BAUMÜLLER

be in motion be in motion be in motion

LSE – LSM – LSC

Linear Motors

90 100 13,750 14,000 14,250 14,500 14,750

Baumüller linear motors were designed as direct drives with synchronous motors. Customized motor concepts can be created using a modular system, meaning that Baumüller linear motors can achieve maximum thrust forces of up to 14,750 N

Baumüller DirectMotion GmbH – Force, dynamic response and precision that'll inspire you!

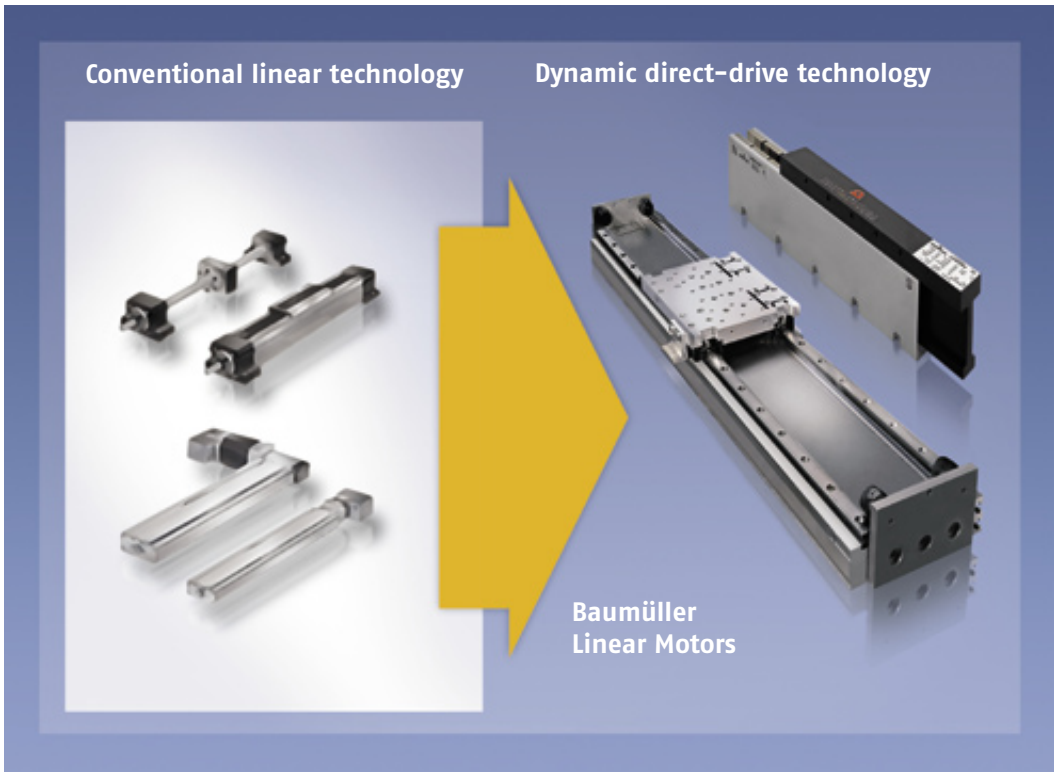
Our service

Thanks to beneficial innovations and optimum quality in the area of direct-drive technology, we have become a preferred business partner of the machine manufacturing industry. Based upon long-term cooperation with our business partners, we work together with them to find the best possible solutions based on our modular systems. We're familiar with the challenges our customers face and provide you with customized solutions.

Baumüller is a pioneer in the field of direct-drive technology and has many years of experience in researching, developing and producing linear motor technology. The direct drive components by Baumüller facilitate maximum integration of the drive technology into the plant and machine components.

The time to switch to direct-drive technology has come

Lower maintenance costs, higher speeds and resulting greater productivity are just a few reasons to make the change. Additional reasons include the greater flexibility with format and product changes and maximum repetition and precision with unbeatable dynamic response. Linear direct-drive technology offers enormous potential for increasing performance.



15,000

The advantages of linear direct-drive technology at a glance

Property	Product advantage	Advantage to the customer
◎ Zero backlash	◎ Very high standard stiffness ◎ Very high precision	◎ Improved product quality ◎ Less waste ◎ Greater profitability
◎ Dynamic response	◎ Shorter cycle times	◎ Increased productivity
◎ Direct load connection	◎ Less wear, as there is no coupling	◎ Maintenance-free ◎ Greater machine availability
◎ Compact packaging size	◎ High degree of integration into the machine	◎ Less space required for the drive technology
◎ Simple design	◎ Fewer components	◎ Less maintenance required ◎ Less machine downtime
◎ High variability	◎ Multiple forcers possible on a single axis	◎ Offset-compensation possible ◎ Increased productivity ◎ New production possibilities

The technology of linear motors

In simplified terms, the basic design of a synchronous linear motor can be imagined as a rotary synchronous motor that has been cut open along the longitudinal axis and unwound flat.

Here, the coil of the linear motor corresponds to the stator of a rotary motor and is comprised of an iron core and three-phase winding. The magnet way with the steel carrier and affixed permanent magnets can be seen as being equivalent to the rotor.

Design and functional principle

With a synchronous linear motor, force is generated in a way that corresponds to the torque generation of a rotary synchronous motor.

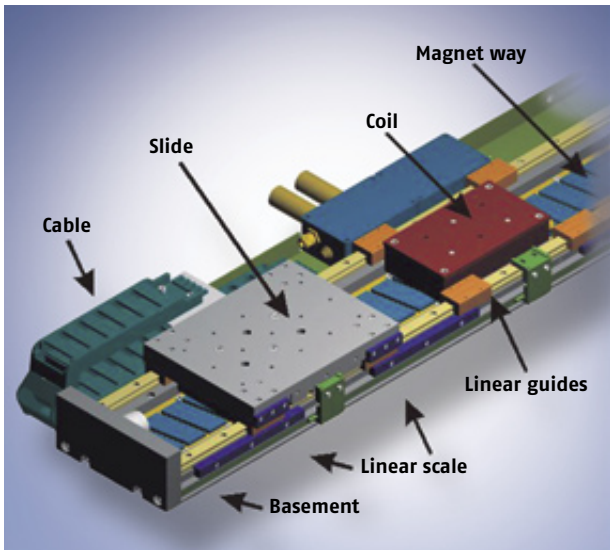
There are two versions, depending on the application:
The coil moves, while the secondary is fixed in place (moving coil). This is the predominant arrangement part used.

The primary part is fixed in place, and the magnet way moves (moving magnet). This is often used in vertical applications where the mass of the primary, but not it's own weight, has to be moved against the force of gravity.

Components and complete axes

Baumüller synchronous linear motors are Component motors available as iron-core and iron-less versions.

The primary part and secondary part motor components are supplied as individual components and allow the user to design the linear motor in the machine or system. The linear motor is then an integral component of the machine.



A complete linear axis consists of the following components:

- Coil
- Magnet way
- Linear guides
- Linear scale
- Cable chain
- Slide
- Basement

LSE10 – The customized solution

The LSE 10 motor series is characterized by its high continuous forces and an extremely compact design. Thanks to theses features, it is ideal for use in applications in extremely confined spaces. LSE 10 linear motors are also available with water cooling for applications with maximum continuous load requirements, alternating loads or high processing forces.

The three-phase synchronous motors are comprised of a coil with a wound, fully encapsulated lamination stack and a magnet way.

By arranging the magnet way one next to another, traverse paths of any length can be implemented.

Advantages

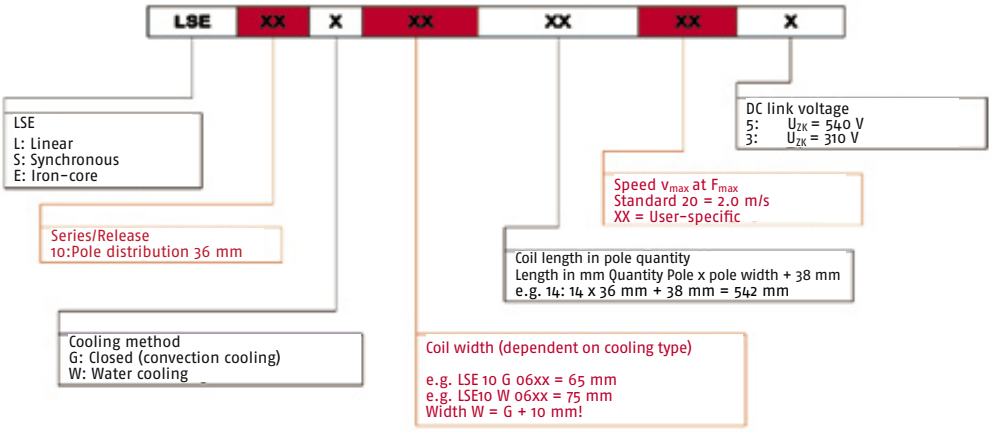
- Modular system
- Minimum latching forces thanks to oblique magnets
- High speed and acceleration
- High thrust force
- Multiple coils possible on a single magnet way
- Optional stainless-steel cover of the magnet way
- Arrangement of the secondaries next to one another possible
- Degree of protection to IP65 for all motor components Insulation class F

Customer benefit

- Cost optimized solution
- High product quality
- Increased productivity
- High flexibility
- Makes use possible in a wide variety of ambient conditions
- Stroke of any length possible

The winding is designed for a DC link voltage of 540 V as standard, but can be modified for single-phase connection or a DC link voltage of 310 V.

Order code LSE10 – Ordering information – Coil



Note:

Standard cable version: 1.5 meter cable, flying leads. Any other lengths and versions must be specified in plain language when ordering.

Order example:

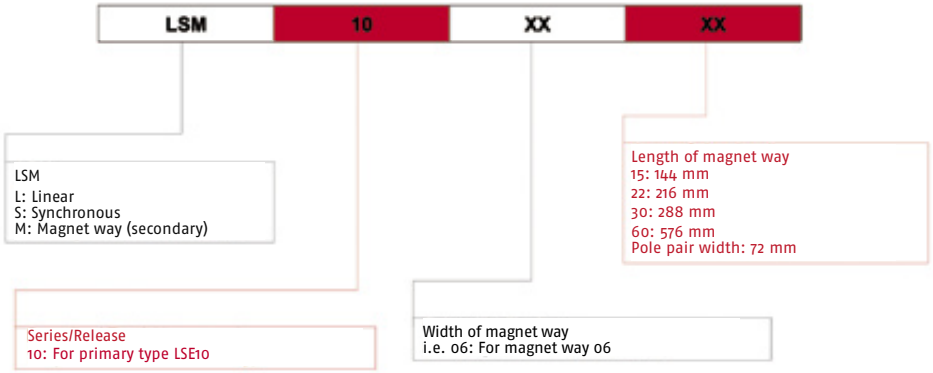
LSE10W 0814-40-5

Iron-core linear synchronous coil of series 10, convection-cooled, 65 mm wide, 542 mm long, v_{max} at F_{max} is 4.0 m/s, DC link voltage is 540 V.

LSE10W 0814-20-5

Iron-core linear synchronous coil of series 10, water-cooled, 75 mm wide, 542 mm long, v_{max} at F_{max} is 2.0 m/s, DC link voltage is 540 V.

Order code LSM10 – Ordering information – Magnet way



Note:

The individual secondaries can be arranged next to one another for longer paths. The individual lengths are multiples of the pole pair width.

Order examples:

LSM10 0615

Linear synchronous magnet way of series 10, 60 mm width, 144 mm length (two pole pairs).

LSM10 1630

Linear synchronous magnet way of series 10, 160 mm width, 288 mm length (four pole pairs).

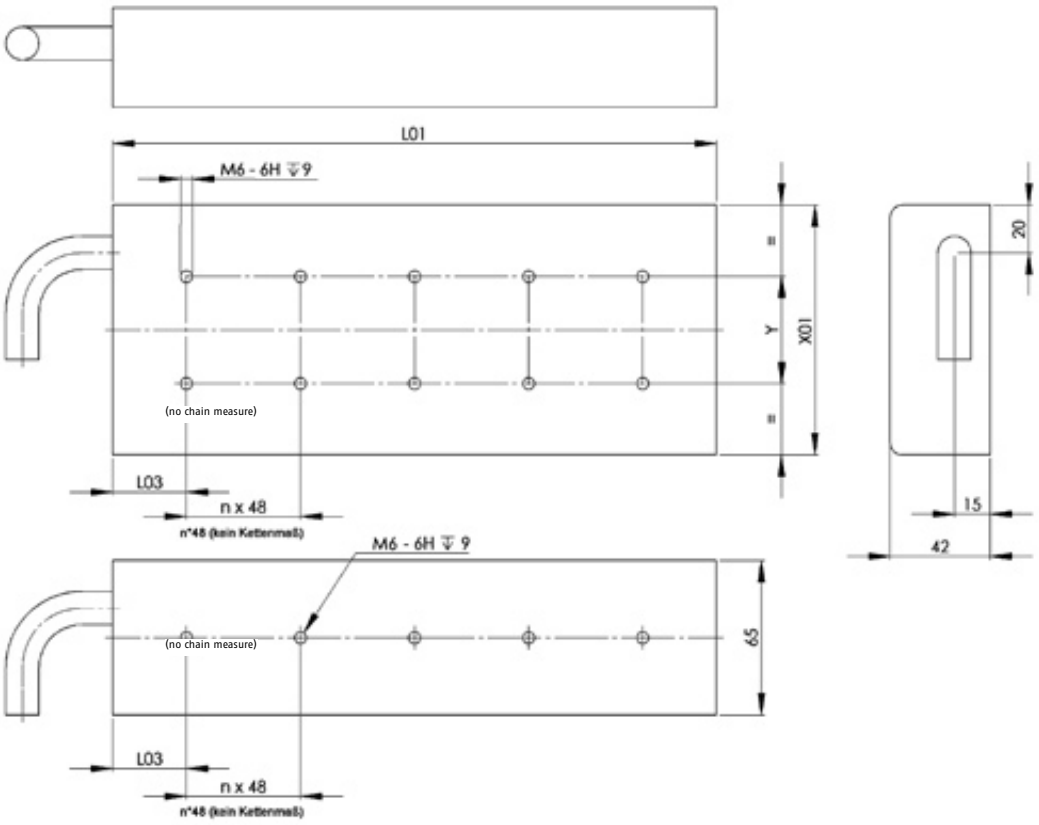
LSE10G XXXX

Primary part Type	Length l_1 [mm]	Width b_1 [mm]	Mass [kg]	Speed $v(F_{nom})$ [m/s]	Speed $v(F_{max})$ [m/s]	Trust force F_N [N]	Trust force F_{max} [N]	$F_{Attr.}$ [N]	Rated current I_n [A]	Rated current I_{max} [A]
As of this size, data for air gap of 0.6 mm										
LSE10G 0804	182	85	3.1	3.68	2.01	110	530	1804	0.8	4.8
LSE10G 0806	254	85	4.6	3.79	1.97	160	840	2706	1.2	7.8
LSE10G 0808	326	85	6.1	3.85	1.99	210	1160	3608	1.6	10.8
LSE10G 0810	398	85	7.6	3.89	1.97	250	1470	4510	1.9	13.7
LSE10G 0814	542	85	10.6	3.95	2.02	340	2100	6314	2.7	19.8
LSE10G 0818	686	85	13.6	3.92	1.95	430	2730	8118	3.3	25.5
LSE10G 1004	182	105	3.9	3.46	2.01	150	740	2514	1.0	6.2
LSE10G 1006	254	105	5.9	3.55	1.98	220	1180	3771	1.5	10.0
LSE10G 1008	326	105	7.8	3.62	2.02	280	1620	5028	2.0	13.9
LSE10G 1010	398	105	9.7	3.65	2.02	340	2060	6286	2.4	17.9
LSE10G 1014	542	105	13.6	3.67	2.00	460	2930	8800	3.3	25.5
LSE10G 1018	686	105	17.5	3.67	1.99	590	3810	11314	4.2	33.1
LSE10G 1304	182	135	5.2	3.27	2.00	210	1060	3580	1.4	8.3
LSE10G 1306	254	135	7.8	3.39	2.01	300	1680	5369	2.0	13.5
LSE10G 1308	326	135	10.4	3.41	1.99	390	2310	7159	2.6	18.6
LSE10G 1310	398	135	12.9	3.40	1.97	470	2930	8949	3.1	23.5
LSE10G 1314	542	135	18.1	3.50	2.03	640	4180	12529	4.4	34.3
LSE10G 1318	686	135	23.2	3.50	2.01	810	5430	16108	5.5	44.6
LSE10G 1604	182	165	6.5	3.14	1.98	270	1370	4645	1.7	10.3
LSE10G 1606	254	165	9.7	3.27	2.00	380	2180	6967	2.4	16.8
LSE10G 1608	326	165	12.9	3.33	2.03	500	2990	9290	3.2	23.5
LSE10G 1610	398	165	16.1	3.33	2.00	600	3800	11612	3.9	29.8
LSE10G 1614	542	165	22.5	3.34	1.98	830	5430	16257	5.4	42.5
LSE10G 1618	686	165	28.9	3.39	2.01	1040	7050	20902	6.8	55.8
As of this size, data for air gap of 1.0 mm										
LSE10G 3204	182	325	13.4	3.05	1.96	550	2880	8791	3.3	20.8
LSE10G 3206	254	325	20.0	3.20	2.03	780	4580	13187	4.8	34.3
LSE10G 3208	326	325	26.6	3.20	1.99	1000	6270	17583	6.2	47.0
LSE10G 3210	398	325	33.2	3.20	1.97	1210	7970	21979	7.5	59.5
LSE10G 3214	542	325	46.3	3.38	2.10	1650	11360	30770	10.8	89.3
LSE10G 3218	686	325	59.5	3.26	1.98	2080	14750	39561	13.1	111.6

All LSE10G XXXX are 42 mm high

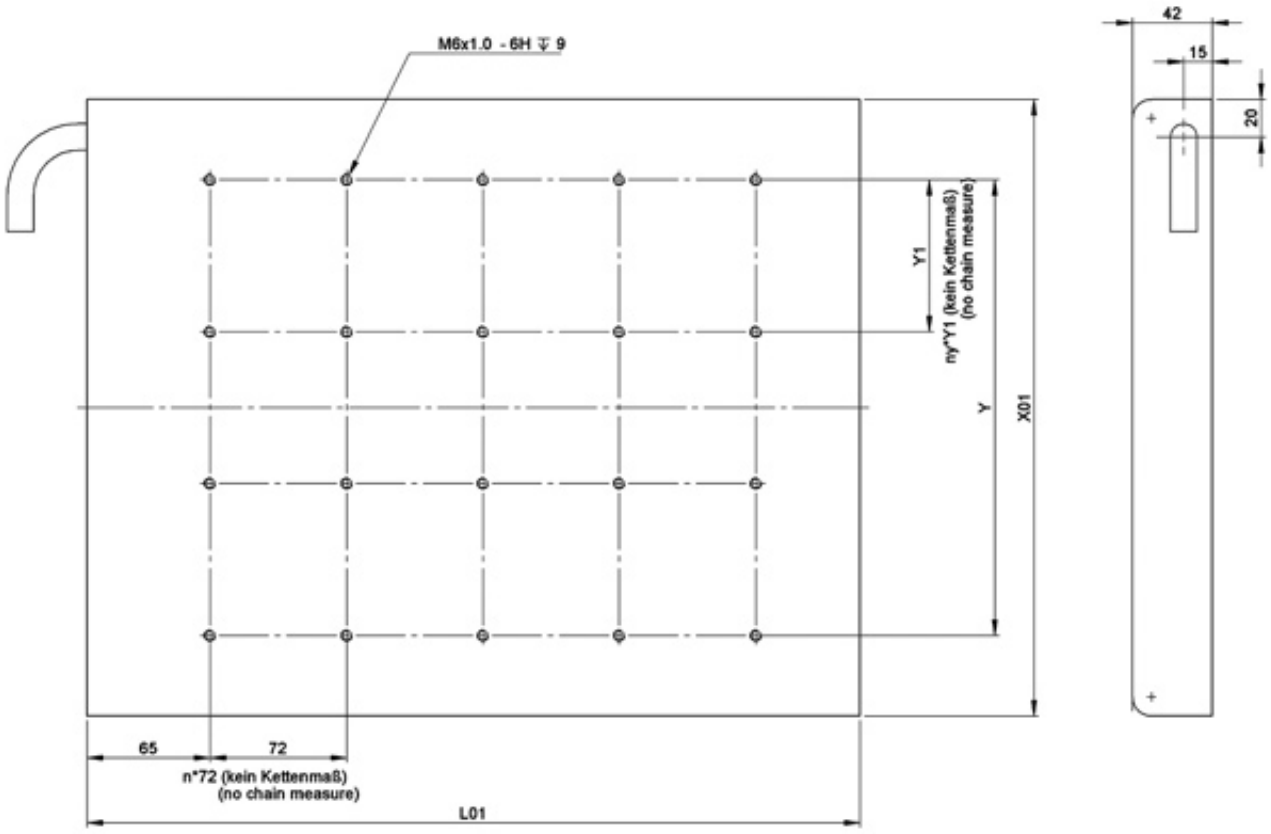
[1] With a DC link voltage of 540 V DC
[2] With an ambient temperature of 40°C without other cooling surfaces and a temperature increase of 100 K

Dimensions LSE10G 08xx – 16xx



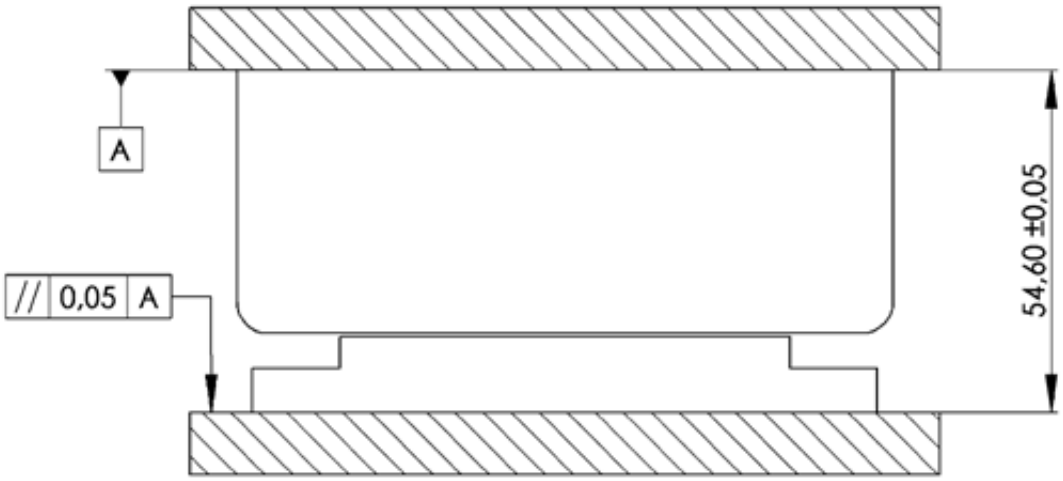
Type	Y	X01	n_max	L01	L03
LSE10G 0804	25	85	2	182	43
LSE10G 0806			4	254	31
LSE10G 0808			5	326	43
LSE10G 0810			7	398	31
LSE10G 0814			10	542	31
LSE10G 0818			13	686	31
LSE10G 1004	45	105	2	182	43
LSE10G 1006			4	254	31
LSE10G 1008			5	326	43
LSE10G 1010			7	398	31
LSE10G 1014			10	542	31
LSE10G 1018			13	686	31
LSE10G 1304	65	135	2	182	43
LSE10G 1306			4	254	31
LSE10G 1308			5	326	43
LSE10G 1310			7	398	31
LSE10G 1314			10	542	31
LSE10G 1318			13	686	31
LSE10G 1604	80	165	2	182	43
LSE10G 1606			4	254	31
LSE10G 1608			5	326	43
LSE10G 1610			7	398	31
LSE10G 1614			10	542	31
LSE10G 1618			13	686	31

Dimensions LSE10G 32xx



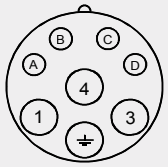
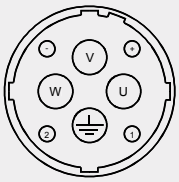
Type	Y	Y1	X01	nx_max	ny_max	L01
LSE10G 3204	240	80	325	1	3	182
LSE10G 3206				2		254
LSE10G 3208				3		326
LSE10G 3210				4		398
LSE10G 3214				6		542
LSE10G 3218				8		686

Installation drawing LSE10G 08xx – 16xx



Main connection – Pin assignment

The connector size is determined by the maximum current Imax of the motor used. Poles of the female main connectors:

		Pin	Signal		Label
Size 1					
		1	Phase U		U
Imax < 30 A			Protective ground connector		green/yellow
		3	Phase V		V V
		4	Phase W		W W W
		A		SJ	red
		B		SJ	black
		C	+	KTY 84	white
		D	–	KTY 84	yellow
Size 1.5					
		1	Phase U		U
Imax < 75 A			Protective ground connector		green/yellow
		3	Phase V		V V
		4	Phase W		W W W
		+		SJ	red
		–		SJ	black
		1	+	KTY 84	white
		2	–	KTY 84	yellow

View of contact side of female connector

Installation drawing LSE10G 32xx

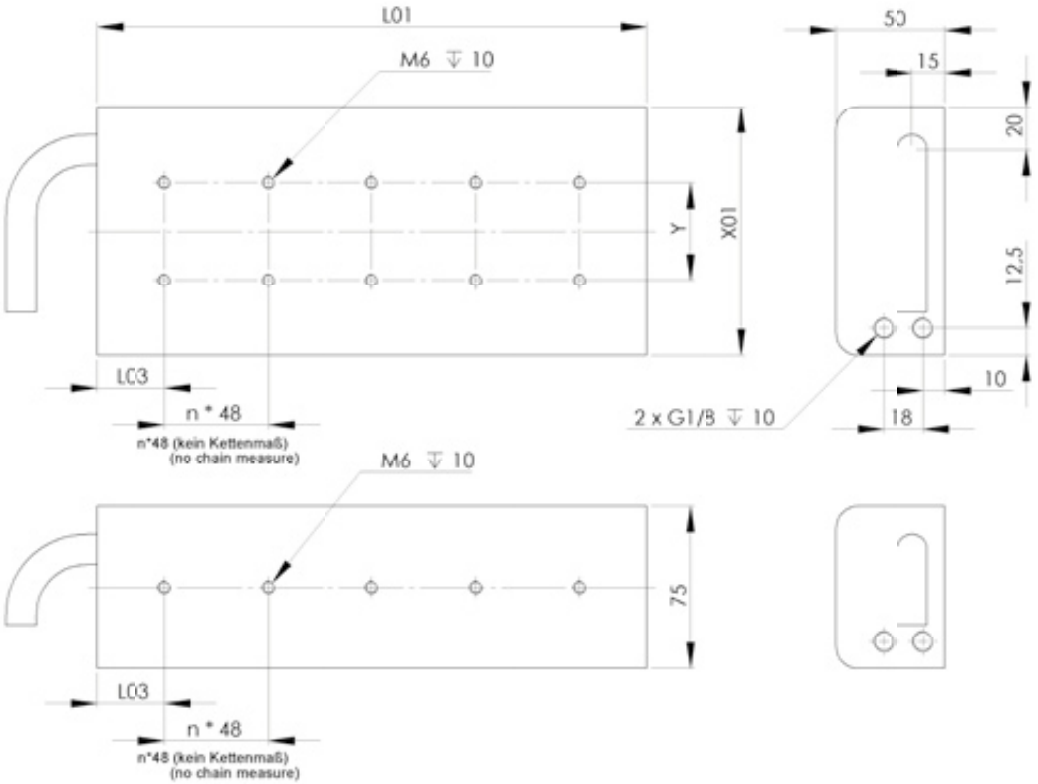
LSE10W XXXX W = water-cooled

Primary part Type	Length l1 [mm]	Width b1 [mm]	Mass [kg]	Speed v(Fnom) [m/s]	Speed v(Fmax) [m/s]	Trust force Fnom [N]	Trust force Fmax [N]	FAttr. [N]	Rated current In [A]	Rated current Imax [A]
As of this size, data for air gap of 0.6 mm										
LSE10W 0804	182	95	3.8	2.89	2.01	360	530	1804	2.6	4.8
LSE10W 0806	254	95	5.7	3.06	1.97	510	840	2706	3.8	7.8
LSE10W 0808	326	95	7.6	3.16	1.99	650	1160	3608	4.9	10.8
LSE10W 0810	398	95	9.5	3.20	1.97	800	1470	4510	6.1	13.7
LSE10W 0814	542	95	13.3	3.29	2.02	1090	2100	6314	8.4	19.8
LSE10W 0818	686	95	17.2	3.26	1.95	1380	2730	8118	10.6	25.5
LSE10W 1004	182	115	4.9	2.79	2.01	490	740	2514	3.4	6.2
LSE10W 1006	254	115	7.3	2.93	1.98	690	1180	3771	4.8	10.0
LSE10W 1008	326	115	9.7	3.03	2.02	840	1620	5028	6.3	13.9
LSE10W 1010	398	115	12.1	3.08	2.02	1080	2060	6286	7.7	17.9
LSE10W 1014	542	115	16.9	3.11	2.00	1480	2930	8800	10.6	25.5
LSE10W 1018	686	115	21.8	3.13	1.99	1870	3810	11314	13.3	33.1
LSE10W 1304	182	145	6.4	2.70	2.00	680	1060	3580	4.4	8.3
LSE10W 1306	254	145	9.6	2.86	2.01	960	1680	5369	6.3	13.5
LSE10W 1308	326	145	12.8	2.91	1.99	1230	2310	7159	8.2	18.6
LSE10W 1310	398	145	16.0	2.91	1.97	1500	2930	8949	9.9	23.5
LSE10W 1314	542	145	22.3	3.02	2.03	2040	4180	12529	13.8	34.3
LSE10W 1318	686	145	28.7	3.04	2.01	2580	5430	16108	17.5	44.6
LSE10W 1604	182	175	8.0	2.62	1.98	870	1370	4645	5.3	10.3
LSE10W 1606	254	175	12.0	2.79	2.00	1220	2180	6967	7.7	16.8
LSE10W 1608	326	175	15.9	2.88	2.03	1560	2990	9290	10.1	23.5
LSE10W 1610	398	175	19.8	2.89	2.00	1910	3800	11612	12.3	29.8
LSE10W 1614	542	175	27.7	2.92	1.98	2600	5430	16257	16.8	42.5
LSE10W 1618	686	175	35.6	2.97	2.01	3280	7050	20902	21.4	55.8
As of this size, data for air gap of 1.0 mm										
LSE10W 3204	182	335	16.4	2.60	1.96	1740	2880	8791	10.3	20.8
LSE10W 3206	254	335	24.4	2.79	2.03	2430	4580	13187	15.0	34.3
LSE10W 3208	326	335	32.4	2.81	1.99	3110	6270	17583	19.2	47.0
LSE10W 3210	398	335	40.4	2.82	1.97	3790	7970	21979	23.3	59.5
LSE10W 3214	542	335	56.5	3.01	2.10	5130	11360	30770	33.2	89.3
LSE10W 3218	686	335	72.6	2.90	1.98	6480	14750	39561	40.4	111.6

All LSE10W XXXX are 50 mm high

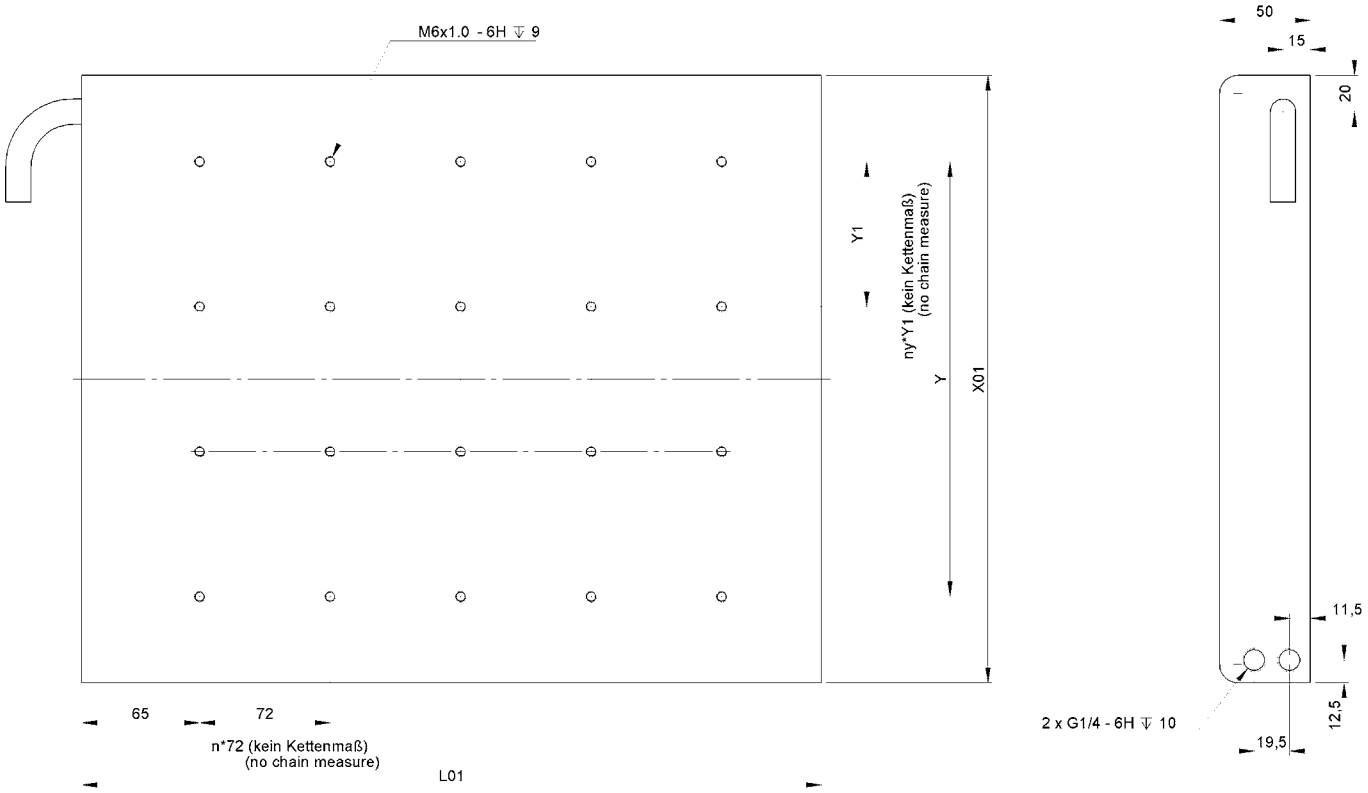
[1] With a DC link voltage of 540 V DC
[2] With an ambient temperature of 40°C without other cooling surfaces and a temperature increase of 100 K

Dimensions LSE10W 08XX – 16XX



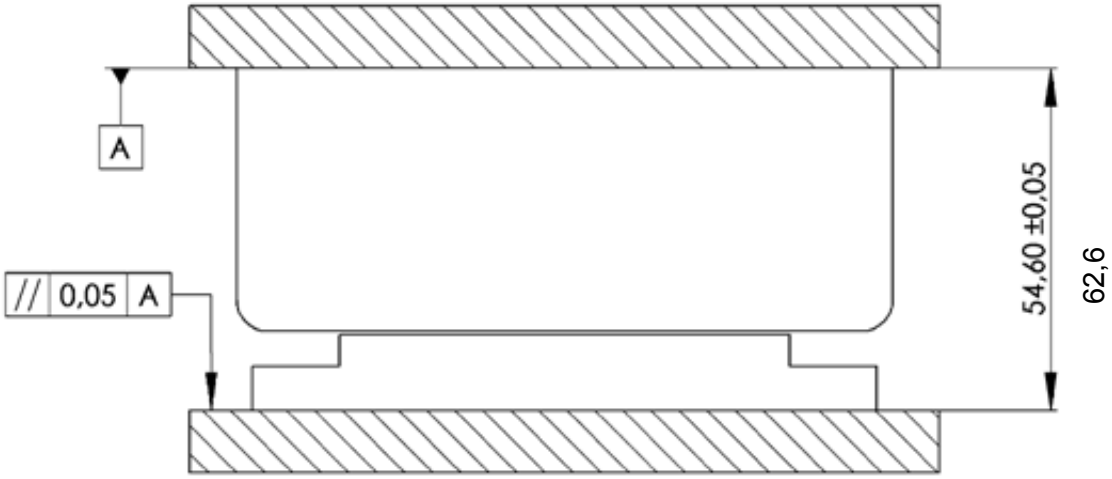
Type	Y	X01	n_max	L01	L03
LSE10W 0804	25	95	2	182	43
LSE10W 0806			4	254	31
LSE10W 0808			5	326	43
LSE10W 0810			7	398	31
LSE10W 0814			10	542	31
LSE10W 0818			13	686	31
LSE10W 1004	45	115	2	182	43
LSE10W 1006			4	254	31
LSE10W 1008			5	326	43
LSE10W 1010			7	398	31
LSE10W 1014			10	542	31
LSE10W 1018			13	686	31
LSE10W 1304	65	145	2	182	43
LSE10W 1306			4	254	31
LSE10W 1308			5	326	43
LSE10W 1310			7	398	31
LSE10W 1314			10	542	31
LSE10W 1318			13	686	31
LSE10W 1604	80	175	2	182	43
LSE10W 1606			4	254	31
LSE10W 1608			5	326	43
LSE10W 1610			7	398	31
LSE10W 1614			10	542	31
LSE10W 1618			13	686	31

Dimensions LSE10W 32X



Type	Y	Y1	X01	nx_max	ny_max	L01
LSE10W 3204	240	80	335	1	3	192
LSE10W 3206				2		264
LSE10W 3208				3		336
LSE10W 3210				4		408
LSE10W 3214				6		552
LSE10W 3218				8		696

Installation drawing LSE10W 08XX – 16XX



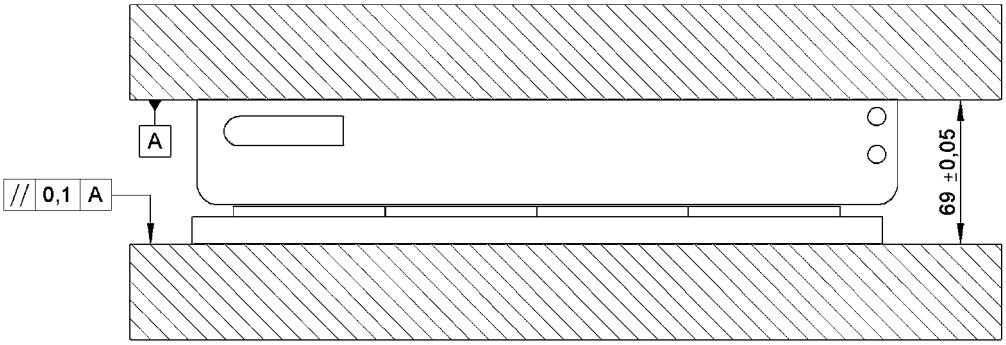
Main connection – Pin assignment

The connector size is determined by the maximum current Imax of the motor used. Poles of the female main connectors:

		Pin	Signal		Label
Size 1					
		1	Phase U		U
Imax < 30 A			Protective ground connector		green/yellow
		3	Phase V		V V
		4	Phase W		W W W
		A		SJ	red
		B		SJ	black
		C	+	KTY 84	white
		D	–	KTY 84	yellow
Größe 1.5					
		1	Phase U		U
Imax < 75 A			Protective ground connector		green/yellow
		3	Phase V		V V
		4	Phase W		W W W
		+		SJ	red
		–		SJ	black
		1	+	KTY 84	white
		2	–	KTY 84	yellow

View of contact side of female connector

Installation drawing LSE10W 32XX

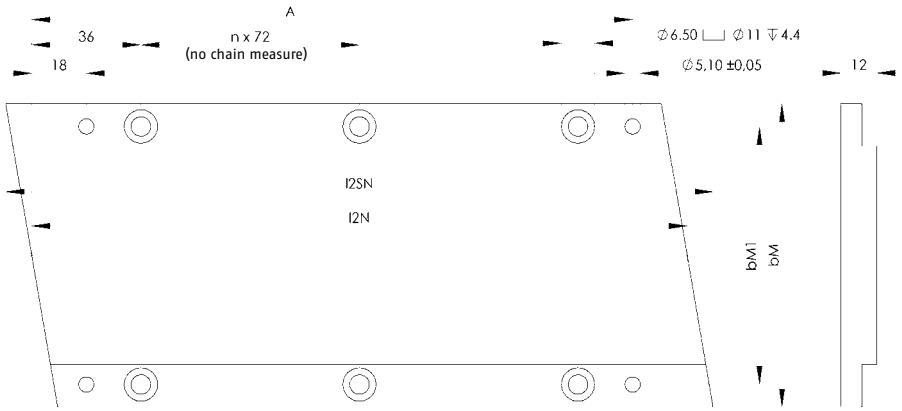


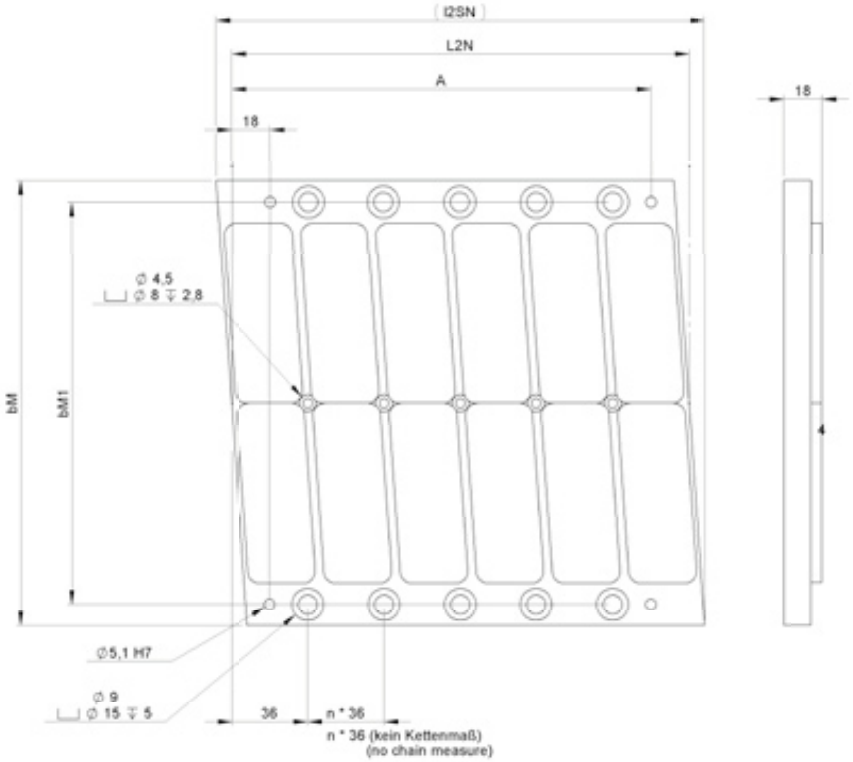
Magnet way LSM10 08xx – 32xx

Magnet way

Type	l2N	l2SN	A	bM	bM1	hM	Weight	n
	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]	[kg/m]	[mm]
LSM10 0815	144	163.2	126	80	65	12	6.0	1
LSM10 0822	216	235.2	198	80	65	12	6.0	2
LSM10 1015	144	161.1	126	100	85	12	7.6	1
LSM10 1022	216	233.1	198	100	85	12	7.6	2
LSM10 1315	144	160.9	126	130	115	12	10.4	1
LSM10 1322	216	232.9	198	130	115	12	10.4	2
LSM10 1615	144	164.8	126	160	145	12	13.1	1
LSM10 1622	216	236.8	198	160	145	12	13.1	2
LSM10 3215	144	157.7	126	330	310	18	42.7	2
LSM10 3222	216	229.7	198	330	310	18	42.7	4

For a longer traversal path, the magnet way can be arranged next to one another in any length.
The pole width is 36 mm.





LSC – The iron-less solution

The LSC iron-less linear motors from Baumüller achieve maximum current and force rise. This makes them ideal for highly dynamic applications with maximum stiffness relative to disturbing forces.

Due to it's principle of operation, this iron-less linear motor does not apply any forces of attraction to the guidance system. As no latching forces occur, this motor is able to achieve a unique degree of synchronicity. The coil is comprised of encapsulated air-core coils of minimal weight.
The U-shaped magnet way can be arranged as desired.

Advantages

- Modular system
- No cogging
- Maximum rates of current and force rise

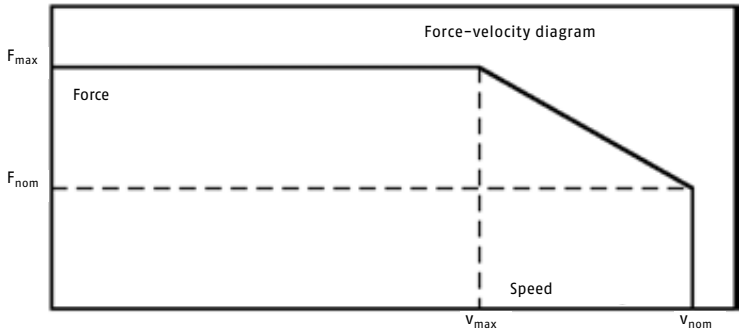
Customer benefit

- Optimum solution in terms of cost
- Increased productivity
- Excellent continous movement

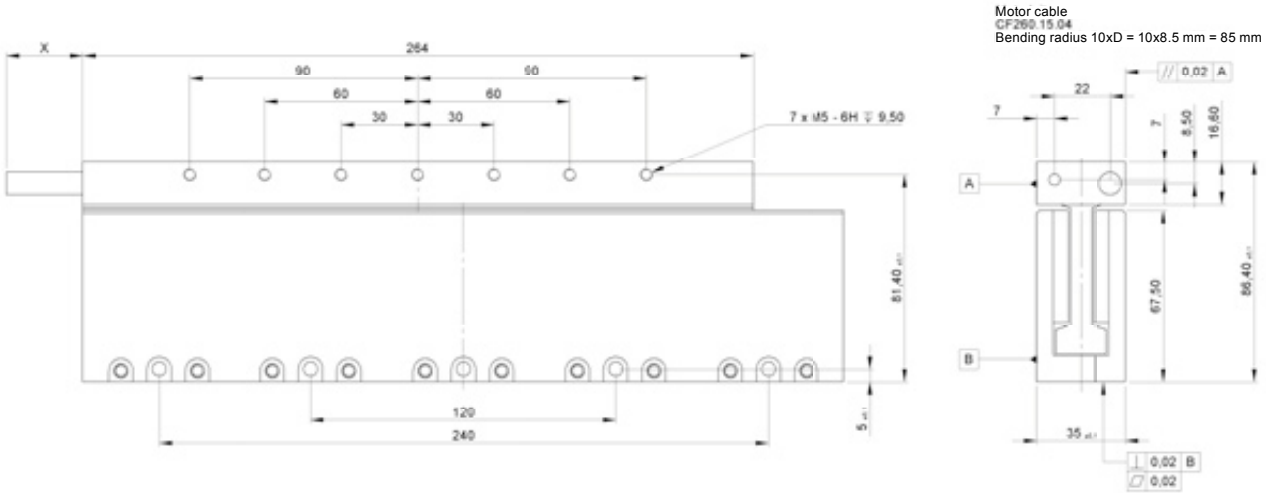
LSC50G 08XX component

Coil Type	Length l1 [mm]	Width [kg]	Speed v(Fnom) [m/s]	Speed v(Fmax) [m/s]	Thrust force Fnom [N]	Thrust force Fmax [N]	Rated current IN [A]	Rated current Imax [A]
LSC50 G 0804	144	0,6	3,20	0,90	60	260	0,4	1,7
LSC50 G 0808	264	1,2	3,20	1,00	120	520	0,8	3,4
LSC50 G 0812	384	1,6	3,20	1,00	180	790	1,2	5,1

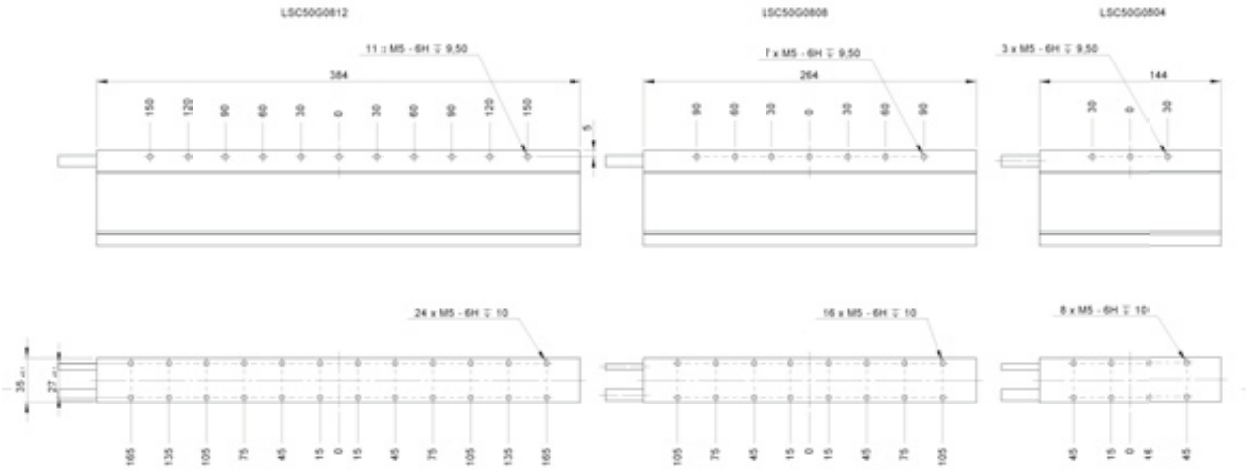
Magnet way Type	Length l1 [mm]	Mass [kg]
LSM50 0812	120	4,6
LSM50 0818	180	6,8
LSM50 0830	300	11,4



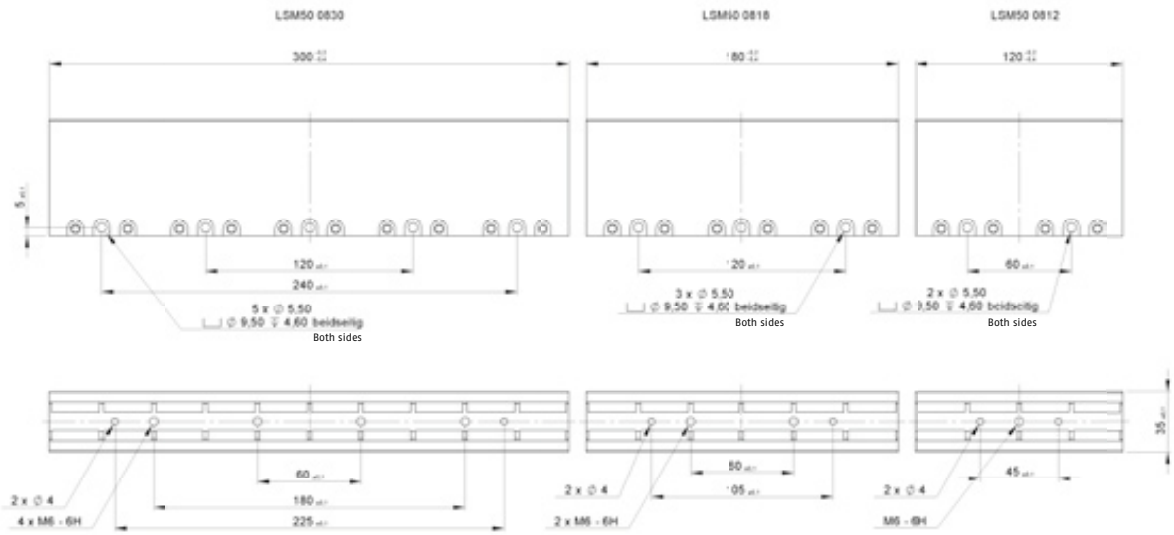
Dimensions



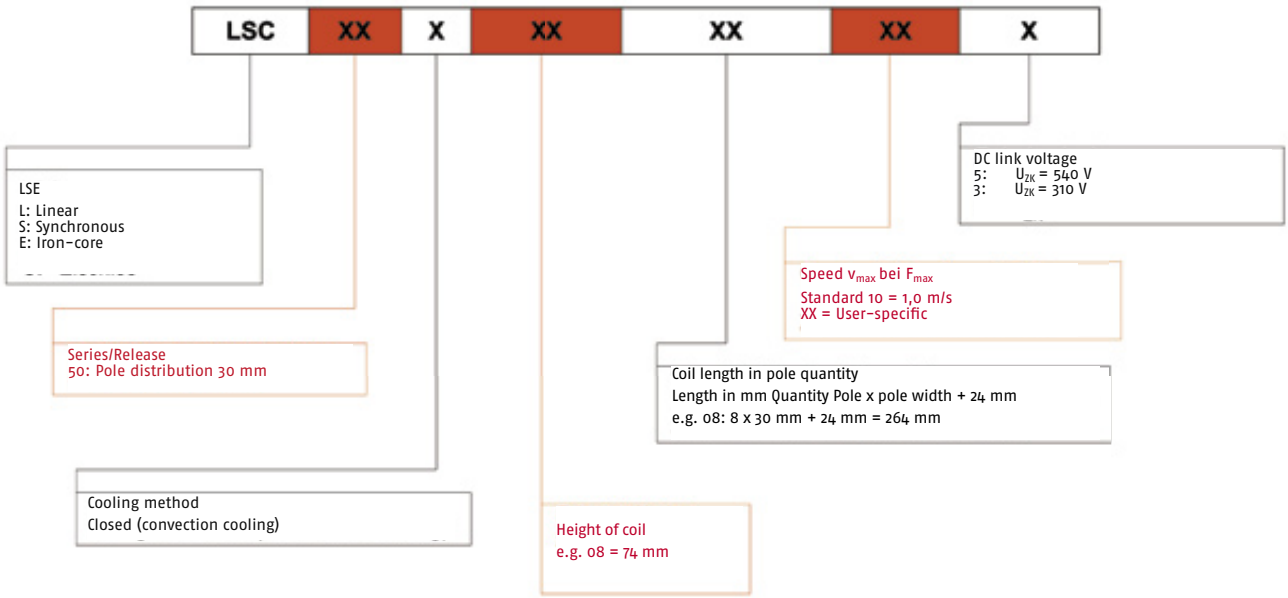
Drawing: Coil



Drawing: Magnet way



Order code LSC50 – Ordering information – Coil



Note:

Standard cable version: 1.5 meter cable, flying leads. Any other lengths and versions must be specified in plain language when ordering.

Order examples

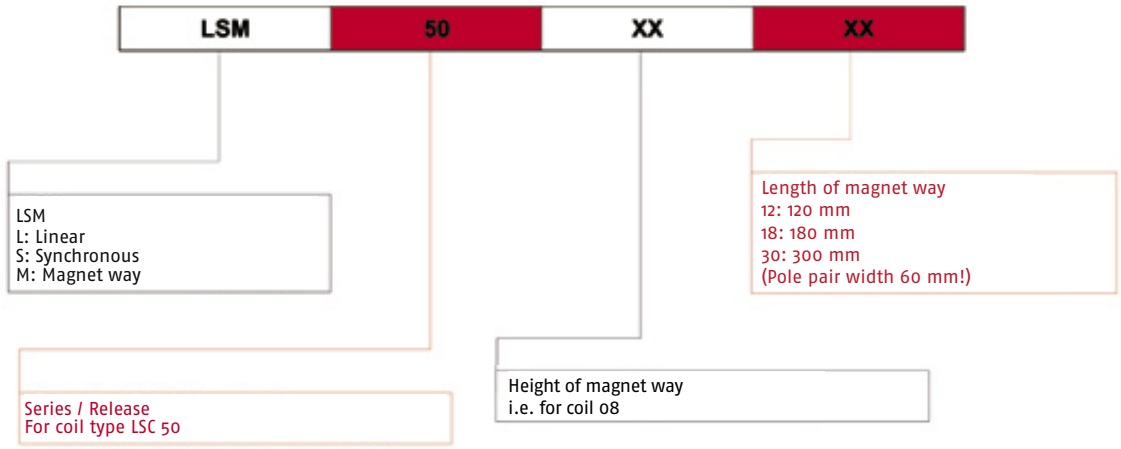
LSC50G 0808-10-5

Iron-core linear synchronous coil of series 50, convection-cooled, 74 mm high, 246 mm long, vmax at Fmax is 1.0 m/s, DC link voltage is 540 V.

LSC50G 0808-10-3

Iron-less linear synchronous coil of series 50, convection-cooled, 74 mm high, 246 mm long, vmax at Fmax is 1.0 m/s, DC link voltage is 310 V.

Order code LSM50 – Ordering information – Magnet way



Note:

The individual magnet way can be arranged next to one another for longer paths. Width: 35 mm, height: 67.5 mm.

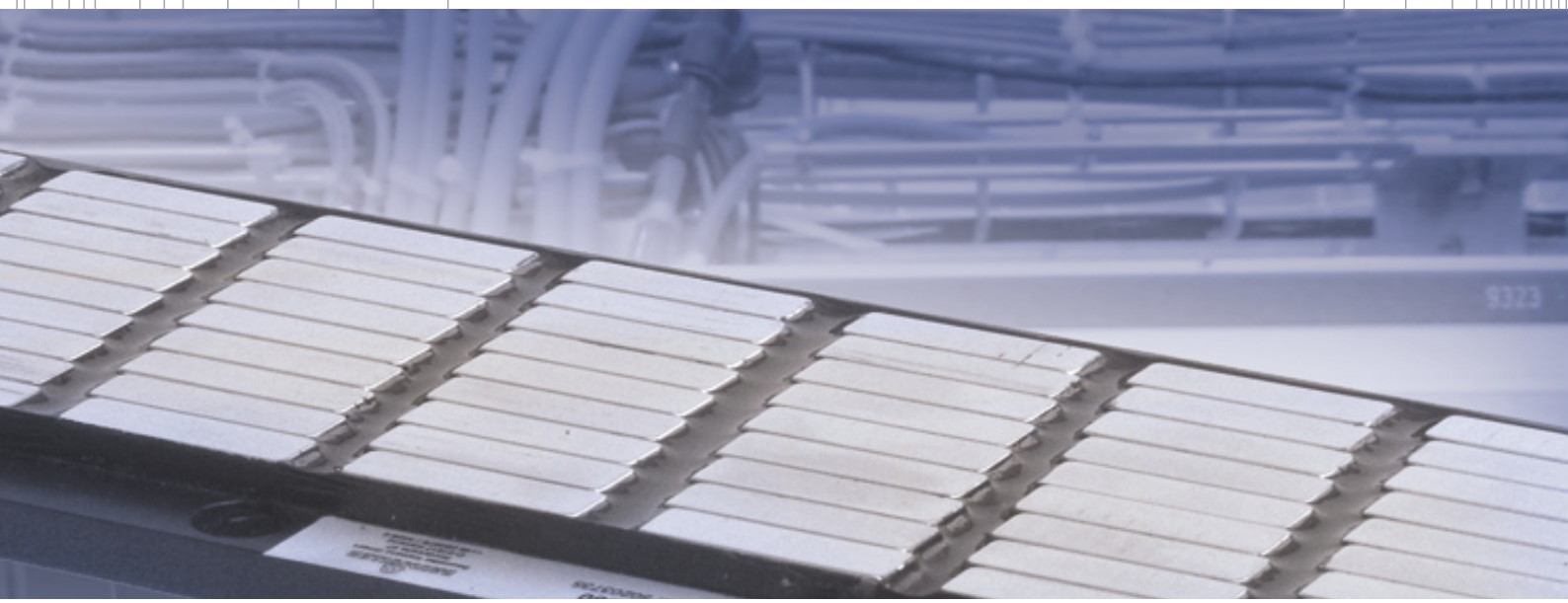
Order examples:

LSM50 0812

Linear synchronous magnet way of series 50, length: 120 mm.

LSM50 0830

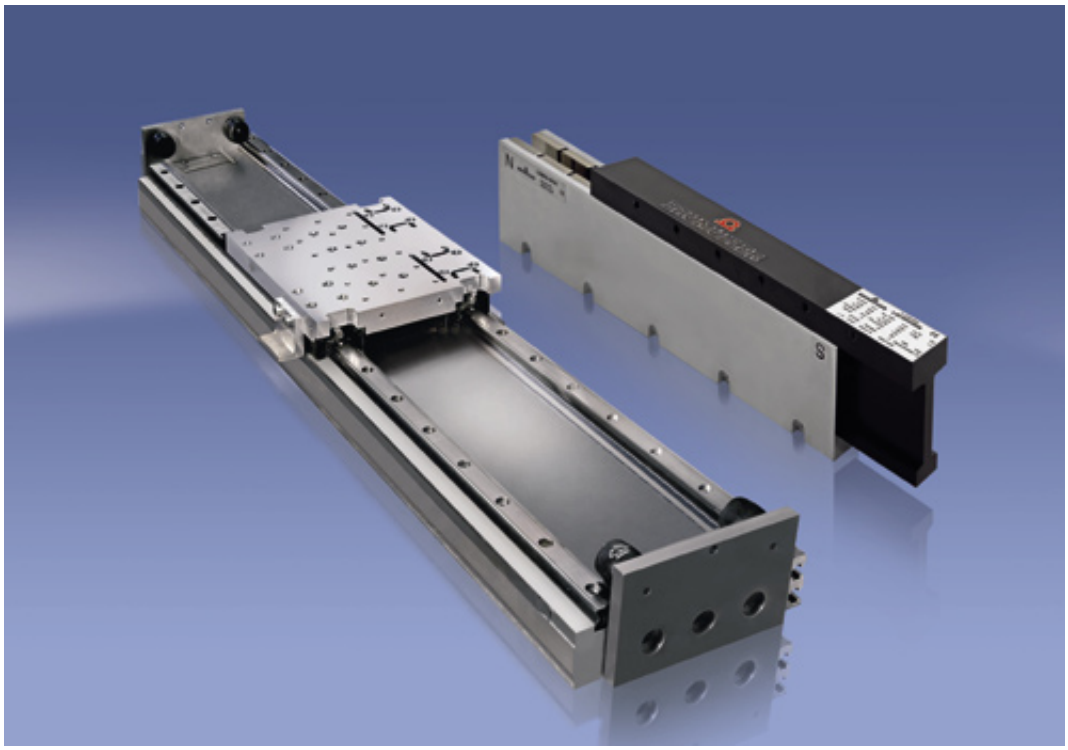
Linear synchronous magnet way of series 50, length: 300 mm.



Application examples
The advantage of Baumüller linear direct drives

Conventional solutions (spindles, belts, chain drives and pneumatic drives) are being replaced in growing numbers by linear direct-drive technology. Our linear motors are designed as scalable, modular system components.

You can select a power rating, geometry and design to suit your requirements and create traverse paths of varying lengths by joining segments in series. Thus, depending on the application, you can create virtually maintenance-free systems with low upkeep costs.



Factors for success of the Baumüller linear motors:

- The tried-and-tested converter and controller technology used in Baumüller rotary drive systems can be used for linear systems without restriction
- Modular system with various motor frame sizes and lengths
- Designed to give maximum performance with thrust forces up to 14,750 N and speeds up to 10 m/s plug & play solutions: Minimizes R&D and assembly costs
- Various winding versions for all motor sizes to ensure optimum speed adjustment
- Up to IP65 degree of protection for all motor components
- Motor winding protected against thermal overload by means of integrated temperature sensors (temperature detector and KTY84)
- Highly flexible, tension-relieved and screened power cable feed
- Repeatability down to 2 µm

Application example 1
PCB-Drilling and routing machines

The fully automatic station is configured with minimal assembly effort via plug & play and requires no complicated special-purpose machine construction. This reduces your R&D costs. By using direct linear drives, multiple drill heads or routing heads on a guide can be moved synchronously or independently of one another.

Features

- Variable x/y motion
- Zero backlash
- High dynamic response
- High repeatability
- Configurable motion profile
- Modular system
- Eliminates mechanical transmission elements

Customer benefit

- Offset compensation of x/y axis
- High productivity
- Format flexibility
- Improved product quality
- Reduced lifecycle costs
- Smaller machine footprint
- Lower R&D costs

Application example 2
Equippage of the transmission station of a textile machine

Increasingly, extremely complex motion sequences must be possible in modern textile machines. Previous implementations using belts, chains and spindles to generate linear movement are often rejected due to the lower performance of the system, increased maintenance and cleaning expenditures and a shorter service life. The linear motors by Baumüller offer an optimum solution for guiding the material.

Advantage to customer in this example application

- Optimization of the production sequence through shorter cycle times
- In the past, two separate axes were replaced by one axis with two primaries
- Reduction of the maintenance expenditure
- Its high integration capacity and very compact design enables the linear axis to be easily mounted into the system and makes it ideal for complex motions.
- Large traverse path of 6,000 mm with linear axis easily possible (no swinging up as with toothed belt or spindle)
- Cost-effective version
- Format change possible without great expenditure

Application example 3
Packaging machine

Linear direct-drive technology is increasingly being used in the automation process when short traverse paths with a high dynamic response, high positioning exactness and precision are required. Again and again, conventional rotary drives are being pushed to their limits in such applications. Linear direct-drive technology is establishing itself in particular in the areas of servo applications, such as packaging machines.

Advantage to the customer in this example application

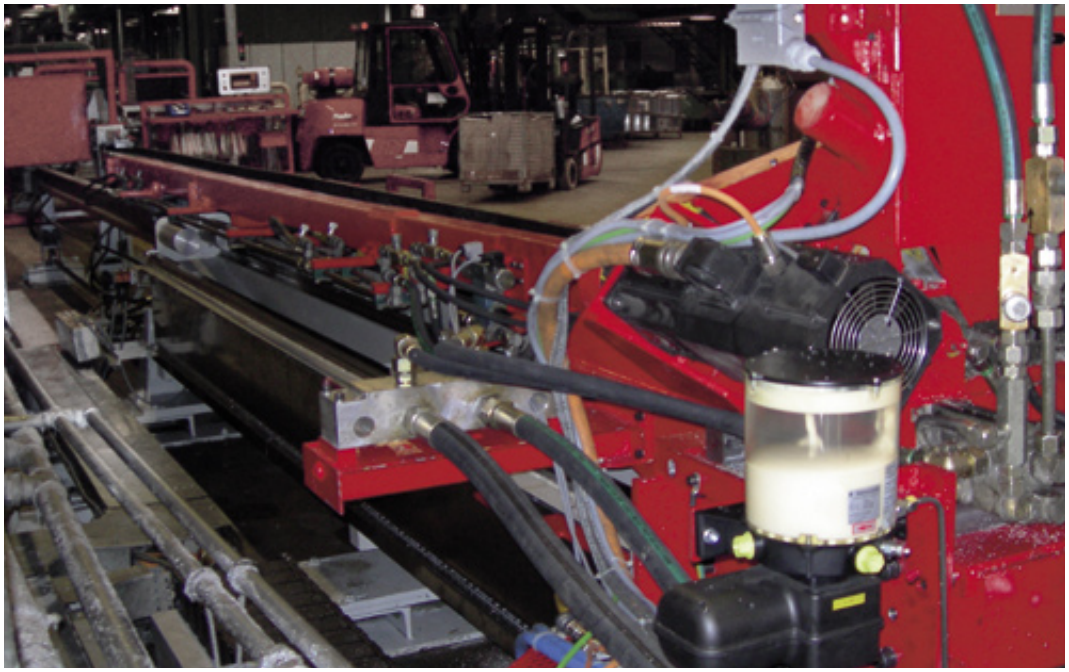
- ◎ Fulfillment of the high requirements regarding cleanliness in the foodstuffs industry
- ◎ Two primaries on the traverse path: save space and reduce costs
- ◎ Increase of the cycle rate of the machine possible through separate movement of the primaries
- ◎ By increasing the performance on the linear axis, the performance of other axes could be reduced at a higher level of machine output
- ◎ Short traverse paths with a high dynamic response, high positioning exactness and precision
- ◎ Increase in machine productivity and reduction of maintenance-dependent operating costs and downtimes

Application example 4
„Flying saw“

In a production system with a continuous flow of material, it is necessary to saw while the material is moving to separate the material. A „flying saw“ is used here. The saw is fastened to a linear slide for this purpose.

Increasing requirements for the freedom from maintenance and wear and high precision and dynamic response lead to the ever more frequent generation of translatory movement by linear motors.

In the solution presented, the individual components are designed in the machine and are thus an integral component of the system.



Advantage for customers in the „flying saw“ example application

- Wear and high-maintenance spindle drive has been replaced by maintenance-free linear motor
- Greater dynamic response possible thanks to rigid connection
- Reduction of the cycle times by a factor of 2 to 3
- Integration of the linear motor in the machine saves space

Dimensioning guide for linear motors

The dimensioning of a linear motor does not differ considerably from that of a rotary motor except for a few particularities.

The kinematic laws for calculating the required speeds, accelerations and forces can be used in a similar way. Only the equivalences between rotating and linear systems need to be considered.

Linear		Rotary
◎ Force	≅	◎ Torque
◎ Path	≅	◎ Angle
◎ Speed	≅	◎ Angular speed (or speed)
◎ Acceleration	≅	◎ Angular acceleration
◎ Mass	≅	◎ Inertia

To design a drive, the mechanical parameters must be known, as must the mass to be moved, the desired cycle time and the parameters of the motion profile (speeds, accelerations and pause times).

Using this data, the values required for maximum force (mostly for acceleration) and effectiveness can be determined for the selection of the linear motor.

Using these values, the suitable linear motor can be selected from the catalog.

Notes:

When determining the total mass to be moved, ensure that the mass of the selected motor is also taken into account, as it affects the maximum and effective forces. **If necessary, the required linear motor must be identified using an iterative process.**

In the case of very short traverse paths (less than 35 mm), the determined required effective force must be multiplied by the value; 2 = 1.42 (derating)!

Iron-core linear motors generate a continually effective force of attraction between the coil and magnet way when installed, depending on their design. **When designing the mechanical structure, in particular when designing the guidance system and the carriage structure, these forces of attraction are to be taken into account!**

Configuration information

Data recorded by: _____

Title ☐ Mr. ☐ Mrs. ☐ Dr. ☐ Prof.

Name _____ Address _____

Company _____ City, ZIP code _____

Department _____ Telephone _____

Sector _____ Fax _____

Country _____ E-mail _____

Project description: What function must be fulfilled?

Application description: _____

Technical data:

Accel time: Δt_1 [s] _____

Travel time: Δt_2 [s] _____

Decel time: Δt_3 [s] _____

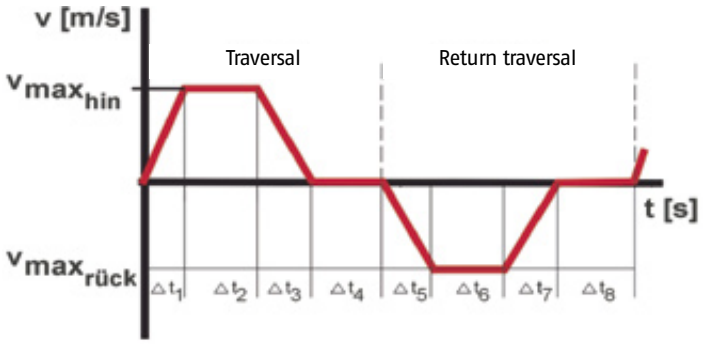
Pause time: Δt_4 [s] _____

Accel time: Δt_5 [s] _____

Travel time: Δt_6 [s] _____

Decel time: Δt_7 [s] _____

Pause time: Δt_8 [s] _____



Load [kg] _____ **Mass of carriage** [kg] _____

Processing force [N] _____ **Width of carriage** [mm] _____

Traversal path [mm] _____ **Length of carriage** [mm] _____

Speed [m/s]: v_max, traversal _____ v_max, return _____ Max. acceleration [m/s²] _____

Number of cycles or duty time: Per hour _____ Or in % _____ Ambient temperature [°] _____

Balancing weight present? (vertical motion): ☐ Yes ☐ No

Friction coefficient (dependent upon the guidance system): _____ **(with components only)**

Motion level: ☐ Horizontal ☐ Vertical Angle [°] _____

Electrical connection: ☐ Free cable end (standard with components)

Cable length in meters: _____

Cable exit: ☐ Right ☐ Left ☐ Special

Proximity switch: (standard inductive type IFFM-08P17A&)

Limit switch (quantity, exact position) _____

Reference switch (exact position) _____

Desired protection class: _____

Number of required drives: _____

_____

Cooling: ☐ Convection cooling (standard) ☐ Water-cooled ☐ Externally ventilated

Cable chain: ☐ Yes ☐ No (standard)

Addl. cables in cable chain ☐ Yes ☐ No Diameter(s) Ø _____

Comments on cable chain _____

Horizontal/vertical mounting _____

position _____

Holding brake: ☐ (Without standard) No ☐ Yes

Mayr ROBA linear stop type 381 size 4 ☐ Single holding force: 2,500 N ☐ Double holding force: 5,000 N

Customer-specific brake _____

Position measurement/Electronics

Controller: ☐ Speed ☐ Position ☐ Force

Position measurement: **Incremental** **Absolute**

Controller: ☐ LE100 ☐ MSA111 ☐ TTK70

Repeatability [mm] _____

accuracy [mm] _____

Drive amplifier, type: _____

Control: _____

Bus interface: _____

Mounting conditions: (esp. cooling surface of primary)

_____

_____

Ambient conditions:

Cooling: ☐ Clean room ☐ Clean

☐ Dust ☐ Chips

☐ Dampness Other _____

Sketch/Drawing:

Additional forces, force acting points, load connection etc.

Business data:

Price range: _____

Desired delivery timeframe: _____

Competitors: _____

Latest offer submission date: _____

Order type: ☐ Individual order ☐ Subsequent orders

Standard-production machine ☐ Yes ☐ Nein

Estimated total potential _____ Euros per year

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Telefax: +49 (0)911-5432-568

22 33 44 55 66 77 88 99

11

4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19

Baumüller has been setting a new standard with the converters and controllers of the b maXX series. This drive generation was developed to meet current and future worldwide requirements for automation technology. b maXX constitutes the basis for five different product series when it comes to both simple and complex automation solutions.

b maXX 5000 – Unachieved dynamics and compactness

Safety

News from the pioneer of direct drive technology: We present to you the new alignable drive system b maXX 5000 as supplement of our successful b maXX 4000 range. The new range offers a performance spectrum of 1 kW to 35 kW in a rack system. With power supplied and regenerative systems, b maXX 5000 can be use worldwide as an energy efficient drive system. With its Connect Drive System, which enables you to commission our drives efficiently and economically, it displays the perfect expansion of our existing product range.

b maXX 4000 – Modular, scalable, open

Baumüller's approved automation and drive solution b maXX can be adapted to the corresponding demands with respect to performance and equipment through its modularity and flexibility. b maXX 4000 offers a power spectrum from 1,1 kW up to 315 kW with different cooling concepts, such as air and water cooling or cold plate variants. With the series b maXX 4100 a regenerative system is at your disposal, which inserts itself smoothly into the automation solution b maXX. Functional safety relay integrated into the drive available as an option. The peak load and rated load devices (b maXX 4600, b maXX 4700) supplement the proven bmaXX series and are available in five frame sizes. Whether you need maximum output for continuous operation or only for short durations, the b maXX series offers a customized drive solution for every application.

b maXX 3300 – Versatile mini servo controller

The servo inverter b maXX 3300 is a high-quality servo controller with integrated position control for power ratings up to 5 kW. b maXX 3300 excels through its compact, space-saving design. The field-oriented control provides for excellent performance. Higher-level speed and position control ensure dynamic and exact positioning. The servo controller is specifically designed for operation with the DSD 28–100 servomotors and the pancake and linear motor series from Baumüller. Functional safety features integrated into the drive are available, as is a manual control device.

b maXX 2000 – Compact mini servo controller

b maXX 2000 rounds off the converter and controller generation b maXX at the lower end of the power range. The mini servo controller b maXX 2400 (< 60V) is specifically designed for operation with the DSD 28–36 servomotors and the pancake and linear motor series from Baumüller.

b maXX 1000 – Highly efficient frequency converter

For a vector control of standard electric motors Baumüller added an high-efficient and easy to operate frequency converter into the program: The b maXX 1000 is available in three sizes with capacity ranges from 0.2 to 11 kW. An integrated EMV filter and various protection and overload monitoring functions ensure a troublefree operation. An extensive control and data management system ensures a continuously and exact overview of the current drive status.

DSDI/DSMI Motors with integrated control and power electronics

The model ranges DSDI and DSMI are servo motors with integrated control and power electronics. These servo drive meet the requirements of modern, decentralized drive architectures in automation. The DSDI is a highly dynamic motor and the DSMI is a high torque servo drive.
Power range 170–385 W (0.23–0.52 hp), speeds up to 4000 rpm, protection rating up to IP65

400

135 200 260 315 400

Baumüller offers an extremely wide range of synchronous and asynchronous motors with shaft heights from 28 mm to 400 mm and many different cooling methods.

DS/DA – General purpose servo motors

The servo motor for all applications with strict energy efficiency requirements.
Type DS: Sizes 45, 56, 71, 100, 132, 160 and 200, power range 0.25–290 kW (0.33–389 hp), speeds up to 6000 min^{-1}, unventilated IP54, ventilated IP23/IP54, water-cooled IP54.
Type DA: Sizes 100, 132, 160, 180, 225 and 280, power range 3.5–400 kW (4.7–536 hp), speeds up to 3000 min^{-1}, ventilated IP23/IP54, water-cooled IP54.

DSC – Compact servo motors

The DSC 45-100 is a series of high-torque servo motors that are up to 30% more compact than conventional servo designs.
Sizes 45, 56, 71 and 100, power range 0.5-18 kW (0.67-24,1 hp), speeds up to 4000 min^{-1}, up to IP65 type of protection

DSD – Dynamic servo motors

The servo motors for highly dynamic applications with the highest requirements of acceleration capacity and the best start-stop qualities.

Sizes 28, 36, 45, 56, 71 and 100, power range 0.28–37 kW (0.38–49.6 hp), speeds up to 6000 min^{-1}, up to IP65 type of protection

DSP – For high speed performance

For applications requiring high rotary speeds, DSP motors complete the existing DSC range, covering nominal rotary speeds of up to 6000 min^{-1}.

Sizes 45, 56, 71, 100, speeds up to 6000 min^{-1}, up to IP65 type of protection

DST – Powerful high torque motors

The high-torque motor DST2 for application with maximum torque requirements.

Sizes 135, 200, 260, 315 and 400, power range 2.7–320 kW (3.6–429 hp), speeds up to 1500 min^{-1}, torque up to 32,900 Nm, IP54 type of protection, water-cooled

GDM & DSM – Disc motors

Baumüller offers a wide range of disc rotors for use in a large number of different applications where installation space is at a premium.

GDM DC disc motors: Power range 16–3000 W (0.02–4 hp)

DSM brushless disc motors: Power range 180–6300 W (0.24–8.4 hp)

DSA external rotor motors

External rotor motors save energy due to their high efficiency rate. Also available are kit solutions for customer-specific installation.

Stator diameter from 74 to 180 mm, performance range from 100 to 300 W (0.13–0.40 hp)

BPx – Baumüller Planetary Gear Series

The BPx planetary gear series in combination with our standard DS/DSD/DSC servo motors are ideally suited for applications with high demands on torque and dynamic.

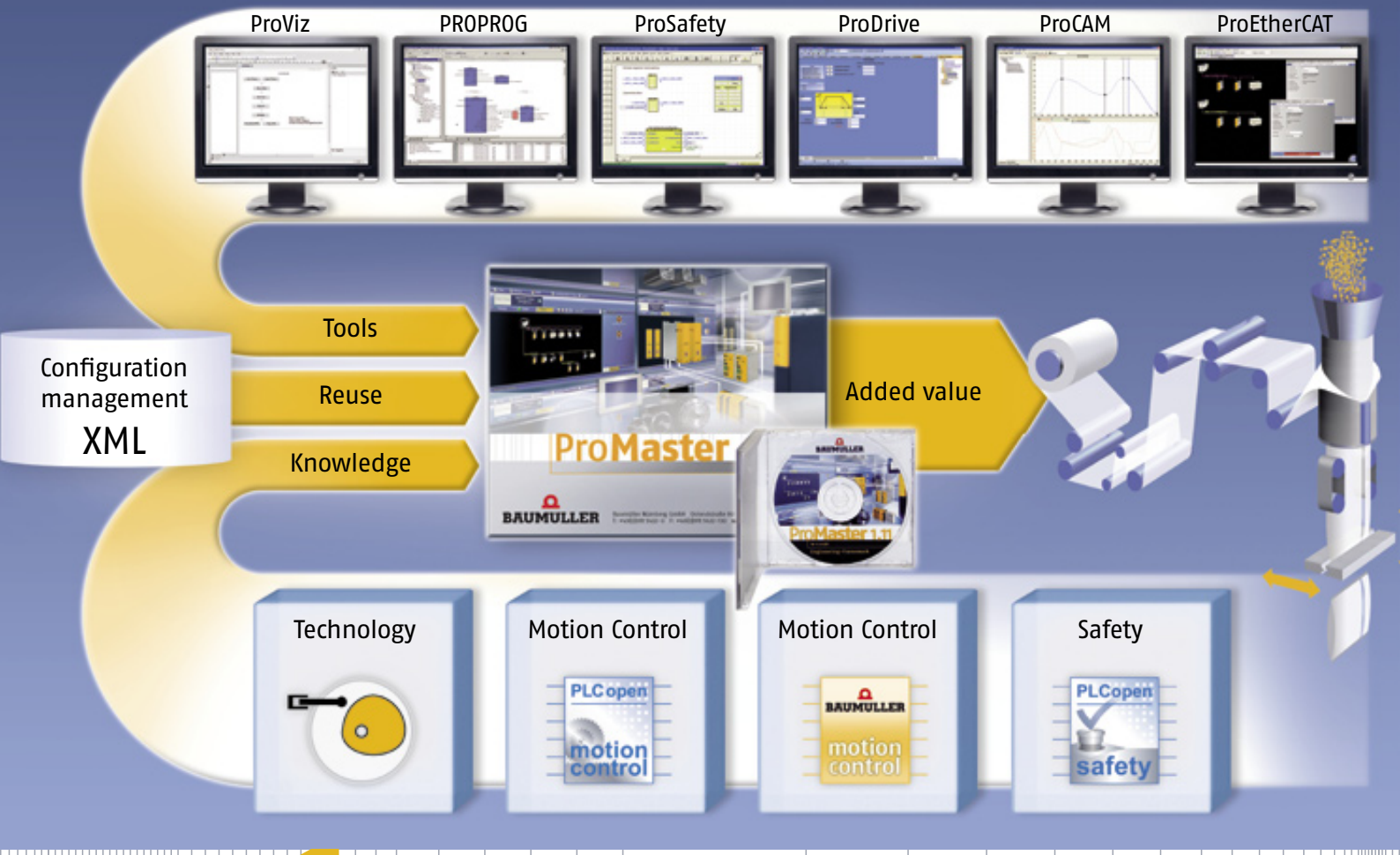
Baumüller Linear drives

The linear motor components LSE10/LSM10 can achieve maximum thrust forces of up to 14.750 N. Customized motor concepts can be realized using a modular system.

DSDI/DSMI motors with integrated control and power electronics

The model ranges DSDI and DSMI are servo motors with integrated control and power electronics. These servo drive meet the requirements of modern, decentralized drive architectures in automation. The DSDI is a highly dynamic motor and the DSMI is a high torque servo drive.

Power range 170–385 W (0.23–0.52 hp), speeds up to 4000 rpm, protection rating up to IP65



1

The more intuitive the engineering, the more efficient will be the automation solution. ProMaster allows you to introduce new machine concepts to the marketplace more quickly and you systematically increase the added value of your machine.

ProMaster – An integrated engineering Framework

Consistent machine configuration, parametrization, programming and diagnosis are the fundamental aspects for a machine-oriented application. The implementation of the independent standards such as Motion Control functionalities in accordance with PLCopen or EtherCAT field bus are used.

Your knowledge is managed in the form of parameters and functions in data-sets and libraries – over the entire machine life cycle.

Thanks to ProMaster you can concentrate on your core competence – your machine.

Operating and visualizing with the bmaxx HMI

The bmaxx HMI model range is designed for special automation requirements. The web-based visualization with the HMIs equipped with a 3.5 inch to 15 inch display meets all the requirements of control panels and visualization. The user-friendly and intelligently designed control and visualization tool ProViz which is integrated in the Baumüller Engineering Framework, Pro Master, allows the machine to be adapted to every production process.

b maXX drivePLC – Drive-Integrated Control System

The b maXX drivePLC makes the drive intelligent. The control system intelligence direct on the drive offers the facility of gaining very rapid access to the set value and actual value of the drive regulator. This allows the function of the drive to be expanded by complex motion control, technological and control functions. This guarantees rapid and economical applications.

The b maXX drivePLC is fully integrated in the Engineering Framework ProMaster. Here you have access to all applications for the creation of the machine/plant topology, the field bus and I/O configurators as well as applications such as the IEC 61131-3 programming environment PROPROGwt III, the cam disk editor ProCAM and others. A b maXX local drivePLC is available for applications on the local axis.

b maXX Controller PLC – Modular and Safe

The b maXX Controller PLC consistently implements the concept of scalability and modularity for flexible individual adapting by the mechanical engineer. Thus the b maXX PLC02-Safe has extended the standard motion control range by a two-channel safety control system that fulfils the requirements of IEC61508 to SIL3 and EN 13849 to PL e. This is the first certificated EtherCAT Motion Control PLC with integrated safety function.

b maXX-PCC – PC based PLC

The calculation performance of an industrial PC in combination with a powerful PLC supplements the range of control systems with a reliable and innovative platform. It is equipped with components of the highest level of performance and is based on open standards in the fields of automation and IT. Multi-core processor architecture provides decisive advantages for automation solutions: various different functions can be distributed and the calculation performance can be allocated to the various tasks. It therefore not only fulfils the high real-time requirements of calculation-intensive applications in a control system, it also takes on additional tasks such as visualization or IT linking on a platform. Both box and panel versions are available.

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