LDDM
Linear Direct Drive Motors

L1 Series

SCHAEFFLER GROUP

The Perfect Drive for Every Application

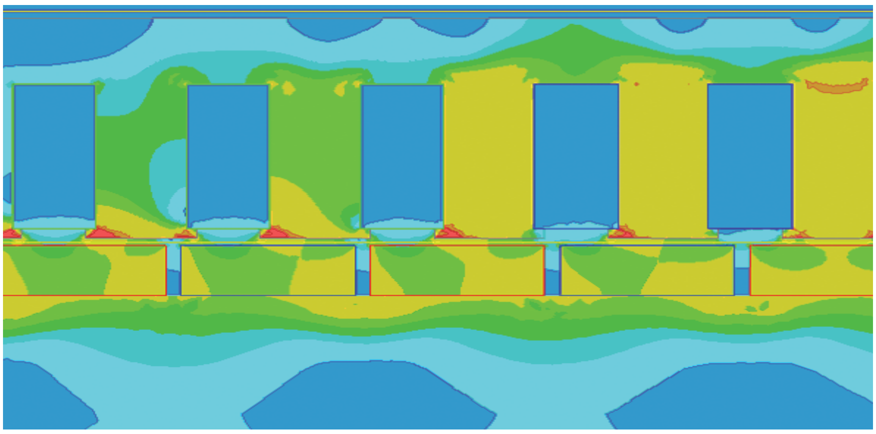
INA - Drives & Mechatronics GmbH & Co. oHG, a company of the Schaeffler Group, specializes in linear and rotary direct drives. These products are supplemented by directly driven positioning systems and related controllers and mechatronics assemblies.
In addition to standard products, IDAM also develops and produces customized drive solutions.
Due to the increasing demands in terms of dynamic performance, precision and cost reduction, direct drives are becoming increasingly more popular in modern machinery and equipment.

The direct connection between motor and accelerated mass increases dynamic and static rigidity, reduces elasticity and therefore enables an extremely high level of positioning performance. Direct drives are non-wearing, as a result of which maintenance and operating costs can be reduced whilst simultaneously increasing availability. In the industries of machine tools and production machinery, automation, productronics/semicon, measuring technology and medical technology, teams at IDAM have been developing direct drives and complex drive systems since 1990.

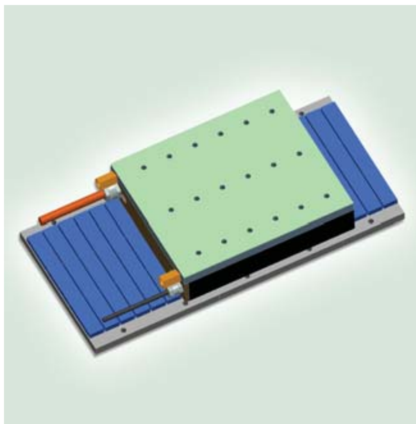
The development of the direct drives and the positioning systems is efficiently supported by the integration of models and simulations.

IDAM employs a state-of-the-art quality management system. At IDAM, quality management is a dynamic process which is examined on a daily basis and is thus continuously improved. IDAM is certified according to standard DIN EN ISO 9001:2008.

Specially developed software are used for the development and design of the motors, including tools for mechanical and thermal simulations. The results of these simulations are available to IDAM customers to help them optimize the assembling designs.



Detail of a FEM model



CAD model

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Advantages of Linear Direct Drives

Performance

1. **No conversion of motion form**
   - The drive train is free of elasticity, backlash, friction and hysteresis caused by transmission or coupling elements.
2. **Compact motor**
   - Thanks to the large feed force with relatively low accelerated mass, very high acceleration performance is achieved. The force can be used from speed 0 right up to the limit speed.
3. **Direct measurement of position**
   - Thanks to direct position measurement and the rigid mechanical structure, positioning is performed dynamically and highly accurate.

Operating costs

1. **No additional moving parts**
   - Assembly, adjustment and maintenance work for the drive assembly is reduced.
2. **No wear in the drive train**
   - Even under high and frequently alternating loads the drive train is extremely durable.
   - Machine downtimes drop as a result.
3. **High availability**
   - In addition to increased service life and reduced wear, the robustness of the linear motors increases the system availability.
   - Mechanical overload in the drive train does not cause damage as is the case with geared motors.

Design

1. **Compact installation space**
   - The compact design results in drive modules with small space requirements.
2. **Low number of components**
   - The mature design facilitates the integration of the motor parts in the overall machine concept.
   - Fewer and more robust parts result in a low failure rate (high MTBF*).
3. **Versatile design variants**
   - Facilitate an optimized integration of the motor parts into the overall machine design concept.

*MTBF: Mean Time Between Failures

Characteristics of Linear Motors

Direct drives enable a linear motion to be performed without motion converter or intermediate gears.
Linear motors comprise a primary part and, generally, a system of permanent magnets which is arranged opposite the primary part and is referred to as the secondary part. A distinction is made between slotted, slotless and ironless direct drives as well as stepper (syncronous reluctance hybrid motor) motors.

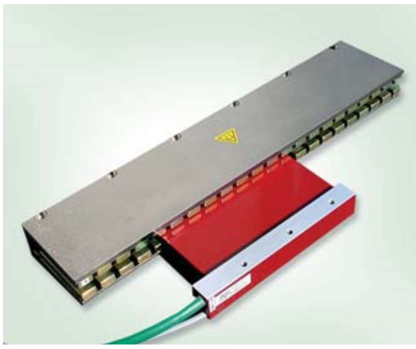
The motor develops a uniform and high typical force across a specific speed range. The force is determined by the active air gap surface between the primary and secondary part.
If a current is applied to the primary part, the electromagnetic field around the motor coils produces a force which acts on the secondary part and generates linear motion.

For a linear axis system a suitable guidance system is required in order to maintain the air gap between primary part and secondary part, as is a linear measuring system which detects the position of the motor.

Every series of motors comprises a selection of different lengths and widths in order to meet the different force and installation requirements and a range of installation and connection variants is also available.

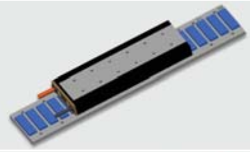
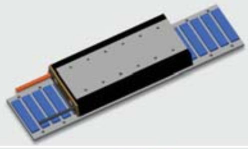
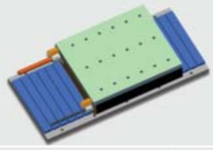
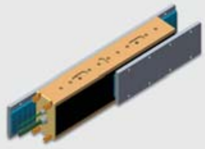
Type L1, primary part

Type L2U, primary part



Type ULIM, primary and secondary part

Overview of Linear Motor Series

Motor types	*Criteria*	*Construction*
Slotted motors		
L1A series	Peak forces up to 1010 N | ultimate force-to-mass ratio | e.g. for applications with limited vertical installation space in automation	 *Type: L1A*
L1B series	Peak forces up to 1521 N | optimised thermal power losses with increased feed force | e.g. for applications in automation	 *Type: L1B*
L1C series	Peak forces up to 5171 N | optimised thermal power losses | water-cooled | e.g. for applications in machine tools	 *Type: L1C*
L2U series	Peak forces up to 12000 N | double-comb version | ultimate force-to-volume ratio | for long service life/highly dynamic performance | constant velocity | cooling options | attraction forces are neutralised | e.g. for applications in machine tools	 *Type: L2U*
Low-iron motors, slotless		
FSM series	Flat design | minimised ripple forces | highly dynamic performance and high accuracy | e.g. for applications in measuring machines	 *Type: FSM*
Ironless motors		
ULIM series	Excellent dynamic performance | constant velocity | compact design | e.g. for applications in printing machines and in productronics	 *Type: ULIM*
Reluctance motors		
LRAM	Stepper motor | non-wearing, precise air bearing | e.g. for pick-and-place applications in productronics | suitable for low masses	 *Type: LRAM*
Special motors		
Moving coil	Excellent dynamic response in the millimetre range | ripple force free | minimised mass | e.g. for applications in Z-axes in the area of productronics	 *Type: Moving coil*
Moving magnet	Excellent dynamic response in the millimetre range | ripple force free | compact design | cooling option | e.g. for applications in Z-axes in the area of productronics	 *Type: Moving magnet*

General Motor Parameters - Efficiency Criteria

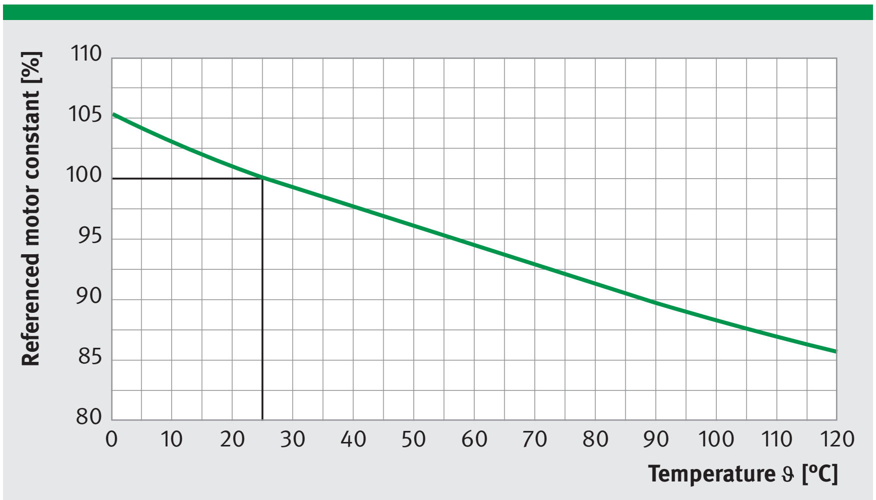
Depending on motor size, the forces and the power losses incurred in the process (copper losses) are fixed for different operating points which are independent on the winding design. As linear motors also generate high forces at standstill without outputting any mechanical power, it is not meaningful to quote the efficiency factor here.
The motor constant k_m can be used as a way of comparing the efficiency of motors. A high motor constant represents a more efficient conversion of current into holding or feed force.
It expresses the quadratic dependency of the generated power loss or heating on the load-independent current. This applies exactly to the linear dynamic range at standstill and at room temperature.

$$P_l = \left(\frac{F}{k_m}\right)^2$$

P_l: Power loss [W]
F: Force [N]
k_m: Motor constant[N/√W]

As the motor warms up, its efficiency decreases as a result of an increase in the winding resistance (refer to the diagram).
With increasing speed, the power loss P_l are supplemented by frequency-dependent magnetic reversal losses and eddy current losses which are not covered by the motor constant k_m, but which become relevant in the limit-speed range and must hence be taken into account. The motor constant k_m relates to the linear region of the force-current characteristic.

The motor constant k_m depends on the ohmic resistance and therefore on the winding temperature of a motor. In the motor data sheets, k_m is specified for 25 °C. The diagram shows the dependency between referenced motor constant and temperature.



Motor constant vs. temperature

Winding Designs and Dependencies

The achievable limit speed of any linear motor depends to a large degree on the winding design and the link voltage (U_{DCL}). Internal voltage drops within the motor increase the voltage demand with increasing speed. At the specified limit speeds, the voltage demand with field-oriented control corresponds to the link voltage of the servo converter. After this point the speed decreases quickly.

The higher the link voltage and the smaller the winding-related voltage constants (k_u), the higher the achievable limit speeds will be. Due to the correlation between voltage constants and force constants, the current demand increases with higher speeds at the same forces.

For the winding data, a standard winding WM was predefined for each motor size for medium dynamic requirements (winding variants WL and WH for lower and higher dynamic requirements respectively are available on request). At lower link voltages the limit speed is reduced almost proportionally.

The force-current characteristic describes the force at various operating points.

The force-speed characteristic presents the relationship between force and speed at different operating points.

L1 linear motors

Force-Speed Characteristic

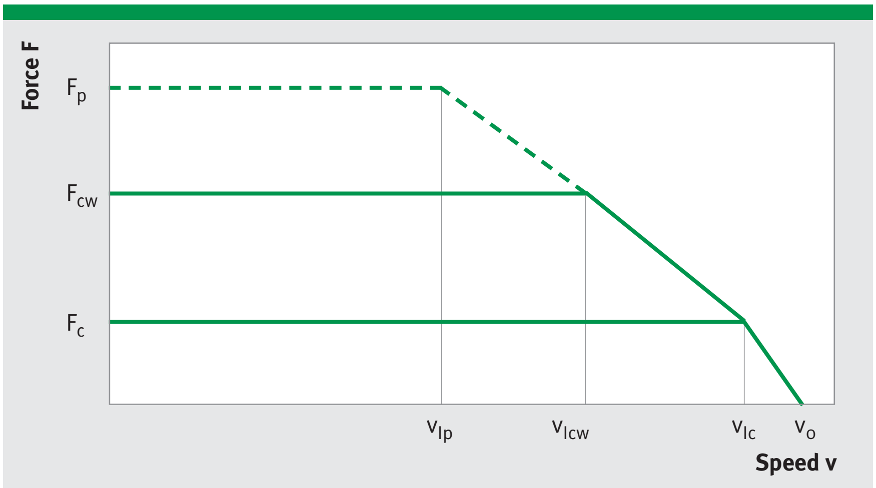
The F(v) characteristics of the permanent magnet synchronous motors are virtually speed-independent at low speeds. This applies to F_p, F_{cw} and F_c up to the associated corner speeds v_{lp}, v_{lcw} and v_{lc}. At higher speeds, the motor force is reduced as a result of the effects of the back EMF*, ultimately right down to zero.

With higher link voltages it is possible to compensate for greater back EMF and achieve higher speeds.

The motor can be operated at any operating point under the F(v) characteristic under the following conditions:

- up to F_c in non cooled continuous operation
- up to F_{cw} in water cooled continuous operation
- up to F_p in periodic intermittent duty (S3**).

Closed-loop controlled motor movements require a suitable distance between potential operating points and the decreasing portion of the F(v) characteristic. Typically, approximately 0.2 times the maximum speed should be applied for this distance (control reserve).



Force vs. speed

L1A motor with cable connection

Force at v = 0 m/s

When using a continuous force at standstill (F_S), e.g. in a Z-axis without mass compensation, it needs to be taken into account that a maximum of 70% of the nominal force can be used. Partial overloading of the motor may occur if this reduced value is exceeded.

*Back EMF: Back electromagnetic force

**S3: Operating mode according to standard VDE 0530

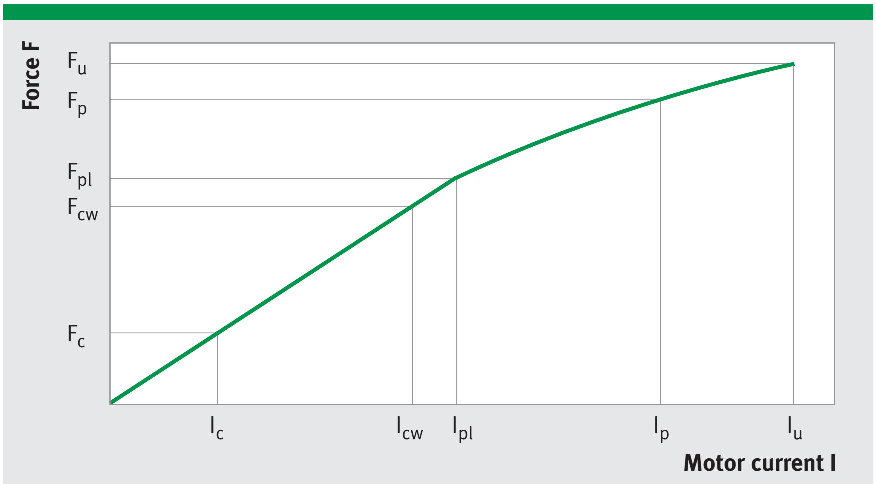
Force-Current Characteristic

The virtually linear portion of the characteristic from origin (0,0) to point (F_{pl}, I_{pl}) is characterised by force constant k_f: $F = I \cdot k_f$. The operating points of the motor for non cooled operation (F_c, I_c) and cooled operation (F_{cw}, I_{cw}) fall within this area.

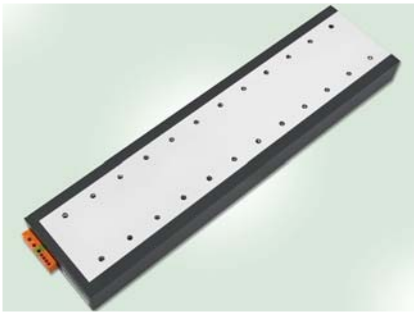
The nonlinearity of the F-I characteristic at large currents results from saturation of the magnetic circuits of a motor. This portion of the characteristic, which is naturally curved, is described in the data sheet and in the diagram by the force-current points (F_p, I_p) and (F_u, I_u). It has a variable slope which is much flatter than k_f.

The motor can be run for short periods (cyclically for ‹3 s) up to operating point (F_p, I_p) provided the average thermal power losses are taken into account. For acceleration processes this is the maximum operating point that should be used.

The limit point (F_u, I_u) must never be exceeded, as otherwise there is a risk of overloading the motor.



Force vs. current



L1A motor with terminal

All parameters are explained in the glossary.

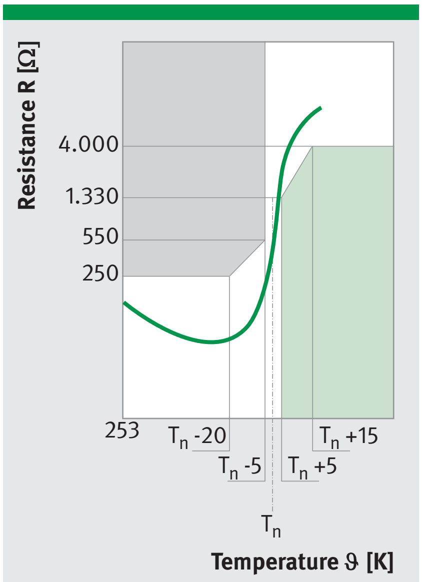
Thermal Motor Protection
Monitoring circuit I

L1B motor with cable connection

Direct drives are often being operated at their thermal performance limits. In addition, unforeseen overloads can occur during operation which result in an additional current load in excess of the permissible nominal current. For this reason, the servo controllers for motors should generally have an overload protection in order to control the motor current. Here, the effective value (root mean square) of the motor current must only be allowed to exceed the permissible nominal current of the motor for a short time. This type of indirect temperature monitoring is very quick and reliable.
IDAM motors are equipped with temperature sensors (PTC and KTY) which should be used for thermal motor protection.

Monitoring circuit I

The three phase-windings are equipped with three series-connected PTCs to ensure motor protection. A PTC is a positive temperature coefficient thermistor. Its thermal time constant when installed is below 5 s.



PTC temperature characteristics

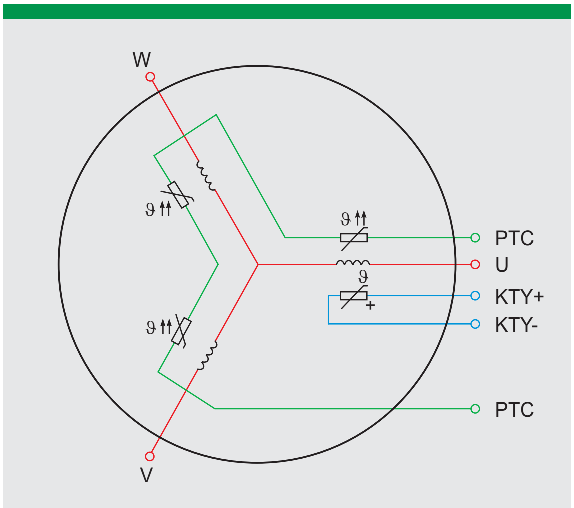
In contrast to a KTY, its resistance increases very sharply when the nominal response temperature T_n is exceeded, increasing to many times the cold value in the process.
With three PTC elements connected in series, this behaviour also generates a clear change in the overall resistance even if only one of the elements exceeds the nominal response temperature T_n.
The use of three sensors ensures that, even if the motor is at a standstill under an asymmetric phase load, there is a signal for a safe shut-down. A commercially available motor protection tripping device which is connected downstream will typically trigger between 1.5 and 3.5 kOhm. In this way, overtemperature is detected to within a discrepancy of a few degrees for every winding.

The tripping devices also react if the resistance is too low in the PTC circuit, which usually indicates a defect in the monitoring circuit. It also ensures secure electrical separation between the controller and the sensors in the motor. The motor protection tripping devices are not included in the scope of supply.
PTCs are not suitable for temperature measurements. The KTY should be used here if required.
Further monitoring sensors can be integrated at the customer’s request.

As a rule, PTC sensor signals must be monitored for protection against overtemperature.

Thermal Motor Protection

Monitoring circuit II



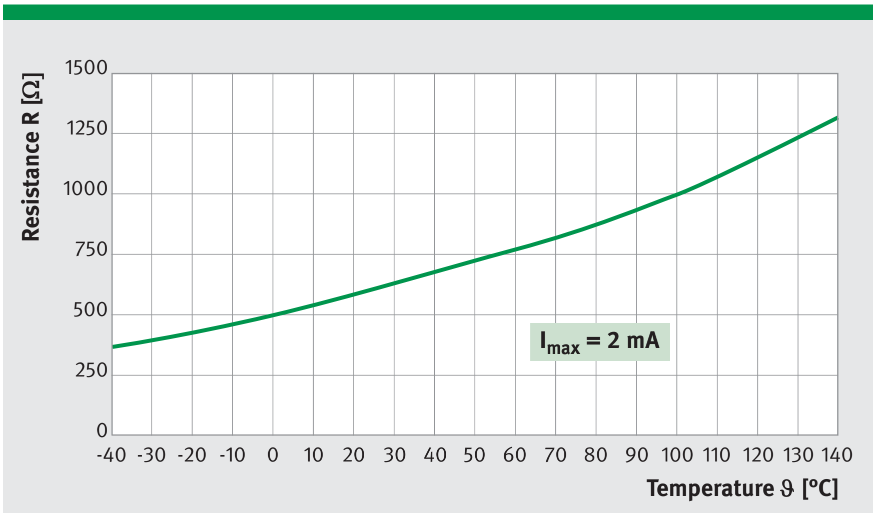
Standard connection of PTC and KTY

Monitoring circuit II

On one phase of the motor there is an additional KTY84-130. This sensor is a semiconductor resistor with a positive temperature coefficient.
A temperature-equivalent signal is generated with a delay which depends on the motor type.

In order to protect the motor against overtemperature, a shut-off limit is defined in the controller. When the motor is at a standstill, constant currents flow through the windings, with the current depending on the respective pole position.

As a result, the motor does not heat up uniformly, which may cause overheating of non-monitored windings. The PTC and KTY sensors have a basic insulation to the motor. They are not suitable for direct connection to PELV/SELV circuits according to standard DIN EN 50178.



Temperature characteristics KTY

The KTY sensor monitors a single winding. Its signal can be used to watching the temperature or issue a warning. Exclusive use for switching off is not permissible.

Electrical Connections

The standard connections of the IDAM motors are routed through the face end. The standard cable length from the point where the cable emerges from the motor is 1000 mm. Different lengths are available upon request. The cross-section of the power cable depends on the continuous motor current and is documented in the catalogue drawing. As standard, the dimensions are laid out for the continuous current I_c at P_l (non cooled) for L1A and L1B and continuous current I_{cw} at P_{lcw} (cooled) for L1C. Motor cables are available from 4G0.75 mm². The sensor cable 4 x 0.14 mm² (d = 5.1 mm) allows temperature monitoring via PTC and KTY. The wire ends are open and fitted with end sleeves. The cables which are used are UL approved and suitable for cable chains.

Motor versions with terminals (type WAGO series 236) for wires up to 1.5 mm² with end sleeves are available as an option. The cable outlets or terminals are shown in the data sheets. For terminals there is a restriction to variants without water cooling and with a continuous current of up to 16 A.

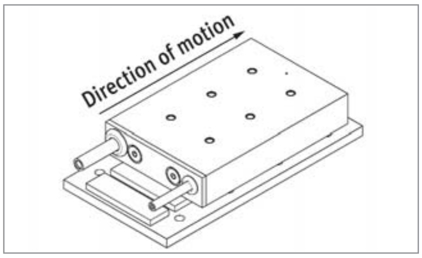
Terminal assignments

Motor Core	Terminal	
U	1	Phase U
VV	2	Phase V
WWW	3	Phase W
GNYE	4	PE
BK		Shield
Sensor		
WH	7	PTC
BN	8	PTC
GN	5	+ KTY
YE	6	- KTY

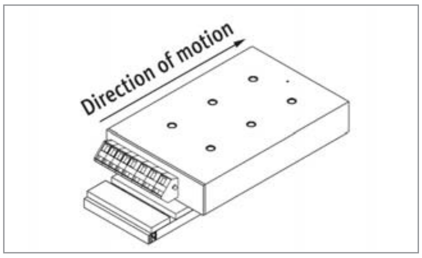
Positive direction of motor motion

On all three-phase motors the electrically positive direction of motion corresponds to a right-handed rotary field, i.e. the phase voltages are induced in the sequence U, V, W.
On IDAM motors, this positive direction of motor motion is

- in the direction of the side without cable(s)
- in the direction of the side without terminal(s).



Direction of motion with positive current feed, example: cable outlet



Direction of motion with positive current feed, example: terminal

Dimensioning of motor cables

Continuous motor current I in A	Motor cable cross-section A in mm²	Diameter d_k in mm	Bending radius, moving r_d in mm	Bending radius, static r_s in mm
≤9	0.75	7.3	73	44
≤16	1.5	10	100	60
≤22	2.5	11.6	120	70

Commutation

Synchronous motors are preferably run in commutated operation. As standard, IDAM linear motors are not equipped with Hall sensors. IDAM recommends measuring system-related commutation.

L1 motors

Insulation Resistance

Insulation resistance for link voltages of up to 600 V_{DC}

IDAM motors comply with EC directive 73/23/EEC and European standards EN 50178 and EN 60204.
Prior to delivery they are tested with differentiated high voltage testing methods and casted under vacuum.

Please make sure that the type-related operating voltages of the motors are observed.

Overvoltages at motor terminals in converter operation

Due to the extremely fast-switching power semiconductors which generate high du/dt loads, significantly higher voltage peaks than the actual converter voltages may occur at the motor terminals, particularly when longer connecting cables (from a length of about 5 m on) are used between motor and converter. This places a very high load on the motor insulation. The du/dt values of the PWM modules must not exceed 8 kV/µs. The motor connecting cables must be kept as short as possible.

In order to protect the motors, an oscilloscope should always be used in the specific configuration to measure the voltage (PWM) applied to the motor via the winding and in relation to PE. The present voltage peaks should not significantly exceed 1 kV.
From approx. 2 kV on a gradual damaging of the insulation should be expected.
IDAM engineers will assist you with your application and help you to determine and reduce excessive voltages.

Please observe the recommendations and configuration notes provided by the manufacturer of the converter.

Cooling and Cooling Circuits

Power losses and thermal losses

In addition to the power losses defined by the motor constant k_m, motors are also subject to frequency-dependent losses occurring especially at higher control frequencies (above 50 Hz). These losses jointly cause the motor and other system assemblies to heat up.

The following rule applies at low control frequencies (‹80 Hz) of the motors: Motors with a high motor constant k_m produce lower power losses in relation to comparable motors with a lower motor constant.

The power losses generated during motor operation are transmitted via the motor assembly to attached components. The overall system is carefully designed to control the way in which this heat distribution is influenced and controlled through convection, conduction and radiation.

For the L1C motors, a cooling system is available as an accessory in order to improve heat dissipation.

The continuous forces of liquid-cooled motors are around twice as high as those of non cooled motors.

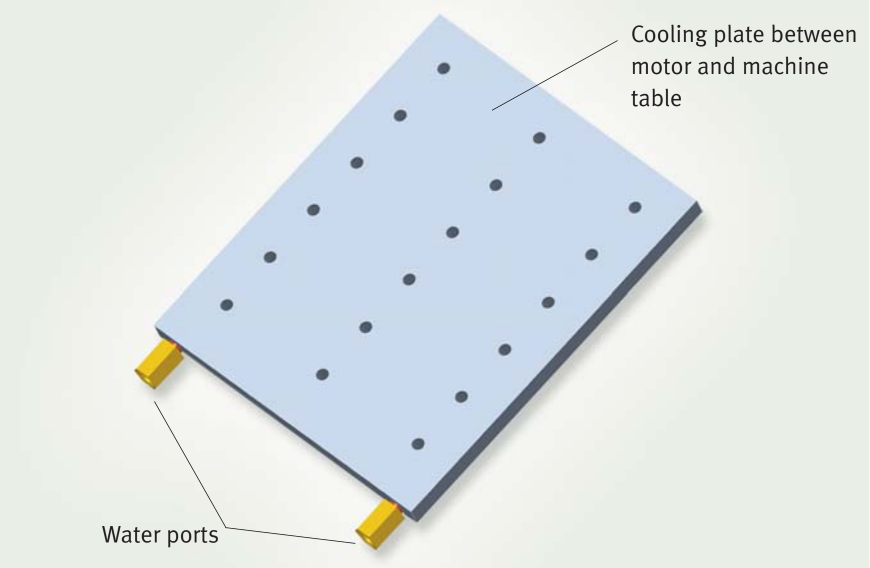
Motors must be designed and integrated into the machine concept in accordance with the requirements for installation space, accuracy and cooling.

Active cooling should be preferably used on machines with high performance and on equipment with highly dynamic operation and correspondingly high bearing loads.

If complete thermal separation of motor and machine is required (e.g. in order to prevent thermal distortion of the machine construction in high-precision machinery), then an additional thermal insulation to the machine bed and/or precision cooling is required. The actual cooling is then referred to as the main cooling or power cooling system. The motor cooling system is realized as a cooling plate between motor and machine table and should be connected by the customer to the cooling circuit of a cooling device.

Thermal insulation and cooling plates can be supplied as motor parts as an option, or they may already be an integral part of the customer's machine design. The cooling medium passes through internal copper pipes from the inlet to the outlet. Inlet and outlet connections can be assigned to the two water ports as required. The connections have an internal thread G 1/8.

When using water as the coolant, additives must be used which prevent corrosion and biological deposits in the cooling circuit.



Cooling plate for water cooling

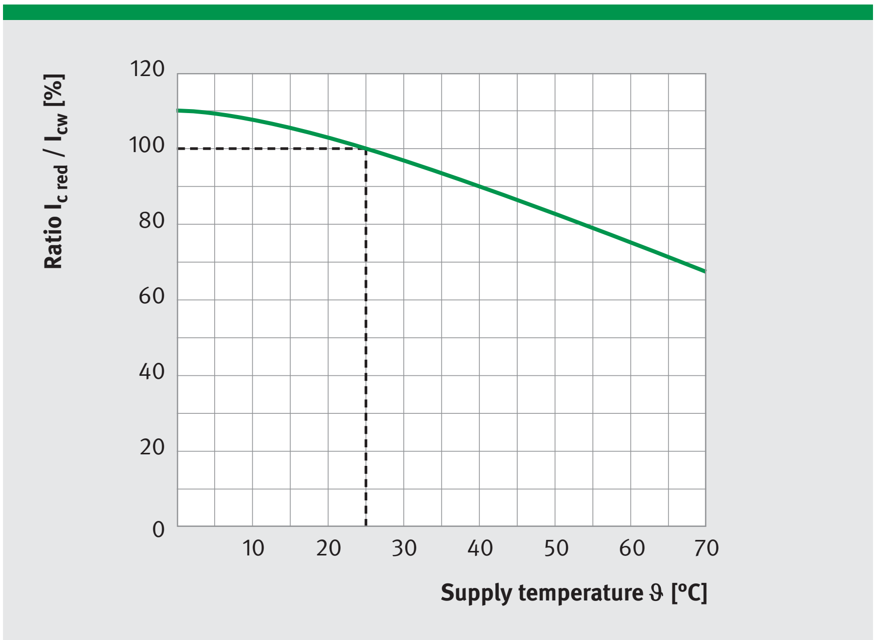
Dependency of Characteristic Data on the Supply Temperature of Cooling Medium

The continuous current I_{cw} indicated in the data sheet for water cooled operation can be achieved at a rated supply temperature ϑ_{nV} of 25 °C. Higher supply temperatures ϑ_V result in a reduction of the cooling performance and therefore also the nominal current. The reduced continuous current $I_{c\ red}$ can be calculated by the following quadratic equation:

$$\frac{I_{c\ red}}{I_{cw}} = \sqrt{\frac{\vartheta_{max} - \vartheta_V}{\vartheta_{max} - \vartheta_{nV}}}$$

$I_{c\ red}$	Reduced continuous current [A]
I_{cw}	Continuous current, cooled at ϑ_{nV} [A]
ϑ_V	Current supply temperature [°C]
ϑ_{nV}	Rated supply temperature [°C]
ϑ_{max}	Maximum permissible winding temperature [°C]

(applies to a constant motor current)



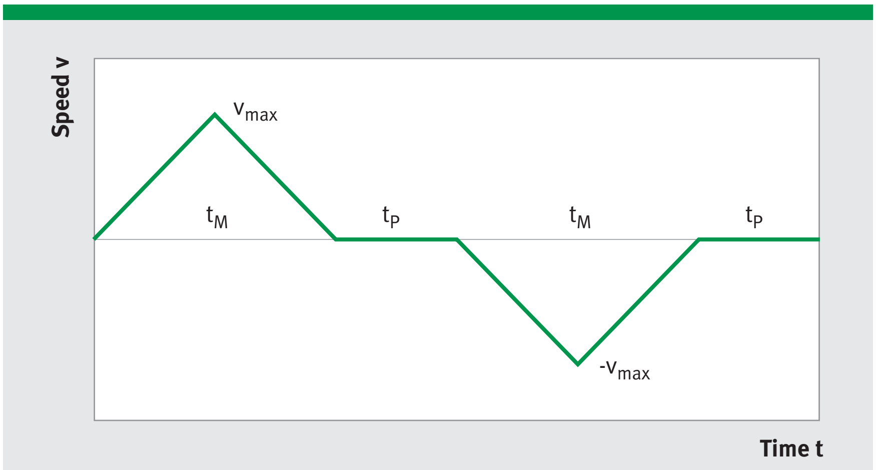
Relative continuous current $I_{c\ red}$ / I_{cw} vs. supply temperature ϑ_V (ϑ_{nV} = 25 °C)

L1C motor with terminal

Selection of Direct Drives for Linear Motions

Cycled applications

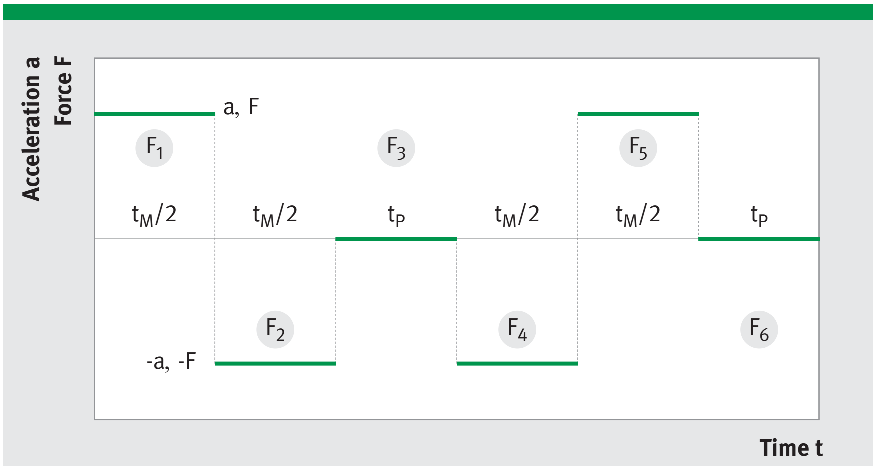
In cycled operation, sequential positioning movements are interspersed with pauses during which no motion takes place.
A simple positioning sequence takes the form of a positively accelerated motion followed by a deceleration (negative acceleration of usually the same magnitude, in which case acceleration and deceleration time are equal). The maximum speed v_{max} is reached at the end of an acceleration phase.



v-t diagram for cycled operation

A cycle is described in the v(t) diagram (v: speed, t: time). The diagram shows a forward-backward movement with pauses (t_M: motion time, t_P: dwell time with no load).

This yields the following a(t) diagram as well as the curve for the force required for the motion: **F = m · a**
(F: force in N, m: mass in kg, a: acceleration in m/s²).



a-t diagram for cycled operation

The motor is selected according to three criteria in accordance with the force curve for a desired cycle:

- maximum force in the cycle $\leq F_P$ according to the data sheet
- effective force in the cycle $\leq F_c$ (motor non cooled) or F_{cw} (motor water-cooled) according to the data sheet
- maximum speed in the cycle $\leq v_{lp}$ according to the data sheet

The effective force is equal to the root mean square of the force curve (here: six force cycles) in the cycle.

$$F_{eff} = \sqrt{\frac{F_1^2 \cdot t_1 + F_2^2 \cdot t_2 + \ldots + F_6^2 \cdot t_6}{t_1 + t_2 + \ldots + t_6}}$$

The safety factor 1.4 in the sample calculation (page 19) also takes into account the operation of the motor in the non-linear region of the force-current characteristic, for which the formula for calculating F_{eff} only applies approximately.

The forces $F_1 = F$; $F_2 = -F$; $F_3 = 0$; $F_4 = -F$; $F_5 = F$; $F_6 = 0$ and the times $t_1 = t_M/2$; $t_2 = t_M/2$; $t_3 = t_P$; $t_4 = t_M/2$; $t_5 = t_M/2$; $t_6 = t_P$ are used to calculate the effective force.

$$F_{eff} = F \cdot \sqrt{\frac{t_M}{t_M + t_P}}$$

This formula applies to the effective force only if all the forces acting in the cycle have the same magnitude (masses and accelerations are constant). Here, the term under the square root is the "sum of motion times divided by the total sum of motion times plus pause times". The denominator is therefore the cycle time.

Acceleration and maximum speed of a positioning motion are calculated with the following formulas:

$$a = \frac{4 \cdot x}{t_M^2}$$

$$v_{max} = \frac{2 \cdot x}{t_M}$$

x	Total stroke in m
t_M	Motion time in s
a	Acceleration in m/s²
v_{max}	Maximum speed in m/s

The described positioning motion is performed with a (theoretically) infinite rate of jerk. If jerk limitation is programmed into the servo converter then the positioning times are extended accordingly. In this case, greater acceleration would be needed in order to maintain unchanged positioning times.

Example: Cycled applications

Preset values:

Total stroke [m]	0.7
Motion time [s]	0.3
Cycle time [s]	1.3

Mass [kg]	10
Friction force [N]	5
Safety factor	1.4

Calculation:

Maximum speed

$$v_{max} = \frac{2 \cdot 0.7}{0.3} \text{ m/s} = 4.67 \text{ m/s}$$

Acceleration

$$a = \frac{4 \cdot 0.7}{0.3^2} \text{ m/s}^2 = 31.1 \text{ m/s}^2$$

Together with the friction force and the safety factor, this yields: maximum force

$$F_{max} = (10.0 \text{ kg} \cdot 31.1 \text{ m/s}^2 + 5 \text{ N}) \cdot 1.4 = 442.4 \text{ N}$$

Effective force

$$F_{eff} = \left(10.0 \text{ kg} \cdot 31.1 \text{ m/s}^2 \cdot \sqrt{\frac{0.3 \text{ s}}{1.3 \text{ s}}} + 5 \text{ N}\right) \cdot 1.4 = 216.2 \text{ N}$$

Motion selection, without water cooling

Compliance with conditions:

$F_{max} \le F_p$ and $F_{eff} \le F_c$

The L1A-3P-200-75-WM meets both conditions.

The speed can be achieved with a link voltage of 600 V.

Motor selection, with water cooling

Compliance with conditions:

$F_{max} \le F_p$ and $F_{eff} \le F_{cw}$

The cooling plate increases the accelerated mass by 500 g, and taking the additional mass into account the L1C-3P-100-75-WM with water cooling meets both conditions. The speed can be achieved with a link voltage of 600 V.

L1 Linear Motors
Sizes L1A, L1B

Type	Length L_1 [mm]	Width B [mm]	Height H [mm]	Peak force F_p [N]	Continuous force non cooled F_c [N]
L1A-3P-100-25	113	57	31 - 0.1	169	37
L1A-3P-100-50	113	82	31 - 0.1	338	81
L1A-3P-100-75	113	107	31 - 0.1	505	116
L1A-3P-200-25	208	57	31 - 0.1	338	72
L1A-3P-200-50	208	82	31 - 0.1	677	148
L1A-3P-200-75	208	107	31 - 0.1	1010	225

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Type	Length L_1 [mm]	Width B [mm]	Height H [mm]	Peak force F_p [N]	Continuous force non cooled F_c [N]
L1B-3P-100-25	113	57	39 - 0.1	171	52
L1B-3P-100-50	113	82	39 - 0.1	340	106
L1B-3P-100-75	113	107	39 - 0.1	507	159
L1B-3P-200-25	208	57	39 - 0.1	341	100
L1B-3P-200-50	208	82	39 - 0.1	679	200
L1B-3P-200-75	208	107	39 - 0.1	1014	299
L1B-3P-300-25	303	57	39 - 0.1	512	147
L1B-3P-300-50	303	82	39 - 0.1	1019	292
L1B-3P-300-75	303	107	39 - 0.1	1521	436

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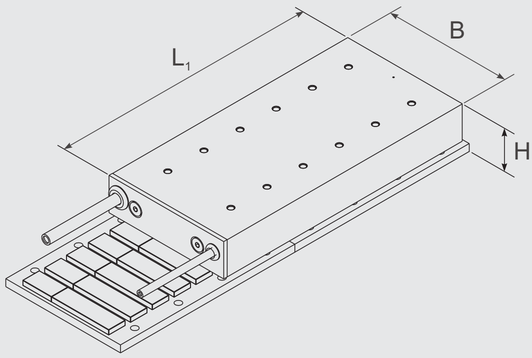

L1 Linear Motors

Sizes L1C

Type	Length L_1 [mm]	Width B [mm] depending on the thread-on variant	Height H [mm] depending on cooling options	Peak force F_p [N]	Continuous force non cooled F_c [N]	Continuous force cooled F_{cw} [N]
L1C-3P-100-50	113	82	53.5/65.5/66.5	439	131	249
L1C-3P-100-75	113	107/110	53.5/65.5/66.5	656	196	395
L1C-3P-100-100	113	132	53.5/65.5/66.5	870	259	543
L1C-3P-100-125	113	157/160	53.5/65.5/66.5	1082	322	691
L1C-3P-100-150	113	182	53.5/65.5/66.5	1293	387	838
L1C-3P-200-50	208	82	53.5/65.5/66.5	878	247	488
L1C-3P-200-75	208	107/110	53.5/65.5/66.5	1311	366	776
L1C-3P-200-100	208	132	53.5/65.5/66.5	1740	487	1067
L1C-3P-200-125	208	157/160	53.5/65.5/66.5	2165	605	1357
L1C-3P-200-150	208	182	53.5/65.5/66.5	2586	724	1645
L1C-3P-300-50	303	82	53.5/65.5/66.5	1317	361	728
L1C-3P-300-75	303	107/110	53.5/65.5/66.5	1967	540	1157
L1C-3P-300-100	303	132	53.5/65.5/66.5	2610	717	1590
L1C-3P-300-125	303	157/160	53.5/65.5/66.5	3247	890	2022
L1C-3P-300-150	303	182	53.5/65.5/66.5	3878	1066	2452
L1C-3P-400-50	398	82	53.5/65.5/66.5	1757	480	967
L1C-3P-400-75	398	107/110	53.5/65.5/66.5	2622	709	1538
L1C-3P-400-100	398	132	53.5/65.5/66.5	3480	942	2113
L1C-3P-400-125	398	157/160	53.5/65.5/66.5	4330	1169	2688
L1C-3P-400-150	398	182	53.5/65.5/66.5	5171	1399	3259

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An overview of peak and continuous forces for the individual motor series can be found on the inside of the back cover.

L1 Linear Motors
Features

L1 linear motors are slotted, permanent magnet-excited AC synchronous motors. The coils of the primary part are fitted in slots on the armature stamping. The secondary part comprises an iron base onto which permanent magnets are fastened.

L1 motors are optimised for ultimate efficiency, which means: maximum force in the available installation space at nominal speed with low power losses.

They excel by low accelerated mass and compact dimensions.

The benefits of the L1 motors include an optimal design and thermal integration into the peripheral structure as well as comprehensive adjustment to the overall requirements of the drive system.

Linear motor: L1A

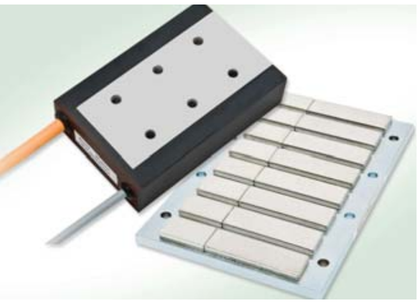
- Installation height of only 31 mm
- Very compact design
- Excellent force-to-mass ratio

Linear motor: L1B

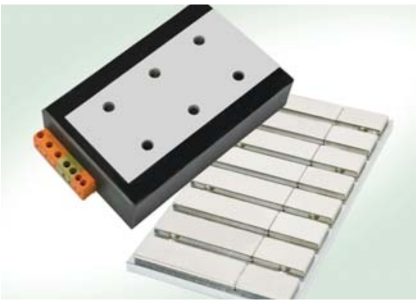
- Installation height of only 39 mm
- Applications with optimised thermal power loss in comparison to L1A
- Higher continuous force than L1A with the same heat generation

Linear motor: L1C

- Installation height 53.5 mm (without cooling plate), 65.5 mm (with cooling plate) or 66.5 mm (with cooling plate and thermal insulation)
- Applications with optimised thermal power loss in comparison to L1B
- Higher continuous force than L1B with equal heat generation
- Cooling options: Cooling plate, thermal insulation to machine bed



L1 motor with cable connection



L1 motor with terminal

L1 Linear Motors

Areas of use, applications, advantages

Areas of use

- Semiconductor industry
- Printed circuit-board processing
- Packaging industry
- Food industry
- Machine tools
- Placement at production lines
- Assembly and handling technology

Applications

Applications with high requirements in terms of accuracy and dynamic performance, plus with limited installation space

- Feed systems
- Laser/water jet cutting systems
- Manipulator operation
- PCB handling systems
- Wafer positioning systems
- AOI systems

Advantages

- High acceleration and deceleration capacity thanks to a significantly better force-to-mass ratio than conventional motors
- Higher speed than conventional motors
- High static and dynamic load rigidity
- Accurate positioning without overshooting
- Excellent constant-velocity properties
- Compact design
- Maintenance-free drive with zero backlash
- Active cooling options

LDDS60 push rod system with a stroke of 170 mm

MKUVS42-LM - high-speed handling

Handling system precision blanking with direct drives

L1A Linear Motors

Type designation for primary parts

Primary part

L1A - 3P - L - B - X - X - X - X - PRIM

Type, design
L1 Linear motor (primary part), laminated
A Flat

Number of motor phases
3P 3-phase

Length classification of coil system
100 mm, 200 mm

Width of magnetic track
25 mm, 50 mm, 75 mm

Winding design
WM Standard
WX Special variant

Cooling variant
O Standard (without)
S Special variant

Temperature monitoring
O Standard (PTC triple sensors at the phases U, V, W, KTY84-130 on one phase)
S Special variant

Connection variant
G Standard, fixed cables for motor and sensor Cable length 1.0 m
W Terminal
S Special variant

Motor part
PRIM Primary part

L1A Linear Motors

Type designation for secondary parts for L1A and L1B

Secondary part

L1 - B - L - X - X - SEK

Type, design
L1 Secondary part for L1A and L1B primary parts

Width of magnetic track
25 mm, 50 mm, 75 mm (100 mm on request)

Length of secondary part
38 mm, 152 mm
(Special variants in raster n x 19 mm on request)

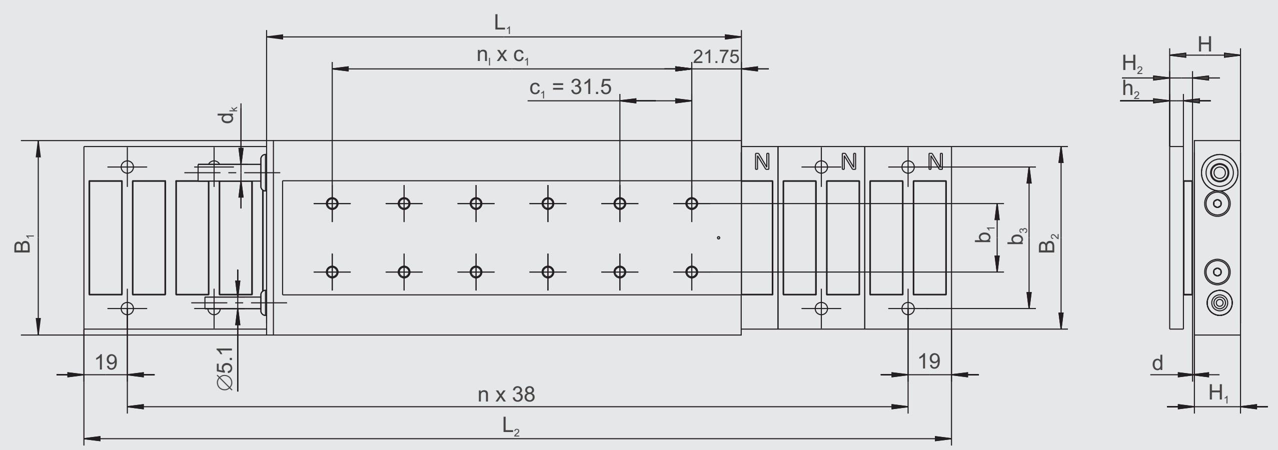
Magnet cover
O Standard (without)
S Special variant (stainless steel)

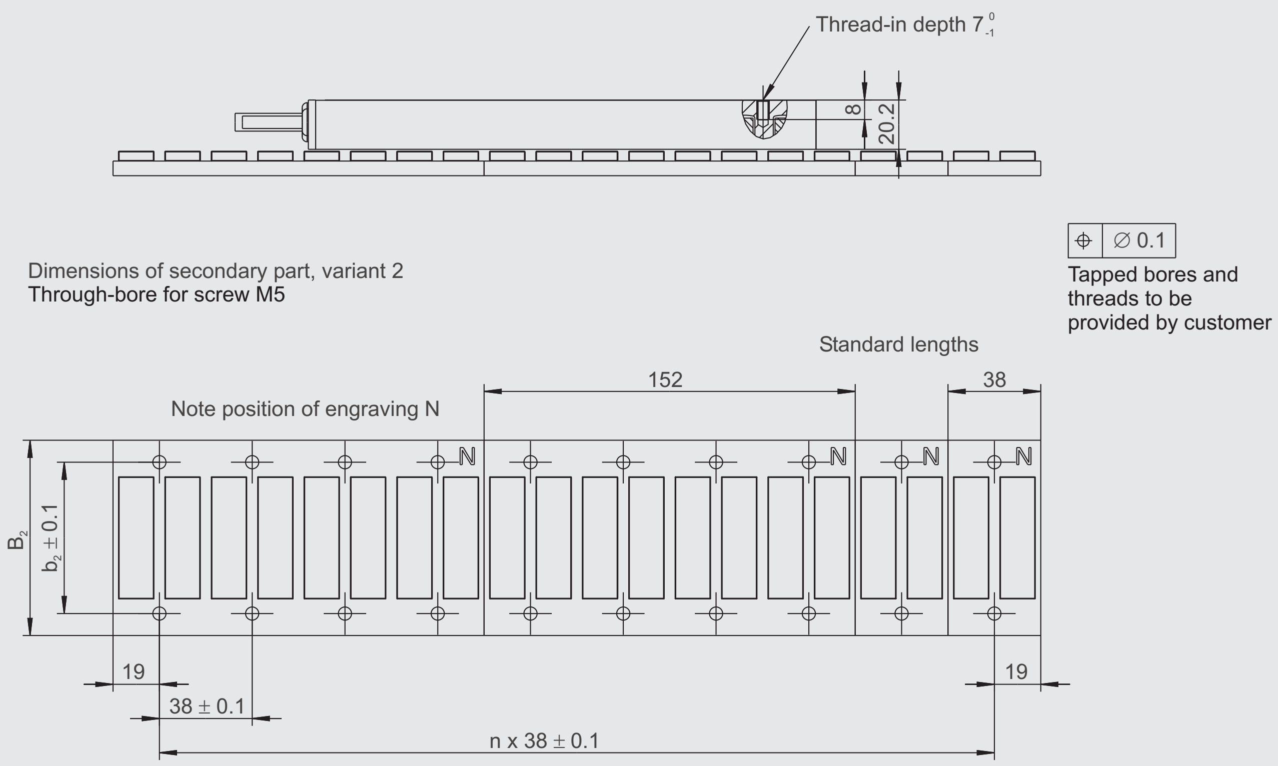
Fastening variant
1 Tapped bore M5 (special variant)
2 Through-bore for bolt M5 DIN 6912 (standard)

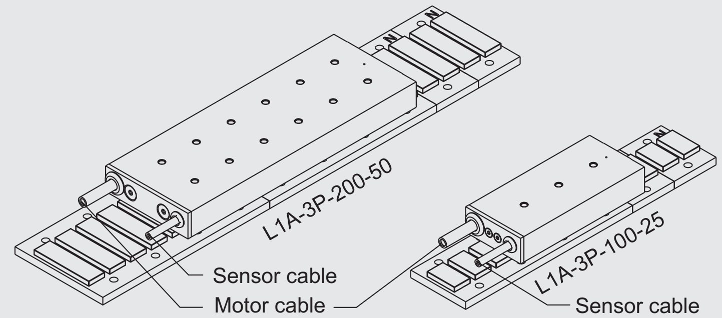
Motor part
SEK Secondary part

L1A Linear Motors

Standard: Primary part with cable connection, secondary part with through-bore (variant 2)

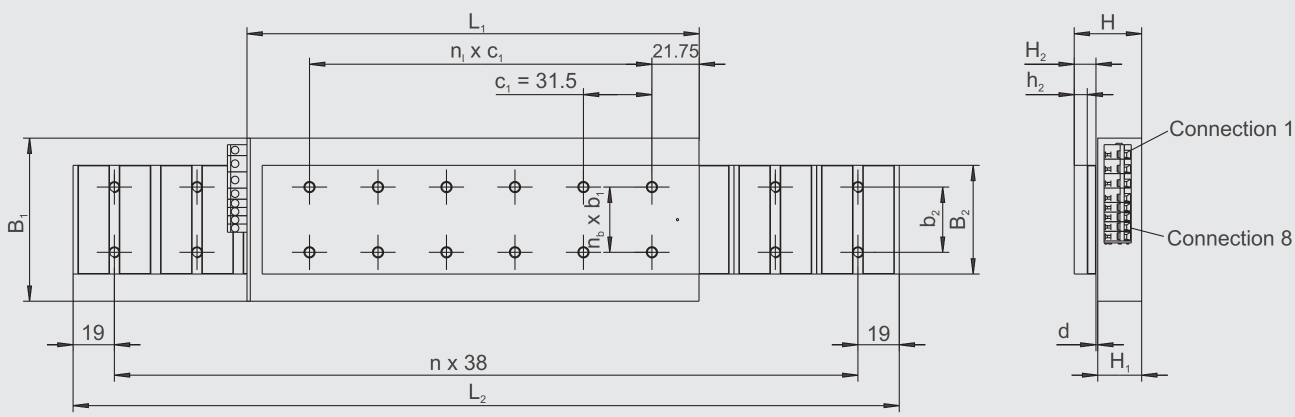


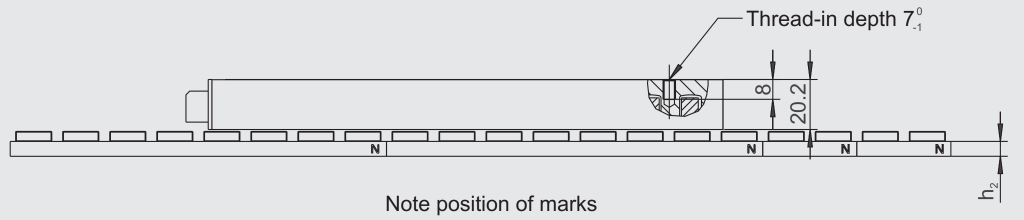




L1A Linear Motors

Primary part with terminal, secondary part with tapped bore (variant 1)

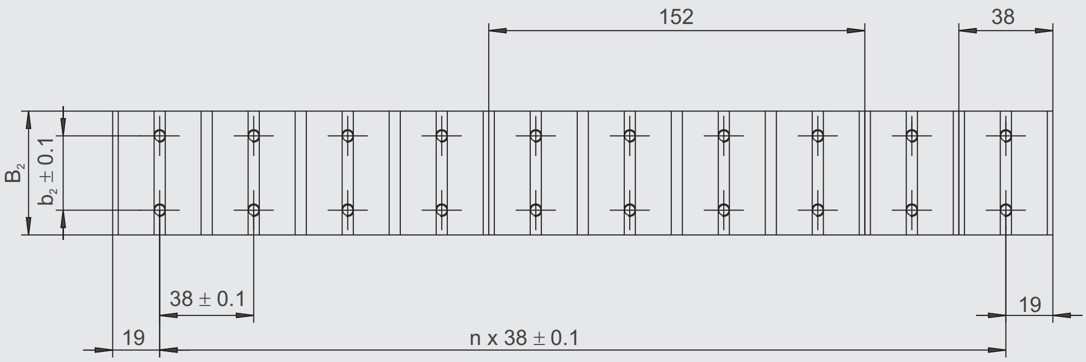


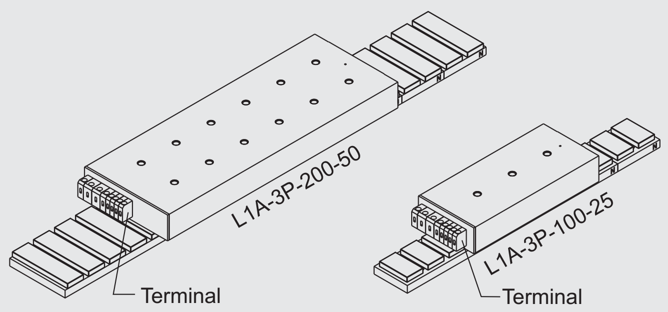


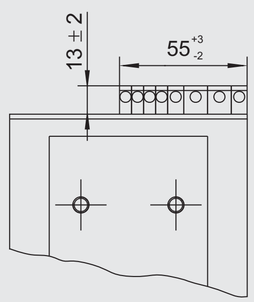
Dimensions of secondary part, variant 1
Tapped bore M5 - thread-in length 5 ± 0.5

⌖ ∅ 0.1
Tapped bores and threads to be provided by customer

Standard lengths







L1A-3P-100-B
Technical data I

Primary part	Symbol	Unit	L1A-3P-100-25-WM	L1A-3P-100-50-WM	L1A-3P-100-75-WM
Length	L_1	mm	113	113	113
Width	B_1	mm	57	82	107
Height	H_1	mm	20.2	20.2	20.2
Mass	m_1	kg	0.5	0.8	1.2
Thread M5, quantity (length x width)	-	-	3 x 1	3 x 2	3 x 2
Thread M5, distance/length	n_l x c_1	mm	2 x 31.5	2 x 31.5	2 x 31.5
Thread M5, distance/width	n_b x b_1	mm	-	1 x 30	1 x 55
Motor cable diameter	d_K	mm	7.3	7.3	7.3
Standard: Secondary part, through-bore (variant 2)					
Width	B_2	mm	50	80	100
Mass, length 38/length 152	m_2	kg/unit	0.11/0.44	0.19/0.76	0.24/0.96
Height of magnetic base	h_2	mm	6	6	6
Height	H_2	mm	10	10	10
Through-bore for screw M5 DIN 6912	b_3	mm	37	62	87
Secondary part, tapped bore (variant 1)					
Width	B_2	mm	30	50	80
Mass, length 38/length 152	m_2	kg/unit	0.076/0.30	0.13/0.52	0.21/0.84
Height of magnetic base	h_2	mm	6	6	6
Height	H_2	mm	10	10	10
Thread M5 (from below)	b_2	mm	15	30	55
Installation dimensions: L1A-3P-L-B					
Overall height PRIM + SEK	H	mm	31 - 0.1	31 - 0.1	31 - 0.1
Mech. air gap	d	mm	approx. 0.8	approx. 0.8	approx. 0.8
Max. width	B	mm	57	82	107
Length of secondary part (38 mm grid)	L_2	mm	L_1 + stroke	L_1 + stroke	L_1 + stroke
Cable length	L_K	mm	≈ 1000	≈ 1000	≈ 1000

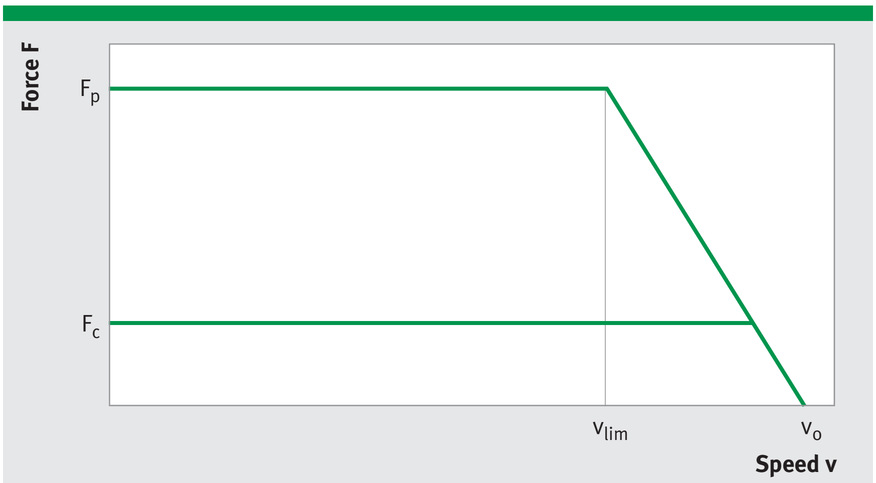
Note: The size specified for the air gap d is an auxiliary dimension and may fluctuate. The only technically relevant dimension is the specified overall installation height H, which must be complied with. A stainless steel cover can be ordered separately for the secondary parts. (The stainless steel cover is not included in the standard equipment.)
Subject to modification without previous notice.

L1A-3P-100-B

Technical data II

Performance data	Symbol	Unit	L1A-3P-100-25-WM	L1A-3P-100-50-WM	L1A-3P-100-75-WM
Ultimate force at I_u	F_u	N	199	398	594
Peak force (saturation range) at I_p	F_p	N	169	338	505
Peak force (linear range) at I_{pl}	F_{pl}	N	117	235	351
Continuous force at I_c	F_c	N	37	81	116
Power loss at I_p (25 °C)	P_{lp}	W	469	682	895
Power loss at I_{pl} (25 °C)	P_{lpl}	W	163	238	312
Power loss at I_c (25 °C)	P_{lc}	W	17	28	34
Motor constant (25 °C)	k_m	N/√W	9.2	15.2	19.9
Damping constant (short-circuit)	k_d	N/(m/s)	84	232	394
Electric time constant	τ_{el}	ms	2.75	3.78	4.32
Attraction force	F_a	N	584	1168	1752
Ripple force (typical cogging)	F_r	N	6	12	18
Pole pair width	$2\tau_p$	mm	38	38	38

Subject to modification without previous notice.
Tolerance range for values: ±5% • Tolerance range for values “attraction force” and “ripple force”: ±10%



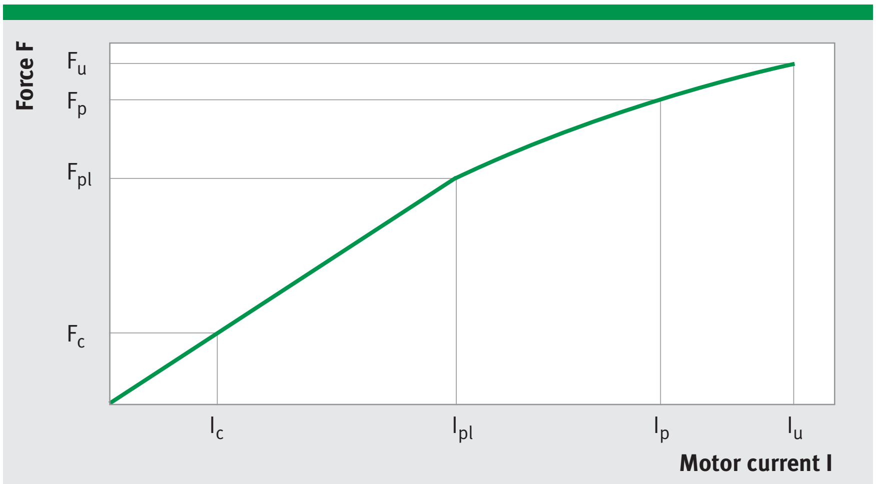
Force vs. speed

The achievable speed limit depends on operating voltage (U_{DCL}) and current (force).
The diagram shows the idealised envelope with the key operating points at peak current (F_p, v_{lim}) and at idle (F_o, v_o).

L1A-3P-100-B
Technical data III

Winding data	Symbol	Unit	L1A-3P-100-25-WM	L1A-3P-100-50-WM	L1A-3P-100-75-WM
Force constant	k_f	N/A_{rms}	17.4	34.9	52.1
Back EMF constant, phase-to-phase	k_u	V/(m/s)	14.3	28.5	42.6
Limit speed at I_p and U_{DCL} = 300 V_{DC}	v_{lim}	m/s	13.0	6.0	3.8
Limit speed at I_p and U_{DCL} = 600 V_{DC}	v_{lim}	m/s	27.3	13.2	8.6
Electric resistance, phase-to-phase (25 °C)	R_{25}	Ω	2.40	3.49	4.58
Inductance, phase-to-phase	L	mH	6.60	13.20	19.80
Ultimate current	I_u	A_{rms}	14.3	14.3	14.3
Peak current (in the saturation range)	I_p	A_{rms}	11.4	11.4	11.4
Peak current (linear range)	I_{pl}	A_{rms}	6.7	6.7	6.7
Continuous current	I_c	A_{rms}	2.1	2.3	2.2
Permissible temperature (at sensor)	ϑ	°C	100	100	100
Max. link voltage	U_{DCL}	V	600	600	600

Subject to modification without previous notice.
Tolerance range for values: ±5% • Tolerance range for values "resistance" and "inductance": ±10%



Force vs. current

Note:
The winding variant WM (standard) described above is suitable for moderately dynamic performance requirements. The winding variants WL and WH suitable for lower and higher dynamic performance requirements are available upon request. The integrated temperature sensors do not display the exact winding temperature. Depending on current load, the winding temperature may be up to approx. 30 K higher.

L1A-3P-200-B
Technical data I

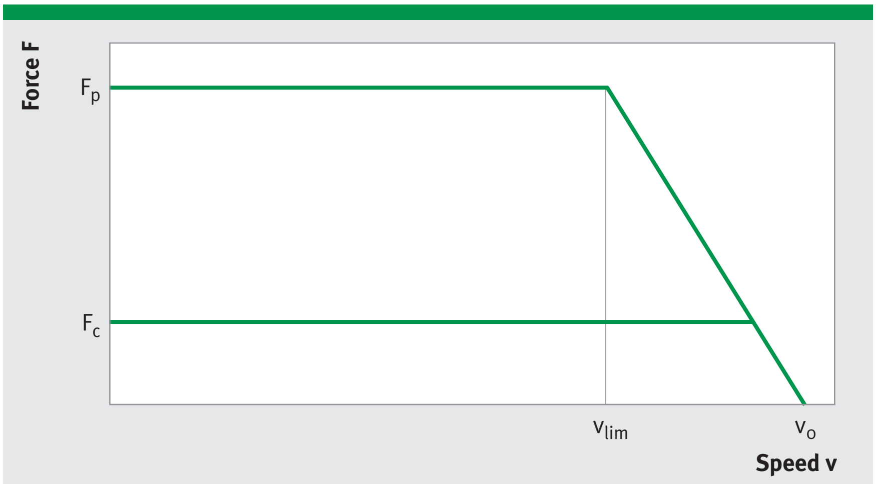
Primary part	Symbol	Unit	L1A-3P-200-25-WM	L1A-3P-200-50-WM	L1A-3P-200-75-WM
Length	L_1	mm	208	208	208
Width	B_1	mm	57	82	107
Height	H_1	mm	20.2	20.2	20.2
Mass	m_1	kg	0.9	1.6	2.2
Thread M5, quantity (length x width)	-	-	6 x 1	6 x 2	6 x 2
Thread M5, distance/length	$n_l \times c_1$	mm	5 x 31.5	5 x 31.5	5 x 31.5
Thread M5, distance/width	$n_b \times b_1$	mm	-	1 x 30	1 x 55
Motor cable diameter	d_K	mm	7.3	7.3	7.3
Standard: Secondary part, through-bore (variant 2)					
Width	B_2	mm	50	80	100
Mass, length 38/length 152	m_2	kg/unit	0.11/0.44	0.19/0.76	0.24/0.96
Height of magnetic base	h_2	mm	6	6	6
Height	H_2	mm	10	10	10
Through-bore for screw M5 DIN 6912	b_3	mm	37	62	87
Secondary part, tapped bore (variant 1)					
Width	B_2	mm	30	50	80
Mass, length 38/length 152	m_2	kg/unit	0.076/0.30	0.13/0.52	0.21/0.84
Height of magnetic base	h_2	mm	6	6	6
Height	H_2	mm	10	10	10
Thread M5 (from below)	b_2	mm	15	30	55
Installation dimensions: L1A-3P-L-B					
Overall height PRIM + SEK	H	mm	31 - 0.1	31 - 0.1	31 - 0.1
Mech. air gap	d	mm	approx. 0.8	approx. 0.8	approx. 0.8
Max. width	B	mm	57	82	107
Length of secondary part (38 mm grid)	L_2	mm	L_1 + stroke	L_1 + stroke	L_1 + stroke
Cable length	L_K	mm	≈ 1000	≈ 1000	≈ 1000

Note: The size specified for the air gap d is an auxiliary dimension and may fluctuate. The only technically relevant dimension is the specified overall installation height H, which must be complied with. A stainless steel cover can be ordered separately for the secondary parts. (The stainless steel cover is not included in the standard equipment.)
Subject to modification without previous notice.

L1A-3P-200-B
Technical data II

Performance data	Symbol	Unit	L1A-3P-200-25-WM	L1A-3P-200-50-WM	L1A-3P-200-75-WM
Ultimate force at I_u	F_u	N	398	796	1188
Peak force (saturation range) at I_p	F_p	N	338	677	1010
Peak force (linear range) at I_{pl}	F_{pl}	N	235	470	701
Nominal force at I_c	F_c	N	72	148	225
Power loss at I_p (25 °C)	P_{lp}	W	938	1364	1774
Power loss at I_{pl} (25 °C)	P_{lpl}	W	327	475	618
Power loss at I_c (25 °C)	P_{lc}	W	31	47	64
Motor constant (25 °C)	k_m	$N/\sqrt{W}$	13.0	21.6	28.2
Damping constant (short-circuit)	k_d	N/(m/s)	169	465	796
Electric time constant	τ_{el}	ms	2.99	4.11	4.74
Attraction force	F_a	N	1128	2256	3383
Ripple force (typical cogging)	F_r	N	7	14	21
Pole pair width	$2\tau_p$	mm	38	38	38

Subject to modification without previous notice.
Tolerance range for values: ±5% • Tolerance range for values “attraction force” and “ripple force”: ±10%



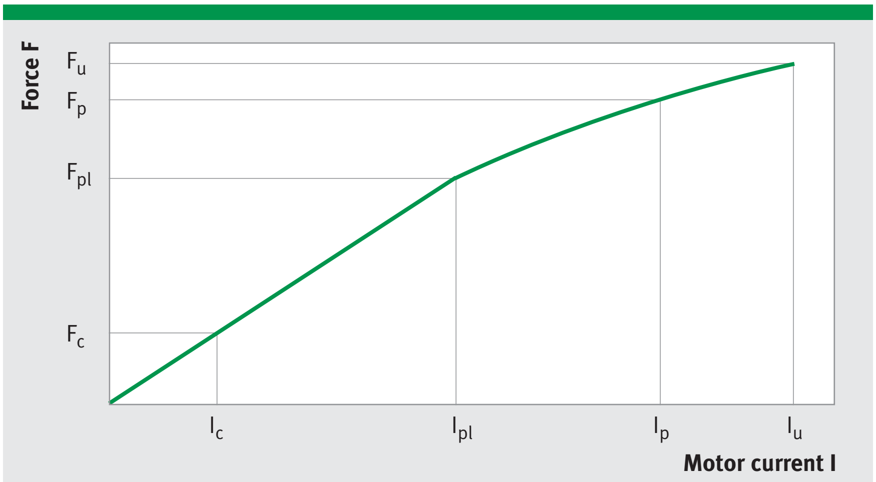
Force vs. speed

The achievable speed limit depends on operating voltage (U_{DCL}) and current (force).
The diagram shows the idealised envelope with the key operating points at peak current (F_p, v_{lim}) and at idle (F_o, v_o).

L1A-3P-200-B
Technical data III

Winding data	Symbol	Unit	L1A-3P-200-25-WM	L1A-3P-200-50-WM	L1A-3P-200-75-WM
Force constant	k_f	N/A_{rms}	34.9	69.8	75.0
Back EMF constant, phase-to-phase	k_u	V/(m/s)	28.5	57.1	61.4
Limit speed at I_p and U_{DCL} = 300 V_{DC}	v_{lim}	m/s	5.5	2.3	2.2
Limit speed at I_p and U_{DCL} = 600 V_{DC}	v_{lim}	m/s	12.7	5.9	5.6
Electric resistance, phase-to-phase (25 °C)	R_{25}	Ω	4.80	6.98	4.72
Inductance, phase-to-phase	L	mH	14.35	28.70	22.36
Ultimate current	I_u	A_{rms}	14.3	14.3	19.8
Peak current (in the saturation range)	I_p	A_{rms}	11.4	11.4	15.8
Peak current (linear range)	I_{pl}	A_{rms}	6.7	6.7	9.3
Continuous current	I_c	A_{rms}	2.1	2.1	3.0
Permissible temperature (at sensor)	ϑ	°C	100	100	100
Max. link voltage	U_{DCL}	V	600	600	600

Subject to modification without previous notice.
Tolerance range for values: ±5% • Tolerance range for values “resistance” and “inductance”: ±10%



Force vs. current

Note:
The winding variant WM (standard) described above is suitable for moderately dynamic performance requirements. The winding variants WL and WH suitable for lower and higher dynamic performance requirements are available upon request. The integrated temperature sensors do not display the exact winding temperature. Depending on current load, the winding temperature may be up to approx. 30 K higher.

L1B Linear Motors

Type designation for primary parts

Primary part

L1B - 3P - L - B - X - X - X - X - PRIM

Type, design
L1 Linear motor (primary part), laminated
B High

Number of motor phases
3P 3-phase

Length classification of coil system
100 mm, 200 mm

Width of magnetic track
25 mm, 50 mm, 75 mm

Winding design
WM Standard
WX Special variant

Cooling variant
O Standard (without)
S Special variant

Temperature monitoring
O Standard (PTC triple sensors at the phases U, V, W, KTY84-130 on one phase)
S Special variant

Connection variant
G Standard, fixed cables for motor and sensor Cable length 1.0 m
W Terminal
S Special variant

Motor part
PRIM Primary part

L1B Linear Motors

Type designation for secondary parts for L1A and L1B

Secondary part
L1 - B - L - X - X - SEK

Type, design
L1 Secondary part for L1A and L1B primary parts

Width of magnetic track
25 mm, 50 mm, 75 mm (100 mm on request)

Length of secondary part
38 mm, 152 mm
(Special variants in raster n x 19 mm on request)

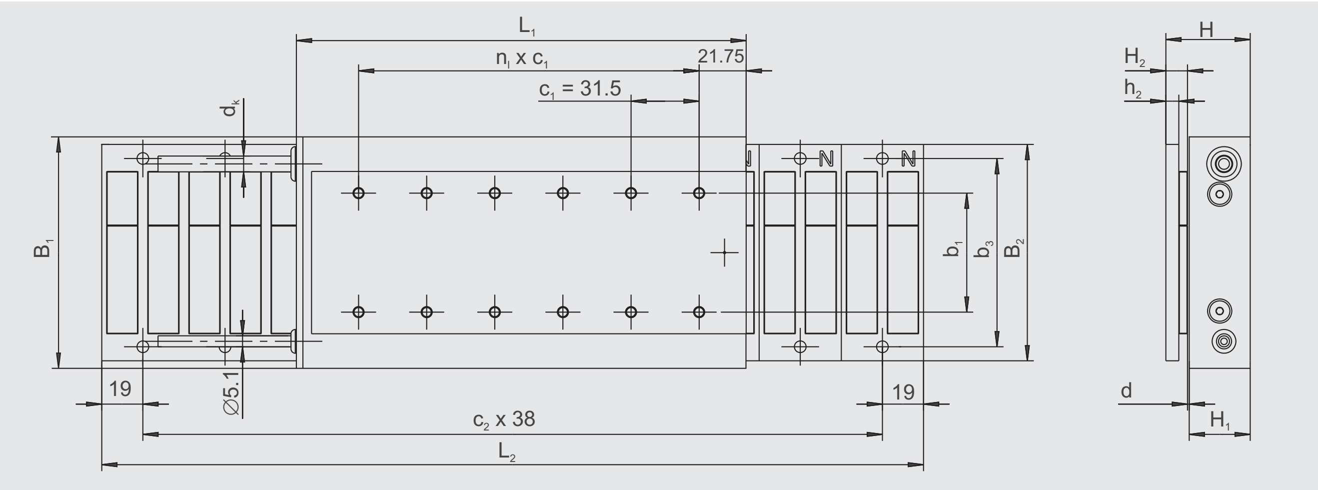
Magnet cover
O Standard (without)
S Special variant (stainless steel)

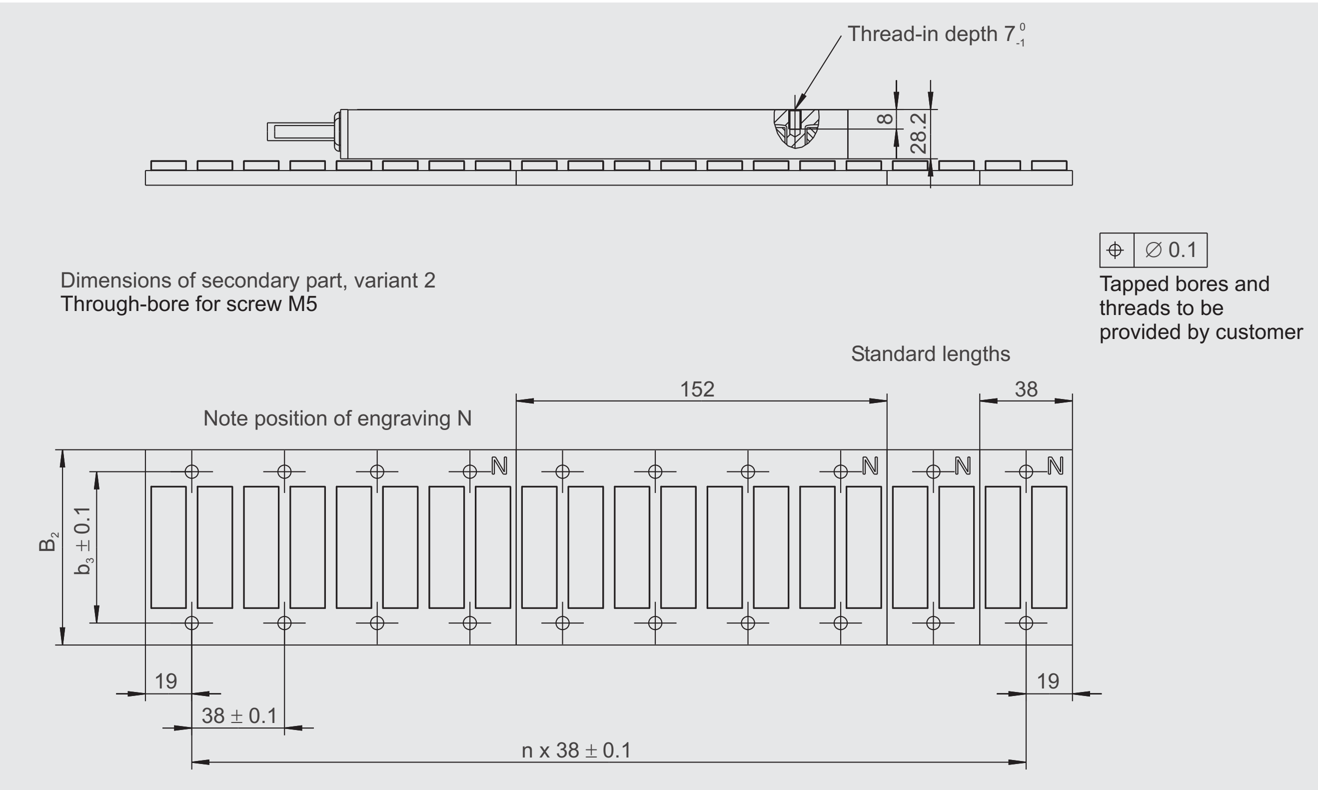
Fastening variant
1 Tapped bore M5 (special variant)
2 Through-bore for bolt M5 DIN 6912 (standard)

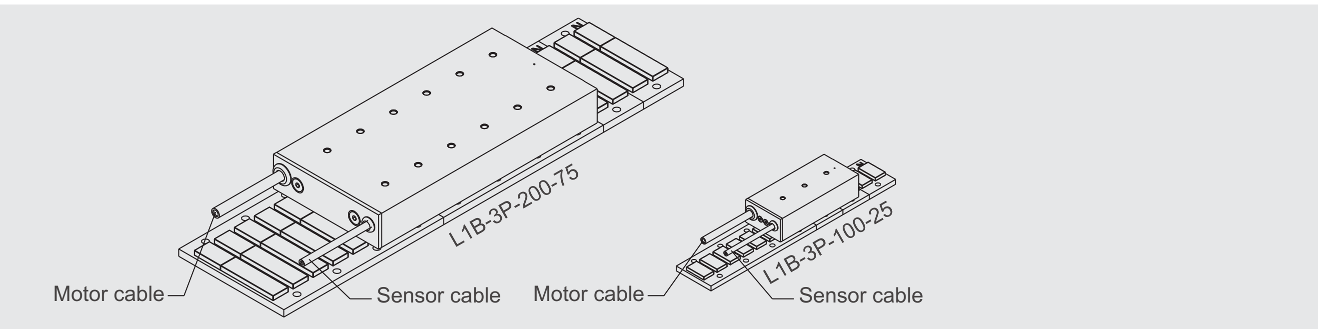
Motor part
SEK Secondary part

L1B Linear Motors

Standard: Primary part with cable connection, secondary part with through-bore (variant 2)

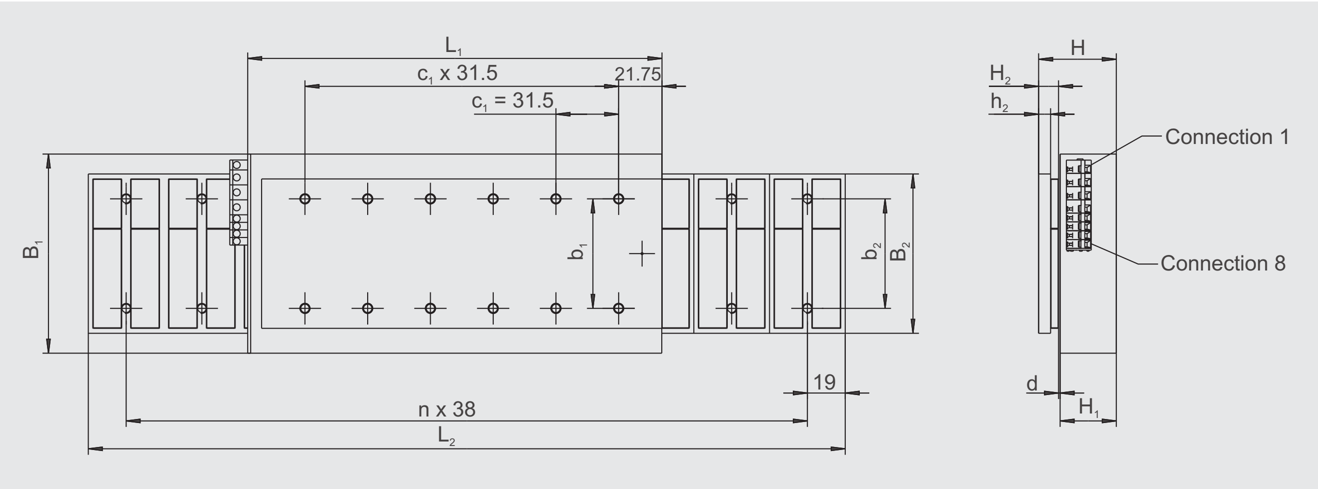


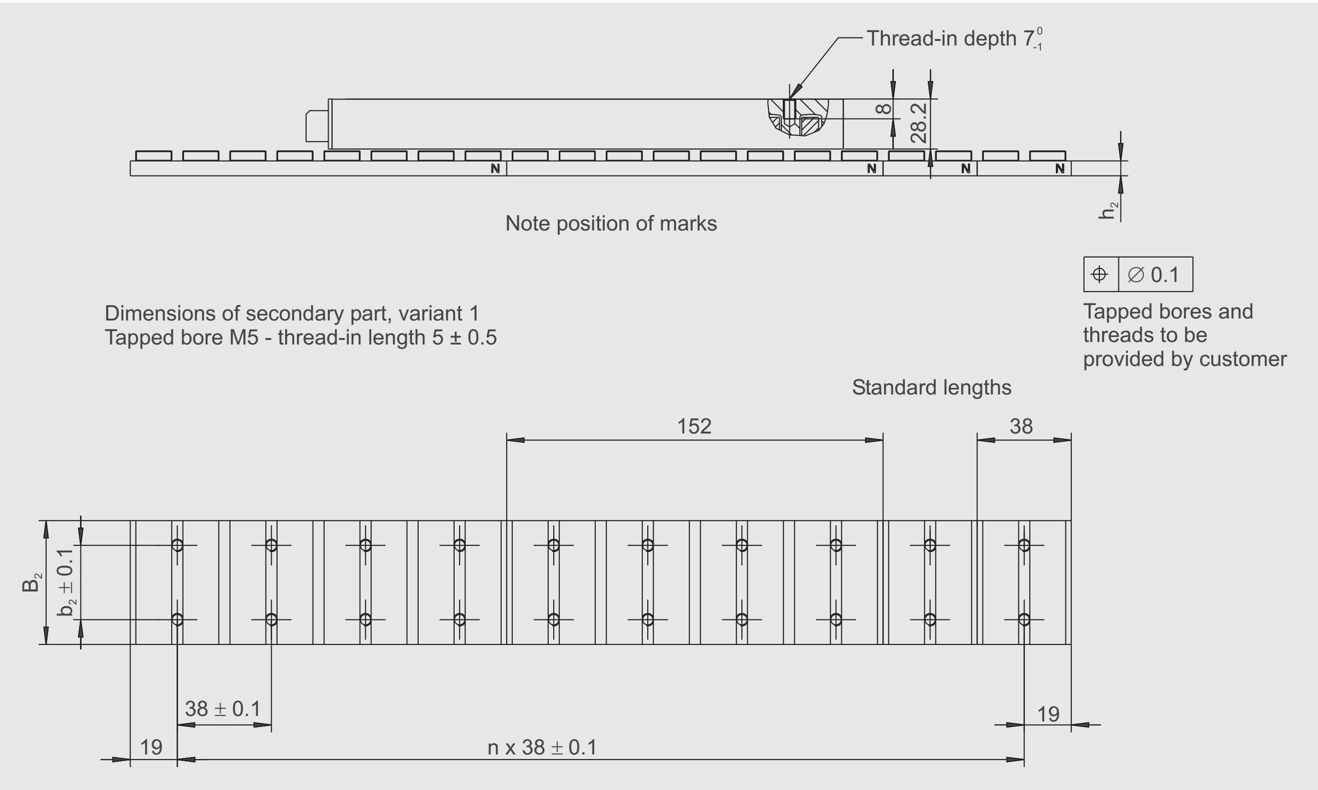


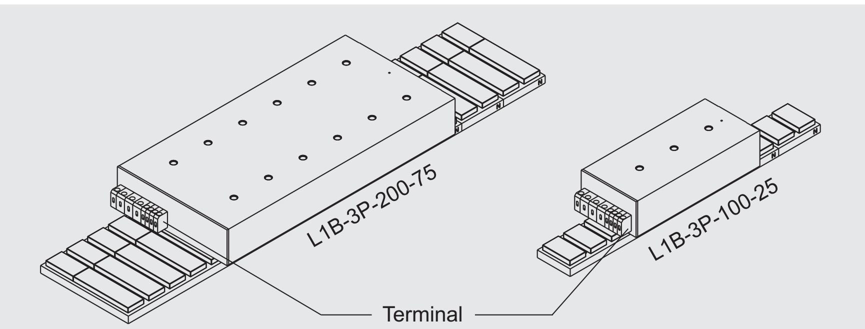


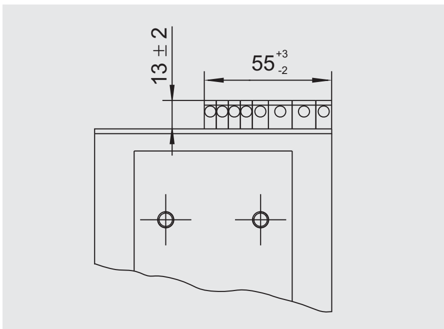
L1B Linear Motors

Primary part with terminal, secondary part with tapped bore (variant 1)









L1B-3P-100-B
Technical data I

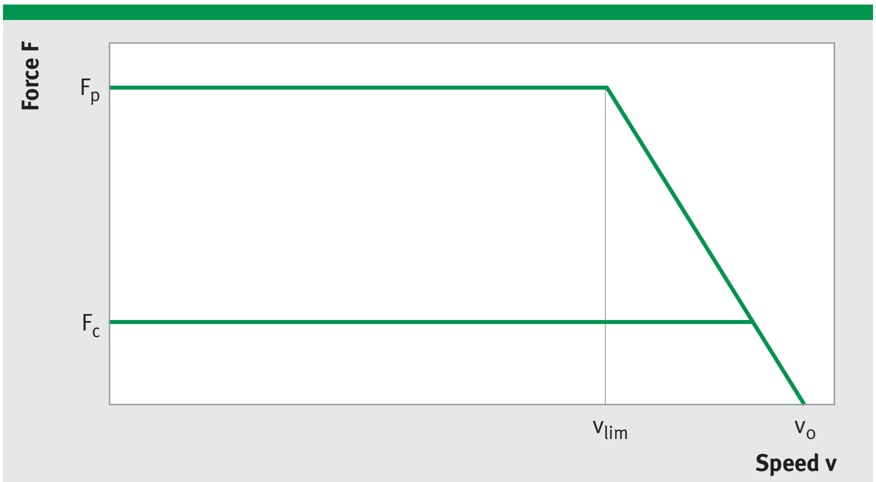
Primary part	**Symbol**	**Unit**	**L1B-3P-100-25-WM**	**L1B-3P-100-50-WM**	**L1B-3P-100-75-WM**
Length	L_1	mm	113	113	113
Width	B_1	mm	57	82	107
Height	H_1	mm	28.2	28.2	28.2
Mass	m_1	kg	0.7	1.2	1.7
Thread M5, quantity (length x width)	-	-	3 x 1	3 x 2	3 x 2
Thread M5, distance/length	$n_l \times c_1$	mm	2 x 31.5	2 x 31.5	2 x 31.5
Thread M5, distance/width	$n_b \times b_1$	mm	-	1 x 30	1 x 55
Motor cable diameter	d_K	mm	7.3	7.3	7.3
Standard: Secondary part, through-bore (variant 2)					
Width	B_2	mm	50	80	100
Mass, length 38/length 152	m_2	kg/unit	0.11/0.44	0.19/0.76	0.24/0.96
Height of magnetic base	h_2	mm	6	6	6
Height	H_2	mm	10	10	10
Through-bore for screw M5 DIN 6912	b_3	mm	37	62	87
Secondary part, tapped bore (variant 1)					
Width	B_2	mm	30	50	80
Mass, length 38/length 152	m_2	kg/unit	0.076/0.30	0.13/0.52	0.21/0.84
Height of magnetic base	h_2	mm	6	6	6
Height	H_2	mm	10	10	10
Thread M5 (from below)	b_2	mm	15	30	55
Installation dimensions: L1B-3P-L-B					
Overall height PRIM + SEK	H	mm	39 - 0.1	39 - 0.1	39 - 0.1
Mech. air gap	d	mm	approx. 0.8	approx. 0.8	approx. 0.8
Max. width	B	mm	57	82	107
Length of secondary part (38 mm grid)	L_2	mm	L_1 + stroke	L_1 + stroke	L_1 + stroke
Cable length	L_K	mm	≈ 1000	≈ 1000	≈ 1000

Note: The size specified for the air gap d is an auxiliary dimension and may fluctuate. The only technically relevant dimension is the specified overall installation height H, which must be complied with. A stainless steel cover can be ordered separately for the secondary parts. (The stainless steel cover is not included in the standard equipment.)
Subject to modification without previous notice.

L1B-3P-100-B
Technical data II

Performance data	Symbol	Unit	L1B-3P-100-25-WM	L1B-3P-100-50-WM	L1B-3P-100-75-WM
Ultimate force at I_u	F_u	N	200	398	594
Peak force (saturation range) at I_p	F_p	N	171	340	507
Peak force (linear range) at I_{pl}	F_{pl}	N	113	225	335
Continuous force at I_c	F_c	N	52	106	159
Power loss at I_p (25 °C)	P_{lp}	W	317	464	610
Power loss at I_{pl} (25 °C)	P_{lpl}	W	89	130	171
Power loss at I_c (25 °C)	P_{lc}	W	19	29	38
Motor constant (25 °C)	k_m	$N/\sqrt{W}$	12.0	19.7	25.6
Damping constant (short-circuit)	k_d	N/(m/s)	144	389	658
Electric time constant	τ_{el}	ms	5.19	7.09	8.08
Attraction force	F_a	N	584	1168	1752
Ripple force (typical cogging)	F_r	N	6	12	18
Pole pair width	$2\tau_p$	mm	38	38	38

Subject to modification without previous notice.
Tolerance range for values: ±5% • Tolerance range for values “attraction force” and “ripple force”: ±10%



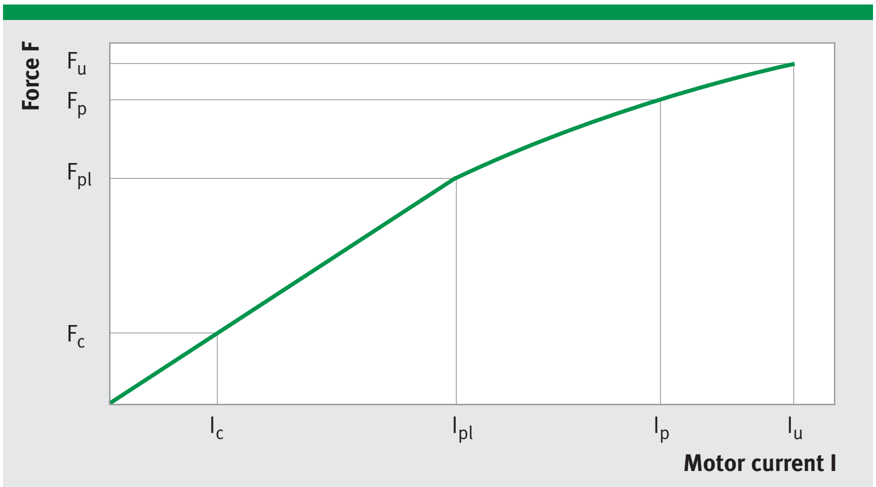
Force vs. speed

The achievable speed limit depends on operating voltage (U_{DCL}) and current (force).
The diagram shows the idealised envelope with the key operating points at peak current (F_p, v_{lim}) and at idle (F_o, v_o).

L1B-3P-100-B
Technical data III

Winding data	Symbol	Unit	L1B-3P-100-25-WM	L1B-3P-100-50-WM	L1B-3P-100-75-WM
Force constant	k_f	N/A_{rms}	29.4	58.5	62.4
Back EMF constant, phase-to-phase	k_u	V/(m/s)	24.1	47.9	51.1
Limit speed at I_p and U_{DCL} = 300 V_{DC}	v_{lim}	m/s	6.8	3.1	3.0
Limit speed at I_p and U_{DCL} = 600 V_{DC}	v_{lim}	m/s	14.6	7.1	6.7
Electric resistance, phase-to-phase (25 °C)	R_{25}	Ω	4.02	5.88	3.95
Inductance, phase-to-phase	L	mH	20.83	41.66	31.92
Ultimate current	I_u	A_{rms}	9.1	9.1	12.7
Peak current (in the saturation range)	I_p	A_{rms}	7.3	7.3	10.2
Peak current (linear range)	I_{pl}	A_{rms}	3.8	3.8	5.4
Continuous current	I_c	A_{rms}	1.8	1.8	2.5
Permissible temperature (at sensor)	ϑ	°C	100	100	100
Max. link voltage	U_{DCL}	V	600	600	600

Subject to modification without previous notice.
Tolerance range for values: ±5% • Tolerance range for values “resistance” and “inductance”: ±10%



Force vs. current

Note:
The winding variant WM (standard) described above is suitable for moderately dynamic performance requirements. The winding variants WL and WH suitable for lower and higher dynamic performance requirements are available upon request. The integrated temperature sensors do not display the exact winding temperature. Depending on current load, the winding temperature may be up to approx. 30 K higher.

L1B-3P-200-B
Technical data I

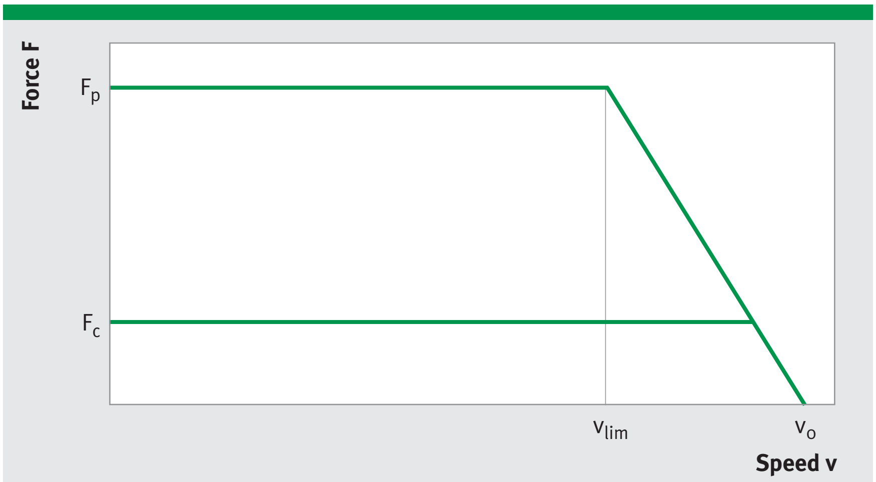
Primary part	Symbol	Unit	L1B-3P-200-25-WM	L1B-3P-200-50-WM	L1B-3P-200-75-WM
Length	L_1	mm	208	208	208
Width	B_1	mm	57	82	107
Height	H_1	mm	28.2	28.2	28.2
Mass	m_1	kg	1.4	2.3	3.2
Thread M5, quantity (length x width)	-	-	6 x 1	6 x 2	6 x 2
Thread M5, distance/length	$n_l \times c_1$	mm	5 x 31.5	5 x 31.5	5 x 31.5
Thread M5, distance/width	$n_b \times b_1$	mm	-	1 x 30	1 x 55
Motor cable diameter	d_K	mm	7.3	7.3	7.3
Standard: Secondary part, through-bore (variant 2)					
Width	B_2	mm	50	80	100
Mass, length 38/length 152	m_2	kg/unit	0.11/0.44	0.19/0.76	0.24/0.96
Height of magnetic base	h_2	mm	6	6	6
Height	H_2	mm	10	10	10
Through-bore for screw M5 DIN 6912	b_3	mm	37	62	87
Secondary part, tapped bore (variant 1)					
Width	B_2	mm	30	50	80
Mass, length 38/length 152	m_2	kg/unit	0.076/0.30	0.13/0.52	0.21/0.84
Height of magnetic base	h_2	mm	6	6	6
Height	H_2	mm	10	10	10
Thread M5 (from below)	b_2	mm	15	30	55
Installation dimensions: L1B-3P-L-B					
Overall height PRIM + SEK	H	mm	39 - 0.1	39 - 0.1	39 - 0.1
Mech. air gap	d	mm	approx. 0.8	approx. 0.8	approx. 0.8
Max. width	B	mm	57	82	107
Length of secondary part (38 mm grid)	L_2	mm	L_1 + stroke	L_1 + stroke	L_1 + stroke
Cable length	L_K	mm	≈ 1000	≈ 1000	≈ 1000

Note: The size specified for the air gap d is an auxiliary dimension and may fluctuate. The only technically relevant dimension is the specified overall installation height H, which must be complied with. A stainless steel cover can be ordered separately for the secondary parts. (The stainless steel cover is not included in the standard equipment.) Subject to modification without previous notice.

L1B-3P-200-B
Technical data II

Performance data	Symbol	Unit	L1B-3P-200-25-WM	L1B-3P-200-50-WM	L1B-3P-200-75-WM
Ultimate force at I_u	F_u	N	400	796	1188
Peak force (saturation range) at I_p	F_p	N	341	679	1014
Peak force (linear range) at I_{pl}	F_{pl}	N	226	449	670
Continuous force at I_c	F_c	N	100	200	299
Power loss at I_p (25 °C)	P_{lp}	W	634	928	1220
Power loss at I_{pl} (25 °C)	P_{lpl}	W	177	260	341
Power loss at I_c (25 °C)	P_{lc}	W	34	51	68
Motor constant (25 °C)	k_m	$N/\sqrt{W}$	16.9	27.9	36.3
Damping constant (short-circuit)	k_d	N/(m/s)	287	777	1316
Electric time constant	τ_{el}	ms	5.19	7.09	8.08
Attraction force	F_a	N	1128	2256	3383
Ripple force (typical cogging)	F_r	N	7	14	21
Pole pair width	$2\tau_p$	mm	38	38	38

Subject to modification without previous notice.
Tolerance range for values: ±5% • Tolerance range for values “attraction force” and “ripple force”: ±10%



Force vs. speed

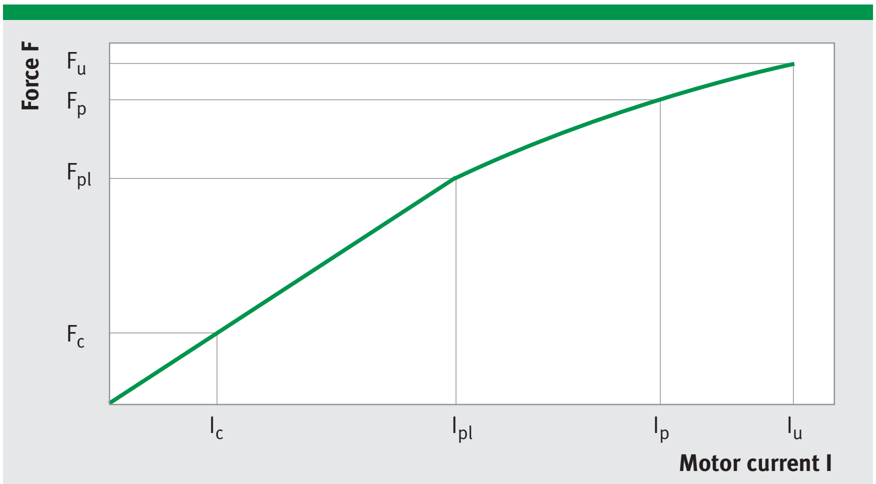
The achievable speed limit depends on operating voltage (U_{DCL}) and current (force).
The diagram shows the idealised envelope with the key operating points at peak current (F_p, v_{lim}) and at idle (F_o, v_o).

L1B-3P-200-B

Technical data III

Winding data	Symbol	Unit	L1B-3P-200-25-WM	L1B-3P-200-50-WM	L1B-3P-200-75-WM
Force constant	k_f	N/A_{rms}	29.4	58.5	62.4
Back EMF constant, phase-to-phase	k_u	V/(m/s)	24.1	47.9	51.1
Limit speed at I_p and U_{DCL} = 300 V_{DC}	v_{lim}	m/s	6.8	3.1	3.0
Limit speed at I_p and U_{DCL} = 600 V_{DC}	v_{lim}	m/s	14.6	7.1	6.7
Electric resistance, phase-to-phase (25 °C)	R_{25}	Ω	2.01	2.94	1.97
Inductance, phase-to-phase	L	mH	10.41	20.83	15.96
Ultimate current	I_u	A_{rms}	18.1	18.1	25.4
Peak current (in the saturation range)	I_p	A_{rms}	14.5	14.5	20.3
Peak current (linear range)	I_{pl}	A_{rms}	7.7	7.7	10.7
Continuous current	I_c	A_{rms}	3.4	3.4	4.8
Permissible temperature (at sensor)	ϑ	°C	100	100	100
Max. link voltage	U_{DCL}	V	600	600	600

Subject to modification without previous notice.
Tolerance range for values: ±5% • Tolerance range for values "resistance" and "inductance": ±10%



Force vs. current

Note:
The winding variant WM (standard) described above is suitable for moderately dynamic performance requirements. The winding variants WL and WH suitable for lower and higher dynamic performance requirements are available upon request. The integrated temperature sensors do not display the exact winding temperature. Depending on current load, the winding temperature may be up to approx. 30 K higher.

L1B-3P-300-B

Technical data I

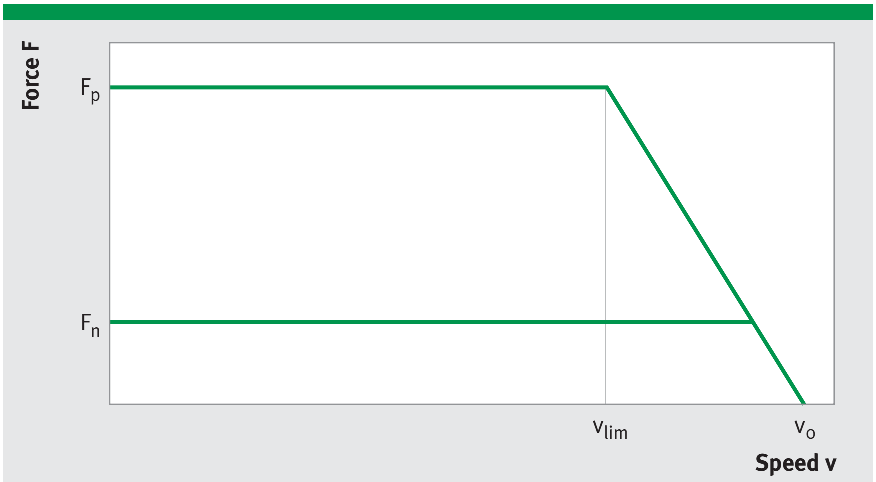
Primary part	Symbol	Unit	L1B-3P-300-25-WM	L1B-3P-300-50-WM	L1B-3P-300-75-WM
Length	L_1	mm	303	303	303
Width	B_1	mm	57	82	107
Height	H_1	mm	28.2	28.2	28.2
Mass	m_1	kg	2.0	3.4	4.8
Thread M5, quantity (length x width)	-	-	9 x 1	9 x 2	9 x 2
Thread M5, distance/length	n_l x c_1	mm	8 x 31.5	8 x 31.5	8 x 31.5
Thread M5, distance/width	n_b x b_1	mm	-	1 x 30	1 x 55
Motor cable diameter	d_K	mm	7.3	7.3	7.3
Standard: Secondary part, through-bore (variant 2)					
Width	B_2	mm	50	80	100
Mass, length 38/length 152	m_2	kg/unit	0.11/0.44	0.19/0.76	0.24/0.96
Height of magnetic base	h_2	mm	6	6	6
Height	H_2	mm	10	10	10
Through-bore for screw M5 DIN 6912	b_3	mm	37	62	87
Secondary part, tapped bore (variant 1)					
Width	B_2	mm	30	50	80
Mass, length 38/length 152	m_2	kg/unit	0.076/0.30	0.13/0.52	0.21/0.84
Height of magnetic base	h_2	mm	6	6	6
Height	H_2	mm	10	10	10
Thread M5 (from below)	b_2	mm	15	30	55
Installation dimensions: L1B-3P-L-B					
Overall height PRIM + SEK	H	mm	39 - 0.1	39 - 0.1	39 - 0.1
Mech. air gap	d	mm	approx. 0.8	approx. 0.8	approx. 0.8
Max. width	B	mm	57	82	107
Length of secondary part (38 mm grid)	L_2	mm	L_1 + stroke	L_1 + stroke	L_1 + stroke
Cable length	L_K	mm	≈ 1000	≈ 1000	≈ 1000

Note: The size specified for the air gap d is an auxiliary dimension and may fluctuate. The only technically relevant dimension is the specified overall installation height H, which must be complied with. A stainless steel cover can be ordered separately for the secondary parts. (The stainless steel cover is not included in the standard equipment.)
Subject to modification without previous notice.

L1B-3P-300-B
Technical data II

Performance data	Symbol	Unit	L1B-3P-300-25-WM	L1B-3P-300-50-WM	L1B-3P-300-75-WM
Ultimate force at I_u	F_u	N	600	1194	1782
Peak force (saturation range) at I_p	F_p	N	512	1019	1521
Peak force (linear range) at I_{pl}	F_{pl}	N	339	674	1005
Continuous force at I_c	F_c	N	147	292	436
Power loss at I_p (25 °C)	P_{lp}	W	951	1392	1832
Power loss at I_{pl} (25 °C)	P_{lpl}	W	266	389	512
Power loss at I_c (25 °C)	P_{lc}	W	50	73	96
Motor constant (25 °C)	k_m	N/√W	20.8	34.1	44.4
Damping constant (short-circuit)	k_d	N/(m/s)	431	1166	1972
Electric time constant	τ_{el}	ms	5.19	7.09	8.08
Attraction force	F_a	N	1672	3343	5015
Ripple force (typical cogging)	F_r	N	8	16	24
Pole pair width	$2\tau_p$	mm	38	38	38

Subject to modification without previous notice.
Tolerance range for values: ±5% • Tolerance range for values “attraction force” and “ripple force”: ±10%



Force vs. speed

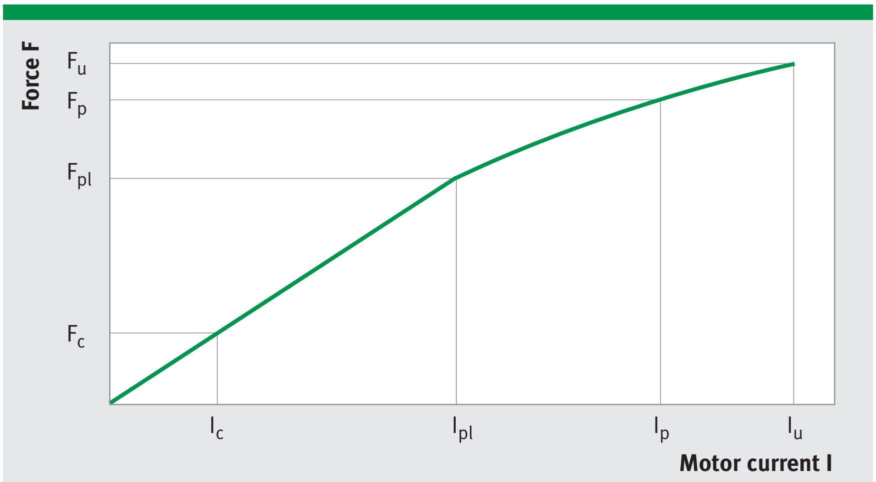
The achievable speed limit depends on operating voltage (U_{zk}) and current (force).
The diagram shows the idealised envelope with the key operating points at peak current (F_p, v_{lim}) and at idle (F_o, v_o).

L1B-3P-300-B

Technical data III

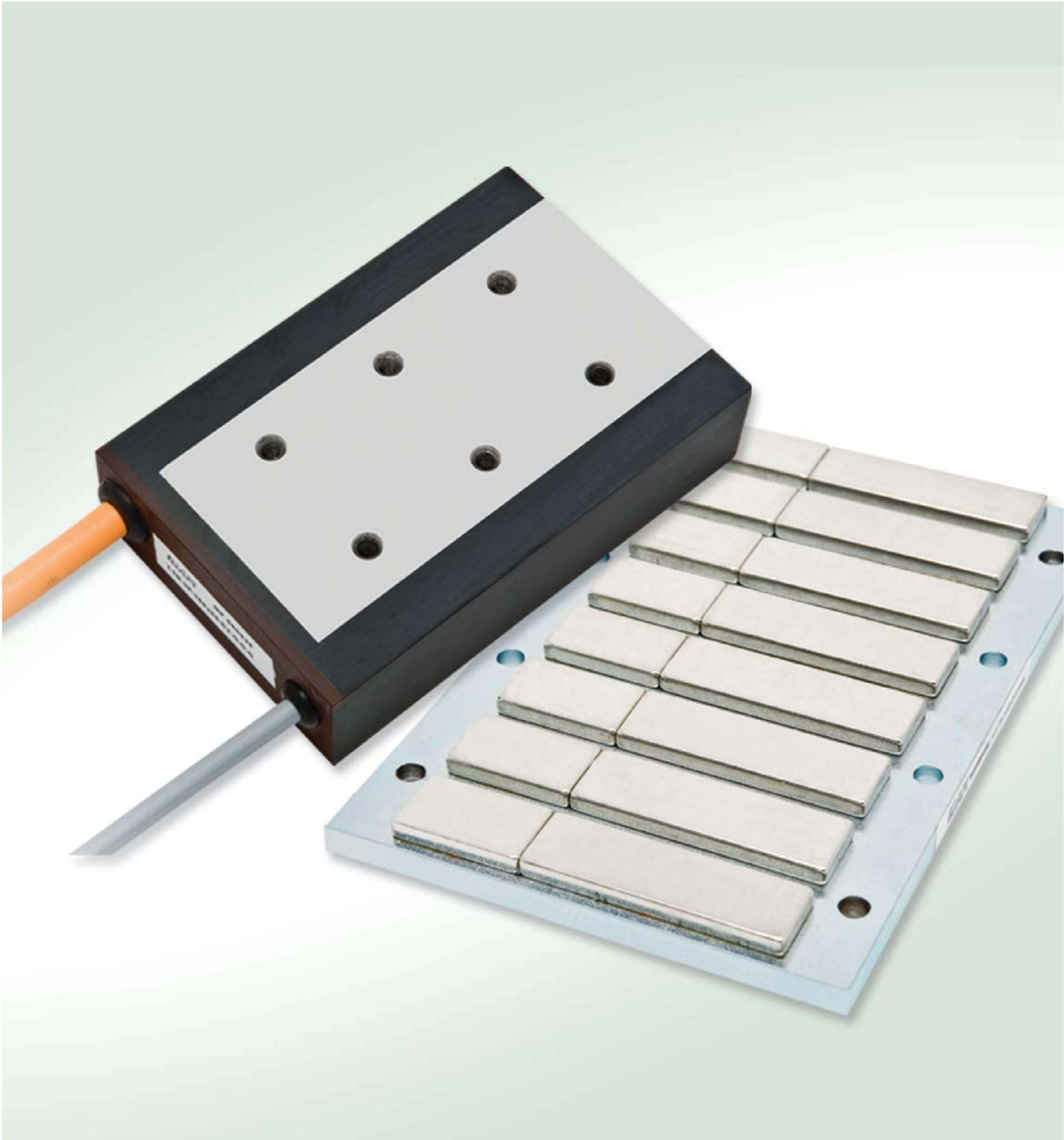
Winding data	Symbol	Unit	L1B-3P-300x25-WM	L1B-3P-300x50-WM	L1B-3P-300x75-WM
Force constant	k_f	N/A_{rms}	29.4	58.5	87.3
Back EMF constant, phase-to-phase	k_u	V/(m/s)	24.1	47.9	71.4
Limit speed at I_p and U_{DCL} = 300 V_{DC}	v_{lim}	m/s	6.8	3.1	1.9
Limit speed at I_p and U_{DCL} = 600 V_{DC}	v_{lim}	m/s	14.6	7.1	4.5
Electric resistance, phase-to-phase (25 °C)	R_{25}	Ω	1.34	1.96	2.58
Inductance, phase-to-phase	L	mH	6.94	13.89	20.83
Ultimate current	I_u	A_{rms}	27.2	27.2	27.2
Peak current (in the saturation range)	I_p	A_{rms}	21.8	21.8	21.8
Peak current (linear range)	I_{pl}	A_{rms}	11.5	11.5	11.5
Continuous current	I_c	A_{rms}	5.0	5.0	5.0
Permissible temperature (at sensor)	ϑ	°C	100	100	100
Max. link voltage	U_{DCL}	V	600	600	600

Subject to modification without previous notice.
Tolerance range for values: ±5% • Tolerance range for values "resistance" and "inductance": ±10%



Force vs. current

Note:
The winding variant WM (standard) described above is suitable for moderately dynamic performance requirements. The winding variants WL and WH suitable for lower and higher dynamic performance requirements are available upon request. The integrated temperature sensors do not display the exact winding temperature. Depending on current load, the winding temperature may be up to approx. 30 K higher.



L1 primary and secondary part

L1C linear motors

Type designation for primary parts

Primary part

L1C - 3P - L - B - X - X - X - X - PRIM

Type, design
L1 Linear motor (primary part), laminated
C With cooling options

Number of motor phases
3P 3-phase

Length classification of coil system
100 mm, 200 mm, 300 mm, 400 mm

Width of magnetic track
50 mm, 75 mm, 100 mm, 125 mm, 150 mm

Winding design
WM Standard
WX Special variant

Cooling variant
O Standard (without)
W Water cooling via additional intermediate plate
T Water cooling and additional thermal insulation
S Special variant on request

Temperature monitoring
O Standard (PTC triple sensors at the phases U, V, W, KTY84-130 on one phase)
S Special variant on request

Connection variant
G Standard, fixed cables for motor and sensor
Cable length 1.0 m
W Terminal (not with water cooling, $I_c \leq 10$ A)
S Special variant on request

Motor part
PRIM Primary part

L1C linear motors

Type designation for secondary parts

Secondary part
L2 - B - L - X - X - SEK

Type, design
L2 Secondary part for L1C primary parts

Width of magnetic track
50 mm, 75 mm, 100 mm, 125 mm, 150 mm

Length of secondary part
76 mm (standard), 152 mm, 380 mm, 760 mm
(Special variants in raster n x 19 mm on request)

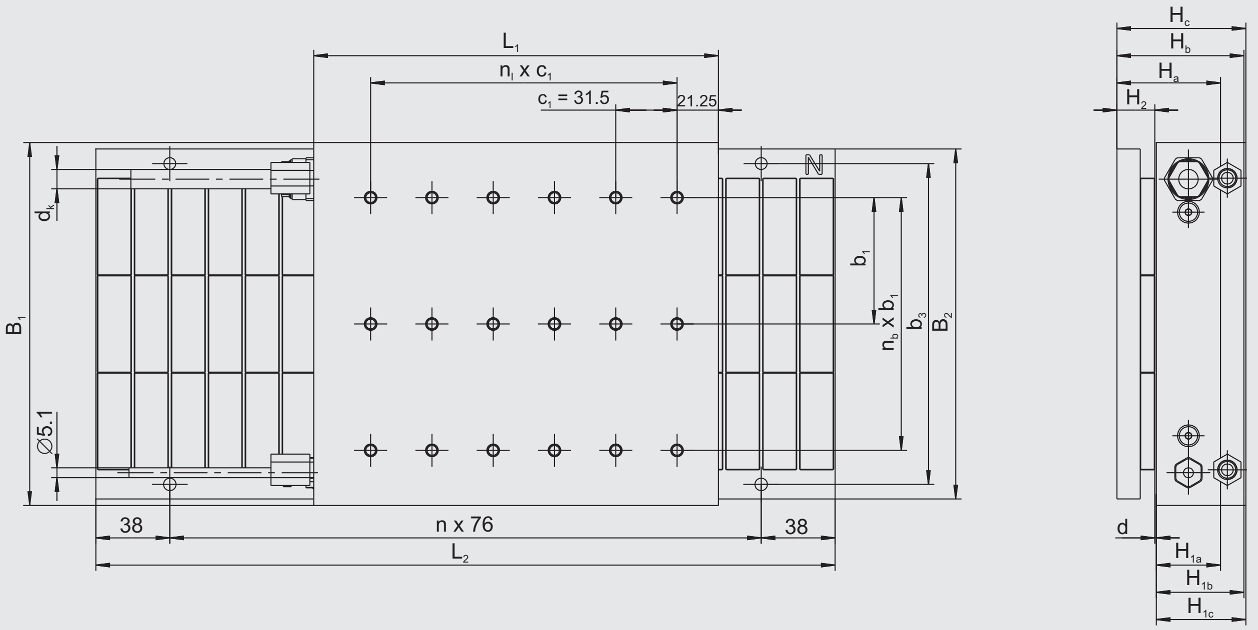
Magnet cover
O Standard (without)
S Special variant (stainless steel)

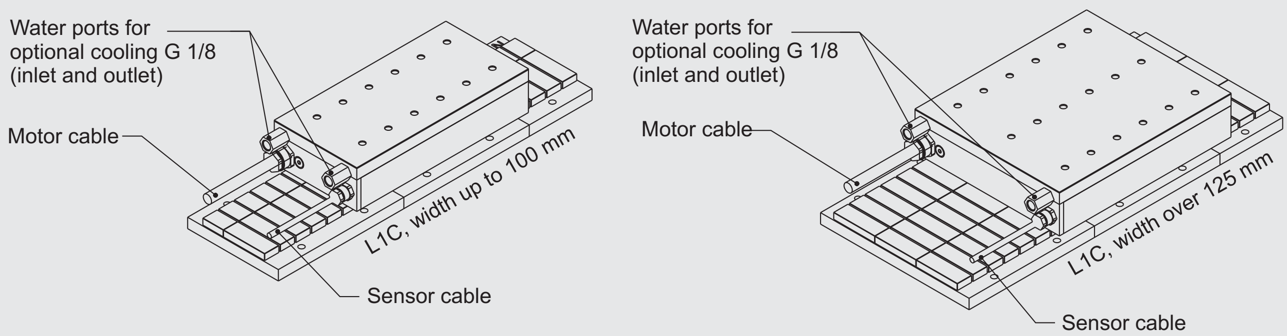
Fastening variant
1 Tapped bore M6 (special variant)
2 Through-bore for bolt M6 ISO 4762 (standard)

Motor part
SEK Secondary part

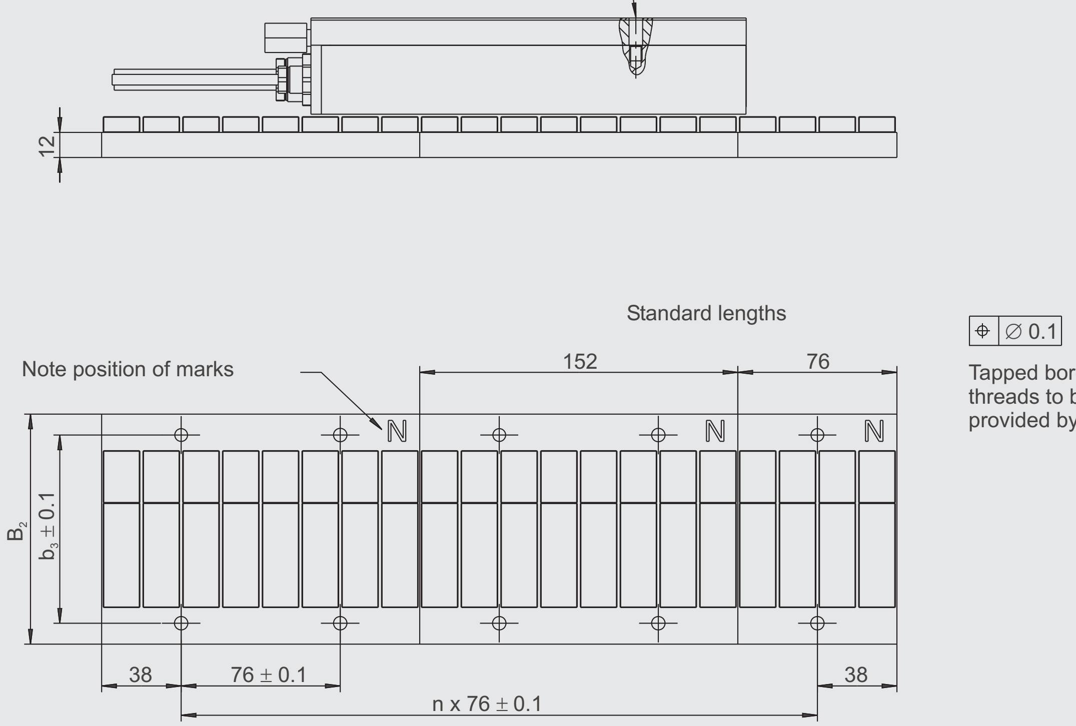
L1C linear motors

Standard: Primary part with cable connection, secondary part with through-bore (variant 2)





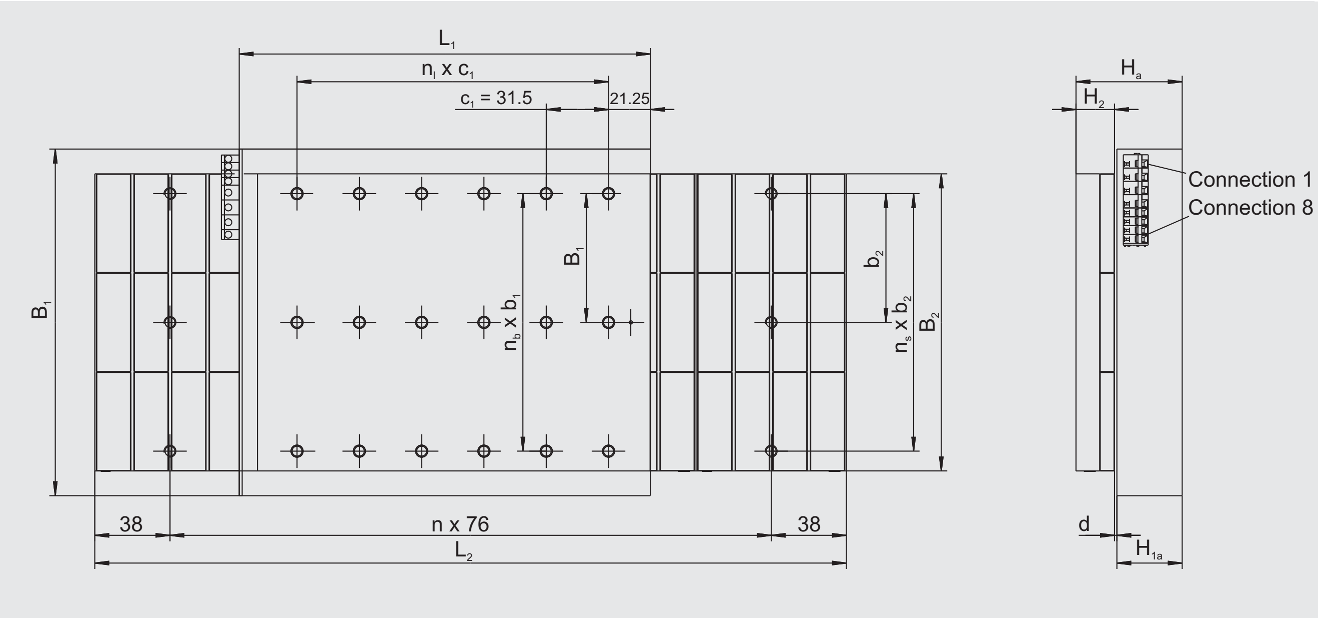
Primary part:
Thread-in depth without cooling: 7^{0}_{-1}
Thread-in depth with water cooling: 19^{0}_{-1}
Thread-in depth with water cooling and thermal insulation: 20^{0}_{-1}

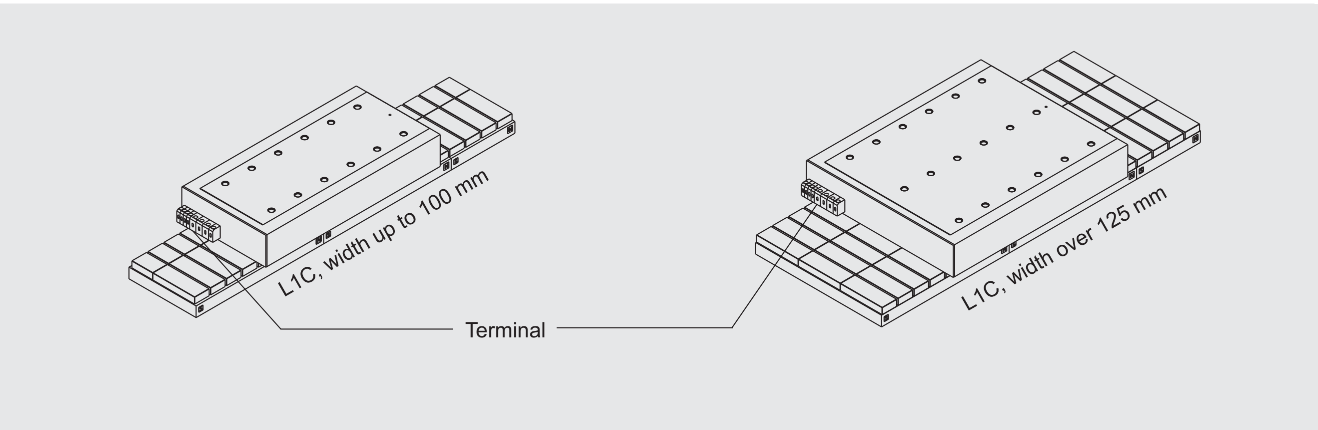


Tapped bores and threads to be provided by customer

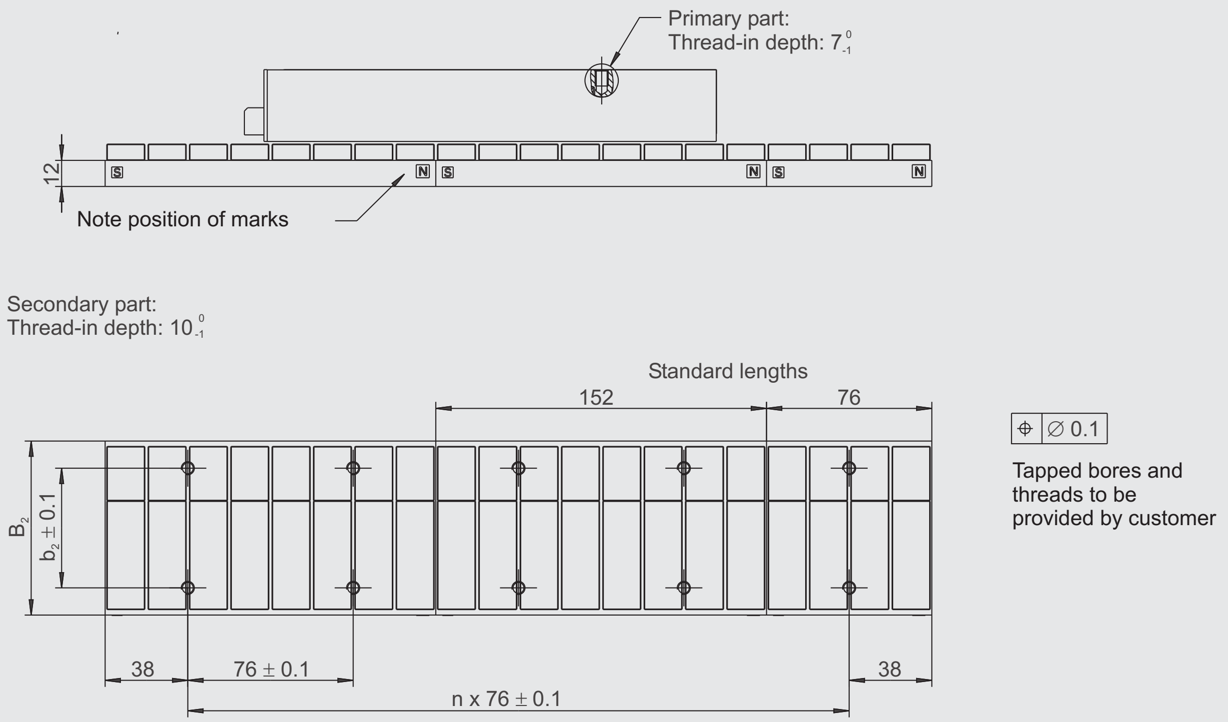
L1C linear motors

Primary part with terminal, secondary part with tapped bore (variant 1)





Note: Primary part with terminal - only variants without water cooling



Primary part:
Thread-in depth: 7 0 -1
12
S
N
S
N
S
N
Note position of marks
Secondary part:
Thread-in depth: 10 0 -1
Standard lengths
152
76
⌖ ∅ 0.1
Tapped bores and
threads to be
provided by customer
B2
b2 ± 0.1
38
76 ± 0.1
38
n x 76 ± 0.1

L1C-3P-100-B

Technical data I

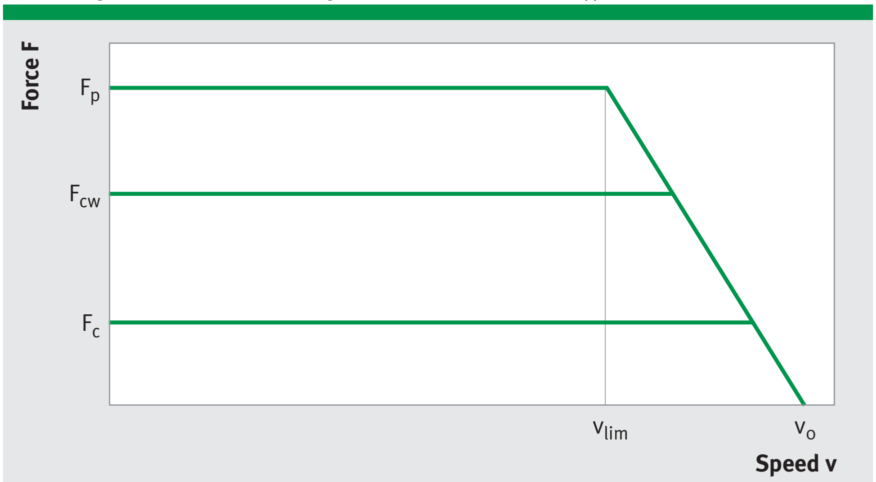
Primary part	Symbol	Unit	L1C-3P-100-50-WM	L1C-3P-100-75-WM	L1C-3P-100-100-WM	L1C-3P-100-125-WM	L1C-3P-100-150-WM
Length	L_1	mm	113	113	113	113	113
Width	B_1	mm	82	107	132	157	182
Height without/with cooling plate	H_{1a} / H_{1b}	mm	33 /45	33 /45	33 /45	33 /45	33 /45
Height with cooling plate + thermal insulation	H_{1c}	mm	46	46	46	46	46
Mass without/with cooling plate	m_{1a}/m_{1b}	kg	1.5 /1.8	2.1 /2.5	2.6 /3.1	3.2 /3.8	3.8 /4.5
Thread M6, quantity (length x width)	-	-	3 x 2	3 x 2	3 x 2	3 x 3	3 x 3
Thread M6, distance/length	n_l x c_1	mm	2x 31.5	2x 31.5	2x 31.5	2x 31.5	2x 31.5
Thread M6, distance/width	n_b x b_1	mm	1x 30	1x 55	1x 80	2x 52.5	2x 65
Motor cable diameter	d_K	mm	7.3	7.3	7.3	7.3	7.3
Standard: Secondary part, through-bore (variant 2)							
Width	B_2	mm	80	110	130	160	180
Mass, length 76/length 152	m_2	kg/unit	0.78/1.56	1.11/2.22	1.36/2.72	1.68/3.36	1.94/3.88
Height	H_2	mm	19.5	19.5	19.5	19.5	19.5
Through-bore for screw M6 ISO 4762	b_3	mm	65	90	115	140	165
Secondary part, tapped bore (variant 1)							
Width	B_2	mm	50	80	100	130	150
Mass, length 76/length 152	m_2	kg/unit	0.58/1.16	0.90/1.80	1.16/2.32	1.47/2.94	1.72/3.44
Height	H_2	mm	19.5	19.5	19.5	19.5	19.5
Thread M6 (from below)	b_2	mm	38	55	80	105	2 x 65
Installation dimensions: L1C-3P-L-B							
Overall height without cooling plate	H_a	mm	53.5 + 0.1	53.5 + 0.1	53.5 + 0.1	53.5 + 0.1	53.5 + 0.1
Overall height with cooling plate	H_b	mm	65.5 + 0.1	65.5 + 0.1	65.5 + 0.1	65.5 + 0.1	65.5 + 0.1
Overall height with cooling plate + therm. ins.	H_c	mm	66.5 + 0.1	66.5 + 0.1	66.5 + 0.1	66.5 + 0.1	66.5 + 0.1
Mechanical air gap	d	mm	approx. 1	approx. 1	approx. 1	approx. 1	approx. 1
Max. width (depending on variant)	B	mm	82	107/110	132	157/160	182
Length of secondary part (76 mm grid)	L_2	mm	L_1 + stroke	L_1 + stroke	L_1 + stroke	L_1 + stroke	L_1 + stroke
Cable length	L_K	mm	≈ 1000	≈ 1000	≈ 1000	≈ 1000	≈ 1000

Note: The size specified for the air gap d is an auxiliary dimension and may fluctuate. The only technically relevant dimension is the specified overall installation height H, which must be complied with.
A stainless steel cover can be ordered separately for the secondary parts. (The stainless steel cover is not included in the standard equipment.)
Subject to modification without previous notice.

L1C-3P-100-B
Technical data II

Performance data	Symbol	Unit	L1C-3P-100-50-WM	L1C-3P-100-75-WM	L1C-3P-100-100-WM	L1C-3P-100-125-WM	L1C-3P-100-150-WM
Ultimate force at I_u	F_u	N	515	768	1020	1268	1515
Peak force (saturation range) at I_p	F_p	N	439	656	870	1082	1293
Peak force (linear range) at I_{pl}	F_{pl}	N	259	387	514	639	763
Continuous force (cooled) at I_{cw}	F_{cw}	N	249	395	543	691	838
Continuous force at I_c	F_c	N	131	196	259	322	387
Power loss at I_p (25 °C)	P_{lp}	W	528	698	869	1039	1209
Power loss at I_{pl} (25 °C)	P_{lpl}	W	118	156	194	232	270
Power loss at I_{cw}	P_{lcw}	W	141	211	282	352	423
Power loss at I_c (25 °C)	P_{lc}	W	30	40	49	59	69
Motor constant (25 °C)	k_m	N/√W	23.9	31.0	36.9	42.0	46.5
Damping constant (short-circuit)	k_d	N/(m/s)	571	962	1362	1762	2160
Electric time constant	τ_{el}	ms	8.67	9.83	10.54	11.02	11.36
Attraction force	F_a	N	1174	1760	2347	2934	3521
Ripple force (typical cogging)	F_r	N	12	18	24	30	36
Pole pair width	$2\tau_p$	mm	38	38	38	38	38
Cooling-water flow-rate	dV/dt	l/min	0.4	0.6	0.8	1.0	1.2
Cooling-water temperature-difference	$\Delta\vartheta$	K	5.0	5.0	5.0	5.0	5.0

Subject to modification without previous notice.
Tolerance range for values: ±5% • Tolerance range for values “attraction force” and “ripple force”: ±10%



Force vs. speed

The achievable speed limit depends on operating voltage (U_{DCL}) and current (force).

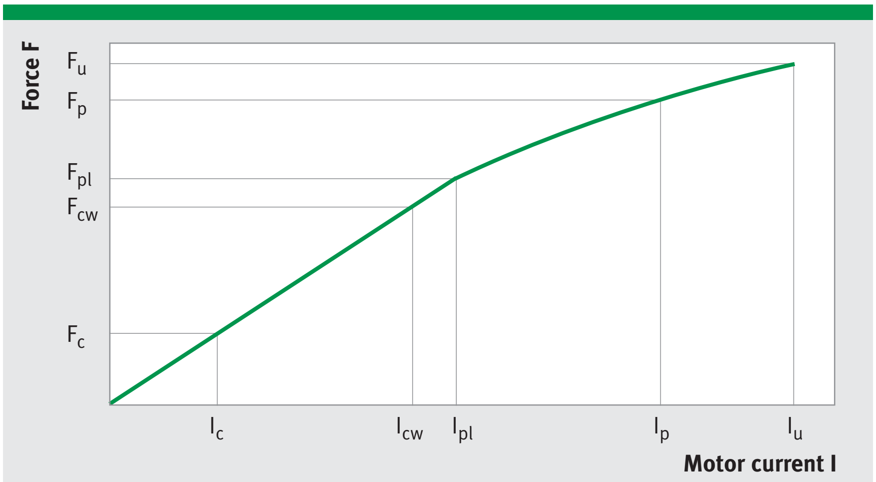
The diagram shows the idealised envelope with the key operating points at peak current (F_p, v_{lim}) and at idle (F_o, v_o).

L1C-3P-100-B

Technical data III

Winding data	Symbol	Unit	L1C-3P-100-50-WM	L1C-3P-100-75-WM	L1C-3P-100-100-WM	L1C-3P-100-125-WM	L1C-3P-100-150-WM
Force constant	k_f	N/A_{rms}	53.7	80.2	106.5	132.5	158.2
Back EMF constant, phase-to-phase	k_u	V/(m/s)	44.0	65.6	87.1	108.4	129.4
Limit speed at I_p and U_{DCL} = 300 V_{DC}	v_{lim}	m/s	3.8	2.4	1.7	1.2	0.9
Limit speed at I_p and U_{DCL} = 600 V_{DC}	v_{lim}	m/s	8.1	5.3	3.9	3.0	2.4
Electric resistance, phase-to-phase (25 °C)	R_{25}	Ω	3.37	4.46	5.55	6.64	7.73
Inductance, phase-to-phase	L	mH	29.26	43.89	58.52	73.15	87.78
Ultimate current	I_u	A_{rms}	12.8	12.8	12.8	12.8	12.8
Peak current (in the saturation range)	I_p	A_{rms}	10.2	10.2	10.2	10.2	10.2
Peak current (linear range)	I_{pl}	A_{rms}	4.8	4.8	4.8	4.8	4.8
Continuous current (cooled)	I_{cw}	A_{rms}	4.6	4.9	5.1	5.2	5.3
Continuous current (non cooled)	I_c	A_{rms}	2.4	2.4	2.4	2.4	2.4
Permissible temperature (at sensor)	ϑ	°C	100	100	100	100	100
Max. link voltage	U_{DCL}	V	600	600	600	600	600

Subject to modification without previous notice.
Tolerance range for values: ±5% • Tolerance range for values "resistance" and "inductance": ±10%



Force vs. current

Note:
The winding variant WM (standard) described above is suitable for moderately dynamic performance requirements. The winding variants WL and WH suitable for lower and higher dynamic performance requirements are available upon request. The integrated temperature sensors do not display the exact winding temperature. Depending on current load, the winding temperature may be up to approx. 30 K higher.

L1C-3P-200-B

Technical data I

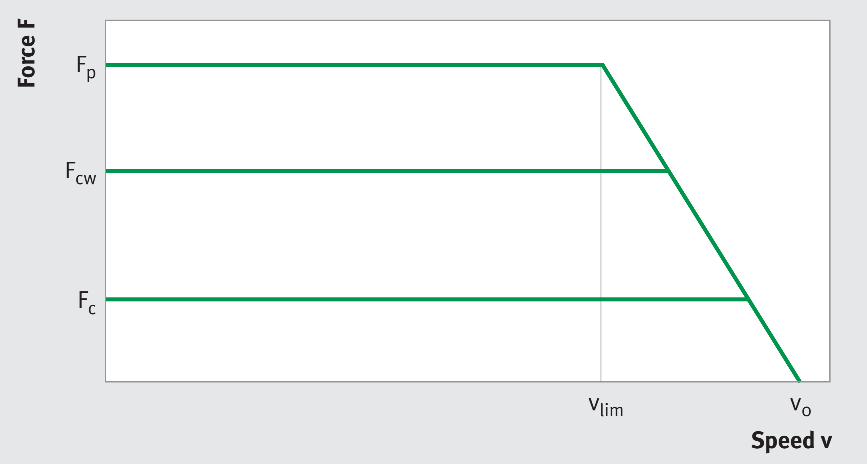
Primary part	Symbol	Unit	L1C-3P-200-50-WM	L1C-3P-200-75-WM	L1C-3P-200-100-WM	L1C-3P-200-125-WM	L1C-3P-200-150-WM
Length	L_1	mm	208	208	208	208	208
Width	B_1	mm	82	107	132	157	182
Height without/with cooling plate	H_{1a} / H_{1b}	mm	33 /45	33 /45	33 /45	33 /45	33 /45
Height with cooling plate + thermal insulation	H_{1c}	mm	46	46	46	46	46
Mass without/with cooling plate	m_{1a}/m_{1b}	kg	2.8 /3.4	3.8 /4.5	5.0 /5.9	6.1 /7.2	7.2 /8.4
Thread M6, quantity (length x width)	-	-	6 x 2	6 x 2	6 x 2	6 x 3	6 x 3
Thread M6, distance/length	$n_l \times c_1$	mm	5x 31.5	5x 31.5	5x 31.5	5x 31.5	5x 31.5
Thread M6, distance/width	$n_b \times b_1$	mm	1x 30	1x 55	1x 80	2x 52.5	2x 65
Motor cable diameter	d_K	mm	10	10	10	10	10
Standard: Secondary part, through-bore (variant 2)							
Width	B_2	mm	80	110	130	160	180
Mass, length 76/length 152	m_2	kg/unit	0.78/1.56	1.11/2.22	1.36/2.72	1.68/3.36	1.94/3.88
Height	H_2	mm	19.5	19.5	19.5	19.5	19.5
Through-bore for screw M6 ISO 4762	b_3	mm	65	90	115	140	165
Secondary part, tapped bore (variant 1)							
Width	B_2	mm	50	80	100	130	150
Mass, length 76/length 152	m_2	kg/unit	0.58/1.16	0.90/1.80	1.16/2.32	1.47/2.94	1.72/3.44
Height	H_2	mm	19.5	19.5	19.5	19.5	19.5
Thread M6 (from below)	b_2	mm	38	55	80	105	2 x 65
Installation dimensions: L1C-3P-L-B							
Overall height without cooling plate	H_a	mm	53.5 + 0.1	53.5 + 0.1	53.5 + 0.1	53.5 + 0.1	53.5 + 0.1
Overall height with cooling plate	H_b	mm	65.5 + 0.1	65.5 + 0.1	65.5 + 0.1	65.5 + 0.1	65.5 + 0.1
Overall height with cooling plate + therm. ins.	H_c	mm	66.5 + 0.1	66.5 + 0.1	66.5 + 0.1	66.5 + 0.1	66.5 + 0.1
Mechanical air gap	d	mm	approx. 1	approx. 1	approx. 1	approx. 1	approx. 1
Max. width (depending on variant)	B	mm	82	107/110	132	157/160	182
Length of secondary part (76 mm grid)	L_2	mm	L_1 + stroke	L_1 + stroke	L_1 + stroke	L_1 + stroke	L_1 + stroke
Cable length	L_K	mm	≈ 1000	≈ 1000	≈ 1000	≈ 1000	≈ 1000

Note: The size specified for the air gap d is an auxiliary dimension and may fluctuate. The only technically relevant dimension is the specified overall installation height H, which must be complied with. A stainless steel cover can be ordered separately for the secondary parts. (The stainless steel cover is not included in the standard equipment.)
Subject to modification without previous notice.

L1C-3P-200-B
Technical data II

Performance data	Symbol	Unit	L1C-3P-200-50-WM	L1C-3P-200-75-WM	L1C-3P-200-100-WM	L1C-3P-200-125-WM	L1C-3P-200-150-WM
Ultimate force at I_u	F_u	N	1029	1537	2039	2537	3030
Peak force (saturation range) at I_p	F_p	N	878	1311	1740	2165	2586
Peak force (linear range) at I_{pl}	F_{pl}	N	518	774	1027	1278	1526
Continuous force (cooled) at I_{cw}	F_{cw}	N	488	776	1067	1357	1645
Continuous force at I_c	F_c	N	247	366	487	605	724
Power loss at I_p (25 °C)	P_{lp}	W	1056	1396	1737	2078	2418
Power loss at I_{pl} (25 °C)	P_{lpl}	W	235	311	387	463	539
Power loss at I_{cw}	P_{lcw}	W	272	407	543	679	815
Power loss at I_c (25 °C)	P_{lc}	W	53	70	87	104	121
Motor constant (25 °C)	k_m	$N/\sqrt{W}$	33.8	43.9	52.2	59.4	65.7
Damping constant (short-circuit)	k_d	N/(m/s)	1141	1924	2724	3525	4319
Electric time constant	τ_{el}	ms	8.67	9.83	10.54	11.02	11.36
Attraction force	F_a	N	2261	3392	4523	5653	6784
Ripple force (typical cogging)	F_r	N	14	20	26	32	38
Pole pair width	$2\tau_p$	mm	38	38	38	38	38
Cooling-water flow-rate	dV/dt	l/min	0.8	1.2	1.6	1.9	2.3
Cooling-water temperature-difference	$\Delta\vartheta$	K	5.0	5.0	5.0	5.0	5.0

Subject to modification without previous notice.
Tolerance range for values: ±5% • Tolerance range for values “attraction force” and “ripple force”: ±10%



Force vs. speed

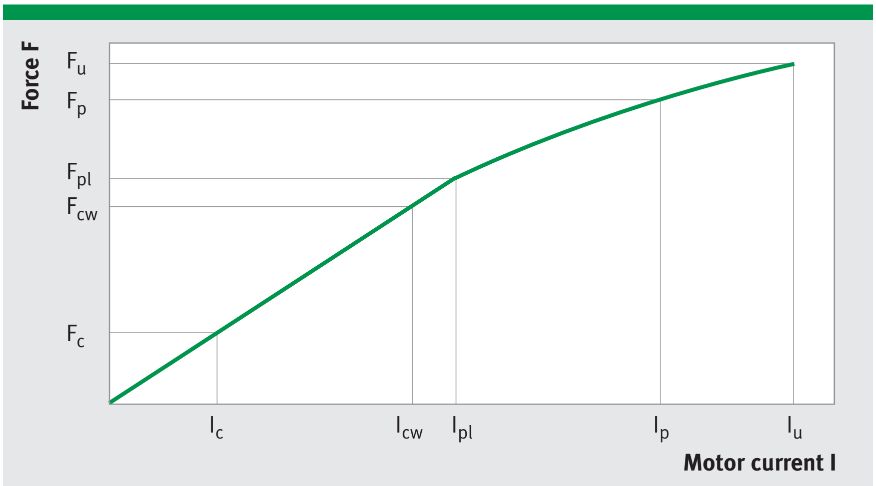
The achievable speed limit depends on operating voltage (U_{DCL}) and current (force).
The diagram shows the idealised envelope with the key operating points at peak current (F_p, v_{lim}) and at idle (F_o, v_o).

L1C-3P-200-B

Technical data III

Winding data	Symbol	Unit	L1C-3P-200-50-WM	L1C-3P-200-75-WM	L1C-3P-200-100-WM	L1C-3P-200-125-WM	L1C-3P-200-150-WM
Force constant	k_f	N/A_{rms}	53.7	80.2	106.5	132.5	158.2
Back EMF constant, phase-to-phase	k_u	V/(m/s)	44.0	65.6	87.1	108.4	129.4
Limit speed at I_p and U_{DCL} = 300 V_{DC}	v_{lim}	m/s	3.6	2.2	1.5	1.1	0.9
Limit speed at I_p and U_{DCL} = 600 V_{DC}	v_{lim}	m/s	7.7	5.0	3.6	2.8	2.3
Electric resistance, phase-to-phase (25 °C)	R_{25}	Ω	1.69	2.23	2.78	3.32	3.86
Inductance, phase-to-phase	L	mH	14.63	21.95	29.26	36.58	43.89
Ultimate current	I_u	A_{rms}	25.5	25.5	25.5	25.5	25.5
Peak current (in the saturation range)	I_p	A_{rms}	20.4	20.4	20.4	20.4	20.4
Peak current (linear range)	I_{pl}	A_{rms}	9.6	9.6	9.6	9.6	9.6
Continuous current (cooled)	I_{cw}	A_{rms}	9.1	9.7	10.0	10.2	10.4
Continuous current (non cooled)	I_c	A_{rms}	4.6	4.6	4.6	4.6	4.6
Permissible temperature (at sensor)	ϑ	°C	100	100	100	100	100
Max. link voltage	U_{DCL}	V	600	600	600	600	600

Subject to modification without previous notice.
Tolerance range for values: ±5% • Tolerance range for values “resistance” and “inductance”: ±10%



Force vs. current

Note:

The winding variant WM (standard) described above is suitable for moderately dynamic performance requirements. The winding variants WL and WH suitable for lower and higher dynamic performance requirements are available upon request. The integrated temperature sensors do not display the exact winding temperature. Depending on current load, the winding temperature may be up to approx. 30 K higher.

L1C-3P-300-B
Technical data I

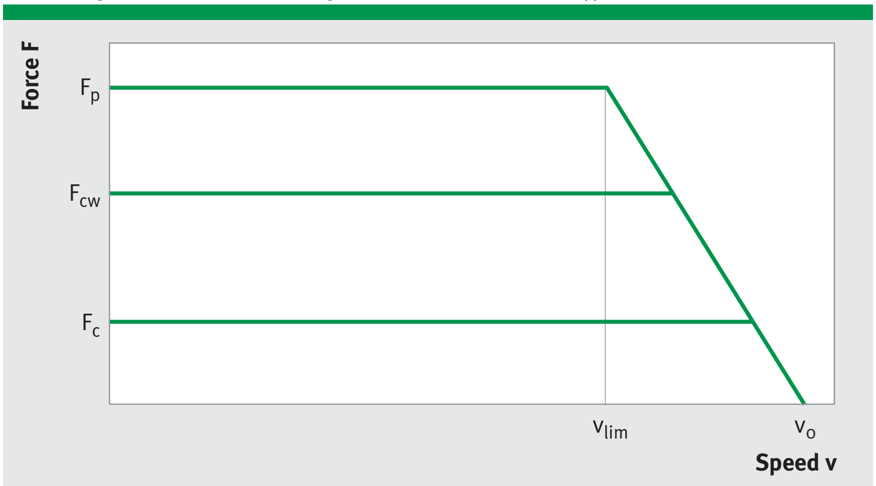
Primary part	Symbol	Unit	L1C-3P-300-50-WM	L1C-3P-300-75-WM	L1C-3P-300-100-WM	L1C-3P-300-125-WM	L1C-3P-300-150-WM
Length	L_1	mm	303	303	303	303	303
Width	B_1	mm	82	107	132	157	182
Height without/with cooling plate	H_{1a} / H_{1b}	mm	33 /45	33 /45	33 /45	33 /45	33 /45
Height with cooling plate + thermal insulation	H_{1c}	mm	46	46	46	46	46
Mass without/with cooling plate	m_{1a}/m_{1b}	kg	4.1 /4.9	5.7 /6.7	7.3 /8.6	8.9 /10.4	10.5 /12.2
Thread M6, quantity (length x width)	-	-	9 x 2	9 x 2	9 x 2	9 x 3	9 x 3
Thread M6, distance/length	$n_l \times c_1$	mm	8x 31.5	8x 31.5	8x 31.5	8x 31.5	8x 31.5
Thread M6, distance/width	$n_b \times b_1$	mm	1x 30	1x 55	1x 80	2x 52.5	2x 65
Motor cable diameter	d_K	mm	10	10	10	10	10
Standard: Secondary part, through-bore (variant 2)							
Width	B_2	mm	80	110	130	160	180
Mass, length 76/length 152	m_2	kg/unit	0.78/1.56	1.11/2.22	1.36/2.72	1.68/3.36	1.94/3.88
Height	H_2	mm	19.5	19.5	19.5	19.5	19.5
Through-bore for screw M6 ISO 4762	b_3	mm	65	90	115	140	165
Secondary part, tapped bore (variant 1)							
Width	B_2	mm	50	80	100	130	150
Mass, length 76/length 152	m_2	kg/unit	0.58/1.16	0.90/1.80	1.16/2.32	1.47/2.94	1.72/3.44
Height	H_2	mm	19.5	19.5	19.5	19.5	19.5
Thread M6 (from below)	b_2	mm	38	55	80	105	2 x 65
Installation dimensions: L1C-3P-L-B							
Overall height without cooling plate	H_a	mm	53.5 + 0.1	53.5 + 0.1	53.5 + 0.1	53.5 + 0.1	53.5 + 0.1
Overall height with cooling plate	H_b	mm	65.5 + 0.1	65.5 + 0.1	65.5 + 0.1	65.5 + 0.1	65.5 + 0.1
Overall height with cooling plate + therm. ins.	H_c	mm	66.5 + 0.1	66.5 + 0.1	66.5 + 0.1	66.5 + 0.1	66.5 + 0.1
Mechanical air gap	d	mm	approx. 1	approx. 1	approx. 1	approx. 1	approx. 1
Max. width (depending on variant)	B	mm	82	107/110	132	157/160	182
Length of secondary part (76 mm grid)	L_2	mm	L_1 + stroke	L_1 + stroke	L_1 + stroke	L_1 + stroke	L_1 + stroke
Cable length	L_K	mm	≈ 1000	≈ 1000	≈ 1000	≈ 1000	≈ 1000

Note: The size specified for the air gap d is an auxiliary dimension and may fluctuate. The only technically relevant dimension is the specified overall installation height H, which must be complied with. A stainless steel cover can be ordered separately for the secondary parts. (The stainless steel cover is not included in the standard equipment.)
Subject to modification without previous notice.

L1C-3P-300-B
Technical data II

Performance data	Symbol	Unit	L1C-3P-300-50-WM	L1C-3P-300-75-WM	L1C-3P-300-100-WM	L1C-3P-300-125-WM	L1C-3P-300-150-WM
Ultimate force at I_u	F_u	N	1544	2305	3059	3805	4545
Peak force (saturation range) at I_p	F_p	N	1317	1967	2610	3247	3878
Peak force (linear range) at I_{pl}	F_{pl}	N	778	1161	1541	1917	2289
Continuous force (cooled) at I_{cw}	F_{cw}	N	728	1157	1590	2022	2452
Continuous force at I_c	F_c	N	361	540	717	890	1066
Power loss at I_p (25 °C)	P_{lp}	W	1584	2095	2606	3117	3627
Power loss at I_{pl} (25 °C)	P_{lpl}	W	353	467	581	695	809
Power loss at I_{cw}	P_{lcw}	W	402	603	804	1005	1207
Power loss at I_c (25 °C)	P_{lc}	W	76	101	126	150	176
Motor constant (25 °C)	k_m	N/√W	41.4	53.7	63.9	72.7	80.5
Damping constant (short-circuit)	k_d	N/(m/s)	1712	2886	4085	5287	6479
Electric time constant	τ_{el}	ms	8.67	9.83	10.54	11.02	11.36
Attraction force	F_a	N	3349	5024	6698	8373	10047
Ripple force (typical cogging)	F_r	N	16	22	28	34	36
Pole pair width	$2\tau_p$	mm	38	38	38	38	38
Cooling-water flow-rate	dV/dt	l/min	1.1	1.7	2.3	2.9	3.4
Cooling-water temperature-difference	$\Delta\vartheta$	K	5.0	5.0	5.0	5.0	5.0

Subject to modification without previous notice.
Tolerance range for values: ±5% • Tolerance range for values "attraction force" and "ripple force": ±10%



Force vs. speed

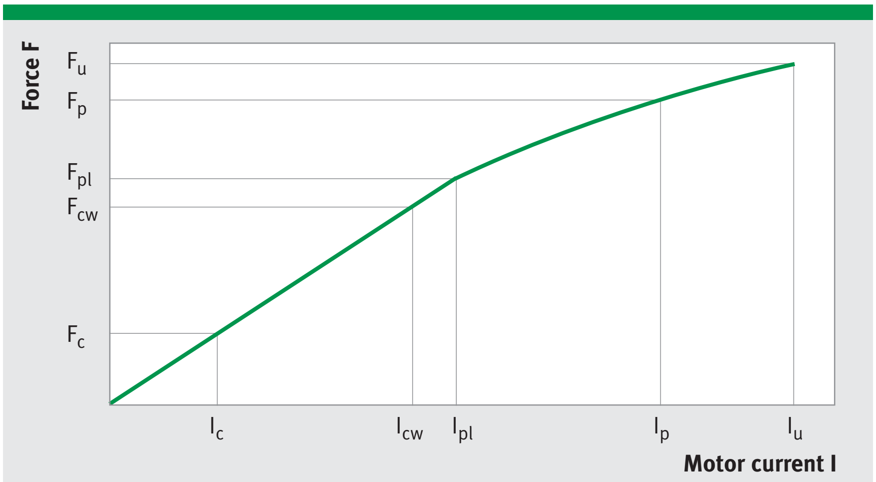
The achievable speed limit depends on operating voltage (U_{DCL}) and current (force).

The diagram shows the idealised envelope with the key operating points at peak current (F_p, v_{lim}) and at idle (F_o, v_o).

L1C-3P-300-B
Technical data III

Winding data	Symbol	Unit	L1C-3P-300-50-WM	L1C-3P-300-75-WM	L1C-3P-300-100-WM	L1C-3P-300-125-WM	L1C-3P-300-150-WM
Force constant	k_f	N/A_{rms}	53.7	80.2	106.5	132.5	158.2
Back EMF constant, phase-to-phase	k_u	V/(m/s)	44.0	65.6	87.1	108.4	129.4
Limit speed at I_p and U_{DCL} = 300 V_{DC}	v_{lim}	m/s	3.6	2.2	1.5	1.1	0.9
Limit speed at I_p and U_{DCL} = 600 V_{DC}	v_{lim}	m/s	7.7	5.0	3.6	2.8	2.3
Electric resistance, phase-to-phase (25 °C)	R_{25}	Ω	1.12	1.49	1.85	2.21	2.58
Inductance, phase-to-phase	L	mH	9.75	14.63	19.51	24.38	29.26
Ultimate current	I_u	A_{rms}	38.3	38.3	38.3	38.3	38.3
Peak current (in the saturation range)	I_p	A_{rms}	30.6	30.6	30.6	30.6	30.6
Peak current (linear range)	I_{pl}	A_{rms}	14.5	14.5	14.5	14.5	14.5
Continuous current (cooled)	I_{cw}	A_{rms}	13.5	14.4	14.9	15.3	15.5
Continuous current (non cooled)	I_c	A_{rms}	6.7	6.7	6.7	6.7	6.7
Permissible temperature (at sensor)	ϑ	°C	100	100	100	100	100
Max. link voltage	U_{DCL}	V	600	600	600	600	600

Subject to modification without previous notice.
Tolerance range for values: ±5% • Tolerance range for values “resistance” and “inductance”: ±10%



Force vs. current

Note:
The winding variant WM (standard) described above is suitable for moderately dynamic performance requirements. The winding variants WL and WH suitable for lower and higher dynamic performance requirements are available upon request. The integrated temperature sensors do not display the exact winding temperature. Depending on current load, the winding temperature may be up to approx. 30 K higher.

L1C-3P-400-B

Technical data I

Primary part	Symbol	Unit	L1C-3P-400-50-WM	L1C-3P-400-75-WM	L1C-3P-400-100-WM	L1C-3P-400-125-WM	L1C-3P-400-150-WM
Length	L_1	mm	398	398	398	398	398
Width	B_1	mm	82	107	132	157	182
Height without/with cooling plate	H_{1a} / H_{1b}	mm	33 /45	33 /45	33 /45	33 /45	33 /45
Height with cooling plate + thermal insulation	H_{1c}	mm	46	46	46	46	46
Mass without/with cooling plate	m_{1a}/m_{1b}	kg	5.4 /6.4	7.5 /8.8	9.6 /11.3	11.8 /13.8	13.9 /16.2
Thread M6, quantity (length x width)	-	-	12 x 2	12 x 2	12 x 2	12 x 3	12 x 3
Thread M6, distance/length	n_l x c_1	mm	11x 31.5	11x 31.5	11x 31.5	11x 31.5	11x 31.5
Thread M6, distance/width	n_b x b_1	mm	1x 30	1x 55	1x 80	2x 52.5	2x 65
Motor cable diameter	d_K	mm	11.6	11.6	11.6	11.6	11.6
Standard: Secondary part, through-bore (variant 2)							
Width	B_2	mm	80	110	130	160	180
Mass, length 76/length 152	m_2	kg/unit	0.78/1.56	1.11/2.22	1.36/2.72	1.68/3.36	1.94/3.88
Height	H_2	mm	19.5	19.5	19.5	19.5	19.5
Through-bore for screw M6 ISO 4762	b_3	mm	65	90	115	140	165
Secondary part, tapped bore (variant 1)							
Width	B_2	mm	50	80	100	130	150
Mass, length 76/length 152	m_2	kg/unit	0.58/1.16	0.90/1.80	1.16/2.32	1.47/2.94	1.72/3.44
Height	H_2	mm	19.5	19.5	19.5	19.5	19.5
Thread M6 (from below)	b_2	mm	38	55	80	105	2 x 65
Installation dimensions: L1C-3P-L-B							
Overall height without cooling plate	H_a	mm	53.5 + 0.1	53.5 + 0.1	53.5 + 0.1	53.5 + 0.1	53.5 + 0.1
Overall height with cooling plate	H_b	mm	65.5 + 0.1	65.5 + 0.1	65.5 + 0.1	65.5 + 0.1	65.5 + 0.1
Overall height with cooling plate + therm. ins.	H_c	mm	66.5 + 0.1	66.5 + 0.1	66.5 + 0.1	66.5 + 0.1	66.5 + 0.1
Mechanical air gap	d	mm	approx. 1	approx. 1	approx. 1	approx. 1	approx. 1
Max. width (depending on variant)	B	mm	82	107/110	132	157/160	182
Length of secondary part (76 mm grid)	L_2	mm	L_1 + stroke	L_1 + stroke	L_1 + stroke	L_1 + stroke	L_1 + stroke
Cable length	L_K	mm	≈ 1000	≈ 1000	≈ 1000	≈ 1000	≈ 1000

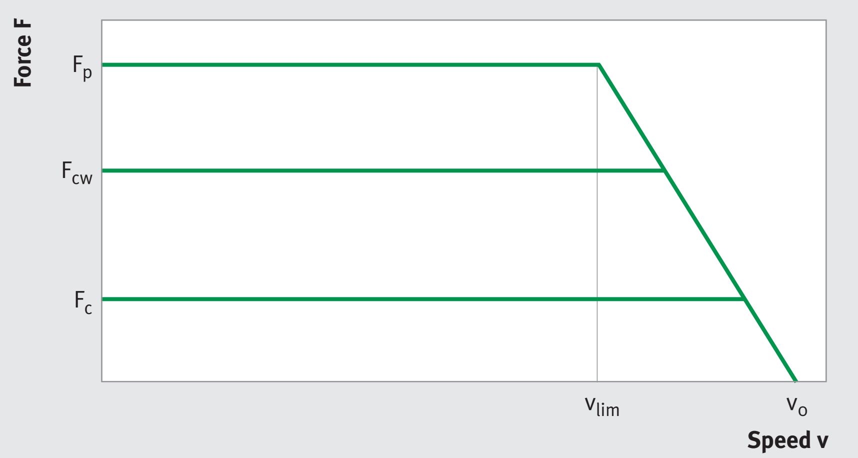
Note: The size specified for the air gap d is an auxiliary dimension and may fluctuate. The only technically relevant dimension is the specified overall installation height H, which must be complied with. A stainless steel cover can be ordered separately for the secondary parts. (The stainless steel cover is not included in the standard equipment.)
Subject to modification without previous notice.

L1C-3P-400-B

Technical data II

Performance data	Symbol	Unit	L1C-3P-400-50-WM	L1C-3P-400-75-WM	L1C-3P-400-100-WM	L1C-3P-400-125-WM	L1C-3P-400-150-WM
Ultimate force at I_u	F_u	N	2058	3073	4078	5074	6060
Peak force (saturation range) at I_p	F_p	N	1757	2622	3480	4330	5171
Peak force (linear range) at I_{pl}	F_{pl}	N	1037	1548	2054	2556	3052
Continuous force (cooled) at I_{cw}	F_{cw}	N	967	1538	2113	2688	3259
Continuous force at I_c	F_c	N	480	709	942	1169	1399
Power loss at I_p (25 °C)	P_{lp}	W	2112	2793	3474	4155	4837
Power loss at I_{pl} (25 °C)	P_{lpl}	W	471	623	775	927	1079
Power loss at I_{cw}	P_{lcw}	W	533	799	1066	1332	1598
Power loss at I_c (25 °C)	P_{lc}	W	101	131	163	194	227
Motor constant (25 °C)	k_m	$N/\sqrt{W}$	47.8	62.0	73.8	84.0	92.9
Damping constant (short-circuit)	k_d	N/(m/s)	2283	3847	5447	7049	8639
Electric time constant	τ_{el}	ms	8.67	9.83	10.54	11.02	11.36
Attraction force	F_a	N	4437	6655	8874	11092	13311
Ripple force (typical cogging)	F_r	N	18	24	30	36	38
Pole pair width	$2\tau_p$	mm	38	38	38	38	38
Cooling-water flow-rate	dV/dt	l/min	1.5	2.3	3.0	3.8	4.6
Cooling-water temperature-difference	$\Delta\vartheta$	K	5.0	5.0	5.0	5.0	5.0

Subject to modification without previous notice.
Tolerance range for values: ±5% • Tolerance range for values "attraction force" and "ripple force": ±10%



Force vs. speed

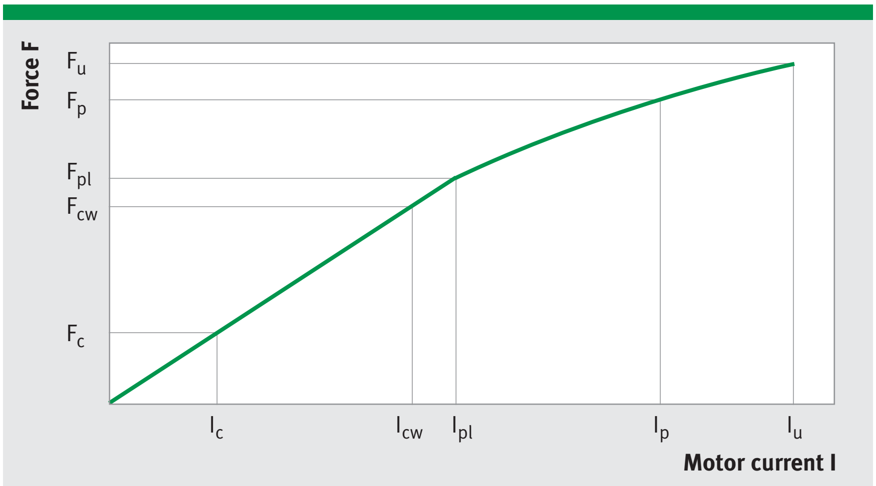
The achievable speed limit depends on operating voltage (U_{DCL}) and current (force).

The diagram shows the idealised envelope with the key operating points at peak current (F_p, v_{lim}) and at idle (F_o, v_o).

L1C-3P-400-B
Technical data III

Winding data	Symbol	Unit	L1C-3P-400-50-WM	L1C-3P-400-75-WM	L1C-3P-400-100-WM	L1C-3P-400-125-WM	L1C-3P-400-150-WM
Force constant	k_f	N/A_{rms}	53.7	80.2	106.5	132.5	158.2
Back EMF constant, phase-to-phase	k_u	V/(m/s)	44.0	65.6	87.1	108.4	129.4
Limit speed at I_p and U_{DCL} = 300 V_{DC}	v_{lim}	m/s	3.6	2.2	1.5	1.1	0.9
Limit speed at I_p and U_{DCL} = 600 V_{DC}	v_{lim}	m/s	7.7	5.0	3.6	2.8	2.3
Electric resistance, phase-to-phase (25 °C)	R_{25}	Ω	0.84	1.12	1.39	1.66	1.93
Inductance, phase-to-phase	L	mH	7.32	10.97	14.63	18.29	21.95
Ultimate current	I_u	A_{rms}	51.1	51.1	51.1	51.1	51.1
Peak current (in the saturation range)	I_p	A_{rms}	40.9	40.9	40.9	40.9	40.9
Peak current (linear range)	I_{pl}	A_{rms}	19.3	19.3	19.3	19.3	19.3
Continuous current (cooled)	I_{cw}	A_{rms}	18.0	19.2	19.8	20.3	20.6
Continuous current (non cooled)	I_c	A_{rms}	8.9	8.8	8.8	8.8	8.8
Permissible temperature (at sensor)	ϑ	°C	100	100	100	100	100
Max. link voltage	U_{DCL}	V	600	600	600	600	600

Subject to modification without previous notice.
Tolerance range for values: ±5% • Tolerance range for values “resistance” and “inductance”: ±10%



Force vs. current

Note:
The winding variant WM (standard) described above is suitable for moderately dynamic performance requirements. The winding variants WL and WH suitable for lower and higher dynamic performance requirements are available upon request. The integrated temperature sensors do not display the exact winding temperature. Depending on current load, the winding temperature may be up to approx. 30 K higher.

Check List for Your Enquiry

Send by fax to: +49 3681 7574-30

This check list can also be downloaded from the download centre at www.idam.de.

Company	**Contact person**	**Industry / appellation of project**
______________________	______________________	______________________
______________________	______________________	______________________
Telephone	**Fax**	**E-mail**
______________________	______________________	______________________

Brief description

____

____

Motor ☐ **System** ☐ **Axis within a multi-axis system** ☐

Spatial position of drive axis

Type of weight compensation: ______________________

Installation conditions for drive

(sketch or drawing, if appropriate)

Max. installation dimensions [mm]: ______________

(length/width/height)

Mechanical interface: ______________

Ambient conditions

Temperature [K]: ______________

Contamination: ______________

Protection class (IP): ______________

Motion variables

Stroke s [mm]: ______________

Payload [kg]: ______________

External forces [N]: ______________

Maximum speed [m/s]: ______________

Constant velocity fluctuations [%] at: ______________

Shortest acceleration

and/or deceleration time [ms]: ______________

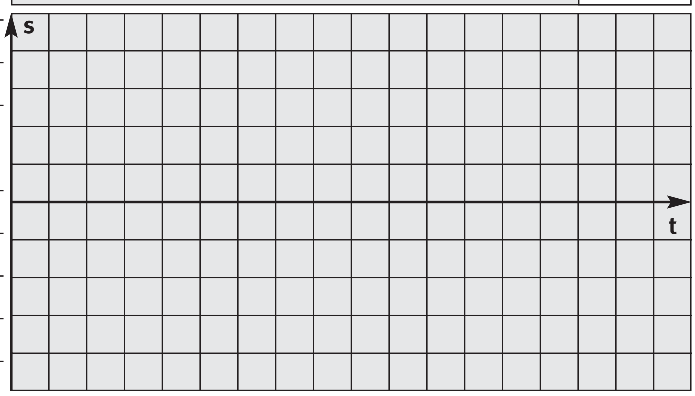
Overshoot in position [µm]: ______________

Settling time [ms]: ______________

Typical cycle per time (diagram): ______________

Service life/operating hours [h]: ______________

Sketch



Required accuracies

(sketch or drawing, if appropriate)

Positioning accuracy [µm]: ____________

Repeatability [µm]: ____________

Cooling

Cooling permissible?

Yes ☐ No ☐

Oil ☐ Water ☐ Air ☐

Max. permissible temperature of

primary part [K]: ____________

secondary part [K]: ____________

Controller

Present?

Yes ☐ No ☐

Link voltage [V_{DC}]: ____________

Controller type:

Components: Servo converter only ☐

Complete controller ☐

Positioning: Point-to-point control ☐

Continuous path control ☐

Sketch

Interfaces: ____________

Options: ____________

General information

Accessories: ____________

Single unit ☐ Series ☐ Prototype for series ☐

Anticipated yearly demand: ____________

Planned series launch: ____________

Price expectation or

costs for previous solution: ____________

Requested date of quotation: ____________

Prepared by: ____________ Date: ____________

Further processing by: ____________ Date: ____________

Feasibility verified by: ____________ Date: ____________

Technical Information and Consulting Services

Class-leading technology and competent consulting services are two of the major benefits of working with IDAM.
IDAM application engineers are looking forward to support you choose the perfect drive for your application.

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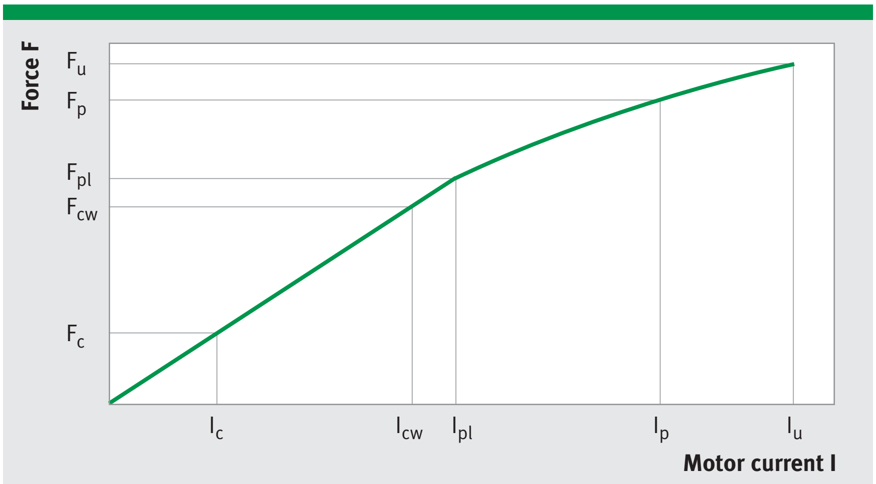
Glossary
Winding-independent parameters

Saturation behaviour

The force initially rises linearly with increasing RMS current, then goes into a curved region before reaching a region with a flatter slope. The curvature is a result of the magnetic saturation of the entire magnetic circuit (“saturation region”).

See also page 10, “Force-current characteristic”



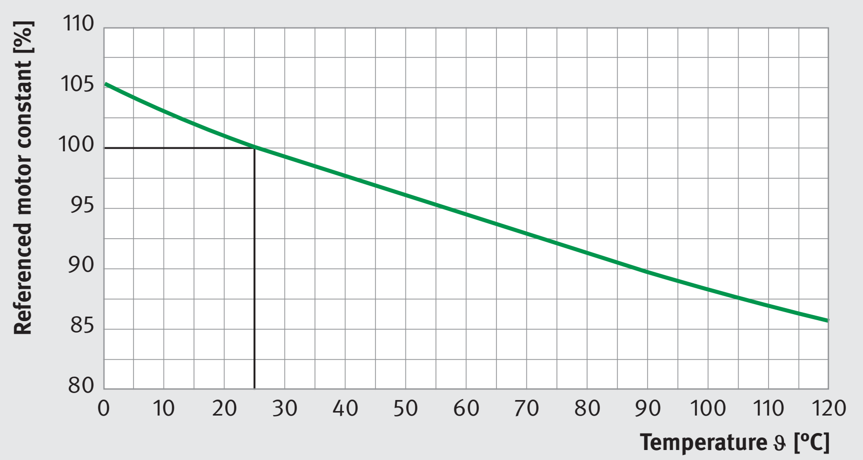
Force vs. current

Symbol	Meaning	Unit	Explanation
F_u	Ultimate force	N	Force at strong saturation of the magnetic circuit. When this force is exceeded there is a risk that the heated motor could become demagnetized or that thermal destruction is immanent shortly! This value must not be used as a dimensioning variable, but must be taken into account in the case of short-circuit braking.
F_p	Peak force	N	Force, which is excited in the saturation range (I_p). The permissible duration depends on the current motor temperature vastly and it is in the range of few seconds (1...3 s).
F_{pl}	Peak force, linear	N	Motor force which can be achieved temporarily (for a few seconds) at the end of the linear dynamic range at $I_{pl} \cdot k_M$.
F_c	Continuous force, non cooled	N	Motor force at continuous current I_c provided all motor phases are subjected to the same load, whereby it is assumed that the heat-exchange surface is an attached plate with approx. 3 times the surface of the primary part.
F_{cw}	Continuous force, cooled	N	Motor force at I_{cw} which is available as a continuous force in rated operation with water cooling and at which a temperature gradient of approx. 100 K between winding and cooling is established. (cooling-water supply-temperature: 20 °C ± 5 °C)
F_s	Standstill force	N	Usable standstill force at standstill and at control frequencies of up to approx. 1 Hz, which is established at the respective standstill current as a result of the non-uniform current distribution in the individual motor phases. Its magnitude is 0.7 times the relevant reference force (F_c, F_{cw}).

Symbol	Meaning	Unit	Explanation
P_l	Power loss	W	The thermal power loss occurring in the motor winding which, as a function of the operating mode (current) and the ambient conditions (cooling) leads to a time-dependent temperature increase. In the upper dynamic range (at F_p), P_l is particularly high because of the quadratic dependency on the current, whereas in the region of the continuous current only a relatively low level of heating occurs. P_l is calculated with the aid of the motor constant k_m for a motion section with the required force F: $\mathbf{P_l = (F/k_m)^2}$
P_{lp}	Peak power loss	W	Peak power loss at I_p
P_{lpl}	Peak power loss, linear	W	Peak power loss at I_{pl}
P_{lc}	Rated power loss, non cooled	W	Power loss at I_c
P_{lcw}	Rated power loss, cooled	W	Power loss at I_{cw}
ϑ	Winding temperature	°C	Permissible winding temperature which is recorded by sensors with a particular offset. The temperature of the motor surface depends on: • the specific installation conditions (dimensions of the machine design) • the heat dissipation conditions • the operating mode and therefore the mean power input and can only be determined if these factors are known.
τ_{el}	Electric time constant	ms	Electric time constant, which describes the L/R ratio. The ratio is - independently of the winding design - approximately constant. The effective time constant in terms of control depends on the degree of voltage overshoot and is lower.
F_r	Ripple force, cogging	N	Force resulting as the sum of reluctance-related forces (cogging), which during movement of the currentless motor act in feed direction and are expressed as a ripple in the forces during operation (peak to peak).

Symbol	Meaning	Unit	Explanation
k_m	Motor constant	$N/\sqrt{W}$	Motor constant which expresses the relationship between the generated force and the power loss (i.e. the efficiency of the motor). It is temperature-dependent and applies specifically only during static operation as well as in the linear dynamic range of the motor, e.g. during positioning procedures at low speeds. At a winding temperature of 100 °C it is reduced to approx. 0.88 times this value.
k_d	Damping constant (short-circuit)	N/(m/s)	At zero impedance (short circuit) the motor generates a regenerative damping force which is speed-dependent and decelerates the motor. $\mathbf{F_d = k_d \cdot v}$
$2\tau_p$	Pole pair width	mm	The pole pair width (also referred to as the magnetic period) $2\tau_p$ describes the path length of a pole pair of the linear motors. τ with the index p is the pole width (magnet width) in the traversing direction with a magnetic field which alternates in relation to N and S.

Thermal behaviour



Motor constant vs. temperature

The temperature-dependent motor constant k_m with the unit $N/\sqrt{W}$ expresses the relationship between force and power loss. For further information about the dependencies between power loss and force and motor constants refer to page 7, "General Motor Parameters".

Winding resistance increases if temperature increases, which leads to a reduction of k_m.
At a winding temperature of 100 °C the motor constant is reduced to about 0.88 times the value at 25 °C.

With a constant current or constant force, the power loss generated in a warm motor is therefore higher than that of a cold motor, and this in turn increases the motor temperature even further.

Glossary
Winding-dependent parameters

Symbol	Meaning	Unit	Explanation
k_f	Force constant	N/A_{rms}	Force constant which, in the linear dynamic range, is multiplied with the current to give the resulting motor force: $\mathbf{F = I_n \cdot k_f}$
k_u	Back EMF constant	V/(m/s)	Voltage constant which in generating service is multiplied with the speed to produce the anchor back EMF present at the motor terminals: $\mathbf{U_{EMF} = k_u \cdot v}$.
v_{lim}	Limit speed	m/s	Temporarily achievable limit speed up to which the force F_p at current I_p can be held relatively constant. At higher values the motor force is reduced. At lower currents/forces the limit speed is higher.
U_{DCL}	Link voltage	V	Link voltage or feeding voltage for the power actuators. It must be higher for higher speeds and thus increasing back EMF and frequency-dependent losses.
R_{25}	Winding resistance	Ω	Phase-to-phase winding resistance at 25 °C. At 100 °C this value increases by a factor of approx. 1.3.
I_u	Ultimate current	A_{rms}	Ultimate current (‹1 second!) at which the magnetic circuit is strongly saturated. Caution: Risk of demagnetization! Thermal destruction of motor is immanent!
I_p	Peak current	A_{rms}	Peak RMS current which is in the region of iron saturation and can be used as a dimensioning variable (see also F_p).
I_{pl}	Peak current, linear	A_{rms}	Peak RMS current up to which an approximately proportional force curve occurs.
I_c	Continuous current, non cooled	A_{rms}	Nominal RMS current at which the associated power loss with a defined size of attached plate (see F_c) without forced cooling leads to a coil temperature of approx. 100 °C.
I_{cw}	Continuous current, cooled	A_{rms}	Nominal RMS current which is achievable with water cooling (cooling-water supply-temperature 25 °C) in continuous operation. The resistance value may be changed corresponding to real coil winding temperature.

Symbol	Meaning	Unit	Explanation
I_s	Standstill current	A_{rms}	RMS standstill current at standstill and with control frequencies of up to approx. 1 Hz. Due to the different current distribution in the motor phases, it is necessary to reduce the motor current to this value in order to prevent local overheating if no noticeable movement beyond a pole pair takes place. Its magnitude is 0.7 times the reference current (I_c, I_{cw}).
L	Motor inductance	mH	Inductance of the motor measured between two phases.

At a Glance: IDAM Brochures

Are you interested in more detailed technical information?

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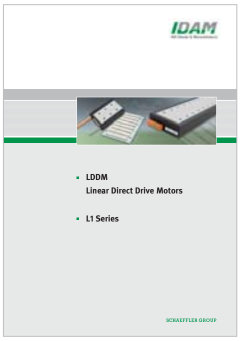
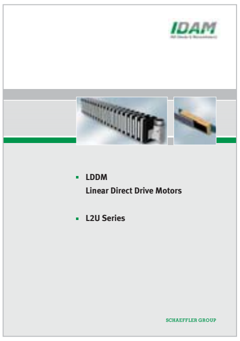


LDDM

Linear motors: L1

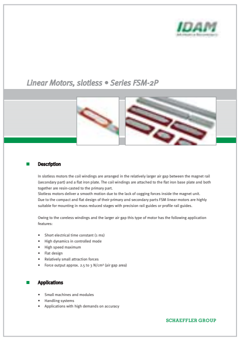


LDDM

Linear motors: L2U

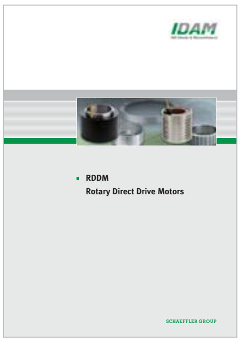
LDDM

Linear motors: ULIM



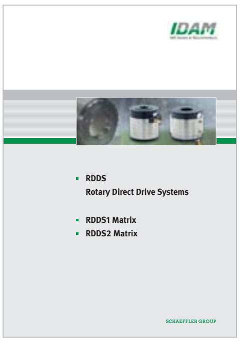
LDDM

Linear motors: FSM



RDDM

Rotary direct drive motors



RDDS

Rotary direct drive systems

Planar reluctance motors

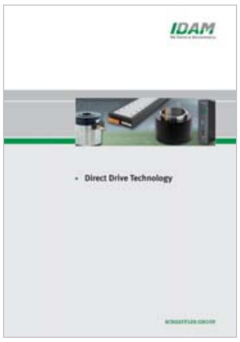
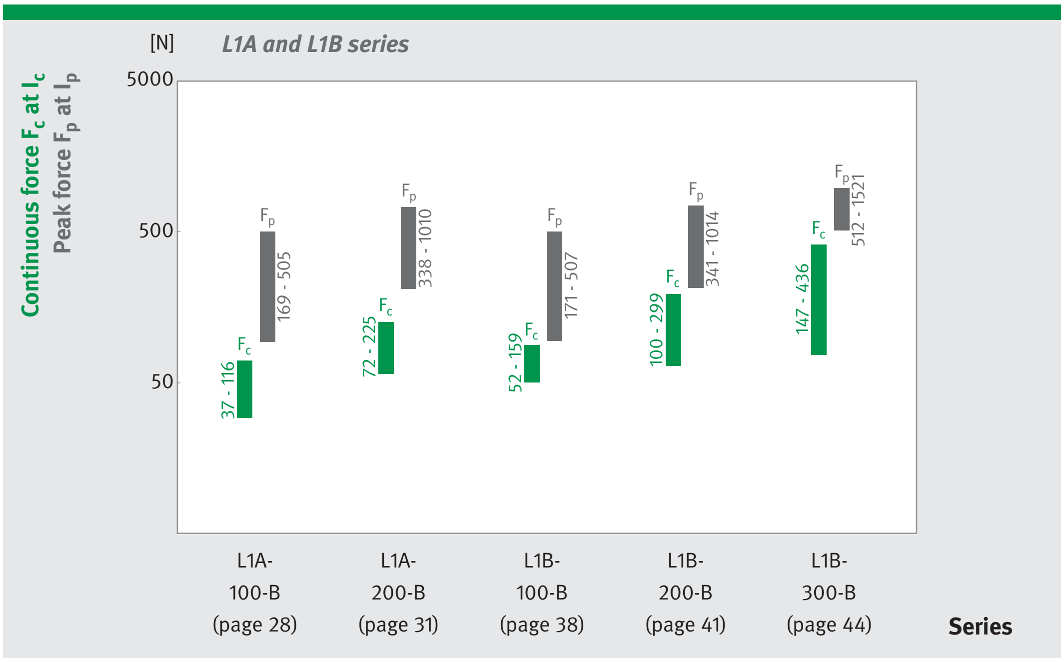
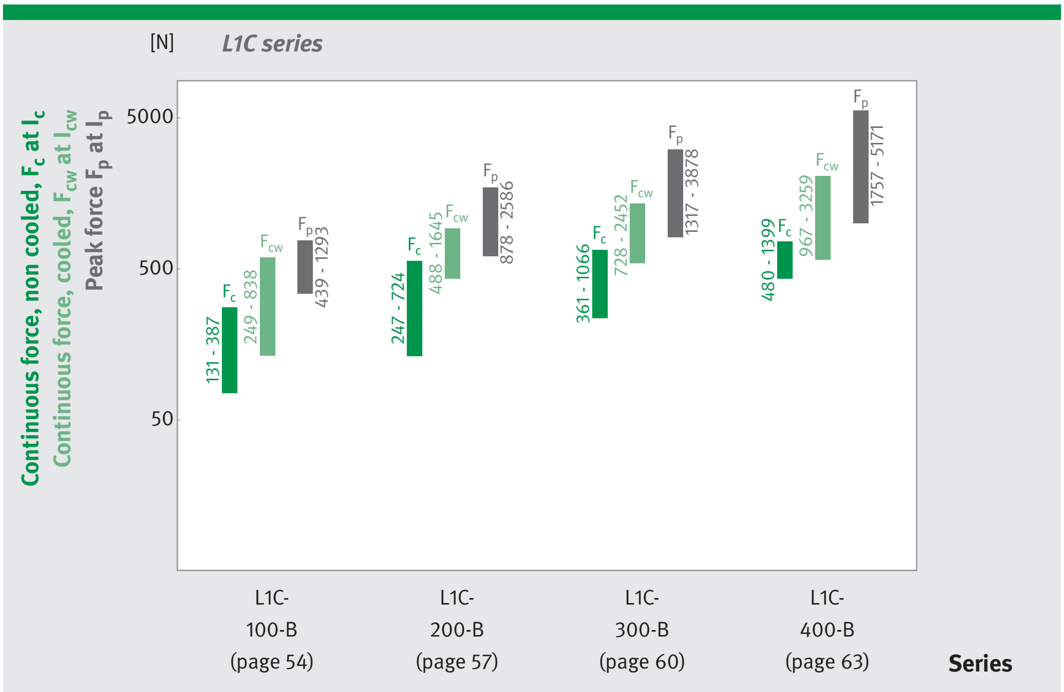


Image brochure: Direct Drive Technology

All information about our motors and systems you can download on IDAM website: www.idam.de

At a Glance: Motor Forces of the L1 Series

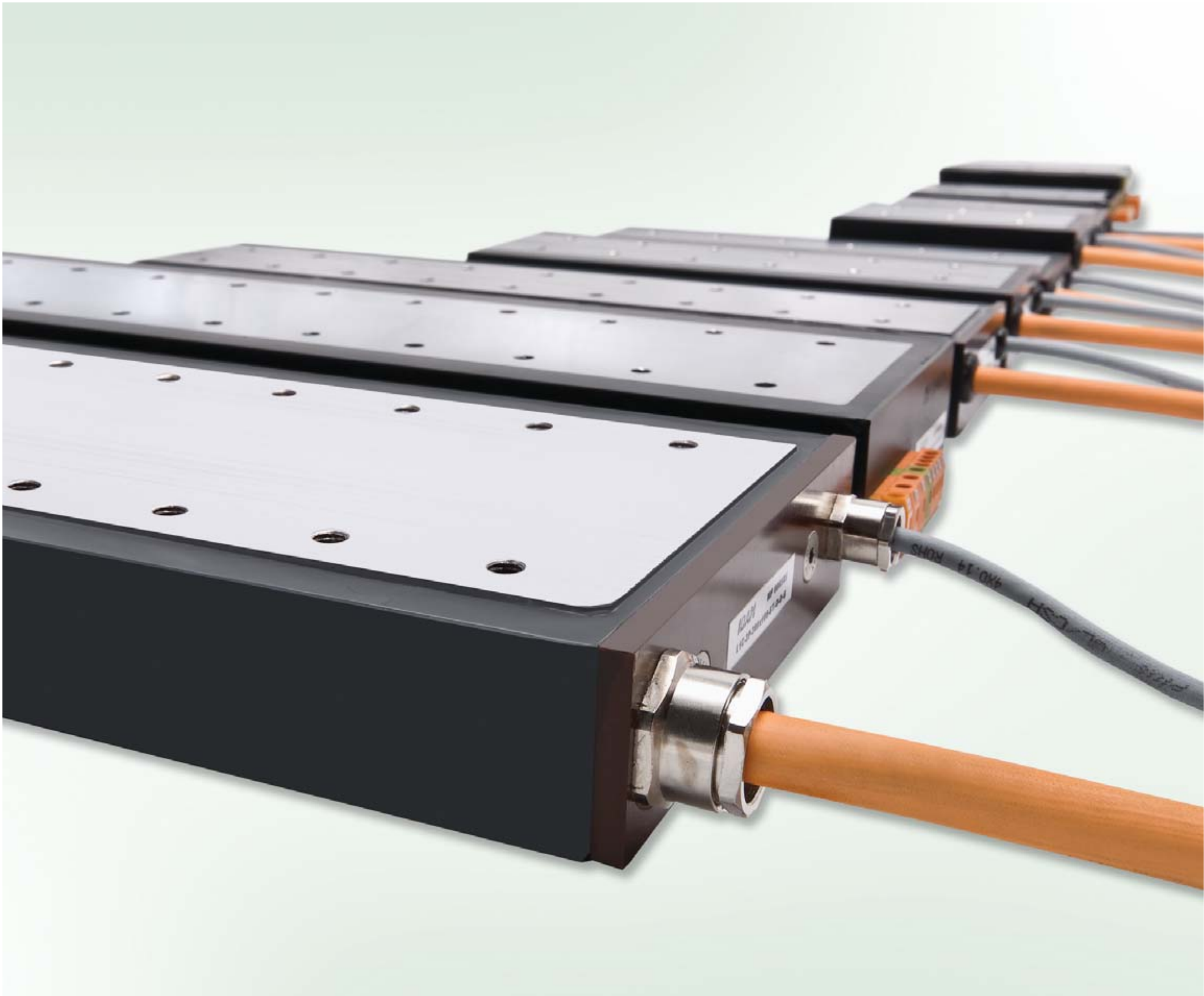




At a Glance: Motor Forces of the L1 Series

To help you select the most suitable L1 motor for your application, an overview of the motor forces of all L1 motors is provided in the following.

Please fold out this page to see the overview.



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