HIWIN®

Motion Control & Systems

Linear Motors

& Positioning Measurement Systems

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HIWIN®
Motion Control & Systems

Welcome to HIWIN

Alongside complete linear motor axes and linear motor axis systems, HIWIN also offers individual linear motor components for customised axis design. The linear motors consist of the primary part (forcer) with motor windings, and magnet tracks (stators) with permanent magnets. By combining several stators, travel distances of any length can be created. Similarly, several forcers can be operated on one linear motor axis. These can either be independently controlled on the axis, or be connected in parallel to increase feed power.

Linear Motors & Positioning Measurement Systems

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HIWIN®
Motion Control & Systems

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Product overview

1. Product overview

HIWIN LMS linear motors

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- High thrust
- High acceleration
- Stators with sheet metal cover
- Attractive price

HIWIN LMSA linear motors

Page 16

- Highest power density
- Flat design
- High acceleration
- High synchronous run
- Permanent magnets in the stator are cast in epoxy resin

HIWIN LMC linear motors

Page 24

- Extremely dynamic
- No cogging, thus highest synchronous operation
- No magnetic pull in the guiding system
- Optional: Design for vacuum applications

HIWIN LMF/LMFA linear motors

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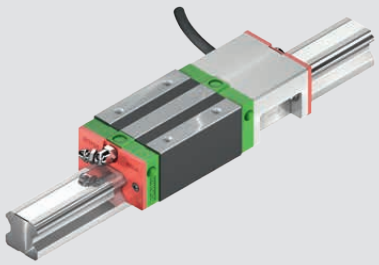
- Efficient cooling system
- Extremely high thrust
- High acceleration
- UL-certified
- High synchronous run



HIWIN MAGIC – magnetic positioning measurement systems

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- Zero contact measurement with 1 V_{PP} or digital output
- Digital resolution of up to 0.5 µm
- Encoder with metal housing and IP67 protection mode
- Signal output in real time

Linear Motors
LMS series

2. HIWIN LMS linear motors

2.1 Special characteristics of the LMS linear motors

The HIWIN LMS synchronous linear motors are the solid all-rounders of linear motors. The proven linear motors in the LMS series stand out for their high thrust and acceleration. The permanent magnets of the secondary parts (stators) are protected by a sheet metal cover. The stators are attractively priced. The benefits of the LMS linear motors make them the preferred choice in the field of dynamic positioning axes in automation systems with long travel distances, e.g. in the packaging industry.

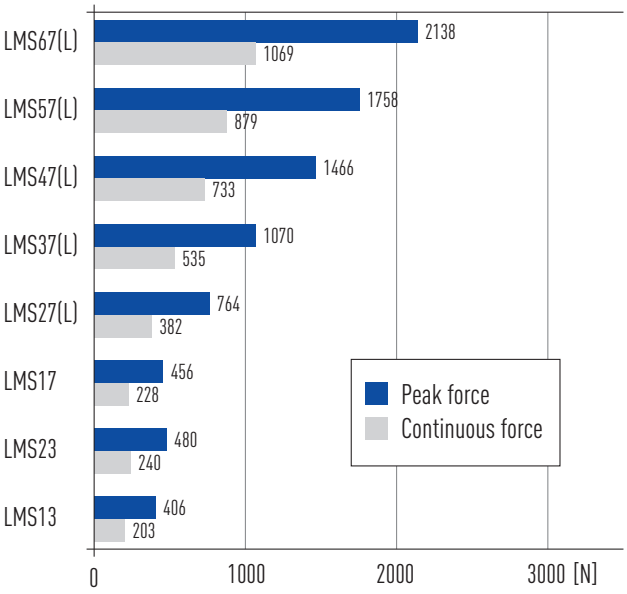
Key features of the LMS linear motor:

- High thrust
- High acceleration
- Stators with sheet metal cover
- Attractive price

Typical fields of application:

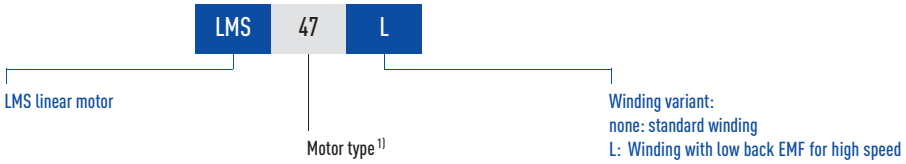
- Automation technology
- Handling
- Packaging

2.2 Force chart for LMS linear motors



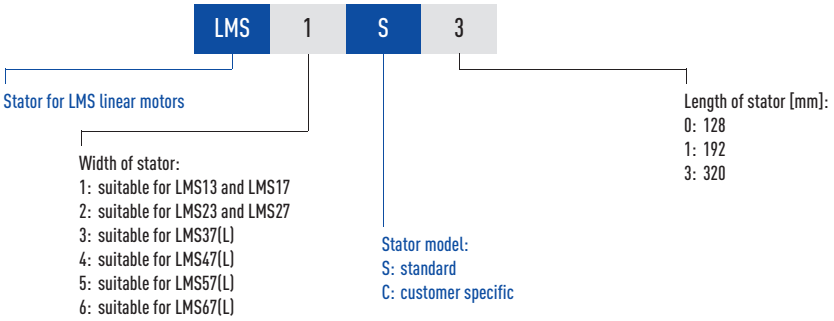
2.3 Order code LMS linear motor

2.3.1 Order code of primary part (forcer)



1) See Table 2.1 (LMS1, LMS2)
Table 2.2 (LMS3, LMS4)
Table 2.3 (LMS5, LMS6)

2.3.2 Order code of magnet track (stator)



2.4 LMS linear motor specifications

2.4.1 LMS1, LMS2 specifications

Force-velocity curves (DC bus voltage: 600 VDC)

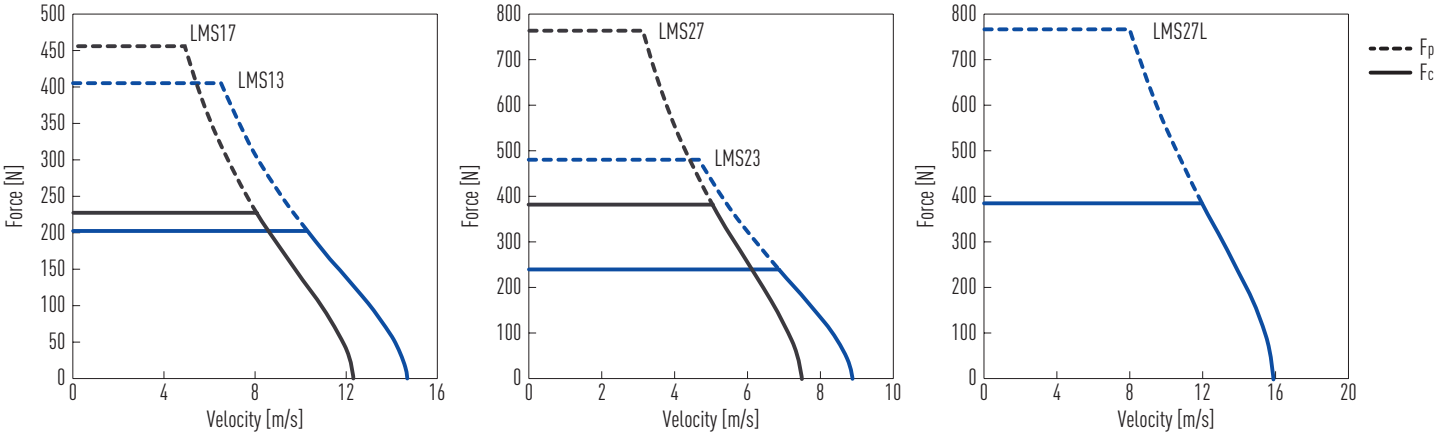


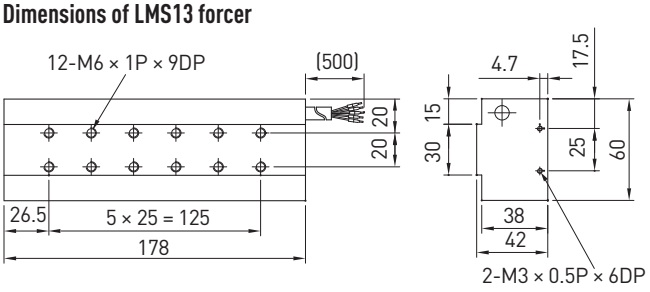
Table 2.1 **Technical data**

	Symbol	Unit	LMS13	LMS17	LMS23	LMS27	LMS27L
Forces and electrical parameters forcer							
Continuous force (at T_{max})	F_c	N	203	228	240	382	382
Continuous current (at T_{max})	I_c	A_{eff}	4.6	3.9	3.9	3.9	7.9
Peak force (for 1 sec.)	F_P	N	406	456	480	764	764
Peak current (for 1 sec.)	I_p	A_{eff}	13.8	11.8	11.8	11.8	23.7
Force constant	K_f	N/A_{eff}	44	58	61	97	46
Attraction force	F_a	N	805	1221	1350	2036	2036
Electrical time constant	K_e	ms	10.4	10.6	10.5	11.3	8.9
Resistance [1)]	R_{25}	Ω	3.1	4.8	4.6	6.8	1.6
Inductance [1)]	L	mH	32.2	50.8	48.4	76.8	14
Back EMF constant	K_u	$V_{eff}/(m/s)$	26	31	43	51	24
Motor constant	K_m	$N/\sqrt{W}$	20.4	21.6	23.2	30.4	31.4
Thermal resistance	R_{th}	°C/W	0.7	0.6	0.7	0.5	0.5
Thermal switch			3 PTC SNM 120 in series				
Max. DC bus voltage		V	600				
Mechanical parameters forcer + stator							
Max. bending radius of motor cable	R_{bend}	mm	69				
Pole pair pitch	2τ	mm	32				
Max. operating temperature	T_{max}	°C	120				
Weight of forcer	M_F	kg	1.8	2.7	2.7	4.1	4.1
Unit mass of stator	M_S	kg/m	4.2	4.2	6.2	6.2	6.2
Width of stator	W_S	mm	60	60	80	80	80
Stator mounting distance	A_S	mm	45	45	65	65	65
Length of stator/Dimension N	L_S	mm	128 mm/N = 2; 192 mm/N = 3; 320 mm/N = 5				
Total height (forcer + stator)	H	mm	55.2	57.4	55.2	57.4	57.4

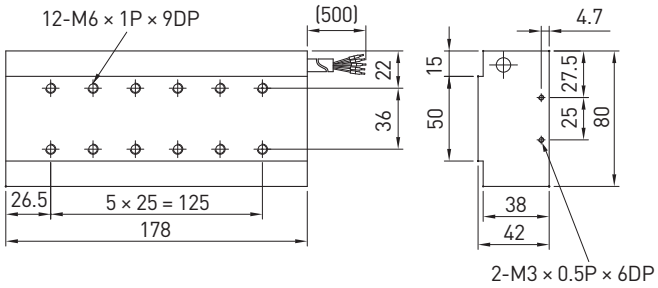
All the specifications in the table (except dimensions) are in ± 10 % of tolerance at 25 °C ambient temperature

[1)] Line to line

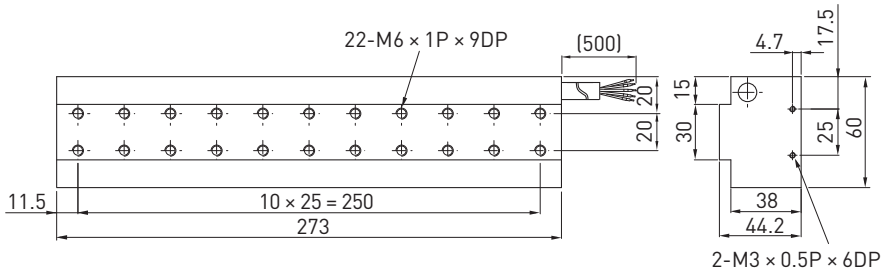
Dimensions of LMS13 forcer



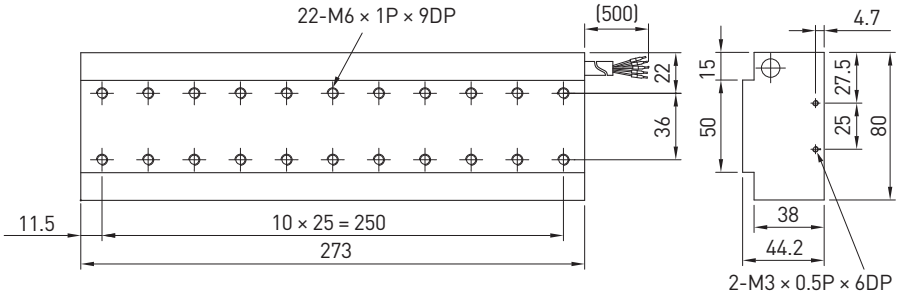
Dimensions of LMS23 forcer



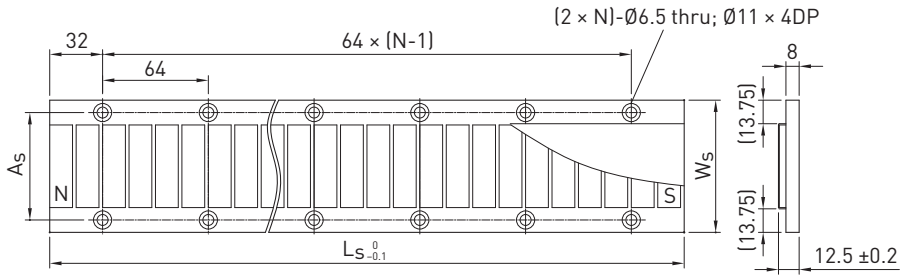
Dimensions of LMS17 forcer



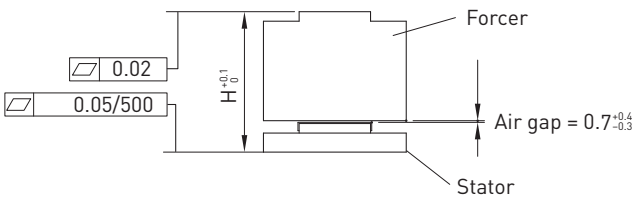
Dimensions of LMS27(L) forcer



Dimensions of stator



Mounting tolerances



2.4.2 LMS3, LMS4 specifications

Force-velocity curves (DC bus voltage: 600 VDC)

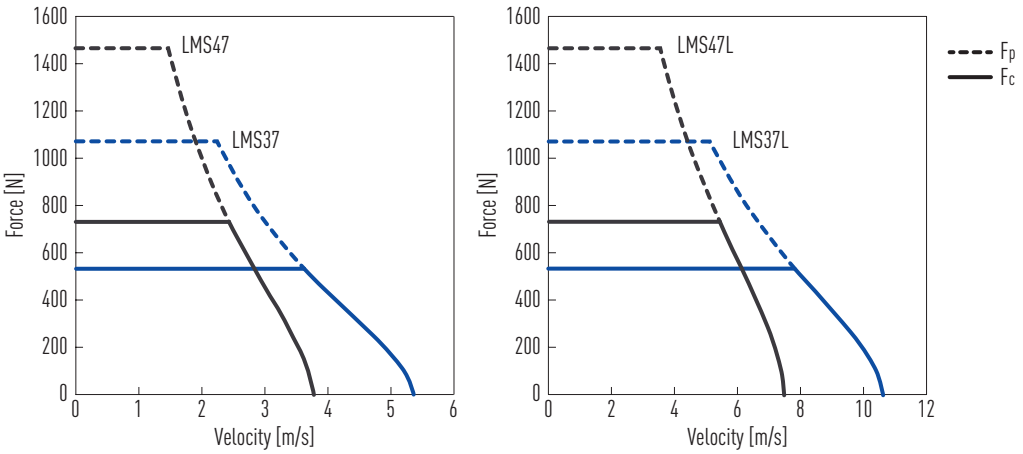


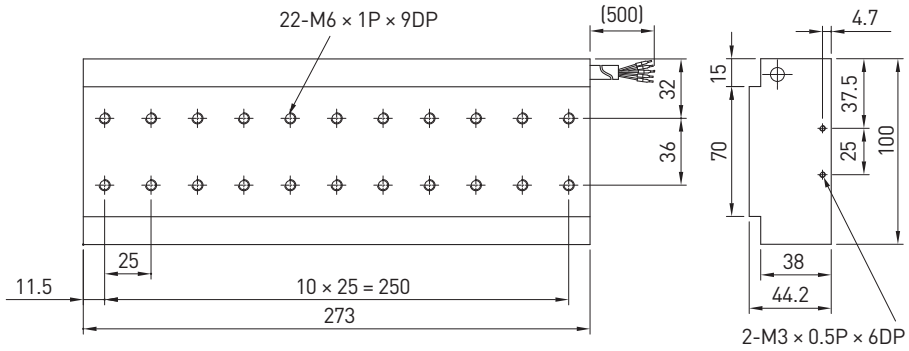
Table 2.2 **Technical data**

	Symbol	Unit	LMS37	LMS37L	LMS47	LMS47L
Forces and electrical parameters forcer						
Continuous force (at T_{max})	F_c	N	535		733	
Continuous current (at T_{max})	I_c	A_{eff}	3.9	7.9	3.9	7.9
Peak force (for 1 sec.)	F_P	N	1070		1466	
Peak current (for 1 sec.)	I_p	A_{eff}	11.8	23.7	11.8	23.7
Force constant	K_f	N/A_{eff}	136	68	186	93
Attraction force	F_a	N	2850		4071	
Electrical time constant	K_e	ms	11.6	11.0	13.0	12.2
Resistance [1)]	R_{25}	Ω	8.9	2.1	11.9	2.7
Inductance [1)]	L	mH	103.4	23.1	154.4	33
Back EMF constant	K_u	$V_{eff}/(m/s)$	71	36	101	51
Motor constant	K_m	$N/\sqrt{W}$	37.2	38.3	44.0	46.2
Thermal resistance	R_{th}	°C/W	0.3	0.4	0.3	0.3
Thermal switch			3 PTC SNM 120 in series			
Max. DC bus voltage		V	600			
Mechanical parameters forcer + stator						
Max. bending radius of motor cable	R_{bend}	mm	69			
Pole pair pitch	2τ	mm	32			
Max. operating temperature	T_{max}	°C	120			
Weight of forcer	M_F	kg	5.9		8	
Unit mass of stator	M_S	kg/m	8.2		11.5	
Width of stator	W_S	mm	100		130	
Stator mounting distance	A_S	mm	85		115	
Length of stator/Dimension N	L_S	mm	128 mm/N = 2; 192 mm/N = 3; 320 mm/N = 5			
Total height (forcer + stator)	H	mm	57.4			

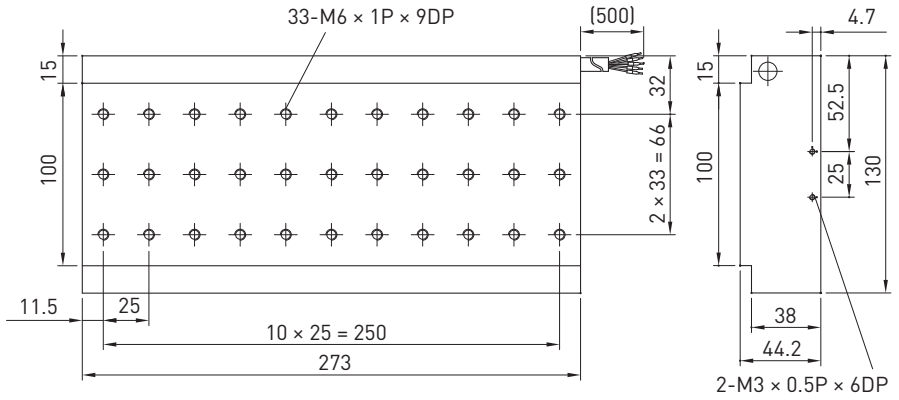
All the specifications in the table (except dimensions) are in ± 10 % of tolerance at 25 °C ambient temperature

[1)] Line to line

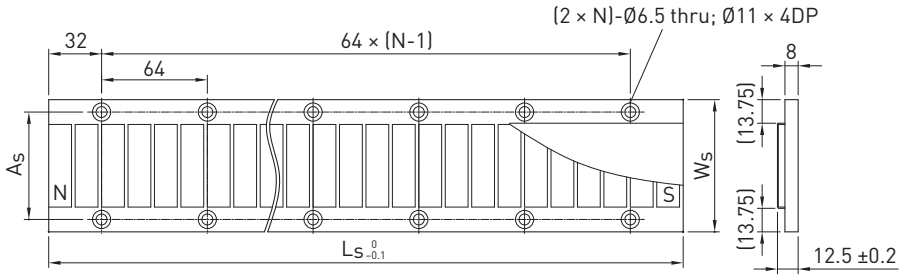
Dimensions of LMS37(L) forcer



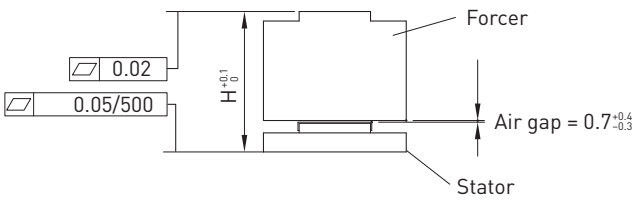
Dimensions of LMS47(L) forcer



Dimensions of stator



Mounting tolerances



2.4.3 LMS5, LMS6 specifications

Force-velocity curves (DC bus voltage: 600 VDC)

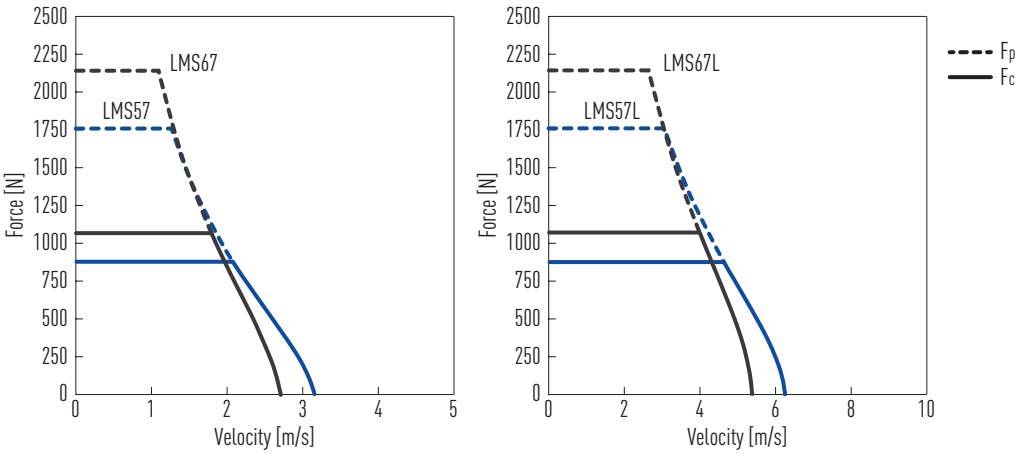


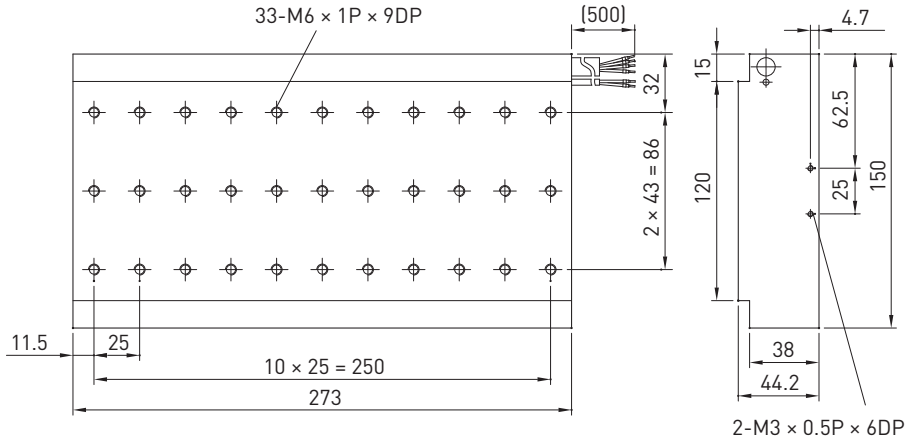
Table 2.3 **Technical data**

	Symbol	Unit	LMS57	LMS57L	LMS67	LMS67L
Forces and electrical parameters forcer						
Continuous force (at T_{max})	F_c	N	879		1069	
Continuous current (at T_{max})	I_c	A_{eff}	3.9	7.9	3.9	7.9
Peak force (for 1 sec.)	F_P	N	1758		2138	
Peak current (for 1 sec.)	I_p	A_{eff}	11.8	23.7	11.8	23.7
Force constant	K_f	N/A_{eff}	223	112	271	136
Attraction force	F_a	N	4885		5700	
Electrical time constant	K_e	ms	12.4	12.0	12.4	12.6
Resistance [1)]	R_{25}	Ω	13.8	3.1	15.4	3.4
Inductance [1)]	L	mH	170.8	37.3	190.7	43
Back EMF constant	K_u	$V_{eff}/(m/s)$	121	61	141	71
Motor constant	K_m	$N/\sqrt{W}$	49.0	51.6	56.4	60.2
Thermal resistance	R_{th}	°C/W	0.2	0.2	0.2	0.2
Thermal switch			3 PTC SNM 120 in series			
Max. DC bus voltage		V	600			
Mechanical parameters forcer + stator						
Max. bending radius of motor cable	R_{bend}	mm	69			
Pole pair pitch	2τ	mm	32			
Max. operating temperature	T_{max}	°C	120			
Weight of forcer	M_F	kg	9.4		10.8	
Unit mass of stator	M_S	kg/m	13.7		15.9	
Width of stator	W_S	mm	150		170	
Stator mounting distance	A_S	mm	135		155	
Length of stator/Dimension N	L_S	mm	128 mm/N = 2; 192 mm/N = 3; 320 mm/N = 5			
Total height (forcer + stator)	H	mm	57.4			

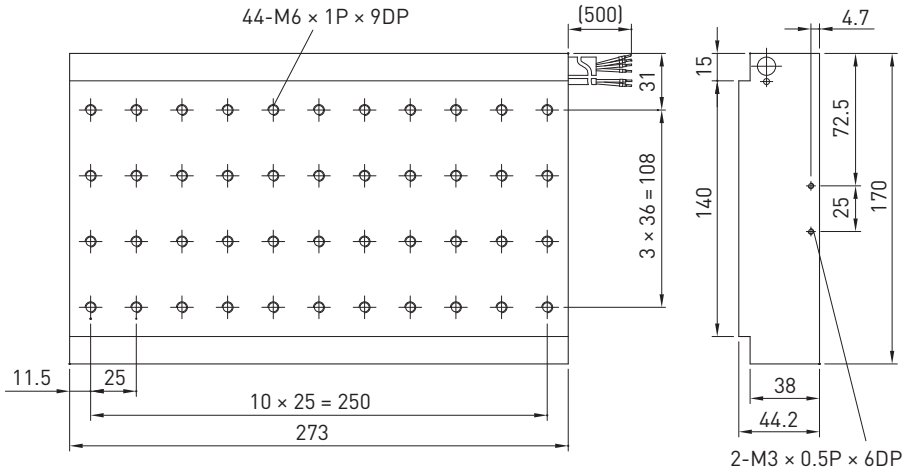
All the specifications in the table (except dimensions) are in ± 10 % of tolerance at 25 °C ambient temperature

[1)] Line to line

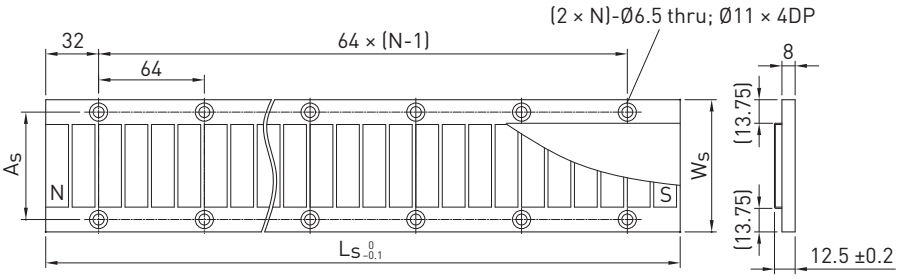
Dimensions of LMS57(L) forcer



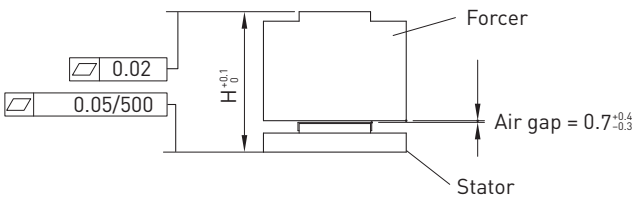
Dimensions of LMS67(L) forcer



Dimensions of stator



Mounting tolerances



Linear motors
LMSA series

3. HIWIN LMSA linear motors

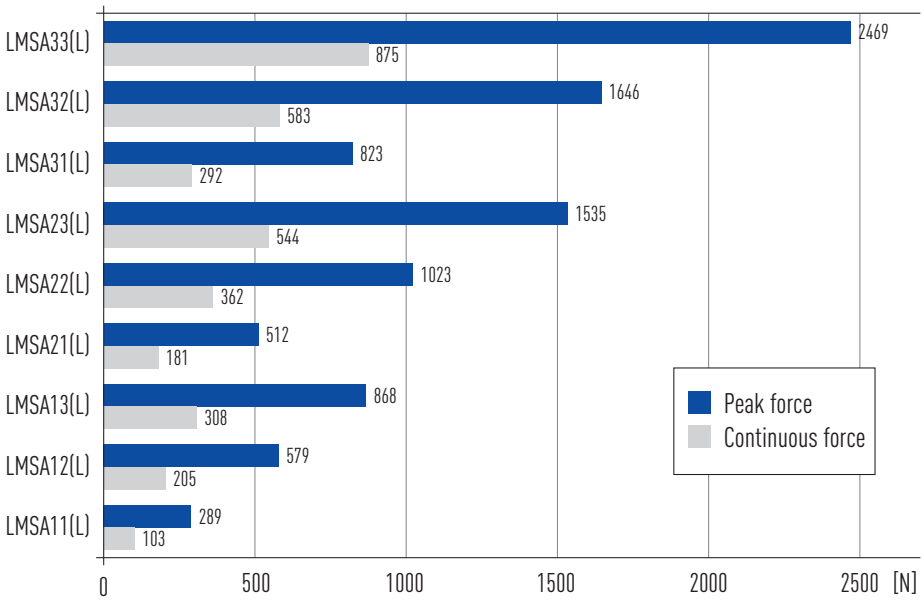
3.1 Special characteristics of the LMSA linear motors

The HIWIN LMSA synchronous linear motors are the compact power packs of linear actuators. The linear motors in the LMSA series stand out for their extremely high power density and very flat design. Due to their low motor mass, the actuators can be operated in a highly dynamic manner. A high synchronous operation is achieved through the optimised configuration of the permanent magnets in the stator. The benefits of the LMSA linear motors make them the preferred choice in fields with limited installation space and high feed thrust requirements.

Key features of the LMSA linear motor:
- Highest power density
- Flat design
- High acceleration
- High synchronous run
- Permanent magnets in the stator are cast in epoxy resin

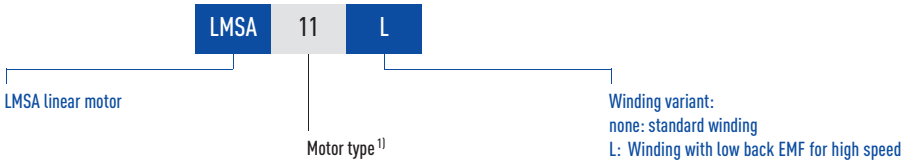
Typical fields of application:
- Semiconductors
- Compact multi-axis systems
- Measuring technology

3.2 Force chart for LMSA linear motors



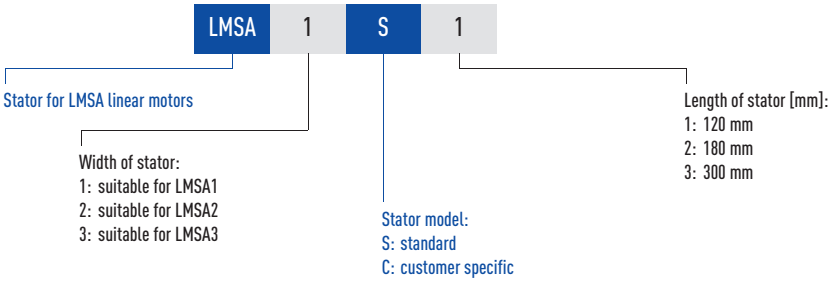
3.3 Order code LMSA linear motor

3.3.1 Order code of primary part (forcer)



1) See Table 3.1 (LMSA1)
Table 3.2 (LMSA2)
Table 3.3 (LMSA3)

3.3.2 Order code of magnet track (stator)



3.4 LMSA linear motor specifications

3.4.1 LMSA1 specifications

Force-velocity curves (DC bus voltage: 600 VDC)

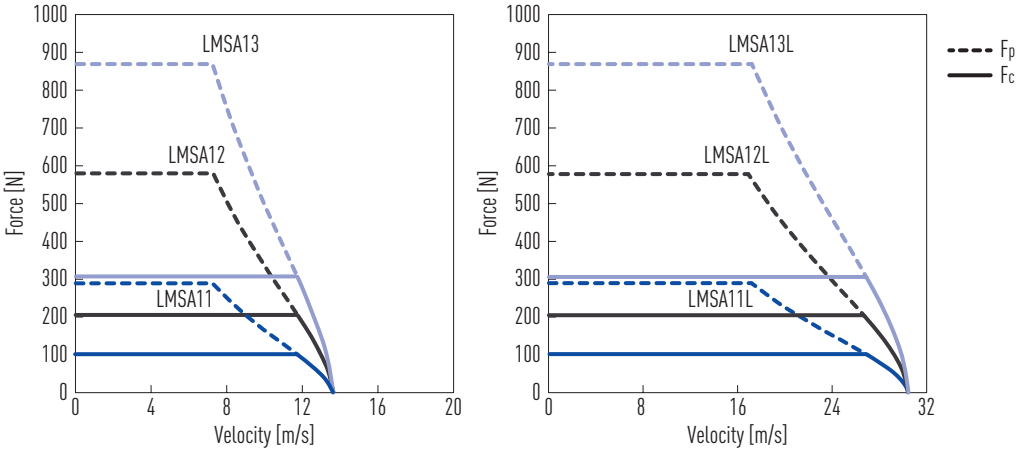


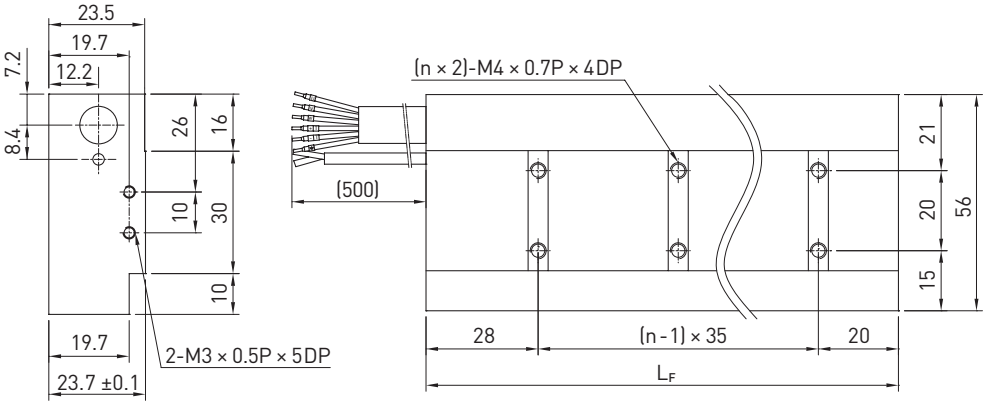
Table 3.1 **Technical data**

	Symbol	Unit	LMSA11	LMSA11L	LMSA12	LMSA12L	LMSA13	LMSA13L
Forces and electrical parameters forcer								
Continuous force (at T_{max})	F_c	N	103		205		308	
Continuous current (at T_{max})	I_c	A_{eff}	2.1	4.7	4.2	9.4	6.3	14.1
Peak force (for 1 sec.)	F_P	N	289		579		868	
Peak current (for 1 sec.)	I_p	A_{eff}	6.3	14.1	12.7	28.3	19.0	42.4
Force constant	K_f	N/A_{eff}	48.6	21.7	48.6	21.7	48.6	21.7
Attraction force	F_a	N	770		1540		2310	
Electrical time constant	K_e	ms	4.4	4.3	4.5	4.1	4.4	4.0
Resistance [1)]	R_{25}	Ω	8.4	1.7	4.1	0.9	2.8	0.6
Inductance [1)]	L	mH	37.1	7.3	18.5	3.7	12.4	2.4
Back EMF constant	K_u	$V_{eff}/(m/s)$	28.1	12.6	28.1	12.6	28.1	12.6
Motor constant	K_m	$N/\sqrt{W}$	13.7	13.6	19.6	18.7	23.7	22.9
Thermal resistance	R_{th}	°C/W	1.23		0.63		0.41	
Thermal switch			3 PTC SNM 120 in series					
Max. DC bus voltage		V	600					
Mechanical parameters forcer + stator								
Max. bending radius of motor cable	R_{bend}	mm	69					
Pole pair pitch	2τ	mm	30					
Max. operating temperature	T_{max}	°C	120					
Mounting holes (forcer)	n		3		6		9	
Weight of forcer	M_F	kg	0.7		1.4		2.1	
Length of forcer	L_F	mm	118		223		328	
Unit mass of stator	M_S	kg/m	2.7					
Length of stator/Dimension N	L_S	mm	120 mm/N = 2; 180 mm/N = 3; 300 mm/N = 5					
Total height (forcer + stator)	H	mm	34					

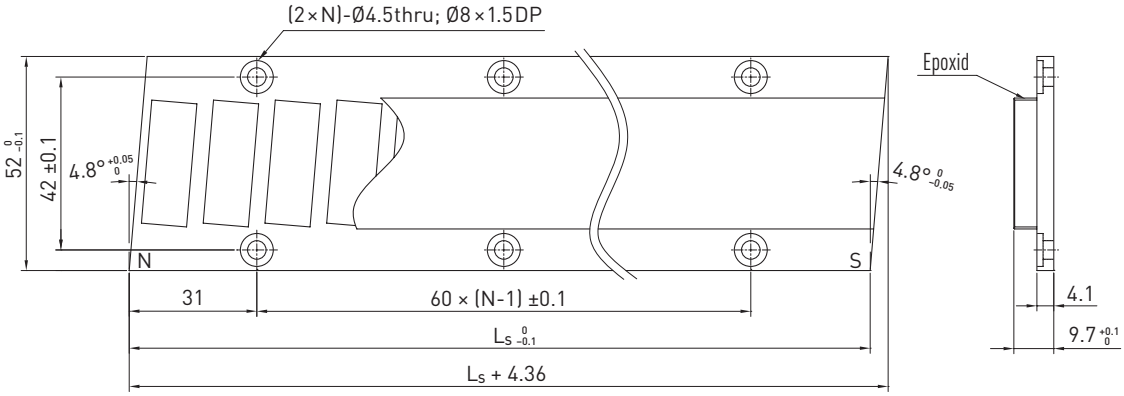
All the specifications in the table (except dimensions) are in ± 10 % of tolerance at 25 °C ambient temperature

[1)] Line to line

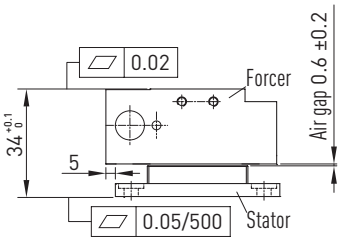
Dimensions of forcer



Dimensions of stator



Mounting tolerances



3.4.2 LMSA2 specifications

Force-velocity curves (DC bus voltage: 600 VDC)

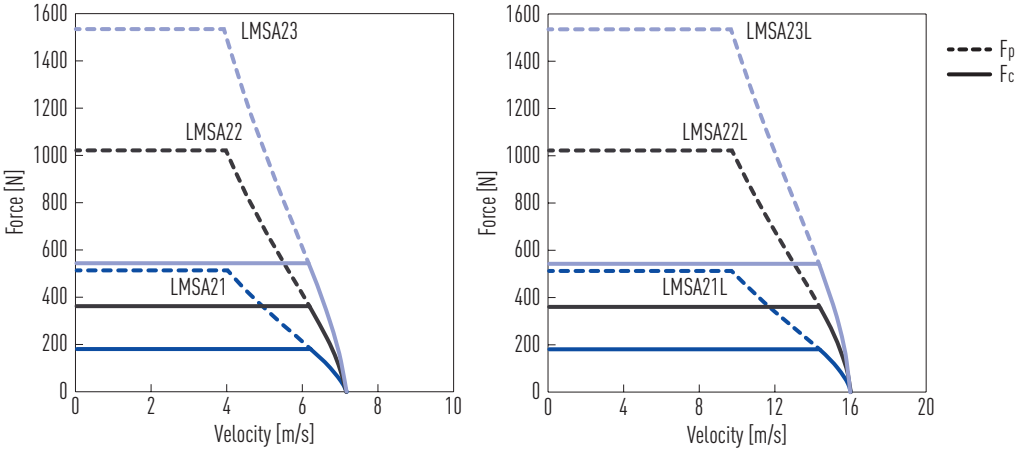


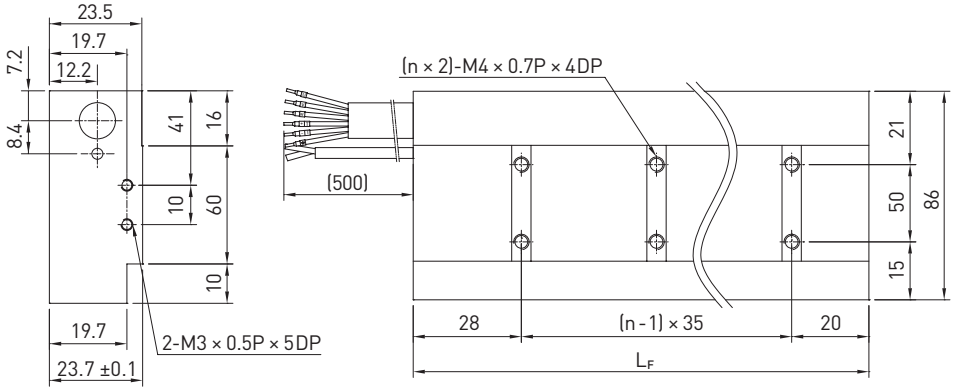
Table 3.2 **Technical data**

	Symbol	Unit	LMSA21	LMSA21L	LMSA22	LMSA22L	LMSA23	LMSA23L
Forces and electrical parameters forcer								
Continuous force (at T_{max})	F_c	N	181		362		544	
Continuous current (at T_{max})	I_c	A_{eff}	2.0	4.4	3.9	8.8	5.9	13.1
Peak force (for 1 sec.)	F_P	N	512		1023		1535	
Peak current (for 1 sec.)	I_p	A_{eff}	5.9	13.1	11.8	26.3	17.6	39.4
Force constant	K_f	N/A_{eff}	92.5	41.4	92.5	41.4	92.5	41.4
Attraction force	F_a	N	1288		2576		3864	
Electrical time constant	K_e	ms	4.6	4.6	4.9	4.6	4.9	4.8
Resistance [1)]	R_{25}	Ω	13.8	2.8	6.8	1.4	4.6	0.9
Inductance [1)]	L	mH	64.0	12.8	33.0	6.4	22.4	4.3
Back EMF constant	K_u	$V_{eff}/(m/s)$	53.4	23.9	53.4	23.9	53.4	23.9
Motor constant	K_m	$N/\sqrt{W}$	20.3	20.2	28.9	28.6	35.2	35.6
Thermal resistance	R_{th}	°C/W	0.87		0.44		0.29	
Thermal switch			3 PTC SNM 120 in series					
Max. DC bus voltage		V	600					
Mechanical parameters forcer + stator								
Max. bending radius of motor cable	R_{bend}	mm	69					
Pole pair pitch	2τ	mm	30					
Max. operating temperature	T_{max}	°C	120					
Mounting holes (forcer)	n		3		6		9	
Weight of forcer	M_F	kg	1.1		2.2		3.3	
Length of forcer	L_F	mm	118		223		328	
Unit mass of stator	M_S	kg/m	4.8					
Length of stator/Dimension N	L_S	mm	120 mm/N = 2; 180 mm/N = 3; 300 mm/N = 5					
Total height (forcer + stator)	H	mm	34					

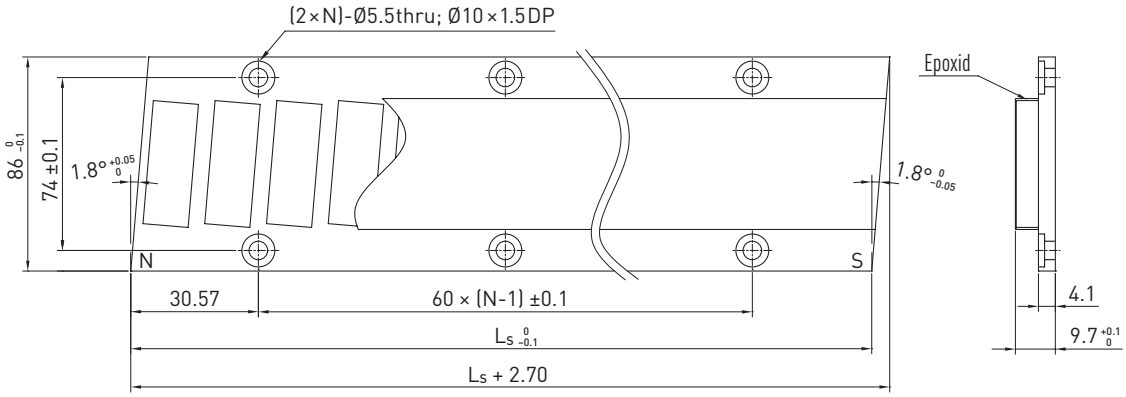
All the specifications in the table (except dimensions) are in ± 10 % of tolerance at 25 °C ambient temperature

[1)] Line to line

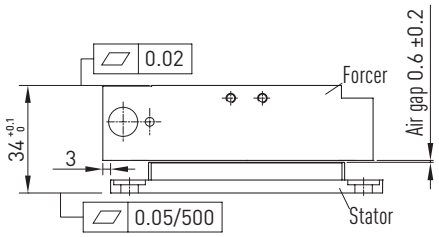
Dimensions of forcer



Dimensions of stator



Mounting tolerances



3.4.3 LMSA3 specifications

Force-velocity curves (DC bus voltage: 600 VDC)

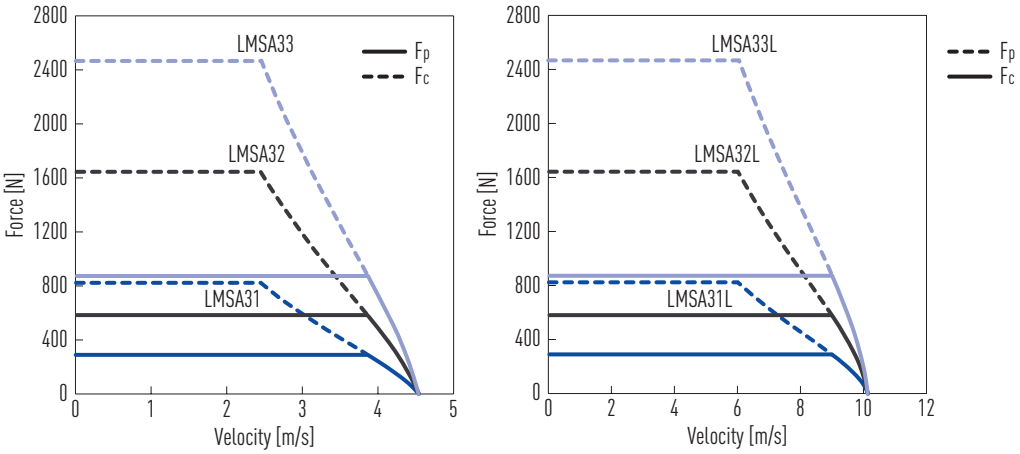


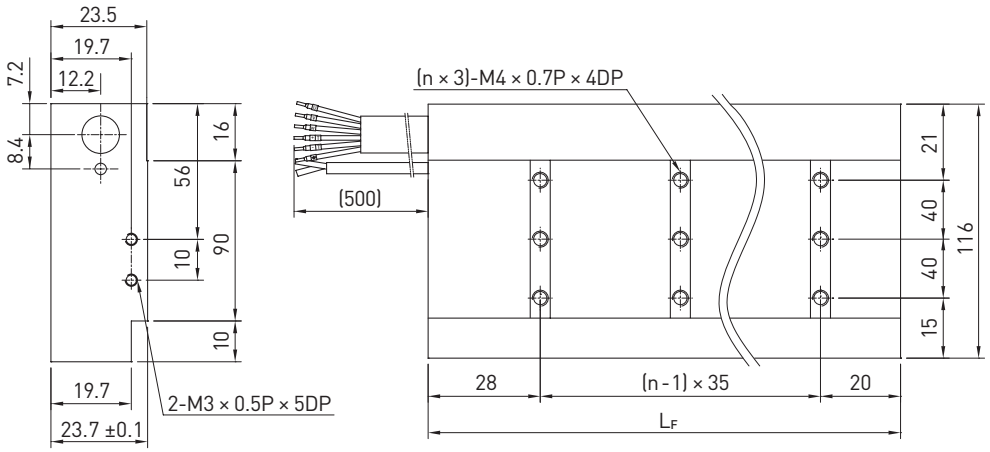
Table 3.3 **Technical data**

	Symbol	Unit	LMSA31	LMSA31L	LMSA32	LMSA32L	LMSA33	LMSA33L
Forces and electrical parameters forcer								
Continuous force (at T_{max})	F_c	N	292		583		875	
Continuous current (at T_{max})	I_c	A_{eff}	2.0	4.5	4.0	8.9	6.0	13.4
Peak force (for 1 sec.)	F_P	N	823		1646		2469	
Peak current (for 1 sec.)	I_p	A_{eff}	6.0	13.4	12.0	26.8	18.0	40.2
Force constant	K_f	N/A_{eff}	145.8	65.2	145.8	65.2	145.8	65.2
Attraction force	F_a	N	2120		4240		6360	
Electrical time constant	K_e	ms	4.9	4.9	4.9	4.9	4.9	5.0
Resistance [1)]	R_{25}	Ω	19.2	4.0	9.6	2.0	6.4	1.3
Inductance [1)]	L	mH	94.1	19.6	47.1	9.8	31.3	6.5
Back EMF constant	K_u	$V_{eff}/(m/s)$	84.2	37.7	84.2	37.7	84.2	37.7
Motor constant	K_m	$N/\sqrt{W}$	27.2	26.6	38.4	37.7	47.0	46.7
Thermal resistance	R_{th}	°C/W	0.60		0.30		0.20	
Thermal switch			3 PTC SNM 120 in series					
Max. DC bus voltage		V	600					
Mechanical parameters forcer + stator								
Max. bending radius of motor cable	R_{bend}	mm	69					
Pole pair pitch	2τ	mm	30					
Max. operating temperature	T_{max}	°C	120					
Mounting holes (forcer)	n		3		6		9	
Weight of forcer	M_F	kg	1.9		3.8		5.7	
Length of forcer	L_F	mm	118		223		328	
Unit mass of stator	M_S	kg/m	8.5					
Length of stator/Dimension N	L_S	mm	120 mm/N = 2. 180 mm/N = 3. 300 mm/N = 5					
Total height (forcer + stator)	H	mm	36					

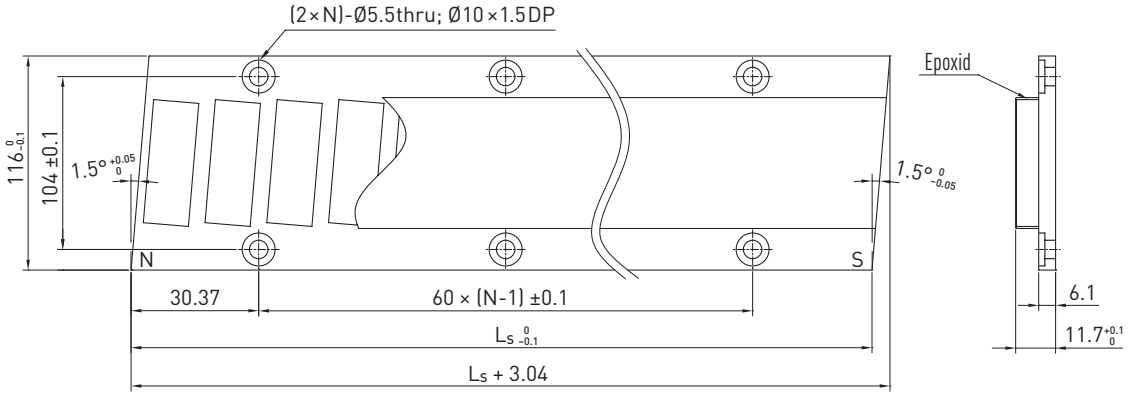
All the specifications in the table (except dimensions) are in ± 10 % of tolerance at 25 °C ambient temperature

[1)] Line to line

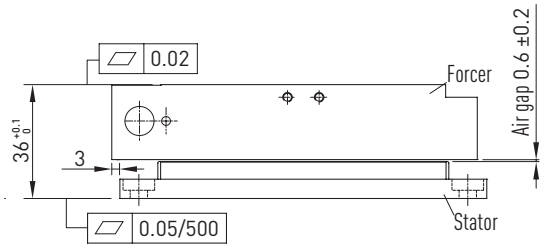
Dimensions of forcer



Dimensions of stator



Mounting tolerances



Linear Motors
LMC series

4. HIWIN LMC linear motors

4.1 Special characteristics of the LMC linear motors

The HIWIN LMC synchronous linear motors are the dynamic sprinters of linear actuators. With the light, ironless forcer and the U-shaped design of the stators with opposing magnets, no cogging torques occur between forcers and stators, and no magnetic forces are introduced into the guiding system. The linear motors in the LMC series thus achieve extremely high synchronism and high acceleration due to the minimal forcer mass. The LMC linear motors are optionally available as a vacuum system. The benefits of the LMC linear motors make them the preferred choice in fields where small masses with a maximum number of cycles need to be positioned very precisely. Due to their very high synchronism, the LMC linear motors are also suitable for application in testing and measuring machines.

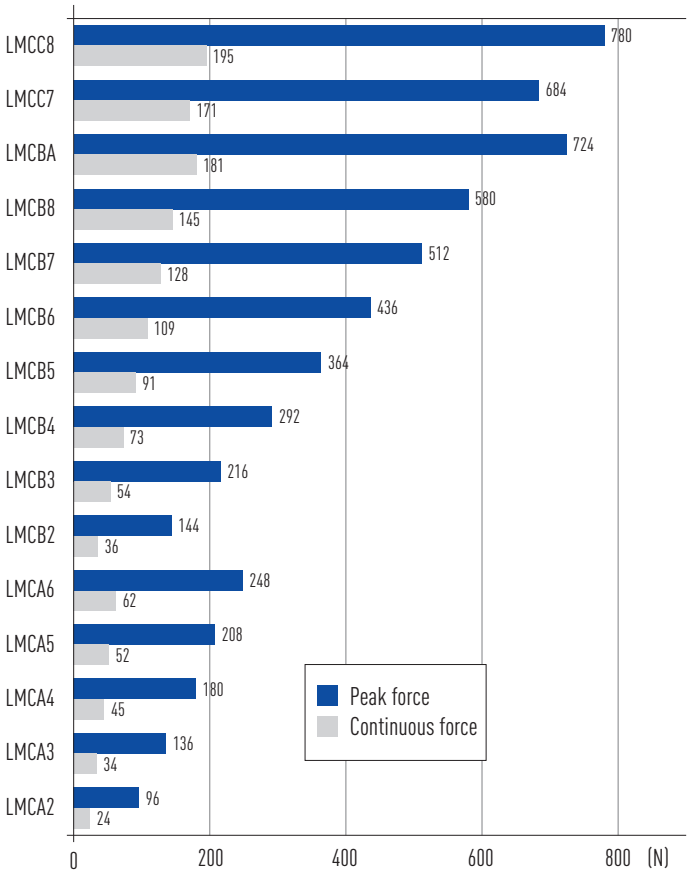
Key features of the LMC linear motor:

- Extremely dynamic
- No cogging, thus highest synchronous operation
- No magnetic pull in the guiding system
- Optional: design for vacuum applications

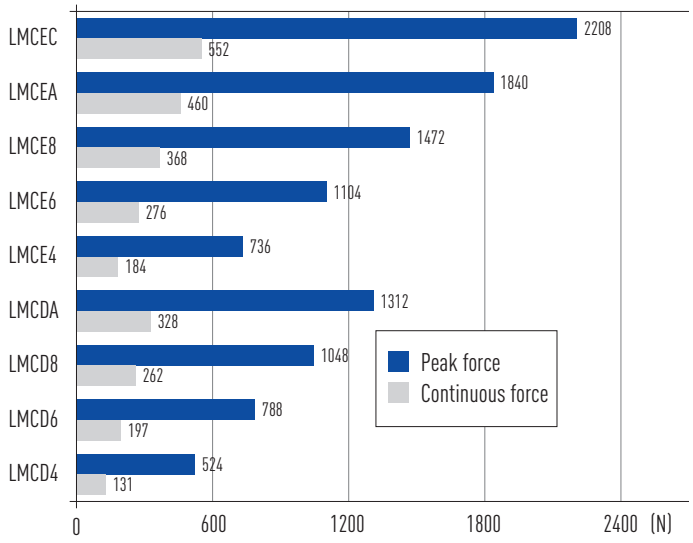
Typical fields of application:

- Pick-and-place machines in semiconductor technology
- Air bearing axes
- Wafer structuring
- Pick-and-place machines
- High-precision measuring and testing machines
- Semiconductors

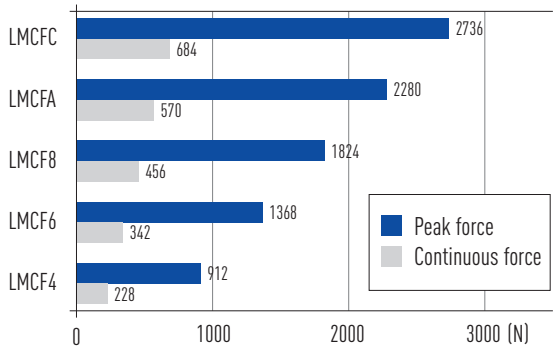
4.2 Force chart for LMC linear motors



Force chart for LMCA, LMCB, LMCC



Force chart for LMCD, LMCE



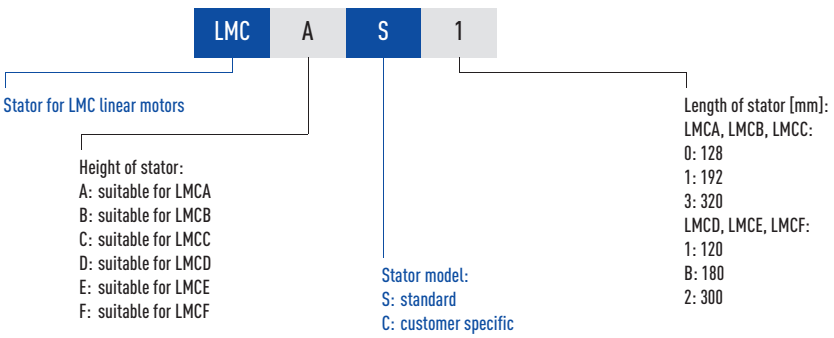
Force chart for LMCF

4.3 Order code LMC linear motor

4.3.1 Order code of primary part (forcer)

1) See Table 4.1 (LMCA, LMCB, LMCC), Table 4.2 (LMCD, LMCE), Table 4.3 (LMCF)

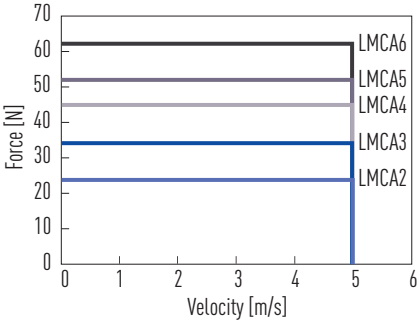
4.3.2 Order code of magnet track (stator)

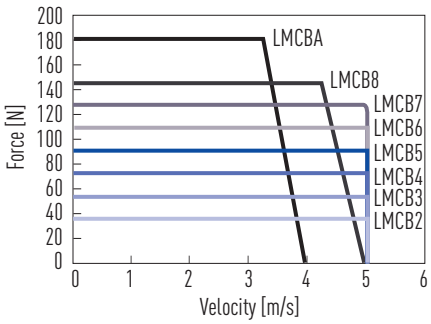


4.4 LMC specifications

4.4.1 LMCA, LMCB, LMCC specifications

Force-velocity curves (DC bus voltage: 330 VDC)





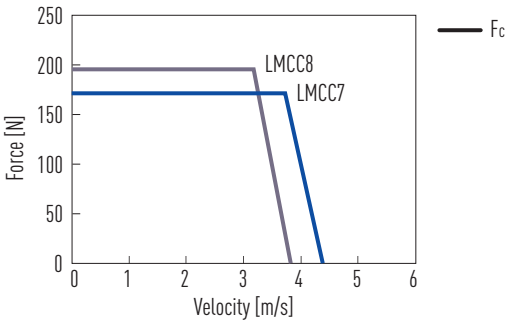


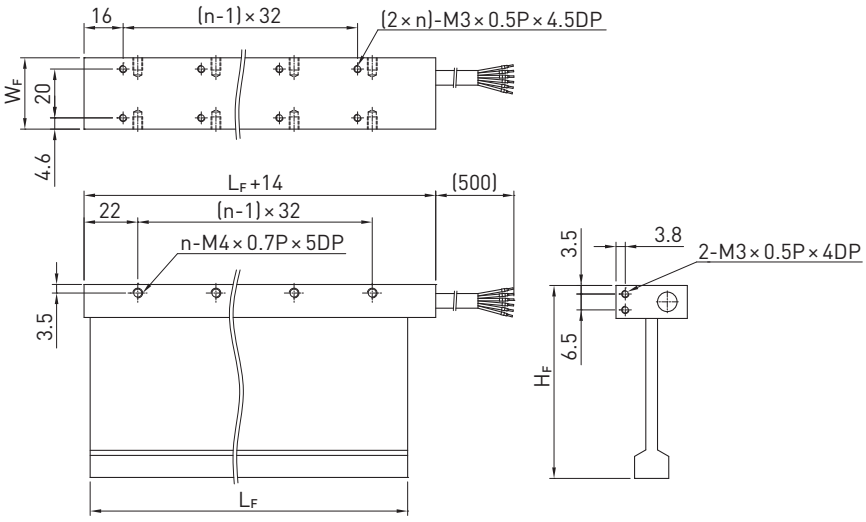
Table 4.1 **Technical data**

	Symbol	Unit	LMCA2	LMCA3	LMCA4	LMCA5	LMCA6	LMCB2	LMCB3	LMCB4	LMCB5	LMCB6	LMCB7	LMCB8	LMCBA	LMCC7	LMCC8
Forces and electrical parameters																	
Continuous force (at T_{max})	F_c	N	24	34	45	52	62	36	54	73	91	109	128	145	181	171	195
Continuous current (at T_{max})	I_c	A_{eff}	2.3	2.1	2.1	1.8	1.8	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Peak force (for 1 sec.)	F_p	N	96	136	180	208	248	144	216	292	364	436	512	580	724	684	780
Peak current (for 1 sec.)	I_p	A_{eff}	9.2	8.4	8.4	7.2	7.2	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0
Force constant	K_f	N/A_{eff}	10.6	15.8	21.2	28.2	33.8	18.1	27.2	36.3	45.4	54.5	63.5	72.5	90.6	85.4	97.5
Electrical time constant	K_e	ms	0.4	0.3	0.3	0.3	0.3	0.4	0.4	0.4	0.4	0.4	0.3	0.3	0.3	0.3	0.3
Resistance [1]	R_{25}	Ω	2.7	4.1	5.4	6.7	8.2	3.6	5.4	7.1	9.0	10.7	12.6	14.6	17.9	15.8	18.2
Inductance [1]	L	mH	1.0	1.4	1.9	2.3	2.8	1.4	1.9	2.6	3.2	3.8	4.4	5.0	6.2	5.5	6.3
Back EMF constant	K_u	$V_{eff}/(m/s)$	5.9	8.8	11.9	14.5	17.4	10.1	15.2	20.0	24.8	29.3	34.7	40.0	50.0	45.4	51.9
Motor constant	K_m	$N/\sqrt{W}$	5.2	6.5	7.5	9.1	9.8	7.7	9.5	11.2	12.4	13.6	14.7	15.5	17.5	17.6	18.7
Thermal resistance	R_{th}	°C/W	2.80	2.21	1.68	1.84	1.50	2.77	1.85	1.41	1.11	0.93	0.79	0.68	0.56	0.63	0.55
Thermal switch			3 PTC SNM 100 in series														
Max. DC bus voltage		V	330														
Mechanical parameters																	
Max. bending radius of motor cable	R_{bend}	mm	37.5														
Pole pair pitch	2τ	mm	32														
Max. operating temperature	T_{max}	°C	100														
Mounting holes (forcer)	n		2	3	4	5	6	2	3	4	5	6	7	8	10	7	8
Weight of forcer	M_F	kg	0.15	0.23	0.31	0.38	0.45	0.2	0.29	0.38	0.48	0.58	0.68	0.72	0.88	0.74	0.76
Width of forcer	W_F	mm	29.2													29.2	
Length of forcer	L_F	mm	66	98	130	162	194	66	98	130	162	194	226	258	322	226	258
Height of forcer	H_F	mm	59					79								99	
Unit mass of stator	M_S	kg/m	7					12								21	
Width of stator	W_S	mm	31.2													35.2	
Length of stator/Dimension N	L_S	mm	128 mm/N = 2; 192 mm/N = 3; 320 mm/N = 5														
Height of stator	H_S	mm	60					80								103	
Total height (forcer + stator)	H	mm	74.5					94.5								117.5	

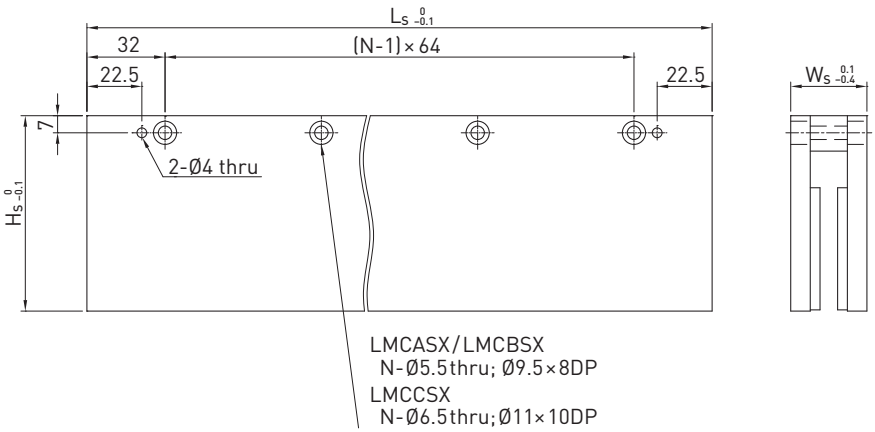
All the specifications in the table (except dimensions) are in ± 10 % of tolerance at 25 °C ambient temperature

[1] Line to line

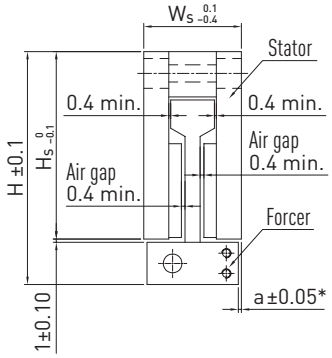
Dimensions of forcer



Dimensions of stator



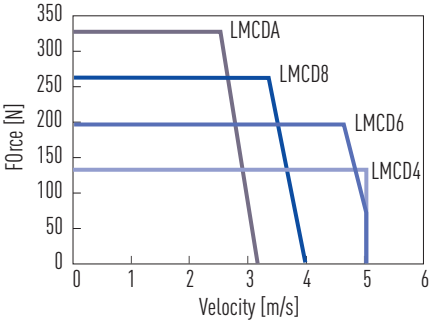
Mounting tolerances



*LMCA, LMCB: a = 1
*LMCC: a = 3

4.4.2 LMCD, LMCE specifications

Force-velocity curves (DC bus voltage: 330 VDC)



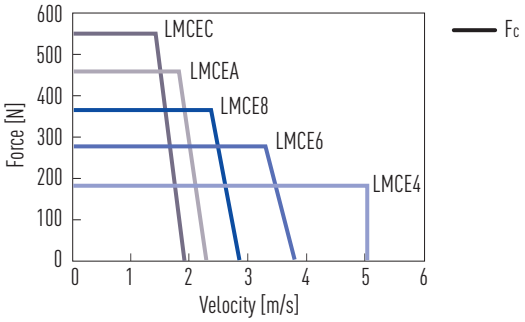


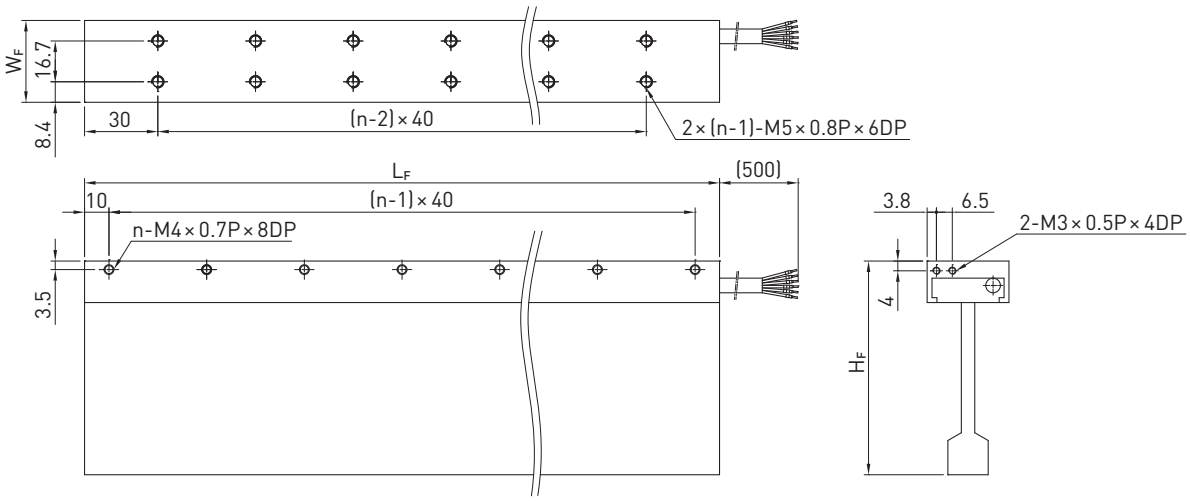
Table 4.2 **Technical data**

	Symbol	Unit	LMCD4	LMCD6	LMCD8	LMCDA	LMCE4	LMCE6	LMCE8	LMCEA	LMCEC
Forces and electrical parameters											
Continuous force (at T_{max})	F_c	N	131	197	262	328	184	276	368	460	552
Continuous current (at T_{max})	I_c	A_{eff}	3.25	3.25	3.25	3.25	3.25	3.25	3.25	3.25	3.25
Peak force (for 1 sec.)	F_p	N	524	788	1048	1312	736	1104	1472	1840	2208
Peak current (for 1 sec.)	I_p	A_{eff}	13	13	13	13	13	13	13	13	13
Force constant	K_f	N/A_{eff}	40.3	60.6	80.6	100.9	56.6	84.9	113.2	141.5	169.8
Electrical time constant	K_e	ms	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
Resistance [1]	R_{25}	Ω	4.6	7.1	9.0	11.6	5.6	8.4	11.0	13.8	16.7
Inductance [1]	L	mH	2.3	3.5	4.7	5.8	2.9	4.4	5.9	7.3	8.8
Back EMF constant	K_u	$V_{eff}/(m/s)$	25	38	50	63	35	53	70	88	106
Motor constant	K_m	$N/\sqrt{W}$	14.6	17.8	20.0	22.2	19.1	23.4	27.0	30.2	33.2
Thermal resistance	R_{th}	°C/W	0.82	0.53	0.42	0.33	0.68	0.45	0.34	0.27	0.23
Thermal switch			3 PTC SNM 100 in series								
Max. DC bus voltage		V	330								
Mechanical parameters											
Max. bending radius of motor cable	R_{bend}	mm	37.5								
Pole pair pitch	2τ	mm	60								
Max. operating temperature	T_{max}	°C	100								
Mounting holes (forcer)	n		7	10	13	16	7	10	13	16	19
Weight of forcer	M_F	kg	0.88	1.32	1.76	2.20	1.23	1.84	2.46	3.08	3.70
Width of forcer	W_F	mm	33.5								
Length of forcer	L_F	mm	260	380	500	620	260	380	500	620	740
Height of forcer	H_F	mm	87.5				107.5				
Unit mass of stator	M_S	kg/m	16				20				
Width of stator	W_S	mm	35.5								
Length of stator/Dimension N	L_S	mm	120 mm/N = 2; 180 mm/N = 3; 300 mm/N = 5								
Height of stator	H_S	mm	86.8				106.8				
Total height (forcer + stator)	H	mm	105				125				

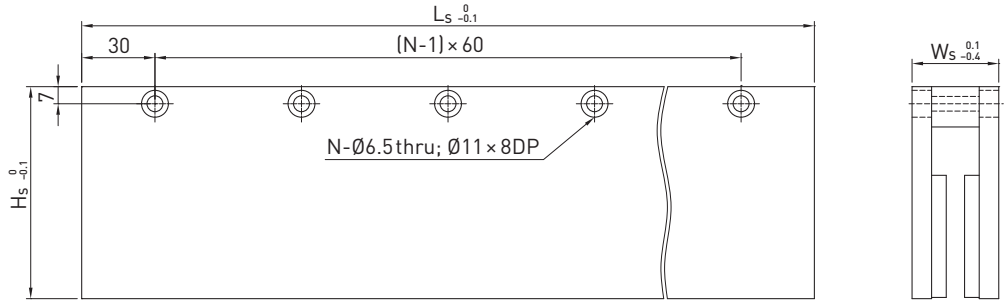
All the specifications in the table (except dimensions) are in ± 10 % of tolerance at 25 °C ambient temperature

[1] Line to line

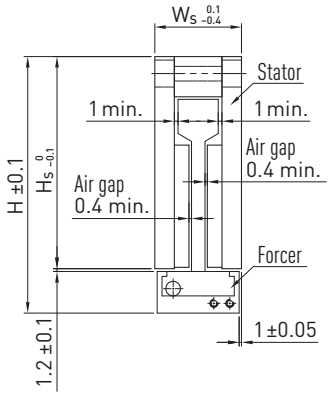
Dimensions of forcer



Dimensions of stator



Mounting tolerances



4.4.3 LMCF specifications

Force-velocity curve (DC bus voltage: 330 VDC)

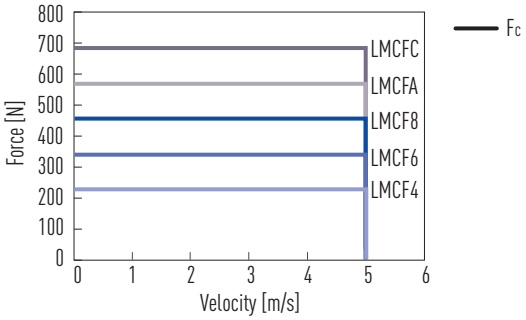


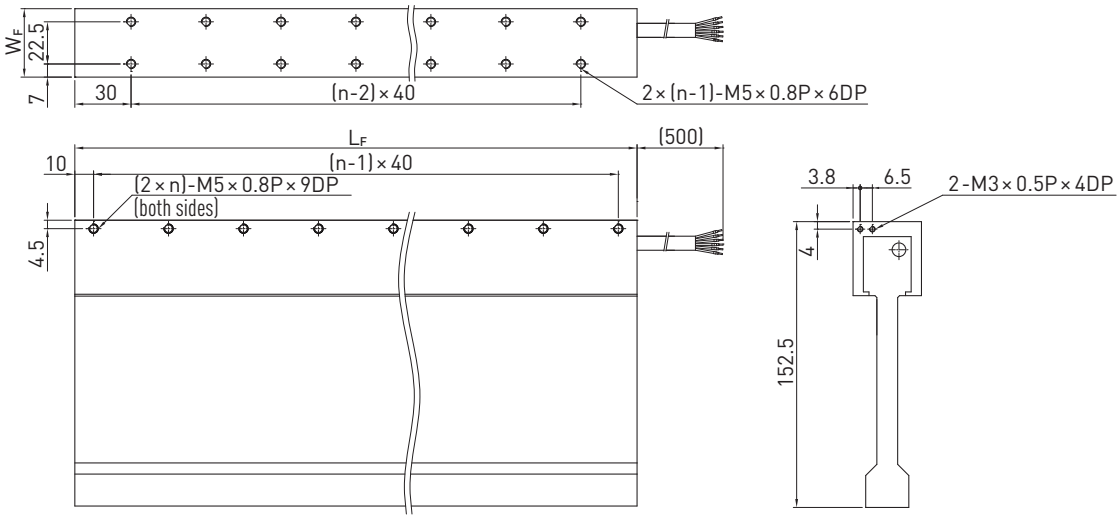
Table 4.3 **Technical data**

	Symbol	Unit	LMCF4	LMCF6	LMCF8	LMCFA	LMCFC
Forces and electrical parameters							
Continuous force (at T_{max})	F_c	N	228	342	456	570	684
Continuous current (at T_{max})	I_c	A_{eff}	3.8	5.7	7.6	9.5	11.4
Peak force (for 1 sec.)	F_p	N	912	1368	1824	2280	2736
Peak current (for 1 sec.)	I_p	A_{eff}	15.2	22.8	30.4	38.0	45.6
Force constant	K_f	N/A_{eff}	60	60	60	60	60
Electrical time constant	K_e	ms	1	1	1	1	1
Resistance [1)]	R_{25}	Ω	3.3	2.2	1.7	1.3	1.1
Inductance [1)]	L	mH	3.3	2.2	1.7	1.3	1.1
Back EMF constant	K_u	$V_{eff}/(m/s)$	34.4	34.4	34.4	34.4	34.4
Motor constant	K_m	$N/\sqrt{W}$	27.0	33.0	37.7	43.0	46.2
Thermal resistance	R_{th}	°C/W	0.84	0.56	0.41	0.34	0.27
Thermal switch			3 PTC SNM 100 in series				
Max. DC bus voltage		V	330				
Mechanical parameters							
Max. bending radius of motor cable	R_{bend}	mm	57.5				
Pole pair pitch	2τ	mm	60				
Max. operating temperature	T_{max}	°C	100				
Mounting holes (forcer)	n		7	10	13	16	19
Weight of forcer	M_F	kg	2.5	3.75	5	6.25	7.5
Width of forcer	W_F	mm	36.5				
Length of forcer	L_F	mm	260	380	500	620	740
Height of forcer	H_F	mm	152.5				
Unit mass of stator	M_S	kg/m	25.6				
Width of stator	W_S	mm	41.1				
Length of stator/Dimension N	L_S	mm	120 mm/N = 2; 180 mm/N = 3; 300 mm/N = 5				
Height of stator	H_S	mm	131.3				
Total height (forcer + stator)	H	mm	172				

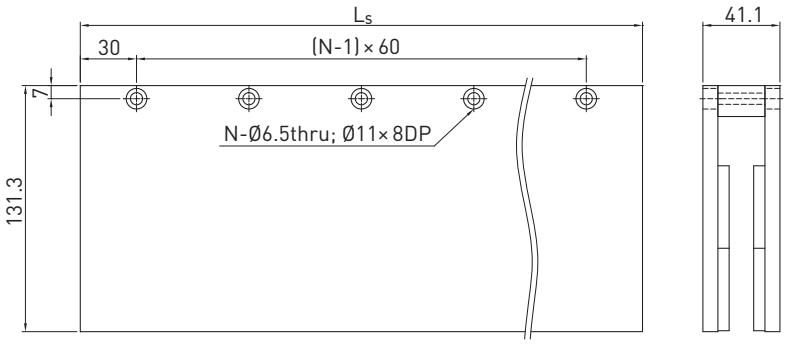
All the specifications in the table (except dimensions) are in ± 10 % of tolerance at 25 °C ambient temperature

[1)] Line to line

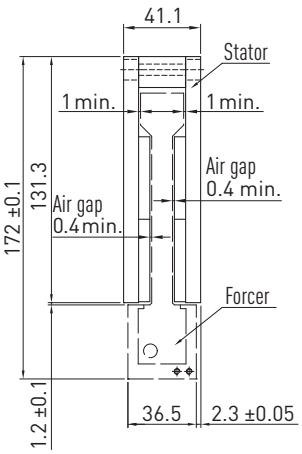
Dimensions of forcer



Dimensions of stator



Mounting tolerances



Linear Motors
LMF/LMFA series

5. HIWIN LMF/LMFA linear motors

5.1 Special characteristics of the LMF/LMFA linear motors

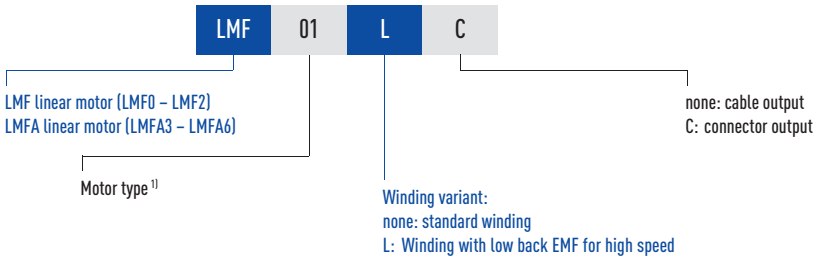
The HIWIN LMF/LMFA synchronous linear motors are the cooled power packs of linear actuators. The UL-certified motors are fitted with a highly efficient cooling system. This enables even higher continuous forces and due to forced cooling, no additional process heat is introduced during machine construction. The linear motors in the LMF/LMFA series achieve extremely high thrust and acceleration. In addition, an extremely high synchronism is achieved through the optimised configuration of the permanent magnets in the stator. The benefits of the LMF/LMFA linear motors make them the preferred choice in fields with very high loads as well as in applications in which no additional process heat must be introduced.

Key features of the LMF/LMFA linear motor:
- Efficient cooling system
- Extremely high thrust
- High acceleration
- UL-certified
- High synchronous run

Typical fields of application:
- Machine tools
- Portal milling machines
- Sheet metal forming machines

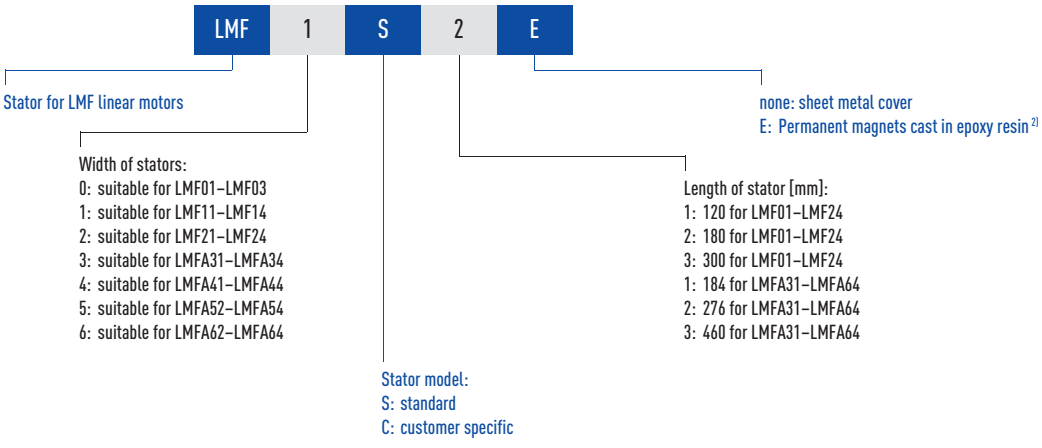
5.2 Order code LMF/LMFA linear motor

5.2.1 Order code of primary part (forcer)



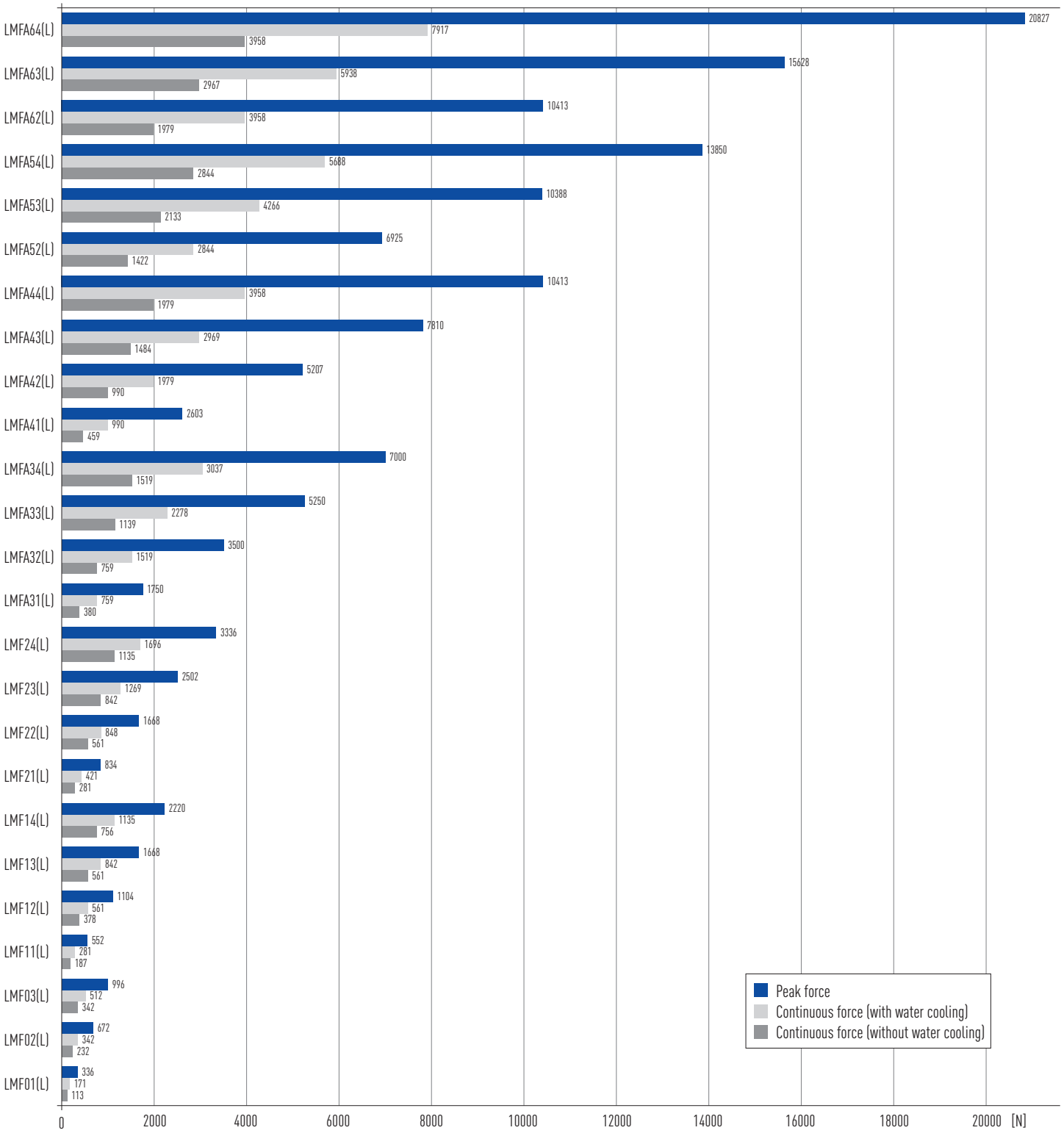
1) See Table 5.1 (LMF0), Table 5.2 (LMF1), Table 5.3 (LMF2) Table 5.4 (LMFA3), Table 5.5 (LMFA4), Table 5.6 (LMFA5), Table 5.7 (LMFA6)

5.2.2 Order code of magnet track (stator)



2) See specifications of particular motor sizes for availability

5.3 Force chart for LMF/LMFA linear motors



5.4 LMF linear motors

5.4.1 LMF0 specifications

Table 5.1 **Technical data**

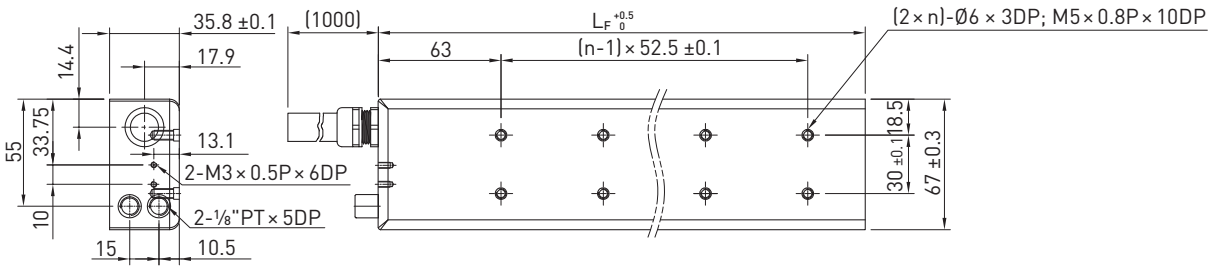
	Symbol	Unit	LMF01	LMF01L	LMF02	LMF02L	LMF03	LMF03L
Forces and electrical parameters								
Continuous force at T_{max}	F_c	N	113		232		342	
Peak force at T_{max} (WC)	F_{c_wc}	N	171		342		512	
Continuous current at T_{max}	I_c	A_{eff}	2.4	5.7	4.9	11.6	7.2	17.1
Continuous current at T_{max} (WC)	I_{c_wc}	A_{eff}	3.6	8.6	7.2	17.1	10.8	25.6
Peak force (for 1 sec.)	F_P	N	336		672		996	
Peak current (for 1 sec.)	I_p	A_{eff}	7.1	16.8	14.2	33.6	21.1	49.8
Force constant	K_f	N/A_{eff}	47.3	20.0	47.3	20.0	47.3	20.0
Attraction force	F_a	N	570		1140		1710	
Resistance [1)]	R_{25}	Ω	9.0	2.1	4.4	1.0	3.0	0.7
Inductance [1)]	L	mH	39.0	7.0	19.3	3.4	12.9	2.3
Back EMF constant	K_u	$V_{eff}/(m/s)$	27.0	11.4	27.0	11.4	27.0	11.4
Motor constant	K_m	$N/\sqrt{W}$	12.9	11.2	18.4	16.0	22.3	19.4
Thermal resistance	R_{th}	°C/W	0.93		0.45		0.31	
Thermal switch			1 × KTY84–130 + 1 × (3 PTC SNM 120 in series)					
Max. DC bus voltage		V	600					
Mechanical parameters								
Pole pair pitch	2τ	mm	30					
Max. operating temperature	T_{max}	°C	120					
Mounting holes (forcer)	n		2		4		6	
Weight of forcer	M_F	kg	1.5		2.3		3.1	
Length of forcer	L_F	mm	145		250		355	
Unit mass of stator	M_S	kg/m	3.7					
Length of stator/Dimension N	L_S	mm	120 mm/N = 2; 180 mm/N = 3; 300 mm/N = 5					

WC: with water cooling

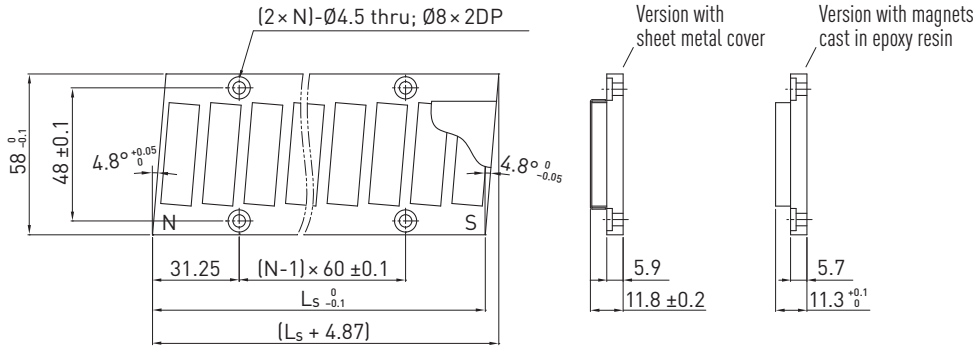
All the specifications in the table (except dimensions) are in ± 10 % of tolerance at 25 °C ambient temperature

[1)] Line to line

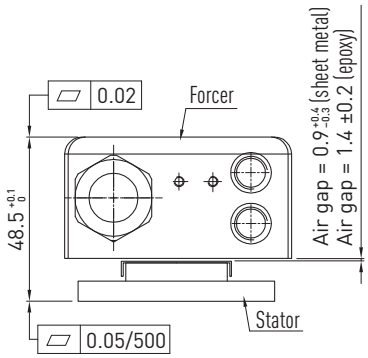
Dimensions of forcer



Dimensions of stator



Mounting tolerances



Stator versions available

Sheet metal:
Magnets protected by painted sheet metal cover.

Epoxy:
Magnets cast in epoxy resin.

Stainless steel cover plate (upon request):
Additional, one-piece stainless steel cover plate for magnet tracks consisting of stators with magnets cast in epoxy resin.

5.4.2 LMF1 specifications

Table 5.2 **Technical data**

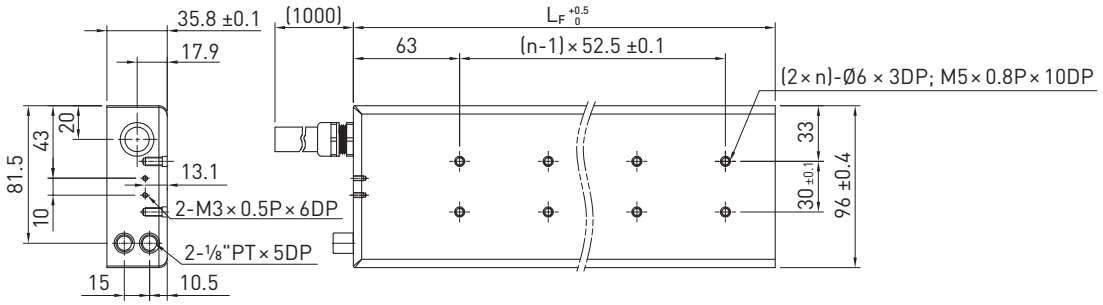
	Symbol	Unit	LMF11	LMF11L	LMF12	LMF12L	LMF13	LMF13L	LMF14	LMF14L
Forces and electrical parameters										
Continuous force at T_{max}	F_c	N	187		378		561		756	
Continuous force at T_{max} (WC)	F_{c_wc}	N	281		561		842		1135	
Continuous current at T_{max}	I_c	A_{eff}	2.2	5.2	4.4	10.4	6.5	15.5	8.8	20.8
Continuous current at T_{max} (WC)	I_{c_wc}	A_{eff}	3.3	7.7	6.5	15.5	9.8	23.2	13.2	31.3
Peak force (for 1 sec.)	F_P	N	552		1104		1668		2220	
Peak current (for 1 sec.)	I_p	A_{eff}	6.4	15.2	12.9	30.4	19.4	46.0	25.9	61.2
Force constant	K_f	N/A_{eff}	85.8	36.3	85.8	36.3	85.8	36.3	85.8	36.3
Attraction force	F_a	N	954		1909		2863		3818	
Resistance [1)]	R_{25}	Ω	12.4	2.9	6.2	1.5	4.4	1.0	3.1	0.7
Inductance [1)]	L	mH	60.7	10.8	30.4	5.4	21.0	3.8	15.2	2.7
Back EMF constant	K_u	$V_{eff}/(m/s)$	49.0	20.7	49.0	20.7	49.0	20.7	49.0	20.7
Motor constant	K_m	$N/\sqrt{W}$	19.9	17.3	28.1	24.5	33.4	29.1	39.8	34.6
Thermal resistance	R_{th}	°C/W	0.82		0.40		0.26		0.2	
Thermal switch			1 × KTY84–130 + 1 × (3 PTC SNM 120 in series)							
Max. DC bus voltage		V	600							
Mechanical parameters										
Pole pair pitch	2τ	mm	30							
Max. operating temperature	T_{max}	°C	120							
Mounting holes (forcer)	n		2		4		6		8	
Weight of forcer	M_F	kg	2.4		4		5.6		7.6	
Length of forcer	L_F	mm	145		250		355		460	
Unit mass of stator	M_S	kg/m	5.8							
Length of stator/Dimension N	L_S	mm	120 mm/N = 2; 180 mm/N = 3; 300 mm/N = 5							

WC: with water cooling

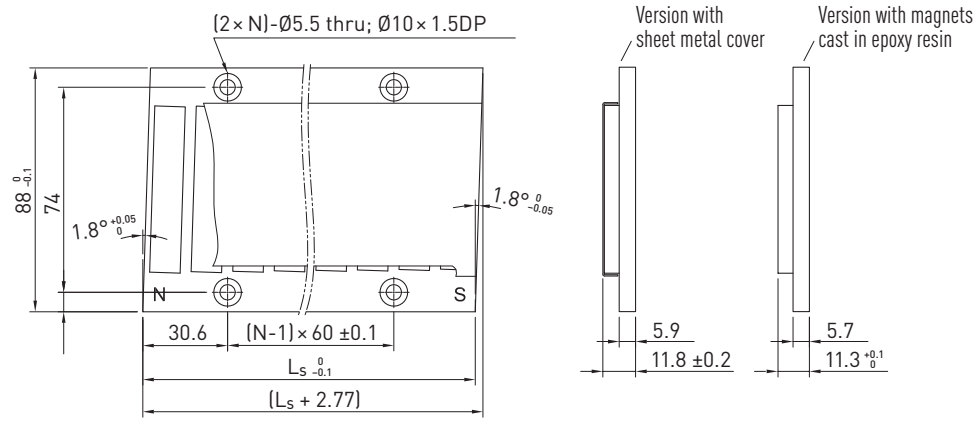
All the specifications in the table (except dimensions) are in ± 10 % of tolerance at 25 °C ambient temperature

[1)] Line to line

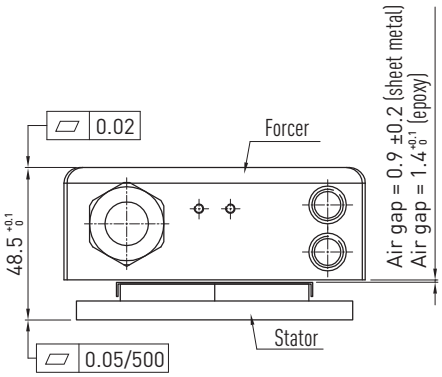
Dimensions of forcer



Dimensions of stator



Mounting tolerances



Stator versions available

Sheet metal:
Magnets protected by painted sheet metal cover.

Epoxy:
Magnets cast in epoxy resin.

Stainless steel cover plate (upon request):
Additional, one-piece stainless steel cover plate for magnet tracks consisting of stators with magnets cast in epoxy resin.

5.4.3 LMF2 specifications

Table 5.3 **Technical data**

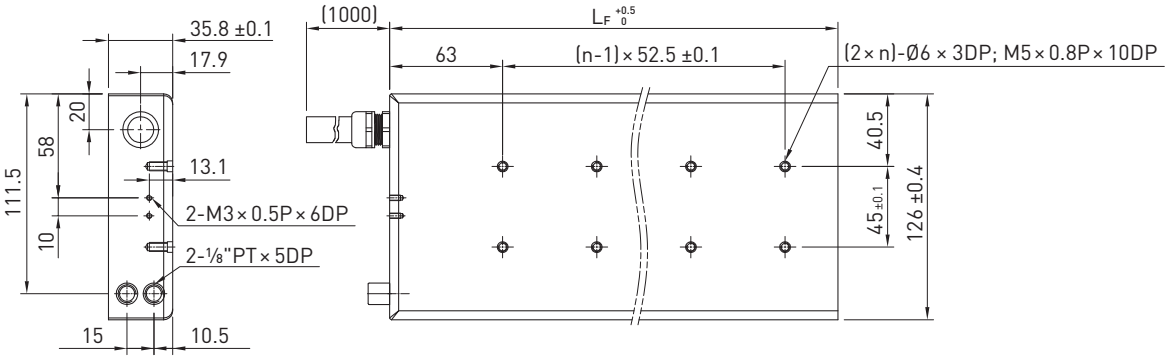
	Symbol	Unit	LMF21	LMF21L	LMF22	LMF22L	LMF23	LMF23L	LMF24	LMF24L
Forces and electrical parameters										
Continuous force at T_{max}	F_c	N	281		561		842		1135	
Continuous force at T_{max} (WC)	F_{c_wc}	N	421		848		1269		1696	
Continuous current at T_{max}	I_c	A_{eff}	2.2	5.2	4.4	10.3	6.5	15.5	8.8	20.9
Continuous current at T_{max} (WC)	I_{c_wc}	A_{eff}	3.3	7.7	6.6	15.6	9.9	23.3	13.2	31.2
Peak force (for 1 sec.)	F_P	N	834		1668		2502		3336	
Peak current (for 1 sec.)	I_p	A_{eff}	6.5	15.3	13.0	30.7	19.4	46.0	25.9	61.3
Force constant	K_f	N/A_{eff}	128.7	54.4	128.7	54.4	128.7	54.4	128.7	54.4
Attraction force	F_a	N	1431		2863		4294		5727	
Resistance [1)]	R_{25}	Ω	17.2	4.1	8.6	2.0	5.8	1.4	4.3	1.0
Inductance [1)]	L	mH	85.6	15.3	44.3	7.9	29.7	5.3	22.6	4.0
Back EMF constant	K_u	$V_{eff}/(m/s)$	73.5	31.1	73.5	31.1	73.5	31.1	73.5	31.1
Motor constant	K_m	$N/\sqrt{W}$	25.3	22.1	35.8	31.2	43.6	38.0	50.7	44.1
Thermal resistance	R_{th}	°C/W	0.59		0.29		0.19		0.14	
Thermal switch			1 × KTY84–130 + 1 × (3 PTC SNM 120 in series)							
Max. DC bus voltage		V	600							
Mechanical parameters										
Pole pair pitch	2τ	mm	30							
Max. operating temperature	T_{max}	°C	120							
Mounting holes (forcer)	n		2		4		6		8	
Weight of forcer	M_F	kg	3.2		5.5		8		10.4	
Length of forcer	L_F	mm	145		250		355		460	
Unit mass of stator	M_S	kg/m	9.8							
Length of stator/Dimension N	L_S	mm	120 mm/N = 2; 180 mm/N = 3; 300 mm/N = 5							

WC: with water cooling

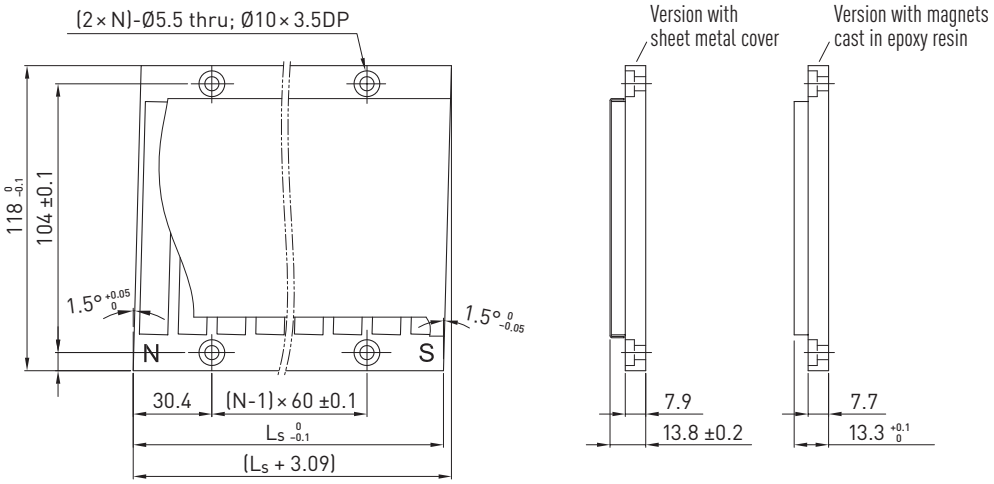
All the specifications in the table (except dimensions) are in ± 10 % of tolerance at 25 °C ambient temperature

[1)] Line to line

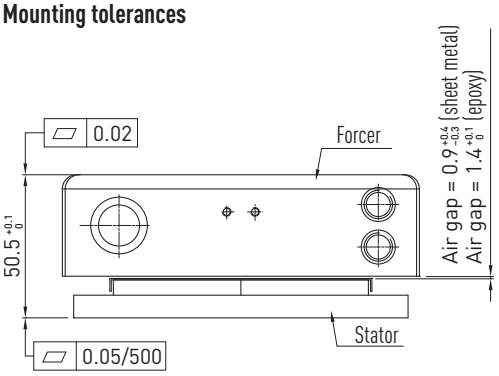
Dimensions of forcer



Dimensions of stator



Mounting tolerances



Stator versions available

Sheet metal:
Magnets protected by painted sheet metal cover.

Epoxy:
Magnets cast in epoxy resin.

Stainless steel cover plate (upon request):
Additional, one-piece stainless steel cover plate for magnet tracks consisting of stators with magnets cast in epoxy resin.

5.4.4 LMFA3 specifications

Force-velocity curves (DC bus voltage: 750 VDC)

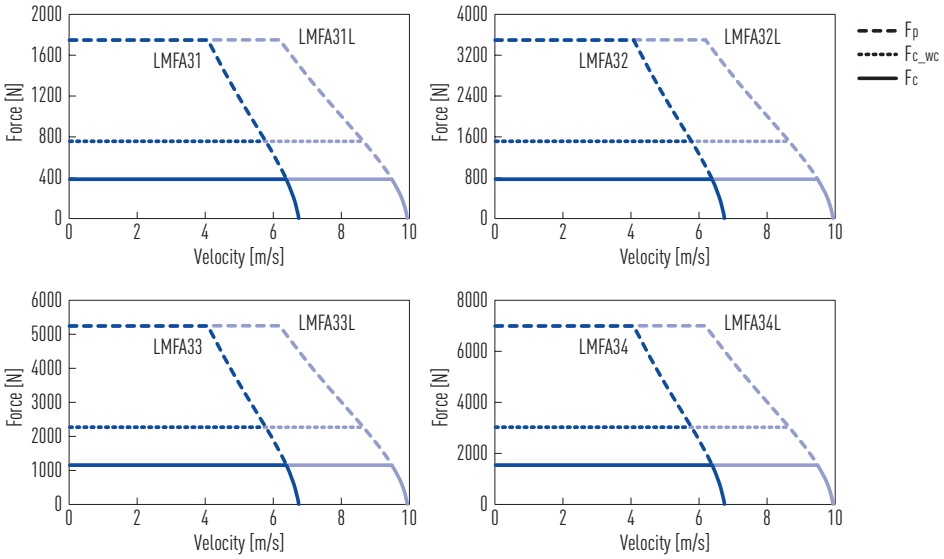


Table 5.4 **Technical data**

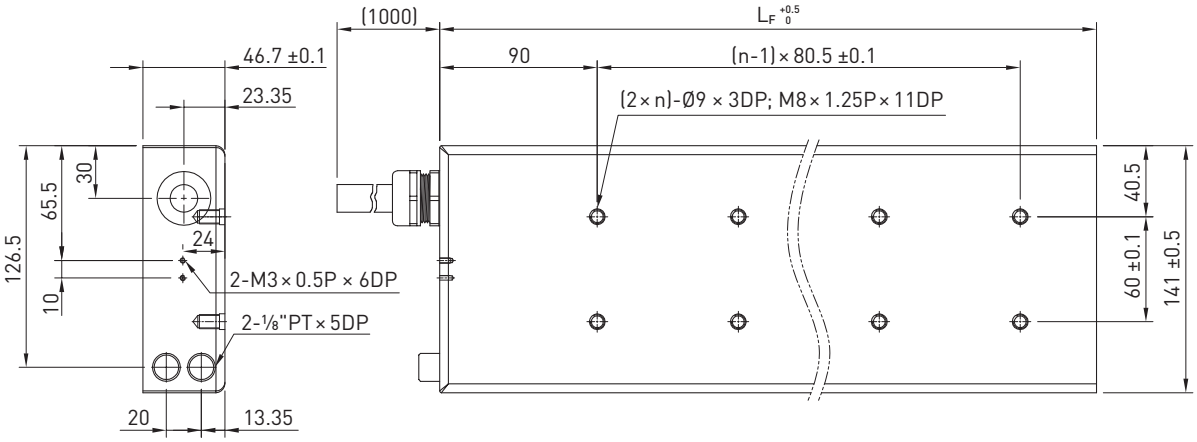
	Symbol	Unit	LMFA31	LMFA31L	LMFA32	LMFA32L	LMFA33	LMFA33L	LMFA34	LMFA34L
Forces and electrical parameters										
Continuous force at T_{max}	F_c	N	380		759		1139		1519	
Continuous force at T_{max} (WC)	F_{c_wc}	N	759		1519		2278		3037	
Continuous current at T_{max}	I_c	A_{eff}	3.1	4.6	6.2	9.1	9.3	13.7	12.4	18.3
Continuous current at T_{max} (WC)	I_{c_wc}	A_{eff}	6.2	9.1	12.4	18.3	18.6	27.4	24.7	36.5
Peak force (for 1 sec.)	F_P	N	1750		3500		5250		7000	
Peak current (for 1 sec.)	I_p	A_{eff}	19.2	28.3	38.4	56.6	57.5	84.9	76.7	113.3
Force constant	K_f	N/A_{eff}	122.7	83.1	122.7	83.1	122.7	83.1	122.7	83.1
Attraction force	F_a	N	3430		6860		10290		13720	
Electrical time constant	K_e	ms	11.3	11.4	11.3	11.4	11.3	11.4	11.3	11.4
Resistance [1)]	R_{25}	Ω	4.3	1.9	2.1	1.0	1.4	0.6	1.1	0.5
Inductance [1)]	L	mH	48.3	22.2	24.2	11.1	16.1	7.4	12.1	5.5
Back EMF constant	K_u	$V_{eff}/(m/s)$	70.9	48.0	70.9	48.0	70.9	48.0	70.9	48.0
Motor constant	K_m	$N/\sqrt{W}$	48.4	48.7	68.5	68.9	83.9	84.4	96.9	97.4
Thermal resistance	R_{th}	°C/W	0.95	0.96	0.47	0.48	0.32	0.32	0.24	0.24
Thermal resistance (WC)	R_{th_wc}	°C/W	1.17	1.19	0.59	0.59	0.39	0.40	0.29	0.30
Thermal switch			1 × KTY84–130 + 1 × (3 PTC SNM 120 in series)							
Max. DC bus voltage		V	750							
Mechanical parameters										
Pole pair pitch	2τ	mm	46							
Max. operating temperature	T_{max}	°C	120							
Mounting holes (forcer)	n		2		4		6		8	
Weight of forcer	M_F	kg	6.4		11.7		17.3		22.5	
Length of forcer	L_F	mm	214		375		536		697	
Unit mass of stator	M_S	kg/m	16.2							
Length of stator/Dimension N	L_S	mm	184 mm/N = 2; 276 mm/N = 3; 460 mm/N = 5							

WC: with water cooling

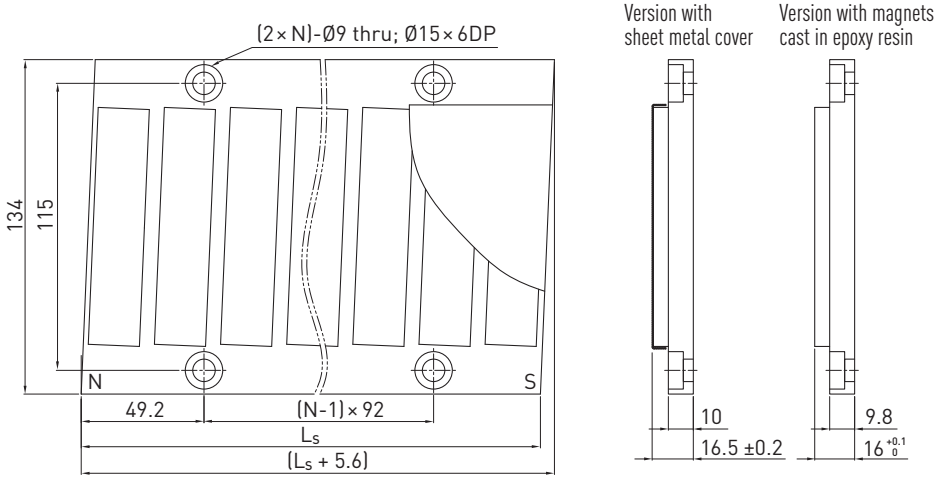
All the specifications in the table (except dimensions) are in ± 10 % of tolerance at 25 °C ambient temperature

[1)] Line to line

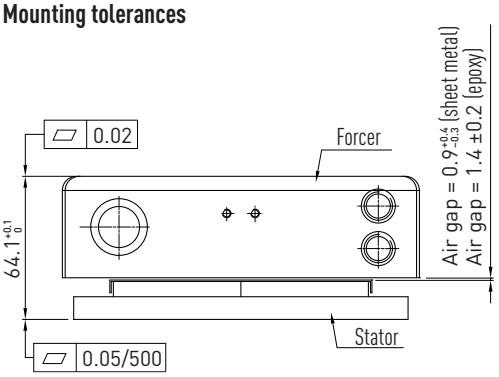
Dimensions of forcer



Dimensions of stator



Mounting tolerances



Stator versions available

Sheet metal:
Magnets protected by painted sheet metal cover.

Epoxy:
Magnets cast in epoxy resin.

Stainless steel cover plate (upon request):
Additional, one-piece stainless steel cover plate for magnet tracks consisting of stators with magnets cast in epoxy resin.

5.4.5 LMFA4 specifications

Force-velocity curves (DC bus voltage: 750 VDC)

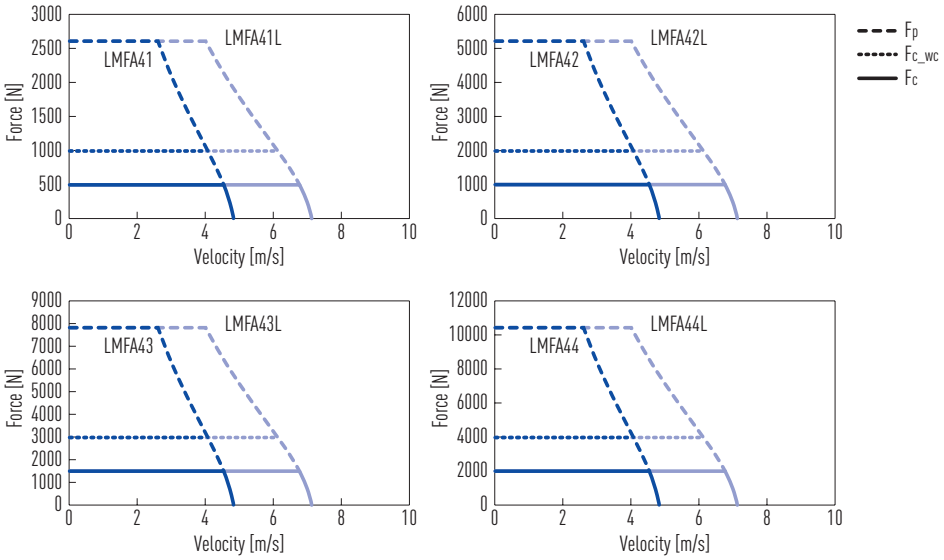


Table 5.5 **Technical data**

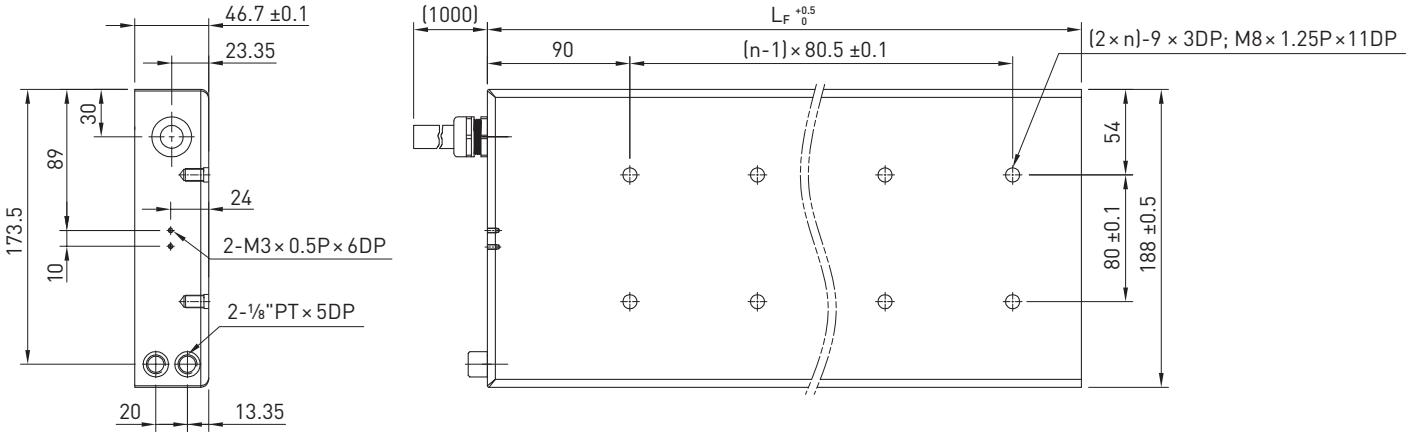
	Symbol	Unit	LMFA41	LMFA41L	LMFA42	LMFA42L	LMFA43	LMFA43L	LMFA44	LMFA44L
Forces and electrical parameters										
Continuous force at T_{max}	F_c	N	495		990		1484		1979	
Continuous force at T_{max} (WC)	F_{c_wc}	N	990		1979		2969		3958	
Continuous current at T_{max}	I_c	A_{eff}	2.9	4.3	5.8	8.5	8.7	12.8	11.5	17.0
Continuous current at T_{max} (WC)	I_{c_wc}	A_{eff}	5.8	8.5	11.5	17.0	17.3	25.6	23.1	34.1
Peak force (for 1 sec.)	F_P	N	2603		5207		7810		10413	
Peak current (for 1 sec.)	I_p	A_{eff}	17.9	26.4	35.8	52.9	53.5	79.3	71.6	105.7
Force constant	K_f	N/A_{eff}	171.4	116.1	171.4	116.1	171.4	116.1	171.4	116.1
Attraction force	F_a	N	5145		10290		15435		20580	
Electrical time constant	K_e	ms	12.0	12.1	12.0	12.1	12.0	12.1	12.0	12.1
Resistance [1]	R_{25}	Ω	6.0	2.7	3.0	1.4	2.0	0.9	1.5	0.7
Inductance [1]	L	mH	72.0	33.0	36.0	16.5	24.0	11.0	18.0	8.3
Back EMF constant	K_u	$V_{eff}/(m/s)$	98.9	67.0	98.9	67.0	98.9	67.0	98.9	67.0
Motor constant	K_m	$N/\sqrt{W}$	57.1	57.5	80.8	81.3	98.9	99.5	114.2	114.9
Thermal resistance	R_{th}	°C/W	0.78	0.79	0.39	0.39	0.26	0.26	0.19	0.20
Thermal resistance (WC)	R_{th_wc}	°C/W	0.96	0.97	0.48	0.49	0.32	0.32	0.24	0.24
Thermal switch			1 × KTY84–130 + 1 × (3 PTC SNM 120 in series)							
Max. DC bus voltage		V	750							
Mechanical parameters										
Pole pair pitch	2τ	mm	46							
Max. operating temperature	T_{max}	°C	120							
Mounting holes (forcer)	n		2		4		6		8	
Weight of forcer	M_F	kg	9.5		16.2		23		29	
Length of forcer	L_F	mm	214		375		536		697	
Unit mass of stator	M_S	kg/m	22.3							
Length of stator/Dimension N	L_S	mm	184 mm/N = 2; 276 mm/N = 3; 460 mm/N = 5							

WC: with water cooling

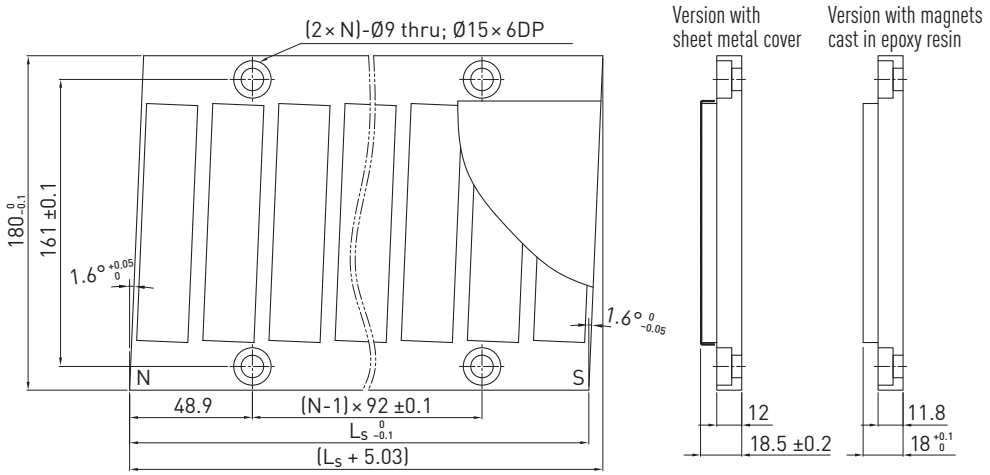
All the specifications in the table (except dimensions) are in ± 10 % of tolerance at 25 °C ambient temperature

[1] Line to line

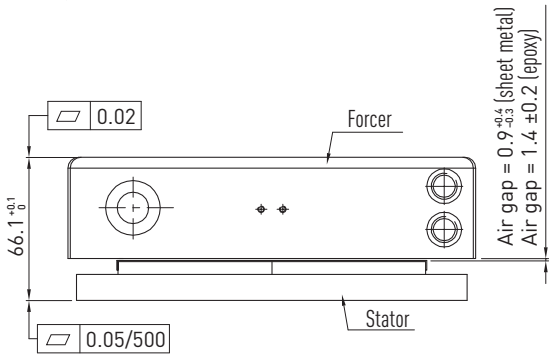
Dimensions of forcer



Dimensions of stator



Mounting tolerances



Stator versions available

Sheet metal:
Magnets protected by painted sheet metal cover.

Epoxy:
Magnets cast in epoxy resin.

Stainless steel cover plate (upon request):
Additional, one-piece stainless steel cover plate for magnet tracks consisting of stators with magnets cast in epoxy resin.

5.4.6 LMFA5 specifications

Force-velocity curves (DC bus voltage: 750 VDC)

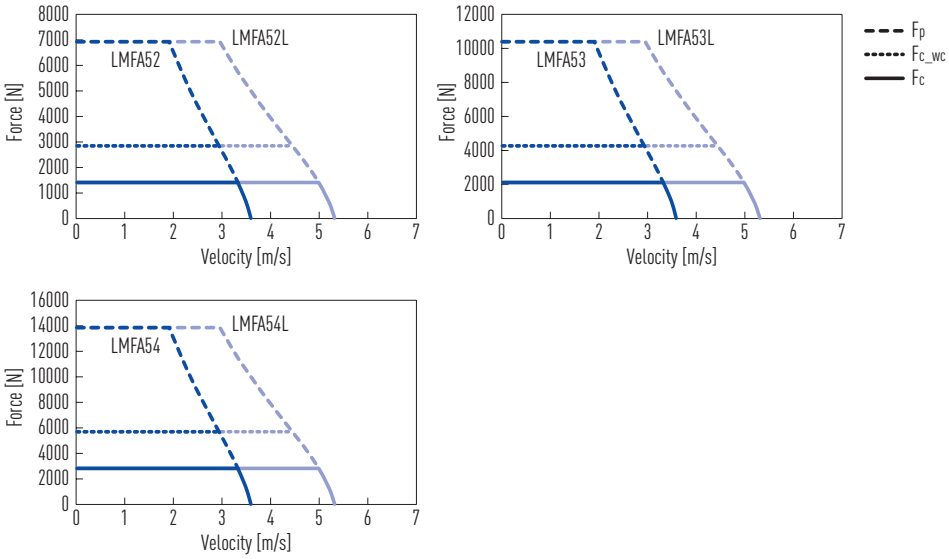


Table 5.6 **Technical data**

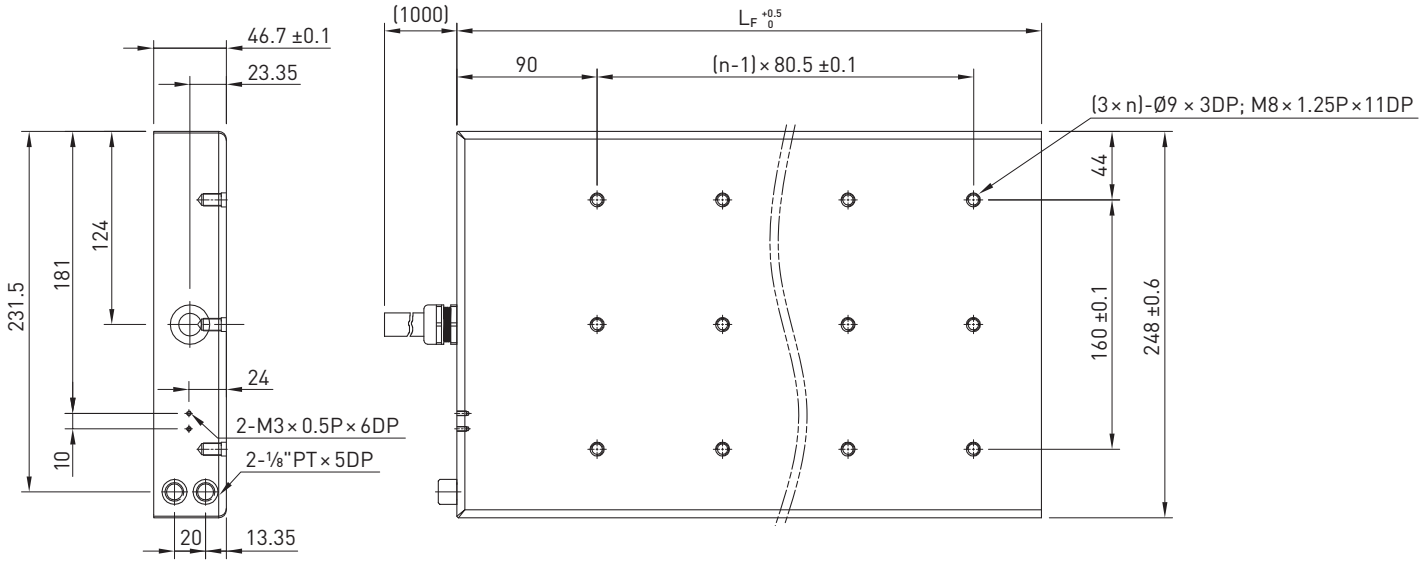
	Symbol	Unit	LMFA52	LMFA52L	LMFA53	LMFA53L	LMFA54	LMFA54L
Forces and electrical parameters								
Continuous force at T_{max}	F_c	N	1422		2133		2844	
Continuous force at T_{max} (WC)	F_{c_wc}	N	2844		4266		5688	
Continuous current at T_{max}	I_c	A_{eff}	6.2	9.1	9.3	13.7	12.4	18.3
Continuous current at T_{max} (WC)	I_{c_wc}	A_{eff}	12.4	18.3	18.6	27.4	24.7	36.5
Peak force (for 1 sec.)	F_P	N	6925		10388		13850	
Peak current (for 1 sec.)	I_p	A_{eff}	38.4	56.6	57.5	84.9	76.7	113.2
Force constant	K_f	N/A_{eff}	229.9	155.7	229.9	155.7	229.9	155.7
Attraction force	F_a	N	13700		20550		27400	
Electrical time constant	K_e	ms	12.2	12.4	12.2	12.4	12.2	12.4
Resistance [1)]	R_{25}	Ω	3.9	1.8	2.6	1.2	2.0	0.9
Inductance [1)]	L	mH	47.7	21.9	31.8	14.6	23.9	10.9
Back EMF constant	K_u	$V_{eff}/(m/s)$	132.7	89.9	132.7	89.9	132.7	89.9
Motor constant	K_m	$N/\sqrt{W}$	95.0	95.6	116.4	117.1	134.4	135.2
Thermal resistance	R_{th}	°C/W	0.26	0.26	0.17	0.18	0.13	0.13
Thermal resistance (WC)	R_{th_wc}	°C/W	0.32	0.33	0.21	0.22	0.16	0.16
Thermal switch			1 × KTY84–130 + 1 × (3 PTC SNM 120 in series)					
Max. DC bus voltage		V	750					
Mechanical parameters								
Pole pair pitch	2τ	mm	46					
Max. operating temperature	T_{max}	°C	120					
Mounting holes (forcer)	n		4		6		8	
Weight of forcer	M_F	kg	23.8		32.3		40.8	
Length of forcer	L_F	mm	375		536		697	
Unit mass of stator	M_S	kg/m	25					
Length of stator/Dimension N	L_S	mm	184 mm/N = 2; 276 mm/N = 3; 460 mm/N = 5					

WC: with water cooling

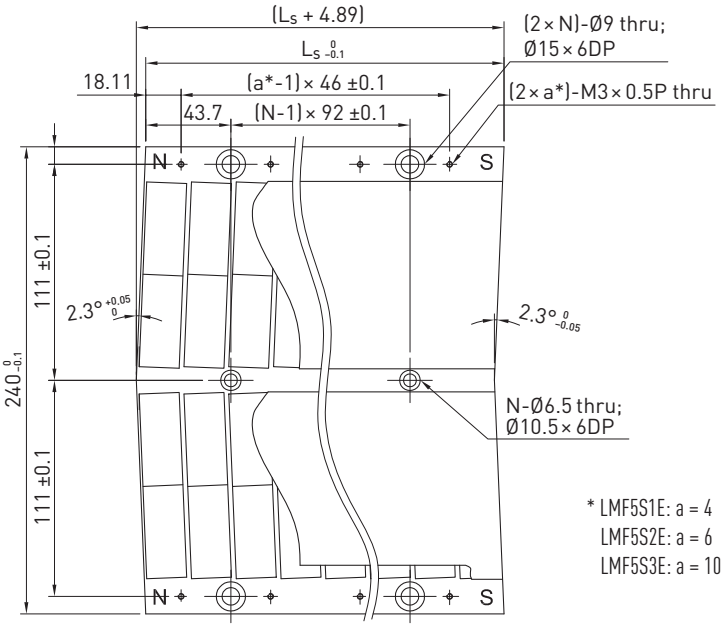
All the specifications in the table (except dimensions) are in ± 10 % of tolerance at 25 °C ambient temperature

[1)] Line to line

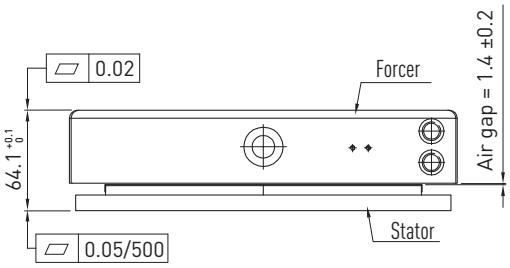
Dimensions of forcer



Dimensions of stator



Mounting tolerances



Stator versions available

Epoxy:
Magnets cast in epoxy resin.

Stainless steel cover plate (upon request):
Additional, one-piece stainless steel cover plate for magnet tracks consisting of stators with magnets cast in epoxy resin.

5.4.7 LMFA6 specifications

Force-velocity curves (DC bus voltage: 750 VDC)

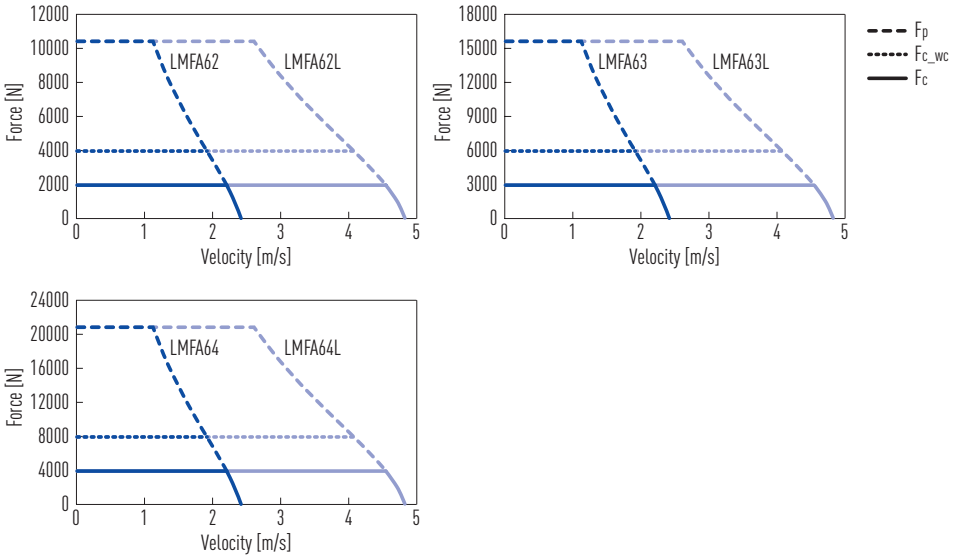


Table 5.7 **Technical data**

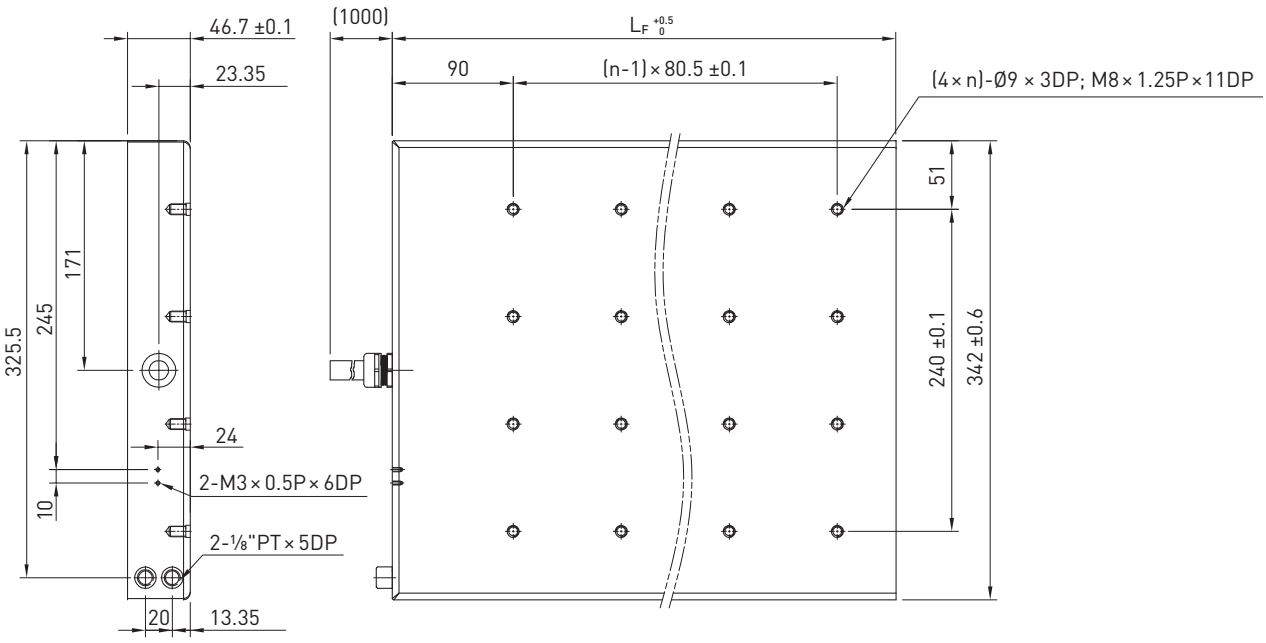
	Symbol	Unit	LMFA62	LMFA62L	LMFA63	LMFA63L	LMFA64	LMFA64L
Forces and electrical parameters								
Continuous force at T_{max}	F_c	N	1979		2969		3958	
Continuous force at T_{max} (WC)	F_{c_wc}	N	3958		5938		7917	
Continuous current at T_{max}	I_c	A_{eff}	5.8	11.5	8.7	17.3	11.5	23.1
Continuous current at T_{max} (WC)	I_{c_wc}	A_{eff}	11.5	23.1	17.3	34.6	23.1	46.2
Peak force (for 1 sec.)	F_P	N	10413		15620		20827	
Peak current (for 1 sec.)	I_p	A_{eff}	35.8	71.6	53.7	107.4	71.3	142.6
Force constant	K_f	N/A_{eff}	342.7	171.4	342.7	171.4	342.7	171.4
Attraction force	F_a	N	20580		30870		41160	
Electrical time constant	K_e	ms	12.0					
Resistance [1)]	R_{25}	Ω	6.0	1.5	4.0	1.0	3.0	0.8
Inductance [1)]	L	mH	72.0	18.0	48.0	12.0	36.0	9.0
Back EMF constant	K_u	$V_{eff}/(m/s)$	197.9	98.9	197.9	98.9	197.9	98.9
Motor constant	K_m	$N/\sqrt{W}$	114.2		139.9		161.6	
Thermal resistance	R_{th}	°C/W	0.19		0.13		0.10	
Thermal resistance (WC)	R_{th_wc}	°C/W	0.24		0.16		0.12	
Thermal switch			1 × KTY84–130 + 1 × (3 PTC SNM 120 in series)					
Max. DC bus voltage		V	750					
Mechanical parameters								
Pole pair pitch	2τ	mm	46					
Max. operating temperature	T_{max}	°C	120					
Mounting holes (forcer)	n		4		6		8	
Weight of forcer	M_F	kg	32.2		44.2		56.2	
Length of forcer	L_F	mm	375		536		697	
Unit mass of stator	M_S	kg/m	40.1					
Length of stator/Dimension N	L_S	mm	184 mm/N = 2; 276 mm/N = 3; 460 mm/N = 5					

WC: with water cooling

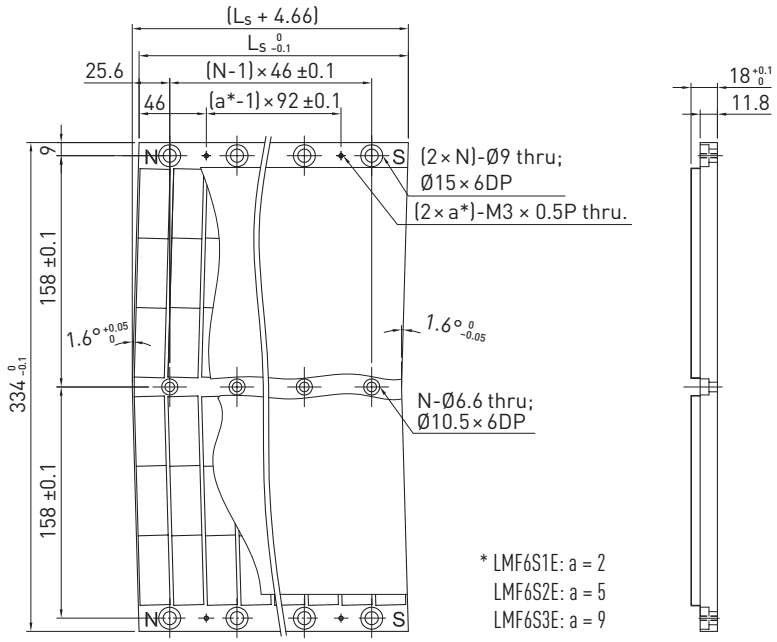
All the specifications in the table (except dimensions) are in ± 10 % of tolerance at 25 °C ambient temperature

[1)] Line to line

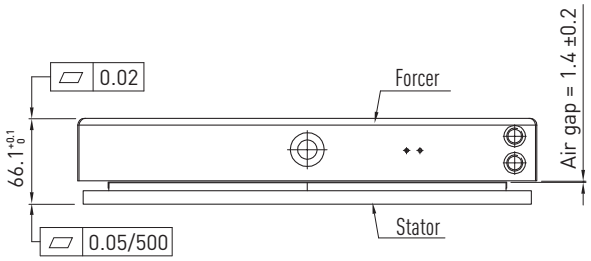
Dimensions of forcer



Dimensions of stator



Mounting tolerances



Stator versions available

Epoxy:
Magnets cast in epoxy resin.

Stainless steel cover plate (upon request):
Additional, one-piece stainless steel cover plate for magnet tracks consisting of stators with magnets cast in epoxy resin.

6. HIWIN MAGIC – Magnetic positioning measurement systems

The distance magnetic measuring systems of the MAGIC series are optimised for measuring the distances travelled in linear movements and particularly on linear motor axes. They are particularly suitable for use in harsh environmental conditions and are resistant to oil, dirt, vibrations and shocks.

The robust housing is electrically shielded, and signals are output in real time. Two types are available:

- HIWIN MAGIC: type with separate encoder
- HIWIN MAGIC-PG: positioning measurement system integrated in a linear guideway

Characteristics of MAGIC and MAGIC-PG

- Zero contact measurement with 1 V_{PP} or digital output
- Digital resolution of up to 0.5 µm
- Encoder and housing are resistant to dust, humidity, oil and chips
- Encoder with metal housing and IP67 protection mode
- Simple assembly
- Signal output in real time
- Special housing for EMC optimization

6.1 HIWIN positioning measurement systems

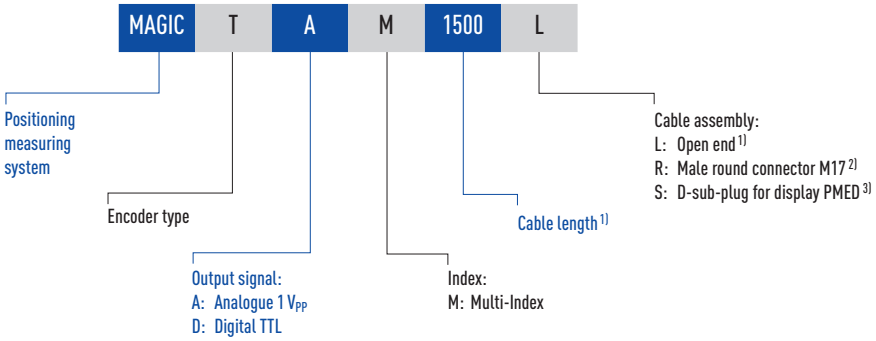
6.1.1 HIWIN MAGIC positioning measurement system

This positioning measurement system consists of a separate encoder (Fig. 6.1) and a magnetic scale (Fig. 6.2). The customer can select suitable positions for both of these and install them. The measurement system HIWIN MAGIC is optimised for use on linear motor axes.

Fig. 6.1 **MAGIC encoder**

Fig. 6.2 **MAGIC magnetic scale**

Order code for HIWIN MAGIC



Comments:

1) For cables with open end the standard cable length is 5000

2) Suitable for the pre-assembled HIWIN extension cable, see chapter 6.3.1

3) The display has to be ordered separately

6.1.2 HIWIN MAGIC-PG positioning measurement system

For this type, the positioning measurement system is integrated in a linear guideway. The complete unit is referred to as a positioning guideway (PG). The encoder is fitted to a standard block. It is suitable for HG-20, HG-25, QH-20 and QH-25. A magnetic scale is integrated directly in a profile rail (see Fig. 6.3).

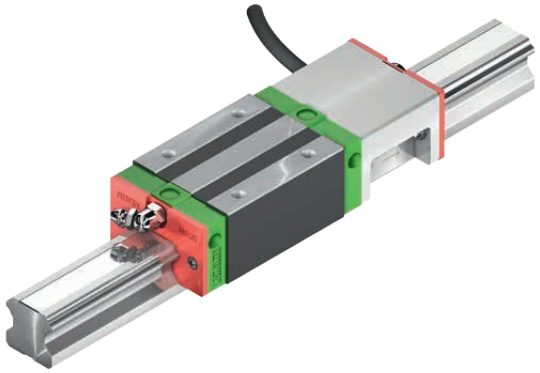


Fig. 6.3 **Linear guideway with MAGIC-PG system**

Order code for HIWIN MAGIC-PG linear guideway

PG	H	W	20	C	A	1	/2	T	1600	ZA	H

- PG: PG series
- H: H: Based on the HG series; Q: Based on the QH series
- W: Block type: W: Flange type; H: Square block; L: Low square block
- 20: Sizes: 20, 25 [6]
- C: Load type: C: Heavy load; H: Super heavy load
- A: Block mounting: A: From above; C: From above or below
- 1: Total number of blocks with sensor per axis [7]
- /2: Number of blocks per rail [7]
- T: Rail mounting: R: From above; T: From below (HGR20 only)
- 1600: Length of rail [mm]
- ZA: Preload ID: Z0, ZA, ZB
- H: Accuracy class: H

Continuation order code

1	/2	KK	E2	M	A	M	2500	L	1

- 1: Number of rails with measurement system
- /2: Rails per axis set [1]
- KK: Dust protection: SS, ZZ, DD, KK, SW, ZWX [2]
- E2: None: standard; E2: with E2 oil lubrication unit
- M: Measurement system type: M: MAGIC
- A: Output signal: A: analogue 1 V_{PP}; D: digital TTL
- M: Index: M: multi index
- 2500: Cable length [mm] [3]
- L: Cable assembly: L: open end [3]; R: M17 round plug connector (male connector) [4]; S: sub-D connector for display PMED [5]
- 1: Encoder orientation [8]: 1: orientation 1 (default); 2: orientation 2; 3: orientation 3; 4: orientation 4

Comments:

[1] Figure 2 is also a quantity statement, i.e. a part of the article described above consists of a pair of rails. No figures are provided for individual linear guideways.

[2] Without specification the block will be delivered with standard dust protection (standard end seal and bottom seal).

[3] For cables with open end the standard cable length is 5000.

[4] Suitable for the pre-assembled HIWIN extension cable, see chapter 6.3.1

[5] The display has to be ordered separately.

[6] Not identical to the standard rail HGR25R without groove. Mounting screw M5 instead of M6.

[7] In the PG series, the total number of blocks per axis is specified (all blocks of the ordered article)

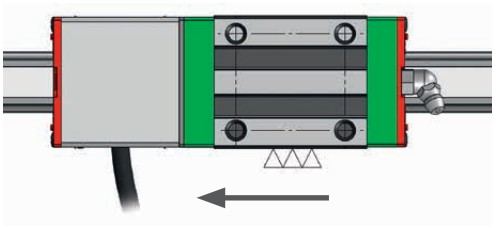
[8] See chapter 6.2.1

6.2 HIWIN MAGIC positioning measurement systems: technical data

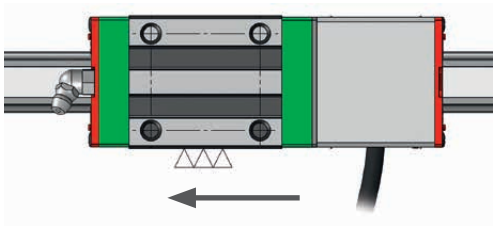
6.2.1 Orientation of the HIWIN MAGIC-PG encoder

The HIWIN MAGIC-PG encoder is available in four orientations as shown below.
Without a statement about the required orientation the encoder is delivered by default (orientation 1).

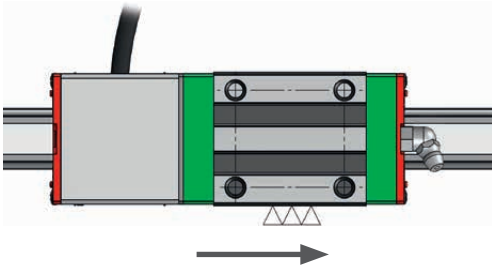
Orientation 1



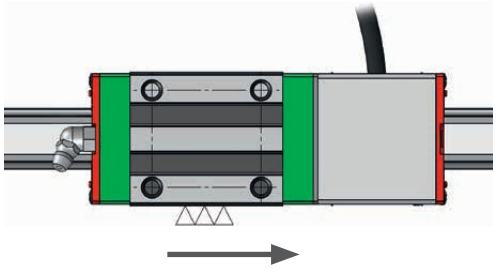
Orientation 2



Orientation 3



Orientation 4

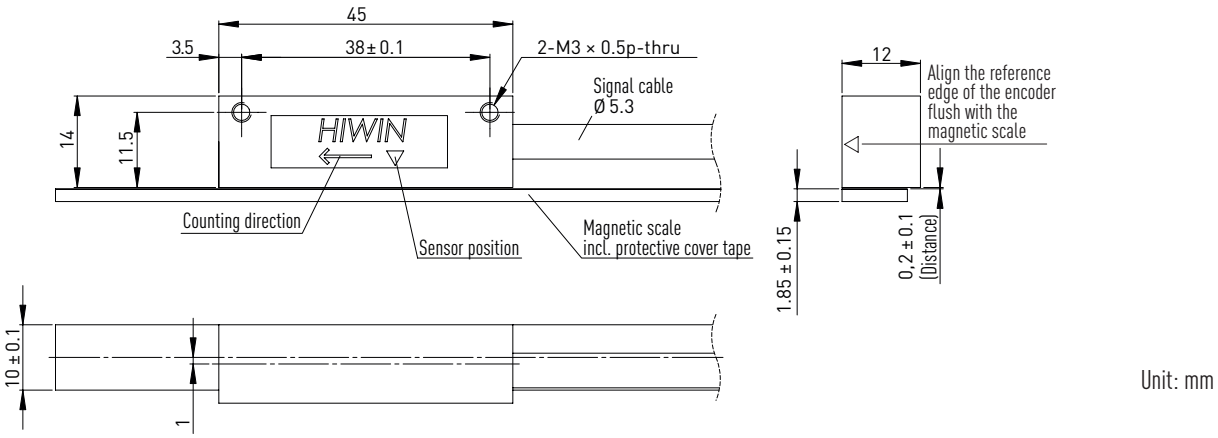


Positive counting direction

Stop edge

6.2.2 Dimensions

6.2.2.1 Dimensions of HIWIN MAGIC



Unit: mm

Fig. 6.4 **Scale drawing of the HIWIN MAGIC encoder**

6.2.2.2 Dimensions HIWIN MAGIC-PG

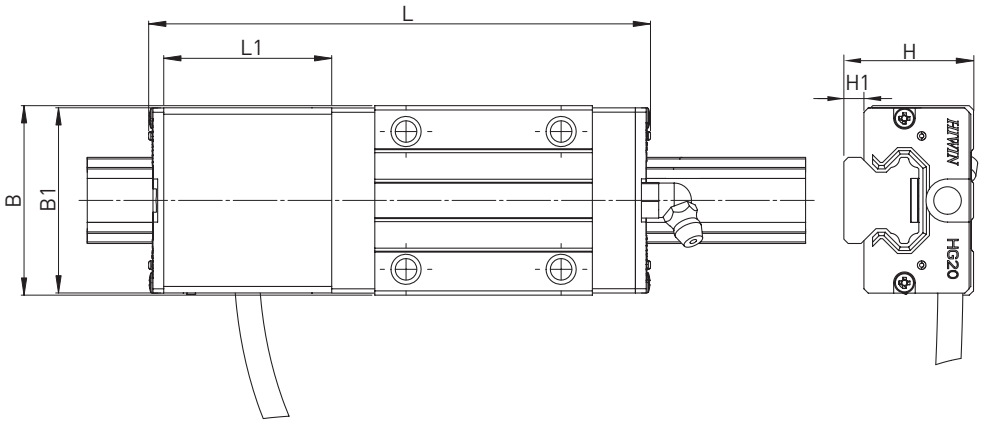


Fig. 6.5 **Scale drawing of the HGH20CA block including the MAGIC-PG housing**

Fig. 6.5 shows an HGH20CA / HGH25CA block. It is also possible to use the modules with HG20, HG25, QH20 and QH25 block sizes (long type and flange type, see the "Linear Guideways" catalogue). The overall dimensions then change accordingly. The dimensions of all block sizes are shown in Table 6.1.

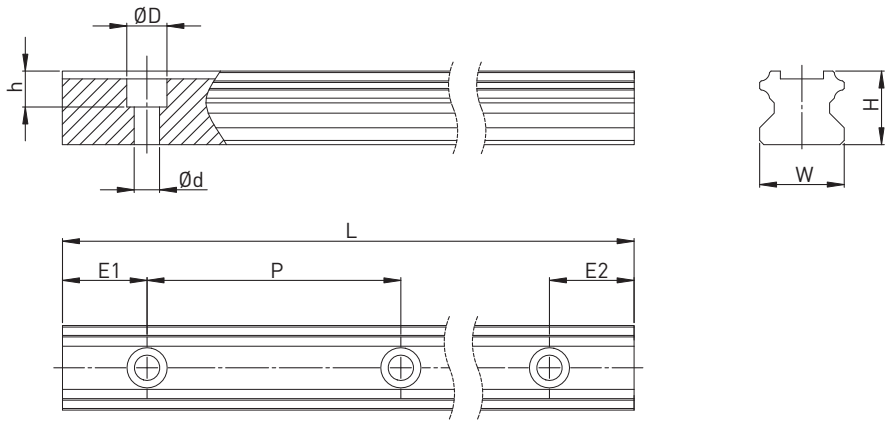
Table 6.1 **Dimensions of the block sizes including MAGIC-PG housing**

	HG_20C	HG_20H	HG_25C	HG_25H	QH_20C	QH_20H	QH_25C	QH_25H
L	118.0	132.7	124.5	145.1	117.2	131.9	123.9	144.5
L1	41.5	41.5	41.5	41.5	41.5	41.5	41.5	41.5
B	44.0	44.0	48.0	48.0	44.0	44.0	48.0	48.0
B1	43.0	43.0	46.4	46.4	43.0	43.0	46.4	46.4
H	30.0	30.0	40.0	40.0	30.0	30.0	40.0	40.0
H1	4.6	4.6	5.5	5.5	4.6	4.6	5.5	5.5

Unit: mm

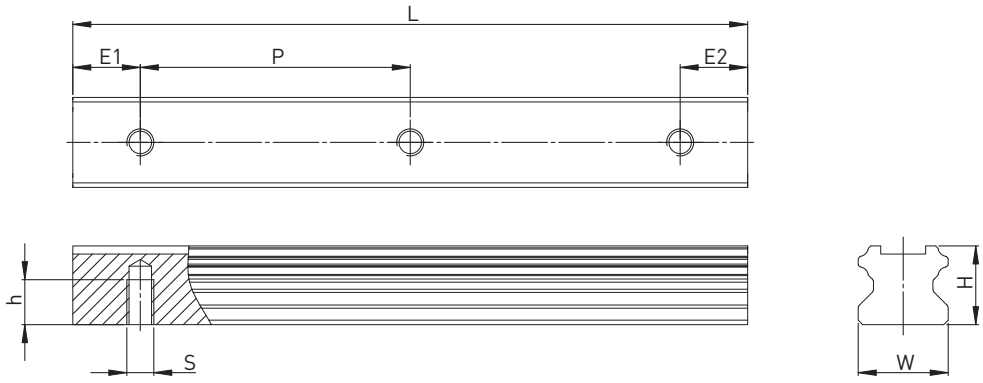
6.2.2.3 Dimensions of PG rail

Rail with groove, mounting from above



Series/size	d [mm]	D [mm]	h [mm]	H [mm]	W [mm]	P [mm]	Max. length [mm]	Max. length $E_1 = E_2$ [mm]	$E_{1/2}$ min [mm]	$E_{1/2}$ max [mm]	Weight [kg/m]
HGR20R G1	6.0	9.5	8.5	17.5	20.0	60.0	4000	3900	7	53	2.05
HGR25R G1C	6.0	9.5	8.5	22.0	23.0	60.0	4000	3900	7	53	3.05

Rail with groove, mounting from below



Series/size	S	h [mm]	H [mm]	W [mm]	P [mm]	Max. length [mm]	Max. length $E_1 = E_2$ [mm]	$E_{1/2}$ min [mm]	$E_{1/2}$ max [mm]	Weight [kg/m]
HGR20T G1	M6	10.0	17.5	20.0	60.0	4000	3900	7	53	2.13

6.2.3 HIWIN MAGIC and HIWIN MAGIC-PG specifications

Table 6.2 **Electrical and mechanical properties of HIWIN MAGIC and HIWIN MAGIC-PG**

Type	1 V_{PP} (analogue)	TTL (digital)
Electrical properties		
Output signal	sin/cos, 1 V_{PP} (0.85 V_{PP} – 1.2 V_{PP})	Quadrature signal, RS 422
Resolution	Infinite, signal period 1 mm	1 µm
Repetition accuracy bidirectional	0.003 mm	0.002 mm
Absolute accuracy	± 20 µm/m	
Reference signal [1]	Periodic index impulse at a distance of 1 mm	
Phase angle	90° ± 0.1° el	90°
DC component	2.5 V ± 0.3 V	
Distortion factor	typ. < 0.1 %	
Operating voltage	5 V ± 5 %	
Power consumption	typ. 35 mA, max. 70 mA	typ. 70 mA, max. 120 mA
Max. measurement speed	10 m/s	5 m/s
EMC class	3, according to IEC 801	
Mechanical properties		
Housing material	High-quality aluminium alloy, encoder bottom made of stainless steel	
Dimensions of MAGIC encoder	L × B × H: 45 × 12 × 14 mm	
Cable length [2]	5 m	
Min. bending radius cable	40 mm	
Protection class	IP67	
Operating temperature	0 °C to +50 °C	
Weight of MAGIC encoder	80 g	
Weight of MAGIC-PG encoder	80 g	
MAGIC-PG suitable for blocks	HG-20, HG-25, QH-20, QH-25	

[1] E.g. usable with reference switch (see chapter 6.5)

[2] For the use in drag chains we recommend our pre-assembled encoder cable with a pre-mounted round connector M17 (coupling, female) on one side, which matches the optional round plug connector M17 (male) of the encoder. For details, please contact your HIWIN technician.

Table 6.3 **Properties of magnetic scale**

Properties		Magnetic scale (incl. stainless steel protective cover tape)
Accuracy class [1]		± 20 µm/m
Linear expansion coefficient		11.5 × 10^{-6} m/K
Period		1 mm
Thickness incl. adhesive tape	Magnetic scale only	1.70 ± 0.10 mm
	with protective cover tape	1.85 ± 0.15 mm
		—
Width		10.05 ± 0.10 mm
Maximum length		24 m
Magnetic remanence		> 240 mT
Pole pitch (distance north/south pole)		1 mm
Single reference marks		optional
Material		Elastomers, nitrile and EPDM
Temperature range		0 °C to +50 °C
Weight		70 g/m

[1] at 20 °C

6.3 Connection analogue and digital variant

6.3.1 Cable assignment (analogue and digital variant)

A high-quality, 8-core cable (1 each of V1+, V1–, V2+, V2– and V0+, V0– or A, Ā, B, B̄ and Z, Z̄ for the digital variant) suitable for cable track is used twisted in pairs.

In drag lines, we generally recommend our pre-assembled extension cables, which are designed especially for use in such lines. The extension cables are supplied with a round plug connector on one end (female coupling) or customised.

6.3.2 Formats and outputs

Signal format of sine/cosine 1 V_{PP} output (analogue)

Electrical signals after the differential input of the downstream electronic components. The sinus/cosinus interface of HIWIN MAGIC-PG is strictly based on the Siemens specifications. The period length of the sinus output signal is 1 mm. The period length of the reference signal is 1 mm.

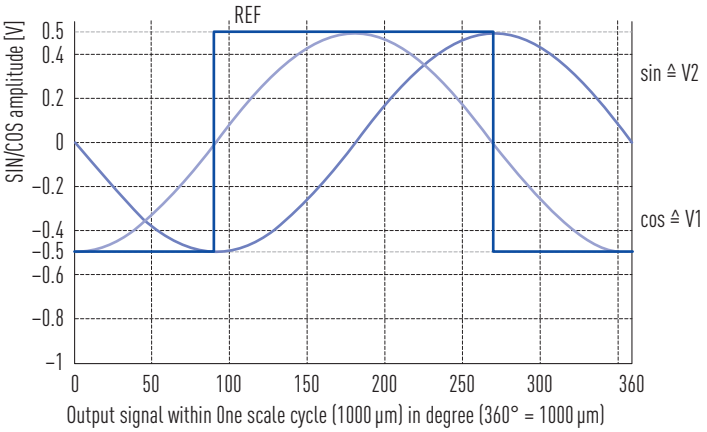


Fig. 6.6 **Electrical signals after the differential input of the downstream electronic components (analogue version)**

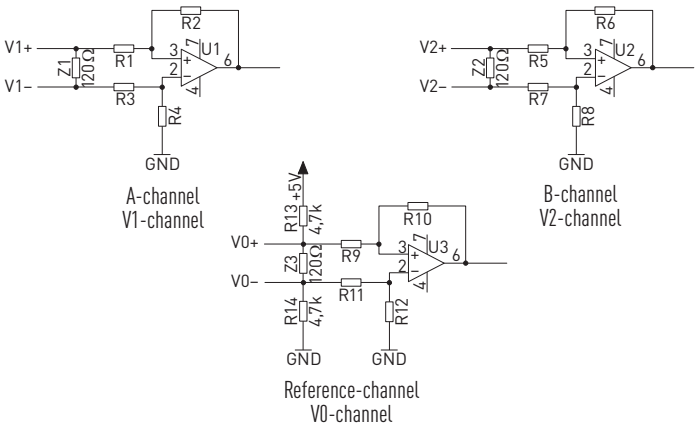


Fig. 6.7 **Recommended switching of the subsequent electronic components for sin/cos 1 V_{PP} output**

Digital TTL Output

- 90° phase shifted square signal in compliance with RS422 specification (according to DIN 66259)
- Recommended termination Z = 120 Ω
- Differential output signal: A, Ā and B, B̄ and Z, Z̄
- Single reference pulse (optional)
- Definition of a minimum pulse duration (optional)

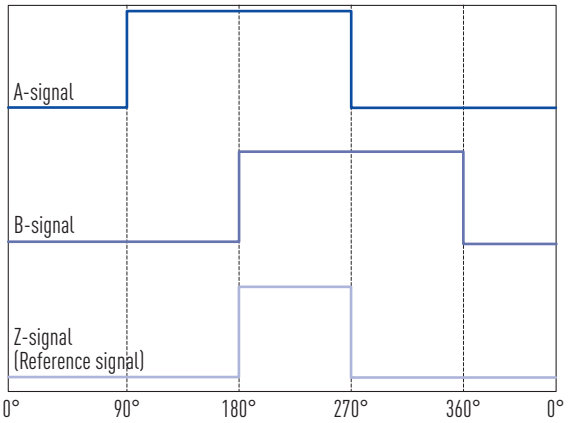


Fig. 6.8 **Signals of the MAGIC encoder (TTL version)**

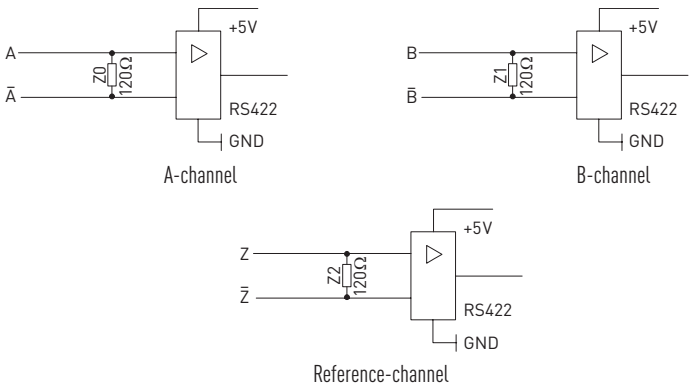


Fig. 6.9 **Recommended switching of the subsequent electronic components for digital TTL output**

6.4 PMED display

Combined with the positioning measurement system HIWIN MAGIC or HIWIN MAGIC-PG the PMED display offers the possibility to display the current position of the encoder. In addition the display has 4 relay outputs and one RS-232 interface.

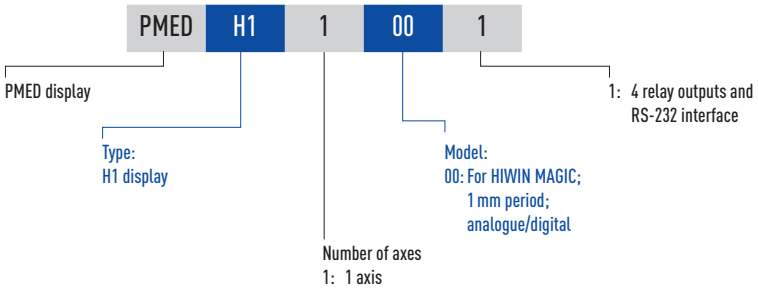
Features

- 8-digit LED display
- For analogue and digital input signal
- Easy handling
- Compact and robust design
- Simple assembly

Functions

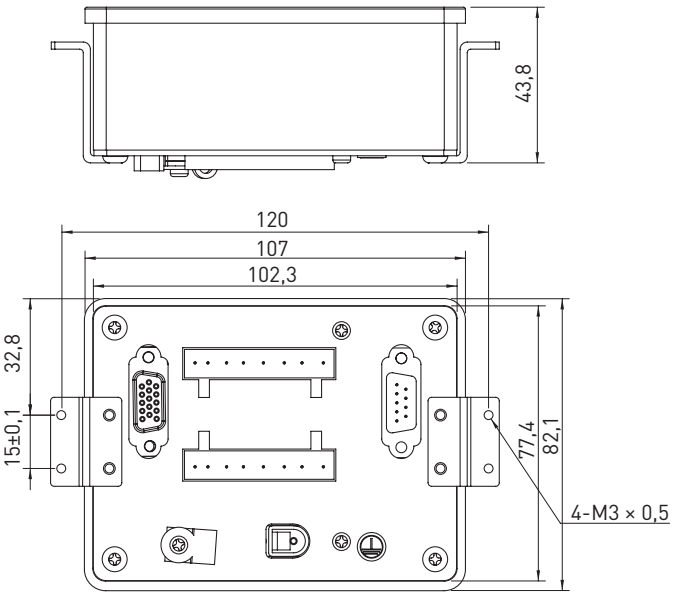
- Flexible zero point adjustment
- Automatic zero point adjustment in the middle of a travel distance
- Absolute and relative counting function
- Units mm/inch
- 4 switchable relay outputs
- RS-232 interface

Order code for PMED display

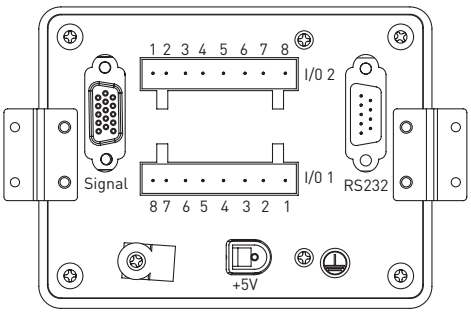


6.4.1 Technical data of PMED display

6.4.1.1 Dimensions of PMED display



6.4.1.2 Inputs and outputs



6.4.1.3 Signal input connector (HD Sub-D, 15 pin)

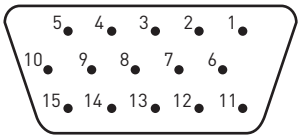


Table 6.4 **Pin definition for signal input connector**

Pin-No.	Signal	Pin-No.	Signal	Pin-No.	Signal
1	+5 V	**6**	FG	**11**	A+ (analogue)
2	GND	**7**	Z+ (reference track)	**12**	A– (analogue)
3	A+ (digital)	**8**	Z– (reference track)	**13**	B+ (analogue)
4	B+ (digital)	**9**	A– (digital)	**14**	B– (analogue)
5	NC	**10**	B– (digital)	**15**	NC

6.4.1.4 Signal output connector

Table 6.5 **Pin definition for signal output connector**

Relay output I/O 1		Relay output I/O 2	
Pin-No.	**Signal**	**Pin-No.**	**Signal**
1	NC	**1**	NC
2		**2**	
3	NC	**3**	NC
4		**4**	
5	Relay 0 (channel 0)	**5**	Relay 2 (channel 2)
6		**6**	
7	Relay 1 (channel 1)	**7**	Relay 3 (channel 3)
8		**8**	

6.5 Reference switch

To reference an axis the HIWIN reference switch can be placed at any position of the axis' travel range. The MAGIC and MAGIC-PG encoder delivers a periodic reference signal (index pulse, see chapter 6.3.2). With a damped reference switch this signal can be used for the precise referencing of the axis.

6.5.1 Technical data of inductive reference switch

Dimensions of reference switch

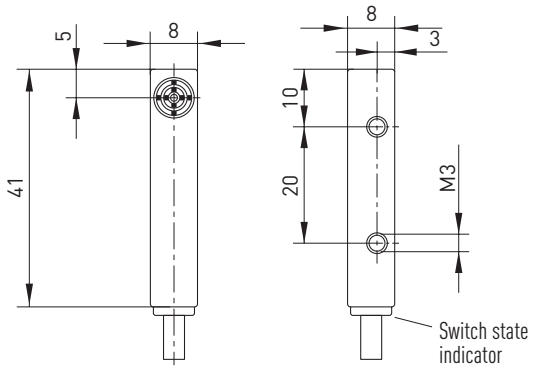
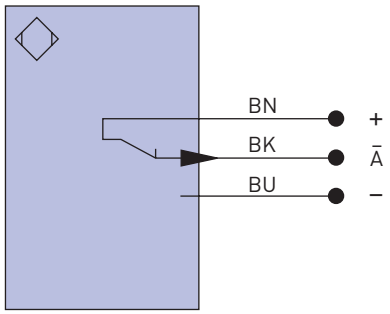


Table 6.6 **Reference switch specifications**

Inductive	
Switching distance	2 mm
Correction factor V2A / brass / Al	0.73 / 0.49 / 0.39
Installation type	Flush
Switch hysteresis	< 15 %
Electrical	
Power supply	10 to 30 VDC
Power input (Ub = 24 V)	< 6 mA
Switching frequency	1500 Hz
Temperature drift	< 10 %
Operating temperature	–25 to +80 °C
Voltage drop switch output	< 2.5 V
Switching current	100 mA
Residual current voltage drop	< 100 µA
Short circuit protection	yes
Reverse polarity protection	yes
Overload protection	yes
Mechanical	
Housing material	Plastic
Full encapsulation	yes
Protection mode	IP 67
Connection type	Cable
Cable length	2 m, 4 m
Protective insulation, rated voltage	50 V

Fig. 6.10 **Circuit diagram of the optional reference switch**



Explanation of symbols
+ Power supply "+"
– Power supply "0V"
A Switch output/opener (NC)

Wire colours
BN Brown
BK Black
BU Blue

Notes

Linear Guideways

Ballscrews

Linear Motor Systems

Linear Axes with Ballscrews

Linear Actuators

Ball Bearings

Linear Motor Components

Rotary Tables

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