HIWIN®

Motion Control & Systems

Linear Motors

& Positioning Measurement Systems

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Note:
The technical data in this catalog may
be changed without prior notice.

Motors, Drives & Accessories

Linear Motors & Positioning Measurement Systems

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.

Contents

Contents

1. Product overview

HIWIN LMSA linear motors

Page 8

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

HIWIN LMC linear motors

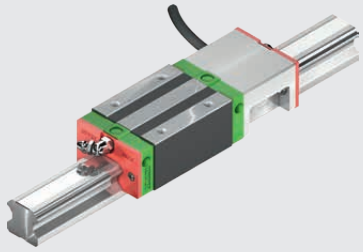
Page 16

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

HIWIN LMFA linear motors

Page 24

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



HIWIN MAGIC – magnetic positioning measurement systems

Page 40

- 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

2. HIWIN LMSA linear motors

2.1 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.

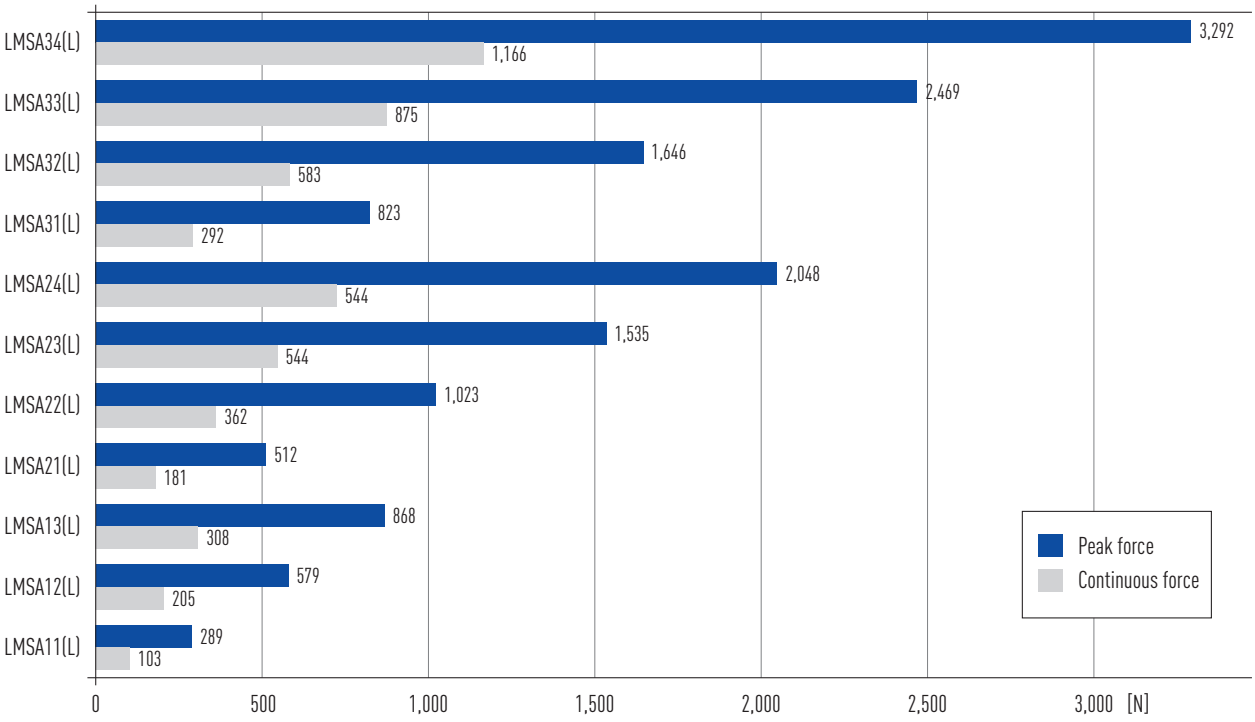
Key features of the LMSA linear motors:

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

Typical fields of application of the LMSA linear motors:

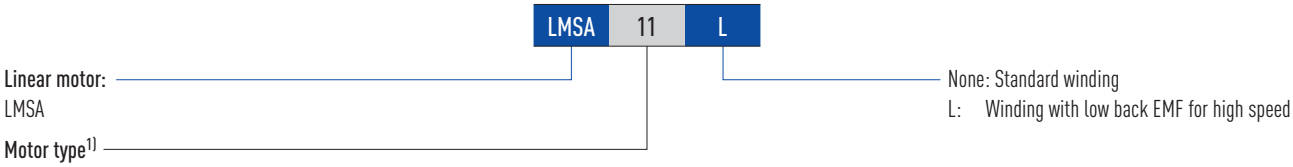
- Automation technology
- Handling
- Packaging
- Semiconductors
- Measuring technology

2.2 Force chart for LMSA linear motors



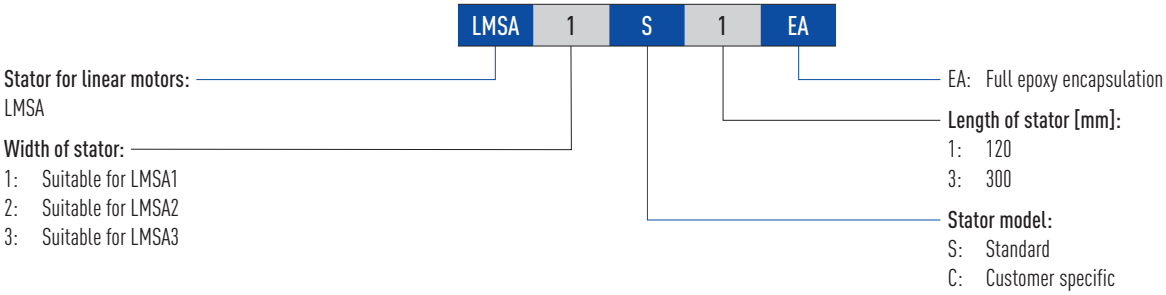
2.3 Order code LMSA linear motors

2.3.1 Order code of primary part (forcer)



[1)] See Table 2.1 (LMSA1)
Table 2.2 (LMSA2)
Table 2.3 (LMSA3)

2.3.2 Order code of magnet track (stator)



2.4 LMSA linear motor specifications

2.4.1 LMSA1 linear motor specifications

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

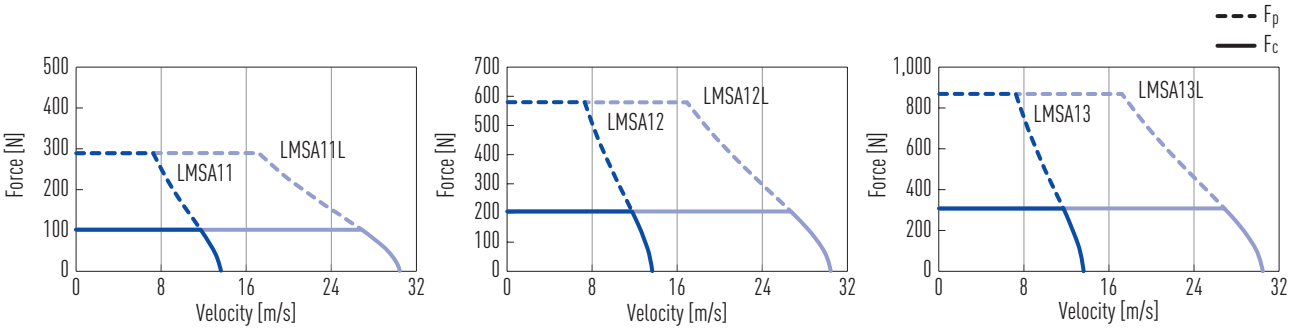


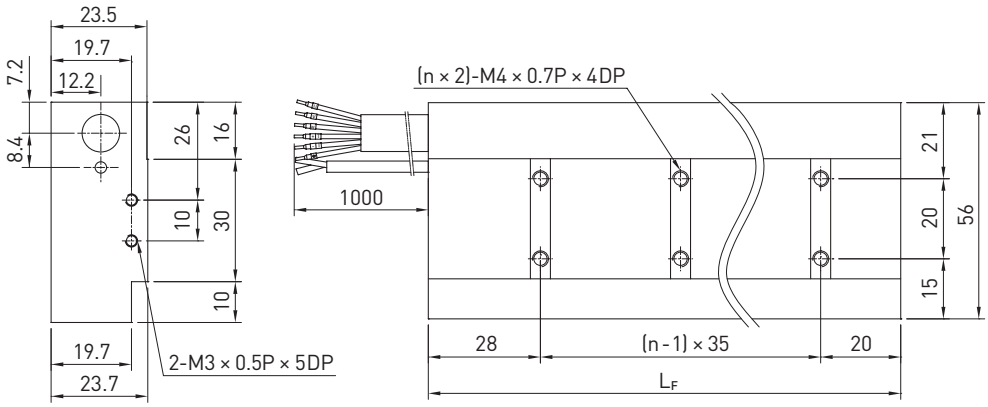
Table 2.1 **Technical data for LMSA1**

	Symbol	Unit	LMSA11	LMSA11L	LMSA12	LMSA12L	LMSA13	LMSA13L
Forces and electrical parameters								
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 s)	F_p	N	289		579		868	
Peak current (for 1 s)	I_p	A_{eff}	6.3	14.1	12.7	28.3	19.0	42.4
Ultimate force (for 0.5 s)	F_u	N	379		759		1,138	
Ultimate current (for 0.5 s)	I_u	A_{eff}	10.6	23.6	21.1	47.1	31.7	70.7
Force constant	K_f	N/A_{eff}	48.6	21.7	48.6	21.7	48.6	21.7
Attraction force	F_a	N	481		963		1,444	
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 time constant	T_{th}	s	1,830		2,720		4,210	
Thermal switch			3 PTC SNM 120 in series					
Max. DC bus voltage		V	600					
Mechanical parameters								
Max. bending radius of motor cable	R_{bend}	mm	69					
Pole pair pitch	2τ	mm	30					
Max. winding 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; 300 mm/N = 5					
Total height (forcer + stator)	H	mm	34					

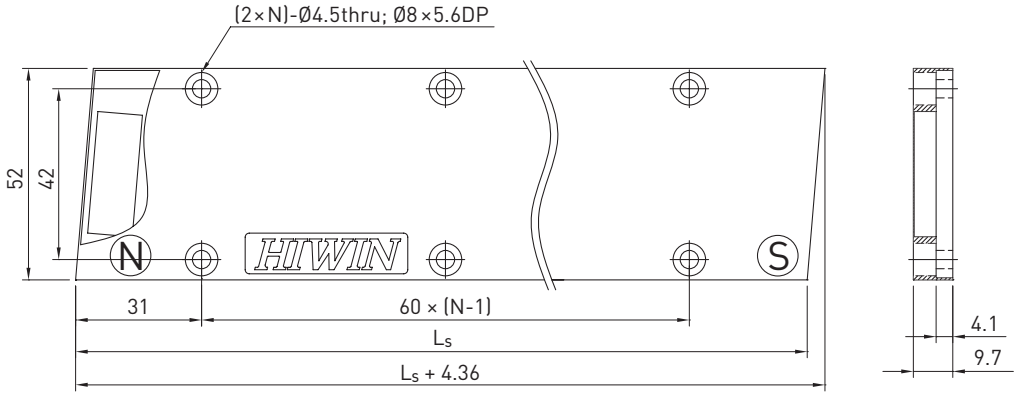
All the specifications in the table (except dimensions) are in ± 10 % of tolerance at 25 °C ambient temperature

[1] Line to line

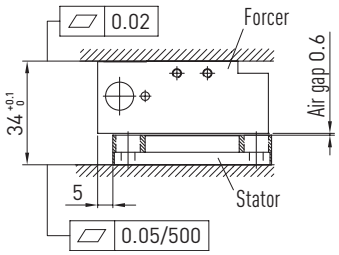
Dimensions of forcer



Dimensions of stator



Mounting tolerances



2.4.2 LMSA2 linear motor specifications

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

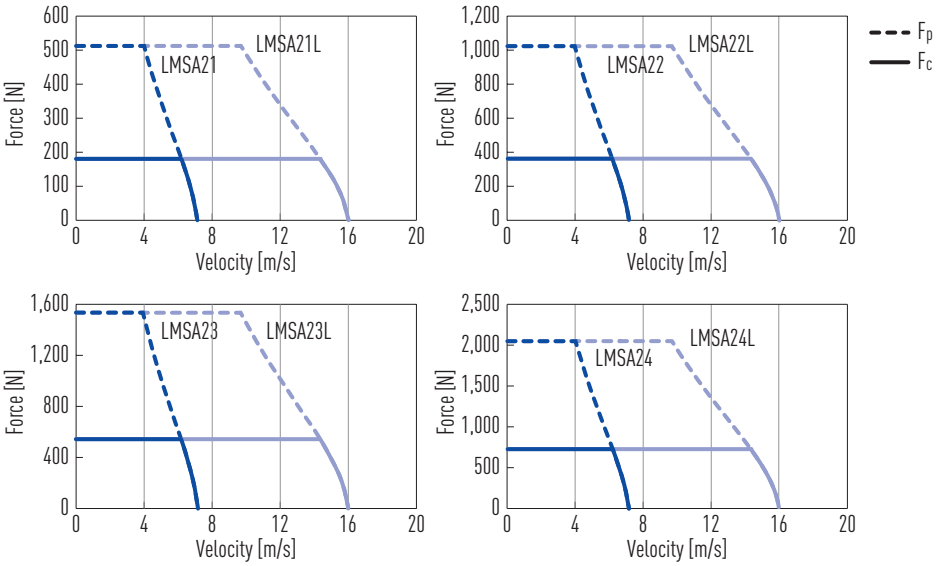


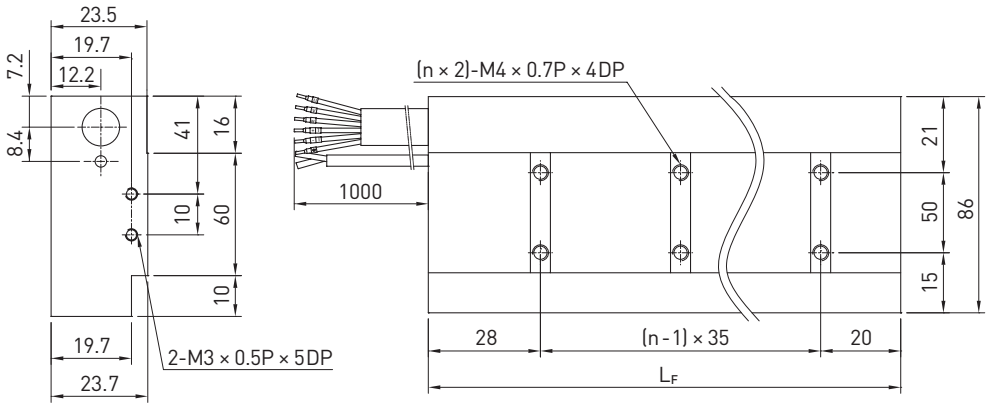
Table 2.2 **Technical data for LMSA2**

	Symbol	Unit	LMSA21	LMSA21L	LMSA22	LMSA22L	LMSA23	LMSA23L	LMSA24	LMSA24L
Forces and electrical parameters										
Continuous force at T_{max}	F_c	N	181		362		544		725	
Continuous current at T_{max}	I_c	A_{eff}	2.0	4.4	3.9	8.8	5.9	13.1	7.8	17.5
Peak force (for 1 s)	F_p	N	512		1,023		1,535		2,048	
Peak current (for 1 s)	I_p	A_{eff}	5.9	13.1	11.8	26.3	17.6	39.4	23.5	52.5
Ultimate force (for 0.5 s)	F_u	N	670		1,341		2,011		2,682	
Ultimate current (for 0.5 s)	I_u	A_{eff}	9.8	21.9	19.6	43.8	29.4	65.7	39.2	87.6
Force constant	K_f	N/A_{eff}	92.5	41.4	92.5	41.4	92.5	41.4	92.5	41.4
Attraction force	F_a	N	963		1,926		2,888		3,851	
Electrical time constant	K_e	ms	4.6	4.6	4.9	4.6	4.9	4.8	4.6	4.7
Resistance [1]	R_{25}	Ω	13.8	2.8	6.8	1.4	4.6	0.9	3.5	0.7
Inductance [1]	L	mH	64.0	12.8	33.0	6.4	22.4	4.3	16.0	3.2
Back EMF constant	K_u	$V_{eff}/(m/s)$	53.4	23.9	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	40.6	40.8
Thermal resistance	R_{th}	°C/W	0.87		0.44		0.29		0.22	
Thermal time constant	T_{th}	s	2,830		4,060		5,080			
Thermal switch			3 PTC SNM 120 in series							
Max. DC bus voltage		V	600							
Mechanical parameters										
Max. bending radius of motor cable	R_{bend}	mm	69							
Pole pair pitch	2τ	mm	30							
Max. winding temperature	T_{max}	°C	120							
Mounting holes (forcer)	n		3		6		9		12	
Weight of forcer	M_F	kg	1.1		2.2		3.3		4.4	
Length of forcer	L_F	mm	118		223		328		433	
Unit mass of stator	M_S	kg/m	4.8							
Length of stator/Dimension N	L_S	mm	120 mm/N = 2; 300 mm/N = 5							
Total height (forcer + stator)	H	mm	34							

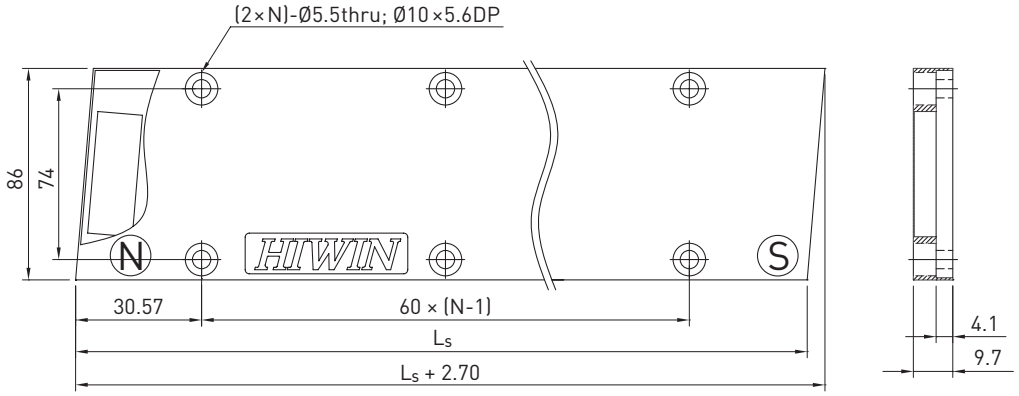
All the specifications in the table (except dimensions) are in ± 10 % of tolerance at 25 °C ambient temperature

[1] Line to line

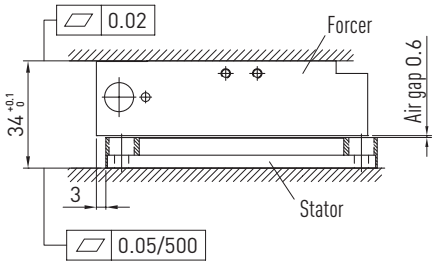
Dimensions of forcer



Dimensions of stator



Mounting tolerances



2.4.3 LMSA3 linear motor specifications

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

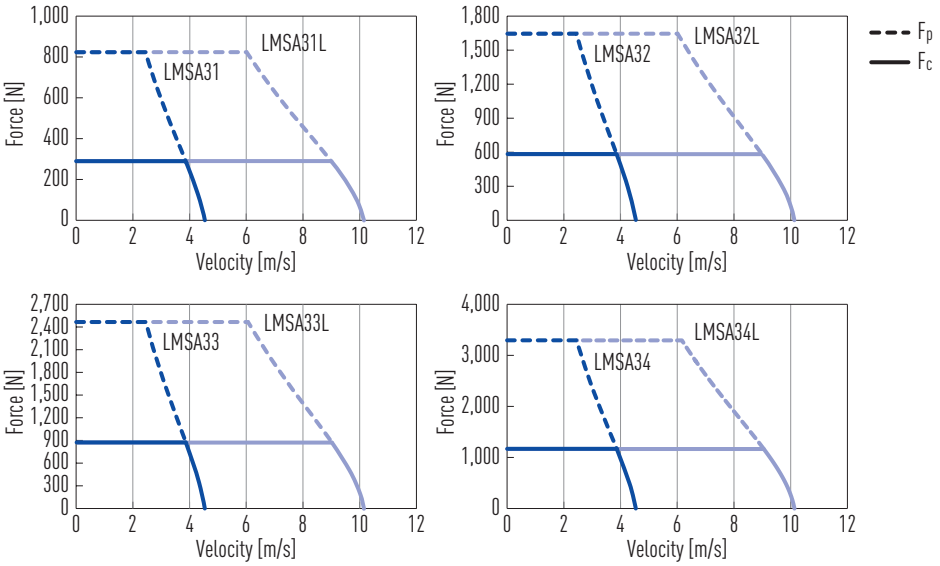


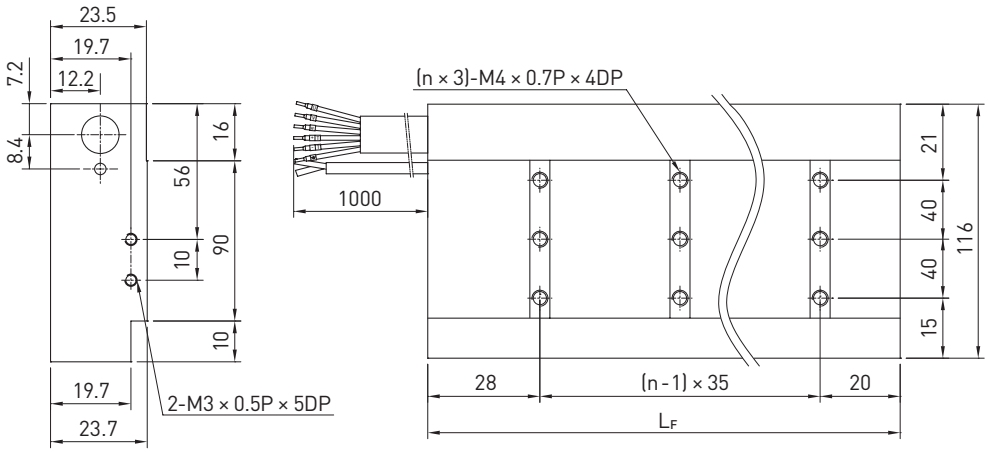
Table 2.3 **Technical data for LMSA3**

	Symbol	Unit	LMSA31	LMSA31L	LMSA32	LMSA32L	LMSA33	LMSA33L	LMSA34	LMSA34L
Forces and electrical parameters										
Continuous force at T_{max}	F_c	N	292		583		875		1,166	
Continuous current at T_{max}	I_c	A_{eff}	2.0	4.5	4.0	8.9	6.0	13.4	8.0	17.9
Peak force (for 1 s)	F_p	N	823		1,646		2,469		3,292	
Peak current (for 1 s)	I_p	A_{eff}	6.0	13.4	12.0	26.8	18.0	40.2	24.0	53.6
Ultimate force (for 0.5 s)	F_u	N	1,079		2,157		3,236		4,314	
Ultimate current (for 0.5 s)	I_u	A_{eff}	10.0	22.3	20.0	44.7	30.0	67.0	40.0	89.4
Force constant	K_f	N/A_{eff}	145.8	65.2	145.8	65.2	145.8	65.2	145.8	65.2
Attraction force	F_a	N	1,444		2,888		4,333		5,777	
Electrical time constant	K_e	ms	4.9	4.9	4.9	4.9	4.9	5.0	4.9	4.9
Resistance [1]	R_{25}	Ω	19.2	4.0	9.6	2.0	6.4	1.3	4.8	1.0
Inductance [1]	L	mH	94.1	19.6	47.1	9.8	31.3	6.5	23.5	4.7
Back EMF constant	K_u	$V_{eff}/(m/s)$	84.2	37.7	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	54.3	54.5
Thermal resistance	R_{th}	°C/W	0.60		0.30		0.20		0.15	
Thermal time constant	T_{th}	s	4,540		5,740		5,580			
Thermal switch			3 PTC SNM 120 in series							
Max. DC bus voltage		V	600							
Mechanical parameters										
Max. bending radius of motor cable	R_{bend}	mm	69							
Pole pair pitch	2τ	mm	30							
Max. winding temperature	T_{max}	°C	120							
Mounting holes (forcer)	n		3		6		9		12	
Weight of forcer	M_F	kg	1.9		3.8		5.7		7.6	
Length of forcer	L_F	mm	118		223		328		433	
Unit mass of stator	M_S	kg/m	8.5							
Length of stator/Dimension N	L_S	mm	120 mm/N = 2; 300 mm/N = 5							
Total height (forcer + stator)	H	mm	36							

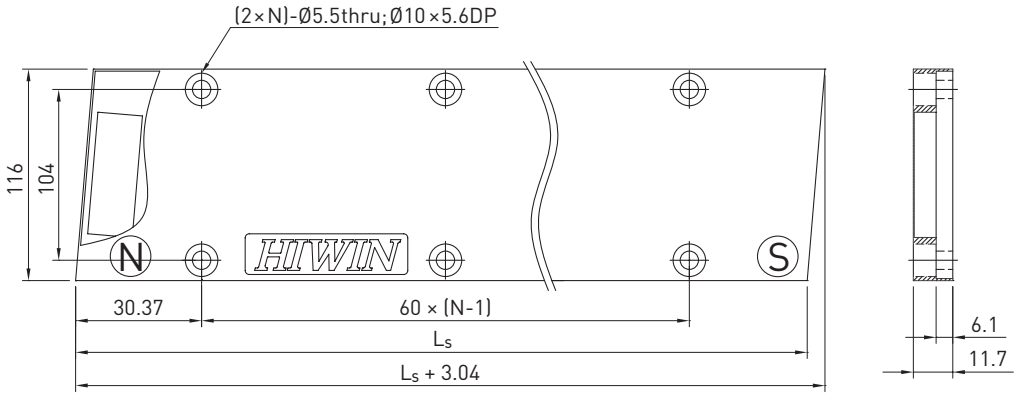
All the specifications in the table (except dimensions) are in ± 10 % of tolerance at 25 °C ambient temperature

[1] Line to line

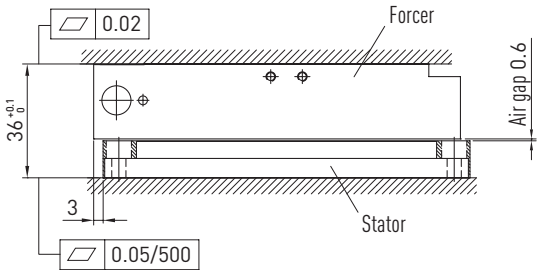
Dimensions of forcer



Dimensions of stator



Mounting tolerances



3. HIWIN LMC linear motors

3.1 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 motors:

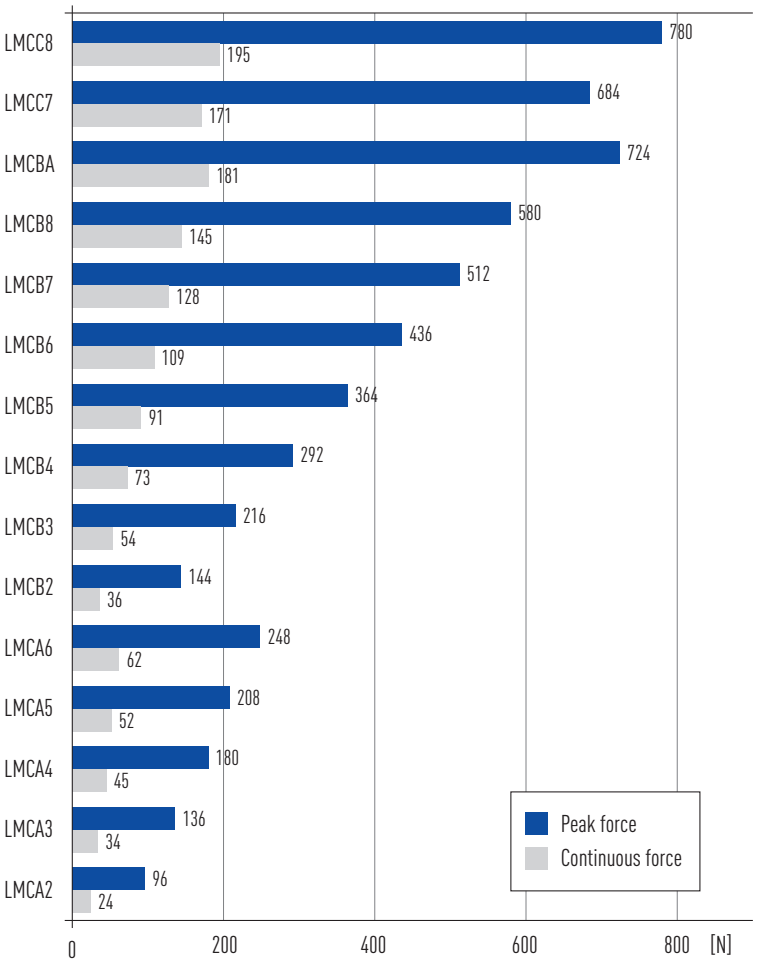
- Extremely dynamic
- No cogging, thus highest synchronous operation
- No magnetic pull in the guiding system
- Optional: design for vacuum applications

Typical fields of application of the LMC linear motors:

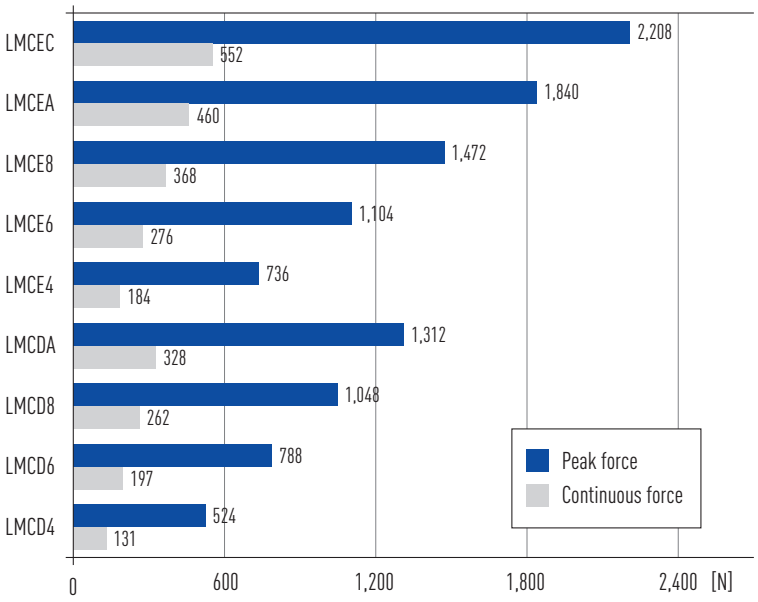
- Pick-and-place machines in semiconductor technology
- Air bearing axes
- Wafer structuring
- Pick-and-place machines
- High-precision measuring and testing machines
- Semiconductors

3.2 Force chart for LMC linear motors

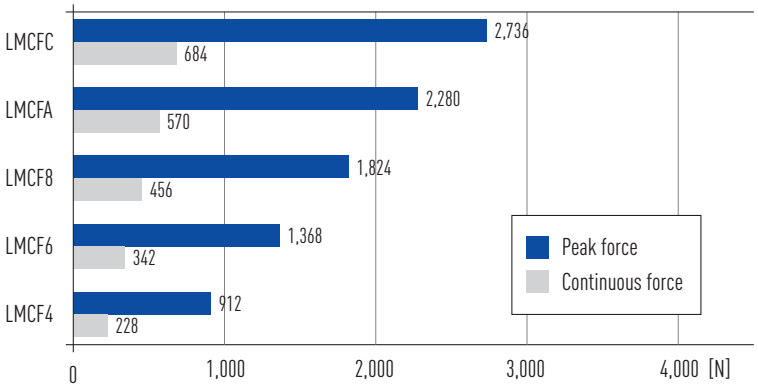
Force chart for linear motors LMCA, LMCB, LMCC



Force chart for linear motors LMCD, LMCE



Force chart for linear motors LMCF



3.3 Order code LMC linear motors

3.3.1 Order code of primary part (forcer)

LMC	A2

Linear motor:
LMC

Motor type[1)]

[1)] See Table 3.1 (LMCA, LMCB, LMCC), Table 3.2 (LMCD, LMCE), Table 3.3 (LMCF)

3.3.2 Order code of magnet track (stator)

LMC	A	S	1

Stator for linear motors:
LMC

Height of stator:
A: Suitable for LMCA
B: Suitable for LMCB
C: Suitable for LMCC
D: Suitable for LMCD
E: Suitable for LMCE
F: Suitable for LMCF

Length of stator [mm]:
LMCA, LMCB, LMCC: 0: 128
3: 320
LMCD, LMCE, LMCF: 1: 120
2: 300

Stator model:
S: Standard
C: Customer specific

3.4 LMC linear motor specifications

3.4.1 LMCA, LMCB, LMCC linear motor specifications

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

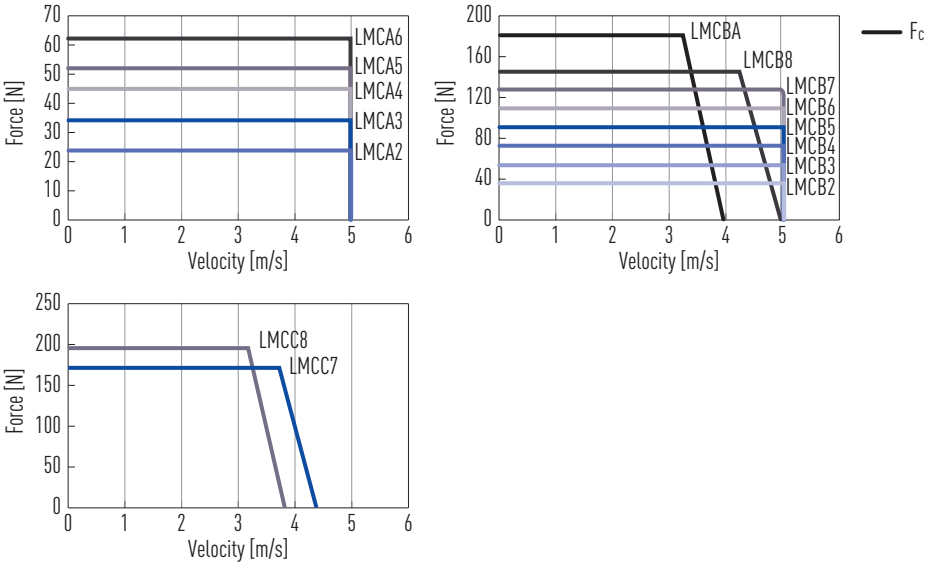
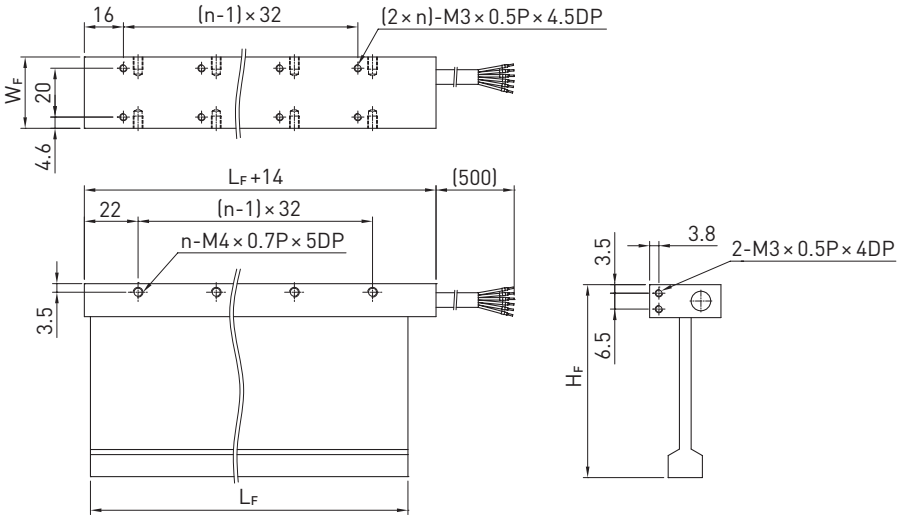


Table 3.1 **Technical data for LMCA, LMCB, LMCC**

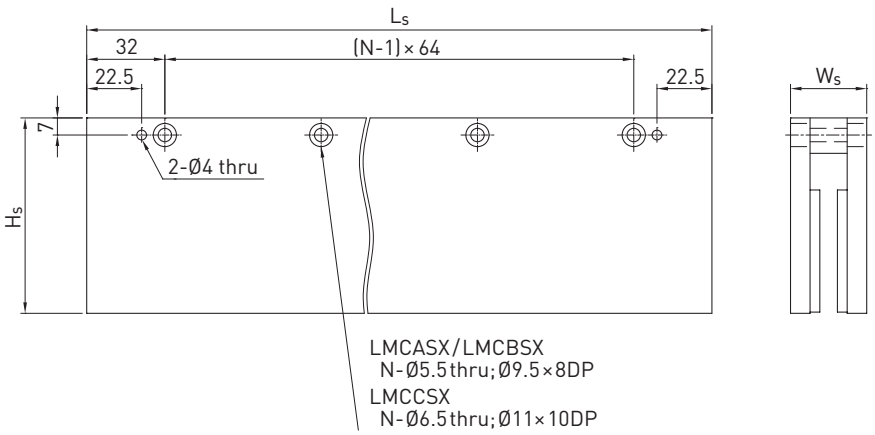
	Symbol	Unit	LMCA2	LMCA3	LMCA4	LMCA5	LMCA6	LMCB2	LMCB3	LMCB4	LMCB5	LMCB6	LMCB7	LMCB8	LMCBA	LMCC7	LMCC8
Forces and electrical parameters																	
Continuous force at T_{max}	F_c	N	24	34	45	52	62	36	54	73	91	109	128	145	181	171	195
Continuous current at T_{max}	I_c	A_{eff}	2.3	2.1	2.1	1.8	1.8	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Peak force (for 1 s)	F_p	N	96	136	180	208	248	144	216	292	364	436	512	580	724	684	780
Peak current (for 1 s)	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. winding 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														
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; 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

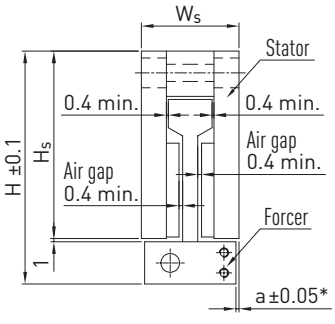
Dimensions of forcer



Dimensions of stator



Mounting tolerances



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

3.4.2 LMCD, LMCE linear motor specifications

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

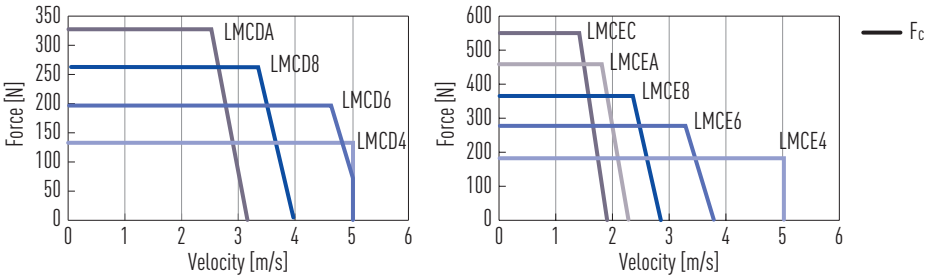
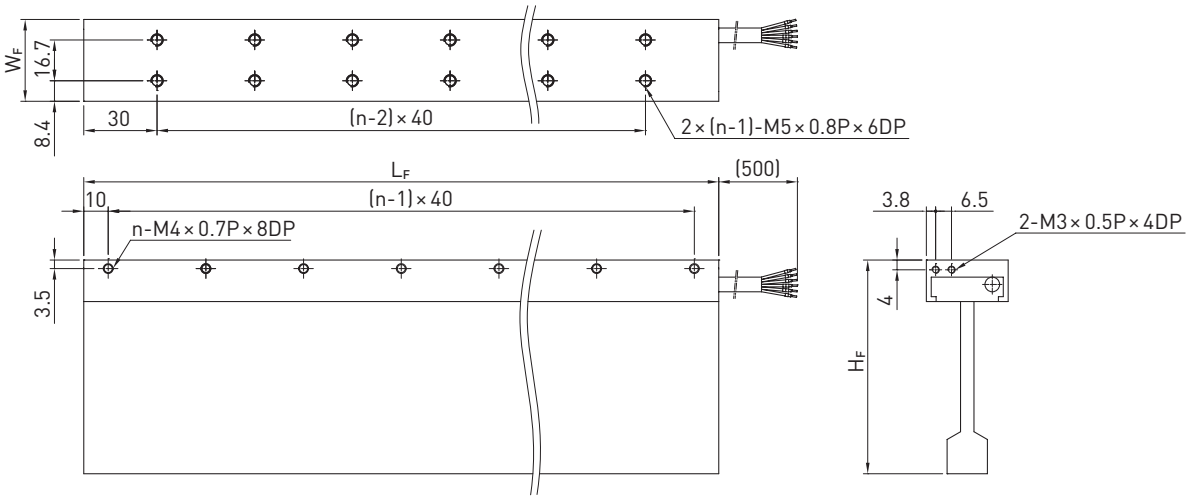


Table 3.2 **Technical data for LMCD, LMCE**

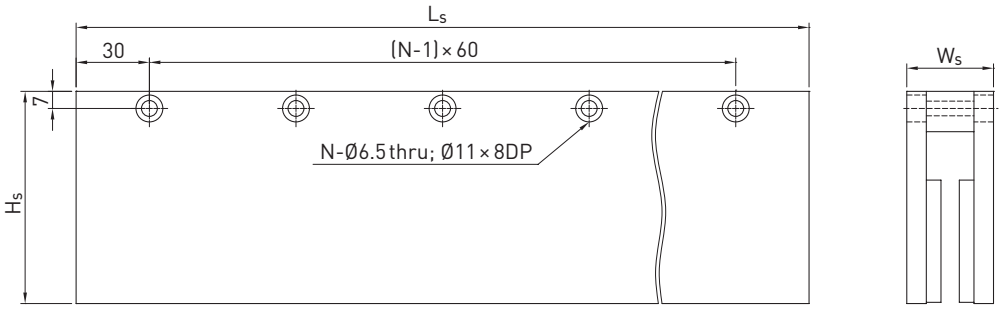
	Symbol	Unit	LMCD4	LMCD6	LMCD8	LMCDA	LMCE4	LMCE6	LMCE8	LMCEA	LMCEC
Forces and electrical parameters											
Continuous force at T_{max}	F_c	N	131	197	262	328	184	276	368	460	552
Continuous current at T_{max}	I_c	A_{eff}	3.25	3.25	3.25	3.25	3.25	3.25	3.25	3.25	3.25
Peak force (for 1 s)	F_p	N	524	788	1,048	1,312	736	1,104	1,472	1,840	2,208
Peak current (for 1 s)	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. winding 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; 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

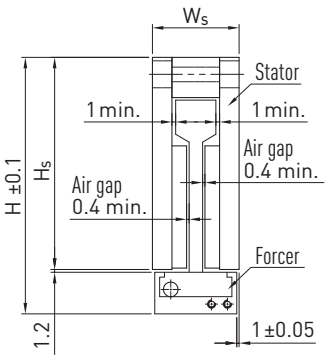
Dimensions of forcer



Dimensions of stator



Mounting tolerances



3.4.3 LMCF linear motor specifications

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

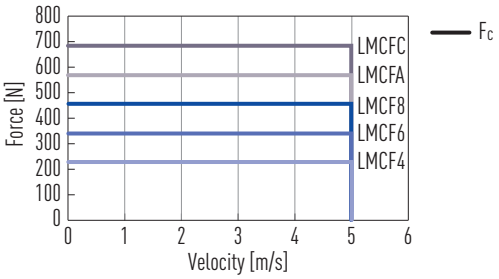
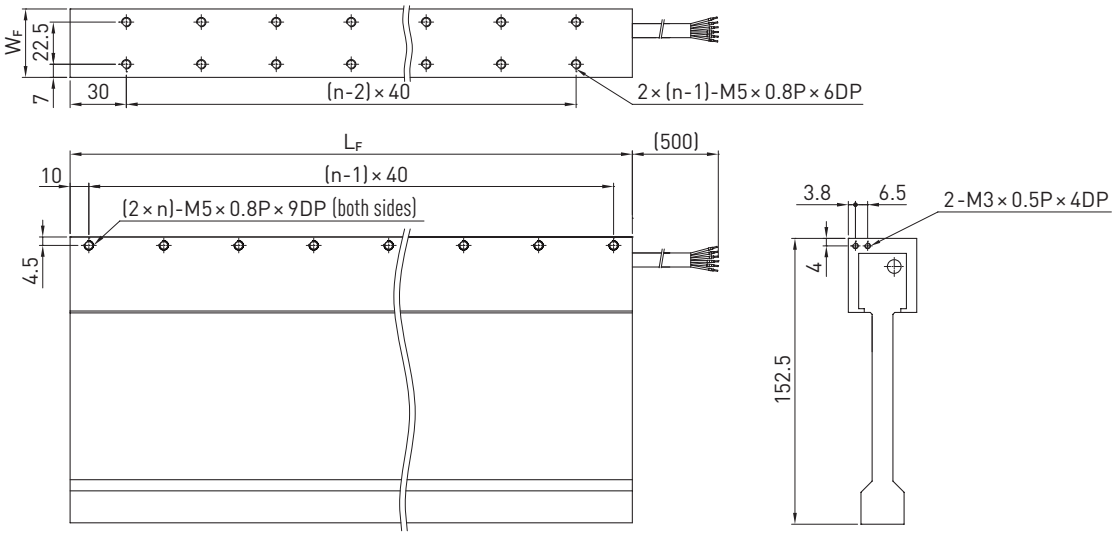


Table 3.3 **Technical data for LMCF**

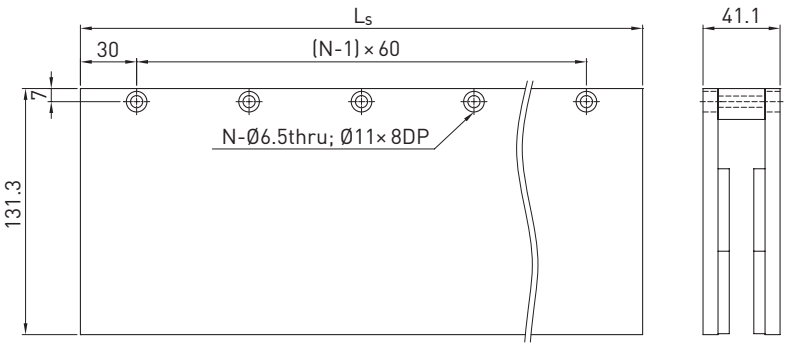
	Symbol	Unit	LMCF4	LMCF6	LMCF8	LMCFA	LMCFC
Forces and electrical parameters							
Continuous force at T_{max}	F_c	N	228	342	456	570	684
Continuous current at T_{max}	I_c	A_{eff}	3.8	5.7	7.6	9.5	11.4
Peak force (for 1 s)	F_p	N	912	1,368	1,824	2,280	2,736
Peak current (for 1 s)	I_p	A_{eff}	15.2	22.8	30.4	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. winding 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; 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

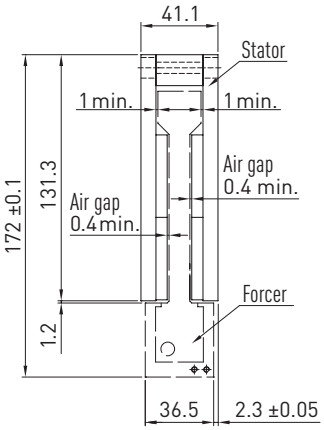
Dimensions of forcer



Dimensions of stator



Mounting tolerances



4. HIWIN LMFA linear motors

4.1 Special characteristics of the LMFA linear motors

The HIWIN 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 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 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 LMFA linear motors:

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

Typical fields of application of the LMFA linear motors:

- Machine tools
- Portal milling machines
- Sheet metal forming machines

4.2 Order code LMFA linear motors

4.2.1 Order code of primary part (forcer)

LMFA	01	L	C

Linear motor:
LMFA

Motor type [1)]

None: Cable output
C: Connector output

None: Standard winding
L: Winding with low back EMF for high speed

[1)] See Table 4.1 (LMFA0), Table 4.2 (LMFA1), Table 4.3 (LMFA2), Table 4.4 (LMFA3), Table 4.5 (LMFA4), Table 4.6 (LMFA5), Table 4.7 (LMFA6)

4.2.2 Order code of magnet track (stator)

LMF	1	S	2	E

Stator for linear motor:
LMFA

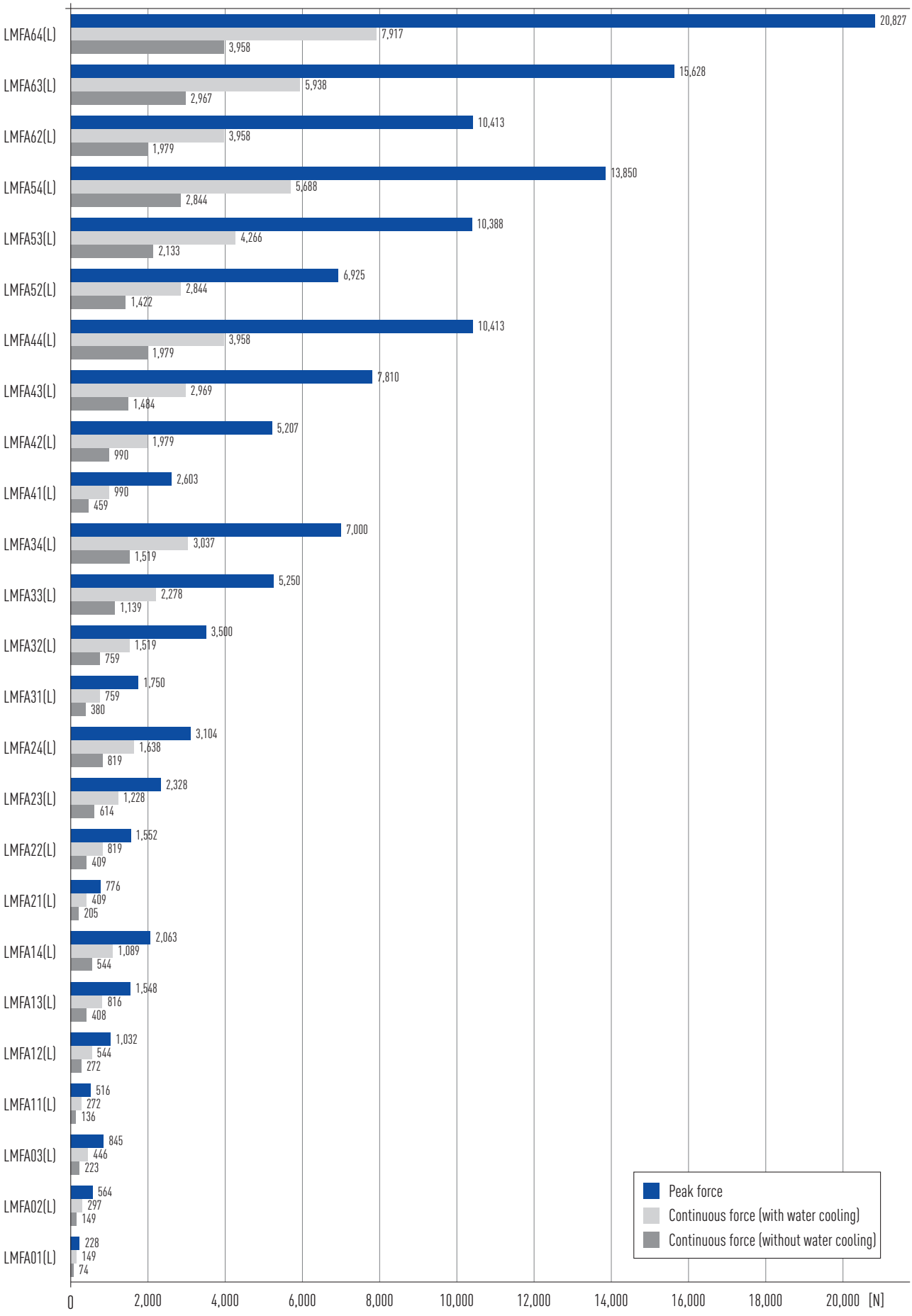
Width of stators:
0: Suitable for LMFA01–LMFA03
1: Suitable for LMFA11–LMFA14
2: Suitable for LMFA21–LMFA24
3: Suitable for LMFA31–LMFA34
4: Suitable for LMFA41–LMFA44
5: Suitable for LMFA52–LMFA54
6: Suitable for LMFA62–LMFA64

E: Permanent magnets cast in epoxy resin

Length of stator [mm]:
1: 120 for LMFA01–LMFA24
3: 300 for LMFA01–LMFA24
1: 184 for LMFA31–LMFA64
3: 460 for LMFA31–LMFA54

Stator model:
S: Standard
C: Customer specific

4.3 Force chart for LMFA linear motors



4.4 LMFA linear motor specifications

4.4.1 LMFA0 linear motor specifications

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

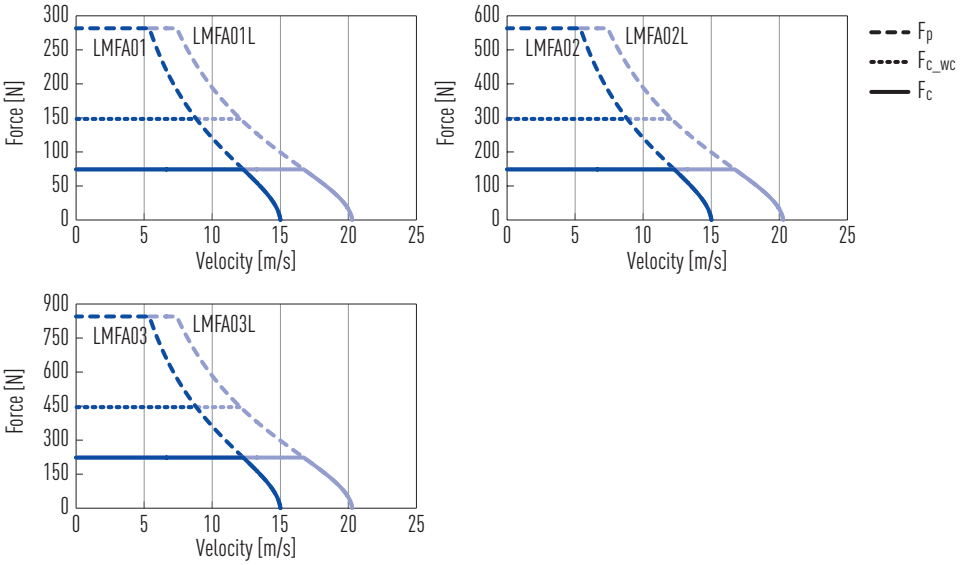
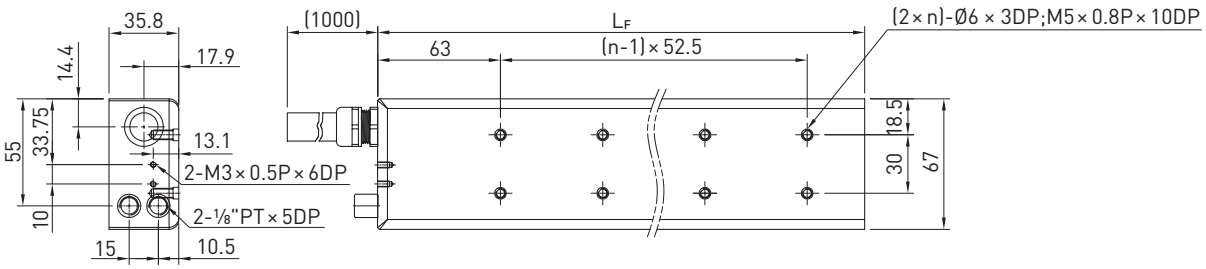


Table 4.1 **Technical data for LMFA0**

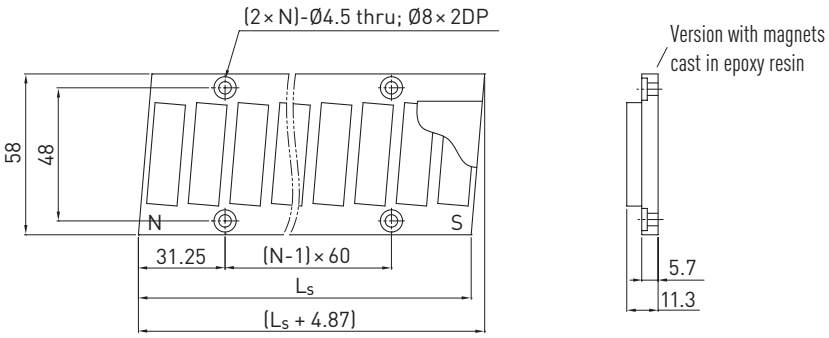
	Symbol	Unit	LMFA01	LMFA01L	LMFA02	LMFA02L	LMFA03	LMFA03L
Forces and electrical parameters								
Continuous force at T_{max}	F_c	N	74		149		223	
Peak force at T_{max} (WC)	F_{c_WC}	N	149		297		446	
Continuous current at T_{max}	I_c	A_{eff}	1.4	1.8	2.7	3.6	4.1	5.5
Continuous current at T_{max} (WC)	I_{c_WC}	A_{eff}	2.7	3.6	5.4	7.3	8.1	10.9
Peak force (for 1 s)	F_p	N	282		564		845	
Peak current (for 1 s)	I_p	A_{eff}	8.4	11.3	16.7	22.6	25.1	33.9
Force constant	K_f	N/A_{eff}	55.1	40.8	55.1	40.8	55.1	40.8
Attraction force	F_a	N	457		914		1,372	
Electrical time constant	K_e	ms	7.2	7.7	7.2	7.7	7.2	7.7
Resistance [1]	R_{25}	Ω	11.7	6.0	5.9	3.0	3.9	2.0
Inductance [1]	L	mH	84.2	46.2	42.1	23.1	28.1	15.4
Back EMF constant	K_u	$V_{eff}/(m/s)$	31.8	23.5	31.8	23.5	31.8	23.5
Motor constant	K_m	$N/\sqrt{W}$	13.1	13.6	18.6	19.2	22.8	23.5
Thermal resistance	R_{th}	°C/W	2.25	2.40	1.13	1.20	0.75	0.80
Thermal resistance (WC)	R_{th_WC}	°C/W	0.56	0.60	0.28	0.30	0.19	0.20
Thermal switch			1 × PT1000 + 1 × (3 PTC SNM 120 in series)					
Max. DC bus voltage		V	750					
Mechanical parameters								
Pole pair pitch	2τ	mm	30					
Max. winding 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; 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

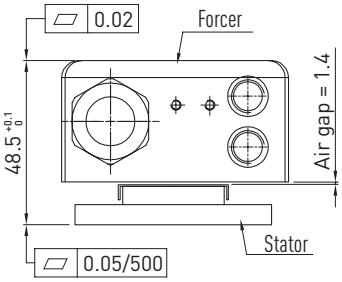
Dimensions of forcer



Dimensions of stator



Mounting tolerances



Stator versions available

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

4.4.2 LMFA1 linear motor specifications

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

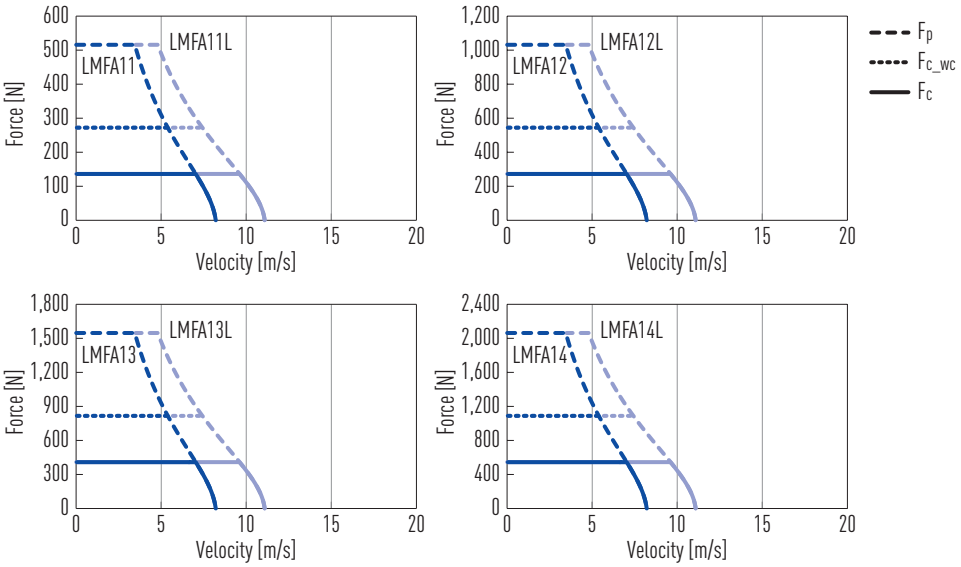
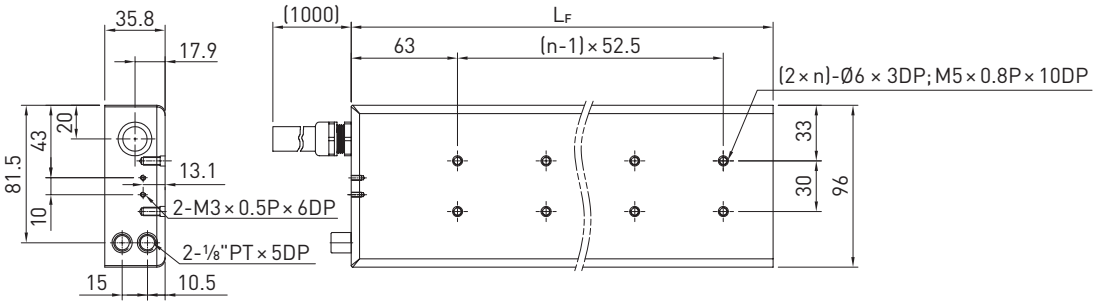


Table 4.2 **Technical data for LMFA1**

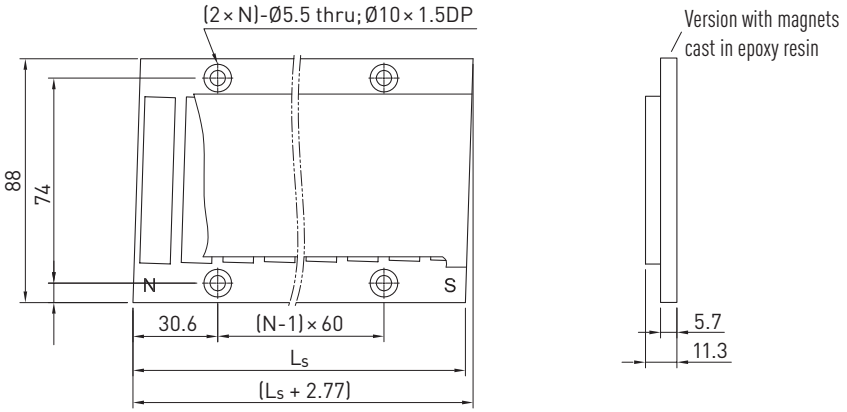
	Symbol	Unit	LMFA11	LMFA11L	LMFA12	LMFA12L	LMFA13	LMFA13L	LMFA14	LMFA14L
Forces and electrical parameters										
Continuous force at T_{max}	F_c	N	136		272		408		544	
Continuous force at T_{max} (WC)	F_{c_WC}	N	272		544		816		1,089	
Continuous current at T_{max}	I_c	A_{eff}	1.4	1.8	2.7	3.6	4.0	5.5	5.4	7.3
Continuous current at T_{max} (WC)	I_{c_WC}	A_{eff}	2.7	3.6	5.4	7.3	8.1	10.9	10.8	14.6
Peak force (for 1 s)	F_p	N	516		1,032		1,548		2,063	
Peak current (for 1 s)	I_p	A_{eff}	8.4	11.3	16.7	22.3	25.1	33.9	33.5	45.2
Force constant	K_f	N/A_{eff}	100.8	74.4	100.8	74.6	100.8	74.6	100.8	74.6
Attraction force	F_a	N	837		1,674		2,511		3,348	
Electrical time constant	K_e	ms	7.2	7.7	7.2	7.7	7.2	7.7	7.2	7.7
Resistance [1]	R_{25}	Ω	16.9	8.7	8.4	4.3	5.6	2.9	4.2	2.2
Inductance [1]	L	mH	121.9	66.8	60.9	33.4	40.6	22.3	30.5	16.7
Back EMF constant	K_u	V_{eff}/(m/s)	58.2	43.1	58.2	43.1	58.2	43.1	58.2	43.1
Motor constant	K_m	N/√W	20.0	20.7	28.3	29.2	34.7	35.8	40.1	41.4
Thermal resistance	R_{th}	°C/W	1.56	1.66	0.78	0.83	0.52	0.55	0.39	0.42
Thermal resistance (WC)	R_{th_WC}	°C/W	0.39	0.42	0.20	0.21	0.13	0.14	0.10	0.10
Thermal switch			1 × PT1000 + 1 × (3 PTC SNM 120 in series)							
Max. DC bus voltage		V	750							
Mechanical parameters										
Pole pair pitch	2τ	mm	30							
Max. winding temperature	T_{max}	°C	120							
Mounting holes (forcer)	n		2		4		6		8	
Weight of forcer	M_F	kg	2.4		4.0		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; 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

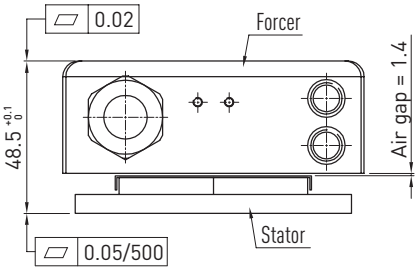
Dimensions of forcer



Dimensions of stator



Mounting tolerances



Stator versions available

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

4.4.3 LMFA2 linear motor specifications

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

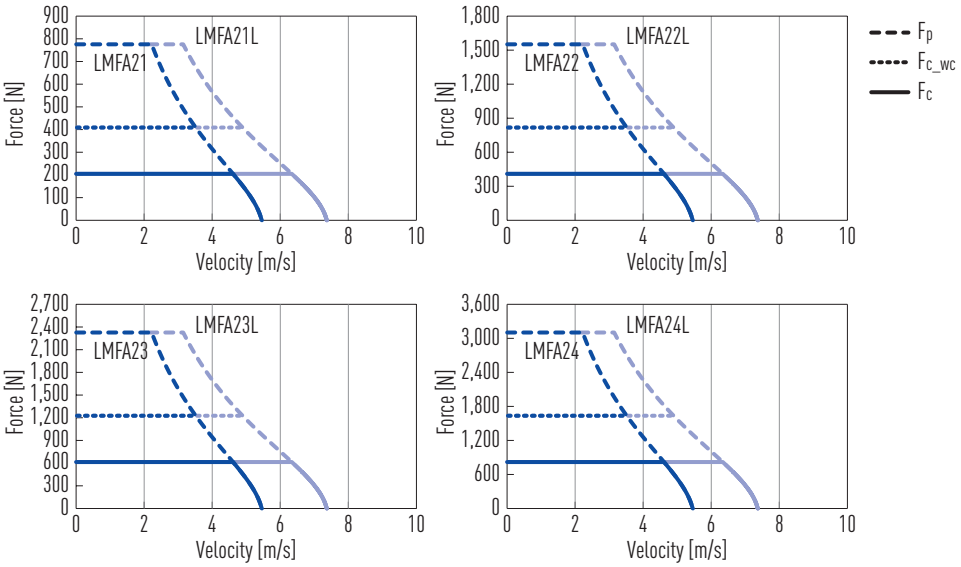
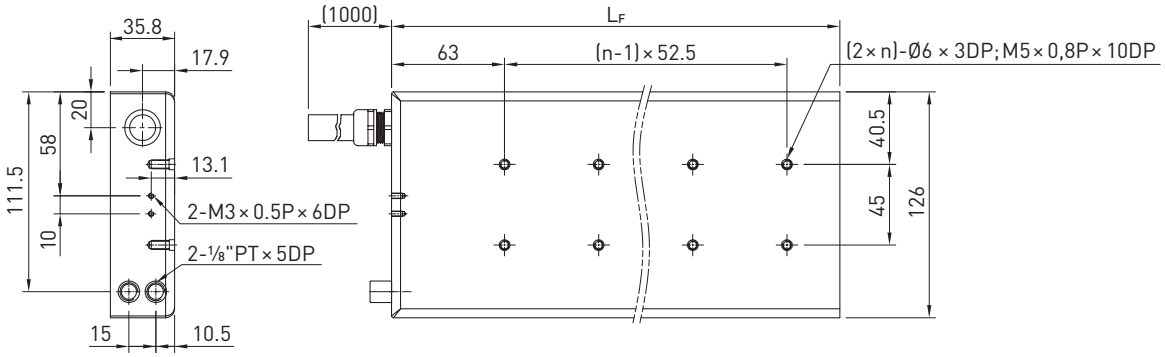


Table 4.3 **Technical data for LMFA2**

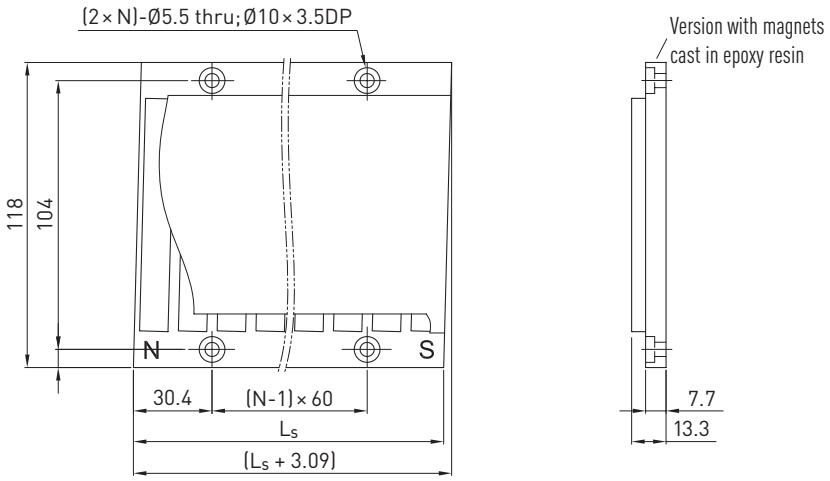
	Symbol	Unit	LMFA21	LMFA21L	LMFA22	LMFA22L	LMFA23	LMFA23L	LMFA24	LMFA24L
Forces and electrical parameters										
Continuous force at T_{max}	F_c	N	205		409		614		819	
Continuous force at T_{max} (WC)	F_{c_WC}	N	409		819		1,228		1,638	
Continuous current at T_{max}	I_c	A_{eff}	1.4	1.8	2.7	3.6	4.1	5.5	5.4	7.3
Continuous current at T_{max} (WC)	I_{c_WC}	A_{eff}	2.7	3.6	5.4	7.3	8.1	10.9	10.8	14.6
Peak force (for 1 s)	F_p	N	776		1,552		2,328		3,104	
Peak current (for 1 s)	I_p	A_{eff}	8.4	11.3	16.7	22.6	25.1	33.9	33.5	45.2
Force constant	K_f	N/A_{eff}	151.6	112.2	151.6	112.2	151.6	112.2	151.6	112.2
Attraction force	F_a	N	1,259		2,518		3,777		5,036	
Electrical time constant	K_e	ms	7.2	7.7	7.2	7.7	7.2	7.7	7.2	7.7
Resistance [1]	R_{25}	Ω	24.8	12.7	12.4	6.4	8.3	4.2	6.2	3.2
Inductance [1]	L	mH	178.6	97.8	89.3	48.9	59.5	32.6	44.6	24.5
Back EMF constant	K_u	$V_{eff}/(m/s)$	87.5	64.8	87.5	64.8	87.5	64.8	87.5	64.8
Motor constant	K_m	$N/\sqrt{W}$	24.9	25.7	35.2	36.3	43.1	44.5	49.7	51.3
Thermal resistance	R_{th}	°C/W	1.06	1.13	0.53	0.57	0.35	0.38	0.27	0.28
Thermal resistance (WC)	R_{th_WC}	°C/W	0.27	0.28	0.13	0.14	0.09	0.09	0.07	0.07
Thermal switch			1 × PT1000 + 1 × (3 PTC SNM 120 in series)							
Max. DC bus voltage		V	750							
Mechanical parameters										
Pole pair pitch	2τ	mm	30							
Max. winding temperature	T_{max}	°C	120							
Mounting holes (forcer)	n		2		4		6		8	
Weight of forcer	M_F	kg	3.2		5.5		8.0		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; 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

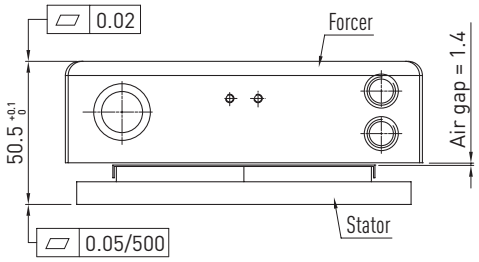
Dimensions of forcer



Dimensions of stator



Mounting tolerances



Stator versions available

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

4.4.4 LMFA3 linear motor specifications

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

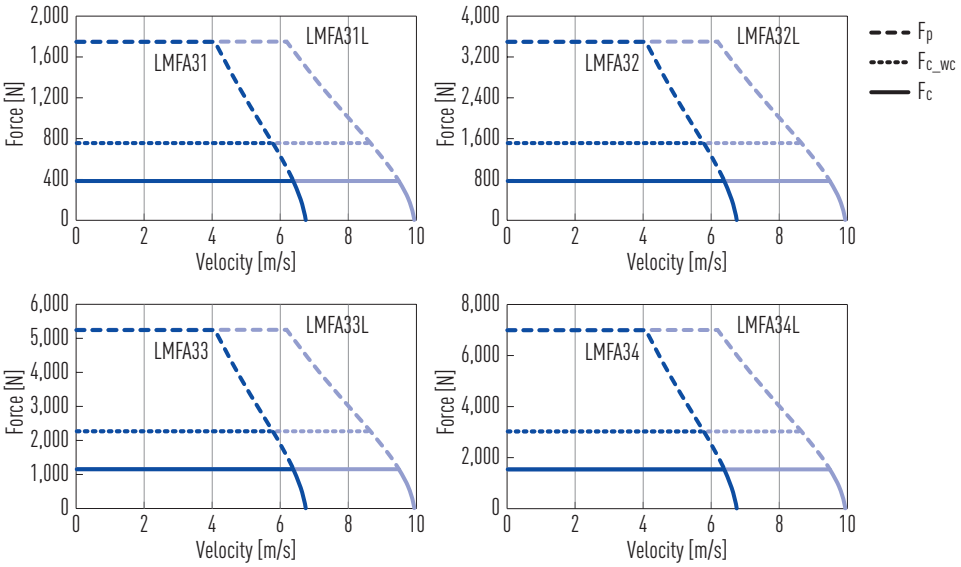
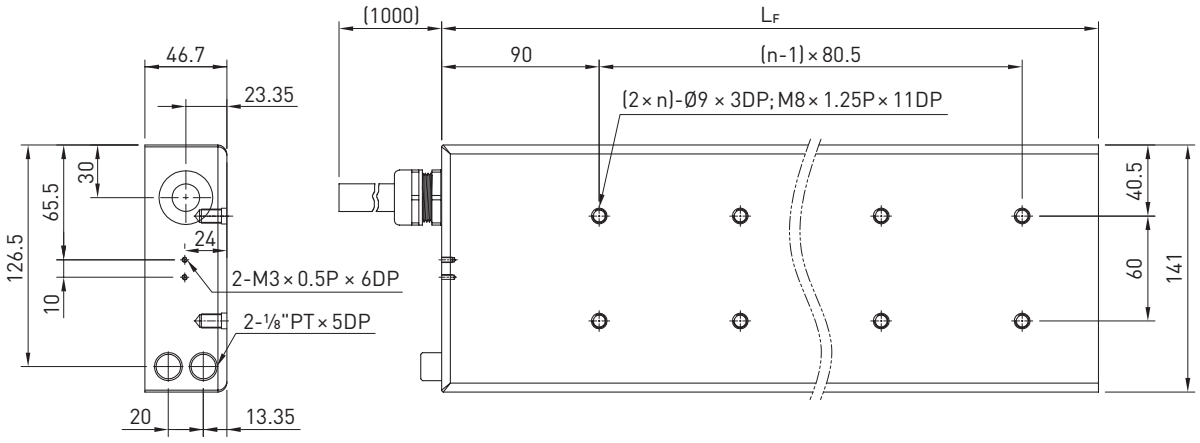


Table 4.4 **Technical data for LMFA3**

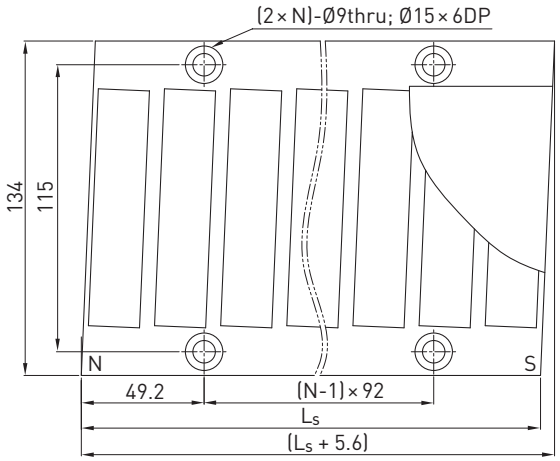
	Symbol	Unit	LMFA31	LMFA31L	LMFA32	LMFA32L	LMFA33	LMFA33L	LMFA34	LMFA34L
Forces and electrical parameters										
Continuous force at T_{max}	F_c	N	380		759		1,139		1,519	
Continuous force at T_{max} (WC)	F_{c_WC}	N	759		1,519		2,278		3,037	
Continuous current at T_{max}	I_c	A_{eff}	3.1	4.6	6.2	9.1	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 s)	F_p	N	1,750		3,500		5,250		7,000	
Peak current (for 1 s)	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	3,430		6,860		10,290		13,720	
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	1.17	1.19	0.59	0.59	0.39	0.40	0.29	0.30
Thermal resistance (WC)	R_{th_WC}	°C/W	0.29	0.30	0.15	0.15	0.10	0.10	0.07	0.07
Thermal switch			1 × PT1000 + 1 × (3 PTC SNM 120 in series)							
Max. DC bus voltage		V	750							
Mechanical parameters										
Pole pair pitch	2τ	mm	46							
Max. winding 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; 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

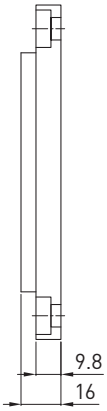
Dimensions of forcer



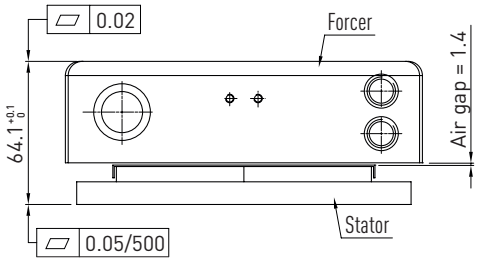
Dimensions of stator



Version with magnets cast in epoxy resin



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

4.4.5 LMFA4 linear motor specifications

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

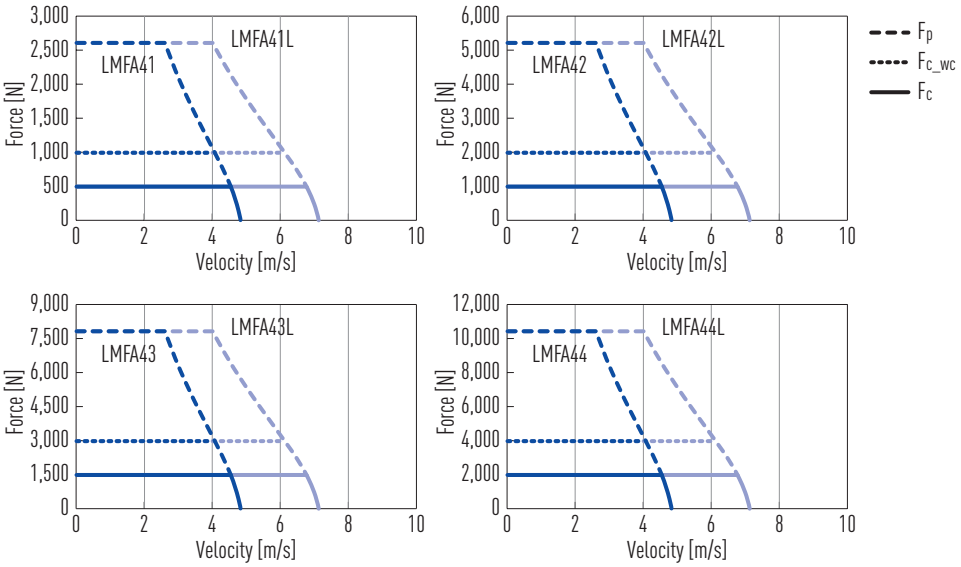
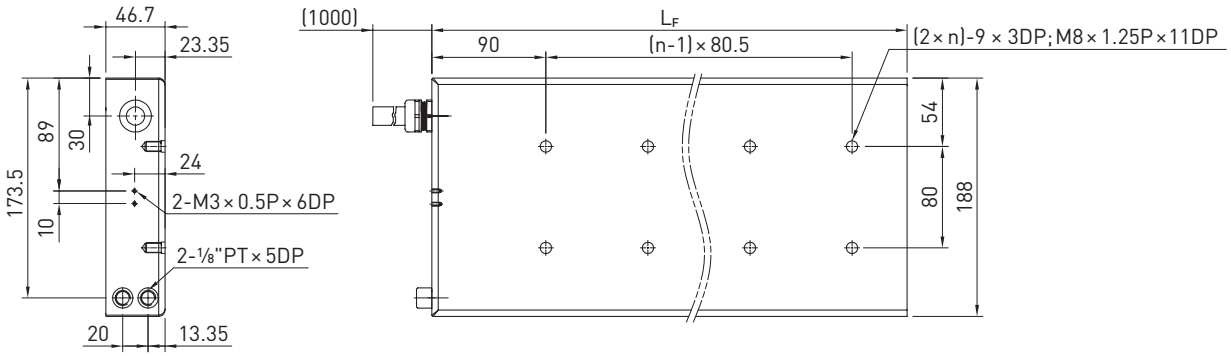


Table 4.5 **Technical data for LMFA4**

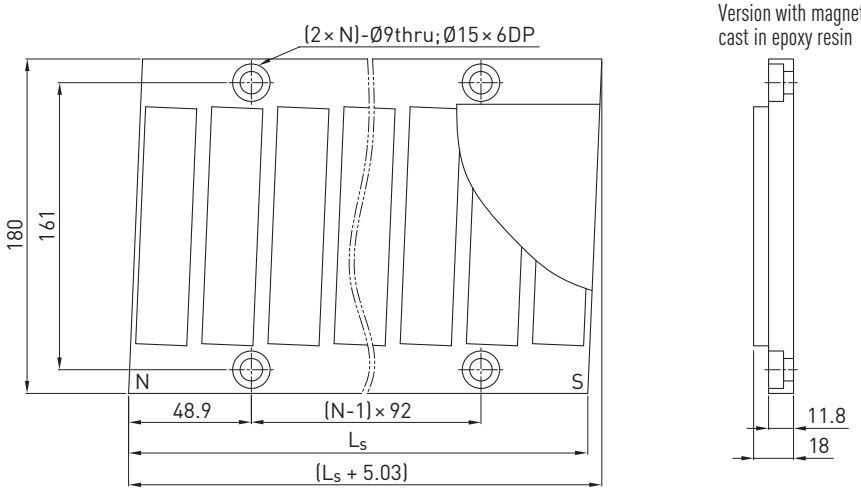
	Symbol	Unit	LMFA41	LMFA41L	LMFA42	LMFA42L	LMFA43	LMFA43L	LMFA44	LMFA44L
Forces and electrical parameters										
Continuous force at T_{max}	F_c	N	495		990		1,484		1,979	
Continuous force at T_{max} (WC)	F_{c_WC}	N	990		1,979		2,969		3,958	
Continuous current at T_{max}	I_c	A_{eff}	2.9	4.3	5.8	8.5	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 s)	F_p	N	2,603		5,207		7,810		10,413	
Peak current (for 1 s)	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	5,145		10,290		15,435		20,580	
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	0.96	0.97	0.48	0.49	0.32	0.32	0.24	0.24
Thermal resistance (WC)	R_{th_WC}	°C/W	0.24	0.24	0.12	0.12	0.08	0.08	0.06	0.06
Thermal switch			1 × PT1000 + 1 × (3 PTC SNM 120 in series)							
Max. DC bus voltage		V	750							
Mechanical parameters										
Pole pair pitch	2τ	mm	46							
Max. winding temperature	T_{max}	°C	120							
Mounting holes (forcer)	n		2		4		6		8	
Weight of forcer	M_F	kg	9.5		16.2		23.0		29.0	
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; 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

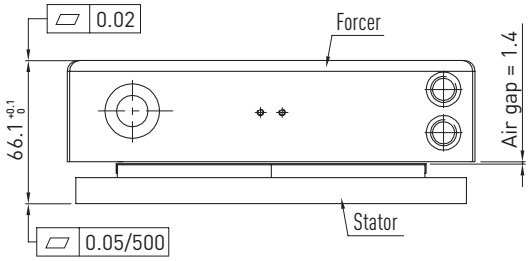


Dimensions of stator



Version with magnets cast in epoxy resin

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

4.4.6 LMFA5 linear motor specifications

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

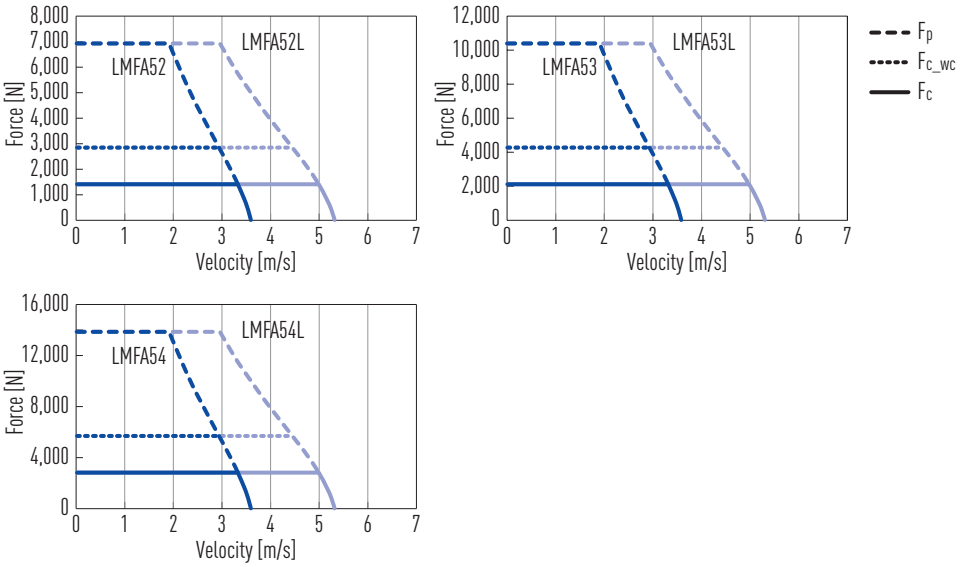
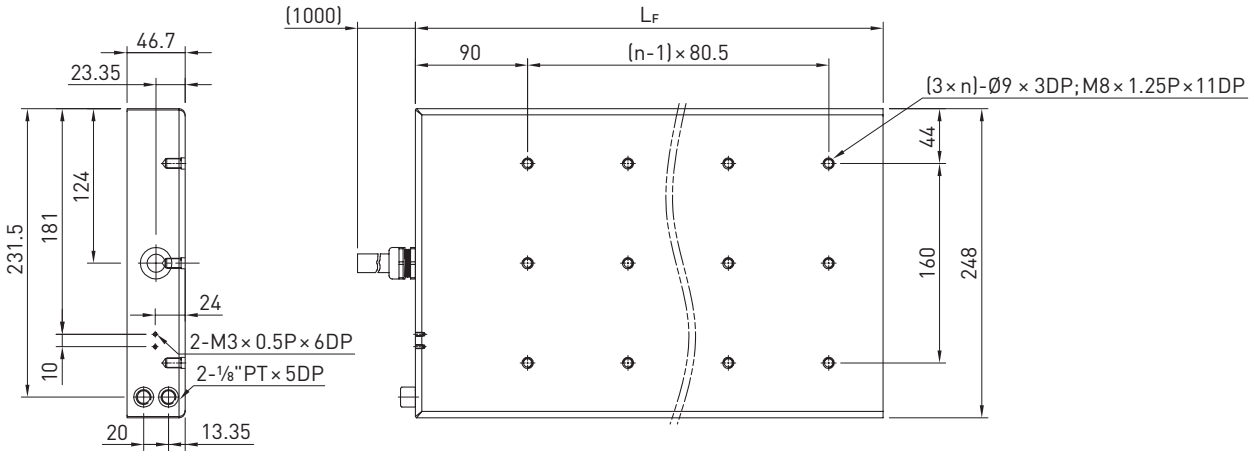


Table 4.6 **Technical data for LMFA5**

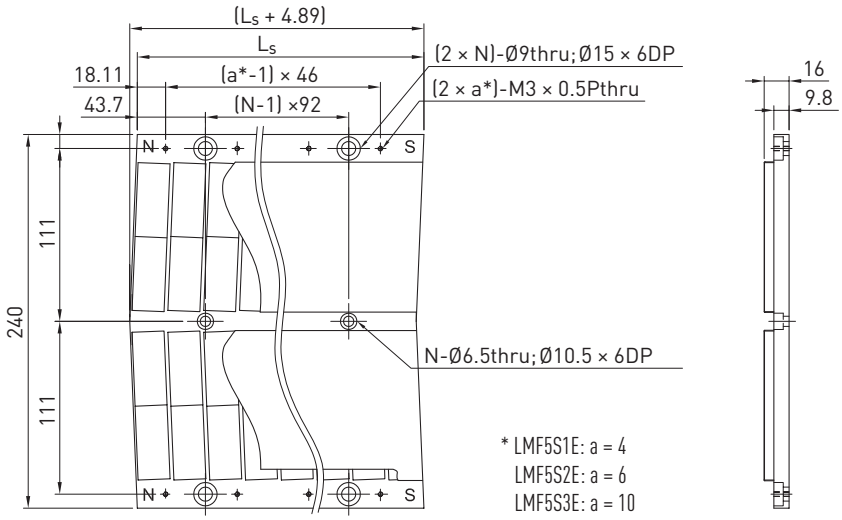
	Symbol	Unit	LMFA52	LMFA52L	LMFA53	LMFA53L	LMFA54	LMFA54L
Forces and electrical parameters								
Continuous force at T_{max}	F_c	N	1,422		2,133		2,844	
Continuous force at T_{max} (WC)	F_{c_WC}	N	2,844		4,266		5,688	
Continuous current at T_{max}	I_c	A_{eff}	6.2	9.1	9.3	13.7	12.4	18.3
Continuous current 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 s)	F_p	N	6,925		10,388		13,850	
Peak current (for 1 s)	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	13,700		20,550		27,400	
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	0.32	0.33	0.21	0.22	0.16	0.16
Thermal resistance (WC)	R_{th_WC}	°C/W	0.08	0.08	0.05	0.05	0.04	0.04
Thermal switch			1 × PT1000 + 1 × (3 PTC SNM 120 in series)					
Max. DC bus voltage		V	750					
Mechanical parameters								
Pole pair pitch	2τ	mm	46					
Max. winding 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; 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

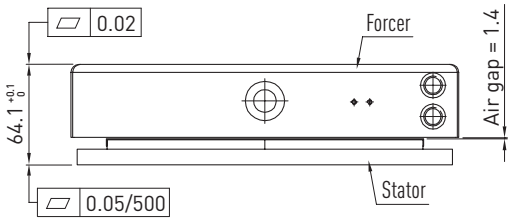
Dimensions of forcer



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

4.4.7 LMFA6 linear motor specifications

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

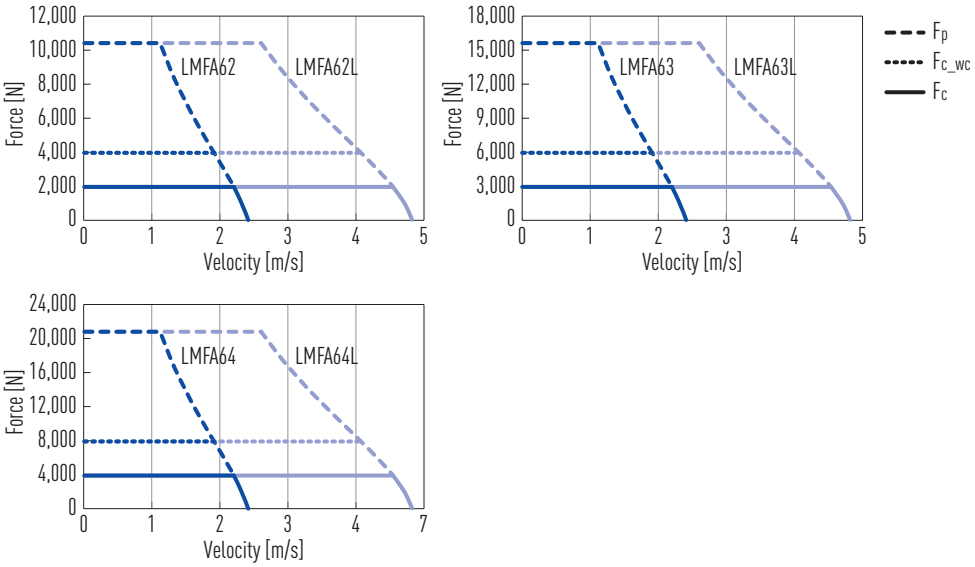
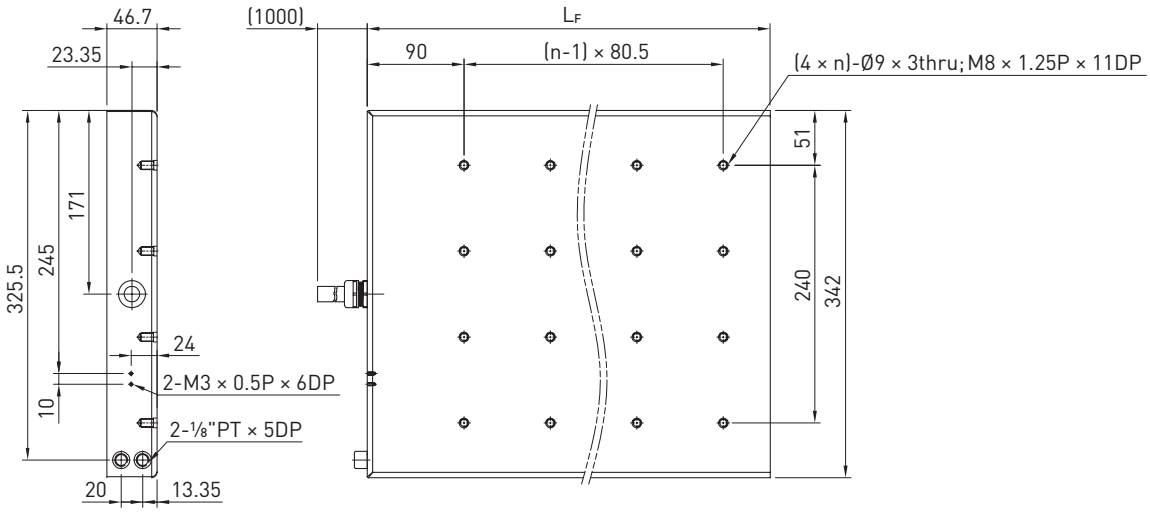


Table 4.7 **Technical data for LMFA6**

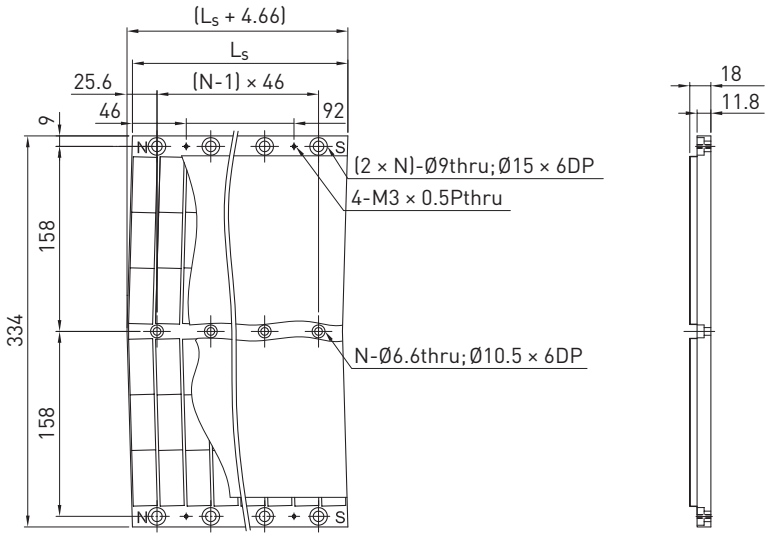
	Symbol	Unit	LMFA62	LMFA62L	LMFA63	LMFA63L	LMFA64	LMFA64L
Forces and electrical parameters								
Continuous force at T_{max}	F_c	N	1,979		2,969		3,958	
Continuous force at T_{max} (WC)	F_{c_WC}	N	3,958		5,938		7,917	
Continuous current at T_{max}	I_c	A_{eff}	5.8	11.5	8.7	17.3	11.5	23.1
Continuous current 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 s)	F_p	N	10,413		15,620		20,827	
Peak current (for 1 s)	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	20,580		30,870		41,160	
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	0.24		0.16		0.12	
Thermal resistance (WC)	R_{th_WC}	°C/W	0.06		0.04		0.03	
Thermal switch			1 × PT1000 + 1 × (3 PTC SNM 120 in series)					
Max. DC bus voltage		V	750					
Mechanical parameters								
Pole pair pitch	2τ	mm	46					
Max. winding 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					

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

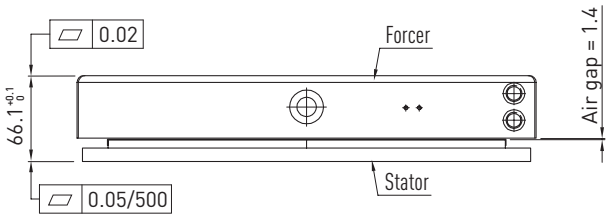
Dimensions of forcer



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. 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

5.1 HIWIN positioning measurement systems

This positioning measurement system consists of a separate encoder (Fig. 5.1) and a magnetic scale (Fig. 5.2). 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. 5.1 **MAGIC encoder**

Fig. 5.2 **MAGIC magnetic scale**

5.1.1 Order code for magnetic scale of HIWIN MAGIC positioning measurement system

MAGIC	PS	B	XXXX

Positioning measurement system
PS: Magnetic scale

Length [mm]

Period:
B: 1 mm

5.1.2 Order code for encoder of HIWIN MAGIC positioning measurement system

MAGIC	T	A	M	1500	L

Positioning measurement system

Encoder type

Output signal:
A: Analogue 1 V_{PP}
D: Digital TTL

Cable assembly:
L: Open end [1]
R: Male round connector M17 [2]
S: D-sub-plug for display PMED [3]

Cable length [1]

Index:
M: Multi-Index

[1] For cables with open end the standard cable length is 5,000
[2] Suitable for the pre-assembled HIWIN extension cable, see Section 5.4.1
[3] The display has to be ordered separately

5.2 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. 5.3).

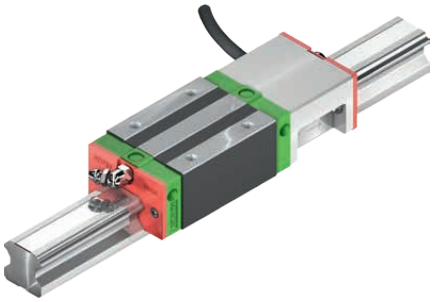


Fig. 5.3 **Linear guideway with MAGIC-PG system**

5.2.1 Order code for HIWIN MAGIC-PG linear guideways

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

PG-series

H: Based on the HG series
Q: Based on the QH series

Block type:

W: Flange type
H: Square block
L: Low square block

Sizes:

20, 25 [1]

Load type:

C: Heavy load
H: Super heavy load

Accuracy class:

H

Preload ID:

Z0, ZA, ZB

Length of rail [mm]

Rail mounting:

R: From above
T: From below (HGR20 only)

Number of blocks per rail [2]

Total number of blocks with sensor per axis [2]

Block mounting:

A: From above
C: From above or below

Continuation order code for HIWIN MAGIC-PG linear guideway

1	/2	KK	E2	M	A	M	2500	L	1

Number of rails with measurement system

Rails per axis set [3]

Dust protection:

SS, ZZ, DD, KK, SW, ZWX [4]

None: Standard
E2: With E2 oil lubrication unit

Measurement system type:

M: MAGIC

Output signal:

A: Analogue 1 V_{PP}
D: Digital TTL

Index:

M: Multi-Index

Cable length [mm] [5]

Cable assembly:

L: Open end [5]
R: M17 round plug connector (male connector) [6]
S: Sub-D connector for display PMED [7]

Encoder orientation [8]**:**

1: Orientation 1 (default)
2: Orientation 2
3: Orientation 3
4: Orientation 4

[1] Not identical to the standard rail HGR25R without groove. Mounting screw M5 instead of M6.
[2] In the PG series, the total number of blocks per axis is specified (all blocks of the ordered article).
[3] 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.
[4] Without specification the block will be delivered with standard dust protection (standard end seal and bottom seal).
[5] For cables with open end the standard cable length is 5,000.
[6] Suitable for the pre-assembled HIWIN extension cable, see Section 5.4.1.
[7] The display has to be ordered separately.
[8] See Section 5.3.1

5.3 HIWIN MAGIC positioning measurement systems: technical data

5.3.1 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).
For more than one block on a rail or on a rail pair, the encoder is assembled on block 1, rail 1, as shown in Fig. 5.4. If a non-standard orientation is needed, this has to be defined in the MAGIC-PG project planning sheet (www.hiwin.de).

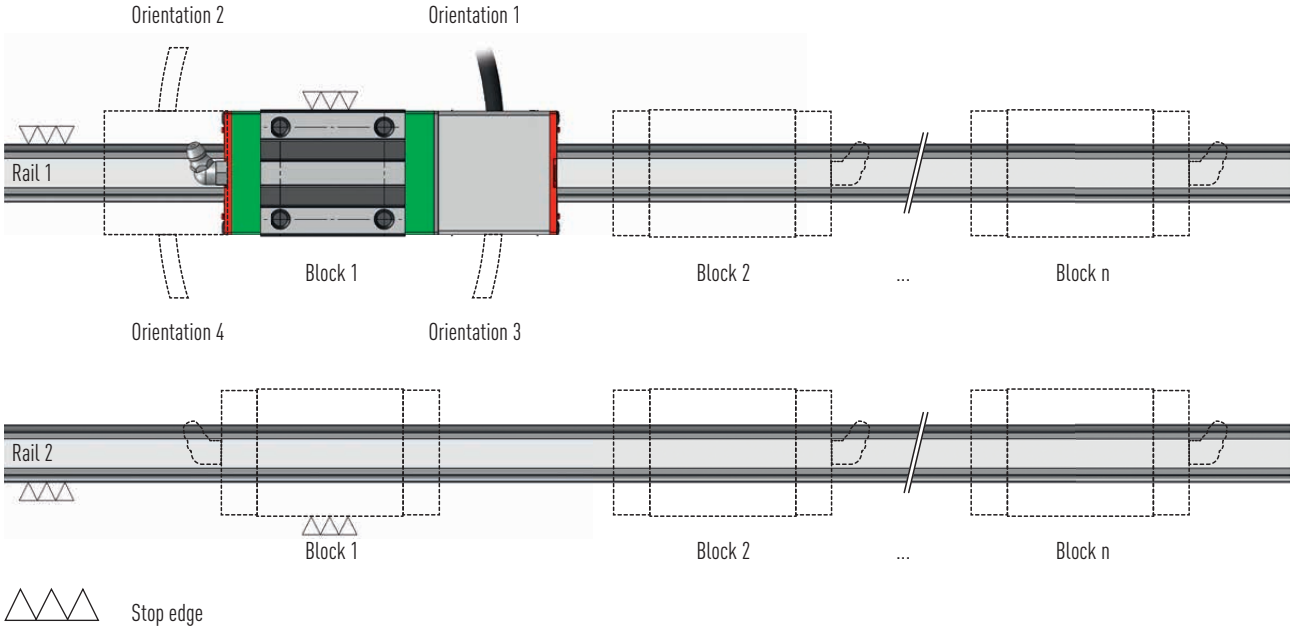


Fig. 5.4 **Orientation of the HIWIN MAGIC-PG encoder**

5.3.2 Dimensions

Dimensions of HIWIN MAGIC

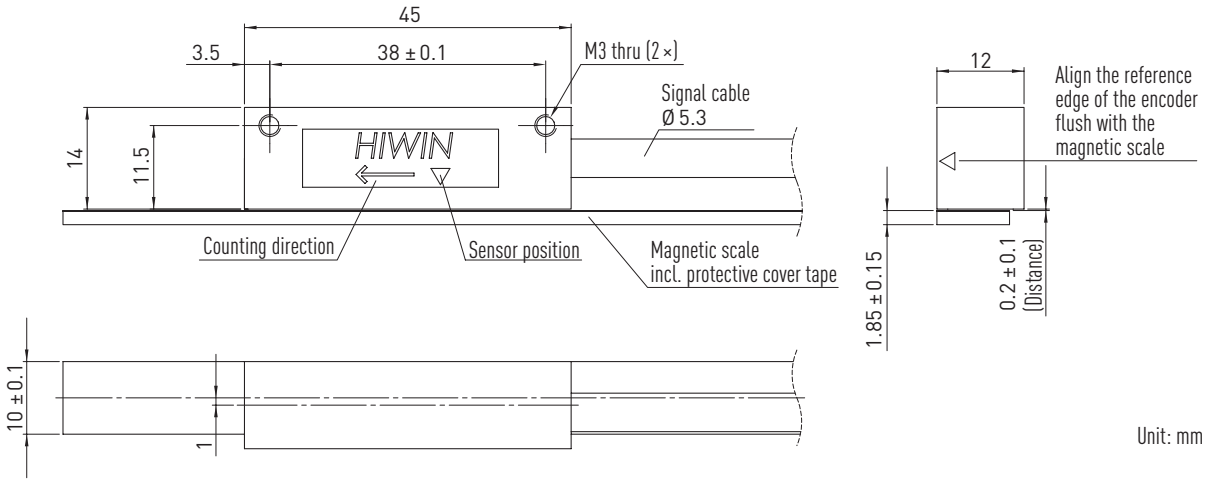


Fig. 5.5 **Scale drawing of HIWIN MAGIC encoder**

Dimensions HIWIN MAGIC-PG

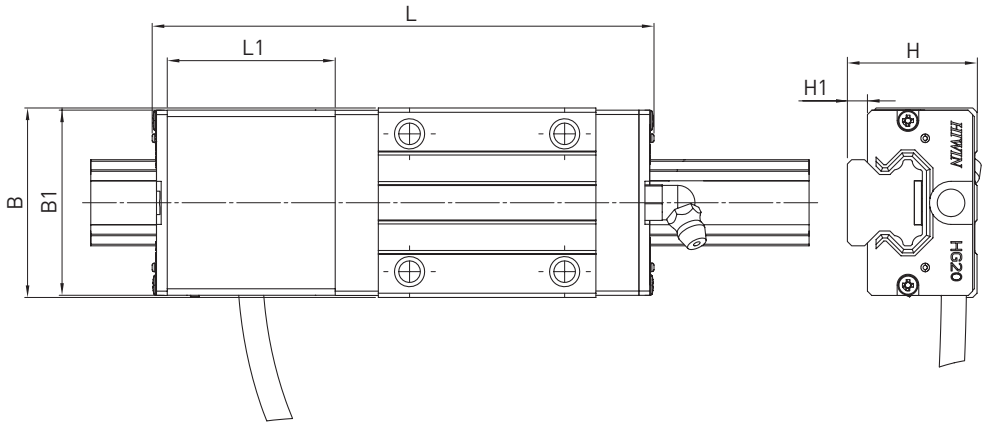


Fig. 5.6 **Scale drawing of the HGH20CA block including the MAGIC-PG housing**

Fig. 5.5 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 5.1.

Table 5.1 **Dimensions of block including MAGIC-PG housing**

Series/Size	L [mm]	L1 [mm]	B [mm]	B1 [mm]	H [mm]	H1 [mm]
HG_20C	118.0	41.5	44	43.0	30	4.6
HG_20H	132.7	41.5	44	43.0	30	4.6
HG_25C	124.5	41.5	48	46.4	40	5.5
HG_25H	145.1	41.5	48	46.4	40	5.5
QH_20C	117.2	41.5	44	43.0	30	4.6
QH_20H	131.9	41.5	44	43.0	30	4.6
QH_25C	123.9	41.5	48	46.4	40	5.5
QH_25H	144.5	41.5	48	46.4	40	5.5

Unit: mm

5.3.2.1 Dimensions of PG rail

Rail with groove, mounting from above

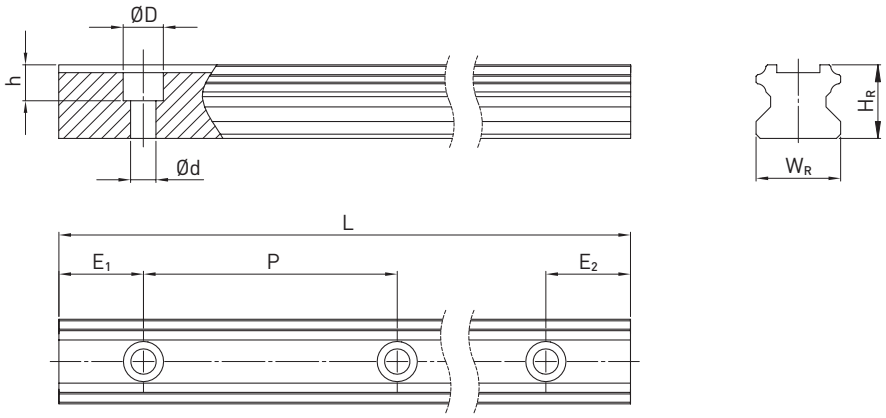


Table 5.2 **Dimensions HGR_R G1**

Series/ Sizes	Mounting bolt for rail [mm]	Dimensions of rail [mm]						Max. length [mm]	Max. length $E_1 = E_2$ [mm]	$E_{1/2}$ min [mm]	$E_{1/2}$ max [mm]	Weight [kg/m]
		W_R	H_R	D	h	d	P					
HGR20R G1	M5 × 16	20	17.5	9.5	8.5	6.0	60	4,000	3,900	7	53	2.05
HGR25R G1C	M5 × 20	23	22.0	9.5	8.5	6.0	60	4,000	3,900	7	53	3.05

Rail with groove, mounting from below

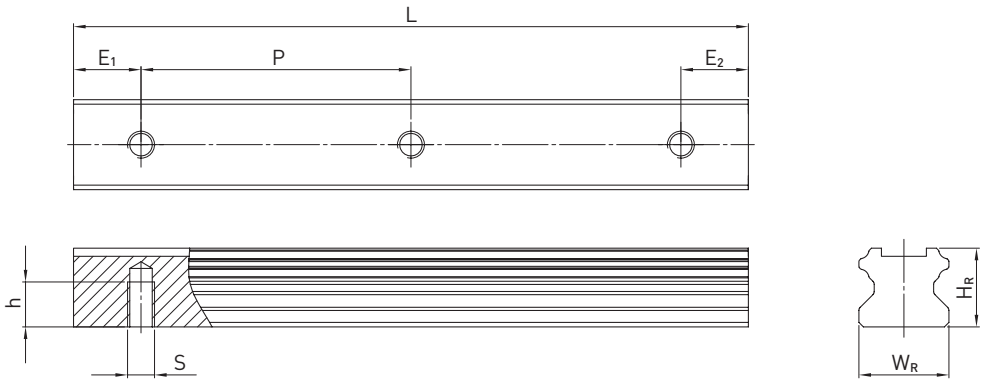


Table 5.3 **Dimensions HGR_T G1**

Series/ Size	Dimensions of rail [mm]					Max. length [mm]	Max. length $E_1 = E_2$ [mm]	$E_{1/2}$ min [mm]	$E_{1/2}$ max [mm]	Weight [kg/m]
	W_R	H_R	S	h	P					
HGR20T G1	20	17.5	M6	10	60	4,000	3,900	7	53	2.13

5.3.3 HIWIN MAGIC and HIWIN MAGIC-PG specifications

Table 5.4 **Electrical and mechanical properties of HIWIN MAGIC and HIWIN MAGIC-PG**

	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, RS422
Resolution	Infinite, signal period 1 mm	1 µm
Repeatability bidirectional	0.003 mm	0.002 m
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	
MAGIC encoder dimensions	L × W × 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] Can be used e.g. with reference switch (see Section 5.6)
[2] For use in drag chains, we recommend our prefabricated encoder cables with M17 round connector on one end (coupling, female), matching the optional M17 round connector (plug, male) for the encoder. For details, please contact your HIWIN technician.

Table 5.5 **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 magnetic scale only	1.70 ± 0.10 mm
Thickness magnetic scale with stainless steel 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 bis +50 °C
Weight	70 g/m

[1] at 20 °C

5.4 Connection analogue and digital variant

5.4.1 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, B 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.

5.4.2 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 1 V_{PP} 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.

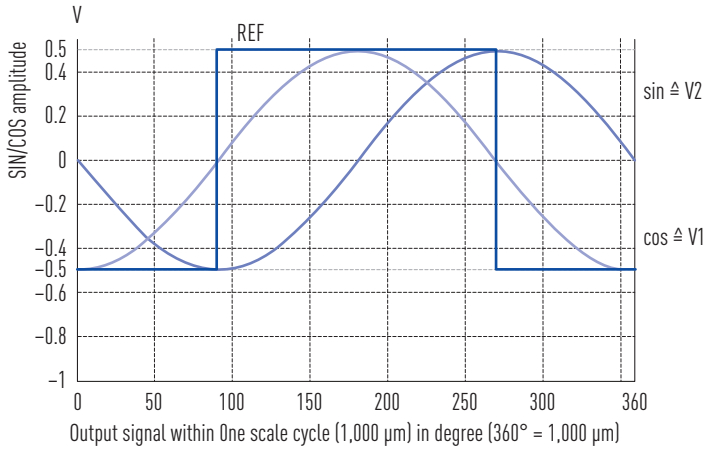


Fig. 5.7 **Electrical signals after the differential input of the downstream electronic components (analogue version)**

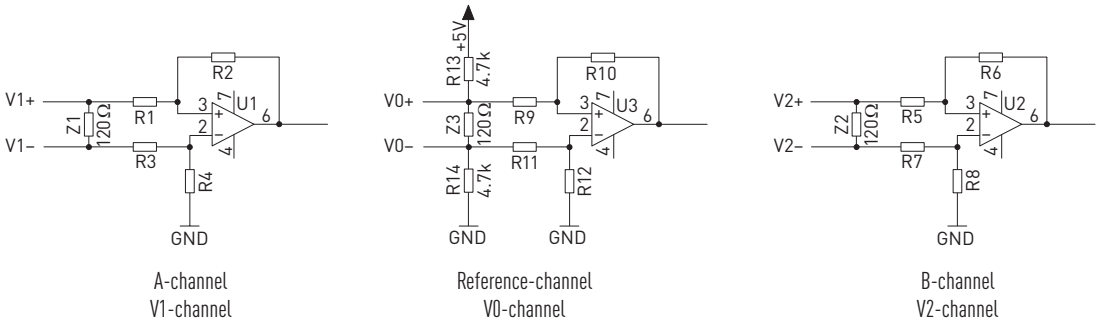


Fig. 5.8 **Recommended switching of the subsequent electronic components for sin/cos 1 V_{PP} output**

TTL-output (digital)

The signals on A and B channels have a 90° phase shift (according to RS422 specification in DIN 66259). Recommended terminal resistance Z = 120 Ω. Output signals: A, Ā, B, B̄ and Z, Z̄. Individual reference pulse (optional) and definition of a minimum pulse duration are possible as an option.

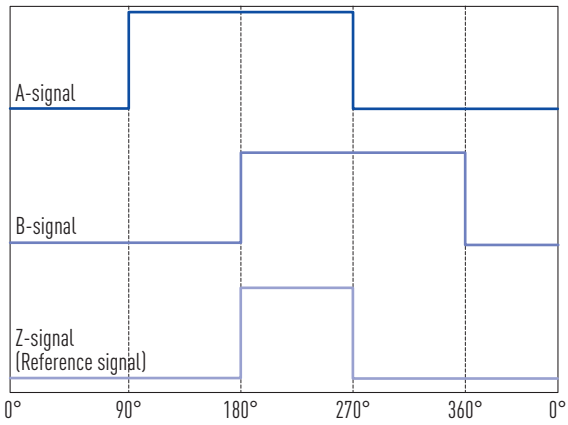
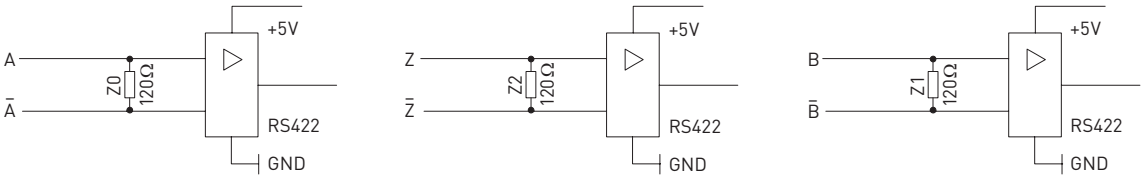


Fig. 5.9 **Signals of the MAGIC encoder (TTL version)**



A-channel Reference-channel B-channel

Fig. 5.10 **Recommended switching of the subsequent electronic components for digital TTL output**

5.5 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

5.5.1 Order code for PMED display

PMED	H2	1	00	1

PMED display

Type:
H2

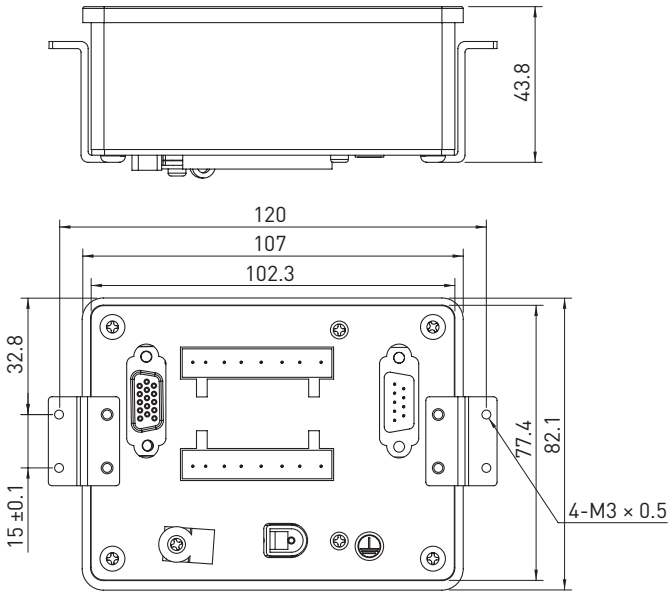
Number of axes:
1: 1 axis

1: 4 relay outputs and RS-232 interface

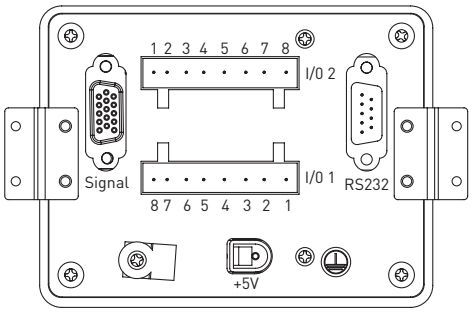
Model:
00: For HIWIN MAGIC; 1 mm period; analogue/digital

5.5.2 Technical data of PMED display

5.5.2.1 Dimensions of PMED display



5.5.2.2 Inputs and outputs



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

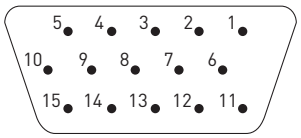


Table 5.6 **Pin definition for signal input connector**

Pin No.	Signal	Pin-No.	Signal	Pin No.	Signal
1	+5 V	**6**	FG (housing shielding)	**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

5.5.2.4 Signal output connector

Table 5.7 **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 0 (channel 2)
6		**6**	
7	Relay 0 (channel 1)	**7**	Relay 0 (channel 3)
8		**8**	

5.6 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 Section 5.4.2). With a damped reference switch this signal can be used for the precise referencing of the axis.

5.6.1 Technical data of inductive reference switch

5.6.1.1 Dimensions of reference switch

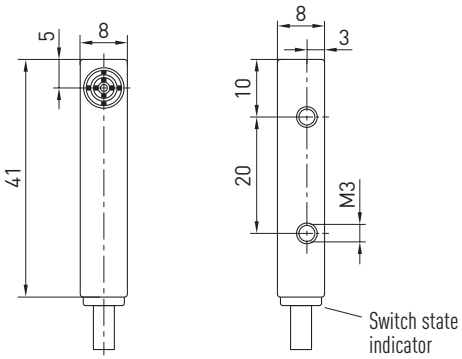
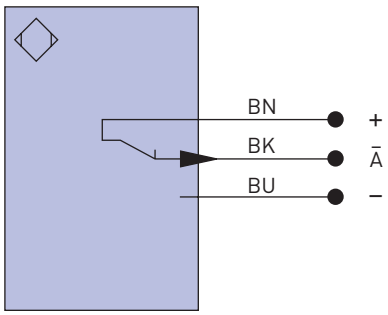


Table 5.8 **Reference switch specifications**	
Inductive	
Switching distance	2 mm
Correction factor V2A/brass/aluminium	1.16 / 0.70 / 0.67
Installation type	Flush
Switch hysteresis	< 10 %
Electrical	
Power supply	10 to 30 VDC
Power input (Ub = 24 V)	< 8 mA
Switching frequency	930 Hz
Temperature drift	< 10 %
Operating temperature	–25 to +80 °C
Voltage drop switch output	< 1 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	4 m
Protection class	III

5.6.1.2 Circuit diagram of the optional reference switch



Explanation of symbols

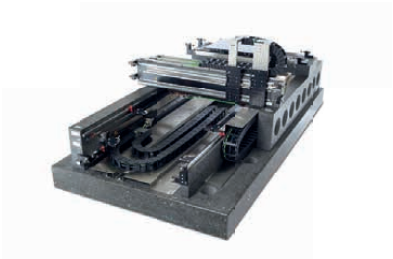
\+ Power supply „+"
– Power supply „0 V"
Ā Switch output/opener (NC)

Wire colours

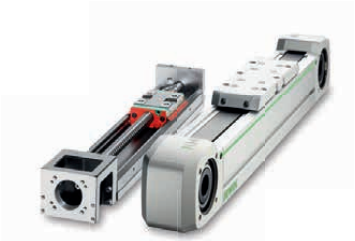
BN Brown
BK Black
BU Blue

Linear Guideways

Ballscrews



Linear Motor Systems



Linear Axes

Linear Actuators

Robots

Linear Motor Components

Rotary Tables

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