Servo-Hydraulic Actuator – SHA

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Servo-Hydraulic Actuator – SHA

Topology

- Linear single actuator
  - Electro-hydraulic
  - Electro-mechanical - EMC
- Closed system - SHA
- Open system (Atmospheric reservoir)
- Compact design
- Distributed design
- Single rod cylinder
- Double rod cylinder – Multiple-area principle
- Industry-specific
## Servo-Hydraulic Actuator – SHA

### Solution matrix

<table>
<thead>
<tr>
<th>Single rod cylinder</th>
<th>Double rod</th>
<th>Synchronous</th>
<th>Discrete multi-chamber</th>
<th>Tandem</th>
<th>Integrated multi-chamber</th>
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<tr>
<td><img src="image1.png" alt="Diagram" /></td>
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### Increasing complexity

- A1
- B1
- ...
- E1

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Servo-Hydraulic Actuator – SHA
System structure – Competencies

System with key competencies of Bosch Rexroth
Servo-Hydraulic Actuator – SHA
System structure – Components

System based on proven components of Bosch Rexroth
Servo-Hydraulic Actuator – SHA
Advantages / Benefits

Advantages of hydraulics

- Large actuating forces – hydraulic operating principle
- Robustness – long service life
- Simple overload protection – pressure relief valves

Advantages of electrics

- High precision and dynamics – servo-motors and converters
- Connectivity – flexible connection to fieldbus
- Easy control and diagnostics – technology function PFC* with monitoring and protective functions

System advantages

- Ready-to-install solution – pre-assembled, filled and with minimum amount of defined interfaces
- Easy startup – Plug & Run
- Low maintenance expenditure – closed system, diagnoseable
- Energy-efficient operation – power on demand
- 4.0-capability – open
- Self-contained, separated from central hydraulics – flexibility
- Bosch Rexroth – key components connected within the system

Customer benefits

- Time savings – fast and easy installation and startup
- High machine uptime
- Reduced operating and maintenance costs – energy and insurance
- Cost savings – open standards in the control concept
- Efficient engineering – construction kit principle
- Bosch Rexroth – custom system solutions, world wide service

* PFC: PositionForceControl
## Servo-Hydraulic Actuator – SHA Designs

<table>
<thead>
<tr>
<th>Integrated</th>
<th>Compact</th>
<th>Distributed</th>
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</table>
| ✓ Complete integration of the cylinder and the motor/pump unit into the hydraulic manifold  
✓ Optimum way for reduced installation space | ✓ Complete or partial integration of the cylinder and the motor/pump unit into the hydraulic manifold  
✓ Optimized in terms of installation space | ✓ Connection of a standard cylinder and a standard motor/pump unit to the hydraulic manifold by means of hose assemblies or pipes  
✓ Optimized in terms of flexibility |
Servo-Hydraulic Actuator – SHA
Operating principle A1

Cylinder extending:
- The pump displaces fluid from A to B
- During extending, the effective area is A1
- The fluid flows from chamber A2 via the pump into piston chamber A1
- The differential volume of piston rod A3 is supplied from the accumulator to piston chamber A1

Cylinder retracting:
- The pump displaces fluid from B to A
- During retracting, the effective area is A2
- The fluid of piston chamber A1 flows via the pump to chamber A2
- The differential volume of piston rod A3 is displaced into the accumulator
Servo-Hydraulic Actuator – SHA
Technical framework A1
Servo-Hydraulic Actuator – SHA

Operating principle E1

**Cylinder extending in rapid speed**
- The pump displaces fluid from B to A
- During extending in rapid speed, the acting surface is A2
- The fluid flows from chamber A2 via the pump into chamber A1
- The displaced volume from chamber A3 flows via valve 1 also into chamber A1

**Cylinder extending in creep speed**
- The pump displaces fluid from B to A
- During extending in creep speed, the acting surface is A1
- The displaced volume from chambers A2 and A3 flows via valve 2 into the chamber A1

**Cylinder retracting in rapid speed**
- The pump displaces fluid from A to B
- During retracting in rapid speed, the acting surface is A2
- The fluid flows from chamber A1 via the pump into piston chamber A2
- The displaced volume from chamber A1 flows via valve 1 also in chamber A3
### Servo-Hydraulic Actuator – SHA

#### Technical framework E1

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- **Standard types**
- **Scope of total power**
- **Exemplary representation of a force/velocity diagram**

* only possible in creep speed

#### Graph

- **Creep speed velocity [mm/s]**
- **Rapid traverse force [kN]**
- **Rapid traverse velocity [mm/s]**

- **F\text{max} [kN]**
- **F\text{cond} [kN]**

- **140 kN**
- **80 mm/s**
Servo-Hydraulic Actuator – SHA
Application examples

Bending

Punching

Moving

Stamping

Folding

Pressing

Closing

Lifting

Positioning

Handling
Servo-Hydraulic Actuator – SHA
Application examples – Food Processing Industry

Components of SHA A1 (distributed):
- 2x single rod cylinder CSH3 40/28/156
- 2x pump A10FZG 008
- 2x synchronous motor MSK071E-0300
- 2x converter HCS02.1-0054
- Technology function PFC
- 1x Hydraulic block (filter, cooler, T and p sensors, compensating tank HAD1,0 und valves)

Schematic diagram of execution A1:

Requirement profile – load profile:
- Max. force: 30 kN (approx. constant)
- Max. velocities → retracting: 500 mm/s; extending: 265 mm/s
Servo-Hydraulic Actuator – SHA
Application examples – Hydro-Erosive Grinding

Components of SHA A2 (compact):
- Single rod cylinder CSH1 100/45/500
- Pump A10VZG 028 (EZ4)
- Synchronous motor MS2N07-E0BQ
- Converter HCS03.1-0070
- Control technology based on MLC
- Hydraulic block (filter, cooler, T and p sensors, compensating tank HAD3,5 and valves)

Requirement profile – load profile:
- Max. force: 140 kN (approx. constant)
- Max. velocities → rapid: 200 mm/s; pressing: 80 mm/s
Servo-Hydraulic Actuator – SHA
Application examples – Surface Grinding Machine

Components of SHA A3 (distributed) – open hydraulic circuit:
- Single rod cylinder CSH1 80/56/2700
- Pump PGH55 RL 100/63
- Synchronous motor MSK101E-0300 (FN)
- Control cabinet, including converter HCS03.1-0100
- Technology function PFC
- Hydraulic block (filter, cooler, T+p sensors, valves)

Requirement profile – load profile:
- Max. Force: 27kN (approx. constant)
- Max. velocities → extending/retracting: 750mm/s

Schematic diagram of execution A3:
Servo-Hydraulic Actuator – SHA
Application examples – Dolly Car

Components of SHA A1 with safety technology:
- Single rod cylinder CSH3 140/90/300
- Pump A10FZG014
- Synchronous motor MS2N07-E0BQA
- Converter HCS02.1E-W0054
- SW including technology function PFC
- Hydraulic block (filter, T and p sensors, compensating tank and valves)

Schematic diagram of execution A1:

Requirement profile – load profile:
- Max. force: 350 kN
- Max. velocities: 30 mm/s
- Stroke: 300 mm
- Safety integrated
Servo-Hydraulic Actuator – SHA
Application examples – Compressor Drive

Components of SHA B1 (compact):
- Double rod cylinder CGS 63/32/200
- Pump A A10FZG010
- Synchronous motor MSK101D-0300
- Control cabinet, including converter HCS03.1-0070
- Application software
- Hydraulic block (filter, T and p sensors, compensating tank, and valves)

Requirement profile – load profile:
- Max. force at both ends: 79 kN
- Nominal force at both ends: 69 kN
- Actuating time per double stroke 2.0 ± 0.1 s
- Repeatability ≤ 0.4 mm
Servo-Hydraulic Actuator – SHA
Application examples – Riveting Presses

SHA E1 with area switching and safety technology (compact):
- Tandem cylinder CVSHA 200/110-110/70/300
- Pump A10FZG010
- Synchronous motor MS2N07-D0BRN
- Converter HCS03.1E-0070
- SW including technology function PFC
- Hydraulic block (filter, cooler, T and p sensors, compensating tank, and valves)

Schematic diagram of execution E1:

Requirement profile – load profile:
- Max. force: 800 kN
- Max. velocities: 300 mm/s; rapid advance: 75 mm/s; pressing speed: 15 mm/s
Servo-Hydraulic Actuator – SHA
References – Publications by customers

SMS Group GmbH O+P Fluidtechnik 11-12/2016

Frey & Co. GmbH Fluid 10/2015

Sonplas GmbH Industrie 10/2018
Servo-Hydraulic Actuator – SHA

Contacts

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Technical information

RE08137

DCEM

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Information

Community

Website (DE)

Customer presentation (DE)

Fair models

DCH179  DCH213
DCH227  DCH225

www.boschrexroth.com/sha