



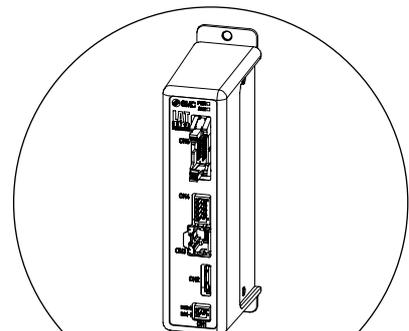
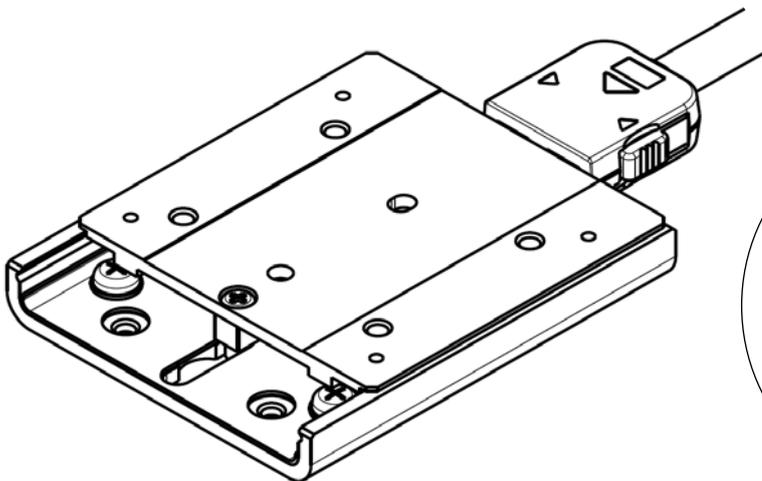
Operation Manual

PRODUCT NAME

Card Motor

Model / Series / Product Number

LAT3 Series



Controller
LATC4 Series

SMC Corporation

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LAT3 Series/Card Motor

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 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 comes first. ^{Note)}

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.

Note) 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 products with production equipment for the manufacture of weapons of mass destruction (VWD) 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.

1. Start up procedures / Simple settings for quick start

The procedures from purchasing to start up using a PLC are explained below.

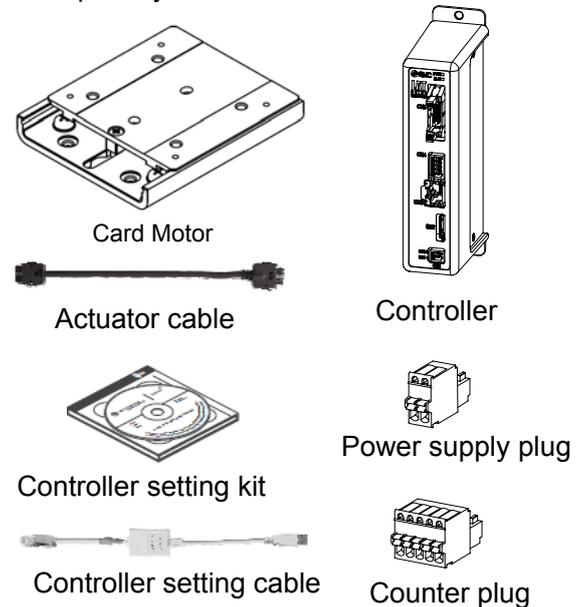
1. 1 Preparation

(1) Items to be prepared

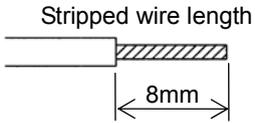
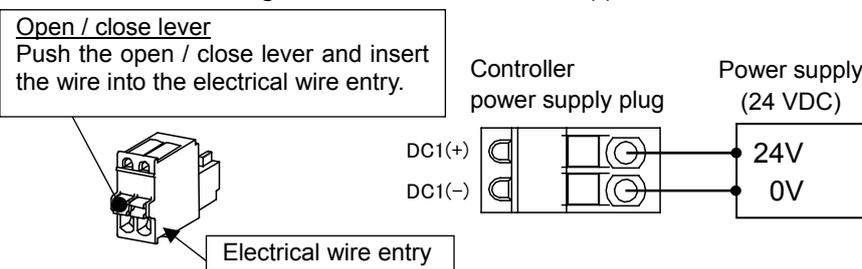
Please check the part numbers on the product labels and the quantity of the accessories to confirm that the order is correct.

LAT3 series

Part No.	Description	Quantity
LAT3*-*	Card Motor	1 pc
LATH1-*	Actuator cable	1 pc
LATC4-*	Card Motor controller	1 pc
(Accessory)	Power supply plug	1 pc
(Accessory)	Counter plug	1 pc
LATC-W1	Controller setting kit	1 pc
(Accessory)	Controller setting cable	1 pc



Items to be prepared by the user.

Description	Conditions
Controller power supply DC24V	Power supply voltage: 24 VDC +/- 10%, 3A or more (Do not use inrush current limiting type)
Power supply cable	20 AWG / 0.5 mm ² Use a single multi-strand wire for each terminal. Twist the wires together, and strip the ends as shown. * The insulation should be rated to withstand 60°C temperature minimum. 
Wiring of the power supply plug	Connect the positive terminal of the 24 VDC power supply to the DC1(+) terminal of the controller power supply plug, and the negative terminal to the DC1(-) terminal. 
Grounding cable	Cable with crimped terminal (cross sectional area: greater than 2 mm ²) Connect to the controller backplate using an M4 screw and a shakeproof washer.
PC	PC with WindowsXP or Windows7 and USB1.1 or USB2.0 port. * Windows [®] , WindowsXP [®] , and Windows7 [®] are registered trademarks of the United States Microsoft Corporation.

(2) Mounting of the Card Motor

【Fixed side / moving side】

Fix the rail to the mounting surface with screws before operating the table.

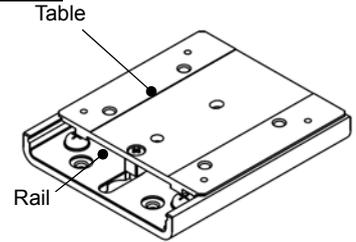
【Mounting surface】

Keep the flatness of the mounting surface of the table and rail 0.02mm or less.

Insufficient flatness of a work piece mounted to the table or insufficient flatness of the mounting surface for the rail can cause play in the guide and an increase in the sliding friction.

Mount the Card Motor on materials with good heat dissipation such as a metal plate.

If heat cannot dissipate, the product may over heat and it may damage the product.



【Mounting screw specifications and tightening torques】

Use stainless steel screws with appropriate length.

Tighten the screws to the recommended tightening torque.

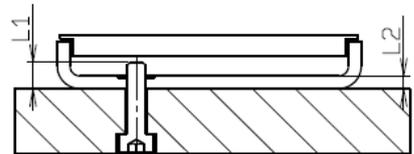
The internal components may get damaged if the maximum screw-in depth is exceeded.

Tightening to a torque greater than the specified range may damage the Card Motor.

Insufficient tightening torque may cause the actuator or the work piece to come loose or position displacement.

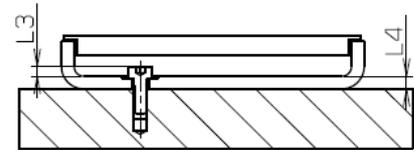
1) Mounting of the Card Motor from the bottom / tapped type.

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



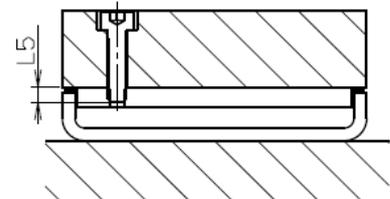
2) Mounting of the Card Motor from above / through hole type.

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



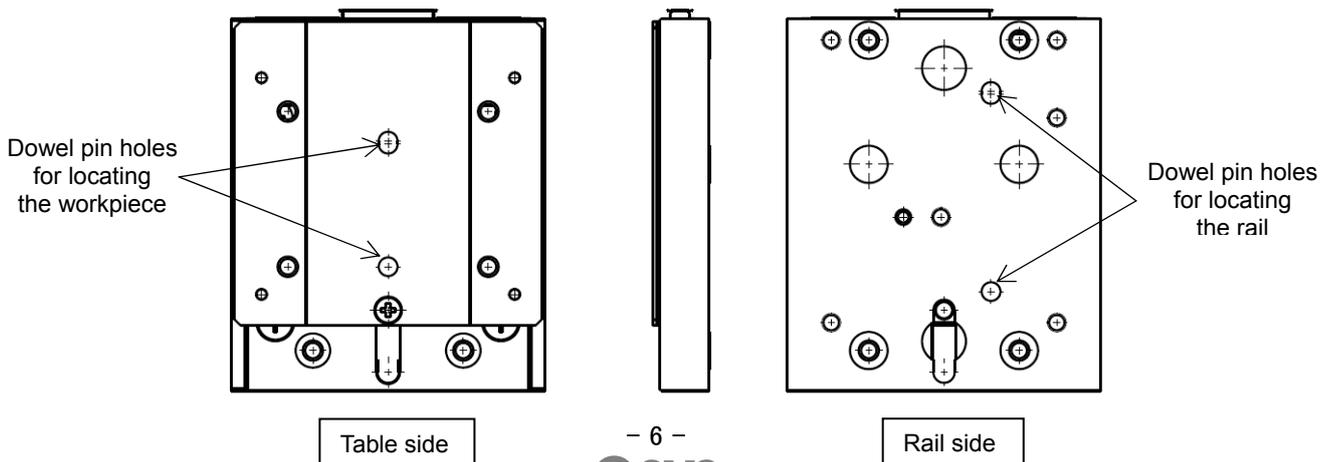
3) Mounting of the work piece on top of the table.

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

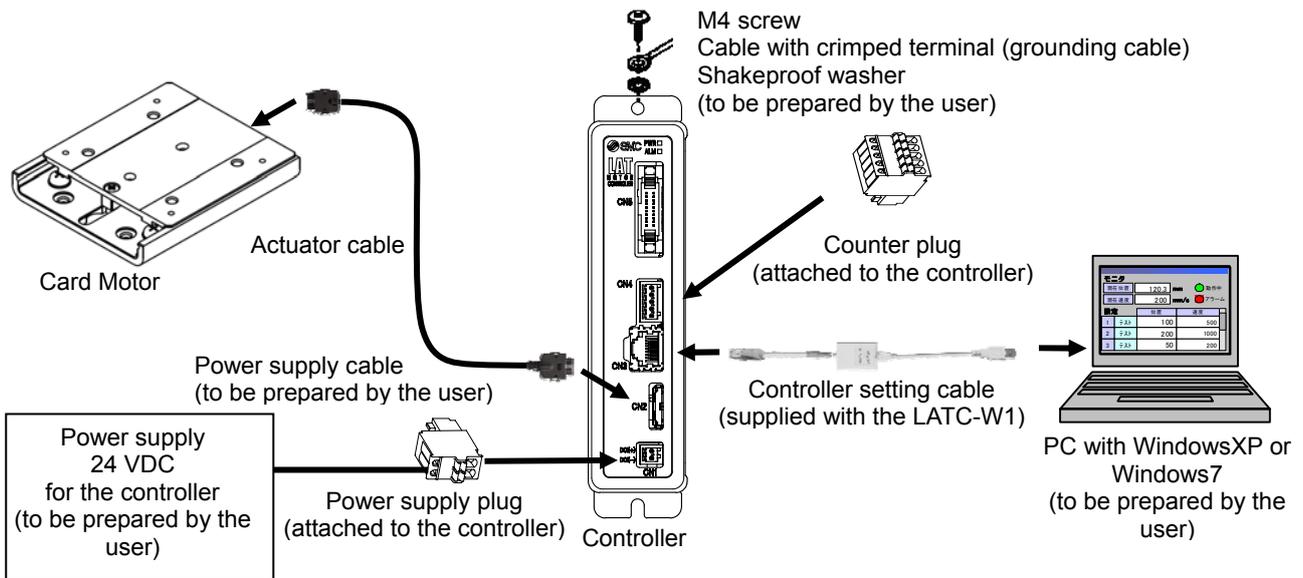


【Locating of the Card Motor and work piece】

Locating of the rail to the mounting surface and locating of the work piece onto the table using the dowel pin holes on the rail and table.



(3) Wiring / Connection / Grounding



⚠ Warning

Adjusting, mounting, inspection or changes to the wiring should never be done while power is being supplied to the product.
Electrical shock, malfunction, and breakage can result.

⚠ Caution

Refer to the LATC4 series (controller) operation manual for detailed wiring.

(4) Installation of the controller setting software

Install the controller setting software in accordance with the installation procedure (PDF) in the controller setting software CD-ROM.

1.2 Controller settings

Card Motor model to be controlled and the controller operating conditions are set using a computer.

(1) Starting the controller setting software

To start the controller setting software, click the controller setting software icon (LATC-W1.exe) after connecting the wires and supplying power to the controller.

The process starts with the LATC-W1.EXE icon. A dialog box titled "Please select COM port No." is shown with "COM5" selected in the dropdown menu and the "OK" button circled in red. An arrow points to the main software interface, which includes sections for "Return to Origin Method", "Card Motor Mounting Orientation", and "Stop Data Input Method".

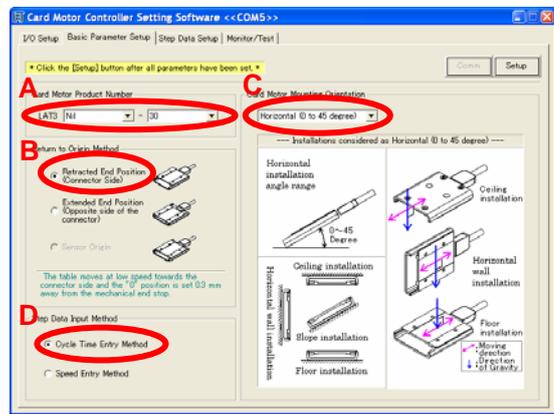
Enter the COM port number of the PC to which the controller setting cable is connected. Note)
 (Once the conversion unit and virtual COM port drivers have been installed for a certain COM port and communication established, the same COM port number will automatically be found by the software when the conversion unit is connected, and the "Please select COM port No." dialog box may not be displayed again.)

Note) See the installation procedure (PDF) in the Controller Setting Software CD-ROM for instructions on how to check the COM port number.

(2) Basic parameter settings

Select the settings in each item described below and register them to the controller by clicking [Setup].

- A. [Card Motor Product Number]:
Select the product number of the applicable Card Motor.
- B. [Method to Return to Origin Position]:
Select homing method and position.
- C. [Card Motor Mounting Orientation]:
Select horizontal or vertical.
- D. [Step Data Input Version]:
Select Cycle Time Entry Method (recommended).



(3) Setting of the operating conditions

–Selection of operation type–

- E. Select the [Step Data Setup] page.
- F. Select operation type in the “Operation” selection section.

Positioning operation

When transferring the workpiece to a specific position.

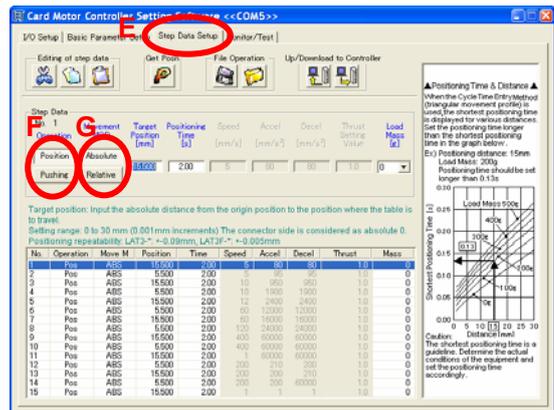
Pushing operation

When applying force to a workpiece or measuring the size of it.

- G. Select movement mode.

Absolute The Card Motor table will move the set distance in relation to the “Origin Position”.

Relative The Card Motor table will move the set distance in relation to the current table position.

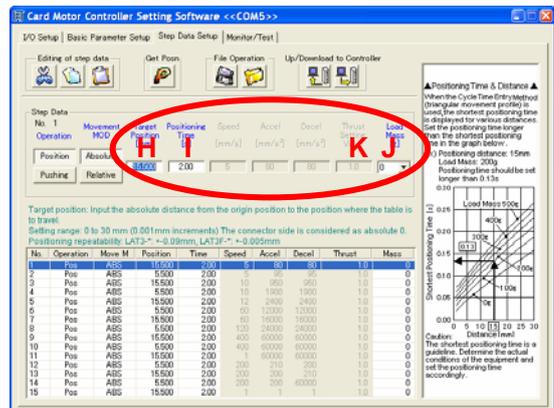


(4) Setting of the operating conditions

–Entering of the operating values–

< In Positioning Operation mode >

- H. **Target Position [mm]**
Distance from the Origin Position (or current table position) to the Target Position.
- I. **Positioning Time [s]**
Time required to move to the Target Position.
- J. **Load Mass [g]**
Select the approximate weight of jigs or workpieces mounted on the Card Motor table.

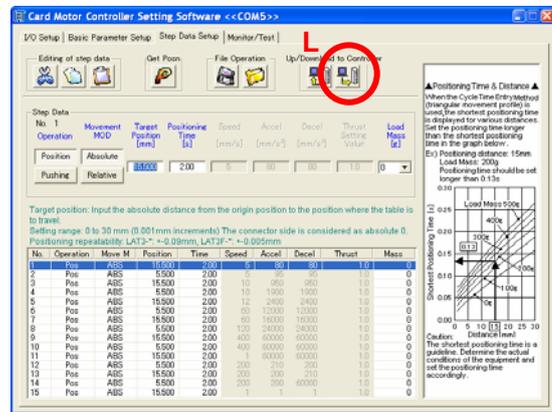


< In Pushing Operation mode >

- H. **Target Position [mm]**
- I. **Positioning Time [s]** + K. **Thrust Setting Value**
- J. **Load Mass [g]**

(5) Settings completed (Download)

After the operating conditions have been set in section (4) above, click the [Download to Controller] button (L) to complete the settings.



Caution

Refer to the LATC4 series (controller) operation manual for details of the data setting procedures and buttons.

The Card Motor Product Number set in the Controller Setting Software must correspond with the connected Card Motor.

If they do not correspond, the Card Motor will operate at a position, speed and thrust different from the settings leading to operation failure.

Set the approximate value of the work load mounted on the table in the Load Mass box in the Step Data section and check the operation.

If the actual weight of the workpiece and jig mounted on the Card Motor is largely different from the work load set in the Step Data, the Card Motor may vibrate or the repeatability performance may be poor. Check the operating conditions before setting and using the Card Motor.

1. 3 Test operation using a computer

A test operation can be performed using a computer. The operating performance and the controller settings can be tested and confirmed by operating the Card Motor under the actual operating conditions using the Card Motor Controller Setting Software in “Test Mode” as follows.

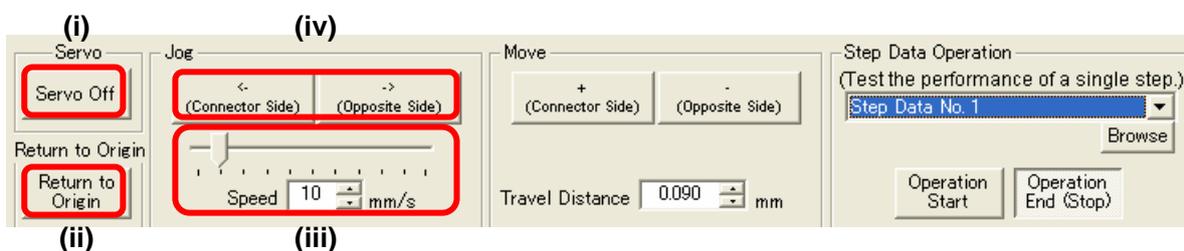
A. Select the “Monitor/Test” tab and switch to “Test Mode”.



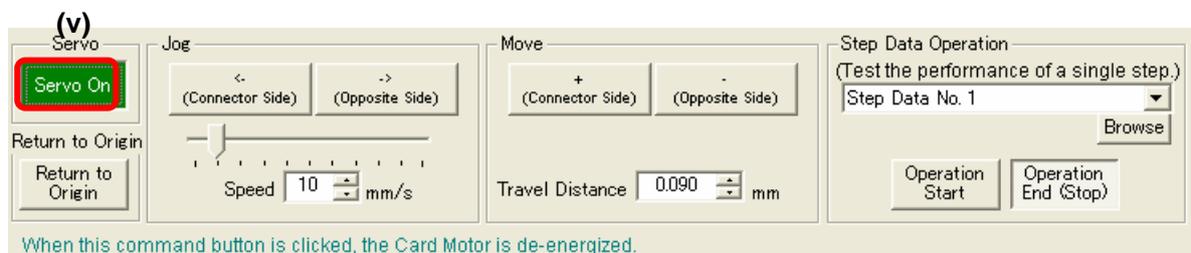
(1) Jogging at a set speed

The Card Motor can be jogged at a constant speed as follows.

- (i) Click the [Servo Off] button to energize the motor.
- (ii) Click the [Return to Origin] button to move the table to the Origin Position.
- (iii) Enter the desired Jog [Speed].
- (iv) The table can now be moved at the set speed in either direction by pressing either the [-< (Connector Side)] or the [-> (Opposite Side)] button. The movement will stop when the button is released.



If it is necessary to stop the operation, press [Servo On] (v) to de-energize the Card Motor.



Warning

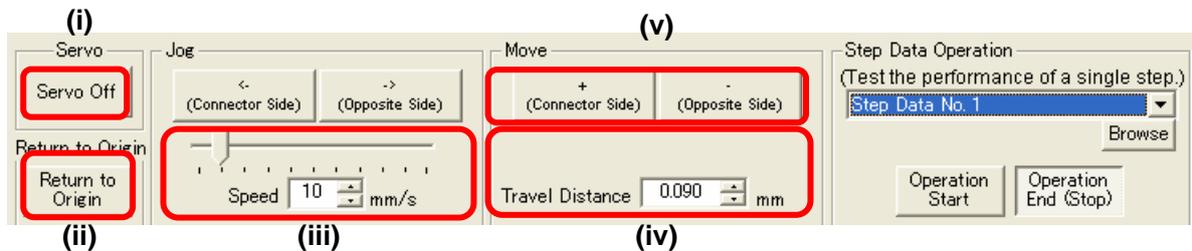
Consider the operational behavior of the table when the power supply to the motor is turned off.

When the [Servo On] button is clicked, the Card Motor will be de-energized, the table will no longer be fixed and can be moved by external forces. Ensure that the table movements cannot cause any human injury or damage to the equipment.

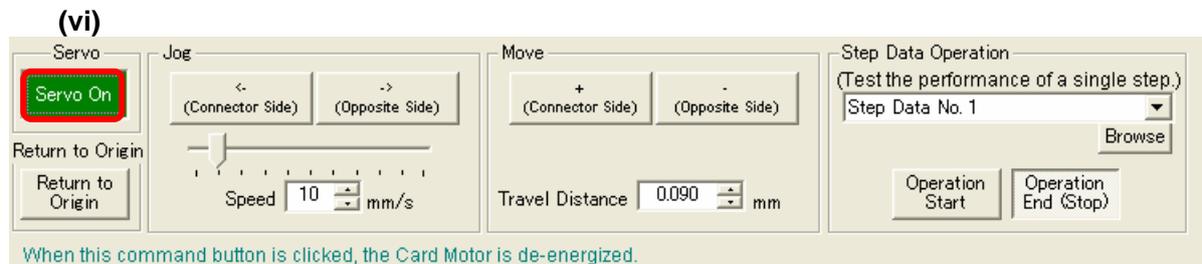
(2) Inching a set distance

The Card Motor can be jogged a certain distance at a time as follows.

- (i) Click the [Servo Off] button to energize the motor.
- (ii) Click the [Return to Origin] button to move the table to the Origin Position.
- (iii) Enter the desired inching [Speed].
- (iv) Enter the desired [Travel Distance].
- (v) When either the [+ (Connector Side)] or [- (Opposite Side)] button is clicked once, the table will move the set travel distance in the specified direction at the set speed.



If it is necessary to stop the operation, press [Servo On] (vi) to de-energize the Card Motor.



Warning

Consider the operational behavior of the table when the power supply to the motor is turned off.

When the [Servo On] button is clicked, the Card Motor will be de-energized, the table will no longer be fixed and can be moved by external forces. Ensure that the table movements cannot cause any human injury or damage to the equipment.

Caution

The table will not move outside of the stroke range.

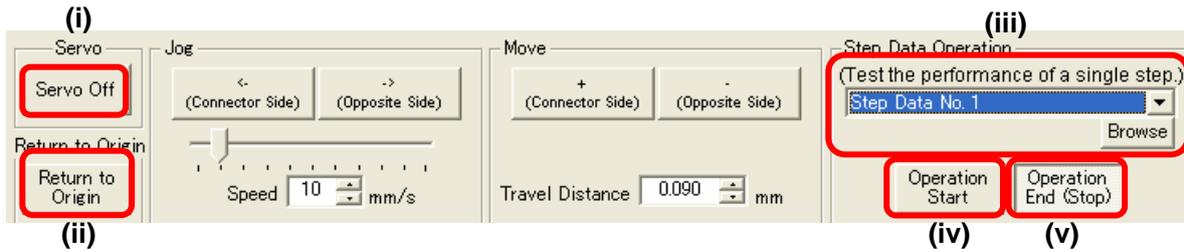
When jogging or inching, the table stops at the stroke end, and does not move outside of the stroke range even if the button is pressed.

(3) Step Data Operation

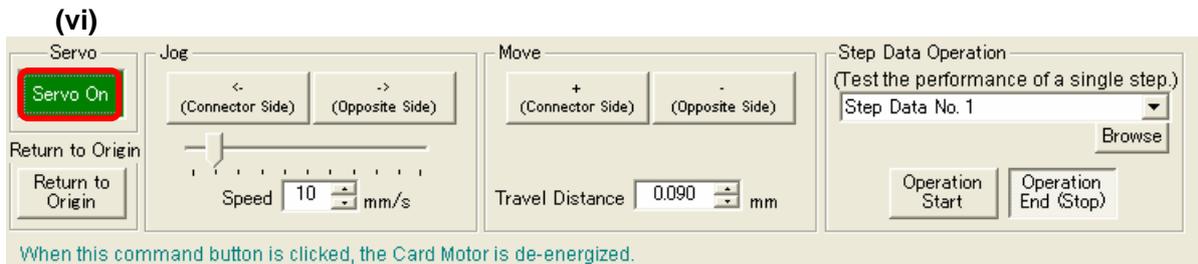
The operation of individual step data can be checked in accordance with the procedure below. The operation of each button corresponds with the I/O signals so it is possible to simulate the PLC operation.

- (i) Press [Servo Off] to energize the motor (equivalent to switching ON the SVON signal).
- (ii) Press [Return to Origin] to move the table and set the Origin position (equivalent to switching the DRIVE signal ON when the IN0 to IN3 signals are OFF).
- (iii) Select the step data (equivalent to the ON/OFF status of IN0 to IN3).
- (iv) Press [Operation start] to start moving the Card Motor in accordance with the selected step data (equivalent to switching the DRIVE signal ON).
- (v) After the operation is completed, click [Operation End (Stop)] to stop the operation (equivalent to switching the DRIVE signal OFF).

Repeat (iii) to (v).



If it is necessary to stop the operation, press [Servo On] (vi) to de-energize the Card Motor.



 Warning
<p>Consider the movements of the table when the Card Motor is de-energized.</p> <p>If [Servo On] is pressed, no power will be supplied to the Card Motor, so the table will not be fixed and can be moved by external force. Check that the table movement cannot cause any human injury or damage to the equipment.</p>
 Caution
<p>Consider table movements of the Card Motor and external forces applied to it when the operation is ended (stopped).</p> <p>When [Operation End (Stop)] is pressed, the table stops moving. However, power is still supplied to the Card Motor to maintain the position of the table where it stopped. If an external force is applied to the table, the motor will generate heat when trying to return to this position. The motor will over heat and damage the Card Motor.</p>
<p>Do not load the Card Motor with continuous or higher thrust than allowed for a prolonged time.</p> <p>When a pushing operation step data is selected, the pushing force is continuously generated from [Operation Start] until [Operation End (Stop)] is pressed.</p> <p>If a Thrust Setting Value is set higher than the maximum allowable value, the Card Motor will overheat and an overheating error and operation failure may occur. When a pushing operation is performed at the maximum allowable set thrust at 100% duty ratio or more, stop (end) the operation within 10 seconds. Refer to section “4. 4 Pushing operation” (P.44) for specifications of the relationship between the set thrust and duty ratio.</p>

(4) Continuous Operation

The operation of a continuous cycle can be checked in accordance with the procedure below.

A. Selection of Return to Origin Position

Select Step "1", and select the "Return to Origin" option in the "Step Data Number" column, and tick the "One Time Ope" operation check box.

B. Selection of Step Data

Select and enter the step data in the order they are to be executed from Step 2 onwards (Step 20 is maximum possible) and enter the required [Operating Time] for each step. ^{Note)}

C. Setting the [Repeat Count]

Enter the amount of times the cycle is to be repeated.

D. Press [Operation Start] to start the operation.

E. Operation End

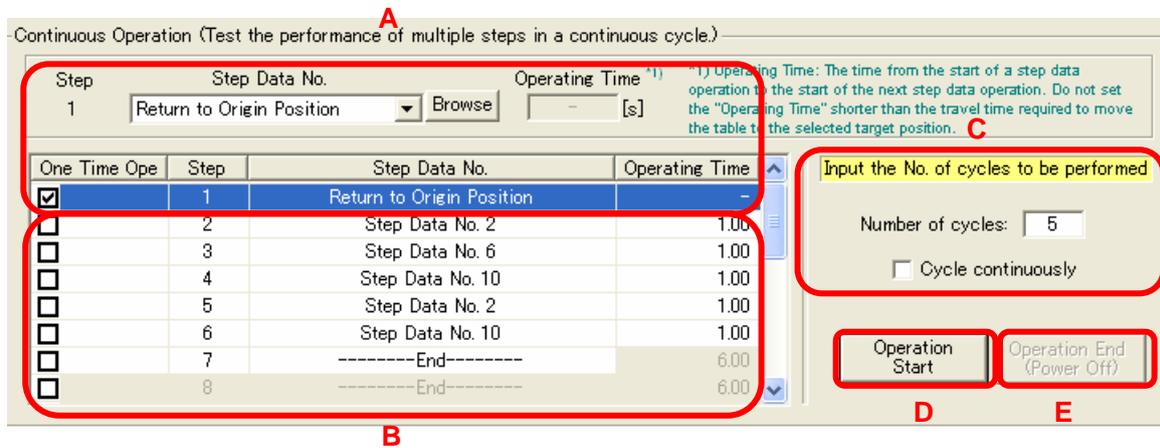
The operation ends and the motor becomes de-energized after the Card Motor has repeated the amount of cycles set in the [Repeat Count] text box in item C in the figure below.

If it is necessary to stop the operation while the product is operating, click [Operation End] (item E shown below) and the motor becomes de-energized.

Note) Operating Time: Time required from the start of one step data operation to the start of the next step data operation. Enter a value larger than the "Positioning Time" of the selected step data.

It is not necessary to enter "Operating Time" for the "Return to Origin Position" function.

The Card Motor will execute the steps in the order they are entered in item B shown below after the "Return to Origin Position" operation has been completed.



Warning

Consider the table movement.

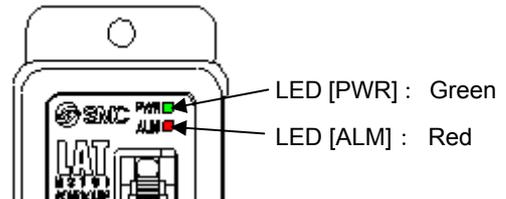
If the operation is ended (the motor becomes de-energized). Because no power is supplied to the Card Motor the table will not be fixed and can be moved by external force or by the table's own weight (including workpieces). Check that the table movement cannot cause any human injury or damage to the equipment.

Caution

When an alarm is generated.

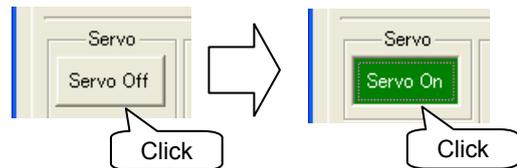
If the LED [ALM] on the front of the controller turns red or flashes, an alarm has been generated.

Press SVON to reset and cancel the alarm after the cause of the alarm has been cleared.



SVON reset

Click [Servo On] first and then [Servo Off].



Note) The type of the alarm can be detected by checking the combination of lit and flashing ALARM and POWER LED's. Refer to section "[8. Alarm detection](#)" (P.60) or the LATC4 series controller operation manual for details of alarm detection.

Complete the "Basic Parameter Setup" and "Step Data Setup" settings before operating the Card Motor.

If the "Basic Parameter Setup and "Step Data Setup" settings have not been completed, the Card Motor will not operate and an alarm will be generated. Refer to section "[1.2 Controller settings](#)" (P.7) for details of Basic Parameter Setup" and Step Data Setup" settings.

In "Monitor Mode" it is not possible to operate the Card Motor with the Controller Setting Software.

Refer to section "[1.4 \(5\) Monitor Mode](#)" (P.19) for details of the "Monitor Mode".

1. 4 Operation by PLC

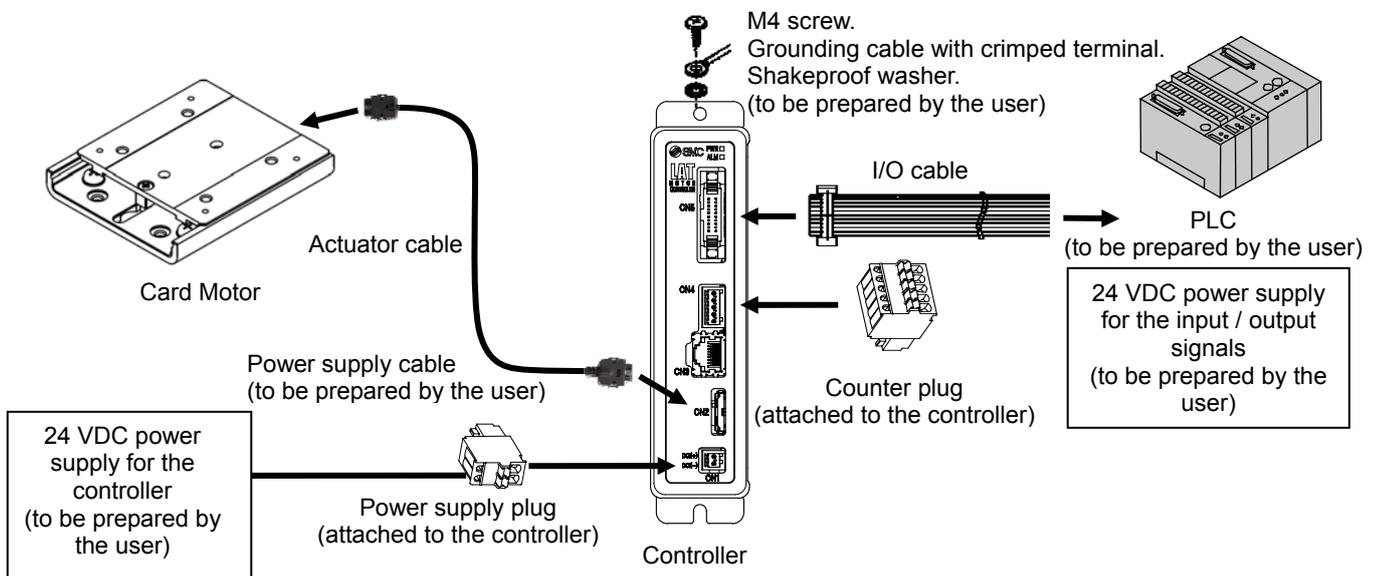
The step data set in the controller can be selected and the Card Motor operated to the steps using the digital I/O signals of a PLC.

Complete and download to the controller the “Basic Parameter Setup” and “Step Data Setup” settings before operating the product using a PLC. Refer to section “1.2 Controller settings” (P.7) for details of the setting procedure.

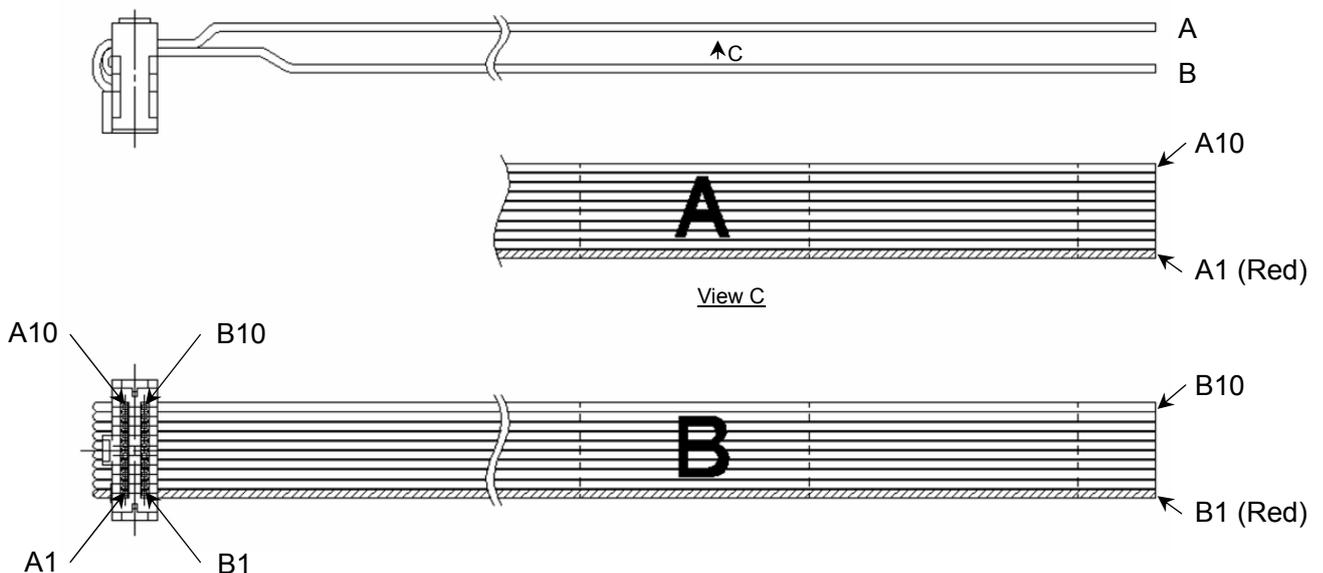
Turn off the Controller Setting Software after the settings have been downloaded to the controller. Then turn off the controller once and turn it on again, or set it to “Monitor Mode” in the “Monitor/Test” tab of the Controller Setting Software. Refer to section “1.4 (5) Monitor Mode” (P.19) for details of the “Monitor Mode”.

(1) Wiring

Switch the power off from the controller, and disconnect the controller setting cable from the controller. Connect the controller and the PLC with the I/O cable.

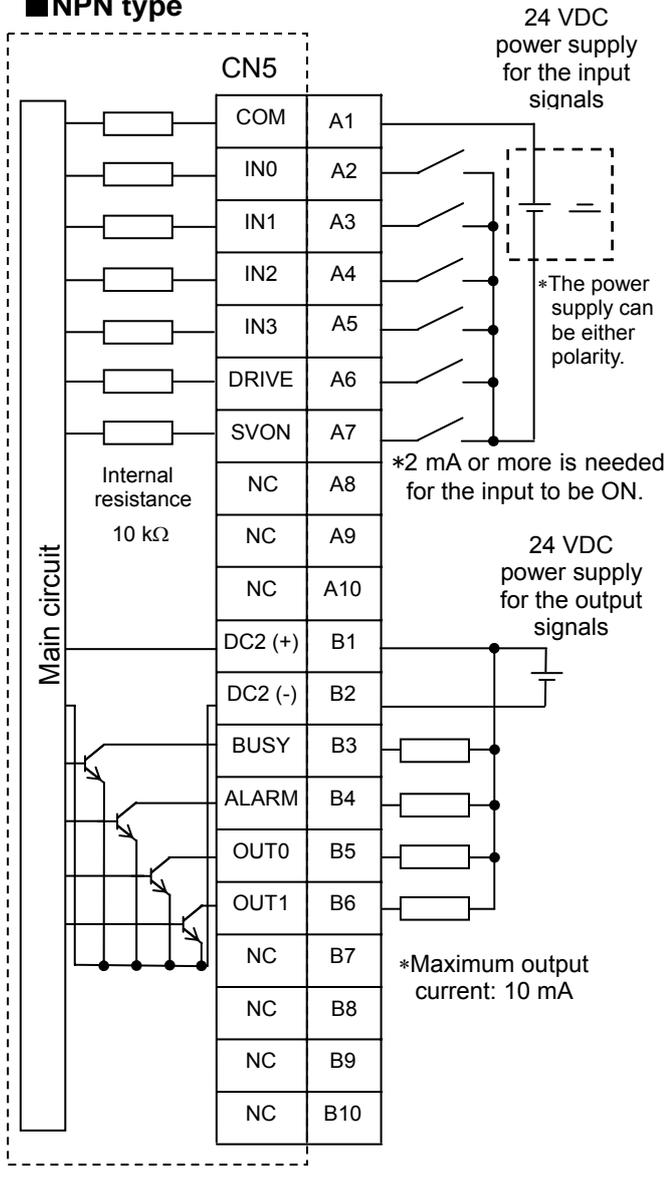


(2) I/O cable

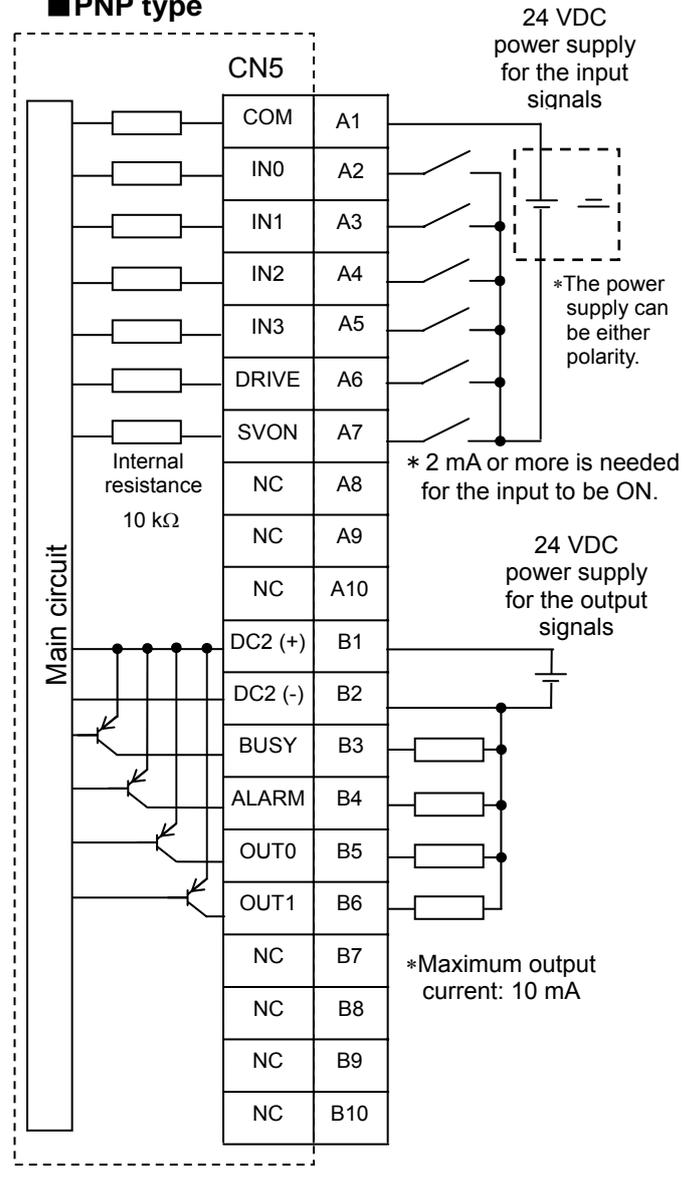


(2) Parallel I/O connector wiring (Example)

■ NPN type



■ PNP type



Input signal details

Name	Details
COM	Connect a 24VDC power supply for the input signals. (Either polarity can be used.)
IN0 to IN3	Bit no. to specify step data number to be operated.
DRIVE	Operation command.
SVON	Turn servo ON command.
NC	Not connected.

Functions that can be assigned to the OUT0 and OUT1 outputs. Note 4)

Name	Description
BUSY	ON when the actuator is moving. <small>Note 1)</small>
INP	ON when the table is within the "INP" output range of the current "Target Position".
INF	ON when the pushing force reaches the "Threshold Force Value".
INFP	ON when the table is within the "Positioning repeatability" range of the connected actuator model for the current "Target Position".
AREA A AREA B	ON when the table is within the set "Area Ranges".

Output signal details

Name	Details
DC2 (+)	Connect the 24 V terminal of the power supply for the output signals
DC2 (-)	Connect the 0 V terminal of the power supply for the output signals
BUSY	ON when the actuator is moving <small>Note 1)</small>
ALARM	OFF in alarm condition <small>Note 2)</small>
OUT0 to OUT1	Select the required output function among BUSY, INP, INFP, INF, AREA A, and AREA B. <small>Note 3)</small>
NC	Not connected

Note 1) Output functions other than BUSY can also be assigned to the BUSY output.

Note 2) This output signal turns ON when power is supplied to the controller, and turns OFF in alarm condition (N.C.).

Note 3) INP is set as a default for OUT0, and INF for OUT1.

Note 4) One output function can be selected respectively for OUT0 and OUT1.

⚠ Caution

There are two types of parallel inputs and outputs for this controller;
NPN type (LATC4-N**) and PNP type (LATC4-P**).

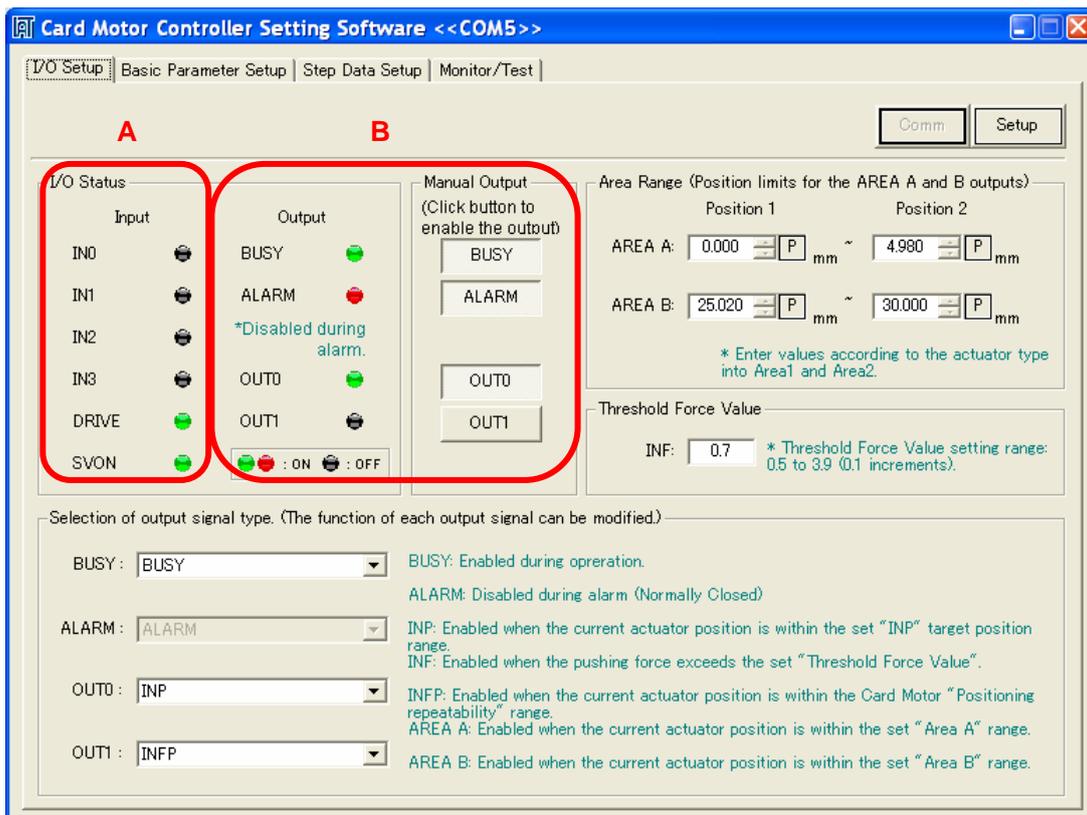
Please confirm the specification before wiring.

The 24 VDC power supply for the controller (CN1), and the 24 VDC power supply for the parallel I/O (CN5) should be separate.

(3) Parallel I/O connection check

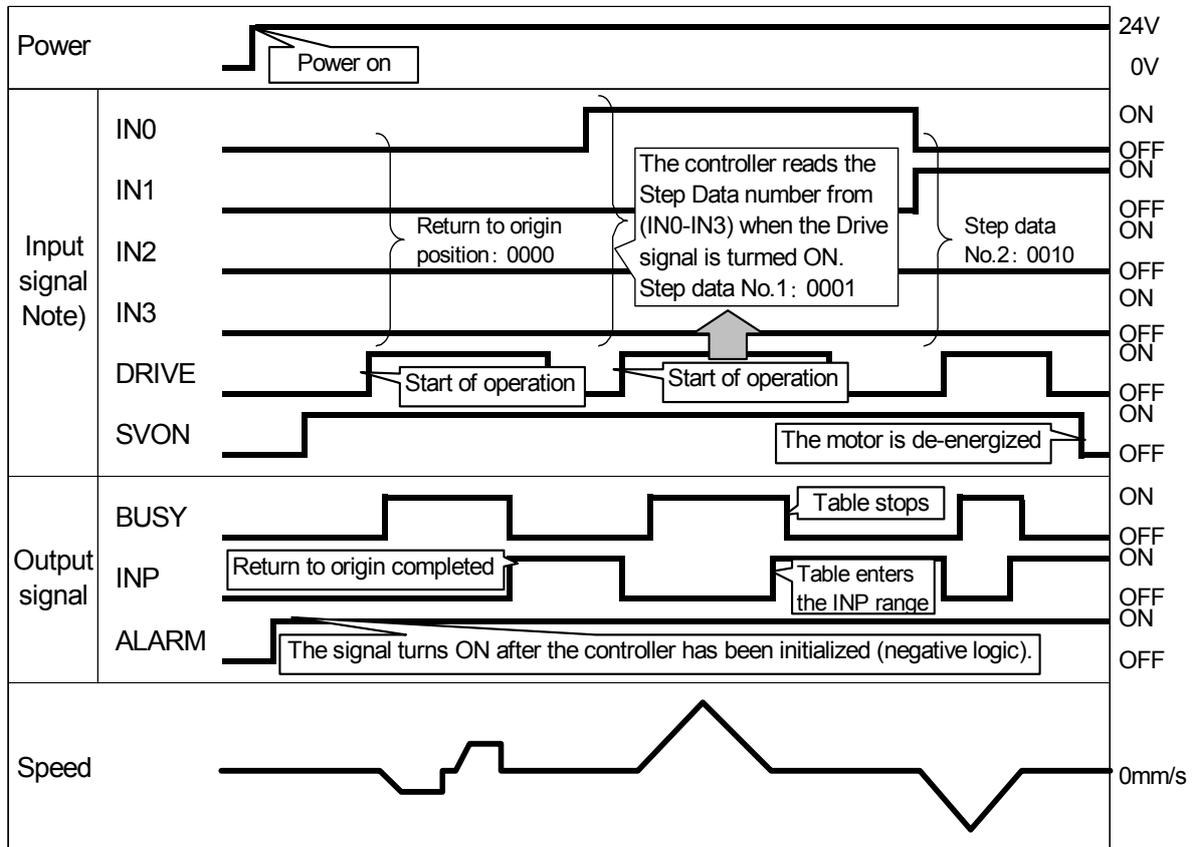
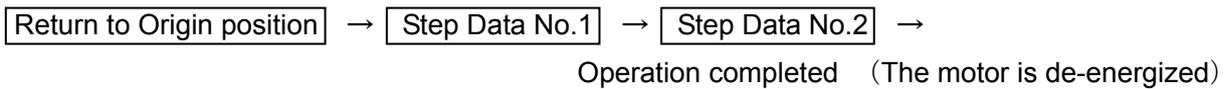
The wiring and connections and the signal status of the controller and PLC can be checked using the “I/O status” and “Manual Output” functions.

- A. Input signal check Use the PLC to turn ON and OFF the output signals to the IN0, IN1, IN2, IN3, DRIVE, and SVON controller inputs and check the corresponding input signals using the Controller Setting Software. The indicator turns green when the controller detects a signal in ON status.
- B. Output signal check .. Turn manually ON and OFF the BUSY, ALARM, OUT0, and OUT1 output signals to check the corresponding input signals to the PLC. The indicator turns green (red for the ALARM output) when the controller outputs are high (ON).



(4) Timing chart (Example)

The timing chart below shows the sequence of the parallel I/O signals for an example operation after power has been supplied to the controller.



Note1) A PLC processing delay and controller scan delay should be considered when using the controller I/O's. Use a 2 msec interval or more between input signals, and maintain the signal state for at least 2 msec.

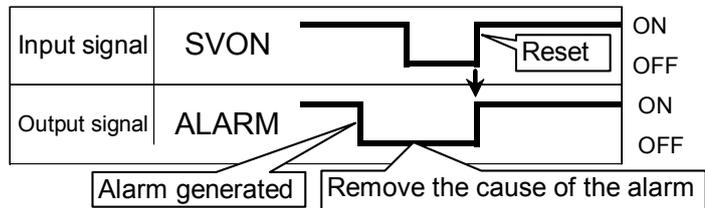
⚠ Caution

When an alarm is generated.

If the LED [ALM] on the front of the controller turns red or flashes, an alarm has been generated. Switch the SVON signal OFF and ON again for at least 2 msec to reset and cancel the alarm after the cause of the alarm has been cleared.



LED [PWR] : Green
LED [ALM] : Red



Note) The type of the alarm can be detected by checking the combination of lit and flashing ALARM and POWER LED's. Refer to section "8. Alarm detection" (P.60) or the LATC4 series controller operation manual for details of controller alarm detection and alarm types.

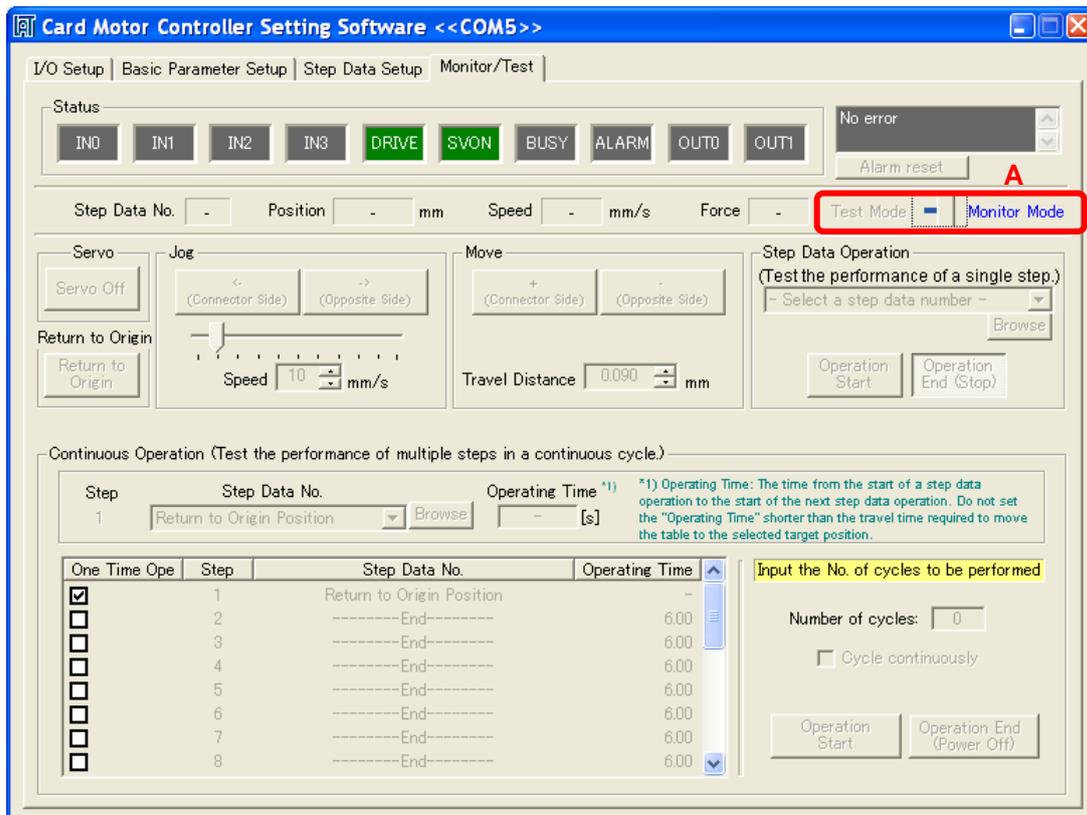
(5) Monitor mode

The status of the parallel I/O signals, the table position, speed and pushing force can be monitored in Monitor Mode when the Card Motor is operating using a PLC to control the parallel I/O signals.

A. Select "Monitor Mode" in the "Test Mode / Monitor Mode" tab.

Test Mode The Card Motor operates based on operation commands from the Controller Setting Software.

Monitor Mode The Card Motor operates based on operation commands sent from the PLC to the controller via the parallel I/O.



Warning

All the limitations are cancelled by switching between Test Mode and Monitor Mode.

The power supply to the Card Motor will be turned off, the table will no longer be fixed and can be moved by external force or the table's own weight (including workpieces). Ensure that the table movements cannot cause any human injury or damage to the equipment.

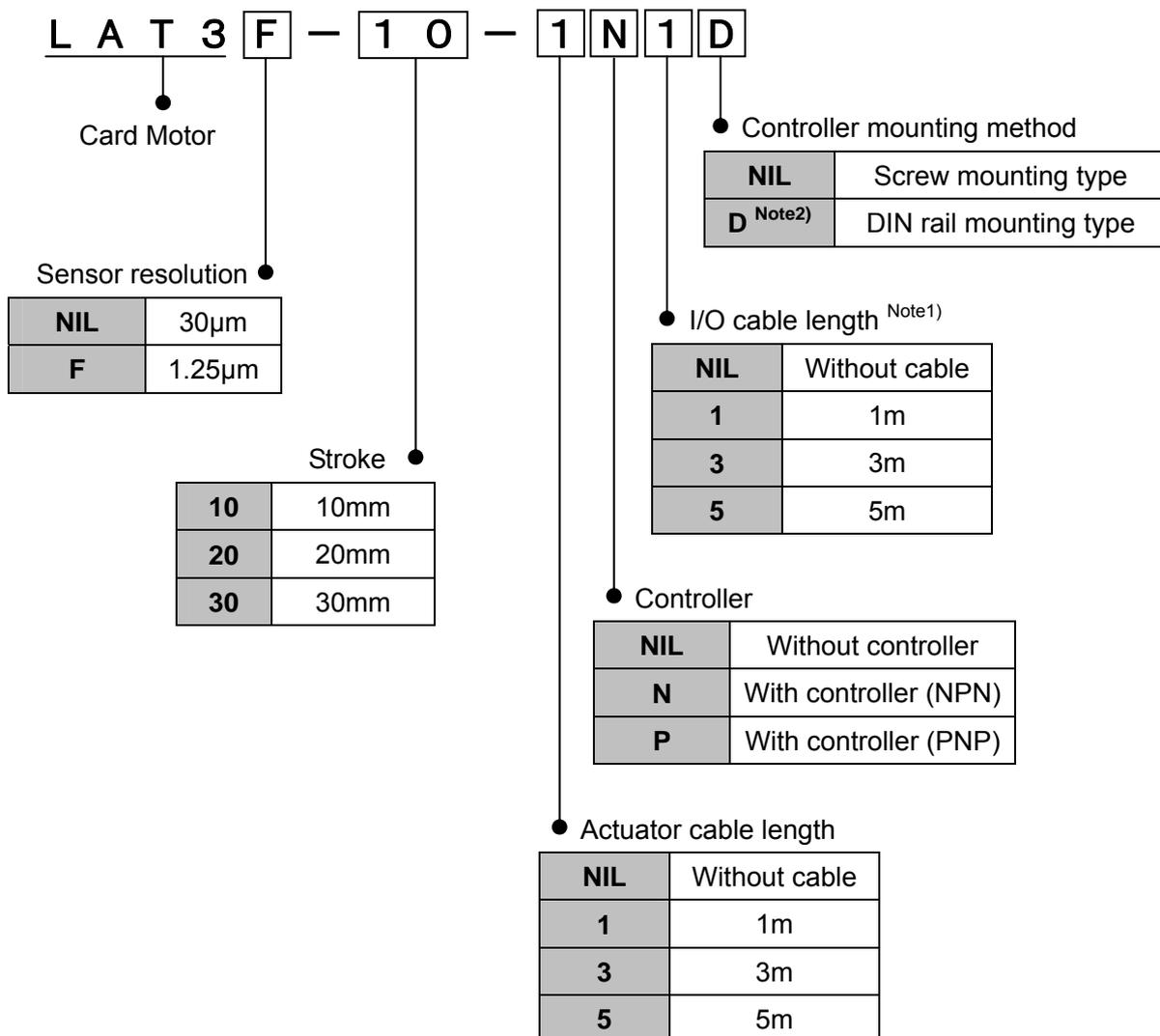
Caution

In Monitor Mode it is not possible to operate the Card Motor using the parallel I/O signals of the PLC.

Return the table to origin after switching between Test Mode and Monitor Mode.

2. Product Outlines

2. 1 How to Order



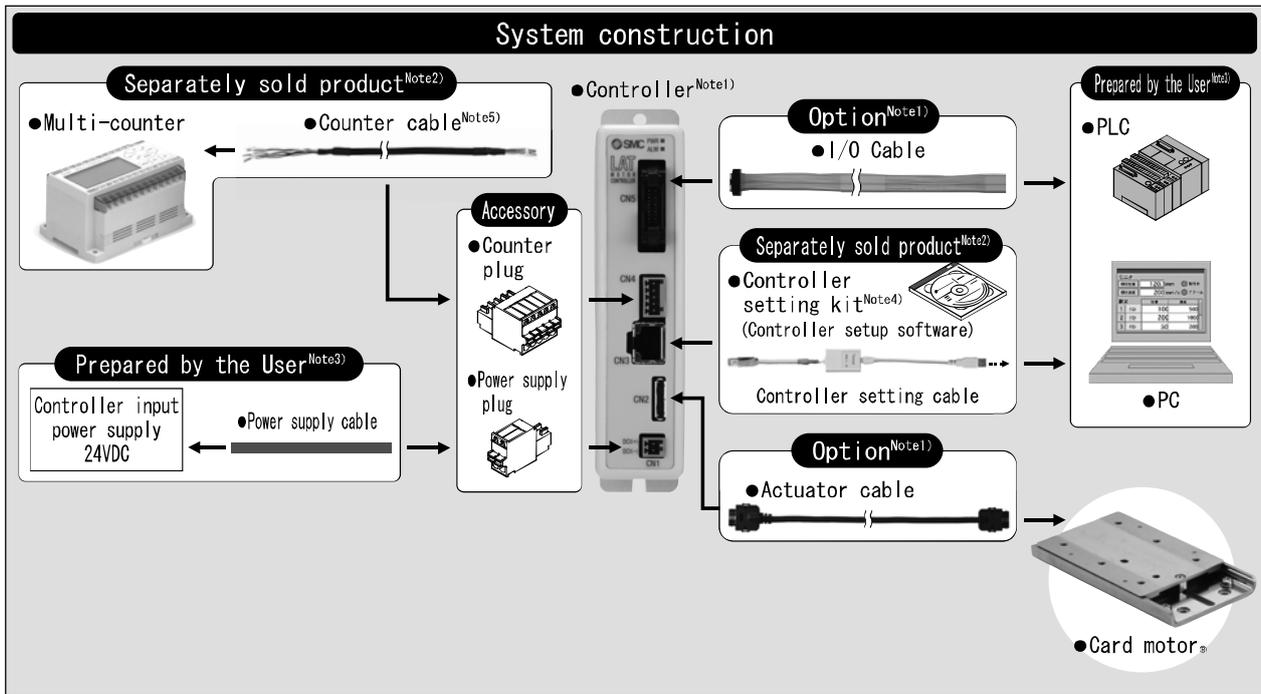
Note 1) If “Without controller” has been selected, the I/O cable is also not included.

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 “3.4 I/O cable” (P.33))

Note 2) The DIN rail is not included. If the DIN rail is required, please order separately. (Refer to the LAT3 series catalogue for details.)

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	LATC4-***
2	Actuator cable	LATH1-*
3	I/O cable	LATH2-*

Accessories

(Supplied with the controller attached to it)

No.	Description	Remarks
1	Power supply plug	For the controller power supply
2	Counter plug	For the multi-counter

Separately sold products

No.	Description	Part No.	Remarks
1	Multi-counter	CEU5***	
2	Counter cable	LATH3-*	
3	Controller setting kit	LATC-W1	Controller setting software Controller setting cable

⚠ Caution

Refer to the LATC4 series controller operation manual for detailed wiring.

Refer to section “7. Common precautions for wiring and cables” (P.59) for instructions regarding wiring and handling of cables.

Complete the “Controller setting cable” assembly by connecting the “USB cable” to the “Conversion unit” attached at the end of the “Communication cable”.

3. Specifications

3.1 Card Motor

(1) Card Motor specifications

Model		LAT3-10	LAT3F-10	LAT3-20	LAT3F-20	LAT3-30	LAT3F-30
Stroke [mm]		10		20		30	
Motor	Type	Moving magnet type linear motor					
	Maximum instantaneous thrust [N] <small>Note 1) Note 2) Note 3)</small>	5.2		6		5.5	
	Continuous thrust [N] <small>Note 1) Note 2) Note 3)</small>	3		2.8		2.6	
Guide	Type	Linear guide with circulating balls					
	Maximum load weight [g]	Horizontal: 500, Vertical: 100				Horizontal: 500, Vertical: 50	
Sensor	Type	Optical linear encoder (incremental)					
	Resolution [μm]	30	1.25	30	1.25	30	1.25
	Origin position signal	None	Provided	None	Provided	None	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	
Positioning operation	Positioning resolution [μm]	30	1.25	30	1.25	30	1.25
	Positioning repeatability [μm] <small>Note 4) Note 5)</small>	± 90	± 5	± 90	± 5	± 90	± 5
Measurement	Accuracy [μm] <small>Note 4) Note 5)</small>	± 100	± 10	± 100	± 10	± 100	± 10
Maximum speed [mm/s] <small>Note 6)</small>		400					
Operating temperature range [$^{\circ}\text{C}$]		5 to 40 (No condensation)					
Operating humidity range [%]		35 to 85 (No condensation)					
Weight [g] <small>Note 7)</small>		130		190		250	
Table weight [g]		50		70		90	

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.23) and to “Fig. 4-3: Allowable thrust force setting values” (P.24) 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.23).

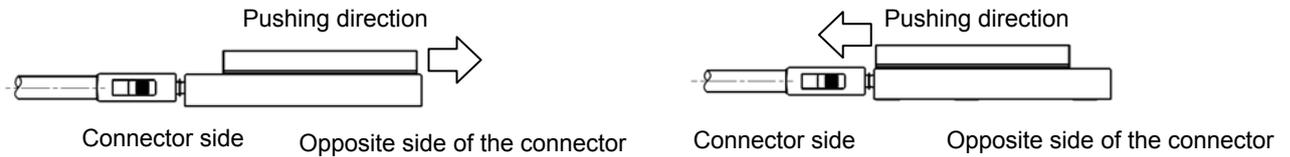
Note 4) When the temperature of the product is 20°C.

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.

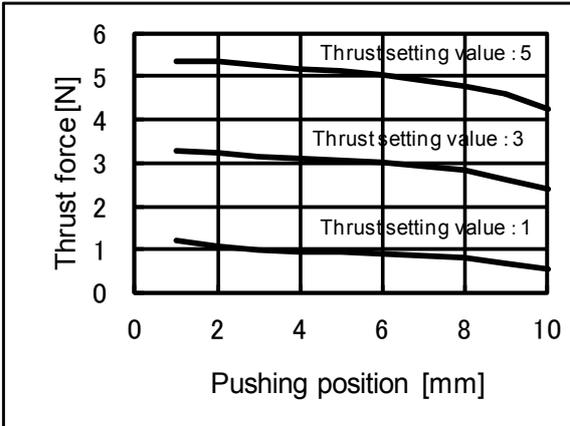
Note 6) The maximum speed varies depending on the operating conditions (load weight, total travel distance).

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

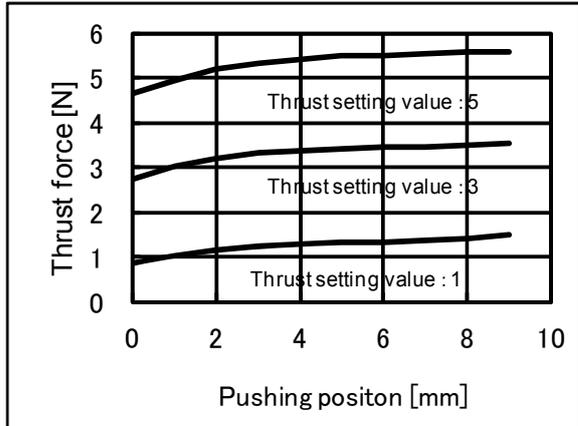
(2) Card motor characteristics



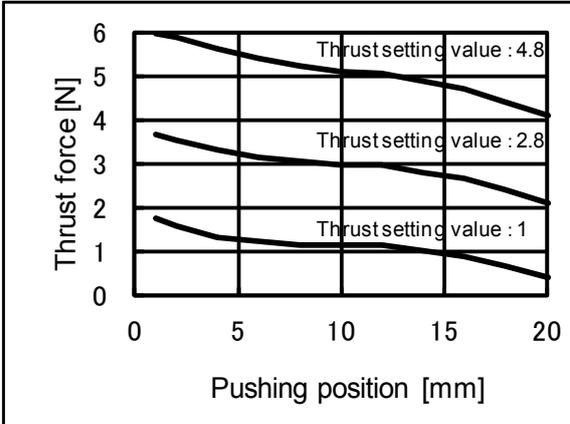
LAT3*-10



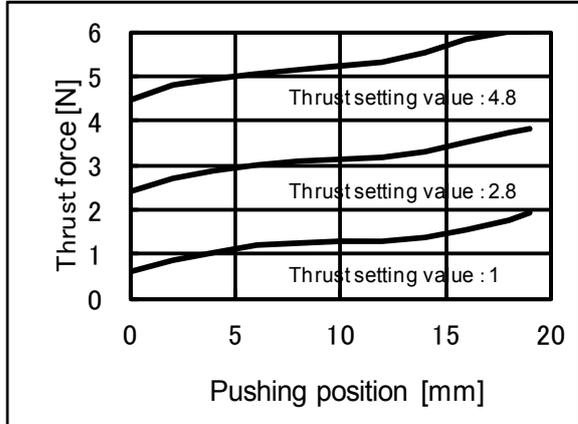
LAT3*-10



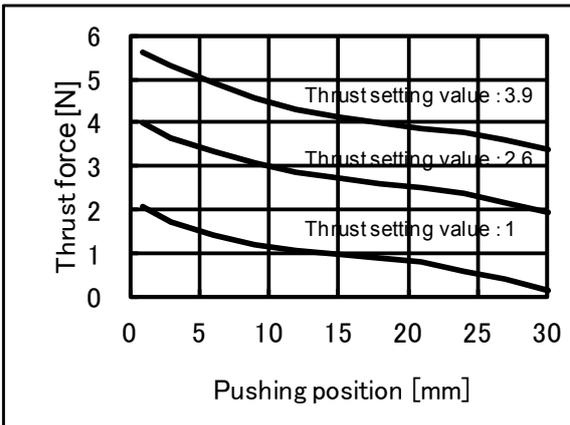
LAT3*-20



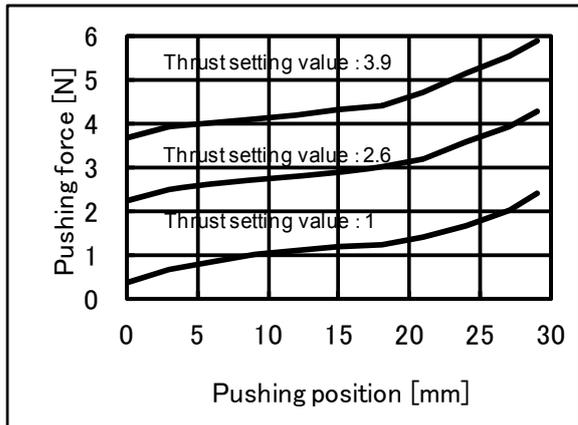
LAT3*-20



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).

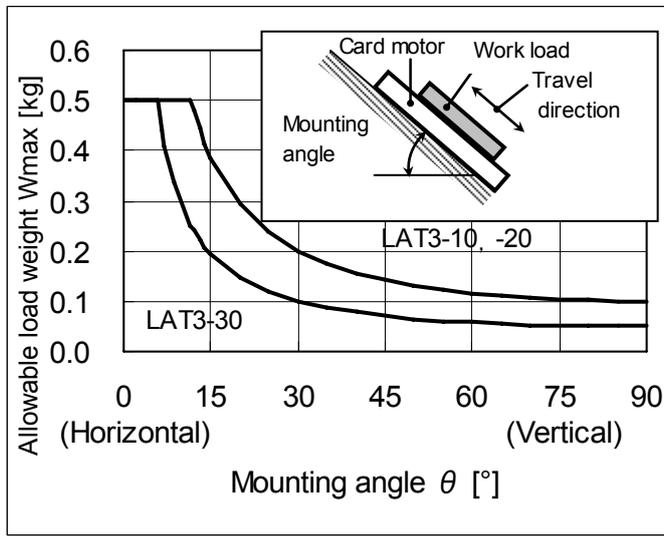


Fig. 4-2 Allowable load weight.

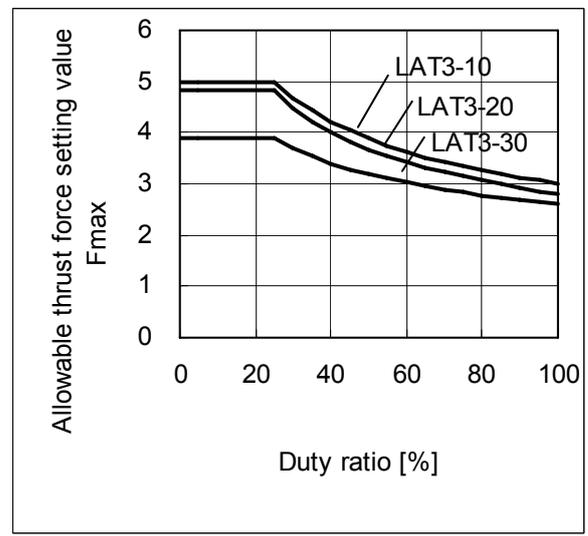


Fig. 4-3 Allowable thrust force setting values.

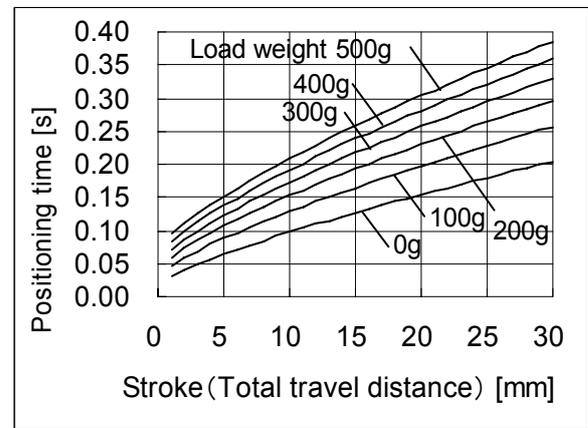
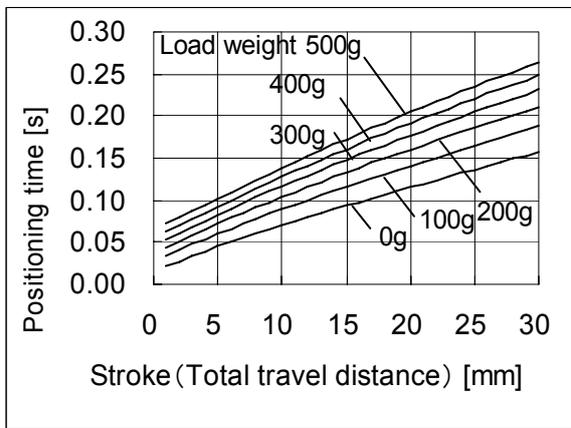
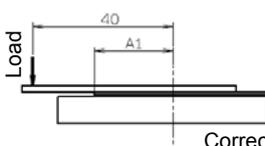


Fig.4-4 Shortest positioning time (guideline)

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

Table displacement due to yawing moment

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

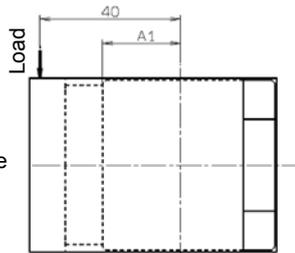


Table displacement due to rolling moment

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

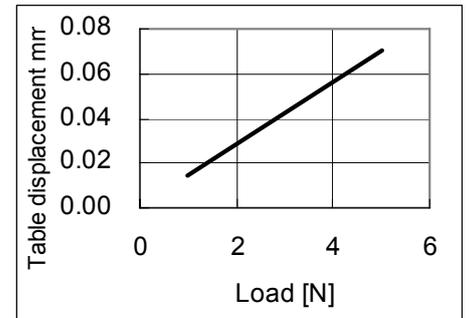
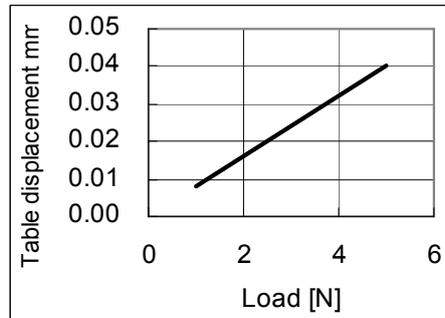
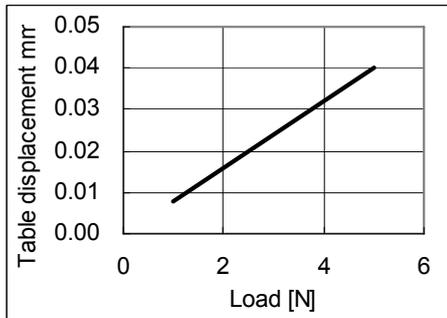
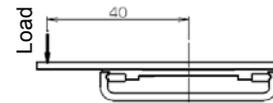
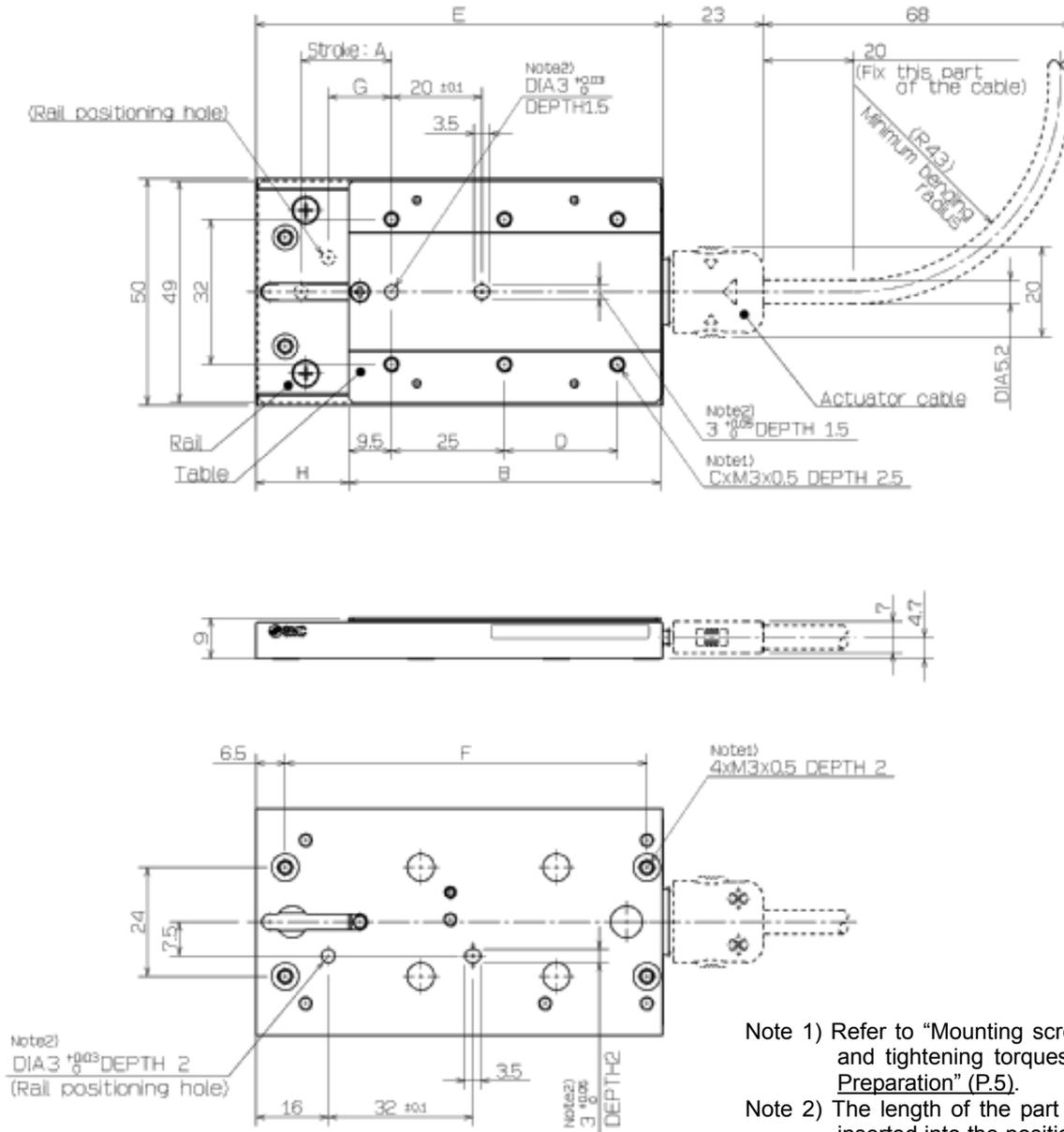


Fig.4-5 Table displacement (guideline)

(3) Card motor dimensions



- Note 1) Refer to “Mounting screw specifications and tightening torques” in section “1.1 Preparation” (P.5).
- 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). Refer to section “4.2 Return to Origin Position” (P.41) for details.

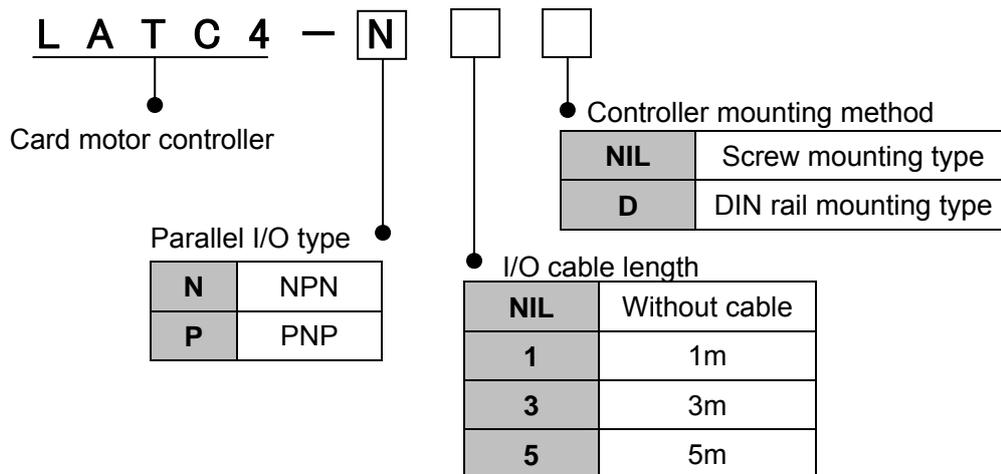
[mm]

Part No.	Stroke	Table dimensions				Rail dimensions		Origin position ^{note 4)}	
	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 Controller

Refer to the LATC4 Series controller operation manual for details.

(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.)

(2) Controller specifications

Item	Specifications
Control method	Step data entry type
Compatible actuator	Card Motor® LAT3 Series
Number of axis	Single axis
Power supply specification ^(Note 1)	Power supply voltage: 24 VDC ±10(%) Current consumption: Rated 2 A (Peak 3 A) ^{Note 2)} Power consumption: 48 W (Maximum 72 W) ^{Note 2)}
Control system	Closed loop
Operation pattern	Positioning operation, Pushing operation
Number of step data	15 points
Parallel input	6 inputs (Optically isolated)
Parallel output	4 outputs (Optically isolated, open collector output)
Position display output ^{Note 3)}	A phase and B phase pulse signals, RESET signal (NPN open collector output)
LED display	2 LED's (Green and Red)
Cooling method	Natural cooling
Operating temperature range	5 to 40 °C (No condensation)
Ambient humidity range	35% to 85% (No condensation)
Insulation resistance	50 MΩ (500 VDC) between the case and the FG terminal
Weight ^{Note 4)}	130g (Screw mounting type), 150g (DIN rail mounting type)
Compatible Setting software for PC ^{Note 5)}	LATC-W1

Note 1) Do not use an inrush current limited type power supply for the controller.

Note 2) Rated current: Current consumption when continuous thrust is generated.

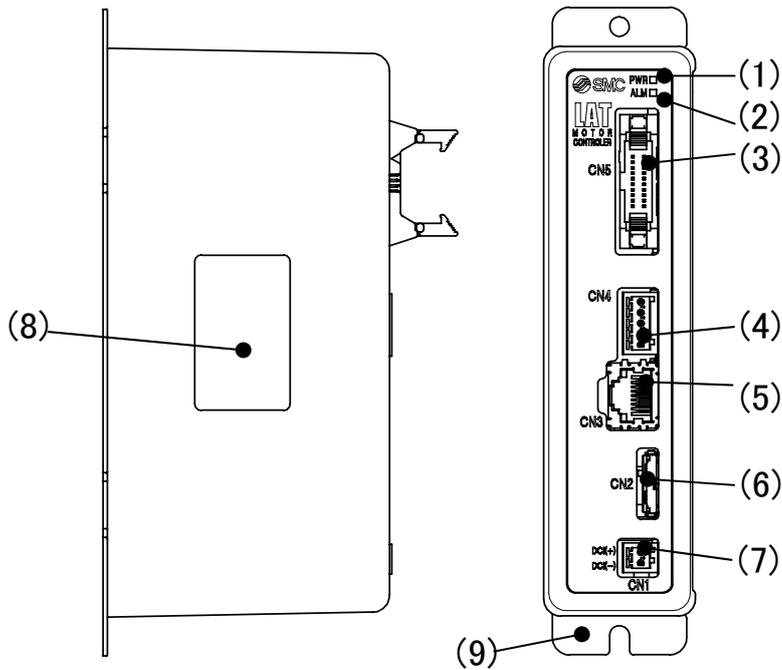
Peak current: Current consumption when maximum instantaneous thrust is generated.

Note 3) Specification for the connection of the separately sold multi-counter (CEU5).

Note 4) Cables are not included.

Note 5) The Controller Setting Software is not supplied with the controller. Refer to section "3.6 Controller setting kit" (P. 34) for how to order separately.

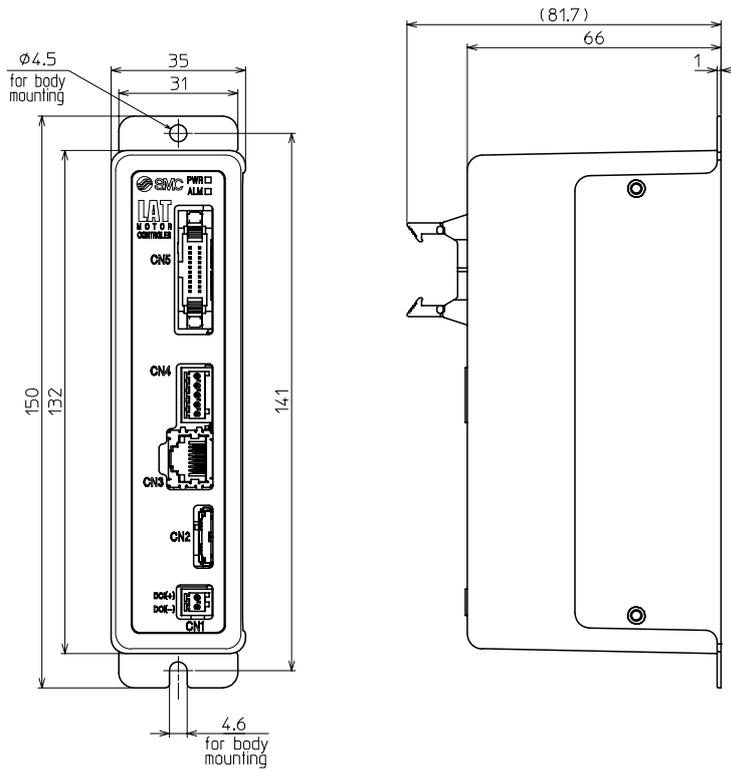
(3) Controller parts description



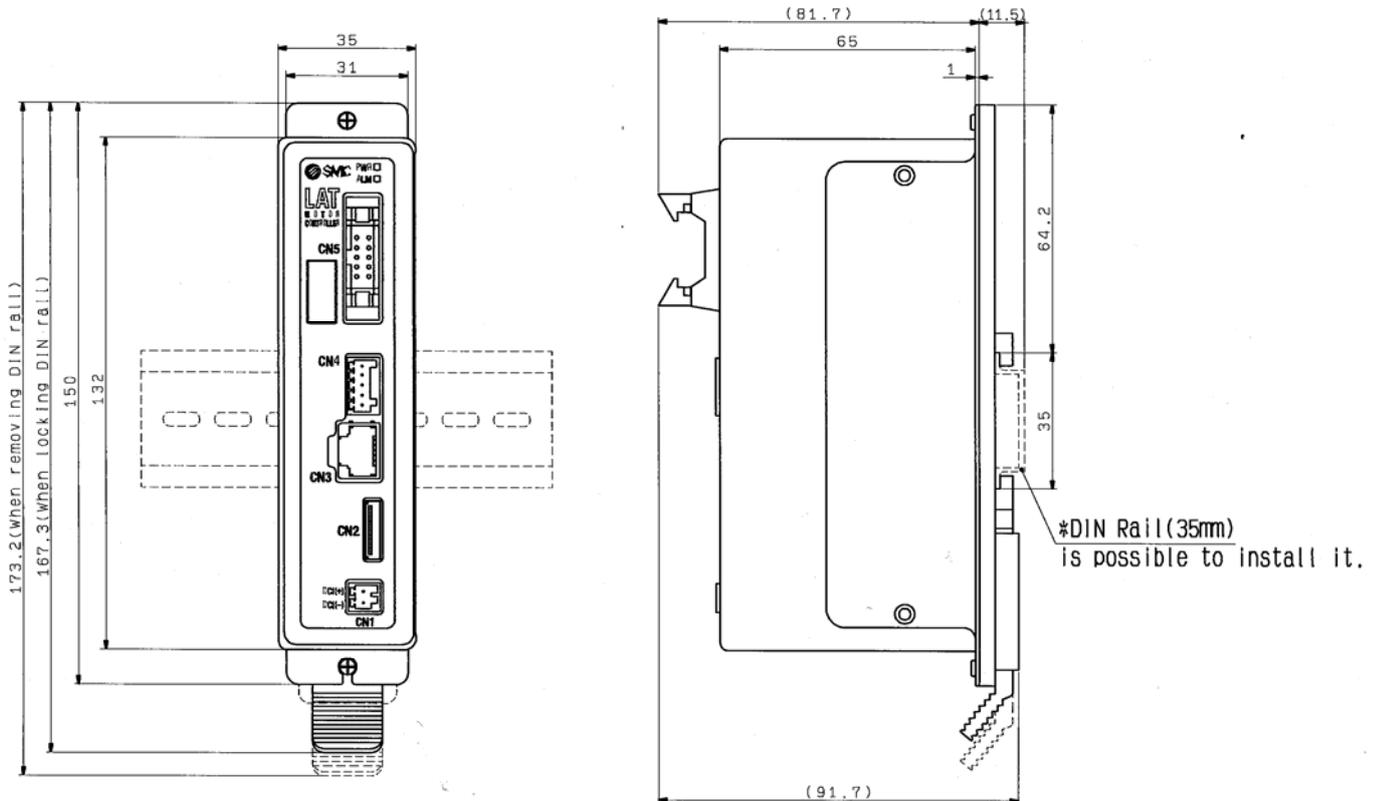
No.	Display	Description	Details
1	PWR	Power supply/Alarm LED (Green)	Normal operation: Green However, if also the ALM LED is lit or flashes, an error has been generated.
2	ALM	Alarm LED (Red)	In alarm condition: Lit or flashes The combination of lit or flashing ALM and PWR LED's indicates the content of an alarm.
3	CN5	Parallel I/O connector (20 pins)	Connection to a PLC via the LATH2-* I/O cable. (6 inputs, common (COM) terminal for the input signals, 4 outputs, positive and negative power supply terminals for the output signals)
4	CN4	Counter connector (5 pins)	Connection to the CEU5 multi-counter via the LATH3-* counter cable.
5	CN3	Serial I/O connector (9 pins)	Connection to a PC via the controller setting cable.
6	CN2	Motor connector (18 pins)	Connection to the Card Motor via the LATH1-* actuator cable.
7	CN1	Power supply connector (2 pins)	24 VDC power supply connection to the controller using the power supply plug and a power supply cable.
8	—	Controller part number label	Label indicating the part number of the controller.
9	—	FG	Frame ground (When the controller is mounted, tighten screws and connect the grounding cable.)

(4) Controller

Screw mounting type (LATC4-**)



DIN rail mounting type (LATC4-**D)



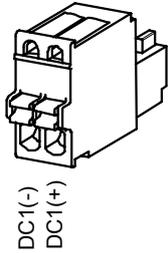
(5) Electrical wiring

Power supply connector: CN1

The power supply plug is an accessory supplied with the controller.

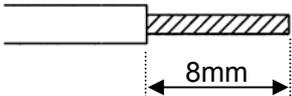
Use the attached power supply plug for connecting a 24 VDC power supply to the controller power supply connector.

Power supply plug



Terminal	Function	Description
DC1(-)	Power supply (-)	Terminal for the power supply (-) to the controller. Power (-) is also supplied to the Card Motor via the internal circuit of the controller and the actuator cable.
DC1(+)	Power supply (+)	Terminal for the power supply (+) to the controller. Power (+) is also supplied to the Card Motor via the internal circuit of the controller and the actuator cable.

Prepare the electrical wiring according to the following specifications (to be prepared by the user).

Item	Specifications
Applicable electrical wire size	20 AWG / 0.5 mm ² Use a single multi-strand wire for each terminal. Twist the wires together, and strip the ends as shown below. The insulation should be rated to withstand 60°C temperature minimum.
Stripped wire length	

Caution

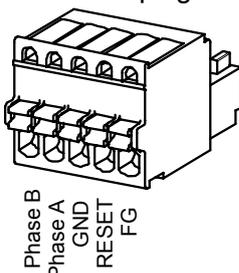
Do not connect multiple wires to one terminal.

Counter connector: CN4

The counter plug is an accessory supplied with the controller.

Use the attached counter plug and the LATH3-* counter cable (sold separately) for connecting the CEU5 Multi-counter to the controller counter connector.

Counter plug

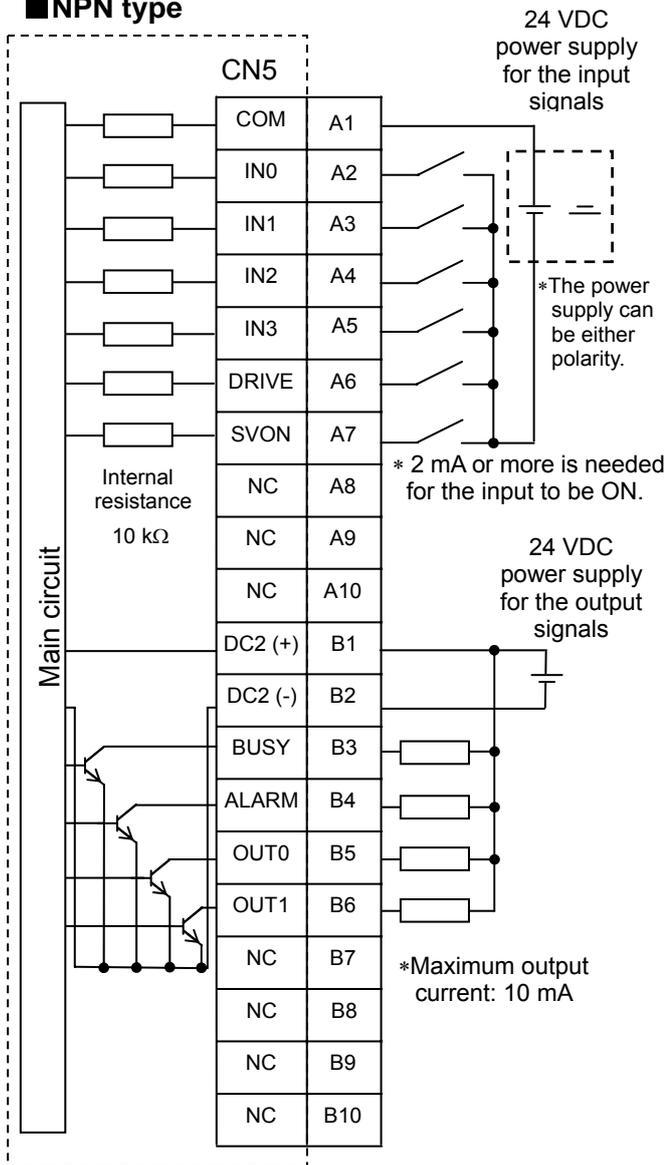


Terminal	Details	Wire colour
Phase B	Connect the phase B wire of the counter cable	White
Phase A	Connect the phase A wire of the counter cable	Red
GND	Connect the GND wire of the counter cable	Light gray
RESET	Connect the Reset wire of the counter cable	Yellow
FG	Connect the FG wire of the counter cable	Green

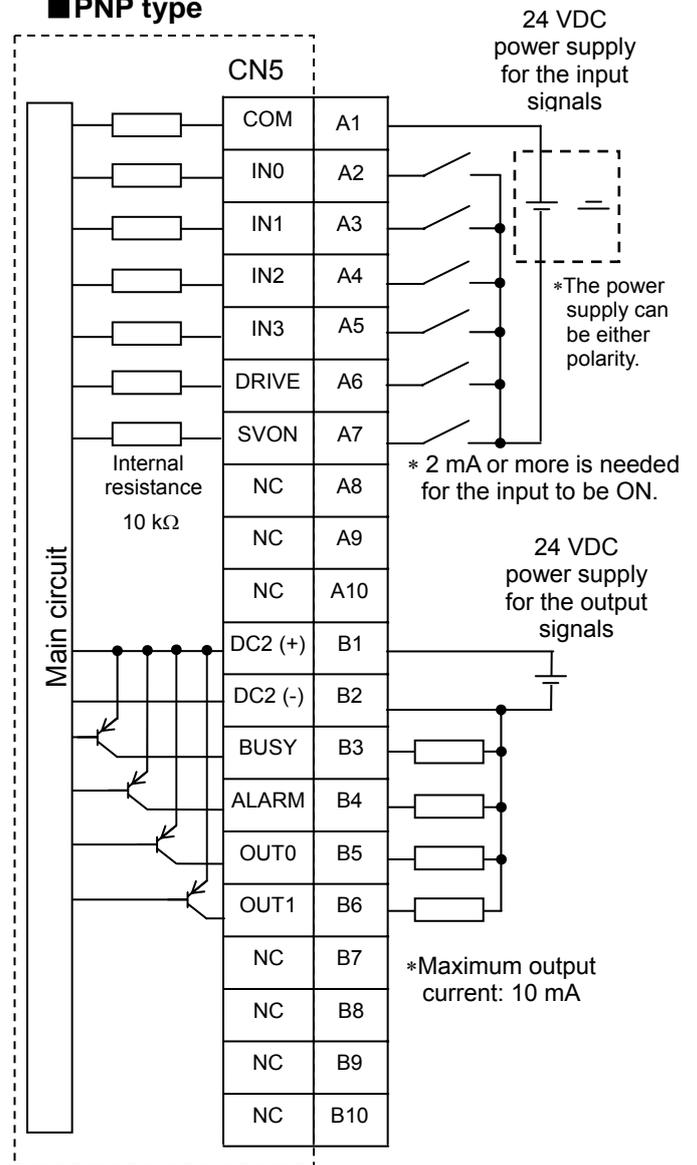
Note) Refer to section [“3.7 Multi-counter” \(P.35\)](#) for Multi-counter wiring and setting instructions.

Parallel I/O connector: CN5

■ NPN type



■ PNP type



Input signal details

Name	Details
COM	Connect a 24VDC power supply for the input signals. (Either polarity can be used.)
IN0 to IN3	Bit no. to specify step data number to be operated.
DRIVE	Operation command.
SVON	Turn servo ON command.
NC	Not connected.

Functions that can be assigned to the OUT0 and OUT1 outputs. Note 4)

Name	Description
BUSY	ON when the actuator is moving. <small>Note 1)</small>
INP	ON when the table is within the "INP" output range of the current "Target Position".
INF	ON when the pushing force reaches the "Threshold Force Value".
INFP	ON when the table is within the "Positioning repeatability" range of the connected actuator model for the current "Target Position".
AREA A AREA B	ON when the table is within the set "Area Ranges".

Output signal details

Name	Details
DC2 (+)	Connect the 24 V terminal of the power supply for the output signals
DC2 (-)	Connect the 0 V terminal of the power supply for the output signals
BUSY	ON when the actuator is moving <small>Note 1)</small>
ALARM	OFF in alarm condition <small>Note 2)</small>
OUT0 to OUT1	Select the required output function among BUSY, INP, INFP, INF, AREA A, and AREA B. <small>Note 3)</small>
NC	Not connected

Note 1) Output functions other than BUSY can also be assigned to the BUSY output.

Note 2) This output signal turns ON when power is supplied to the controller, and turns OFF in alarm condition (N.C.).

Note 3) INP is set as a default for OUT0, and INF for OUT1.

Note 4) One output function can be selected respectively for OUT0 and OUT1.

Caution

Use the LATH2-* I/O cable for connecting a PLC to the controller parallel I/O connector.

**There are two types of parallel inputs and outputs for this controller;
NPN type (LATC4-N**) and PNP type (LATC4-P**).**
Please confirm the specification before wiring.

The 24 VDC power supply for the controller (CN1), and the 24 VDC power supply for the parallel I/O (CN5) should be separate.

(6) OUT0, OUT1

The OUT0 and OUT1 output functions can be reconfigured to perform the functions described below in the "I/O Setup" tab of the Controller Setting Software. INP is set as a default for OUT0, and INF for OUT1.

INP signal

The output turns ON when the Card Motor table is within the INP output range of the "Target Position". The output condition varies depending on each operation mode.

- During the Return to Origin operationThe output turns ON when the Return to Origin operation has been completed.
- During positioning operationThe output turns ON when the Card Motor table has reached within the INP output range of the current "Target Position".
- During pushing operationThe output turns ON when the Card Motor table is within the INP output range of the current "Target Position".
If the table exceeds the target position and moves outside the INP output range, the INP signal will turn OFF again.

INF signal

Turns ON when the pushing force exceeds the set "Threshold Force Value" after the Card Motor table has come into contact with the workpiece during pushing operation. The INF signal is disabled in positioning operation both when moving and when held in position.

The "Threshold Force Value" can be set in the "I/O Setup" tab in the Controller Setting Software.

! Caution

The "Threshold Force Value" is set in the "I/O Setup" tab as a general value for all pushing operation Step Data, and the "Thrust Setting Value" can be set individually for each Step Data. Therefore the INF output may be activated also when the pushing force differs from the set "Thrust Setting Value".

INFP signal

Turns ON when the current Card Motor table position has reached within the positioning repeatability range for the connected Card Motor. The output conditions for each operation mode are similar to those for the INP signal.

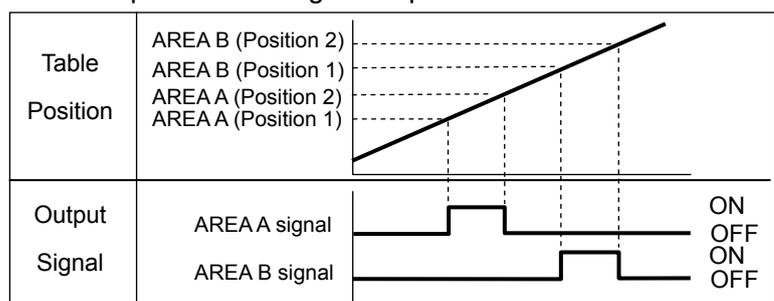
AREA signal

Turns ON when the actuator is within the output range between "Position 1" and "Position 2".

The "Position 1" to "Position 2" range can be set in the "I/O Setup" tab in the Card Motor Controller Setting Software.

A maximum of two position ranges, "AREA A" and "AREA B", can be selected for the AREA output signal, and the "Position 1" to "Position 2" range can be set individually for each of them. It is possible to set only one signal function per output for OUT0 and OUT1.

Example of AREA signal output



3. 3 Actuator cable

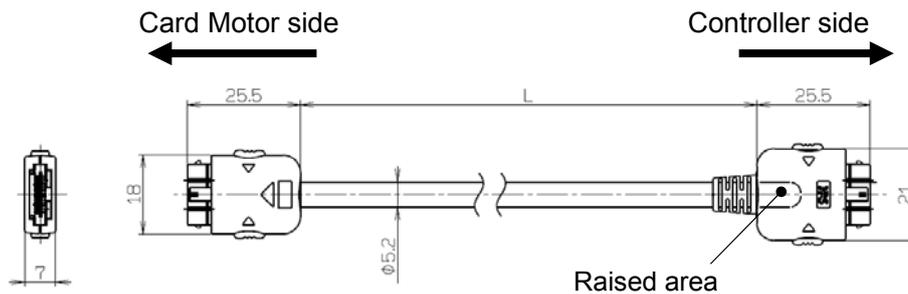
(1) How to Order

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. 4 I/O cable

(1) How to Order

L A T H 2 - 1

● Cable length (L)

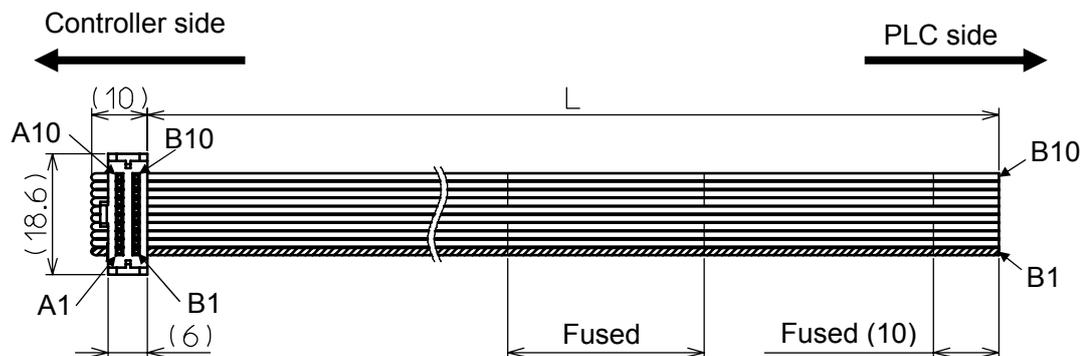
1	1m
3	3m
5	5m

(2) Parallel I/O plug terminal table

Terminal number	Function
A1	COM
A2	IN 0
A3	IN 1
A4	IN 2
A5	IN 3
A6	DRIVE
A7	SVON
A8	NC
A9	NC
A10	NC

Terminal number	Function
B1	DC2 (+)
B2	DC2 (-)
B3	BUSY
B4	ALARM
B5	OUT 0
B6	OUT 1
B7	NC
B8	NC
B9	NC
B10	NC

(3) Dimensions



Number of ways	20
AWG size	28 AWG

3. 5 Counter cable

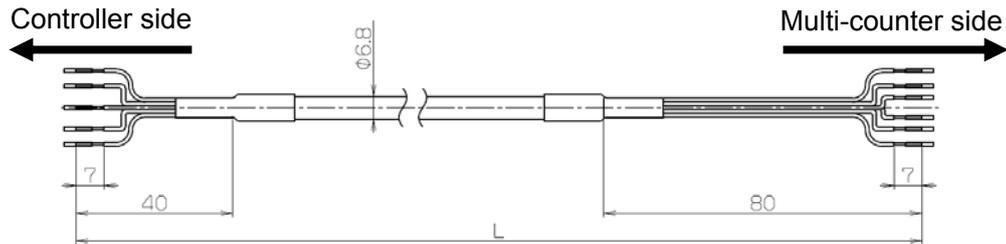
(1) How to Order

L A T H 3 - 1

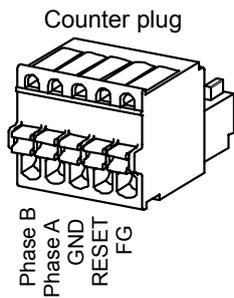
● Cable length (L)

1	1m
3	3m
5	5m

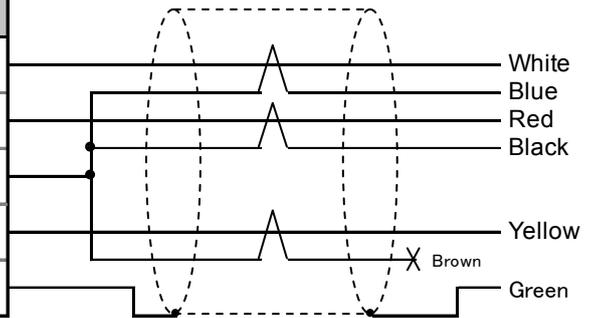
(2) Dimensions



(3) Wiring diagram



Terminal no.	Signal name	Insulation colour
1	PhaseB	White
2	PhaseA	Red
3	GND	Light gray
4	RESET	Yellow
5	FG	Green



3. 6 Controller setting kit

Refer to the LATC4 controller operation manual for details of the controller setting software.

(1) How to order

L A T C - W 1

● Controller setting kit



Controller setting software



Controller setting cable

(2) Contents of kit

- (i) Controller setting software (CD-ROM)
- (ii) Controller setting cable (Communication cable, conversion unit, USB cable)

(3) Hardware and operating system requirements

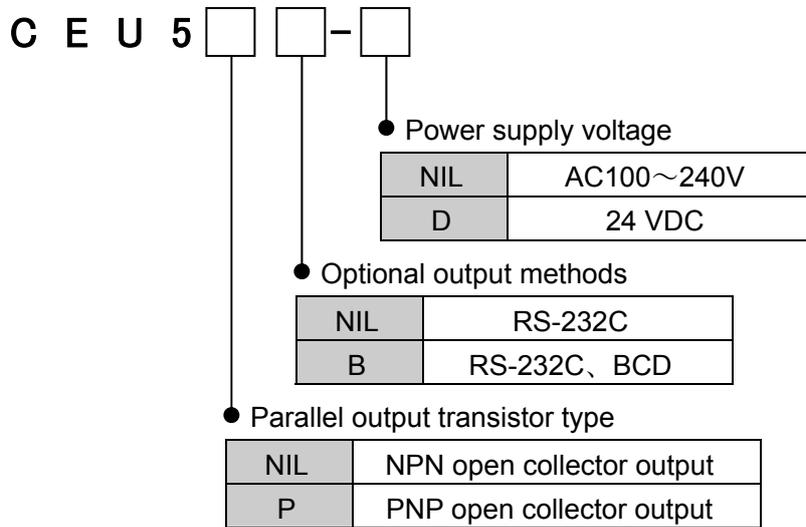
PC with WindowsXP or Windows7 and USB1.1 or USB2.0 port.

* Windows[®], WindowsXP[®], and Windows7[®] are registered trademarks of the United States Microsoft Corporation.

3.7 Multi-counter

Refer to the CEU5 series Multi-counter operation manual for details.

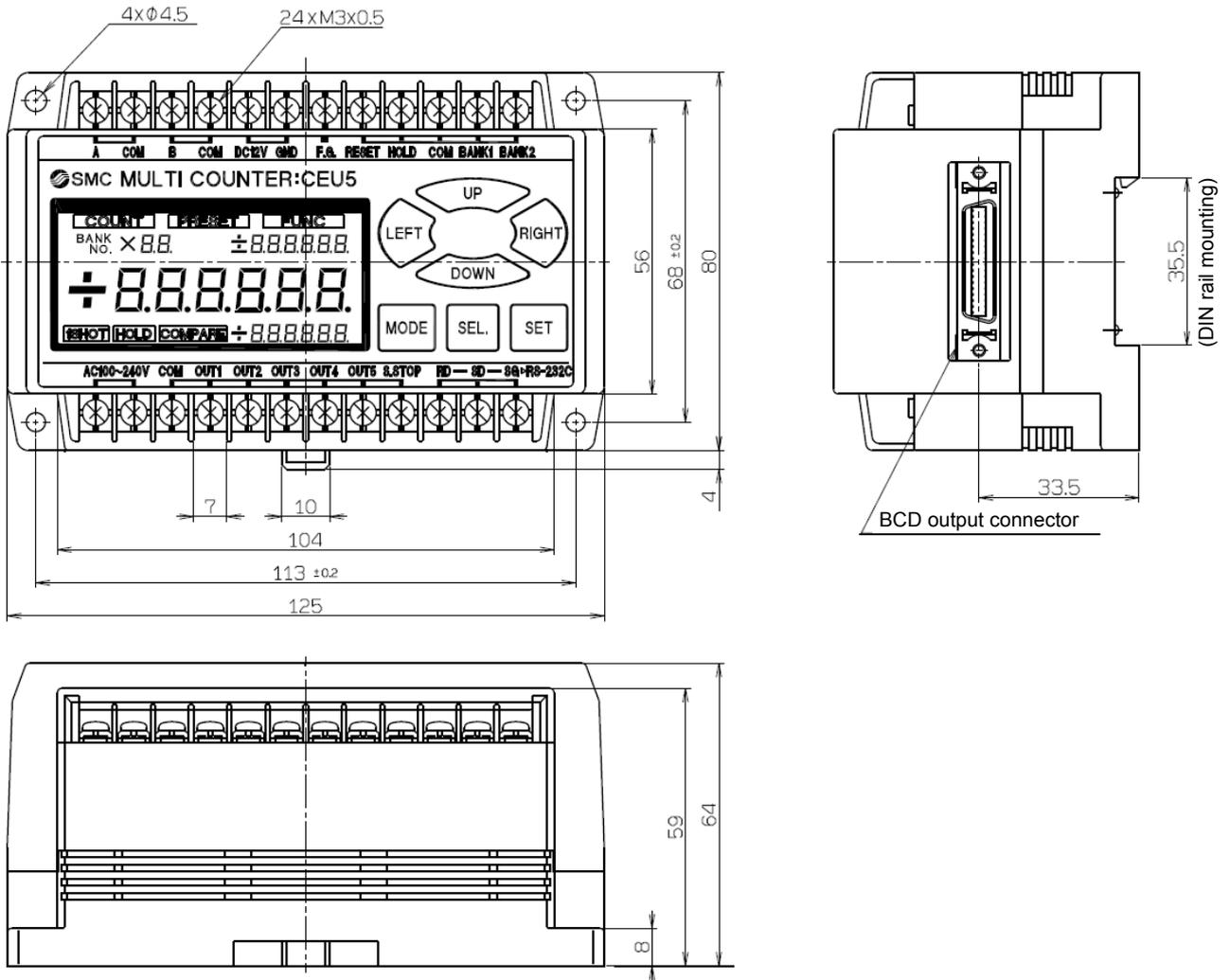
(1) How to Order



(2) Specifications

Model	CEU5***
Mounting method	Surface mounting (Fixed by DIN rail or screws)
Operation modes	Operating mode, Data setting mode, Function setting mode
Display type	LCD with back light
Number of digits	6 digits
Counting speed	100 kHz
Insulation resistance	Between case and AC line: 500 VDC, 50 MΩ or more
Ambient temperature	0 to 50°C (No freezing)
Ambient humidity	35 to 85% RH (No condensation)
Weight	350 g or less

(3) Dimensions



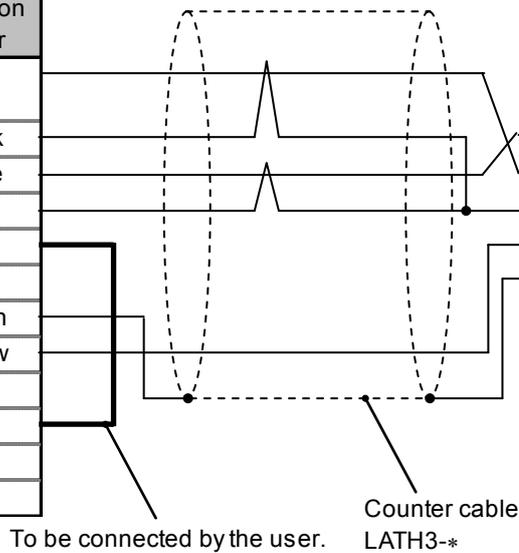
(4) Wiring diagram

Terminal block of the CEU5 Multi-counter

Name	Insulation colour
A	Red
COM	Black
B	White
COM	Blue
DC12V	—
GND	—
F.G.	Green
RESET	Yellow
HOLD	—
COM	—
BANK1	—
BANK2	—

Counter plug for the LATC4 controller

Insulation colour	Name
White	PhaseB
Red	PhaseA
Light gray	GND
Yellow	RESET
Green	F.G.



(5) User instructions

When the LATC4 controller executes Step data No.0 (Return to Origin Position), the controller reset signal will go high after the actuator has completed the [Return to Origin Position] operation. The Multi-counter is reset based on this signal and the position will be set to zero.

When the [Sensor Origin] homing method is selected, the Origin Position of the sensor will be set to zero.

When [Extended End Position] is set as Origin Position, the position at fully extended stroke is set to zero. Therefore use the "OFFSET" function of the Multi-counter to adjust the displayed and output position as required.

When the Origin Position is set to [Retracted End Position] or [Extended End Position], the Origin Position will be approximately 0.3 mm away from their respective table mechanical end stop.

If another position, defined by stopping the table against an external mechanical stop, is used to display the zero position in the Multi-counter, use a PLC, or a similar device capable of outputting the reset signal to the Multi-counter, to reset the Multi-counter after the table has stopped against the external mechanical stop.

Caution

In the CEU5 Multi-counter "Function mode" [FUNC.], set the "Pre-scale" [PRESCL] parameters according to the connected Card Motor as follows.

	LAT3-□	LAT3F-□		
Encoder resolution (μm)	30	5	2.5	1.25 ^{Note 1)}
Connected model	MANUAL			
Multiplier factor	X4	X1	X2	X4
Value per 1 pulse	00.0300	00.0050	00.0025	0.00125
Decimal point position	**,****			*,*****
Input signal type	2PHASE			

Note 1) Since the CEU5 Multi-counter has a 6-digit display, the decimal numbers will not be displayed when the resolution is set to 1.25.

The Multi-counter may lose pulses when a long counter cable is used or the Card Motor is driven at high speed.

Refer to the CEU5 Multi-counter operation manual for setting details.

4. Setting and operation

In order to move the Card Motor to a specific position, it is necessary to set the operation patterns in the LATC4 controller using a PC with the controller setting software installed, or using the teaching box. The sequence of the step data set in the controller is programmed and controlled using a PLC connected to the controller.

Refer to the LATC4 series controller operation manual for details of the step data setting procedure, step data selection using a PLC and operation instructions.

4.1 Step data setting method

There are two methods for setting the step data in the Card Motor controller as described below.

Description	Description
Cycle time entry method (Recommended)	To operate the table based on position and positioning time, or to operate it at high frequency (triangular movement profile). After the required position and positioning time have been set, the speed, acceleration and deceleration are calculated automatically by the controller.
Speed entry method	To operate the table at a constant speed (trapezoidal movement profile). The table moves to the set position based on the set speed, acceleration and deceleration.

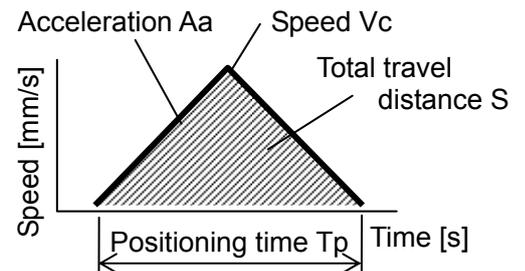
(1) Cycle time entry method

Setting items: , ,

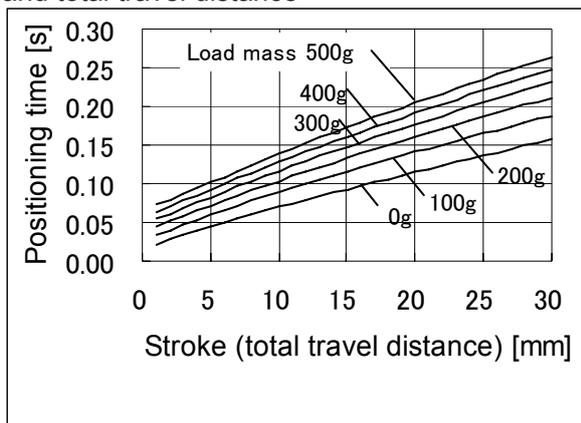
To obtain the total travel distance S [mm] in absolute positioning mode, calculate the difference between the position from where the table travel starts to the target position. The table will move to the Target Position within the set Positioning Time T_p [s] according to a triangular movement profile as shown in the diagram on the right.

In relative positioning mode the travel distance S [mm] is equal to the Target Position.

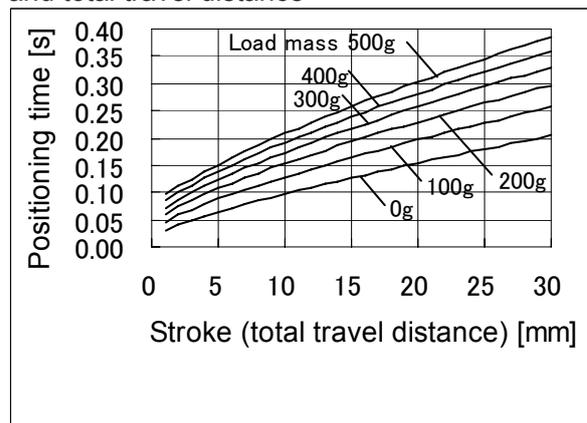
The positioning time (T_p) should be set larger than the minimum positioning time (T_{min}) shown below in relation to the travel distance and to the load weight applied during the operation. If over shoot or vibration occurs, set the positioning time longer.



LAT3-* relationship between positioning time and total travel distance



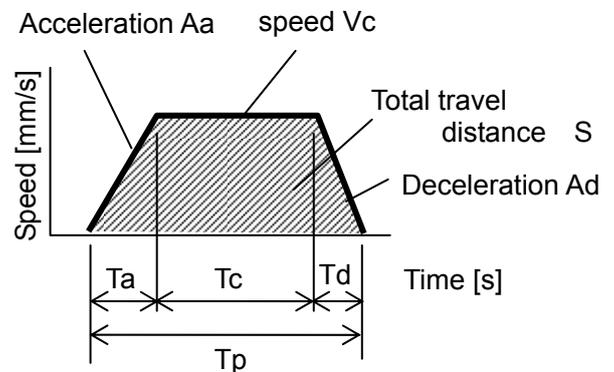
LAT3F-* relationship between positioning time and total travel distance



(2) Speed entry method

Setting items: , , , ,

To obtain the total travel distance S [mm] in absolute positioning mode, calculate the difference between the position from where the table travel starts to the target position. The table will move to the Target Position according to a trapezoidal movement profile as shown in the diagram on the right based on the set speed V_c [mm/s], acceleration A_a [mm/s²] and deceleration A_d [mm/s²].



In relative positioning mode the travel distance S [mm] is equal to the Target Position.

For how to calculate the acceleration/deceleration and constant velocity times and the travel distance, see the equations below:

$$\text{Acceleration time : } T_a = V_c / A_a \text{ [s]}$$

$$\text{Deceleration time : } T_d = V_c / A_d \text{ [s]}$$

$$\text{Acceleration distance : } S_a = 0.5 \times A_a \times T_a^2 \text{ [mm]}$$

$$\text{Deceleration distance : } S_d = 0.5 \times A_d \times T_d^2 \text{ [mm]}$$

$$\text{Travel distance with constant velocity : } S_c = S - S_a - S_d \text{ [mm]}$$

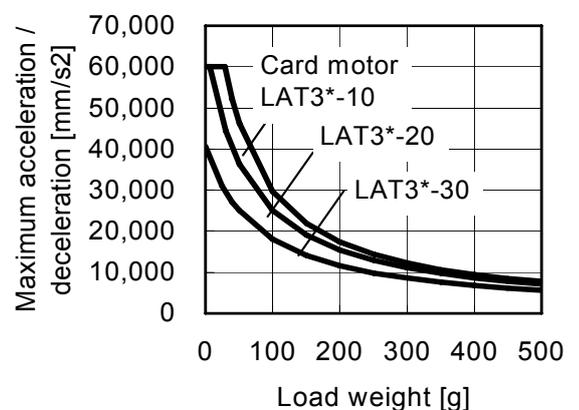
$$\text{Travel time with constant velocity : } T_c = S_c / V_c \text{ [s]}$$

$$\text{Positioning time : } T_p = T_a + T_c + T_d \text{ [s]}$$

Add settling time $T_s^{(*)}$ to the total travel time T_t to get the total positioning time T_p .

(*) The settling time varies depending on the travel distance and load weight. 0.15 seconds can be used as a reference value.

The acceleration and deceleration should be set lower than the maximum acceleration / deceleration in relation to the load weight during operation as shown in the graph on the right.



Caution

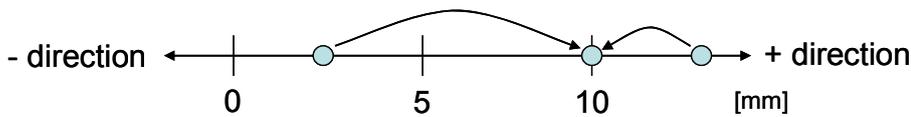
If the acceleration and deceleration is low, the table may not reach the set speed, because the movement profile becomes triangular.

(3) Movement modes (Absolute positioning, Relative positioning)

The target positions can be specified as absolute or relative positions.

Absolute positioning

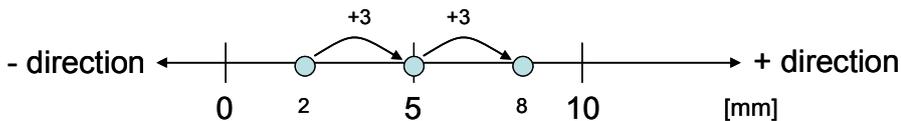
The Target Position is determined based on the "Origin Position" at the retracted end. An example is shown below.



This example shows the Target Position set at 10 mm. The table of the Card Motor moves to 10 mm from any point.

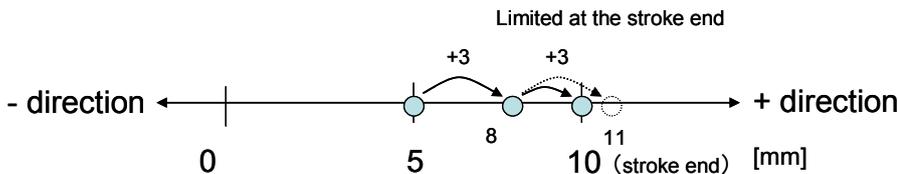
Relative positioning

The Target Position is determined based on the current position. An example is shown below.



This example shows the Target Position set at +3 mm. The table moves +3 mm from the current position.

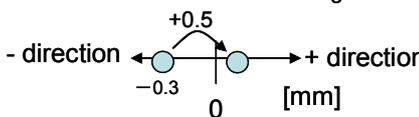
When the destination exceeds the stroke end as shown in the figure below, the table motion will be limited at the end of the stroke, and the INP or INFP signals will not be output. (No alarm will be generated.)



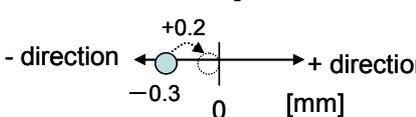
The Card Motor performs relative positioning operations as shown below if the table starts from a position outside of the software stroke range, for example when the table has reached the mechanical end stop in pushing operation or when it has been moved by an external force without the Card Motor being energized.

- If the target position is within the software stroke range:
 - The table moves the set travel distance from the current position.
- If the target position is outside of the software stroke range:
 - In "positioning" operation the table maintains the current position.
 - In "pushing" operation the table performs the pushing operation with the set Thrust Setting Value in the pushing direction from the current position.

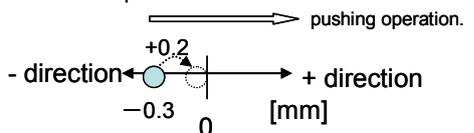
The table moves when the target position is within the available stroke range.



The table stays in the current position when the target position is outside the available stroke range.



If the target position is outside of the software stroke range in pushing operation the Card Motor performs the pushing operation in the extended direction from the current position.



Caution

In relative positioning the deviation will remain. Therefore the table destination may be shifted because of this deviation.

Carefully check the initial position of the Card Motor table before starting relative positioning.

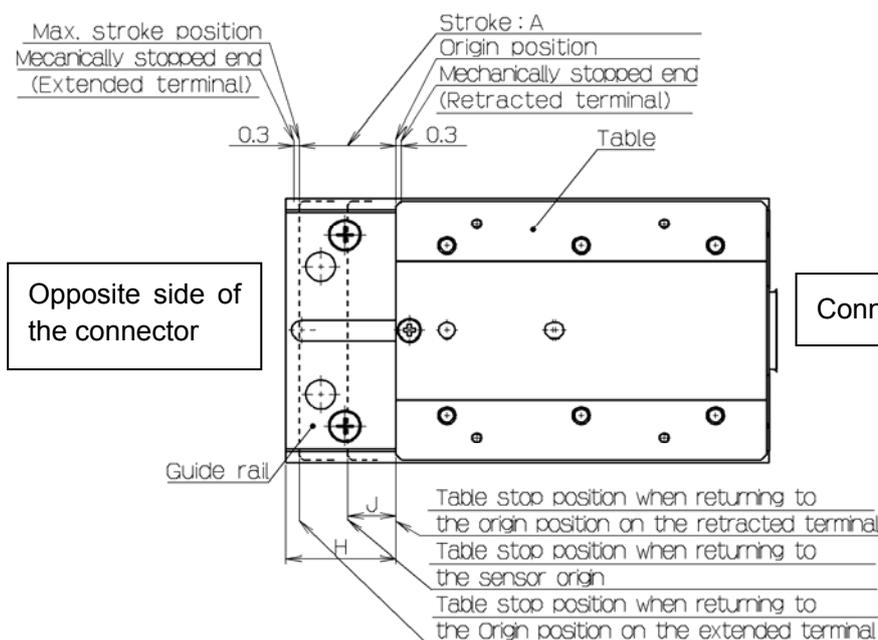
4. 2 Return to Origin position

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.



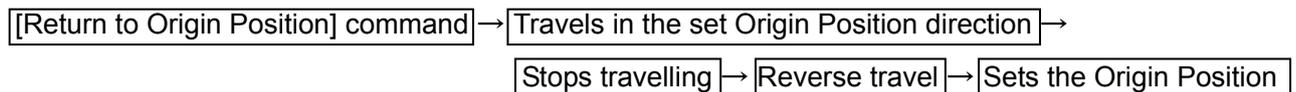
Model	A	H	J ^{Note)}
LAT3□-10	10	10.5	5
LAT3□-20	20	20.5	5
LAT3□-30	30	30.5	15

Note) This applies only to LAT3F-*

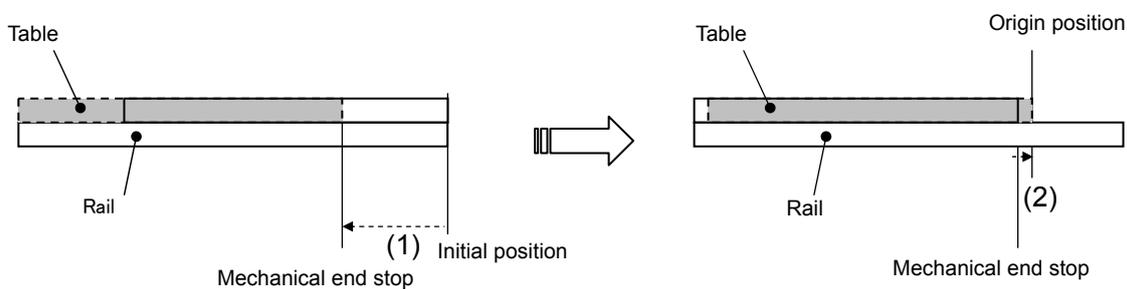
■ Returning to Origin Position movements

When the Card Motor is commanded to return to Origin, the Card Motor starts moving from the position where it was in the direction set in the controller setting software in the [Basic Parameter Setup] page under [Method to Return to Origin]. Refer to "(1)" in the figure below.

The Card Motor moves to the respective stroke end until it is stopped by the mechanical end stop and waits there for a specific time, until the controller has recognized the position as the mechanical end stop. Then, the Card Motor moves in the opposite direction at low speed, stops at a pre-defined distance and sets that position as the Origin Position. Refer to "(2)" in the figure below.



Return to Origin Position reference example



* The controller uses the "Load Mass" value set in "Step Data No. 1" for the "Return to Origin" operation.

Therefore confirm that the "Load Mass" value for "Step Data No. 1" is appropriate for the "Return to Origin" operation.

! Caution

The movement direction of the [Return to Origin Position] operation varies depending on the used [Return to Origin Position] method.

The Origin position varies depending on the used [Return to Origin Position] method.

Set the operation conditions according to the requirements of the actual equipment in your application.

With the LAT3F series it is possible to return to the sensor Origin. The sensor Origin position varies depending on the stroke.

If the return to Origin position is performed using an external jig or workpiece to stop the table, the Origin position may be set outside of the travel range. Do not set the target position of the step data outside of the Card Motor movable range. It may damage the workpieces and the Card Motor.

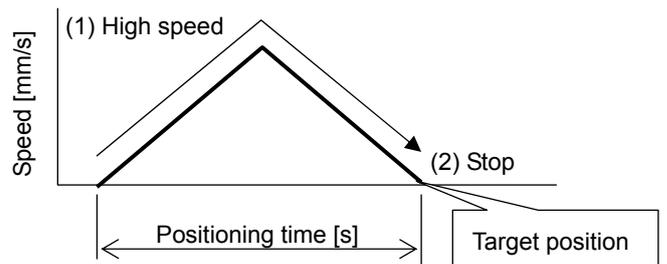
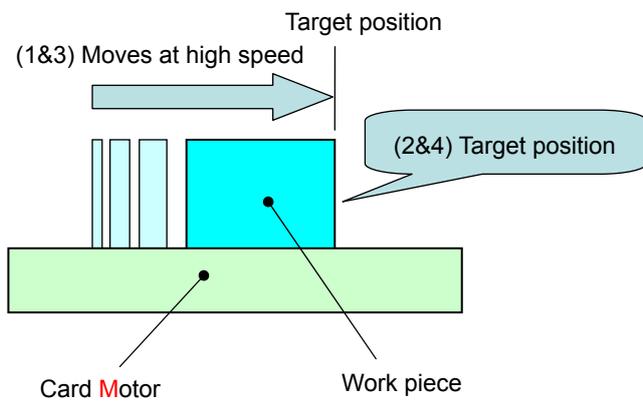
4. 3 Positioning operation

Cycle Time Entry Method

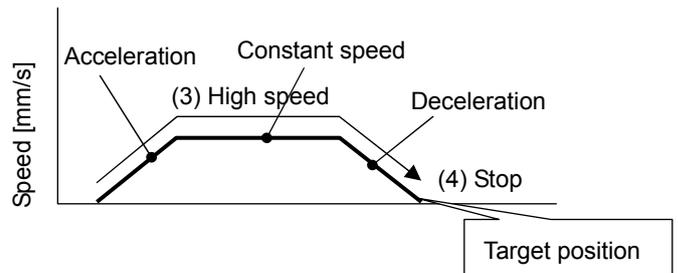
The acceleration and deceleration are automatically calculated by the controller based on the set target position and positioning time. The table moves according to a triangular movement profile (1) and stops at the set target position (2).

Speed Entry Method

The table moves based on the set acceleration, speed and deceleration according to a trapezoidal movement profile (3) and stops at the set target position (4).



Movement profile for the Cycle Time Entry method (triangular).



Movement profile for the Speed Entry Method (trapezoidal).

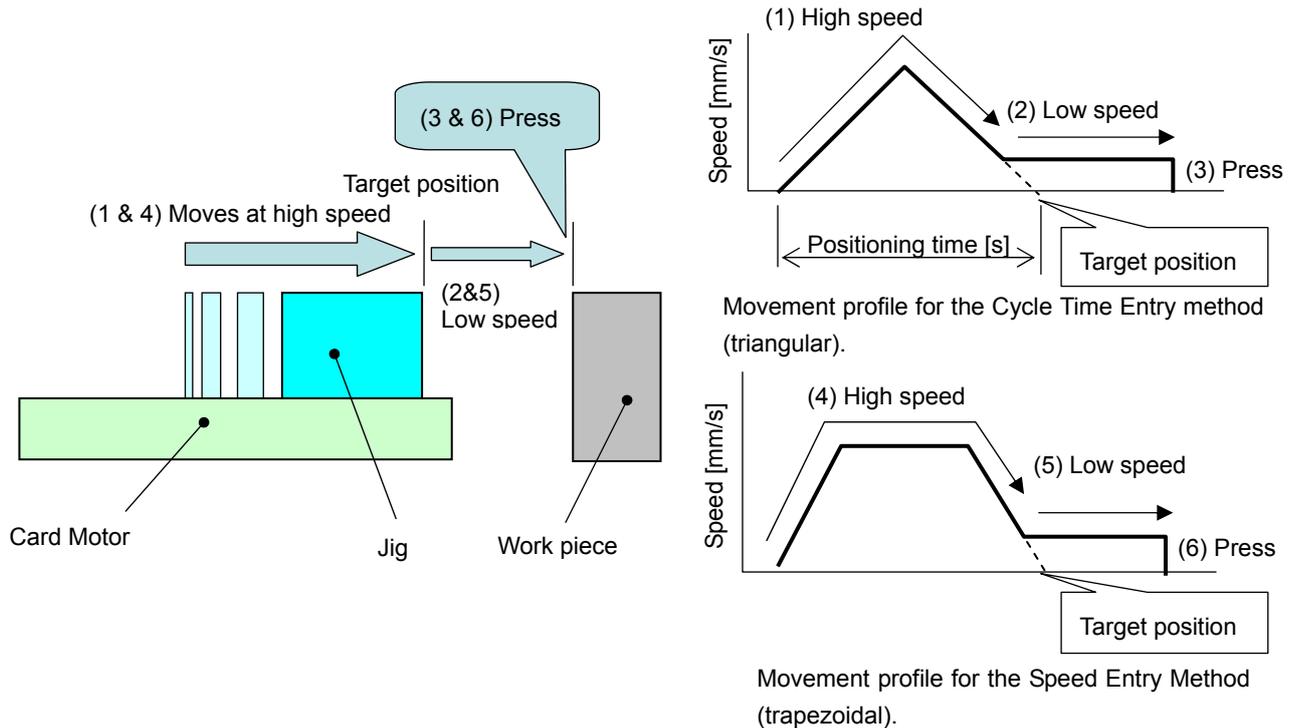
4. 4 Pushing operation

Cycle Time Entry Method

The acceleration and deceleration are automatically calculated by the controller based on the set target position and positioning time. The table accelerates and decelerates according to a triangular movement profile close to the target position (1), thereafter it continues to move at low speed (6 mm/s) until it comes into contact with the work piece (2). After the table has come into contact with the work piece, the Card Motor presses the work piece with the set thrust force (3).

Speed Entry Method

The table moves based on the set acceleration, speed and deceleration according to a trapezoidal movement profile close to the target position (4), thereafter it continues to move at low speed (6 mm/s) until it comes into contact with the work piece (5). After the table has come into contact with the work piece, the Card Motor presses the work piece with the set thrust force (6).



Note) When the table travels at a maximum speed of 6 mm/s or less before it has started pushing (1 & 4), the pushing speed (2 & 5) will be the same as the maximum travelled speed (1 & 4).

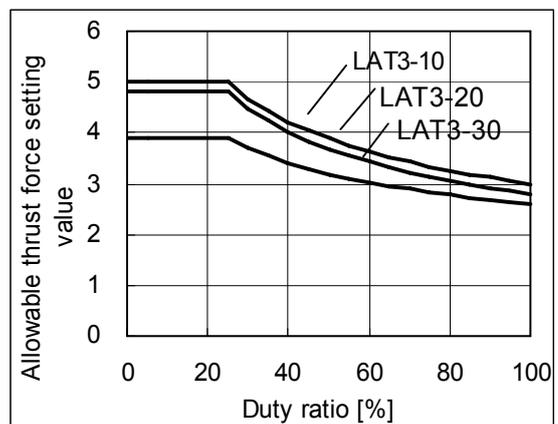
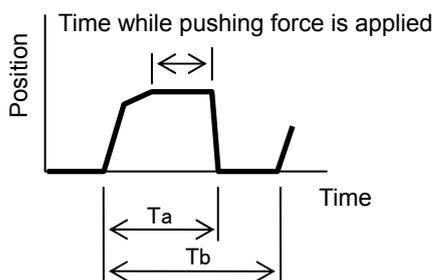
[Allowable thrust force setting value]

The temperature of the Card Motor increases during operation due to heating of the coil. Consider the used duty ratio and set the thrust force setting value in the step data equal to or lower than the allowable thrust force setting value specified in the diagram below.

Duty ratio is calculated according to the equation below.

$$\text{Duty ratio} = T_a / T_b \times 100 [\%]$$

Where, T_a : total travel time + pushing time [s]
 T_b : cycle time [s]



Warning

Consider possible unexpected movements of the Card Motor in the event of an emergency stop, alarm or power failure.

If power is not supplied to the Card Motor 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. If the Card Motor is mounted vertically or at a slant, the table will drop.

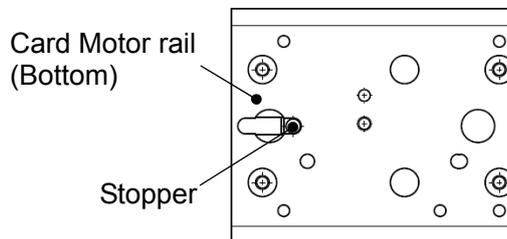
Design the Card Motor application so that people and equipment will not be injured or damaged by the table movement.

Caution

Do not hit the stroke ends with the work piece in operations other than return to Origin position or at speeds higher than the pushing speed during pushing operation.

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.

Install a separate external stopper if the operating conditions require.



For pushing operations, set the target position at least 1 mm away from the position where the table or the pushing tool comes into contact with the work piece.

Otherwise, the table may hit the work piece at a speed exceeding the specified 6 mm/s pushing speed, which could damage the work piece and the Card Motor.

The Card Motor must not overheat.

The temperature rise of the Card Motor depends on the ambient conditions and usage. Take the following countermeasures if the temperature of the Card Motor rises so high that a temperature alarm is generated:

- Reduce the thrust force setting value.
- Reduce the duty ratio by increasing the cycle time.
- Improve the heat transfer properties of the mounting base and the surroundings.

Refer to section "[8. Alarm detection](#)" (P.60) for details.

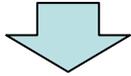
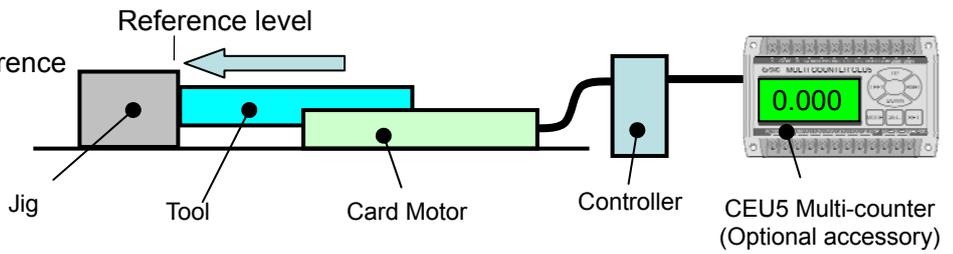
The thrust force generated by the Card Motor varies in relation to the "Thrust Setting Value", depending on the table position, pushing direction and operating environment.

The "Thrust Setting Value" in the step data is a nominal value. Therefore please calibrate the "Thrust Setting Value" according to the application under real conditions.

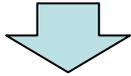
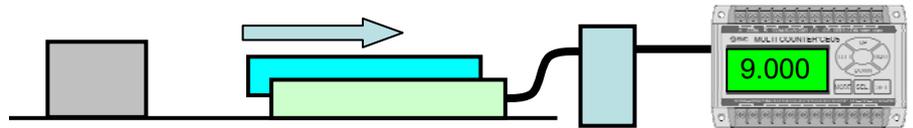
5.5 Measurement

The position sensor (encoder) built into the Card Motor detects the travel distance of the table, and measures the dimensions of the workpiece.

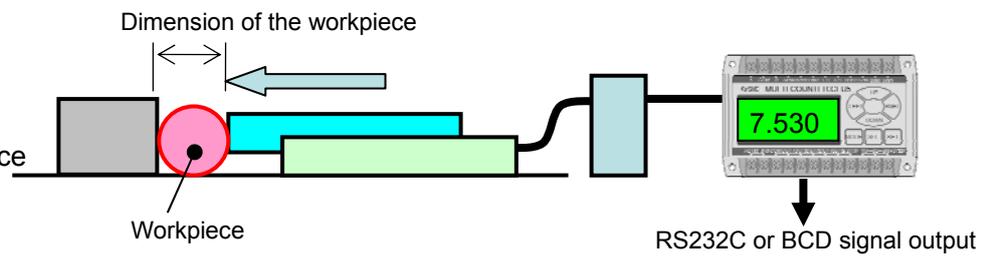
- (1) Push the tool against the reference level, and reset the counter.



- (2) The tool is withdrawn.



- (3) Push the tool against the workpiece to measure the workpiece dimension. (The counter displays and outputs the dimension.)



CEU5 Multi-counter settings

	LAT3-□	LAT3F-□		
Encoder resolution (μm)	30	5	2.5	1.25 ^{Note 1)}
Connected model	MANUAL			
Multiplier factor	X4	X1	X2	X4
Value per 1 pulse	00.0300	00.0050	00.0025	0.00125
Decimal point position	*.****			*.****
Input signal type	2PHASE			

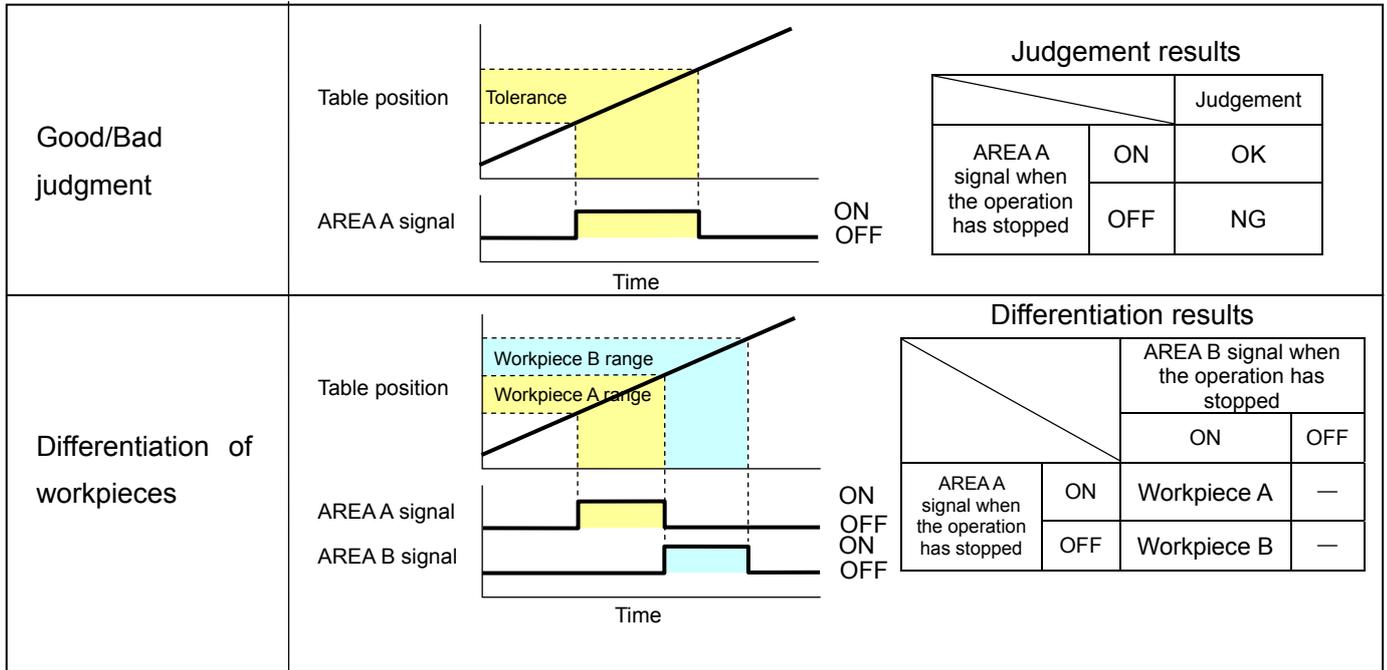
Note 1) Since the CEU5 Multi-counter has a 6-digit display, the decimal numbers will not be displayed when the resolution is set to 1.25.

! Caution

The Multi-counter may lose pulses when a long counter cable is used or the Card Motor travels at high speed.

Good/Bad Judgement and Differentiation of workpieces

The area output ranges preset in the controller are compared with the table position, and the AREA output signals are activated by the controller when the table is within the preset range. Based on these output signals the dimension of the workpiece can be judged to be good or bad, and workpieces of different size can be differentiated.



It is possible to output up to 31 preset positions using the CEU5 Multi-counter.

5. Card Motor[®] / Specific Product Precautions

5. 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 LATC4 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.

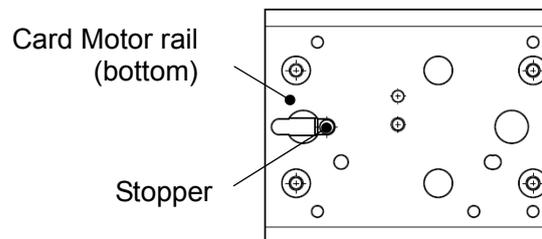
If thrust force setting values outside the allowable limits are used, it may cause overheating of the Card Motor, the work piece or the mounting surface.

(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.

5. 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.

5. 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.

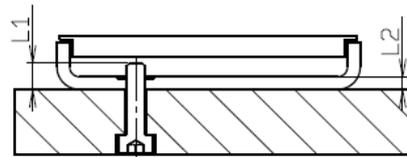
(4) When mounting the Card Motor, use stainless steel screws with appropriate length and tighten with recommended tightening torque.

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.

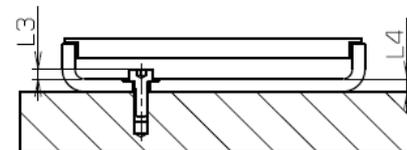
1) Body mounting from the bottom / tapped type

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



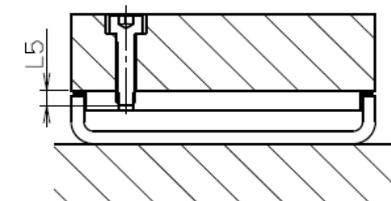
2) Body mounting from above / through hole type

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.

5. 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.

5. 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.

6. Controller and Peripheral Devices / Specific Product Precautions

6. 1 Design / Selection

Warning

- (1) Use the specified voltage.**

If the applied voltage is higher than the specified voltage, malfunction and damage to the controller may result. If the applied voltage is lower than the specified voltage, there is a possibility that the load cannot be moved due to internal voltage drop. Check the operating voltage prior to start. Check also that the operating voltage does not drop below the specified voltage during operation.

If the current is too low, the Card Motor may not be able to generate the maximum force or cause a malfunction.

- (2) Do not use the products outside the specifications.**

Fire, malfunction, or damage to the product can result. Please check the specifications before using it.

- (3) Install an emergency stop circuit.**

Install an emergency stop outside the enclosure in easy reach to the operator so that the operator can stop the system operation immediately and intercept the power supply.

- (4) To prevent danger and damage due to a breakdown or malfunction of this product, which may occur at a certain probability, a backup system should be arranged in advance by using a multiple-layered structure or by making a fail-safe equipment design, etc.**

- (5) If there is a risk of fire or personal injury due to abnormal heat generation, sparking, smoke generated by the product, etc., cut off the power supply from this product and the system immediately.

6. 2 Handling Precautions

Warning

- (1) **Never touch the inside of the controller and its peripheral devices.**
It may cause an electric shock, or it may damage the controller.
- (2) **Do not operate or set up this equipment with wet hands.**
It may cause an electric shock, or it may damage the equipment.
- (3) **Do not use a product that is damaged or missing any components.**
Electric shock, fire, and injury can result.
- (4) **Do not connect the controller to other devices than the Card Motor.**
It may cause damage to the controller or to the other equipment.
- (5) **Be careful not to touch, get caught or hit by the work piece while the actuator is moving.**
It may cause an injury.
- (6) **Do not connect the power supply or power up the product until it is confirmed that the work piece can be moved safely within the area that can be reached by the work piece.**
The movement of the work piece may cause an accident.
- (7) **Do not touch the product when it is energized and for some time after the power has been disconnected, as it is very hot.**
It may cause burns due to the high temperature.
- (8) **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.
- (9) **Static electricity may cause malfunction or damage to the controller. Do not touch the controller while power is supplied to it.**
Take sufficient safety measures to eliminate static electricity when it is necessary to touch the controller for maintenance.

Caution

- (1) **When the Multi-counter is not used, attach the counter plug to the counter connector of the controller.**
If foreign matter such as metal fragments enters the counter connector, short-circuit may occur.
- (2) **Be sure to perform return to Origin position prior to start.**
If the Origin position is not set, the product will not operate even if the step data is performed.
- (3) **The positioning time entered and set in the controller setting software is just a target value. It cannot be guaranteed.**
The operation may not have been completed even if the set positioning time has passed. In such a case, the BUSY and INP digital output signals can be used to detect when the operation has been completed.

(4) Set the “Load Mass” value in the controller setting software according to the approximate weight of jigs or work pieces mounted on the Card Motor.

If the “Load Mass” value in the controller setting software and the weight of the workload are different, the product may vibrate or the positioning accuracy may be reduced.

(5) INP output signal (OUT0)

The INP signal will go high (ON) when the table has reached within the INP output range of the target position both in positioning operation and pushing operation.

In pushing operation, if the table exceeds the target position and moves outside the INP output range, the INP signal will go low (OFF) again.

Output range of the INP signal (OUT0).

Model	Output range (mm)
LAT3F-*	±0.05
LAT3-*	±0.3

6. 3 Installation

Warning

(1) Install the controller and its peripheral devices on fireproof material.

Direct installation on or near flammable material may cause fire.

(2) Do not install these products in a place subject to vibration and impact.

Damage and malfunction can result.

(3) Do not mount the controller and its peripheral devices on the same base together with a large-sized electromagnetic contactor or no-fuse breaker that generate vibration. Mount them on different base plates, or keep the controller and its peripheral devices away from such sources of vibration.

Damage and malfunction can result.

(4) Install the controller and its peripheral devices on a flat surface.

If the mounting surface is not flat or uneven, excessive force may be applied to the housing and other parts resulting in malfunction.

6. 4 Power supply

Warning

(1) Use a power supply with low noise between lines and between power and ground.

In cases where noise is high, use an isolation transformer.

(2) The power supplies for the controller and for the parallel I/O can be separate, and both power supplies must not be of “inrush-current limited” type.

If the power supply is of “inrush-current limited” type, a voltage drop may occur during the acceleration or deceleration of the actuator.

(3) Take appropriate measures to prevent surges from lightning. Ground the surge absorber for lightning separately from the grounding of the controller and its peripheral devices.

(4) Use the UL-certified products listed below as direct current power supplies.

a) Limited voltage current circuit in accordance with UL508.

A circuit which power is supplied by secondary coil of an insulated transformer that meets the following conditions:

- Maximum voltage (No load) : 30 Vrms (42.4 V peak) or less
- Maximum current : 8 A or less (including short circuit)

Limited by circuit protector (such as fuse) with the following ratings

Voltage without load (V peak)	Maximum current rating (A)
0 to 20 [V]	5.0
Over 20 [V] up to 30 [V]	$\frac{100}{\text{Peak voltage}}$

b) Circuit (class 2) with maximum 30 Vrms (42.4 V peak) or less, which uses class 2 power supply unit in accordance with UL1310 or class 2 transformer in accordance with UL1585 as the power supply.

6. 5 Grounding

Warning

(1) Make sure the product is grounded to ensure the noise tolerance of the controller.

Otherwise it may cause malfunction, damage, electric shock or fire.

Do not share the earth with devices or equipment that generate a strong electromagnetic noise.

(2) Use dedicated grounding.

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

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

(4) In the unlikely event that malfunction may be caused by the ground, it may be disconnected.

6. 6 Wiring

Warning

(1) Preparation for wiring

Switch the power supply off before wiring or plugging and unplugging of connectors.

Mount a protective cover over the terminals after the wires have been connected.

(2) Do not route the digital I/O signal and power cables together.

Malfunctions stemming from noise may occur if the digital I/O signal and power cables are routed together.

(3) Confirm proper wiring before switching the power on.

Incorrect wiring will lead to malfunction or may damage the controller or its peripheral devices.

Confirm that there is no mis-wiring before switching the power on.

(4) Reserve enough space for the routing of the cables

If the cables are forced into unreasonable positions, it may damage the cables and connectors, which may lead to misconnection or short-circuit and result in malfunction.

Avoid bending the cables in sharp angles close to the connectors or where they enter the product.

Fix the cable as close as possible to the connectors so that mechanical stress cannot be applied to the connectors.

6. 7 Operating environment

Caution

- (1) 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.**
Damage and malfunction can result.
- (2) Do not use the products in a magnetic field.**
The ambient magnetic field may result in malfunction.
- (3) 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.
- (4) Avoid heat radiation from strong heat sources, such as direct sunlight or a hot furnace.**
It will cause malfunction of or damage to the controller or its peripheral devices.
- (5) Do not use the products in an environment with cyclic temperature changes.**
It will cause damage to the controller or its peripheral devices.
- (6) Do not use the products in an environment where surges are generated.**
Devices that generate a large amount of surge around the product (Ex. solenoid type lifters, high frequency induction furnaces, motors, etc.) may lead to deterioration or damage to the internal circuits of the products. Avoid supplies of surge generation and crossed power and signal lines.
- (7) The Card Motor and the controller are not immune to lightning strikes.**
- (8) Do not install these products in a place subject to vibration and impact.**
It will cause damage or malfunction.
- (9) If this product is used to drive a relay or solenoid, please use a voltage surge absorbing element.**

6. 8 Maintenance

Warning

- (1) Perform maintenance checks periodically.**
Confirm that wiring and screws are not loose. Loose screws or wires may cause unexpected malfunction.
- (2) Conduct an appropriate functional inspection and test after completed maintenance.**
In case of any abnormalities (if the actuator does not move or the equipment does not operate properly, etc.), stop the operation of the system. Otherwise, unexpected malfunction may occur and safety cannot be assured. Conduct a test of the emergency stop to confirm the safety of the equipment.
- (3) Do not disassemble, modify or repair the controller or its peripheral devices.**
- (4) Do not put anything conductive or flammable inside the controller.**
Fire or explosion can result.
- (5) Do not conduct an insulation resistance test or insulation withstanding voltage test.**

Caution

(1) Reserve sufficient space for maintenance.

Design the system so that it allows required space for maintenance.

7. 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.

8. Alarm detection

The cause of the alarms is indicated by a combination of lit and flashing ALM and PWR LEDs. When an alarm has been generated, deactivate the alarm after troubleshooting and after the error has been corrected by referring to section “8.2 Alarms and countermeasures” (P.61).

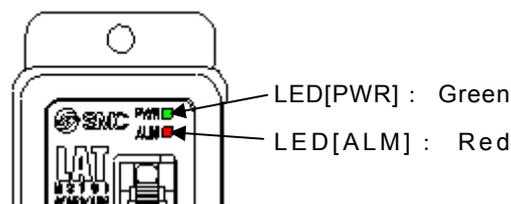
Alarms are divided into two types.

- One can be cleared by resetting (ON-OFF-ON) the SVON input signal.
- The other can only be cleared by switching off the power supply to the controller.

8.1 Alarm LED display

The controller uses LED's to indicate the cause of the alarm when an alarm has been generated.

Name of alarm	LED		
	PWR	ALM	Flashing pattern
Memory error	Flashing	Flashing	Both LED's flashing alternately by 0.5 seconds
Temperature error	Flashing	Flashing	Both LED's flashing simultaneously by 0.5 seconds
Over current error	Flashing	ON	PWR LED flashing by 0.5 seconds
Parameter error	ON	Flashing	ALM LED flashing by 0.5 seconds
Return to Origin Position non-execution error	ON	ON	—



8. 2 Alarms and countermeasures

Alarm name	Recovery method	Content / Countermeasure		
Memory error	Turn the power off and on again.	<p><Content of error> The internal memory fails. Check if the conditions described below occurs. (1) Power supply shut-off during data writing (2) Power interruption of the power supply voltage (3) Noise due to crossing of cables and power lines. <Countermeasure> Turn off the power and then turn it on again.</p>		
Temperature error	Turn the power off and on again or reset using the SVON input.	<p><Content of error> The rated temperature is exceeded due to increase in temperature in the motor. Check if the conditions described below occurs. (1) The product is used in a location where the specified ambient temperature is exceeded. (2) There is a heat generating source around the motor. (3) The product is used with the force exceeding the allowable thrust setting value. <Countermeasure> Review the ambient temperature and check the operation again after supplying power again or turning the SVON input signal OFF temporarily.</p> <table border="1" style="width: 100%;"> <thead> <tr> <th style="text-align: center;"> Caution</th> </tr> </thead> <tbody> <tr> <td> <p>Please refer to the manual or the catalogue of the actuator for the allowable thrust setting value. When the Card Motor is not connected to the controller, temperature error can be generated due to unstable temperature information. Check the Card Motor and controller connection.</p> </td> </tr> </tbody> </table>	 Caution	<p>Please refer to the manual or the catalogue of the actuator for the allowable thrust setting value. When the Card Motor is not connected to the controller, temperature error can be generated due to unstable temperature information. Check the Card Motor and controller connection.</p>
 Caution				
<p>Please refer to the manual or the catalogue of the actuator for the allowable thrust setting value. When the Card Motor is not connected to the controller, temperature error can be generated due to unstable temperature information. Check the Card Motor and controller connection.</p>				
Over current error (Motor overload error) (Over current error)	Turn the power off and on again or reset using the SVON input.	<p><Content of error> This alarm is generated when the Card Motor has been overloaded causing an overcurrent to flow through the Card Motor, and when overcurrent flows through the parallel output terminals. Check if the conditions described below occur. (1) The motor cannot reach the target position during positioning due to obstacles. (2) The connection of the output signal is not correct. <Countermeasure> Check the motor type and rated value. Turn the power off and on again Check the operation again after turning the SVON input signal OFF.</p>		
Parameter error (Origin parameter error) (Step Data parameter error) (Invalid parameter error)	Turn the power off and on again or reset using the SVON input.	<p><Content of error> The basic parameter setup and step data setup settings are not correct. Check if any of the conditions described below occur. (1) Error related to the basic parameter data - [Card Motor product number] has not been selected. (2) Error related to the step data - "Target Position" of the step data is set outside of the stroke range, or the "positioning time", "speed", "acceleration" or "deceleration" is set to 0. - It is not possible to achieve the [Target position] and [Positioning time] using the Cycle Time Entry Method (or "Speed", "Acceleration" or "Deceleration" using the Speed Entry Method) for the next step data from the current table position. <Countermeasure> Check the basic parameter data and step data. Check the operation again after turning off and on the power supply or turning the SVON input signal OFF.</p>		
Return to origin position non-execution error	Turn the power off and on again or reset using the SVON input.	<p><Content of error> The operation is instructed while return to origin position has not been executed yet. <Countermeasure> Perform the return to origin position after turning the SVON input signal OFF.</p>		

9. 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 LATC4 series controller operation manual for details.

9. 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. → 4. External Wiring Diagram (P.17) → 5. CN1: Power supply plug (P.19)
	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. → 7.3 The parallel I/O signal (P.24)
	Incorrect wiring	Check if the wiring is correct. Refer to the operation manual of the controller to check wiring, for broken wires and short-circuits.	Correct wiring and check if the input/output of each signal is correct. Separate the power supply for the CN1 controller power supply and the CN5 I/O signal power supply. → 4. External connection (P.17) → 7.4 Parallel I/O connector wiring (Example) (P.28)
	Alarm generated	Controller alarm is generated? Refer to the operation manual of the controller. Check the type of alarm.	Refer to the operation manual of the controller and take appropriate measures. → 14. Alarm Detection (P.66)
	Unsuitable specification	Check that the Basic Parameter Setup settings in the controller (product number and mounting orientation of the Card Motor) correspond to the product number and mounting orientation of the Card Motor that is connected to the controller.	Set the product number and mounting orientation of the connected Card Motor to the controller. → 12.2 Basic Parameter Setup window (P.51)
	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 Setting Software, or terminate the setting software. → 11.1 Overview of the operation instructions (P.46) → 12.4 Monitor/Test window (P.57)
	Signal timing	The parallel I/O signals have been activated after the power supply has been turned on and before the ALARM output has turned ON. The DRIVE signal is turned OFF during operation (except when the Card Motor is performing a pushing operation).	Activate the parallel I/O signals first after that the ALARM signal has been activated after the power supply has been turned on. If the DRIVE signal is turned OFF during operation, the table of the Card Motor stops on the spot, and holds the position. If it is required to complete the operation, do not turn OFF the DRIVE signal until the operation has been completed. → 11.2 Parallel I/O operation procedures (P.46) → 7.3 Parallel I/O signal (P.24)

Operation stops intermittently	Alarm generated	Controller alarm is generated? Refer to the operation manual of the controller. Check the type of alarm.	Refer to the operation manual of the controller and take appropriate measures. → 14. Alarm Detection (P.66)
	Incorrect wiring	Check if the wiring is correct. Refer to the operation manual of the controller to reconfirm wiring, broken wires and short-circuits.	Correct wiring and check if the input / output of each signal are correct. Separate the power supply for the CN1 controller power supply and the CN5 I/O signal power supply. → 4. External connection (P.17) → 7.4 Parallel I/O connector wiring (Example) (P.28)
	Noise	Ground properly. Avoid bundling the cables.	Refer to the operation manual of the controller and take appropriate measures. → 3.4 Mounting (P.15)
	Parameter wrong input	Check if parameter values are correct. Reconfirm if appropriate controller is used for the actuator.	Modify the parameters to appropriate ones and test the operation. → 8. Setting Data Entry (P.29)
	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. → 3. Product Specifications (P.12)
	Unsuitable specification	Check that the Basic Parameter Setup settings in the controller (product number and mounting orientation of the Card Motor) correspond to the product number and mounting orientation of the Card Motor that is connected to the controller.	Set the product number and mounting orientation of the connected Card Motor to the controller. → 12.2 Basic Parameter Setup window (P.51)
	Signal timing	Check the timing of the signal from the PLC to the controller.	PLC processing delay and controller scan delay are generated. Please ensure an interval of 2msec or more between input signals, and maintain the signal state. → 9.5 Controller input signal response time (P.41)
	Setting error	The "Operating Time" in the "Continuous Operation (Test of the continuous operation)" menu in the Controller Setting Software is set to be too short.	Modify the "Operating Time" settings. → 12.4 Monitor/Test window (P.57)
The Card Motor vibrates.	Unsuitable specification	Check that the Basic Parameter Setup settings in the controller (product number and mounting orientation of the Card Motor) correspond to the product number and mounting orientation of the Card Motor that is connected to the controller.	Set the product number and mounting orientation of the connected Card Motor to the controller. → 12.2 Basic Parameter Setup window (P.51)
	Inappropriate parameter input	Check that the parameter values are appropriate and that the program is correct. Check and confirm that the target position, positioning time and load mass values are correct.	Amend the parameters by modifying the Step Data settings. Set the "Load Mass" value as close as possible to the weight of the workpiece mounted on the Card Motor. If the Card Motor still vibrates reduce the "Load Mass" value. After the possible causes are eliminated switch off the power supply once and switch it on again. Modify the parameters to the appropriate ones and test the operation. → 8.2 Step Data Setup setting method and movement profiles (P.30) → 8.3 Step Data setup (P.33)
	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 LAT3 Card Motor Operation Manual for details of tightening torques and how to fix them.

Communication with the controller cannot be established. (LATC-W1)	The USB driver is not installed	Check that the USB driver for the conversion unit is installed.	<p>If the USB driver has not been installed, the installation of the USB driver starts automatically when the conversion unit is connected to the PC.</p> <p>For details of the installation procedure refer to the "LATC-W1 Controller Setting Software Installation Manual".</p> <p>The USB driver needs to be installed individually for every COM port.</p> <p>If the installation does not start when the conversion unit is connected to the PC, the USB driver may have already been installed. A specific COM port number is assigned to each COM port the conversion unit is connected to. Check that the COM port number match with the COM port the conversion unit connected to.</p> <p>The COM port number can be checked using the Device Manager of the PC. For details of the COM port checking method refer to the "LATC-W1 Controller Setting Software Installation Manual".</p>
	Incorrect COM port setting	Check that the correct COM port is set to the Controller Setting Software.	<p>The COM port allocated to the conversion unit is different for different PC's. Check and confirm the COM port number with the conversion unit connected to the PC. The COM port number can be checked using the Device Manager in the PC. For details of the COM port checking and setting methods refer to the "LATC-W1 Controller Setting Software Installation Manual".</p>
	Connection failure	Confirm the connection status.	<p>Confirm that the LATC4 controller communication cable, conversion unit, USB cable, and PC are connected correctly. For example, communication cannot be established if the connector has been damaged.</p> <p>Check that the power supply to the controller (LATC4) has been turned on. Communication cannot be established if the power supply is off.</p> <p>If any external equipment (PLC and measurement hardware), except the LATC4 controller, are connected to the PC, disconnect them. (There is a possibility that the other equipment connected to the PC interfere with the communication.)</p>
	The CPU of the PC is busy or overloaded	Confirm that no other applications except the Card Motor Controller Setting Software are running simultaneously, and that the CPU of the computer is not overloaded.	<p>Terminate all other applications except the Card Motor Controller Setting Software.</p>

*The page numbers shown in the brackets in the countermeasures refer to page numbers in the LATC4 series controller operation manual.

9. 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.).
	Inappropriate parameter input	Check if the values for the parameter are appropriate and the program is correct. Reconfirm the target position, positioning time and load mass.	Modify the parameters to appropriate ones and test the operation. → 8. Setting Data input (P.29)
	Unsuitable specification	Check that the Basic Parameter Setup settings in the controller (product number and mounting orientation of the Card Motor) correspond to the product number and mounting orientation of the Card Motor that is connected to the controller.	Set the product number and mounting orientation of the Card Motor to the controller. → 12.2 Basic Parameter Setup window (P.51)
	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.
	Signal timing	The Card Motor has been commanded to execute a new relative step data whilst the table of the Card Motor was still moving. A relative positioning has been performed from a position with remained deviation.	In relative positioning the table moves the set travel distance from the current table position. Therefore ensure that the initial table starting position is where the table is supposed to be before starting relative positioning. → 8.2 Step Data Setup setting method and movement profiles (P.32)
Doesn't move to the correct position	Incorrect wiring	Check if the wiring is correct. Refer to the operation manual of the controller to check wiring, broken wires and short-circuits.	Correct wiring and check if the input/output of each signal is correct. Separate the power supply for the CN1 controller power supply and the CN5 I/O signal power supply. → 4. External connection (P.17) → 7.4 Parallel I/O connector wiring (Example) (P.28)
	Unsuitable specification	Check that the Basic Parameter Setup settings in the controller (product number and mounting orientation of the Card Motor) correspond to the product number and mounting orientation of the Card Motor that is connected to the controller.	Set the product number and mounting orientation of the Card Motor to the controller. → 12.2 Basic Parameter Setup window (P.51)
	Signal timing	Check the timing of the signals from the PLC to the controller. The DRIVE signal is turned OFF whilst a step data is being executed.	PLC processing and controller scan delay times are generated. Ensure an interval of 2 msec or more between input signals, and maintain the signal state for at least 2 msec. When the DRIVE signal is turned OFF, the table of the Card Motor stops on the spot, and holds the position. If it is required that the operation is completed, do not turn OFF the DRIVE signal until the operation has been completed. → 9.5 Response time for the controller input signals (P.41) → 7.3 Parallel I/O signals (P.24)

Doesn't move to the correct position	Data writing failure	Check whether data (step data, parameter) is written correctly. Do not turn off the controller input power or remove the cable while data is being written.	Turn the power OFF and ON again. Re- input correct data (step data, parameter) again and confirm operation. → 3.2 Parts description (P.13) → 8. Setting Data Entry (P.29)
Speed does not reach the desired speed.	Inappropriate parameters	Check if parameter values are correct. Reconfirm the target position, positioning time and load mass.	Modify the parameters to appropriate ones and test the operation. → 8. Setting Data Entry (P.29)
	Operation pattern is not suitable.	Check that appropriate positioning time and load mass is entered based on the current and target position.	Shorten the positioning time or increase the load mass. → 8. Setting Data Entry (P.29)
	Unsuitable specification	Check that the Basic Parameter Setup settings in the controller (product number and mounting orientation of the Card Motor) correspond to the product number and mounting orientation of the Card Motor that is connected to the controller.	Set the product number and mounting orientation of the Card Motor to the controller. → 12.2 Basic Parameter Setup window (P.51)
	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. → 3. Product Specifications (P.12)
Pushing thrust does not reach the thrust setting value.	Inappropriate parameters	Check that the parameter values are set correctly for a pushing operation Step Data.	Set the maximum speed to be 1 mm/s or more for pushing operation. Modify all other parameters to appropriate ones and test the operation. → 8. Setting Data Entry (P.29) → 9.3 Pushing operation (page 39)
	Unsuitable specification	Check that the Basic Parameter Setup settings in the controller (product number and mounting orientation of the Card Motor) correspond to the product number and mounting orientation of the Card Motor that is connected to the controller.	Set the product number and mounting orientation of the Card Motor to the controller. → 12.2 Basic Parameter Setup window (P.51)
	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. → 3. Product Specifications (P.12)

* The page numbers shown in the brackets in the countermeasures refer to page numbers in the LATC4 series controller operation manual.

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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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