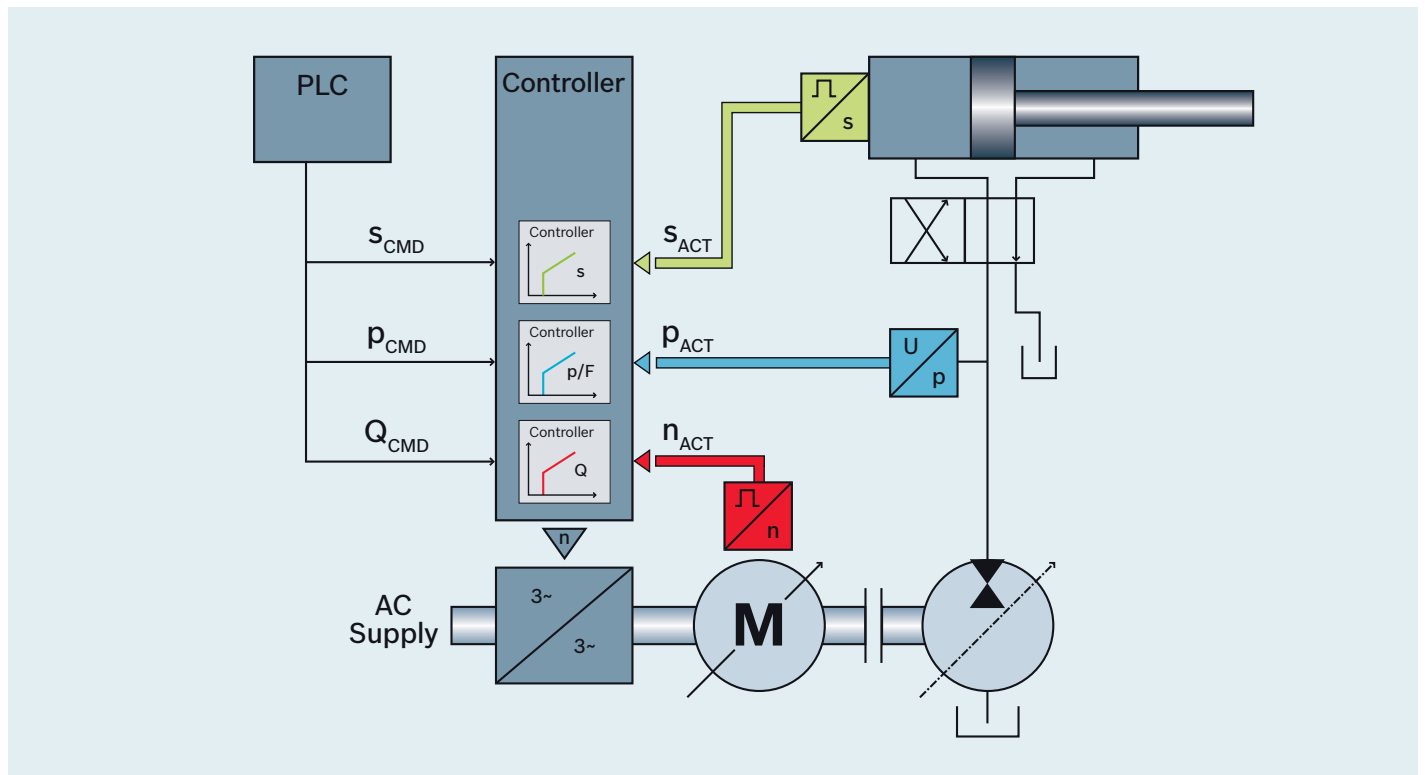


### Functionality

Using an internal gear pump, type PGH or PGM, the required flow is controlled directly by motor speed. The pumps are optimized for variable-speed operation and achieve a high overall efficiency due to low leakage, and operate with minimum noise.

In operation, sensors measure pressure, actuator position and the servo motor speed, which are used by the servo controller. Command values, which can be set by the machine control, are compared by the IndraDrive, which adjusts the pump drive speed to match the system requirements.

SvP block diagram



# SvP 7010

## Features

- ▶ Performance up to 80 kW effective
- ▶ Suitable for axis control in open and closed hydraulic systems
- ▶ Two quadrant operation

## Components

- ▶ MSK motors with air and liquid-cooled
- ▶ PGH and PGM pumps
- ▶ HCS and HMS IndraDrive controllers

## Application

The SvP 7010 offers performance up to 80 kW and is ideal in the following application areas:

- ▶ Plastics processing machines
- ▶ Die-casting machines
- ▶ Injection molding machines
- ▶ Presses\*

The controller is optimized for Sytronix applications and compensates for the characteristics of hydraulic systems to provide optimal dynamics and accuracy.

\* Consider fan approval directive in press applications.



# SvP 7010 with PGH (4.5), MSK forced-ventilated Direct coupling

## Selection guide for Sytronix SvP 7010 with PGH

Pumps <sup>1)</sup> n <sub>max</sub> = 3000 rpm					Motors <sup>1)</sup> (forced-ventilated)											
					MSK101								MSK133			
					C-0202	C-0300	D-0202	D-0300	E-0202	E-0300	F-0202	F-0300	B-0202	C-0202	D-0202	E-0202
Type	NG	p <sub>cont.</sub> [bar]	p <sub>max</sub> [bar]	Q [l/min]	48.0	48.0	75.0	75.0	105.0	105.0	124.5	124.5	152.0	204.0	263.0	293.0
					110.0	110.0	160.0	160.0	231.0	231.0	310.0	310.0	320.0	425.0	520.0	630.7
					p <sub>cont.</sub> [bar]											
PGH4	020	315	350	60	150	150	234	234								
	025	315	350	75	119	119	186	186	261	261	309	309				
	032	315	350	100	92	92	144	144	202	202	239	239				
	040	315	350	120	75	75	118	118	165	165	195	195				
	050	250	310	150	59	59	93	93	130	130	154	154				
	063	210	250	190	47	47	73	73	102	102	121	121				
PGH5	063	315	350	190									148	198	255	285
	080	315	350	240									117	157	203	226
	100	315	350	300									95	128	165	184
	125	315	350	375									76	102	132	147
	160	210	260	480									59	79	102	113
					K [%]											
Controller	Rexroth IndraDrive C	HCS02.1E	-W0054	149	123											
			-W0070	188	159	137										
				227	199	171	135	130		118						
		HCS03.1E	-W0070													
			-W0100		229	206										
			-W0150				212	214	184	217	176	188	155	128	115	
	Rexroth IndraDrive M	HMS01.1N	-W0210						220		246	211	208	175	166	
			-W0350											198	215	
			-W0036	133	111											
			-W0054	199	169	145	110									
			-W0070		188	161	126	121								
			-W0110		229	210	177	173	142	164	130	143	115			
			-W0150				213	217	187	223	181	193	159	132	119	
			-W0210						220		245		208	174	165	
			-W0300											198	191	

<sup>1)</sup> Pump and motor can also be ordered separately as motor-pump-assembly MPA01 (see „Motor-pump-assemblies“ starting on page 47).  
Note: For a detailed explanation of the tables, see page 10.

## Selection example for system key

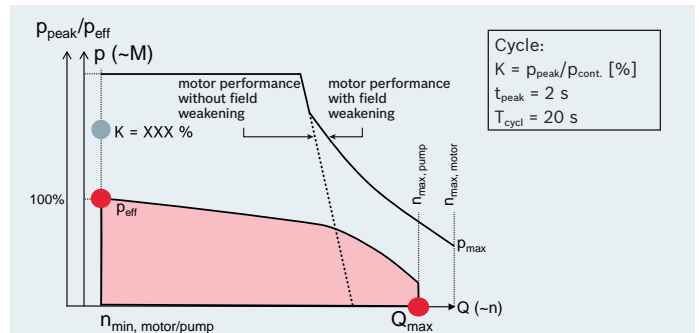
SYT-SVP7010-PGH **\*\*\*** -D-MSKHA **\*\*\*** -HM **\*\*\*** -NNNN -----> SYT-SVP7010-PGH **375** -D-MSKHA **132** -HM **198** -NNNN

### Detailed component information:

Motors: see “Motors” starting on page 63

Pumps: data sheet 10223

Controller: catalog R999000018 (DE), R999000019 (EN)



Performance curve for SvP 7010 – forced-ventilated



# SvP 7010 with PGH (5), MSK liquid-cooled Direct coupling

## Selection guide for Sytronix SvP 7010 with PGH

Pumps <sup>1)</sup> n <sub>max</sub> = 3000 rpm					Motors <sup>1)</sup> (liquid-cooled)				M <sub>eff</sub> [Nm] M <sub>max</sub> [Nm]
Type	NG	p <sub>cont.</sub> [bar]	p <sub>max</sub> [bar]	Q [l/min]	MSK133				
					B-0203	C-0203	D-0203	E-0203	
					162.0	232.5	290.0	342.0	
					300.0	400.0	500.0	583.0	
					p <sub>cont.</sub> [bar]				
PGH5	063	315	350	190	157	226	282		
	080	315	350	240	125	179	224	264	
	100	315	350	300	102	146	182	214	
	125	315	350	375	81	117	145	171	
	160	210	260	480	63	90	112	132	
					K [%]				
Controller	Rexroth IndraDrive C	HCS03.1E	-W0100	129					
			-W0150	176	136	116			
			-W0210		183	159	142		
		HCS04.2E	-W0350			179	184		
	Rexroth IndraDrive M	HMS01.1N	-W0110	134					
			-W0150	181	140	119			
			-W0210		183	158	141		
			-W0300			179	164		

<sup>1)</sup> Pump and motor can also be ordered separately as motor-pump-assembly MPA01 (see „Motor-pump-assemblies“ starting on page 47)

Note: For a detailed explanation of the tables, see page 10.

## Selection example for system key

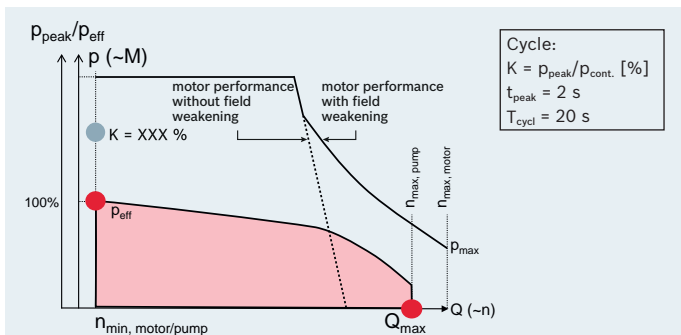
SYT-SVP7010-PGH<sup>\*\*\*</sup>-D-MSKHL<sup>\*\*\*</sup>-HM<sup>\*\*\*</sup>-NNNN -----> SYT-SVP7010-PGH<sup>240</sup>-D-MSKHL<sup>125</sup>-HM<sup>134</sup>-NNNN

### Detailed component information:

Motors: see “Motors” starting on page 63

Pumps: data sheet 10223

Controller: catalog R999000018 (DE), R999000019 (EN)



# SvP 7010 with PGH (2,3,4,5), MSK forced-ventilated Standard coupling

## Selection guide for Sytronix SvP 7010 with PGH

Pumps <sup>1)</sup> n <sub>max</sub> = 3000 rpm					Motors <sup>1)</sup> (forced-ventilated)																		M <sub>eff</sub> [Nm] M <sub>max</sub> [Nm]
					MSK071						MSK101								MSK133				
					C-0202	C-0300	D-0202	D-0300	E-0202	E-0300	C-0202	C-0300	D-0202	D-0300	E-0202	E-0300	F-0202	F-0300	B-0202	C-0202	D-0202	E-0202	
Type	NG	p <sub>cont.</sub> [bar]	p <sub>max</sub> [bar]	Q [l/min]	18.0	18.0	26.3	26.3	34.5	35.5	48.0	48.0	75.0	75.0	105.0	105.0	124.5	124.5	152.0	204.0	263.0	293.0	
					44.0	44.0	66.0	66.0	84.0	84.0	110.0	110.0	160.0	160.0	231.0	231.0	310.0	310.0	320.0	425.0	520.0	630.7	
p <sub>cont.</sub> [bar]																							
PGH2	005	315	350	15	217	217																	
	006	315	350	18	174	174	254	254															
	008	315	350	24	138	138	202	202	264	264													
PGH3	011	315	350	33	103	103	150	150	197	197													
	013	315	350	39	85	85	124	124	163	163													
	016	315	350	48	71	71	103	103	135	135													
PGH4	020	315	350	60	56	56	82	82	108	108	Direct coupling available. Standard coupling on request.												
	025	315	350	75	45	45	65	65	86	86													
	032	315	350	100	35	35	51	51	66	66													
	040	315	350	120	28	28	41	41	54	54													
	050	250	315	150	22	22	33	33	43	43													
PGH5	063	315	350	190							47	47	73	73	102	102	121	121	Direct coupling available. Standard coupling on request.				
	080	315	350	240							37	37	58	58	81	81	96	96					
	100	315	350	300							30	30	47	47	66	66	78	78					
	125	315	350	375							24	24	38	38	53	53	62	62					
	160	210	260	480							19	19	29	29	41	41	48	48					
	200	170	210	600							15	15	24	24	33	33	39	39					
	250	135	170	750									19	19	26	26	31	31					
K [%]																							
Controller	Rexroth IndraDrive C	HCS02.1E	-W0028	226	175	177	146	132															
			-W0054		244	251	229	206	175	149	123												
			-W0070				251	243	221	188	159	137											
		HCS03.1E	-W0070						243	227	199	171	135	130		118							
			-W0100								229	206	172	168	138	158	125	138	111				
			-W0150										212	214	184	217	176	188	155	128	115		
	Rexroth IndraDrive M	HCS04.2E	-W0210												220	246	211	208	175	166			
			-W0350																198	215			
		HMS01.1N	-W0020	197	149	150	123	112															
			-W0036		237	243	206	186	152	133	111												
			-W0054					243	227	199	169	145	111										
			-W0070								188	161	126	121									
			-W0110							229	210	177	173	142	164	130	143	115					
			-W0150									213	217	188	223	181	193	159	132	119			
			-W0210											220	245		208	174	165				
			-W0300															198	191				

Note: For a detailed explanation of the tables, see page 10

## Selection example for system key

SYT-SVP7010-PGH **\*\*\*** -S-MSKNA **\*\*\*** -HC **\*\*\*** -NNNN -----> SYT-SVP7010-PGH **075** -S-MSKNA **086** -HC **175** -NNNN

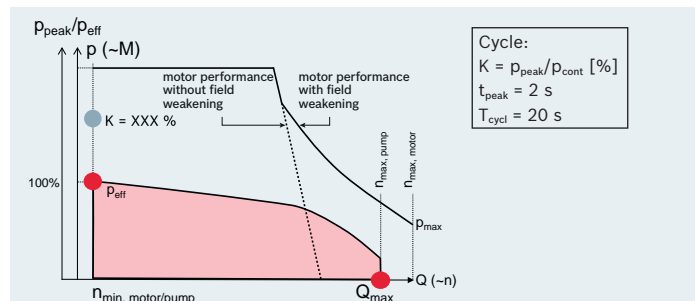
### Detailed component information:

Motors: see "Motors" starting on page 63

Pumps: data sheets 10223, 10227

Controller: catalog R999000018 (DE), R999000019 (EN)

Performance curve for SvP 7010 – forced-ventilated



# SvP 7010 with PGH5, MSK liquid-cooled Standard coupling

## Selection guide for Sytronix SvP 7010 with PGH

Pumps <sup>1)</sup> n <sub>max</sub> = 3000 rpm					Motors <sup>1)</sup> (liquid-cooled)				M <sub>eff</sub> [Nm] M <sub>max</sub> [Nm]						
Type	NG	p <sub>cont.</sub> [bar]	p <sub>max</sub> [bar]	Q [l/min]	MSK133										
					B-0203	C-0203	D-0203	E-0203							
					162.0	232.5	290.0	342.0							
					300.0	400.0	500.0	583.0							
					p <sub>cont.</sub> [bar]										
PGH5	063	315	350	190	Direct coupling available. Standard coupling on request.										
	080	315	350	240											
	100	315	350	300											
	125	315	350	375											
	160	210	260	480											
K [%]															
Modular	Rexroth IndraDrive C	HCS03.1E	-W0100	129											
			-W0150	176						136	116				
			-W0210							183	159				142
		HCS04.2E	-W0350			179	184								
	Rexroth IndraDrive M	HMS01.1N	-W0110	134											
			-W0150	181						140	119				
			-W0210							183	158				141
			-W0300								179				164

Note: For a detailed explanation of the tables, see page 10

## Selection example for system key

SYT-SVP7010-PGH **\*\*\*** -S-MSKHL **\*\*\*** -HM **\*\*\*** -NNNN -----> SYT-SVP7010-PGH **300** -S-MSKHL **146** -HM **140** -NNNN

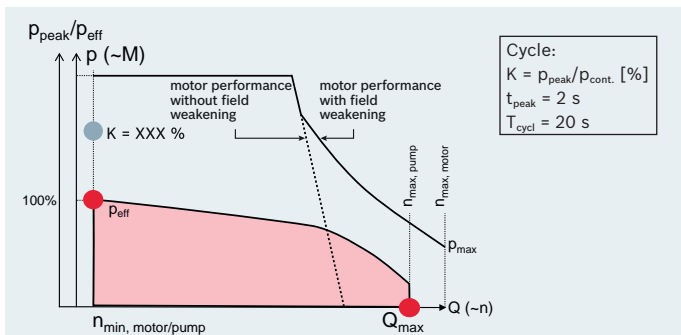
**1** **2** **3** **1** **2** **3**

### Detailed component information:

Motors: see "Motors" starting on page 63

Pumps: data sheet 10223

Controller: catalog R999000018 (DE), R999000019 (EN)



# SvP 7010 with PGM (4, 5), MSK forced-ventilated Standard coupling

## Selection guide for Sytronix SvP 7010 with PGM

Pumps <sup>1)</sup> n <sub>max</sub> = 3000 rpm					Motors <sup>1)</sup> (forced-ventilated)								M <sub>eff</sub> [Nm]	M <sub>max</sub> [Nm]
Type	NG	p <sub>cont.</sub> [bar]	p <sub>max</sub> [bar]	Q [l/min]	MSK101				MSK133					
					C-0202	D-0202	E-0202	F-0202	B-0202	C-0202	D-0202	E-0202		
					48.0	75.0	105.0	124.5	152.0	204.0	263.0	293.0		
					110.0	160.0	231.0	310.0	320.0	425.0	520.0	630.7		
p <sub>cont.</sub> [bar]														
PGM4	025	175	210	75	119									
	032	175	210	100	92	144								
	040	175	210	120	75	118	165							
	050	175	210	150	59	93	130	154						
	063	175	210	190	46	72	101	119						
PGM5	080	175	210	240					117	157				
	100	175	210	300					95	128	165			
	125	175	210	375					76	102	132	147		
K [%]														
Controller	Rexroth IndraDrive C	HCS02.1E	-W0054	149										
			-W0070	188	137									
		HCS03.1E	-W0070	227	171	130	118							
			-W0100		206	168	158	138	111					
			-W0150			214	217	188	155	128	115			
			-W0210					211	208	175	166			
	HCS04.2E	-W0350							198	215				
	Rexroth IndraDrive M	HMS01.1N	-W0036	133										
			-W0054	199	145									
			-W0070		161	121								
			-W0110		210	173	164	143	115					
			-W0150			217	223	193	159	132	119			
			-W0210						208	174	165			
			-W0300							198	191			

<sup>1)</sup> Pump and motor can also be ordered separately as motor-pump-assembly MPAS1 (see „Motor-pump-assemblies“ starting on page 47)

Note: For a detailed explanation of the tables, see page 10

## Selection example for system key

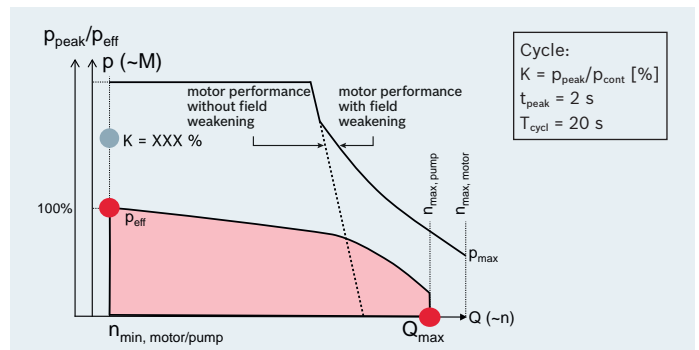
SYT-SVP7010-PGM **\*\*\*** -S-MSKHA **\*\*\*** -HC **\*\*\*** -NNNN -----> SYT-SVP7010-PGM **100** -S-MSKHA **144** -HC **171** -NNNN

### Detailed component information:

Motors: see motors starting on page 63

Pumps: data sheet 10229

Controller: catalog R999000018 (DE), R999000019 (EN)



Performance curve for SvP 7010 – forced-ventilated

# Sytronix DFE variable-speed pump drives

## DFE systems

Sytronix DFE systems consist of an electrohydraulically controlled axial piston pump, driven by a variable-speed asynchronous motor

Pump drives DFE 5010 and DFE 7010 are based on the proven DFE pressure and flow pump control system. Using industry standard inverter duty motors, up to 315 kW, results in a high price/performance ratio and high performance capabilities.

When using the **“teach-in” version**, the machine cycle pressure and flow profile is stored in the DFE control electronics. This allows the DFE system to accelerate the electric motor ahead of a required flow demand. In machines operating without a predictable operating cycle, such as wood and metallurgy applications, a **“real-time” mode** can be used. The DFE controller calculates an optimal combination of motor speed and pump swivel angle to maximize energy savings. Identical mechanical interfaces permit cost-effective retrofitting, e.g. of a DFE 5010, as a replacement for a SYDFEE/SYDFEC by simply exchanging the integrated pump valve electronics. The control system is available for A10 and A4 pumps and can thus be used for a wide variety of applications.

## Components

- ▶ Axial piston variable pump with integrated control electronics
- ▶ MOT-FC standard asynchronous motor
- ▶ VFD to control motor speed
- ▶ Pressure transducer

## Applications

Sytronix DFE is suitable for use in open hydraulic systems, with one or multiple hydraulic consumers, for control of pressure and flow.

## Sytronix DFE systems

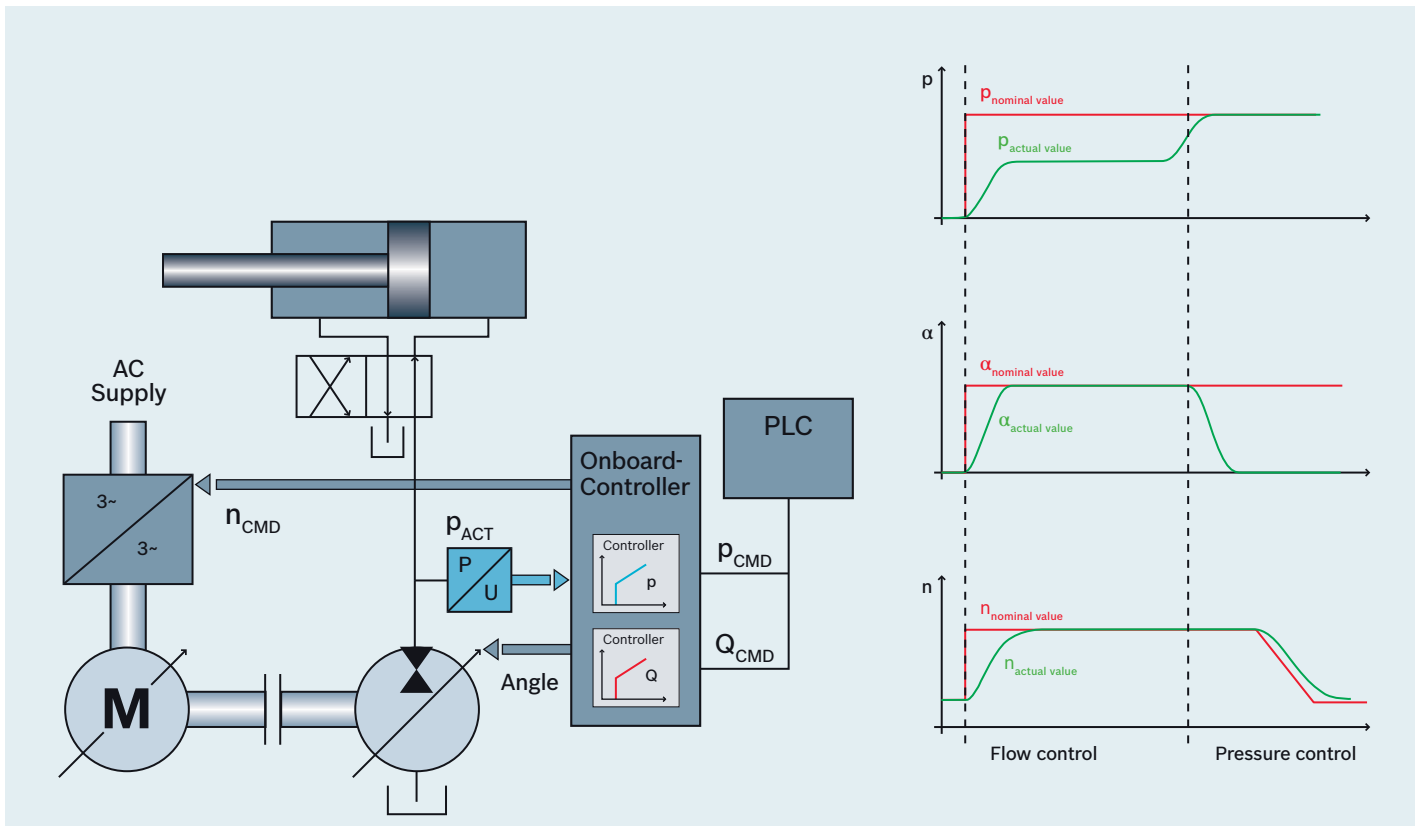
- ▶ Reduction of installed power by speed and flow control
- ▶ Easy retrofit for power units with variable displacement pumps
- ▶ High performance capability
- ▶ Multi-consumer system capability



### Function

A DFE system utilizes an electrohydraulically controlled axial piston pump to command the pump's VFD drive. The digital on-board electronics calculates the optimal combination of swivel angle and motor speed based on system pressure. By reducing the pump swivel angle during pressure holding, the motor load is reduced and pump flow matches the system demand. With an optimal design, the power of installed electric motors can be reduced when compared to traditional designs.

DFE block diagram



# DFE 7010

## Features

- ▶ Performance up to 315 kW effective
- ▶ Suitable for use in open hydraulic systems with one or more hydraulic consumers, with pressure and flow control.

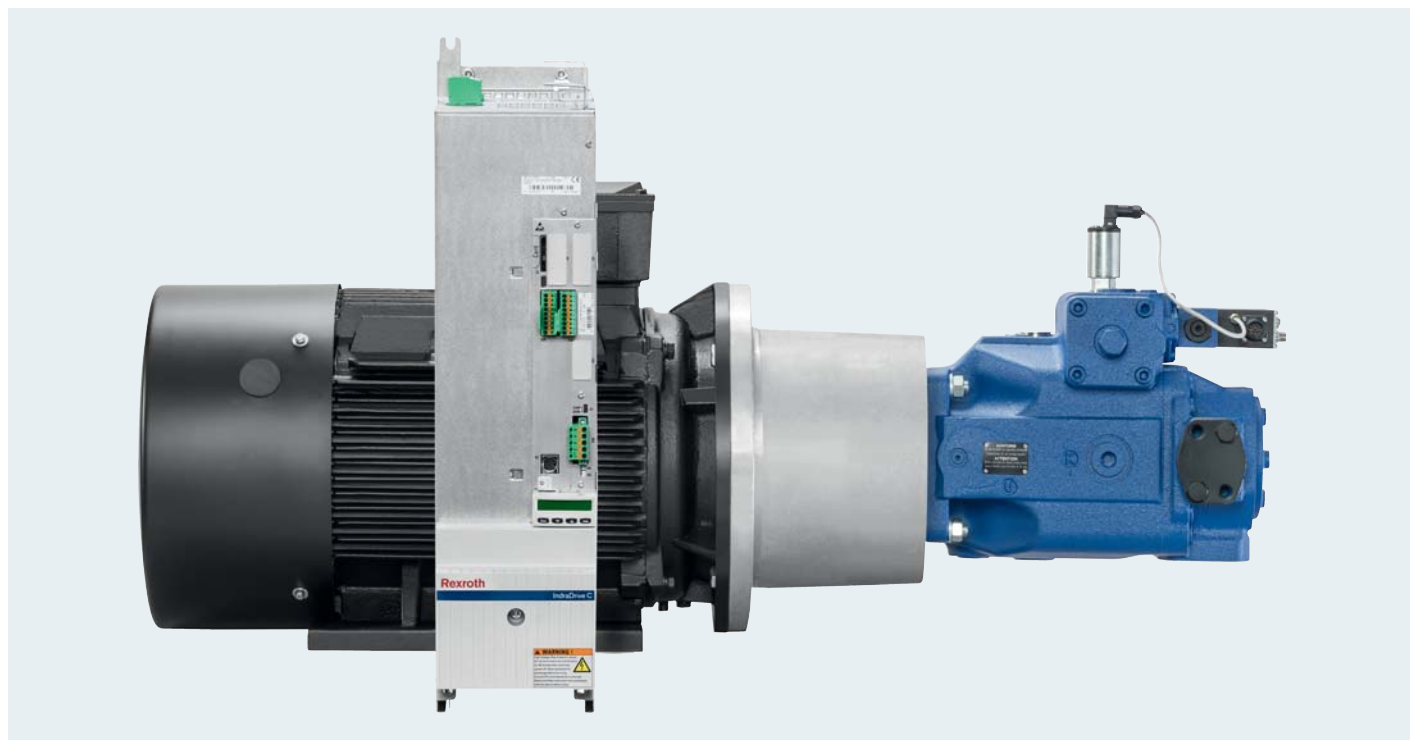
## Components

- ▶ MOT-FC motor with self-ventilation
- ▶ SYDFEn-3X and SYHDFEn-1X pumps
- ▶ IndraDrive servo controller

## Applications

Covering a power range up to 315 kW (on request up to 630 kW), it is particularly suited for use in harsh industrial environments, such as for presses, plastics processing machines, wood and metal industries.

Based on its mechanical interface, Sytronix DFE is suitable for designing pump combinations for multi-circuit systems and master-slave operation. This allows for direct energy coupling and mechanical regeneration via the pump shaft. No drive system capable of line regeneration is required!





# DFE 7010 with SYDFEn-3X (A10VSO)

## Selection guide for Sytronix DFE 7010 with SYDFEn-3X (A10VSO)

Pumps <sup>1)</sup>						Motors <sup>1)</sup>																P <sub>nom</sub> [kW] n <sub>max</sub> [rpm]
Type	NG	p <sub>cont</sub> [bar]	p <sub>max</sub> [bar]	n <sub>max</sub> [rpm]	Q [l/min]	MOT-FC IC411 (self-ventilated)																
						3 4000	4 4000	5.5 4000	7.5 4000	11 3800	15 3800	18.5 3800	22 3800	30 3800	37 2800	45 2800	55 2800	75 2800	90 2800			
						p <sub>eff</sub> [bar]																
A10VSO	071	280	350	2550	181	18	23	32	43	64	87	106	126	171	210	256						
	100	280	350	2300	230		16	23	31	45	62	75	90	122	150	182	222					
	149	280	350	2200	308			16	22	32	44	54	64	87	107	130	159	217	260			
	180	280	350	1800	324				17	25	34	42	50	68	83	101	124	169	202			
						K [%]																
Controller	Rexroth IndraDrive C	HCS01.1E	-W0018 -W0028 -W0054			125																
						189	146	105														
								191	140	100												
		HCS02.1E	-W0070						187	133	100											
											161	132	113									
													183	135	109							
		HCS03.1E	-W0070 -W0100 -W0150 -W0210											176	142	117						
															179	146	112					
																	189	158				
		HCS04.2E	-W0350 -W0420															192				

<sup>1)</sup> The pump and motor can also be ordered separately as motor-pump-assembly MPE (see „Motor-pump-assemblies“ starting on page 47)

Note: For a detailed explanation of the tables, see page 10

## Selection example for system key

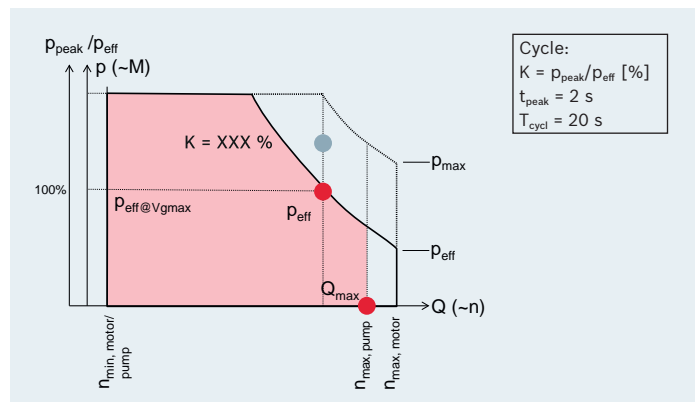
SYT-DFE7010-A10 **\*\*\*** -S-FC2FS **\*\*\*** -HC **\*\*\*** -NNNN -----> SYT-DFE7010-A10 **230** -S-FC2FS **122** -HC **135** -NNNN

### Detailed component information:

Motors: see “Motors” starting on page 63

Pumps: data sheet 10213

Controller: catalogs R999000018 (DE), R999000019 (EN), R999000241 (DE), R999000242 (EN)



Performance curve for DFE 7010 – self-ventilated

DFE 7010 with SYHDFEn-1X (A4VSO)

Selection guide for Sytronix DFE 7010 with SYHDFEn-1X (A4VSO)

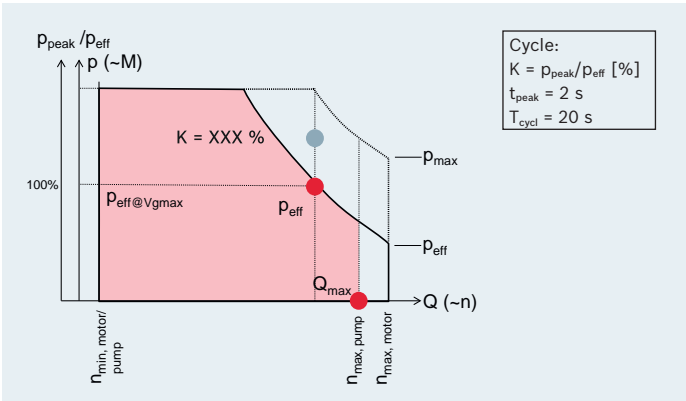
Pumps <sup>1)</sup>						Motors <sup>1)</sup>																		
Type	NG	p <sub>cont</sub> [bar]	p <sub>max</sub> [bar]	n <sub>max</sub> [rpm]	Q [l/min]	MOT-FC IC411 (self-ventilated)															P <sub>nom</sub> [kW] n <sub>max</sub> [rpm]			
						18.5	22	30	37	45	55	75	90	110	132	160	200	250	315					
						3800	3800	3800	2800	2800	2800	2800	2800	2500	2500	2500	2500	2200	2200					
p <sub>eff</sub> [bar]																								
A4VSO	125	350	400	1800	225	60	72	98	120	146	178	243	292											
	180	350	400	1800	324			68	83	101	124	169	202	246	297									
	250	350	400	1900	475				60	73	89	121	146	177	214	259	323							
	355	350	400	1700	603					51	63	85	103	125	150	182	227	285	358					
K [%]																								
Controller	Rexroth IndraDrive C	HCS03.1E	-W0070 -W0100 -W0150 -W0210			132	113																	
							183	135	109															
								176	142	117														
										179	146	112												
		HCS04.2E				-W0350 -W0420 -W0520 -W0640 -W0790 -W1010										189	158	129	108					
																	192	157	132	110				
																		192	161	134	107			
																				168	135	109		
																					172	139	110	
																						171	136	

<sup>1)</sup> The pump and motor can also be ordered separately as motor-pump-assembly MPE (see „Motor-pump-assemblies“ starting on page 47)  
Note: For a detailed explanation of the tables, see page 10

Selection example for system key

SYT-DFE7010-A04 **\*\*\*** -S-FC2FS **\*\*\*** -HC **\*\*\*** -NNNN -----> SYT-DFE7010-A04 **324** -S-FC2FS **169** -HC **189** -NNNN

**Detailed component information:**  
Motors: see “Motors” starting on page 63  
Pumps: data sheet 10213  
Controller: catalogs R999000018 (DE), R999000019 (EN), R999000241 (DE), R999000242 (EN)



Performance curve for DFE 7010 – self-ventilated

# DFE 5010

## Features

- ▶ Performance up to 90 kW effective
- ▶ Suitable for use in open hydraulic systems with one or more hydraulic consumers, with pressure and flow control.
- ▶ Two quadrant operation

## Components

- ▶ MOT-FC motor with self-ventilation
- ▶ SYDFEn-3X and SYHDFEn-1X pumps
- ▶ Rexroth Fv VFD drive

## Applications

Covering a power range up to 90 kW, it is suited for use in presses, plastics processing machines, wood and metal industries.

Based on its mechanical interface, Sytronix DFE is suitable for designing pump combinations for multi-circuit systems and master-slave operation. This allows for direct energy coupling and mechanical regeneration via the pump shaft. No drive system capable of line regeneration is required!



DFE 5010 with SYDFEn-3X (A10VSO)

Selection guide for Sytronix DFE 5010 with SYDFEn-3X (A10VSO)

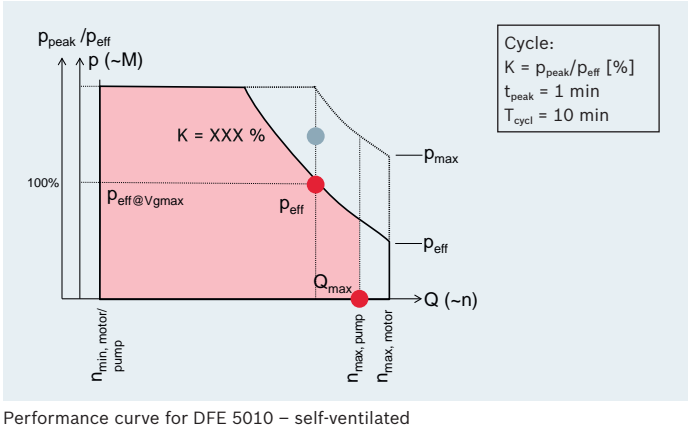
Pumps <sup>1)</sup>						Motors <sup>1)</sup>															P <sub>nom</sub> [kW]	n <sub>max</sub> [rpm]
						MOT-FC IC411 (self-ventilated)																
Type	NG	p <sub>cont</sub> [bar]	p <sub>max</sub> [bar]	n <sub>max</sub> [rpm]	Q [l/min]	3	4	5.5	7.5	11	15	18.5	22	30	37	45	55	75	90			
						4000	4000	4000	4000	3800	3800	3800	3800	3800	2800	2800	2800	2800	2800	2800		
						p <sub>eff</sub> [bar]																
A10VSO	071	280	315	2550	181	18	23	32	43	64	87	106	126	171	210	256						
	100	280	350	2300	230		16	23	31	45	62	75	90	122	150	182	222					
	140	280	350	2200	308			16	22	32	44	54	64	87	107	130	159	217	260			
	180	280	350	1800	324				17	25	34	42	50	68	83	101	124	169	202			
						K [%]																
Controller	Rexroth FVCA01.1	4K00				164	127															
		5K50					165	118														
		7K50						155	113													
		11K0							160	114												
		15K0								157	118											
		18K5								186	139	115										
		22K0								157	129	110										
		30K0									176	150	111									
		37K0										188	139	112								
		45K0											176	142	117							
		55K0												164	136	111						
		75K0													188	154	117					
		90K0															185	141	117			

<sup>1)</sup> The pump and motor can also be ordered separately as motor-pump-assembly MPE (see „Motor-pump-assemblies“ starting on page 47)  
 Note: For a detailed explanation of the tables, see page 10

Selection example for system key

SYT-DFE5010-D10 **\*\*\*** -S-FC2FS **\*\*\*** -FV **\*\*\*** -NNNN -----> SYT-DFE5010-D10 **308** -S-FC2FS **087** -FV **139** -NNNN

**Detailed component information:**  
 Motors: see “Motors” starting on page 63  
 Pumps: data sheet 62241  
 Controller: catalogs R999000241 (DE), R999000242 (EN)



## DFE 5010 with SYHDFEn-1X (A4VSO)

### Selection guide for Sytronix DFE 5010 with SYHDFEn-1X (A4VSO)

Pumps <sup>1)</sup>						Motors <sup>1)</sup>								P <sub>nom</sub> [kW] n <sub>max</sub> [rpm]
						MOT-FC IC411 (self-ventilated)								
Type	NG	p <sub>cont</sub> [bar]	p <sub>max</sub> [bar]	n <sub>max</sub> [rpm]	Q [l/min]	18.5 3800	22 3800	30 3800	37 2800	45 2800	55 2800	75 2800	90 2800	
						p <sub>eff</sub> [bar]								
A4VSO	125	350	400	1800	225	60	72	98	120	146	178	243	292	
	180	350	400	1800	324			68	83	101	124	169	202	
	250	350	400	1900	475				60	73	89	121	146	
	355	350	400	1700	603					51	63	85	103	
						K [%]								
Controller	Rexroth FVCA01.1	18K5				115								
		22K0				129								
		30K0				110 176								
		37K0				150								
		45K0				188								
		55K0				111								
		75K0				139								
		90K0				112								
				176	112	117								
					142	117								
					164	136	111							
						188	154	117						
							185	141	117					

<sup>1)</sup> The pump and motor can also be ordered separately as motor-pump-assembly MPE (see „Motor-pump-assemblies“ starting on page 47)  
Note: For a detailed explanation of the tables, see page 10

### Selection example for system key

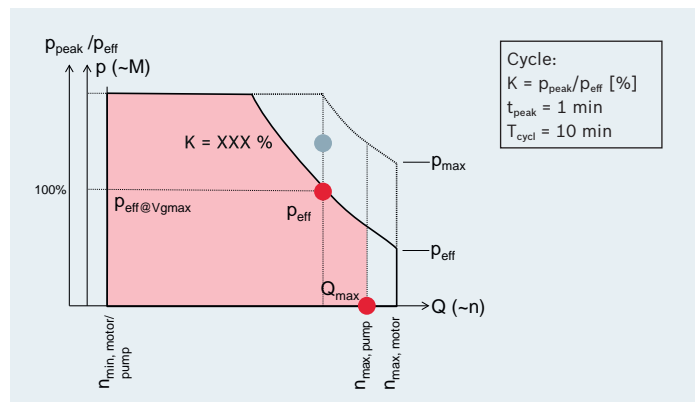
SYT-DFE5010-A04 \*\*\* -S-FC2FS \*\*\* -FV \*\*\* -NNNN -----> SYT-DFE5010-A04 324 -S-FC2FS 169 -FV 117 -NNNN

#### Detailed component information:

Motors: see “Motors” starting on page 63

Pumps: data sheet 62242

Controller: catalogs R999000241 (DE), R999000242 (EN)



Performance curve for DFE 5010 – self-ventilated

# Sytronix individual solutions

## Individually configured systems

In addition to preconfigured systems in the FcP, SvP, and DFE Sytronix series, the Sytronix product range also provides the option of configuring **individual solutions**. These systems can be planned and configured by combining modules and individual components, using questionnaires on application criteria and system parameters, in collaboration with Rexroth specialists.

## Rexroth – synonymous with planning security

- ▶ Sytronix product range for customized solutions
- ▶ Products with excellent dynamics and control accuracy
- ▶ Proven product quality for high machine reliability
- ▶ Industry-specific consulting and engineering support
- ▶ Global Rexroth presence and support

Components and modules for Sytronix systems can be found in „Components and modules“ starting on page 46.



# 8 steps for a system solution

Step	Example	Help
<b>1 Determine system requirements</b> <ul style="list-style-type: none"> <li>▶ Hydraulics schematic (open/closed circuit)</li> <li>▶ General conditions (fluid, filtration, supply voltage, interface, or high-level control system, etc.)</li> <li>▶ Load cycle (pressure, flow, worst case, etc.)</li> <li>▶ Performance (control accuracy, dynamics)</li> </ul>	<b>Pressure supply for core shooter systems</b> <ul style="list-style-type: none"> <li>▶ Open hydraulic circuit</li> <li>▶ Constant pressure: 100 bar</li> <li>▶ Average flow: 30 l/min</li> <li>▶ Maximum flow: 100 l/min</li> <li>▶ Fluid: HLP 46</li> <li>▶ Line voltage: 400 VAC</li> <li>▶ Analog set points</li> <li>▶ High dynamic performance</li> </ul>	<b>Guidelines for energy-efficient hydraulics assemblies</b> Questionnaire
<b>2 Select required Sytronix features</b> <ul style="list-style-type: none"> <li>▶ Control quality</li> <li>▶ Dynamics</li> <li>▶ Open or closed loop</li> <li>▶ Pressure or flow control</li> <li>▶ Alternating pressure/flow control</li> <li>▶ Force control, speed control, position control</li> </ul>	<b>SvP 7010</b> <ul style="list-style-type: none"> <li>▶ Pressure control</li> <li>▶ High dynamic performance</li> </ul>	<b>FcP, SvP, DFE systems</b> FcP: starting on page 13 SvP: starting on page 26 DFE: starting on page 34
<b>3 Select pump</b> <ul style="list-style-type: none"> <li>▶ Maximum pressure</li> <li>▶ Maximum flow</li> <li>▶ Minimum speed</li> <li>▶ Open or closed loop</li> </ul>	<b>PGH4-3X/050 internal gear pump</b> <ul style="list-style-type: none"> <li>▶ Continuous nominal pressure: 315 bar</li> <li>▶ Maximum flow: 150 l/min</li> <li>▶ Open circuit</li> </ul>	<b>SytronixSize program for system dimensioning</b>  <b>Pumps</b> starting on page 68
<b>4 Determine drive requirements</b> (Load cycle conversion using the pump displacement) <ul style="list-style-type: none"> <li>▶ RMS torque, maximum torque</li> <li>▶ Average speed, maximum speed</li> </ul>	<b>Parameters</b> <ul style="list-style-type: none"> <li>▶ RMS torque: 85 Nm</li> <li>▶ Maximum torque: 118 Nm</li> <li>▶ Average speed: 630 rpm</li> <li>▶ Maximum speed: 2,050 rpm</li> </ul>	<b>SytronixSize program for system dimensioning</b>
<b>5 Select drive/motor combination</b> <ul style="list-style-type: none"> <li>▶ Torques, speed</li> <li>▶ Drive family</li> <li>▶ Compact or modular power unit</li> <li>▶ Electrical connection on the motor</li> <li>▶ Motor cooling type</li> <li>▶ Encoder</li> </ul>	<b>IndraDrive C with MPA01</b> HCS03.1E-W0100-A-05-NNBV MPA01-PGH4P-NN-VBB-M11EBHA-S3F-NN <ul style="list-style-type: none"> <li>▶ Stall torque: 105 Nm</li> <li>▶ Maximum torque: 180.6 Nm</li> <li>▶ Maximum speed: 2,400 rpm</li> </ul>	<b>SytronixSize program for system dimensioning</b>  <b>Power units, motor-pump-assemblies, motors</b> starting on page 46





# Selection guides

## Energy-efficient hydraulics assemblies – questionnaire

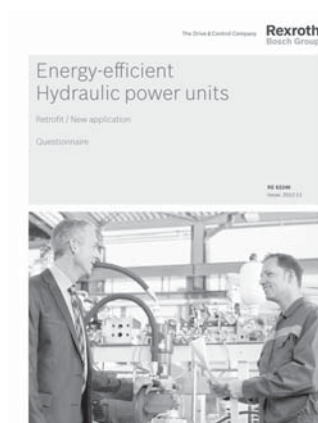
To implement a variable-speed drive solution, for retrofit or new applications, a customer-specific series of application conditions needs to be considered. This is in addition to the load profile of the machine. In hydraulics, critical factors such as the type of fluid, hydraulics schematic diagram, cooling requirements, and the presence of an accumulator can affect the configuration of a Sytronix system. Electrical parameters, such as supply voltage, the higher-level control system used, ambient temperatures, and performance required for the overall system are critical factors in the configuration of a Sytronix solution.

The questionnaire for energy-efficient hydraulic assemblies is intended as an aid for documenting all of the required information. Contact a Bosch Rexroth sales partner for more information.

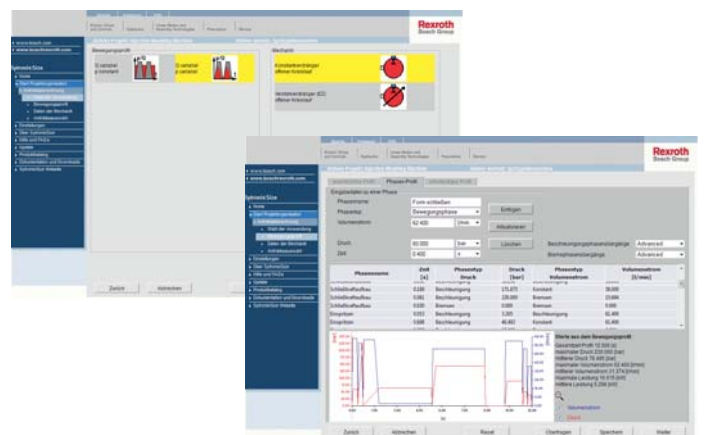
## SytronixSize software tool

Sizing components to meet the machine's energy requirement is key to an energy-efficient, cost-effective variable-speed drive solution. SytronixSize, Bosch Rexroth's design tool, is configured to provide the answers. The choice of hydraulic pump is made using the design criteria followed by selection of the electric motor and matching VFD or servo drive controller from the Bosch Rexroth product portfolio.

SytronixSize is only available for use by Bosch Rexroth applications specialists. Availability of SytronixSize to third parties is currently not planned due to legal restrictions. Inquire with a Bosch Rexroth sales partner for more information.



RE 62246



# Components and modules



Rexroth offers a comprehensive range of pumps, power units, motors and control software for Sytronix variable-speed pump drives. Rexroth can provide support in the selection of individual components for custom designed Sytronix systems.

<b>Motor-pump-assemblies</b>	<b>47</b>
Motor and pumps are available as preconfigured assemblies.	
<b>Drives</b>	<b>54</b>
Drives for synchronous or standard motors.	
<b>Motors</b>	<b>63</b>
Synchronous and asynchronous motors for pump drives in Sytronix systems.	
<b>Pumps</b>	<b>68</b>
Internal gear or axial piston pumps for a wide range of system pressures.	
<b>Accessories</b>	<b>76</b>
Extensive range of Rexroth accessories including line filters, braking resistors, line chokes, power and encoder cables, and auxiliary components (interconnection kits, attachment kits and assembly kits).	

# Motor-pump-assemblies

A selection of standard motor-pump-assemblies is available for Sytronix variable-speed pump drives, consisting of a motor, coupling and pump. The flexible solutions of preassembled modules are available in a variety of mounting configurations.

## **Assembly MPA01**

The MPA01 assembly was developed specifically for the SvP 7010 system and features direct motor-pump coupling.

## **Assembly MPAS1**

Like the MPA01, the MPAS1 assembly was also developed for the SvP 7010 system, but uses a conventional motor-pump coupling.

## **Assemblies MPES2 and MPES3**

The MPES2 and MPES3 assemblies are used with FcP 5010, FcP 7010, DFE 5010, and DFE 7010 systems. These assemblies use conventional motor-pump coupling; MPES2 is designed for the European and Asian markets, while the MPES3 is designed for the North American market.



# Motor-pump-assembly MPA01 with MSK & PGH



- ▶ Direct coupling
- ▶ Reduced overall length
- ▶ Horizontal and vertical mounting possible

**Features**

- ▶ Available with 3 motor configurations
- ▶ Available with 8 pump configurations
- ▶ Mounting options: flange, foot mount, or motor feet (only MSK133)

**Product description**

The MPA01 with direct coupling provides a compact solution, offering a range of motor and pump options.

**Detailed information:**

Assembly instructions R911339498 (DE), R911339499(EN), R911341599(DE), R911341600(EN)

**Technical data**

Motor	MSK101	MSK133	MSK133
Overall length	C, D, E, F	B, C, D, E	B, C, D, E
Cooling	Forced-ventilated	Forced-ventilated	Liquid-cooled
Pump	PGH4	PGH5	PGH5
Nominal size	20...63	63...160	63...160

# Motor-pump-assembly MPAS1 with MSK & PGM, PGH



- ▶ Standard motor-pump coupling
- ▶ Horizontal and vertical mounting possible

## Features

- ▶ Available with 3 motor configurations
- ▶ Available with 2 pump configurations
- ▶ Mounting options: flange, foot mount

## Product description

The MPAS1 utilizes conventional motor-pump coupling using a bell mount adapter.

## Detailed information:

See media directory

## Technical data

Motor	MSK071	MSK101	MSK101	MSK133
Overall length	C, D, E,	C, D, E, F	C, D, E, F	B, C, D, E
Cooling	Forced-ventilated	Forced-ventilated	Forced-ventilated	Forced-ventilated
Pump	PGH2, PGH3, PGH4	PGM4	PGH4, PGH5	PGM5
Nominal size	5...63	25...63	20...250	80...125
Motor			MSK133	MSK133
Overall length			B, C, D, E	B, C, D, E
Cooling			Forced-ventilated	Liquid-cooled
Pump			PGH5	PGH5
Nominal size			63...250	63...250

## Motor-pump-assembly MPES2

### with MOT-FC & PGF, PGH, A10, A4, SYDFEn-3X, SYHDFEn-1X



#### Features

- ▶ Wide range of motor-pump-assemblies
- ▶ Available with different pump configurations, depending on the pump type
- ▶ Mounting options: varies, based on motor size
- ▶ Horizontal and vertical mounting possible

#### Product description

MPES2 is designed for the European and Asian markets. The MPES2 assembly uses a conventional motor-pump coupling and a bell mount adapter.

#### Technical data

Motor		MOT-FC	MOT-FC	MOT-FC	MOT-FC
Performance	kW	1.5...11	1.5...15	18.5...90	1.5...90
Cooling		Self-ventilated	Self-ventilated	Forced-ventilated	Self-ventilated
Pump		PGF2	PGH2, PGH3, PGH4, PGH5	PGH4, PGH5	A10VZO-EZ4 (2-point adjustment)
Nominal size		6...22	5...250	25...250	10...180

Motor		MOT-FC	MOT-FC	MOT-FC	
Performance	kW	18.5...90	3...90	18.5...315	
Cooling		Self-ventilated	Self-ventilated	Self-ventilated	
Pump		A4VSO-EZ (2-point adjustment)	SYDFEn-3X	SYHDFEn-1X	
Nominal size		40...500	71...180	125...355	

## Motor-pump-assembly MPES3 with MOT-FC & PGF, A10



### Features

- ▶ Wide range of motor-pump assemblies
- ▶ Available with different pump configurations, depending on the pump type
- ▶ Mounting options: varies, based on motor size

### Product description

MPES3 is designed for the North American market. The MPES3 assembly uses a conventional motor-pump coupling and a bell mount adapter.

Can be mounted horizontally or vertically.

### Technical data

Motor		MOT-FC	MOT-FC
Performance	hp	2...20	2...125
Cooling		Self-ventilated	Self-ventilated
Pump		PGF2	A10VZO-EZ4
Nominal size		6...22	10...180

# Variable-speed pressure and control system SYHDFEn-1X



- ▶ Infinitely variable flow control
- ▶ Long service life
- ▶ Real-time mode for non-cyclic processes
- ▶ “Teach-in” mode for cyclic processes
- ▶ Universal through drive

## Features

- ▶ Pressure transducer
- ▶ A4VSO axial piston variable displacement pump
- ▶ VT-DFPn-2X proportional valve with integrated electronic control system
- ▶ Swivel angle transducer
- ▶ Suitable for HFC fluids as per RD 92053
- ▶ Mineral oil in accordance with DIN 51524 (HL/HLP)
- ▶ Use in Sytronix DFE systems

## Product description

The SYHDFEn-1X electrohydraulically controls the displacement, pressure and power/torque of an axial piston variable displacement pump.

The control utilizes the following components:

- ▶ A4VSO axial piston variable displacement pump
- ▶ VT-DFPn-2X proportional pilot valve, with spool position feedback and integrated electronics.
- ▶ Swivel angle transducer
- ▶ Pressure transducer

## Detailed information:

Data sheet 62242

## Technical data

Nominal size			125	180	250	355
Displacement	$V_{g \max}$	cm <sup>3</sup>	125	180	250	355
Max. speed	$n_{0 \max}$	rpm	1800	1800	1800	1500
Min. speed	$n_{\min}$	rpm	50	50	50	50
Max. flow at max. speed	$q_{v0 \max}$	l/min	225	324	450	533
Max. flow at $n_E = 1500$ rpm		l/min	186	270	375	533
Max. performance ( $\Delta p = 280$ bar) at max. speed	$P_{0 \max}$	kW	131	189	263	311
Max. performance ( $\Delta p = 280$ bar) at $n_E = 1500$ rpm		kW	109	158	219	311
Mass (without fluid)	$m$	kg	88	102	184	207
Suction pressure	$p$	bar	0.8...30	0.8...30	0.8...30	0.8...30
Max. permissible operating pressure	$p_{\max}$	bar	350	350	350	350
Min. operating pressure	$p_{\min}$	bar	≥20	≥20	≥20	≥20



# Variable-speed pressure and control system

## SYDFEn-3X



- ▶ Infinitely variable flow control
- ▶ Long service life
- ▶ With pulsation damping
- ▶ High-speed version
- ▶ Universal through drive

### Features

- ▶ Pressure transducer (order separately)
- ▶ SYDZ pre-load sequence valve (optional)
- ▶ A10VSO.../32 axial piston variable displacement pump
- ▶ VT-DFPn-2X proportional valve with integrated electronic control system
- ▶ Swivel angle transducer
- ▶ Mineral oils (HL, HLP) in accordance with DIN 51524, part 2
- ▶ Use in Sytronix DFE systems

### Product description

The SYDFEn-3X electrohydraulically controls the displacement, pressure and power/torque of an axial piston variable displacement pump.

The control utilizes the following components:

- ▶ A10VSO.../32 variable displacement axial piston pump
- ▶ VT-DFPn-2X proportional pilot valve, with spool position feedback and integrated electronics
- ▶ Swivel angle transducer
- ▶ Pressure transducer
- ▶ SYDZ pre-load sequence valve with pressure limiting function

### Detailed information:

Data sheet 62241

### Technical data

Nominal size			71	100	140	180
Displacement	$V_{g \max}$	cm <sup>3</sup>	71.1	100	140	180
Max. speed	$n_{0 \max}$	rpm	2550	2300	2200	1800
Min. speed	$n_{\min}$	rpm	50	50	50	50
Max. flow at max. speed	$q_{v0 \max}$	l/min	181	230	308	324
Max. flow at $n_E = 1500$ rpm		l/min	106.7	150	210	270
Max. performance ( $\Delta p = 280$ bar) at max. speed	$P_{0 \max}$	kW	84	107	144	151
Max. performance ( $\Delta p = 280$ bar) at $n_E = 1500$ rpm		kW	50	70	98	125
Mass (without through drive, incl. pilot valve)	$m$	kg	49	71	75	80
Nominal pressure	$p_{\text{nom}}$	bar	280	280	280	280
Max. permissible operating pressure	$p_{\max}$	bar	350	350	350	350
Min. operating pressure	$p_{\min}$	bar	≥20	≥20	≥20	≥20

# Drives

## Drives

Drive units are converters or inverters based on the IndraDrive family portfolio or frequency converters Rexroth Fv (VFD). The IndraDrive units consists of a power component and a control section, for the control of servo and standard motors. The part of the drive controller equipped with all the control functions and interfaces for installation in the power unit is referred to as the control section. The power component contains the power electronics to control the motors and is used to hold the control section. The converter (IndraDrive C - HCS) takes the line voltage with its fixed amplitude and frequency and generates a three-phase alternating current with variable amplitude and frequency.

The inverter (IndraDrive M - HMS) takes the DC bus voltage and generates a three-phase alternating current with variable amplitude and frequency.

The frequency converter Rexroth Fv (VFD) includes the power and control function in one device to control standard asynchronous motors. The VFD converts the fixed amplitude and frequency line power into variable amplitude and frequency three-phase alternating current.

## IndraDrive – compact drives

- ▶ Power range from 1.5 kW to 630 kW, with maximum current from 12 A to 1,535 A
- ▶ High overload capacity
- ▶ Compact design for single-axis applications
- ▶ Can be connected to a converter for cost-effective solutions
- ▶ Direct line connection from 200 V to 500 VAC

## Rexroth Fv VFD

The Rexroth Fv VFD is the drive solution optimized for automation applications with a power range up to 90 kW.

## Firmware

Unit-specific software for automation applications. With the IndraDrive servo drives and the Rexroth Fv VFDs, firmware is stored in read-only memory. IndraDrive has the option of updating the firmware using CompactFlash.



# Drives - IndraDrive

## Converter HCS02.1E-W0028/-W0054/-0070



- ▶ 2.5x overload capacity
- ▶ Maximum current from 28 A to 70 A
- ▶ Can be connected to a converter for cost-effective solutions
- ▶ Direct line connection from 200 V to 500 VAC

### Features

- ▶ Continuous power from 1.5 kW to 11 kW
- ▶ Internal or external braking resistors

### Product description

IndraDrive HCS02 series of drives integrate inverter and power supply in one unit. Contains line connections for compact construction making it suitable for single-axis applications.

### Detailed information:

Instructions R911309635 (DE), R911309636 (EN)  
Catalog R999000018 (DE), R999000019 (EN)

### Technical data

Continuous current <sup>1)</sup>	A	11.3...28.3
Maximum current	A	28.3...70.8
DC bus continuous power without/with choke	kW	5.1...9/5.1...14
Maximum output without/with choke	kW	8...14/10...19
Line voltage	V	3 AC 200...500, 1 AC 200...250 (±10 %)
Continuous input line current	A	13...30
Dependence of output on line voltage		at $U_{LN} < 400$ V: 1% power reduction per 4 V at $U_{LN} > 400$ V: 1% power gain per 5 V
Maximum braking power	kW	10...25
Control voltage, external	V	DC 24 ±20% (DC 24 ±5% when supplying motor holding brake)
Power consumption	W	14...23
Dimensions (H x W x D)	mm	65 to 105 x 352 x 252
Weight	kg	3.8...6.8

All data for nominal rating at 3 AC 400 V line voltage and 4 kHz switching frequency. <sup>1)</sup> In case of output frequency less than 4 Hz the output current will be reduced.

## Drives - IndraDrive

### Converter HCS03.1E-W0070/-W0100/-W0150/-W0210



- ▶ Maximum current from 70 A to 210 A
- ▶ Can be connected to a converter for cost-effective solutions
- ▶ Direct line connection from 400 V to 500 V

#### Features

- ▶ Continuous power with/without choke  
kW 13 to 42/25 to 85
- ▶ High overload capacity

#### Product description

IndraDrive HCS03 series of drives integrate inverter and power supply in one unit. Contains line connections for compact construction making it suitable for singles axis applications.

#### Detailed information:

Instructions R911309635 (DE), R911309636 (EN)  
Catalog R999000018 (DE), R999000019 (EN)

#### Technical data

Continuous current <sup>1)</sup>	A	45...145
Maximum current	A	70...210
DC bus continuous power without/with choke	kW	13...42/25...85
Maximum output without/with choke	kW	20...68/40...124
Line voltage (+10%/–15%)	V	3 AC 400...500
Continuous input line current	A	50...146
Dependence of output on line voltage		at $U_{LN} < 400$ V: 1% power reduction per 4 V decrease in voltage
Maximum braking power	kW	42...137
Control voltage, external	V	DC 24 ±20% (DC 24 ±5% when supplying motor holding brake)
Power consumption	W	22.5...30
Dimensions (H x W x D)	mm	125...350 x 440 x 315
Weight	kg	13...38

All data for nominal rating at 3 AC 400 V line voltage and 4 kHz switching frequency. <sup>1)</sup> In case of output frequency less than 4 Hz the output current will be reduced.

# Drives - IndraDrive Converter HCS04



## Features

- ▶ Wide range of power and voltage
- ▶ Robust construction
- ▶ Comprehensive options

- ▶ Integrated RFI filter for industrial environments
- ▶ Through-hole technology
- ▶ Optimized for mounting in control cabinets
- ▶ Intelligent limitation and protection
- ▶ Decoupled DC control terminals
- ▶ Worldwide approval

## Product description

IndraDrive HCS04 series converters are used to drive three-phase asynchronous and synchronous motors. They feature state-of-the-art components and technology and are suitable for drive and regenerative operation of motors in both rotary directions. When braking, regenerated energy is dissipated in braking resistors. HCS04.2E converters are stand-alone units with an internal controller and power supply and utilize forced air cooling.

## Detailed information:

Data sheet R911327333 (DE), R911327334 (EN)  
Catalog R999000018 (DE), R999000019 (EN)

## Technical data

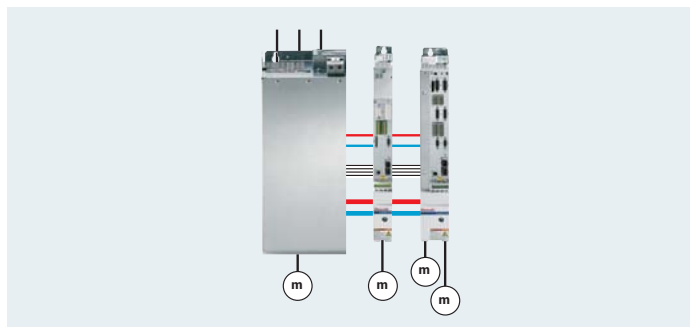
Typical motor rating	kW	High continuous load <sup>1)</sup> : 132...630; high overload <sup>2)</sup> : 110...500
Continuous current	A	High continuous load <sup>1)</sup> : 259...1,126; high overload <sup>2)</sup> : 215...930
Maximum current 60 s	A	High continuous load <sup>1)</sup> : 311...1,351; high overload <sup>2)</sup> : 323...1,395
Maximum current 2 s	A	High continuous load <sup>1)</sup> : 350...1,520; high overload <sup>2)</sup> : 355...1,535
Continuous input line current <sup>3)</sup>	A	High continuous load <sup>1)</sup> : 226...1,037; high overload <sup>2)</sup> : 194...834
Line voltage	V	3 AC 380...480 (+10%/–15%)
Brake chopper		Internal/external
Permanent braking power	kW	85...400
Maximum brake power 10 s	kW	165...750
Control voltage, external	V	DC 24 (±20%)
Dimensions (H x W x D)	mm	330...1,110 x 782...1,150 x 380
Weight, approx.	kg	74...300

All data for nominal rating at 3 AC 400 V line voltage and 4 kHz switching frequency with line or DC choke.

<sup>1)</sup> Overload 20% for 60 s, 35% for 2 s <sup>2)</sup> Overload 50% for 60 s, 65% for 2 s <sup>3)</sup> With DC choke HLL

## Drives - IndraDrive

### Power supply HMV01.1E, HMV01.1R, HMV02.1R



- ▶ Energy-saving line regeneration (optional)
- ▶ Integrated line contactor
- ▶ Integrated braking resistor

#### Features

- ▶ Power range from 18 kW to 120 kW
- ▶ Direct line connection from 400 V to 480 V
- ▶ Protection to IP20

#### Product description

IndraDrive HMV power supply units are used in conjunction with modular HMS inverters.

#### Detailed information:

Catalog R999000018 (DE), R999000019 (EN)

#### Technical data

Line voltage	V	3 AC 400...480 (+10%/–15%)
Supply frequency	Hz	48...62
DC bus continuous output	kW	18...120
Overload capacity		1.5x/1.5...2.5x
Suitable for cabinet depth	mm	HMx01: 400
Line contactor/brake chopper/braking resistor		Internal <sup>1)</sup> / internal <sup>1)</sup> / internal <sup>1)</sup>
Control voltage DC 24 V		External
Environmental rating		IP20
Installation height	m	1,000 above sea level, with derating to 4,000 <sup>2)</sup>
Ambient temperature	°C	0 to +40, with derating to +55
Cooling type		Air cooling
CE mark		Low Voltage Directive 73/23/EEC, EMC Directive 89/336/EEC
Certifications/EMC		EN 61800-5-1, EN 61800-3, UL 508C, C22.2 No. 14-05/C3 (EN 61800-3)

All data for nominal rating at 3 AC 400 V line voltage and 4 kHz switching frequency. <sup>1)</sup> Not applicable for HMV01.1R-W0120; <sup>2)</sup> HCS04 only up to 3,000 m.

## Drives - IndraDrive

### Inverter HMS01, HMS02



- ▶ Space-saving design with multi-axis applications
- ▶ Can be powered via power supply unit
- ▶ Power sharing via common DC bus
- ▶ Can be connected to a converter for cost-effective solutions

#### Features

- ▶ Modular single-axis inverter
- ▶ Single-axis inverter with maximum current from 20 A to 350 A

#### Product description

IndraDrive HMS inverter series for single and dual axes in the modular drive system. They have a power output to drive a motor and operate with HMV01/02 supply units and HCS02 and HC03 drive controllers.

#### Detailed information:

Instructions R911309635 (DE), R911309636 (EN)  
Catalog R999000018 (DE), R999000019 (EN)

#### Technical data

Continuous current	A	12.1...250
Maximum current	A	20...350
DC bus capacity	mF	–/0.14/0.27
Control voltage, external	V	DC 24 ±20% (DC 24 ±5% when supplying motor holding brake)
Power consumption without control unit and motor brake	W	10...218 (including HAB blower unit)
Continuous current without control unit and motor brake	A	0.4...9.1 (including HAB blower unit)
Width	mm	50...350
Height	mm	352/440 <sup>1)</sup>
Depth	mm	252/309
Weight	kg	5.3...31.7

All data apply to nominal rating at 3 AC 400 V line voltage and 4 kHz switching frequency

<sup>1)</sup> Overall height HSM01.1N-W0350 with auxiliary fan HAB: 748 mm

# Drives - IndraDrive

## Control unit CSH01 ADVANCED



- Use with Sytronix SvP
- Option: safety on board
- Available with standard performance and functionality, CSB01 BASIC version, for use with Sytronix

### Features

- Solution for standard and high-end applications
- Integrated motion logic with advanced features
- Open interfaces for international use
- On request, certified safety technology per EN 13849-1 and EN 62061

### Product description

The ADVANCED control unit offers the highest performance and dynamics. In addition to performance, a wide range of control communications and encoder interfaces are available. Digital and analog inputs and outputs are available in the base controller using an I/O expansion. The controller can be equipped with certified safety technology per EN 13849-1 and EN 62061, as an option. The ADVANCED controller is an ideal platform for a drive-integrated PLC with IndraMotion MLD.

Using a PC with the engineering tool IndraWorks, a complete configuration and startup can be performed.

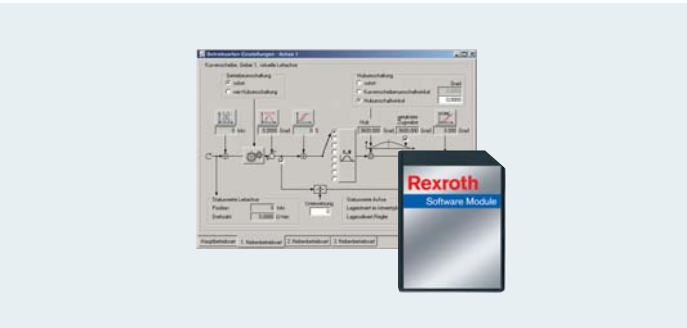
**Detailed information:**  
 Catalog R999000018 (DE), R999000019 (EN)

### Technical data

Control communication	Optional: analog interface, PROFIBUS, SERCOS III, ProfiNet, EtherCat, EtherNet/IP, CANopen, DeviceNet	
Digital inputs		7
Digital inputs for measuring probe		2
Digital inputs/outputs (configurable)		4
Analog inputs		1
Analog outputs		2
Relay outputs		1



# Firmware FWS



### Features

- ▶ All standard functions included
- ▶ Function extensions
- ▶ Industry-specific functions
- ▶ Integrated IEC-compliant logic

### Product description

The stock firmware can perform standard drive functions – from simple V/f control through positioning control mode. Extension packages provide options of electronic synchronization, servo functions and main spindle drives. The freely-programmable motion logic with integrated PLC conforming to IEC 61131-3 and ready-to-use functions enable simple execution of complex machine processes.

**Detailed information:**  
Catalog R999000018 (DE), R999000019 (EN)

### Technical data

Technology functions	HPU	IMC	PFC
FcP 7010	p = const		
SvP 7010		p/Q control	x/F control

# Rexroth Fv Frequency Converter for Sytronix FVCA01.1 (-XXX-P002)



- ▶ Multiple operating modes to suit a variety of applications
- ▶ Simple operation and maintenance
- ▶ Removable fan
- ▶ LCD operator interface panel
- ▶ Advanced functionality and high performance
- ▶ Optional PROFIBUS control communication

## Features

- ▶ Quality and reliability
- ▶ Worldwide service
- ▶ CE-compliant
- ▶ UL-listed

## Product description

The Rexroth Fv VFD for Sytronix is an optimal drive solution for automation of a variety of applications with power ratings up to 90 kW. It can operate in voltage/frequency (V/f), sensorless vector control (SVC), or field-oriented vector control (FOC) modes to suit a wide range of applications.

## Detailed information:

Instructions R912004739 (EN)

## Technical data

Rated motor power	kW	1.5...90
Nominal motor voltage	V	0...480
Line voltage	V AC	380...480
Supply frequency	Hz	50...60
Rated continuous current	A	4...183
Overload capacity	%	200 (in 1 s)/150 (in 1 min)
Motor cable length (internal line filter C3)	m	5/10
Motor cable length (external line filter C3)	m	50/75
Ambient temperature	°C	−10...+40
Controller		PID
Bus systems		Modbus/PROFIBUS
Display		LCD: pressure, speed, voltage, current, etc.

# Motors

Synchronous and asynchronous motors for use in Sytronix variable-speed pump drive systems.

## **IndraDyn S synchronous servo motors (MSK)**

- ▶ Maximum torques up to 631 Nm
- ▶ Environmental protection: IP65
- ▶ Choice of cooling systems
- ▶ High dynamic performance
- ▶ Compact design

## **IndraDyn A asynchronous servo motors (MAD)**

- ▶ Rated outputs up to 93 kW
- ▶ Maximum speeds up to 11,000 rpm
- ▶ Encoder systems for a wide range of applications
- ▶ Environmental protection: IP65
- ▶ Motor designed for easy maintenance

## **Standard asynchronous motors (MOT-FC)**

- ▶ Energy efficiency class IE2 (Europe/Asia)
- ▶ NEMA Premium efficiency (North America)
- ▶ Low “total cost of ownership”
- ▶ Standard product series



# IndraDyn synchronous servo motor

## MSK071, MSK101, MSK133



- ▶ Compact and powerful
- ▶ Broad performance range
- ▶ Multiple models to match load requirements
- ▶ Maximum torques up to 631 Nm
- ▶ Maximum speeds up to 6,000 rpm

### Features

- ▶ Maximum torques up to 631 Nm
- ▶ Axial or radial blower optional
- ▶ Environmental protection: IP65
- ▶ Choice of cooling systems

### Product description

Outstanding features of the MSK range of motors include broad power range and model variants to match load requirements. Encoders are available in single or multi-turn versions. Additional options include shaft keyways, holding brakes, and increased runout to match any application. For applications with high continuous power operation, blowers are available for axial and radial installation.

### Detailed information:

Catalog R999000018 (DE), R999000019 (EN)

### Technical data

Type			MSK071	MSK101	MSK133
Maximum speed	$n_{Max}$	rpm	3500...6000	3300...6000	3300
Continuous torque at stall	$M_0$	Nm	12...23	32...70	152...293
Maximum torque	$M_{Max}$	Nm	44...84	110...231	320...631
Continuous current at stall	$I_0$	A	5.2...20	14.9...58.3	63...115
Maximum current	$I_{Max}$	A	23.4...90.1	67.1...262.4	160...305
Moment of inertia	$J$	kgm <sup>2</sup>	0.00173...0.0029	0.0065...0.0164	0.0476...0.09
Flange size	$A$	mm	140	192/208	260
Motor length	$O$	mm	272...352	350...688	582...732
Max. motor height	$H$	mm	202	262/276	370
Shaft diameter	$D$	mm	32	38	48
Weight		kg	13.9...23.5	28.3...53.5	91.6...146.0

# IndraDyn Asynchronous servo motor

## MAD100, MAD130, MAD160, MAD180



- ▶ Maximum torque 850 Nm
- ▶ Optional MAF version with liquid cooling for higher continuous outputs

### Features

- ▶ Encoder systems for a wide range of applications
- ▶ Environmental protection: IP65
- ▶ Motor designed for easy maintenance

### Product description

The high power density of the MAD motor series makes them ideal for use in metal forming machines with output torque up to 850 Nm.

High-resolution single and multi-turn encoders along with outstanding true running quality guarantee maximum accuracy. The motor's environmental protection rating IP65 includes the fan motor, making it suitable for use in harsh industrial environments. The easy-maintenance design of the motor allows for fan assembly exchange while the motor is in service.

### Detailed information:

Catalog R999000018 (DE), R999000019 (EN)

### Technical data

Type			MAD100	MAD130	MAD160	MAD180
Rated torque	$M_N$	Nm	34...70	95...180	220/240	325/390
Maximum torque	$M_{Max}$	Nm	75.1...153.6	208.8... 395.6	483.9/528.2	715.5/857.8
Rated power	$P_N$	kW	1.8...3.7	5...9.4	11.5/12.6	17/20.4
Rated current	$I_N$	A	5.3...10.1	12.8...24.2	26.1/27.6	38.2/39.7
Moment of inertia	$J_R$	kgm <sup>2</sup>	0.019...0.0392	0.084...0.164	0.25/0.311	0.458/0.594
Flange size	$A$	mm	192	260	316	320
Motor length	$O$	mm	462...612	570...770	748/838	979/1,089
Max. motor height	$H$	mm	287	368	420	447/469
Shaft diameter	$D$	mm	32	42	55	60
Weight		kg	43...72	100...165	201/238	334/403

# Rexroth standard asynchronous motor

## MOT-FC: Europe/Asia



### Features

- ▶ Motor design conforming to DIN EN 60034 (IEC 72)
- ▶ Standard asynchronous motors – MOT-FC (IEC) for use outside of North America
- ▶ Environmental protection to IP55
- ▶ For use with VFD or IndraDrive Bosch Rexroth recommends MOT-FC standard asynchronous motors for FcP 5010/7010 and DFE 5010/7010.

### Product description

Low voltage three-phase squirrel cage motors for VFD operation (inverter duty).

Rexroth's MOT-FC motor family is optimized for use in FcP 5010/7010 and DFE 5010/7010 with frequency converters.

### Detailed information:

See ZN10601-2

### Technical data

Mechanical version		IEC
Power range	kW	1.5...315
Nominal voltage	V	< 3 kW (230/460 V); > 3 kW (400/690 V)
Number of poles 1500 rpm		4
Energy efficiency		IE2
Type of construction (EN 60034-7)		IM B35; IM B 5, IM V1
Housing material		Aluminum (1.5...7.5 kW), gray cast iron (from 11 kW)
Cooling (EN 60034-6)		IC 411 (self-ventilated); IC 416 (forced-ventilated)
Permissible ambient temperature	°C	–20...+40
Permissible installation height	m	1000
Motor/winding protection (DIN EN 60947-8)		PTC
Terminal box position (IEC 60034-7 AMD 1)		Above

# Standard asynchronous motor

## MOT-FC: North America



### Features

- ▶ Motor version per NEMA MG1
- ▶ Standard asynchronous motors – MOT-FC (NEMA) for use in North America
- ▶ Environmental protection to IP55
- ▶ For use with VFDs and IndraDrive, Bosch Rexroth recommends MOT-FC standard as synchronous motors for FcP 5010/7010 and DFE 5010/7010.

### Product description

Low voltage three-phase squirrel cage motors for VFD operation (inverter duty).

The MOT-FC motor family is optimized for use in FcP 5010/7010 and DFE 5010/7010 with frequency converters.

### Detailed information:

See ZN10601-2

### Technical data

Mechanical version		NEMA
Power range	hp	2...125 (larger powers on request)
Nominal voltage	V	208...230/460 V
Number of poles at 1800 rpm		4
Energy efficiency		NEMA Premium efficiency
Type of construction (EN 60034-7)		Vertical or horizontal, with foot and flange, only flange
Housing material		Gray cast iron
Cooling (EN 60034-6)		TEFC (self-ventilated) TEBC (forced-ventilated)
Permissible ambient temperature	°C	-20...+40
Permissible installation height	m	1000
Motor/winding protection (DIN EN 60947-8)		PTC
Terminal box position (IEC 60034-7 AMD 1)		Left

# Pumps

A variety of pump types can be used with Sytronix variable-speed drives.

## Internal gear pumps

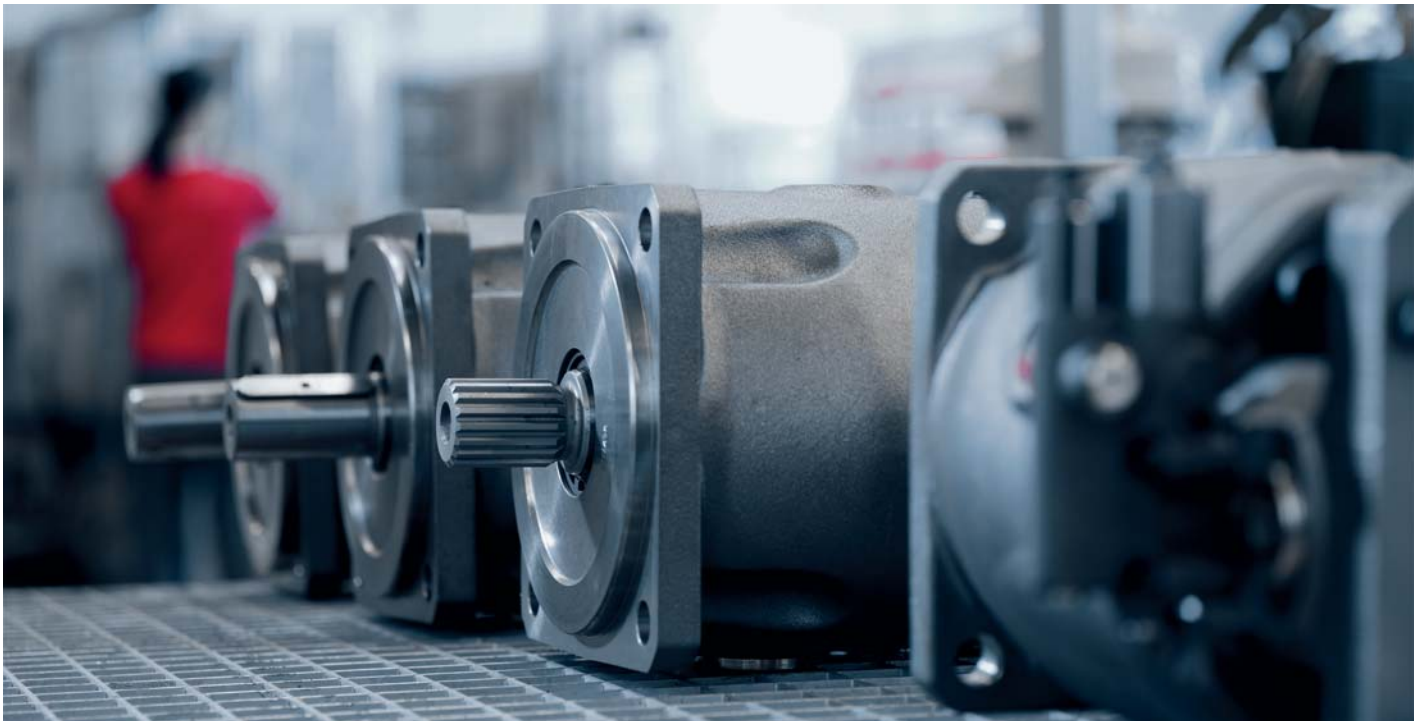
Internal gear pumps, type PGF-2X, PGH-2X, PGH-3X, and PGM-4X, are suitable for use in Sytronix systems. Operating in open hydraulic circuits, they are capable of a maximum continuous pressure of 315 bar, dependent on the type. Reverse rotation is permissible for 2 quadrant operation. The internal gear pumps are ideal for low noise requirements and use in pressure holding operation due to low internal leakage.

## Axial piston pumps

The series A10 and A4 axial piston pumps are also suitable for use in Sytronix systems.

The A10 series can be used in pressure holding operation for long duration due to leakage flow being externally drained. They can also deliver flow in both directions for closed circuit operation, and additionally be used as motors.

The A4 series axial piston pumps are very robust and have proven successful in many press applications due to large displacements and pressure capability up to 400 bar. Suitable for extended pressure holding, these pumps are ideal for use in Sytronix drives thanks to an external leakage drain and wide range of drive speeds.





# Internal gear pump

## PGF-2X



- ▶ Long service life
- ▶ Suitable for a wide range of viscosities and speeds
- ▶ Excellent suction characteristics
- ▶ Can be used in a variety of system sizes and combinations
- ▶ Can be combined with other pumps

### Features

- ▶ Fixed displacement
- ▶ Low operating noise
- ▶ Low flow ripple
- ▶ High efficiency

### Product description

PGF fixed displacement internal gear pumps are pressure-balanced to minimize internal leakage. They are suitable for low to medium power Sytronix drives, up to mid-pressure operation in industrial applications, such as machine tool applications

### Detailed information:

Data sheet 10213

### Technical data

Frame size			2
Nominal size		NG	6...22
Displacement		cm <sup>3</sup>	6.5...22.0
Pressure	$p_{nom}$	bar	210 <sup>1)</sup>
	$p_{max}$	bar	250
Speed	$n_{min}$	rpm	200
	$n_{max}$	rpm	3600
Flow <sup>2)</sup>	$q_v$	l/min	9.4...31.9
Fluid			HL mineral oil (DIN 51524 part 1); HLP mineral oil (DIN 51542 part 2); HEES fluids (DIN ISO 15380); HEPR fluids (DIN ISO 12380)
Temperature	HLP fluid	°C	-20...+100
	Ambient	°C	-20...+60
Filtration class		Class	20/18/15

<sup>1)</sup> When NG = 22:  $p_{nom}$  = 180;  $p_{max}$  = 210;  $n_{max}$  = 3000

<sup>2)</sup> Measured at  $n$  = 1450 rpm and  $p$  = 10 bar

# Internal gear pump

## PGH-2X



- ▶ Size 2: Nominal size 5 to 8
- ▶ Size 3: Nominal size 11 to 16
- ▶ Maximum pressure 350 bar
- ▶ Maximum displacement 16 cm<sup>3</sup>
- ▶ Series 2X

### Features

- ▶ Fixed displacement
- ▶ Low operating noise
- ▶ Low flow ripple
- ▶ High efficiency at low speeds and viscosities due to dynamic pressure balancing
- ▶ Suitable for a wide range of viscosities and speeds
- ▶ Can be used in a variety of system sizes and combinations

### Product description

PGH fixed displacement internal gear pumps are pressure balanced to minimize internal leakage. The driven pinion shaft is supported by hydrodynamic bearings and drives an internal toothed ring gear. Fluid is pumped within the gear tooth cavities and a sickle-shaped segment assembly. Axial sealing plates are dynamically pressure-balanced to ensure optimal sealing of the pump gears.

### Detailed information:

Data sheet 10223

### Technical data

System size			2	3
Nominal size			5...8	11...16
Displacement	$V_g$	cm <sup>3</sup>	5.24...8.2	11.0...16.0
Speed	$n_{min}$	rpm	600	600
	$n_{max}$	rpm	3000	3000
Flow <sup>1)</sup>	$q_v$	l/min	7.5...11.8	15.8...23.0
Pressure	$p_{nom}$	bar	315	315
	$p_{nom}$	bar	350	350
Temperature	HLP fluid <sup>2)</sup>	°C	-10...+80	-10...+80
	Ambient	°C	-20...+80	-20...+80
Filtration class		Class	20/18/15	20/18/15

<sup>1)</sup> Measured at  $n = 1450$  rpm and  $p = 10$  bar

<sup>2)</sup> HLP mineral oil (DIN 51524) part 2

# Internal gear pump

## PGH-3X



- ▶ Size 4: Nominal size 20 to 50
- ▶ Size 5: Nominal size 63 to 250
- ▶ Maximum pressure 350 bar
- ▶ Maximum displacement 250 cm<sup>3</sup>
- ▶ Series 3X

### Features

- ▶ Fixed displacement
- ▶ Low operating noise
- ▶ Low flow ripple
- ▶ High efficiency, even at low speeds and viscosities due to dynamic pressure balancing
- ▶ Suitable for a wide range of viscosities and speeds
- ▶ Suitable for use with HFC fluid
- ▶ For more information on pressure fluids, see the data sheet.

### Product description

PGH fixed displacement internal gear pumps are pressure balanced to minimize internal leakage. The driven pinion shaft is supported by hydrodynamic bearings and drives an internal toothed ring gear. Fluid is pumped within the gear tooth cavities and a sickle-shaped segment assembly. Axial sealing plates are dynamically pressure-balanced to ensure optimal sealing of the pump gears.

### Detailed information:

Data sheet 10227

### Technical data

System size			4	5
Nominal size			20...63	63...250
Displacement	$V_g$	cm <sup>3</sup>	20.1...65.5	64.7...250.5
Speed	$n_{min}$	rpm	200	200
	$n_{max}$	rpm	3000	3000
Flow <sup>1)</sup>	$q_v$	l/min	28.9...94.1	92.8...359.6
Nominal pressure, continuous	$p_N$	bar	210...315	135...315

<sup>1)</sup> Measured at  $n = 1450$  rpm and  $p = 10$  bar

# Internal gear pumps

## PGM-4X



- ▶ Size 4: Nominal size 25 to 63
- ▶ Size 5: Nominal size 80 to 125
- ▶ Maximum pressure 210 bar

### Features

- ▶ Fixed displacement
- ▶ Very low operating noise
- ▶ Low flow ripple
- ▶ High efficiency at low speeds and viscosities due to dynamic pressure balancing
- ▶ Suitable for a wide range of viscosities and speeds

### Product description

PGM-4X fixed displacement internal gear pumps are pressure-balanced to minimize internal leakage. Available in large displacements and suitable for medium pressure operation, these pumps are ideally suited for variable-speed operation along with frequent pressure cycling and are ideal for use in plastics processing machines.

### Detailed information:

Data sheet 10229

### Technical data

System size			4	5
Nominal size			25...63	80...125
Displacement		cm <sup>3</sup>	25.3...65.5	81.4...125.3
Pressure	$p_{nom}$	bar	175	175
	$p_{max}$	bar	210	210
Speed	$n_{min}$	rpm	200	200
	$n_{max}$	rpm	3000	3000
Flow <sup>1)</sup>	$q_v$	l/min	36.3...94.0	116.9...179.8
Fluid			HLP mineral oil (DIN 51524) part 2	HLP mineral oil (DIN 51524) part 2
Fluid temperature – HLP		°C	–10...+80	–10...+80
Ambient temperature		°C	–20...+60	–20...+60
Filtration class			20/18/15	20/18/15

<sup>1)</sup> Measured at  $n = 1450$  rpm and  $p = 10$  bar

# Axial piston pumps

## A4VSO



- ▶ Modular design
- ▶ Fast control times
- ▶ Multiple through-drive options
- ▶ Visual swivel angle indicator
- ▶ No restrictions on mounting position
- ▶ Operation with HF fluid with restrictions

### Features

- ▶ Variable displacement
- ▶ Excellent suction characteristics
- ▶ Low noise
- ▶ Long service life
- ▶ HFC operation with a special version, see RD 92053
- ▶ Mineral oils and HFD pressure fluids

### Product description

A4VSO axial piston variable pumps feature a swashplate design and are suitable for open circuit operation.

### Detailed information:

Data sheet 92050

### Technical data

Nominal size			40...500
Displacement		cm <sup>3</sup>	40...500
Pressure	$p_{nom}$	bar	350
	$p_{max}$	bar	400
Speed	$n_{min}$	rpm	On request
	$n_{max}$	rpm	1900...3200
Flow <sup>1)</sup>	$q_v$	l/min	60...533
Pump operation			Yes
Motor operation			No
Performance ( $\Delta p = 350$ bar; $V_{g max}$ ; $n = 1500$ rpm)	$P_{max}$	kW	35...311
Torque ( $\Delta p = 350$ bar, $V_{g max}$ )	$M_{max}$	Nm	223...1976

<sup>1)</sup> Measured at  $n = 1500$  rpm

## Axial piston pumps

### A10VSO series 31/32



- ▶ Nominal size for series 31: 18 to 140
- ▶ Nominal size for series 32: 45 to 180
- ▶ Nominal pressure 280 bar
- ▶ Maximum pressure 350 bar
- ▶ Open circuit

#### Features

- ▶ Axial piston swashplate construction
- ▶ Excellent suction characteristics
- ▶ Low noise
- ▶ Long service life
- ▶ Versatile range of controllers
- ▶ Fast control times
- ▶ Hydrostatic cradle bearings
- ▶ Low pressure ripple
- ▶ High efficiency
- ▶ Designed to minimize cavitation and suction port flow drops, and improve shaft sealing with case pressure peaks
- ▶ HFA, HFB, HFC pressure fluid (except Skydrol)

#### Detailed information:

Data sheet 92711

#### Product description

The A10VSO variable displacement swashplate pump is usable in open circuit designs. Flow is proportional to drive speed and pump displacement. Swashplate can be used to control displacement of the pump.

#### Technical data

Series			31	32
Nominal size			18...140	45...180
Displacement		cm <sup>3</sup>	18...140	45...180
Pressure	$p_{nom}$	bar	280	280
	$p_{max}$	bar	350	350
Speed	$n_{min}$	rpm	50	50
	$n_{max}$	rpm	2100...3900	1800
Flow <sup>1)</sup>	$q_v$	l/min	27...210	67.5...270
Pump operation			Yes	Yes
Motor operation			Yes	Yes
Performance ( $\Delta p = 280$ bar) at $V_{g\ max}$ and $n = 1800$ rpm	$P_{max}$	kW	15...117	38...151
Torque ( $\Delta p = 280$ bar) at $V_{g\ max}$	$M_{max}$	Nm	80...623	200...802

<sup>1)</sup> Measured at  $n = 1500$  rpm

# Axial piston pumps

## A10FZO, A10FZG, A10VZO, A10VZG



- ▶ Proven A10 technology
- ▶ Optional through drive
- ▶ High efficiency

### Features

- ▶ Suitable for variable-speed operation
- ▶ Designed for start/stop service
- ▶ Capable of long pressure holding operation
- ▶ Usable as a pump or motor
- ▶ Mineral oils (HL, HLP) in accordance with DIN 51524, part 2

### Product description

As an advanced design of the proven A10 family of pumps, these products are specifically adapted for variable speed drives in energy-efficient systems.

A10 family axial piston pumps are available as fixed displacement pumps in open (A10FZO) or closed (A10FZG) circuits, or as variable displacement pumps in open (A10VZO) or closed (A10VZG) circuits.

**Detailed information:**  
Data sheet 91485

### Technical data

Type			A10FZO	A10FZG	A10VZO	A10VZG
Nominal size			6...45 <sup>1)</sup>	6...45 <sup>1)</sup>	10...180	10...63 <sup>2)</sup>
Displacement		cm <sup>3</sup>	6...45	6...45	10.8...180	10...63
Pressure	$p_{nom}$	bar	315	315	250 (NG10)/315	315
	$p_{max}$	bar	350	350	315 (NG10)/350	350
Speed	$n_{min}$	rpm	0	0	0	0
	$n_{max}$	rpm	3000...3600	3000	1800...3600	3000
Flow <sup>3)</sup>	$q_v$	l/min	9...67.5	9...67.5	15...270	15...94.5
Performance	$P_{max}$	kW	1.5...11.25	1.5...11.25	2.5...45	2.5...15.75
Torque	$M_{max}$	Nm	9.5...72	9.5...72	17...286	17...101

<sup>1)</sup> 58 to 63 on request <sup>2)</sup> On request

<sup>3)</sup> Measured at  $n = 1500$  rpm

# Accessories

A comprehensive range of accessories is available for your Sytronix system.

## Line filters

Line filters ensure that the EMC limit values are adhered to and suppress leakage current generated by line capacitors.

## Braking resistors

Braking resistors provide energy dissipation, in the form of heat, resulting from dynamic braking of the drive.

## Line chokes

Line chokes reduce the harmonics coupled into the supply grid. As an IndraDrive accessory, they are used to increase the continuous DC bus output and to suppress harmonics.

## Power and encoder cables

Power cables are used to connect the motor to the drive unit. Encoder cables are used to connect the feedback encoder to the drive.

## Auxiliary components

Accessories for connecting modules, such as the HAS01, include bus bars, fastening materials, etc. Additional items include shielded motor cables for connecting to drive units (HAS02), mounting flange assemblies (HAS07) and commissioning cable (RKB0001).

### Detailed information:

Catalog R999000018 (DE), R999000019 (EN)





# Pressure transducers for hydraulic applications

## SUP-E01-SYT-HM20-2X



- ▶ 3 pressure levels: 100/250/400
- ▶ Electrical connection:: plug, 4-pin, M12x1
- ▶ Angled plug

### Features

- ▶ Sensor utilizing thin-film technology
- ▶ Stainless steel wetted surfaces
- ▶ Enhanced reliability including high burst pressure, reverse polarity, overvoltage and short-circuit protection
- ▶ Excellent temperature characteristics
- ▶ UL-listed for the US and Canadian markets

### Product description

Pressure transducers are used for measurement and control in hydraulic systems. Measured pressure produces a linear electrical output signal. A kit is available including angled plug and cable, and in three standard pressure ranges for Sytronix drives.

### Detailed information:

Data sheet 30272

### Technical data

Operating voltage	$U$	V DC	16...36
Output signals	$U$	V	0.1...10
	$I$	mA	4...20
Pressure range	$p$	bar	0...100/250/400
Accuracy class			0.5
Settling time (10 to 90%)	$t$	ms	< 1
Temperature coefficient	$T_c$	%	< 0.1/10 K
Fluid temperature range	$T_{\text{Fluid}}$	°C	-40...+90
Ambient temperature range	$T_{\text{Ambient}}$	°C	-40...+85
Environmental rating			IP65/IP67
Electrical connection			M12 plug, 4-pin
Pressure port			G1/4





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