

# **HIWIN®**

Motion Control & Systems



## **Linear Motors**

& Positioning Measuring Systems



## Motors, Drives & Accessories

### Linear Motors & Positioning Measuring 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.



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# Linear Motors & Positioning Measuring Systems

Product overview

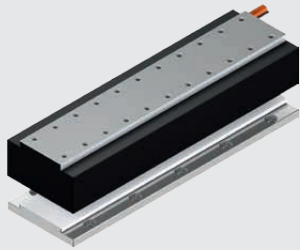
## 1. Product overview



HIWIN LMSA linear motors – “The compact power pack”

[Page 8](#)

- Optimised for highest power density
- Extremely compact and flat design
- High acceleration
- UL-certified



HIWIN LMS linear motors – “The solid all-rounder”

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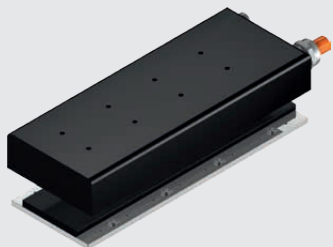
- Proven endurance runner
- High feed forces
- High acceleration



HIWIN LMC linear motors – “The dynamic sprinter”

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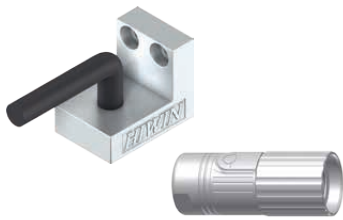
- Ironless lightweight
- Extremely dynamic
- No cogging, thus highest synchronous operation



HIWIN LMFA linear motors – “The cooled heavy-duty drive”

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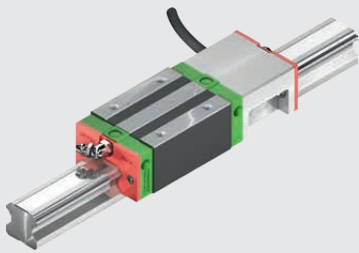
- Integrated cooling system
- Extremely high thrust up to 20,000 N
- High acceleration
- UL-certified



#### Accessories

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- Hall sensors
- Motor cables
- Motor connectors



#### HIWIN MAGIC – magnetic positioning measuring systems

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- Zero contact measuring with 1 V<sub>PP</sub> 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 & Positioning Measuring Systems

HIWIN LMSA linear motors

## 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.



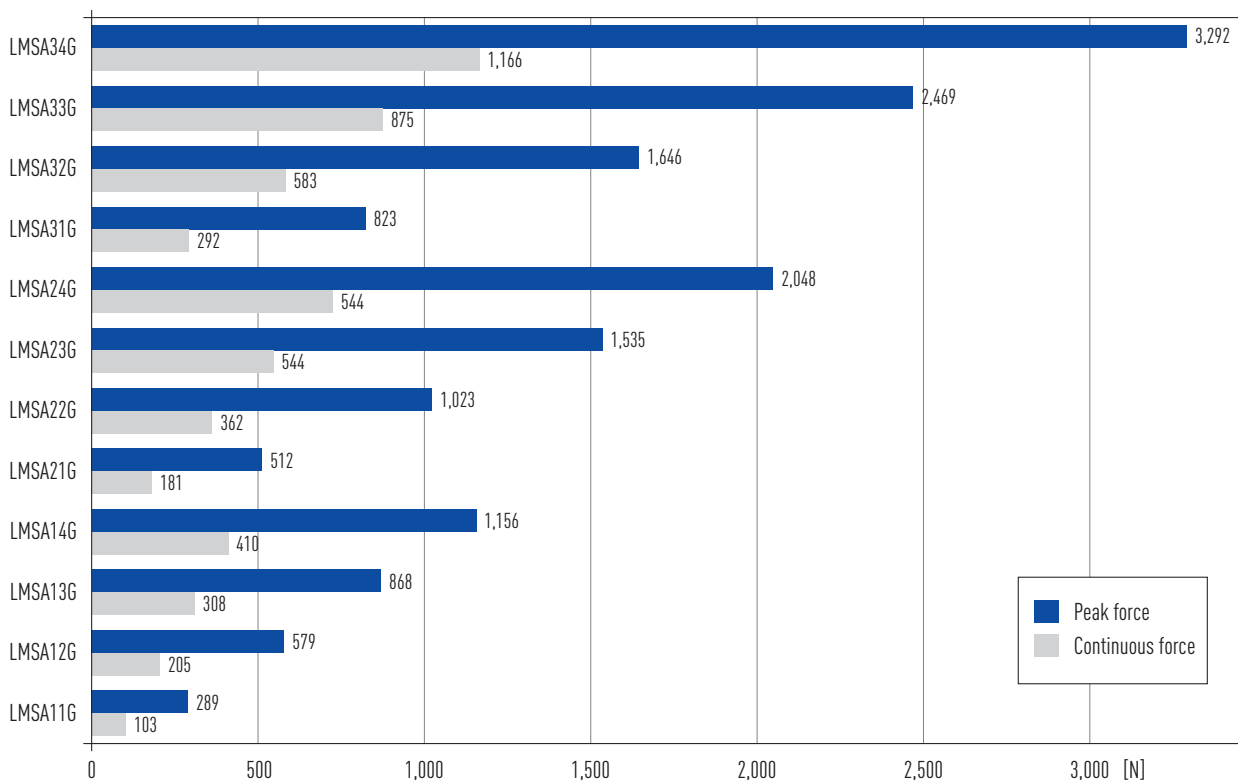
#### Key features of the LMSA linear motors:

- Highest power density
- Flat design
- High acceleration
- High synchronous run
- Full epoxy encapsulation of permanent magnets in the stator
- UL-certified
- Optional: version with Hall sensor

#### Typical fields of application of the LMSA linear motors:

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

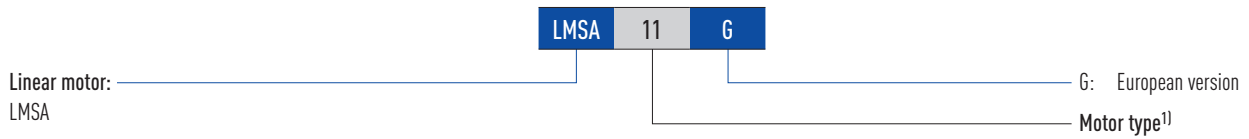
### 2.2 Force chart for LMSA linear motors





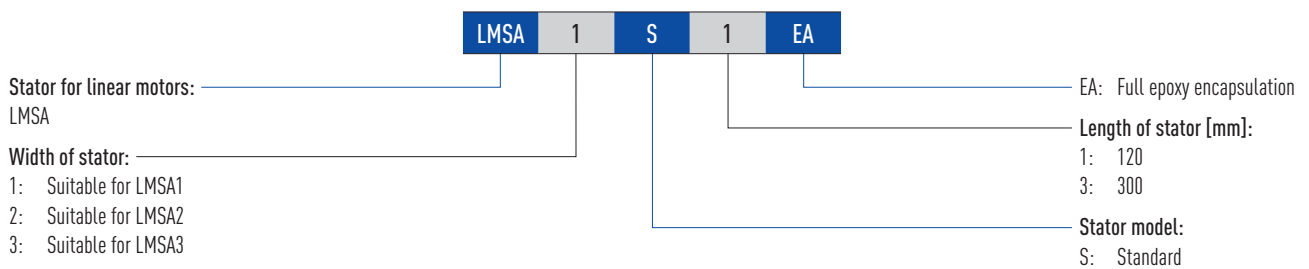
## 2.3 Order code LMSA linear motors

### 2.3.1 Order code of primary part (forcer)



<sup>1)</sup> See [Table 2.1](#) (LMSA1)  
[Table 2.3](#) (LMSA2)  
[Table 2.5](#) (LMSA3)

### 2.3.2 Order code of magnet track (stator)



# Linear Motors & Positioning Measuring Systems

HIWIN LMSA linear motors

## 2.4 LMSA linear motor specifications

### 2.4.1 LMSA1 linear motor specifications

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

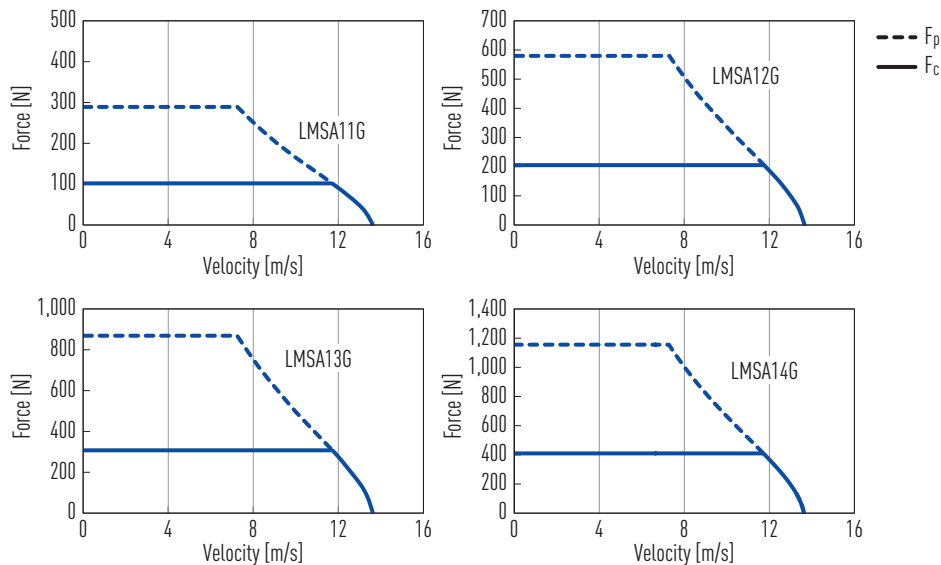


Table 2.1 Technical data for LMSA1

	Symbol	Unit	LMSA11G	LMSA12G	LMSA13G	LMSA14G
Forces and electrical parameters						
Continuous force at T <sub>max</sub>	F <sub>c</sub>	N	103	205	308	410
Continuous current at T <sub>max</sub>	I <sub>c</sub>	A <sub>eff</sub>	2.1	4.2	6.3	8.4
Peak force (for 1 s)	F <sub>p</sub>	N	289	579	868	1,156
Peak current (for 1 s)	I <sub>p</sub>	A <sub>eff</sub>	6.3	12.7	19.0	25.3
Ultimate force (for 0.5 s)	F <sub>u</sub>	N	379	759	1,138	1,517
Ultimate current (for 0.5 s)	I <sub>u</sub>	A <sub>eff</sub>	10.6	21.1	31.7	42.2
Force constant	K <sub>f</sub>	N/A <sub>eff</sub>	48.6	48.6	48.6	48.6
Attraction force	F <sub>a</sub>	N	481	963	1,444	1,926
Electrical time constant	K <sub>e</sub>	ms	4.4	4.5	4.4	4.4
Resistance <sup>1)</sup>	R <sub>25</sub>	Ω	8.4	4.1	2.8	2.1
Inductance <sup>1)</sup>	L	mH	37.1	18.5	12.4	9.3
Back EMF constant	K <sub>u</sub>	V <sub>eff</sub> /(m/s)	28.1	28.1	28.1	28.1
Motor constant	K <sub>m</sub>	N/√W	13.7	19.6	23.7	27.4
Thermal resistance	R <sub>th</sub>	°C/W	1.23	0.63	0.41	0.31
Thermal time constant	T <sub>th</sub>	s	1,830	2,720	4,210	
Thermal switch			1 × PT1000 + 1× {3 PTC SNM 120 in series}			
Max. DC bus voltage		V	750			
Mechanical parameters						
Max. bending radius of motor cable	R <sub>bend</sub>	mm	69			
Pole pair pitch	2τ	mm	30			
Max. winding temperature	T <sub>max</sub>	°C	120			
Mounting holes (forcer)	n		2	4	6	8
Weight of forcer	M <sub>F</sub>	kg	0.7	1.4	2.1	2.8
Length of forcer	L <sub>F</sub>	mm	118	223	328	433
Unit mass of stator	M <sub>S</sub>	kg/m	2.7			
Length of stator/Dimension N	L <sub>S</sub>	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  $\pm 10\%$  of tolerance at 25  $^{\circ}C$  ambient temperature <sup>1)</sup> Line to line

Technical drawing of the cable tray assembly, showing front and side views with dimensions.

**Front View Dimensions:**

- Overall width: 23.5
- Distance from left edge to center of hole: 19.7
- Distance from left edge to center of hole: 6
- Distance from center of hole to right edge: 10.5
- Distance from top edge to center of hole: 8
- Distance from top edge to center of hole: 26
- Distance from top edge to center of hole: 16
- Distance from bottom edge to center of hole: 10
- Distance from bottom edge to center of hole: 30
- Overall width: 19.7
- Overall width: 23.7

**Side View Dimensions:**

- Overall length: 500
- Distance from left edge to center of hole: 37
- Distance from center of hole to right edge:  $(n-1) \times 52.5$
- Overall length:  $L_F$
- Overall width: 21
- Overall width: 20
- Overall width: 56

**Labels and Notes:**

- 4-M4  $\times$  0.7P  $\times$  6DP
- (+) Moving direction  $\rightarrow$
- 2-M3  $\times$  0.5P  $\times$  5DP

Technical drawing of a Hiwin linear guide assembly. The top view shows a rectangular guide with a central track and two end caps labeled 'N' and 'S'. The side view shows the profile of the guide with a height of 42 mm and a total height of 52 mm. The drawing includes the following dimensions and labels:

- Overall height: 52
- Track height: 42
- End cap height: 4.1
- End cap thickness: 9.7
- End cap width: 31
- Track width:  $60 \times [N-1]$
- Track length:  $L_s$
- Total length:  $L_s + 4.36$
- Mounting holes:  $(2 \times N) - \varnothing 4.5 \text{ thru}; \varnothing 8 \times 5.6 \text{ DP}$
- Hiwin logo

Technical drawing of a stator assembly. The drawing shows a cross-section of a stator with a rotor assembly inside. The stator has a total height of 34 mm with a tolerance of +0.1 mm. The rotor assembly is shown with a diameter of 5 mm. The stator has a surface finish of 0.02 mm. The rotor assembly has a surface finish of 0.05/500 mm. The stator is labeled "Stator" and the rotor assembly is labeled "Forcer". The air gap between the stator and the rotor is 0.6 mm.

Motor cable	Signal		Diameter [mm]
1	U		9.2
2	V		
3	W		
Green/Yellow	GND		
Yellow	T1+	PTC SNM 120	5.5
Green	T1–		
Brown	T2+	PT1000	
White	T2–		

# Linear Motors & Positioning Measuring Systems

HIWIN LMSA linear motors

## 2.4.2 LMSA2 linear motor specifications

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

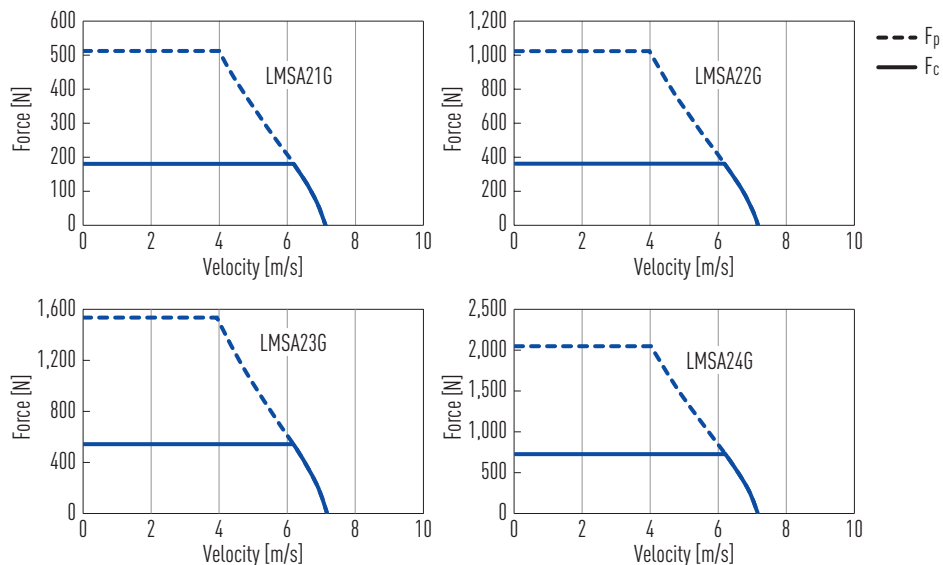


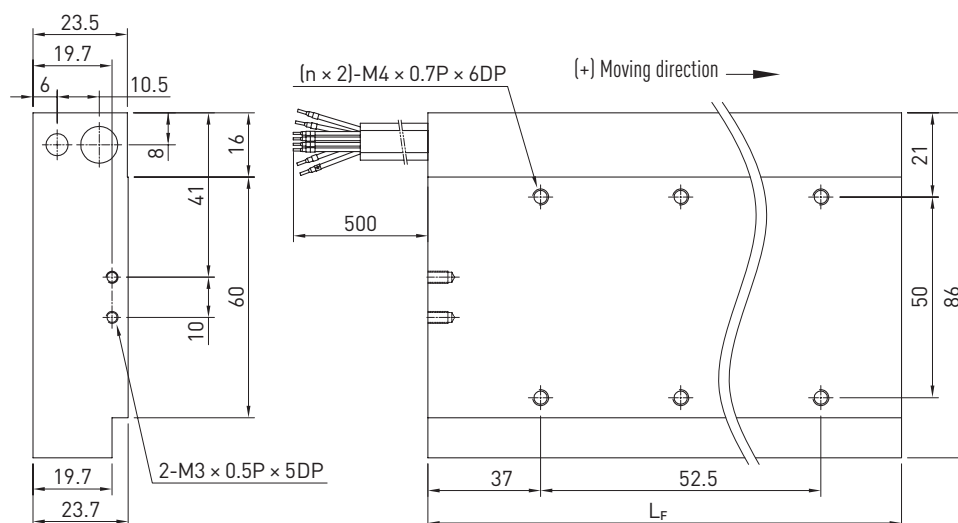
Table 2.3 Technical data for LMSA2

	Symbol	Unit	LMSA21G	LMSA22G	LMSA23G	LMSA24G
Forces and electrical parameters						
Continuous force at T <sub>max</sub>	F <sub>c</sub>	N	181	362	544	725
Continuous current at T <sub>max</sub>	I <sub>c</sub>	A <sub>eff</sub>	2.0	3.9	5.9	7.8
Peak force (for 1 s)	F <sub>p</sub>	N	512	1,023	1,535	2,048
Peak current (for 1 s)	I <sub>p</sub>	A <sub>eff</sub>	5.9	11.8	17.6	23.5
Ultimate force (for 0.5 s)	F <sub>u</sub>	N	670	1,341	2,011	2,682
Ultimate current (for 0.5 s)	I <sub>u</sub>	A <sub>eff</sub>	9.8	19.6	29.4	39.2
Force constant	K <sub>f</sub>	N/A <sub>eff</sub>	92.5	92.5	92.5	92.5
Attraction force	F <sub>a</sub>	N	963	1,926	2,888	3,851
Electrical time constant	K <sub>e</sub>	ms	4.6	4.9	4.9	4.6
Resistance <sup>1)</sup>	R <sub>25</sub>	Ω	13.8	6.8	4.6	3.5
Inductance <sup>1)</sup>	L	mH	64.0	33.0	22.4	16.0
Back EMF constant	K <sub>u</sub>	V <sub>eff</sub> /(m/s)	53.4	53.4	53.4	53.4
Motor constant	K <sub>m</sub>	N/√W	20.3	28.9	35.2	40.6
Thermal resistance	R <sub>th</sub>	°C/W	0.87	0.44	0.29	0.22
Thermal time constant	T <sub>th</sub>	s	2,830	4,060	5,080	
Thermal switch			1 × PT1000 + 1× (3 PTC SNM 120 in series)			
Max. DC bus voltage		V	750			
Mechanical parameters						
Max. bending radius of motor cable	R <sub>bend</sub>	mm	69			
Pole pair pitch	2τ	mm	30			
Max. winding temperature	T <sub>max</sub>	°C	120			
Mounting holes (forcer)	n		2	4	6	8
Weight of forcer	M <sub>F</sub>	kg	1.1	2.2	3.3	4.4
Length of forcer	L <sub>F</sub>	mm	118	223	328	433
Unit mass of stator	M <sub>S</sub>	kg/m	4.8			
Length of stator/Dimension N	L <sub>S</sub>	mm	120 mm/N = 2; 300 mm/N = 5			
Total height (forcer + stator)	H	mm	34			

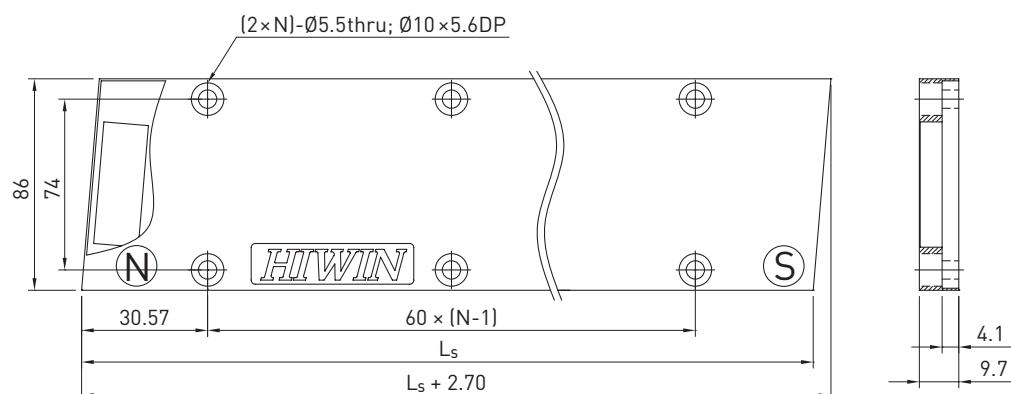
All the specifications in the table (except dimensions) are in  $\pm 10\%$  of tolerance at  $25^{\circ}C$  ambient temperature

<sup>1)</sup> Line to line

### Dimensions offorcer



### Dimensions of stator



### Mounting tolerances

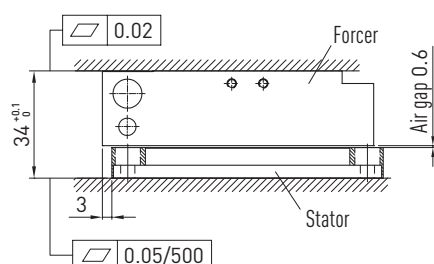


Table 2.4 LMSA2 motor cable assignment

Motor cable	Signal		Diameter [mm]
1	U		9.2
2	V		
3	W		
Green/Yellow	GND		
Yellow	T1+	PTC SNM 120	5.5
Green	T1–		
Brown	T2+	PT1000	
White	T2–		

# Linear Motors & Positioning Measuring Systems

HIWIN LMSA linear motors

## 2.4.3 LMSA3 linear motor specifications

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

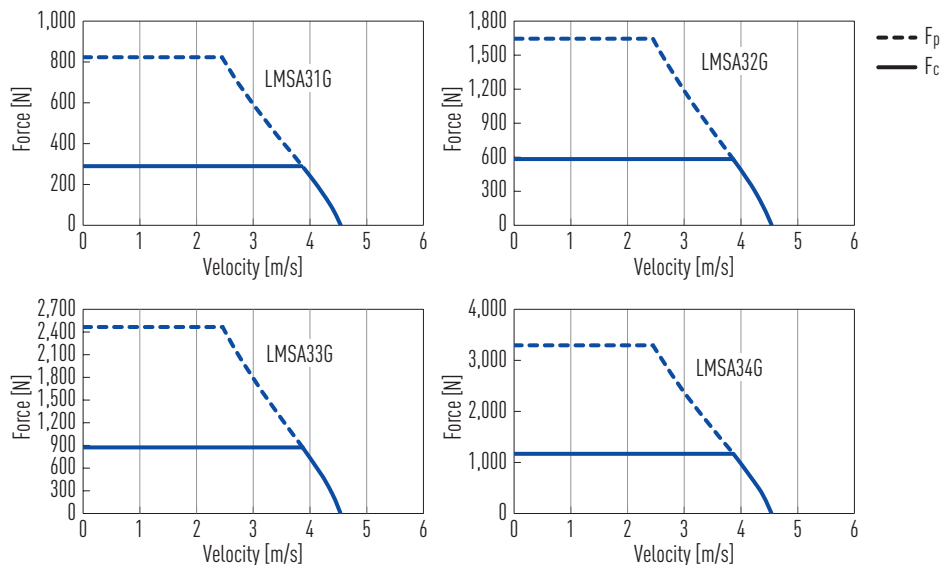


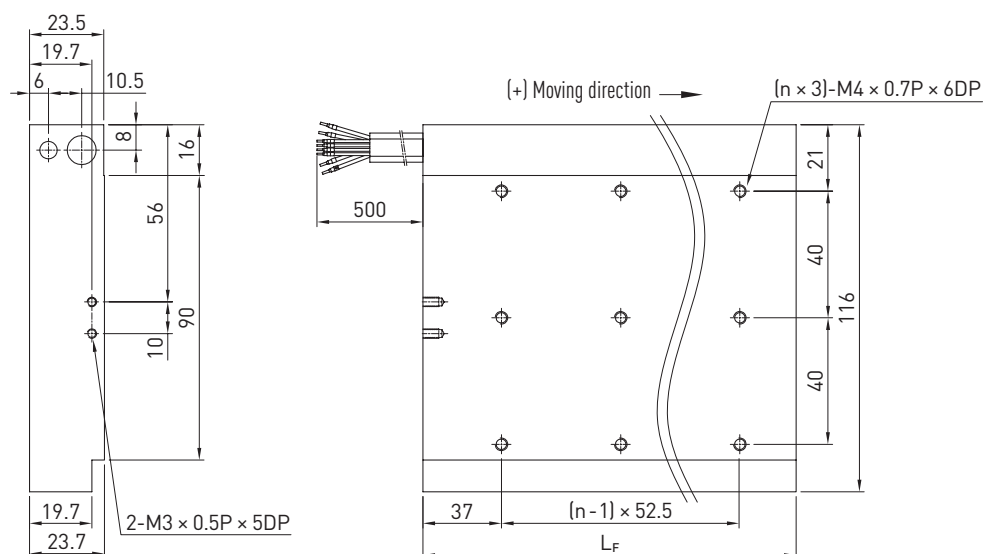
Table 2.5 Technical data for LMSA3

	Symbol	Unit	LMSA31G	LMSA32G	LMSA33G	LMSA34G
Forces and electrical parameters						
Continuous force at T <sub>max</sub>	F <sub>c</sub>	N	292	583	875	1,166
Continuous current at T <sub>max</sub>	I <sub>c</sub>	A <sub>eff</sub>	2.0	4.0	6.0	8.0
Peak force (for 1 s)	F <sub>p</sub>	N	823	1,646	2,469	3,292
Peak current (for 1 s)	I <sub>p</sub>	A <sub>eff</sub>	6.0	12.0	18.0	24.0
Ultimate force (for 0.5 s)	F <sub>u</sub>	N	1,079	2,157	3,236	4,314
Ultimate current (for 0.5 s)	I <sub>u</sub>	A <sub>eff</sub>	10.0	20.0	30.0	40.0
Force constant	K <sub>f</sub>	N/A <sub>eff</sub>	145.8	145.8	145.8	145.8
Attraction force	F <sub>a</sub>	N	1,444	2,888	4,333	5,777
Electrical time constant	K <sub>e</sub>	ms	4.9	4.9	4.9	4.9
Resistance <sup>1)</sup>	R <sub>25</sub>	Ω	19.2	9.6	6.4	4.8
Inductance <sup>1)</sup>	L	mH	94.1	47.1	31.3	23.5
Back EMF constant	K <sub>u</sub>	V <sub>eff</sub> /(m/s)	84.2	84.2	84.2	84.2
Motor constant	K <sub>m</sub>	N/√W	27.2	38.4	47.0	54.3
Thermal resistance	R <sub>th</sub>	°C/W	0.60	0.30	0.20	0.15
Thermal time constant	T <sub>th</sub>	s	4,540	5,740	5,580	
Thermal switch			1 × PT1000 + 1× (3 PTC SNM 120 in series)			
Max. DC bus voltage		V	750			
Mechanical parameters						
Max. bending radius of motor cable	R <sub>bend</sub>	mm	69			
Pole pair pitch	2τ	mm	30			
Max. winding temperature	T <sub>max</sub>	°C	120			
Mounting holes (forcer)	n		2	4	6	8
Weight of forcer	M <sub>F</sub>	kg	1.9	3.8	5.7	7.6
Length of forcer	L <sub>F</sub>	mm	118	223	328	433
Unit mass of stator	M <sub>S</sub>	kg/m	8.5			
Length of stator/Dimension N	L <sub>S</sub>	mm	120 mm/N = 2; 300 mm/N = 5			
Total height (forcer + stator)	H	mm	36			

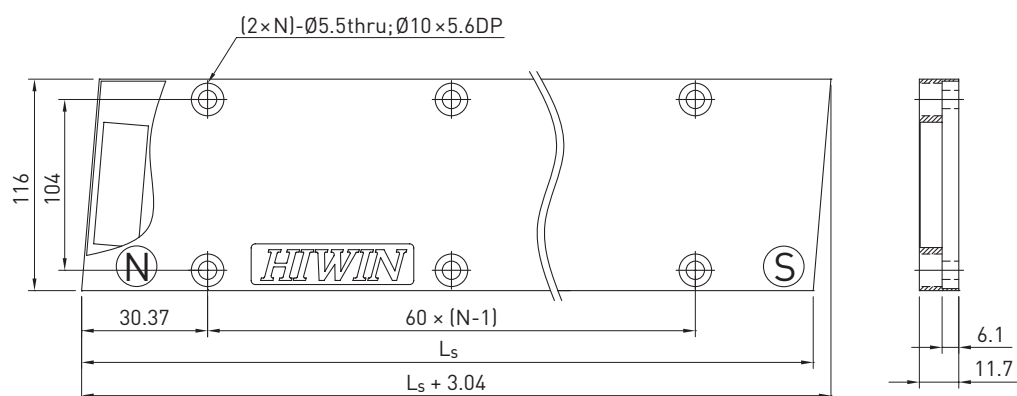
All the specifications in the table (except dimensions) are in  $\pm 10\%$  of tolerance at 25  $^{\circ}C$  ambient temperature

<sup>1)</sup> Line to line

### Dimensions offorcer



### Dimensions of stator



### Mounting tolerances

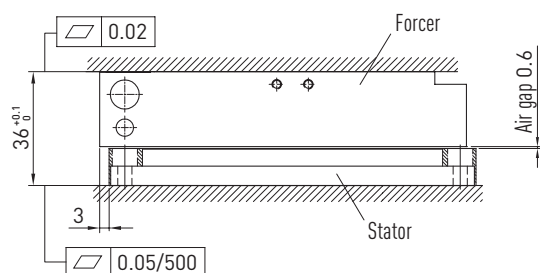


Table 2.6 LMSA3 motor cable assignment

Motor cable	Signal		Diameter [mm]
1	U		9.2
2	V		
3	W		
Green/Yellow	GND		
Yellow	T1+	PTC SNM 120	5.5
Green	T1–		
Brown	T2+	PT1000	
White	T2–		

# Linear Motors & Positioning Measuring Systems

## HIWIN LMS linear motors

### 3. HIWIN LMS linear motors

#### 3.1 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 robust design as well as high thrust and acceleration. The permanent magnets of the secondary parts (stators) are protected by a sheet metal cover. The benefits of the LMS linear motors make them the preferred choice in the field of dynamic positioning axes in automation systems especially with long travel distances.



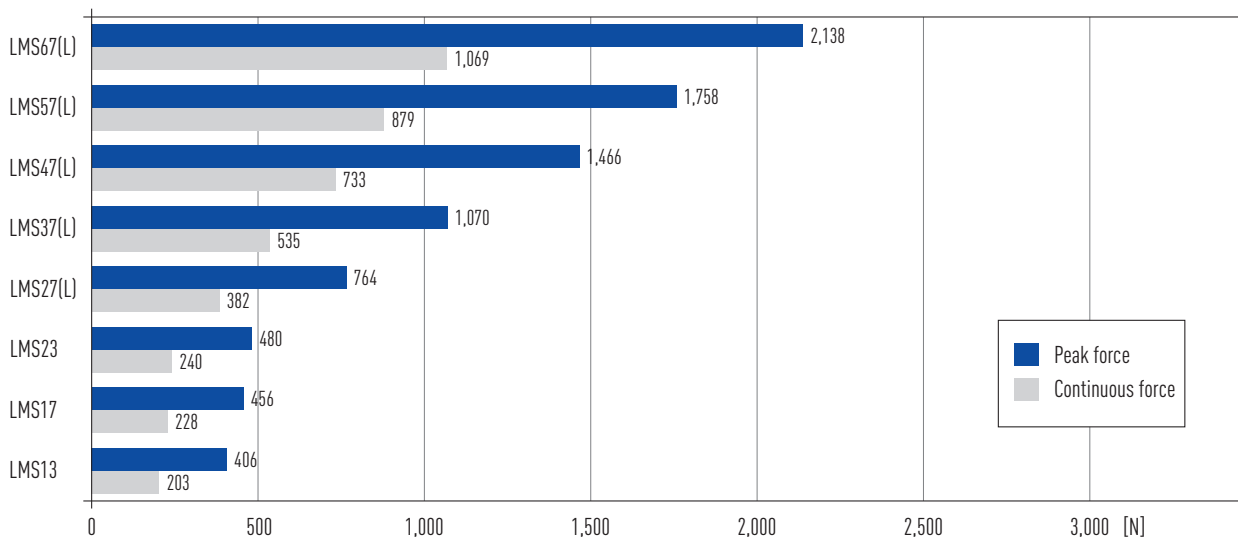
#### Key features of the LMS linear motors:

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

#### Typical fields of application of the LMS linear motors:

- Automation technology
- Handling
- Packaging

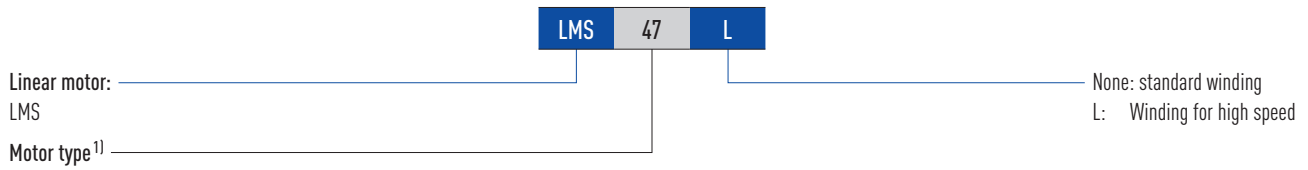
#### 3.2 Force chart for LMS linear motors





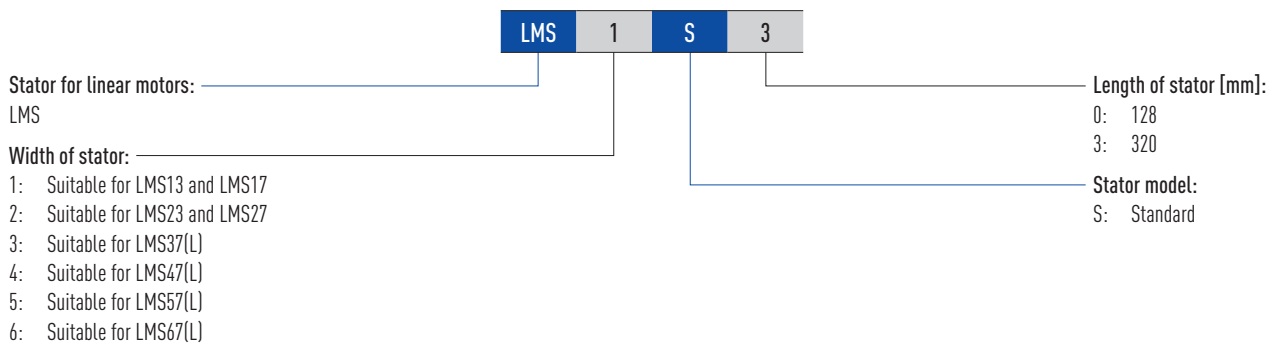
### 3.3 Order code LMS linear motors

#### 3.3.1 Order code of primary part (forcer)



<sup>1)</sup> See [Table 3.1](#) (LMS1)  
[Table 3.3](#) (LMS2)  
[Table 3.5](#) (LMS3, LMS4)  
[Table 3.7](#) (LMS5, LMS6)

#### 3.3.2 Order code of magnet track (stator)



# Linear Motors & Positioning Measuring Systems

HIWIN LMS linear motors

## 3.4 LMS linear motor specifications

### 3.4.1 LMS1 linear motor specifications

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

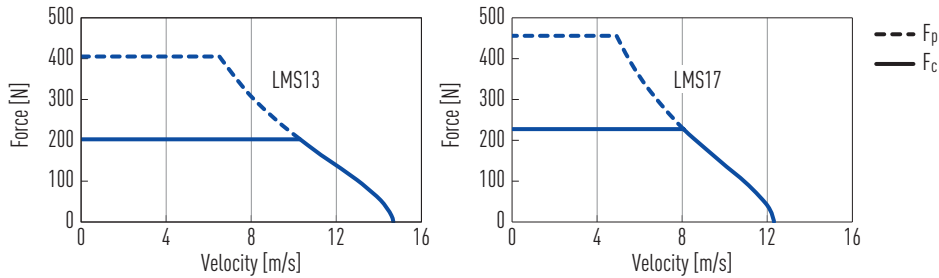


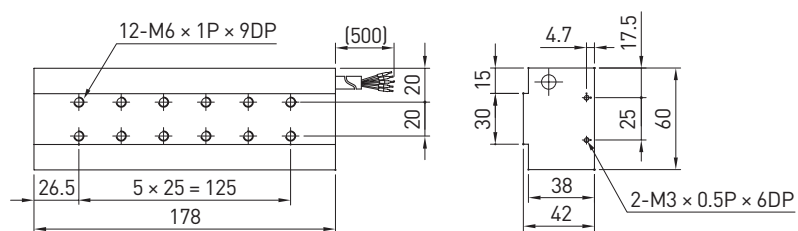
Table 3.1 Technical data for LMS1

	Symbol	Unit	LMS13	LMS17
Forces and electrical parameters				
Continuous force at T <sub>max</sub>	F <sub>c</sub>	N	203	228
Continuous current at T <sub>max</sub>	I <sub>c</sub>	A <sub>eff</sub>	4.6	3.9
Peak force (for 1 s)	F <sub>p</sub>	N	406	456
Peak current (for 1 s)	I <sub>p</sub>	A <sub>eff</sub>	13.8	11.8
Force constant	K <sub>f</sub>	N/A <sub>eff</sub>	44	58
Attraction force	F <sub>a</sub>	N	805	1,221
Electrical time constant	K <sub>e</sub>	ms	10.4	10.6
Resistance <sup>1)</sup>	R <sub>25</sub>	Ω	3.1	4.8
Inductance <sup>1)</sup>	L	mH	32.2	50.8
Back EMF constant	K <sub>u</sub>	V <sub>eff</sub> /(m/s)	26	31
Motor constant	K <sub>m</sub>	N/√W	20.4	21.6
Thermal resistance	R <sub>th</sub>	°C/W	0.7	0.6
Thermal time constant	T <sub>th</sub>	s	4,350	4,950
Thermal switch			3 PTC SNM 120 in series	
Max. DC bus voltage		V	600	
Mechanical parameters				
Max. bending radius of motor cable	R <sub>bend</sub>	mm	69	
Pole pair pitch	2τ	mm	32	
Max. winding temperature	T <sub>max</sub>	°C	120	
Weight of forcer	M <sub>F</sub>	kg	1.8	2.7
Unit mass of stator	M <sub>S</sub>	kg/m	4.2	
Length of stator/Dimension N	L <sub>S</sub>	mm	128 mm/N = 2; 320 mm/N = 5	
Total height (forcer + stator)	H	mm	55.2	57.4

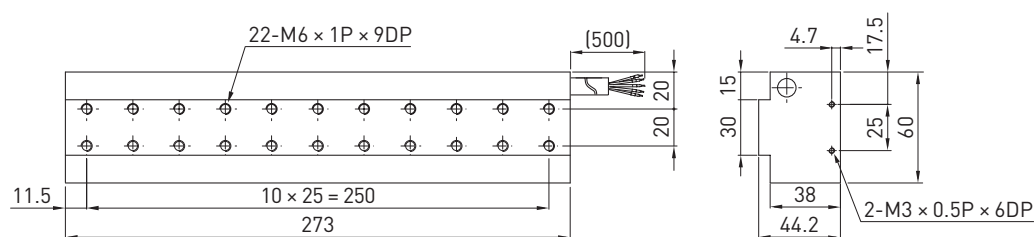
All the specifications in the table (except dimensions) are in  $\pm 10\%$  of tolerance at 25  $^{\circ}C$  ambient temperature

<sup>1)</sup> Line to line

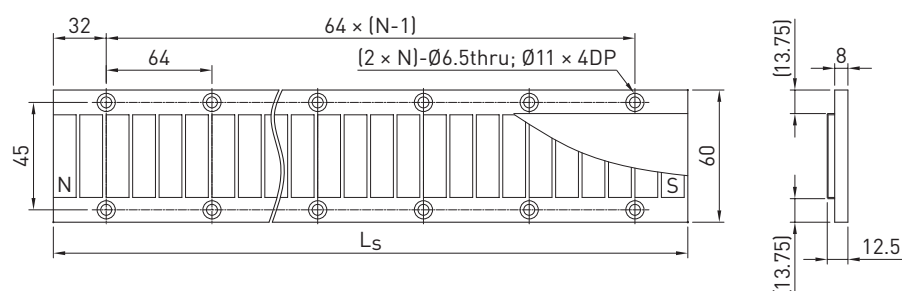
### Dimensions of forcer LMS13



### Dimensions of forcer LMS17



### Dimensions of stator



### Mounting tolerances

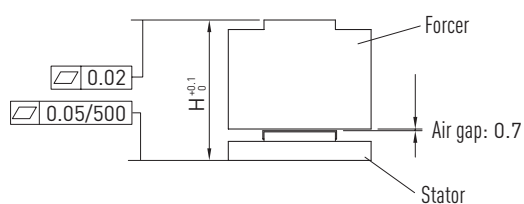


Table 3.2 LMS1 motor cable assignment

Motor cable	Signal	Diameter [mm]
1	V	9.0
2	U	
3	W	
4	—	
5	T+	
6	T-	
Green/Yellow	GND	

# Linear Motors & Positioning Measuring Systems

HIWIN LMS linear motors

## 3.4.2 LMS2 linear motor specifications

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

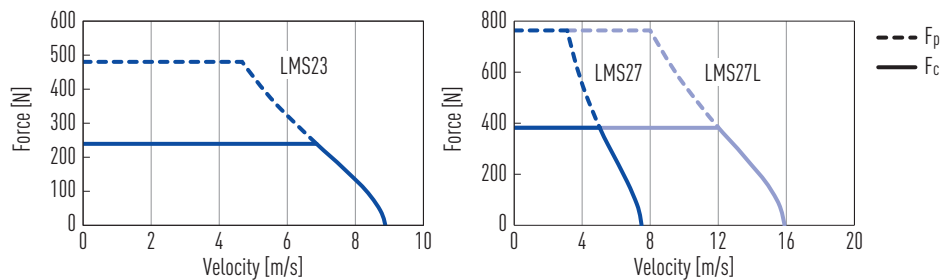


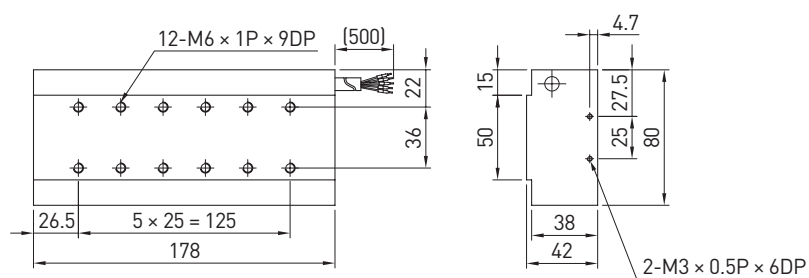
Table 3.3 Technical data for LMS2

	Symbol	Unit	LMS23	LMS27	LMS27L
Forces and electrical parameters					
Continuous force at T <sub>max</sub>	F <sub>c</sub>	N	240	382	
Continuous current at T <sub>max</sub>	I <sub>c</sub>	A <sub>eff</sub>	3.9	3.9	7.9
Peak force (for 1 s)	F <sub>p</sub>	N	480	764	
Peak current (for 1 s)	I <sub>p</sub>	A <sub>eff</sub>	11.8	11.8	23.7
Force constant	K <sub>f</sub>	N/A <sub>eff</sub>	61	97	46
Attraction force	F <sub>a</sub>	N	1,350	2,036	
Electrical time constant	K <sub>e</sub>	ms	10.5	11.3	8.9
Resistance <sup>1)</sup>	R <sub>25</sub>	Ω	4.6	6.8	1.6
Inductance <sup>1)</sup>	L	mH	48.4	76.8	14.0
Back EMF constant	K <sub>u</sub>	V <sub>eff</sub> /(m/s)	43	51	24
Motor constant	K <sub>m</sub>	N/√W	23.2	30.4	31.4
Thermal resistance	R <sub>th</sub>	°C/W	0.7	0.5	0.5
Thermal time constant	T <sub>th</sub>	s	4,730	6,820	
Thermal switch			3 PTC SNM 120 in series		
Max. DC bus voltage		V	600		
Mechanical parameters					
Max. bending radius of motor cable	R <sub>bend</sub>	mm	69		
Pole pair pitch	2τ	mm	32		
Max. winding temperature	T <sub>max</sub>	°C	120		
Weight of forcer	M <sub>F</sub>	kg	2.7	4.1	
Unit mass of stator	M <sub>S</sub>	kg/m	6.2		
Length of stator/Dimension N	L <sub>S</sub>	mm	128 mm/N = 2; 320 mm/N = 5		
Total height (forcer + stator)	H	mm	55.2	57.4	

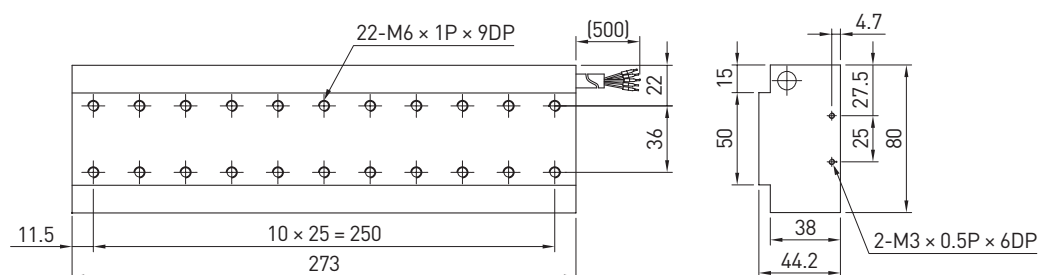
All the specifications in the table (except dimensions) are in  $\pm 10\%$  of tolerance at 25  $^{\circ}C$  ambient temperature

<sup>1)</sup> Line to line

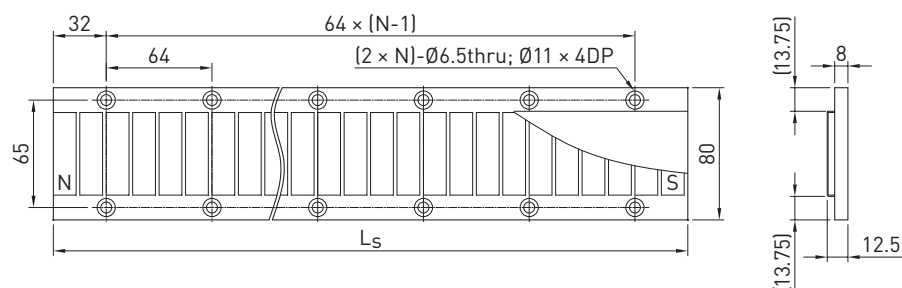
### Dimensions of forcer LMS23



### Dimensions of forcer LMS27(L)



### Dimensions of stator



### Mounting tolerances

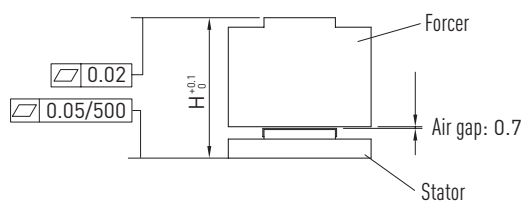


Table 3.4 LMS2 motor cable assignment

Motor cable	Signal	Diameter [mm]
1	V	9.0
2	U	
3	W	
4	—	
5	T+	
6	T-	
Green/Yellow	GND	

# Linear Motors & Positioning Measuring Systems

HIWIN LMS linear motors

## 3.4.3 LMS3, LMS4 linear motor specifications

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

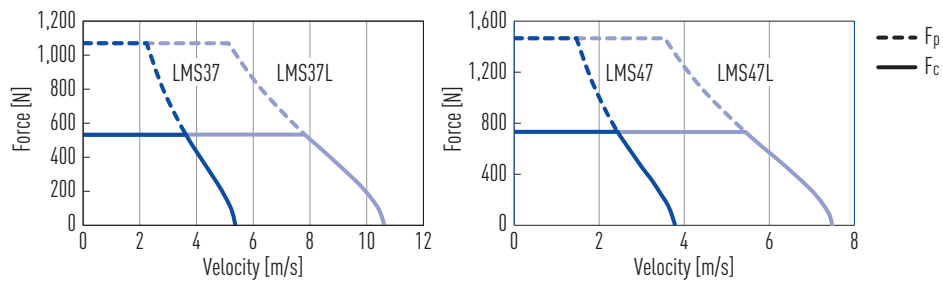


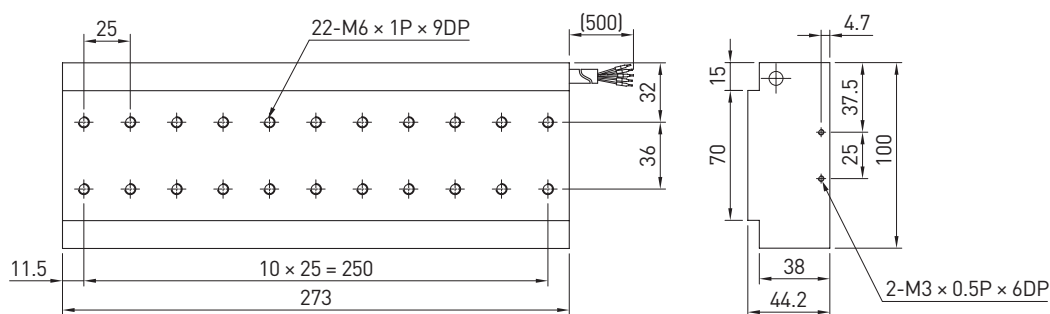
Table 3.5 Technical data for LMS3, LMS4

	Symbol	Unit	LMS37	LMS37L	LMS47	LMS47L
Forces and electrical parameters						
Continuous force at T <sub>max</sub>	F <sub>c</sub>	N	535		733	
Continuous current at T <sub>max</sub>	I <sub>c</sub>	A <sub>eff</sub>	3.9	7.9	3.9	7.9
Peak force (for 1 s)	F <sub>p</sub>	N	1,070		1,466	
Peak current (for 1 s)	I <sub>p</sub>	A <sub>eff</sub>	11.8	23.7	11.8	23.7
Force constant	K <sub>f</sub>	N/A <sub>eff</sub>	136	68	186	93
Attraction force	F <sub>a</sub>	N	2,850		4,071	
Electrical time constant	K <sub>e</sub>	ms	11.6	11.0	13.0	12.2
Resistance <sup>1)</sup>	R <sub>25</sub>	Ω	8.9	2.1	11.9	2.7
Inductance <sup>1)</sup>	L	mH	103.4	23.1	154.4	33.0
Back EMF constant	K <sub>u</sub>	V <sub>eff</sub> /(m/s)	71	36	101	51
Motor constant	K <sub>m</sub>	N/√W	37.2	38.3	44.0	46.2
Thermal resistance	R <sub>th</sub>	°C/W	0.3	0.4	0.3	0.3
Thermal time constant	T <sub>th</sub>	s	5,685		8,356	
Thermal switch			3 PTC SNM 120 in series			
Max. DC bus voltage		V	600			
Mechanical parameters						
Max. bending radius of motor cable	R <sub>bend</sub>	mm	69			
Pole pair pitch	2τ	mm	32			
Max. winding temperature	T <sub>max</sub>	°C	120			
Weight of forcer	M <sub>F</sub>	kg	5.9		8.0	
Unit mass of stator	M <sub>S</sub>	kg/m	8.2		11.5	
Width of stator	W <sub>S</sub>	mm	100		130	
Stator mounting distance	A <sub>S</sub>	mm	85		115	
Length of stator/Dimension N	L <sub>S</sub>	mm	128 mm/N = 2; 320 mm/N = 5			
Total height (forcer + stator)	H	mm	57.4			

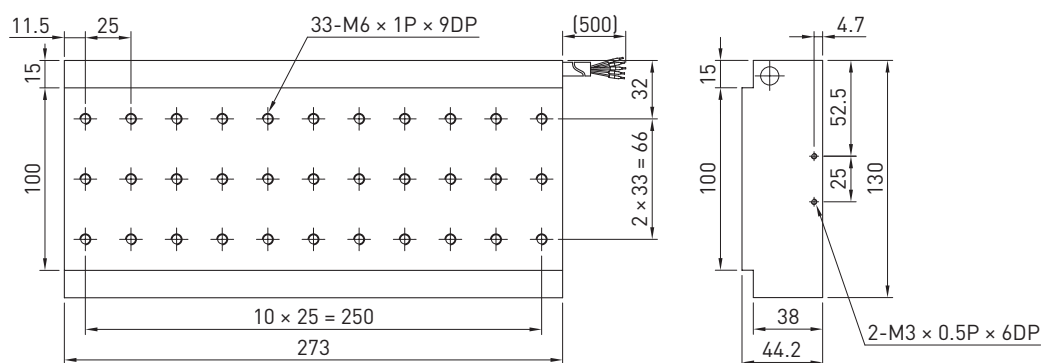
All the specifications in the table (except dimensions) are in  $\pm 10\%$  of tolerance at 25  $^{\circ}C$  ambient temperature

<sup>1)</sup> Line to line

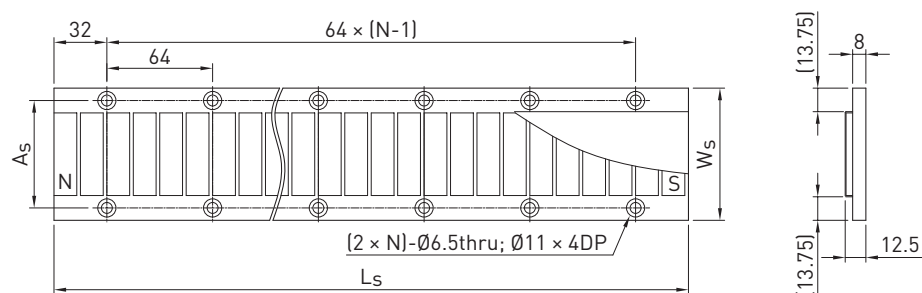
### Dimensions of forcer LMS37(L)



### Dimensions of forcer LMS47(L)



### Dimensions of stator



### Mounting tolerances

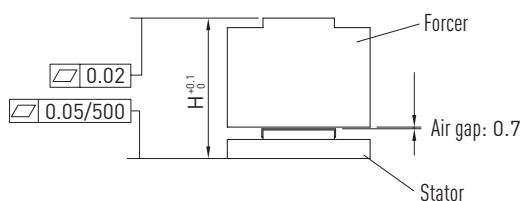


Table 3.6 LMS3, LMS4 motor cable assignment

Motor cable	Signal	Diameter [mm]
1	V	9.0
2	U	
3	W	
4	—	
5	T+	
6	T-	
Green/Yellow	GND	

# Linear Motors & Positioning Measuring Systems

HIWIN LMS linear motors

## 3.4.4 LMS5, LMS6 linear motor specifications

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

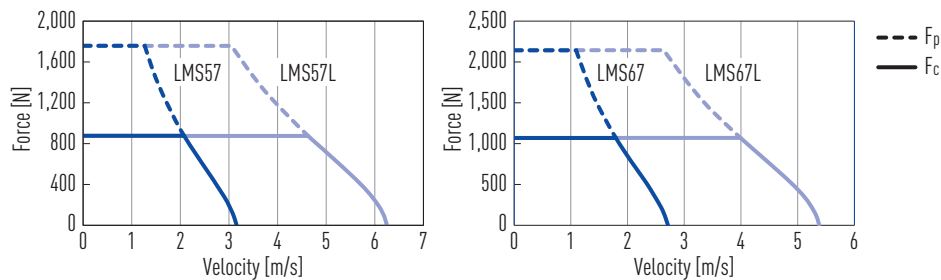


Table 3.7 Technical data for LMS5, LMS6

	Symbol	Unit	LMS57	LMS57L	LMS67	LMS67L
Forces and electrical parameters						
Continuous force at T <sub>max</sub>	F <sub>c</sub>	N	879		1,069	
Continuous current at T <sub>max</sub>	I <sub>c</sub>	A <sub>eff</sub>	3.9	7.9	3.9	7.9
Peak force (for 1 s)	F <sub>p</sub>	N	1,758		1,466	
Peak current (for 1 s)	I <sub>p</sub>	A <sub>eff</sub>	11.8	23.7	11.8	23.7
Force constant	K <sub>f</sub>	N/A <sub>eff</sub>	223	112	271	136
Attraction force	F <sub>a</sub>	N	4,885		5,700	
Electrical time constant	K <sub>e</sub>	ms	12.4	12.0	12.4	12.6
Resistance <sup>1)</sup>	R <sub>25</sub>	Ω	13.8	3.1	15.4	3.4
Inductance <sup>1)</sup>	L	mH	170.8	37.3	190.7	43.0
Back EMF constant	K <sub>u</sub>	V <sub>eff</sub> /(m/s)	121	61	141	71
Motor constant	K <sub>m</sub>	N/√W	49.0	51.6	56.4	60.2
Thermal resistance	R <sub>th</sub>	°C/W	0.2	0.2	0.2	0.2
Thermal time constant	T <sub>th</sub>	s	6,460		7,440	
Thermal switch			3 PTC SNM 120 in series			
Max. DC bus voltage		V	600			
Mechanical parameters						
Max. bending radius of motor cable	R <sub>bend</sub>	mm	69			
Pole pair pitch	2τ	mm	32			
Max. winding temperature	T <sub>max</sub>	°C	120			
Weight of forcer	M <sub>F</sub>	kg	9.4		10.8	
Unit mass of stator	M <sub>S</sub>	kg/m	13.7		15.9	
Width of stator	W <sub>S</sub>	mm	150		170	
Stator mounting distance	A <sub>S</sub>	mm	135		155	
Length of stator/Dimension N	L <sub>S</sub>	mm	128 mm/N = 2; 320 mm/N = 5			
Total height (forcer + stator)	H	mm	57.4			

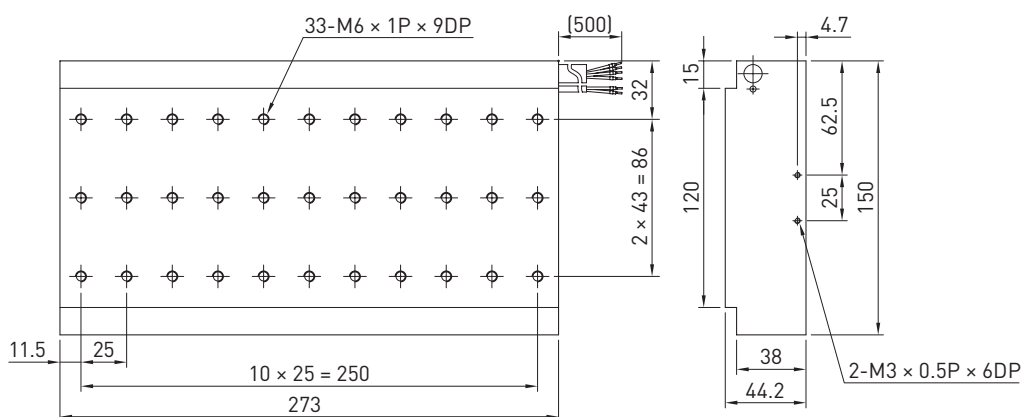
All the specifications in the table (except dimensions) are in  $\pm 10\%$  of tolerance at 25  $^{\circ}C$  ambient temperature; <sup>1)</sup> Line to line

Table 3.8 LMS5, LMS6 motor cable assignment

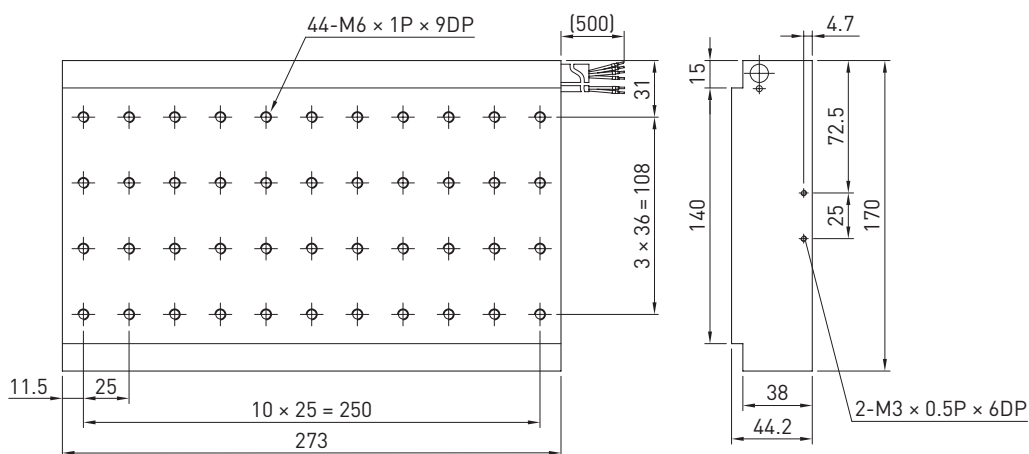
Motor cable	Signal	Diameter [mm]
1	V	9.0
2	U	
3	W	
4	—	
5	T+	
6	T-	
Green/Yellow	GND	



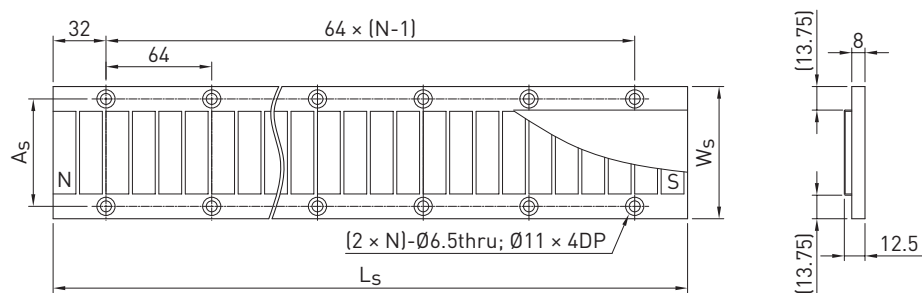
### Dimensions of forcer LMS57(L)



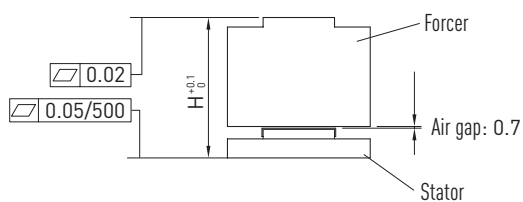
### Dimensions of forcer LMS67(L)



### Dimensions of stator



### Mounting tolerances



# Linear Motors & Positioning Measuring Systems

HIWIN LMC linear motors

## 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 motors:

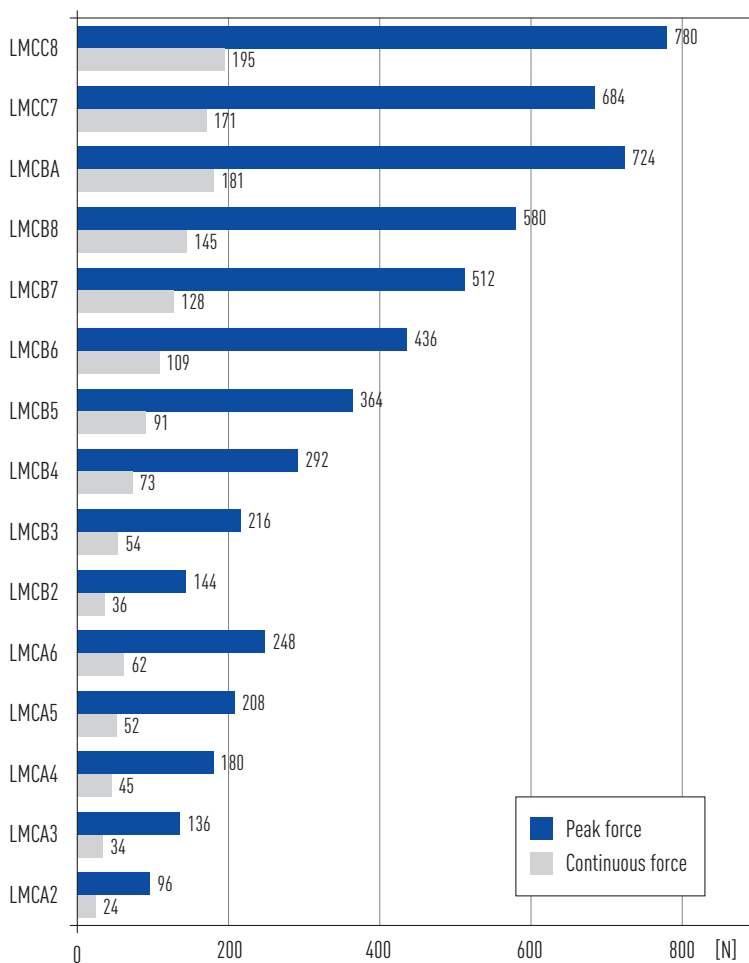
- Extremely dynamic
- No cogging, thus highest synchronous operation
- No magnetic pull in the guiding system
- Optional: design for vacuum applications
- Optional: version with Hall sensor

#### Typical fields of application of the LMC linear motors:

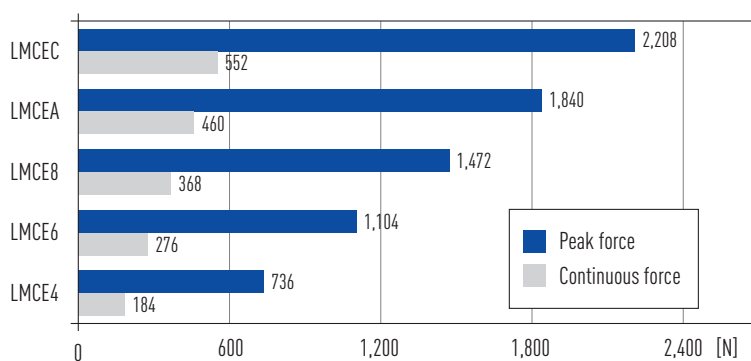
- Pick-and-place machines in semiconductor technology
- Air bearing axes
- Wafer structuring
- Pick-and-place machines
- High-precision measuring and testing machines
- Semiconductors

### 4.2 Force chart for LMC linear motors

Force chart for linear motors LMCA, LMCB, LMCC

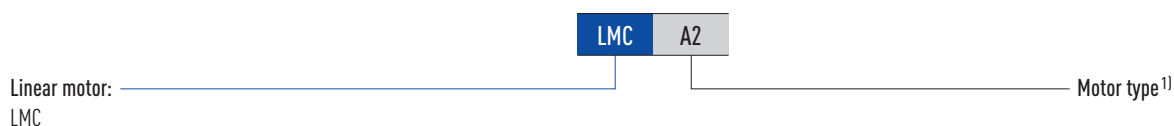


**Force chart for linear motors LMCE**



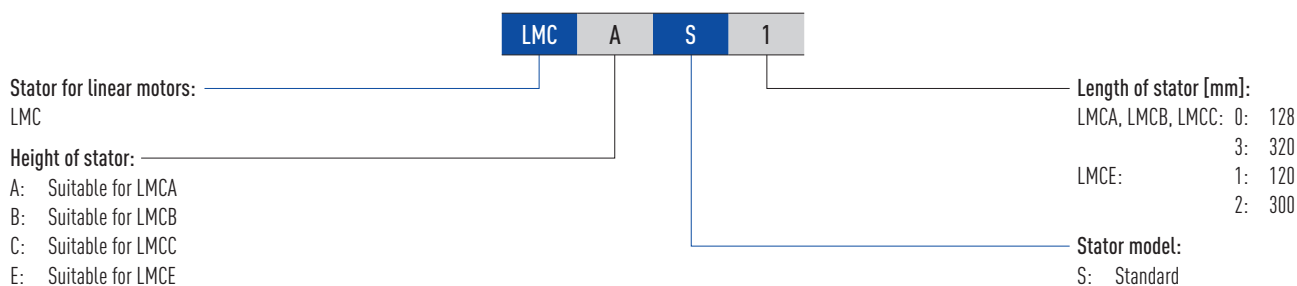
### 4.3 Order code LMC linear motors

#### 4.3.1 Order code of primary part (forcer)



<sup>1)</sup> See [Table 4.1](#) (LMCA)  
[Table 4.3](#) (LMCB)  
[Table 4.5](#) (LMCC)  
[Table 4.7](#) (LMCE)

#### 4.3.2 Order code of magnet track (stator)



# Linear Motors & Positioning Measuring Systems

HIWIN LMC linear motors

## 4.4 LMC linear motor specifications

### 4.4.1 LMCA linear motor specifications

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

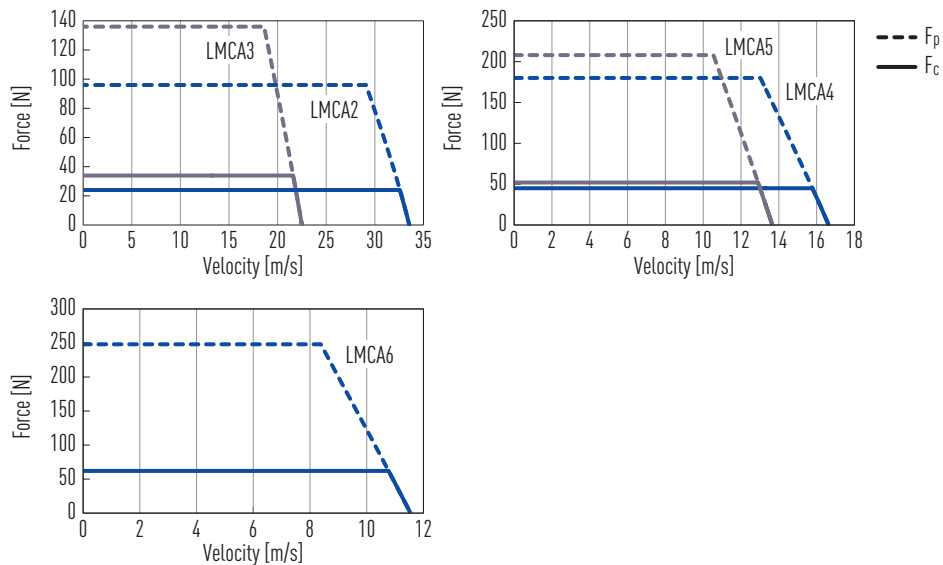


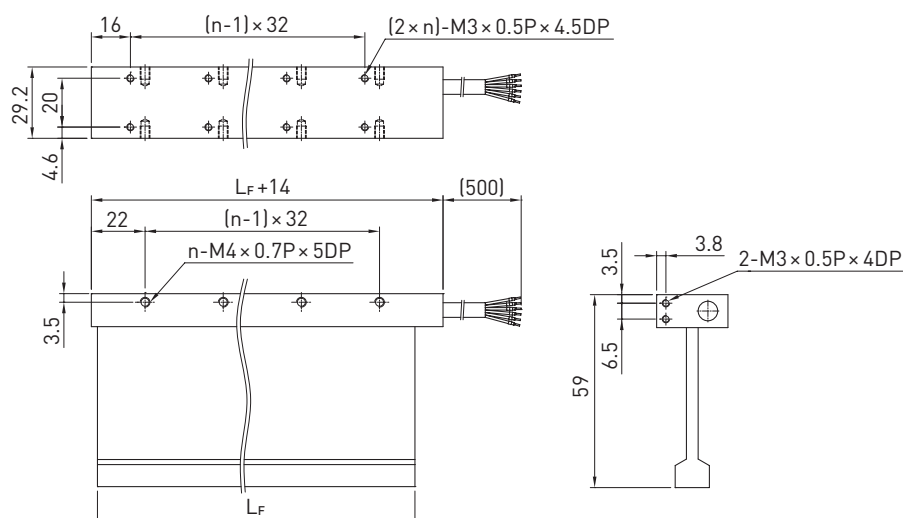
Table 4.1 Technical data for LMCA

	Symbol	Unit	LMCA2	LMCA3	LMCA4	LMCA5	LMCA6
Forces and electrical parameters							
Continuous force at T <sub>max</sub>	F <sub>c</sub>	N	24	34	45	52	62
Continuous current at T <sub>max</sub>	I <sub>c</sub>	A <sub>eff</sub>	2.3	2.1	2.1	1.8	1.8
Peak force (for 1 s)	F <sub>p</sub>	N	96	136	180	208	248
Peak current (for 1 s)	I <sub>p</sub>	A <sub>eff</sub>	9.2	8.4	8.4	7.2	7.2
Force constant	K <sub>f</sub>	N/A <sub>eff</sub>	10.6	15.8	21.2	28.2	33.8
Electrical time constant	K <sub>e</sub>	ms	0.4	0.3	0.3	0.3	0.3
Resistance <sup>1)</sup>	R <sub>25</sub>	Ω	2.7	4.1	5.4	6.7	8.2
Inductance <sup>1)</sup>	L	mH	1.0	1.4	1.9	2.3	2.8
Back EMF constant	K <sub>u</sub>	V <sub>eff</sub> /(m/s)	5.9	8.8	11.9	14.5	17.4
Motor constant	K <sub>m</sub>	N/√W	5.2	6.5	7.5	9.1	9.8
Thermal resistance	R <sub>th</sub>	°C/W	2.80	2.21	1.68	1.84	1.50
Thermal switch			3 PTC SNM 100 in series				
Max. DC bus voltage		V	330				
Mechanical parameters							
Max. bending radius of motor cable	R <sub>bend</sub>	mm	37.5				
Pole pair pitch	2τ	mm	32				
Max. winding temperature	T <sub>max</sub>	°C	100				
Mounting holes (forcer)	n		2	3	4	5	6
Weight of forcer	M <sub>F</sub>	kg	0.15	0.23	0.31	0.38	0.45
Length of forcer	L <sub>F</sub>	mm	66	98	130	162	194
Unit mass of stator	M <sub>S</sub>	kg/m	7				
Length of stator/Dimension N	L <sub>S</sub>	mm	128 mm/N = 2; 320 mm/N = 5				

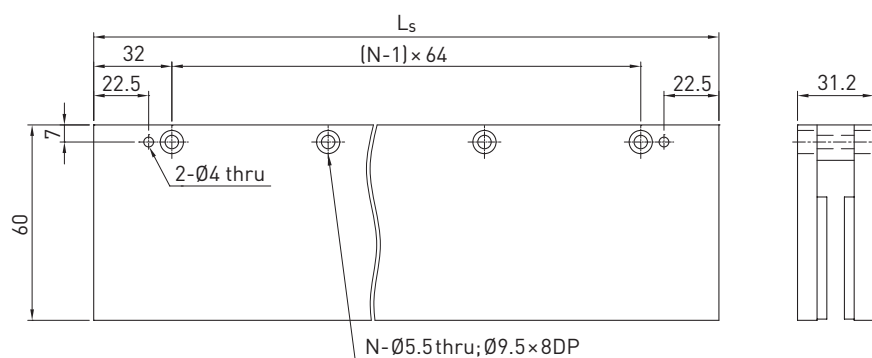
All the specifications in the table (except dimensions) are in  $\pm 10\%$  of tolerance at  $25^{\circ}C$  ambient temperature

<sup>1)</sup> Line to line

### Dimensions of forcer



### Dimensions of stator



### Mounting tolerances

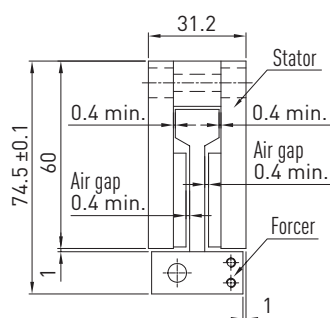


Table 4.2 LMCA motor cable assignment

Motor cable	Signal	Diameter [mm]
Brown	U	7.5
White	V	
Grey	W	
Black	GND	
Yellow	T+	
Green	T-	

# Linear Motors & Positioning Measuring Systems

HIWIN LMC linear motors

## 4.4.2 LMCB linear motor specifications

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

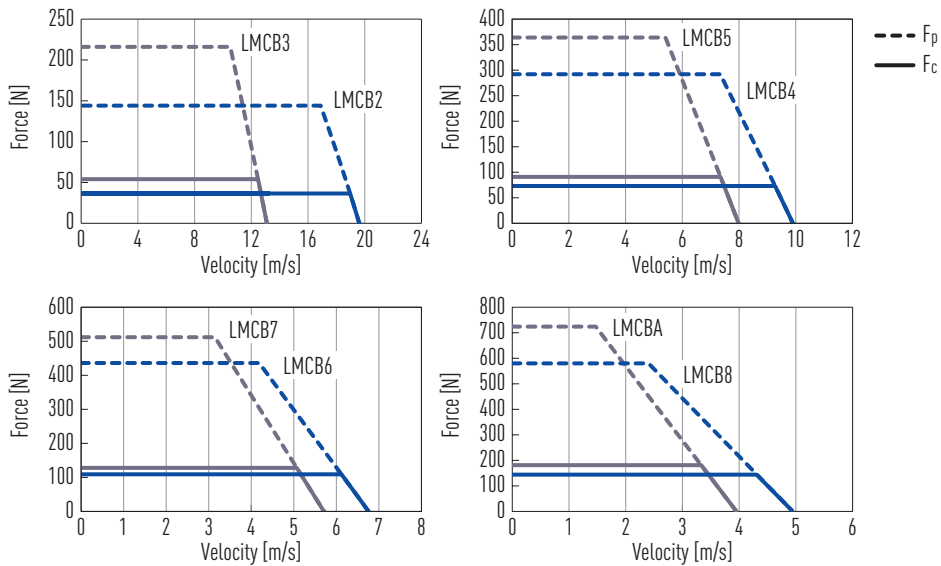


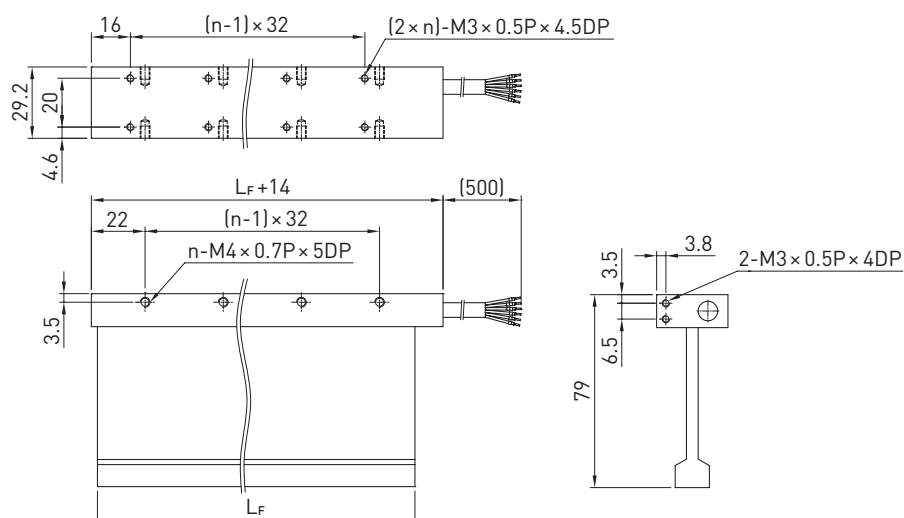
Table 4.3 Technical data for LMCB

	Symbol	Unit	LMCB2	LMCB3	LMCB4	LMCB5	LMCB6	LMCB7	LMCB8	LMCBA
Forces and electrical parameters										
Continuous force at T <sub>max</sub>	F <sub>c</sub>	N	36	54	73	91	109	128	145	181
Continuous current at T <sub>max</sub>	I <sub>c</sub>	A <sub>eff</sub>	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Peak force (for 1 s)	F <sub>p</sub>	N	144	216	292	364	436	512	580	724
Peak current (for 1 s)	I <sub>p</sub>	A <sub>eff</sub>	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0
Force constant	K <sub>f</sub>	N/A <sub>eff</sub>	18.1	27.2	36.3	45.4	54.5	63.5	72.5	90.6
Electrical time constant	K <sub>e</sub>	ms	0.4	0.4	0.4	0.4	0.4	0.3	0.3	0.3
Resistance <sup>1)</sup>	R <sub>25</sub>	Ω	3.6	5.4	7.1	9.0	10.7	12.6	14.6	17.9
Inductance <sup>1)</sup>	L	mH	1.4	1.9	2.6	3.2	3.8	4.4	5.0	6.2
Back EMF constant	K <sub>u</sub>	V <sub>eff</sub> /(m/s)	10.1	15.2	20.0	24.8	29.3	34.7	40.0	50.0
Motor constant	K <sub>m</sub>	N/√W	7.7	9.5	11.2	12.4	13.6	14.7	15.5	17.5
Thermal resistance	R <sub>th</sub>	°C/W	2.77	1.85	1.41	1.11	0.93	0.79	0.68	0.56
Thermal switch			3 PTC SNM 100 in series							
Max. DC bus voltage		V	330							
Mechanical parameters										
Max. bending radius of motor cable	R <sub>bend</sub>	mm	37.5							
Pole pair pitch	2τ	mm	32							
Max. winding temperature	T <sub>max</sub>	°C	100							
Mounting holes (forcer)	n		2	3	4	5	6	7	8	10
Weight of forcer	M <sub>F</sub>	kg	0.20	0.29	0.38	0.48	0.58	0.68	0.72	0.88
Length of forcer	L <sub>F</sub>	mm	66	98	130	162	194	226	258	322
Unit mass of stator	M <sub>S</sub>	kg/m	12							
Length of stator/Dimension N	L <sub>S</sub>	mm	128 mm/N = 2; 320 mm/N = 5							

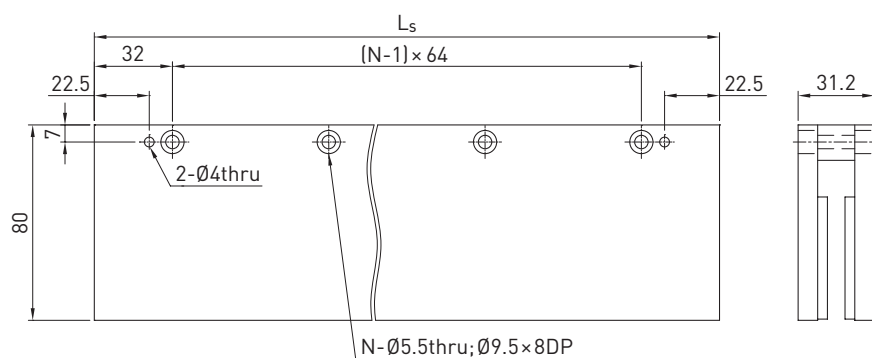
All the specifications in the table (except dimensions) are in  $\pm 10\%$  of tolerance at  $25^{\circ}C$  ambient temperature

<sup>1)</sup> Line to line

### Dimensions of forcer



### Dimensions of stator



### Mounting tolerances

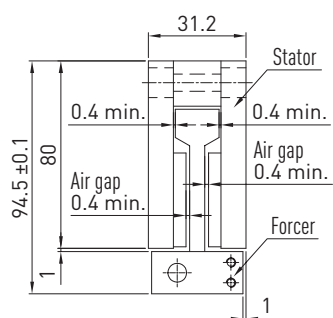


Table 4.4 LMCB motor cable assignment

Motor cable	Signal	Diameter [mm]
Brown	U	7.5
White	V	
Grey	W	
Black	GND	
Yellow	T+	
Green	T-	

# Linear Motors & Positioning Measuring Systems

HIWIN LMC linear motors

## 4.4.3 LMCC linear motor specifications

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

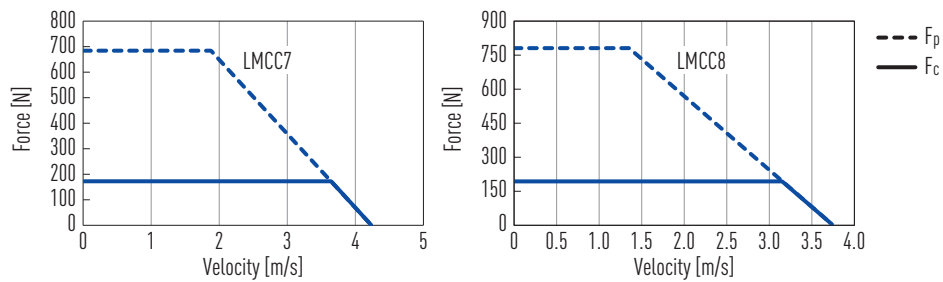


Table 4.5 Technical data for LMCC

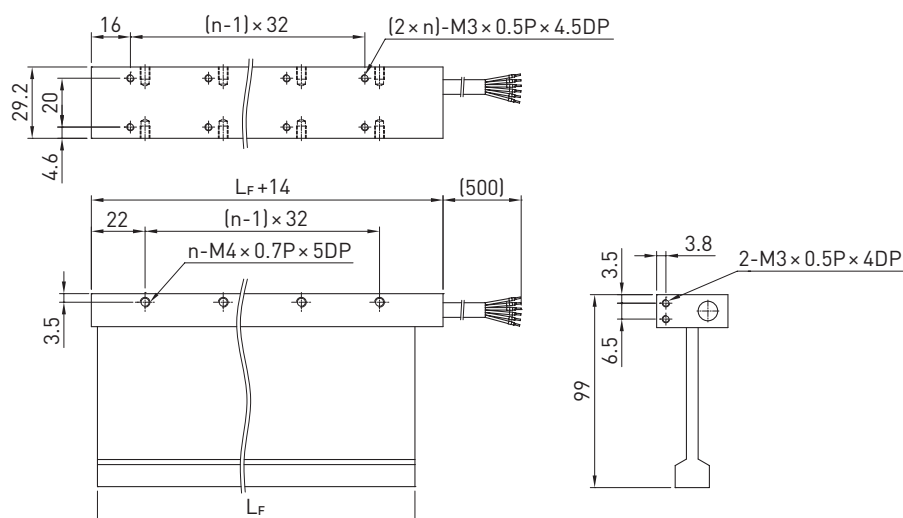
	Symbol	Unit	LMCC7	LMCC8
Forces and electrical parameters				
Continuous force at T <sub>max</sub>	F <sub>c</sub>	N	171	195
Continuous current at T <sub>max</sub>	I <sub>c</sub>	A <sub>eff</sub>	2.0	2.0
Peak force (for 1 s)	F <sub>p</sub>	N	684	780
Peak current (for 1 s)	I <sub>p</sub>	A <sub>eff</sub>	8.0	8.0
Force constant	K <sub>f</sub>	N/A <sub>eff</sub>	85.4	97.5
Electrical time constant	K <sub>e</sub>	ms	0.3	0.3
Resistance <sup>1)</sup>	R <sub>25</sub>	Ω	15.8	18.2
Inductance <sup>1)</sup>	L	mH	5.5	6.3
Back EMF constant	K <sub>u</sub>	V <sub>eff</sub> /(m/s)	45.4	51.9
Motor constant	K <sub>m</sub>	N/√W	17.6	18.7
Thermal resistance	R <sub>th</sub>	°C/W	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 <sub>bend</sub>	mm	37.5	
Pole pair pitch	2τ	mm	32	
Max. winding temperature	T <sub>max</sub>	°C	100	
Mounting holes (forcer)	n		7	8
Weight of forcer	M <sub>F</sub>	kg	0.74	0.76
Length of forcer	L <sub>F</sub>	mm	226	258
Unit mass of stator	M <sub>S</sub>	kg/m	21	
Length of stator/Dimension N	L <sub>S</sub>	mm	128 mm/N = 2; 320 mm/N = 5	

All the specifications in the table (except dimensions) are in  $\pm 10\%$  of tolerance at 25  $^{\circ}C$  ambient temperature

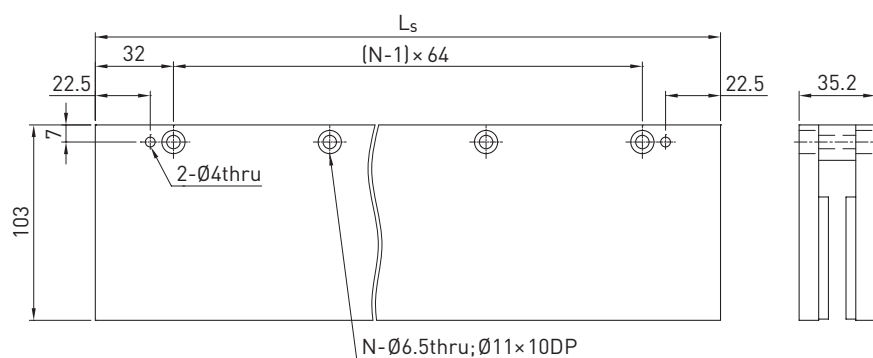
<sup>1)</sup> Line to line



### Dimensions of forcer



### Dimensions of stator



### Mounting tolerances

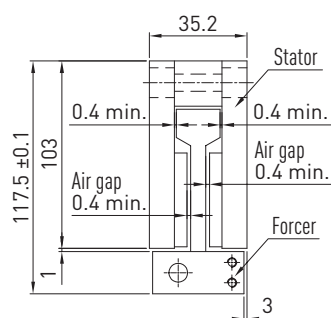


Table 4.6 LMCC motor cable assignment

Motor cable	Signal	Diameter [mm]
Brown	U	7.5
White	V	
Grey	W	
Black	GND	
Yellow	T+	
Green	T-	

# Linear Motors & Positioning Measuring Systems

HIWIN LMC linear motors

## 4.4.4 LMCE linear motor specifications

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

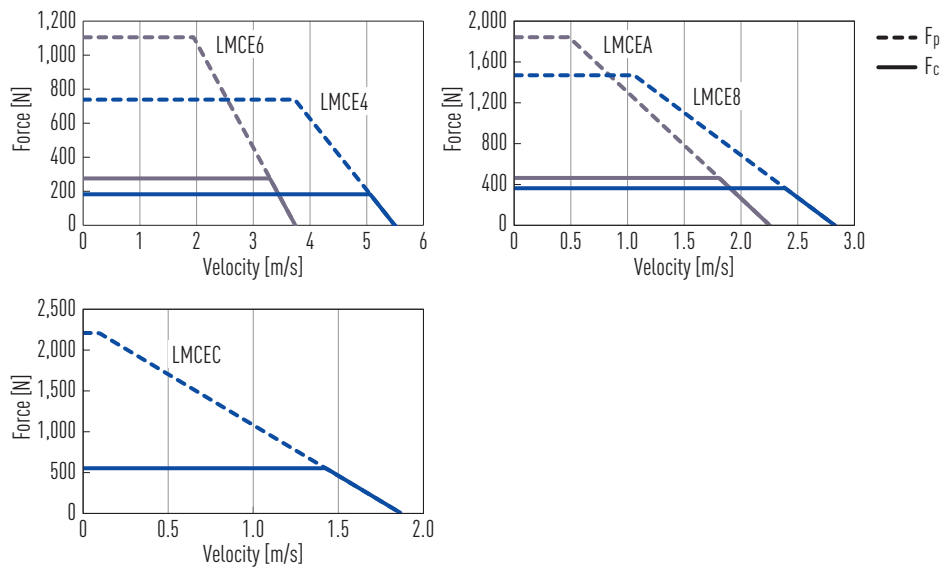


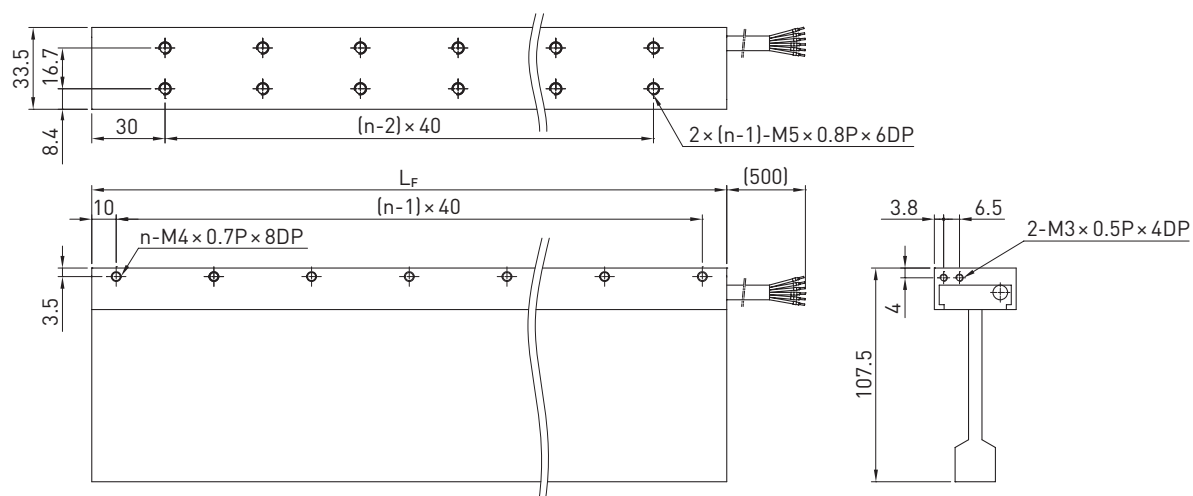
Table 4.7 Technical data for LMCE

	Symbol	Unit	LMCE4	LMCE6	LMCE8	LMCEA	LMCEC
Forces and electrical parameters							
Continuous force at T <sub>max</sub>	F <sub>c</sub>	N	184	276	368	460	552
Continuous current at T <sub>max</sub>	I <sub>c</sub>	A <sub>eff</sub>	3.25	3.25	3.25	3.25	3.25
Peak force (for 1 s)	F <sub>p</sub>	N	736	1,104	1,472	1,840	2,208
Peak current (for 1 s)	I <sub>p</sub>	A <sub>eff</sub>	13	13	13	13	13
Force constant	K <sub>f</sub>	N/A <sub>eff</sub>	56.6	84.9	113.2	141.5	169.8
Electrical time constant	K <sub>e</sub>	ms	0.5	0.5	0.5	0.5	0.5
Resistance <sup>1)</sup>	R <sub>25</sub>	Ω	5.6	8.4	11.0	13.8	16.7
Inductance <sup>1)</sup>	L	mH	2.9	4.4	5.9	7.3	8.8
Back EMF constant	K <sub>u</sub>	V <sub>eff</sub> /(m/s)	35	53	70	88	106
Motor constant	K <sub>m</sub>	N/√W	19.1	23.4	27.0	30.2	33.2
Thermal resistance	R <sub>th</sub>	°C/W	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 <sub>bend</sub>	mm	37.5				
Pole pair pitch	2τ	mm	60				
Max. winding temperature	T <sub>max</sub>	°C	100				
Mounting holes (forcer)	n		7	10	13	16	19
Weight of forcer	M <sub>F</sub>	kg	1.23	1.84	2.46	3.08	3.70
Length of forcer	L <sub>F</sub>	mm	260	380	500	620	740
Unit mass of stator	M <sub>S</sub>	kg/m	20				
Length of stator/Dimension N	L <sub>S</sub>	mm	120 mm/N = 2; 300 mm/N = 5				

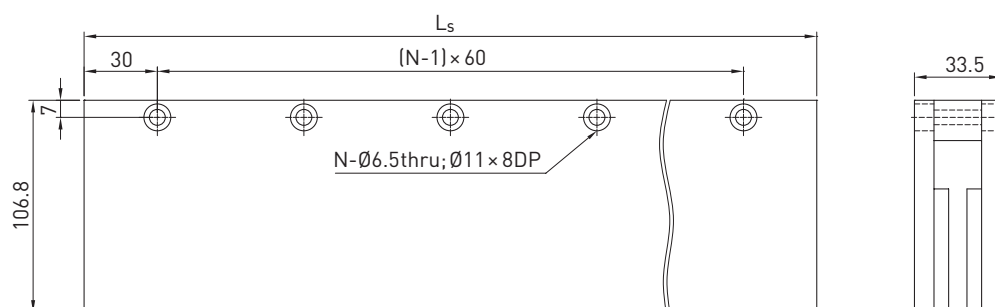
All the specifications in the table (except dimensions) are in  $\pm 10\%$  of tolerance at 25  $^{\circ}C$  ambient temperature

<sup>1)</sup> Line to line

### Dimensions of forcer



### Dimensions of stator



### Mounting tolerances

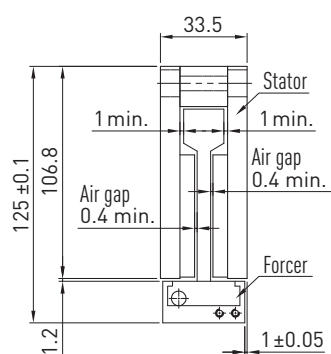


Table 4.8 LMCE motor cable assignment

Motor cable	Signal	Diameter [mm]
Brown	U	7.5
White	V	
Grey	W	
Black	GND	
Yellow	T+	
Green	T-	

# Linear Motors & Positioning Measuring Systems

## HIWIN LMFA linear motors

### 5. HIWIN LMFA linear motors

#### 5.1 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:

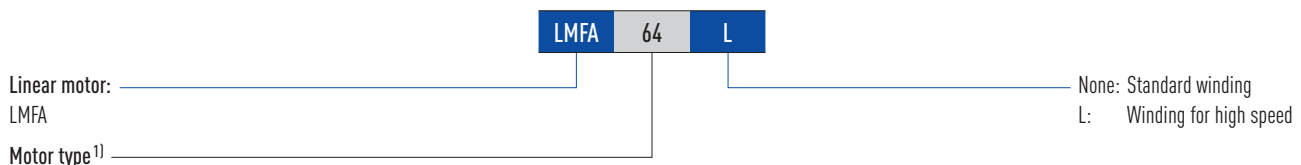
- Efficient cooling system
- Extremely high thrust
- High acceleration
- UL-certified
- High synchronous run
- Full epoxy encapsulation of permanent magnets in the stator
- Optional: version with Hall sensor

#### Typical fields of application of the LMFA linear motors:

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

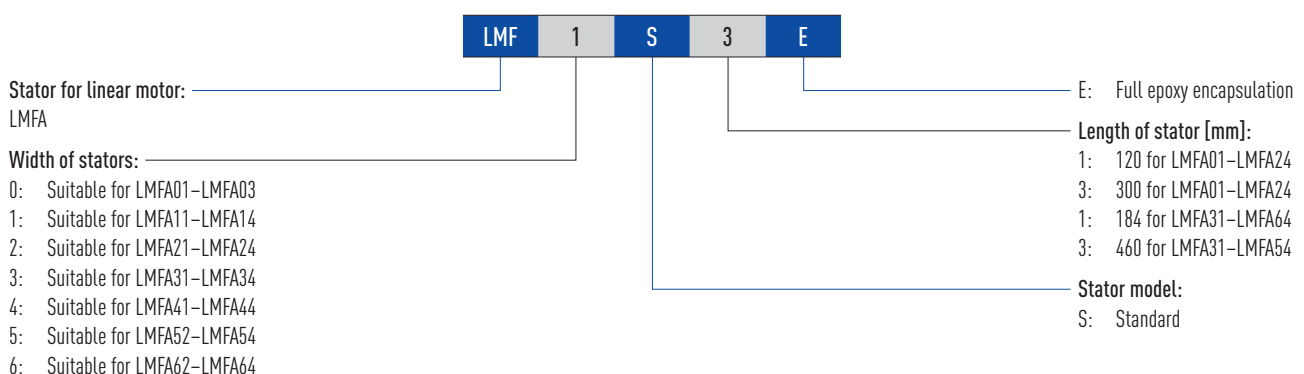
#### 5.2 Order code LMFA linear motors

##### 5.2.1 Order code of primary part (forcer)

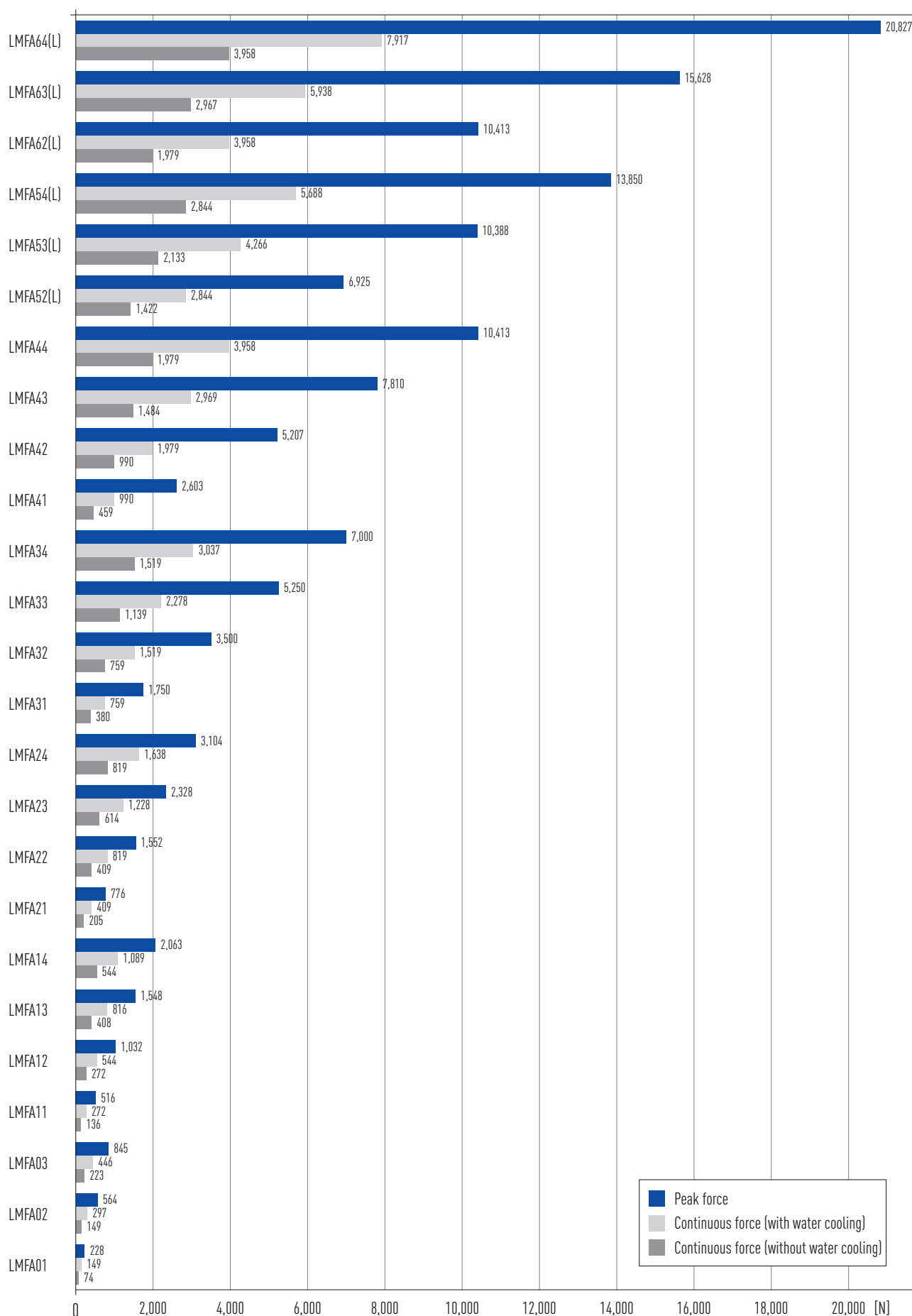


<sup>1)</sup> See Table 5.1 (LMFA0), Table 5.2 (LMFA1), Table 5.3 (LMFA2), Table 5.4 (LMFA3), Table 5.5 (LMFA4), Table 5.6 (LMFA5), Table 5.7 (LMFA6)

##### 5.2.2 Order code of magnet track (stator)



### 5.3 Force chart for LMFA linear motors



# Linear Motors & Positioning Measuring Systems

HIWIN LMFA linear motors

## 5.4 LMFA linear motor specifications

### 5.4.1 LMFA0 linear motor specifications

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

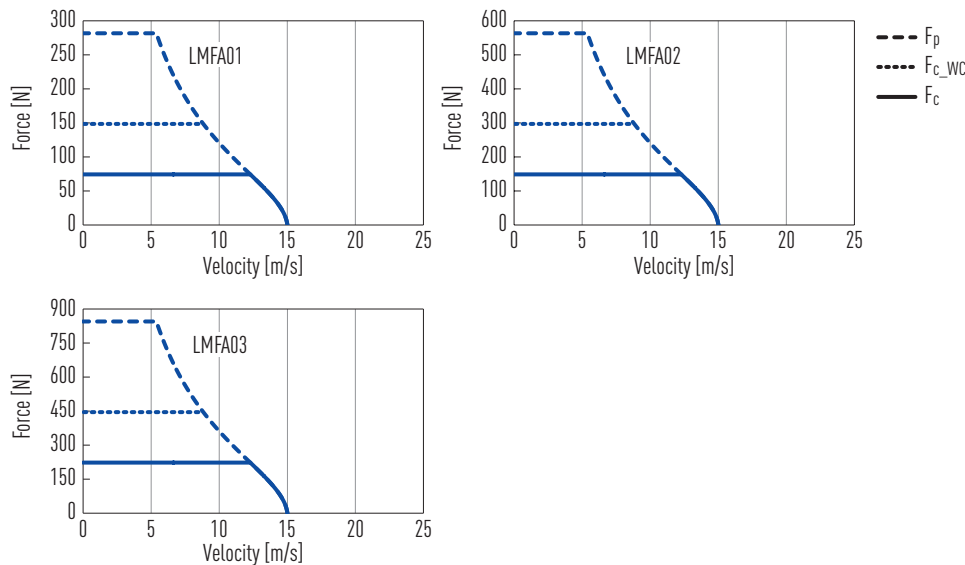


Table 5.1 Technical data for LMFA0

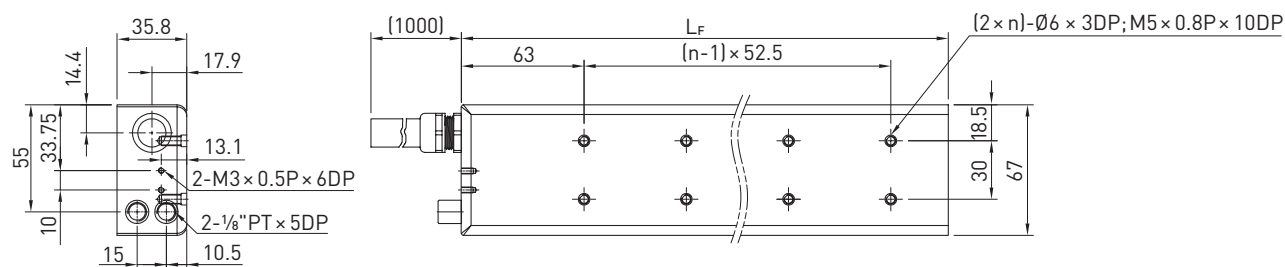
	Symbol	Unit	LMFA01	LMFA02	LMFA03
Forces and electrical parameters					
Continuous force at T <sub>max</sub>	F <sub>c</sub>	N	74	149	223
Peak force at T <sub>max</sub> (WC)	F <sub>c_WC</sub>	N	149	297	446
Continuous current at T <sub>max</sub>	I <sub>c</sub>	A <sub>eff</sub>	1.4	2.7	4.1
Continuous current at T <sub>max</sub> (WC)	I <sub>c_WC</sub>	A <sub>eff</sub>	2.7	5.4	8.1
Peak force (for 1 s)	F <sub>p</sub>	N	282	564	845
Peak current (for 1 s)	I <sub>p</sub>	A <sub>eff</sub>	8.4	16.7	25.1
Force constant	K <sub>f</sub>	N/A <sub>eff</sub>	55.1	55.1	55.1
Attraction force	F <sub>a</sub>	N	457	914	1,372
Electrical time constant	K <sub>e</sub>	ms	7.2	7.2	7.2
Resistance <sup>1)</sup>	R <sub>25</sub>	Ω	11.7	5.9	3.9
Inductance <sup>1)</sup>	L	mH	84.2	42.1	28.1
Back EMF constant	K <sub>u</sub>	V <sub>eff</sub> /(m/s)	31.8	31.8	31.8
Motor constant	K <sub>m</sub>	N/√W	13.1	18.6	22.8
Thermal resistance	R <sub>th</sub>	°C/W	2.25	1.13	0.75
Thermal resistance (WC)	R <sub>th_WC</sub>	°C/W	0.56	0.28	0.19
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 <sub>max</sub>	°C	120		
Mounting holes (forcer)	n		2	4	6
Weight of forcer	M <sub>F</sub>	kg	1.5	2.3	3.1
Length of forcer	L <sub>F</sub>	mm	145	250	355
Unit mass of stator	M <sub>S</sub>	kg/m	3.7		
Length of stator/Dimension N	L <sub>S</sub>	mm	120 mm/N = 2; 300 mm/N = 5		

WC: with water cooling

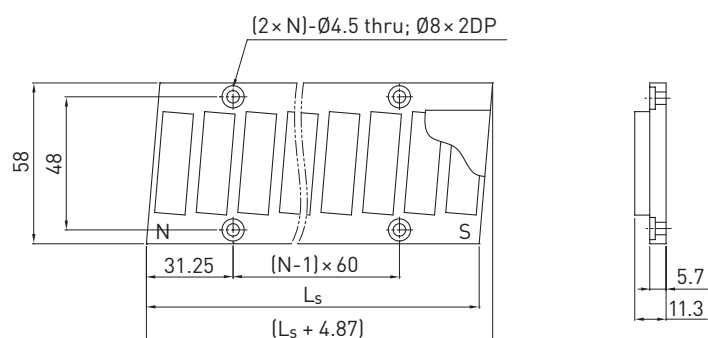
All the specifications in the table (except dimensions) are in  $\pm 10\%$  of tolerance at  $25^{\circ}C$  ambient temperature

<sup>1)</sup> Line to line

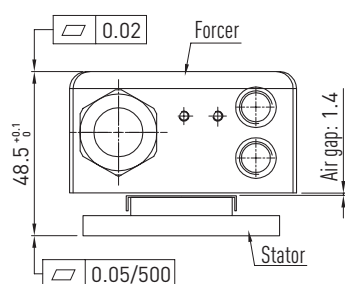
### Dimensions offorcer



### Dimensions of stator



### Mounting tolerances



### Stator versions available



Epoxy: Full epoxy encapsulation of permanent magnets

Stainless steel cover plate (upon request): Additional, one-piece stainless steel cover plate for magnet tracks

# Linear Motors & Positioning Measuring Systems

HIWIN LMFA linear motors

## 5.4.2 LMFA1 linear motor specifications

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

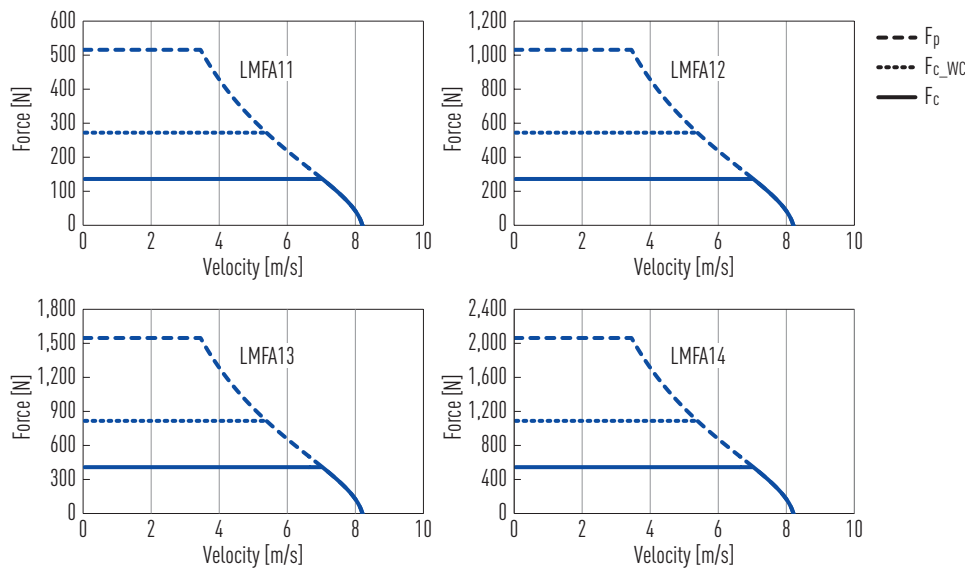


Table 5.2 Technical data for LMFA1

	Symbol	Unit	LMFA11	LMFA12	LMFA13	LMFA14
Forces and electrical parameters						
Continuous force at T <sub>max</sub>	F <sub>c</sub>	N	136	272	408	544
Continuous force at T <sub>max</sub> (WC)	F <sub>c_WC</sub>	N	272	544	816	1,089
Continuous current at T <sub>max</sub>	I <sub>c</sub>	A <sub>eff</sub>	1.4	2.7	4.0	5.4
Continuous current at T <sub>max</sub> (WC)	I <sub>c_WC</sub>	A <sub>eff</sub>	2.7	5.4	8.1	10.8
Peak force (for 1 s)	F <sub>p</sub>	N	516	1,032	1,548	2,063
Peak current (for 1 s)	I <sub>p</sub>	A <sub>eff</sub>	8.4	16.7	25.1	33.5
Force constant	K <sub>f</sub>	N/A <sub>eff</sub>	100.8	100.8	100.8	100.8
Attraction force	F <sub>a</sub>	N	837	1,674	2,511	3,348
Electrical time constant	K <sub>e</sub>	ms	7.2	7.2	7.2	7.2
Resistance <sup>1)</sup>	R <sub>25</sub>	Ω	16.9	8.4	5.6	4.2
Inductance <sup>1)</sup>	L	mH	121.9	60.9	40.6	30.5
Back EMF constant	K <sub>u</sub>	V <sub>eff</sub> /(m/s)	58.2	58.2	58.2	58.2
Motor constant	K <sub>m</sub>	N/√W	20.0	28.3	34.7	40.1
Thermal resistance	R <sub>th</sub>	°C/W	1.56	0.78	0.52	0.39
Thermal resistance (WC)	R <sub>th_WC</sub>	°C/W	0.39	0.20	0.13	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 <sub>max</sub>	°C	120			
Mounting holes (forcer)	n		2	4	6	8
Weight of forcer	M <sub>F</sub>	kg	2.4	4.0	5.6	7.6
Length of forcer	L <sub>F</sub>	mm	145	250	355	460
Unit mass of stator	M <sub>S</sub>	kg/m	5.8			
Length of stator/Dimension N	L <sub>S</sub>	mm	120 mm/N = 2; 300 mm/N = 5			

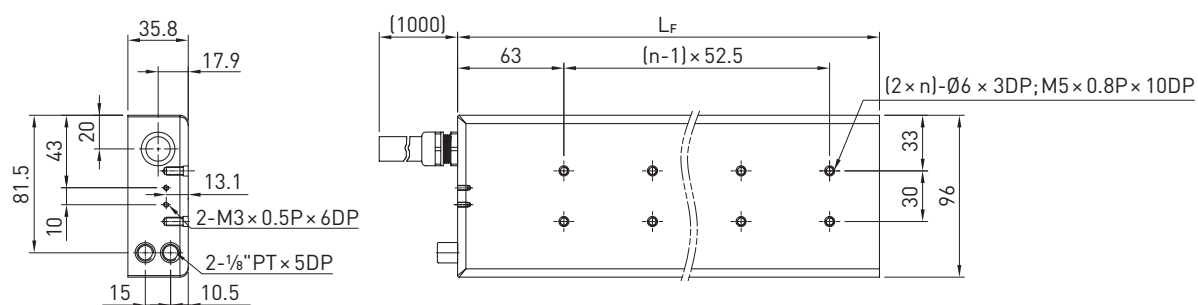
WC: with water cooling

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

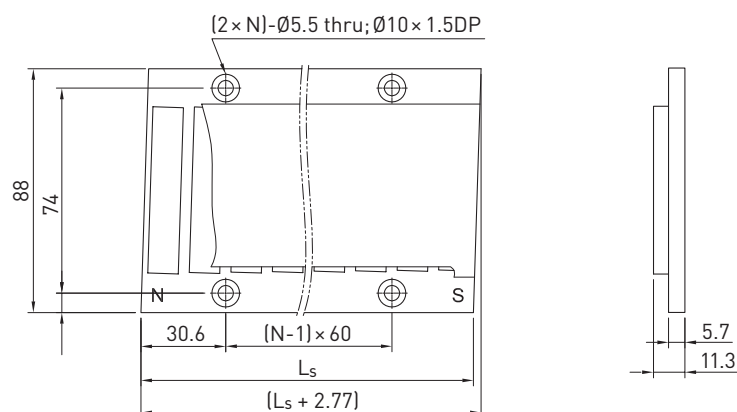
<sup>1)</sup> Line to line



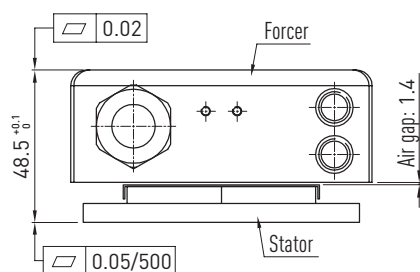
### Dimensions of forcer



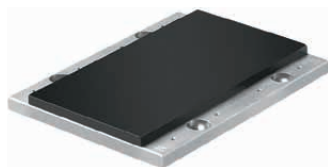
### Dimensions of stator



### Mounting tolerances



### Stator versions available



Epoxy: Full epoxy encapsulation of permanent magnets



Stainless steel cover plate (upon request): Additional, one-piece stainless steel cover plate for magnet tracks

# Linear Motors & Positioning Measuring Systems

HIWIN LMFA linear motors

## 5.4.3 LMFA2 linear motor specifications

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

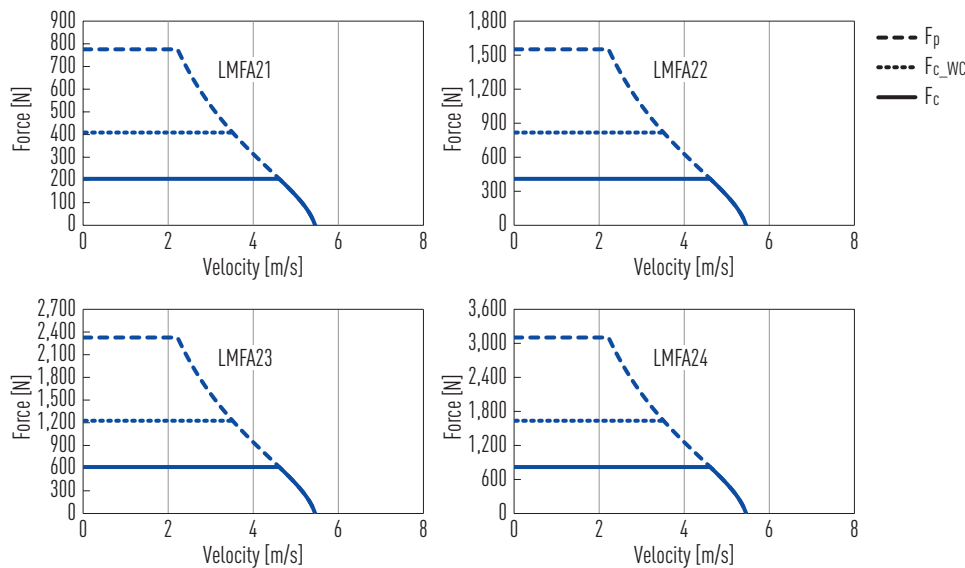


Table 5.3 Technical data for LMFA2

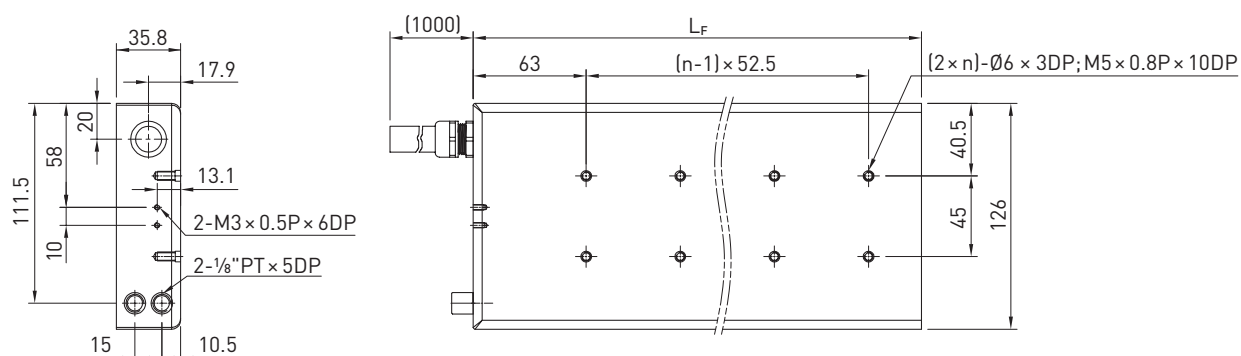
	Symbol	Unit	LMFA21	LMFA22	LMFA23	LMFA24
Forces and electrical parameters						
Continuous force at T <sub>max</sub>	F <sub>c</sub>	N	205	409	614	819
Continuous force at T <sub>max</sub> (WC)	F <sub>c_WC</sub>	N	409	819	1,228	1,638
Continuous current at T <sub>max</sub>	I <sub>c</sub>	A <sub>eff</sub>	1.4	2.7	4.1	5.4
Continuous current at T <sub>max</sub> (WC)	I <sub>c_WC</sub>	A <sub>eff</sub>	2.7	5.4	8.1	10.8
Peak force (for 1 s)	F <sub>p</sub>	N	776	1,552	2,328	3,104
Peak current (for 1 s)	I <sub>p</sub>	A <sub>eff</sub>	8.4	16.7	25.1	33.5
Force constant	K <sub>f</sub>	N/A <sub>eff</sub>	151.6	151.6	151.6	151.6
Attraction force	F <sub>a</sub>	N	1,259	2,518	3,777	5,036
Electrical time constant	K <sub>e</sub>	ms	7.2	7.2	7.2	7.2
Resistance <sup>1)</sup>	R <sub>25</sub>	Ω	24.8	12.4	8.3	6.2
Inductance <sup>1)</sup>	L	mH	178.6	89.3	59.5	44.6
Back EMF constant	K <sub>u</sub>	V <sub>eff</sub> /(m/s)	87.5	87.5	87.5	87.5
Motor constant	K <sub>m</sub>	N/√W	24.9	35.2	43.1	49.7
Thermal resistance	R <sub>th</sub>	°C/W	1.06	0.53	0.35	0.27
Thermal resistance (WC)	R <sub>th_WC</sub>	°C/W	0.27	0.13	0.09	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 <sub>max</sub>	°C	120			
Mounting holes (forcer)	n		2	4	6	8
Weight of forcer	M <sub>F</sub>	kg	3.2	5.5	8.0	10.4
Length of forcer	L <sub>F</sub>	mm	145	250	355	460
Unit mass of stator	M <sub>S</sub>	kg/m	9.8			
Length of stator/Dimension N	L <sub>S</sub>	mm	120 mm/N = 2; 300 mm/N = 5			

WC: with water cooling

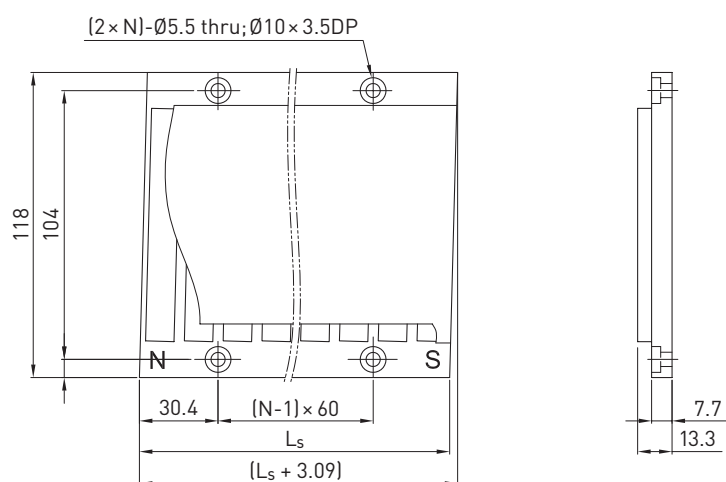
All the specifications in the table (except dimensions) are in  $\pm 10\%$  of tolerance at 25 °C ambient temperature

<sup>1)</sup> Line to line

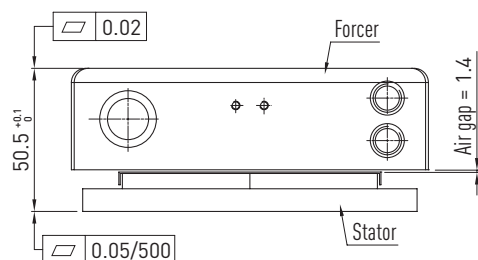
### Dimensions offorcer



### Dimensions of stator



### Mounting tolerances



### Stator versions available



Epoxy: Full epoxy encapsulation of permanent magnets

Stainless steel cover plate (upon request): Additional, one-piece stainless steel cover plate for magnet tracks

# Linear Motors & Positioning Measuring Systems

HIWIN LMFA linear motors

## 5.4.4 LMFA3 linear motor specifications

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

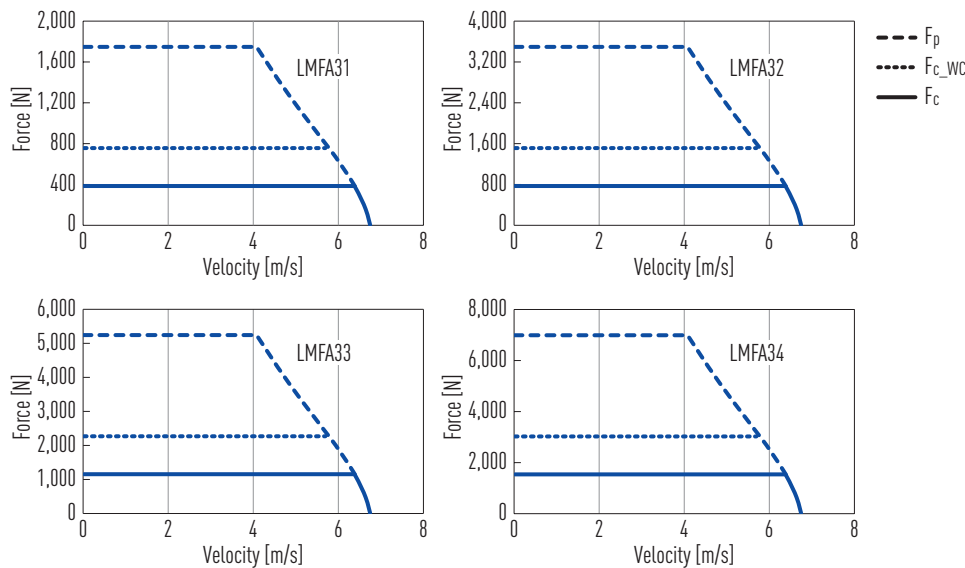


Table 5.4 Technical data for LMFA3

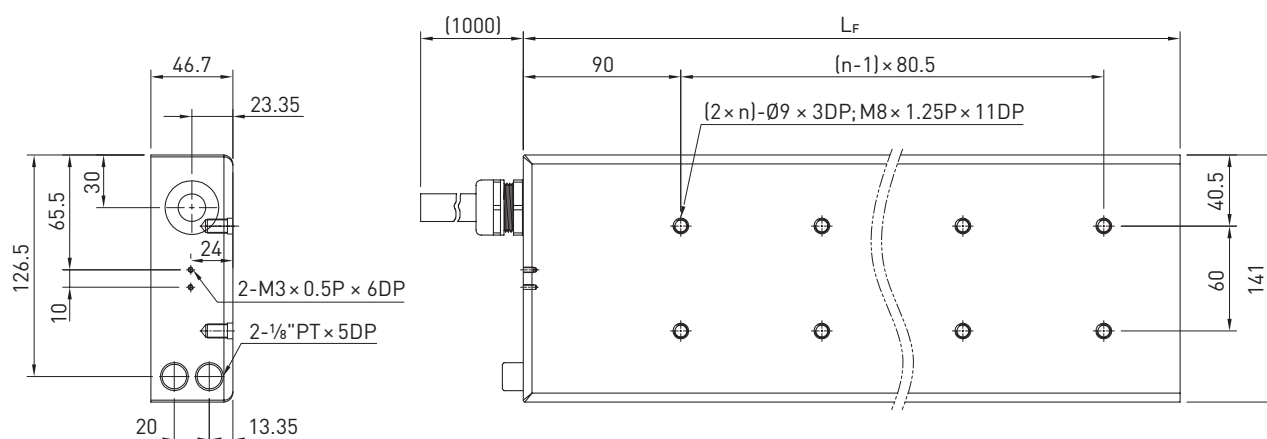
	Symbol	Unit	LMFA31	LMFA32	LMFA33	LMFA34
Forces and electrical parameters						
Continuous force at T <sub>max</sub>	F <sub>c</sub>	N	380	759	1,139	1,519
Continuous force at T <sub>max</sub> (WC)	F <sub>c_WC</sub>	N	759	1,519	2,278	3,037
Continuous current at T <sub>max</sub>	I <sub>c</sub>	A <sub>eff</sub>	3.1	6.2	9.3	12.4
Continuous current at T <sub>max</sub> (WC)	I <sub>c_WC</sub>	A <sub>eff</sub>	6.2	12.4	18.6	24.7
Peak force (for 1 s)	F <sub>p</sub>	N	1,750	3,500	5,250	7,000
Peak current (for 1 s)	I <sub>p</sub>	A <sub>eff</sub>	19.2	38.4	57.5	76.7
Force constant	K <sub>f</sub>	N/A <sub>eff</sub>	122.7	122.7	122.7	122.7
Attraction force	F <sub>a</sub>	N	3,430	6,860	10,290	13,720
Electrical time constant	K <sub>e</sub>	ms	11.3	11.3	11.3	11.3
Resistance <sup>1)</sup>	R <sub>25</sub>	Ω	4.3	2.1	1.4	1.1
Inductance <sup>1)</sup>	L	mH	48.3	24.2	16.1	12.1
Back EMF constant	K <sub>u</sub>	V <sub>eff</sub> /(m/s)	70.9	70.9	70.9	70.9
Motor constant	K <sub>m</sub>	N/√W	48.4	68.5	83.9	96.9
Thermal resistance	R <sub>th</sub>	°C/W	1.17	0.59	0.39	0.29
Thermal resistance (WC)	R <sub>th_WC</sub>	°C/W	0.29	0.15	0.10	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 <sub>max</sub>	°C	120			
Mounting holes (forcer)	n		2	4	6	8
Weight of forcer	M <sub>F</sub>	kg	6.4	11.7	17.3	22.5
Length of forcer	L <sub>F</sub>	mm	214	375	536	697
Unit mass of stator	M <sub>S</sub>	kg/m	16.2			
Length of stator/Dimension N	L <sub>S</sub>	mm	184 mm/N = 2; 460 mm/N = 5			

WC: with water cooling

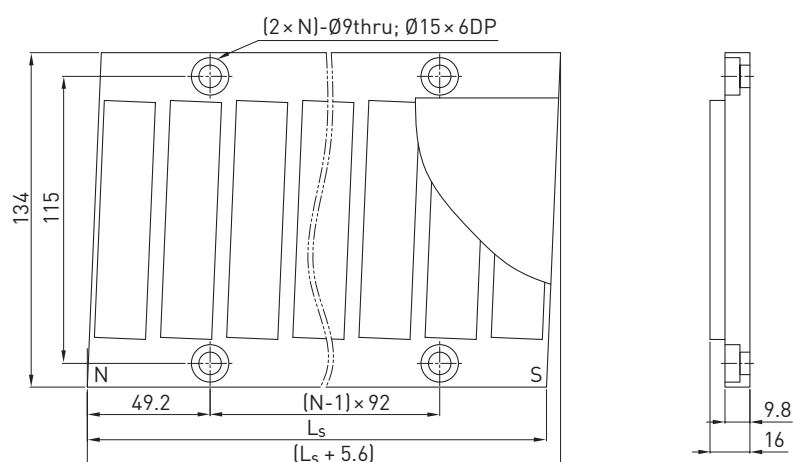
All the specifications in the table (except dimensions) are in  $\pm 10\%$  of tolerance at  $25^{\circ}C$  ambient temperature

<sup>1)</sup> Line to line

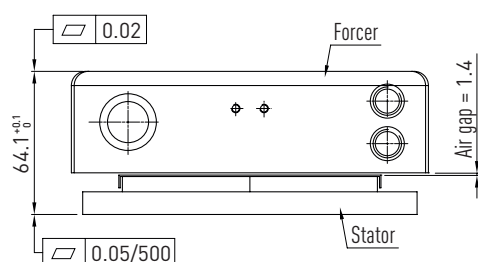
## Dimensions offorcer



## Dimensions of stator



## Mounting tolerances



## Stator versions available



Epoxy: Full epoxy encapsulation of permanent magnets

Stainless steel cover plate (upon request): Additional, one-piece stainless steel cover plate for magnet tracks

# Linear Motors & Positioning Measuring Systems

HIWIN LMFA linear motors

## 5.4.5 LMFA4 linear motor specifications

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

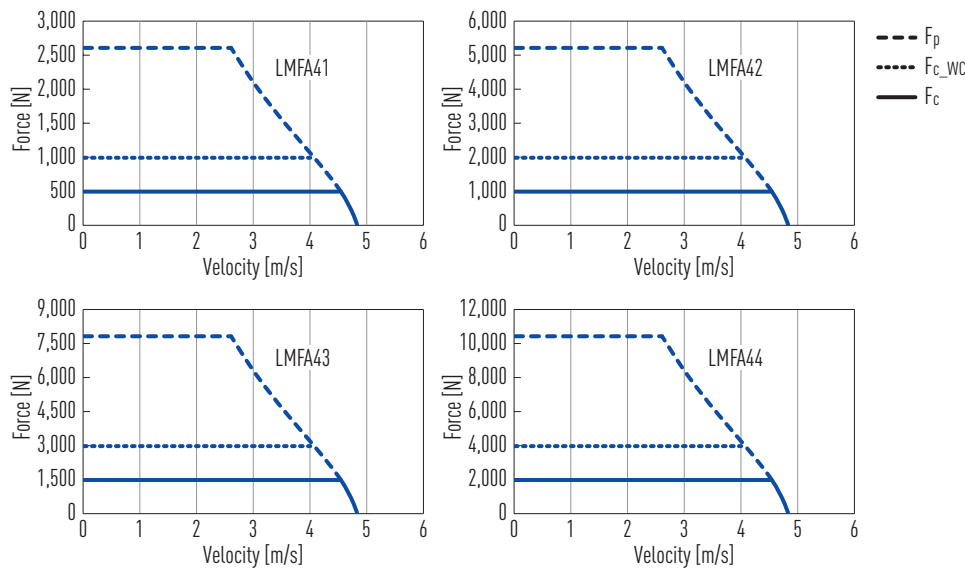


Table 5.5 Technical data for LMFA4

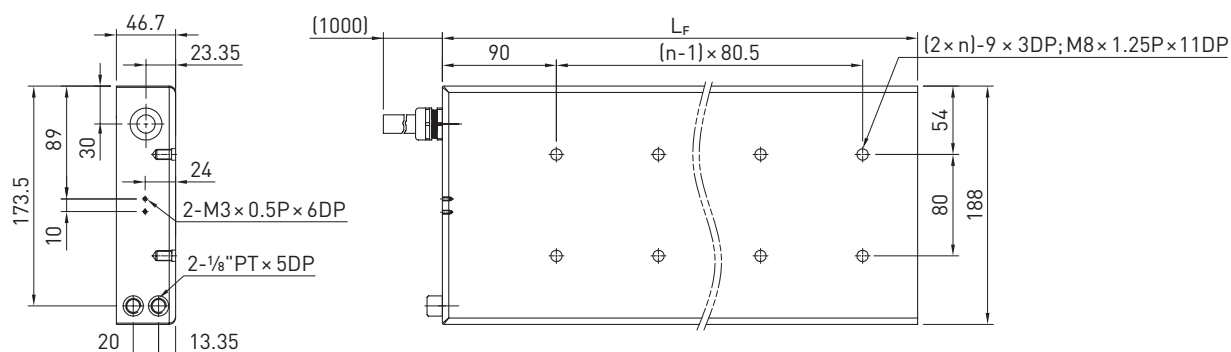
	Symbol	Unit	LMFA41	LMFA42	LMFA43	LMFA44
Forces and electrical parameters						
Continuous force at T <sub>max</sub>	F <sub>c</sub>	N	495	990	1,484	1,979
Continuous force at T <sub>max</sub> (WC)	F <sub>c_WC</sub>	N	990	1,979	2,969	3,958
Continuous current at T <sub>max</sub>	I <sub>c</sub>	A <sub>eff</sub>	2.9	5.8	8.7	11.5
Continuous current at T <sub>max</sub> (WC)	I <sub>c_WC</sub>	A <sub>eff</sub>	5.8	11.5	17.3	23.1
Peak force (for 1 s)	F <sub>p</sub>	N	2,603	5,207	7,810	10,413
Peak current (for 1 s)	I <sub>p</sub>	A <sub>eff</sub>	17.9	35.8	53.5	71.6
Force constant	K <sub>f</sub>	N/A <sub>eff</sub>	171.4	171.4	171.4	171.4
Attraction force	F <sub>a</sub>	N	5,145	10,290	15,435	20,580
Electrical time constant	K <sub>e</sub>	ms	12.0	12.0	12.0	12.0
Resistance <sup>1)</sup>	R <sub>25</sub>	Ω	6.0	3.0	2.0	1.5
Inductance <sup>1)</sup>	L	mH	72.0	36.0	24.0	18.0
Back EMF constant	K <sub>u</sub>	V <sub>eff</sub> /(m/s)	98.9	98.9	98.9	98.9
Motor constant	K <sub>m</sub>	N/√W	57.1	80.8	98.9	114.2
Thermal resistance	R <sub>th</sub>	°C/W	0.96	0.48	0.32	0.24
Thermal resistance (WC)	R <sub>th_WC</sub>	°C/W	0.24	0.12	0.08	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 <sub>max</sub>	°C	120			
Mounting holes (forcer)	n		2	4	6	8
Weight of forcer	M <sub>F</sub>	kg	9.5	16.2	23.0	29.0
Length of forcer	L <sub>F</sub>	mm	214	375	536	697
Unit mass of stator	M <sub>S</sub>	kg/m	22.3			
Length of stator/Dimension N	L <sub>S</sub>	mm	184 mm/N = 2; 460 mm/N = 5			

WC: with water cooling

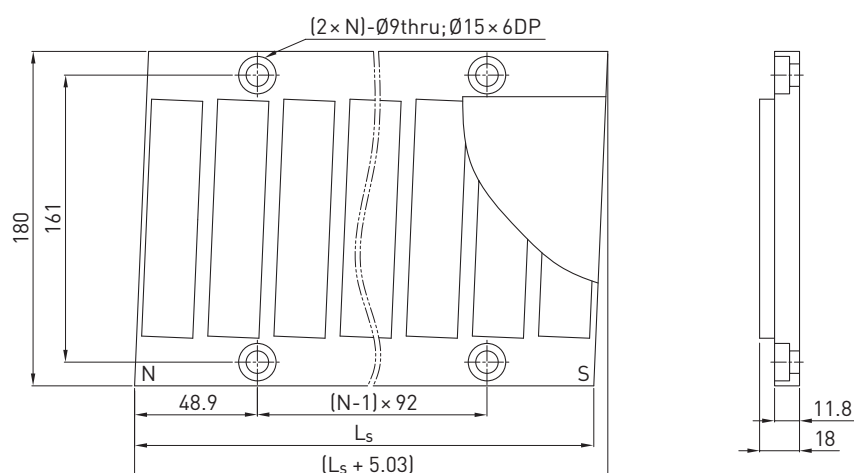
All the specifications in the table (except dimensions) are in  $\pm 10\%$  of tolerance at 25 °C ambient temperature

<sup>1)</sup> Line to line

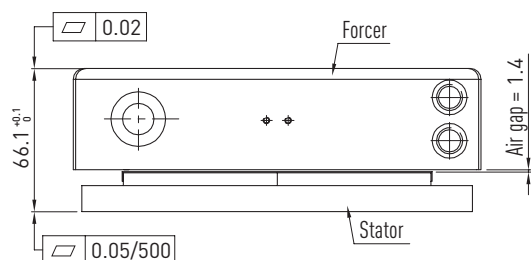
### Dimensions of forcer



### Dimensions of stator



### Mounting tolerances



### Stator versions available



# Linear Motors & Positioning Measuring Systems

## HIWIN LMFA linear motors

### 5.4.6 LMFA5 linear motor specifications

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

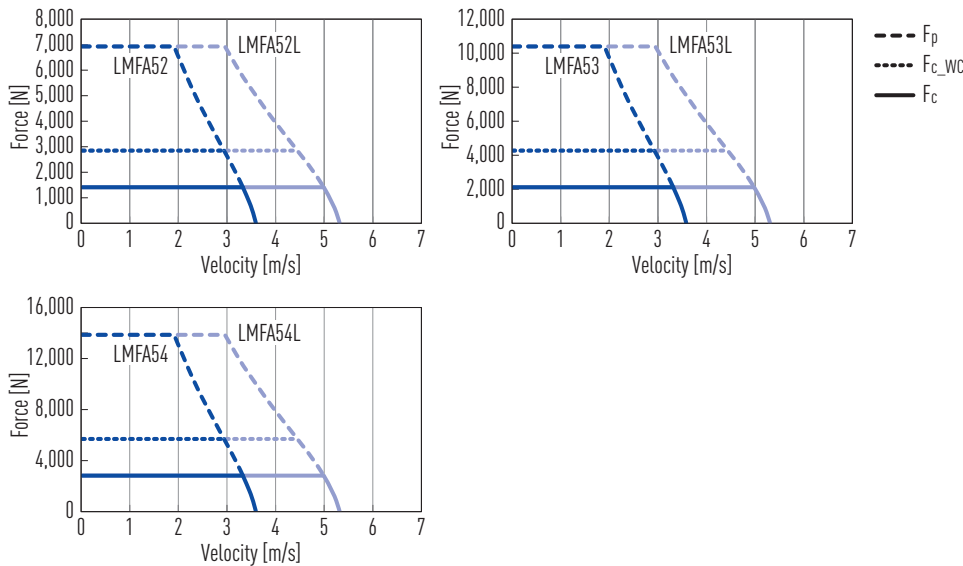


Table 5.6 Technical data for LMFA5

	Symbol	Unit	LMFA52	LMFA52L	LMFA53	LMFA53L	LMFA54	LMFA54L
Forces and electrical parameters								
Continuous force at T <sub>max</sub>	F <sub>c</sub>	N	1,422		2,133		2,844	
Continuous force at T <sub>max</sub> (WC)	F <sub>c_WC</sub>	N	2,844		4,266		5,688	
Continuous current at T <sub>max</sub>	I <sub>c</sub>	A <sub>eff</sub>	6.2	9.1	9.3	13.7	12.4	18.3
Continuous current at T <sub>max</sub> (WC)	I <sub>c_WC</sub>	A <sub>eff</sub>	12.4	18.3	18.6	27.4	24.7	36.5
Peak force (for 1 s)	F <sub>p</sub>	N	6,925		10,388		13,850	
Peak current (for 1 s)	I <sub>p</sub>	A <sub>eff</sub>	38.4	56.6	57.5	84.9	76.7	113.2
Force constant	K <sub>f</sub>	N/A <sub>eff</sub>	229.9	155.7	229.9	155.7	229.9	155.7
Attraction force	F <sub>a</sub>	N	13,700		20,550		27,400	
Electrical time constant	K <sub>e</sub>	ms	12.2	12.4	12.2	12.4	12.2	12.4
Resistance <sup>1)</sup>	R <sub>25</sub>	Ω	3.9	1.8	2.6	1.2	2.0	0.9
Inductance <sup>1)</sup>	L	mH	47.7	21.9	31.8	14.6	23.9	10.9
Back EMF constant	K <sub>u</sub>	V <sub>eff</sub> /(m/s)	132.7	89.9	132.7	89.9	132.7	89.9
Motor constant	K <sub>m</sub>	N/√W	95.0	95.6	116.4	117.1	134.4	135.2
Thermal resistance	R <sub>th</sub>	°C/W	0.32	0.33	0.21	0.22	0.16	0.16
Thermal resistance (WC)	R <sub>th_WC</sub>	°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 <sub>max</sub>	°C	120					
Mounting holes (forcer)	n		4			6		8
Weight of forcer	M <sub>F</sub>	kg	23.8			32.3		40.8
Length of forcer	L <sub>F</sub>	mm	375			536		697
Unit mass of stator	M <sub>S</sub>	kg/m	25					
Length of stator/Dimension N	L <sub>S</sub>	mm	184 mm/N = 2; 460 mm/N = 5					

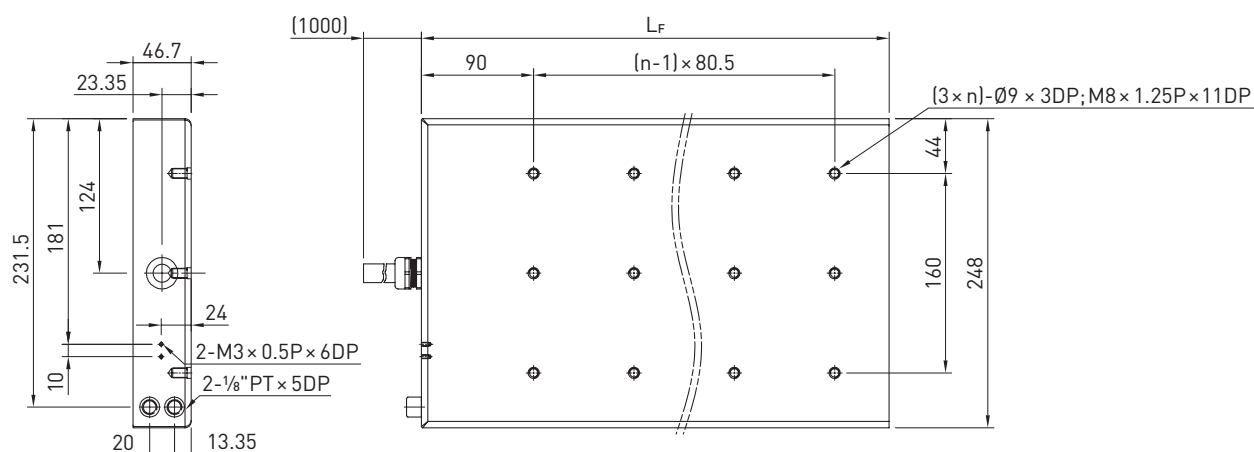
WC: with water cooling

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

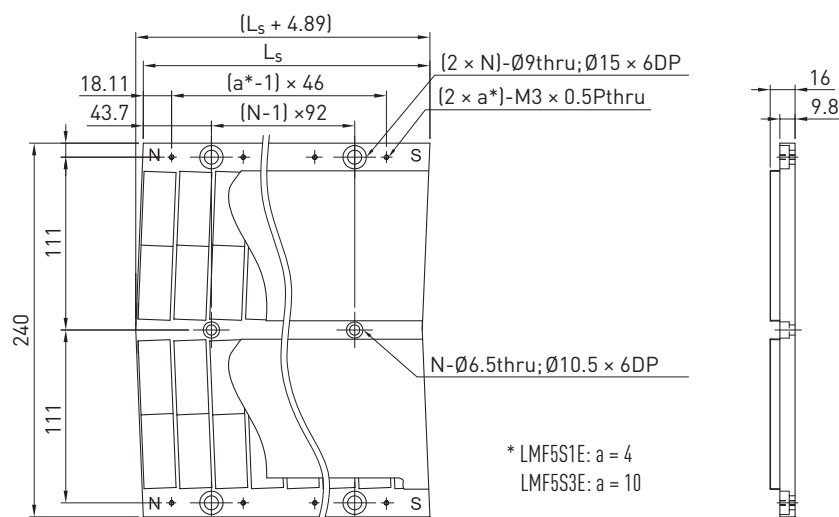
<sup>1)</sup> Line to line



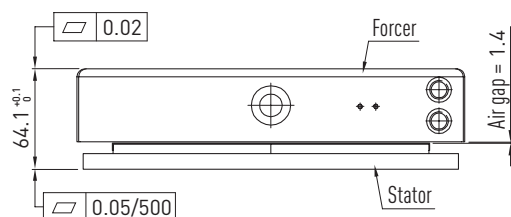
## Dimensions of forcer



## Dimensions of stator



## Mounting tolerances



## Stator versions available



Epoxy: Full epoxy encapsulation of permanent magnets

Stainless steel cover plate (upon request):  
Additional, one-piece stainless steel cover plate for magnet tracks

# Linear Motors & Positioning Measuring Systems

HIWIN LMFA linear motors

## 5.4.7 LMFA6 linear motor specifications

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

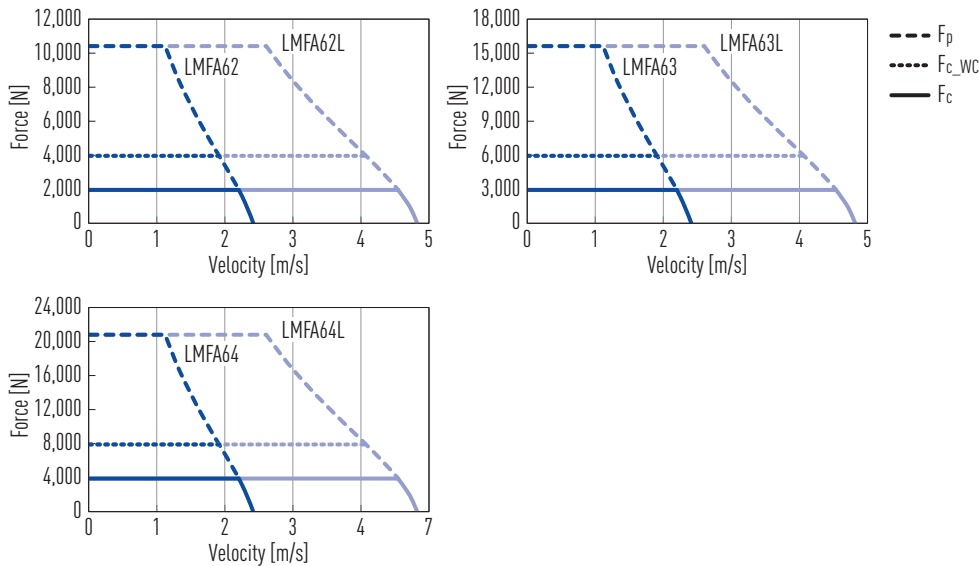


Table 5.7 Technical data for LMFA6

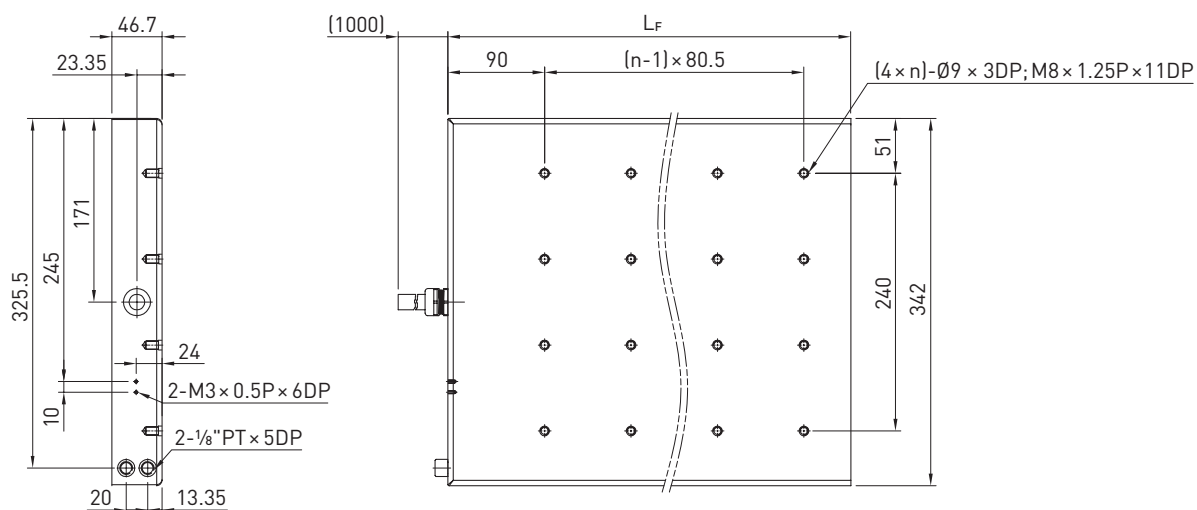
	Symbol	Unit	LMFA62	LMFA62L	LMFA63	LMFA63L	LMFA64	LMFA64L
Forces and electrical parameters								
Continuous force at T <sub>max</sub>	F <sub>c</sub>	N	1,979		2,969		3,958	
Continuous force at T <sub>max</sub> (WC)	F <sub>c_WC</sub>	N	3,958		5,938		7,917	
Continuous current at T <sub>max</sub>	I <sub>c</sub>	A <sub>eff</sub>	5.8	11.5	8.7	17.3	11.5	23.1
Continuous current at T <sub>max</sub> (WC)	I <sub>c_WC</sub>	A <sub>eff</sub>	11.5	23.1	17.3	34.6	23.1	46.2
Peak force (for 1 s)	F <sub>p</sub>	N	10,413		15,620		20,827	
Peak current (for 1 s)	I <sub>p</sub>	A <sub>eff</sub>	35.8	71.6	53.7	107.4	71.3	142.6
Force constant	K <sub>f</sub>	N/A <sub>eff</sub>	342.7	171.4	342.7	171.4	342.7	171.4
Attraction force	F <sub>a</sub>	N	20,580		30,870		41,160	
Electrical time constant	K <sub>e</sub>	ms	12.0					
Resistance <sup>1)</sup>	R <sub>25</sub>	Ω	6.0	1.5	4.0	1.0	3.0	0.8
Inductance <sup>1)</sup>	L	mH	72.0	18.0	48.0	12.0	36.0	9.0
Back EMF constant	K <sub>u</sub>	V <sub>eff</sub> /(m/s)	197.9	98.9	197.9	98.9	197.9	98.9
Motor constant	K <sub>m</sub>	N/√W	114.2		139.9		161.6	
Thermal resistance	R <sub>th</sub>	°C/W	0.24		0.16		0.12	
Thermal resistance (WC)	R <sub>th_WC</sub>	°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 <sub>max</sub>	°C	120					
Mounting holes (forcer)	n		4			6		8
Weight of forcer	M <sub>F</sub>	kg	32.2			44.2		56.2
Length of forcer	L <sub>F</sub>	mm	375			536		697
Unit mass of stator	M <sub>S</sub>	kg/m	40.1					
Length of stator/Dimension N	L <sub>S</sub>	mm	184 mm/N = 2					

WC: with water cooling

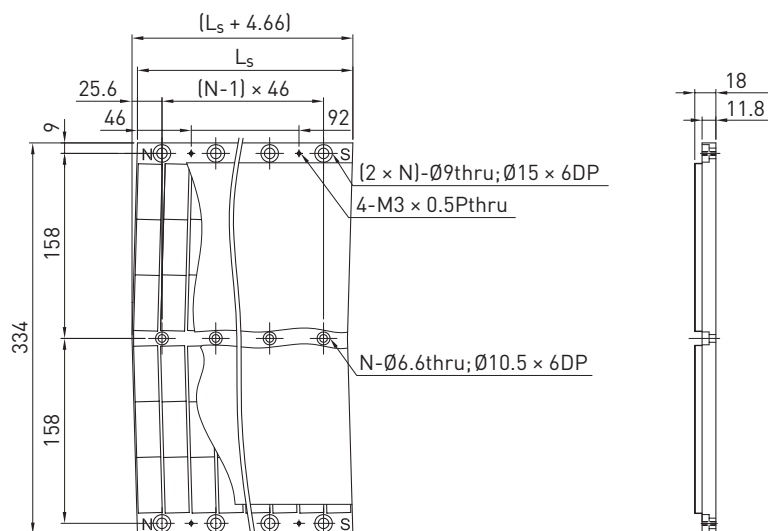
All the specifications in the table (except dimensions) are in  $\pm 10\%$  of tolerance at  $25^{\circ}C$  ambient temperature

<sup>1)</sup> Line to line

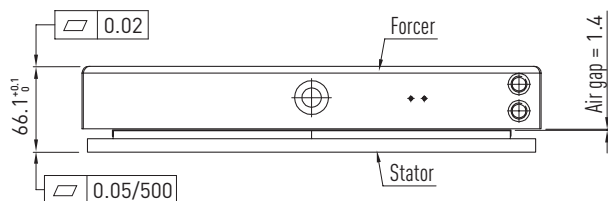
### Dimensions offorcer



### Dimensions of stator



### Mounting tolerances



### Stator versions available



# Linear Motors & Positioning Measuring Systems

## Accessories

### 6. Accessories

#### 6.1 Hall sensors

Hall sensors with analogue and digital output signal are available for each linear motor. The analogue Hall sensors have a sin/cos output signal of  $1V_{pp}$  (see Fig. 6.1) The digital Hall sensors have three square signals offset through  $120^\circ$  (see Fig. 6.2).

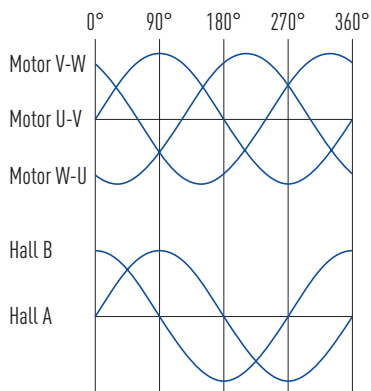


Fig. 6.1 Output signal from analogue Hall sensor with differential output

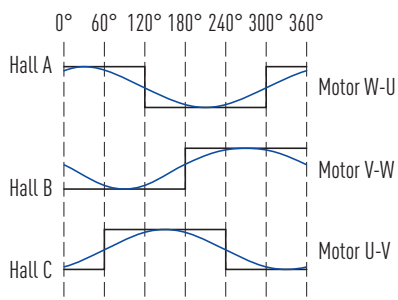


Fig. 6.2 Output signal from digital Hall sensor with single ended output

Table 6.1 Article numbers for Hall sensors

Article number	Version	Motor
8-08-0330	Digital	LMSA
8-08-0387	Digital	LMS
8-08-0386	Digital	LMCA, LMCA, LMCC
8-08-0422	Digital	LMCE
8-08-0454	Digital	LMFA0, LMFA2, LMFA2
8-08-0519	Digital	LMFA3, LMFA4, LMFA5, LMFA6
8-08-0369	Analogue	LMSA
8-08-0388	Analogue	LMS
8-08-0432	Analogue	LMCA, LMCA, LMCC
8-08-0456	Analogue	LMFA0, LMFA2, LMFA2
8-08-0368	Analogue	LMFA3, LMFA4, LMFA5, LMFA6

## 6.2 Motor extension cables

### 6.2.1 Extension cables for linear motors LMSA, LMS, LMFA

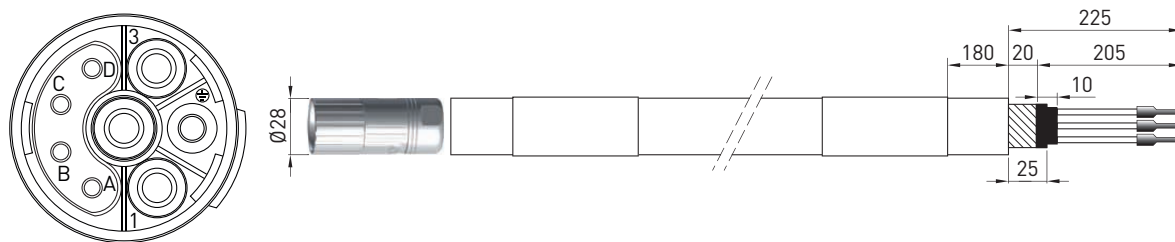


Table 6.2 Extension cables for motors LMS, LMSA, LMSC and LMFA (iron-core)

Article number	Designation	Cross-section	Plug	Length [m]
8-10-0069	Chainflex CF27.15.05.04.D	$4 \times 1.5 \text{ mm}^2; 4 \times 0.5 \text{ mm}^2$	M23, 8-pin	3
8-10-0070				5
8-10-0071				8
8-10-0072				10
8-10-0074				15
8-10-0593	Chainflex CF27.25.05.04.D	$4 \times 2.5 \text{ mm}^2; 4 \times 0.5 \text{ mm}^2$	M23, 8-pin	3
8-10-0594				5
8-10-0595				8
8-10-0596				10
8-10-0598				15
8-10-0946	Chainflex CF27.40.05.04.D	$4 \times 4.0 \text{ mm}^2; 4 \times 0.5 \text{ mm}^2$	M23, 8-pin	3
8-10-0971				5
8-10-0972				8
8-10-0973				10
8-10-0947				15
8-10-0879	Chainflex CF27.40.05.04.D	$4 \times 4.0 \text{ mm}^2; 4 \times 0.5 \text{ mm}^2$	M40, 8-pin	3
8-10-0880				5
8-10-0881				8
8-10-0882				10
8-10-0974				15

### 6.2.2 Extension cables for linear motors LMC

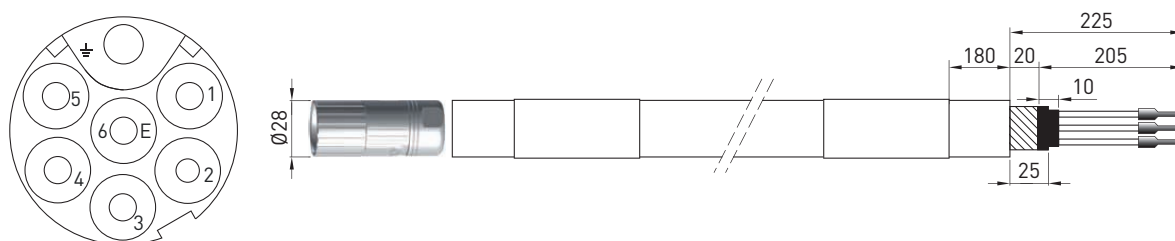


Table 6.3 Extension cables for motors LMS (ironless)

Article number	Designation	Cross-section	Length [m]
8-10-0258	Chainflex CF10.07.07	$7 \times 0.75 \text{ mm}^2$	3
8-10-0259			5
8-10-0260			8
8-10-0261			10
8-10-0263			15

# Linear Motors & Positioning Measuring Systems

## Accessories

### 6.3 Motor connectors

#### 6.3.1 Recommended motor connectors for iron-core linear motors

By default, the temperature sensor is continued via the motor extension cable, which is why the temperature sensor cable is attached to the motor connector. For continuous currents up to 30 A we recommend the M23 couplings and connectors, for continuous currents over 30 A the M40 couplings and connectors.

Table 6.4 Recommended motor connector for continuous currents up to 30 A for LMSA, LMS and LMFA motors



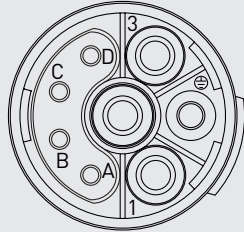
Coupling M23, 8-pin	Connector M23, 8-pin	Pin assignment
		
Article number: 8-10-0421	Article number: 8-10-0422	Coupling: connector-end view

Table 6.5 Recommended motor connector for continuous currents from 30 A for LMFA motors


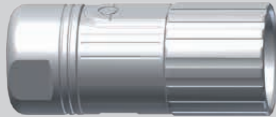
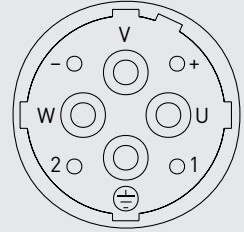
Coupling M40, 8-pin	Connector M40, 8-pin	Pin assignment
		
Article number: 8-10-0507	Article number: 8-10-0508	Coupling: connector-end view

Table 6.6 Pin assignment of motor connector M23, 8-pin

Motor cable	Pin no.	Signal	Function	Extension cable
Black-1	1	U	Motor phase	Black-1
Black-2	4	V	Motor phase	Black-2
Black-3	3	W	Motor phase	Black-3
<b>LMFA</b>				
Red	A	T+ <sup>1)</sup>	Thermal protection	Red
Yellow	B	T- <sup>1)</sup>	Thermal protection	Yellow
Black	C	T+ <sup>2)</sup>	Thermal protection	Black
White	D	T- <sup>2)</sup>	Thermal protection	White
<b>LMSA</b>				
Yellow	A	T+	Thermal protection	Red
Green	B	T-	Thermal protection	Yellow
Brown	C	T+	Thermal protection	Black
White	D	T-	Thermal protection	White
<b>LMS</b>				
Brown	A	T+ <sup>1)</sup>	Thermal protection	Red
Blue	B	T- <sup>1)</sup>	Thermal protection	Yellow
—	C	—	—	Black
—	D	—	—	White
Green /Yellow	Protective earth/ground		GND	Green /Yellow

<sup>1)</sup> PTC temperature sensor

<sup>2)</sup> PT1000/KTY84 temperature sensor

### 6.3.2 Recommended motor connectors for ironless linear motors

By default, the temperature sensor is continued via the motor extension cable, which is why the temperature sensor cable is attached to the motor connector.

Table 6.7 Recommended motor connector for continuous currents up to 30 A for LMC motors



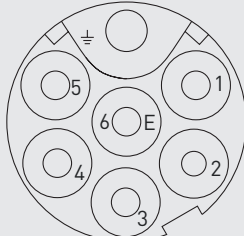
Coupling M17, 7-pin	Connector M17, 7-pin	Pin assignment
		
Article number: 8-10-0437	Article number: 8-10-0433	Coupling: connector-end view

Table 6.8 Pin assignment of motor connector M17, 7-pin

Motor cable	Pin no.	Signal	Function	Extension cable
Brown	1	U	Motor phase	Black-1
White	4	V	Motor phase	Black-2
Grey	3	W	Motor phase	Black-3
Yellow	5	T+ <sup>1)</sup>	Thermal protection	Black-5
Green	6	T- <sup>1)</sup>	Thermal protection	Black-6
	2	—	Not assigned	—
Green/Yellow	Protective earth/ground	—	GND	Green/Yellow

<sup>1)</sup> PTC temperature sensor

# Linear Motors & Positioning Measuring Systems

## HIWIN MAGIC – Magnetic positioning measuring systems

### 7. HIWIN MAGIC – Magnetic positioning measuring 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 measuring system integrated in a linear guideway

#### Characteristics of MAGIC and MAGIC-PG

- Zero contact measurement with 1 V<sub>PP</sub> 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

#### 7.1 HIWIN positioning measuring systems

This positioning measuring system consists of a separate encoder (Fig. 7.1) and a magnetic scale (Fig. 7.2). The customer can select suitable positions for both of these and install them. The measuring system HIWIN MAGIC is optimised for use on linear motor axes.

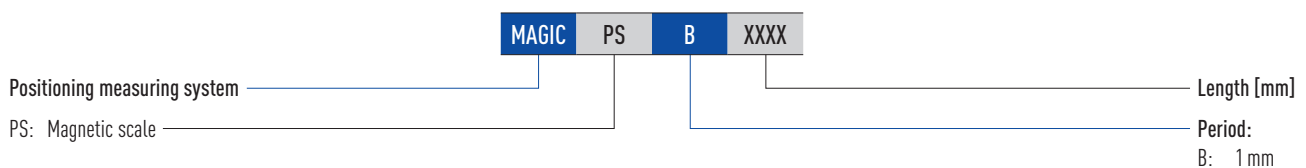


Fig. 7.1 MAGIC encoder

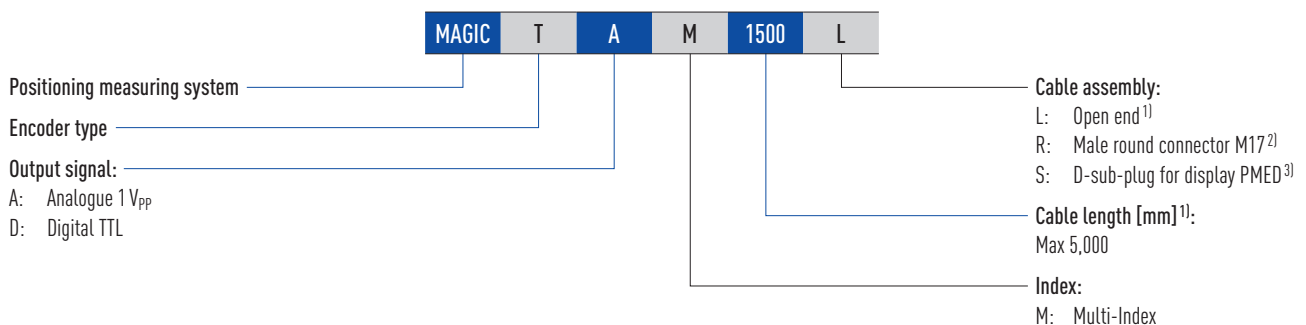


Fig. 7.2 MAGIC magnetic scale

#### 7.1.1 Order code for magnetic scale of HIWIN MAGIC positioning measuring system



#### 7.1.2 Order code for encoder of HIWIN MAGIC positioning measuring system



<sup>1)</sup> For cables with open end the standard cable length is 1,000 mm (optionally 5,000 mm)

<sup>2)</sup> Suitable for the pre-assembled HIWIN extension cable, see Section 7.4.1

<sup>3)</sup> The display has to be ordered separately



## 7.2 HIWIN MAGIC-PG positioning measuring system

For this type, the positioning measuring 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. 7.3).

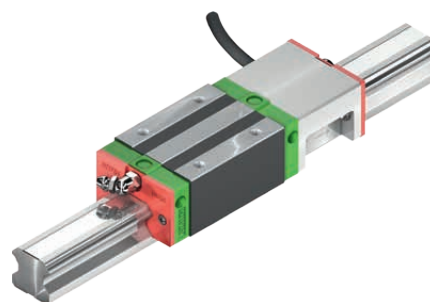


Fig. 7.3 Linear quideway with MAGIC-PG system

### 7.2.1 Order code for HIWIN MAGIC-PG linear guideways

[illegible]

Continuation order code for HIWIN MAGIC-PG linear guideway

	1	/2	KK	E2	M	A	M	2500	L	1	
--	---	----	----	----	---	---	---	------	---	---	--

**Number of rails with measuring system:** 1 → Encoder orientation<sup>8)</sup>:

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

**Rails per axis set<sup>3)</sup>:** /2 → Cable assembly:

- L: Open end<sup>5)</sup>
- R: M17 round plug connector (male connector)<sup>6)</sup>
- S: Sub-D connector for display PMED<sup>7)</sup>

**Dust protection:** KK → Cable length [mm]<sup>5)</sup>: Max 5,000

SS, ZZ, DD, KK, SW, ZWX<sup>4)</sup>

**None: Standard**      E2: With E2 oil lubrication unit

**Measuring system type:** M → Index:  
M: Multi-Index

**Output signal:** A → Analogue 1 V<sub>pp</sub>  
D: Digital TTL

<sup>1)</sup> Not identical to the standard rail HGR25R without groove. Mounting screw M5 instead of M6

<sup>2)</sup> In the PG series, the total number of blocks per axis is specified (all blocks of the ordered article)

<sup>3)</sup> 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.

<sup>4)</sup> Without specification the block will be delivered with standard dust protection (standard end seal and bottom seal)

<sup>5)</sup> For cables with open end the standard cable length is 1.000 mm (optionally 5.000 mm).

<sup>6)</sup> Suitable for the pre-assembled HIWIN extension cable, see Section 7.4.1

7) The display has to be ordered separately

<sup>8)</sup> See Section 7.3.1

# Linear Motors & Positioning Measuring Systems

## HIWIN MAGIC – Magnetic positioning measuring systems

### 7.3 HIWIN MAGIC positioning measuring systems: technical data

#### 7.3.1 Orientation of the HIWIN MAGIC-PG encoder

According to the order code (Section 7.2.1) the HIWIN MAGIC-PG encoder is available in four orientations. 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. 7.4. If a non-standard orientation is needed, this has to be defined in the MAGIC-PG project planning sheet ([www.hiwin.de](http://www.hiwin.de)).

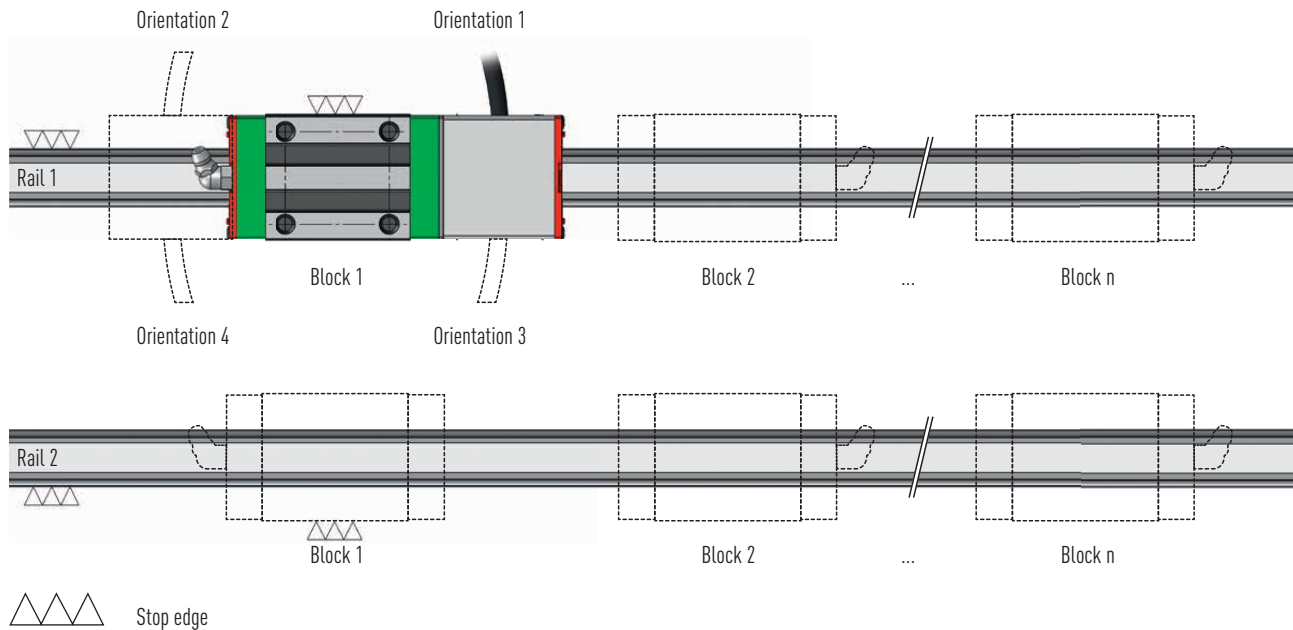


Fig. 7.4 Orientation of the HIWIN MAGIC-PG encoder

### 7.3.2 Dimensions

#### Dimensions of HIWIN MAGIC

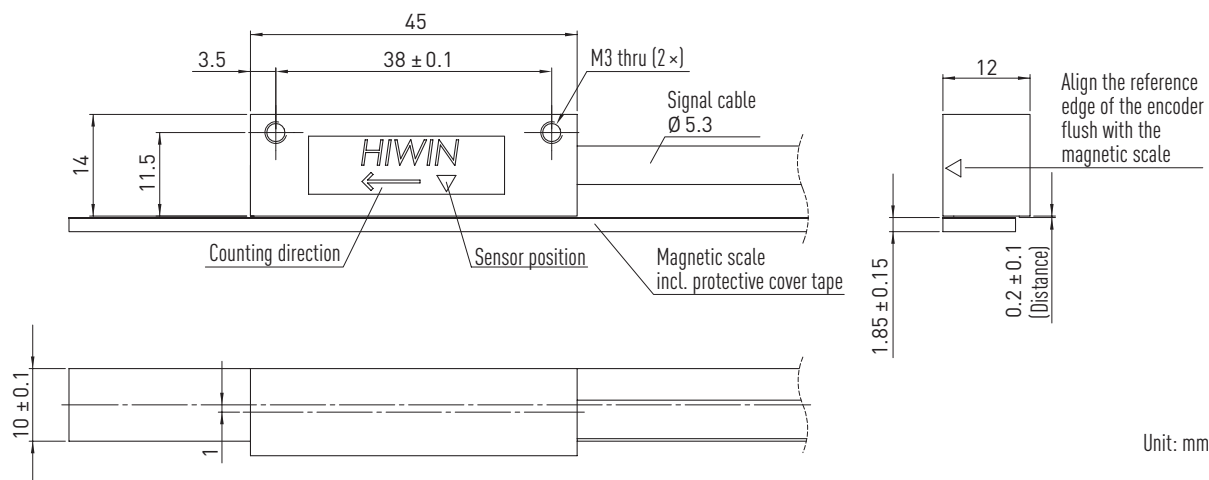


Fig. 7.5 Scale drawing of HIWIN MAGIC encoder

#### Dimensions HIWIN MAGIC-PG

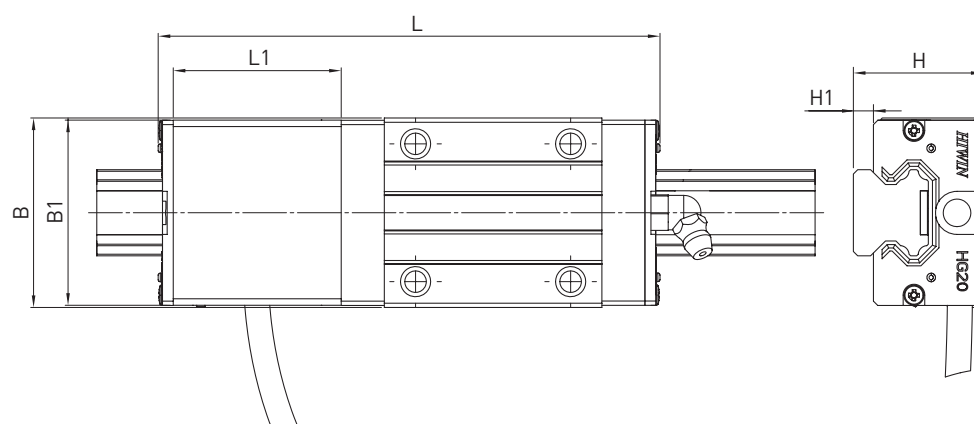


Fig. 7.6 Scale drawing of the HG20CA block including the MAGIC-PG housing

Fig. 7.5 shows an HG20CA / HG25CA 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 7.1.

Table 7.1 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

# Linear Motors & Positioning Measuring Systems

HIWIN MAGIC – Magnetic positioning measuring systems

## 7.3.2.1 Dimensions of PG rail

Rail with groove, mounting from above

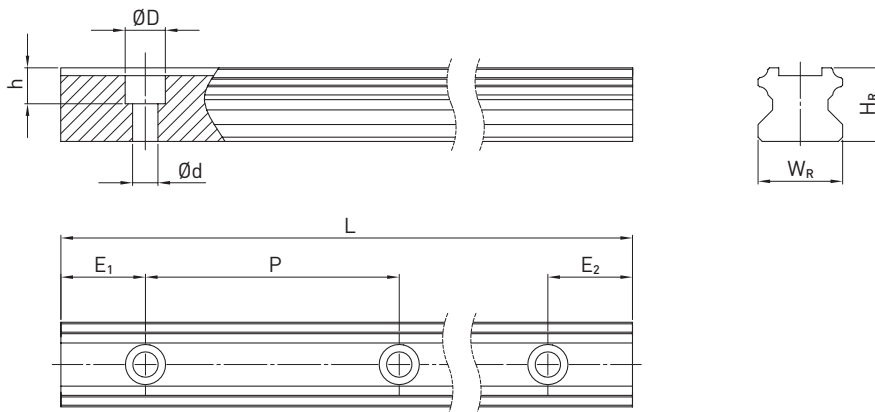


Table 7.2 Dimensions HGR\_R G1

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

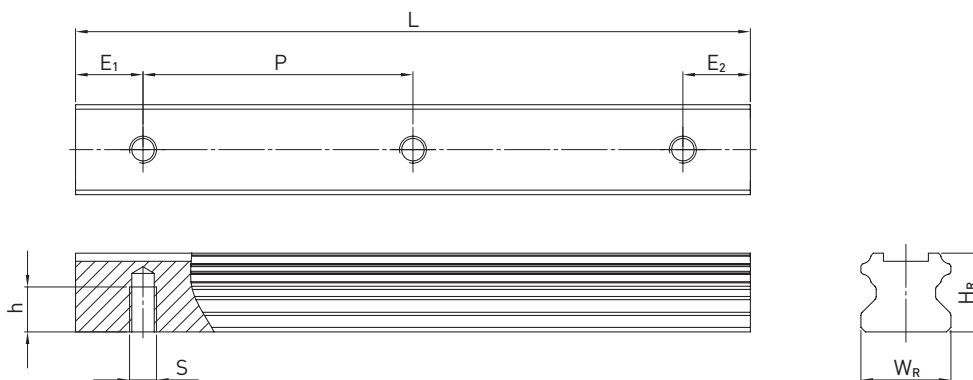


Table 7.3 Dimensions HGR\_T G1

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

### 7.3.3 HIWIN MAGIC and HIWIN MAGIC-PG specifications

Table 7.4 Electrical and mechanical properties of HIWIN MAGIC and HIWIN MAGIC-PG

	1 V <sub>PP</sub> (analogue)	TTL (digital)
Electrical properties		
Output signal	sin/cos, 1 V <sub>PP</sub> (0.85 V <sub>PP</sub> – 1.2 V <sub>PP</sub> )	Quadrature signal, RS422
Resolution	Infinite, signal period 1 mm	1 µm
Repeatability bidirectional	0.003 mm	0.002 mm
Absolute accuracy	± 20 µm/m	
Reference signal <sup>1)</sup>	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 <sup>2)</sup>	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	

<sup>1)</sup> Can be used e.g. with reference switch (see Section 7.6)

<sup>2)</sup> 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 7.5 Properties of magnetic scale

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

<sup>1)</sup> at 20 °C

# Linear Motors & Positioning Measuring Systems

## HIWIN MAGIC – Magnetic positioning measuring systems

### 7.4 Connection analogue and digital variant

#### 7.4.1 Cable assignment (analogue and digital variant)

A high-quality, 8-core cable (1 each of V1+, V1–, V2+, V2– and V0+, V0– or A,  $\bar{A}$ , B,  $\bar{B}$  and Z,  $\bar{Z}$  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.

#### 7.4.2 Formats and outputs

##### Signal format of sine/cosine 1 V<sub>PP</sub> output (analogue)

Electrical signals after the differential input of the downstream electronic components. The sinus/cosinus 1 V<sub>PP</sub> 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.

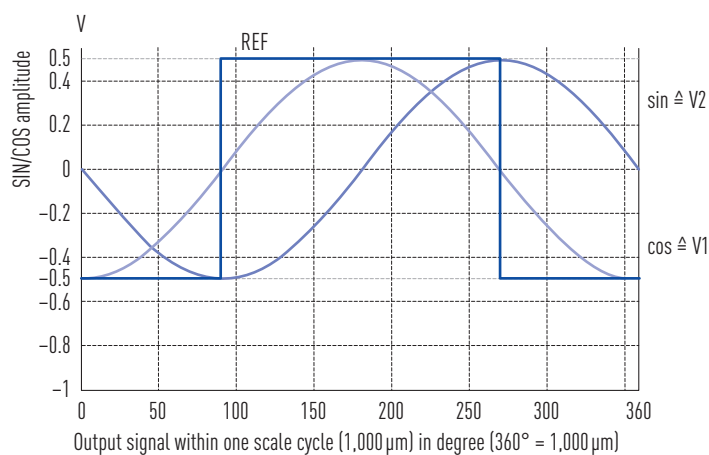


Fig. 7.7 Electrical signals after the differential input of the downstream electronic components (analogue version)

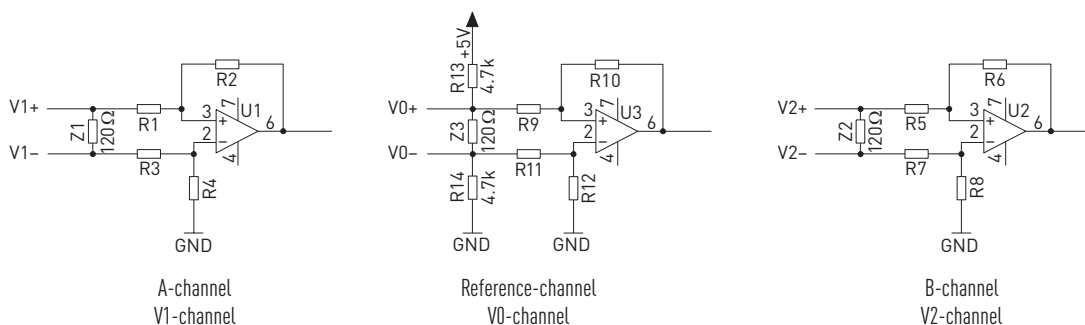


Fig. 7.8 Recommended switching of the subsequent electronic components for sin/cos 1 V<sub>PP</sub> output

##### 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  $Z = 120 \Omega$ . Output signals: A,  $\bar{A}$ , B,  $\bar{B}$  and Z,  $\bar{Z}$ . Individual reference pulse (optional) and definition of a minimum pulse duration are possible as an option.

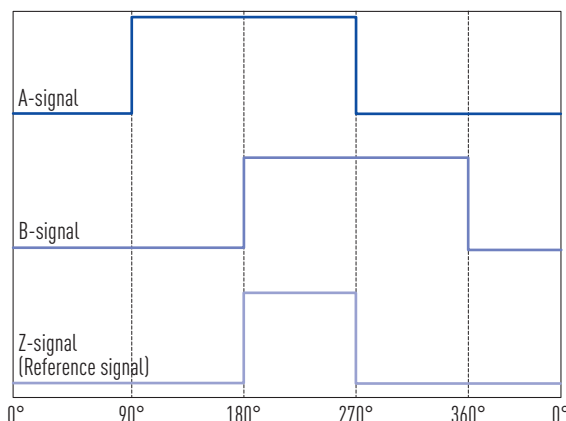


Fig. 7.9 Signals of the MAGIC encoder (TTL version)

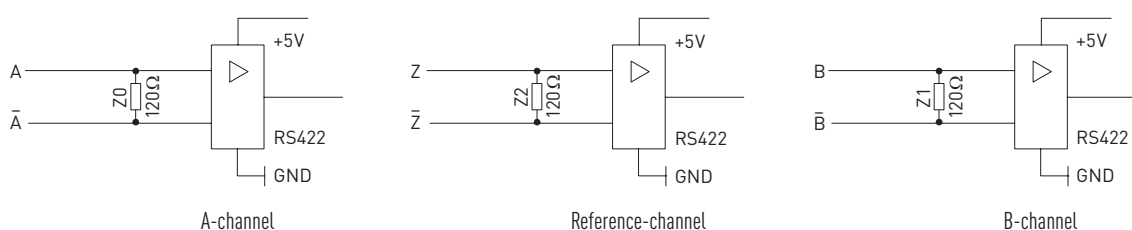


Fig. 7.10 Recommended switching of the subsequent electronic components for digital TTL output

## 7.5 PMED display

Combined with the positioning measuring 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

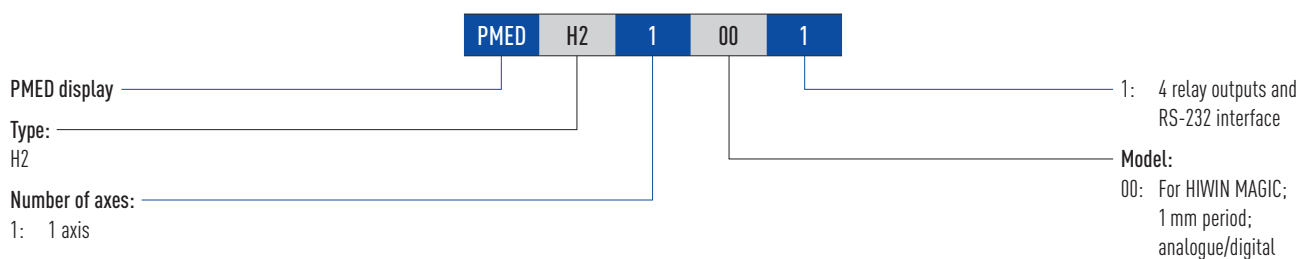
- 8-digit LED display
- For analogue and digital input signal
- Easy handling
- Compact and robust design
- Simple assembly

### 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



### 7.5.1 Order code for PMED display

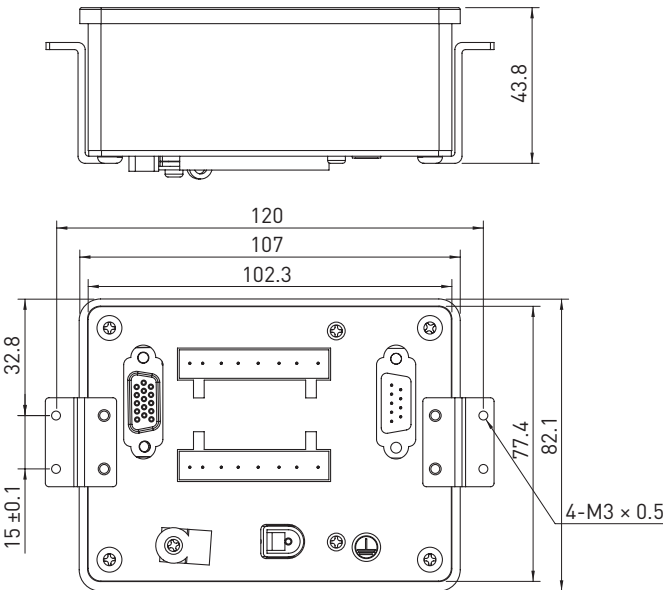


# Linear Motors & Positioning Measuring Systems

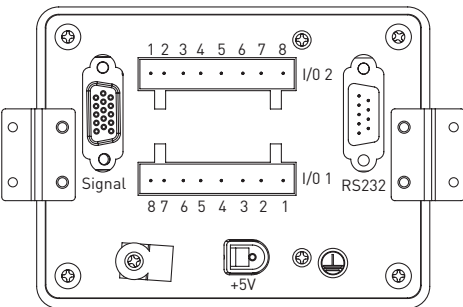
HIWIN MAGIC – Magnetic positioning measuring systems

## 7.5.2 Technical data of PMED display

### 7.5.2.1 Dimensions of PMED display



### 7.5.2.2 Inputs and outputs



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

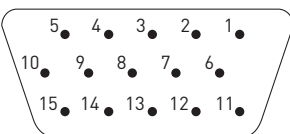


Table 7.6 Pin definition for signal input connector

Pin No.	Signal	Pin-No.	Signal	Pin No.	Signal
1	+5V	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



#### 7.5.2.4 Signal output connector

Table 7.7 Pin definition for signal output connector

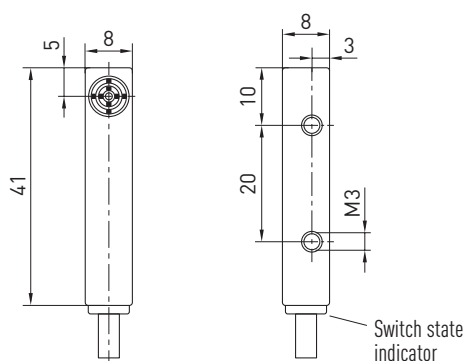
Relay output I/O 1		Relay output I/O 2	
Pin-No.	Signal	Pin-No.	Signal
1	NC	1	NC
2		2	
3	NC	3	NC
4		4	
5	Relay 0 (channel 0)	5	Relay 0 (channel 2)
6		6	
7	Relay 0 (channel 1)	7	Relay 0 (channel 3)
8		8	

#### 7.6 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 7.4.2). With a damped reference switch this signal can be used for the precise referencing of the axis.

##### 7.6.1 Technical data of inductive reference switch

###### 7.6.1.1 Dimensions of reference switch



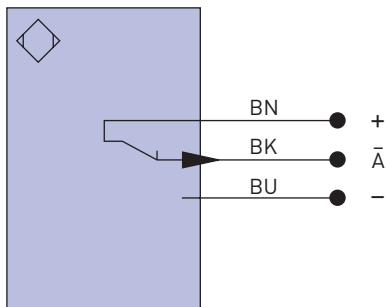
# Linear Motors & Positioning Measuring Systems

HIWIN MAGIC – Magnetic positioning measuring systems

Table 7.8 Reference switch specifications

<b>Inductive</b>	
Switching distance	2 mm
Correction factor V2A/brass/aluminium	1.16 / 0.70 / 0.67
Installation type	Flush
Switch hysteresis	< 10 %
<b>Electrical</b>	
Power supply	10 to 30 VDC
Power input (U <sub>b</sub> = 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
<b>Mechanical</b>	
Housing material	Plastic
Full encapsulation	Yes
Protection mode	IP67
Connection type	Cable
Cable length	2 m/4 m
Protection class	III

## 7.6.1.2 Circuit diagram of the optional reference switch



### Explanation of symbols

- + Power supply „+“
- Power supply „0 V“
- $\bar{A}$  Switch output/opener (NC)

### Wire colours

- BN Brown
- BK Black
- BU Blue

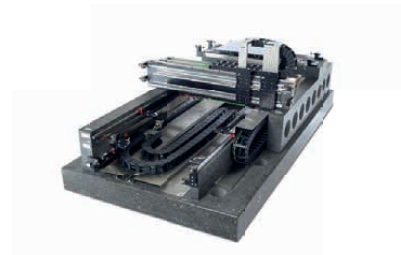




Linear Guideways



Ballscrews



Linear Motor Systems



Linear Axes



Linear Actuators



Robots



Linear Motor Components



Rotary Tables



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