



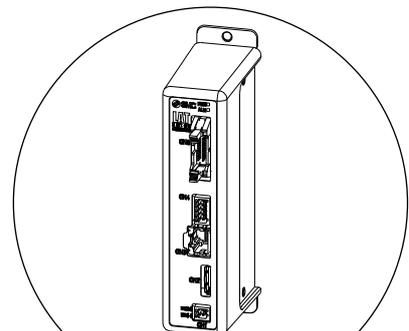
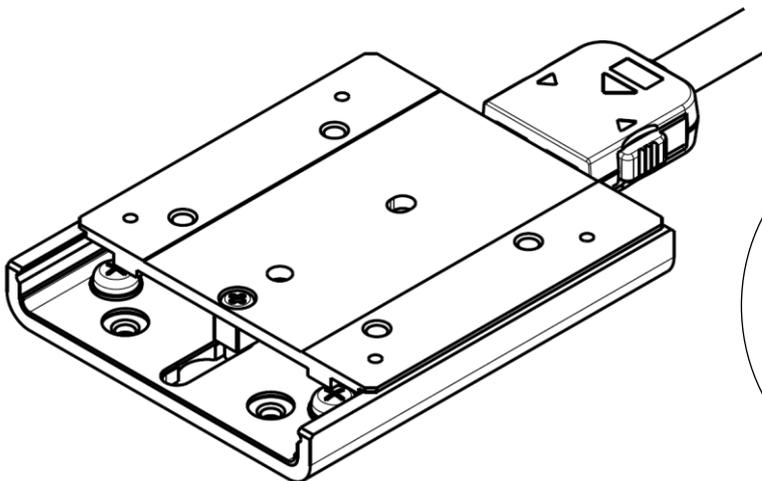
# Operation Manual

PRODUCT NAME

***Card Motor***

Model / Series / Product Number

**LAT3 Series**



Controller  
LATCA Series

**SMC Corporation**



### **About this operation manual**

This operation manual summarizes how to operate the LAT3 Card Motor.

For operation of the Card motor Controller, refer to the operation manual for the [Card Motor Controller].

For initial setting and installation of the LAT3 Card Motor refer to the operation manual [Card Motor Simple Setting Manual].

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# LAT3 Series/Card Motor

## 1. Safety Instructions

These safety instructions are intended to prevent hazardous situations and/or equipment damage. These instructions indicate the level of potential hazard with the labels of "Caution," "Warning" or "Danger."

They are all important notes for safety and must be followed in addition to International Standards (ISO/IEC)\*1), and other safety regulations.

\*1) ISO 4414: Pneumatic fluid power -- General rules relating to systems.

ISO 4413: Hydraulic fluid power -- General rules relating to systems.

IEC 60204-1: Safety of machinery -- Electrical equipment of machines .(Part 1: General requirements)

ISO 10218-1992: Manipulating industrial robots -Safety.

etc.



### Caution

**Caution** indicates a hazard with a low level of risk which, if not avoided, could result in minor or moderate injury.



### Warning

**Warning** indicates a hazard with a medium level of risk which, if not avoided, could result in death or serious injury.



### Danger

**Danger** indicates a hazard with a high level of risk which, if not avoided, will result in death or serious injury.

## Warning

### 1. The compatibility of the product is the responsibility of the person who designs the equipment or decides its specifications.

Since the product specified here is used under various operating conditions, its compatibility with specific equipment must be decided by the person who designs the equipment or decides its specifications based on necessary analysis and test results.

The expected performance and safety assurance of the equipment will be the responsibility of the person who has determined its compatibility with the product.

This person should also continuously review all specifications of the product referring to its latest catalog information, with a view to giving due consideration to any possibility of equipment failure when configuring the equipment.

### 2. Only personnel with appropriate training should operate machinery and equipment.

The product specified here may become unsafe if handled incorrectly.

The assembly, operation and maintenance of machines or equipment including our products must be performed by an operator who is appropriately trained and experienced.

### 3. Do not service or attempt to remove product and machinery/equipment until safety is confirmed.

1. The inspection and maintenance of machinery/equipment should only be performed after measures to prevent falling or runaway of the driven objects have been confirmed.

2. When the product is to be removed, confirm that the safety measures as mentioned above are implemented and the power from any appropriate source is cut, and read and understand the specific product precautions of all relevant products carefully.

3. Before machinery/equipment is restarted, take measures to prevent unexpected operation and malfunction.

### 4. Contact SMC beforehand and take special consideration of safety measures if the product is to be used in any of the following conditions.

1. Conditions and environments outside of the given specifications, or use outdoors or in a place exposed to direct sunlight.

2. Installation on equipment in conjunction with atomic energy, railways, air navigation, space, shipping, vehicles, military, medical treatment, combustion and recreation, or equipment in contact with food and beverages, emergency stop circuits, clutch and brake circuits in press applications, safety equipment or other applications unsuitable for the standard specifications described in the product catalog.

3. An application which could have negative effects on people, property, or animals requiring special safety analysis.

4. Use in an interlock circuit, which requires the provision of double interlock for possible failure by using a mechanical protective function, and periodical checks to confirm proper operation.



# LAT3 Series/Card Motor

## 1.Safety Instructions

### Caution

#### **1.The product is provided for use in manufacturing industries.**

The product herein described is basically provided for peaceful use in manufacturing industries.

If considering using the product in other industries, consult SMC beforehand and exchange specifications or a contract if necessary.

If anything is unclear, contact your nearest sales branch.

## Limited warranty and Disclaimer/Compliance Requirements

The product used is subject to the following “Limited warranty and Disclaimer” and “Compliance Requirements”.

Read and accept them before using the product.

### Limited warranty and Disclaimer

#### **1. The warranty period of the product is 1 year in service or 1.5 years after the product is delivered,whichever is first.\*2)**

**Also, the product may have specified durability, running distance or replacement parts. Please consult your nearest sales branch.**

#### **2. For any failure or damage reported within the warranty period which is clearly our responsibility,**

**a replacement product or necessary parts will be provided.**

**This limited warranty applies only to our product independently, and not to any other damage incurred due to the failure of the product.**

#### **3. Prior to using SMC products, please read and understand the warranty terms and disclaimers noted in the specified catalog for the particular products.**

#### **\*2) Vacuum pads are excluded from this 1 year warranty.**

**A vacuum pad is a consumable part, so it is warranted for a year after it is delivered.**

**Also, even within the warranty period, the wear of a product due to the use of the vacuum pad or failure due to the deterioration of rubber material are not covered by the limited warranty.**

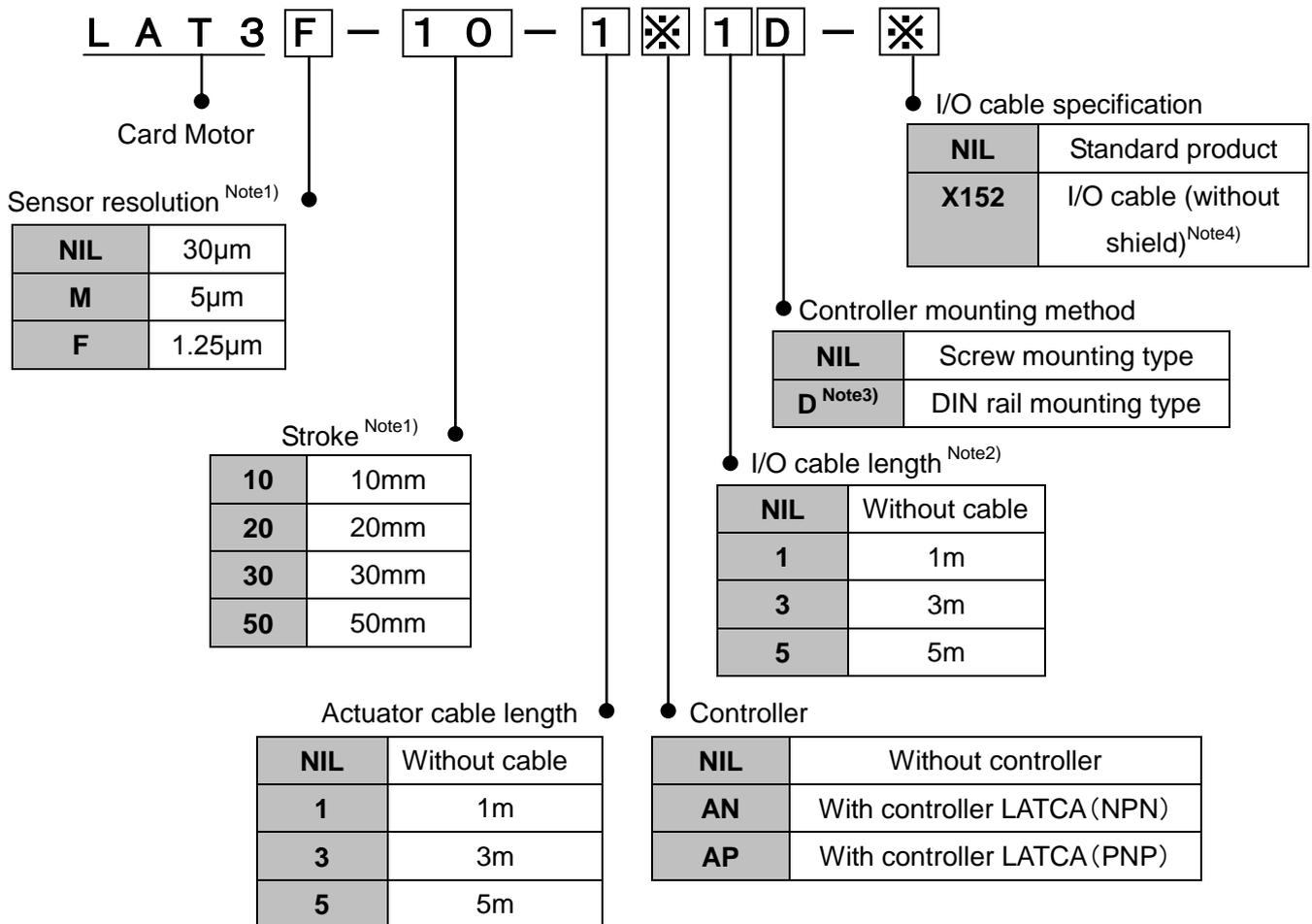
### Compliance Requirements

#### **1. The use of SMC products with production equipment for the manufacture of weapons of mass destruction(WMD) or any other weapon is strictly prohibited.**

#### **2. The exports of SMC products or technology from one country to another are governed by the relevant security laws and regulation of the countries involved in the transaction. Prior to the shipment of a SMC product to another country, assure that all local rules governing that export are known and followed.**

## 2. Product Outlines

### 2.1 How to Order



Note1) Refer to the table below for the Card motor model resolution and stroke available.

		Stroke			
		10mm	20mm	30mm	50mm
Model No.	LAT3	○	○	○	-
	LAT3M	-	-	-	○
	LAT3F	○	○	○	○

○: Available    -: Not available

Note 2) If "Without controller" has been selected, the I/O cable is also not included. Therefore it is not possible to select the I/O cable for this option.

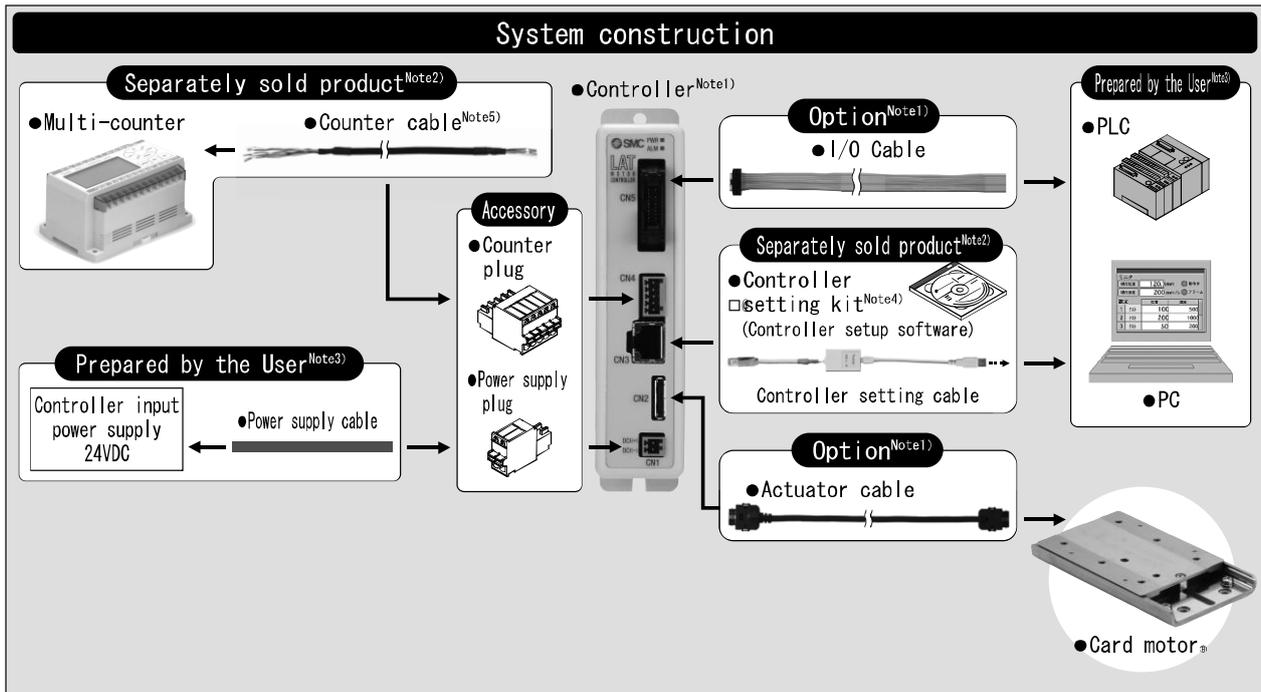
If the I/O cable is required, please order separately. (Refer to section "3.5 I/O cable" (P.19))

Note 3) The DIN rail is not included. If the DIN rail is required, please order separately.

(Refer to the LAT3 series catalogue for details.)

Note 4) The I/O cable supplied is changed from the standard shielded cable (LATH5) to the cable without shield (LATH2).

## 2. 2 System structure



Note 1) "Options" such as controller and cables can be added to the How to Order for the main products (Card Motor and Card Motor controller). Refer to How to Order for details.

Note 2) "Separately sold products" cannot be added to the How to Order for the main products (Card Motor and Card Motor controller). These should be ordered separately.

Note 3) Power supply, power supply cables, PLC, and PC should be prepared by the user.

Note 4) These items are used to set the parameters and step data and to perform test operations.

Note 5) These items are used to display the table position and to signal active pre-set positions to external devices via digital outputs when measuring the length.

### Options

(Can be ordered separately or with the motor)

No.	Description	Part No.
1	Controller	LATCA-□
2	Actuator cable	LATH1-□
3	I/O cable (Without shield)	LATH2-□
4	I/O cable (With shield)	LATH5-□

### Accessories

(Supplied with the controller attached to it)

No.	Description	Part No.
1	Power supply plug	LATC4P-020S
2	Counter plug	LATC4P-050S

### Separately sold products

No.	Description	Part No.	Remarks
1	Multi-counter	CEU5□□-□	
2	Counter cable	LATH3-□	Connection of LATCA and CEU5.
3	Communication cable	LATH6-□	For serial communication
4	Branch communication cable	LATH7-□	For serial communication
5	Controller setting kit	LATC-W2	Controller setting software Controller setting cable

 **Caution**

Refer to the Card Motor Controller operation manual for detailed wiring.

Refer to section “5. Common Precautions for wiring and cables” (P.28) for instructions regarding wiring and handling of cables.

Refer to the Card Motor Controller operation manual for parts which are not included.

## 3. Specifications

### 3.1 Card Motor

#### (1) Card Motor specifications

Model		LAT3-10	LAT3F-10	LAT3-20	LAT3F-20	LAT3-30	LAT3F-30	LAT3M-50	LAT3F-50
Stroke [mm]		10		20		30		50	
Motor	Type	Moving magnet type linear motor							
	Maximum instantaneous thrust [N] <small>Note 1) Note 2) Note 3)</small>	5.2		6		5.5		2.5	
	Continuous thrust [N] <small>Note 1) Note 2) Note 3)</small>	3		2.8		2.6		1.5	
Guide	Type	Linear guide with circulating balls							
	Maximum load weight [g]	Horizontal: 1000, Vertical: 100				Horizontal: 1000, Vertical: 50		Horizontal: 1000, Vertical load not allowed.	
Sensor	Type	Optical linear encoder (incremental)							
	Resolution [ $\mu$ m]	30	1.25	30	1.25	30	1.25	5	1.25
	Origin position signal	None	Provided	None	Provided	None	Provided	Provided	
Pushing operation	Pushing speed [mm/s]	6							
	Set value of force <small>Note 1) Note 2) Note 3)</small>	1 to 5		1 to 4.8		1 to 3.9		1 to 2	
Positioning operation	Positioning resolution [ $\mu$ m]	30	1.25	30	1.25	30	1.25	5	1.25
	Positioning repeatability [ $\mu$ m] <small>Note 4) Note 5)</small>	$\pm 90$	$\pm 5$	$\pm 90$	$\pm 5$	$\pm 90$	$\pm 5$	$\pm 20$	$\pm 5$
Measurement	Accuracy [ $\mu$ m] <small>Note 4) Note 5)</small>	$\pm 100$	$\pm 10$	$\pm 100$	$\pm 10$	$\pm 100$	$\pm 10$	$\pm 40$	$\pm 10$
Maximum speed [mm/s] <small>Note 6)</small>		400							
Operating temperature range [°C]		5 to 40 (No condensation)							
Operating humidity range [%]		35 to 85 (No condensation)							
Weight [g] <small>Note 7)</small>		130		190		250		360	
Table weight [g]		50		70		90		110	

Note 1) Continuous thrust can be generated and maintained continuously. Instantaneous maximum thrust can be generated only momentarily. Refer to "Fig. 4-1: Thrust force characteristics" (P.9) and to "Fig. 4-3: Allowable thrust force setting values" (P.11) for details.

Note 2) When mounted on a base with good heat dissipating capacity at 20°C ambient temperature.

Note 3) The pushing force varies depending on the operating environment, pushing direction and table position. Refer to "Fig. 4-1 Thrust force characteristics" (P.9).

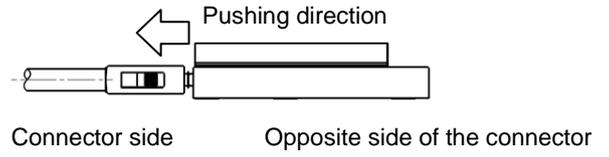
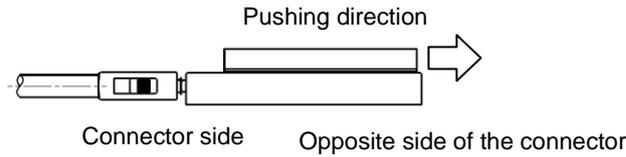
Note 4) When the temperature of the product is 20°C.

Note 5) The accuracy after mounting the Card Motor may vary depending on the mounting conditions, operating conditions and environment, so please calibrate it with the equipment used in your application.

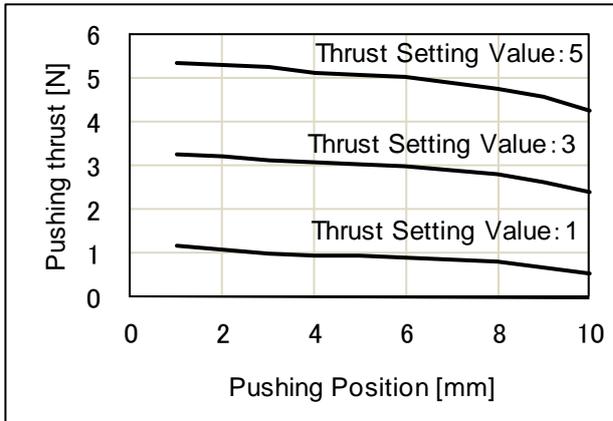
Note 6) The maximum speed varies depending on the operating conditions (load weight, total travel distance).

Note 7) The weight of the Card Motor itself. Controllers and cables are not included.

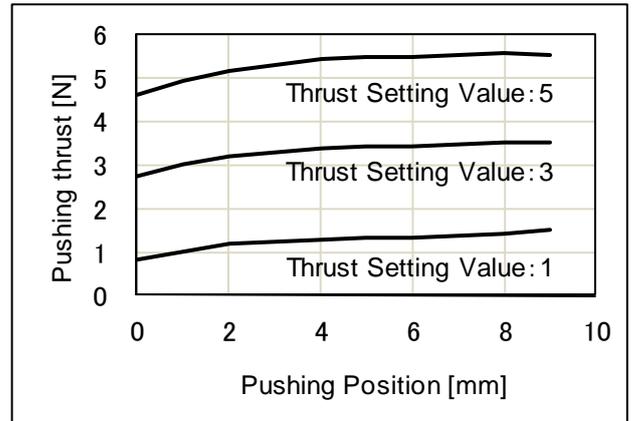
## (2) Card motor characteristics



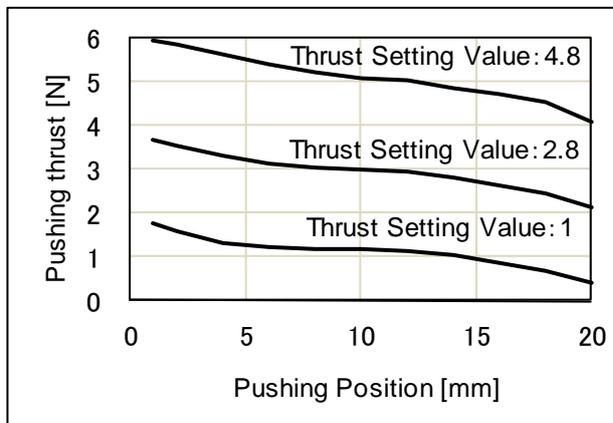
LAT3□-10



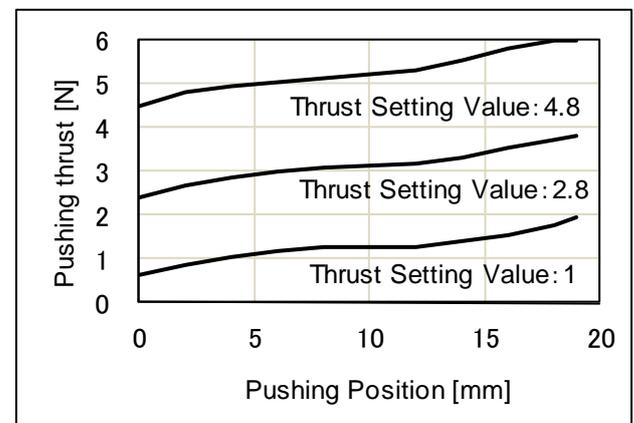
LAT3□-10



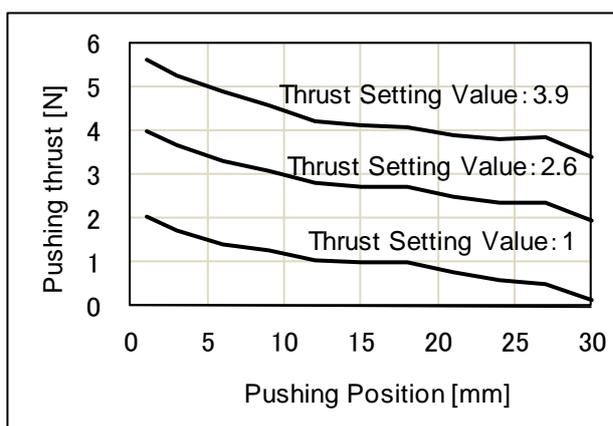
LAT3□-20



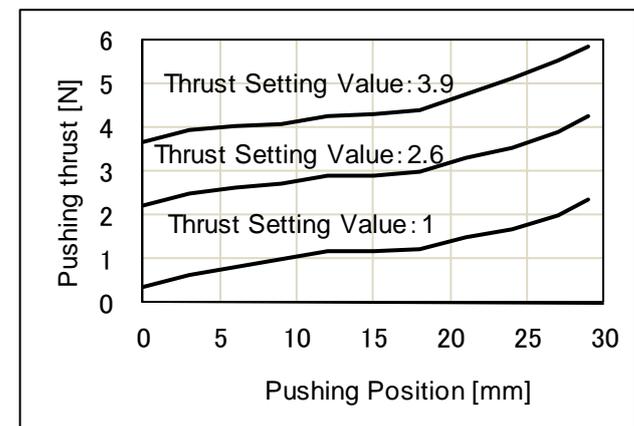
LAT3□-20



LAT3□-30



LAT3□-30



**Operating conditions:**

**Mounting orientation:**

Horizontal table mounting.

**Base material:**

Aluminum alloy.

**Table start position:**

Connector side (retracted).

**Pushing direction:**

Towards the "Opposite side of the connector".

**Pushing position:**

The travel distance from the connector side.

**Operating conditions:**

**Mounting orientation:**

Horizontal table mounting.

**Base material:**

Aluminum alloy.

**Table start position:**

Opposite side of the connector (extended).

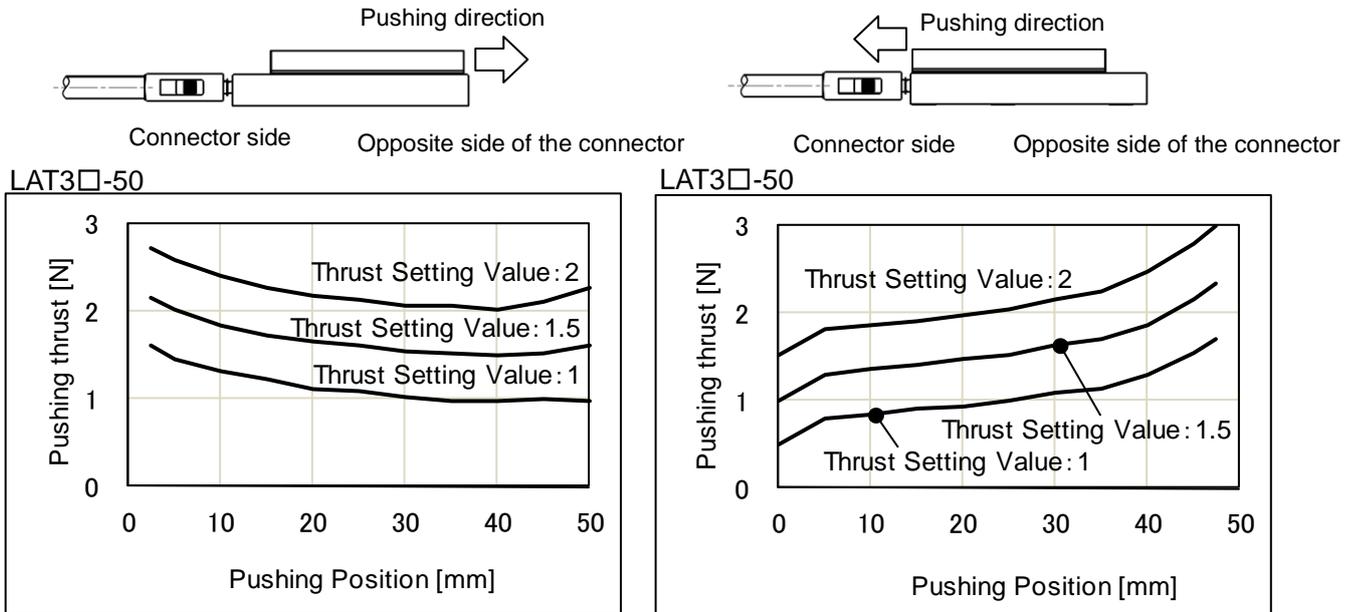
**Pushing direction:**

Towards the "Connector side".

**Pushing position:**

The travel distance from the connector side.

Fig. 4-1 Thrust force characteristics (guideline).



**Operating conditions:**

**Mounting orientation:**

Horizontal table mounting.

**Base material:**

Aluminum alloy.

**Table start position:**

Connector side (retracted).

**Pushing direction:**

Towards the "Opposite side of the connector".

**Pushing position:**

The travel distance from the connector side.

**Operating conditions:**

**Mounting orientation:**

Horizontal table mounting.

**Base material:**

Aluminum alloy.

**Table start position:**

Opposite side of the connector (extended).

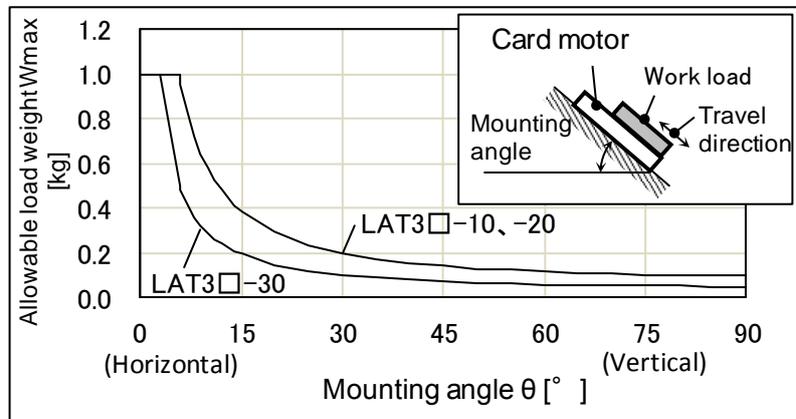
**Pushing direction:**

Towards the "Connector side".

**Pushing position:**

The travel distance from the connector side.

Fig. 4-1 Thrust force characteristics (guideline).



Note) LAT3□-50 is applicable mounted horizontally only.

Fig. 4-2 Allowable load weight.

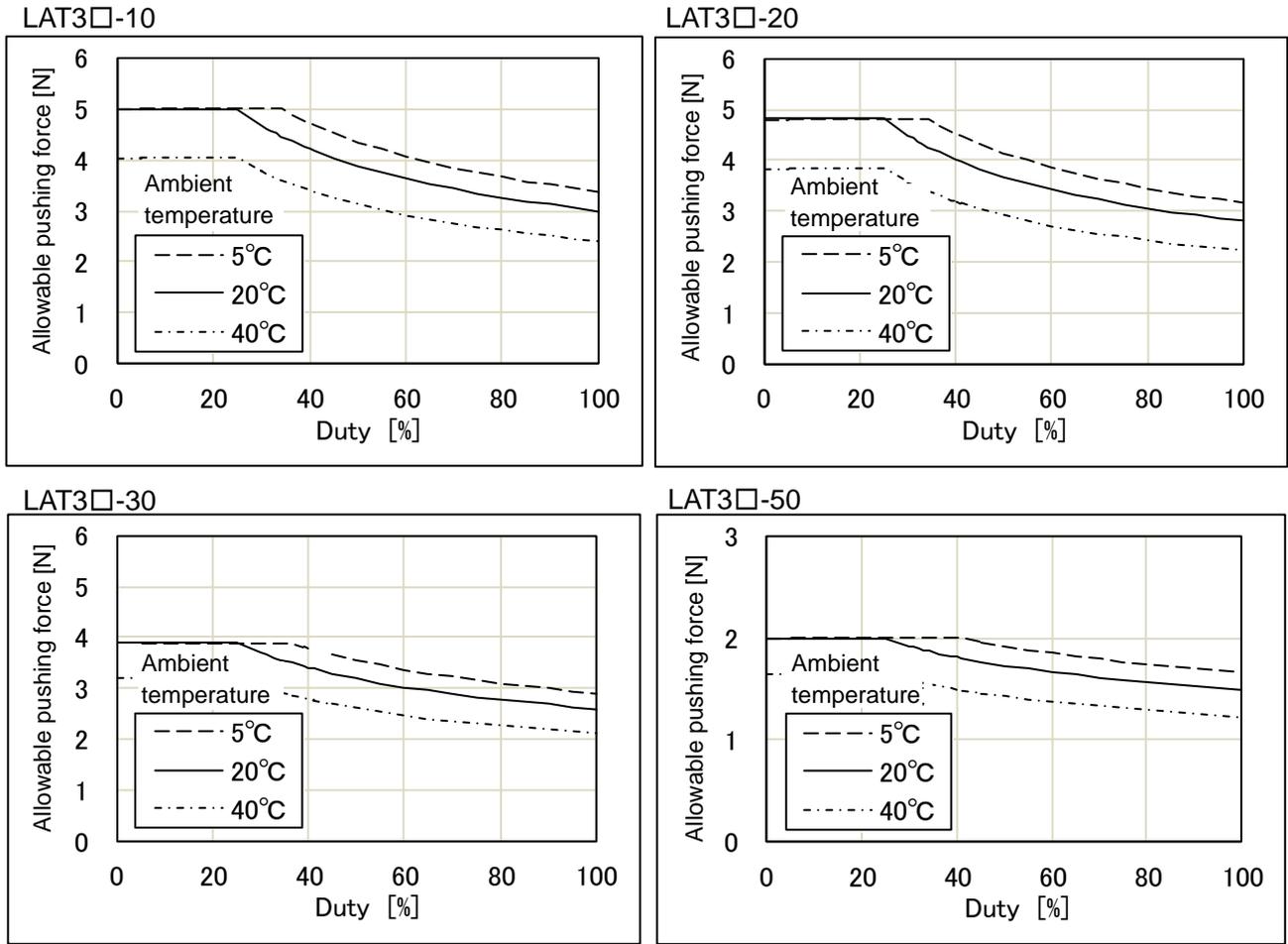
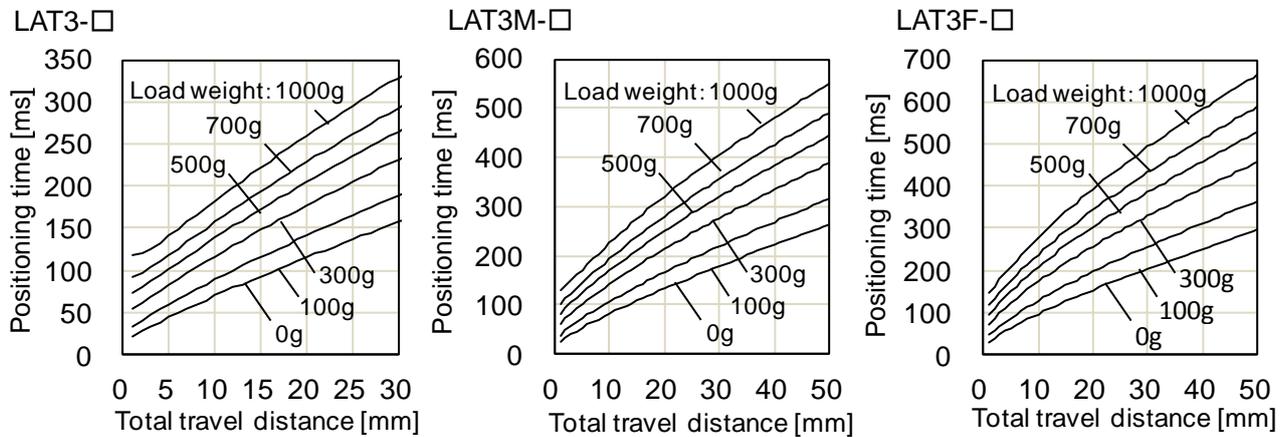


Fig. 4-3 Allowable thrust force setting values.

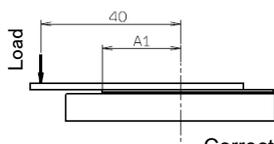


Operating condition (Common for 3 types)  
 Mounting orientation: Horizontal / vertical  
 Step data input method: Takt input method (Triangle wave operation)

Fig. 4-4 Shortest positioning time (guideline)

**Table displacement due to pitching moment**

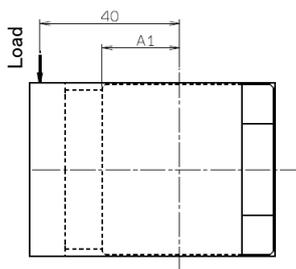
Displacement when a load is applied to the point indicated by the arrow.



Correction values (A1) for the distances to the moment centre  
 LAT3□-10 : 22.5mm  
 LAT3□-20 : 32.5mm  
 LAT3□-30 : 42.5mm  
 LAT3□-50 : 35mm

**Table displacement due to yawing moment**

Displacement when a load is applied to the point indicated by the arrow.



**Table displacement due to rolling moment**

Displacement when a load is applied to the point indicated by the arrow.

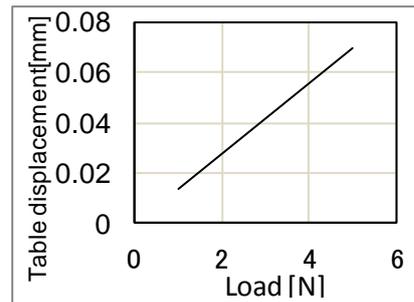
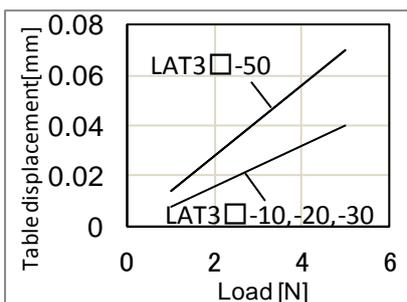
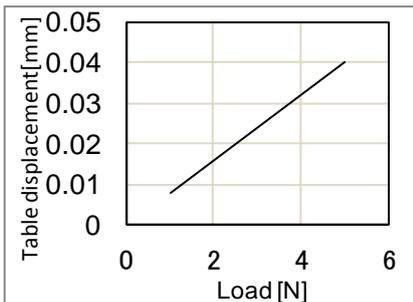
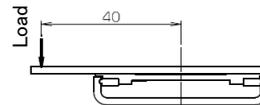
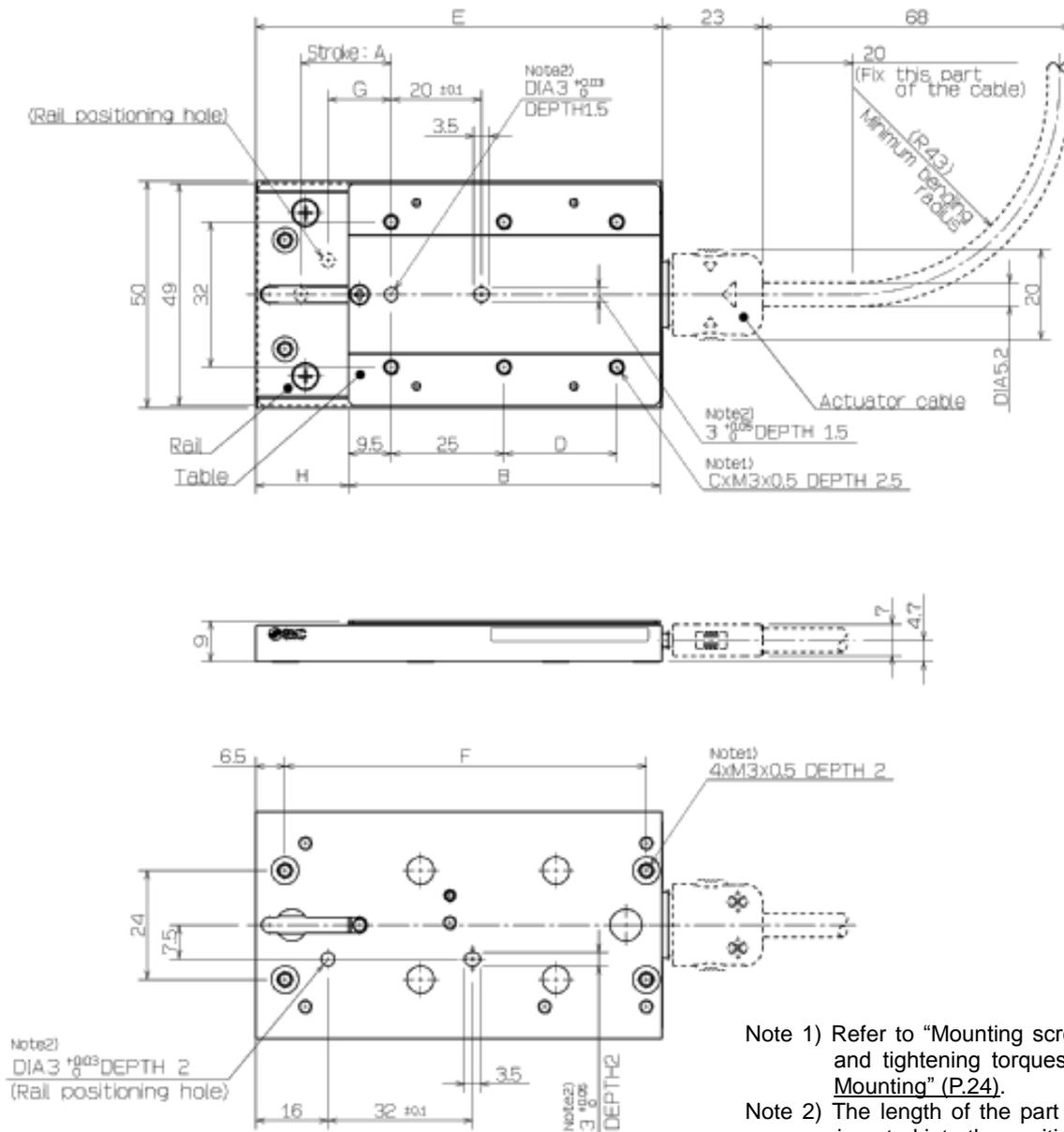


Fig4-5 Table displacement (guideline)

### (3) Card motor dimensions

LAT3□-10、LAT3□-20、LAT3□-30



- Note 1) Refer to “Mounting screw specifications and tightening torques” in section “4.3 Mounting” (P.24).
- Note 2) The length of the part of the dowel pin inserted into the positioning hole should be shorter than the specified depth.
- Note 3) This drawing shows the Origin Position.
- Note 4) The G and H Origin position dimensions are reference values (guidelines).

[mm]

Part No.	Stroke	Table dimensions				Rail dimensions		Origin position <sup>note 4)</sup>	
	A	B	C	D	E	F	G	H	
LAT3□-10	10	49	4	-	60	50	4	10.5	
LAT3□-20	20	69	6	25	90	80	14	20.5	
LAT3□-30	30	89	6	25	120	110	24	30.5	



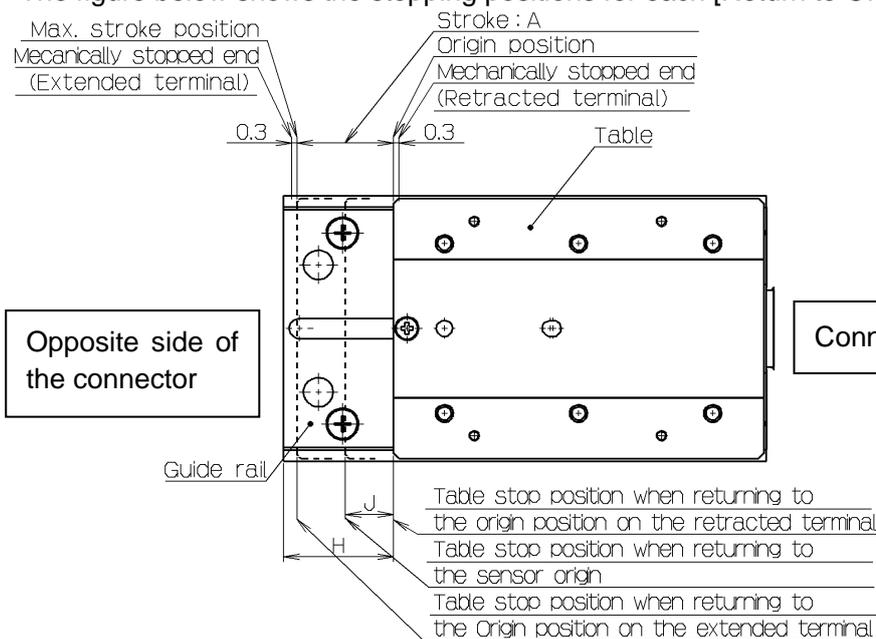
### 3. 2 Card Motor Return to Origin

The Card Motor uses an incremental type sensor (linear encoder) to detect the position of the table. Therefore, it is necessary to return the table to the Origin Position after the power has been switched on. There are three [Return to Origin Position] methods as described below. In any of the methods, the Origin position (0) will be set at the connector side.

When the table is moved towards the opposite side of the connector, after the [Return to OriginPosition] operation has been completed, the position of the table registered in the controller will be added (incremental positive direction).

Method	Description
Retracted End Position (Connector Side) (Recommended)	The table moves towards the connector side until it is stopped by the retracted mechanical end stop, and the Origin Position (0) is set 0.3 mm away from the retracted mechanical end stop. After [Return to Origin Position] is completed, the table stops at the Origin position (0). The return to Origin position method is set to [Retracted End Position] in the initial condition.
Extended End Position	The table moves towards the opposite side of the connector until it is stopped by the extended mechanical end stop, and the Origin position (0) is set at stroke A + 0.3 mm away from the retracted mechanical end stop. After [Return to Origin Position] is completed, the table stops at the Maximum Stroke position.
Sensor Origin	The table moves until it receives a signal from the sensor Origin position integrated into the linear encoder, and the Origin Position (0) is set at a certain distance J from that position towards the connector side. After [Return to Origin Position] is completed, the table stops at the sensor Origin position. This method is used to achieve high repeatability of the Origin position. This [Return to Origin Position] method applies only to LAT3F-□, which is the only model equipped with [Origin Position signal] in the sensor.

The figure below shows the stopping positions for each [Return to Origin Position] method.



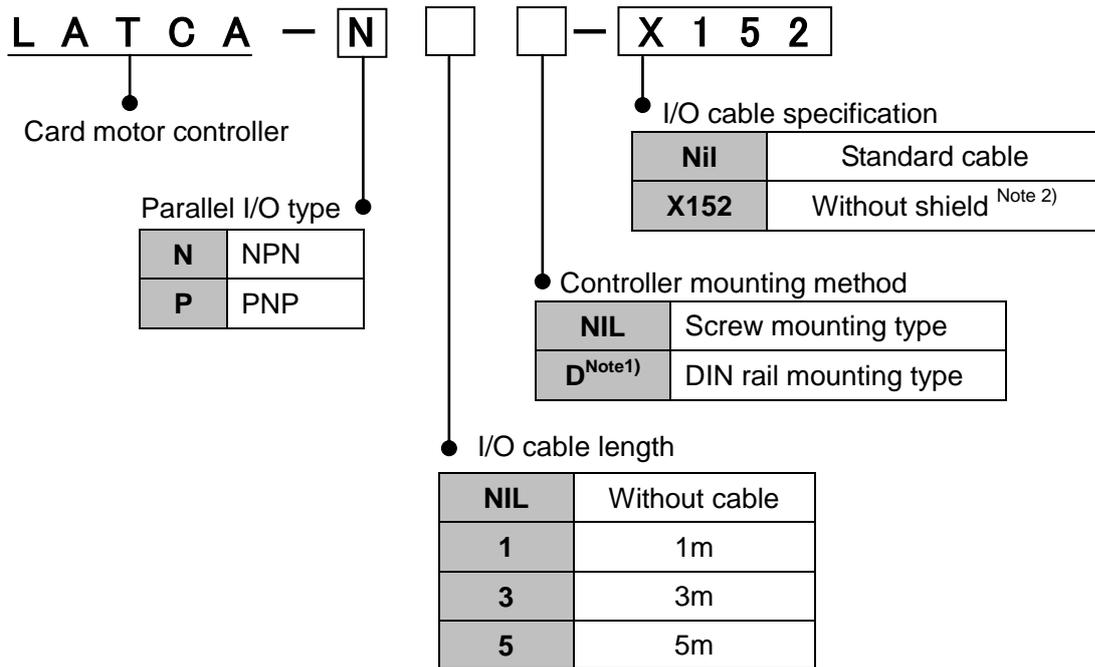
Model	A	H	J <sup>Note)</sup>
LAT3□-10	10	10.5	5
LAT3□-20	20	20.5	5
LAT3□-30	30	30.5	15
LAT3□-50	50	70	25

Note) LAT3F-□、LAT3M-□

### 3. 3 Card Motor Controller

Refer to the Card Motor Controller operation manual.

#### (1) How to Order

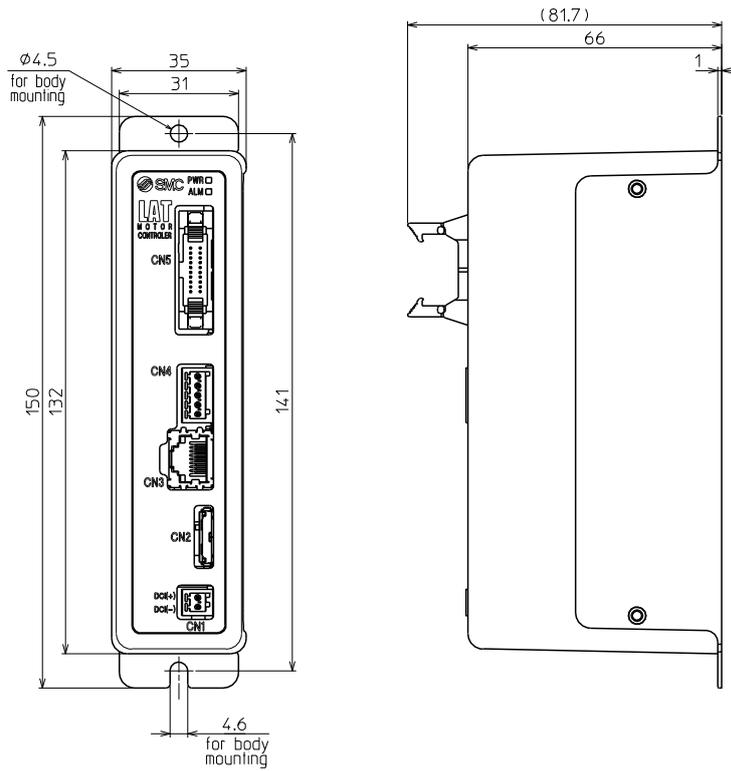


Note 1) The DIN rail is not included. If the DIN rail is required, please order separately.  
(Refer to the LAT3 series catalogue for details.)

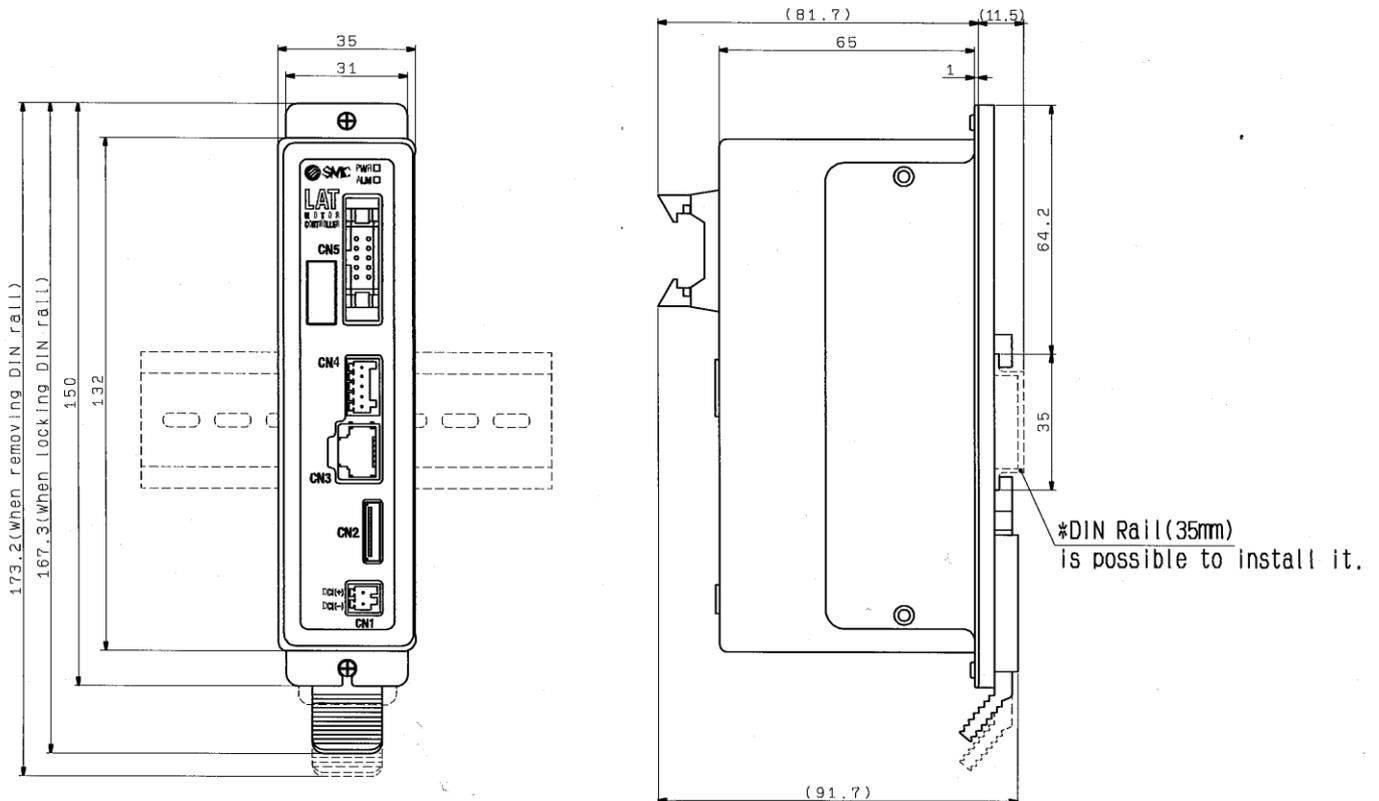
Note2) When the standard I/O cable option is selected, the I/O cable (LATH5-□) with shield is included.  
The I/O cable can be changed to without shield (LATH2-□) by changing the I/O cable specification.

## (2) Controller

Screw mounting type (LATCA-□□)



DIN rail mounting type (LATCA-□□D)



### 3. 4 Actuator cable

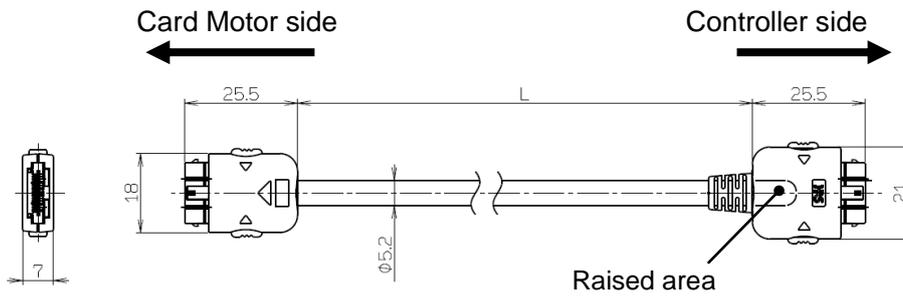
#### (1) How to Order

L A T H 1 - 1

● Cable length (L)

1	1m
3	3m
5	5m

#### (2) Dimensions



Note) The actuator cable is direction dependent.  
Connect the Card Motor side of the cable to the Card motor, and vice versa.  
A small area of the connector is raised on the controller side.

### 3. 5 I/O cable

#### (1) How to Order

L A T H **2** - **1**

I/O cable type

<b>2</b>	Without shield
<b>5</b>	With shield

Cable length(L)

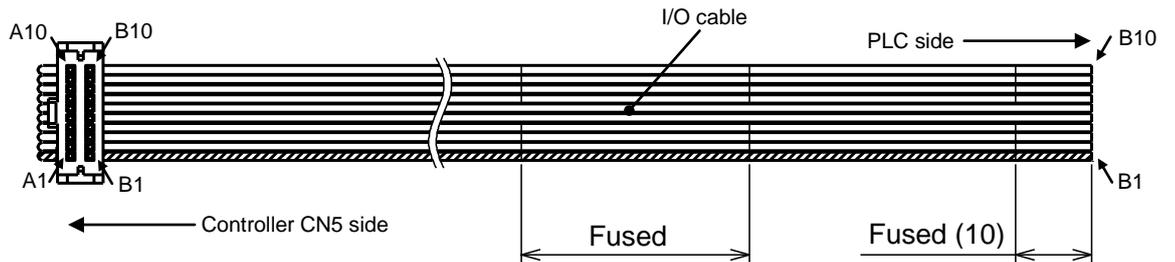
<b>1</b>	1m
<b>3</b>	3m
<b>5</b>	5m

#### (2) Parallel I/O plug terminal table

Terminal number	LATH2-*	LATH5-*		
	Insulator colour	Insulator colour	Dot	Dot colour
A1	Red	Light brown	■	Red
A2	Grey			Black
A3	Grey	Yellow	■	Red
A4	Grey			Black
A5	Green	Light green	■	Red
A6	Grey			Black
A7	Grey	Gray	■	Red
A8	Grey			Black
A9	Grey	White	■	Red
A10	Green			Black
B1	Red	Light brown	■ ■	Red
B2	Grey			Black
B3	Grey	Yellow	■ ■	Red
B4	Grey			Black
B5	Green	Light green	■ ■	Red
B6	Grey			Black
B7	Gray	Grey	■ ■	Red
B8	Grey			Black
B9	Grey	White	■ ■	Red
B10	Green			Black

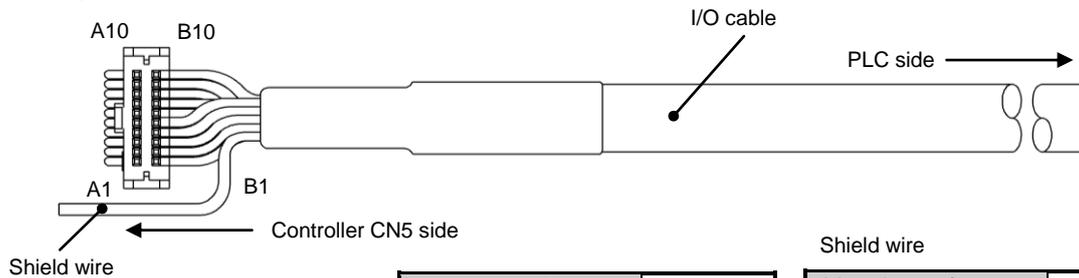
#### (3) Dimensions

##### i. LATH2-\*



Number of ways	20
AWG size	28 AWG

##### ii. LATH5-\*



Number of ways	20
AWG size	AWG28

Number of ways	1
AWG size	AWG24

\*Refer to the Card Motor Controller operation manual for detailed wiring.

## 4. Card Motor® / Specific Product Precautions

### 4. 1 Design / Selection

#### Warning

- (1) Make sure that you have read and understood this operation manual for the Card Motor and the one for the LATCA series controller.**

Handling, usage or operation other than that specified in the operation manuals may lead to breakage, malfunction and operation failure of the product. Any damage caused by usage out of the specifications and descriptions in the operation manuals is not guaranteed.

- (2) If a change in the force of friction in the Card Motor due to stress between the sliding surfaces or a change in the load weight, jerking motion at a speed exceeding the set speed may occur caused by stick-slip.**

In such cases, human injury may occur; e.g., fingers hands or feet caught in the machinery, or damage to the machinery itself may occur. Therefore, the machine should be designed to operate smoothly and to avoid such dangers.

- (3) A protective cover is recommended to minimize the risk of personal injury.**

If there is a possibility that a driven object or moving parts of the Card Motor may lead to personal injury, mount a protective cover to prevent direct physical contact.

- (4) Tighten securely all stationary parts and parts mounted to the Card Motor so that they will not come loose.**

When the Card Motor operates with high frequency or is installed where there is a lot of vibration, ensure that all parts remain secure.

- (5) Consider the possibility of power source related malfunctions.**

Take measures to prevent human injury and damage to the equipment in the case of a power source failure.

- (6) Consider possible movements of the actuator in the event of an emergency stop, an alarm or power failure.**

If power is not supplied to the product due to an emergency stop, if the SVON signal is switched OFF, in the event of an alarm (when the temperature of the Card Motor exceeds 70°C) or at power failure, the table will not be held in place and may be moved by external forces. Design the Card Motor application so that people and equipment will not be injured or damaged by the table movement.

- (7) Consider the operation conditions when the operation is restarted after an emergency stop or abnormal stop.**

Design the machinery so that it cannot cause injury or equipment damage when restarting the operation.

- (8) Do not disassemble the product or make any modifications to it.**

Do not modify or alter the product (including any additional machining of the product). It may cause accidents and/or injury.

- (9) When using it in vertical orientation, it is necessary to build in a safety device.**

Install safety equipment, which prevent human injury or damage to the equipment if the load drops.

## Caution

### (1) Operate within the limits of the maximum usable stroke.

The stopper will be damaged if the Card Motor is used with a stroke outside the maximum stroke limits. Refer to the Card Motor specifications for maximum strokes.

### (2) Do not apply a load outside the specifications.

The Card Motor should be fitted for the application based on the maximum workload and allowable moments. If the product is used outside the specifications, the excess load applied to the guide will lead to play in the guide, decrease in accuracy and the life span of the product will be shortened.

### (3) When the product is repeatedly cycled with short strokes, operate it at a full stroke at least once every 10 strokes.

Otherwise, the parts of guides where it is being used may run out of lubrication.

### (4) In pushing operation use thrust force setting values within the allowable limits based on the used duty ratio.

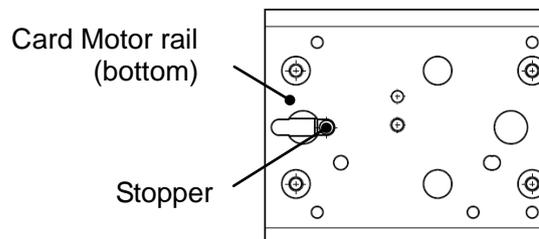
If thrust force setting values outside the allowable limits are used, it may cause overheating of the Card Motor, the work piece or the mounting surface.

### (5) Strong magnet

The Card Motor contains a strong rare-earth magnet, whose magnetic field may affect the work piece. Mount the work piece away from the Card Motor far enough to prevent the magnetic field from affecting the work piece.

### (6) Do not use the product in applications where impact or excessive external force is applied to it.

The Card Motor is equipped with a stopper to prevent the table from coming off and to be resistant to the light impacts generated when returning to Origin position and when transferring work pieces within the specified limits. Excessive external force or impact may damage the Card Motor, so install a separate external stopper if the operating conditions require.



### (7) It is not possible to perform [Return to Origin Position] during another operation.

It is not possible to perform [Return to Origin position] during positioning and pushing operation.

### (8) The flatness of the mounting surface of the table and rail must be 0.02 mm or less.

Insufficient flatness of the mounting base for the Card Motor, or of a work piece mounted to it can cause play in the guide and an increase in the sliding friction.

### (9) SMC products are not intended for use instruments for legal metrology.

Measurement instruments that SMC manufactures or sells have not been qualified by type approval tests relevant to the metrology (measurement) laws of each country. Therefore, SMC products cannot be used for business or certification ordained by the metrology (measurement) laws of each country.

### (10) Mount the work piece to the body securely to prevent vibration.

Loose mounting of the work piece may lead to vibration during positioning.

## 4. 2 Handling Precautions

### Warning

**(1) Do not touch the product when it is energized or for some time after it has been de-energized.**

The surface temperature of the Card Motor can increase up to approximately 70°C depending on the operating conditions. Energizing alone may also cause the temperature to rise. Do not touch the Card Motor during operation or when energized to prevent burns or other injuries.

**(2) When there is abnormal temperature rise, burning or smoking, shut off the power supply.**

**(3) Strong magnet warning.**

In case abnormal operation noise or vibration occurs, the Card Motor may have been improperly mounted or is loose. Unless operation is stopped for inspection, machinery can be seriously damaged.

**(4) When installing, adjusting, inspecting or performing maintenance on the Card Motor, controller and related equipment, be sure to switch off the power supply to them first, then lock it so that no one else except the person working on it can switch the power on, or implement other counter measures such as using a safety plug.**

### Caution

**(1) Check the product for the following matters before operation.**

- a) Any damage in the power line and each signal line.
- b) Play and looseness in the connector of each power line and signal line.
- c) Play and looseness in the mounting.
- d) Abnormal operation.
- e) Emergency stop of the equipment.

**(2) When more than one person is working with the products, decide regarding the procedures, signals, measures for emergency and how to start the operation after these measures have been taken. Also, designate a separate person to supervise the work other than those working with the products.**

**(3) Strong magnet.**

The Card Motor contains a strong rare-earth magnet. If a magnetic card is brought close to the Card Motor, the card data may get distorted or lost. Do not bring items, which are sensitive to or affected by magnetism close to the product.

**(4) Do not operate the Card Motor continuously with maximum thrust force.**

The Card Motor may overheat due to the heat generated by the Card Motor itself, and a temperature error or malfunction may occur.

**(5) Do not hit the stroke ends during operation, except during return to Origin position and in pushing operation.**

Impact at the stroke ends may damage the Card Motor.

**(6) For pushing operations, set the target position at least 1 mm away from the position where the pushing tool comes into contact with the work piece.**

Otherwise, the table may hit the work piece at a speed exceeding the specified pushing speed.

**(7) Do not remove the product label.**

**(8) Initial operation tests should be performed at low speed. Begin to operate at the specified**

speed only after confirming it cannot cause any trouble.

**(9) Be careful not to touch, get caught or hit by the work piece while the actuator is moving.**

It may cause an injury.

**(10) The table and guide rail are made of special stainless steel, but can rust in an environment where droplets of water adhere to it.**

**(11) Do not dent, scratch or cause other damage to the steel ball rolling surface of the table and rail.**

It will result in play or increased sliding friction.

**(12) Positioning accuracy, thrust and measurement accuracy may vary after the Card Motor or the workload have been mounted, depending on the mounting conditions and environment.**

Calibrate them according to the actual application.

**(13) Consider mounting an elastic bumper on the pushing surface.**

If impact to the Card Motor cannot be avoided during pushing operation, it is recommended to mount an elastic bumper.

## **【Grounding】**

 **Warning**

**(1) Always ground the Card Motor.**

**(2) Use a dedicated grounding.**

Use a D-class grounding. (Ground resistance less than 100Ω.)

**(3) The grounding point should be as close as possible to the actuator, and the ground wires as short as possible.**

## **【Unpacking】**

 **Caution**

**(1) Check that the received product is as ordered.**

If a product different from the one ordered is installed or used, injury or damage can result.

## 4. 3 Mounting

### Warning

**(1) Read and understand the Operation Manual before installing and operating the product. Also keep this manual available whenever necessary.**

**(2) Strong magnet.**

The Card Motor contains a strong rare-earth magnet. If magnetized work pieces, tools and metallic parts are brought in the vicinity of the Card Motor, they will be attracted, which could cause injury to operators and damage the equipment. Take special care when handling and operating the product.

**(3) Do not make any alterations or modification to this product.**

Alterations or modification made to this product may lead to a loss of durability and damage to the product, which can lead to human injury and damage to other equipment and machines.

**(4) When an external guide is used, connect the moving part of the actuator and the load in such a way that there is no jamming at any point along the stroke.**

**(5) Do not use the product until you have verified that the equipment can operate properly.**

After mounting or repair, connect the power supply to the product and perform appropriate functional inspections to check it is mounted properly.

**(6) When mounting a work piece, do not apply impact or large moment to the Card Motor.**

If an external force higher than the allowable moment is applied, it may cause play in the guide part and an increase in the sliding friction or other damage.

**(7) Do not scratch or damage any sliding part by hitting it with an object.**

The components are manufactured to high precision. Therefore even a slight deformation may cause operation failure.

### Caution

**(1) Mount the Card Motor on a base with good cooling performance, for example a metal plate.**

If the cooling performance is not good enough, the temperature of the Card Motor will increase, which may cause damage.

**(2) Do not apply strong impact or excessive moment while mounting a work piece.**

The product may overheat during operation and a temperature error or failure may occur.

**(3) Do not dent, scratch or cause other damage to the mounting surface of the table and rail.**

It can cause reduction in flatness, play in the guide and increase in the sliding friction.

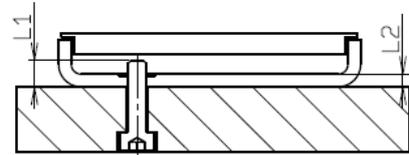
**(4) When mounting the Card Motor, use stainless steel screws with appropriate length and tighten with recommended tightening torque.**

If the maximum screw-in depth is exceeded, it may damage the internal components.

Using a tightening torque higher than the specified torque may cause malfunction, and using a lower tightening torque may displace the work piece or cause it to drop off.

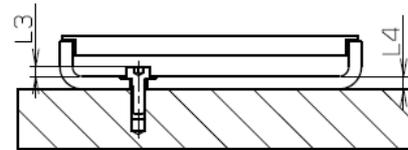
**1) Body mounting from the bottom / tapped type**

Screw material	SUS
Screw dimensions	M3 x 0.5
Recommended tightening torque [Nm]	0.48 to 0.63
L1 (Maximum screw-in depth) [mm]	4.6
L2 (Plate thickness) [mm]	2.1



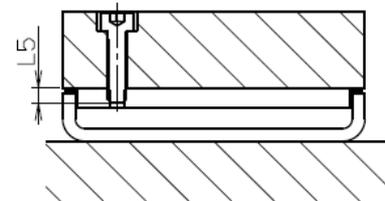
**2) Body mounting from above / through hole type**

Screw material	SUS
Screw dimensions	M2.5 x 0.45
Recommended tightening torque [Nm]	0.27 to 0.36
L3 (Maximum screw-in depth) [mm]	2.5
L4 (Plate thickness) [mm]	2.1



**3) Work piece mounting / top mounting type**

Screw material	SUS
Screw dimensions	M3 x 0.5
Recommended tightening torque [Nm]	0.48 to 0.63
L5 (Maximum screw-in depth) [mm]	2.5



**(5) When connecting the cables, avoid applying any stress to the connector from the cable side.**

If an external force or vibration is applied to the connector, damage may result. Do not bend the cable for approximately 20 mm from the connector and fix this part of the cable with a cable fixture.

**(6) Use non-magnetic material for mounting the frame of the card motor and for mounting the work piece to the card motor.**

This may lead to vibration.

## 4. 4 Operating environment

### Caution

#### **(1) Avoid use in the following environments.**

1. Locations where large amounts of dust or cutting chips are airborne.
2. Locations where the ambient temperature is outside the operating temperature range (refer to the specifications for details).
3. Locations where the ambient humidity is outside the operating humidity range (refer to the specifications for details).
4. Locations where corrosive gas, flammable gas, sea water, water and steam are present.
5. Locations where strong magnetic or electric fields are present.
6. Locations where vibration or impact is applied to the product.
7. Locations that are dusty, or exposed to splashes of water and oil drops.
8. Locations exposed to direct sunlight (ultraviolet rays).

#### **(2) Do not use the products in an area where they could be exposed to dust, metallic powder, machining chips or splashes of water, oil or chemicals.**

A failure and malfunction can result.

#### **(3) Do not use the products in a magnetic field.**

The ambient magnetic field may affect the motor and malfunction and damage could result.

#### **(4) Do not expose the product to strong light sources, such as direct sunlight.**

The Card Motor uses an optical sensor to detect the position, so if it is exposed to a strong light source such as direct sunlight, a malfunction could result. In such a case, install a light shielding cover to shield the sensor from light.

#### **(5) Do not use the products in an environment where flammable, explosive or corrosive gases, liquids or other substances are present.**

Fire, explosion or corrosion can result.

#### **(6) Avoid heat radiation from strong heat sources, such as direct sunlight or a hot furnace.**

The product can overheat and malfunction and damage can result.

#### **(7) Do not use the products in an environment with cyclic temperature changes.**

This may cause damage.

#### **(8) The base oil of the grease can dissipate depending on the external environment and operating conditions. This may reduce the lubrication performance and shorten the life of the equipment.**

### **【Storage】**

#### Warning

#### **(1) Do not store the product in a place in direct contact with rain or water drops or where it is exposed to harmful gas, liquid or other substances.**

#### **(2) Store in a location that is shielded from direct sunlight and has a temperature and humidity within the specified range (-10°C to 60°C and 35 to 85%, no freezing or condensation).**

#### **(3) Do not apply vibrations and impact to the product during storage.**

## 4. 5 Maintenance

### Warning

- (1) Before performing installation, wiring and maintenance, check for accumulated voltage using a tester at least 5 minutes after the power supply has been switched off.**

Accumulated voltage can result in electric shock, fire, and injury.

### Caution

- (1) Perform regular maintenance and inspections.**

Confirm that there is no twisting of wires, play in the table or large sliding friction. This may result in malfunction.

- (2) Conduct an appropriate functional inspection and test after completed maintenance.**

Stop operation if a device or equipment does not work correctly. Safety cannot be assured in the event of unexpected malfunction. Conduct a test of the emergency stop to confirm the safety of the equipment.

- (3) Do not disassemble, modify or repair the product.**

- (4) Removal of equipment.**

When the equipment is serviced, first confirm that measures are in place to prevent dropping of driven objects and loss of equipment, etc., and then cut the power supply from the system. Confirm safety before restarting the equipment.

- (5) Maintenance space.**

Allow sufficient space for maintenance and inspection.

## 5. Common Precautions for wiring and cables

### Warning

- (1) **The power supply to the product must always be switched off before adjusting, mounting, inspection or wiring is done.**

An electric shock, malfunction, and breakage can result.

- (2) **Never disassemble the cable. Never use cables other than specified.**
- (3) **Never connect or disconnect a connector and cable when it is energized.**

### Caution

- (1) **Do not apply any voltage to the terminals outside the specified levels in the operation manual.**

- (2) **Wire the connectors securely.**

Check what the connector should be wired with and its direction.

- (3) **Take appropriate measures against noise.**

Noise in a signal line may cause malfunction. As a countermeasure, separate high voltage and low voltage cables, and keep the wire lengths as short as possible, etc.

- (4) **Do not route the wires and the cables together with power or high voltage cables.**

It can cause malfunction to the product due to noise and surge voltage interference from power and high voltage cables to the signal line. Route the wires of the Card Motor separately from power or high voltage cables.

- (5) **Take care that the cables are not caught by the actuator movements.**

- (6) **Operate the Card Motor with the cables secured. Avoid bending and fixing the cables with the minimum bending radius or less. Avoid bending the cables at the cable entries.**

- (7) **Avoid twisting, folding, rotating or applying external forces to the cables. Also avoid operating at the minimum bending radius or less.**

Otherwise it can result in electric shock, breakage or contact failure of the cable or loss of control of the product.

- (8) **Confirm insulation performance of the wiring.**

Insulation damage, interference with other circuits, poor insulation between terminals etc. could induce excessive voltage or current to the controller or its peripheral devices and damage them. The controller or its peripheral devices could be damaged due to the excessive voltage or current.

- (9) **The speed / pushing force may vary, depending on the cable length, load and mounting conditions etc.**

If the cable length exceeds 1 m, the speed / pushing force will decrease by a maximum of 10% per 2m. (If the cable length is 5 m: Maximum 20% reduction.)

### **【Transportation】**

#### Caution

- (1) **Do not pull the cable or drag the product when transporting.**

## 6. Troubleshooting

Refer to the table below for troubleshooting.

When none of the causes in the troubleshooting can be confirmed, it is presumed that the product is faulty and normal operation can only be recovered by the replacement of a part.

There is a possibility that this product has been damaged due to the operating conditions (problems relating to the application), so please contact SMC to discuss appropriate measures.

Refer to the Card Motor controller operation manual.

### 6. 1 Operation troubles

Error Problem	Error Possible causes	Investigation method and the location of possible causes	Countermeasures
Does not operate at all.	Power supply failure.	Is the green LED in the controller lit?	Check the supplied voltage and current for power supply to the controller.
	External equipment failure	PLC connected to the controller operates properly? Check the operation of the controller itself by test operation, which is a function of the setting software.	Refer to the operation manual of the controller and take appropriate measures.
	Duplicated operation commands	The parallel I/O signals are activated in "Test Mode" whilst the Controller Setting Software is being started.	Select "Monitor Mode" in the Monitor/Test window of the Controller Set up Software, or terminate the set up software and input the I/O signal again.
Operation stops intermittently	Voltage drop	Temporary voltage drop in the power supply.	Possibility of momentary voltage drop due to an inadequate power supply capacity is inadequate, or the power supply is inrush current suppressor type.
The Card Motor vibrates.	The Card Motor or the workpiece is loose	Check if something has come loose and confirm that the Card Motor is fixed properly to the mounting frame, and that the workpiece is fixed properly to the Card Motor table.	Tighten the Card Motor and the workpiece securely. Refer to the 4.3 Mounting (p.24) for fixing details.

## 6. 2 Position / Speed / Thrust troubles

Error Problem	Error Possible causes	Investigation method and the location of possible causes	Countermeasures
Displacement	Displaced from the origin position	In case of return to origin position on the pushing or retracting end position, does the actuator travel to the origin position? Perform return to origin position several times to check the origin position.	Check actuator's operation (if foreign matter is caught in the product etc.).
	Use in a strong light source.	Check that the Card Motor is not exposed to a strong light source such as direct sunlight.	Install a light shielding plate as a cover.
Speed does not reach the desired speed.	Voltage drop	Temporary voltage drop in the power supply.	Possibility of momentary voltage drop due to an inadequate power supply capacity is inadequate, or the power supply is inrush current suppressor type.
Pushing thrust does not reach the thrust setting value.	Voltage drop	Temporary voltage drop in the power supply.	Possibility of momentary voltage drop due to an inadequate power supply capacity is inadequate, or the power supply is inrush current suppressor type

#### Revision history

1<sup>st</sup> printing: Revised in May 2012  
A: Revised in November 2012  
B: Revised in April 2013  
    Addition to note  
    Correction of words  
    Correction of timing chart  
C: Revised in November 2015

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Note: Specifications are subject to change without prior notice and any obligation on the part of the manufacturer.

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