

Linear Motors & Distance 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.



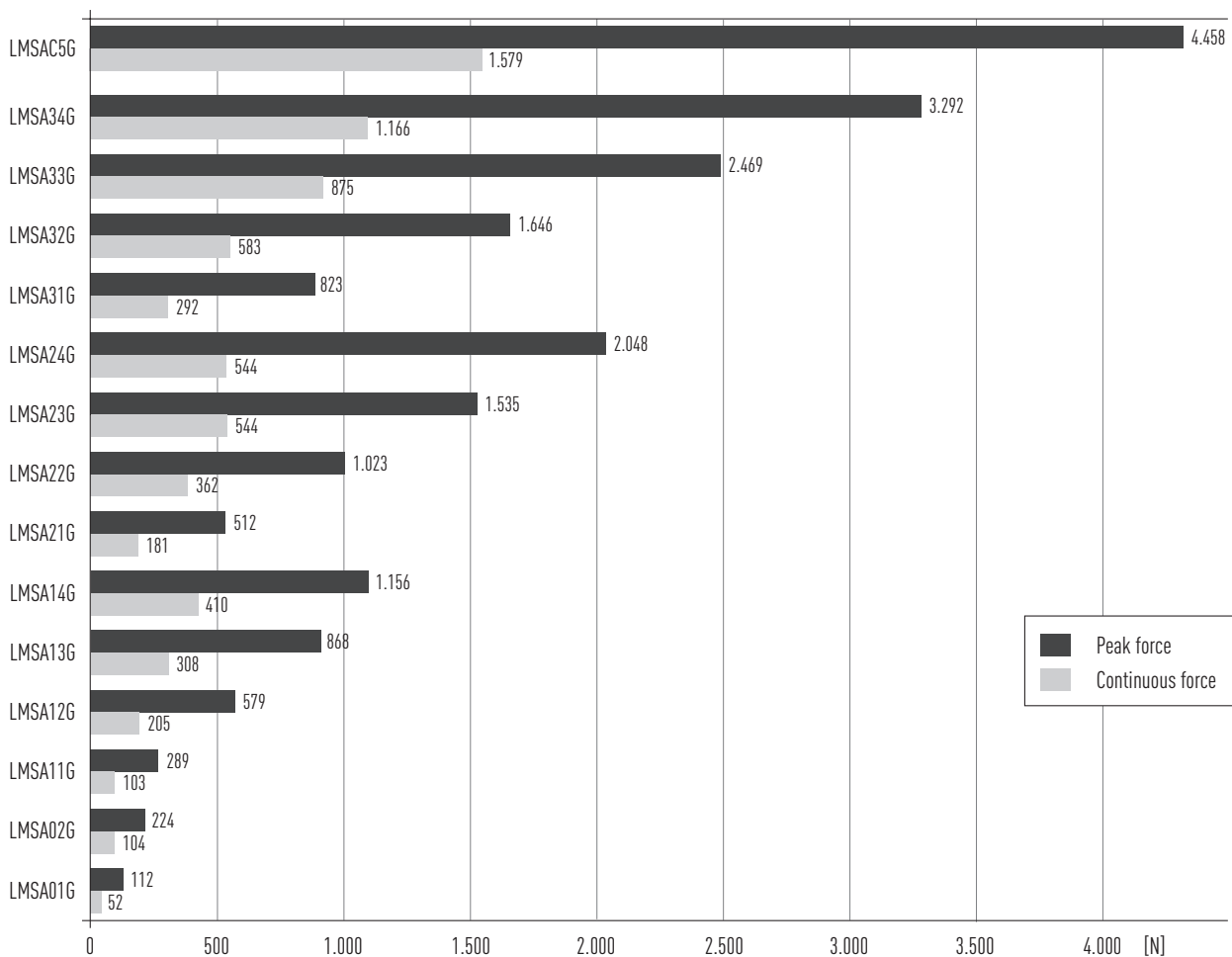
Key features of the LMSA linear motors:

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

Typical fields of application of the LMSA linear motors:

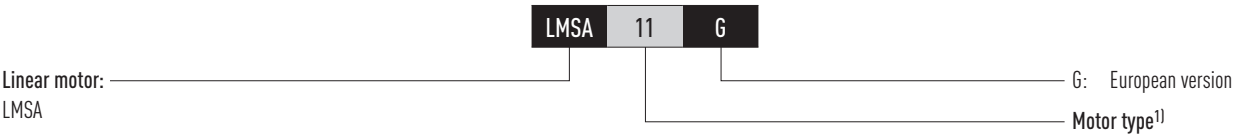
- Automation technology
- Handling
- Packaging
- Semiconductors
- Measuring technology

2.2 Force chart for LMSA linear motors



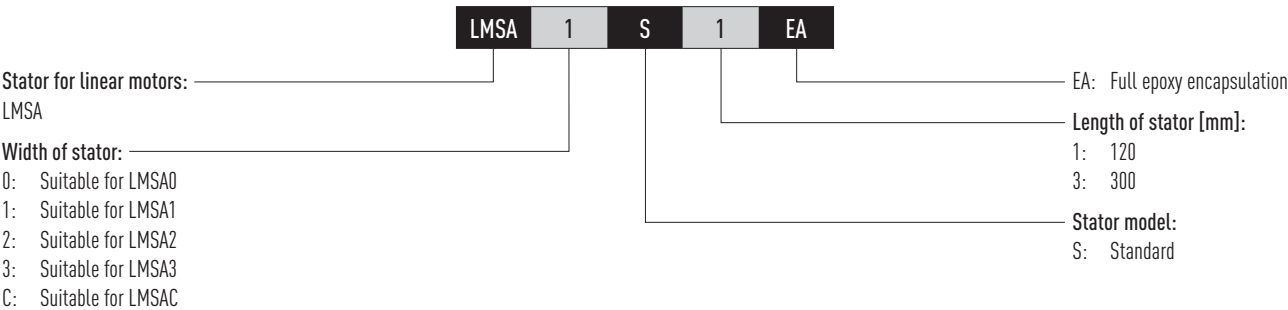
2.3 Order code LMSA linear motors

2.3.1 Order code of primary part (forcer)



¹⁾ See Table 2.1 (LMSA0)
Table 2.3 (LMSA1)
Table 2.5 (LMSA2)
Table 2.7 (LMSA3)
Table 2.9 (LMSAC)

2.3.2 Order code of magnet track (stator)



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2.4 LMSA linear motor specifications

2.4.1 LMSA0 linear motor specifications

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

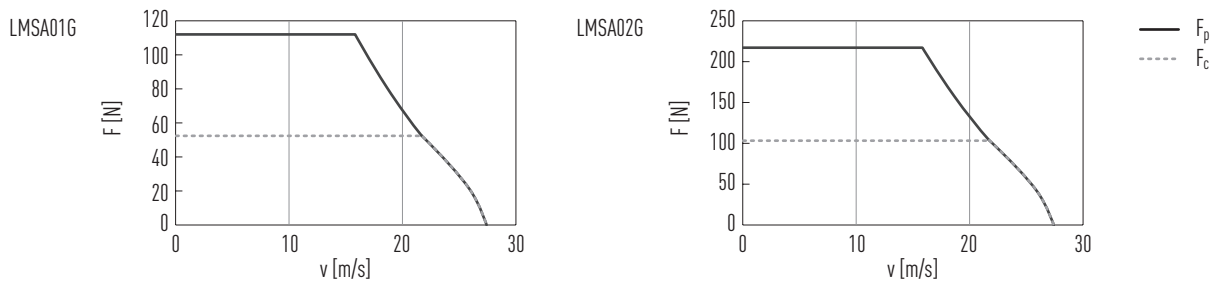
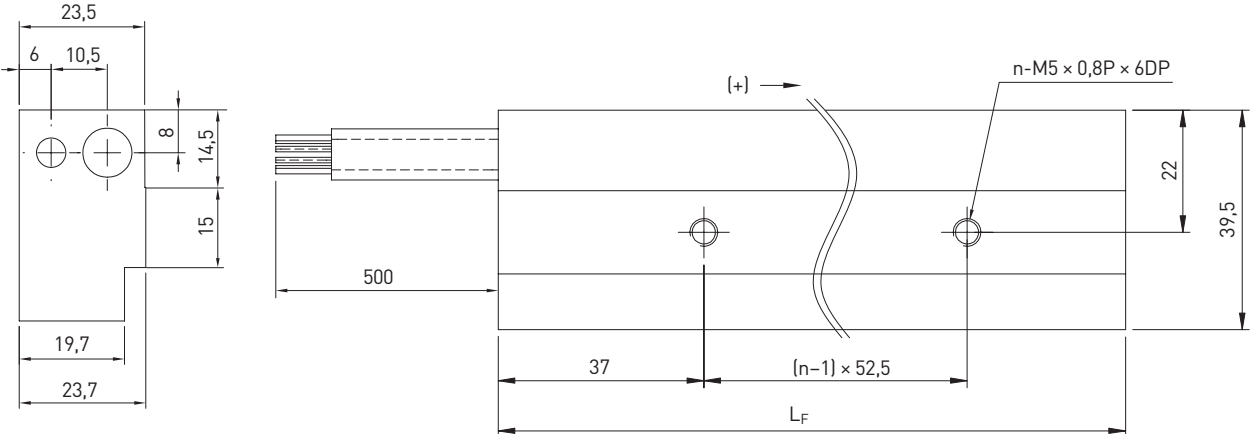


Table 2.1 Technical data for LMSA0

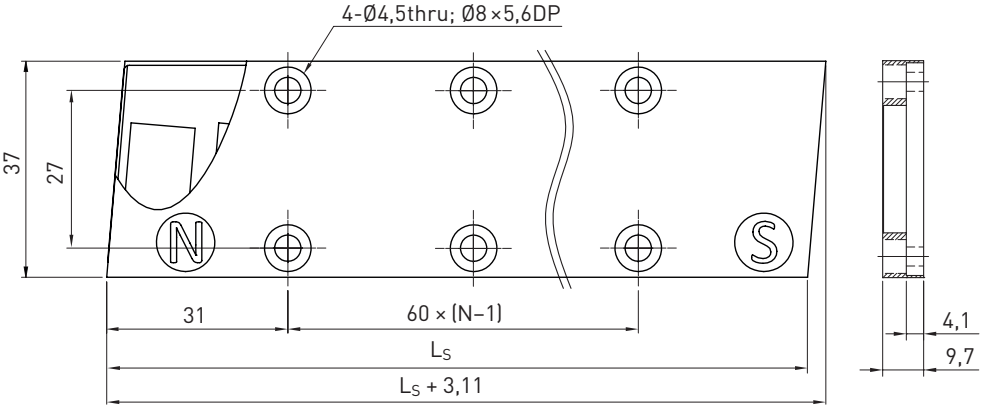
	Symbol	Unit	LMSA01G	LMSA02G
Forces and electrical parameters				
Continuous force at T _{max}	F _c	N	52	104
Continuous current at T _{max}	I _c	A _{eff}	2.1	4.2
Peak force (for 1 s)	F _p	N	112	224
Peak current (for 1 s)	I _p	A _{eff}	6.3	12.6
Ultimate force (for 0.5 s)	F _u	N	143	286
Ultimate current (for 0.5 s)	I _u	A _{eff}	10.6	21.1
Force constant	K _f	N/A _{eff}	24.5	24.5
Attraction force	F _a	N	241	482
Electrical time constant	K _e	ms	3.0	3.7
Resistance ¹⁾	R ₂₅	Ω	6.2	3.1
Inductance ¹⁾	L	mH	23	11.6
Back EMF constant	K _u	V _{eff} /(m/s)	14.2	14.2
Motor constant	K _m	N/√W	8.1	11.5
Thermal resistance	R _{th}	°C/W	1.69	0.83
Thermal time constant	T _{th}	s	431	610
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 _{bend}	mm	69	
Pole pair pitch	2τ	mm	30	
Max. winding temperature	T _{max}	°C	120	
Mounting holes (forcer)	n		2	4
Weight of forcer	M _F	kg	0.49	0.98
Length of forcer	L _F	mm	118	223
Unit mass of stator	M _S	kg/m	1.9	
Stator length/Dimension N	L _S	mm	120 mm/N = 2; 300 mm/N = 5	
Total height (forcer + stator)	H	mm	34	

All specifications are in $\pm 10\%$ of tolerance at 25 $^{\circ}C$ ambient temperature ¹⁾ Line to line

Dimensions of forcer



Dimensions of stator



Mounting tolerances

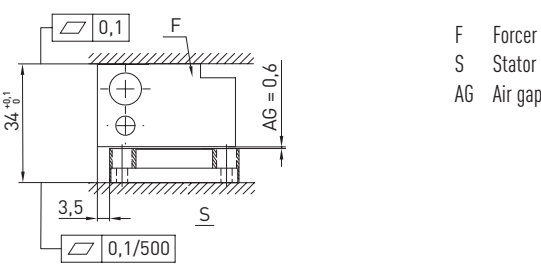


Table 2.2 LMSA1 motor cable assignment			
Motor cable	Signal		Diameter [mm]
1	U		9.2
2	V		
3	W		
Green/Yellow	GND		
Yellow	T1+	PTC SNM 120	5.5
Green	T1–		
Brown	T2+	PT1000	
White	T2–		

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2.4.2 LMSA1 linear motor specifications

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

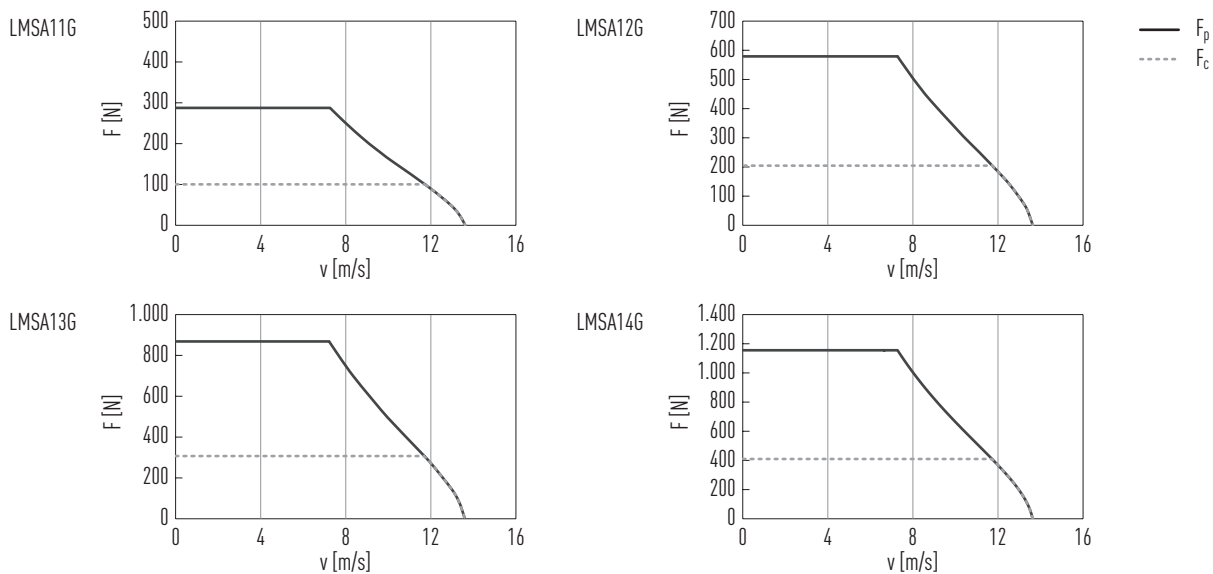
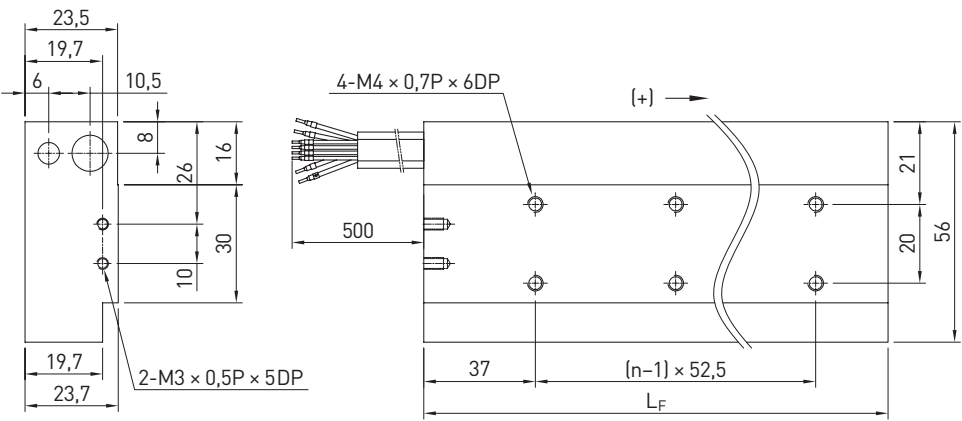


Table 2.3 Technical data for LMSA1

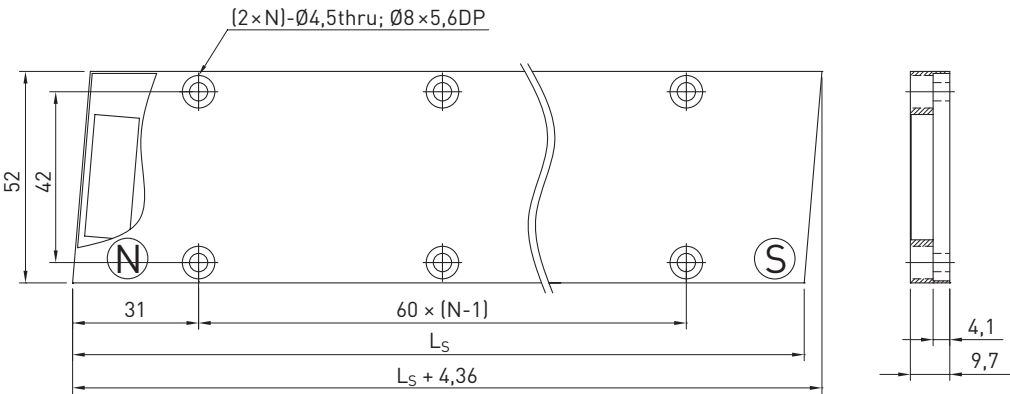
	Symbol	Unit	LMSA11G	LMSA12G	LMSA13G	LMSA14G
Forces and electrical parameters						
Continuous force at T _{max}	F _c	N	103	205	308	410
Continuous current at T _{max}	I _c	A _{eff}	2.1	4.2	6.3	8.4
Peak force (for 1 s)	F _p	N	289	579	868	1,156
Peak current (for 1 s)	I _p	A _{eff}	6.3	12.7	19.0	25.3
Ultimate force (for 0.5 s)	F _u	N	379	759	1,138	1,517
Ultimate current (for 0.5 s)	I _u	A _{eff}	10.6	21.1	31.7	42.2
Force constant	K _f	N/A _{eff}	48.6	48.6	48.6	48.6
Attraction force	F _a	N	481	963	1,444	1,926
Electrical time constant	K _e	ms	4.4	4.5	4.4	4.4
Resistance ¹⁾	R ₂₅	Ω	8.4	4.1	2.8	2.1
Inductance ¹⁾	L	mH	37.1	18.5	12.4	9.3
Back EMF constant	K _u	V _{eff} /(m/s)	28.1	28.1	28.1	28.1
Motor constant	K _m	N/√W	13.7	19.6	23.7	27.4
Thermal resistance	R _{th}	°C/W	1.23	0.63	0.41	0.31
Thermal time constant	T _{th}	s	610	890	2,290	4,430
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 _{bend}	mm	69			
Pole pair pitch	2τ	mm	30			
Max. winding temperature	T _{max}	°C	120			
Mounting holes (forcer)	n		2	4	6	8
Weight of forcer	M _F	kg	0.7	1.4	2.1	2.8
Length of forcer	L _F	mm	118	223	328	433
Unit mass of stator	M _S	kg/m	2.7			
Stator length/Dimension N	L _S	mm	120 mm/N = 2; 300 mm/N = 5			
Total height (forcer + stator)	H	mm	34			

All specifications are in $\pm 10\%$ of tolerance at $25^{\circ}C$ ambient temperature ¹⁾ Line to line

Dimensions of forcer



Dimensions of stator



Mounting tolerances

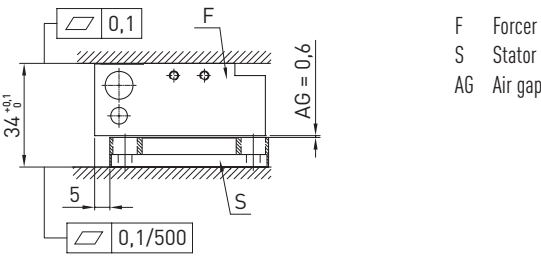


Table 2.4 LMSA1 motor cable assignment			
Motor cable	Signal		Diameter [mm]
1	U		9.2
2	V		
3	W		
Green/Yellow	GND		
Yellow	T1+	PTC SNM 120	5.5
Green	T1–		
Brown	T2+	PT1000	
White	T2–		

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2.4.3 LMSA2 linear motor specifications

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

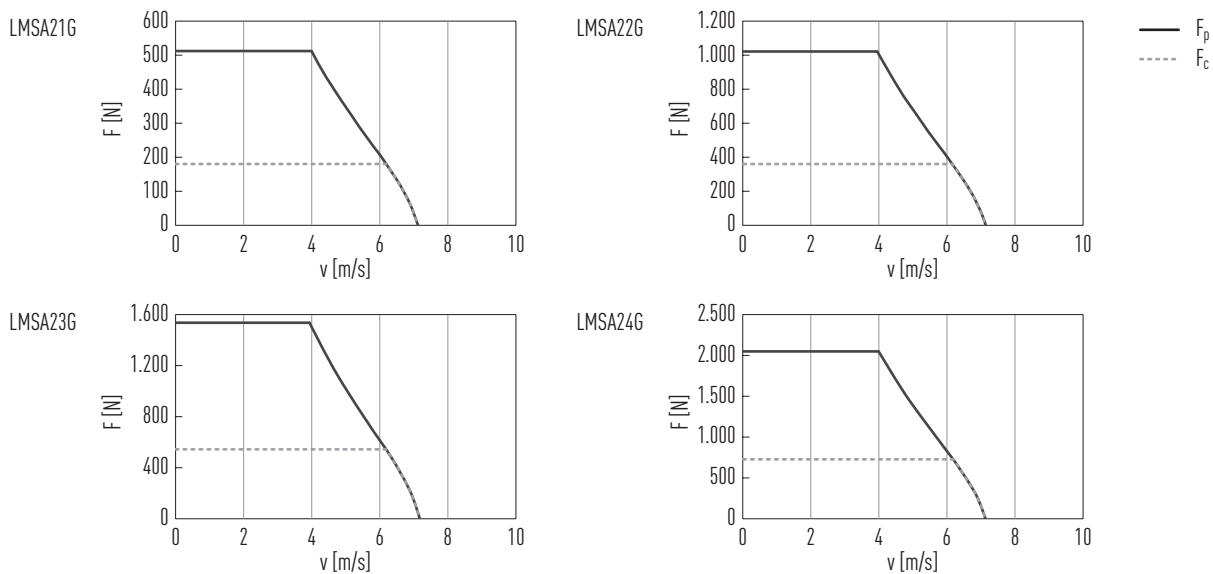


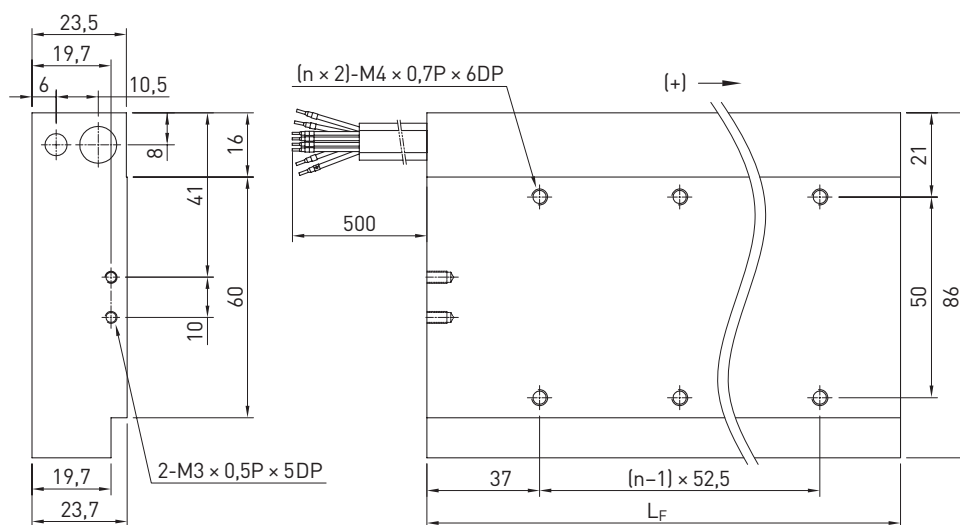
Table 2.5 Technical data for LMSA2

	Symbol	Unit	LMSA21G	LMSA22G	LMSA23G	LMSA24G
Forces and electrical parameters						
Continuous force at T _{max}	F _c	N	181	362	544	725
Continuous current at T _{max}	I _c	A _{eff}	2.0	3.9	5.9	7.8
Peak force (for 1 s)	F _p	N	512	1,023	1,535	2,048
Peak current (for 1 s)	I _p	A _{eff}	5.9	11.8	17.6	23.5
Ultimate force (for 0.5 s)	F _u	N	670	1,341	2,011	2,682
Ultimate current (for 0.5 s)	I _u	A _{eff}	9.8	19.6	29.4	39.2
Force constant	K _f	N/A _{eff}	92.5	92.5	92.5	92.5
Attraction force	F _a	N	963	1,926	2,888	3,851
Electrical time constant	K _e	ms	4.6	4.9	4.9	4.6
Resistance ¹⁾	R ₂₅	Ω	13.8	6.8	4.6	3.5
Inductance ¹⁾	L	mH	64.0	33.0	22.4	16.0
Back EMF constant	K _u	V _{eff} /(m/s)	53.4	53.4	53.4	53.4
Motor constant	K _m	N/√W	20.3	28.9	35.2	40.6
Thermal resistance	R _{th}	°C/W	0.87	0.44	0.29	0.22
Thermal time constant	T _{th}	s	975	2.540	2.670	3.270
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 _{bend}	mm	69			
Pole pair pitch	2τ	mm	30			
Max. winding temperature	T _{max}	°C	120			
Mounting holes (forcer)	n		2	4	6	8
Weight of forcer	M _F	kg	1.1	2.2	3.3	4.4
Length of forcer	L _F	mm	118	223	328	433
Unit mass of stator	M _S	kg/m	4.8			
Stator length/mounting holes	L _S	mm	120 mm/N = 2; 300 mm/N = 5			
Total height (forcer + stator)	H	mm	34			

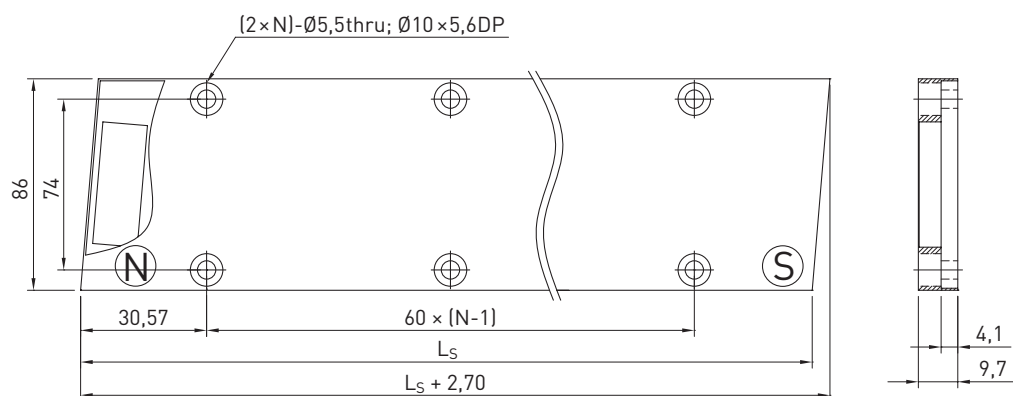
All specifications are in $\pm 10\%$ of tolerance at 25 $^{\circ}C$ ambient temperature

¹⁾ Line to line

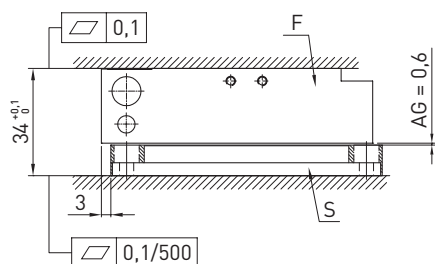
Dimensions of forcer



Dimensions of stator



Mounting tolerances



F Forcer
S Stator
AG Air gap

Table 2.6 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–		

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2.4.4 LMSA3 linear motor specifications

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

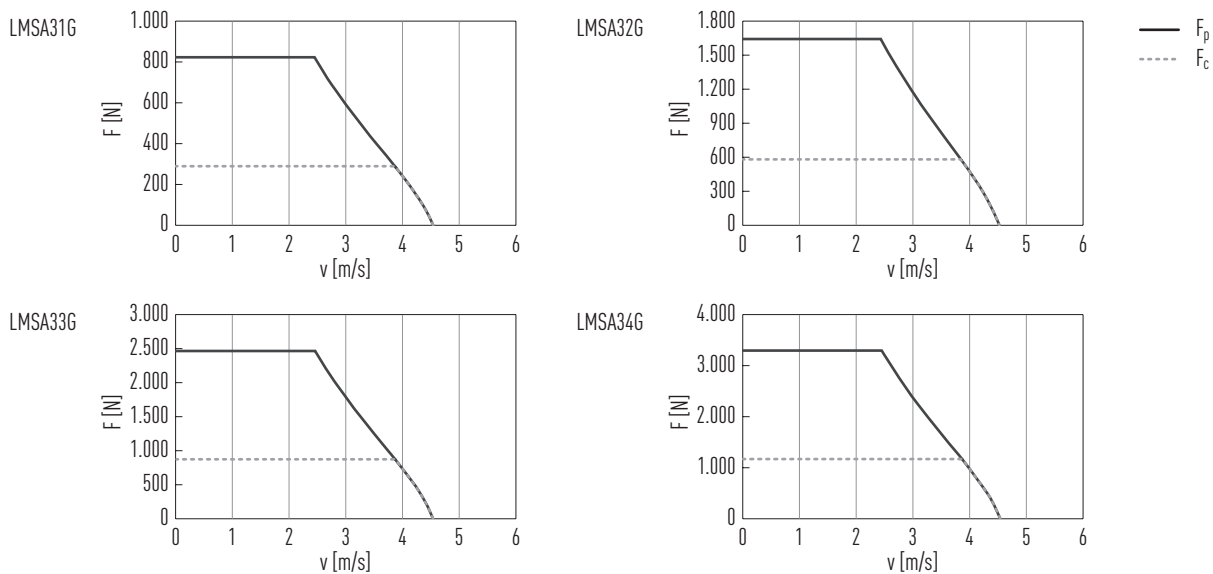


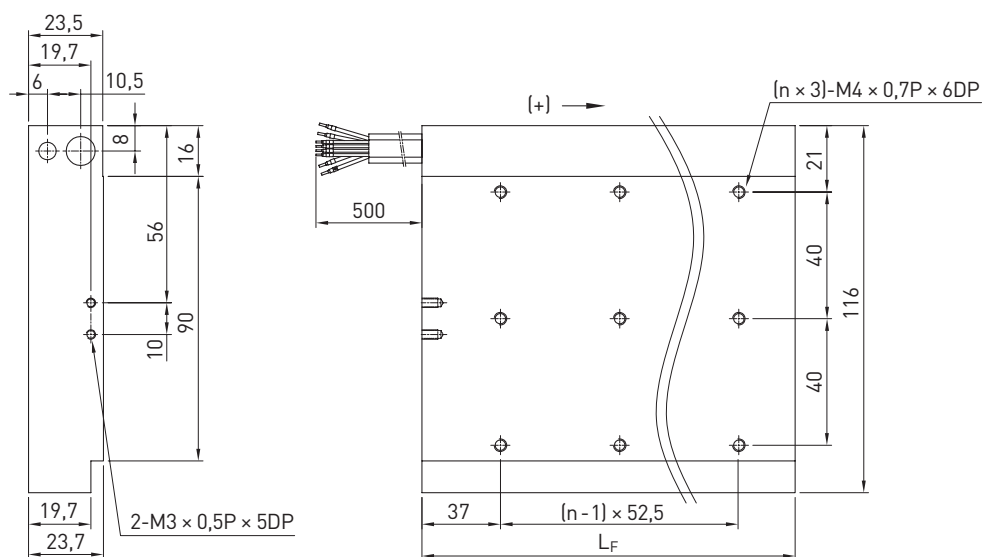
Table 2.7 Technical data for LMSA3

	Symbol	Unit	LMSA31G	LMSA32G	LMSA33G	LMSA34G
Forces and electrical parameters						
Continuous force at T _{max}	F _c	N	292	583	875	1,166
Continuous current at T _{max}	I _c	A _{eff}	2.0	4.0	6.0	8.0
Peak force (for 1 s)	F _p	N	823	1,646	2,469	3,292
Peak current (for 1 s)	I _p	A _{eff}	6.0	12.0	18.0	24.0
Ultimate force (for 0.5 s)	F _u	N	1,079	2,157	3,236	4,314
Ultimate current (for 0.5 s)	I _u	A _{eff}	10.0	20.0	30.0	40.0
Force constant	K _f	N/A _{eff}	145.8	145.8	145.8	145.8
Attraction force	F _a	N	1,444	2,888	4,333	5,777
Electrical time constant	K _e	ms	4.9	4.9	4.9	4.9
Resistance ¹⁾	R ₂₅	Ω	19.2	9.6	6.4	4.8
Inductance ¹⁾	L	mH	94.1	47.1	31.3	23.5
Back EMF constant	K _u	V _{eff} /(m/s)	84.2	84.2	84.2	84.2
Motor constant	K _m	N/√W	27.2	38.4	47.0	54.3
Thermal resistance	R _{th}	°C/W	0.60	0.30	0.20	0.15
Thermal time constant	T _{th}	s	1.440	3.060	3.480	4.800
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 _{bend}	mm	69			
Pole pair pitch	2τ	mm	30			
Max. winding temperature	T _{max}	°C	120			
Mounting holes (forcer)	n		2	4	6	8
Weight of forcer	M _F	kg	1.9	3.8	5.7	7.6
Length of forcer	L _F	mm	118	223	328	433
Unit mass of stator	M _S	kg/m	8.5			
Stator length/mounting holes	L _S	mm	120 mm/N = 2; 300 mm/N = 5			
Total height (forcer + stator)	H	mm	36			

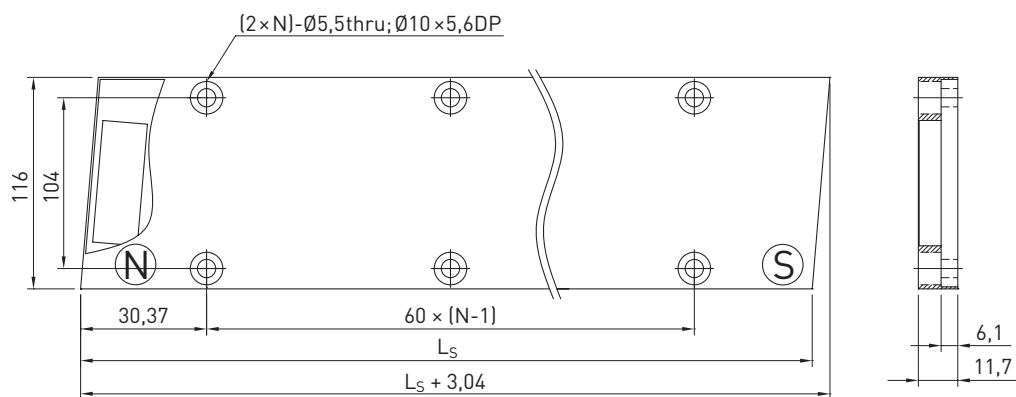
All specifications are in $\pm 10\%$ of tolerance at $25^{\circ}C$ ambient temperature

¹⁾ Line to line

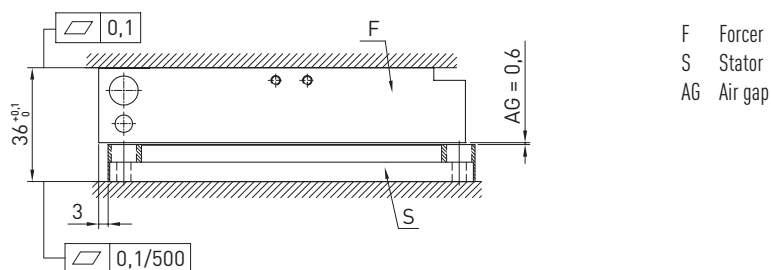
Dimensions of forcer



Dimensions of stator



Mounting tolerances

Table 2.8 **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-		

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2.4.5 LMSAC linear motor specifications

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

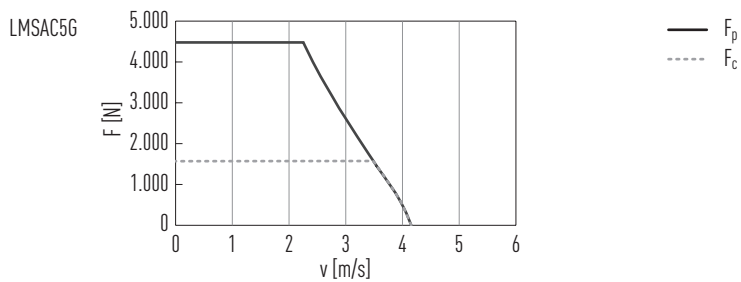


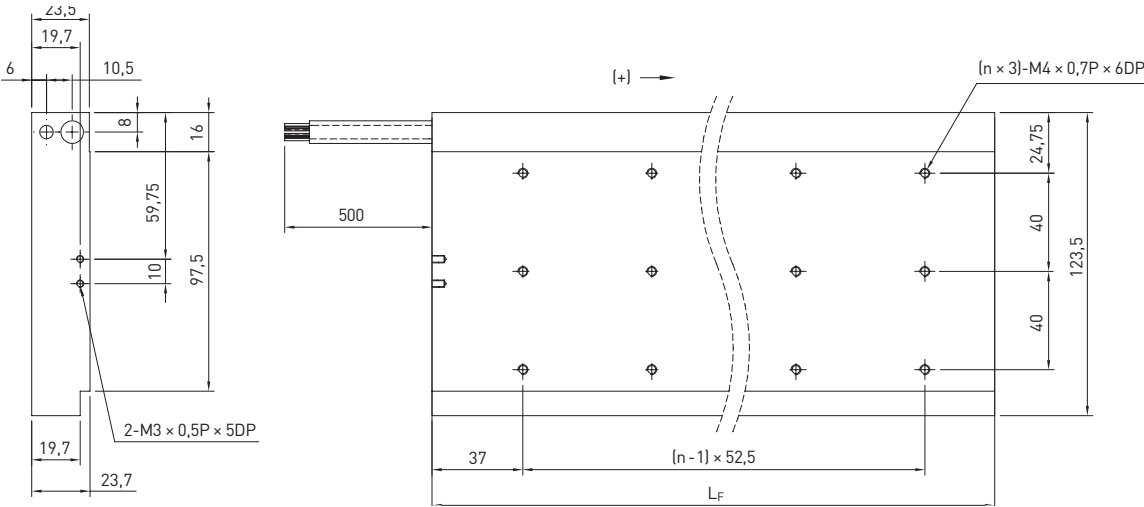
Table 2.9 Technical data for LMSAC

	Symbol	Unit	LMSAC5G
Forces and electrical parameters			
Continuous force at T_{max}	F_c	N	1,579
Continuous current at T_{max}	I_c	A _{eff}	10.0
Peak force (for 1 s)	F_p	N	4,458
Peak current (for 1 s)	I_p	A _{eff}	30.0
Ultimate force (for 0.5 s)	F_u	N	5,842
Ultimate current (for 0.5 s)	I_u	A _{eff}	50.0
Force constant	K_f	N/A _{eff}	157.9
Attraction force	F_a	N	7,823
Electrical time constant	K_e	ms	5.0
Resistance ¹⁾	R_{25}	Ω	4.1
Inductance ¹⁾	L	mH	20.3
Back EMF constant	K_u	V _{eff} /(m/s)	91.2
Motor constant	K_m	N/ $\sqrt{W}$	63.7
Thermal resistance	R_{th}	°C/W	0.11
Thermal time constant	T_{th}	s	4,530
Thermal switch			1 × PT1000 + 1 × (3 PTC SNM 120 in Serie)
Max. DC bus voltage		V	750
Mechanical parameters			
Max. bending radius of motor cable	R_{bend}	mm	69
Pole pair pitch	2τ	mm	30
Max. winding temperature	T_{max}	°C	120
Mounting holes (forcer)	n		10
Weight of forcer	M_F	kg	10.5
Length of forcer	L_F	mm	538
Unit mass of stator	M_S	kg/m	9.7
Stator length/mounting holes	L_S	mm	120 mm/N = 2; 300 mm/N = 5
Total height (forcer + stator)	H	mm	36

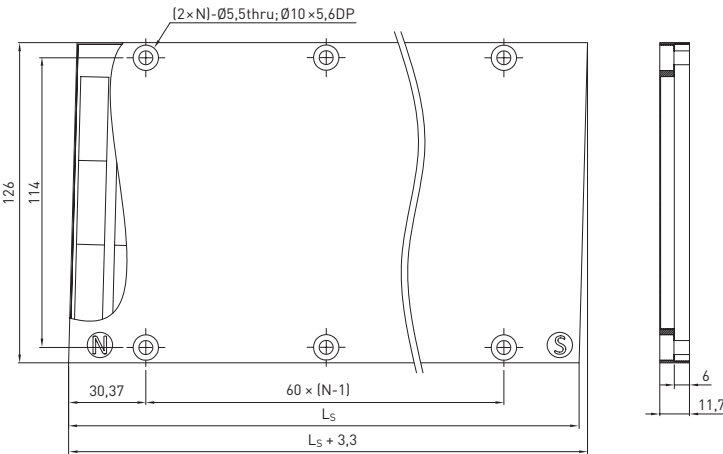
All specifications are in $\pm 10\%$ of tolerance at 25 °C ambient temperature

¹⁾ Line to line

Dimensions of forcer



Dimensions of stator



Mounting tolerances

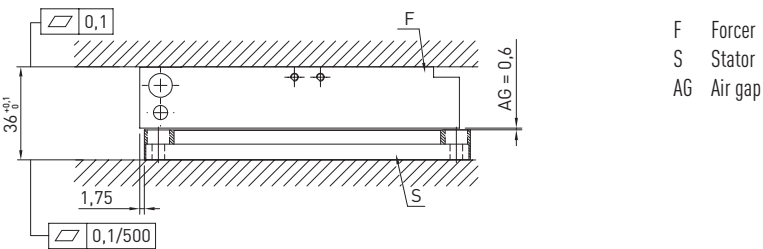


Table 2.10 LMSA3 motor cable assignment			
Motor cable	Signal		Diameter [mm]
1	U		9.2
2	V		
3	W		
Green/Yellow	GND		
Yellow	T1+	PTC SNM 120	5.5
Green	T1−		
Brown	T2+	PT1000	
White	T2−		