

**Linear motors - Main features**

The main difference between rotary and linear motors is that linear produce a force and rotary produce a torque.

Their operation is identical to that of rotary motors from which they are derived.

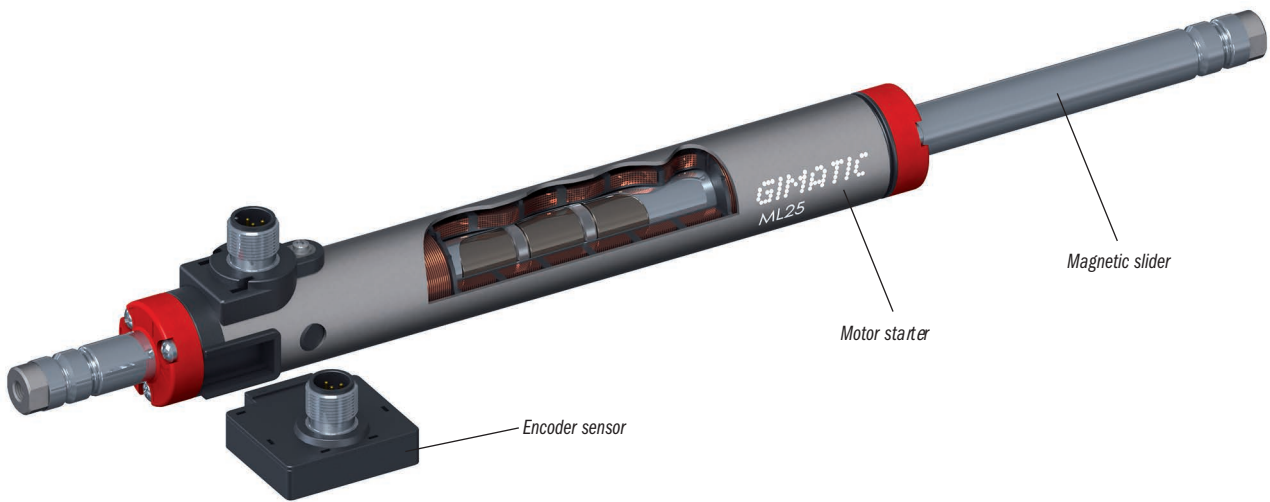
Use of this type of actuator is very convenient in automatic motion where it is necessary to drive the linear motion directly eliminating the motion conversion parts such as the belts, cogs, or lead-screws.

This is why they are commonly called "direct drive:" they are directly linked to the load.

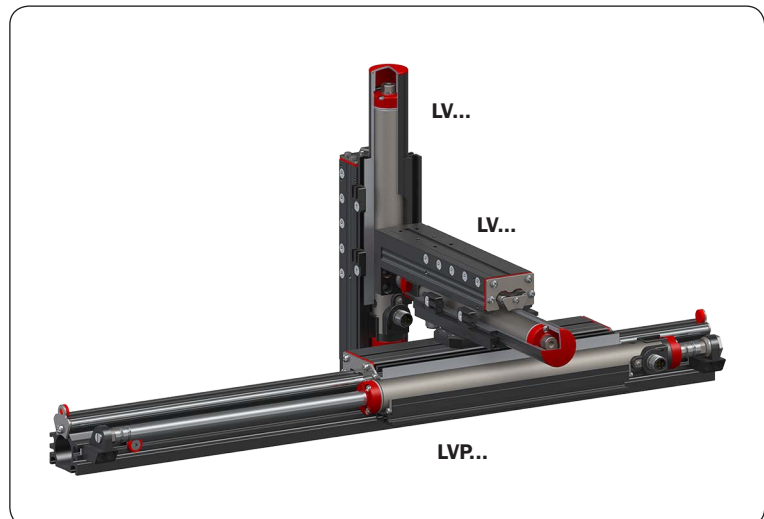
Without the conversion parts, motion is better and more accurate thanks to the stiffness, lower inertial mass, no backlash and the elasticity of the system.

The main parts of a linear motor are the stator (primary) where the coils and temperature sensor are housed, and the slider (secondary) where the permanent magnets are located.

A removable encoder with M12 connectors for robotic applications completes the system. An extruded bar is used for heat dissipation as well as to facilitate fixing thanks to the T-grooves and the ISO dimensioned cylinders.



**Application example**



### Linear motors - Technology

The working principle of the cylindrical linear motor is the same as that of a standard synchronous brushless motor.

Based on the application, the stator, where the coils are located, can remain still and move the slider with magnets inside, or vice versa, the slider can be fixed and the stator move.

Magnets are positioned in a North-South sequence in order permit the measurement system, located on the stator, to verify the reciprocal position.

These motors can be controlled using common drives for traditional brushless motors. These converters control the current to the primary in order to obtain a 90° electric offset with the magnetic poles, maximising the thrust.

The alternating polarity of the magnets produces a force called COGGING which can easily be eliminated by special functions (feed-forward) integrated in the drives.



### Linear motors - Advantages

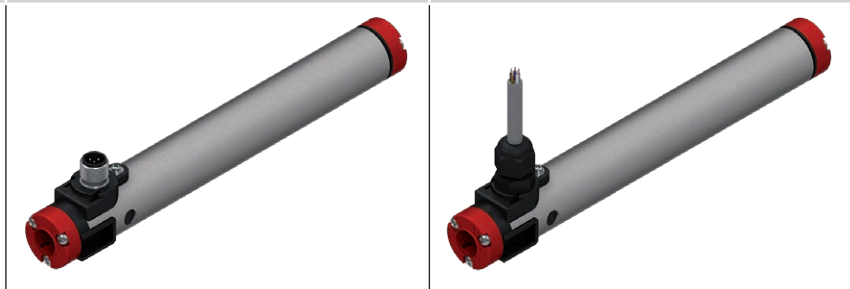
- No gear box.
- No belt and pulley.
- No periodic lubrication.
- No periodic adjustments.
- No rotary drive shaft.
- No backlash.
- No mechanical wear.
- Direct thrust motor.
- Simple mechanical assembly.
- Few moving parts.
- No internal moving parts.
- Less mass to move.
- Greater efficiency.
- Lower inertia.
- Easy replacement.
- Moving part (stator or slider) selection based on the desired application.
- High acceleration.
- High speed.
- Low weight.
- Zero axial moment.

**Motor stator**

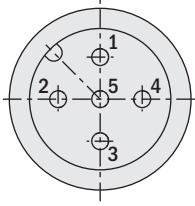
- 3 phase motor delta connection.
- PTC positive temperature coefficient component.
- M12 or flex cable connection.
- High-slidability rod wiper.
- Operating temperature: 25 °C.
- Maximum motor temperature: 110 °C.

**3-PHASE MOTOR - Main data**

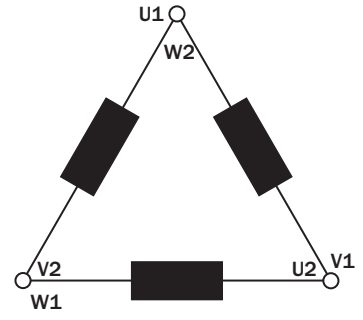
	ML2570X4	ML2570X6	ML25300X4 (*)	ML25300X6 (*)
Motor length	199 mm	270 mm	199 mm	270 mm
Three-phase coil units	4	6	4	6
Pole pitch	35.4 mm	35.4 mm	35.4 mm	35.4 mm
Motor external diameter	Ø25 mm	Ø25 mm	Ø25 mm	Ø25 mm
Mass	273 g	384 g	273 g	384 g
BUS voltage	72 Vdc	72 Vdc	325 Vdc	325 Vdc
Peak force	98.1 N	105.4 N	117 N	131.6 N
Peak current (110°C)	7.7 A	5.2 A	3.1 A	2.1 A
Force constant	12.7 N/A	20.3 N/A	34.4 N/A	62.7 N/A
Continuous force	20.6 N	36.9 N	18.3 N	37.6 N
Continuous current (110°C)	1.6 A	1.8 A	0.5 A	0.6 A
Maximum speed	6 m/s	4 m/s	9 m/s	5.7 m/s
Phase resistance at 25°C/110°C	4.8/6.5 Ohm	7.1/9.6 Ohm	48.6/67.5 Ohm	77.5/105.1 Ohm
Phase inductance	1.2 mH	1.9 mH	11.2 mH	20.5 mH
BEMF constant	11.6 Vs/m	18.2 Vs/m	36.3 Vs/m	57.7 Vs/m
Thermal resistance	3.3°C/W	1.8°C/W	2.8°C/W	1.5°C/W
Max phase temperature	110°C	110°C	110°C	110°C
PTC value	3K3 Ohm @25°C	3K3 Ohm @25°C	3K3 Ohm @25°C	3K3 Ohm @25°C
PTC max voltage	40 Vdc			
Connection	M12x1	M12x1	Cavo Cable	Cavo Cable
Environmental Degree	IP67	IP67	IP67	IP67
Reference standards	EN 61000-6-2 + EC + IS1 EN 61000-6-4		EN 61000-6-2 + EC + IS1 EN 61000-6-4 EN 62233	



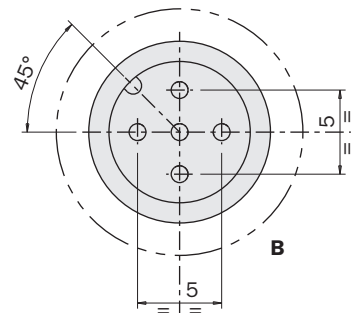
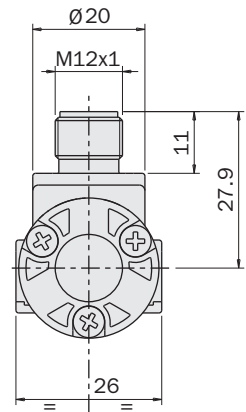
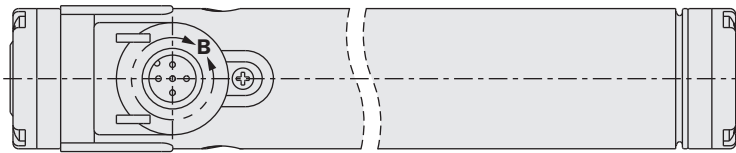
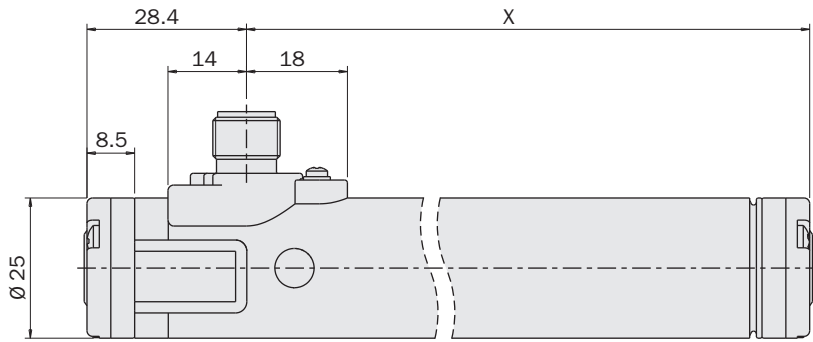
**Electrical connections**



	Phase	Color
PIN 1	U	Brown
PIN 4	V	Black
PIN 3	W	Blue
PIN 2	PTC	White
PIN 5	PTC	Grey



**Dimensions (mm)**

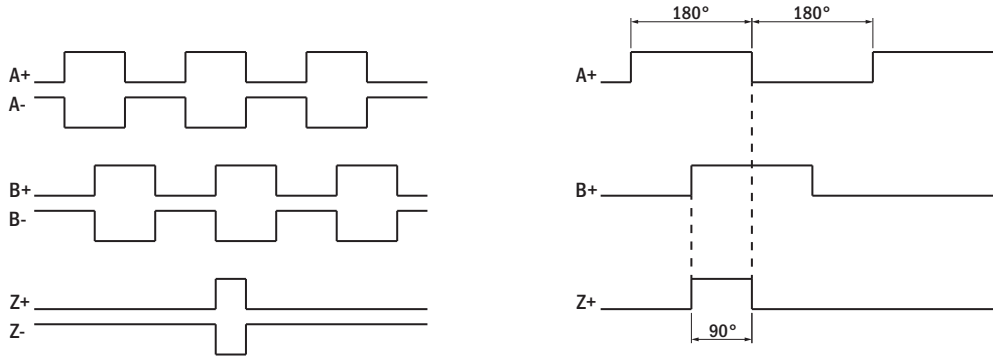


	X
ML2570X4 ML25300X4	170.6
ML2570X6 ML25300X6	241.6

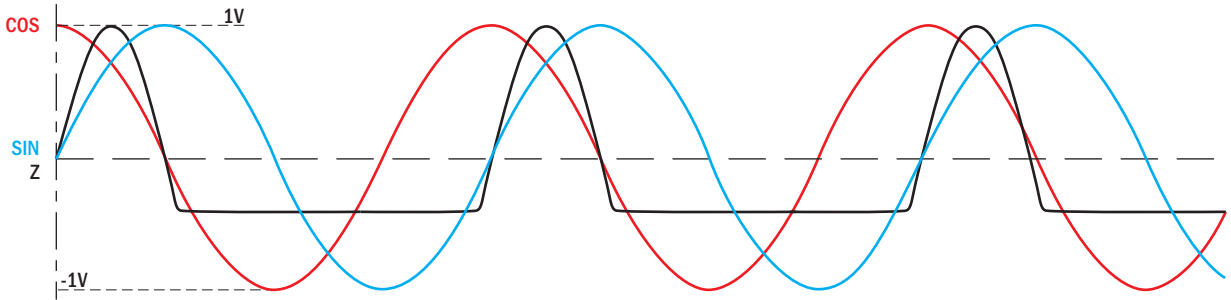


Feedback signals

SE9ABZ1



SE9SIN1



SE9HALL1

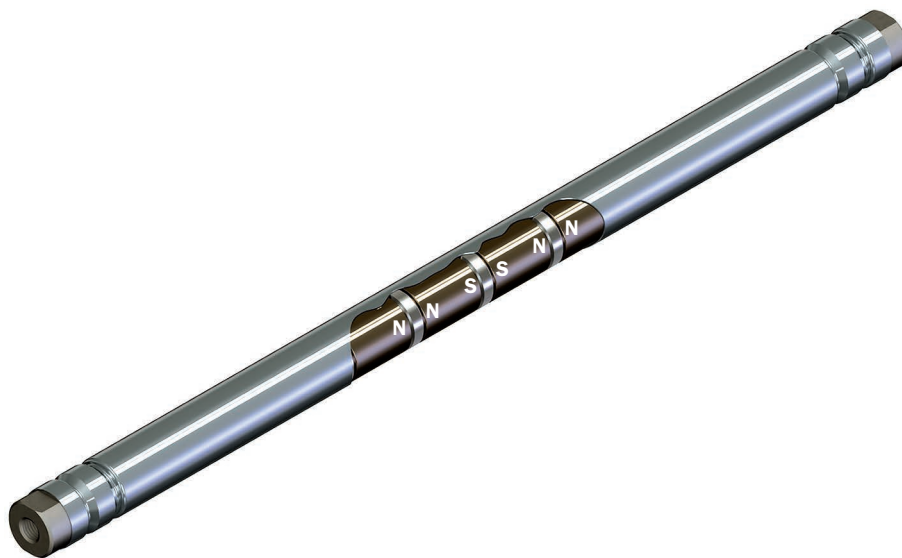
	0	5.9	11.8	17.7	23.6	29.5	35.4	
	0	60	120	180	240	300	360	Mechanical pitch
								Electrical degrees
HALL 1	1	1	1	0	0	0	0	HALL 1
HALL 2	0	0	1	1	1	0	0	HALL 2
HALL 3	1	0	0	0	1	1	0	HALL 3

**Magnetic slider**

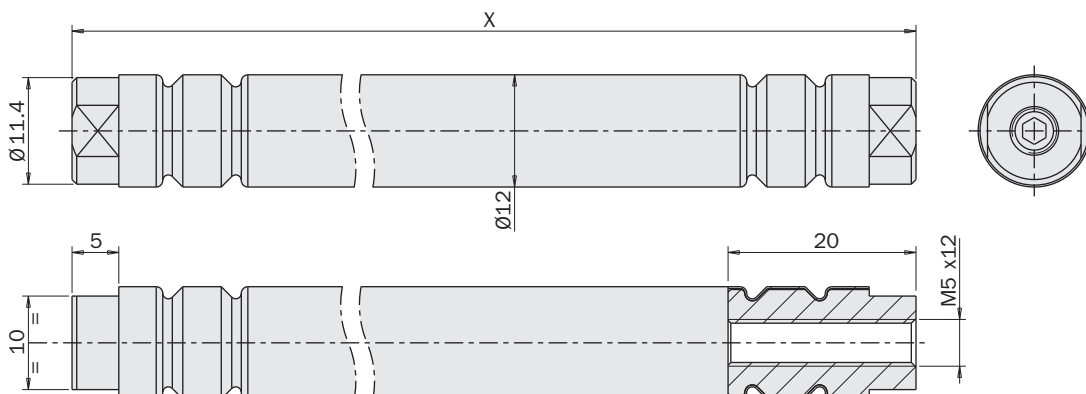
- Neodymium magnets.
- Ø12 mm stainless steel pipe.
- M5 internal cap thread and 12 mm wrench.

	ML12X10L218	ML12X13L271	ML12X16L325	ML12X20L395
Standard length (X)	218 mm	271 mm	325 mm	395 mm
Mass	190 g	235 g	285 g	350 g
Number of magnets	10	13	16	20
Pole pitch	35.4 mm	35.4 mm	35.4 mm	35.4 mm

	ML12X27L519	ML12X33L625	ML12X39L730	ML12X44L820
Standard length (X)	519 mm	625 mm	730 mm	820 mm
Mass	460 g	560 g	655 g	735 g
Number of magnets	27	33	39	44
Pole pitch	35.4 mm	35.4 mm	35.4 mm	35.4 mm

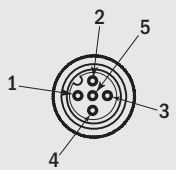
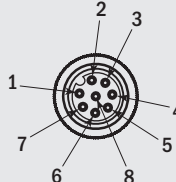


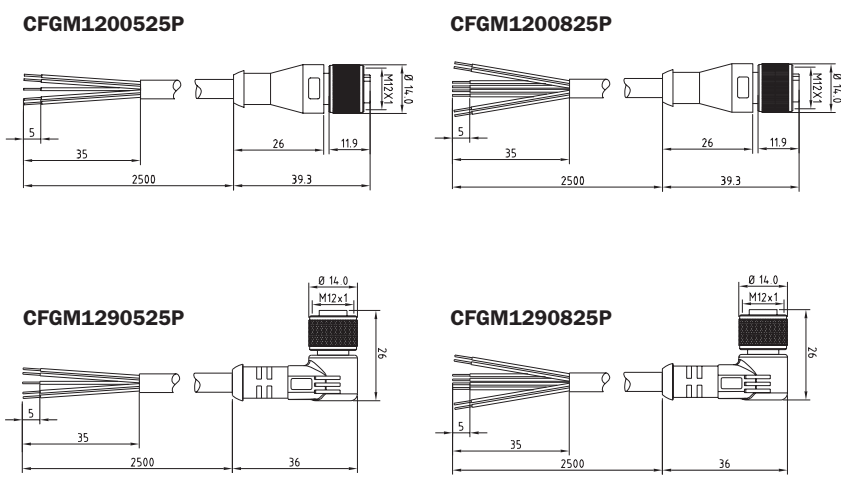
**Dimensions (mm)**



**Connectors**

Motor, transducers and feedback sensors can be connected by means of axial and angular connectors with flexible cable for moving applications.

0° axial	<b>CFGM1200525P</b>	<b>CFGM1200825P</b>	
90° angular	<b>CFGM1290525P</b>	<b>CFGM1290825P</b>	
Application	Motor	Encoder	
Contact type	Female		
Number of contacts	5	8	
Standard length	2.5 m		
Material	Bare Copper		
Stranding	42 x 0.10 mm	32 x 0.10 mm	
Section - AWG	0.34 mm <sup>2</sup> / 22	0.25 mm <sup>2</sup> / 24	
Electrical resistance	< 58.16 Ω/km	< 76.33 Ω/km	
Conductor diameter	Ø 1.30 mm	Ø 1.15 mm	
Conductor compound	PP		
Shield	Fully shielded		
Shield type	Braid		
Cable diameter	Ø 6.3 mm ±0.2 mm		
Cable material	PUR		
Cable color	RAL 9005		
Features	Oil, Hydraulic fluid and UV resistant, Silicone, Pb, Cd, Hg, FCKW and Halogen free		
Min. bending radius	63 mm		
Reference standards	2002/95/CE, EN 50363-10-2, IEC 60344		
Color layout	<ul style="list-style-type: none"> <li>1 Brown</li> <li>2 White</li> <li>3 Blue</li> <li>4 Black</li> <li>5 Gray</li> </ul> 	<ul style="list-style-type: none"> <li>1 White</li> <li>2 Brown</li> <li>3 Green</li> <li>4 Yellow</li> <li>5 Gray</li> <li>6 Pink</li> <li>7 Blue</li> <li>8 Red</li> </ul> 	





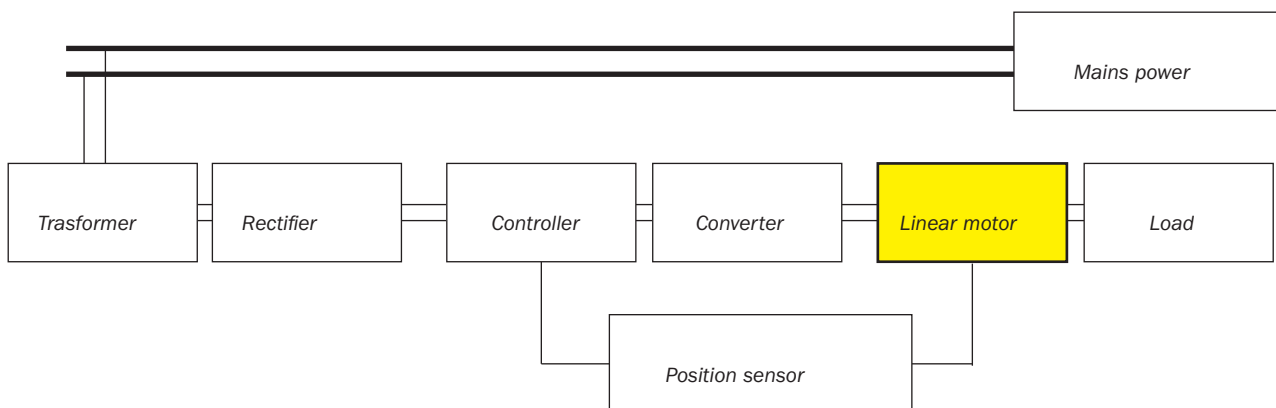
**Driver**

The Gimatic linear motor is compatible with most drives on the market.

The following is a list of some commercial drives tested.

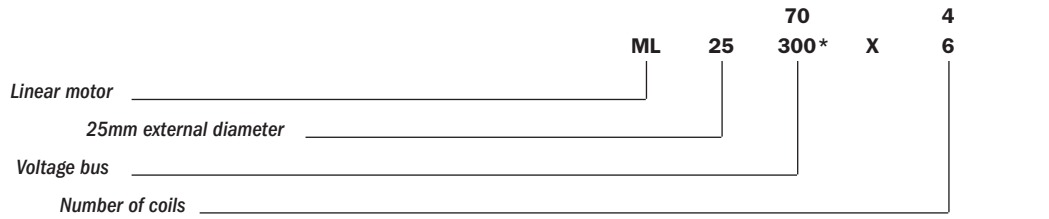
BRAND	CODE
LinMot	B1100; E1100
Copley	Accelnet
Hitachi	Servo AD
Advanced Motion Control	DPRALTE-020B080
Technosoft	IDM680
Janaer	Ecovario 114
BR Automation	Apocos
Elmo	Harmonica Drive
Servotronix	LVD drive
MaxonMotor	Epos Drive 70/10
LeadShine	ACS806
Aerotech	Ensemble HPE 10
Baldor / ABB	MicroFlex
Galil	CDS-3310
Infranor	XtraPlusPac
HDT	Digifox
Siemens	SINAMICS S120
Selema	Micro ECO

**Example of a typical architecture**

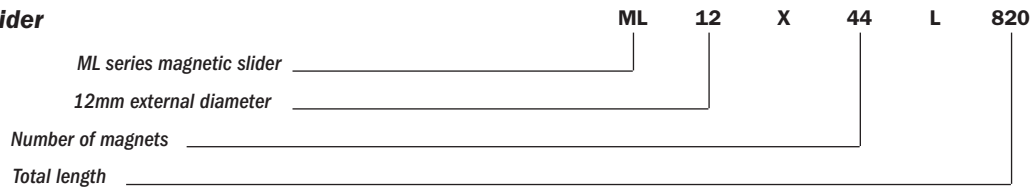


**Order code**

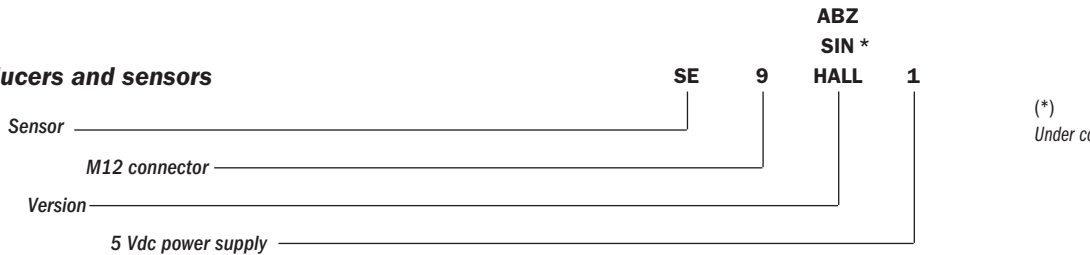
**Motor**



**Magnetic slider**

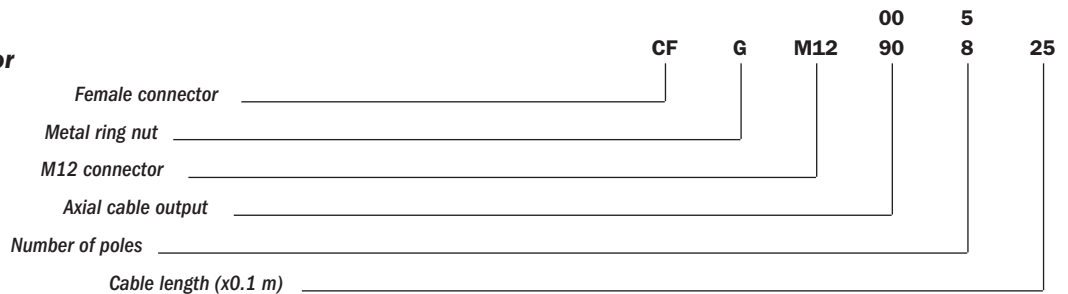


**Transducers and sensors**



(\*) Under construction

**Connector**



**Code combination**

	70 Vdc X 4	70 Vdc X 6	300 Vdc X 4	300 Vdc X 6
ML	ML2570X4	ML2570X6	ML25300X4	ML25300X6
ABZ	ML2570X4-ABZ	ML2570X6-ABZ	ML25300X4-ABZ	ML25300X6-ABZ
ABZ+HALL	ML2570X4-ABZ-HALL	ML2570X6-ABZ-HALL	ML25300X4-ABZ-HALL	ML25300X6-ABZ-HALL
SIN	ML2570X4-SIN	ML2570X6-SIN	ML25300X4-SIN	ML25300X6-SIN
SIN+HALL	ML2570X4-SIN-HALL	ML2570X6-SIN-HALL	ML25300X4-SIN-HALL	ML25300X6-SIN-HALL
ML12	ML12X10L218	ML12X13L271	ML12X16L325	ML12X20L395
ML12	ML12X27L519	ML12X33L625	ML12X39L730*	ML12X44L820