

Electric power instead of oil



SERAC[®] electric cylinder
ASCA servo screw

Drive systems



Maximum performance – Always more than you expect

For Ortlieb, the PRECISION COMPANY, innovation, quality and precision have a long tradition. Everyday customer proximity has been and remains the basis for economic and precise solutions in drive and clamping technology.

Ortlieb customers benefit from the concentrated, continuous further advancement of its development and manufacturing expertise aimed at the greatest possible customer benefit.

But Ortlieb does not just react to the demands of the market, we also offer innovative momentum. The development of the planetary roller screw to the industrially usable production ASCA servo screw is an example of our pioneering spirit and willingness to convince. Often, this will open up completely new possibilities.

MADE IN GERMANY is the quality guarantee of Ortlieb. It goes right through from the basic technical development to the hardware delivered. A highly efficient production structure is the basis for the marketability of innovative products which are manufactured in Germany with good reason.

Concentration on the essentials leads to outstanding results

Drive systems

The two sister companies, Wilhelm Narr GmbH & Co. KG and Ortlieb Präzisions-Spannzeuge GmbH + Co. have merged and from 2011 have traded as Ortlieb Präzisionssysteme GmbH & Co. KG. In the light of this all Narr products and drive systems can be found in this catalogue.



Clamping systems

Since 1911 we have stood for innovative and extremely reliable solutions in workpiece and tool clamping. Whether you need standard collet chucks or manufacture of special clamping devices to specification – the benefit of our extensive know-how is at your service.



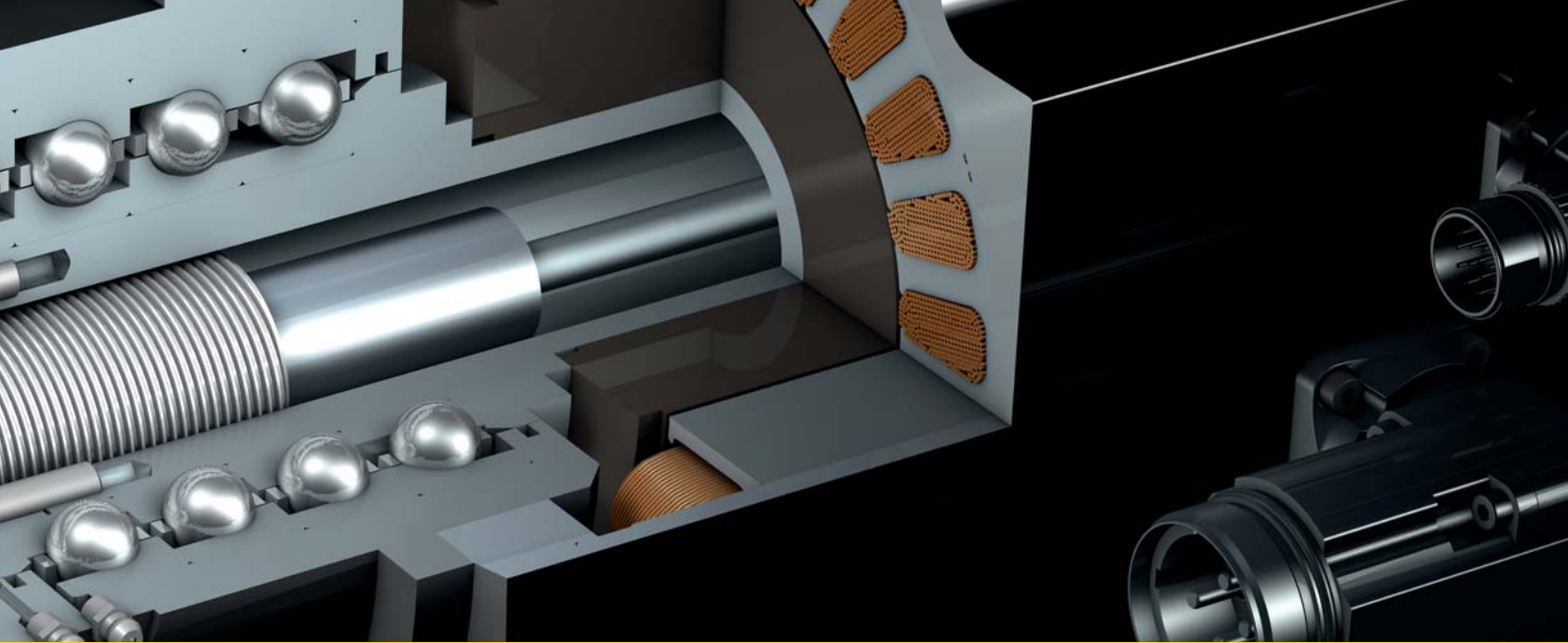


Drive systems with maximum power density

With the ASCA servo screw, a genuine alternative now exists for applications which until now have been dependent on hydraulic drives. The basis is the technology of the PWG planetary roller screw. The ASCA servo screw is the technological basis of the SERAC® electric cylinders.

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ASCA servo screw

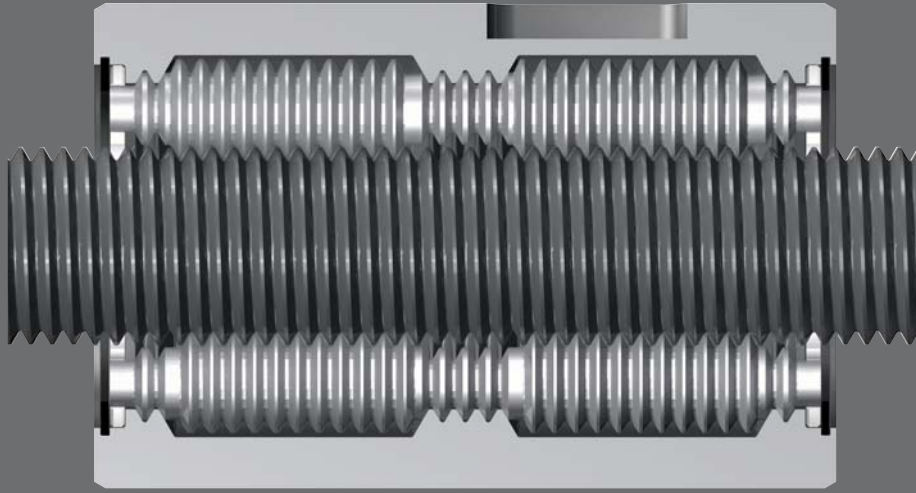
The ASCA servo screw combines the functions of a planetary gear unit with those of a screw. The merging of these two functions leads to a considerable reduction in the space and weight of a drive axis.



SERAC® electric cylinders

These fully redesigned servo linear drives utilize the many benefits of the ASCA servo screw. A typical example of the many advantages of the SERAC® electric cylinders is their high dynamics. They are increasingly replacing previous hydraulic solutions in many applications.





ASCA servo screw – unique power density for automation

The ASCA servo screw is based on the PWG planetary roller screw design principle. This new screw technology converts the rotary motion of a motor directly into linear motion.

The dimensions of the ASCA servo screw can be extremely compact in form considering the force achieved. Because the reduction of a planetary gear unit is part of its functionality, the motor connection can be made directly without additional gears.

With its compact size and the potential for reaching very high forces and rapid motion with small motors, the ASCA servo screw follows the trend in mechatronics towards compact, efficient solutions.

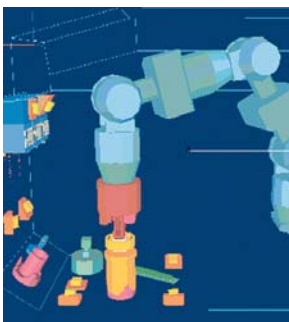
Drive technology from space travel ...

Development background

The German Aerospace Center (DLR) developed the first remote-controlled robot for the D2 mission (1993).

The problem of meeting the strict weight limit while generating the required force could not be solved with conventional screw drives. Because of these conflicting requirements, the DLR decided to look for a completely new approach.

The project for this solution led to the development of the PWG planetary roller screw. The functional principle was patented worldwide by the DLR.



The industrial solution

Brilliant design is one thing, but turning it into an industrial-scale product that works reliably in all situations is quite another.

Wilhelm Narr GmbH & Co. KG, an Ortlieb sister company within the Narr group, acquired the licence from the DLR, recognising the great potential of the PWG planetary roller screw with its completely new functionality.

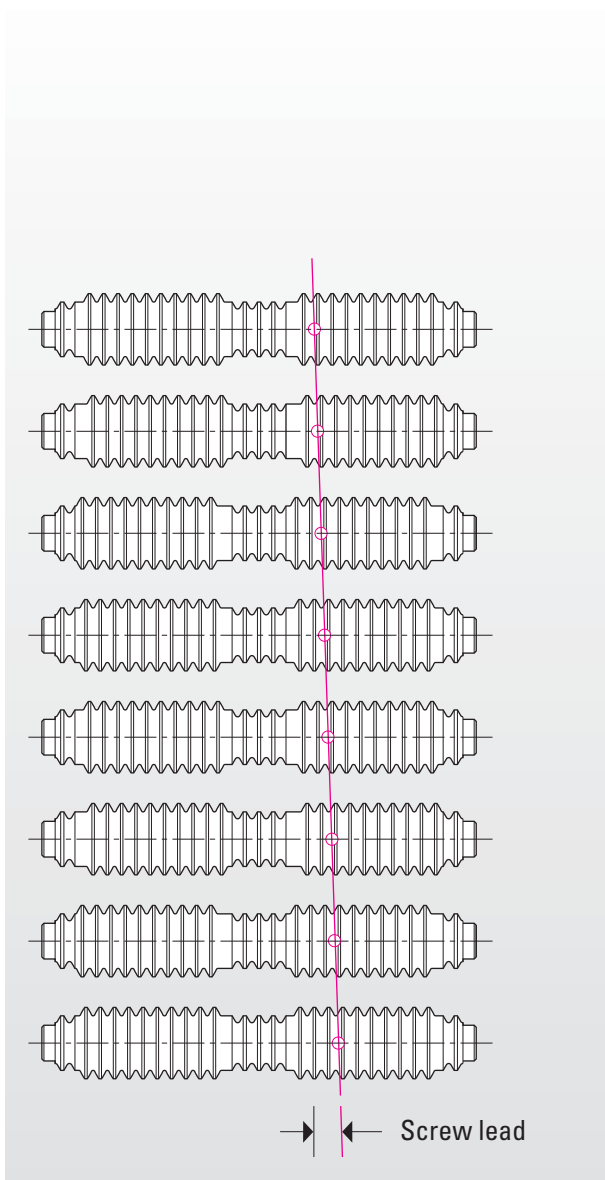
Initial tests under the most severe conditions met every expectation. The results were extremely promising. They provided the impetus to continue to develop the technology on an industrial scale, particularly in terms of production engineering and tribology.

With the merger of Narr and Ortlieb to form Ortlieb Präzisionssysteme GmbH & Co. KG, the well-known Narr servo screw was incorporated into the Ortlieb portfolio as the ASCA servo screw.



The functional principle ...

PWG Planetary roller screw



Power transmission can be through the screw shaft or the screw nut. The connection between nut and screw is formed by several rotating planetary rollers.

The transmission of the drive torque is by frictional locking. This causes low slip – which is not to be confused with backlash.

The planetary rollers with their circumferential drive grooves emulate the screw thread according to their various positions in the planet carrier.

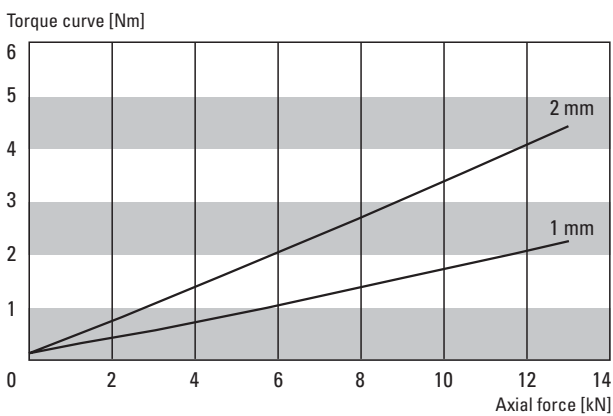
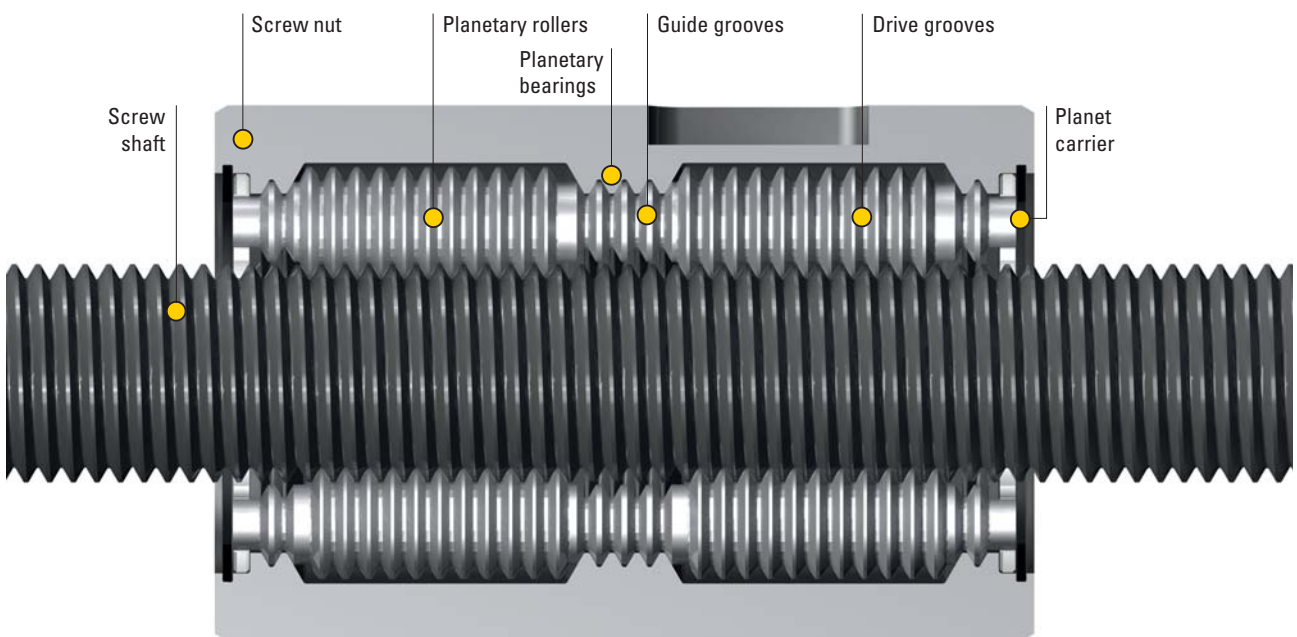
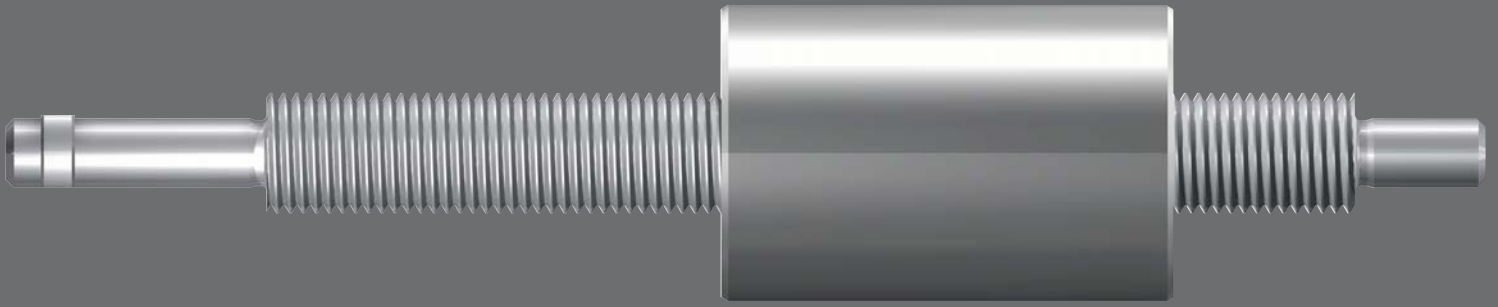
As they orbit the screw as they spin, the screw is driven axially according to the direction of rotation. The large number of contact surfaces gives the structure high axial rigidity.

The system-related slip contributes to the robustness and durability because the contact points of the screw and planetary roller flanks change constantly, which prevents the parts being eroded. The level of slip depends on the direction and level of force, speed, temperature and lubrication.

Example:

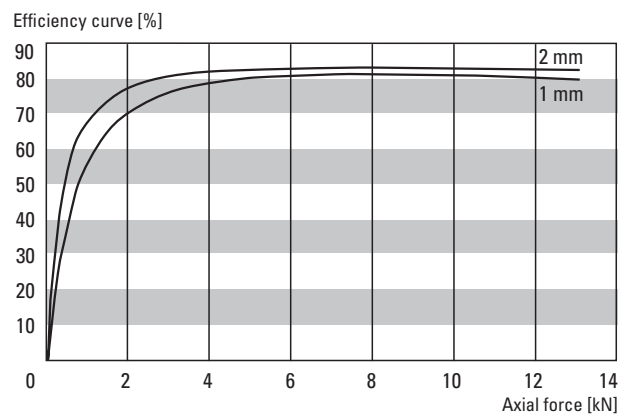
At maximum force slip of about 1% must be allowed for. At 1 mm lead, for example, 19.80 mm travel is obtained at 20 revolutions. The slip can be compensated for by direct or indirect travel measurement. A positive feature is that the slip does not impact on the dynamic behaviour of a controlled drive axis.

The graphic (left) shows a developed view of the planetary rollers which in total represent a sort of internal thread. The axial displacement of the drive grooves is obtained from the screw lead.



The diagram shows the driving torque required to generate a specific force (without allowing for the screw bearing).

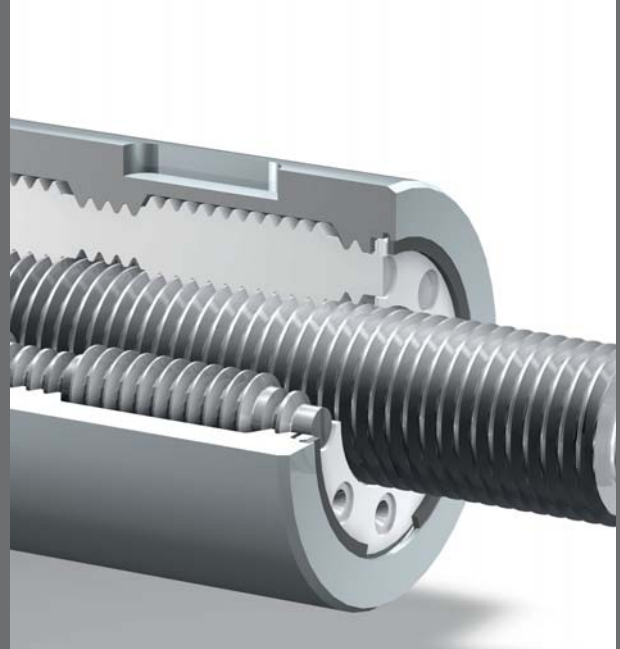
Example: At 2 mm lead, torque of only 3.4 Nm is needed to generate 10 kN. At 1 mm lead this is reduced to 1.9 Nm.



The diagram shows the efficiency curve of an ASCA servo screw with 1 mm and 2 mm lead.

It is clear that very high efficiency levels can be obtained even at small leads. Due to the preloading of the planetary rollers, the efficiency is relatively low in the lower force ranges but rises as the force increases.

ASCA servo screw – lead from 1 mm



- High travel speeds
- High translation rates
- High efficiency
- High stability
and high load capacity
with minimal volume!

The combination of the “screw” and “planetary gear” principles gives great variability and optimization of the design. Under this principle an electric cylinder with an ASCA servo screw does not generally need an additional gear unit.

The specific advantages of this innovative construction include the ability to use a lead of only 1 mm without any problem. The result is very high translation rates and efficiency levels of up to 90 % are achieved despite the small lead. So small, lightweight motors can be used to generate very high forces.

The ASCA servo screw is ideally suited for dynamic drive solutions because it is backlash-free.

The translation ratio from rotational to linear motion can be set within wide limits by varying the screw lead.

The ASCA servo screw is suitable for both dynamic applications and creep movements.

High travel rates can be reached due to great high speed capability and the use of greater leads.

The ASCA servo screw is also superior to traditional ball and roller screw systems at short strokes.

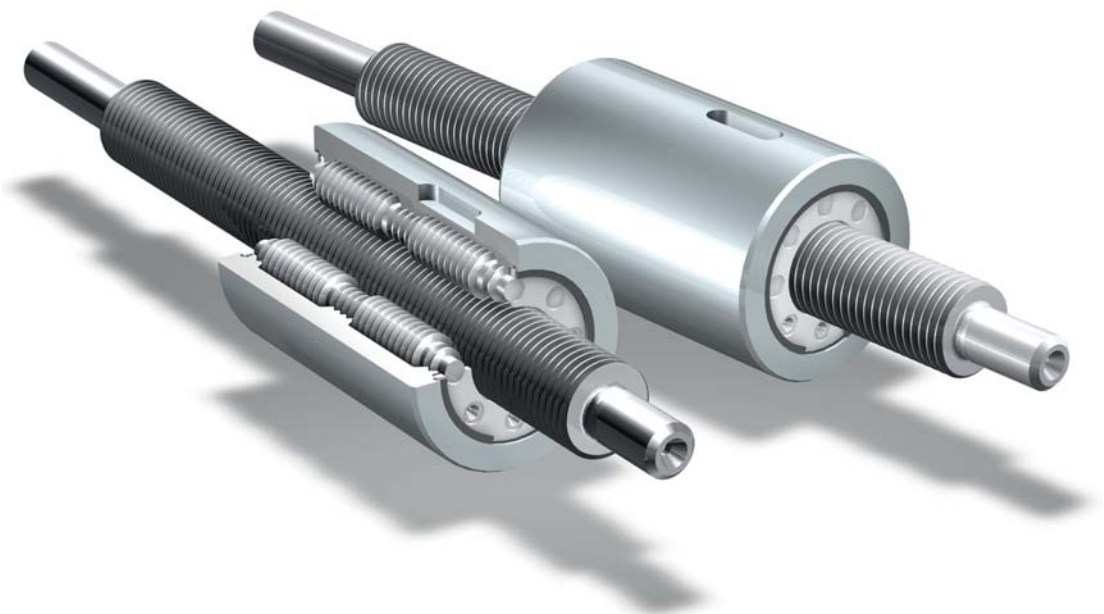
Specific technological advantages for many different solutions

The versatile potential of the ASCA servo screw:

- Leads from 1 to 12 mm
- High translation rate
- High power density
- High load capacity
- High efficiency
- High dynamics
- High travel speed
- Long life
- Low noise
- Robust construction
- High rigidity
- No backlash

The ASCA servo screw offers the solution
for many different applications:

- Replacement of hydraulic and
pneumatic cylinders
- Short cycle time
- Limited space application
- High force requirement
- High travel speed
- Extreme creep movement
- High dynamics
- Quiet running – without roller resetting
- Lightweight construction
- Short strokes



ASCA servo screw

– standard version or customer design

Suitable for series motors or integrated solutions

The standard ASCA servo screw series is available in eight sizes with different leads. The screw nut design comes in two different standard versions for different types of mounting.

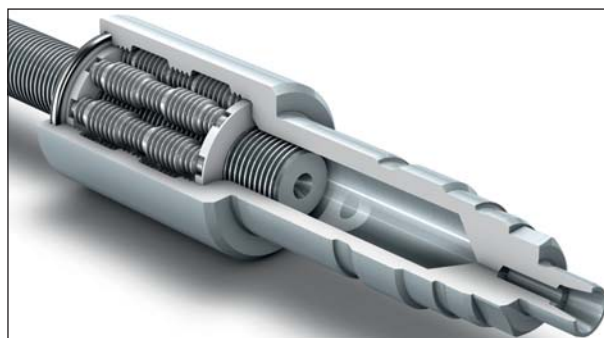
As an alternative, the design flexibility of the ASCA servo screw offers the option of customized production of screw and nut.

It is also possible to create specialized screw drives. With its Customer Design, Ortlieb offers complete design of specific solutions with integrated motor – also non-standard. And from a batch size of one if required, to utilize the specific potential of the ASCA servo screw for special individual applications as well.

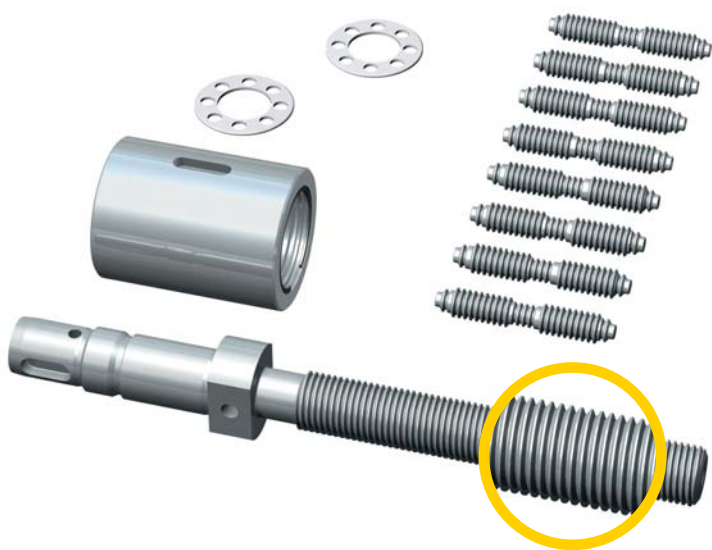
The Ortlieb Customer Design section specializes in customized screw drives for minimal, small and medium series production.



ASCA servo screw (PWG 16), standard version



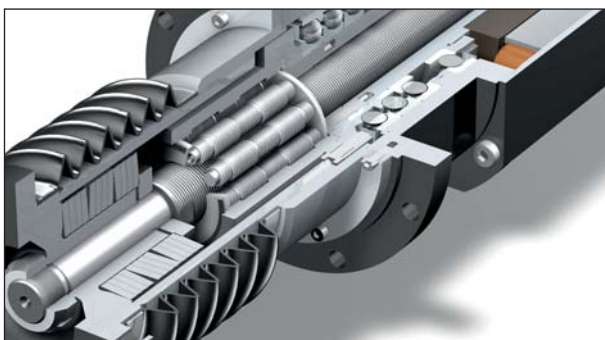
ASCA servo screw (PWG 20) with sealed nut housing, non-standard version (customer design)



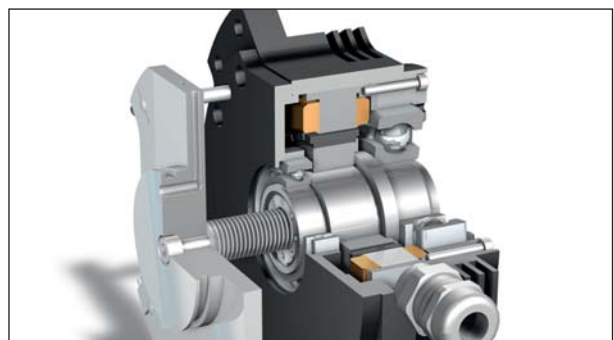
Precise and robust due to few components

The number of components in a PWG planetary roller screw is astonishingly low. Which makes the demand for production quality even higher. The two factors "few components" and "high precision" give high reliability and extreme robustness even with small leads.

Important: The ASCA servo screw operates without roller resetting, making it much quieter.

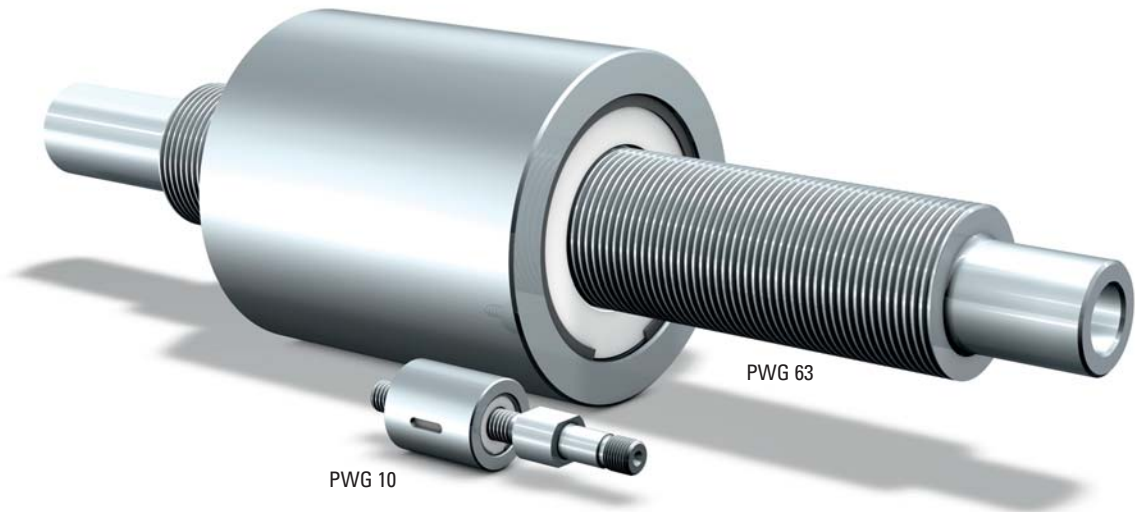


ASCA servo screw in customer design version with standard motor



ASCA servo screw in customer design version with non-standard motor

ASCA servo screw in standard version



Series overview

Model	Lead p [mm]	Rated Ø screw d [mm]	Recommended max. force [kN]	Dynamic load rating C [kN]	Speed limit n _{max} [rpm]
PWG 10	1 2	9.4	4.5	8	14000
PWG 12	1 2	11.7	9	17	11660
PWG 16	1 2 3	15.7	12	26	8750
PWG 20	1 2 3 4	19.7	22	45	7000
PWG 25	1 2 3 4 5	24.7	30	60	5600
PWG 32	1.5 3 4.5 6	31.7	60	95	4370
PWG 44	1.5 3 4.5 6 7.5 9	43.4	100	200	3180
PWG 63	2 4 6 8 10 12	62.7	170	330	2220



Screw nut (A1)
Cylindrical with keyway



Screw nut (A2)
With flange (flat sides)

Screw nut versions

Dimensions (cylindrical type)

Type: A1 cylindrical		Model	D g6	L1	L2	a	b	t	
		PWG 10 x..-A1	27	35	15	3	12	1.8	
		PWG 12 x..-A1	35	45.5	17	4	14	2.5	
		PWG 16 x..-A1	38	49	19	4	16	2.5	
		PWG 20 x..-A1	49	62	25	5	20	3	
		PWG 25 x..-A1	54	69.5	27.5	6	22	3.5	
		PWG 32 x..-A1	70	87	35	8	30	4	
		PWG 44 x..-A1	100	122	50	12	40	5	
		PWG 63 x..-A1	130	160	On request				

All dimensions in mm

Dimensions (flat-sided flange type)

Type: A2 flat-sided flange		Model	D1 g6	D2	D3	D4	L1	L2	L3	L4	N	W
		PWG 10 x..-A2	26	39	32.5	3.4	35	6	5	29	6	45°
		PWG 12 x..-A2	33	49	41	4.5	45.5	8	7	36	6	45°
		PWG 16 x..-A2	37	56	47	5.5	49	9	8.5	42	6	45°
		PWG 20 x..-A2	48	72	60	6.6	62	11	9.5	52	6	45°
		PWG 25 x..-A2	54	78	66	6.6	69.5	12	10	60	6	45°
		PWG 32 x..-A2	70	100	85	9	87	15	12	75	6	45°
		PWG 44 x..-A2	100	136	118	11	122	20	16	110	8	30°
		PWG 63 x..-A2	130	On request		160	On request					

All dimensions in mm

Lubricating nipple DIN3405 D1 M3: PWG 10/12
Lubricating nipple DIN71412 H1 M6: PWG 16 - 63

ASCA servo screw in standard version

Model codes/order data

Equipment parameter	Version specification	Order code	PWG 10	PWG 12	PWG 16	PWG 20	PWG 25	PWG 32	PWG 44	PWG 63
Screw lead	1 mm		1	1	1	1	1			
	1.5 mm							1.5	1.5	
	2 mm		2	2	2	2	2			2
	3 mm				3	3	3	3	3	
	4 mm					4	4			4
	4.5 mm							4.5	4.5	
	5 mm						5			
	6 mm							6	6	6
	7.5 mm								7.5	
	8 mm									8
	9 mm								9	
	10 mm									10
12 mm									12	
Nut type	Cylindrical	A	1	1	1	1	1	1	1	1
	Flat-sided flange	A	2	2	2	2	2	2	2	2

Sample order **PWG 16** x **2** - **A** **1**

Size
 Screw lead
 Nut type

ASCA servo screw with special adaptations

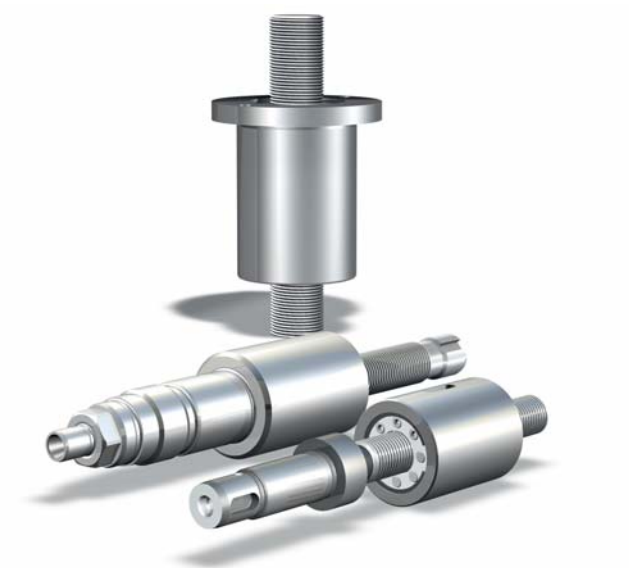
Do you need different mechanical interfaces or special performance characteristics?

We shall be pleased to check their feasibility. Send us your drawing or let's talk about your ideas. We will produce a proposal without commitment for you for a specially designed or adapted version.

Consultancy service

Because there are many design options for an ASCA servo screw, we generally recommend a discussion for preliminary clarification as early as possible. The potential of the ASCA servo screw can then be utilized to the full.

We look forward to your call to arrange a meeting at your facility. Tel.: +49 7021 9469-35



Calculation of ASCA servo screw service life

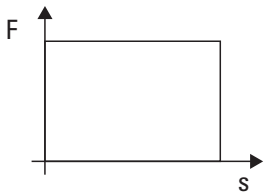
The service life of ASCA servo screws follows an S-N (or Wöhler) curve with $k = 3$.

$$L_{10} = 10^6 \left(\frac{C}{F_A} \right)^3 \text{ revs.}$$

L_{10} Service life with 10 % probability of failure
 C Dynamic load rating
 F_A Equivalent load

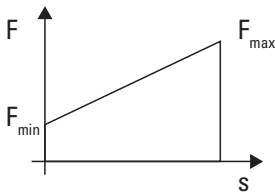
Calculation of equivalent load F_A

1) Constant load



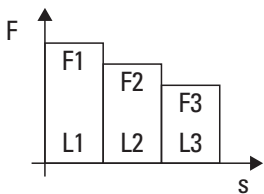
$$F_A = F$$

2) Increasing load



$$F_A = \frac{F_{Min} + 2F_{Max}}{3}$$

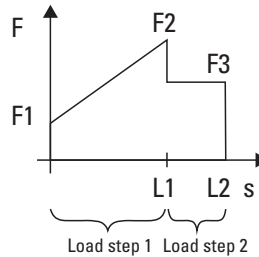
3) Load steps



$$F_A = \sqrt[3]{\frac{\sum_{i=1}^m F_i^3 L_i}{\sum_{i=1}^m L_i}}$$

Sample calculation

The equivalent load and service life are determined for the following load profile:



$F_1 = 1 \text{ kN}$
 $F_2 = 10 \text{ kN}$
 $F_3 = 5 \text{ kN}$

$L_1 = 15 \text{ mm}$
 $L_2 = 20 \text{ mm}$

Applicable to load step 1:

$$F_{A1} = \frac{F_1 + 2F_2}{3} = \frac{1 \text{ kN} + 2 \cdot 10 \text{ kN}}{3} = 7 \text{ kN}$$

Applicable to load step 2:

$$F_{A2} = F_3 = 5 \text{ kN}$$

Therefore for $F_{A_{tot}}$:

$$\begin{aligned} F_{A_{tot}} &= \sqrt[3]{\frac{F_{A1}^3 \cdot L_1 + F_{A2}^3 \cdot (L_2 - L_1)}{L_{21}}} \\ &= \sqrt[3]{\frac{(7 \text{ kN})^3 \cdot 15 \text{ mm} + (5 \text{ kN})^3 \cdot 5 \text{ mm}}{20 \text{ mm}}} \\ &= 6.6 \text{ kN} \end{aligned}$$

An ASCA servo screw PWG 16 with lead $p = 2 \text{ mm}$ is used.

The dynamic load rating is 26 kN.

The service life is calculated as follows:

$$L_{10} = 10^6 \left(\frac{26 \text{ kN}}{6.6 \text{ kN}} \right)^3 \text{ revs.} \approx 61.1 \text{ million revolutions}$$

At a stroke of $s = 35 \text{ mm}$ and a lead of $p = 2 \text{ mm}$, the ASCA servo screw makes 17.5 revolutions per stroke.

The service life in strokes is calculated as:

$$\frac{61.1 \text{ mill.}}{17.5} = 3.5 \text{ million strokes}$$

Calculation of motor torque and speed

Calculation of motor torque

The driving torque of the ASCA servo screw is calculated as follows:

$$M_{\text{PVG}} = \frac{p \cdot F_a}{2\pi \cdot \eta_{\text{PVG}}}$$

M_{PVG} Driving torque of ASCA servo screw

p Lead

F_a Axial force

η_{PVG} Efficiency of ASCA servo screw

Sample calculation

At an axial force of $F = 14 \text{ kN}$, a screw lead of $p = 1 \text{ mm}$ and an efficiency of the ASCA servo screw of 85 %, the driving torque required for the ASCA servo screw is obtained as follows:

$$M_{\text{PVG}} = \frac{1 \text{ mm} \cdot 14 \text{ kN}}{2\pi \cdot 0.85} = 2.62 \text{ Nm}$$

The bearing friction must also be considered when designing the motor torque; it depends on the type of bearing and the lubrication.

More precise data should be requested from the bearing manufacturer.

In this example the bearing friction at 14 kN is approx. 0.5 Nm.

A required driving torque for the motor of approx. 3.12 Nm is obtained. Safety factors of 30-50 % should be considered when selecting the motor.

* Efficiency at rated load and a speed of $n = 200 \text{ rpm}$; lower efficiency can be expected at higher speeds due to the increasing grease friction

Calculation of motor speed

The motor speed is calculated as follows:

$$n = \frac{s}{p \cdot t_{\text{stroke}}}$$

s Stroke

p Lead

t_{stroke} Time in which the stroke s must be travelled

In the above example a stroke of approx. 10 mm should be completed in less than 0.5 s.

Without considering acceleration and braking, this gives:

$$n = \frac{s}{p \cdot t_{\text{stroke}}} = \frac{10 \text{ mm}}{1 \text{ mm} \cdot 0.5 \text{ s}} \cdot \frac{60 \text{ s}}{\text{min}} = 1200 \frac{1}{\text{min}}$$

The duration for acceleration and braking can only be calculated when the mass moment of inertia is known.

A required average speed for the motor of $n = 1200 \text{ rpm}$ is obtained.

A correspondingly higher maximum speed would result if acceleration and braking were included.

Speed limit

The following factor applies to the maximum speed limit of the ASCA servo screw:

$$d \cdot n < 140\,000$$

d ASCA servo screw nominal diameter in mm

n Speed in rpm

Sample calculation

An ASCA servo screw PWG 44 is to be operated at a speed $n = 3000 \text{ rpm}$.

The nominal diameter is $d = 43.4 \text{ mm}$.

This gives:

$$d \cdot n = 43.4 \text{ mm} \cdot 3000 \frac{1}{\text{min}} = 130\,200 < 140\,000$$

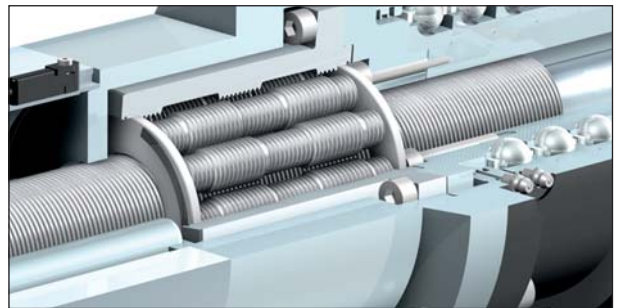
Therefore a speed of 3000 rpm is allowable for the ASCA servo screw.

Electric power instead of oil

SERAC® electric cylinder – with integrated ASCA servo screw

With the development of the SERAC® electric cylinder, all the technological advantages of an ASCA servo screw can be exploited in a complete series solution.

The direct power transmission of the ASCA servo screw (without additional reduction gears) and the smooth motion without roller resetting provide a range of unique selling points (page 21).





Ultra compact models with high power density for limited space applications

With the high control quality of the backlash-free ASCA servo screw, applications with very short cycle times are possible.

So SERAC® electric cylinders are suitable for many different uses as a clean alternative to hydraulic cylinders.

With the typical slimline design of the SERAC® electric cylinders, it is possible in many cases to replace the hydraulic cylinders in existing systems.

Typical applications



Joining



Punching



Forming



Bending

The specific SERAC® system advantages offer new options for many different applications

- Maximum power density due to small screw leads
- Screw lead selectable in 1 mm steps, so good adaptability to the application
- Direct power transmission of the ASCA servo screw without additional gears, so good variability and high dynamics
- Long life through the use of a heavy duty screw drive with many force transmission points
- No axial backlash
- ASCA servo screw subject to slip, so long life even with short strokes
- Integrated linear travel measurement system for maximum positioning accuracy under load
- Low noise through the use of the ASCA servo screw without roller resetting
- Made in Germany

Complete solutions ready for connection

SERAC® XH

The slimline design largely corresponds to a hydraulic cylinder, so that the construction cost of conversion to an electric drive is low in many cases. In this series the motor shaft is rod style. So superior dynamic performance is achieved.



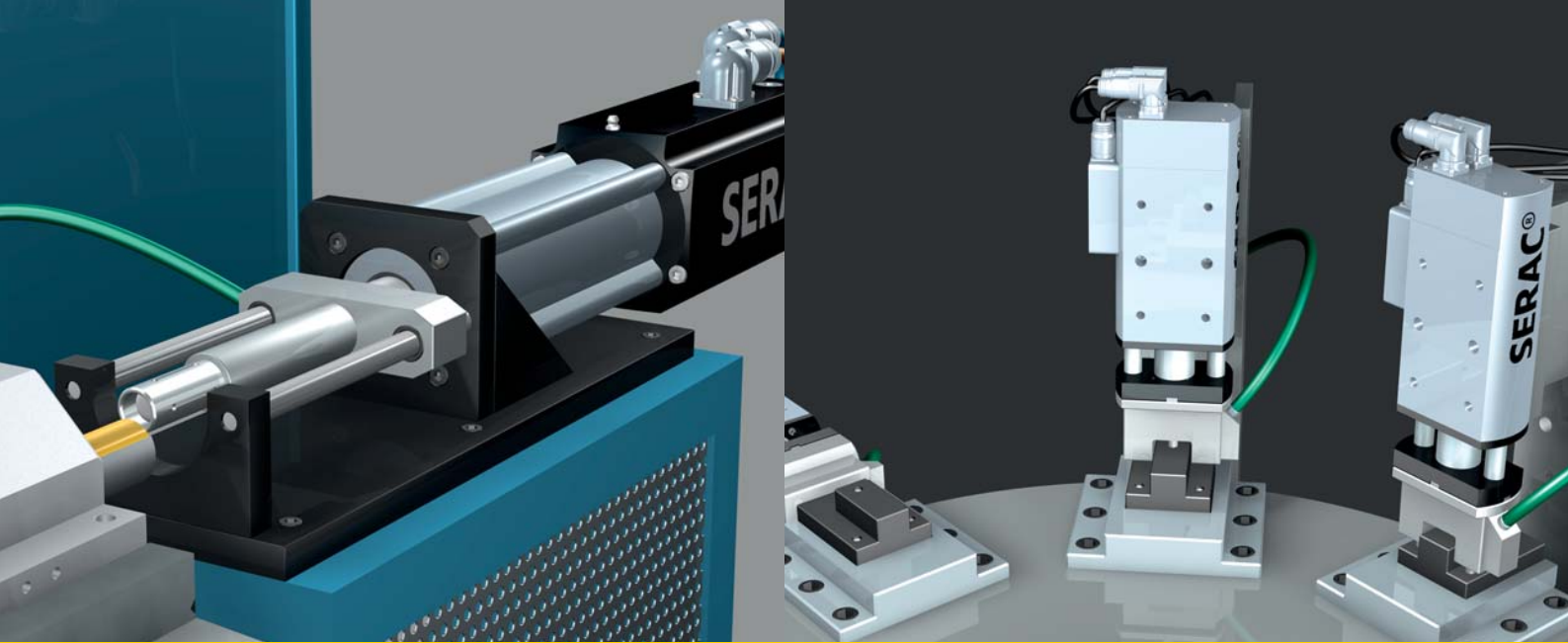
SERAC® XH5 and XH12
Stroke length up to 150 mm
Maximum axial force 4.5 kN to 12 kN
Max. speed 320 mm/s
More from page 24

SERAC® KH

High-rigidity construction with stable guide to absorb overhung loads in a compact housing. Front and side mounting options for customized installation.

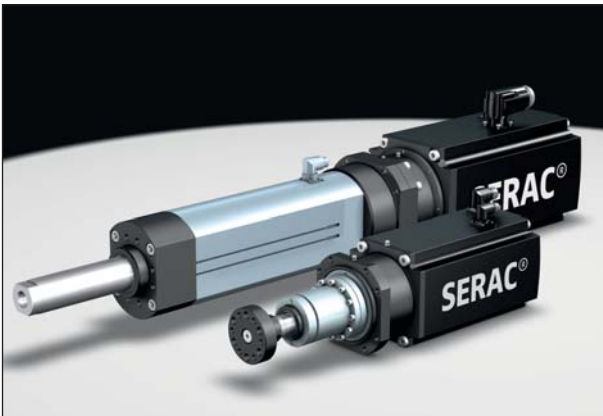


SERAC® KH5 to KH30
Stroke length up to 90 mm
Maximum axial/radial force ± 4.5 kN to ± 30 kN
Max. speed 230 mm/s
More from page 28



SERAC® LH

A fully modular structure characterises the LH series. The design with hollow shaft motor and directly driven screw nut allows long strokes to be obtained in this ultra compact electric cylinder.



SERAC® LH50 / LH100
 Stroke length up to 200 mm
 Maximum axial force 60 kN to 100 kN
 Max. speed 313 mm/s
 More from page 32

ServoOne

The servo controls should preferably be high-performance controllers from LTI, but it is also possible to use controllers of your choice for the drive control.



ServoOne servo controller
 With DriveManager 5 PC user software
 More from page 36

The robust electric cylinder for high dynamics applications



SERAC® XH – ultra slim design

In many cases this compact electric cylinder is ideally suited for direct use instead of hydraulic cylinders.

The shaft of the torque motor is in the form of a screw at the output end, to drive the nut directly. This results in a low mass moment of inertia, giving optimum dynamic behaviour.

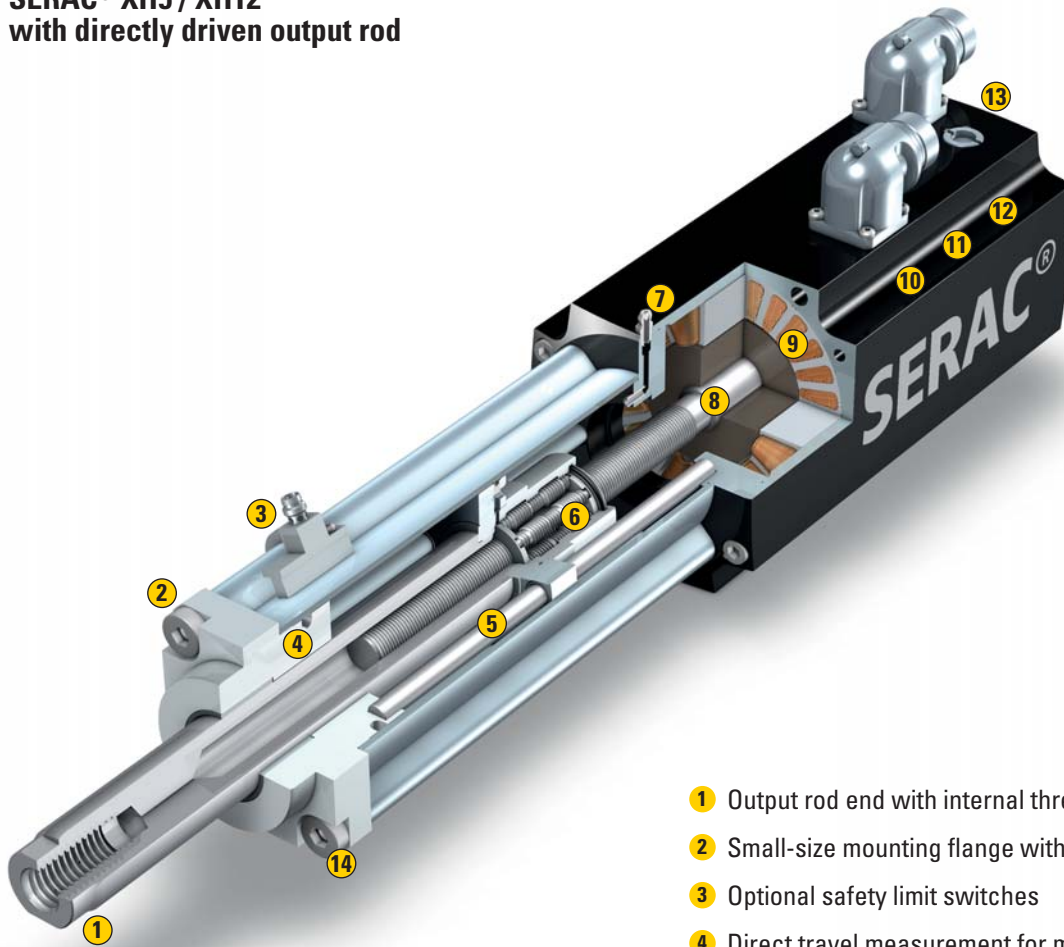
Maximum force 12 kN
Maximum speed up to 320 mm/s
Acceleration up to 26.5 m/s²
Stroke up to 150 mm

Short profile:

- Suitable for high dynamics applications (acceleration up to 26.5 m/s² possible)
- Low moment of inertia due to power transmission via output rod
- High control quality for rapid positioning
- Very short cycle times achieved
- Integrated locking element for smart designs
- Limit switch mountable directly on the cylinder
- SERAC® XH is available with optional holding brake

SERAC® electric cylinders can be operated with servo controllers from a range of well-known manufacturers. For complete, one-stop solutions, we cooperate with LTi DRIVES, manufacturer of the LTi ServoOne controller (page 36).

SERAC® XH5 / XH12
with directly driven output rod



Pictured:
SERAC® XH12

- 1 Output rod end with internal thread (M16 x 32 mm)
- 2 Small-size mounting flange with internal threads
- 3 Optional safety limit switches
- 4 Direct travel measurement for maximum positioning accuracy under load
- 5 Guide with locking element
- 6 ASCA servo screw
- 7 Lubricating nipple for screw drive
- 8 Motor shaft and screw in one piece
- 9 Torque motor with low cogging torque
- 10 High-quality bearing
- 11 Motor holding brake
- 12 Motor encoder (resolver or sin/cos 1 Vss)
- 13 Electrical connections (power and encoder connectors)
- 14 M6 internal thread for flange mounting



Performance data

SERAC® XH5 / XH12 performance data

Model	Lead mm	Continuous force ¹		Maximum force ²		Speed ³ mm/s	Brake holding force kN	Force constant ⁴ kN/A	Acceleration ⁵ m/s ²
		kN	Current A	kN	Current A				
SERAC® XH5	1	2.2	1.1	4.5	2.5	125	4.5	1.9	13.3
	2	1.2	1.1	3.6	4.0	250	2.8	1.1	26.5
SERAC® XH12	1	12.0	3.5	12.0	3.5	75	12.0	3.4	4.5
	2	9.8	5.3	12.0	6.5	150	12.0	1.9	9.1
	3	7.2	5.3	12.0	9.2	225	12.0	1.4	13.6
	4	5.8	5.3	12.0	11.8	300	11.0	1.1	18.2

¹ Continuous force at low speed (only 2/3 thereof at complete standstill)

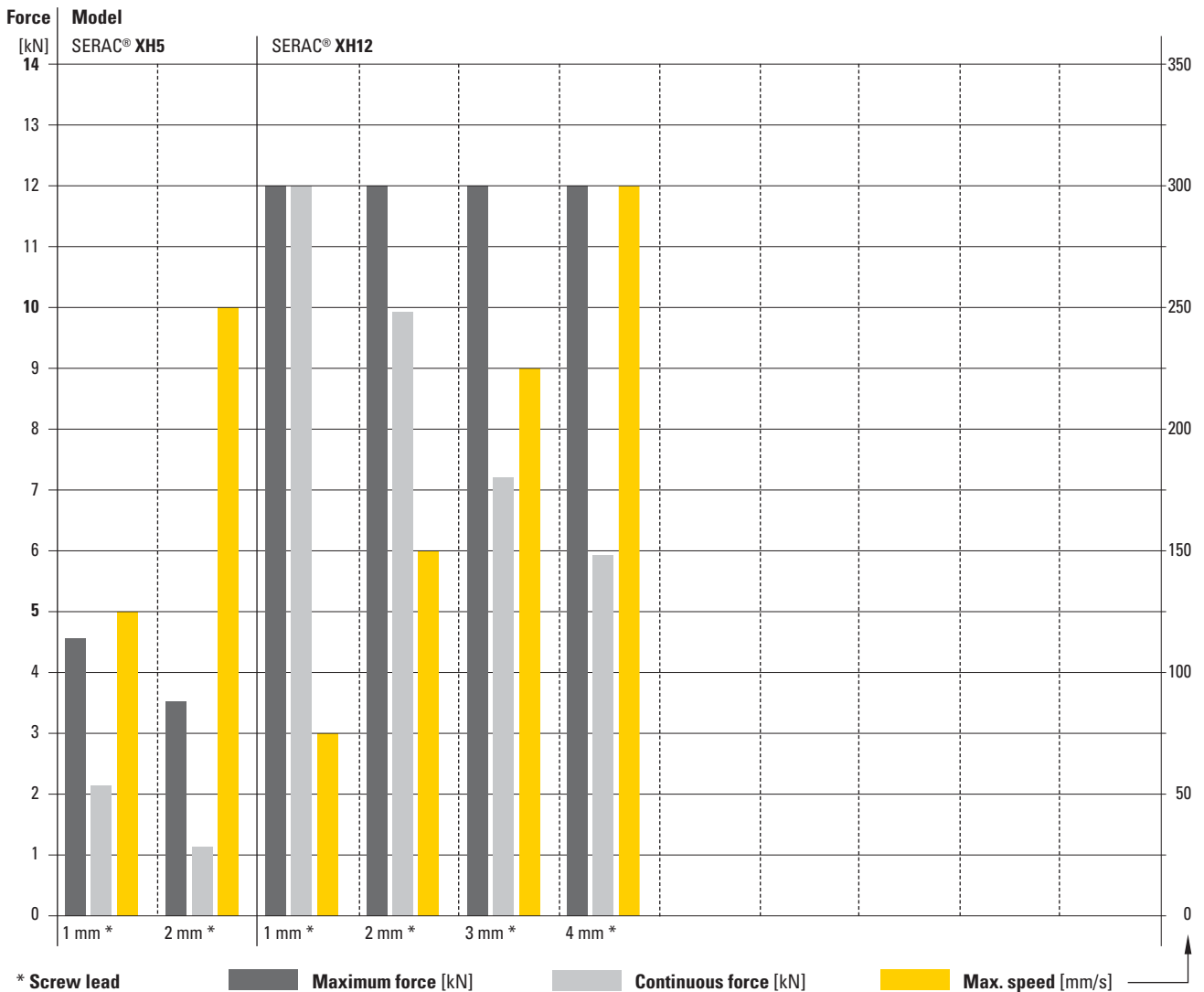
² Maximum short-time force

³ Maximum short-time speed at continuous force

⁴ Force per ampere at low constant speed

⁵ No-load acceleration at twice rated current

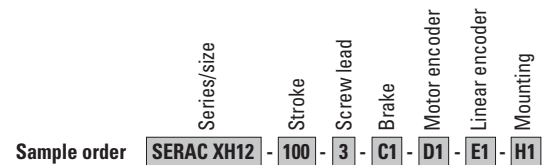
Screw leads from 1 to 4 mm



Model codes and stroke lengths

SERAC® XH model codes/order data

Equipment parameter	Model specification	Order code	Series/size	
			XH5	XH12
Stroke	50 mm		050	050
	100 mm		100	100
	150 mm			150
	200 mm			200
Screw lead	1 mm		1	1
	2 mm		2	2
	3 mm			3
	4 mm			4
Brake	0 = No brake	C	0	0
	1 = Holding brake 24 VDC	C	1	1
Motor encoder	1 = Resolver, 2-pole	D		1
	2 = sin/cos 1 Vss	D	2	
Linear encoder	0 = No linear encoder	E	0	0
	1 = Direct travel measurement, incremental, sin/cos 1 Vss	E	1	1
	2 = Direct travel measurement, incremental, RS422	E	2	2
	3 = Direct travel measurement, SSI absolute	E		3
Mounting	1 = Front flange mounting	H	1	1
	2 = Swivel bearing in motor area	H		2



Dimensions and stroke lengths

Model	Stroke (H)	Length (L) *
SERAC XH5-050...C0	50	222
SERAC XH5-100...C0	100	272

* Models with brake (C1) are 15 mm longer



Model	Stroke (H)	Length (L) *	
		E0 / E1 / E2	E3 (SSI absolute)
SERAC XH12-050...	50	328	378
SERAC XH12-100...	100	378	428
SERAC XH12-150...	150	428	478
SERAC XH12-200...	200	478	528

* Both models (with and without brake) have same length

All dimensions in mm



Ultra compact electric cylinder for short strokes



SERAC® KH – All in, all on

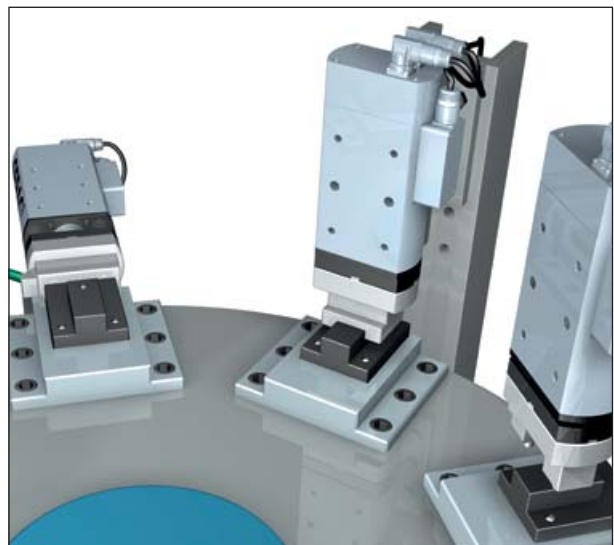
The striking housing design of the SERAC® KH electric cylinder is both attractive and eminently practical. All the components of this complete, preassembled drive are housed in this totally smooth housing.

Maximum force 30 kN
 Maximum short-time speed up to 320 mm/s
 Acceleration up to 12.7 m/s²
 Stroke up to 90 mm

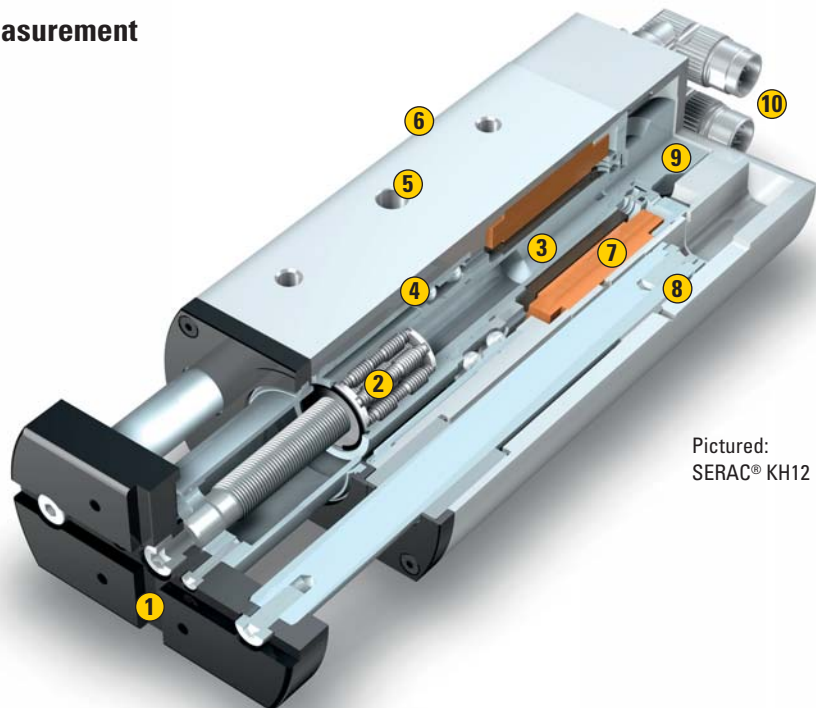
Short profile:

- High rigidity construction
- Stable guide to absorb overhung loads
- Short length
- Side mounting options or flange mounting for customized installation
- Mounting option on either side offers universality and very easy installation
- Heat sink for liquid cooling (optional)
- Ideal uses: punching, sheet metal working
- Direct travel measurement for maximum positioning accuracy under load

SERAC® electric cylinders can be operated with servo controllers from a range of well-known manufacturers. For complete, one-stop solutions, we cooperate with LTI DRIVES, manufacturer of the LTI ServoOne controller (page 36).

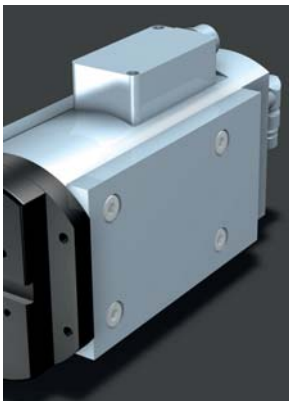


SERAC® KH5 / KH12 / KH30
with integrated guide and travel measurement

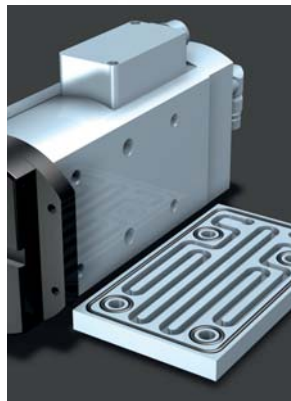


Pictured:
SERAC® KH12

Flexible in use and equipment



Optional liquid cooling with adaptable cooling plates to increase the continuous rating



Mounting option on either side offers universality and very easy installation



The housing cover (A side) is available with optional flange version for front mounting

- 1 Grooves for exact tool positioning; asymmetrical hole pattern to ensure tool is mounted in the correct position
- 2 ASCA servo screw
- 3 Motor shaft and screw nut in one piece
- 4 High-quality bearing for very high rigidity and service life
- 5 Holes for locating pins for exact positioning and force transmission
- 6 Direct travel measurement for maximum positioning accuracy under load
- 7 Torque motor with low cogging torque
- 8 Stable guide due to wide bearing span; ball bushings to absorb overhung loads
- 9 Motor encoder (resolver or Hiperface)
- 10 Electrical connections (power and encoder connectors)

SERAC® KH5 / KH12 / KH30 performance data

Model	Lead mm	Continuous force ¹		Maximum force ²		Speed ³ mm/s	Force constant ⁴ kN/A	Acceleration ⁵ m/s ²
		kN	Current A	kN	Current A			
SERAC® KH5	1	2.0	1.1	4.5	2.8	125	1.8	4.8
	2	1.2	1.1	3.6	4.0	250	1.1	9.6
SERAC® KH12	1	7.6	2.6	12.0	4.1	80	3.0	3.2
	2	4.5	2.6	11.1	6.3	160	1.8	6.4
	3	3.3	2.6	8.0	6.3	240	1.3	9.5
	4	2.5	2.6	6.0	6.3	320	1.0	12.7
SERAC® KH30	1	30.0	6.4	30.0	6.4	55	4.7	1.9
	2	18.5	6.5	30.0	10.8	110	2.8	3.7
	3	13.3	6.5	30.0	15.5	165	2.0	5.6
	4	10.0	6.5	30.0	22.0	220	1.5	7.5
	5	8.0	6.5	30.0	30.0	275	1.2	9.3

¹ Continuous force at low speed (only 2/3 thereof at complete standstill)

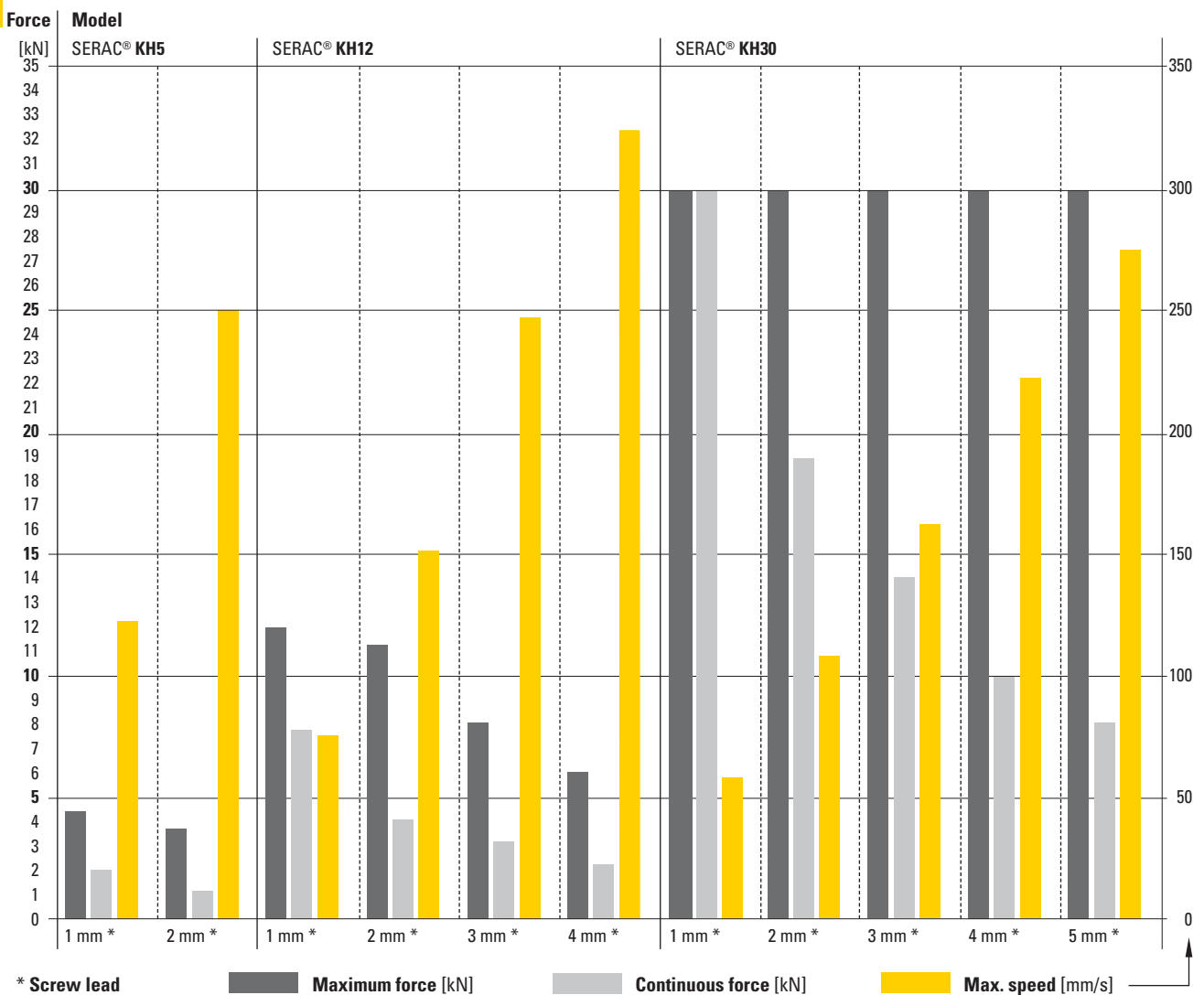
² Maximum short-time force

³ Maximum short-time speed at continuous force

⁴ Force per ampere at low constant speed

⁵ No-load acceleration at twice rated current

Screw leads from 1 to 5 mm



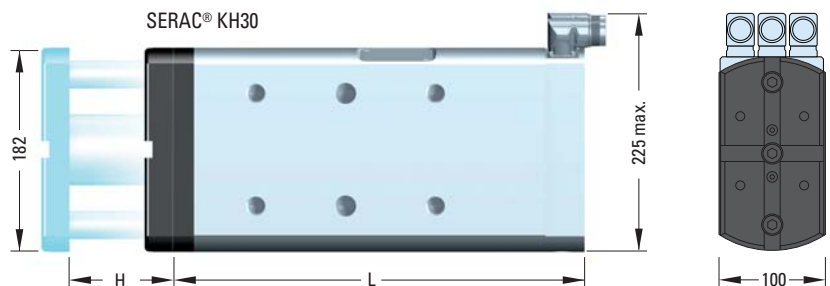
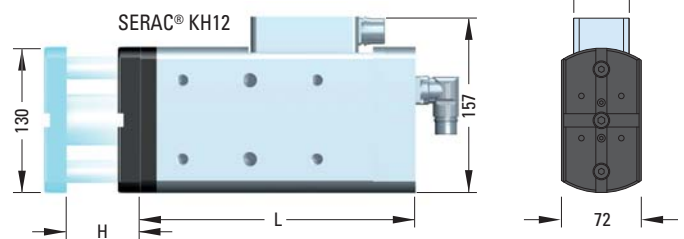
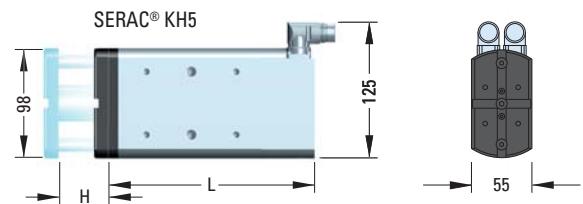
Model codes and stroke lengths

SERAC® KH model codes/order data

Equipment parameter	Model specification	Order code	Series/size		
			KH5	KH12	KH30
Stroke	45 mm		45		
	65 mm			65	
	90 mm				90
Screw lead	1 mm		1	1	1
	2 mm			2	2
	3 mm			3	3
	4 mm			4	4
	5 mm				5
Motor encoder	1 = Resolver, 2-pole	D	1	1	1
	2 = Hiperface	D		2	2
Linear encoder	0 = No linear encoder	E	0	0	0
	1 = Direct travel measurement, incremental, sin/cos 1 Vss	E	1	1	1
	2 = Direct travel measurement, incremental, RS422	E	2	2	2
	3 = Direct travel measurement, SSI absolute	E		3	3
Mounting	1 = Front flange mounting	H	1	1	1
	2 = Side mounting	H	2	2	2

Sample order **SERAC KH12 - 65 - 3 - D1 - E1 - H1**

Series/size
Stroke
Screw lead
Motor encoder
Linear encoder
Mounting

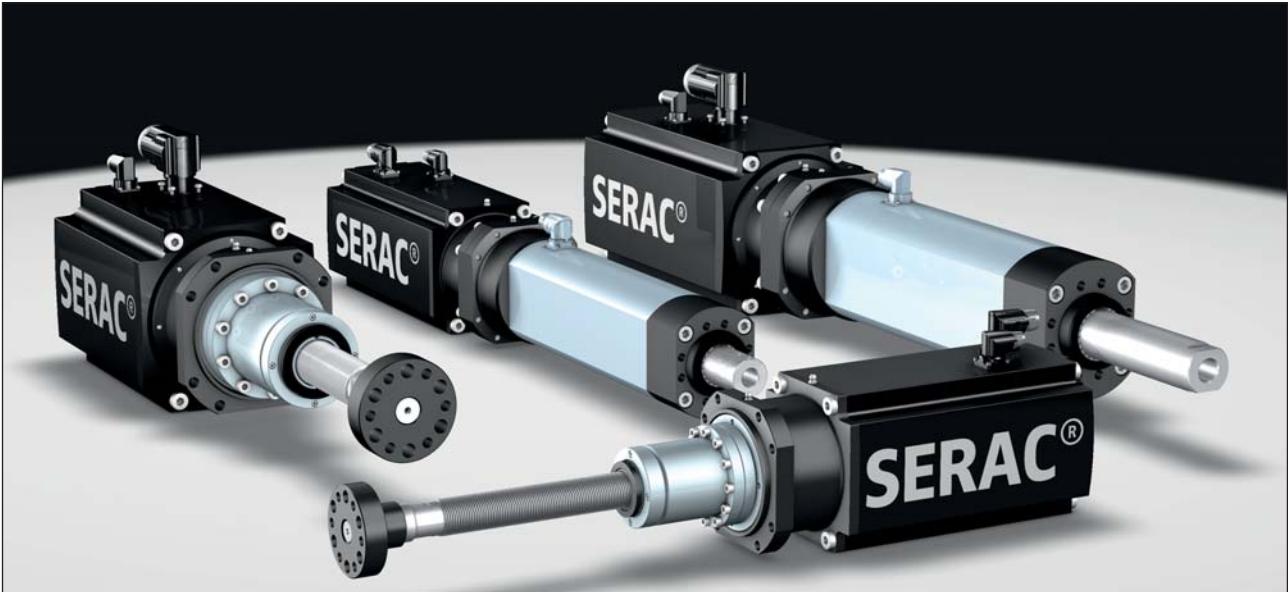


Dimensions and stroke lengths

Model	Stroke (H)	Length (L)
SERAC KH5	45	184
SERAC KH12	65	245.5
SERAC KH30	90	367

All dimensions in mm

Electric cylinder with or without integrated locking element



SERAC® LH – Modular structure for a many different solutions

All the options in any combination can be selected over and above the basic LH50 and LH100 versions:

- Anti-rotate unit (fully enclosed)
- Motor holding brake
- Linear measuring system
- Stroke length 200 mm
- Different screw leads
- Different motor encoders

Some upgrade and conversion retrofits can also be carried out by us.

On this series the screw nut is driven directly by a hollow shaft torque motor.

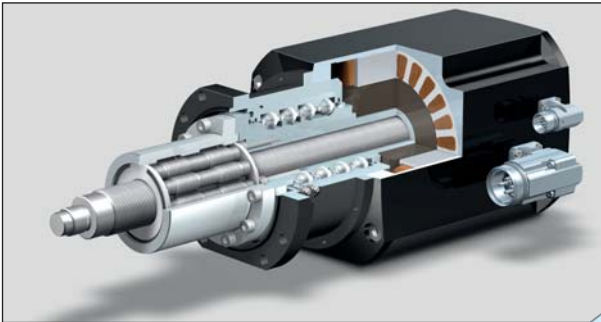
Short profile:

- Slimline cylindrical design
- Rigid construction
- Modular construction
- Anti-rotate unit, holding brake, integrated linear travel measurement etc. optional
- Small lead (e.g. 1.5 mm) possible even at high forces (100 kN)
- Limit switch mountable directly on cylinder
- Size LH30 is under preparation

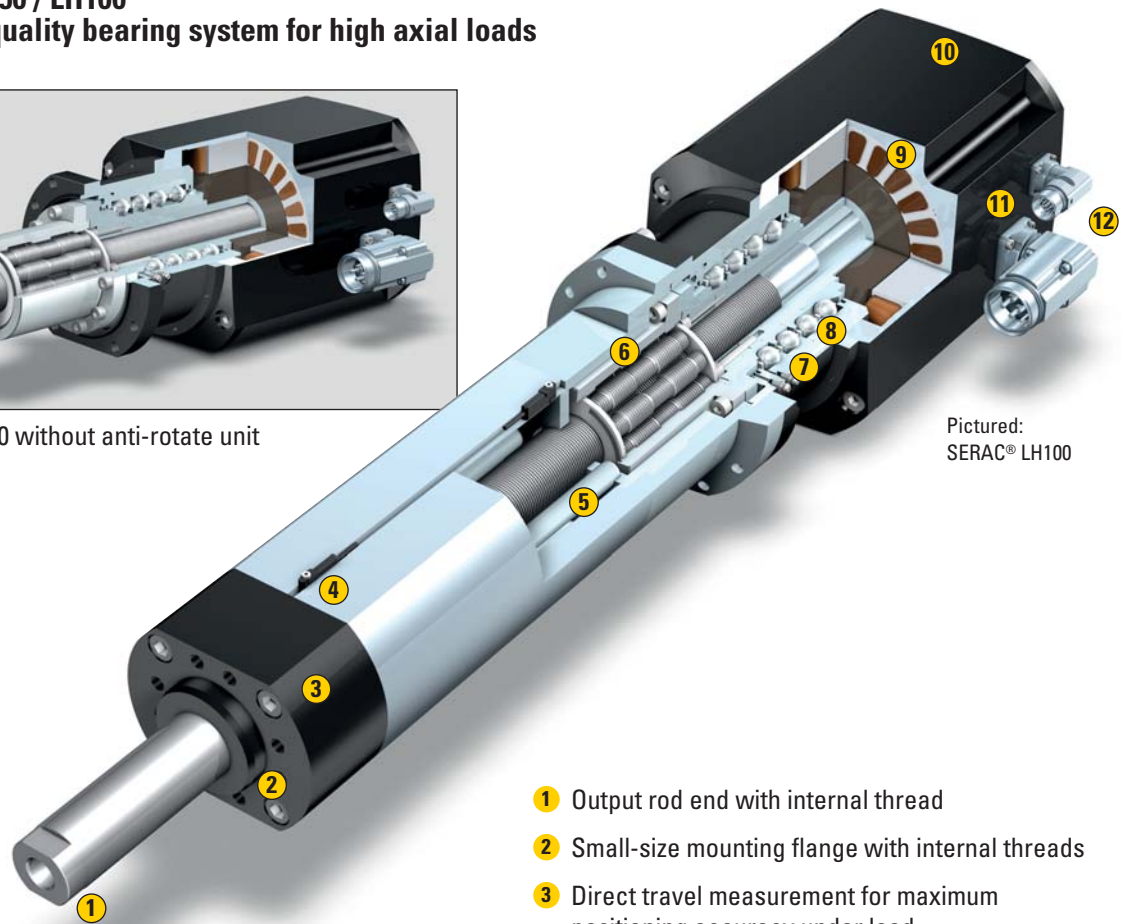
SERAC® electric cylinders can be operated with servo controllers from a range of well-known manufacturers. For complete, one-stop solutions, we cooperate with LTI DRIVES, manufacturer of the LTI ServoOne controller (page 36).

Maximum force 100 kN
 Maximum short-time speed up to 313 mm/s
 Acceleration up to 4.7 m/s²
 Stroke up to 200 mm

SERAC® LH50 / LH100
with high-quality bearing system for high axial loads



SERAC® LH100 without anti-rotate unit



Pictured:
SERAC® LH100

- 1 Output rod end with internal thread
- 2 Small-size mounting flange with internal threads
- 3 Direct travel measurement for maximum positioning accuracy under load
- 4 Optional safety limit switches
- 5 Guide with anti-rotate unit
- 6 ASCA servo screw with directly driven screw nut
- 7 Lubricating nipple for screw and bearing system
- 8 High quality bearing system
- 9 Hollow shaft torque motor with low cogging torque
- 10 Motor encoder (resolver or Hiperface)
- 11 Motor holding brake
- 12 Electrical connections (power and encoder connectors)

SERAC® LH50 / LH100 performance data

Model	Lead mm	Continuous force ¹		Maximum force ²		Speed ³ mm/s	Brake holding force kN	Force constant ⁴ kN/A	Acceleration ⁵ m/s ²
		kN	Current A	kN	Current A				
SERAC® LH50	1.5	60	17	60	17	65	60	3.6	1.2
	3	37	19	60	31	130	60	2.0	2.3
	4.5	27	19	60	44	195	60	1.4	3.5
	6	22	19	60	57	260	30	1.2	4.7
SERAC® LH100	1.5	100	28	100	28	63	100	3.6	0.5
	3	59	30	100	53	125	100	2.0	1.1
	4.5	43	30	100	79	188	100	1.4	1.6
	6	35	30	100	108	250	100	1.2	2.1
	7.5	28	30	90	132	313	100	0.9	2.7

¹ Continuous force at low speed (only 2/3 thereof at complete standstill)

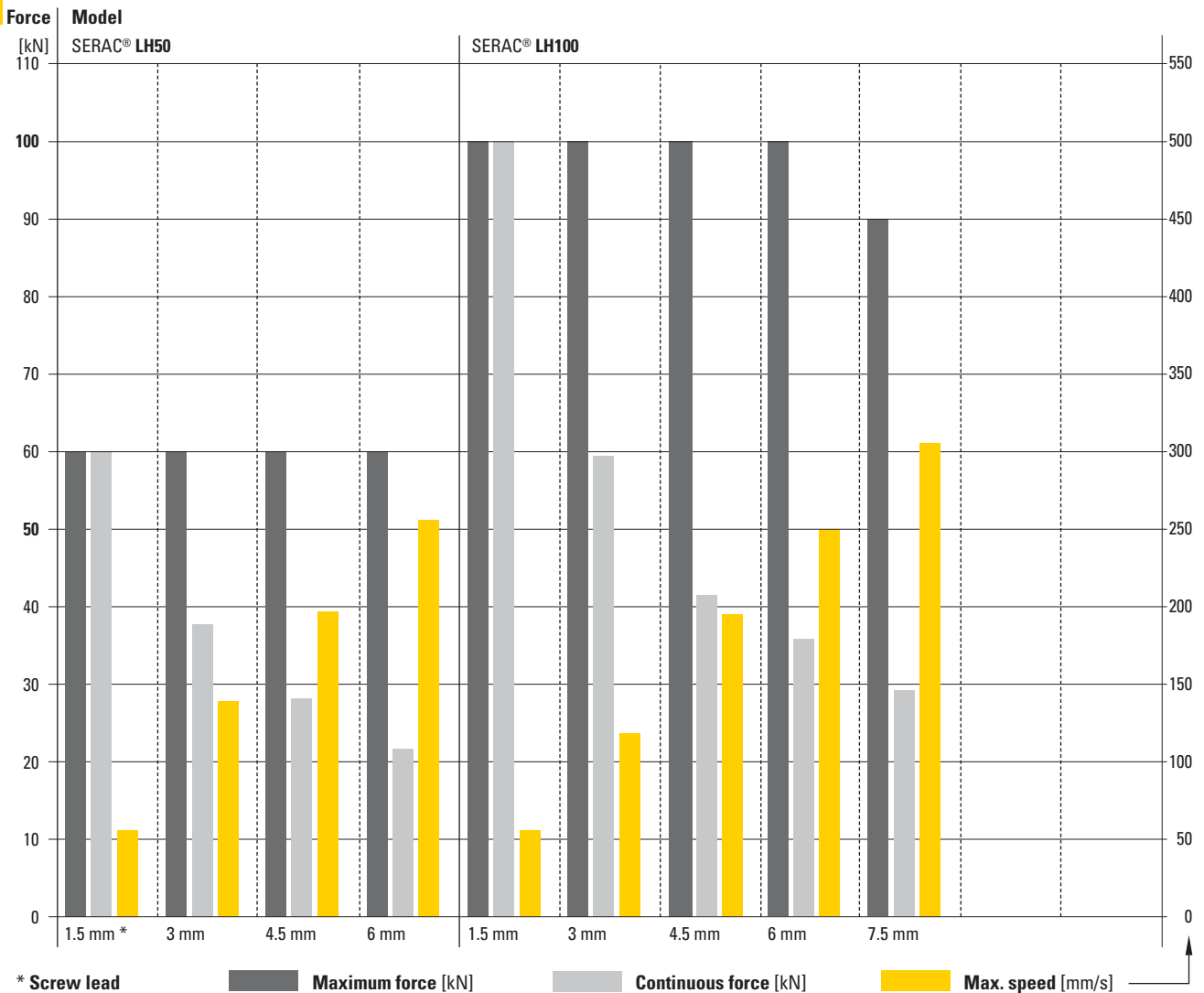
² Maximum short-time force

³ Maximum short-time speed at continuous force

⁴ Force per ampere at low constant speed

⁵ No-load acceleration at twice rated current

Screw leads from 1.5 to 7.5 mm

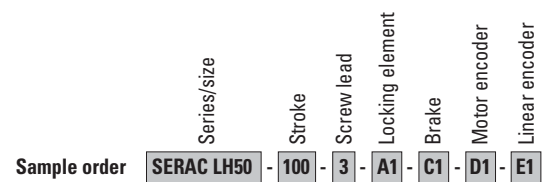


Model codes and stroke lengths

SERAC® LH model codes/order data

Equipment parameter	Model specification	Order code	Series/size	
			LH50	LH100
Stroke *	100 mm		100	100
	200 mm		200	200
Screw lead	1.5 mm		1.5	1.5
	3 mm		3	3
	4.5 mm		4.5	4.5
	6 mm		6	6
	7.5 mm			7.5
Locking element	0 = Without guide or locking element	A	0	0
	1 = With guide and locking element	A	1	1
Brake	0 = No brake	C	0	0
	1 = Holding brake 24 VDC	C	1	1
Motor encoder	1 = Hiperface, single turn absolute encoder	D	1	1
	2 = Resolver, 2-pole	D	2	2
Linear encoder	0 = No linear encoder	E	0	0
	1 = Direct travel measurement, SSI absolute (only possible for A1)	E	1	1
	2 = Direct travel measurement, incremental, sin/cos 1 Vss (only possible for A1)	E	2	2
	3 = Indirect travel measurement, incremental, sin/cos 1 Vss	E	3	3

* Greater strokes on request

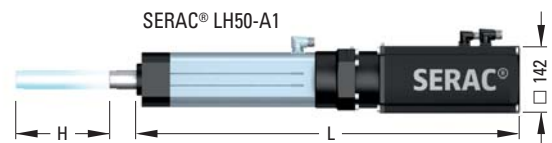


Dimensions and stroke lengths

SERAC® LH50

Model	Stroke (H)	Length (L)
SERAC LH50-100-A0-C0	100	433
SERAC LH50-100-A0-C1	100	468
SERAC LH50-200-A0-C0	200	433
SERAC LH50-200-A0-C1	200	468

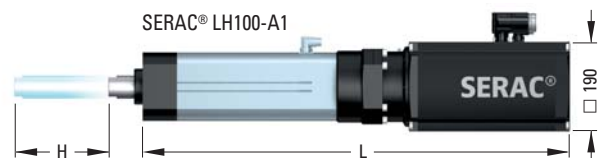
Model	Stroke (H)	Length (L)
SERAC LH50-100-A1-C0	100	668.5
SERAC LH50-100-A1-C1	100	706.5
SERAC LH50-200-A1-C0	200	768.5
SERAC LH50-200-A1-C1	200	806.5



SERAC® LH100

Model	Stroke (H)	Length (L)
SERAC LH100-100-A0-C0	100	489
SERAC LH100-100-A0-C1	100	550
SERAC LH100-200-A0-C0	200	489
SERAC LH100-200-A0-C1	200	550

Model	Stroke (H)	Length (L)
SERAC LH100-100-A1-C0	100	748
SERAC LH100-100-A1-C1	100	809
SERAC LH100-200-A1-C0	200	848
SERAC LH100-200-A1-C1	200	909



All dimensions in mm

ServoOne – the system integrated servo controllers



SERAC® and ServoOne

If you prefer one-stop linear drive solutions, we can offer you pre-parametered LTi servo controllers to suit your application, in close cooperation with LTi DRIVES GmbH.

The hardware and software in the ServoOne servo controller range offer unrestricted use of the specific dynamics of the SERAC® electric cylinders.

Two series for customized solutions

The servo controllers in the ServoOne and ServoOne junior series are used.

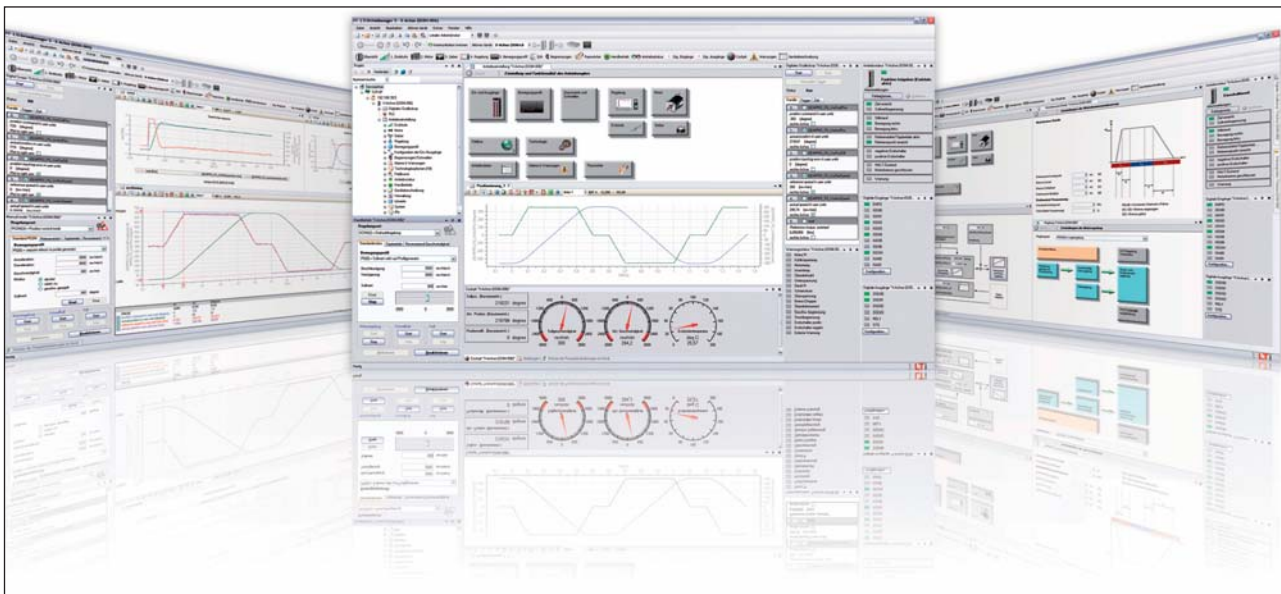
Pictured above, left to right, are:

- ServoOne junior BG2 (rated current 3.5 A)
- ServoOne junior BG4 (rated current 6.5 A)
- ServoOne BG1 (rated current 6 A)
- ServoOne BG3 (rated current 20 A)

Short ServoOne profile:

- **High-speed communication**
Via popular field bus interfaces such as PROFIBUS, EtherCAT®, SERCOS II & III, PROFINET IRT, CANopen® ...
- **High-performance control**
For precise and dynamic linear motion
- **Optional integration of iPLC to IEC 61131**
Allows rapid adaptation to the actual application with direct access to the drive controller peripherals
- **Integrated functional safety**
STO (Safe Torque Off) as standard. Other functions are available as options
- **Compact size**
For optimum control cabinet utilization

PC user software and peripherals



DriveManager 5

With the DriveManager PC user software, parameter adjustments and fine tuning can be carried out during commissioning. The user has access to all the main parameters.

At the same time the DriveManager with cockpit and 6-channel oscilloscope offers extremely good diagnosis options and support with project management.

Activation

The servo controller can be controlled via either the most popular field bus systems or an integrated PLC to IEC 61131 or analog and digital inputs.

Parameter set

For quick and easy commissioning of the drive, the servo controllers are equipped before delivery with a parameter set tailored to SERAC® drives. It contains the motor data, the encoder parameter settings and a basic setting for the controller.

After connection to the field bus system of the installation, the many different drive functions can then be obtained by a few adjustments to the parameter set.

New Help system

- DriveManager 5 Help
- Device Help for ServoOne single-axis system and ServoOne junior
- The Help is implemented in DriveManager 5
- It is also available separately as a chm or pdf file under Downloads.

Cable sets

SERAC® drives are connected to the ServoOne servo system by preassembled power and encoder cables.

Compatible cable sets for connection to many different makes of servo controller are also available.

Other accessories for the LTi servo controller

With line chokes, brake resistors and line filters compatible with the ServoOne servo system, all the components for a complete drive package are available.

General Terms and Conditions of Sale

[effective 01/11]

I. Scope

1. Our General Terms and Conditions of Sale apply to all – including future – legal relationships between the parties to the Contract. Agreements to the contrary are only valid if confirmed by us in writing.
2. We are not bound by any contrary or contradictory General Terms and Conditions of the other party to the Contract – hereinafter referred to as the Purchaser – even if we do not expressly object to them.
3. Our Terms and Conditions only apply in respect of Companies as defined in § 310 Section 1 BGB [Civil Code].
4. Should any provision contained in our General Terms and Conditions of Sale prove to be or become invalid the validity of all remaining provisions shall not be thereby affected.

II. Tender and Tender Documentation

1. Our tender is subject to confirmation in the absence of anything to the contrary ensuing from the offer.
2. We can accept orders within a period of 6 weeks. The said period commences upon receipt of order.
3. Our written Confirmation of Order is definitive in respect of supply of goods or services. Assurances regarding characteristics, supplements or ancillary agreements must be in writing to take legal effect.
4. Our sales staff are not authorised to enter into verbal ancillary agreements or to give assurances extending beyond the content of the written Contract.
5. We retain title and intellectual property rights to all diagrams, drawings, calculations and other documentation. Prior to transmission thereof to third parties the Purchaser requires our express written permission.
6. We are entitled to make part deliveries if this may be considered reasonable for the customer.

III. Prices and Terms of Payment

1. If nothing to the contrary emerges from the Confirmation of Order our prices are „ex stock“ or „ex works“ and exclusive of shipping and handling charges, customs or excise duty, packaging and are liable to the prevailing rate of statutory VAT.
2. Minimum value of goods per order is EUR 25.00 net.
3. Separately invoiced are market-dependent surcharges for raw materials at current daily prices. Similarly, services over and above the purchase price plus additionally agreed work are separately invoiced. We reserve the right to adjust our prices accordingly if subsequent to conclusion of the Contract cost reductions or cost increases, in particular as a consequence of collective wage agreements, changes in the cost of materials or currency fluctuations take place. Evidence of the above shall be made available to the Purchaser on request.
4. Deduction of discount requires separate written agreement. If nothing to the contrary emerges from the Confirmation of Order the net purchase price shall be due for payment (without deduction) within 8 days from date of invoice. Part invoices shall be presented for part deliveries. Payment terms shall run separately for each part invoice. Statutory provisions apply in the event of payment arrears. Discounts are forfeit and payment due immediately if there is payment default in respect of any other goods or services. This also applies in the event of any out-of-court composition proceedings or any court insolvency proceedings with effect from the point in time of application.
5. We only accept drafts or cheques in payment and not in lieu of payment after separate agreement. Our account is not settled until the date on which the funds are available to us without having to make allowance for charge-back claims. Collection charges, discount charges or bill charges including interest shall in all cases be borne by the Purchaser and are payable immediately.
6. The Purchaser may only offset against a claim which is undisputed or legally binding. He may only exercise a right of retention to the extent that his counterclaim is based on the same contractual relationship.
7. One-off costs such as for example tooling and development costs are invoiced at 50 % directly upon receipt of order. The remaining 50 % of the said costs are due upon delivery of the first series production components.

IV. Product Information and Design Modifications

1. The Purchaser undertakes to provide us with a comprehensive description of every aspect and detail of the conditions under which the goods supplied shall be used.
2. We reserve the right to introduce design modifications in the interests of technical progress provided the latter do not involve any changes in the function of the goods.

V. Delivery Period

1. Information regarding delivery periods is unbinding unless the delivery date has been exceptionally agreed as „binding“.
2. The delivery period shall commence with the date of confirmation of order but not however prior to provision of items required to be furnished by the Purchaser i.e. supporting documentation, official approvals and releases including receipt of any agreed payment, opening of any letter of credit required or evidence of arrangement of any collateral agreed.
3. The delivery period shall be deemed met if the goods have left the Kirchheim/Teck warehouse facility within the delivery period.
4. Should any unforeseen impediments outside our control arise which despite the requisite care required given the particular circumstances of the case we are not in a position to avert – irrespective of whether the said impediments occur with us or at subcontractors – including force majeure (e.g. war or natural catastrophe) or delays in the supply of essential raw materials or other circumstances for which we are not responsible – we are entitled to withdraw from the Supply Contract either wholly or in part or alternatively to extend the delivery period by the duration of the impediment. We shall be entitled to the same rights in the event of strikes and lockouts at our premises or those of our upstream suppliers. We shall immediately notify our customers of any such circumstances.
5. In the event of delay in delivery the Purchaser may, following the expiry of an appropriate period of grace to no effect, withdraw from the Contract; in the event of the practical impossibility of supply of goods on our part he is also entitled to do so without notice. A period of 14 days shall be deemed appropriate and in the case of special custom-made products this shall be a minimum of 1 month. Delayed delivery shall equate to impossibility if delivery does not follow after 2 months or 12 weeks in the case of special custom-made products. Claims for damages (including any consequential loss) shall be excluded irrespective of Section 6; the same shall apply in the case of reimbursement of expenses.
6. The liability disclaimer provision under Section 5 shall not apply if any exclusion or restriction of liability is agreed in respect of injury to life, physical injury or damage to health which is due to intentional or negligent dereliction of duty on the part of any legal representative or vicarious agent of the user; nor shall it apply if any exclusion or limitation of liability is agreed for other forms of damage caused by any intentional or grossly negligent dereliction of duty on the part of any legal representative or vicarious agent of the user. If we culpably infringe any essential contractual obligation or any

cardinal obligation liability shall not be excluded but shall be limited to typical foreseeable contractual damage.

In the event of reimbursement of expenses the above shall apply accordingly.

7. If any commercial fixed date transaction has been agreed the liability limitations arising from Sections 5 and Section 6 shall not apply; the same applies if the Purchaser is in a position to claim that as a consequence of the delay for which we are responsible his interest in performance of the Contract ceases to apply.
8. In the case of call orders calls shall be notified to us in a timely manner to enable orderly manufacture and supply and at least 6 weeks prior to the desired delivery date. Call orders must be called forward within 12 months from the date of order if no other fixed deadlines have been agreed. If call does not follow or not completely within 12 months from the date of order or on the agreed call terms the Purchaser shall be deemed in default of acceptance.
9. Should the Purchaser fall into acceptance arrears or infringe duties of cooperation we are entitled to claim compensation for loss incurred by us including any additional expenses. In such event risk of accidental destruction or loss or accidental deterioration of the item of purchase shall transfer to the Purchaser if the latter is in default of acceptance.

VI. Transfer of Risk, Packaging Costs and Insurance

1. Upon handover to the forwarding agent or carrier and at the latest upon leaving our premises risk of accidental destruction or loss and accidental deterioration transfers to the Purchaser. Incoterms 2000 „ex works/ab Werk“ Clause (German version) applies.
2. Should a carrier be involved due to any circumstance for which the Purchaser is responsible or as a consequence of the latter's instructions risk shall transfer to the Purchaser with effect from the date of notification of readiness for despatch. At the express written request of the Purchaser we undertake to insure goods stored with us at the Purchaser's cost. This also applies in those cases where a delivery period has not been expressly agreed with the proviso that risk transfers to the Purchaser 7 calendar days following notification of readiness for despatch.
3. If the Purchaser wishes we shall cover delivery by transport insurance; costs in this regard shall be borne by the Purchaser.
4. Transportation and all other packaging shall not be returned subject to requirements of the German Packaging Ordinance. Pallets are excluded. The Purchaser undertakes to arrange disposal of packaging materials at his own cost.
5. Delivered items shall be received and accepted by the Purchaser even if they display minor imperfections irrespective of his rights under the terms of §§ 433 ff. BGB.

VII. Reservation of Title

1. Up to the point of full settlement of the purchase price including all subsidiary claims and prior to settlement of all other claims arising from the business association goods delivered shall remain our property. Up until that point the Purchaser is not entitled to pledge the goods to third parties or to assign them as security. The Purchaser shall store the reserved goods for us at no charge.
2. In the event of processing and combination of reserved title goods with other goods by the Purchaser we shall acquire joint title to the new item in the ratio of the invoiced value of the reserved title goods to the combined material entity. The joint title rights accordingly ensuing shall be considered as reserved title goods as defined in Clause 1.
3. The Purchaser is entitled to sell the reserved title goods in the due process of sale provided he is not in payment arrears in respect of our purchase price claims.
4. The Purchaser hereby assigns to us at this point in time all claims accruing to him as a result of resale of the reserved title goods vis-à-vis third parties. If the reserved title goods are sold following processing, combination or amalgamation assignment of the claim arising from resale shall apply only up to the extent of the value of the reserved title goods invoiced to the Purchaser by the Vendor. This shall also apply if the reserved title goods are resold together with other goods which similarly do not belong to the Vendor.
5. The Purchaser is also authorised to collect the claim even following assignment. We may restrict the said collection authorisation on the basis of justifiable interest or revoke the same on due cause founded, in particular in the event of payment arrears. We may require that the Purchaser shall notify us of the claims assigned to him and of related debtors plus all information necessary for collection and surrender to us all associated documentation and disclose the said assignment to his debtors.
6. We undertake to release the securities due to us on the basis of the above provisions at our discretion upon the Purchaser's request to the extent that their realisable value exceeds the claim secured by 20 % or more.
7. The Purchaser hereby declares his consent that the persons authorised by us in connection with assignment of the reserved title goods may enter the property or building on or in which the items are situated in order to take possession of the reserved title goods.
8. The Purchaser shall immediately inform us in respect of any confiscation, compulsory enforcement or other third party intervention adversely affecting our rights of ownership. The Purchaser shall bear the costs of measures to remedy third party interference in particular of any possible intervention procedures.

VIII. Guarantee and Liability

1. Should there be any defect for which we are responsible we are entitled to decide between rectification and replacement at our own discretion. A precondition in such an event is that the defect is not imminent. In the event of rectification we undertake to bear the costs of transportation, labour and materials provided these are not increased due to the fact that the goods supplied have not been moved to a location other than the place of performance. Should one of or both forms of remedy prove impossible or disproportionate we are entitled to refuse it. We may refuse to effect a remedy for as long as the Purchaser fails to meet his payment obligations towards us to an extent equating to the fault-free portion of the goods or services.
2. Should rectification or replacement fail to be made within an appropriate period – with due consideration of our supply options – or if rectification and/or replacement should fail the Purchaser may demand a reduction of remuneration (abatement) or withdrawal from the Contract.
3. The Purchaser's rights in the event of defect assume that the latter has met his obligation under § 377 HGB [Civil Code] to inspect and submit complaints upon receipt of the goods in a timely manner.
4. If nothing to the contrary emerges under Section 6 below further claims on the part of the Purchaser, irrespective of legal grounds (in particular claims arising from infringement of main and ancillary contractual obligations, reimbursement of expenses with the exception of those defined in § 439 II BGB, impermissible act and any other tortious liability) are excluded; this applies in particular to damage not occurring to the item supplied itself including compensation claims for lost profit; also included are claims which do not result from the faulty nature of the purchased item or a lesser quantity.
5. The above provisions also apply in the case of delivery of another item or a lesser quantity.
6. The liability disclaimer provision under Section 4 shall not apply if any exclusion or restriction of liability agreed for injury to life, physical injury or damage to health is due to intentional or

negligent dereliction of duty on the part of the user or intentional or negligent dereliction of duty on the part of any legal representative or vicarious agent of the user; nor shall it apply if any exclusion or limitation of liability is agreed for other forms of damage caused by any intentional or grossly negligent dereliction of duty on the part of any legal representative or vicarious agent of the user.

If we culpably infringe any essential contractual obligation or any „cardinal“ obligation liability shall not be excluded but shall be limited to typical foreseeable contractual damage; in other respects it is excluded under Section 4.

The liability disclaimer additionally does not apply in those cases where under product liability legislation in the event of defects in the goods supplied there is liability in the case of personal injury or damage to property relating to privately used items.

Nor does it apply in the case of assumption of a guarantee and assurance of a characteristic feature if a defect covered thereby activates our liability.

In the event of reimbursement of expenses the above shall apply accordingly.

7. No guarantee is assumed in the event of damage attributable to inappropriate use, faulty assembly by the Purchaser or third parties, natural wear and tear, incorrect or negligent treatment, improper modifications carried out without our prior consent or servicing work by the Purchaser or third parties.
8. Claims for remedy, damages and replacement use shall be time-barred one year from the date of purchase of the item concerned. This does not apply to any item used in accordance with its customary purpose for a building and has caused faultiness in the latter in which case time-barring is after 5 years. Claims for abatement of price and exercise of any right of withdrawal are excluded if the claim for remedy is time-barred. In the event of operation of Sentence 3 however the Purchaser may only refuse payment of the purchase price to the extent that he would be entitled to do so as a consequence of withdrawal or abatement; in the event of withdrawal exclusion and subsequent payment refusal we are entitled to withdraw from the Contract.
9. Claims arising from manufacturer redress remain unaffected by this Section.

IX. Liability for Collateral Obligations

If through any fault on our part the item supplied cannot be used as stated under the terms of the Contract or if damage occurs as a consequence of omitted or faulty implementation of suggestions and consultations prior to and subsequent to conclusion of the Contract including other contractual collateral obligations to the exclusion of further claims on the part of the Purchaser the provisions of Clauses VIII and X shall apply accordingly.

X. Withdrawal by the Purchaser and other Liabilities on our part

1. The following provisions shall apply in the event of infringements over and above liability for defect and shall neither exclude nor limit statutory right of withdrawal. Similarly, lawful or contractual claims due to us shall be neither excluded nor limited.
2. The Purchaser may withdraw from the Contract if the overall performance is definitively impractical, the same applying to incapacity. The Purchaser may also withdraw from the entire Contract if in the event of an order for similar items implementation of part of the supply is impossible in terms of numerical quantity due to our representation obligation and if he has no interest in partial supply; if this is not the case the Purchaser may abate the consideration accordingly; the right of withdrawal shall not apply in the case of immaterial infringement of obligation.
3. Should there be any delay in performance and provided the Purchaser grants us an appropriate period to complete performance following justification of the delay and should the said period fail to be observed the Purchaser shall be entitled to withdraw. In the event of partial delay in performance Section 1 Sentence 2 shall apply accordingly. If prior to delivery the Purchaser requires in any aspect alternative execution of the item supplied the delivery period shall be interrupted until the date of agreement regarding execution and if necessary extended by the time necessary for alternative execution.
4. Withdrawal shall be excluded if the Purchaser is solely or to a large extent predominantly responsible for the circumstance entitling him to withdrawal or if the circumstance for which we are responsible occurs at the point in time of default in acceptance on the part of the Purchaser.

In the event of impracticality we retain in the above cases our claim to consideration as defined in § 326 Section 2 BGB [Civil Code].

5. Further claims on the part of the Purchaser, irrespective of legal grounds (in particular claims arising from default at the point of conclusion of the Contract, infringement of main and ancillary contractual obligations, reimbursement of expenses, impermissible act and any other tortious liability) are excluded; this applies in particular to damage not occurring to the item supplied itself including compensation claims for lost profit; also included are claims which do not result from the faulty nature of the purchased item.

This shall not apply if the cause of damage is to intent or gross negligence on our part, our legal representatives or vicarious agents. Nor shall this apply if the damage arises from culpable injury to life, physical injury or damage to health.

To a similarly lesser degree liability in the event of assumption of a guarantee is excluded if an obligation infringement covered thereby activates our liability.

If we culpably infringe any essential contractual obligation or any „cardinal“ obligation liability shall not be excluded but shall be limited to typical foreseeable contractual damage.

XI. Place of Performance and Jurisdiction

1. Place of performance of both parts arising from all legal relationships is 73230 Kirchheim/Teck.
2. In respect of the legal relationship between the Purchaser and us the laws of the Federal Republic of Germany apply. UN Sale of Goods legislation (CISG) is expressly excluded.
3. Legal venue for all disputes arising from the contractual relationship is Kirchheim/Teck. We are also entitled to file an action at the domicile of the Purchaser.



Directions

A8 Stuttgart – München
 exit "Kirchheim/Teck-Ost"
 direction "Kirchheim/Teck" (B297)
 1st exit to the right "Kirchheim Süd" on to
 "Aichelbergstrasse"
 turn left on to "Eichendorffstrasse" direction
 "Stadtmitte/Polizei"
 turn right at the crossing on to "Lenninger Strasse"
 turn left at 1st traffic light on to "Dettinger Strasse"
 our company is about 500 m on the left on the
 corner to "Faberweg".

If you use a car navigation system please enter
 "Faberweg" as your point of destination.



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