WITTENSTEIN | alpha

alpha Mechatronic Systems
Product catalog

More flexible
More efficient
More productive

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More flexible
More efficient
More productive

Dear Business Associates,

The world of industrial manufacturing has never before been so complex, nor has it offered so many opportunities. The secured productivity of each and every customer requires machines which are flexible, reliable and energy efficient. New modular machine concepts are required for efficient multi-variant production with fast module changes, which offer maximum flexibility and adaptation.

Our mechatronic drive systems have the potential to positively influence all the relevant performance parameters, and to do so reliably, 24/7, worldwide. The alpha Mechatronic systems are more than the sum of their intelligently designed individual components. Owing to their compactness, they can also be used in extremely confined installation spaces. Low moments of inertia increase the productivity of your machine and optimize energy efficiency.

With experience, know-how, system expertise and industry knowledge, we deliver on the quality pledge behind all of our system solutions.

Whatever alpha solution you opt for: with us, you always reach the goal quickly and easily. We offer integrated mechanical and mechatronic drive solutions for all types of axis. On demand we also provide complete solutions from a single source – complete systems including actuators – also for linear systems.

Miniaturization, integration suitability, networkability and intelligence are the principal focus during the development of our products. Our top priority is our customers' success.
We understand this, and make it our daily motivation.

Take our word for it!

Erik Roßmeißl
Managing Director WITTENSTEIN alpha GmbH

alpha Mechatronic Systems HIGHLIGHTS

HIGHEST POWER DENSITY
The complete power unit comprised of motor and gearbox provides high performance in a significantly smaller installation space.

LOW MASS MOMENT OF INERTIA
The significantly lower moment of inertia increases productivity and reduces energy consumption.

HIGH RIGIDITY
The high torsional and tilting rigidity of the drive bearings ensure improved control quality of the servo actuator.

LOW BACKLASH
The precision of the system can be effectively increased through the minimal backlash.

ABSOLUTE SCALABILITY
The technical properties of the unit can be scaled in accordance with the application requirements.

HIGH CONNECTIVITY
The electrical interface enables high connectivity to many different servo controllers.

premo®

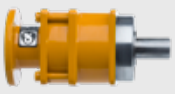
With premo® absolute precision meets perfect motion. The platform for scalable machine concepts can be flexibly used at all interfaces and can be mechanically and electrically adapted to customer requirements.

TPM+

Productive, efficient, precise – these attributes characterize the proven TPM+ servo actuator family with drive flange. This is valid everywhere: from robotics to machine tools, from dynamic to high-load applications.

YOUR WORLD IS OUR DRIVE.

FOR MORE THAN 30 YEARS.



SP

LP

Linear systems

TPM+

High Performance Linear System

1983	1994	1996	1999	2002	2004	2006	2007	2011	2013
	TP		cymex® sizing software		XP+ / TP+ / SP+ / LP+		TPK+ / SPK+ / HG+ / SK+ / TK+		HDV Hygienic Design

PERFORMANCE

Performance where it counts:
High torque, outstanding precision and high power density – essential for our products and systems.

FUTURE PROOF

We live processes:
Only those who know the exact details of customer processes and requirements are in a position to develop solutions that offer added value in the short and long term.

SCALABILITY

You never make compromises:
Whatever the performance area – we offer solutions that grow with your requirements.

WITTENSTEIN | alpha

It is good to know today what will be needed tomorrow. Applying it in practice is even better. We develop technology that shapes the future – ENGINEERING FUTURE SOLUTIONS.

EFFICIENCY

We like it „lean“:
We offer products and systems that are energy-efficient and require minimal installation space in machines.

AVAILABILITY

You need reliability:
We have the widest range of products on the market and can implement your application „just in time“.

CONNECTIVITY

We think in terms of interfaces:
All of our systems can be integrated in a wide range of peripherals.

alpha Value Line

DP+ for Delta robots

INIRA®

alpha Linear Systems

alpha Basic Line

2015 | 2016 | 2017 | 2018

cymex® 5

SIZING ASSISTANT

V-Drive Family

premo®

CAD POINT

WITTENSTEIN alpha in all axes

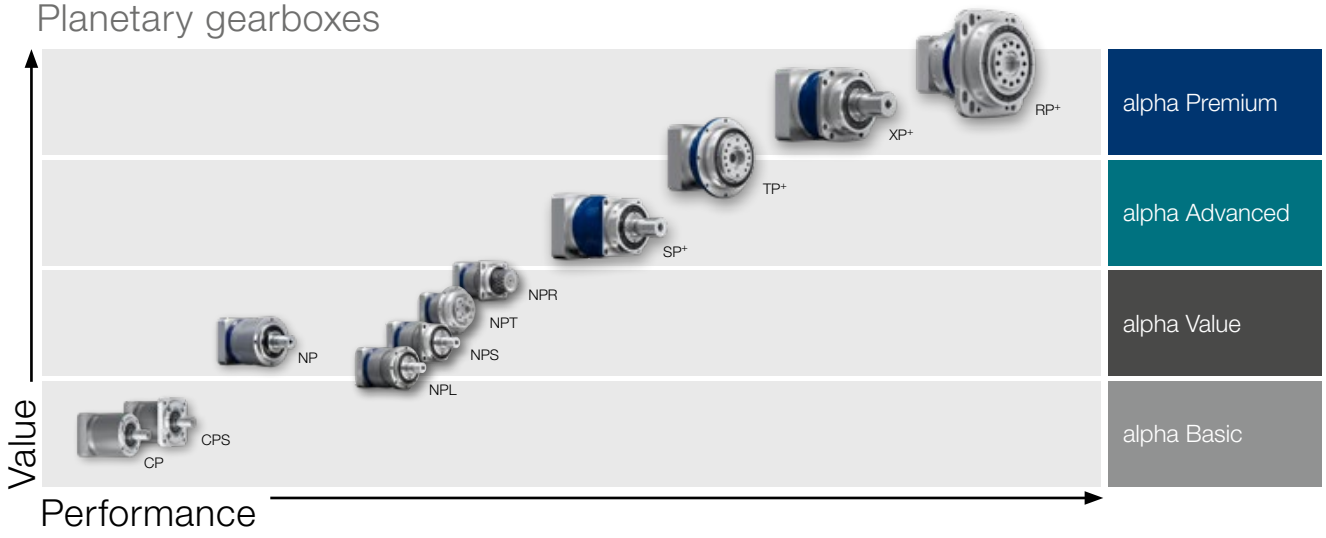
Complete drive solutions under one roof

We offer the best solutions for almost every application. In addition to gearboxes, our product portfolio includes a wide range of drive solutions with linear systems and servo actuators. Adapted accessories such as couplings and shrink discs round off the product portfolio.

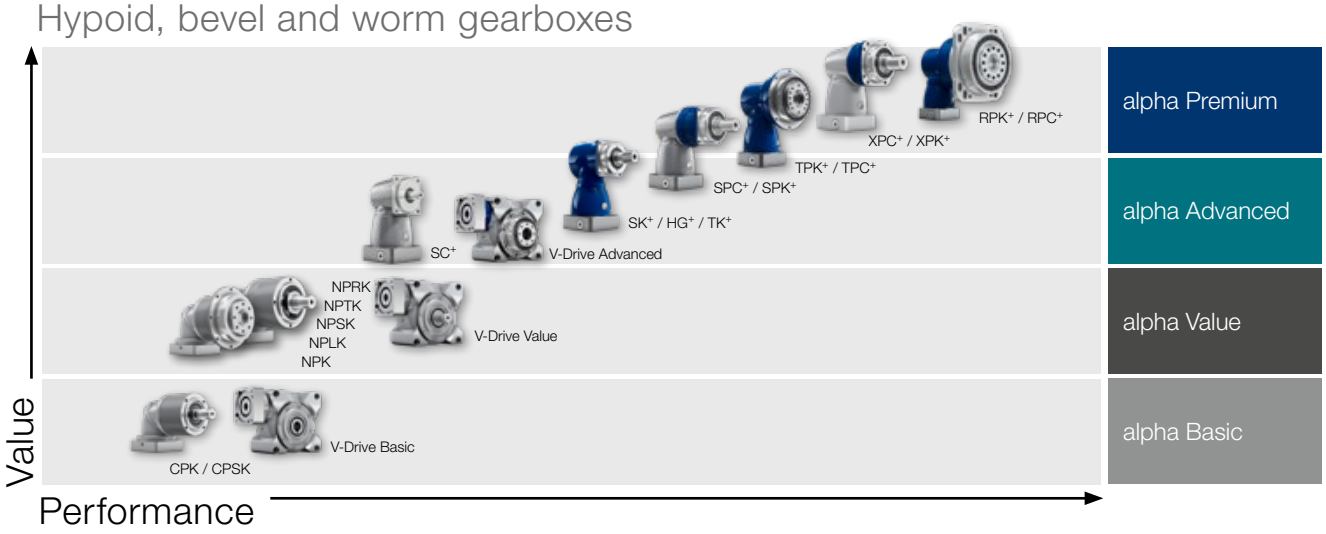
Our products are divided into the Basic, Value, Advanced and Premium Segments in terms of “Performance” and “Value”. We want to make it even easier for our customers to find the right solution from our large portfolio for each specific application.

Overview of our product portfolio:

Planetary gearboxes



Hypoid, bevel and worm gearboxes

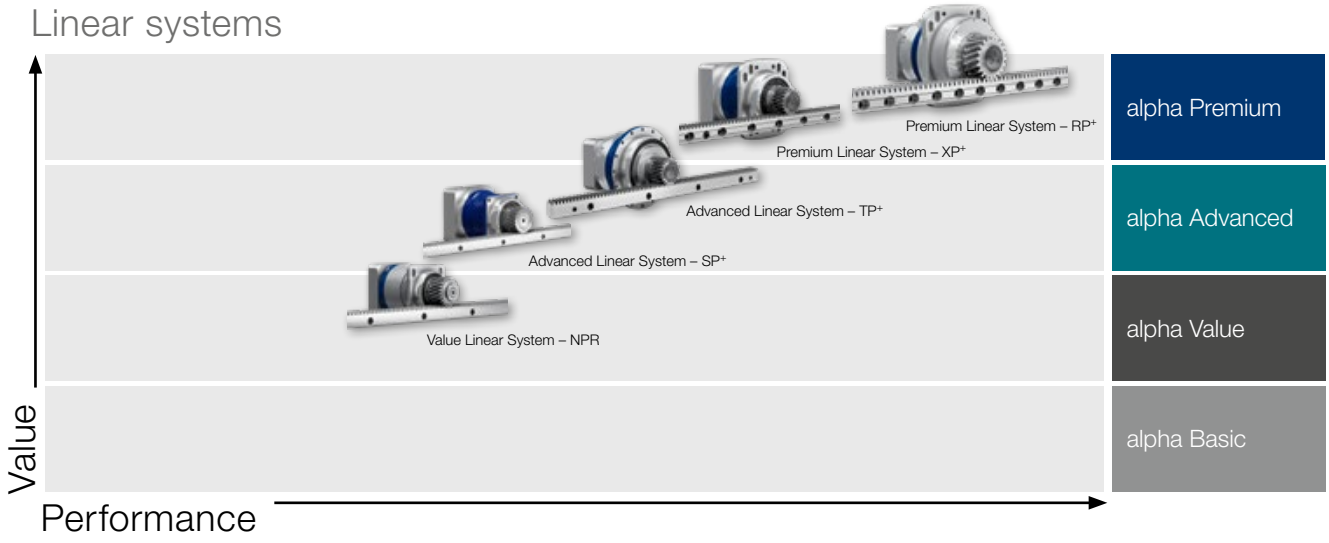


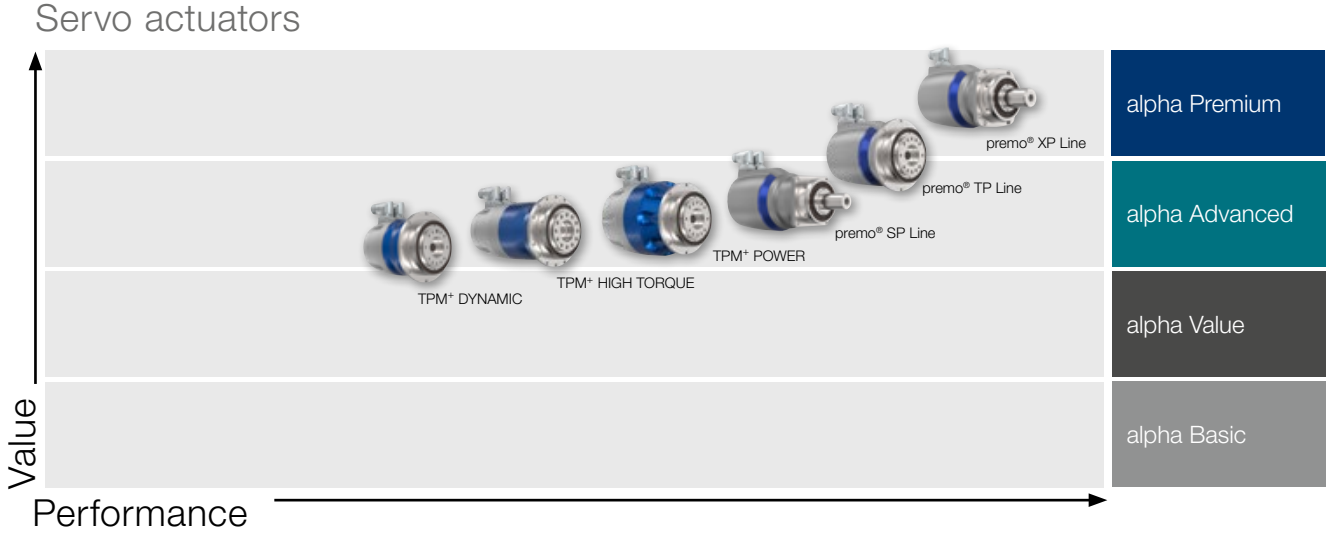
Know-how in every sector

Our solutions range from high-precision axes in manufacturing systems to packaging machines that must operate with maximum productivity in the smallest installation space.

Overview:

- Machine tools and production technology
- Food and packaging machines
- Wood working machinery
- Printing and paper machines
- Robotics and automation



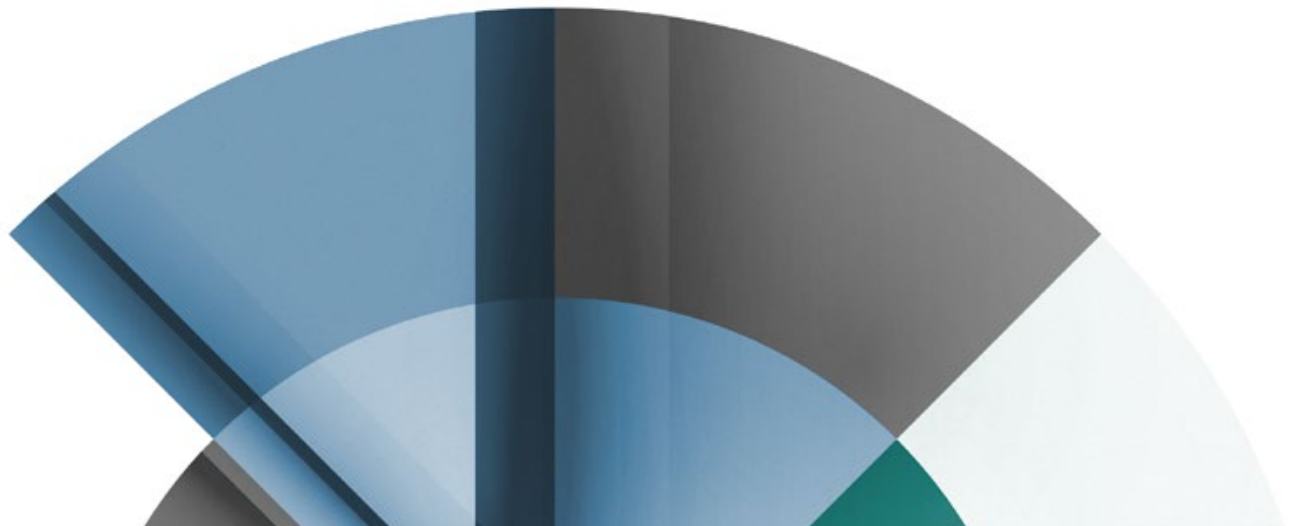


We live mechatronics

Our servo actuators for greater efficiency and precision

Our customers‘ challenges are our own. For this reason, mechatronics has a very creative dimension for us: To custom-integrate sensors, software, gearbox, motor and electronics to the greatest possible extent in order to produce **intelligent, highly efficient and controllable drive systems** – even for extreme environmental conditions. To meet these requirements, we think ahead, laterally and in networks.

The objective during the development of our servo actuators is always the **reduction of complexity** for the customer – with **optimal efficiency, reliability, connectivity and innovation.** This is the measurable added value that counts.



TPM+

premo®

Sector-specific high performance

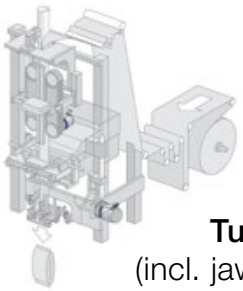
Maximum efficiency and reliability, as well as comprehensive compatibility in the various application areas: Thanks to their high dynamics, our servo actuators ensure high productivity. The high power density reduces energy consumption and the compact installation dimension also permits the use in difficult, confined spaces.

Whatever the requirements: WITTENSTEIN alpha offers sector-specific, high-performance solutions – as cost-effective serial solutions and customized high-end developments.

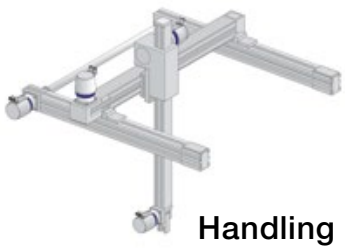
Wide-ranging **applications**

The WITTENSTEIN alpha servo actuators can be used in numerous applications.
Here are a few examples:

Folding box packaging
(incl. assembly / folding, filling valve)

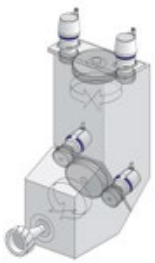


Tubular bag packaging
(incl. jaw stroke, sealing jaw, blade)



Handling gantry
(Z-axis, swivel / rotating axis)

Delta robot
(axis 1–3, swivel axis)



Machine tool milling
(rotating axes A–C, tool changer)

Plastic thermoform
(tool axis)

Intralogistics
(driverless transport systems)

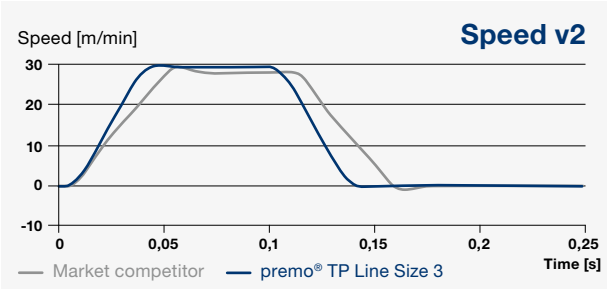
More efficient in the application

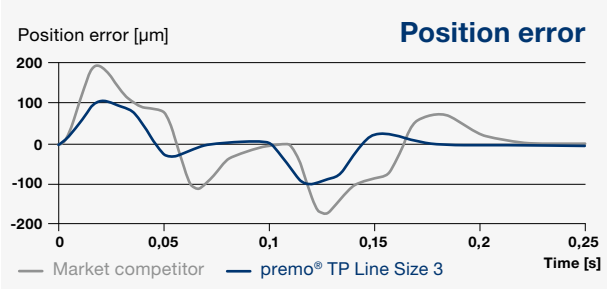
Due to the high power density, the low mass moment of inertia, the high rigidity and the low backlash of the WITTENSTEIN alpha servo actuators, two important objectives can be achieved:

1. Increased productivity with comparable energy requirement

To increase the productivity of a system, it is most important to reduce the cycle time of the time-critical axis. This is achieved through increased acceleration torques allowing for a reduction in the dynamic time components as well as through increased torsional rigidity for improved response times and tighter control loops.

The following example of a packaging machine shows that a premo® TP Line Size 3 with 20 % higher acceleration torque and 30 % more torsional rigidity with comparable energy requirement achieves a significant increase in productivity. The movement path of 50 mm in the time-critical axis is completed 50 ms faster, which corresponds to a production increase of 29 %.

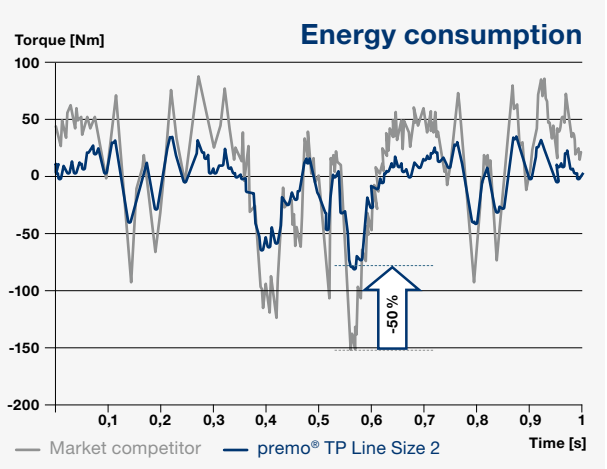




2. Reduced energy consumption with the same productivity

By using a smaller, more efficient actuator with lower inertia and higher rigidity, a smaller servo controller can also be used, thus saving upfront cost as well as operating costs in the form of lower energy consumption while achieving the same productivity. The solution here is a combination of a lower mass moment of inertia and a higher degree of rigidity.

Example Delta robot: Using a premo® TP Line Size 2, the same result is achieved as with the significantly larger motor of a market competitor. The high rigidity of the servo actuator together with the lower moment of inertia enables the use of a smaller motor. At 6.5 A, the power consumption of the Size 2 premo® is approx. 50 % below the power consumption of the comparable product. This enables the selection of servo controller and supply module that are one level smaller, which involves significant savings potential in the 3-axis application.



Perfect dimensioning of servo actuators: **cymex® 5**

With cymex® 5, the dimensioning and sizing of complete drive trains (application + transformation + gearbox + motor) is now fast, simple and reliable.
Calculation is made much easier using predefined standard applications. Consideration of all major influencing factors guarantees an optimal design and increases the efficiency of your machine.

Free download in 11 languages

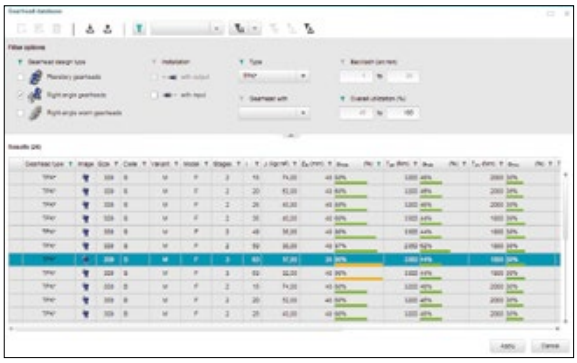
The basic version of the cymex® 5 sizing software is available as a free download.

www.wittenstein-cymex.com

cymex® 5

cymex® 5 has a unique optimization calculator*

During the design process, cymex® 5 provides optimization suggestions for the selected servo actuator, which increase reliability and efficiency while ensuring your servo actuator has the perfect dimensions e.g. through downsizing. This allows you to save costs and reduces the installation space in the machine.

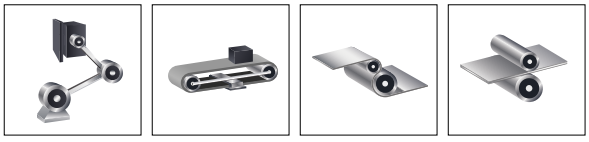


cymex® 5 has an extremely comprehensive database

More than 17,500 motors from the 50 most prominent motor manufacturers are stored in the design tool. Continuously updated, always state-of-the-art. Moreover, more than 10,000 gearbox and 700 servo actuator versions from WITTENSTEIN alpha and over 200 combinations of linear systems with all relevant technical specifications can be found here.

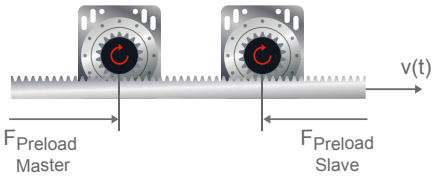
cymex® 5 offers comprehensive documentation

Following the geometry comparison, cymex® 5 creates calculation documentation and generates data sheets for gearbox and motor on request. Furthermore, the 2D and 3D CAD data of selected components can be retrieved.



cymex® 5 enables the precise simulation of motion and load variables

The optimized software offers many options for the individual sizing of the drive train. These have been integrated to supplement the previously existing applications in cymex® 3: the crank, conveyor, center winder and feed roll.



cymex® 5 incorporates the completely new Master / Slave function*

The Master / Slave function enables the electrically preloaded configuration of two drives. The preload between master and slave eliminates the backlash in the drive train and offers a high degree of rigidity in the machine.

cymex® 5 can define any number of axes simultaneously

In contrast to other design tools, cymex® 5 can define any number of axes at the same time. The version calculation is up to 60 % quicker as a result.

*Premium function, on request.

premo®
servo actuators

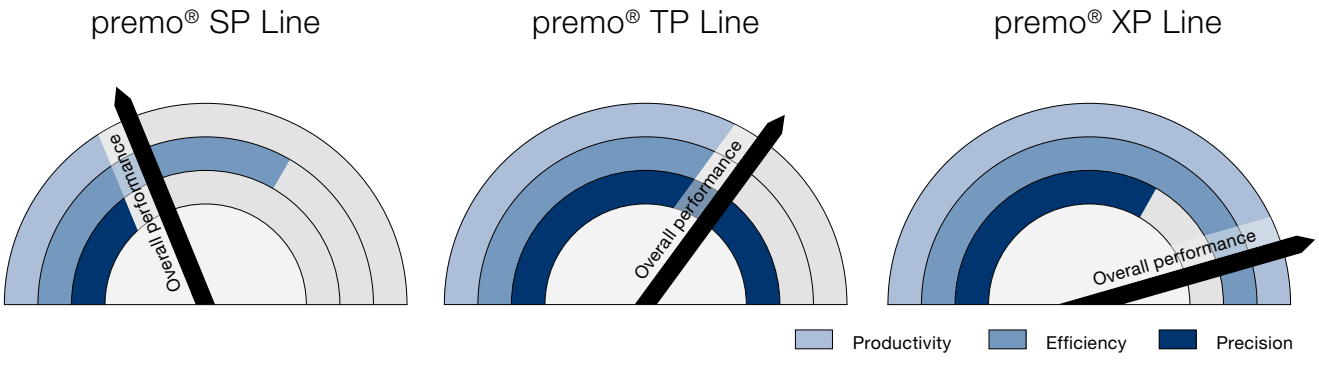
premo® –
the powerful servo actuator platform

Absolute precision meets perfect motion:
premo® combines precision with motion – more efficiently than ever.

The central idea **behind the first fully scalable servo-actuator platform** from WITTENSTEIN alpha is uncompromising flexibility from the viewpoint of the user. Motors and gearboxes with application-related graduated performance characteristics can be configured modularly **to individual motor / gearbox units.** The result is a modular system that is significantly more versatile and more individual with regard to performance for the most diverse applications, that meets almost all the challenges of drive technology, integration and industry specification. Thanks to the **modular platform concept**, premo®-servo actuators can also be quickly manufactured and made available for the relevant task.

The core of the motor / gearbox unit is a **torsionally rigid precision gearbox** with low backlash and excellent torque density in combination with the equally powerful, **permanent magnet synchronous servo motor**, which guarantees low cogging and minimal velocity ripple thanks to the split winding.
Due to the intelligent design principle implemented for the first time, premo® not only sets **completely new standards with regard to flexibility and sustainability** – the premo® servo actuator generation also opens up new dimensions in performance: **doubled power with minimal increase in size**, increased productivity and optimized energy efficiency thanks to digital, single-cable technology provide more freedom during planning, design and storage as well as lower investment costs.

All **three lines** of this innovative servo actuator generation can be equipped with **the latest digital encoder technology** and are characterized by a particularly easy-to-clean and maintenance friendly design without exposed screws.



Flexible mechanical and electrical interfaces for high scalability

premo® SP Line – the entry level class

Optimum performance for all positioning tasks

- Short cycle times thanks to low backlash and extreme rigidity
- Very good positioning accuracy
- Basic configuration with smooth output shaft and resolver

premo® TP Line – the dynamic class

Precision for positioning and processing tasks

- High torsional rigidity and low backlash allow high acceleration and tight control
- Basic configuration with output flange and HIPERFACE® absolute encoder singleturn, SIL 2

premo® XP Line – the extra class

Versatile in almost all sectors

- Maximum power density with high torsional rigidity and radial load capacity
- Basic configuration with smooth output shaft and HIPERFACE DSL® absolute encoder singleturn, SIL 2

Individual upgrading of all lines possible due to a variety of options:

- *Analog and digital rotary encoders as well as reliable encoders according to SIL 2*
- *One and two-connector versions*
- *Permanent magnet holding brake*
- *Reduced backlash*
- *Various output types*

premo® – clearly superior in performance

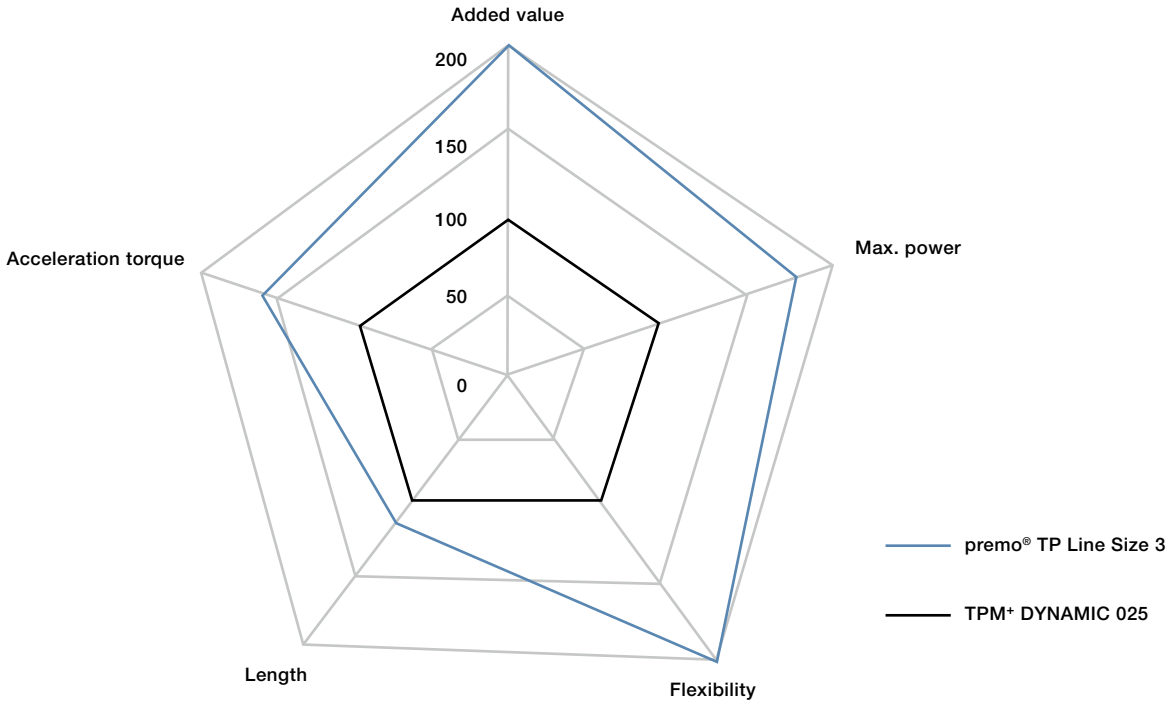
- **Higher machine performance** thanks to higher acceleration torque
- High torque density **combined with a compact design** allow for the realization of higher performance machines with significant space saving
- **Improved connectivity to next generation controllers** from leading system providers due to the use of digital encoders (EnDat 2.2, DSL, HIPERFACE DSL®, DRIVE-CLiQ) and compatibility for high operating voltage up to 750 V DC
- **Reduced wiring requirement** due to single-connector technology
- **Improved reliability and safety** thanks to the use of more powerful brakes and SIL 2 encoders
- **Use in washdown and food applications** thanks to hygienic housing design with smooth surfaces

premo® – the new energy-efficiency class

Utilizing planetary gearboxes with a wide range of gear ratios **and an efficiency up to 97 %**, combined with servo motors with an **efficiency of up to 92 %** – the premo® platform utilizes the entire experience of WITTENSTEIN alpha in the energy-efficient design of servo actuators. The power requirement during acceleration is reduced thanks to lower inertia due to the elimination of the motor shaft coupling, as well as through a design to optimize current saturation losses.

Moreover, the digital single-cable technology for the power supply and data transmission between motor and controller requires the use of **only one** connector and connection cable. This **reduces the wiring requirement by half** and also saves weight for moving drives. This also reduces the energy consumption in the integration of premo® in robots or moving machine structures. Overall, top class energy efficiency is achieved.

premo® – absolute flexibility in all cases



In comparison with the proven TPM+ series, the new premo® servo actuators exhibit significantly greater flexibility and performance potential. The mechanical interface to the machine can be designed in multiple versions.

The interface to the servo controller offers almost unlimited connection options through the voltage range up to 750 V DC and the wide selection of analog and digital encoders.

Our know-how – your benefit

Flexible gearbox interface suitable for any application
B

All external surfaces with smooth, hygienic design
A

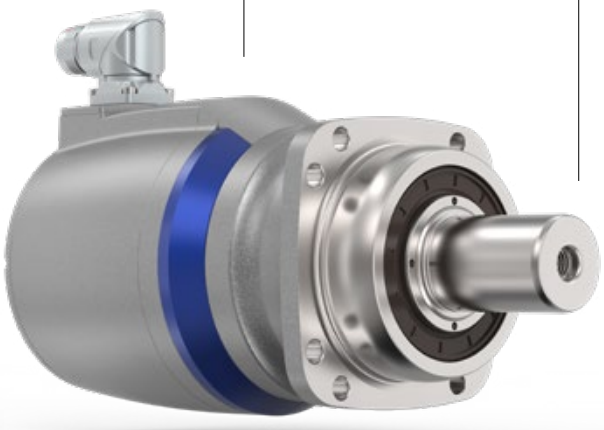
Bayonet-coupling connector for fast installation
A

Conical cover without screws
A C

Reduced wiring requirement due to single-cable technology with digital encoders
B C D

Robust bearing with long service life
A C

Brake with enhanced holding torque
C D



Your requirement	Our solution
Resistant and easy-to-clean actuator surface	High-quality design without screw heads for optimum cleaning conditions and high value stability
High operating voltage and absolute connectivity to system providers	Enhanced performance through intermediate operating voltage up to 750 V DC, interfaces for EnDat 2.2, HIPERFACE DSL®, DRIVE-CLiQ, partly in single-cable technology for the greatest flexibility in adapting to external controllers and maximum productivity
Maximum individual freedom in design	Intelligent premo® modular system with various gearbox outputs, short lengths as optimal design basis, for example in the case of restricted installation space, simplified design for reduced interference contour even on smaller machines, savings in the drive train through improved energy efficiency and single-cable connection, a maximum of design freedom thanks to a wide choice of rotary sensors for different applications
Maximum machine reliability and investment protection	Intelligent, energy-efficient product concept: higher reliability through the elimination of the shaft coupling, minimized electrical component size due to low current requirements allowing reduction in size of the servo drive, cables, fuses and electrical contacts. The single-cable solution offers less wiring and smaller cable tracks while higher braking torques offer faster emergency stopping and improved reliability for vertical axes. Greater reliability thanks to the functional safety in the mechanical connection of the encoder.

A **Increased productivity / higher OEE***

B **Simplified machine design**

C **Reliability / service life**

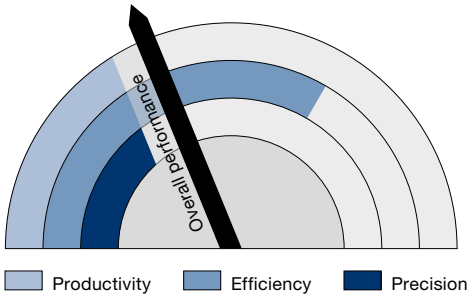
D **Safety**

* Overall Equipment Effectiveness

premo®
SP Line

The entry level class

- Especially suitable for positioning tasks
- Short cycle times
- Special benefits with moving axes: the low weight and the short overall length
- Mechanical interface with output shaft
- Ideal for connecting couplings, toothed belt pulleys and pinions
- In addition to the smooth shaft version, key and splined shaft versions are also available
- Electric interface with resolver as standard

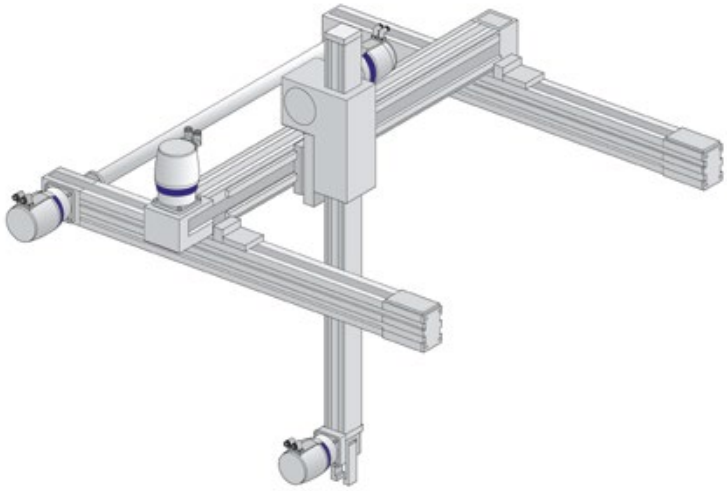


- Precision adequate for most applications
- Optionally extendable with all available encoders and connector versions

Application example

Handling gantries are useful aids if pallets, crates, trays or similar are transported from A to B – the faster, the better.

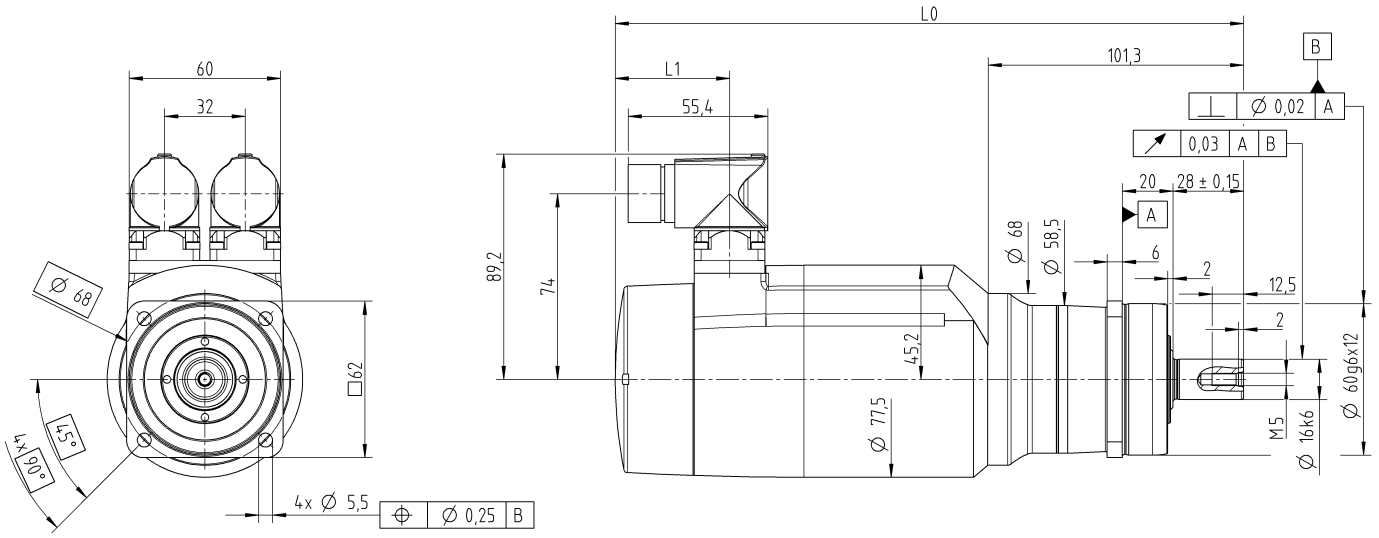
premo® SP Line copes with this task thanks to its high power-to-weight ratio and excellent dynamics.



			2-stage								
Ratio	**i**		**16**	**20**	**25**	**28**	**35**	**40**	**50**	**70**	**100**
Operating voltage	U_D	*V DC*	560								
Max. acceleration torque (max. 1000 cycles per hour)	T_{2B}	*Nm*	41.6	42	42	42	42	42	42	42	32
		in.lb	368	372	372	372	372	372	372	372	283
Static output torque	T_{20}	*Nm*	16.5	20.8	26	26	26	19.9	25	26	17
		in.lb	146	184	230	230	230	176	221	230	150
Brake holding torque (at 120 °C)	T_{2Br}	*Nm*	20.8	26	32.5	36.4	45.5	20.8	26	36.4	52
		in.lb	184	230	288	322	403	184	230	322	460
Max. speed at output	n_{2max}	*rpm*	375	300	240	214	171	150	120	85.7	60
Speed limit for T_{2B}	n_{2B}	*rpm*	375	300	240	214	171	150	120	85.7	60
Max. motor acceleration torque	T_{1max}	*Nm*	2.84	2.84	2.84	2.84	2.84	1.4	1.4	1.4	1.4
		in.lb	25	25	25	25	25	12	12	12	12
Max. motor acceleration current	I_{MaxDyn}	A_{eff}	4.47	4.47	4.47	4.47	4.47	2.52	2.52	2.52	2.52
Static motor current	I_0	A_{eff}	1.71	1.71	1.71	1.71	1.71	1	1	1	1
Max. backlash	j_t	*arcmin*	Standard ≤ 6 Reduced ≤ 4								
Torsional rigidity (Gearbox)	C_{t21}	*Nm/arcmin*	3.5								
		in.lb/arcmin	31								
Max. axial force [a]	F_{2AMax}	*N*	2400								
		lb_f	540								
Max. lateral force [a]	F_{2QMax}	*N*	2800								
		lb_f	630								
Max. tilting moment	M_{2KMax}	*Nm*	152								
		in.lb	1345								
Service life	L_h	*h*	> 20000								
Weight (without brake)	*m*	*kg*	3.2 to 3.6								
		lb_m	7.1 to 8								
Ambient temperature		*°C*	0 to +40								
		°F	+32 to +104								
Lubrication			Lubricated for life								
Insulating material class			F								
Protection class			IP 65								
Paint			Pearl dark grey and innovation blue								
Metal bellows coupling (recommended product type – validate sizing with cymex®)			BC2-00060AA016.000-X								
Bore diameter of coupling on the application side		*mm*	X = 012.000 - 035.000								
Mass moment of inertia (relates to the drive)	J_1	$kgcm^2$	0.37	0.37	0.36	0.36	0.36	0.22	0.22	0.22	0.22
		10^{-3} $in.lb.s^2$	0.33	0.33	0.32	0.32	0.32	0.19	0.19	0.19	0.19

Please use our sizing software cymex® for a detailed sizing – **www.wittenstein-cymex.com**

[a] Refers to center of the output shaft or flange



without brake

Ratio	Encoder	Length L0 in mm	Length L1 in mm
i = 16 – 35	Resolver	226.6	22.8
	HIPERFACE®	249.1	45.3
	EnDat		
	DRIVE-CLiQ	279.5	75.7
i = 40 – 100	Resolver	211.6	22.8
	HIPERFACE®	234.1	45.3
	EnDat		
	DRIVE-CLiQ	264.5	75.7

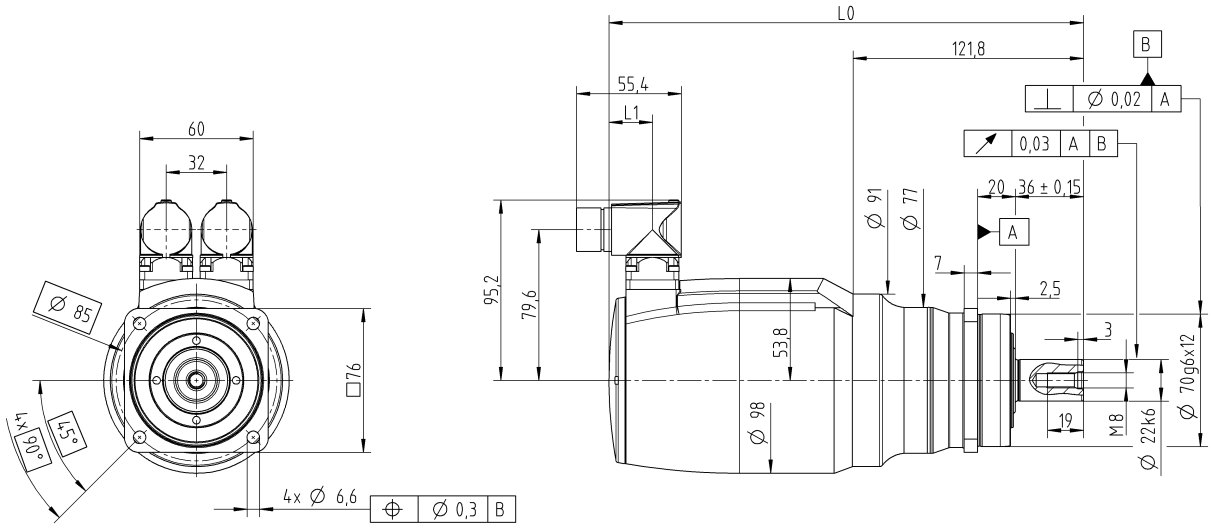
with brake

Ratio	Encoder	Length L0 in mm	Length L1 in mm
i = 16 – 35	Resolver	262.6	22.8
	HIPERFACE®	285.1	45.3
	EnDat		
	DRIVE-CLiQ	315.5	75.7
i = 40 – 100	Resolver	239.1	22.8
	HIPERFACE®	261.6	45.3
	EnDat		
	DRIVE-CLiQ	292	75.7

			2-stage								
Ratio	**i**		**16**	**20**	**25**	**28**	**35**	**40**	**50**	**70**	**100**
Operating voltage	U_D	*V DC*	560								
Max. acceleration torque (max. 1000 cycles per hour)	T_{2B}	*Nm*	81.5	102	110	110	110	102	110	110	90
		in.lb	721	903	974	974	974	903	974	974	797
Static output torque	T_{20}	*Nm*	30	37.9	47.8	53.7	67.3	39.1	49.2	69.2	52
		in.lb	266	335	423	475	596	346	435	612	460
Brake holding torque (at 120 °C)	T_{2Br}	*Nm*	37.4	46.8	58.5	65.5	81.9	52	65	91	130
		in.lb	331	414	518	580	725	460	575	805	1151
Max. speed at output	n_{2max}	*rpm*	375	300	240	214	171	150	120	85.7	60
Speed limit for T_{2B}	n_{2B}	*rpm*	269	215	184	176	155	119	104	85.7	60
Max. motor acceleration torque	T_{1max}	*Nm*	5.53	5.53	5.53	5.53	5.53	2.76	2.76	2.76	2.76
		in.lb	49	49	49	49	49	24	24	24	24
Max. motor acceleration current	I_{MaxDyn}	A_{eff}	6.94	6.94	6.94	6.94	6.94	4.45	4.45	4.45	4.45
Static motor current	I_0	A_{eff}	2.33	2.33	2.33	2.33	2.33	1.58	1.58	1.58	1.58
Max. backlash	j_t	*arcmin*	Standard ≤ 6 Reduced ≤ 4								
Torsional rigidity (Gearbox)	C_{t21}	*Nm/arcmin*	10								
		in.lb/arcmin	89								
Max. axial force [a]	F_{2AMax}	*N*	3350								
		lb_f	754								
Max. lateral force [a]	F_{2QMax}	*N*	4200								
		lb_f	945								
Max. tilting moment	M_{2KMax}	*Nm*	236								
		in.lb	2089								
Service life	L_h	*h*	> 20000								
Weight (without brake)	*m*	*kg*	5.1 to 5.6								
		lb_m	11 to 12								
Ambient temperature		*°C*	0 to +40								
		°F	+32 to +104								
Lubrication			Lubricated for life								
Insulating material class			F								
Protection class			IP 65								
Paint			Pearl dark grey and innovation blue								
Metal bellows coupling (recommended product type – validate sizing with cymex®)			BC2-00150AA022.000-X								
Bore diameter of coupling on the application side		*mm*	X = 019.000 - 042.000								
Mass moment of inertia (relates to the drive)	J_1	$kgcm^2$	0.9	0.87	0.87	0.85	0.85	0.47	0.47	0.47	0.47
		10^{-3} $in.lb.s^2$	0.8	0.77	0.77	0.75	0.75	0.42	0.42	0.42	0.42

Please use our sizing software cymex® for a detailed sizing – **www.wittenstein-cymex.com**

[a] Refers to center of the output shaft or flange



without brake

Ratio	Encoder	Length L0 in mm	Length L1 in mm
i = 16 – 35	Resolver	250.8	23
	HIPERFACE®	273.1	45.3
	EnDat		
	DRIVE-CLiQ	303.3	75.5
i = 40 – 100	Resolver	235.8	23
	HIPERFACE®	258.1	45.3
	EnDat		
	DRIVE-CLiQ	288.3	75.5

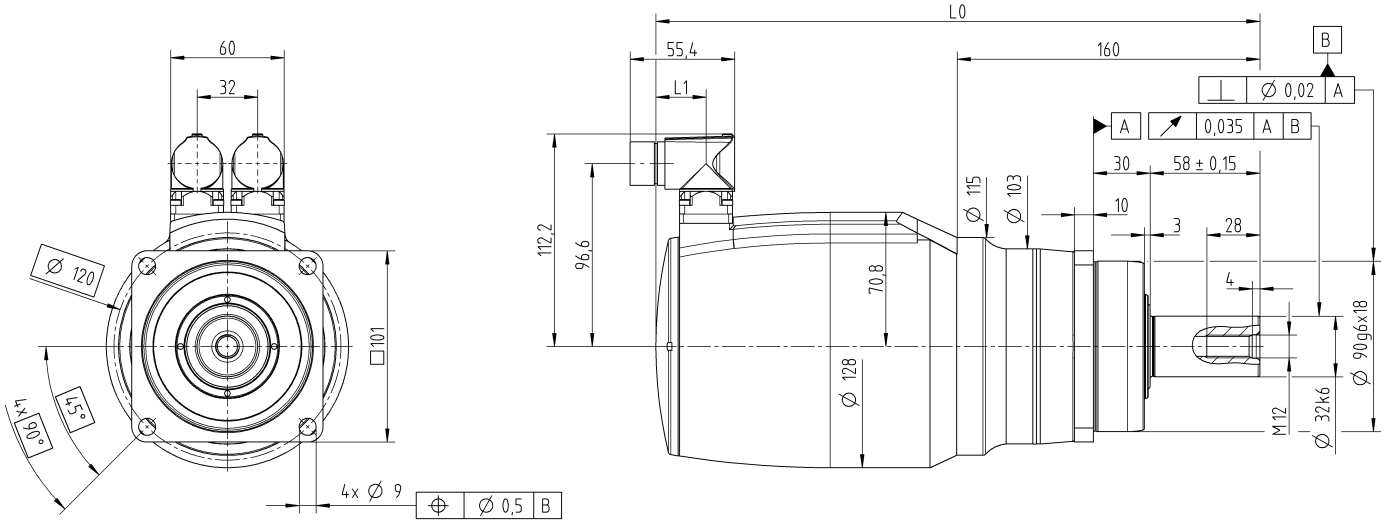
with brake

Ratio	Encoder	Length L0 in mm	Length L1 in mm
i = 16 – 35	Resolver	289.8	23
	HIPERFACE®	312.1	45.3
	EnDat		
	DRIVE-CLiQ	342.3	75.5
i = 40 – 100	Resolver	251.6	23
	HIPERFACE®	273.9	45.3
	EnDat		
	DRIVE-CLiQ	304.1	75.5

			2-stage								
Ratio	**i**		**16**	**20**	**25**	**28**	**35**	**40**	**50**	**70**	**100**
Operating voltage	U_D	*V DC*	560								
Max. acceleration torque (max. 1000 cycles per hour)	T_{2B}	*Nm*	248	310	315	315	315	226	283	315	235
		in.lb	2195	2744	2788	2788	2788	2000	2505	2788	2080
Static output torque	T_{20}	*Nm*	93	117	146	164	175	89.4	112	158	120
		in.lb	823	1036	1292	1452	1549	791	991	1398	1062
Brake holding torque (at 120 °C)	T_{2Br}	*Nm*	116	146	182	204	255	93.6	117	164	234
		in.lb	1027	1292	1611	1806	2257	828	1036	1452	2071
Max. speed at output	n_{2max}	*rpm*	375	300	240	214	171	150	120	85.7	60
Speed limit for T_{2B}	n_{2B}	*rpm*	322	257	220	205	171	108	86.4	70	60
Max. motor acceleration torque	T_{1max}	*Nm*	16.7	16.7	16.7	16.7	16.7	6.09	6.09	6.09	6.09
		in.lb	148	148	148	148	148	54	54	54	54
Max. motor acceleration current	I_{MaxDyn}	A_{eff}	19.8	19.8	19.8	19.8	19.8	7.7	7.7	7.7	7.7
Static motor current	I_0	A_{eff}	7.05	7.05	7.05	7.05	7.05	2.77	2.77	2.77	2.77
Max. backlash	j_t	*arcmin*	Standard ≤ 5 Reduced ≤ 3								
Torsional rigidity (Gearbox)	C_{t21}	*Nm/arcmin*	31								
		in.lb/arcmin	274								
Max. axial force [a]	F_{2AMax}	*N*	5650								
		lb_f	1271								
Max. lateral force [a]	F_{2QMax}	*N*	6600								
		lb_f	1485								
Max. tilting moment	M_{2KMax}	*Nm*	487								
		in.lb	4310								
Service life	L_h	*h*	> 20000								
Weight (without brake)	*m*	*kg*	10 to 11.7								
		lb_m	22 to 26								
Ambient temperature		*°C*	0 to +40								
		°F	+32 to +104								
Lubrication			Lubricated for life								
Insulating material class			F								
Protection class			IP 65								
Paint			Pearl dark grey and innovation blue								
Metal bellows coupling (recommended product type – validate sizing with cymex®)			BC2-00300AA032.000-X								
Bore diameter of coupling on the application side		*mm*	X = 024.000 - 060.000								
Mass moment of inertia (relates to the drive)	J_1	$kgcm^2$	4.42	4.32	4.31	4.23	4.22	1.62	1.61	1.61	1.61
		10^{-3} $in.lb.s^2$	3.9	3.8	3.8	3.7	3.7	1.4	1.4	1.4	1.4

Please use our sizing software cymex® for a detailed sizing – **www.wittenstein-cymex.com**

[a] Refers to center of the output shaft or flange



without brake

Ratio	Encoder	Length L0 in mm	Length L1 in mm
i = 16 – 35	Resolver	319.2	26.5
	HIPERFACE®		
	EnDat		
	DRIVE-CLiQ	351.2	58.5
i = 40 – 100	Resolver	295.1	26.5
	HIPERFACE®		
	EnDat		
	DRIVE-CLiQ	327.1	58.5

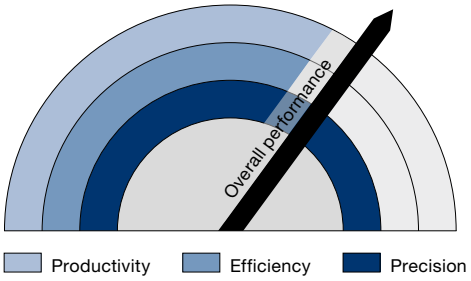
with brake

Ratio	Encoder	Length L0 in mm	Length L1 in mm
i = 16 – 35	Resolver	364.7	26.5
	HIPERFACE®		
	EnDat		
	DRIVE-CLiQ	396.7	58.5
i = 40 – 100	Resolver	319.1	26.5
	HIPERFACE®		
	EnDat		
	DRIVE-CLiQ	351.1	58.5

premo®
TP Line

The dynamic class

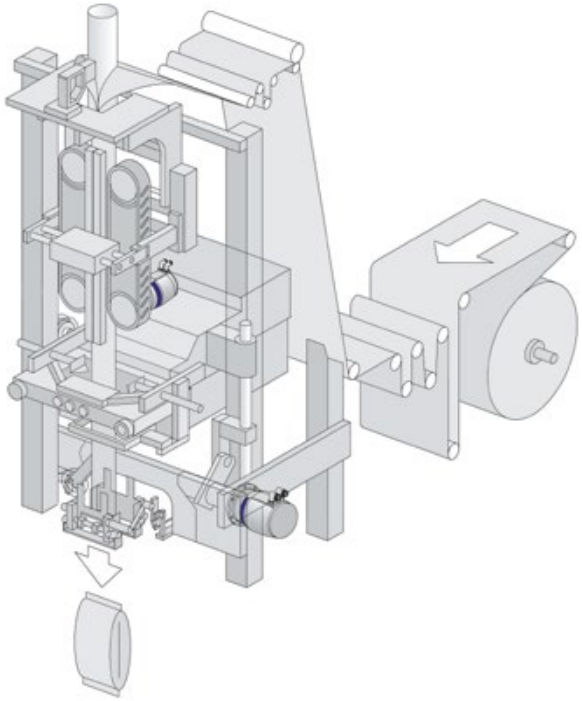
- Ideal for challenging positioning and processing tasks
- Minimal backlash and maximum torsional rigidity allow for the shortest cycle times and excellent surface finish
- Mechanical interface with output flange
- Ideal for connecting lever arms or pinions
- Electric interface with absolute encoder HIPERFACE® singleturn for high positioning accuracy as standard
- Optionally extendable with all available encoders and connector versions



Application example

Tubular bag machines continuously package bulk material of all types – including foodstuffs such as chips or candy. The aim here is to achieve maximum throughput. It is particularly important that all the bags are clean and tightly sealed.

premo® TP Line solves this challenge thanks to its exceptional precision and power density.



			2-stage								
Ratio	**i**		**16**	**20**	**25**	**28**	**35**	**40**	**50**	**70**	**100**
Operating voltage	U_D	*V DC*	560								
Max. acceleration torque (max. 1000 cycles per hour)	T_{2B}	*Nm*	41.6	52.3	55	55	55	50.2	55	55	35
		in.lb	368	463	487	487	487	444	487	487	310
Static output torque	T_{20}	*Nm*	16.5	20.9	26.2	29.3	37	20.1	25.3	35.5	18
		in.lb	146	185	232	259	327	178	224	314	159
Brake holding torque (at 120 °C)	T_{2Br}	*Nm*	20.8	26	32.5	36.4	45.5	20.8	26	36.4	52
		in.lb	184	230	288	322	403	184	230	322	460
Max. speed at output	n_{2max}	*rpm*	375	300	240	214	171	150	120	85.7	60
Speed limit for T_{2B}	n_{2B}	*rpm*	375	300	240	214	171	150	120	85.7	60
Max. motor acceleration torque	T_{1max}	*Nm*	2.84	2.84	2.84	2.84	2.84	1.4	1.4	1.4	1.4
		in.lb	25	25	25	25	25	12	12	12	12
Max. motor acceleration current	I_{MaxDyn}	A_{eff}	4.47	4.47	4.47	4.47	4.47	2.52	2.52	2.52	2.52
Static motor current	I_0	A_{eff}	1.71	1.71	1.71	1.71	1.71	1	1	1	1
Max. backlash	j_t	*arcmin*	Standard ≤ 4 Reduced ≤ 2								
Torsional rigidity (Gearbox)	C_{t21}	*Nm/arcmin*	12	12	12	12	12	11	12	11	8
		in.lb/arcmin	106	106	106	106	106	97	106	97	71
Tilting rigidity	C_{2K}	*Nm/arcmin*	85								
		in.lb/arcmin	752								
Max. axial force [a]	F_{2AMax}	*N*	1630								
		lb_f	367								
Max. tilting moment	M_{2KMax}	*Nm*	110								
		in.lb	974								
Service life	L_h	*h*	> 20000								
Weight (without brake)	*m*	*kg*	2.7 to 3.1								
		lb_m	6 to 6.9								
Ambient temperature		*°C*	0 to +40								
		°F	+32 to +104								
Lubrication			Lubricated for life								
Insulating material class			F								
Protection class			IP 65								
Paint			Pearl dark grey and innovation blue								
Metal bellows coupling (recommended product type – validate sizing with cymex®)			BCT-00015AAX-031.500								
Bore diameter of coupling on the application side		*mm*	X = 012.000 - 028.000								
Mass moment of inertia (relates to the drive)	J_1	$kgcm^2$	0.37	0.37	0.36	0.36	0.36	0.22	0.22	0.22	0.22
		10^{-3} *in.lb.s²*	0.33	0.33	0.32	0.32	0.32	0.19	0.19	0.19	0.19

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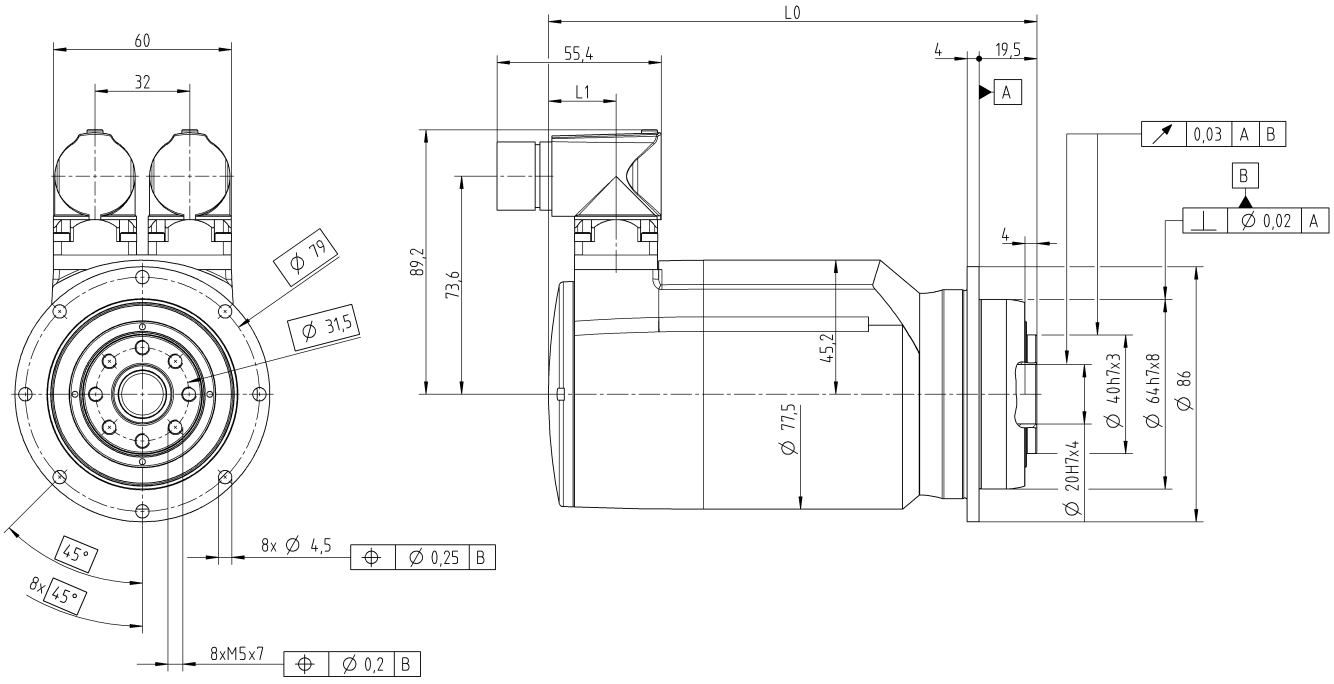
[a] Refers to center of the output shaft or flange



without brake

Ratio	Encoder	Length L0 in mm	Length L1 in mm
i = 16 – 35	Resolver	164.8	22.8
	HIPERFACE®	187.3	45.3
	EnDat		
	DRIVE-CLiQ	217.7	75.7
i = 40 – 100	Resolver	149.8	22.8
	HIPERFACE®	172.3	45.3
	EnDat		
	DRIVE-CLiQ	202.7	75.7

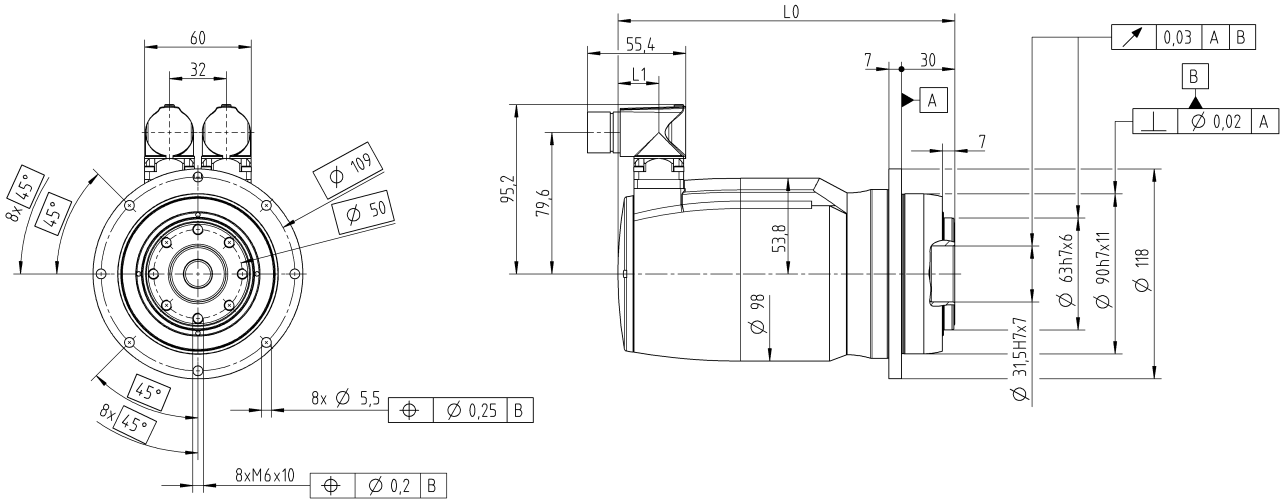
with brake

Ratio	Encoder	Length L0 in mm	Length L1 in mm
i = 16 – 35	Resolver	200.8	22.8
	HIPERFACE®	223.3	45.3
	EnDat		
	DRIVE-CLiQ	253.7	75.7
i = 40 – 100	Resolver	177.3	22.8
	HIPERFACE®	199.8	45.3
	EnDat		
	DRIVE-CLiQ	230.2	75.7

			2-stage								
Ratio	**i**		**16**	**20**	**25**	**28**	**35**	**40**	**50**	**70**	**100**
Operating voltage	U_D	*V DC*	560								
Max. acceleration torque (max. 1000 cycles per hour)	T_{2B}	*Nm*	81.3	102	128	143	143	102	127	143	105
		in.lb	720	903	1133	1266	1266	903	1124	1266	929
Static output torque	T_{20}	*Nm*	29.9	37.7	47.3	53.2	67.3	38.7	48.4	68.8	60
		in.lb	265	334	419	471	596	343	428	609	531
Brake holding torque (at 120 °C)	T_{2Br}	*Nm*	37.4	46.8	58.5	65.5	81.9	52	65	91	130
		in.lb	331	414	518	580	725	460	575	805	1151
Max. speed at output	n_{2max}	*rpm*	375	300	240	214	171	150	120	85.7	60
Speed limit for T_{2B}	n_{2B}	*rpm*	269	215	172	154	138	119	95.2	78	60
Max. motor acceleration torque	T_{1max}	*Nm*	5.53	5.53	5.53	5.53	5.53	2.76	2.76	2.76	2.76
		in.lb	49	49	49	49	49	24	24	24	24
Max. motor acceleration current	I_{MaxDyn}	A_{eff}	6.94	6.94	6.94	6.94	6.94	4.45	4.45	4.45	4.45
Static motor current	I_0	A_{eff}	2.33	2.33	2.33	2.33	2.33	1.58	1.58	1.58	1.58
Max. backlash	j_t	*arcmin*	Standard ≤ 3 Reduced ≤ 1								
Torsional rigidity (Gearbox)	C_{t21}	*Nm/arcmin*	32	32	32	31	32	30	30	28	22
		in.lb/arcmin	283	283	283	274	283	266	266	248	195
Tilting rigidity	C_{2K}	*Nm/arcmin*	225								
		in.lb/arcmin	1991								
Max. axial force [a]	F_{2AMax}	*N*	2150								
		lb_f	484								
Max. tilting moment	M_{2KMax}	*Nm*	270								
		in.lb	2390								
Service life	L_h	*h*	> 20000								
Weight (without brake)	*m*	*kg*	5.1 to 5.6								
		lb_m	11 to 12								
Ambient temperature		*°C*	0 to +40								
		°F	+32 to +104								
Lubrication			Lubricated for life								
Insulating material class			F								
Protection class			IP 65								
Paint			Pearl dark grey and innovation blue								
Metal bellows coupling (recommended product type – validate sizing with cymex®)			BCT-00060AAX-050.000								
Bore diameter of coupling on the application side		*mm*	X = 014.000 - 035.000								
Mass moment of inertia (relates to the drive)	J_1	$kgcm^2$	0.91	0.88	0.87	0.85	0.85	0.48	0.47	0.47	0.47
		10^{-3} *in.lb.s²*	0.81	0.78	0.77	0.75	0.75	0.42	0.42	0.42	0.42

Please use our sizing software cymex® for a detailed sizing – **www.wittenstein-cymex.com**

[a] Refers to center of the output shaft or flange



without brake

Ratio	Encoder	Length L0 in mm	Length L1 in mm
i = 16 – 35	Resolver	189.5	23
	HIPERFACE®	211.8	45.3
	EnDat		
	DRIVE-CLiQ	242	75.5
i = 40 – 100	Resolver	174.5	23
	HIPERFACE®	196.8	45.3
	EnDat		
	DRIVE-CLiQ	227	75.5

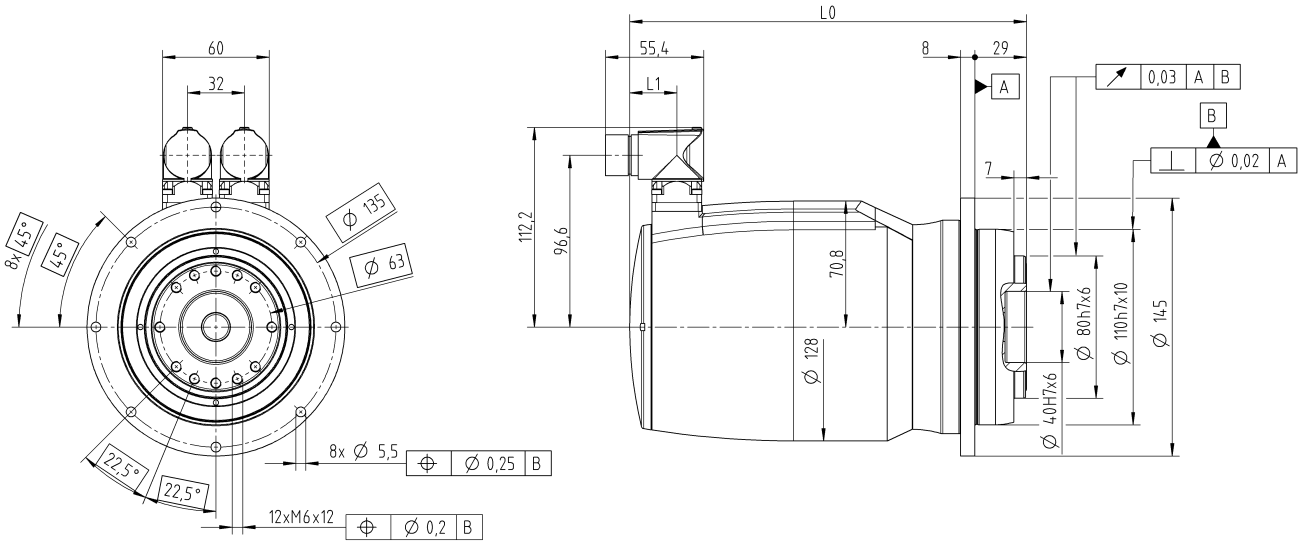
with brake

Ratio	Encoder	Length L0 in mm	Length L1 in mm
i = 16 – 35	Resolver	228.5	23
	HIPERFACE®	250.8	45.3
	EnDat		
	DRIVE-CLiQ	281	75.5
i = 40 – 100	Resolver	190.3	23
	HIPERFACE®	212.6	45.3
	EnDat		
	DRIVE-CLiQ	242.8	75.5

			2-stage								
Ratio	**i**		**16**	**20**	**25**	**28**	**35**	**40**	**50**	**70**	**100**
Operating voltage	U_D	*V DC*	560								
Max. acceleration torque (max. 1000 cycles per hour)	T_{2B}	*Nm*	247	310	380	350	380	226	283	330	265
		in.lb	2186	2744	3363	3098	3363	2000	2505	2921	2345
Static output torque	T_{20}	*Nm*	92.6	116	146	164	206	89.1	112	158	120
		in.lb	820	1027	1292	1452	1823	789	991	1398	1062
Brake holding torque (at 120 °C)	T_{2Br}	*Nm*	116	146	182	204	255	93.6	117	164	234
		in.lb	1027	1292	1611	1806	2257	828	1036	1452	2071
Max. speed at output	n_{2max}	*rpm*	375	300	240	214	171	150	120	85.7	60
Speed limit for T_{2B}	n_{2B}	*rpm*	322	257	206	197	166	108	86.4	68	60
Max. motor acceleration torque	T_{1max}	*Nm*	16.7	16.7	16.7	16.7	16.7	6.09	6.09	6.09	6.09
		in.lb	148	148	148	148	148	54	54	54	54
Max. motor acceleration current	I_{MaxDyn}	A_{eff}	19.8	19.8	19.8	19.8	19.8	7.7	7.7	7.7	7.7
Static motor current	I_0	A_{eff}	7.05	7.05	7.05	7.05	7.05	2.77	2.77	2.77	2.77
Max. backlash	j_t	*arcmin*	Standard ≤ 3 Reduced ≤ 1								
Torsional rigidity (Gearbox)	C_{t21}	*Nm/arcmin*	81	81	83	80	82	76	80	71	60
		in.lb/arcmin	717	717	735	708	726	673	708	628	531
Tilting rigidity	C_{2K}	*Nm/arcmin*	550								
		in.lb/arcmin	4868								
Max. axial force [a]	F_{2AMax}	*N*	4150								
		lb_f	934								
Max. tilting moment	M_{2KMax}	*Nm*	440								
		in.lb	3894								
Service life	L_h	*h*	> 20000								
Weight (without brake)	*m*	*kg*	8.8 to 10.5								
		lb_m	19 to 23								
Ambient temperature		*°C*	0 to +40								
		°F	+32 to +104								
Lubrication			Lubricated for life								
Insulating material class			F								
Protection class			IP 65								
Paint			Pearl dark grey and innovation blue								
Metal bellows coupling (recommended product type – validate sizing with cymex®)			BCT-00150AAX-063.000								
Bore diameter of coupling on the application side		*mm*	X = 019.000 - 042.000								
Mass moment of inertia (relates to the drive)	J_1	$kgcm^2$	4.46	4.35	4.33	4.24	4.23	1.62	1.62	1.61	1.61
		10^{-3} *in.lb.s²*	3.9	3.8	3.8	3.8	3.7	1.4	1.4	1.4	1.4

Please use our sizing software cymex® for a detailed sizing – **www.wittenstein-cymex.com**

[a] Refers to center of the output shaft or flange



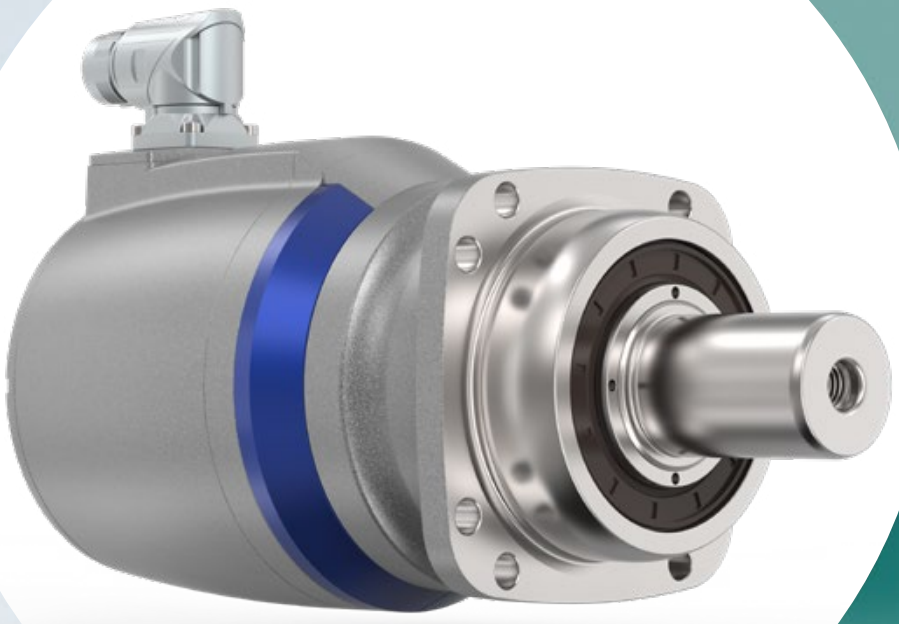
without brake

Ratio	Encoder	Length L0 in mm	Length L1 in mm
i = 16 – 35	Resolver	223.2	26.5
	HIPERFACE®		
	EnDat		
	DRIVE-CLiQ	255.2	58.5
i = 40 – 100	Resolver	199.1	26.5
	HIPERFACE®		
	EnDat		
	DRIVE-CLiQ	231.1	58.5

with brake

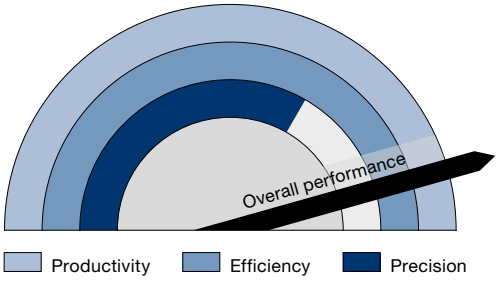
Ratio	Encoder	Length L0 in mm	Length L1 in mm
i = 16 – 35	Resolver	268.7	26.5
	HIPERFACE®		
	EnDat		
	DRIVE-CLiQ	300.7	58.5
i = 40 – 100	Resolver	223.1	26.5
	HIPERFACE®		
	EnDat		
	DRIVE-CLiQ	255.1	58.5

premo®
XP Line



The extra class

- Particularly high power density and load capacity
- Extremely low backlash, high torsional rigidity and maximum load capacity of the output bearing enable a highly compact servo actuator platform for enhanced machine performance
- Mechanical interface with output shaft, ideal for connecting couplings or pinions
- In addition to the smooth shaft version, key and splined shaft versions are also available
- Electric interface with absolute encoder HIPERFACE DSL®, singleturn as standard incl. functional safety and single-cable connection

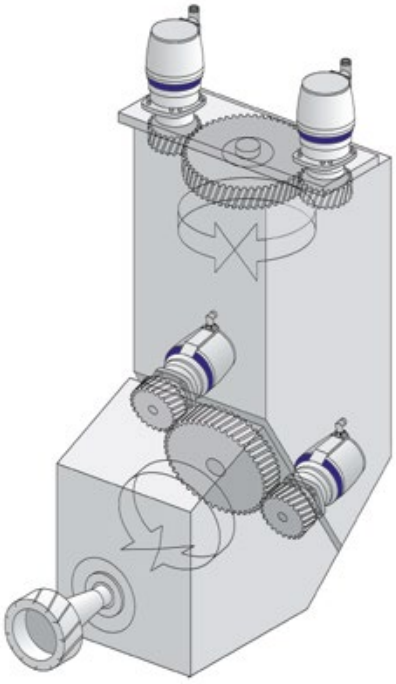


- Safety requirements are united with the latest connection technology
- Optionally extendable with all available encoders and connector versions

Application example

Especially in the milling head of a machining center, high disturbing forces occur due to the material processing.

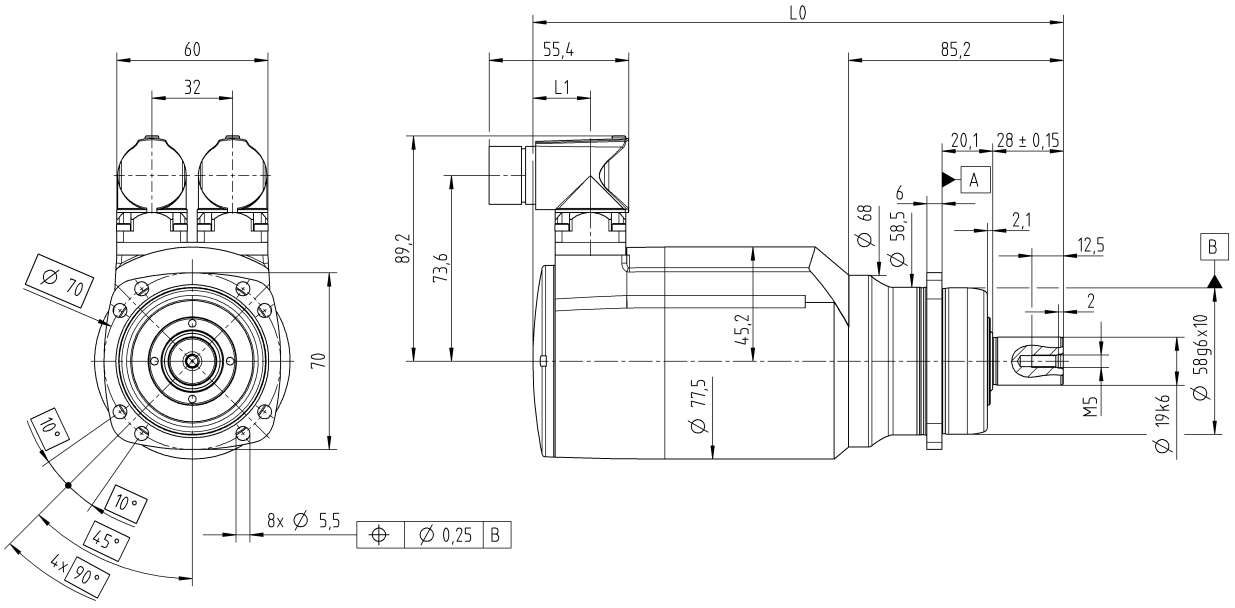
Due to the restricted installation space, actuators with the highest power density and load capacity are required here. premo® XP Line offers the ideal solution.



			2-stage								
Ratio	**i**		**16**	**20**	**25**	**28**	**35**	**40**	**50**	**70**	**100**
Operating voltage	U_D	*V DC*	560								
Max. acceleration torque (max. 1000 cycles per hour)	T_{2B}	*Nm*	41.8	52.3	65.3	73.4	80	50.3	62.9	60	35
		in.lb	370	463	578	650	708	445	557	531	310
Static output torque	T_{20}	*Nm*	16.6	20.9	26	29.4	36.9	20.3	25.3	35.5	20
		in.lb	147	185	230	260	327	180	224	314	177
Brake holding torque (at 120 °C)	T_{2Br}	*Nm*	20.8	26	32.5	36.4	45.5	20.8	26	36.4	52
		in.lb	184	230	288	322	403	184	230	322	460
Max. speed at output	n_{2max}	*rpm*	375	300	240	214	171	150	120	85.7	60
Speed limit for T_{2B}	n_{2B}	*rpm*	375	300	240	214	171	150	120	85.7	60
Max. motor acceleration torque	T_{1max}	*Nm*	2.84	2.84	2.84	2.84	2.84	1.4	1.4	1.4	1.4
		in.lb	25	25	25	25	25	12	12	12	12
Max. motor acceleration current	I_{MaxDyn}	A_{eff}	4.47	4.47	4.47	4.47	4.47	2.52	2.52	2.52	2.52
Static motor current	I_0	A_{eff}	1.71	1.71	1.71	1.71	1.71	1	1	1	1
Max. backlash	j_t	*arcmin*	Standard ≤ 5 Reduced ≤ 3								
Torsional rigidity (Gearbox)	C_{t21}	*Nm/arcmin*	6.5	6.5	6.5	6.5	6.5	6.5	6.5	6.5	5
		in.lb/arcmin	58	58	58	58	58	58	58	58	44
Max. axial force [a]	F_{2AMax}	*N*	3600								
		lb_f	810								
Max. lateral force [a]	F_{2QMax}	*N*	3800								
		lb_f	855								
Max. tilting moment	M_{2KMax}	*Nm*	339								
		in.lb	3000								
Service life	L_h	*h*	> 20000								
Weight (without brake)	*m*	*kg*	2.9 to 3.3								
		lb_m	6.4 to 7.3								
Ambient temperature		*°C*	0 to +40								
		°F	+32 to +104								
Lubrication			Lubricated for life								
Insulating material class			F								
Protection class			IP 65								
Paint			Pearl dark grey and innovation blue								
Metal bellows coupling (recommended product type – validate sizing with cymex®)			BC3-00150AA019.000-X								
Bore diameter of coupling on the application side		*mm*	X = 015.000 - 038.000								
Mass moment of inertia (relates to the drive)	J_1	$kgcm^2$	0.38	0.37	0.37	0.36	0.36	0.22	0.22	0.22	0.22
		10^{-3} *in.lb.s²*	0.34	0.33	0.33	0.32	0.32	0.19	0.19	0.19	0.19

Please use our sizing software cymex® for a detailed sizing – **www.wittenstein-cymex.com**

[a] Refers to center of the output shaft or flange



without brake

Ratio	Encoder	Length L0 in mm	Length L1 in mm
i = 16 – 35	Resolver	210.3	22.8
	HIPERFACE®	232.8	45.3
	EnDat		
	DRIVE-CLiQ	263.2	75.7
i = 40 – 100	Resolver	195.3	22.8
	HIPERFACE®	217.8	45.3
	EnDat		
	DRIVE-CLiQ	248.2	75.7

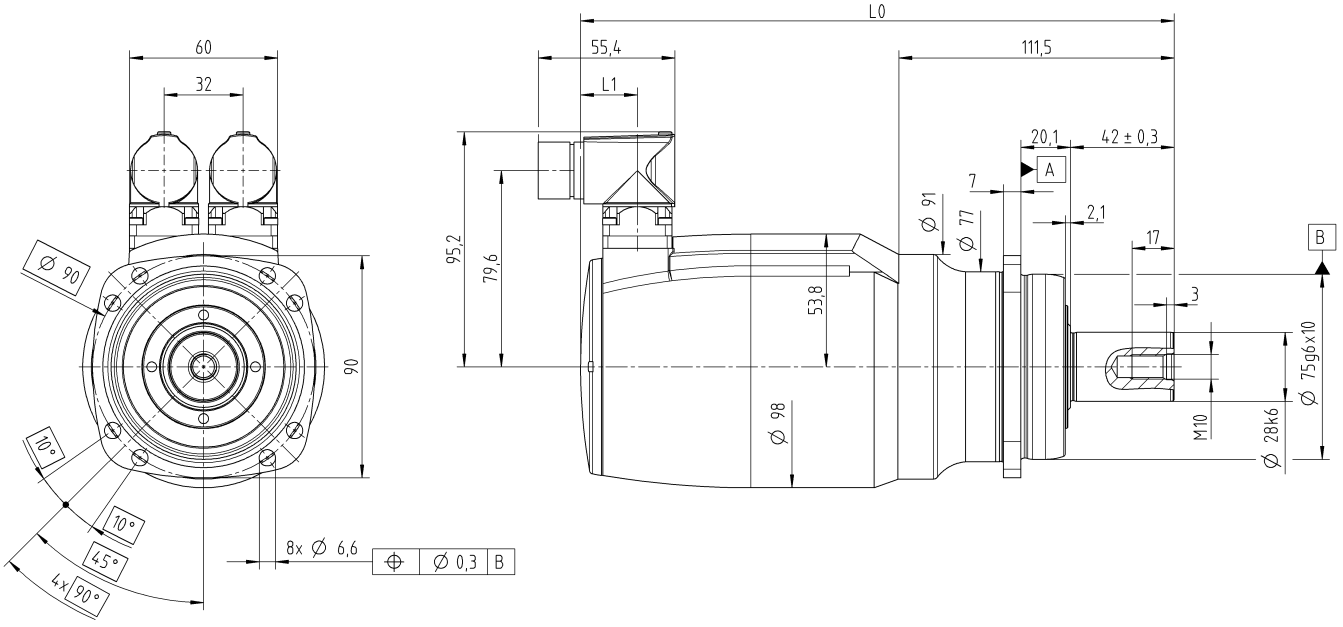
with brake

Ratio	Encoder	Length L0 in mm	Length L1 in mm
i = 16 – 35	Resolver	246.3	22.8
	HIPERFACE®	268.8	45.3
	EnDat		
	DRIVE-CLiQ	299.2	75.7
i = 40 – 100	Resolver	222.8	22.8
	HIPERFACE®	245.3	45.3
	EnDat		
	DRIVE-CLiQ	275.7	75.7

			2-stage								
Ratio	**i**		**16**	**20**	**25**	**28**	**35**	**40**	**50**	**70**	**100**
Operating voltage	U_D	*V DC*	560								
Max. acceleration torque (max. 1000 cycles per hour)	T_{2B}	*Nm*	81.9	103	128	144	180	102	128	165	105
		in.lb	725	912	1133	1275	1593	903	1133	1460	929
Static output torque	T_{20}	*Nm*	30.5	38.4	47.8	54	67.5	39.1	49	68.8	60
		in.lb	270	340	423	478	597	346	434	609	531
Brake holding torque (at 120 °C)	T_{2Br}	*Nm*	37.4	46.8	58.5	65.5	81.9	52	65	91	130
		in.lb	331	414	518	580	725	460	575	805	1151
Max. speed at output	n_{2max}	*rpm*	375	300	240	214	171	150	120	85.7	60
Speed limit for T_{2B}	n_{2B}	*rpm*	269	215	172	154	123	119	95.2	70.1	60
Max. motor acceleration torque	T_{1max}	*Nm*	5.53	5.53	5.53	5.53	5.53	2.76	2.76	2.76	2.76
		in.lb	49	49	49	49	49	24	24	24	24
Max. motor acceleration current	I_{MaxDyn}	A_{eff}	6.94	6.94	6.94	6.94	6.94	4.45	4.45	4.45	4.45
Static motor current	I_0	A_{eff}	2.33	2.33	2.33	2.33	2.33	1.58	1.58	1.58	1.58
Max. backlash	j_t	*arcmin*	Standard ≤ 4 Reduced ≤ 2								
Torsional rigidity (Gearbox)	C_{t21}	*Nm/arcmin*	19.5	19.5	19.5	19.5	19.5	19.5	19.5	18	15
		in.lb/arcmin	173	173	173	173	173	173	173	159	133
Max. axial force [a]	F_{2AMax}	*N*	4000								
		lb_f	900								
Max. lateral force [a]	F_{2QMax}	*N*	6000								
		lb_f	1350								
Max. tilting moment	M_{2KMax}	*Nm*	675								
		in.lb	5974								
Service life	L_h	*h*	> 20000								
Weight (without brake)	*m*	*kg*	5 to 5.5								
		lb_m	11 to 12								
Ambient temperature		*°C*	0 to +40								
		°F	+32 to +104								
Lubrication			Lubricated for life								
Insulating material class			F								
Protection class			IP 65								
Paint			Pearl dark grey and innovation blue								
Metal bellows coupling (recommended product type – validate sizing with cymex®)			BC3-00300AA028.000-X								
Bore diameter of coupling on the application side		*mm*	X = 024.000 - 056.000								
Mass moment of inertia (relates to the drive)	J_1	$kgcm^2$	0.91	0.88	0.87	0.85	0.85	0.48	0.47	0.47	0.47
		10^{-3} $in.lb.s^2$	0.81	0.78	0.77	0.75	0.75	0.42	0.42	0.42	0.42

Please use our sizing software cymex® for a detailed sizing – **www.wittenstein-cymex.com**

[a] Refers to center of the output shaft or flange



without brake

Ratio	Encoder	Length L0 in mm	Length L1 in mm
i = 16 – 35	Resolver	240.5	23
	HIPERFACE®	262.8	45.3
	EnDat		
	DRIVE-CLiQ	293	75.5
i = 40 – 100	Resolver	225.5	23
	HIPERFACE®	247.8	45.3
	EnDat		
	DRIVE-CLiQ	278	75.5

with brake

Ratio	Encoder	Length L0 in mm	Length L1 in mm
i = 16 – 35	Resolver	279.5	23
	HIPERFACE®	301.8	45.3
	EnDat		
	DRIVE-CLiQ	332	75.5
i = 40 – 100	Resolver	241.3	23
	HIPERFACE®	263.6	45.3
	EnDat		
	DRIVE-CLiQ	293.8	75.5

			2-stage								
Ratio	**i**		**16**	**20**	**25**	**28**	**35**	**40**	**50**	**70**	**100**
Operating voltage	U_D	*V DC*	560								
Max. acceleration torque (max. 1000 cycles per hour)	T_{2B}	*Nm*	248	310	388	435	450	226	283	350	275
		in.lb	2195	2744	3434	3850	3983	2000	2505	3098	2434
Static output torque	T_{20}	*Nm*	93.3	117	147	164	206	89.3	112	158	130
		in.lb	826	1036	1301	1452	1823	790	991	1398	1151
Brake holding torque (at 120 °C)	T_{2Br}	*Nm*	116	146	182	204	255	93.6	117	164	234
		in.lb	1027	1292	1611	1806	2257	828	1036	1452	2071
Max. speed at output	n_{2max}	*rpm*	375	300	240	214	171	150	120	85.7	60
Speed limit for T_{2B}	n_{2B}	*rpm*	322	257	206	184	157	108	86.4	65.7	60
Max. motor acceleration torque	T_{1max}	*Nm*	16.7	16.7	16.7	16.7	16.7	6.09	6.09	6.09	6.09
		in.lb	148	148	148	148	148	54	54	54	54
Max. motor acceleration current	I_{MaxDyn}	A_{eff}	19.8	19.8	19.8	19.8	19.8	7.7	7.7	7.7	7.7
Static motor current	I_0	A_{eff}	7.05	7.05	7.05	7.05	7.05	2.77	2.77	2.77	2.77
Max. backlash	j_t	*arcmin*	Standard ≤ 4 Reduced ≤ 2								
Torsional rigidity (Gearbox)	C_{t21}	*Nm/arcmin*	45	45	45	45	45	45	45	42	35
		in.lb/arcmin	398	398	398	398	398	398	398	372	310
Max. axial force [a]	F_{2AMax}	*N*	5700								
		lb_f	1283								
Max. lateral force [a]	F_{2QMax}	*N*	9000								
		lb_f	2025								
Max. tilting moment	M_{2KMax}	*Nm*	1296								
		in.lb	11471								
Service life	L_h	*h*	> 20000								
Weight (without brake)	*m*	*kg*	9.7 to 11.4								
		lb_m	21 to 25								
Ambient temperature		*°C*	0 to +40								
		°F	+32 to +104								
Lubrication			Lubricated for life								
Insulating material class			F								
Protection class			IP 65								
Paint			Pearl dark grey and innovation blue								
Metal bellows coupling (recommended product type – validate sizing with cymex®)			BC3-00500AA038.000-X								
Bore diameter of coupling on the application side		*mm*	X = 024.000 - 056.000								
Mass moment of inertia (relates to the drive)	J_1	$kgcm^2$	4.46	4.35	4.33	4.24	4.23	1.62	1.62	1.61	1.61
		10^{-3} *in.lb.s²*	3.9	3.8	3.8	3.8	3.7	1.4	1.4	1.4	1.4

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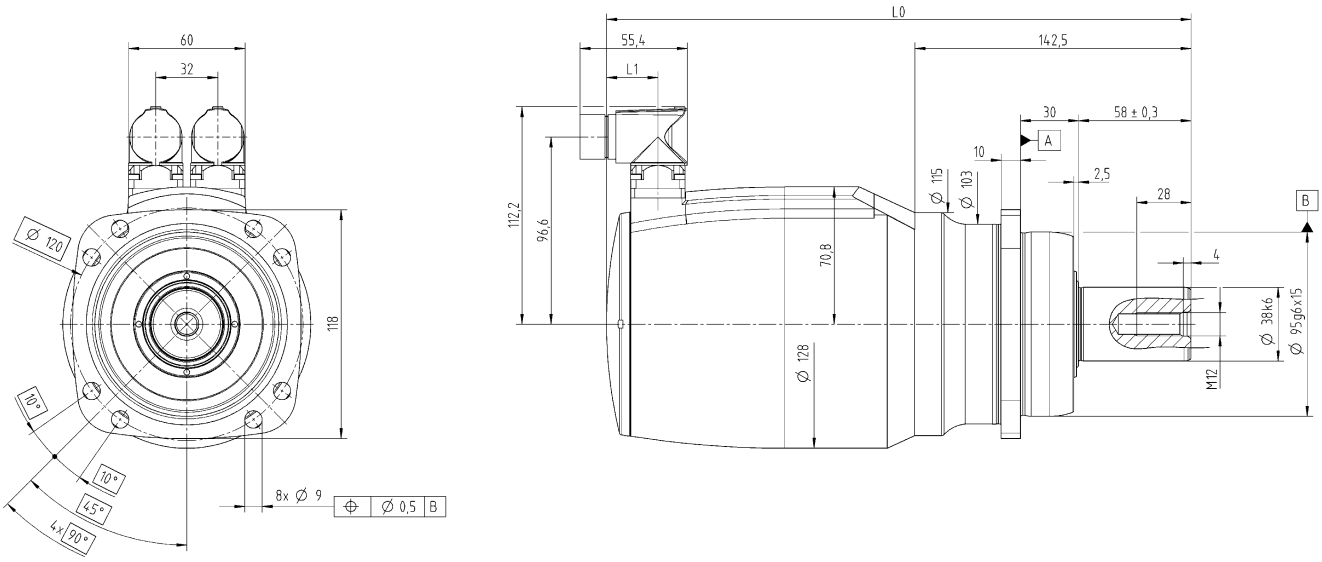
[a] Refers to center of the output shaft or flange



without brake

Ratio	Encoder	Length L0 in mm	Length L1 in mm
i = 16 – 35	Resolver	301.7	26.5
	HIPERFACE®		
	EnDat		
	DRIVE-CLiQ	333.7	58.5
i = 40 – 100	Resolver	277.6	26.5
	HIPERFACE®		
	EnDat		
	DRIVE-CLiQ	309.6	58.5

with brake

Ratio	Encoder	Length L0 in mm	Length L1 in mm
i = 16 – 35	Resolver	347.2	26.5
	HIPERFACE®		
	EnDat		
	DRIVE-CLiQ	379.2	58.5
i = 40 – 100	Resolver	301.6	26.5
	HIPERFACE®		
	EnDat		
	DRIVE-CLiQ	333.6	58.5

premo® options

Electrical connection
Straight or right-angled version, alignment of outlets to gearbox flange (XP Line) and single-cable connection for DSL protocol and EnDAT 2.2 available.

Encoder
In addition to the standard version in the respective product line, optional encoder systems with the protocols EnDat 2.1, EnDat 2.2, HIPERFACE®, HIPERFACE DSL® and DRIVE-CLiQ are available.

Pin assignment
For a number of servo controllers, we offer special pin assignments for power and signal.

Temperature sensor
Choose from PTC for temperature switch functionality or KTY for a linear reading of operating temperature.

Operating voltage
Depending on the application and servo controller, windings for 320 and 560 V DC are available.

Holding brake
A suitable permanent-magnet holding brake adapted to the motor power is available.

Lubrication
Select from the standard lubrication with oil or grease as well as food-grade grease and oil.

Backlash
To improve precision, the gearbox backlash can be reduced.

Gearbox model
Within the respective product line, there are different versions of output and housing flange.

premo® options

Gearbox model

Several mechanical interface versions are available:

Version	SP Line	TP Line	XP Line
Output	- Smooth shaft (standard) - Key (option) - Splined (option)	- Flange (standard) - System output (option)	- Smooth shaft (standard) - Key (option) - Splined (option) - System output (option)
Housing	Round through bore (standard)	Round through bore (standard)	- Round through bore (standard) - Slotted through bore (option)

Lubrication

Depending on the application, the requirements regarding the lubricant in the gearbox change.

The following lubricants are available for our servo actuators:

- Oil lubricant (Standard)
- Grease lubricant
  (Reduction of output torque by up to 20 %)
- Food-grade oil lubricant
  (Reduction of output torque by up to 20 %)
- Food-grade grease lubricant
  (Reduction of output torque by up to 40 %)

Operating voltage

The premo® servo actuators are available for operating voltages of 320 V and 560 V. The dielectric strength goes up to 750 V, so the use with servo controllers with the appropriate operating voltage is possible.

Temperature sensor

Different sensors are available to protect the motor coil from overheating.
- PTC resistor, type STM 160 according to DIN 44081/82
- KTY 84-130

Encoder

Connectivity is the magic word. Here, WITTENSTEIN alpha offers its customers maximum flexibility.

A large selection of encoder systems is available for positioning and speed measurement.

Resolver
- 2 poles, one sine / cosine cycle per revolution
  (standard SP Line)

HIPERFACE® absolute encoder, safety acc. to SIL 2
- Singleturn, resolution 4096 positions per revolution,
  128 sine/cosine (standard TP Line)
- Multiturn, resolution 4096 positions per revolution,
  128 sine/cosine, 4096 revolutions

HIPERFACE DSL® absolute encoder, safety acc. to SIL 2
- Singleturn, resolution 20 bits per revolution,
  (standard XP Line)
- Multiturn, resolution 20 bits per revolution, 4096 revolutions

EnDat 2.1, absolute encoder
- Singleturn, resolution 8192 positions per revolution,
  512 sine/cosine
- Multiturn, resolution 8192 positions per revolution,
  512 sine/cosine, 4096 revolutions

EnDat 2.2, absolute encoder, safety acc. to SIL 2
- Singleturn, resolution 23 bits per revolution
- Multiturn, resolution 23 bits per revolution, 4096 revolutions

DRIVE-CLiQ, absolute encoder, safety acc. to SIL 2
- Singleturn, resolution 24 bits per revolution
- Multiturn, resolution 24 bits per revolution, 4096 revolutions

Holding brake

A compact permanent magnet brake is fitted to secure the motor shaft when the actuator is disconnected from the power. Characteristics include no torsional backlash, no residual torque when the brake is released and unlimited duty cycles at zero speed.

		Size 1		Size 2		Size 3	
Ratio		**16 – 35**	**40 – 100**	**16 – 35**	**40 – 100**	**16 – 35**	**40 – 100**
Static holding torque at 120 °C[1)]	Nm	1.3	0.52	2.34	1.3	7.28	2.34
Supply voltage	V DC	24	24	24	24	24	24
Current at nominal voltage and 20 °C	A DC	0.46	0.42	0.5	0.46	0.71	0.5
Connection time	ms	≤ 8	≤ 10	≤ 20	≤ 8	–	≤ 20
Separation time	ms	≤ 35	≤ 18	≤ 50	≤ 35	≤ 60	≤ 50

[1)] Please refer to our project planning note on the brake.

For the precise holding torques at the output, please refer to the relevant data tables for the servo actuators, e.g. premo® TP Line Size 3. In the case of transmission ratios in which the holding torque at the output is above T_{2B}, the brake can be used max. 1000 times on the rotating motor.

Electrical connection

In addition to the conventional connection via two integral sockets for power and signal, a version for a single-cable connection in conjunction with EnDat 2.2 or HIPERFACE DSL® is available.

Integral sockets used:

Single-cable connection	Power and signal	Integral power socket M23 Bayonet coupling, 13/9-pin
Two-cable connection	Power	Integral power socket M23 Bayonet coupling, 6/9-pin
	Signal	Integral signal socket M23 Bayonet coupling, 9/12/17-pin

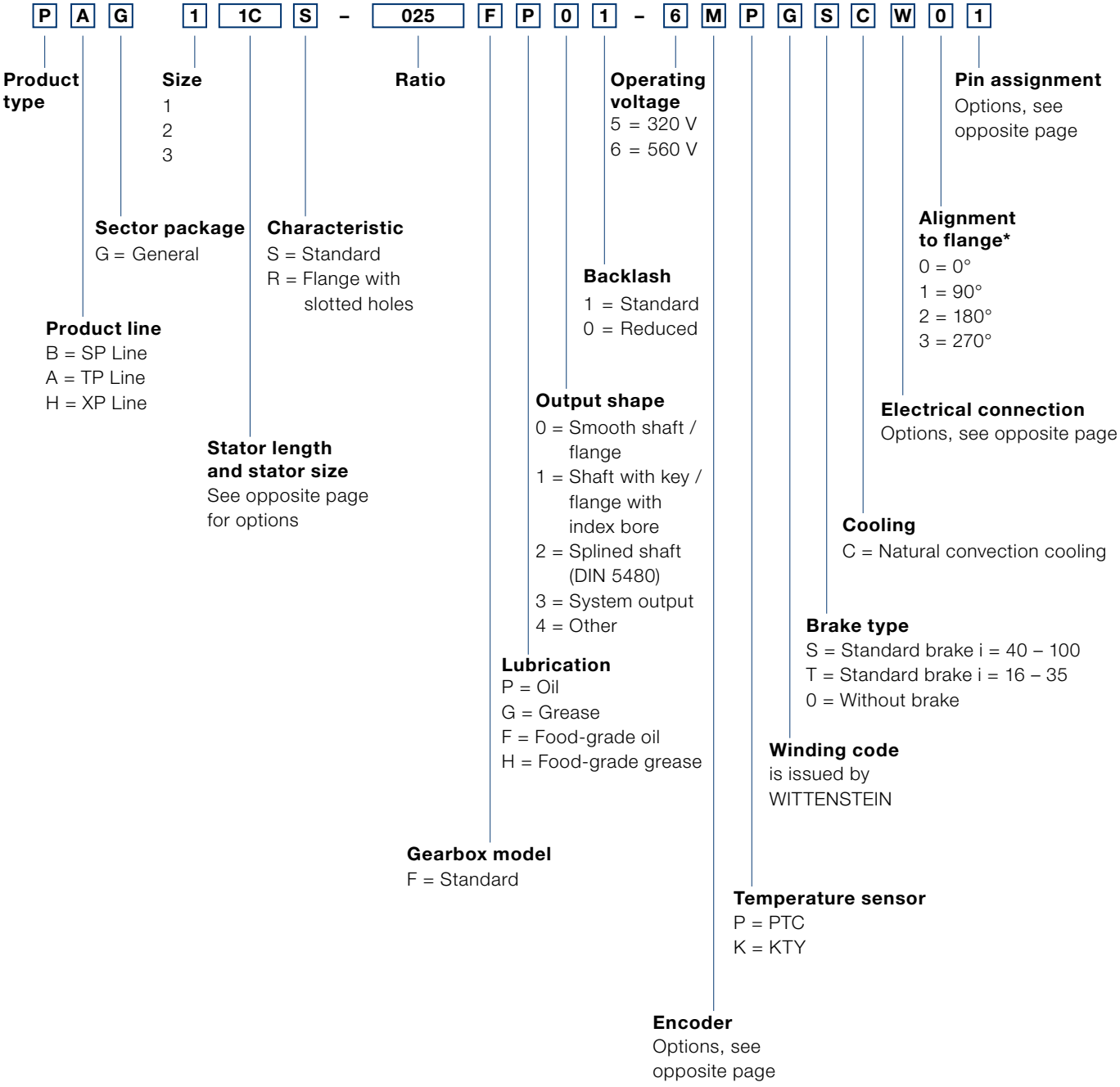
Pin assignment

The great flexibility of the new premo® servo actuator platform is also demonstrated by the pin assignments. In addition to two standard WITTENSTEIN pin assignments, a number of compatible connections are available for various servo controller suppliers.

Pin assignment 1	WITTENSTEIN alpha-Standard, temperature sensor in signal cable Resolver, DRIVE-CLiQ
Pin assignment 2	Siemens-compatible (except DRIVE-CLiQ), temperature sensor in signal cable Resolver, EnDat 2.1
Pin assignment 4	WITTENSTEIN alpha-Standard, temperature sensor in power cable HIPERFACE®, EnDat 2.2
Pin assignment 5	Rockwell compatible HIPERFACE®, HIPERFACE DSL® (single-cable)

Pin assignment 6	B&R compatible Resolver, EnDat 2.2 (single-cable)
Pin assignment 8	Schneider compatible HIPERFACE®
Pin assignment 9	Beckhoff compatible HIPERFACE DSL® (single-cable)

premo® Ordering code



* The position of the electrical connection with respect to the flange is relevant for XP Line with characteristic R (flange with slotted holes). This information relates to the offset of the integral sockets to the slotted holes as seen on the servo actuator from the rear.

Electrical connection options

R	Angled integral socket, 1-cab
W	Angled integral socket, 2-cab
S	Straight integral socket, 1-cab
G	Straight integral socket, 2-cab

Pin assignment options

1	WITTENSTEIN alpha Standard with temperature sensor in signal line
2	Siemens compatible w/o DRIVE-CLiQ
4	WITTENSTEIN alpha Standard with temperature sensor in power cable
5	Rockwell compatible
6	B&R compatible
8	Schneider compatible
9	Beckhoff compatible

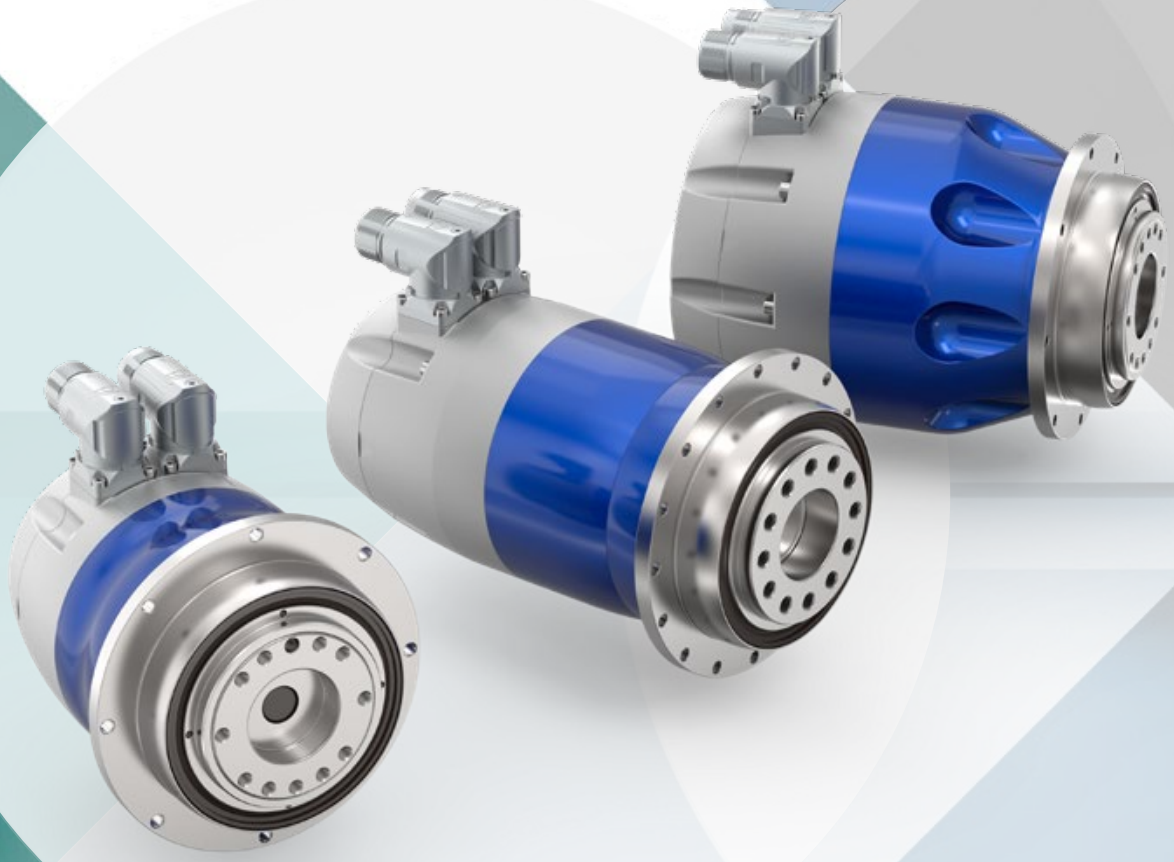
Stator length and stator size options

	Ratio 16 to 35	**Ratio 40 to 100**
Size 1	2C	1C
Size 2	2D	1D
Size 3	3F	1F

Encoder options

R	Resolver, 2 poles
S	EnDat 2.1 absolute, singleturn
M	EnDat 2.1 absolute, multiturn
F	EnDat 2.2 absolute, singleturn
W	EnDat 2.2 absolute, multiturn
N	HIPERFACE® absolute, singleturn
K	HIPERFACE® absolute, multiturn
G	HIPERFACE DSL® absolute, singleturn
H	HIPERFACE DSL® absolute, multiturn
L	DRIVE-CLiQ absolute, singleturn
D	DRIVE-CLiQ absolute, multiturn
E	Rockwell absolute, singleturn
V	Rockwell absolute, multiturn
J	Rockwell DSL absolute, singleturn
P	Rockwell DSL absolute, multiturn

TPM+ servo actuators



Overview of the **TPM+ product family**

The TPM+ product family is convincing. With its dynamics, torque and torsional rigidity. Extremely compact, high power density and superior smooth-running operation. Combined with its practice oriented performance graduation always an economic advantage in your production.

Product declarations

Servo actuator
The TPM+ product family is above all dynamic and compact. Servo motors and gearboxes merge seamlessly into a single versatile unit. The benefit: maximum power density in a smaller footprint allows for design flexibility.

Motor
Outstanding performance: permanently activated synchronous motor with highest power density thanks to rare earth magnets, a high pole count and a high fill factor with very low cogging (pole cogging torque).

Gearbox
The planetary gearboxes offer minimal backlash while achieving a high degree of torsional and tilting rigidity. The smooth-running helical toothing guarantees silent operation.

More productive. More efficient. More precise.

More productive ...
The benefits: A servo actuator with a low moment of inertia and an extremely rigid drive train provides for maximum precision and power. A decisive increase in productivity.

More efficient ...
Low torsional backlash, an output bearing with a high degree of tilting rigidity and integration of the gearbox pinion in the motor shaft result in: smaller motors, reduced energy consumption and lower investment costs.

More precise ...
Low levels of operating noise due to helical toothing and outstanding control properties ensure greater precision in your machines and plants. The result: genuinely economical products.

Additional features
- Various encoders and permanent magnet holding brake available.
- Direct attachment of drive components (pinion, belt pulley, indexing table) to standardized output flange.
- UL version as standard.
- Pre-assembled cables for selected servo controllers available.
- Simple commissioning thanks to special instructions for numerous servo controllers.
- Torsional backlash reduction to less than 1 arcmin possible.
- Electrical connection via time-saving bayonet couplings.
- Robust output bearing eliminates the need for additional bearing point.

TPM+ DYNAMIC

More dynamic – Shorter – Quieter

Extra productivity: Outstanding dynamics, compact dimensions and extremely smooth running. Servo actuator with two-stage gearbox designed primarily for rotary applications.

TPM+ HIGH TORQUE

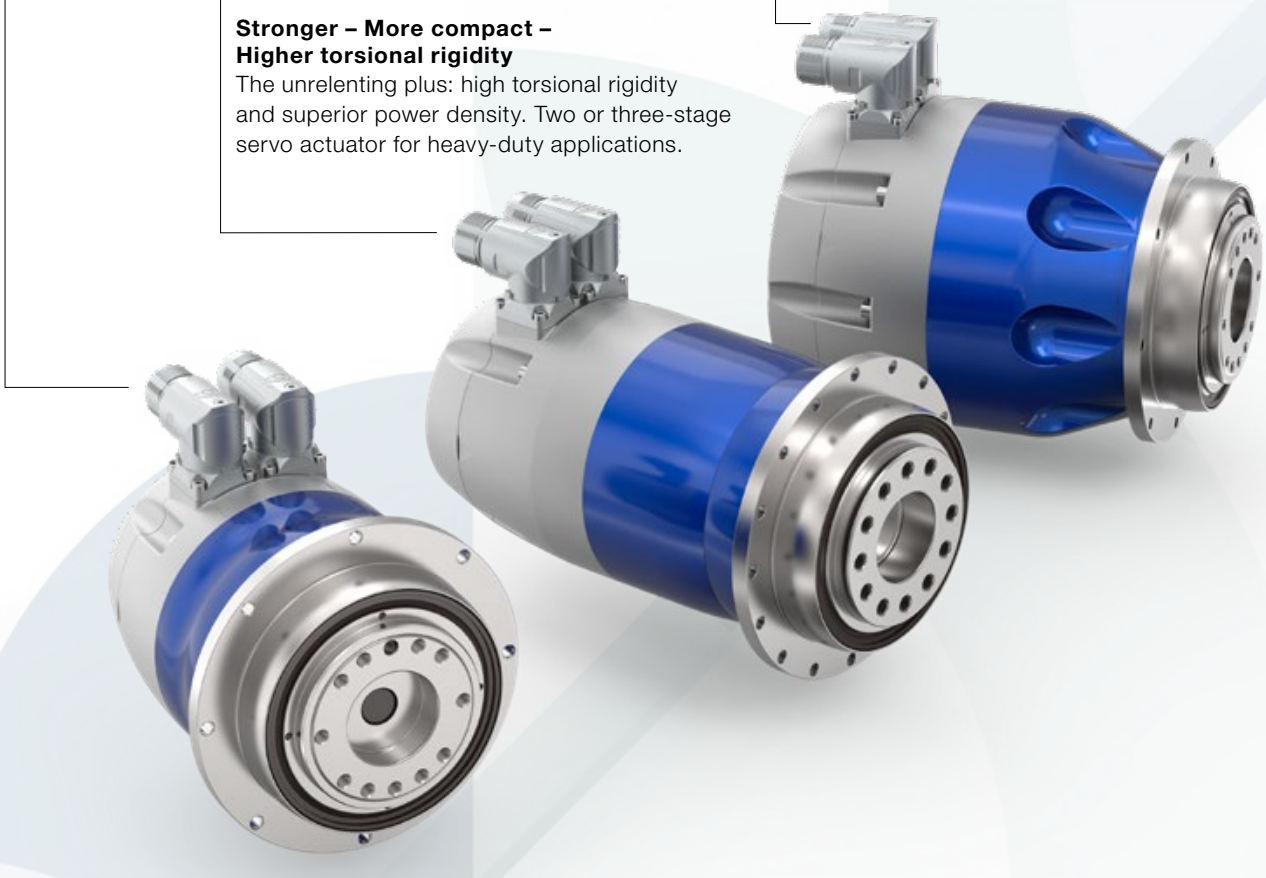
Stronger – More compact – Higher torsional rigidity

The unrelenting plus: high torsional rigidity and superior power density. Two or three-stage servo actuator for heavy-duty applications.

TPM+ POWER

Stronger – Quieter – More compact

Extra power: high torque, compact dimensions. Single or two-stage servo actuator gearbox combination for linear and rotary applications.



TPM+ DYNAMIC

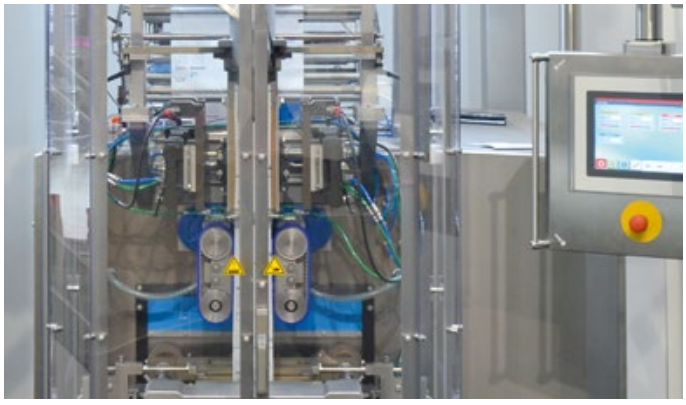
Dynamic. Shorter. Quieter.

Experience extraordinary dynamics thanks to modern motor technology with high power density, a low moment of inertia and optimal torsional rigidity. Benefit from a reduced installation length: The coupling-free connection between motor and gearbox and the space-saving attachment of motor instruments make the TPM+ DYNAMIC over 50 % more compact than conventional gearbox motors. Helical-toothed precision planetary gearboxes ensure low-vibration and silent operation.

Size	Installation length in mm	Max. acceleration torque in Nm	Max. power in kW
004	from 113	up to 40	up to 1
010	from 142	up to 100	up to 1.5
025	from 153	up to 300	up to 4.7
050	from 187	up to 650	up to 10.2
110	from 268	up to 1300	up to 14.2

Application example

Whether used as an axis drive for spraying robots, a swivel drive in the production of optical media and semiconductors, in packaging machines or as a drive for changer systems in machine tools or wood processing systems, the TPM+ DYNAMIC is ideal for all robotic and automated applications.

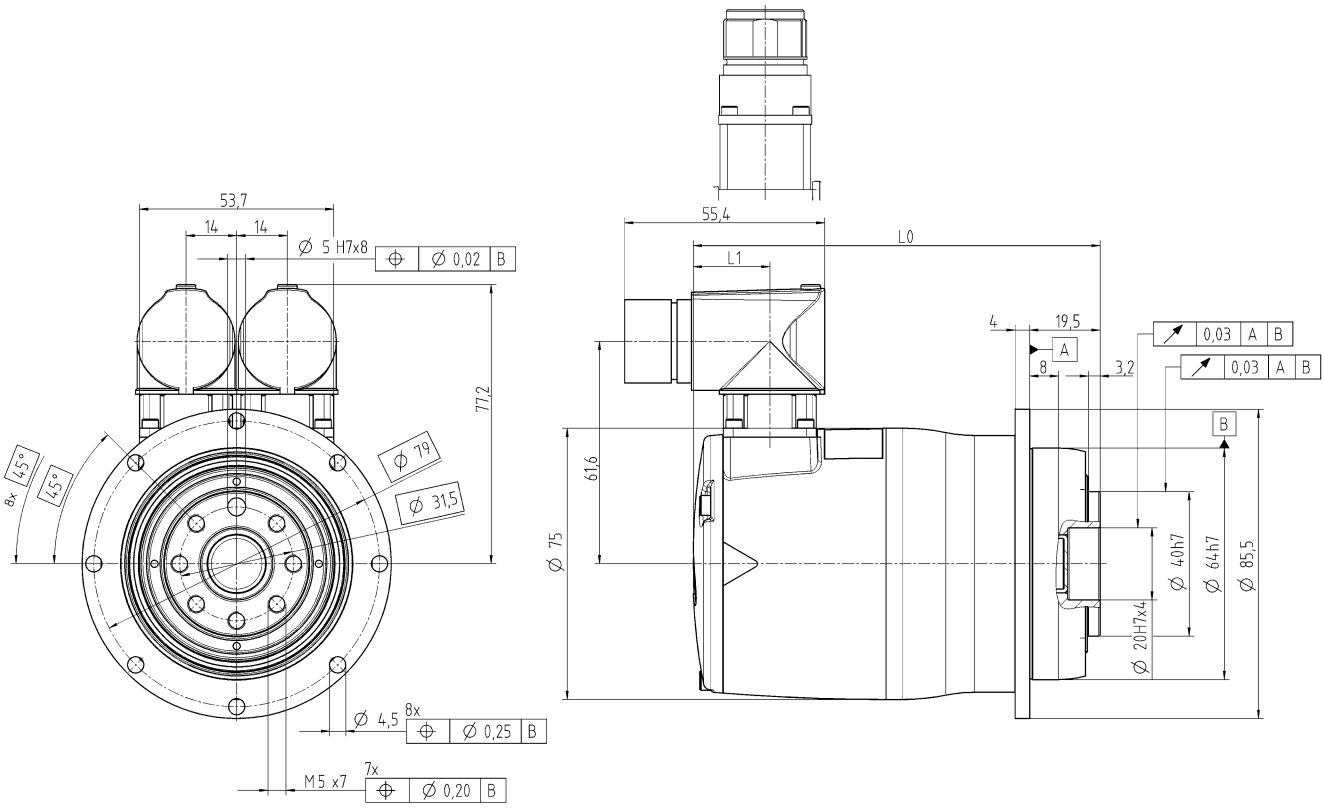


Source: Hastamat Verpackungstechnik

			2-stage					
Ratio	**i**		**16**	**21**	**31**	**61**	**64**	**91**
Operating voltage	U_D	*V DC*	560					
Max. acceleration torque (max. 1000 cycles per hour)	T_{2B}	*Nm*	30	32	40	32	32	32
		in.lb	266	283	354	283	283	283
Static output torque	T_{20}	*Nm*	8	11	17	15	15	15
		in.lb	71	97	150	133	133	133
Brake holding torque (at 120 °C)	T_{2Br}	*Nm*	18	23	34	67	70	100
		in.lb	159	204	301	593	620	885
Max. speed at output	n_{2max}	*rpm*	375	286	194	98	94	66
Speed limit for T_{2B}	n_{2B}	*rpm*	313	262	189	98	94	66
Max. motor acceleration torque	T_{1max}	*Nm*	2	2	2	1	1	1
		in.lb	18	18	18	9	9	9
Max. motor acceleration current	I_{MaxDyn}	A_{eff}	3.2	3.2	3.2	2.4	2.4	2.4
Static motor current	I_0	A_{eff}	1.1	1.1	1.1	0.8	0.8	0.8
Max. backlash	j_t	*arcmin*	Standard ≤ 4 Reduced ≤ 2					
Torsional rigidity (Gearbox)	C_{t21}	*Nm/arcmin*	–	10	9	9	–	7
		in.lb/arcmin	–	89	80	80	–	62
Tilting rigidity	C_{2K}	*Nm/arcmin*	85					
		in.lb/arcmin	752					
Max. axial force [a]	F_{2AMax}	*N*	1630					
		lb_f	367					
Max. tilting moment	M_{2KMax}	*Nm*	110					
		in.lb	974					
Service life	L_h	*h*	> 20000					
Weight (without brake)	*m*	*kg*	2 to 2.2					
		lb_m	4.4 to 4.9					
Ambient temperature		*°C*	0 to +40					
		°F	+32 to +104					
Lubrication			Lubricated for life					
Insulating material class			F					
Protection class			IP 65					
Paint			Blue metallic 250 and natural cast aluminium					
Metal bellows coupling (recommended product type – validate sizing with cymex®)			BCT-00015AAX-031.500					
Bore diameter of coupling on the application side		*mm*	X = 012.000 - 028.000					
Mass moment of inertia (relates to the drive)	J_1	$kgcm^2$	0.21	0.2	0.2	0.12	0.11	0.12
		10^{-3} *in.lb.s²*	0.19	0.18	0.18	0.11	0.1	0.11

Please use our sizing software cymex® for a detailed sizing – **www.wittenstein-cymex.com**

[a] Refers to center of the output shaft or flange



without brake

Ratio	Encoder	Length L0 in mm	Length L1 in mm
i = 16/21/31	Resolver	128	22
	HIPERFACE®	153	47
	EnDat	157	51
i = 61/64/91	Resolver	113	22
	HIPERFACE®	138	47
	EnDat	142	51

with brake

Ratio	Encoder	Length L0 in mm	Length L1 in mm
i = 16/21/31	Resolver	165	22
	HIPERFACE®	190	47
	EnDat	194	51
i = 61/64/91	Resolver	150	22
	HIPERFACE®	175	47
	EnDat	179	51

			2-stage					
Ratio	**i**		**16**	**21**	**31**	**61**	**64**	**91**
Operating voltage	U_D	*V DC*	560					
Max. acceleration torque (max. 1000 cycles per hour)	T_{2B}	*Nm*	57	75	100	80	80	80
		in.lb	504	664	885	708	708	708
Static output torque	T_{20}	*Nm*	13	18	27	29	28	35
		in.lb	115	159	239	257	248	310
Brake holding torque (at 120 °C)	T_{2Br}	*Nm*	18	23	34	67	70	100
		in.lb	159	204	301	593	620	885
Max. speed at output	n_{2max}	*rpm*	375	286	194	98	94	66
Speed limit for T_{2B}	n_{2B}	*rpm*	256	195	132	81	78	54
Max. motor acceleration torque	T_{1max}	*Nm*	3.8	3.8	3.8	1.9	1.9	1.9
		in.lb	34	34	34	17	17	17
Max. motor acceleration current	I_{MaxDyn}	A_{eff}	5.2	5.2	5.2	3	3	3
Static motor current	I_0	A_{eff}	1.3	1.3	1.3	0.9	0.9	0.9
Max. backlash	j_t	*arcmin*	Standard ≤ 3 Reduced ≤ 1					
Torsional rigidity (Gearbox)	C_{t21}	*Nm/arcmin*	–	26	24	24	–	21
		in.lb/arcmin	–	230	212	212	–	186
Tilting rigidity	C_{2K}	*Nm/arcmin*	225					
		in.lb/arcmin	1991					
Max. axial force [a]	F_{2AMax}	*N*	2150					
		lb_f	484					
Max. tilting moment	M_{2KMax}	*Nm*	270					
		in.lb	2390					
Service life	L_h	*h*	> 20000					
Weight (without brake)	*m*	*kg*	4.3 to 4.8					
		lb_m	9.5 to 11					
Ambient temperature		*°C*	0 to +40					
		°F	+32 to +104					
Lubrication			Lubricated for life					
Insulating material class			F					
Protection class			IP 65					
Paint			Blue metallic 250 and natural cast aluminium					
Metal bellows coupling (recommended product type – validate sizing with cymex®)			BCT-00060AAX-050.000					
Bore diameter of coupling on the application side		*mm*	X = 014.000 - 035.000					
Mass moment of inertia (relates to the drive)	J_1	$kgcm^2$	0.32	0.32	0.32	0.17	0.17	0.17
		10^{-3} *in.lb.s²*	0.28	0.28	0.28	0.15	0.15	0.15

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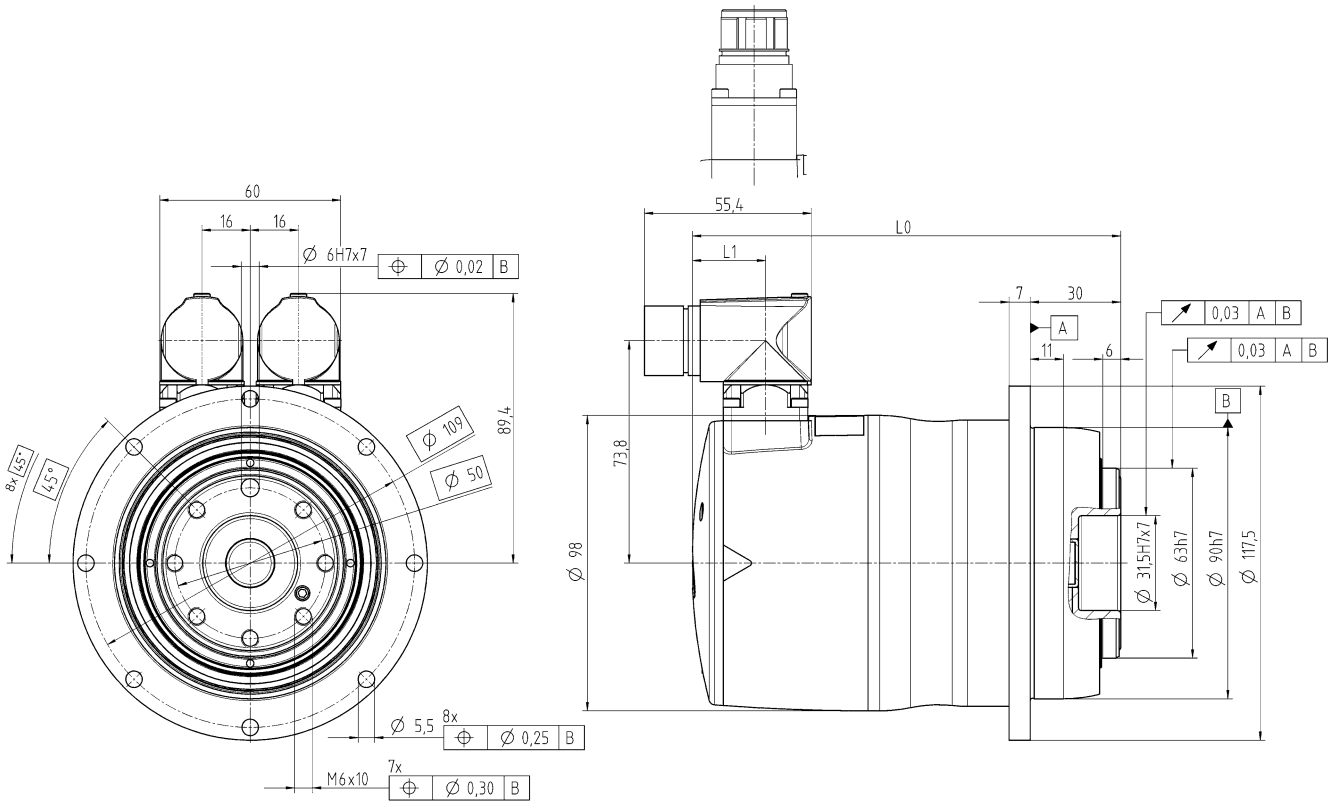
[a] Refers to center of the output shaft or flange



without brake

Ratio	Encoder	Length L0 in mm	Length L1 in mm
i = 16/21/31	Resolver	157	24
	HIPERFACE®	178	45
	EnDat	182	49
i = 61/64/91	Resolver	142	24
	HIPERFACE®	163	45
	EnDat	167	49

with brake

Ratio	Encoder	Length L0 in mm	Length L1 in mm
i = 16/21/31	Resolver	178	24
	HIPERFACE®	199	45
	EnDat	202	49
i = 61/64/91	Resolver	163	24
	HIPERFACE®	184	45
	EnDat	187	49

			2-stage					
Ratio	**i**		**16**	**21**	**31**	**61**	**64**	**91**
Operating voltage	U_D	*V DC*	560					
Max. acceleration torque (max. 1000 cycles per hour)	T_{2B}	*Nm*	182	239	300	250	250	250
		in.lb	1611	2115	2655	2213	2213	2213
Static output torque	T_{20}	*Nm*	74	97	146	87	83	100
		in.lb	655	859	1292	770	735	885
Brake holding torque (at 120 °C)	T_{2Br}	*Nm*	72	94	140	274	288	410
		in.lb	637	832	1239	2425	2549	3629
Max. speed at output	n_{2max}	*rpm*	375	286	194	98	94	66
Speed limit for T_{2B}	n_{2B}	*rpm*	244	185	125	59	56	39
Max. motor acceleration torque	T_{1max}	*Nm*	12.1	12.1	12.1	4.4	4.4	4.4
		in.lb	107	107	107	39	39	39
Max. motor acceleration current	I_{MaxDyn}	A_{eff}	17	17	17	6	6	6
Static motor current	I_0	A_{eff}	5.7	5.7	5.7	1.9	1.9	1.9
Max. backlash	j_t	*arcmin*	Standard ≤ 3 Reduced ≤ 1					
Torsional rigidity (Gearbox)	C_{t21}	*Nm/arcmin*	–	70	54	61	–	55
		in.lb/arcmin	–	620	478	540	–	487
Tilting rigidity	C_{2K}	*Nm/arcmin*	550					
		in.lb/arcmin	4868					
Max. axial force [a]	F_{2AMax}	*N*	4150					
		lb_f	934					
Max. tilting moment	M_{2KMax}	*Nm*	440					
		in.lb	3894					
Service life	L_h	*h*	> 20000					
Weight (without brake)	*m*	*kg*	7.1 to 8.5					
		lb_m	16 to 19					
Ambient temperature		*°C*	0 to +40					
		°F	+32 to +104					
Lubrication			Lubricated for life					
Insulating material class			F					
Protection class			IP 65					
Paint			Blue metallic 250 and natural cast aluminium					
Metal bellows coupling (recommended product type – validate sizing with cymex®)			BCT-00150AAX-063.000					
Bore diameter of coupling on the application side		*mm*	X = 019.000 - 042.000					
Mass moment of inertia (relates to the drive)	J_1	$kgcm^2$	2.16	2.16	2.17	0.77	0.76	0.76
		10^{-3} *in.lb.s²*	1.9	1.9	1.9	0.68	0.67	0.67

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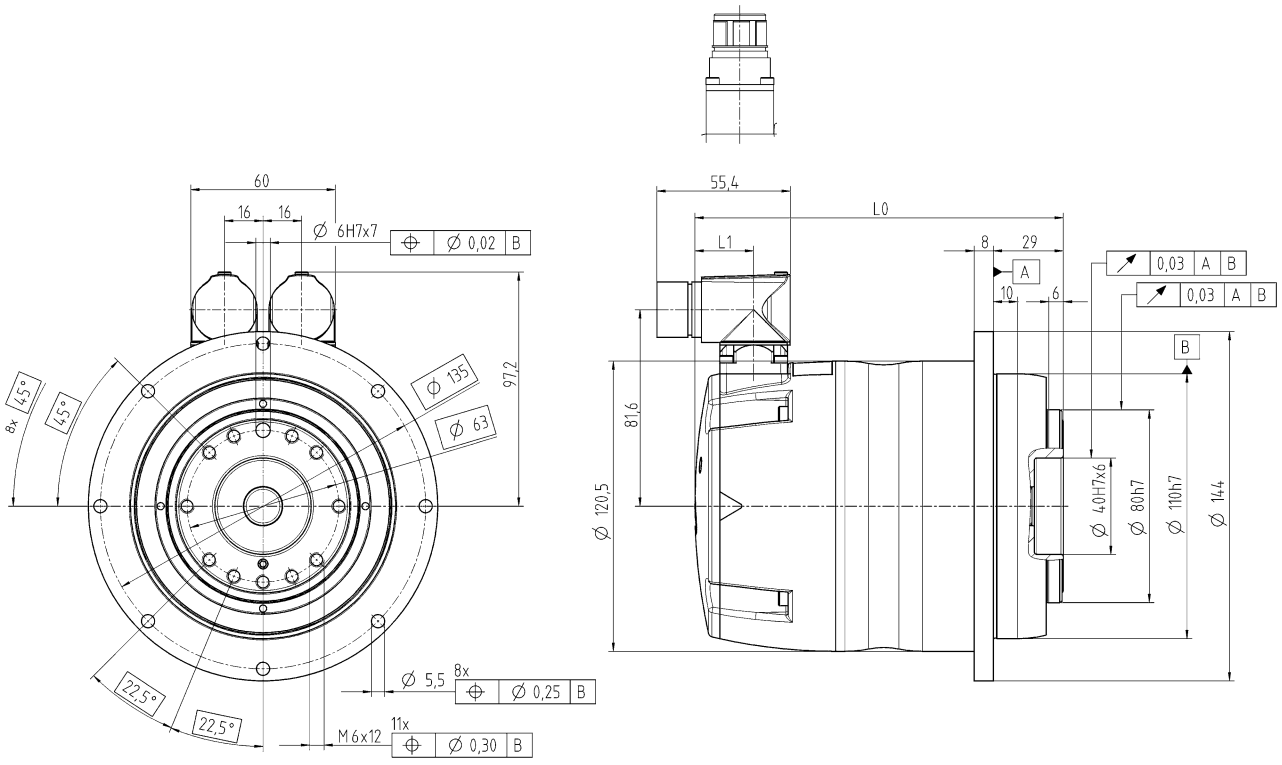
[a] Refers to center of the output shaft or flange



without brake

Ratio	Encoder	Length L0 in mm	Length L1 in mm
i = 16/21/31	Resolver	183	24
	HIPERFACE®	204	45
	EnDat	208	49
i = 61/64/91	Resolver	153	24
	HIPERFACE®	174	45
	EnDat	178	49

with brake

Ratio	Encoder	Length L0 in mm	Length L1 in mm
i = 16/21/31	Resolver	202	24
	HIPERFACE®	223	45
	EnDat	227	49
i = 61/64/91	Resolver	172	24
	HIPERFACE®	193	45
	EnDat	197	49

			2-stage					
Ratio	**i**		**16**	**21**	**31**	**61**	**64**	**91**
Operating voltage	U_D	*V DC*	560					
Max. acceleration torque (max. 1000 cycles per hour)	T_{2B}	*Nm*	435	500	650	447	469	500
		in.lb	3850	4425	5753	3956	4151	4425
Static output torque	T_{20}	*Nm*	185	220	370	173	166	220
		in.lb	1637	1947	3275	1531	1469	1947
Brake holding torque (at 120 °C)	T_{2Br}	*Nm*	208	273	403	793	832	1183
		in.lb	1841	2416	3567	7019	7364	10470
Max. speed at output	n_{2max}	*rpm*	312	238	161	82	78	55
Speed limit for T_{2B}	n_{2B}	*rpm*	225	171	116	59	56	39
Max. motor acceleration torque	T_{1max}	*Nm*	28.9	28.9	28.9	7.8	7.8	7.8
		in.lb	256	256	256	69	69	69
Max. motor acceleration current	I_{MaxDyn}	A_{eff}	40	40	40	12	12	12
Static motor current	I_0	A_{eff}	13.7	13.7	13.7	3.8	3.8	3.8
Max. backlash	j_t	*arcmin*	Standard ≤ 3 Reduced ≤ 1					
Torsional rigidity (Gearbox)	C_{t21}	*Nm/arcmin*	–	145	130	123	–	100
		in.lb/arcmin	–	1283	1151	1089	–	885
Tilting rigidity	C_{2K}	*Nm/arcmin*	560					
		in.lb/arcmin	4956					
Max. axial force [a]	F_{2AMax}	*N*	6130					
		lb_f	1379					
Max. tilting moment	M_{2KMax}	*Nm*	1335					
		in.lb	11816					
Service life	L_h	*h*	> 20000					
Weight (without brake)	*m*	*kg*	14.7 to 18.5					
		lb_m	32 to 41					
Ambient temperature		*°C*	0 to +40					
		°F	+32 to +104					
Lubrication			Lubricated for life					
Insulating material class			F					
Protection class			IP 65					
Paint			Blue metallic 250 and natural cast aluminium					
Metal bellows coupling (recommended product type – validate sizing with cymex®)			BCT-00300AAX-080.000					
Bore diameter of coupling on the application side		*mm*	X = 024.000 - 060.000					
Mass moment of inertia (relates to the drive)	J_1	$kgcm^2$	9.07	9.07	8.94	2.51	2.49	2.49
		10^{-3} *in.lb.s²*	8	8	7.9	2.2	2.2	2.2

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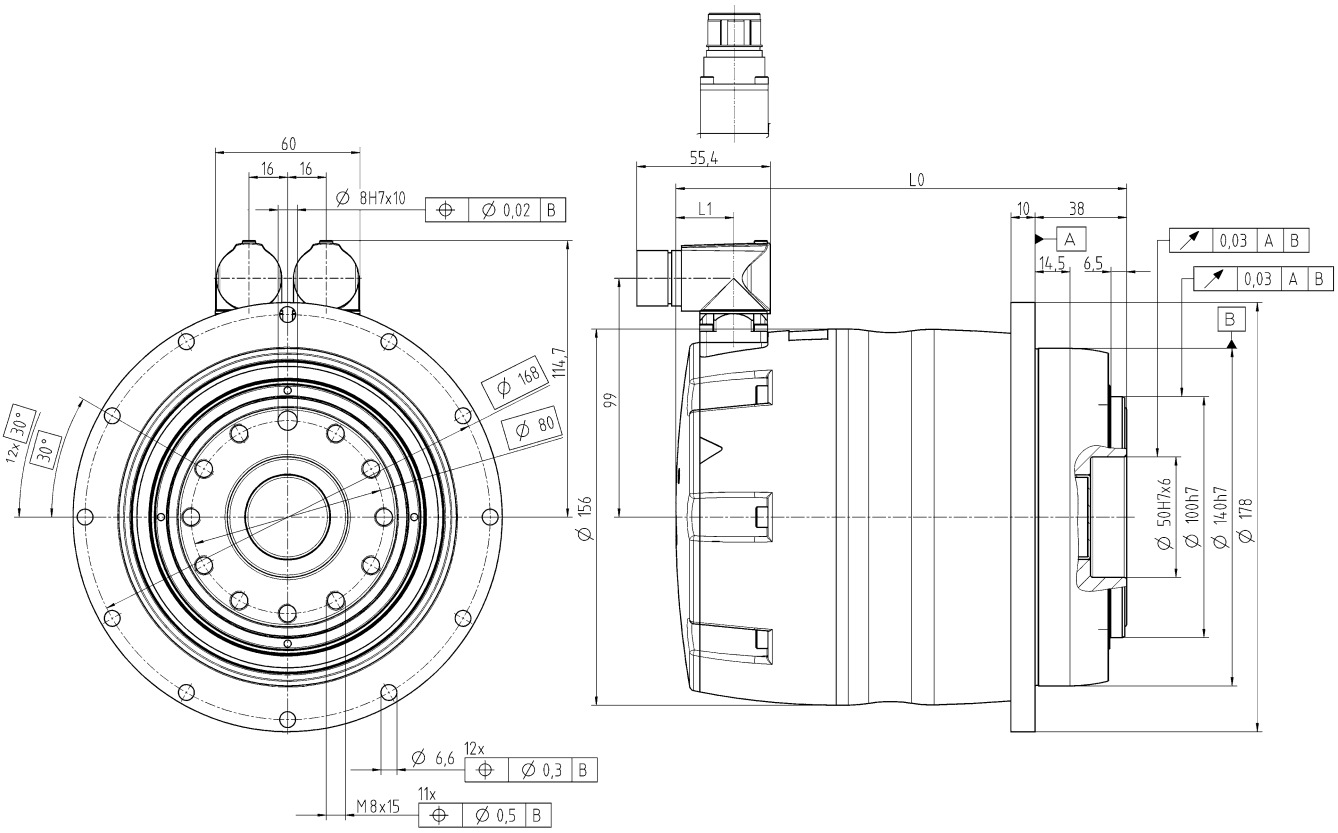
[a] Refers to center of the output shaft or flange



without brake

Ratio	Encoder	Length L0 in mm	Length L1 in mm
i = 16/21/31	Resolver	232	24
	HIPERFACE®	253	45
	EnDat	257	49
i = 61/64/91	Resolver	187	24
	HIPERFACE®	208	45
	EnDat	212	49

with brake

Ratio	Encoder	Length L0 in mm	Length L1 in mm
i = 16/21/31	Resolver	256	24
	HIPERFACE®	278	45
	EnDat	281	49
i = 61/64/91	Resolver	211	24
	HIPERFACE®	233	45
	EnDat	236	49

			2-stage					
Ratio	**i**		**16**	**21**	**31**	**61**	**64**	**91**
Operating voltage	U_D	*V DC*	560					
Max. acceleration torque (max. 1000 cycles per hour)	T_{2B}	*Nm*	660	867	1279	1300	1300	1300
		in.lb	5842	7674	11320	11506	11506	11506
Static output torque	T_{20}	*Nm*	208	278	419	700	700	700
		in.lb	1841	2461	3708	6196	6196	6196
Brake holding torque (at 120 °C)	T_{2Br}	*Nm*	208	273	403	793	832	1183
		in.lb	1841	2416	3567	7019	7364	10470
Max. speed at output	n_{2max}	*rpm*	312	238	161	82	78	55
Speed limit for T_{2B}	n_{2B}	*rpm*	206	157	106	59	56	39
Max. motor acceleration torque	T_{1max}	*Nm*	43.9	43.9	43.9	28.9	28.9	28.9
		in.lb	389	389	389	256	256	256
Max. motor acceleration current	I_{MaxDyn}	A_{eff}	70	70	70	40	40	40
Static motor current	I_0	A_{eff}	16.7	16.7	16.7	13.7	13.7	13.7
Max. backlash	j_t	*arcmin*	Standard ≤ 3 Reduced ≤ 1					
Torsional rigidity (Gearbox)	C_{t21}	*Nm/arcmin*	–	465	440	415	–	360
		in.lb/arcmin	–	4116	3894	3673	–	3186
Tilting rigidity	C_{2K}	*Nm/arcmin*	1452					
		in.lb/arcmin	12851					
Max. axial force [a]	F_{2AMax}	*N*	10050					
		lb_f	2261					
Max. tilting moment	M_{2KMax}	*Nm*	3280					
		in.lb	29031					
Service life	L_h	*h*	> 20000					
Weight (without brake)	*m*	*kg*	35.9 to 37.1					
		lb_m	79 to 82					
Ambient temperature		*°C*	0 to +40					
		°F	+32 to +104					
Lubrication			Lubricated for life					
Insulating material class			F					
Protection class			IP 65					
Paint			Blue metallic 250 and natural cast aluminium					
Metal bellows coupling (recommended product type – validate sizing with cymex®)			BCT-01500AAX-125.000					
Bore diameter of coupling on the application side		*mm*	X = 050.000 - 080.000					
Mass moment of inertia (relates to the drive)	J_1	$kgcm^2$	13.14	13.14	12.84	8.89	8.83	8.83
		10^{-3} *in.lb.s²*	12	12	11	7.9	7.8	7.8

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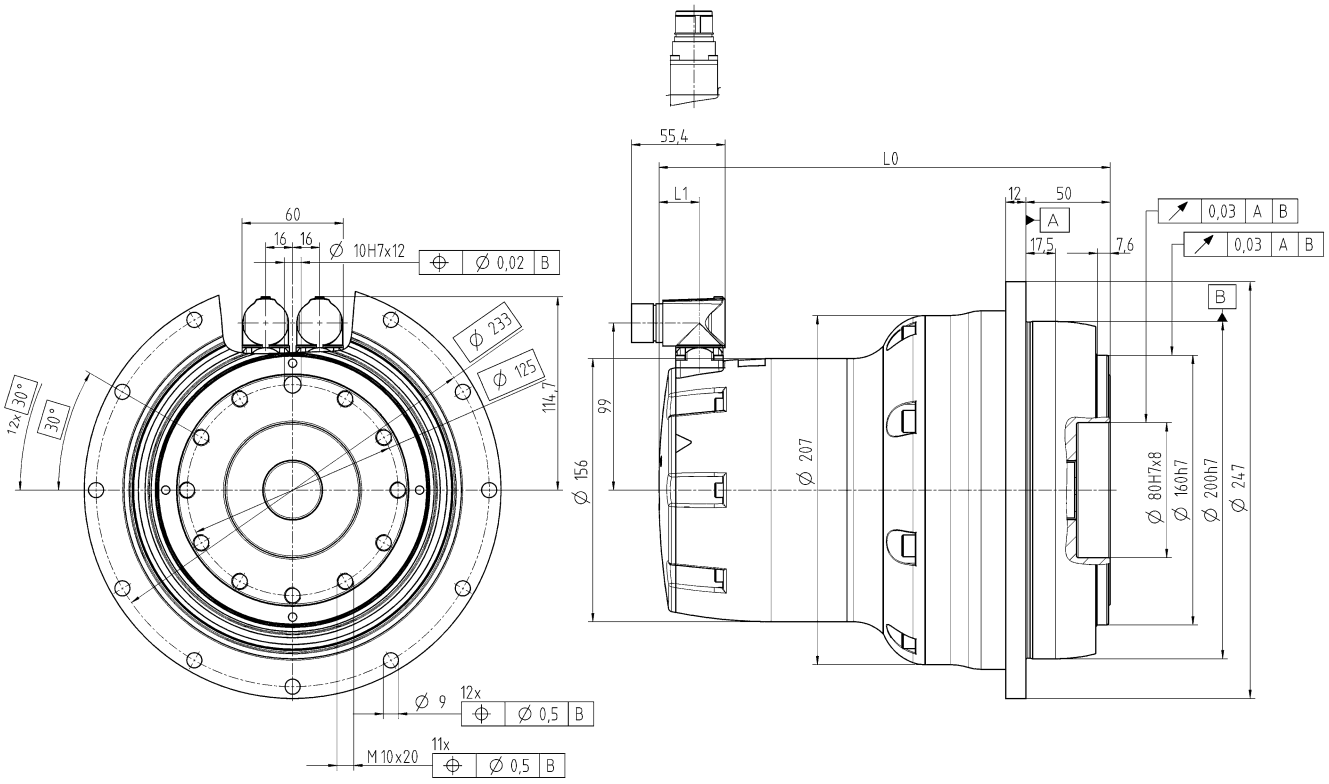
[a] Refers to center of the output shaft or flange



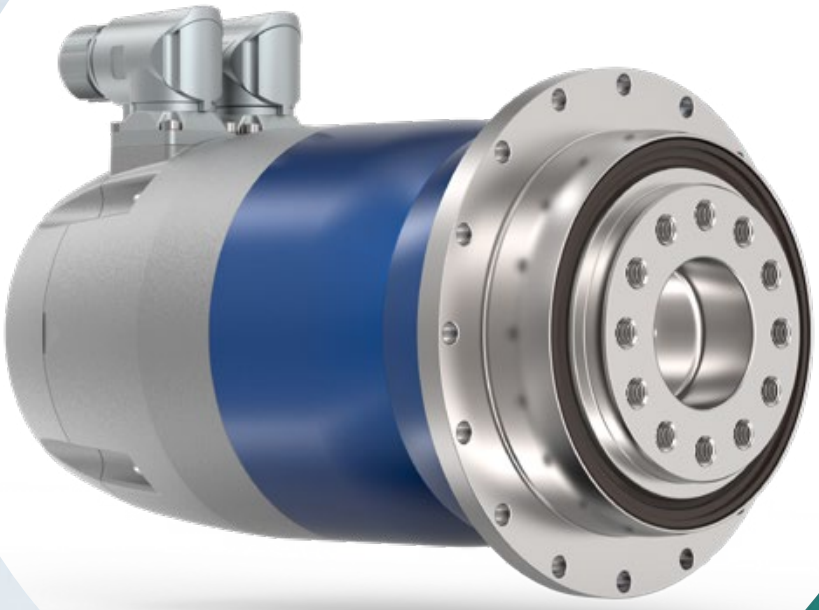
without brake

Ratio	Encoder	Length L0 in mm	Length L1 in mm
i = 16/21/31	Resolver	283	24
	HIPERFACE®	304	45
	EnDat	308	49
i = 61/64/91	Resolver	268	24
	HIPERFACE®	289	45
	EnDat	293	49

with brake

Ratio	Encoder	Length L0 in mm	Length L1 in mm
i = 16/21/31	Resolver	307	24
	HIPERFACE®	328	45
	EnDat	332	49
i = 61/64/91	Resolver	292	24
	HIPERFACE®	313	45
	EnDat	317	49

TPM+
HIGH TORQUE



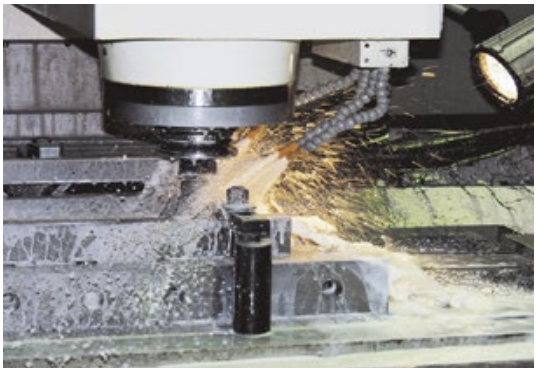
Stronger. More compact. Higher torsional rigidity.

This servo actuator brings you even further: with 50 % more torque and improved performance. Even better power transmission due to the more rigid drive train offers higher acceleration and shorter cycle times. Effectiveness from which you benefit. An additional planet in the gearbox significantly increases the torsional rigidity of the particularly short and light servo actuator. The coupling-free integration of motor and gearbox and the efficient attachment of motor instruments is the formula for success.

Size	Installation length in mm	Max. acceleration torque in Nm	Max. power in kW
010	from 183	up to 230	up to 4.5
025	from 219	up to 530	up to 9.8
050	from 279	up to 950	up to 15.6
110	from 328	up to 3100	up to 49.9

Application example

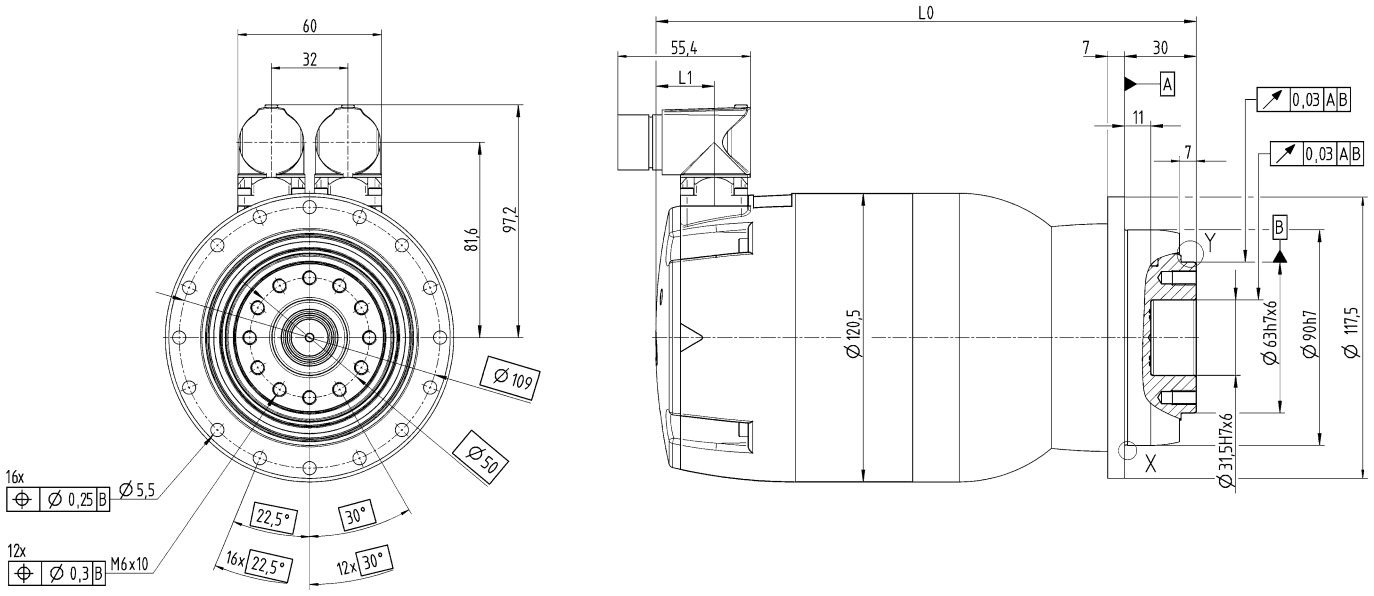
Thanks to the TPM+ HIGH TORQUE, machine tools and swivel axes become significantly more productive. The high torsional rigidity and the ample torque reserve in the case of disturbing forces ensure extremely stable drive control. The reliable servo actuator therefore guarantees dynamics and precision for your (heavy-duty) tasks.



			2-stage				3-stage			
Ratio	**i**		**22**	**27,5**	**38,5**	**55**	**88**	**110**	**154**	**220**
Operating voltage	U_D	*V DC*	560							
Max. acceleration torque (max. 1000 cycles per hour)	T_{2B}	*Nm*	230	230	230	230	230	230	230	230
		in.lb	2036	2036	2036	2036	2036	2036	2036	2036
Static output torque	T_{20}	*Nm*	79	99	139	110	180	180	180	180
		in.lb	699	876	1230	974	1593	1593	1593	1593
Brake holding torque (at 120 °C)	T_{2Br}	*Nm*	99	124	173	248	396	495	277	396
		in.lb	876	1097	1531	2195	3505	4381	2452	3505
Max. speed at output	n_{2max}	*rpm*	220	176	126	88	55	44	31	22
Speed limit for T_{2B}	n_{2B}	*rpm*	187	163	126	88	55	44	31	22
Max. motor acceleration torque	T_{1max}	*Nm*	12	12	12	12	12	12	4.4	4.4
		in.lb	106	106	106	106	106	106	39	39
Max. motor acceleration current	I_{MaxDyn}	A_{eff}	17	17	17	17	17	17	6	6
Static motor current	I_0	A_{eff}	5	5	5	5	5	5	1.9	1.9
Max. backlash	j_t	*arcmin*	≤ 1							
Torsional rigidity (Gearbox)	C_{t21}	*Nm/arcmin*	43	43	43	42	42	42	42	42
		in.lb/arcmin	381	381	381	372	372	372	372	372
Tilting rigidity	C_{2K}	*Nm/arcmin*	225							
		in.lb/arcmin	1991							
Max. axial force [a]	F_{2AMax}	*N*	2150							
		lb_f	484							
Max. tilting moment	M_{2KMax}	*Nm*	400							
		in.lb	3540							
Service life	L_h	*h*	> 20000							
Weight (without brake)	*m*	*kg*	6.5 to 8							
		lb_m	14 to 18							
Ambient temperature		*°C*	0 to +40							
		°F	+32 to +104							
Lubrication			Lubricated for life							
Insulating material class			F							
Protection class			IP 65							
Paint			Blue metallic 250 and natural cast aluminium							
Metal bellows coupling (recommended product type – validate sizing with cymex®)			BCT-00150AAX-050.00A							
Bore diameter of coupling on the application side		*mm*	X = 016.000 - 038.000							
Mass moment of inertia (relates to the drive)	J_1	$kgcm^2$	2.06	2.03	2.01	1.99	2.01	2	0.68	0.67
		10^{-3} *in.lb.s²*	1.8	1.8	1.8	1.8	1.8	1.8	0.6	0.59

Please use our sizing software cymex® for a detailed sizing – **www.wittenstein-cymex.com**

[a] Refers to center of the output shaft or flange



without brake

Ratio	Encoder	Length L0 in mm	Length L1 in mm
i = 22/27.5/38.5/55	Resolver	207	24
	HIPERFACE®	228	45
	EnDat	232	49
i = 88/110	Resolver	213	24
	HIPERFACE®	234	45
	EnDat	238	49
i = 154/220	Resolver	183	24
	HIPERFACE®	204	45
	EnDat	208	49

with brake

Ratio	Encoder	Length L0 in mm	Length L1 in mm
i = 22/27.5/38.5/55	Resolver	226	24
	HIPERFACE®	247	45
	EnDat	251	49
i = 88/110	Resolver	232	24
	HIPERFACE®	253	45
	EnDat	257	49
i = 154/220	Resolver	202	24
	HIPERFACE®	223	45
	EnDat	227	49

			2-stage				3-stage				
Ratio	**i**		**22**	**27,5**	**38,5**	**55**	**66**	**88**	**110**	**154**	**220**
Operating voltage	U_D	*V DC*	560								
Max. acceleration torque (max. 1000 cycles per hour)	T_{2B}	*Nm*	530	530	530	530	480	480	480	480	480
		in.lb	4691	4691	4691	4691	4248	4248	4248	4248	4248
Static output torque	T_{20}	*Nm*	232	291	375	375	260	260	260	260	260
		in.lb	2053	2576	3319	3319	2301	2301	2301	2301	2301
Brake holding torque (at 120 °C)	T_{2Br}	*Nm*	286	358	500	715	297	396	495	693	990
		in.lb	2531	3169	4425	6328	2629	3505	4381	6134	8762
Max. speed at output	n_{2max}	*rpm*	220	176	126	88	73	55	44	31	22
Speed limit for T_{2B}	n_{2B}	*rpm*	177	155	122	88	70	55	44	31	22
Max. motor acceleration torque	T_{1max}	*Nm*	28.9	28.9	28.9	28.9	12	12	12	12	12
		in.lb	256	256	256	256	106	106	106	106	106
Max. motor acceleration current	I_{MaxDyn}	A_{eff}	40	40	40	40	17	17	17	17	17
Static motor current	I_0	A_{eff}	13.1	13.1	13.1	13.1	5.8	5.8	5.8	5.8	5.8
Max. backlash	j_t	*arcmin*	≤ 1								
Torsional rigidity (Gearbox)	C_{t21}	*Nm/arcmin*	105	105	105	100	95	95	95	95	95
		in.lb/arcmin	929	929	929	885	841	841	841	841	841
Tilting rigidity	C_{2K}	*Nm/arcmin*	550								
		in.lb/arcmin	4868								
Max. axial force [a]	F_{2AMax}	*N*	4150								
		lb_f	934								
Max. tilting moment	M_{2KMax}	*Nm*	550								
		in.lb	4868								
Service life	L_h	*h*	> 20000								
Weight (without brake)	*m*	*kg*	10 to 14.8								
		lb_m	22 to 33								
Ambient temperature		*°C*	0 to +40								
		°F	+32 to +104								
Lubrication			Lubricated for life								
Insulating material class			F								
Protection class			IP 65								
Paint			Blue metallic 250 and natural cast aluminium								
Metal bellows coupling (recommended product type – validate sizing with cymex®)			BCT-00300AAX-063.00A								
Bore diameter of coupling on the application side		*mm*	X = 030.000 - 056.000								
Mass moment of inertia (relates to the drive)	J_1	$kgcm^2$	9.01	8.83	8.74	8.69	2.03	1.96	1.93	1.91	1.89
		10^{-3} *in.lb.s²*	8	7.8	7.7	7.7	1.8	1.7	1.7	1.7	1.7

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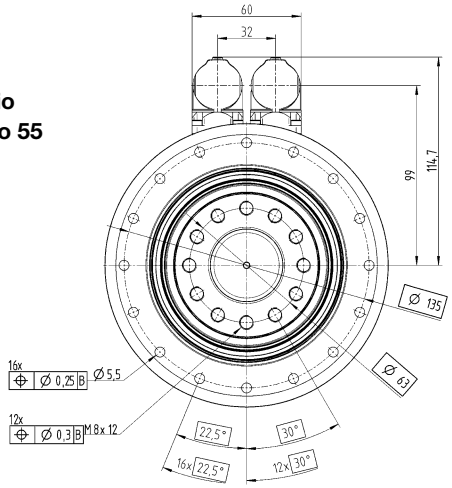
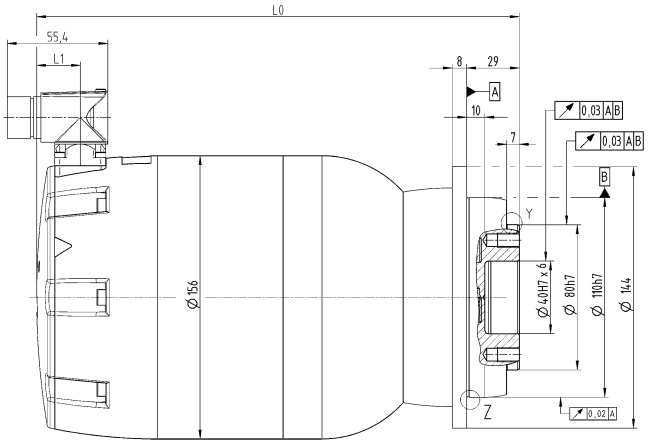
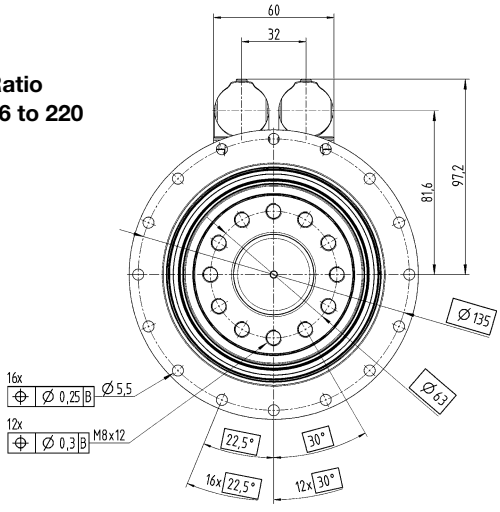
[a] Refers to center of the output shaft or flange

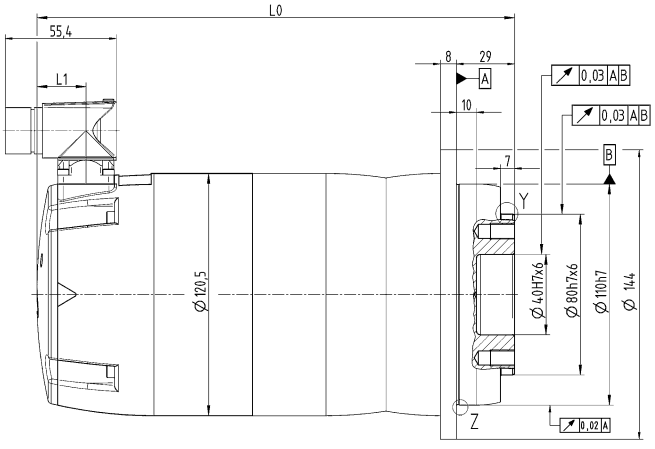
Ratio
22 to 55





Ratio
66 to 220





without brake

Ratio	Encoder	Length L0 in mm	Length L1 in mm
i = 22/27.5/38.5/55	Resolver	242	24
	HIPERFACE®	263	45
	EnDat	267	49
i = 66/88/110/154/220	Resolver	219	24
	HIPERFACE®	240	45
	EnDat	244	49

with brake

Ratio	Encoder	Length L0 in mm	Length L1 in mm
i = 22/27.5/38.5/55	Resolver	266	24
	HIPERFACE®	287	45
	EnDat	291	49
i = 66/88/110/154/220	Resolver	238	24
	HIPERFACE®	259	45
	EnDat	263	49

			2-stage				3-stage				
Ratio	**i**		**22**	**27.5**	**38.5**	**55**	**66**	**88**	**110**	**154**	**220**
Operating voltage	U_D	*V DC*	560								
Max. acceleration torque (max. 1000 cycles per hour)	T_{2B}	*Nm*	950	950	950	950	950	950	950	950	950
		in.lb	8408	8408	8408	8408	8408	8408	8408	8408	8408
Static output torque	T_{20}	*Nm*	406	513	650	675	675	675	675	675	675
		in.lb	3593	4540	5753	5974	5974	5974	5974	5974	5974
Brake holding torque (at 120 °C)	T_{2Br}	*Nm*	506	632	886	1265	858	1144	1430	2002	2375
		in.lb	4479	5594	7842	11196	7594	10125	12657	17719	21021
Max. speed at output	n_{2max}	*rpm*	205	164	117	82	73	55	44	31	22
Speed limit for T_{2B}	n_{2B}	*rpm*	156	136	108	82	69	55	44	31	22
Max. motor acceleration torque	T_{1max}	*Nm*	56.6	56.6	56.6	56.6	28.9	28.9	28.9	28.9	28.9
		in.lb	501	501	501	501	256	256	256	256	256
Max. motor acceleration current	I_{MaxDyn}	A_{eff}	63.5	63.5	63.5	63.5	40	40	40	40	40
Static motor current	I_0	A_{eff}	17.9	17.9	17.9	17.9	12.6	12.6	12.6	12.6	12.6
Max. backlash	j_t	*arcmin*	≤ 1								
Torsional rigidity (Gearbox)	C_{t21}	*Nm/arcmin*	220	220	220	220	205	205	205	205	205
		in.lb/arcmin	1947	1947	1947	1947	1814	1814	1814	1814	1814
Tilting rigidity	C_{2K}	*Nm/arcmin*	560								
		in.lb/arcmin	4956								
Max. axial force [a]	F_{2AMax}	*N*	6130								
		lb_f	1379								
Max. tilting moment	M_{2KMax}	*Nm*	1335								
		in.lb	11816								
Service life	L_h	*h*	> 20000								
Weight (without brake)	*m*	*kg*	21.8 to 25.3								
		lb_m	48 to 56								
Ambient temperature		*°C*	0 to +40								
		°F	+32 to +104								
Lubrication			Lubricated for life								
Insulating material class			F								
Protection class			IP 65								
Paint			Blue metallic 250 and natural cast aluminium								
Metal bellows coupling (recommended product type – validate sizing with cymex®)			BCT-00300AAX-080.00A								
Bore diameter of coupling on the application side		*mm*	X = 045.000 - 056.000								
Mass moment of inertia (relates to the drive)	J_1	$kgcm^2$	23.8	23.35	22.99	22.81	9.23	9.04	8.84	8.74	8.69
		10^{-3} *in.lb.s²*	21	21	20	20	8.2	8	7.8	7.7	7.7

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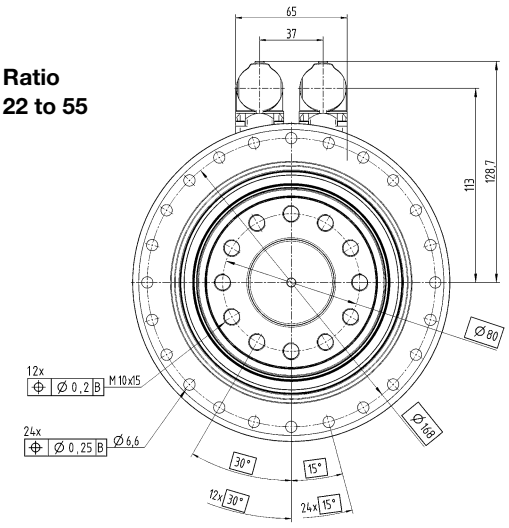
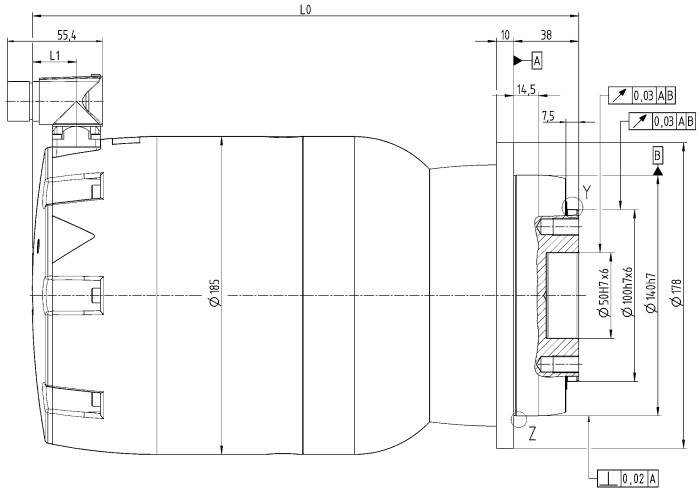
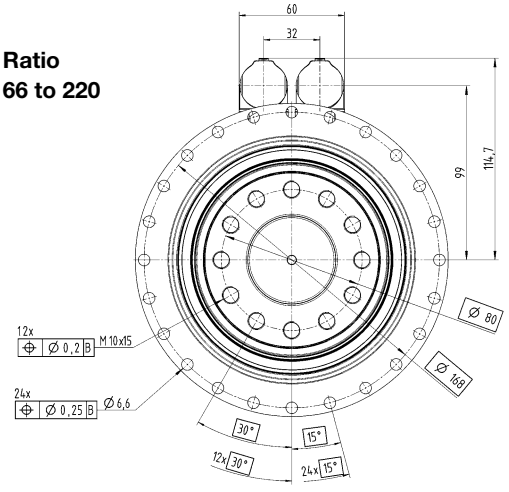
[a] Refers to center of the output shaft or flange

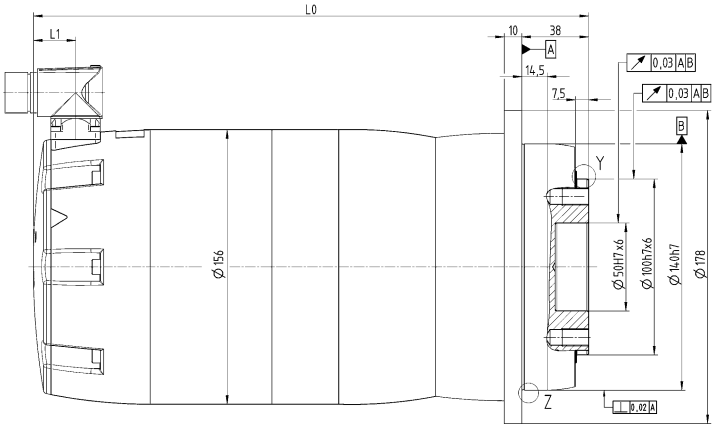
Ratio
22 to 55





Ratio
66 to 220





without brake

Ratio	Encoder	Length L0 in mm	Length L1 in mm
i = 22/27.5/38.5/55	Resolver	279	26
	HIPERFACE®	304	50
	EnDat	304	50
i = 66/88/110/154/220	Resolver	292	24
	HIPERFACE®	313	45
	EnDat	317	49

with brake

Ratio	Encoder	Length L0 in mm	Length L1 in mm
i = 22/27.5/38.5/55	Resolver	319	26
	HIPERFACE®	344	50
	EnDat	344	50
i = 66/88/110/154/220	Resolver	316	24
	HIPERFACE®	337	45
	EnDat	341	49

			2-stage				3-stage				
Ratio	**i**		**22**	**27.5**	**38.5**	**55**	**66**	**88**	**110**	**154**	**220**
Operating voltage	U_D	*V DC*	560								
Max. acceleration torque (max. 1000 cycles per hour)	T_{2B}	*Nm*	3100	3100	3100	2000	2600	2600	2600	2600	2600
		in.lb	27437	27437	27437	17702	23012	23012	23012	23012	23012
Static output torque	T_{20}	*Nm*	1368	1600	1650	1400	1600	1750	1750	1750	1750
		in.lb	12108	14161	14604	12391	14161	15489	15489	15489	15489
Brake holding torque (at 120 °C)	T_{2Br}	*Nm*	1584	1980	2772	3960	4752	6336	2530	3542	5060
		in.lb	14020	17525	24534	35049	42059	56079	22393	31350	44785
Max. speed at output	n_{2max}	*rpm*	189	151	108	75	63	47	41	29	20
Speed limit for T_{2B}	n_{2B}	*rpm*	154	135	106	75	63	47	38	29	20
Max. motor acceleration torque	T_{1max}	*Nm*	164.5	164.5	164.5	164.5	88	88	56.6	56.6	56.6
		in.lb	1456	1456	1456	1456	779	779	501	501	501
Max. motor acceleration current	I_{MaxDyn}	A_{eff}	160	160	160	160	100	100	63.5	63.5	63.5
Static motor current	I_0	A_{eff}	53.7	53.7	53.7	53.7	40.9	40.9	20.5	20.5	20.5
Max. backlash	j_t	*arcmin*	≤ 1								
Torsional rigidity (Gearbox)	C_{t21}	*Nm/arcmin*	730	725	715	670	650	650	650	650	650
		in.lb/arcmin	6461	6417	6328	5930	5753	5753	5753	5753	5753
Tilting rigidity	C_{2K}	*Nm/arcmin*	1452								
		in.lb/arcmin	12851								
Max. axial force [a]	F_{2AMax}	*N*	10050								
		lb_f	2261								
Max. tilting moment	M_{2KMax}	*Nm*	3280								
		in.lb	29031								
Service life	L_h	*h*	> 20000								
Weight (without brake)	*m*	*kg*	45.5 to 76.8								
		lb_m	101 to 170								
Ambient temperature		*°C*	0 to +40								
		°F	+32 to +104								
Lubrication			Lubricated for life								
Insulating material class			F								
Protection class			IP 65								
Paint			Blue metallic 250 and natural cast aluminium								
Metal bellows coupling (recommended product type – validate sizing with cymex®)			BCT-01500AAX-125.00A								
Bore diameter of coupling on the application side		*mm*	X = 055.000 - 070.000								
Mass moment of inertia (relates to the drive)	J_1	$kgcm^2$	220.4	218.9	217.6	216.9	111.8	108.2	22.9	22.5	22.3
		10^{-3} *in.lb.s²*	195	194	193	192	99	96	20	20	20

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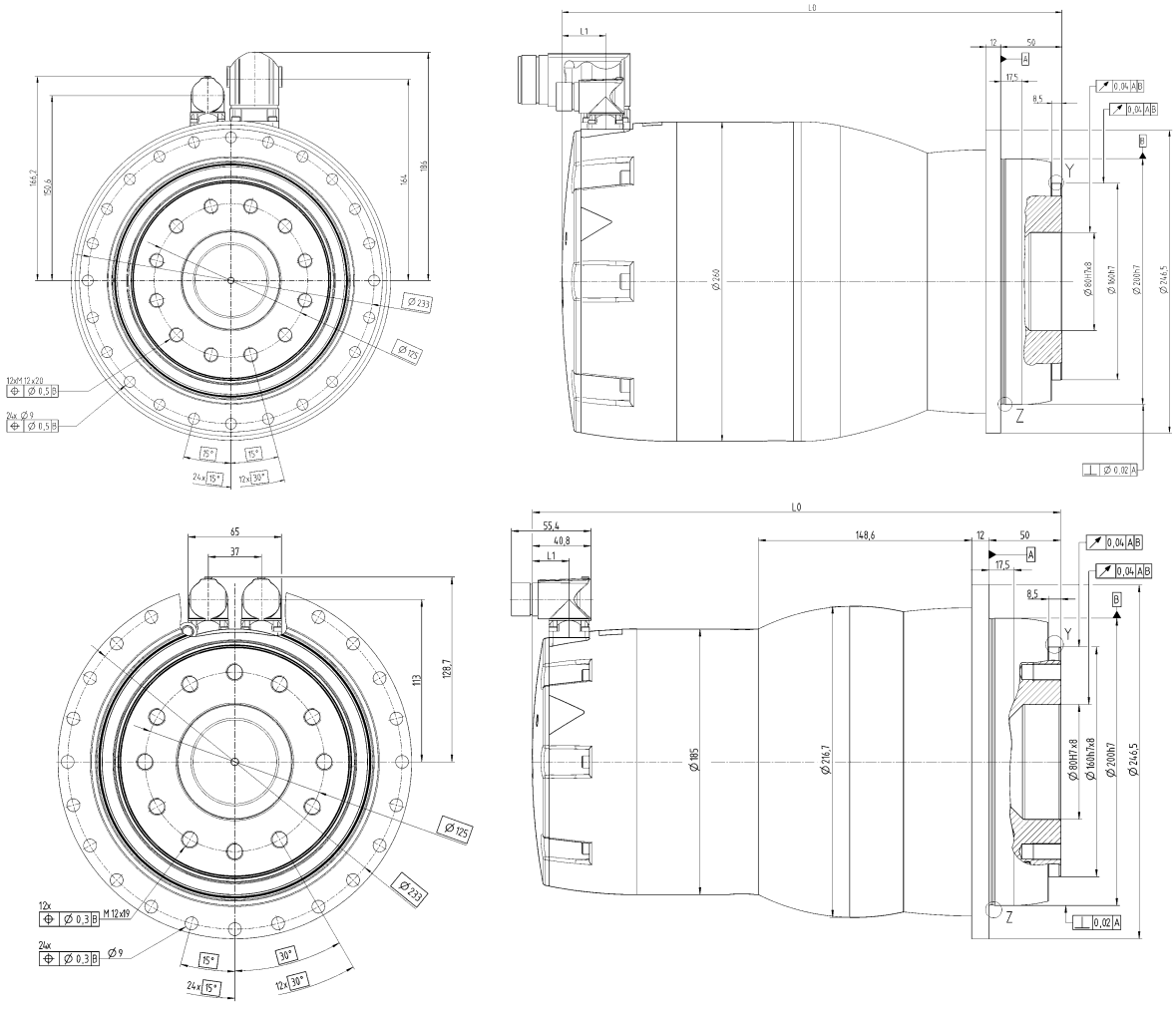
[a] Refers to center of the output shaft or flange



without brake

Ratio	Encoder	Length L0 in mm	Length L1 in mm
i = 22/27.5/38.5/55	Resolver	417	36
	HIPERFACE®	441	60
	EnDat	441	60
i = 66/88	Resolver	357	36
	HIPERFACE®	381	60
	EnDat	381	60
i = 110/154/220	Resolver	328	26
	HIPERFACE®	353	50
	EnDat	353	50

with brake

Ratio	Encoder	Length L0 in mm	Length L1 in mm
i = 22/27.5/38.5/55	Resolver	467	36
	HIPERFACE®	491	60
	EnDat	491	60
i = 66/88	Resolver	407	36
	HIPERFACE®	431	60
	EnDat	431	60
i = 110/154/220	Resolver	368	26
	HIPERFACE®	393	50
	EnDat	393	50

TPM+ POWER

Stronger. More compact. Quieter.

Generate more power: More torque, high capability. A perfect combination of motors and efficient planetary gearboxes makes light work of even the most difficult motion applications. 40 % more compact due to coupling-free connection of motor and gearbox and efficient attachment of motor instruments. Shorter installation length for greater flexibility when mounting. Helical-toothed precision planetary gearboxes for extremely quiet and low-vibration operation reduce operating noise to very low levels.

Size	Installation length in mm	Max. acceleration torque in Nm	Max. power in kW
004	from 149	up to 50	up to 1.4
010	from 175	up to 130	up to 4.7
025	from 197	up to 380	up to 10.6
050	from 236	up to 750	up to 16.5
110	from 307	up to 1600	up to 32

Application example

The compact TPM+ POWER drive unit easily copes with highly dynamic linear applications with rack and pinions or ball screws as well as in rotary movements with high masses and disturbing forces.

Source: Schmale Maschinenbau GmbH

			1-stage			
Ratio	**i**		**4**	**5**	**7**	**10**
Operating voltage	U_D	*V DC*	560			
Max. acceleration torque (max. 1000 cycles per hour)	T_{2B}	*Nm*	15	18	26	26
		in.lb	133	159	230	230
Static output torque	T_{20}	*Nm*	4	6	8	12
		in.lb	35	53	71	106
Brake holding torque (at 120 °C)	T_{2Br}	*Nm*	4	6	8	11
		in.lb	35	53	71	97
Max. speed at output	n_{2max}	*rpm*	1500	1200	857	600
Speed limit for T_{2B}	n_{2B}	*rpm*	1040	830	590	460
Max. motor acceleration torque	T_{1max}	*Nm*	3.8	3.8	3.8	3.8
		in.lb	34	34	34	34
Max. motor acceleration current	I_{MaxDyn}	A_{eff}	5.2	5.2	5.2	5.2
Static motor current	I_0	A_{eff}	1.6	1.6	1.6	1.6
Max. backlash	j_t	*arcmin*	Standard ≤ 4 Reduced ≤ 2			
Torsional rigidity (Gearbox)	C_{t21}	*Nm/arcmin*	12	12	11	8
		in.lb/arcmin	106	106	97	71
Tilting rigidity	C_{2K}	*Nm/arcmin*	85			
		in.lb/arcmin	752			
Max. axial force [a]	F_{2AMax}	*N*	1630			
		lb_f	367			
Max. tilting moment	M_{2KMax}	*Nm*	110			
		in.lb	974			
Service life	L_h	*h*	> 20000			
Weight (without brake)	*m*	*kg*	3.6			
		lb_m	8			
Ambient temperature		*°C*	0 to +40			
		°F	+32 to +104			
Lubrication			Lubricated for life			
Insulating material class			F			
Protection class			IP 65			
Paint			Blue metallic 250 and natural cast aluminium			
Metal bellows coupling (recommended product type – validate sizing with cymex®)			BCT-00015AAX-031.500			
Bore diameter of coupling on the application side		*mm*	X = 012.000 - 028.000			
Mass moment of inertia (relates to the drive)	J_1	$kgcm^2$	0.39	0.36	0.33	0.31
		10^{-3} $in.lb.s^2$	0.35	0.32	0.29	0.27

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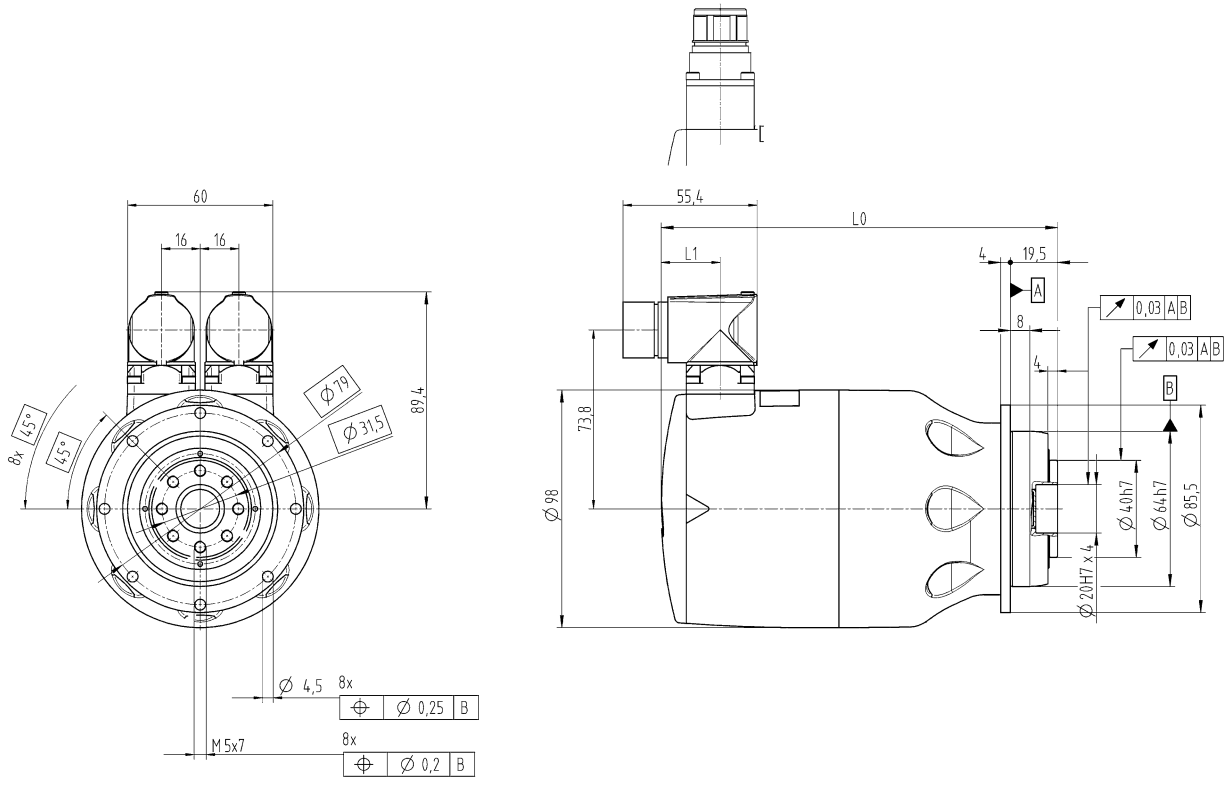
[a] Refers to center of the output shaft or flange



without brake

Ratio	Encoder	Length L0 in mm	Length L1 in mm
i = 4/5/7/10	Resolver	164	24
	HIPERFACE®	185	45
	EnDat	189	49

with brake

Ratio	Encoder	Length L0 in mm	Length L1 in mm
i = 4/5/7/10	Resolver	184	24
	HIPERFACE®	205	45
	EnDat	209	49

			2-stage								
Ratio	**i**		**16**	**20**	**25**	**28**	**35**	**40**	**50**	**70**	**100**
Operating voltage	U_D	*V DC*	560								
Max. acceleration torque (max. 1000 cycles per hour)	T_{2B}	*Nm*	50	50	50	50	50	50	50	50	35
		in.lb	443	443	443	443	443	443	443	443	310
Static output torque	T_{20}	*Nm*	18	23	28	32	40	24	30	40	18
		in.lb	159	204	248	283	354	212	266	354	159
Brake holding torque (at 120 °C)	T_{2Br}	*Nm*	18	22	28	31	38	44	55	77	110
		in.lb	159	195	248	274	336	389	487	682	974
Max. speed at output	n_{2max}	*rpm*	375	300	240	214	171	150	120	86	60
Speed limit for T_{2B}	n_{2B}	*rpm*	260	230	200	185	158	144	120	86	60
Max. motor acceleration torque	T_{1max}	*Nm*	3.8	3.8	3.8	3.8	3.8	1.9	1.9	1.9	1.9
		in.lb	34	34	34	34	34	17	17	17	17
Max. motor acceleration current	I_{MaxDyn}	A_{eff}	5.2	5.2	5.2	5.2	5.2	3	3	3	3
Static motor current	I_0	A_{eff}	1.6	1.6	1.6	1.6	1.6	1	1	1	1
Max. backlash	j_t	*arcmin*	Standard ≤ 4 Reduced ≤ 2								
Torsional rigidity (Gearbox)	C_{t21}	*Nm/arcmin*	12	12	12	12	12	11	12	11	8
		in.lb/arcmin	106	106	106	106	106	97	106	97	71
Tilting rigidity	C_{2K}	*Nm/arcmin*	85								
		in.lb/arcmin	752								
Max. axial force [a]	F_{2AMax}	*N*	1630								
		lb_f	367								
Max. tilting moment	M_{2KMax}	*Nm*	110								
		in.lb	974								
Service life	L_h	*h*	> 20000								
Weight (without brake)	*m*	*kg*	3.3 to 3.7								
		lb_m	7.3 to 8.2								
Ambient temperature		*°C*	0 to +40								
		°F	+32 to +104								
Lubrication			Lubricated for life								
Insulating material class			F								
Protection class			IP 65								
Paint			Blue metallic 250 and natural cast aluminium								
Metal bellows coupling (recommended product type – validate sizing with cymex®)			BCT-00015AAX-031.500								
Bore diameter of coupling on the application side		*mm*	X = 012.000 - 028.000								
Mass moment of inertia (relates to the drive)	J_1	$kgcm^2$	0.32	0.31	0.31	0.31	0.31	0.16	0.16	0.16	0.16
		10^{-3} $in.lb.s^2$	0.28	0.27	0.27	0.27	0.27	0.14	0.14	0.14	0.14

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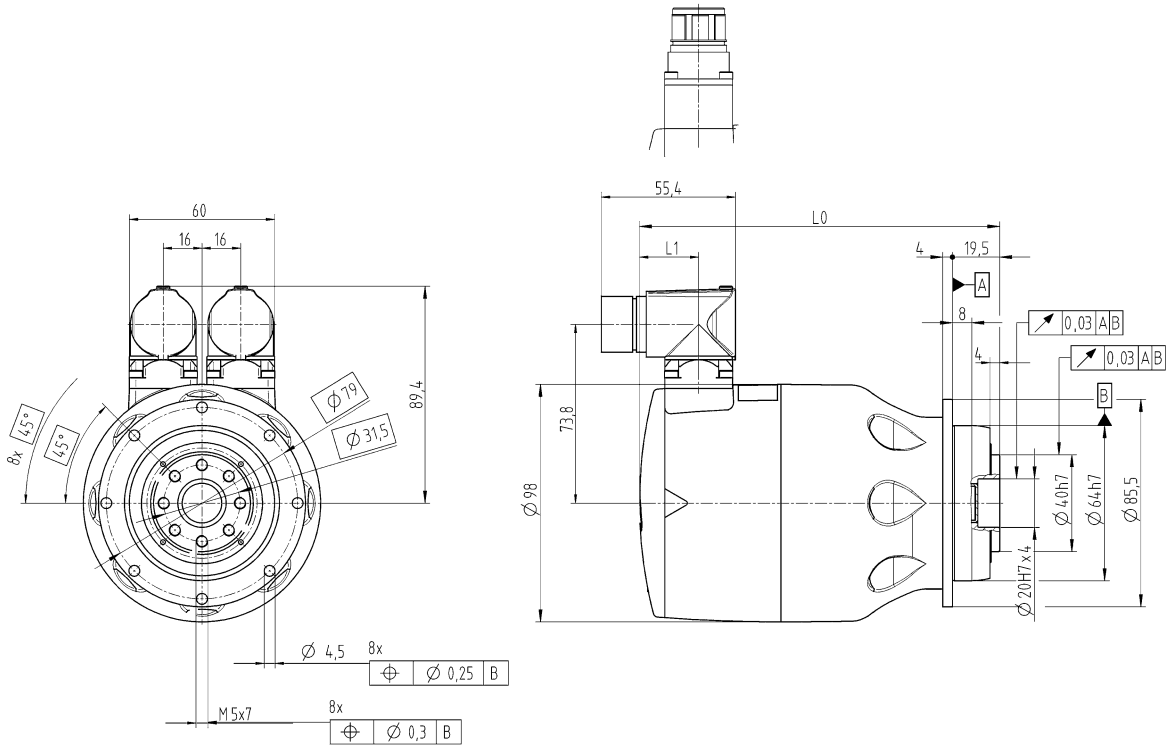
[a] Refers to center of the output shaft or flange



without brake

Ratio	Encoder	Length L0 in mm	Length L1 in mm
i = 16/20/25/28/35	Resolver	164	24
	HIPERFACE®	185	45
	EnDat	189	49
i = 40/50/70/100	Resolver	149	24
	HIPERFACE®	170	45
	EnDat	174	49

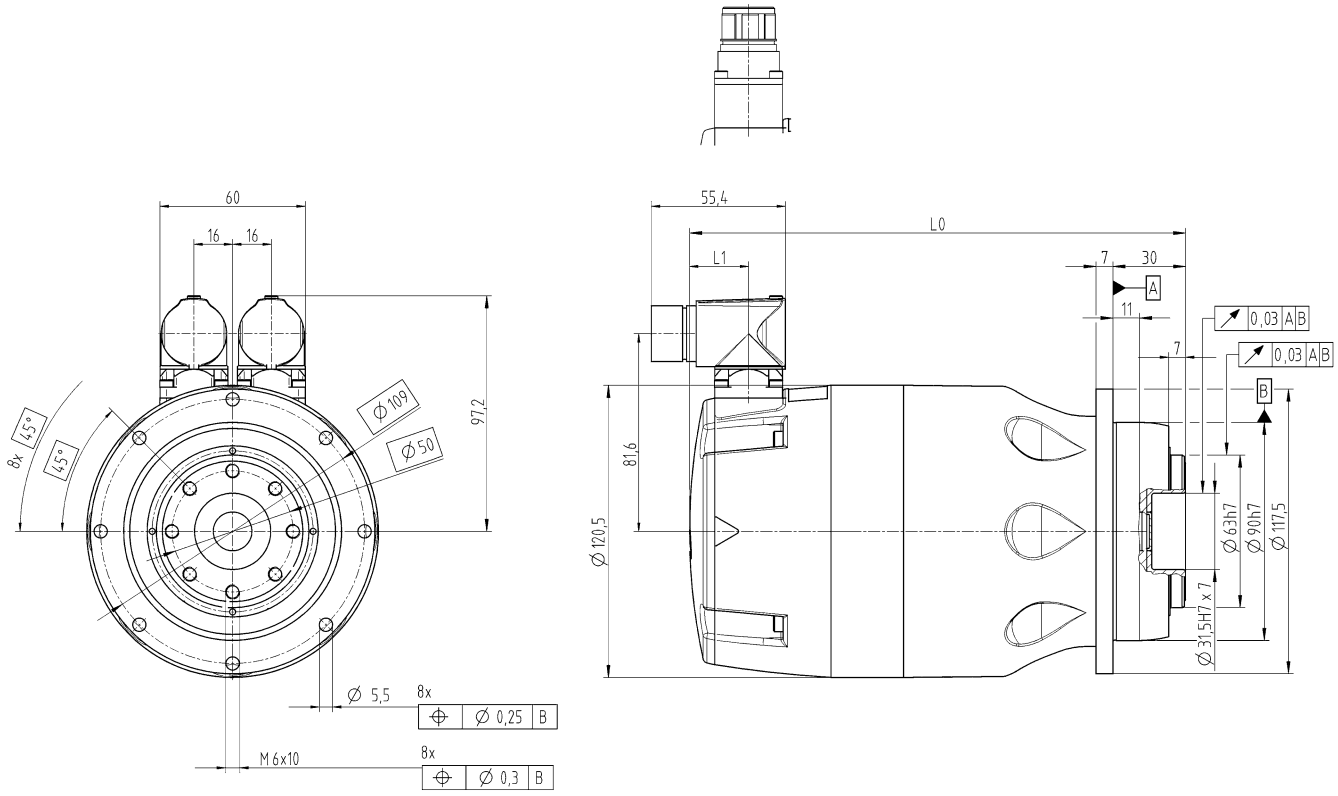
with brake

Ratio	Encoder	Length L0 in mm	Length L1 in mm
i = 16/20/25/28/35	Resolver	184	24
	HIPERFACE®	205	45
	EnDat	209	49
i = 40/50/70/100	Resolver	169	24
	HIPERFACE®	190	45
	EnDat	194	49

			1-stage			
Ratio	**i**		**4**	**5**	**7**	**10**
Operating voltage	U_D	*V DC*	560			
Max. acceleration torque (max. 1000 cycles per hour)	T_{2B}	*Nm*	44	56	80	85
		in.lb	389	496	708	752
Static output torque	T_{20}	*Nm*	14	18	27	40
		in.lb	124	159	239	354
Brake holding torque (at 120 °C)	T_{2Br}	*Nm*	18	22	32	45
		in.lb	159	195	283	398
Max. speed at output	n_{2max}	*rpm*	1500	1200	857	600
Speed limit for T_{2B}	n_{2B}	*rpm*	980	780	560	440
Max. motor acceleration torque	T_{1max}	*Nm*	12.1	12.1	12.1	12.1
		in.lb	107	107	107	107
Max. motor acceleration current	I_{MaxDyn}	A_{eff}	17	17	17	17
Static motor current	I_0	A_{eff}	5.4	5.4	5.4	5.4
Max. backlash	j_t	*arcmin*	Standard ≤ 3 Reduced ≤ 1			
Torsional rigidity (Gearbox)	C_{t21}	*Nm/arcmin*	32	33	30	23
		in.lb/arcmin	283	292	266	204
Tilting rigidity	C_{2K}	*Nm/arcmin*	225			
		in.lb/arcmin	1991			
Max. axial force [a]	F_{2AMax}	*N*	2150			
		lb_f	484			
Max. tilting moment	M_{2KMax}	*Nm*	270			
		in.lb	2390			
Service life	L_h	*h*	> 20000			
Weight (without brake)	*m*	*kg*	7.2			
		lb_m	16			
Ambient temperature		*°C*	0 to +40			
		°F	+32 to +104			
Lubrication			Lubricated for life			
Insulating material class			F			
Protection class			IP 65			
Paint			Blue metallic 250 and natural cast aluminium			
Metal bellows coupling (recommended product type – validate sizing with cymex®)			BCT-00060AAX-050.000			
Bore diameter of coupling on the application side		*mm*	X = 014.000 - 035.000			
Mass moment of inertia (relates to the drive)	J_1	$kgcm^2$	2.38	2.22	2.08	2
		10^{-3} $in.lb.s^2$	2.1	2	1.8	1.8

Please use our sizing software cymex® for a detailed sizing – **www.wittenstein-cymex.com**

[a] Refers to center of the output shaft or flange



without brake

Ratio	Encoder	Length L0 in mm	Length L1 in mm
i = 4/5/7/10	Resolver	205	24
	HIPERFACE®	226	45
	EnDat	230	49

with brake

Ratio	Encoder	Length L0 in mm	Length L1 in mm
i = 4/5/7/10	Resolver	224	24
	HIPERFACE®	245	45
	EnDat	249	49

			2-stage								
Ratio	**i**		**16**	**20**	**25**	**28**	**35**	**40**	**50**	**70**	**100**
Operating voltage	U_D	*V DC*	560								
Max. acceleration torque (max. 1000 cycles per hour)	T_{2B}	*Nm*	130	130	130	130	130	130	130	130	100
		in.lb	1151	1151	1151	1151	1151	1151	1151	1151	885
Static output torque	T_{20}	*Nm*	66	84	90	90	90	48	62	86	60
		in.lb	584	743	797	797	797	425	549	761	531
Brake holding torque (at 120 °C)	T_{2Br}	*Nm*	72	90	112	126	158	180	225	250	180
		in.lb	637	797	991	1115	1398	1593	1991	2213	1593
Max. speed at output	n_{2max}	*rpm*	375	300	240	214	171	150	120	86	60
Speed limit for T_{2B}	n_{2B}	*rpm*	280	240	200	185	158	100	88	70	55
Max. motor acceleration torque	T_{1max}	*Nm*	12.1	12.1	12.1	12.1	12.1	4.4	4.4	4.4	4.4
		in.lb	107	107	107	107	107	39	39	39	39
Max. motor acceleration current	I_{MaxDyn}	A_{eff}	17	17	17	17	17	6	6	6	6
Static motor current	I_0	A_{eff}	5.4	5.4	5.4	5.4	5.4	1.9	1.9	1.9	1.9
Max. backlash	j_t	*arcmin*	Standard ≤ 3 Reduced ≤ 1								
Torsional rigidity (Gearbox)	C_{t21}	*Nm/arcmin*	32	32	32	31	32	30	30	28	22
		in.lb/arcmin	283	283	283	274	283	266	266	248	195
Tilting rigidity	C_{2K}	*Nm/arcmin*	225								
		in.lb/arcmin	1991								
Max. axial force [a]	F_{2AMax}	*N*	2150								
		lb_f	484								
Max. tilting moment	M_{2KMax}	*Nm*	270								
		in.lb	2390								
Service life	L_h	*h*	> 20000								
Weight (without brake)	*m*	*kg*	6 to 7.4								
		lb_m	13 to 16								
Ambient temperature		*°C*	0 to +40								
		°F	+32 to +104								
Lubrication			Lubricated for life								
Insulating material class			F								
Protection class			IP 65								
Paint			Blue metallic 250 and natural cast aluminium								
Metal bellows coupling (recommended product type – validate sizing with cymex®)			BCT-00060AAX-050.000								
Bore diameter of coupling on the application side		*mm*	X = 014.000 - 035.000								
Mass moment of inertia (relates to the drive)	J_1	$kgcm^2$	2.02	1.99	1.98	1.96	1.96	0.72	0.72	0.72	0.72
		10^{-3} *in.lb.s²*	1.8	1.8	1.8	1.7	1.7	0.64	0.64	0.64	0.64

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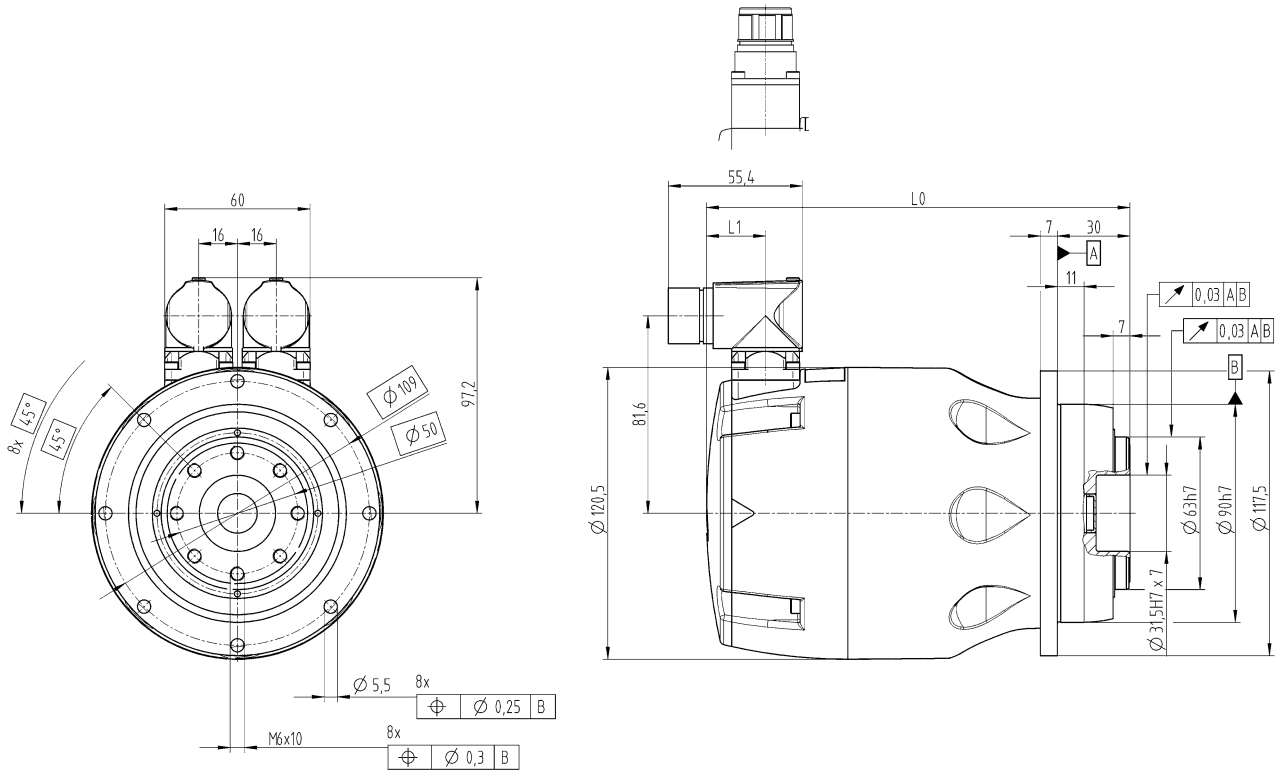
[a] Refers to center of the output shaft or flange



without brake

Ratio	Encoder	Length L0 in mm	Length L1 in mm
i = 16/20/25/28/35	Resolver	205	24
	HIPERFACE®	226	45
	EnDat	230	49
i = 40/50/70/100	Resolver	175	24
	HIPERFACE®	196	45
	EnDat	200	49

with brake

Ratio	Encoder	Length L0 in mm	Length L1 in mm
i = 16/20/25/28/35	Resolver	224	24
	HIPERFACE®	245	45
	EnDat	249	49
i = 40/50/70/100	Resolver	194	24
	HIPERFACE®	215	45
	EnDat	219	49

			1-stage			
Ratio	**i**		**4**	**5**	**7**	**10**
Operating voltage	U_D	*V DC*	560			
Max. acceleration torque (max. 1000 cycles per hour)	T_{2B}	*Nm*	112	141	199	200
		in.lb	991	1248	1761	1770
Static output torque	T_{20}	*Nm*	43	55	78	113
		in.lb	381	487	690	1000
Brake holding torque (at 120 °C)	T_{2Br}	*Nm*	52	65	91	130
		in.lb	460	575	805	1151
Max. speed at output	n_{2max}	*rpm*	1500	1200	857	600
Speed limit for T_{2B}	n_{2B}	*rpm*	900	720	520	420
Max. motor acceleration torque	T_{1max}	*Nm*	28.9	28.9	28.9	28.9
		in.lb	256	256	256	256
Max. motor acceleration current	I_{MaxDyn}	A_{eff}	40	40	40	40
Static motor current	I_0	A_{eff}	13.7	13.7	13.7	13.7
Max. backlash	j_t	*arcmin*	Standard ≤ 3 Reduced ≤ 1			
Torsional rigidity (Gearbox)	C_{t21}	*Nm/arcmin*	80	86	76	62
		in.lb/arcmin	708	761	673	549
Tilting rigidity	C_{2K}	*Nm/arcmin*	550			
		in.lb/arcmin	4868			
Max. axial force [a]	F_{2AMax}	*N*	4150			
		lb_f	934			
Max. tilting moment	M_{2KMax}	*Nm*	440			
		in.lb	3894			
Service life	L_h	*h*	> 20000			
Weight (without brake)	*m*	*kg*	14			
		lb_m	31			
Ambient temperature		*°C*	0 to +40			
		°F	+32 to +104			
Lubrication			Lubricated for life			
Insulating material class			F			
Protection class			IP 65			
Paint			Blue metallic 250 and natural cast aluminium			
Metal bellows coupling (recommended product type – validate sizing with cymex®)			BCT-00150AAX-063.000			
Bore diameter of coupling on the application side		*mm*	X = 019.000 - 042.000			
Mass moment of inertia (relates to the drive)	J_1	$kgcm^2$	9.98	9.5	9.07	8.84
		10^{-3} $in.lb.s^2$	8.8	8.4	8	7.8

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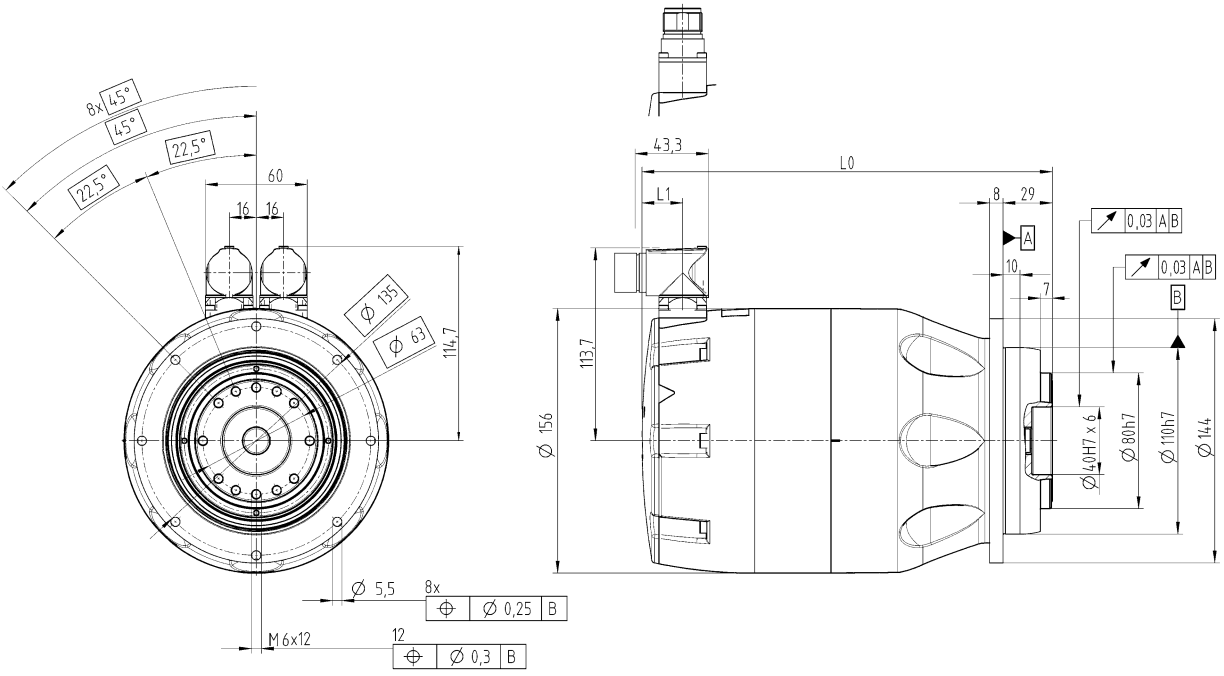
[a] Refers to center of the output shaft or flange



without brake

Ratio	Encoder	Length L0 in mm	Length L1 in mm
i = 4/5/7/10	Resolver	242	24
	HIPERFACE®	263	45
	EnDat	267	49

with brake

Ratio	Encoder	Length L0 in mm	Length L1 in mm
i = 4/5/7/10	Resolver	266	24
	HIPERFACE®	287	45
	EnDat	291	49

			2-stage								
Ratio	**i**		**16**	**20**	**25**	**28**	**35**	**40**	**50**	**70**	**100**
Operating voltage	U_D	*V DC*	560								
Max. acceleration torque (max. 1000 cycles per hour)	T_{2B}	*Nm*	350	350	380	350	380	305	380	330	265
		in.lb	3098	3098	3363	3098	3363	2699	3363	2921	2345
Static output torque	T_{20}	*Nm*	181	210	200	210	220	113	142	200	120
		in.lb	1602	1859	1770	1859	1947	1000	1257	1770	1062
Brake holding torque (at 120 °C)	T_{2Br}	*Nm*	208	260	325	364	455	520	625	625	600
		in.lb	1841	2301	2877	3222	4027	4602	5532	5532	5310
Max. speed at output	n_{2max}	*rpm*	375	300	240	214	171	150	120	86	60
Speed limit for T_{2B}	n_{2B}	*rpm*	260	220	185	170	140	90	70	65	50
Max. motor acceleration torque	T_{1max}	*Nm*	28.9	28.9	28.9	28.9	28.9	7.8	7.8	7.8	7.8
		in.lb	256	256	256	256	256	69	69	69	69
Max. motor acceleration current	I_{MaxDyn}	A_{eff}	40	40	40	40	40	12	12	12	12
Static motor current	I_0	A_{eff}	13.7	13.7	13.7	13.7	13.7	4	4	4	4
Max. backlash	j_t	*arcmin*	Standard ≤ 3 Reduced ≤ 1								
Torsional rigidity (Gearbox)	C_{t21}	*Nm/arcmin*	81	81	83	80	82	76	80	71	60
		in.lb/arcmin	717	717	735	708	726	673	708	628	531
Tilting rigidity	C_{2K}	*Nm/arcmin*	550								
		in.lb/arcmin	4868								
Max. axial force [a]	F_{2AMax}	*N*	4150								
		lb_f	934								
Max. tilting moment	M_{2KMax}	*Nm*	440								
		in.lb	3894								
Service life	L_h	*h*	> 20000								
Weight (without brake)	*m*	*kg*	10.3 to 14.5								
		lb_m	23 to 32								
Ambient temperature		*°C*	0 to +40								
		°F	+32 to +104								
Lubrication			Lubricated for life								
Insulating material class			F								
Protection class			IP 65								
Paint			Blue metallic 250 and natural cast aluminium								
Metal bellows coupling (recommended product type – validate sizing with cymex®)			BCT-00150AAX-063.000								
Bore diameter of coupling on the application side		*mm*	X = 019.000 - 042.000								
Mass moment of inertia (relates to the drive)	J_1	$kgcm^2$	8.94	8.83	8.81	8.72	8.71	2.48	2.48	2.48	2.47
		10^{-3} *in.lb.s²*	7.9	7.8	7.8	7.7	7.7	2.2	2.2	2.2	2.2

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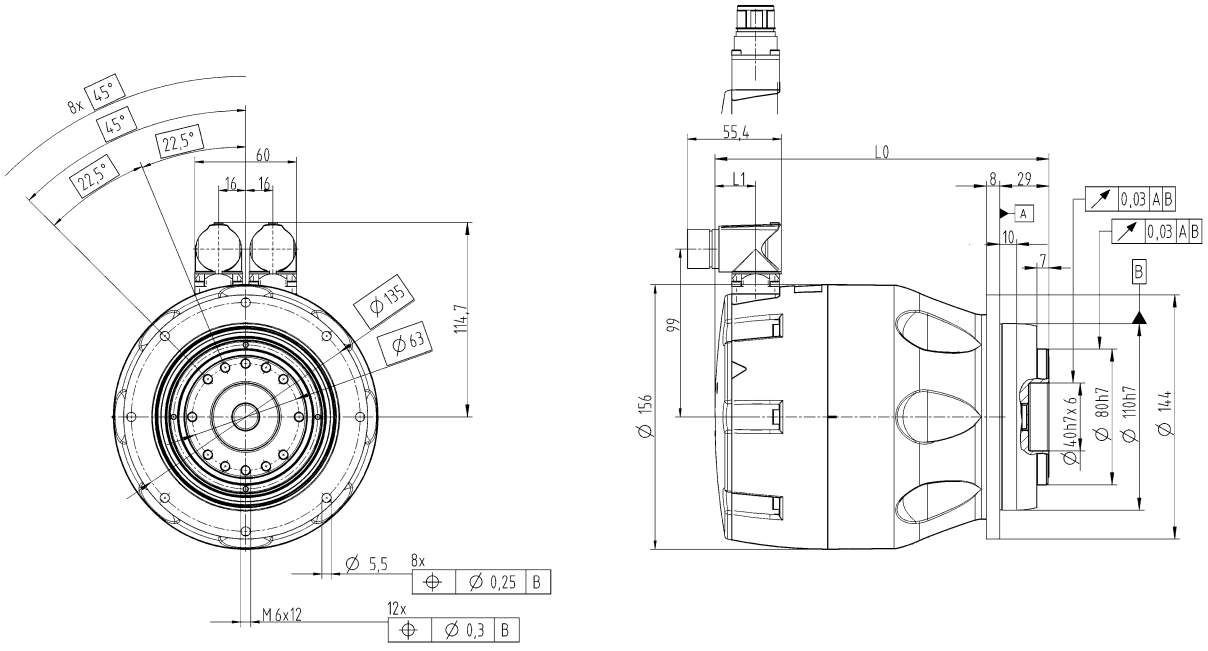
[a] Refers to center of the output shaft or flange



without brake

Ratio	Encoder	Length L0 in mm	Length L1 in mm
i = 16/20/25/28/35	Resolver	242	24
	HIPERFACE®	263	45
	EnDat	267	49
i = 40/50/70/100	Resolver	197	24
	HIPERFACE®	218	45
	EnDat	222	49

with brake

Ratio	Encoder	Length L0 n mm	Length L1 in mm
i = 16/20/25/28/35	Resolver	266	24
	HIPERFACE®	287	45
	EnDat	291	49
i = 40/50/70/100	Resolver	221	24
	HIPERFACE®	242	45
	EnDat	246	49

			1-stage			
Ratio	**i**		**4**	**5**	**7**	**10**
Operating voltage	U_D	*V DC*	560			
Max. acceleration torque (max. 1000 cycles per hour)	T_{2B}	*Nm*	221	278	340	350
		in.lb	1956	2461	3009	3098
Static output torque	T_{20}	*Nm*	72	91	130	188
		in.lb	637	805	1151	1664
Brake holding torque (at 120 °C)	T_{2Br}	*Nm*	92	115	161	230
		in.lb	814	1018	1425	2036
Max. speed at output	n_{2max}	*rpm*	1250	1000	714	500
Speed limit for T_{2B}	n_{2B}	*rpm*	780	620	450	370
Max. motor acceleration torque	T_{1max}	*Nm*	56.6	56.6	56.6	56.6
		in.lb	501	501	501	501
Max. motor acceleration current	I_{MaxDyn}	A_{eff}	63.5	63.5	63.5	63.5
Static motor current	I_0	A_{eff}	19	19	19	19
Max. backlash	j_t	*arcmin*	Standard ≤ 3 Reduced ≤ 1			
Torsional rigidity (Gearbox)	C_{t21}	*Nm/arcmin*	190	187	159	123
		in.lb/arcmin	1682	1655	1407	1089
Tilting rigidity	C_{2K}	*Nm/arcmin*	560			
		in.lb/arcmin	4956			
Max. axial force [a]	F_{2AMax}	*N*	6130			
		lb_f	1379			
Max. tilting moment	M_{2KMax}	*Nm*	1335			
		in.lb	11816			
Service life	L_h	*h*	> 20000			
Weight (without brake)	*m*	*kg*	23.6			
		lb_m	52			
Ambient temperature		*°C*	0 to +40			
		°F	+32 to +104			
Lubrication			Lubricated for life			
Insulating material class			F			
Protection class			IP 65			
Paint			Blue metallic 250 and natural cast aluminium			
Metal bellows coupling (recommended product type – validate sizing with cymex®)			BCT-00300AAX-080.000			
Bore diameter of coupling on the application side		*mm*	X = 024.000 - 060.000			
Mass moment of inertia (relates to the drive)	J_1	$kgcm^2$	26.4	24.8	23.3	22.5
		10^{-3} $in.lb.s^2$	23	22	21	20

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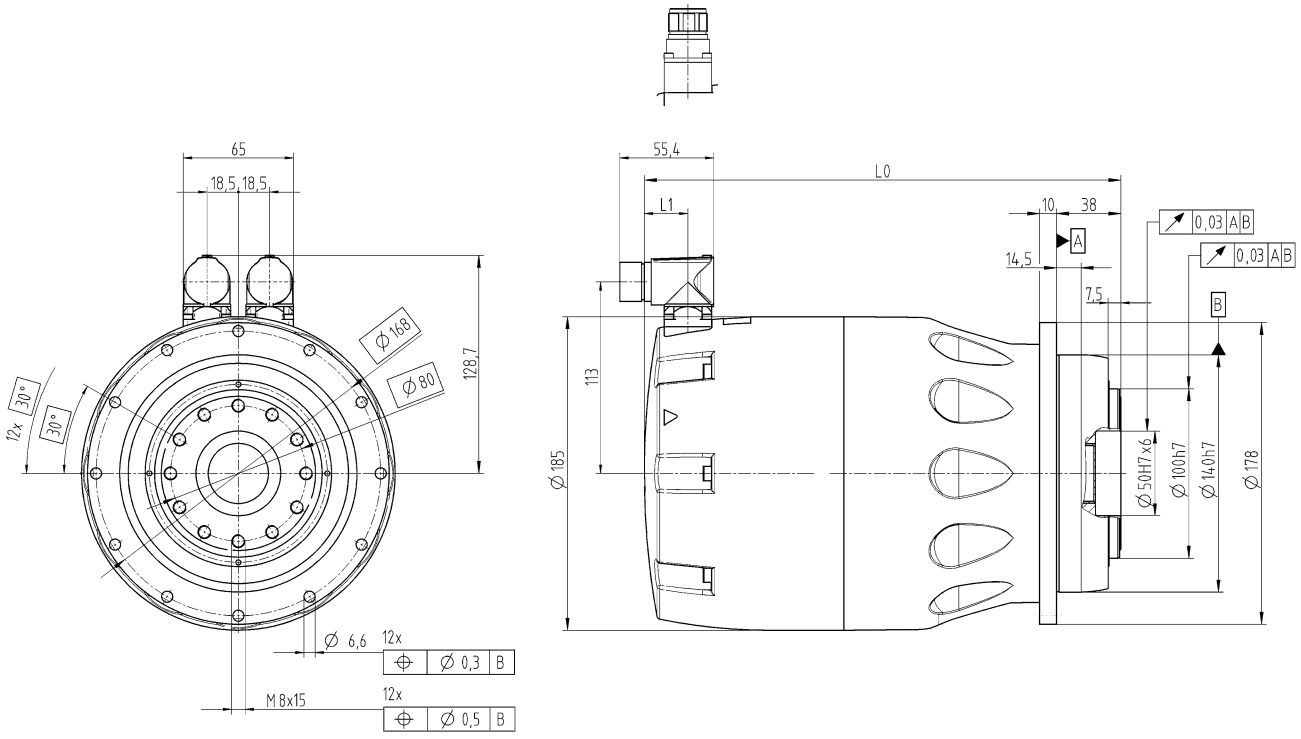
[a] Refers to center of the output shaft or flange



without brake

Ratio	Encoder	Length L0 in mm	Length L1 in mm
i = 4/5/7/10	Resolver	281	26
	HIPERFACE®	306	50
	EnDat	306	50

with brake

Ratio	Encoder	Length L0 in mm	Length L1 in mm
i = 4/5/7/10	Resolver	321	26
	HIPERFACE®	346	50
	EnDat	346	50

			2-stage								
Ratio	**i**		**16**	**20**	**25**	**28**	**35**	**40**	**50**	**70**	**100**
Operating voltage	U_D	*V DC*	560								
Max. acceleration torque (max. 1000 cycles per hour)	T_{2B}	*Nm*	750	750	750	750	750	607	750	700	540
		in.lb	6638	6638	6638	6638	6638	5372	6638	6196	4779
Static output torque	T_{20}	*Nm*	293	371	400	400	400	199	250	354	240
		in.lb	2593	3284	3540	3540	3540	1761	2213	3133	2124
Brake holding torque (at 120 °C)	T_{2Br}	*Nm*	368	460	575	644	805	920	1150	1250	1100
		in.lb	3257	4071	5089	5700	7125	8143	10178	11064	9736
Max. speed at output	n_{2max}	*rpm*	312	250	200	179	143	125	100	71	50
Speed limit for T_{2B}	n_{2B}	*rpm*	210	180	155	145	125	90	80	65	50
Max. motor acceleration torque	T_{1max}	*Nm*	56.6	56.6	56.6	56.6	56.6	15.6	15.6	15.6	15.6
		in.lb	501	501	501	501	501	138	138	138	138
Max. motor acceleration current	I_{MaxDyn}	A_{eff}	63.5	63.5	63.5	63.5	63.5	33	33	33	33
Static motor current	I_0	A_{eff}	19	19	19	19	19	7.5	7.5	7.5	7.5
Max. backlash	j_t	*arcmin*	Standard ≤ 3 Reduced ≤ 1								
Torsional rigidity (Gearbox)	C_{t21}	*Nm/arcmin*	180	185	180	180	175	175	175	145	115
		in.lb/arcmin	1593	1637	1593	1593	1549	1549	1549	1283	1018
Tilting rigidity	C_{2K}	*Nm/arcmin*	560								
		in.lb/arcmin	4956								
Max. axial force [a]	F_{2AMax}	*N*	6130								
		lb_f	1379								
Max. tilting moment	M_{2KMax}	*Nm*	1335								
		in.lb	11816								
Service life	L_h	*h*	> 20000								
Weight (without brake)	*m*	*kg*	19.4 to 25.1								
		lb_m	43 to 55								
Ambient temperature		*°C*	0 to +40								
		°F	+32 to +104								
Lubrication			Lubricated for life								
Insulating material class			F								
Protection class			IP 65								
Paint			Blue metallic 250 and natural cast aluminium								
Metal bellows coupling (recommended product type – validate sizing with cymex®)			BCT-00300AAX-080.000								
Bore diameter of coupling on the application side		*mm*	X = 024.000 - 060.000								
Mass moment of inertia (relates to the drive)	J_1	$kgcm^2$	23.1	22.6	22.6	22.2	22.2	6.3	6.3	6.3	6.3
		10^{-3} *in.lb.s²*	20	20	20	20	20	5.6	5.6	5.6	5.6

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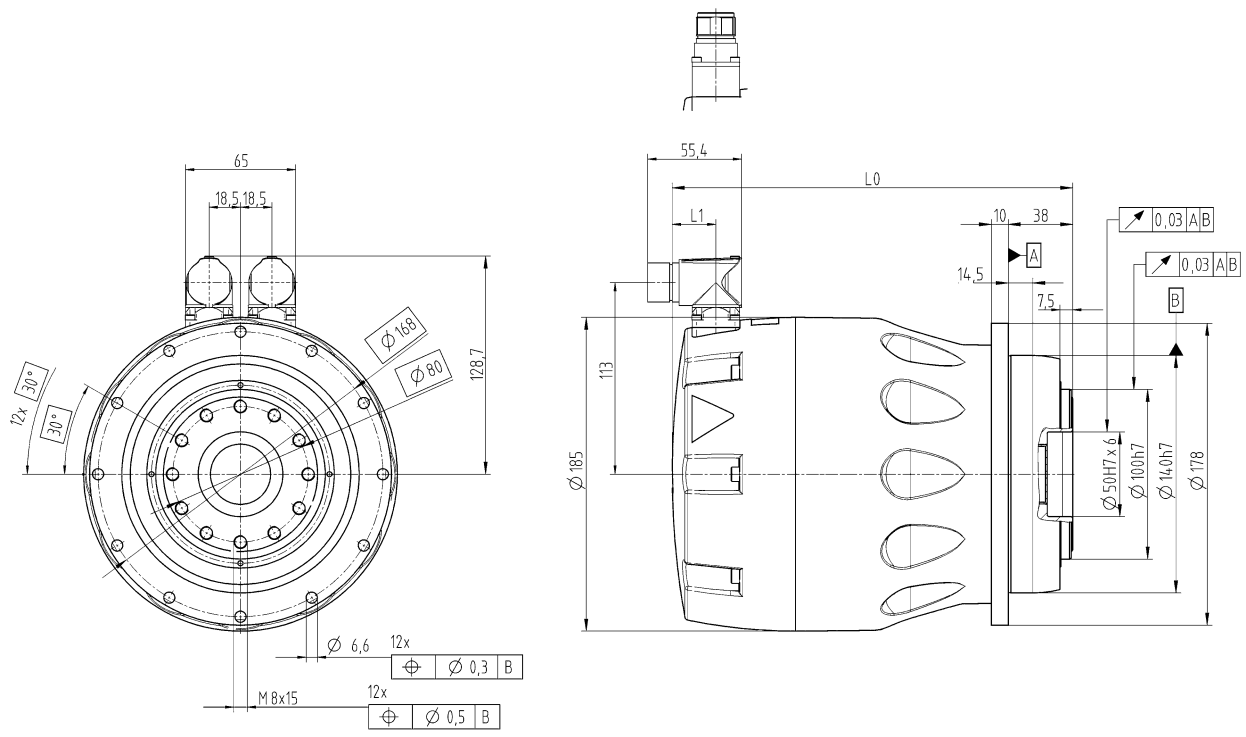
[a] Refers to center of the output shaft or flange



without brake

Ratio	Encoder	Length L0 in mm	Length L1 in mm
i = 16/20/25/28/35	Resolver	281	26
	HIPERFACE®	306	50
	EnDat	306	50
i = 40/50/70/100	Resolver	236	26
	HIPERFACE®	261	50
	EnDat	261	50

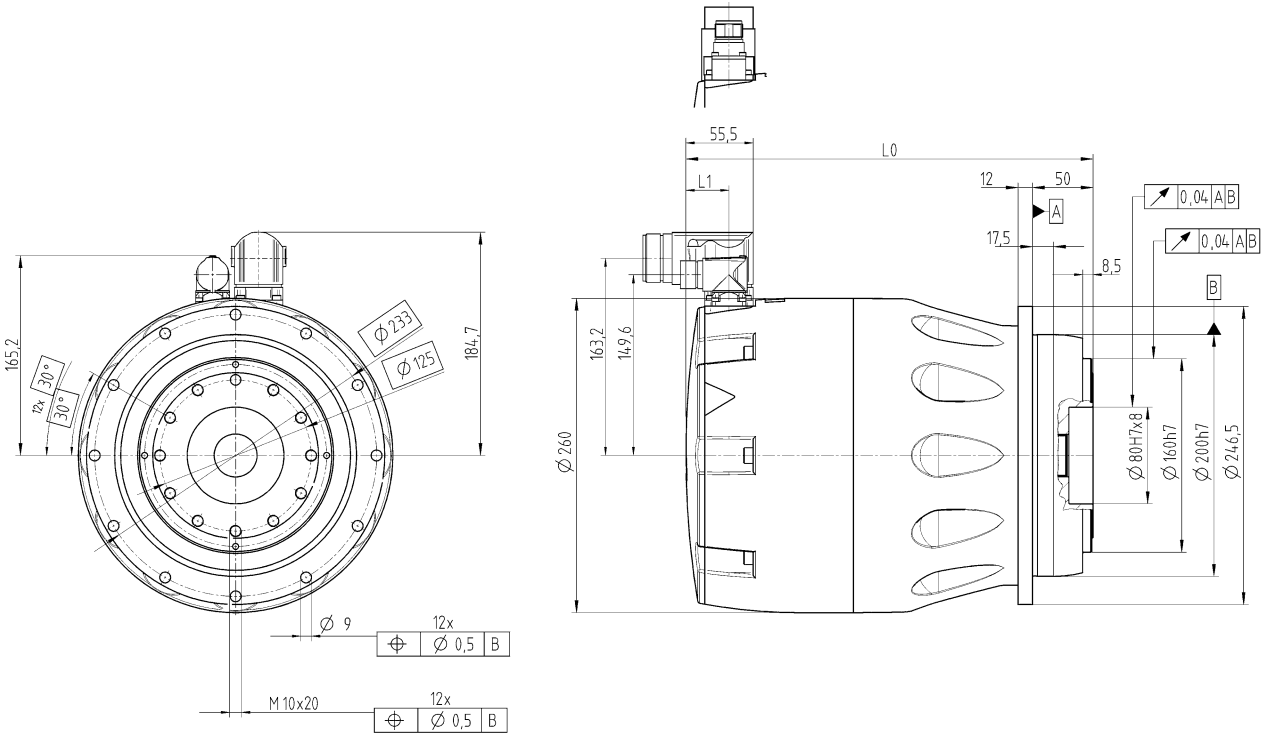
with brake

Ratio	Encoder	Length L0 in mm	Length L1 in mm
i = 16/20/25/28/35	Resolver	321	26
	HIPERFACE®	346	50
	EnDat	346	50
i = 40/50/70/100	Resolver	276	26
	HIPERFACE®	301	50
	EnDat	301	50

			1-stage			
Ratio	**i**		**4**	**5**	**7**	**10**
Operating voltage	U_D	*V DC*	560			
Max. acceleration torque (max. 1000 cycles per hour)	T_{2B}	*Nm*	340	428	603	555
		in.lb	3009	3788	5337	4912
Static output torque	T_{20}	*Nm*	136	172	246	356
		in.lb	1204	1522	2177	3151
Brake holding torque (at 120 °C)	T_{2Br}	*Nm*	288	360	504	720
		in.lb	2549	3186	4461	6373
Max. speed at output	n_{2max}	*rpm*	1050	840	643	450
Speed limit for T_{2B}	n_{2B}	*rpm*	950	750	540	450
Max. motor acceleration torque	T_{1max}	*Nm*	88	88	88	88
		in.lb	779	779	779	779
Max. motor acceleration current	I_{MaxDyn}	A_{eff}	100	100	100	100
Static motor current	I_0	A_{eff}	38.6	38.6	38.6	38.6
Max. backlash	j_t	*arcmin*	Standard ≤ 3 Reduced ≤ 1			
Torsional rigidity (Gearbox)	C_{t21}	*Nm/arcmin*	610	610	550	445
		in.lb/arcmin	5399	5399	4868	3939
Tilting rigidity	C_{2K}	*Nm/arcmin*	1452			
		in.lb/arcmin	12851			
Max. axial force [a]	F_{2AMax}	*N*	10050			
		lb_f	2261			
Max. tilting moment	M_{2KMax}	*Nm*	3280			
		in.lb	29031			
Service life	L_h	*h*	> 20000			
Weight (without brake)	*m*	*kg*	58.8			
		lb_m	130			
Ambient temperature		*°C*	0 to +40			
		°F	+32 to +104			
Lubrication			Lubricated for life			
Insulating material class			F			
Protection class			IP 65			
Paint			Blue metallic 250 and natural cast aluminium			
Metal bellows coupling (recommended product type – validate sizing with cymex®)			BCT-01500AAX-125.000			
Bore diameter of coupling on the application side		*mm*	X = 050.000 - 080.000			
Mass moment of inertia (relates to the drive)	J_1	$kgcm^2$	142	132	123	118
		10^{-3} $in.lb.s^2$	126	117	109	104

Please use our sizing software cymex® for a detailed sizing – **www.wittenstein-cymex.com**

[a] Refers to center of the output shaft or flange



without brake

Ratio	Encoder	Length L0 in mm	Length L1 in mm
i = 4/5/7/10	Resolver	337	36
	HIPERFACE®	361	60
	EnDat	361	60

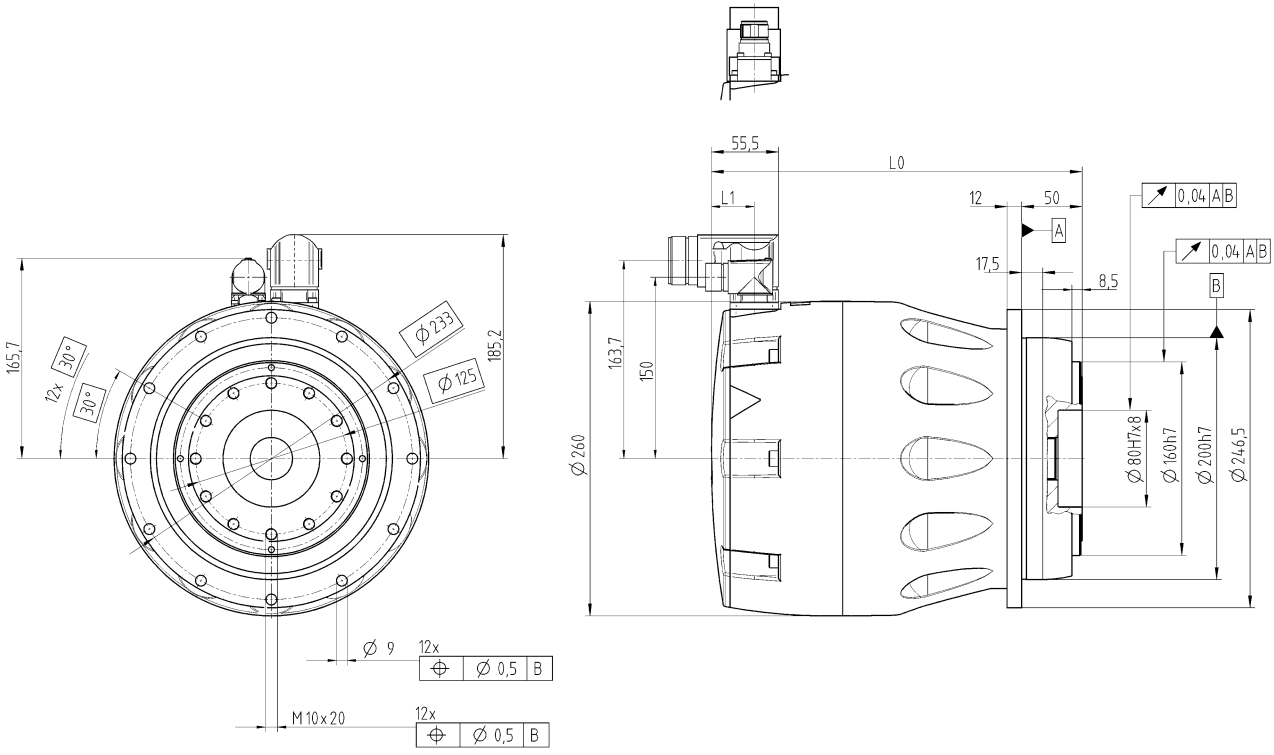
with brake

Ratio	Encoder	Length L0 in mm	Length L1 in mm
i = 4/5/7/10	Resolver	387	36
	HIPERFACE®	411	60
	EnDat	411	60

			2-stage								
Ratio	**i**		**16**	**20**	**25**	**28**	**35**	**40**	**50**	**70**	**100**
Operating voltage	U_D	*V DC*	560								
Max. acceleration torque (max. 1000 cycles per hour)	T_{2B}	*Nm*	1375	1600	1600	1600	1600	1600	1600	1600	1400
		in.lb	12170	14161	14161	14161	14161	14161	14161	14161	12391
Static output torque	T_{20}	*Nm*	558	705	886	999	1250	794	997	900	800
		in.lb	4939	6240	7842	8842	11064	7028	8824	7966	7081
Brake holding torque (at 120 °C)	T_{2Br}	*Nm*	1152	1440	1800	2016	2520	2750	2750	1750	2500
		in.lb	10196	12745	15931	17843	22304	24340	24340	15489	22127
Max. speed at output	n_{2max}	*rpm*	281	225	180	161	129	112	90	64	45
Speed limit for T_{2B}	n_{2B}	*rpm*	230	190	170	160	135	95	85	65	50
Max. motor acceleration torque	T_{1max}	*Nm*	88	88	88	88	88	44.2	44.2	44.2	44.2
		in.lb	779	779	779	779	779	391	391	391	391
Max. motor acceleration current	I_{MaxDyn}	A_{eff}	100	100	100	100	100	50	50	50	50
Static motor current	I_0	A_{eff}	38.6	38.6	38.6	38.6	38.6	21.9	21.9	21.9	21.9
Max. backlash	j_t	*arcmin*	Standard ≤ 3 Reduced ≤ 1								
Torsional rigidity (Gearbox)	C_{t21}	*Nm/arcmin*	585	580	570	560	560	520	525	480	395
		in.lb/arcmin	5178	5133	5045	4956	4956	4602	4647	4248	3496
Tilting rigidity	C_{2K}	*Nm/arcmin*	1452								
		in.lb/arcmin	12851								
Max. axial force [a]	F_{2AMax}	*N*	10050								
		lb_f	2261								
Max. tilting moment	M_{2KMax}	*Nm*	3280								
		in.lb	29031								
Service life	L_h	*h*	> 20000								
Weight (without brake)	*m*	*kg*	52.3 to 59.6								
		lb_m	116 to 132								
Ambient temperature		*°C*	0 to +40								
		°F	+32 to +104								
Lubrication			Lubricated for life								
Insulating material class			F								
Protection class			IP 65								
Paint			Blue metallic 250 and natural cast aluminium								
Metal bellows coupling (recommended product type – validate sizing with cymex®)			BCT-01500AAX-125.000								
Bore diameter of coupling on the application side		*mm*	X = 050.000 - 080.000								
Mass moment of inertia (relates to the drive)	J_1	$kgcm^2$	117	117	116	115	115	60	60	60	60
		10^{-3} *in.lb.s²*	104	104	103	102	102	53	53	53	53

Please use our sizing software cymex® for a detailed sizing – **www.wittenstein-cymex.com**

[a] Refers to center of the output shaft or flange



without brake

Ratio	Encoder	Length L0 in mm	Length L1 in mm
i = 16/20/25/28/35	Resolver	337	36
	HIPERFACE®	361	60
	EnDat	361	60
i = 40/50/70/100	Resolver	307	36
	HIPERFACE®	331	60
	EnDat	331	60

with brake

Ratio	Encoder	Length L0 in mm	Length L1 in mm
i = 16/20/25/28/35	Resolver	387	36
	HIPERFACE®	411	60
	EnDat	411	60
i = 40/50/70/100	Resolver	357	36
	HIPERFACE®	381	60
	EnDat	381	60

TPM+ options

Electrical connection
Straight or angled version.

Encoder
In addition to the standard version with resolver, optional encoder systems with the protocols EnDat 2.1 and HIPERFACE® are available.

Pin assignment
For a number of servo controllers, we offer special pin assignments for power and signal.

Temperature sensor
Choose from PTC for temperature switch functionality or KTY for a linear reading of operating temperature.

Operating voltage
Depending on the application and servo regulator, windings for 48, 320 and 560 V DC are available.

Holding brake
A suitable permanent-magnet holding brake adapted to the motor power is available.

Lubrication
Select from the standard lubrication with oil or grease as well as food-grade grease and oil.

Backlash
To improve precision, the gearbox backlash can be reduced.

Increased corrosion protection
For applications with requirements in terms of resistance to water and cleaning agents a version with greater corrosion protection and protection class IP 66 is available.

TPM+ options

Lubrication

Depending on the application, the requirements regarding the lubricant in the gearbox change.

The following lubricants are available for our servo actuators:

- Oil (Standard)
- Grease
  (Reduction of output torque by up to 20 %)
- Food-grade oil
  (Reduction of output torque by up to 20 %)
- Food-grade grease
  (Reduction of output torque by up to 40 %)

Operating voltage

The TPM+ servo actuators are available for operating voltages of 48 V (only TPM+ DYNAMIC 004 and 010, TPM+ POWER 004), 320 V and 560 V.

Temperature sensor

Different sensors are available to protect the motor coil from overheating.
- PTC resistor, type STM 160 according to DIN 44081/82
- KTY 84-130

Encoder

A large selection of encoder systems is available for positioning and speed measurement:

Resolver
- 2-pin, one sine / cosine cycle per rotation

HIPERFACE® absolute encoder
- Singleturn, resolution 4096 positions per revolution, 128 sine / cosine
- Multiturn, resolution 4096 positions per revolution, 128 sine / cosine, 4096 revolutions

EnDat 2.1, absolute encoder
- Singleturn, resolution 8192 positions per revolution, 512 sine / cosine
- Multiturn, resolution 8192 positions per revolution, 512 sine / cosine, 4096 revolutions

HIPERFACE DSL®, EnDat 2.2 or DRIVE-CLiQ upon request

Holding brake

A compact permanent magnet brake is fitted to secure the motor shaft when the actuator is disconnected from the power. Characteristics include holding without torsional backlash, no residual torque when the brake is released and unlimited power-on time at zero speed.

Size DYNAMIC		**004 and 010**	**025**	**050 and 110**
Holding torque at 120 °C	Nm	1.1	4.5	13
Supply voltage	V DC	24 + 6% / –10%		
Current	A	0.42	0.42	0.71

Size POWER		**004**	**010**	**025**	**050**	**110**
Holding torque at 120 °C	Nm	1.1	4.5	13	23	72
Supply voltage	V DC	24 + 6% / –10%				
Current	A	0.42	0.42	0.51	1	1.2

Size HIGH TORQUE		**10**		**25**		**50**		**110**	
Rations		22 – 110	154 – 220	22 – 55	66 – 220	22 – 55	66 – 220	22 – 88	110 – 220
Holding torque at 120 °C	Nm	4.5	1.8	13	4.5	23	13	72	23
Supply voltage	V DC	24 + 6% / –10%							
Current	A	0.42	0.42	0.71	0.42	1	0.71	1.2	1

In the case of high ratios, a brake with a reduced holding torque is partly used to prevent damage to the gearbox. The exact holding torques at the output can be found in the relevant data tables for the actuators, e.g. TPM⁺ POWER 110 2-stage. In the case of transmission ratios in which the holding torque at the output is above T_{2B}, the brake can be used max. 1000 times for emergency stopping on the rotating motor.

TPM+ options

Electrical connection

The conventional connection via two integral sockets for power and signal is available, as well as a version for a single-cable connection, which is available upon request.

Integral sockets used:

Two-cable connection	Power	Integral power socket M23 Bayonet coupling, 6/9-pin
	Signal	Integral signal socket M23 Bayonet coupling, 9/12/17-pin

Pin assignment

In addition to two standard WITTENSTEIN pin assignments, a number of compatible connections are available for various servo controller suppliers.

Pin assignment 1	WITTENSTEIN alpha-Standard, temperature sensor in signal cable Resolver, HIPERFACE®, EnDat 2.1
Pin assignment 4	WITTENSTEIN alpha-Standard, temperature sensor in power cable Resolver, HIPERFACE®, EnDat 2.1
Pin assignment 5	Rockwell compatible HIPERFACE®

Pin assignment 6	B&R compatible Resolver, EnDat 2.1
Pin assignment 8	Schneider compatible HIPERFACE®
Pin assignment 9	Beckhoff compatible Resolver, EnDat 2.1

Increased corrosion protection

All actuators of the "TPM$^+$" product range (except Size 004 DYNAMIC) are optionally available with increased corrosion protection.

Versions

1. Chemically nickel-plated gearbox housing.
2. Stainless steel output flange and shaft nut.
3. Small external stainless steel screws.
4. Additional U-seals on the external screws.
5. Base (chemically nickel plated) for integral socket with laser-marking of identification plate.
6. All versions are generally equipped with straight integral socket only.
7. The TPM$^+$ is completely painted with a highly resistant, two-component epoxy resin based material.
   Colors: - Ultramarine blue silk matte (RAL 5002)
   - Papyrus white silk matte (RAL 9018)

Fields of application

- Outdoor use in gates, conveyors etc.
- Packaging machines outside of the food sector.
- Textile machines.
- Pharmaceutical plants outside of the medical sector.

Resistance

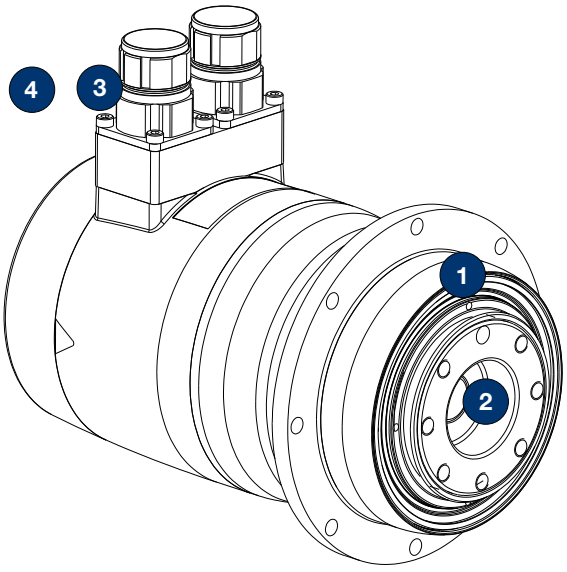
- to water and moisture.
- restricted due to cleaning agents, especially under extended exposure period.

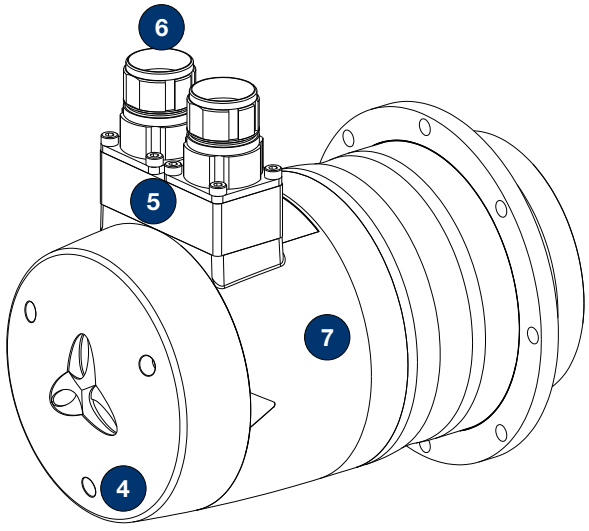
Successful tests with Oxofoam VF5L (Johnson Diversey) and Ultraclean VK3 (Johnson Diversey).

- Further cleaning agents can be qualified on request.

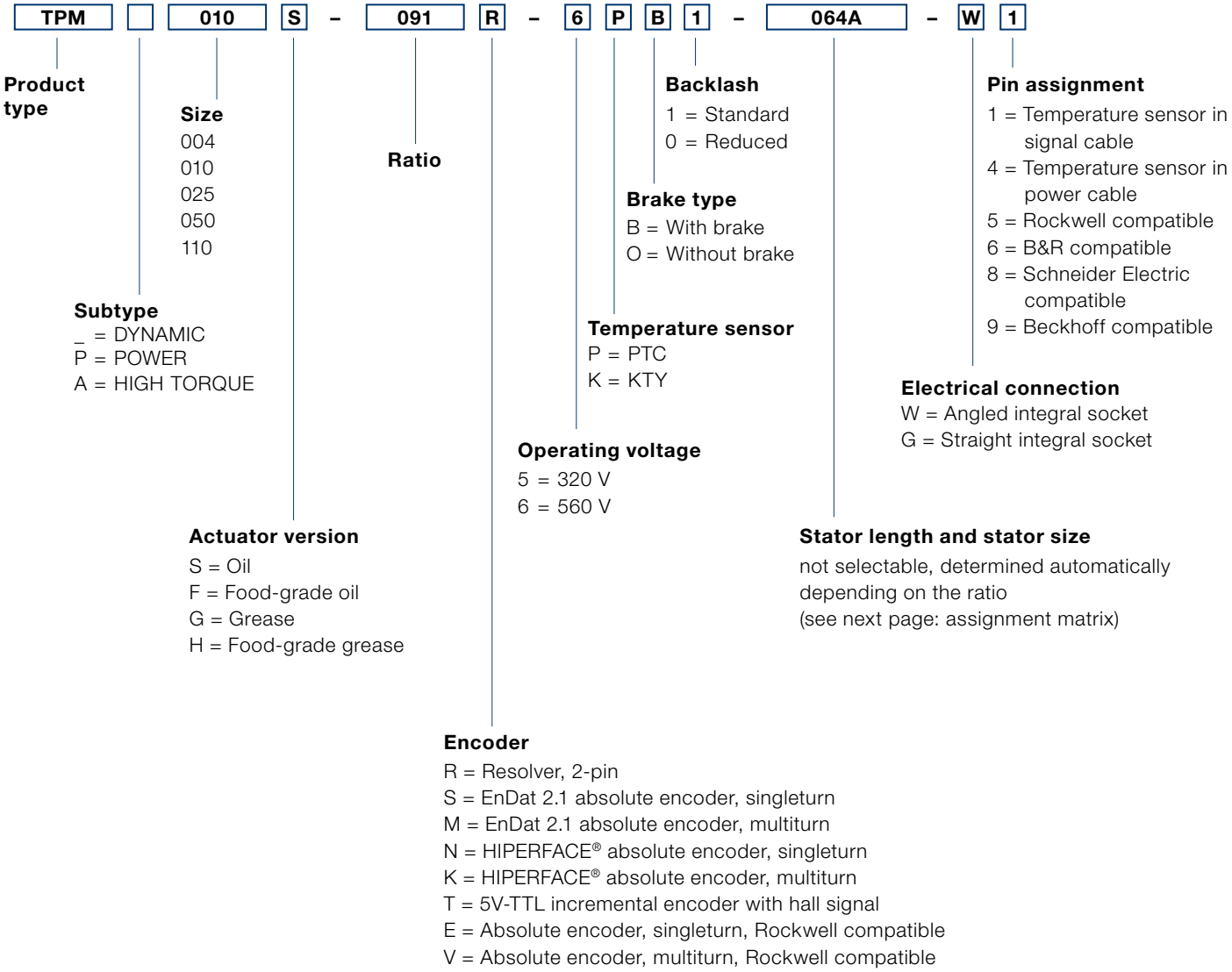
Protection class

Against spray water: IP 66





TPM+ Ordering code

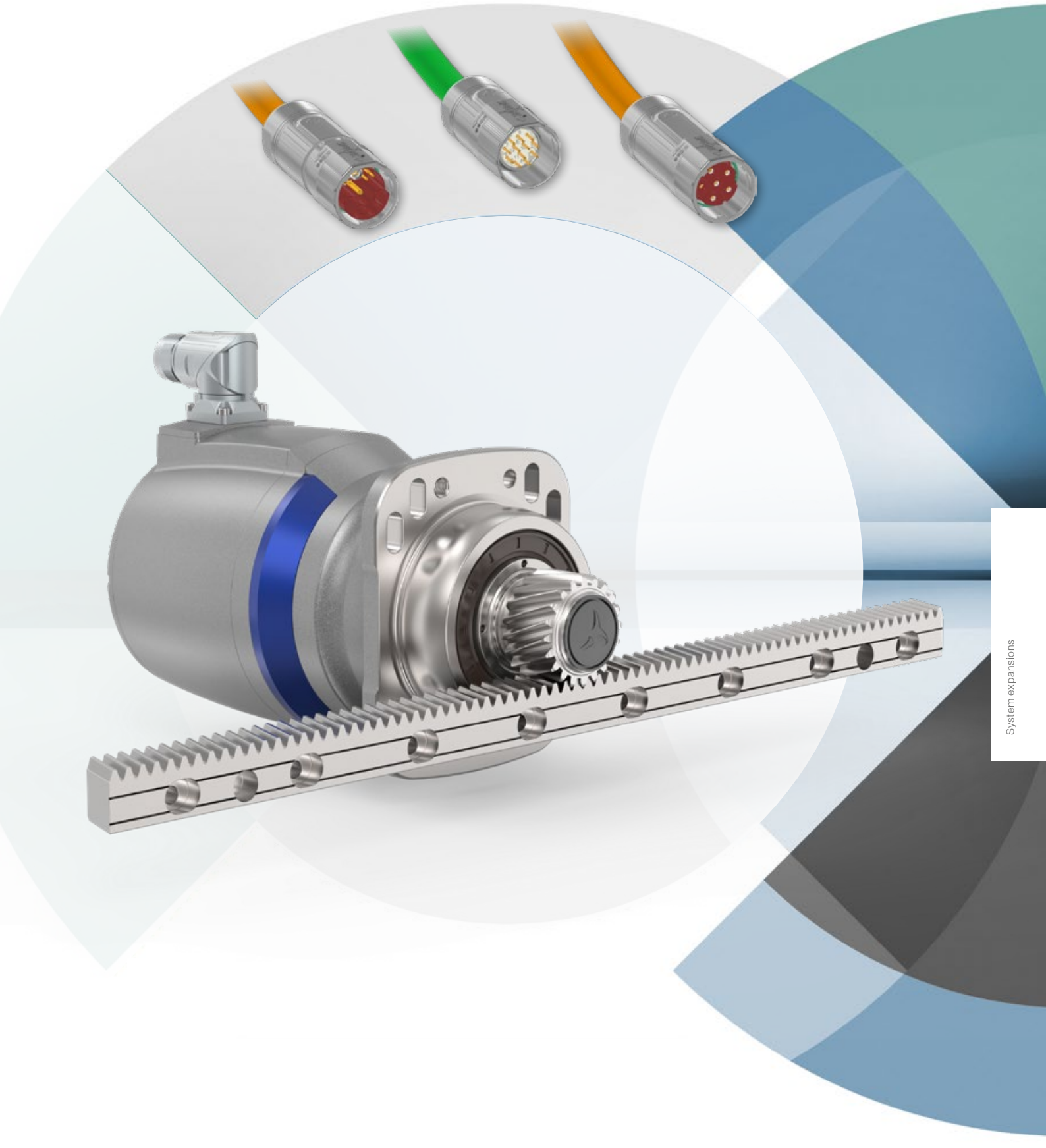


Motor / gearbox assignment matrix

Ratio	Size 004		Size 010			Size 025			Size 050			Size 110		
	DYNAMIC	POWER	DYNAMIC	POWER	HIGH TORQUE	DYNAMIC	POWER	HIGH TORQUE	DYNAMIC	POWER	HIGH TORQUE	DYNAMIC	POWER	HIGH TORQUE
4	x	64B	x	94C	x	x	130D	x	x	155D	x	x	220D	x
5	x	64B	x	94C	x	x	130D	x	x	155D	x	x	220D	x
7	x	64B	x	94C	x	x	130D	x	x	155D	x	x	220D	x
10	x	64B	x	94C	x	x	130D	x	x	155D	x	x	220D	x
16	53B	64B	64B	94C	x	94C	130D	x	130D	155D	x	130E	220D	x
20	x	64B	x	94C	x	x	130D	x	x	155D	x	x	220D	x
21	53B	x	64B	x	x	94C	x	x	130D	x	x	130E	x	x
22	x	x	x	x	94C	x	x	130D	x	x	155D	x	x	220H
25	x	64B	x	94C	x	x	130D	x	x	155D	x	x	220D	x
27,5	x	x	x	x	94C	x	x	130D	x	x	155D	x	x	220H
28	x	64B	x	94C	x	x	130D	x	x	155D	x	x	220D	x
31	53B	x	64B	x	x	94C	x	x	130D	x	x	130E	x	x
35	x	64B	x	94C	x	x	130D	x	x	155D	x	x	220D	x
38,5	x	x	x	x	94C	x	x	130D	x	x	155D	x	x	220H
40	x	64A	x	94A	x	x	130A	x	x	155A	x	x	220B	x
50	x	64A	x	94A	x	x	130A	x	x	155A	x	x	220B	x
55	x	x	x	x	94C	x	x	130D	x	x	155D	x	x	220H
61	53A	x	64A	x	x	94A	x	x	130A	x	x	130D	x	x
64	53A	x	64A	x	x	94A	x	x	130A	x	x	130D	x	x
66	x	x	x	x	x	x	x	94C	x	x	130D	x	x	220D
70	x	64A	x	94A	x	x	130A	x	x	155A	x	x	220B	x
88	x	x	x	x	94C	x	x	94C	x	x	130D	x	x	220D
91	53A	x	64A	x	x	94A	x	x	130A	x	x	130D	x	x
100	x	64A	x	94A	x	x	130A	x	x	155A	x	x	220B	x
110	x	x	x	x	94C	x	x	94C	x	x	130D	x	x	155D
154	x	x	x	x	94A	x	x	94C	x	x	130D	x	x	155D
220	x	x	x	x	94A	x	x	94C	x	x	130D	x	x	155D

x = no standard combination

System expansions premo® / TPM+



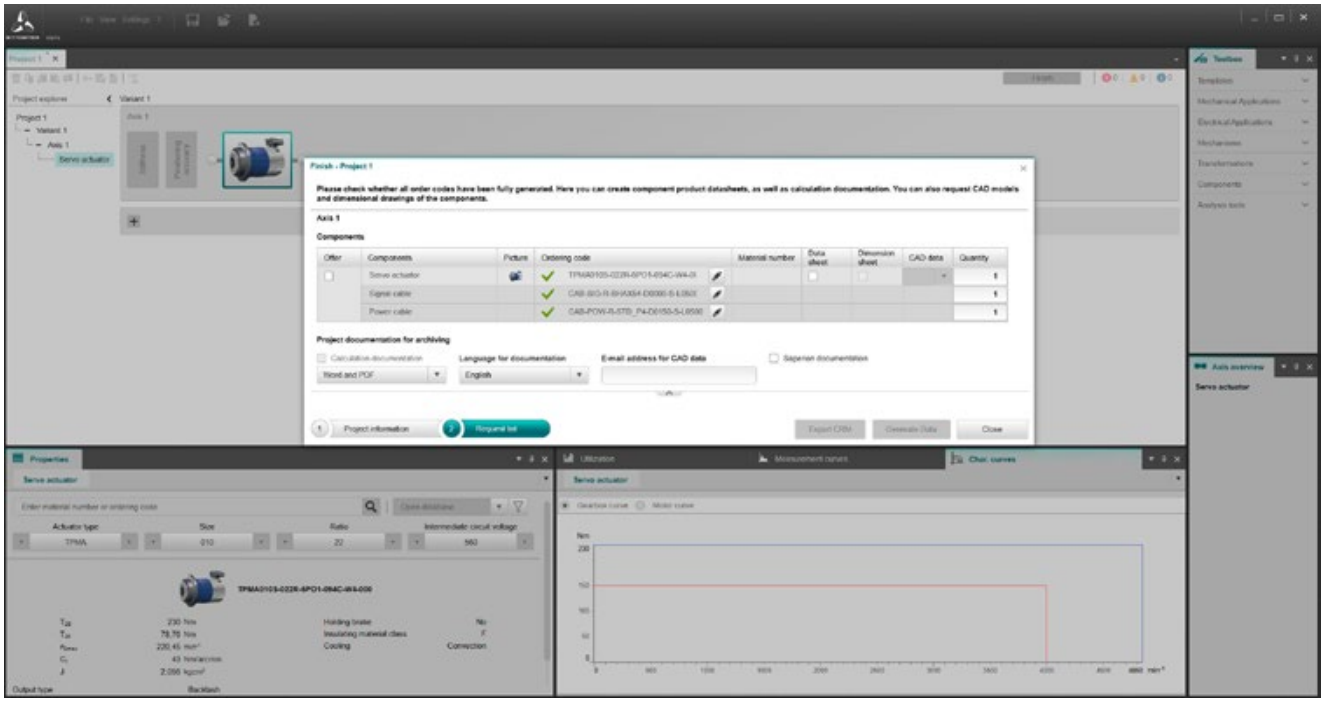
System expansions Cable

The range of high-performance servo actuators is completed by the appropriate connection technology:
Our special system cables support the high performance of the machine most effectively and therefore represent the optimal system expansion “directly from the manufacturer”.

All the cables are characterized by excellent quality and are compatible with drag chains using highly flexible lines according to DIN VDE 0295, class 6. They are also oil and flame-resistant as well as halogen, silicone and CFC-free.

Power and signal cables as well as hybrid cables for single-cable connections are available.
In the version with separate cables, a distinction is also made as to whether the temperature signal is transmitted in the power or signal cable.

The cable cross sections are adapted to the relevant power requirement of the servo actuators and range from 1.5 to 16 mm^2.



We offer numerous pre-assembled cables for a variety of servo actuator and controller versions, e.g. from Siemens upon request. The available versions can be found using cymex® 5.

System expansions
Rack&Pinion System

Strong performance in the advanced segment

Advanced Linear Systems are adapted to applications with average to high demands in terms of smooth running, positioning accuracy and feed force. Different gearbox variants and options such as HIGH TORQUE or HIGH SPEED can be selected to produce the best system for the application. Typical fields of application include wood, plastic and composite machining, machining centers and automation.

For a wide range of applications

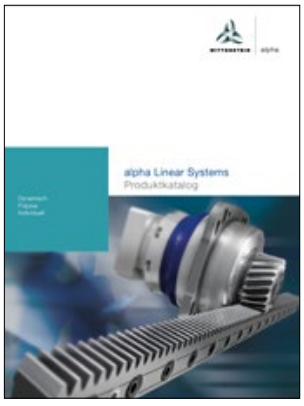
Linear systems from WITTENSTEIN alpha are suitable for a wide range of applications and industries. New standards and advantages have been achieved in the following areas:

- Smooth running
- Positioning accuracy
- Feed force
- Power density
- Rigidity
- Easy assembly
- Design options
- Scalability

Together with a comprehensive range of services, we pledge to support you from the initial concept to the design, installation and commissioning phase.
We will also ensure a consistent supply of spare parts.

The alpha preferential linear system – The best from each segment

Our preferential linear systems in the advanced segment are always comprised of the perfect combination of gearbox, pinion, rack and lubrication system. The systems have been optimized to achieve the required feed force, feed speed, rigidity and degree of utilization of the individual components.



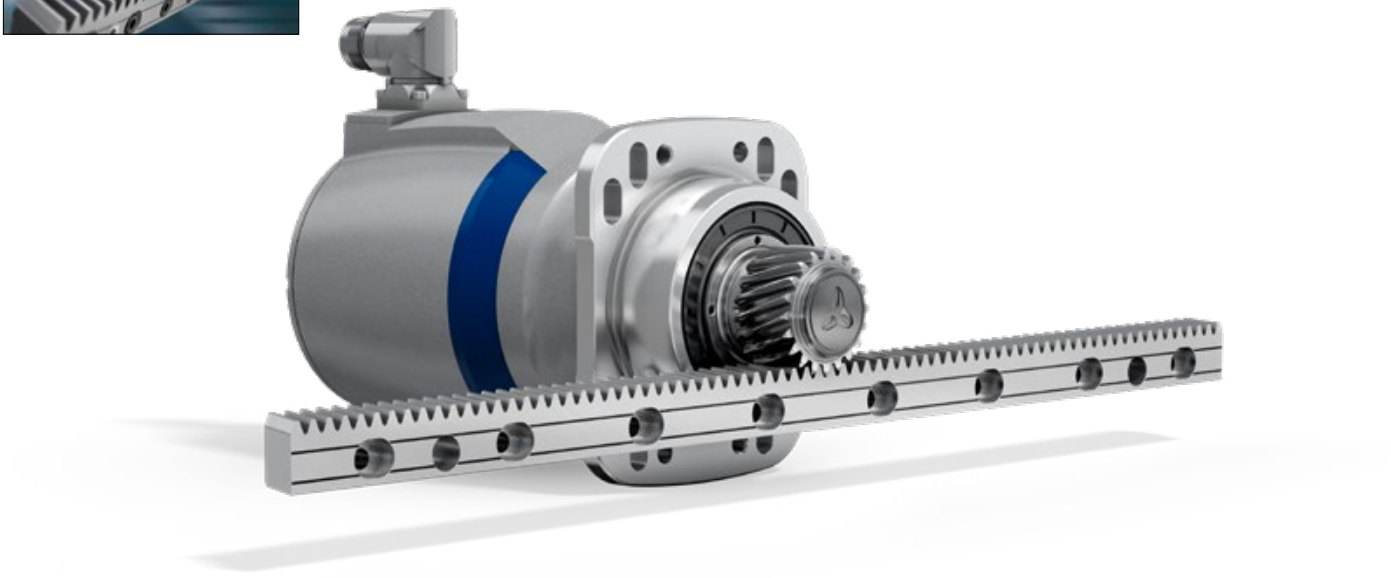
Please refer to our alpha Linear Systems catalog and the website for more information: www.wittenstein-alpha.com/linear-systems

Your benefits at a glance

Perfectly adapted linear systems available with planetary, right-angle and worm gearboxes or as a servo actuator

Optionally with INIRA®

Large individual configuration space due to numerous pinion / gearbox combinations



Simply scan the QR code using your smartphone to see INIRA® in action.

INIRA®: The revolution in rack installation

INIRA® combines our existing innovative concepts for the simple, safe and efficient installation of racks. INIRA® clamping, INIRA® adjusting and INIRA® pinning have already made the installation process much faster, more accurate and more ergonomic. Available for the Advanced and Premium Linear Systems.

INIRA® clamping: Simply faster and more ergonomic

Previously, enormous effort was required to clamp racks to the machine bed using screw clamps. INIRA® clamping integrates the clamping device in the rack. The rack incorporates a mounting sleeve which is guided over the head of the fastening screw to ensure quick and ergonomic clamping.

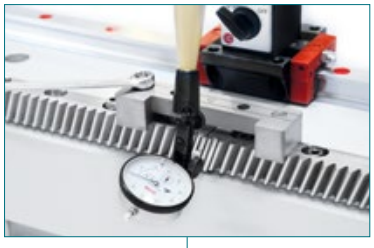
INIRA® adjusting: Simply safer and more precise

In combination with INIRA® clamping, INIRA® adjusting is the ideal solution for perfectly adjust the transition between two rack segments. The innovative adjustment tool can adjust the transition extremely reliable and precise, accurate to the micrometer.

INIRA® pinning: Simply better and more efficient

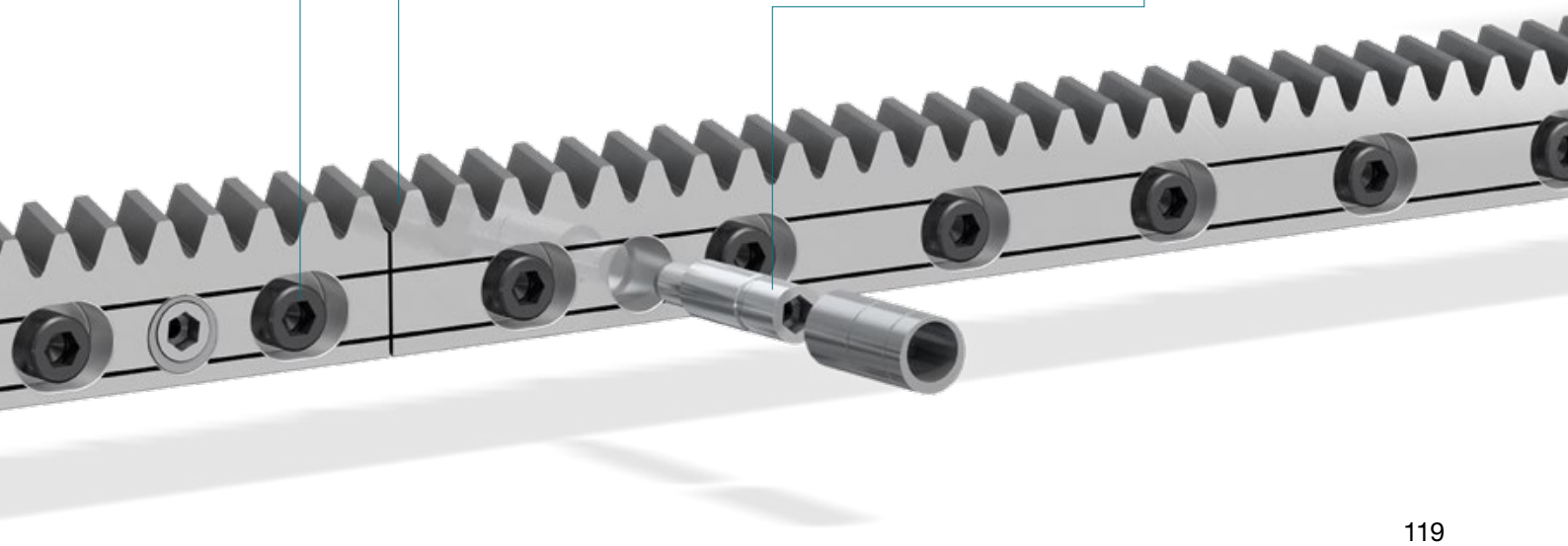
The previous method used for pinning racks was extremely time-consuming. Precision bores had to be drilled and the chips generated must be carefully removed from the assembly. INIRA® pinning now offers a completely new solution for the chipless pinning of racks, which reduces installation times considerably (time spent on each rack ~ 1 min).

INIRA® clamping



INIRA® adjusting

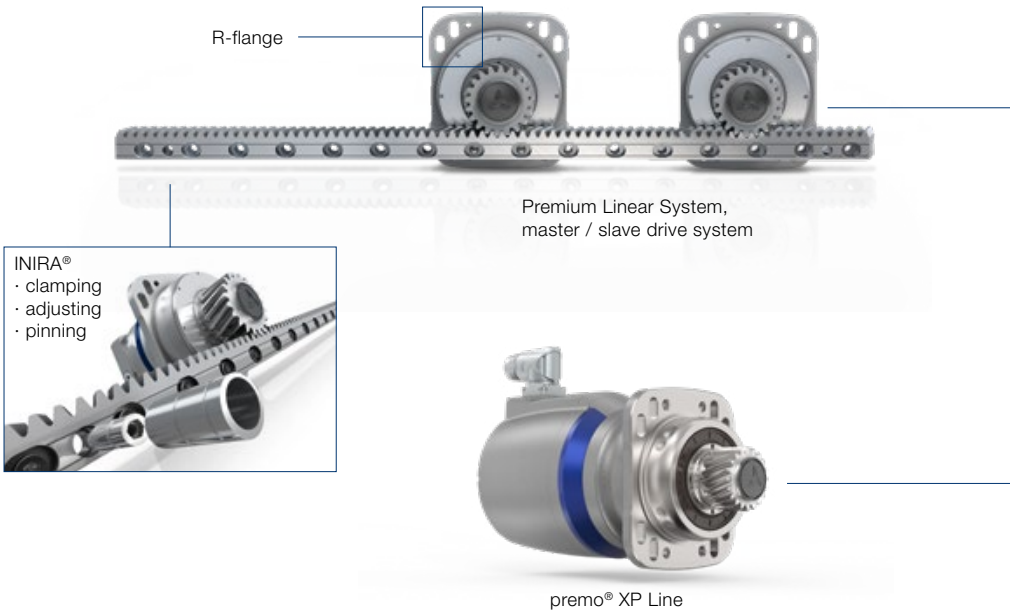
INIRA® pinning



WITTENSTEIN alpha – compatible with all axes

We offer complete drive solutions for each axis from a single source. The fields of application of our linear systems are virtually unlimited, ranging from automation solutions to high-precision axes in machine tools and manufacturing systems that are required to achieve maximum productivity. We always stand as a synonym for the highest quality and reliability, extremely smooth running and high positioning accuracy and feed force combined with maximum power density and outstanding rigidity. Our linear systems offer innovative drive and assembly solutions.

User-friendly assembly solutions



References across all segments

7. Axis
Source: YASKAWA Nordic AB

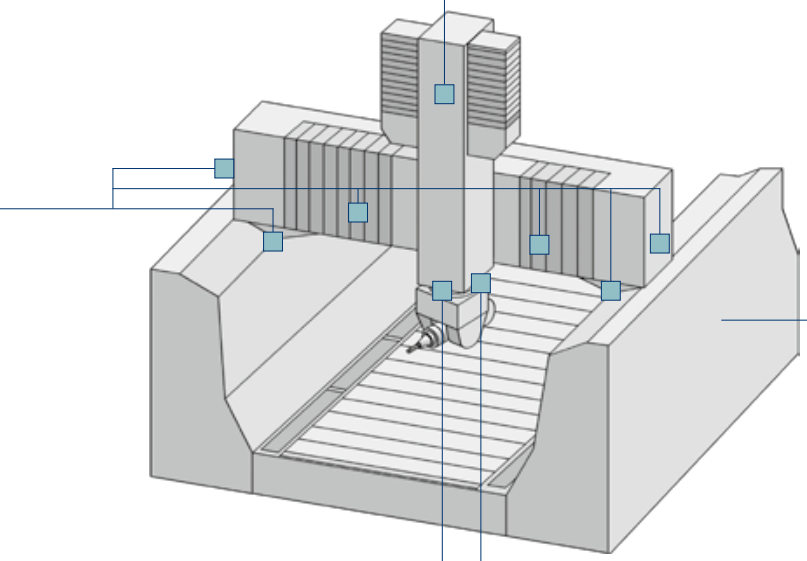
Pipe bending machine
Source: Wafios AG

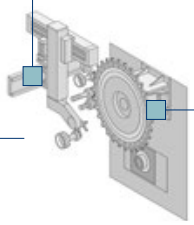
CNC machining centers for wood, plastic and composite materials
Source: MAKA Systems GmbH

Exemplary product solutions in a portal milling machine

Premium Linear System with RPM+

Value Linear System with NPR





premo® TP Line

Galaxie® drive system

Lubrication system
for all axes

Flatbed laser
Source: Yamazaki Mazak Corporation

Press transfer
Source: Strothmann Machines & Handling GmbH

HSC portal milling machine
Source: F. Zimmermann GmbH

Information

Glossary – the **alpha**bet

Ambient temperature

It describes the temperature of the air for the operation of servo actuators according to DIN EN 60204-1.

cymex®

cymex® is the calculation software developed by our company for dimensioning complete drive trains. The software enables the precise simulation of motion and load variables. The software is available for download from our website (www.wittenstein-cymex.de). We can also provide training to enable you to make full use of all the possibilities provided by the software.

DRIVE-CLiQ

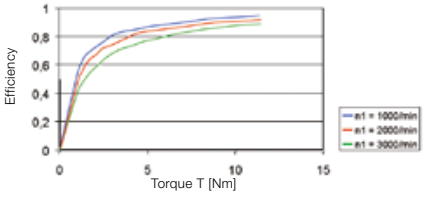
Protocol for transmitting absolute values and parameters, developed by Siemens.

Efficiency (η)

Efficiency [%] η is the ratio of output power to input power. Power lost through friction reduces efficiency to less than 1 or 100 %.

$\eta = P_{off} / P_{on} = (P_{on} - P_{loss}) / P_{on}$

Example efficiency curve for a planetary gearbox as a function of torque



WITTENSTEIN alpha always measures the efficiency of a gearbox / servo actuator during operation at full load. If the input power or torque are lower, the efficiency rating is also lower due to the constant no-load torque. Power losses do not increase as a result. A lower efficiency is also expected at high speeds (see illustration).

Encoder

The rotary encoder represents an important part of the servo system, which determines the current speed and position for control purposes. Different measuring methods are used here: Electromagnetic induction (resolver) or optical sensing of an encoder disc (absolute encoder).

EnDat

Protocol for transmitting absolute values and parameters, developed by Heidenhain.

HIPERFACE®

Protocol for transmitting absolute values and parameters, developed by Sick Stegmann.

Holding brake

The holding brake serves to lock an axis when stationary. In contrast to a service brake, it is not used to reduce the speed, except in emergency stop situations. The number of possible emergency stops can be calculated based on the speed and moved mass information.

Insulation class

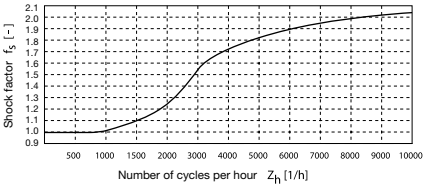
The motor insulation class defines the maximum operating temperatures of the insulation materials used. At Class F, this is 155 °C.

Jerk

Jerk is derived from acceleration and is defined as the change in acceleration within a unit of time. The term impact is used if the acceleration curve changes abruptly and the jerk is infinitely large.

Load factor (f_s)

The maximum permissible acceleration torque during cyclic operation specified in the catalog applies for a cycle rate of less than 1,000/h. Higher cycle rates combined with short acceleration times can cause vibrations in the drive train. Use the load factor f_s to include the resulting excess torque values in calculations. The load factor f_s can be determined with reference to the curve.



This calculated value is multiplied by the actual acceleration torque T_{2b} and then compared with the maximum permissible acceleration torque T_{2B}. ($T_{2b} \cdot f_s = T_{2b,\,fs} < T_{2B}$)

Mass inertia ratio (λ = Lambda)

The mass inertia ratio λ is the ratio of external inertia (application side) to internal inertia (motor and gearbox side). It is an important parameter determining the controllability of an application. Accurate control of dynamic processes becomes more difficult with differing mass moments of inertia and as λ becomes greater. Conversely, the energy consumption can be reduced through a higher lambda value.

A gearbox reduces the external mass moment of inertia by a factor of $1/i^2$.

$$\lambda = \frac{J_{external}}{J_{internal}}$$

$J_{external}$ reduced at input:

$J'_{external} = J_{external} / i^2$

The increased rigidity of the servo actuators permits higher lambda values compared to standard motor / gearbox combinations:

Simple applications ≤ 20

Dynamic applications ≤ 10

Highly dynamic applications ≤ 2

Mass moment of inertia (*J*)

The mass moment of inertia *J* [kgm^2] is a measure of the effort applied by an object to maintain its momentary condition (at rest or moving).

Max. acceleration current

Depending on the application, a distinction is made between a static and a dynamic acceleration current / acceleration torque. Please refer to the chapter Compendium on page 136 for more detailed information.

OEE

Acronym for the “Overall Equipment Effectiveness” value. After subtraction of the planned downtimes, it is a measure for the added value of a system and is calculated based on the factors of availability, performance and quality. The value is between 0 % and 100 %.

Operating voltage

The motor windings are available for various operating voltages. The operating voltage (intermediate circuit voltage) corresponds to the rectified peak value of the supply voltage from the grid.

Pin assignment

It defines the assignment of the individual pins in the mounting socket. The supply voltage for the motor and brake, the temperature signal and the motor encoder signals are applied via these pins.

Safety note

For applications with special safety requirements (e.g. vertical axes, clamped drives), we recommend exclusive use of our Premium and Advanced products (excluding V-Drive).

Servo actuator

In addition to a high-precision planetary gearbox, the servo actuator is fitted with a powerful, permanently energized synchronous servo motor with a distributed winding that guarantees a high power density and a constant speed. As a result, linear drives that are even more compact and powerful can be implemented. By using a smaller, more efficient actuator with lower inertia and higher rigidity, a smaller servo controller can also be used, thus saving upfront cost as well as operating costs in the form of lower energy consumption while achieving the same productivity. The solution here is a combination of a lower mass moment of inertia and a higher degree of rigidity.

SIL

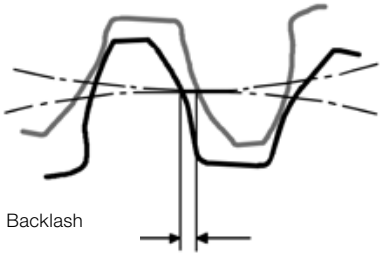
Stands for the safety integrity level from the area of functional safety and is referred to as safety level or safety integrity level in accordance with the IEC 61508 / IEC61511 standard. There are 4 levels. Up to level 2, the manufacturers can make the hazard assessments on their own authority, from level 3 upwards, this must be carried out by an independent, accredited body.

Tilting moment (M_{2K})

The tilting moment M_{2K} is a result of the axial and lateral forces applied and their respective points of application in relation to the inner radial bearing on the output side.

Torsional backlash (j_t)

Torsional backlash j_t [arcmin] is the maximum angle of torsion of the output shaft in relation to the input. Simply put, the torsional backlash represents the gap between two tooth flanks.



Torsional backlash is measured with the input shaft locked.

The output is then loaded with a defined test torque, to overcome the internal gearbox friction. The main factor affecting torsional backlash is the face clearance between the gear teeth. The low torsional backlash of WITTENSTEIN alpha gearboxes is due to their high manufacturing accuracy and the specific combination of gears.

Glossary – Formulary

Formulary

Torque [Nm]	$T = J \cdot \alpha$	J = Mass moment of inertia [kgm^2] α = Angular acceleration [1/s^2]
Torque [Nm]	$T = F \cdot l$	F = Force [N] l = Lever, length [m]
Acceleration force [N]	$F_b = m \cdot a$	m = Mass [kg] a = Linear acceleration [m/s^2]
Frictional force [N]	$F_{Reib} = m \cdot g \cdot \mu$	g = Acceleration due to gravity 9.81 m/s^2 μ = Coefficient of friction
Angular speed [1/s]	$\omega = 2 \cdot \pi \cdot n / 60$	n = Speed [rpm] π = PI = 3.14 ...
Linear speed [m/s]	$v = \omega \cdot r$	v = Linear speed [m/s] h = Radius [m]
Linear speed [m/s] (Ballscrew)	$v = \omega \cdot h / (2 \cdot \pi)$	h = Screw pitch [m]
Linear acceleration [m/s^2]	$a = v / t_b$	t_b = Acceleration time [s]
Angular acceleration [1/s^2]	$\alpha = \omega / t_b$	
Pinion path [mm]	$s = m_n \cdot z \cdot \pi / \cos \beta$	m_n = Normal module [mm] z = Number of teeth [–] β = Helix angle [°]

Conversion table

1 mm	= 0.039 in
1 Nm	= 8.85 in.lb
1 kgcm^2	= 8.85 x 10^{-4} in.lb.s^2
1 N	= 0.225 lb$_f$
1 kg	= 2.21 lb$_m$

Initials

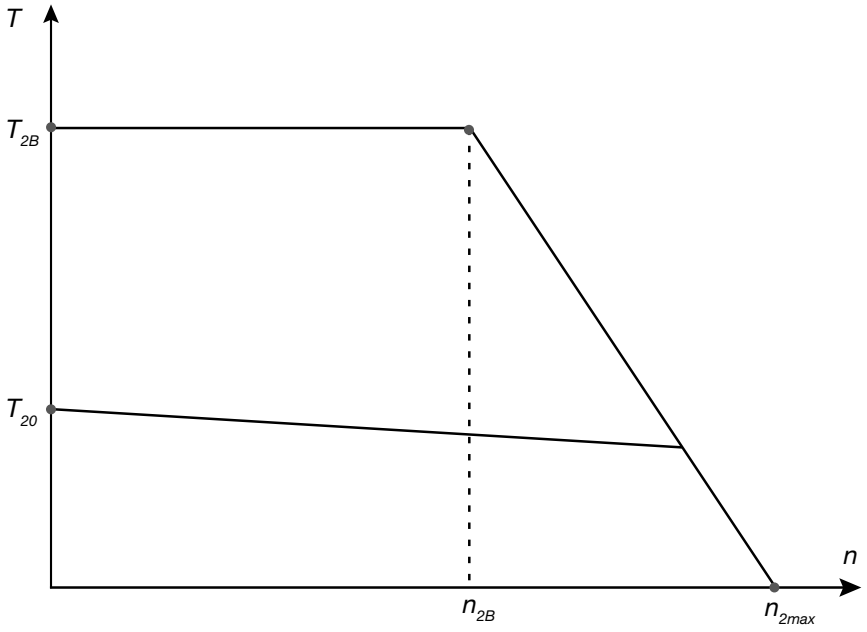
Initials	Unit	Name
a	m/s^2	Linear acceleration
C	Nm/arcmin	Rigidity
ED	%, min	Power-on time
F	N	Force
f_s	–	Load factor
f_e	–	Factor for duty cycle
h	m	Ballscrew pitch
i	–	Ratio
I	A_{eff}	Effective current
j_t	arcmin	Backlash
J	kgm^2	Mass moment of inertia
$K1$	Nm	Factor for bearing calculation
L	h	Service life
L_{PA}	dB(A)	Operating noise
l	m	(Lever) length
m	kg	Weight
m_n	mm	Normal module
M	Nm	Torque
n	rpm	Speed
p	–	Exponent for bearing calculation
P	W	Power
r	m	Radius
s	m	Dist.
t	s	Time
T	Nm	Torque
v	m/min	Linear speed
z	1/h	Number of cycles
α	rad/s^2	Angular acceleration
β	°	Helix angle
η	%	Efficiency
λ	-	Ratio of mass moment of inertia, coupling factor
μ	-	Coefficient of friction
ω	rad/s	Angular speed

Index

Index	Name
Capital letter	Permissible values
Small letter	Actual values
1	Drive
2	Output
A/a	axial
out	Output side
B/b	Acceleration
c	constant
d	Delay
dyn	Dynamic
e	Dwell
in	Input side
ext	External
h	Hour(s)
int	Internal
K/k	Tilting
L	Load. load side
m	Mean
Max./max.	maximum
M, Mot	Motor
N	Nominal
Not/not	Emergency stop
0	No load
opt	Optimized
Pr	Process side
Q/q	Lateral
Reib	Friction
stat	Stationary
t	Torsional
T	Tangential
Total	Total, overall
Loss	Loss

Project planning

Basic design instructions



General graph for a servo actuator characteristic curve

To fully utilize the servo actuators, please check the maximum permissible acceleration torques with regard to the following points:

Calculate the maximum acceleration torque required at the gearbox output:

$$T_{2dyn} = \alpha \cdot J_L$$

Identify additional process loads and calculate the total load torque at the gearbox output:

$$T_{2b} = T_{2dyn} + T_{2Pr}$$

Then calculate the total load torque required at the motor:

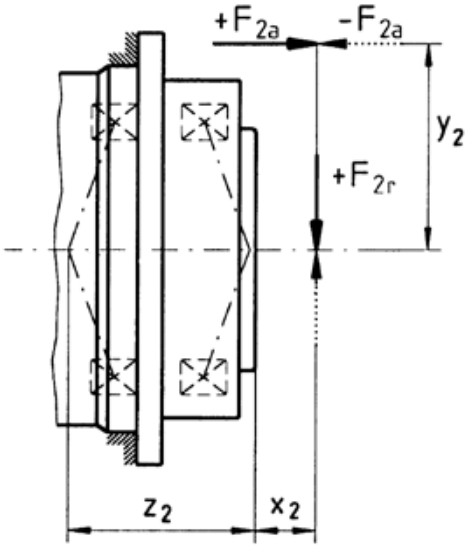
$$T_{1b} = (\alpha \cdot J_L + T_{2Pr}) \cdot \frac{1}{\eta \cdot i} + \alpha \cdot i \cdot J_1$$

To fully utilize the servo actuator during acceleration, the following conditions must be adhered to:

Condition for the total load torque at the gearbox output: $T_{2b} \leq T_{2B}$

Condition for the total load torque at the motor: $T_{1b} \leq T_{Mmax}$

When using a flange at the servo actuator output, the tilting torque produced from prevailing radial and axial forces must be determined and compared with the permissible value:



$$M_{2k} = \frac{F_{2a} \cdot y_2 + F_{2r} \cdot (x_2 + z_2)}{1000}$$

$M_{2k} \leq M_{2K\,max}$

Project planning

TPM+ DYNAMIC	004	010	025	050	110
Z_2 [mm]	57.6	82.7	94.5	81.2	106.8

TPM+ HIGH TORQUE		010	025	050	110
Z_2 [mm]		82.7	94.5	81.2	106.8

TPM+ POWER	004	010	025	050	110
Z_2 [mm]	57.6	82.7	94.5	81.2	106.8

premo® TP Line	1	2	3		
Z_2 [mm]	57.6	82.7	94.5		

If you require a more complex sizing, in particular the thermal characteristics of our drives, we recommend analyzing the drive train using our sizing software cymex®.

Project planning note on brakes

The holding brakes used in the servo actuators are subject to various factors, e.g. oxidation of abraded particles, flattening of friction surfaces due to frequent application of the brakes in the same position or air gap changes due to wear.

This may result in a reduction of available holding torques. The specified holding torques apply under optimal conditions without detrimental influences. Such influences can be countered by means of a regular brake refresh cycle. For detailed information on the recommended refresh cycles, please refer to our operating instructions.

For critical applications we recommend dimensioning for an adequately large holding torque to take account of these factors of uncertainty. Our internal technical service is available to help you with the appropriate dimensioning.

Depending on the ratio configured for the event of an emergency stop, the brakes used in the servo actuators can generate a dynamic braking torque at the output which exceeds the maximum permissible acceleration torque T_{2B}. In this case, the number of dynamic braking procedures must be limited to 1,000 over the entire service life of the servo actuator.

Compatibility of servo actuator and servo controller

The premo servo actuators and TPM+ actuator can be operated using many different servo controllers. The following table provides information to assist in selecting the correct options. Please observe the current consumption of the servo actuator during selection of the servo controller used.

		Encoder						Temperature sensor		Operating voltage		
Manufacturer	Version / Type	Resolver	EnDat 2.1	EnDat 2.2	HIPER-FACE®	HIPER-FACE DSL®	DRIVE-CLiQ	PTC	KTY	48 V DC	320 V DC	560 V DC
Bosch Rexroth	IndraDrive	x	x	–	x	–	–	x	x	–	x	x
Beckhoff	AX5000	x	x	x	x	x	–	x	x	–	x	x
B & R	AcoPos	x	x	x	x	–	–	x	x	–	x	x
Control Techniques	UniDrive M	x	x	x	x	–	–	x	–	–	x	x
Kollmorgen	Servostar 700	x	x	x	x	–	–	x	–	–	x	x
	AKD	x	x	x	x	–	–	x	–	–	x	x
Lenze	Global Drive 94xx	x	x	–	x	–	–	x	x	–	x	x
	TopLine 8400	x	–	–	x	–	–	x	x	–	–	–
	ECS Servosystem	x	–	–	x	–	–	x	–	–	–	–
Rockwell	Kinetix 5500	–	–	–	x	x	–	x	–	–	x	x
	Kinetix 5700	–	–	–	x	x	–	x	–	–	–	x
	Kinetix 6000	–	–	–	x	–	–	x	–	–	x	x
	Kinetix 6200	–	–	–	x	–	–	x	–	–	x	x
	Kinetix 6500	–	–	–	x	–	–	x	–	–	x	x
Siemens	Sinamics	x	x	x	–	–	x	–	x	–	–	x
Schneider electric	PacDrive MC-4	–	–	–	x	–	–	x	–	–	x	x
	PacDrive 3	–	–	–	x	–	–	x	–	–	x	x
WITTENSTEIN cyber motor	simco® drive	x	–	x	–	–	–	–	x	x	–	–

Influence of the coupling factor λ on the energy efficiency in the drive train

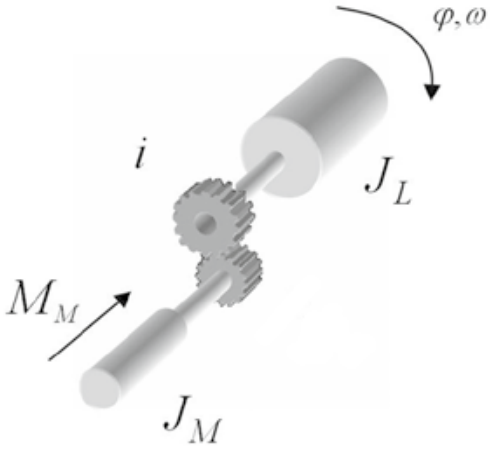
Considerations regarding the energy efficiency in drive trains have increasingly gained in significance during recent years. The fundamental relationships based upon which optimization of the influencing factors can take place are therefore listed below.

Simplified modeling of the common mechatronic drive trains in which gearboxes or servo actuators are installed, is based on the description of two different mass moments of inertia. One of these is the mass moment of inertia of the driving electric motor J_M. The mass moment of inertia attributable to the gearbox output of the application is also used.

The latter is the result of the corresponding conversion of the moving masses or external mass moments of inertia (levers, adjustment wheels, rotary tables etc.) to the coordinates of the axis of rotation at the gearbox or servo actuator output and is consequently referred to as the load moment of inertia J_L.

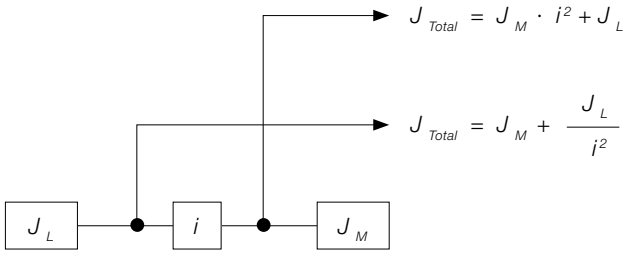
The conceptually assumed gearbox is described by the ratio i. The following variables from the diagram below are also relevant:

Physical variable	Designation
Motor torque	M_M
Drive torque	M_{ab}
Angle coordinate at output	φ
Angular speed at output	ω



The following examination of the energy efficiency now also includes the ratio between the external mass moment of inertia and the mass moment of inertia of the motor. For this purpose, the external mass moment of inertia and the mass moment of the motor must first be converted with respect to a reference coordinate. The figure below shows the possible approaches

In both cases, the transmission ratio i is squared in the conversion.



The coupling factor λ describes the ratio of the external mass moments of inertia to the mass moment of inertia of the drive. In this example, the reference coordinate is defined as the motor shaft. In accordance with the equation, the following applies to the coupling factor λ:

$$\lambda = \frac{J_{ext}}{J_{int}} = \frac{\frac{J_L}{i^2}}{J_M} \triangleright J_M = \frac{J_L}{i^2 \cdot \lambda}$$

Here, the square influence of the gearbox ratio again becomes clear, which shows that a wide-reaching influence can be taken on the coupling ratio in the drive train by means of this sizing variable. The following conversion and calculation of the total mass moment of inertia in the drive train results in the following equation:

$$J_{Total} = \frac{J_L}{i^2 \cdot \lambda} \cdot i^2 + J_L = J_L \cdot \left(\frac{1}{\lambda} + 1\right)$$

The distribution of the consumed power P during accelerations in the drive train is directly proportional to the distribution of the mass moments of inertia. This means that the share of the power consumed by the application can be described as the same function of the coupling factor.

$$P_{Total} = P_L \cdot \left(\frac{1}{\lambda} + 1\right)$$

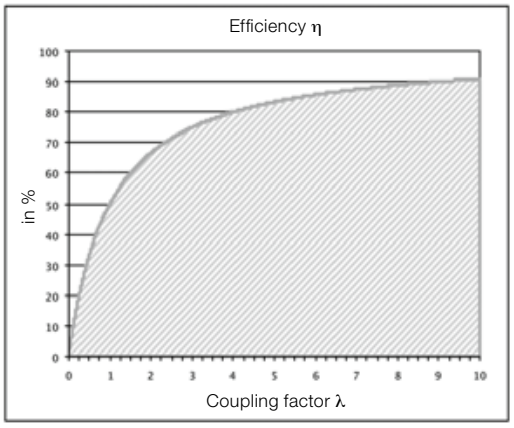
The efficiency, described as η as a parameter for efficiency is derived on the basis of the quotient from the total converted power and the actual power required for acceleration of the application.

$$\eta = \frac{P_L}{P_{Total}}$$

The following equation thus results for the efficiency dependent on the coupling factor:

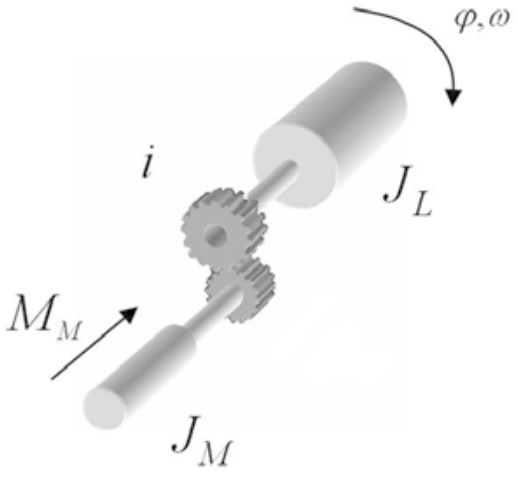
$$\eta = \frac{P_L}{P_L \left(1 + \frac{1}{\lambda}\right)} = \frac{\lambda}{\lambda + 1}$$

A graphic representation illustrates the resulting relationship and the relevant ranges in which the coupling factor has a significant influence on energy consumption in accelerated drive trains.



Influence of the ratio *i* on the dynamics in the drive train

In addition to examination of the energy efficiency, the requirements of short cycle times in conjunction with high acceleration capability are often a priority from a design point of view. Here again, the coupling factor has a major influence. By way of illustration, a simplified model of the drive train is shown here:



For the acceleration α as a function depending on the ratio *i* in the drive train, the following applies:

$$\alpha = \varphi'' = \frac{i \cdot M_M}{J_L + i^2 \cdot J_M}$$

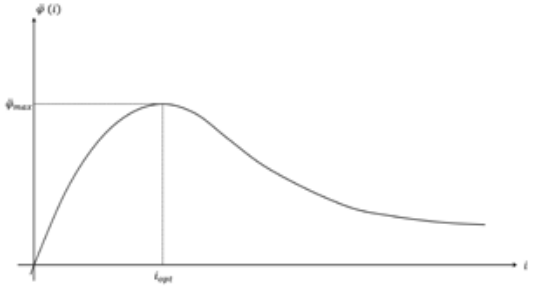
Once again, the coupling factor is defined as follows:

$$\lambda = \frac{J_L}{J_M \cdot i^2}$$

To obtain the optimal acceleration of the application, an optimal value is determined for the ratio by setting the first derivation to zero according to *i*:

$$\frac{d\alpha}{di} = 0 \Rightarrow i_{opt} = \sqrt{\frac{J_L}{J_M}}$$

For all the optimal ratios possible as solutions, it applies that the coupling factor must always be $\lambda = 1$, regardless of the mass moment of inertia of the load, to achieve the highest accelera-tion characteristics in the application. This local extremum in the acceleration function dependent on the ratio *i* is shown in the graph below.

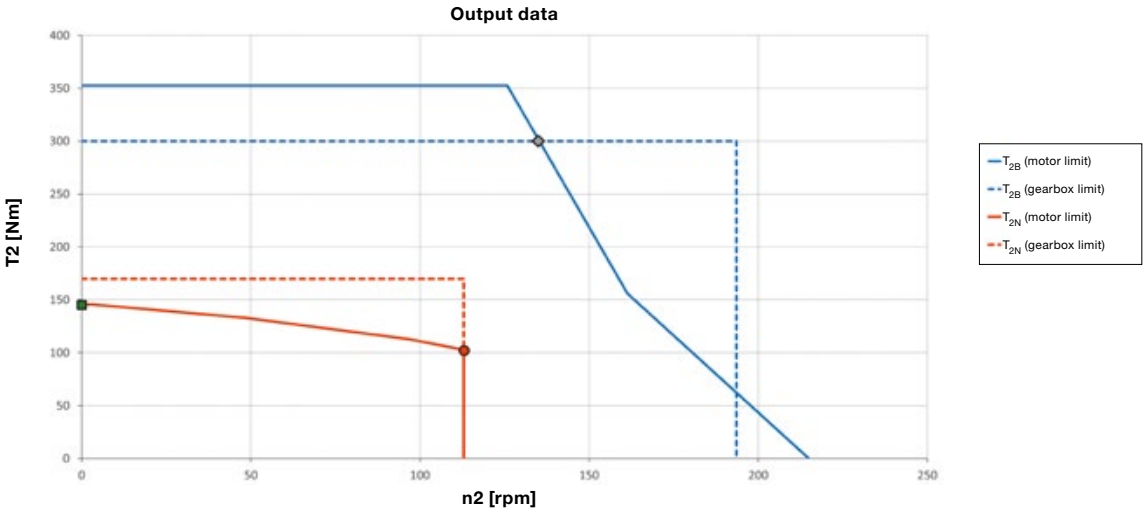


For this purpose the conflict of interests arising from the obser-vations on the energy efficiency and the dynamics in drive trains is again worthy of mention. It should be noted here that the approaches described resort to simplified models and that the requirements with regard to energy efficiency and dynamics must be assessed on a case-by-case basis during drive configuration. The simple and quick evaluation enabled by the cymex® sizing software allows for targeted op-timization of the drive train so that this conflict of objectives can beeffectively resolved

Evaluation of stationary and dynamic load cases for servo actuators

During basic configuration for the use of servo actuators, the indi-vidual components have different limits in virtually all cases, which can be limited to the maximum and continuous currents to be set in the servo controllers.

The figure below shows an example of available torques at the servo actuator output.



The dotted characteristic curves apply to the torque / speed limits of the gearbox used in the servo actuator. The solid characteristic curves show the maximum and permanent torques supplied by the motor in relation to the servo actuator output. Owing to the various motor and gearbox pairings, depending on the transmission ratio, the operating limits of both components cannot always be fully harmonized. This is not, however, restricted to the servo actuators, but also generally applies to the separately mounted gearboxes and servo motors offered by various manufacturers. The case described shows a relationship in which the maximum torque of the integrated servo motor is higher than the drive torque transmittable by the mechanical gearbox components. For this reason a distinction must be made in this case in relation to the relevant cycle as to whether the load on the drive train is more stationary or whether the application cycle is characterized by a high level of dynamics.

In the following case, when a maximum load occurs, which is short-term but stationary in character, the maximum current to be set in the servo controller must be selected such that overloading of the gearbox components is prevented. For this purpose, WITTENSTEIN alpha specifies a permissible maximum current for short-term stationary loads $I_{max,\ stat}$ in the relevant data sheets.

In the second case, in which the application cycle is characterized by a high level of dynamics and a coupling factor is present, the motor also requires a correspondingly high torque for its own acceleration. Consequently, in this case, a higher maximum current can be set in the servo controller parameterization so that no over-loading of the gearbox components occurs as a result.

For this case, WITTENSTEIN alpha specifies a permissible maximum dynamic current $I_{max,\ dyn}$, which is overload limited through the motor in its default configuration.

The distinction between the character of the application and the resulting differing limitations of the maximum current limits to be set in the servo controller also applies to the limitations during parametrization of the servo controller with regard to the permissible continuous currents.
For this purpose, a distinction is made between two current limits in the data sheets, i.e., I_0 and $I_{0,\,stat.}$.
For limitation of the acting continuous currents it must be examined which averaged torque portions tend to burden the motor owing to dynamic processes in the application and that the gearbox is not fully utilized in terms of its available nominal torque.

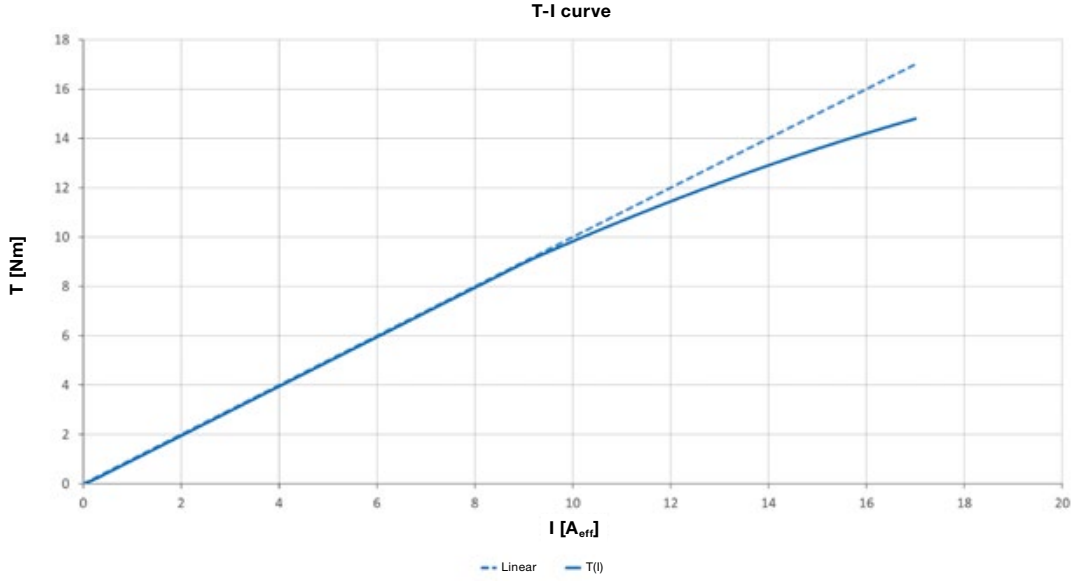
In this case, a higher permissible continuous current setting to the specified value of I_0 for the motor would be permissible. If, however the application has a stationary character with regard to the required permanent torque, the gearbox should transmit the available permanent torque of the motor. For this reason, additional limitation to the value I_0 may have to be performed during para-meterization of the servo controller.

For a targeted evaluation of the prevailing relationships in the application, use of the cymex® sizing software is recommended.

Consideration of saturation effects

Depending on their size and design, the motors from the applied product range display different saturation behaviors. As a result, the linear correlation between the acting motor current and the generated torque is lost above a certain current.

The graph below shows an example of the saturation characteristic of a synchronous servo motor and the effects that this has on the available torque.



Here, it becomes clear that, starting at a motor current of 14 A_{eff}, the saturation already leads to a 10 % deviation to the proportional torque / current characteristic. The torque constant usually taken as a variable K_T is therefore reduced by half within the usable current range through the saturation during the following curve, which must be taken into account when subsequently selecting the required servo controller.
We will be glad to help you with the configuration and selection of a servo actuator for your application.

Product portfolio & company

Basic Line gearbox overview

Product type		**CP**	**CPS**	**CPK**	**CPSK**	**CVH**	**CVS**
Version		MF	MF	MF	MF	MF / MT	MF / MT
Ratio [c]	min. *i* =	3	3	3	3	7	7
	max. *i* =	100	100	100	100	40	40
Max. torsional backlash [arcmin] [c]	Standard	≤ 12	≤ 12	≤ 13	≤ 15	≤ 15	≤ 15
	Reduced	–	–	–	–	–	–
Output type							
Smooth shaft		x	x	x	x	–	x
Shaft with key [d]		x	x	x	x	–	x
Splined shaft (DIN 5480)		–	–	–	–	–	–
Blind hollow shaft		–	–	–	–	–	–
Hollow shaft interface		–	–	–	–	x	–
Keyed hollow shaft		–	–	–	–	x	–
Flanged hollow shaft		–	–	–	–	–	–
Flange		–	–	–	–	–	–
System output		–	–	–	–	–	–
Output on both sides		–	–	–	–	x	x
Input type							
Motor-mounted		x	x	x	x	x	x
Self-contained version [b]		–	–	–	–	–	–
Characteristic							
Flange with slotted holes		–	–	–	–	–	–
ATEX [a]		–	–	–	–	–	–
Food-grade lubrication [a] [b]		x	x	x	x	x	x
Corrosion resistant [a] [b]		–	–	–	–	–	–
Optimized mass inertia [a]		–	–	–	–	–	–
System solutions							
Linear system (rack/pinion)		–	–	–	–	–	–
Servo actuator		–	–	–	–	–	–
Accessories (please refer to the product pages for further options)							
Coupling		x	x	x	x	–	x
Shrink disc		–	–	–	–	x	–
Mounting ring		–	–	–	–	–	–

[a] Power reduction: technical data available on request
[b] Please contact WITTENSTEIN alpha
[c] In relation to reference sizes
[d] Power reduction: Please use our sizing software cymex® for a detailed sizing – **www.wittenstein-cymex.com**

Value Line gearbox overview

Product type		NP	NPL	NPS	NPT	NPR	NPK	NPLK	NPSK	NPTK	NPRK	NVH	NVS	HDV
Version		MF / MA	MF / MA	MF / MA	MF / MA	MF / MA	MF	MF	MF	MF	MF	MF	MF	MF / MT
Ratio [c]	min. i =	3	3	3	3	3	3	3	3	3	3	4	4	4
	max. i =	100	100	100	100	100	100	100	100	100	100	400	400	400
Max. torsional backlash [arcmin] [c]	Standard	≤ 8	≤ 8	≤ 8	≤ 8	≤ 8	≤ 11	≤ 11	≤ 11	≤ 11	≤ 11	≤ 6	≤ 6	≤ 10
	Reduced	–	–	–	–	–	–	–	–	–	–	–	–	–
Output type														
Smooth shaft		x	x	x	–	x	x	x	x	–	x	–	x	x
Shaft with key [d]		x	x	x	–	x	x	x	x	–	x	–	x	x
Splined shaft (DIN 5480)		–	x	x	–	x	–	x	x	–	x	–	–	–
Blind hollow shaft		–	–	–	–	–	–	–	–	–	–	–	–	–
Hollow shaft interface		–	–	–	–	–	–	–	–	–	–	x	–	–
Keyed hollow shaft		–	–	–	–	–	–	–	–	–	–	x	–	–
Flanged hollow shaft		–	–	–	–	–	–	–	–	–	–	–	–	–
Flange		–	–	–	x	–	–	–	–	x	–	–	–	–
System output		–	–	–	–	–	–	–	–	–	–	–	–	–
Output on both sides		–	–	–	–	–	–	–	–	–	–	x	x	–
Input type														
Motor-mounted		x	x	x	x	x	x	x	x	x	x	x	x	x
Self-contained version [b]		–	–	–	–	–	–	–	–	–	–	–	–	–
Characteristic														
Flange with slotted holes		–	–	–	–	x	–	–	–	–	x	–	–	–
ATEX [a]		–	–	–	–	–	–	–	–	–	–	–	–	–
Food-grade lubrication [a] [b]		x	x	x	x	x	x	x	x	x	x	x	x	x
Corrosion resistant [a] [b]		–	–	–	–	–	–	–	–	–	–	x	x	x
Optimized mass inertia [a]		–	–	–	–	–	–	–	–	–	–	–	–	–
System solutions														
Linear system (rack/pinion)		x	x	x	–	x	x	x	x	–	x	–	x	–
Servo actuator		–	–	–	–	–	–	–	–	–	–	–	–	x
Accessories (please refer to the product pages for further options)														
Coupling		x	x	x	–	x	x	x	x	–	x	–	x	–
Shrink disc		–	–	–	–	–	–	–	–	–	–	x	–	–
Mounting ring		–	–	–	–	–	–	–	–	–	–	–	–	–

[a] Power reduction: technical data available on request
[b] Please contact WITTENSTEIN alpha
[c] In relation to reference sizes
[d] Power reduction: Please use our sizing software cymex® for a detailed sizing – **www.wittenstein-cymex.com**

Advanced Line gearbox overview

Product type		SP+	SP+ HIGH SPEED	SP+ HIGH SPEED friction optimized	TP+	TP+ HIGH TORQUE	HG+	SK+	SPK+
Version		MF	MC	MC-L	MF	MA	MF	MF	MF
Ratio [c]	min. *i* =	3	3	3	4	22	3	3	12
	max. *i* =	100	100	10	100	302.5	100	100	10000
Max. torsional backlash [arcmin] [c]	Standard	≤ 3	≤ 4	≤ 4	≤ 3	≤ 1	≤ 4	≤ 4	≤ 4
	Reduced	≤ 1	≤ 2	≤ 2	≤ 1	–	–	–	≤ 2
Output type									
Smooth shaft		x	x	x	–	–	–	x	x
Shaft with key [d]		x	x	x	–	–	–	x	x
Splined shaft (DIN 5480)		x	x	x	–	–	–	x	x
Blind hollow shaft		x	x	x	–	–	–	–	x
Hollow shaft interface		–	–	–	–	–	x	–	–
Keyed hollow shaft		–	–	–	–	–	–	–	–
Flanged hollow shaft		–	–	–	–	–	–	–	–
Flange		–	–	–	x	x	–	–	–
System output		–	–	–	x	x	–	–	–
Output on both sides		–	–	–	–	–	x	x	x
Input type									
Motor-mounted		x	x	x	x	x	x	x	x
Self-contained version [b]		x	–	–	x	–	–	–	–
Characteristic									
Flange with slotted holes		x	–	–	–	–	–	–	–
ATEX [a]		x	x	–	–	–	x	x	–
Food-grade lubrication [a] [b]		x	x	x	x	x	x	x	x
Corrosion resistant [a] [b]		x	x	x	x	x	x	x	x
Optimized mass inertia [a]		x	x	x	x	x	–	–	–
System solutions									
Linear system (rack/pinion)		x	x	–	x	x	–	x	x
Servo actuator		x	–	–	x	x	–	–	–
Accessories (please refer to the product pages for further options)									
Coupling		x	x	x	x	x	–	x	x
Shrink disc		x	x	x	–	–	x	–	x
Mounting ring		–	–	–	x	x	–	–	–

[a] Power reduction: technical data available on request
[b] Please contact WITTENSTEIN alpha
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[d] Power reduction: Please use our sizing software cymex® for a detailed sizing – **www.wittenstein-cymex.com**

TK+	TPK+	TPK+ HIGH TORQUE	SC+	SPC+	TPC+	VH+	VS+	VT+	DP+	HDP+
MF	MF	MA	MF	MF	MF	MF	MF	MF	MF / MA	MA
3	12	66	1	4	4	4	4	4	16	22
100	10000	5500	2	20	20	400	400	400	55	55
≤ 4	≤ 4	≤ 1.3	≤ 4	≤ 4	≤ 4	≤ 3	≤ 3	≤ 3	≤ 3	≤ 1
–	≤ 2	–	–	≤ 2	≤ 2	≤ 2	≤ 2	≤ 2	≤ 1	–
–	–	–	x	x	–	–	x	–	–	–
–	–	–	x	x	–	–	x	–	–	–
–	–	–	–	x	–	–	x	–	–	–
–	–	–	–	x	–	–	–	–	–	–
–	–	–	–	–	–	x	–	–	–	–
–	–	–	–	–	–	x	–	–	–	–
x	–	–	–	–	–	–	–	x	–	–
–	x	x	–	–	x	–	–	–	x	x
–	x	x	–	–	x	–	–	–	–	–
x	x	x	–	–	–	x	x	–	–	–
x	x	x	x	x	x	x	x	x	x	x
–	–	–	–	–	–	–	–	–	–	–
–	–	–	–	–	–	–	–	–	–	–
x	–	–	–	–	–	–	–	–	–	–
x	x	x	x	x	x	x	x	x	x	x
x	x	x	–	–	–	x	x	x	x	x
–	–	–	–	–	–	–	–	–	x	x
x	x	x	x	x	x	–	x	x	–	–
–	–	–	–	–	–	–	–	–	–	–
x	x	x	x	x	x	–	x	x	–	–
–	–	–	–	x	–	x	–	–	–	–
–	–	–	–	–	–	–	–	–	x	–

Premium Line gearbox overview

Product type		XP+	RP+	XPK+	RPK+	XPC+	RPC+
Version		MF / MC	MF / MA	MF	MA	MF	MA
Ratio [c]	min. *i* =	3	22	12	48	4	22
	max. *i* =	100	220	1000	5500	20	55
Max. torsional backlash [arcmin] [c]	Standard	≤ 3	≤ 1	≤ 4	≤ 1.3	≤ 4	≤ 1.3
	Reduced	≤ 1	–	≤ 2	–	≤ 2	–
Output type							
Smooth shaft		x	–	x	–	x	–
Shaft with key [d]		x	–	x	–	x	–
Splined shaft (DIN 5480)		x	–	x	–	x	–
Blind hollow shaft		x	–	x	–	x	–
Hollow shaft interface		–	–	–	–	–	–
Keyed hollow shaft		–	–	–	–	–	–
Flanged hollow shaft		–	–	–	–	–	–
Flange		–	x	–	x	–	x
System output		x	x	x	x	x	x
Output on both sides		–	–	–	–	–	–
Input type							
Motor-mounted		x	x	x	x	x	x
Self-contained version [b]		x	–	–	–	–	–
Characteristic							
Flange with slotted holes		x	x	x	x	x	x
ATEX [a]		–	–	–	–	–	–
Food-grade lubrication [a] [b]		x	x	x	x	x	x
Corrosion resistant [a] [b]		–	–	–	–	–	–
Optimized mass inertia [a]		x	x	–	–	–	–
System solutions							
Linear system (rack / pinion)		x	x	x	x	x	x
Servo actuator		x	x	–	–	–	–
Accessories (please refer to the product pages for further options)							
Coupling		x	–	x	–	x	–
Shrink disc		x	–	x	–	x	–
Mounting ring		–	–	–	–	–	–

[a] Power reduction: technical data available on request
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[d] Power reduction: Please use our sizing software cymex® for a detailed sizing – **www.wittenstein-cymex.com**

Servo actuator overview

Product type		PBG	PAG	PHG	RPM+	TPM+ DYNAMIC	TPM+ HIGH TORQUE	TPM+ POWER
Version		Standard	Standard	Standard	Customer specific	Standard	Standard	Standard
Catalog page		28	36	44	148	62	74	84
Ratio [c]	min. i =	16	16	16	22	16	22	4
	max. i =	100	100	100	220	91	220	100
Max. torsional backlash [c] [arcmin]	Standard	≤ 6	≤ 3	≤ 3	≤ 1	≤ 3	≤ 1	≤ 3
	Reduced	≤ 3	≤ 1	≤ 1	–	≤ 1	≤ 1	≤ 1
Output shape								
Smooth shaft		x	–	x	–	–	–	–
Shaft with key [d]		x	–	x	–	–	–	–
Splined shaft (DIN 5480)		x	–	x	–	–	–	–
Blind hollow shaft		–	–	–	–	–	–	–
Hollow shaft interface		–	–	–	–	–	–	–
Keyed hollow shaft		–	–	–	–	–	–	–
Flanged hollow shaft		–	–	–	–	–	–	–
Flange		–	x	–	x	x	x	x
System output		–	x	x	x	x	x	x
Output on both sides		–	–	–	–	–	–	–
Input type								
Motor-mounted		–	–	–	–	–	–	–
Self-contained version		–	–	–	–	–	–	–
Characteristic								
Flange with slotted holes		x	–	x	x	–	–	–
ATEX [a]		–	–	–	–	–	–	–
Food-grade lubrication [a] [b]		x	x	x	x	x	x	x
Corrosion resistant [a] [b]		–	–	–	–	x	x	x
Optimized mass Inertia [a]		–	–	–	–	–	–	–
System solutions								
Linear system (rack / pinion)		x	x	x	x	x	x	x
Accessories (please refer to the product pages for further options)								
Coupling		x	x	x	–	x	x	x
Shrink disc		x	–	–	–	–	–	–
Power cable, signal cable, hyprid cable		x	x	x	x	x	x	x

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[c] In relation to reference sizes
[d] Power reduction: Please use our sizing software cymex® for a detailed sizing – **www.wittenstein-cymex.com**

Customized solutions

SPM+/TPM+ endurance

Motor + housing + gearbox = optimal combination for your application

The SPM+ and TPM+ endurance system ranges demonstrate the level of customization and optimization that is possible in drive technology today: A number of gearboxes can be inte-grated to suit the various motors. Therefore the highly compact WITTENSTEIN alpha format opens up completely new degrees of design freedom for customers.

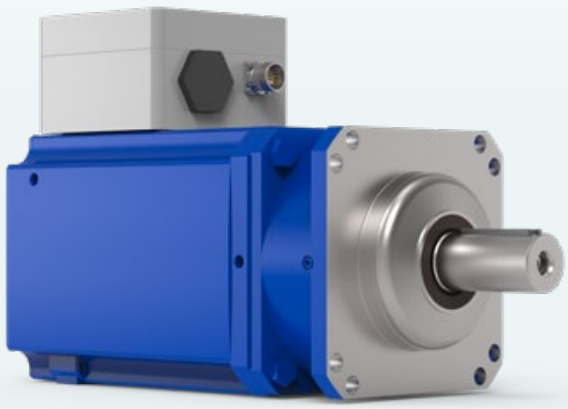
All in all, an optimum symbiosis of different disciplines is created. Or as we would say: mechatronics as it should be today – for the full benefit of the customer.

Maximum efficiency High power density. Extremely short cycle times.

Utilizing the innovative stainless steel cooling technology of the SPM+/TPM+ endurance servo actuators, the motor surface only reaches a temperature of approx. 50 °C, even during continuous operation.

- Increasing energy efficiency
- Increased productivity
- Greater availability

Particularly during use in open cooling circuits, the stainless steel cooling system ensures a durable and low-maintenance drive solution.



Stainless steel cooling system

One-piece cast housing technology

Increasing the service life of the shaft seals through targeted heat dissipation

No risk of confusion at the water cooling feed

Can be used with water or convection cooling

A significantly increased benefit can be achieved with the technological substitution of asynchronous and hydro motors: The highly compact design opens up **numerous degrees of freedom in design.** And through the **significantly increased performance and productivity enhancements, the machine footprint is reduced considerably,** so that the **energy saving potential is significantly greater.**

Customized solutions

Premium Linear System

with RPM+ servo actuator

More dynamic. More compact. More precise.

The RPM+ servo actuator is particularly dynamic, extremely compact and perfectly adapted for rack and pinion applications. In the RPM+, maximum power density – through the special design of the integrated motor – and functional design are combined in one unit. This offers effective dimensional benefits for an even more compact design!

4 x 1 = one

Motor, gearbox, rack and pinion from a single source

The servo actuator guarantees outstanding performance – thanks to its special design, it ensures maximum power density.

- If your drive requires maximum power.

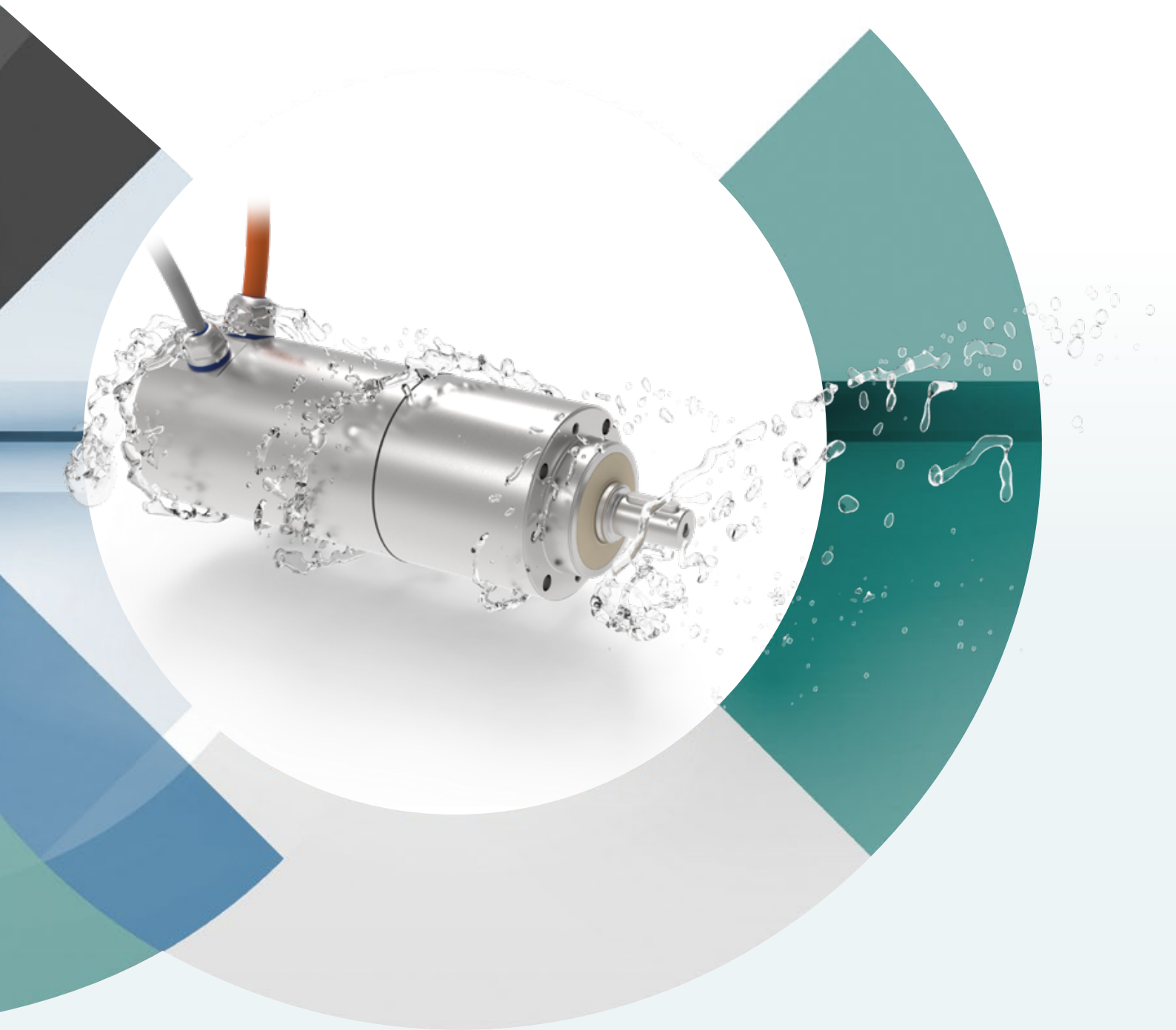
- If the system needs to be even more compact.

- If precision is required in your application.

- If you value superior consulting.

Customized solutions

axenia value



More resistant. More compact. More compatible.

The compact axenia value servo actuator was specially developed and produced for challenging applications. It is manufactured with highly resistant stainless steel and therefore offers long-term resistance to numerous corrosive substances, such as cleaning agents and disinfectants Furthermore, it provides a highly precise and dynamic connection between motor and gearbox.

Your technical benefits

- Hygienic design: Cavity-free design
- Long service life due to the use of CIP-compatible materials
- Integrated, optimized servo actuator sealing concept
- Resistant against aggressive cleaning agents and disinfectants
- Food-grade lubrication
- Powerful motor performance
- Low gearbox torsional backlash

Your benefits

- Simple and hygienic cleaning
- Smaller machines possible
- No complicated encapsulation
- Fewer wearing parts in the machine
- Low drive failure probability
- Low maintenance and repair costs

At a glance

- Three sizes
- Max. acceleration torque up to 200 Nm
- Ratios: 16 to 100
- Large selection of encoder systems
- With or without brake
- Protection class IP 69K (at 30 bar)

Galaxie®
drive system

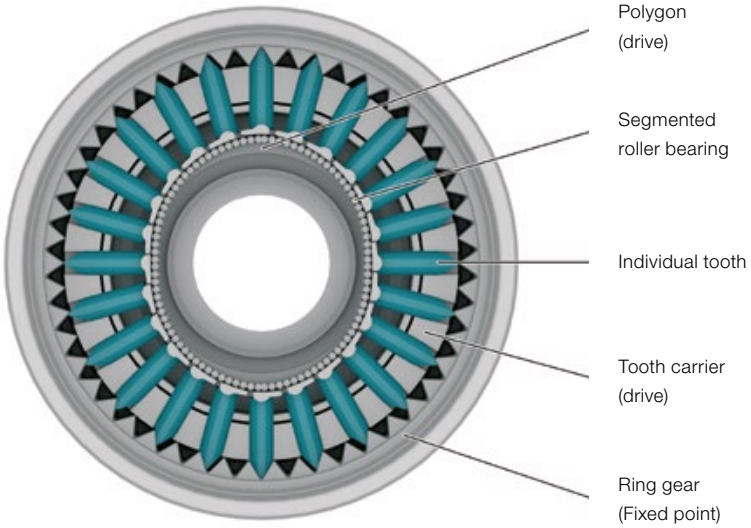
A new dimension in performance

This award-winning innovation by Wittenstein surpasses all previous drives in terms of torsional backlash, torque density, rigidity and compactness. The innovative core of the Galaxie® drive is the nearly full surface contact during power transmission, which produces a defined torque density as well as exceptional torsional rigidity and zero backlash – even at the zero crossing.

HERMES AWARD 2015

INNOVATIONSPREIS DER DEUTSCHEN WIRTSCHAFT
ERSTER INNOVATIONSPREIS DER WELT®

Schematic diagram



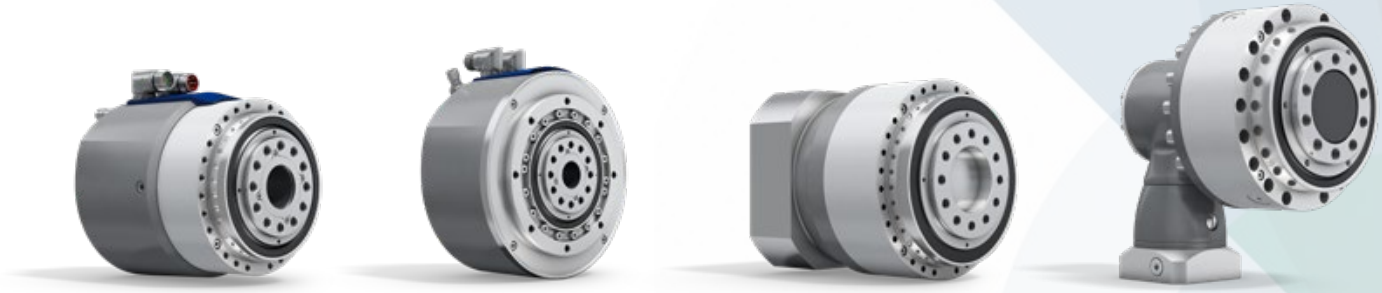
Product highlights

- High torsional rigidity
- No backlash – even at the zero crossing
- Hydrodynamic surface contact
- Maximum torque density
- High robustness
- Hollow shaft

Options

- Integrated holding brake
- Different feedback systems
- Additional encoder system at the input

An ingenious concept in four variants and five sizes



Galaxie® D

Hollow-shaft compact drive, axially integrated permanently energized synchronous motor with standard sensor systems.

Galaxie® DF

Ultra-flat hollow-shaft compact drive, radially integrated permanently energized synchronous motor with standard sensor systems.

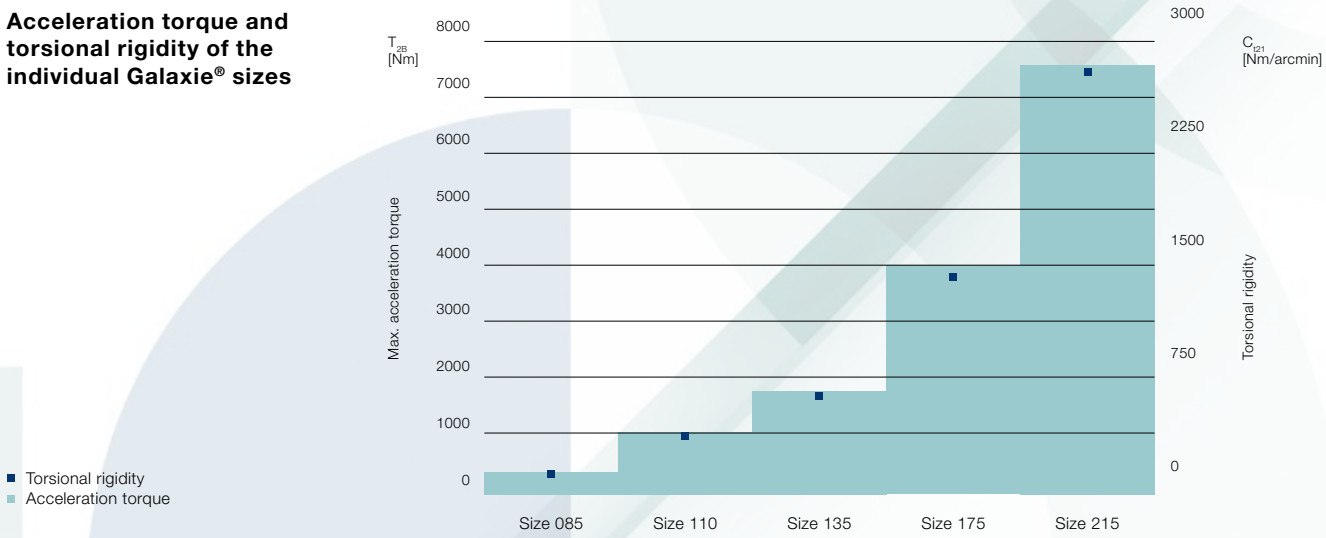
Galaxie® G

Backlash-free gearbox with optional coaxial planetary input stage and adapter plate for mounting on standard industrial servo motors.

Galaxie® GH

Galaxie® Right-angle gear-boxes with hypoid input stage and adapter plate for mounting on standard industrial servo motors.

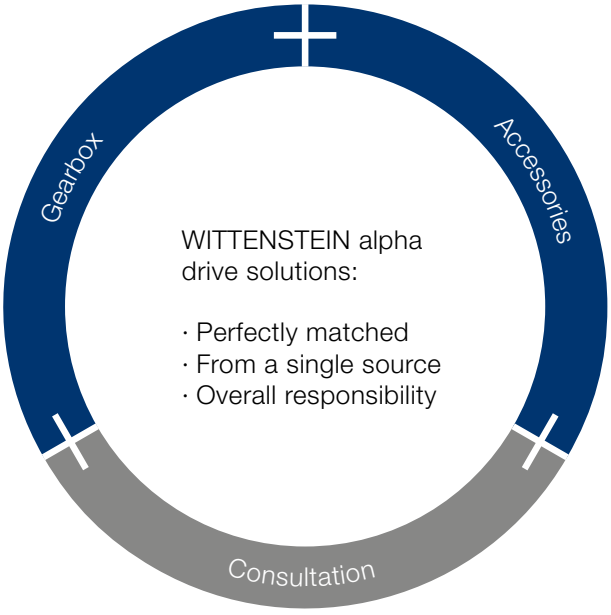
Acceleration torque and torsional rigidity of the individual Galaxie® sizes



Accessories – smart additions for intelligent performance

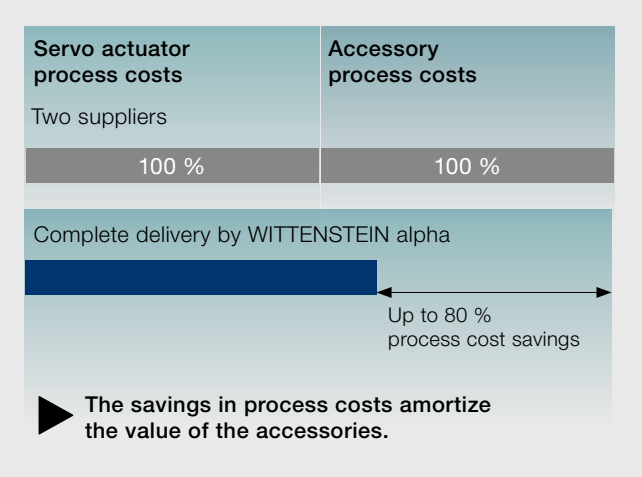
In addition to gearboxes, servo actuators, and linear systems, we offer our customers an extensive portfolio of matching accessories.
The alpha Premium Line and alpha Advanced Line servo actuators can be further optimized by using metal bellows couplings. Perfectly matched with the servo actuator, they meet the expectations of customers.

Servo actuator, accessories and consulting from a single source



Optimization of your added value chain

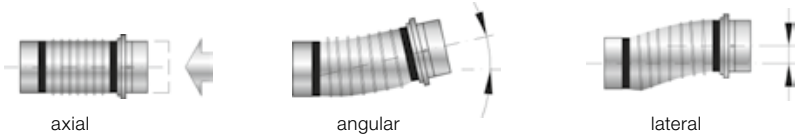
Use the combination of servo actuator and accessories in a complete package to streamline your internal processes.



Couplings

Our innovative couplings, which are used in various drive technology sectors, ensure efficiency and process reliability in the applications.

Our couplings have the following properties:
· Completely backlash-free torque transmission
· Maintenance free
· Durable
· Compensation of shaft misalignments (axial, angular, lateral)



axial angular lateral

Metal bellows coupling

· High torsional rigidity
· Minimal reset forces
· High true-running accuracy
· Corrosion resistant version available as an option (BC2, BC3, BCT)
· Large temperature range −30 °C to +300 °C
· Preferred coupling for alpha Advanced Line and alpha Premium Line

alpha Premium

alpha Advanced

Elastomer coupling

· Choice of torsional rigid/damping
· Compact, plug-in design
· Extremely easy assembly
· Temperature range −30 °C to +120 °C
· Preferred coupling for alpha Basic Line and alpha Value Line

alpha Value

alpha Basic

Torque limiter

· Torque infinitely adjustable
· Easy to assemble
· Precise repeatability
· Precise, preset overload protection (switch-off in 1–3 ms)

Suitable for all alpha gearbox series

Preferred coupling series

The technical dimensional sheets for the gearboxes include a preselection of couplings. These are based on the maximum transmittable torque of the gearbox. Standard industrial conditions for the number of cycles (1000/h) and ambient temperature were adopted.

Please note that the coupling load is based on the torque the gearbox can transmit and not the torque in your application. For a detailed sizing we recommend using our cymex® 5 design software.

You can find detailed information about our couplings at
www.wittenstein-alpha.com

Support at each interaction stage

With the WITTENSTEIN alpha service concept, we are also setting new standards in the field of customer support.

DESIGN

We offer the right sizing methodology for every requirement. Whether easy downloading of CAD data, quick and easy calculation, or precise sizing of the drive train.

STARTUP

Our service experts are happy to support you in the installation and startup of complex mechatronic systems, guaranteeing maximum availability of your plant.

SERVICING

WITTENSTEIN alpha guarantees fast repairs of the highest quality and precision.
In addition, we will provide you with information about various measurements, material analyses, and condition monitoring inspections.

Consultation

· Personal contact on site
· Professional application calculations and drive design

Engineering

Catalog gearboxes:

· Advanced software tools for accurate calculation, simulation, and analysis of the drive train
· Optimization of your productivity

Special gearboxes:

· Development and production of special gearboxes
· Toothing design and development
· Send all enquiries to: **sondergetriebe@wittenstein.de**

CAD POINT
YOUR SMART CATALOG

SIZING ASSISTANT **
YOUR GEARBOX WITHIN SECONDS

cymex® 5
CALCULATE ON THE BEST

See pages 18 –19 for more information about cymex® 5

Delivery of speedline®**

Tel. +49 7931 493-10444

· Delivery of standard series in 24 or 48 hours ex works*
· Fast deliveries at short notice

Operating and installation instructions

· Detailed description of how to use the product
· Installation and motor mounting videos

Installation on site**

· Professional installation
· Optimal application integration
· Introduction to the operation of the drive

Pick-up & return service

· Minimization of downtimes
· Professional logistics organization
· Reduction of transport risks

* Non-binding delivery time depending on part availability

24 h service hotline

Tel. +49 7931 493-14900

Maintenance and inspection

· Documentation regarding condition and expected service life
· Customer-specific maintenance schedules

cymex® statistics

· Systematic field data entry
· Reliability calculations (MTBF)

Repairs

· Restoring to nominal condition
· Immediate response in time-critical situations

Modernization

· Professional retrofitting
· Reliable compatibility testing of existing solutions

** Not available for servo actuators

The WITTENSTEIN group – The company and its fields of business

With approximately 2,900 employees worldwide, WITTENSTEIN SE stands for innovation, precision and excellence in the world of mechatronic drive technology, both nationally and internationally. The group is active in seven innovative fields of business. Furthermore, WITTENSTEIN SE is represented by some 60 subsidiaries in around 40 countries in all important technology and sales markets worldwide.

Our fields of expertise

We provide know-how for a host of different sectors:

- Machine and plant construction
- Software development
- Aerospace
- Automotive & E-mobility
- Energy
- Oil & Gas Exploration and Production
- Medical technology
- Measurement and testing technology
- Nanotechnology
- Simulation

The WITTENSTEIN Group

WITTENSTEIN | alpha

WITTENSTEIN alpha GmbH
High-precision servo drives and linear systems

WITTENSTEIN | cyber motor

WITTENSTEIN cyber motor GmbH
Highly dynamic servo motors and drive electronics

WITTENSTEIN | galaxie

WITTENSTEIN galaxie GmbH
Superior gearboxes and drive systems

WITTENSTEIN | motion control

WITTENSTEIN motion control GmbH
Customized linear and rotary servo systems

WITTENSTEIN | aerospace & simulation

WITTENSTEIN aerospace & simulation GmbH
Mechatronic drive systems for aerospace & simulation

attocube
WITTENSTEIN Group

attocube systems AG
Nanoprecision drive and measurement technology solutions

baramundi

baramundi software AG
Secure management of IT infrastructure in offices and production areas

WITTENSTEIN – one with the future

www.wittenstein.de

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WITTENSTEIN alpha – Intelligent drive systems

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alpha Advanced Line. Maximum power density and outstanding positioning accuracy for complex applications.

alpha Basic Line & alpha Value Line. Reliable, flexible and economical solutions for a wide range of applications.

alpha Linear Systems. Precise, dynamic system solutions for every requirement.

alpha Mechatronic Systems. Energy-efficient, versatile and flexible mechatronic drive systems.