

WEBSMART Motor sizing

General procedure

The sizing of linear motors is mainly determined by the application-related characteristics of velocity and feed force. First of all, the user should determine velocity and force profiles for the required application and set the proper parameters about payload, thrust force, ambient temperature and axis tilt. Then, the choice of the motor size is given either by simply calculating its physical limits, or by using a motor sizing application.

One online application for motor sizing is provided at the address: [Websmart](#)

Step by step with websmart

Step 1) Specify the operating condizions of the motor.

For example, an external payload of 1.2 kgs and a motor type wanted of NL tubular linear motors. Then press Motion Profile button.

The screenshot shows the 'Linear motor sizing' web application interface. At the top, there is a logo for 'NiLAB' and the text 'Linear motor sizing Vers. 3 Rev 022017'. Below the header, there is a 'Project from file' button. The main area is titled 'Operating Conditions' and contains several input fields and dropdown menus:

- Friction coefficient: 0.01 (unit: N/N)
- Inertial payload: 1.2 (unit: Kg)
- Additional thrust force: 0 (unit: Newton)
- Ambient temperature: 40 (unit: Celsius)
- Axis tilt: 0 (unit: °)
- Servo driver supply: 400 (unit: VAC)
- Requested full stroke: (unit: mm)
- Configuration: Moving magnets (dropdown)
- Motor type: NL minilature tubular (dropdown)
- Guiding system: Nitek Linear Guide type (dropdown)
- N. blocks / rails: (dropdown)

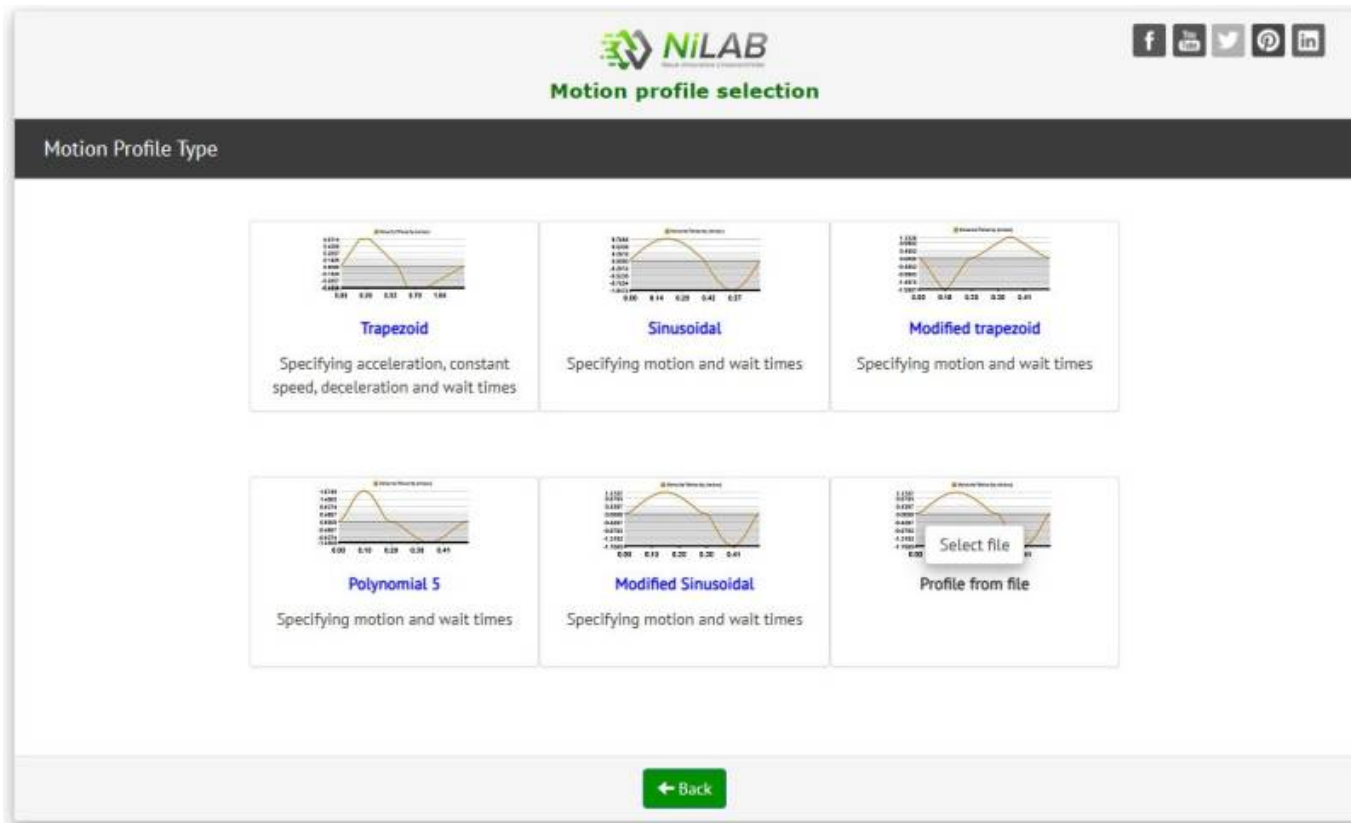
At the bottom of the form, there are two buttons: 'Cancel' and 'Motion Profile →'.

Step 2) Select a motion profile.

There are different options for the motion profile type. The simplest one is polynomial 5.

It is also possible to upload a cam profile file based on position points. Here an example of motion profile file: [cam_profile_example.zip](#)


This example must contain as in the first rows the number of position point, second rows the time resolution and then the position data point with unit in meters




Step 3) create a polynomial 5 motion profile

As an example, we selected the Polynomial 5 motion profile. The motor will move from 0 to 10 mm, with a cycle time = 0.2 sec and a waiting time of 0.1 sec.

Press the "Add segment" button to update the motion cycle.

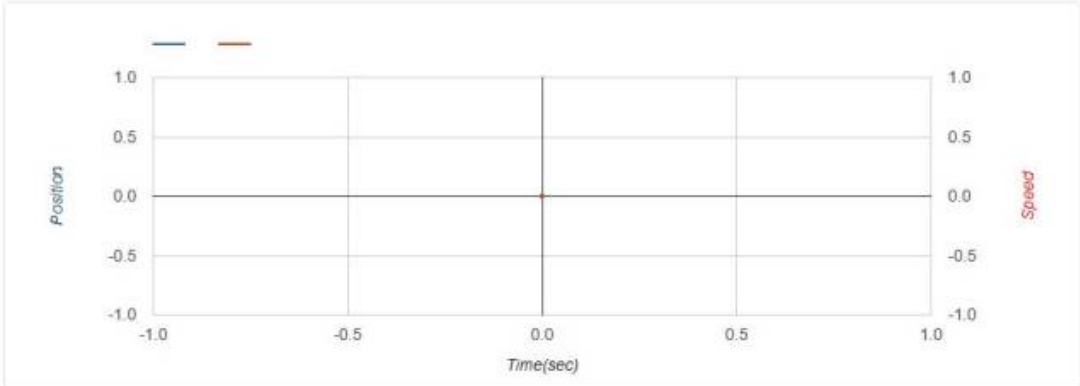

Motion profiles



Motion Profile Type:Polynomial 5 ▾


Motion profile specifications


Movement <input type="text" value="10"/> mm	Cycle time <input type="text" value="0.2"/> sec	Current position [m] <input type="text" value="0"/>	Current cycle time [s] <input type="text" value="0"/>
Dwell time <input type="text" value="0.1"/> sec	Repetitions <input type="text" value="1"/> + Add segment		



Split chart

← BackUndoResetSizing →

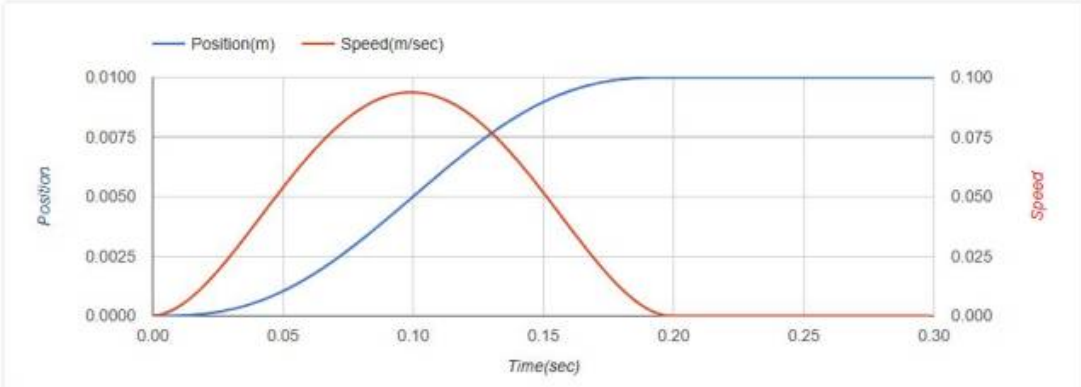

Motion profiles



Motion Profile Type: Polynomial 5 ▾

Motion profile specifications

Movement 0 - 10000 mm	Cycle time 0 - 30 sec	Current position [m] 0.01000	Current cycle time [s] 0.30000
Dwell time 0 - 10 sec	Repetitions 1	<input type="button" value="+ Add segment"/>	



Position(m) Speed(m/sec)

0.0100 0.100
0.0075 0.075
0.0050 0.050
0.0025 0.025
0.0000 0.000

0.00 0.05 0.10 0.15 0.20 0.25 0.30

Time(sec)

Then, we move back of 10 mm with different timing.

Motion Profile Type: Polynomial 5

Motion profile specifications

Movement: 0 - 10000 mm

Cycle time: 0 - 30 sec

Dwell time: 0 - 10 sec

Repetitions: 1

Current position [m]	Current cycle time [s]
0.00000	1.10100

Position(m) Speed(m/sec)

Time(sec)

Split chart

Back Undo Reset Sizing

Step 4) When the motion cycle is complete press Sizing button to go ahead.

A summary window with all the application data will be shown.

Home

NILAB
Motion profile graphs

Charts Compatible motors

Motion profile graphs: Operatings conditions:

Position (m) vs time (t) graph showing a trapezoidal profile. The y-axis ranges from 0.0000 to 0.0100 m, and the x-axis ranges from 0.00000 to 0.94500 s.

Speed (m/sec) vs time (t) graph showing a trapezoidal profile. The y-axis ranges from -0.10 to 0.10 m/sec, and the x-axis ranges from 0.00000 to 0.94500 s.

Acceleration (m/sec²) vs time (t) graph showing a trapezoidal profile. The y-axis ranges from -2 to 2 m/sec², and the x-axis ranges from 0.00 to 0.95 s.

Parameter	Value	Unit
Axis tilt	0	degrees
Payload (linear guide mass)	1.2 (0)	kg
Additional thrust force	0	N
Total stroke	10	mm
Friction coefficient	0.01	N/N
Ambient temperature	40	celsius
Max speed	0.09375	m/s
	6	m/min
Max acceleration	0.1471	G
	1.44	m/sec ²
Cycle time	1.10	sec
Linear guide type	0 x 0	
Mechanical assembly	Moving magnets	
Movement	54.42	mov/min
Duty cycle motion	45.58	%
Power supply	400	VAC

← Back Save session Save profile as PDF

Step 5) Compatible motors

Click on the Compatibl motor folder a list of compatible motor will be shown.

The screenshot shows the NiLAB Motion profile graphs interface. At the top, there is a 'Home' button, the NiLAB logo, and social media icons. Below the logo is the title 'Motion profile graphs'. A 'Charts' tab is active, and a 'Compatible motors' sub-tab is selected. A search bar is present. The main content is a table with 11 columns: Motor code, Magnets Mass, Winding [Celsius], Temperature [%], RMS Power [W], RMS Voltage [kV], RMS Current [A], MAX current [A], RMS Force [N], MAX force [N], and Motor load [%]. Each cell contains a numerical value and a small green progress bar. At the bottom, there are buttons for 'Back', 'Save session', and 'Save profile as PDF'.

Motor code	Magnets Mass	Winding [Celsius]	Temperature [%]	RMS Power [W]	RMS Voltage [kV]	RMS Current [A]	MAX current [A]	RMS Force [N]	MAX force [N]	Motor load [%]
NL080X	0.07	41.90	31	0.26	0.00	0.19	0.57	0.72	2.16	8
NL040Q	0.01	56.10	42	1.36	0.02	0.24	0.73	0.62	1.88	56
NL120Q4P	0.90	63.94	47	13.30	0.01	2.52	3.23	10.57	13.56	50
NL120Q	0.15	40.12	30	0.05	0.00	0.07	0.21	0.89	2.52	4
NL040X	0.01	47.93	36	0.69	0.01	0.24	0.73	0.62	1.89	30
NL120X	0.24	40.11	30	0.05	0.00	0.10	0.27	1.11	2.92	3
NL120X-FC-S157	0.36	42.09	31	4.19	0.01	0.97	1.17	10.55	12.78	15
NL080Q4P	0.05	42.91	32	0.36	0.00	0.32	0.96	0.68	2.06	13
NL080Q	0.05	43.74	32	0.47	0.01	0.18	0.54	0.68	2.06	13


Step 6) Performance and limits check

Click on the motor code the diagram about the motor limits and the requirements are shown.




Step 7) Check safety margin

Click on the Parameter tables the safety margin about the motor performance are shown.



Motor code: NL080X-10



Charts
Parameter tables

MOTOR DATA

Parameter	Value
Phase Resistance	4.86 ohm
Phase Inductance	0.6 mH
Force constant	3.79 N/A
Rated current	2.44 Arms
Back EMF	2.19 V/m/s
Rated Power	27 W
Electrical constant	0.12 msec
Motor constant	0.34 N/radq(W)
Motor shaft length Ls	198 mm
Motor length F	176 mm
Motor dimension H	50 mm

PARAMETERS AND MARGINS OVERVIEW

Motor Parameter	Value	Request by application	Value	Safety margin
Peak force	41.33 N	Requested Peak Force	2.16 N	94.77 %
RMS force	9.25 N	Requested RMS Force	0.72 N	92.22 %
Servo DCBUS	565.60 VDC	Requested DCBUS voltage	4.49 VDC	99.21 %

ENERGY SAVING DATA(BETA Version)

Parameter	Value
Pneumatic cylinder	120603
Air pressure	3 bar
Cylinder outer diameter	12 mm
Cylinder rod diameter	6 mm
Cylinder force	229 N
Air consumption	0.008 nL/cycle
Compressor cost	0.012 Euro/m ³
Air consumption cost	2.86 Euro/year
Motor consumption cost	28.38 Euro/year
Energy saving	-892.3 %
CO2 Saving	-119 Tons/year

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