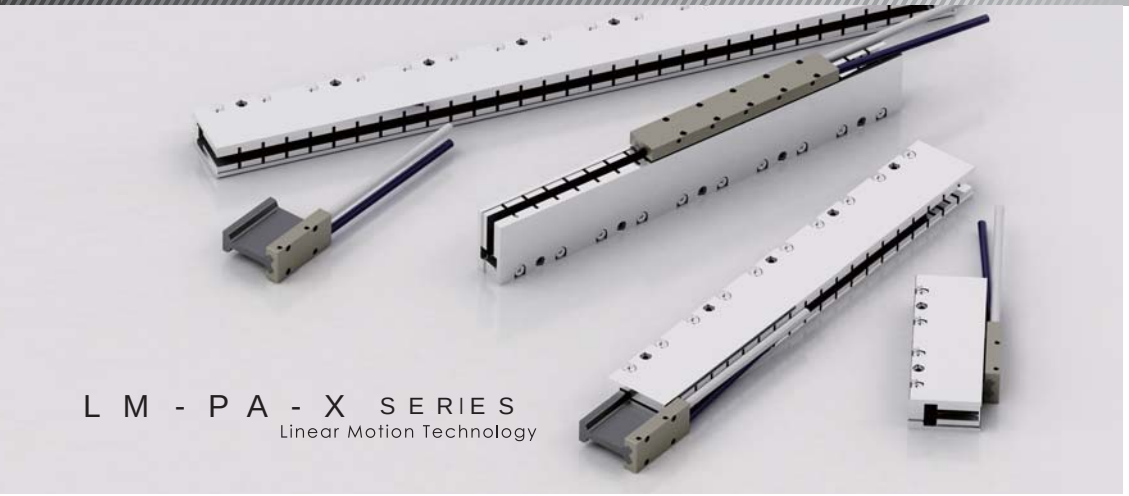


LM-PA-X Coil Assembly Model

Coil Assembly Model	LM-PA-X1	LM-PA-X2		LM-PA-X3		LM-PA-X4			LM-PA-X5	
Winding code	W1	W1	W2	W1	W2	W1	W2	W3	W1	W2
Performance[4]										
Peak force(N)[1][2]	65.4	123.8		175.4		220.2			258	
Continuous force with heat sink(N)[1][2]	16.3	31		43.9		55			64.5	
Continuous force without heat sink(N)[2][3]	11.2	20.6		28.4		37.8			47.3	
Peak power(W)[1][2]	491	881.3		1179.1		1392.6			1537.2	
Continuous power(W)[1][2]	30.7	55.1		73.7		87			96.1	
Mechanical										
Coil assembly length(mm)	50	80		110		140			170	
Coil assembly weight(kg)[2]	0.08	0.13		0.18		0.23			0.28	
Magnetic way weight(kg/m)[2]	4.4	4.4		4.4		4.4			4.4	
Pole pitch(mm)	30	30		30		30			30	
Electrical[4]										
Continuous current with heat sink(A_{pk})[1][2]	1.9	1.8	3.6	1.7	3.4	1.6	3.2	6.4	1.5	3
Continuous current without heat sink(A_{pk})[2][3]	1.3	1.2	2.4	1.1	2.2	1.1	2.2	4.4	1.1	2.2
Peak current[1][2]	7.6	7.2	14.4	6.8	13.6	6.4	12.8	25.6	6	12
Force constant(N/A_{pk})[2]	8.6	17.2	8.6	25.8	12.9	34.4	17.2	8.6	43	21.5
Back EMF constant($V_{pk(l-l)}$ / m/s)[2]	10	20	10	30	15	40	20	10	50	25
Resistance(Ohms)[2]	8.5	17	4.3	25.5	6.4	34	8.5	2.1	42.7	10.7
Inductance(mH)[2]	1.65	3.3	0.83	4.95	1.24	6.6	1.65	0.41	8.27	2.07
Time constant(ms)[2]	0.19	0.19	0.19	0.19	0.19	0.19	0.19	0.19	0.19	0.19
Thermal resistance with heat sink(°C/W)[1][2]	2.8	1.5		1.1		0.9			0.9	
Thermal resistance without heat sink(°C/W)[2][3]	6	3.5		2.8		2.1			1.6	
Heat sink(mm)	250x250x25	250x250x25		250x250x25		250x250x25			250x250x25	
Motor constant(N/√W)[2]	2.9	4.2		5.1		5.9			6.6	
Ph-PE dielectric strength[2]	≥ 5KV(AC)	≥ 5KV(AC)		≥ 5KV(AC)		≥ 5KV(AC)			≥ 5KV(AC)	
Ph-PE insulation resistance[2]	≥ 1KV(DC)	≥ 1KV(DC)		≥ 1KV(DC)		≥ 1KV(DC)			≥ 1KV(DC)	

(1) Value applies to the static sinusoidal drive, under specific heat sink and temperatures form 25℃ to 110℃. Actual performance depends on heat sink configuration, system cooling conditions and the ambient temperature.
(2) The tolerance of all performance and electrical specification is ±10%.
(3) The value applies to the static sinusoidal drive at temperatures from 25℃ up to 110℃, without heat sink.
(4) The above "without heat sink" figure assumes a working condition of 1atm at a 25℃ ambient temperature, with the stationary linear motor not in contact with any other objects, relying only on air convection for cooling. As all heat conductive objects in direct contact with the linear motor, including the sliding plate, linear guide, and base, can be considered a type of heat sink, the "with heat sink" figure should be taken as the primary reference for actual application design.

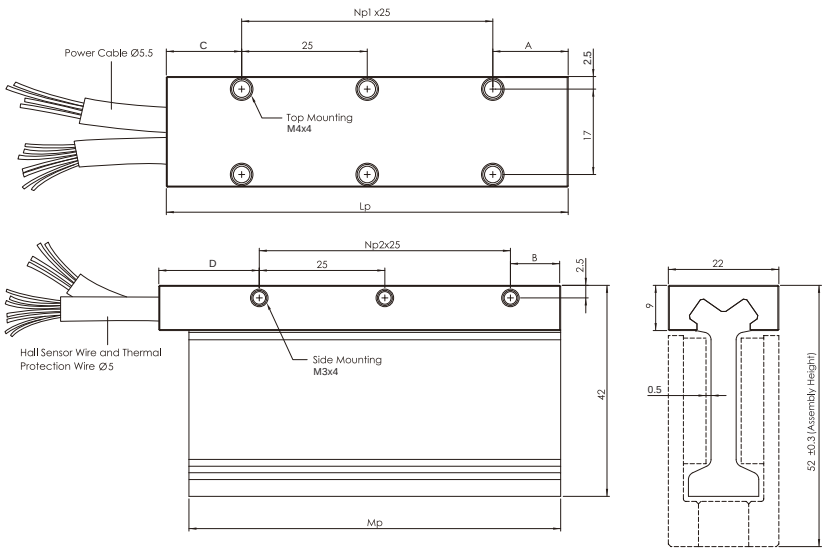
LM-PA-X Coil Assembly

	Np1	Np2	Lp	Mp	A	B	C	D
LM-PA-X1	1	1	50	44	10	5	15	20
LM-PA-X2	2	2	80	74	15	10	15	20
LM-PA-X3	3	3	110	104	20	15	15	20
LM-PA-X4	4	4	140	134	25	20	15	20
LM-PA-X5	6	5	170	164	5	25	15	20

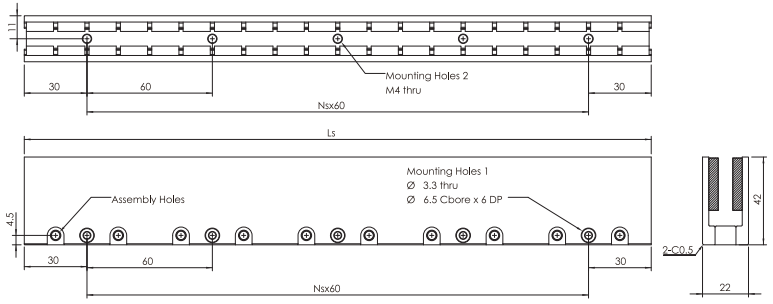
LM-SA-X Magnetic Way

	Ns	Ls
LM-SA-X0	1	120
LM-SA-X1	4	300
LM-SA-X2	7	480

LM-PA-X Coil Assembly

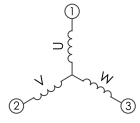


LM-SA-X Magnetic Way



OUTPUT CABLE (All cable standard length is 400 mm)

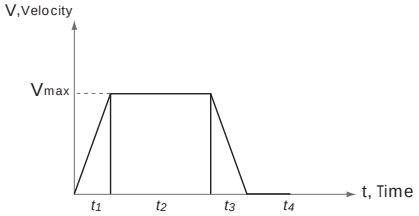
Motor Wire Table			Hall Sensor Wire Table and Thermal Protection Wire Table					
Pin Number	Function	Cross section	Color	Function	Cable Dia.	Color	Function	Cable Dia.
White	U phase	0.25 mm²	Pink	Hall A U phase	0.14 mm²	Brown	Thermal sensor	0.14 mm²
Yellow	V phase	0.25 mm²	Yellow	Hall B V phase	0.14 mm²	Blue		
Brown	W phase	0.25 mm²	Green	Hall C W phase	0.14 mm²	Shielding		
Green	PE + shielding	0.25 mm²	Grey	Hall IC + 5V	0.14 mm²			
			White	GND	0.14 mm²			



Sizing Example

Condition 1: Motion profile containing cruising section

Driver maximum output voltage：300 VDC
Driver continuous output current：2A
Driver peak output current：5A
Max. velocity：Vmax = 2 [m/s]
Load mass：m=5 [kg]
Acceleration：a = 10 [m/s2]
Accelerating time：$t1$ = 0.2 [s]
Cruising time：$t2$ = 3 [s]
Decelerating time：$t3$ = 0.2 [s]
Dwell time：$t4$ = 2 [s]
Friction Force：f = 5 [N]



Symbol	Parameter	Metric	Imperial
$t1$	Accelerating time	s	s
$t2$	Cruising time	s	s
$t3$	Decelerating time	s	s
$t4$	Dwell time	s	s
Vmax	Max. velocity	m/S	in/S

Step1: Thrust force calculation

F1 = ma + f = 5 x 10 +5 = 55 [N]

F2 = f = 5 [N]

F3 = ma – f = 5 x 10 - 5 = 45 [N]

F4 = 0 [N]

$$Frms = \sqrt{\frac{F1^2 \times t1 + F2^2 \times t2 + F3^2 \times t3 + F4^2 \times t4}{t1 + t2 + t3 + t4}}$$

$$= \sqrt{\frac{55^2 \times 0.2 + 5^2 \times 3 + 45^2 \times 0.2 + 0}{0.2 + 3 + 0.2 + 2}} = 14.2 \text{ [N]}$$

Fmax = F1 = 55 [N]

Safety factor = 1.5

Motor required peak force needs to be greater than
Fmax x 1.5 = 55 x 1.5 = 82.5 [N]
Motor required continuous force needs to be greater than
Frms x 1.5 = 14.2 x 1.5 = 21.3 [N]
Hence choose LM-PA-X2
(Peak Force= 123.8[N], Continuous force = 31[N])

Step2: Wiring selection

If W1 model is chosen

Irms = Frms / Kf = 21.3 / 17.2 = 1.24 [A]

Imax = Fmax / kf = 82.5 / 17.2 = 4.8 [A]

Required voltage = Vmax x Ke + Imax x R

= 2 x 20 + 4.8 x 17 = 121.6 [V]

Take safety factor = 1.3

Required supply voltage 121.6 x 1.3 = 158.1 [V]

Driver：

Continuous output current 2A > 1.24A

Peak output current 5A > 4.8A

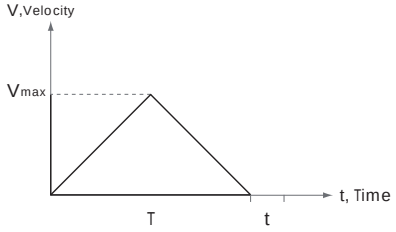
Max. output voltage 300 V > 158.1V

W1 model matches requirements.

LM-PA-X2-W1 will be applicable.

Condition 2 : Motion Profile without cruising velocity section

Driver maximum output voltage：80VDC
Driver continuous output current：2A
Driver peak output current：4A
Load mass：5 [kg]
Moving Time：T = 1 [s]
Stroke：S = 1[m]
Friction Force：f = 5 [N]



Symbol	Parameter	Metric	Imperial
t	Stop time	s	s
T	Moving time	s	s
Vmax	Max. velocity	m/s	in/s
a	Acceleration	m/s²	in/s²
s	Stroke	m	in

Step1: Thrust force calculation

a =4S/T²= 4 x 1/1 = 4 m/s²

F1 = ma + f = 5 x 4 +5 = 25 [N]

F2 = ma – f = 5 x 4–5 =15 [N]

F3 = 0[N]

$$Frms = \sqrt{\frac{F1^2 \times t1 + F2^2 \times t2 + F3^2 \times t3}{t1 + t2 + t3}}$$

$$Frms = \sqrt{\frac{25^2 \times 0.5 + 15^2 \times 0.5 + 0}{0.5 + 0.5 + 0.2}} = 18.8 \text{ [N]}$$

Fmax = F1 = 25 [N]

Safety factor = 1.5

Motor required peak force needs to be greater than
Fmax x 1.5 = 25 x 1.5 =37.5 [N]
Motor required peak force needs to be greater than
Frms x 1.5 = 18.8 x 1.5 = 28.2 [N]
Hence choose LM-PA-X4
(Peak Force= 151.4[N]，Continuous force = 37.8[N])

Step2: Wiring selection

If W1 model is chosen

Irms = Frms / Kf = 18.8 / 34.4 = 0.55 [A]

Imax = Fmax/ Kf = 25 / 34.4 = 0.73 [A]

Vmax = T/2 x a =1/2 x 4 = 2 [m/s]

Required voltage = Vmax x Ke + Imax x R

= 2 x 40 + 0.73 x 34 = 104.8 [V]

Take safety factor =1.3

Required supply voltage 104.8 x 1.3 = 136.2 [V]

Driver：

Continuous output current 2A > 0.55A

Peak output current 4A > 0.73A

Max. output voltage 80V < 136.2V

Max. velocity cannot be reached with W1.

If W2 model is chosen

Irms = Frms / Kf = 18.8/17.2 = 1.1 [A]

Imax = Fmax / Kf = 25/17.2 = 1.45 [A]

Required voltage = Vmax. x Ke + Imax x R

= 2 x 20+ 1.45 x 8.5 = 52.3 [V]

Take safety factor = 1.3

Required supply voltage 52.3 x 1.3 = 68 [V]

Driver：

Continuous output current 2A > 1.1A

Peak output current 4A > 1.45A

Max. output voltage 80V > 68V

W2 model matches requirements.

LM-PA-X4-W2 will be applicable.

Note: For other calculation constraints or special requirements please contact cpc.

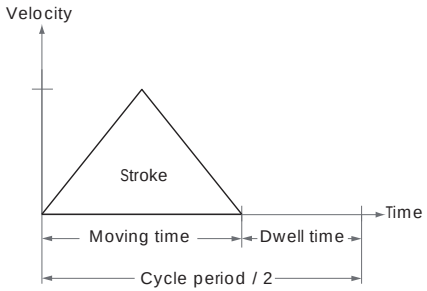
Sizing Form

Customer Name /	Filling Date (DD/MM/YEAR) /
Contact Person /	Telephone /
E-mail /	Fax /

1. Point-to-point motion without constant velocity

Property: Specific travel distance in specific time
Application: Pick and place, carriage etc.

a. Known Motion Condition	
(1) Load mass	kg
(2) Effective stroke	m
(3) Moving time	s
(4) Dwell time	s



b. Driver Condition	
(1) Max. output voltage	V
(2) Continuous current	A
(3) Peak current	A

c. Encoder	
(1) ☐ Analog ☐ Digital	
(2) Resolution	μm

f. Motion Direction
(1) ☐ Horizontal
(2) ☐ Vertical
(3) ☐ Tilt_____ degrees

d. Working Environment
(1) ☐ Room temperature
(2) ☐ Constant temperature _____°C
(3) ☐ Vacuum _____ Torr
(4) ☐ Clean room _____ level

g. Installation Method
(1) ☐ Lying flat
(2) ☐ Vertically standing
(3) ☐ Wall mount

e. Motion Precision	
(1) Positioning accuracy	μm
(2) Repetitive accuracy	μm

h. Space Restrictions
(1) ☐ None
(2) ☐ Yes _____mm x_____mm x_____mm

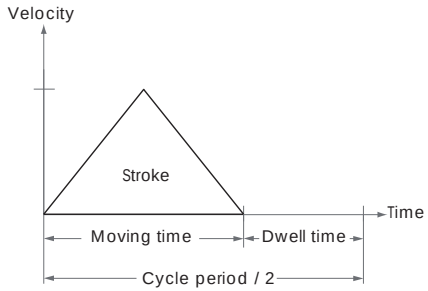
Sizing Form

Customer Name /	Filling Date (DD/MM/YEAR) /
Contact Person /	Telephone /
E-mail /	Fax /

2. Point-to-Point Motion without constant velocity

Property: Specific travel distance in specific time
Application: Pick and place, carriage etc.

a. Known Motion Condition	
(1) Load mass	kg
(2) Effective stroke	m
(3) Frequency	Hz
(4) Dwell time	s



b. Driver Condition	
(1) Max. output voltage	V
(2) Continuous current	A
(3) Peak current	A

c. Encoder	
(1) ☐ Analog ☐ Digital	
(2) Resolution	μm

f. Motion Direction
(1) ☐ Horizontal
(2) ☐ Vertical
(3) ☐ Tilt_____ Degrees

d. Working Environment
(1) ☐ Room temperature
(2) ☐ Constant temperature _____°C
(3) ☐ Vacuum _____ Torr
(4) ☐ Clean room _____ level

g. Installation Method
(1) ☐ Lying flat
(2) ☐ Vertically standing
(3) ☐ Wall mount

e. Motion Precision	
(1) Positioning accuracy	μm
(2) Repetitive accuracy	μm

h. Space Restrictions
(1) ☐ None
(2) ☐ Yes _____mm x_____mm x_____mm

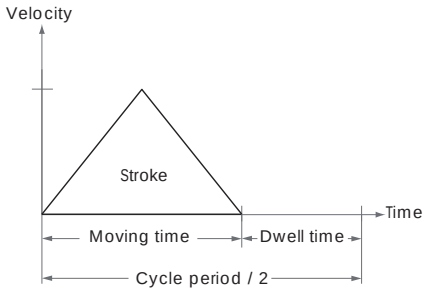
Sizing Form

Customer Name /	Filling Date (DD/MM/YEAR) /
Contact Person /	Telephone /
E-mail /	Fax /

3. Point-to-Point Motion without constant velocity

Property: Specific travel distance in specific time
Application: Pick and place, carriage etc.

a. Known Motion Condition	
(1) Load mass	kg
(2) Effective stroke	m
(3) Acceleration	m/s²
(4) Dwell time	s



b. Driver Condition	
(1) Max. output voltage	V
(2) Continuous current	A
(3) Peak current	A

c. Encoder	
(1) ☐ Analog ☐ Digital	
(2) Resolution	μm

f. Motion Direction
(1) ☐ Horizontal
(2) ☐ Vertical
(3) ☐ Tilt_____ degrees

d. Working Environment
(1) ☐ Room temperature
(2) ☐ Constant temperature _____°C
(3) ☐ Vacuum _____ Torr
(4) ☐ Clean room _____ level

g. Installation Method
(1) ☐ Lying flat
(2) ☐ Vertically standing
(3) ☐ Wall mount

e. Motion Precision	
(1) Positioning accuracy	μm
(2) Repetitive accuracy	μm

h. Space Restrictions
(1) ☐ None
(2) ☐ Yes _____mm x_____mm x_____mm

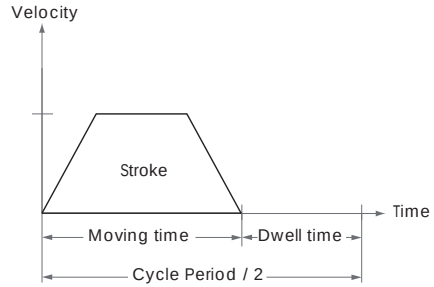
Sizing Form

Customer Name /	Filling Date (DD/MM/YEAR) /
Contact Person /	Telephone /
E-mail /	Fax /

4. Point-to-Point Motion with constant velocity

Property: Work performed under constant velocity
Application: Scanning, inspection, cutting etc.

a. Motion Condition	
(1) Load mass	kg
(2) Effective stroke	m
(3) Moving time	s
(4) Dwell time	s
(5) Acceleration	m/s²



b. Driver Condition	
(1) Max. output voltage	V
(2) Continuous current	A
(3) Peak current	A

c. Encoder	
(1) ☐ Analog ☐ Digital	
(2) Resolution	μm

f. Motion Direction
(1) ☐ Horizontal
(2) ☐ Vertical
(3) ☐ Tilt_____ degrees

d. Working Environment
(1) ☐ Room Temperature
(2) ☐ Constant Temperature _____°C
(3) ☐ Vacuum _____ Torr
(4) ☐ Clean room _____ level

g. Installation Method
(1) ☐ Lying flat
(2) ☐ Vertically standing
(3) ☐ Wall mount

e. Motion Precision	
(1) Positioning accuracy	μm
(2) Repetitive accuracy	μm

h. Space Restrictions
(1) ☐ None
(2) ☐ Yes _____mm x_____mm x_____mm

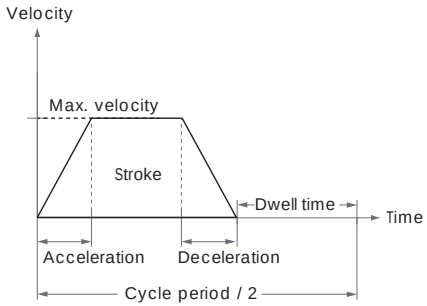
Sizing Form

Customer Name /	Filling Date (DD/MM/YEAR) /
Contact Person /	Telephone /
E-mail /	Fax /

5. Point-to-point motion with constant velocity

Property: Work performed under constant velocity
Application: Scanning, inspection, cutting etc.

a. Motion Condition	
(1) Load mass	kg
(2) Effective stroke	m
(3) Max. velocity	m/s
(4) Acceleration time	s
(5) Dwell time	s



b. Driver Condition	
(1) Max. output voltage	V
(2) Continuous current	A
(3) Peak current	A

c. Encoder	
(1) ☐ Analog ☐ Digital	
(2) Resolution	μm

f. Motion Direction
(1) ☐ Horizontal
(2) ☐ Vertical
(3) ☐ Tilt_____ degrees

d. Working Environment
(1) ☐ Room temperature
(2) ☐ Constant temperature _____°C
(3) ☐ Vacuum _____ Torr
(4) ☐ Clean room _____ level

g. Installation Method
(1) ☐ Lying flat
(2) ☐ Vertically standing
(3) ☐ Wall mount

e. Motion Precision	
(1) Positioning accuracy	μm
(2) Repetitive accuracy	μm

h. Space Restrictions
(1) ☐ None
(2) ☐ Yes _____mm x_____mm x_____mm

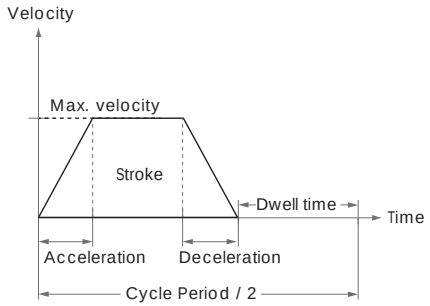
Sizing Form

Customer Name /	Filling Date (DD/MM/YEAR) /
Contact Person /	Telephone /
E-mail /	Fax /

6. Point-to-Point Motion with constant velocity section

Property: Work performed under constant velocity
Application: Scanning, inspection, cutting etc.

a. Motion Condition	
(1) Load mass	kg
(2) Effective stroke	m
(3) Moving time	s
(4) Acceleration	m/s^2
(5) Dwell time	s



b. Driver Condition	
(1) Max. output voltage	V
(2) Continuous current	A
(3) Peak current	A

c. Encoder	
(1) ☐ Analog ☐ Digital	
(2) Resolution	μm

f. Motion Direction
(1) ☐ Horizontal
(2) ☐ Vertical
(3) ☐ Tilt_____ degrees

d. Working Environment
(1) ☐ Room temperature
(2) ☐ Constant temperature _____°C
(3) ☐ Vacuum _____ Torr
(4) ☐ Clean room _____ level

g. Installation Method
(1) ☐ Lying flat
(2) ☐ Vertically standing
(3) ☐ Wall mount

e. Motion Precision	
(1) Positioning accuracy	μm
(2) Repetitive accuracy	μm

h. Space Restrictions
(1) ☐ None
(2) ☐ Yes _____mm x_____mm x_____mm