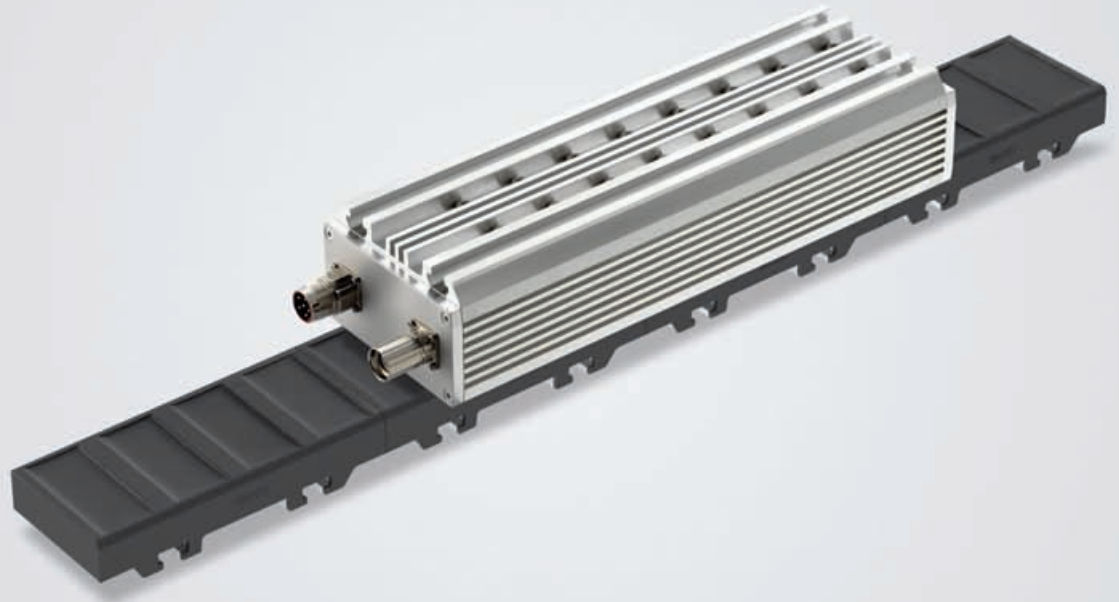


Synchronous linear motor 1FN6

The electrical gear rack

Brochure · September 2008



Motors

SIEMENS

Synchronous linear motor 1FN6

Overview

Linear motors are preferred for applications with linear axes in machine and plant engineering with stringent requirements for dynamic response and precision.

As a result of their high force density and because they can manage without vibration-susceptible, mechanical transmission components such as gearing, belts, gear racks and ball screw spindles, they are capable of fast acceleration, extremely accurate closed-loop control and low wear.

Due to the increasing susceptibility of mechanical transmission components to torsion and vibration as the travel length increases, the strengths of the linear motors with regard to dynamic response and precision become more apparent in the case of long traversing paths.

Until now linear motors have been available as high dynamic synchronous linear motors with magnetic secondary section or as less dynamic asynchronous linear motors.

The product

With the linear motor 1FN6, Siemens is now offering another synchronous variant of a linear motor that is characterized by its non-magnetic secondary section. This can be used to implement extremely high dynamic applications with long traversing paths cost-effectively. The non-magnetic secondary section also allows a highly dynamic linear motor to be used under environmental conditions in which magnetic secondary sections are undesirable.

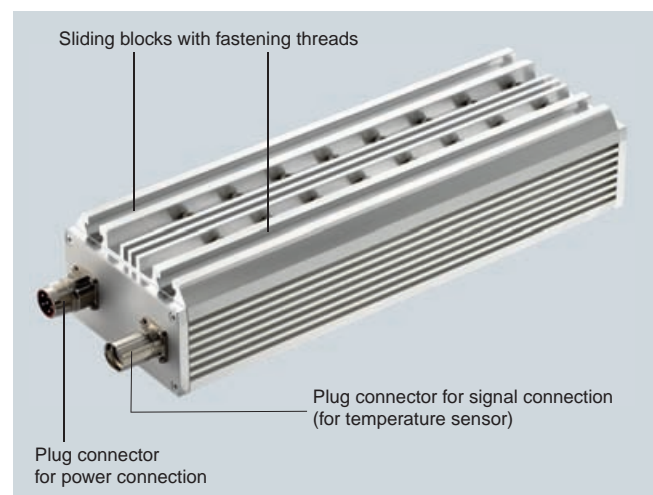
Maximum forces of between 900 and 8080 N give the motors an impressive acceleration capability at maximum velocities of 170 to 540 m/min.

As the shape of the secondary section is reminiscent of a gear rack, and due to its possible use in place of a classical rack and pinion systems, the term "electrical gear rack" has been coined for the 1FN6 linear motor.

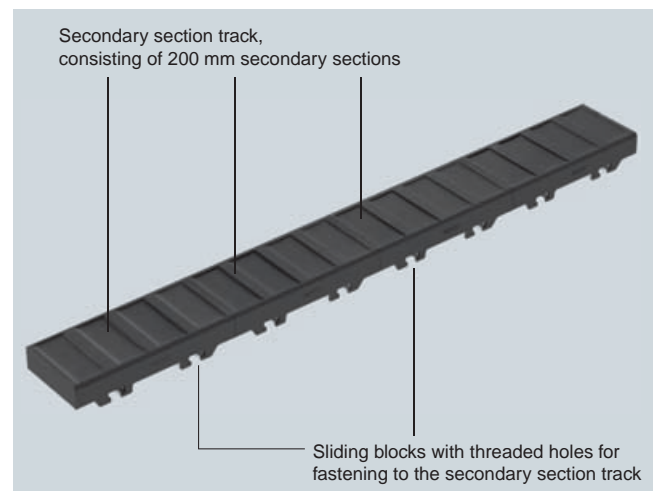
Compared to asynchronous linear motors, it is characterized by a higher level of dynamic response, greater energy efficiency and a more compact construction format.

Highlights

- High force density
- High level of dynamic response and precision
- High energy efficiency
- Large air gap, so highly resistant to external influences
- Low thermal expansion
- Excellent control capability



1FN6 primary section



1FN6 secondary section

Design

The 1FN6 linear motors comprise a primary section that is equipped with coils and permanent magnets and a non-magnetic, toothed secondary section in which the intermediate spaces are filled.

Sliding blocks, located on the top, are used to fix the primary section to a moving slide fitted onto a guide rail. The secondary section has sliding block with threaded holes underneath for bolting it onto the machine.

Long traversing paths can be realized by lining up individual secondary sections with a grid spacing of 200 mm. The only restrictions that apply are due to the maximum permissible cable lengths or the maximum lengths of the measuring systems to be selected by the customer.

A linear position measuring system is installed on the machine side alongside the secondary section track for sensing the position and velocity.

Preferred applications

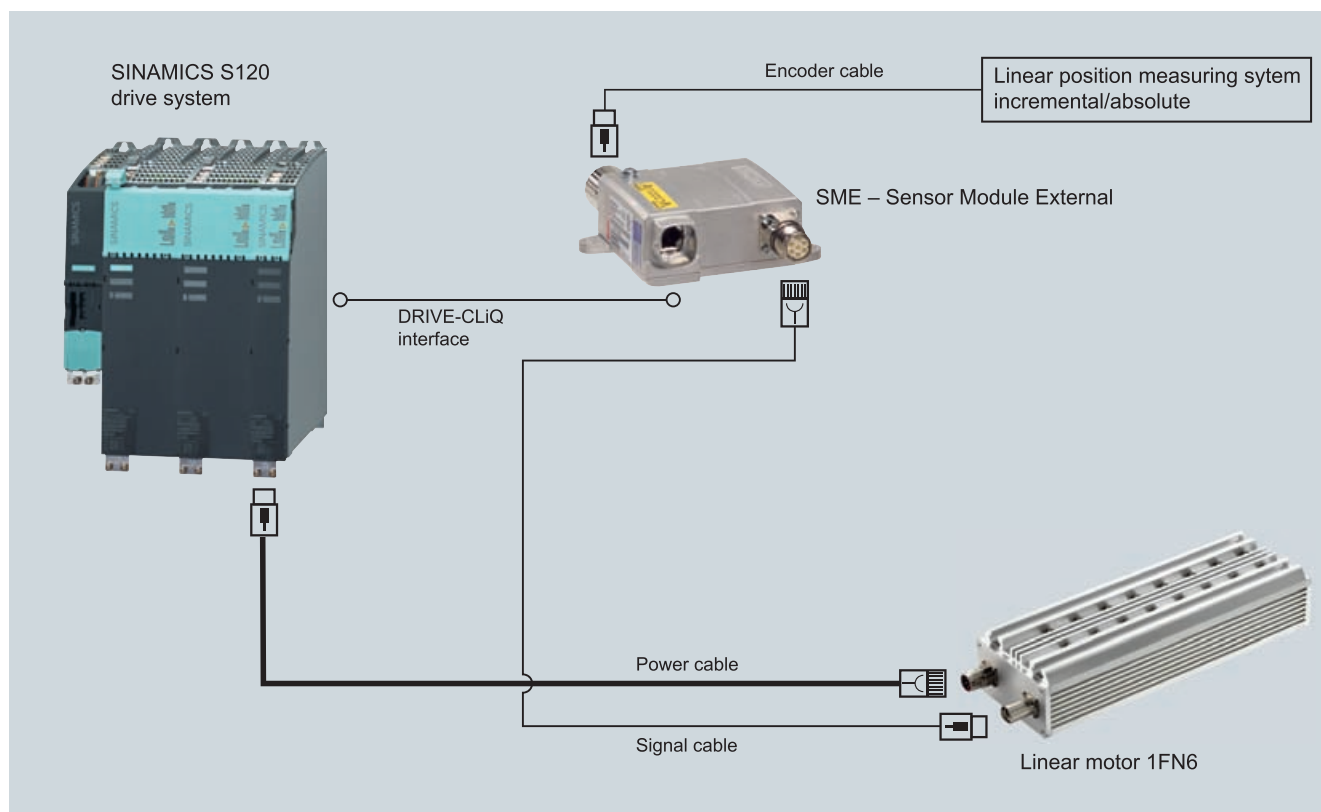
The linear motor series 1FN6 supplements the current range of familiar 1FN linear motors. As a result of the relatively cost-effective non-magnetic secondary section track, the synchronous linear motor 1FN6 is predestined for highly dynamic applications with long traversing paths or for applications in which the use of magnetic secondary sections is undesirable.

Typical areas of application:

- Conveyors, assembly and transfer lines
- Handling gantries and robotic applications with long traversing paths
- Water jet and laser-cutting machines with long horizontal traversing axes

System integration

Linear motors of the 1FN6 series merge perfectly into the system environment of the SINAMICS S120 drive system. Thanks to the plug connector mounted on the front, the pre-assembled power and signal cables mean that the drive is ready to use in the shortest possible time.



Drive solution, 1FN6 linear motor with the SINAMICS S120 drive system

Comparison: Synchronous linear motor 1FN6 versus asynchronous linear motor

1FN6	asynchronous linear motor
Magnetic primary section / non-magnetic secondary section	Non-magnetic primary section / non-magnetic secondary section
High force density, therefore more compact construction	Low force density (approx. 30 to 60 % of 1FN6)
Maximum precision ¹⁾	Lower precision due to more difficult closed-loop control
Higher energy efficiency due to lower power losses	High power losses
Larger air gap, therefore insensitive to thermal effects	Minimal air gap, so extremely sensitive to thermal effects

Technical properties

	Version
Type of motor	Permanently excited synchronous linear motor with non-magnetic secondary section
Construction type	Modular type of construction, delivered as components
Cooling	Natural cooling
Degree of protection/explosion protection	IP 23 / as stated by machine manufacturer
Line voltage	400 to 480 V
Max. velocity at rated force F_{rated}	170 ... 540 m/min
Rated force F_{rated}	235 ... 2110 N
Static force F_o	$0.7 \times F_{rated}$
Overload capability	$3.8 \times F_{rated}$
Max. velocity v_{max}	up to 541 m/min
Connection method	Cables connected through plug-in connections
Stator winding insulation	Temperature class 155 (F)
Sound pressure level (tolerance + 3 dB)	Depending on machine design
Encoder system	External encoder, depending on machine design
Siemens converter system	SINAMICS S120
Typical applications	Applications with stringent demands on precision for a high level of dynamic response, e.g.: <ul style="list-style-type: none"> • Applications with long traversing paths • Applications that require a non-magnetic secondary section track • Transport of materials/tools in assembly and production lines • Water jet and laser cutting machines

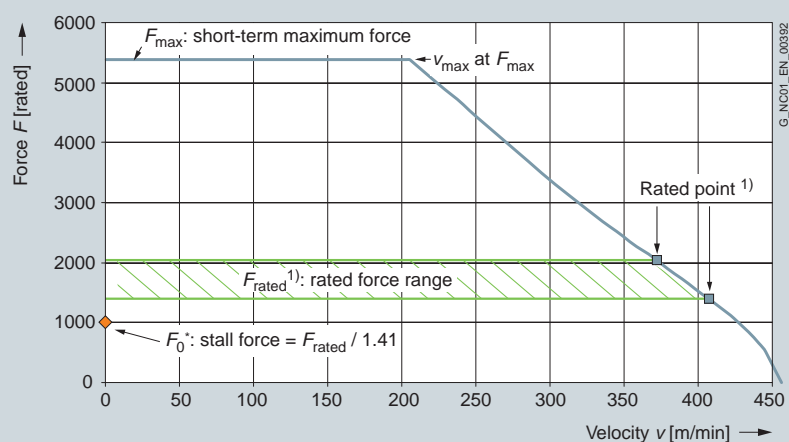
¹⁾ When using a suitable measurement system

Synchronous linear motor 1FN6

Technical data

Primary section Order No.:	$F_{\text{rated}}^{1)}$ rated	F_{max} rated	v_{max} at F_{rated} m/min	v_{max} at F_{max} m/min	$I_{\text{rated}}^{1)}$ A	I_{max} A
1FN6008-1LC17-0KA1	235 ... 350	900	263	103	1.7 ... 2.6	9
1FN6008-1LC37-0KA1	235 ... 350	900	541	224	3.5 ... 5.3	18
1FN6008-1LE16-0KA1	470 ... 710	1800	260	96	3.5 ... 5.3	18
1FN6008-1LE34-0KA1	470 ... 710	1800	532	206	7.0 ... 10.5	36
1FN6008-1LG16-0KA1	705 ... 1060	2690	257	93	5.2 ... 7.8	27
1FN6008-1LG33-0KA1	705 ... 1060	2690	528	200	10.5 ... 16.0	54
1FN6016-1LC18-0KA1	470 ... 710	1800	268	109	3.5 ... 5.3	18
1FN6016-1LC30-0KA1	470 ... 710	1800	419	176	5.4 ... 8.0	28
1FN6016-1LE17-0KA1	935 ... 1400	3590	263	101	7.0 ... 10.5	36
1FN6016-1LE27-0KA1	935 ... 1400	3590	411	162	10.8 ... 16.3	56
1FN6016-1LG16-0KA1	1405 ... 2110	5390	261	98	10.5 ... 16.0	54
1FN6016-1LG26-0KA1	1405 ... 2110	5390	408	157	16.2 ... 24.3	84
1FN6024-1LC12-0KA1	705 ... 1060	2690	176	69	3.5 ... 5.3	18
1FN6024-1LC20-0KA1	705 ... 1060	2690	277	114	5.4 ... 8.0	28
1FN6024-1LE11-0KA1	1405 ... 2110	5390	173	64	7.0 ... 10.5	36
1FN6024-1LE18-0KA1	1405 ... 2110	5390	272	106	10.8 ... 16.3	56
1FN6024-1LG10-0KA1	2110 ... 3170	8080	172	62	10.5 ... 16.0	54
1FN6024-1LG17-0KA1	2110 ... 3170	8080	270	102	16.2 ... 24.3	84

Sample characteristic curve: Force via velocity (600 V DC link voltage)



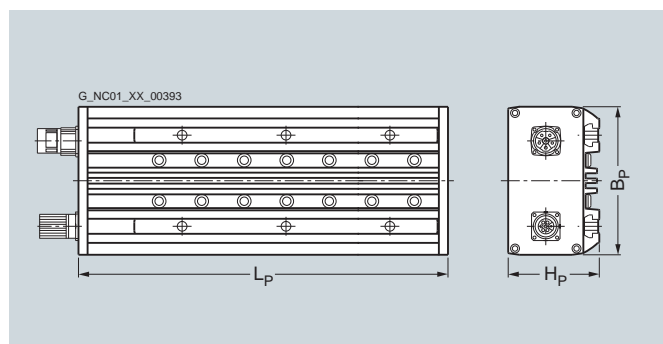
Characteristic curve for 1FN6016-1LG26

- 1) The rated force F_{rated} that the motor can permanently achieve is dependent on the installation conditions and ambient conditions. The large surface area for cooling and/or high flow velocity of air ensure that the motor achieves a high rated force.

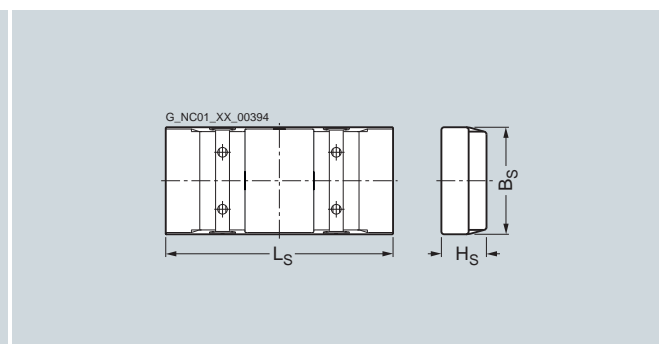
Synchronous linear motor 1FN6

Mounting dimensions in mm

Primary section				Secondary section			
Type	H _P	B _P	L _P	Type	H _S	B _S	L _S
1FN6008-1LC	80.4	130	392	1FN6008-1SC00-0AA0	40	94	200
1FN6008-1LE	80.4	130	642				
1FN6008-1LG	80.4	130	892				
1FN6016-1LC	80.4	209	392	1FN6016-1SC00-0AA0	40	174	200
1FN6016-1LE	80.4	209	642				
1FN6016-1LG	80.4	209	892				
1FN6024-1LC	80.4	289	392	1FN6024-1SC00-0AA0	40	254	200
1FN6024-1LE	80.4	289	642				
1FN6024-1LG	80.4	289	892				



Primary section



Secondary section

Siemens AG
Industry Sector
Drive Technologies
Motion Control
Postfach 31 80
91050 ERLANGEN
GERMANY

www.siemens.com/linearmotors

Subject to change without prior notice
Order No.: 6ZB5711-0AN02-0BA0
Dispo 18401
BR 0908 6.0 VOG 6 EN / 822295
Printed in Germany
© Siemens AG 2008

The information provided in this brochure contains merely general descriptions or performance characteristics, which in case of actual use do not always apply as described or which may change as a result of further development of the products.

An obligation to provide the respective characteristics shall only exist if expressly agreed in the terms of contract.

Availability and technical specifications are subject to change without prior notice.

All product designations may be trademarks or product names of Siemens AG or supplier companies whose use by third parties for their own purposes could violate the rights of the owners.