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Operation Manual

Card Motor Controller
(Pulse input edition)

LATCA　Series

SMC Corporation

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<u>About this operation manual</u>

This operation manual summarizes how to operate the Card Motor controller (LATCA-∗, Ver2.5) and controller setting software (Ver 2.2) when it is used in pulse input mode.

Refer to operation manual [Card Motor controller (step data input edition)] when it is used in step data input mode, and refer to operation manual [Card Motor controller (serial communication edition)] or [Card Motor controller (MODBUS communication edition)] when serial communication is used.

Configuration Software

Use a setting software corresponding to the version of the controller.

The setting software can be downloaded from the SMC website.

https://www.smcworld.com/products/pickup/en-jp/electric_actuator/download.html

Correspondence table for controller version and configuration software version

Use the latest version of configuration software corresponding to the version of the controller.

Setting software version	Major changes	Controller version (the time in the bracket indicates the schedule for switching)		
		Ver 2.0 (August 2014)	Ver2.1 to Ver2.4 (Sept. 2015)	Ver2.5 (June 2020)
Ver 2.0	First edition	✓Note1) Note2)	✓Note1) Note2)	—
Ver 2.1	50mm stroke is Added	—	✓Note2)	—
Ver 2.2 (Recommended)	Communication setting, error log display	—	✓Note2)	✓

✓ :　Connectable

✓Note1) : LAT3M and 50 mm stroke are not available

　　　LAT3M-∗ and LAT3∗-50 cannot be set when the card motor type is selected.

✓Note2) : Error log display and communication speed setting are not available.

　　　Error log display and communication speed setting cannot be used.

— :　Not connectable

　　　If the setting software is started "Unsupported controller is connected." will be displayed.

∗When the controller version must be checked, refer to section <u>14.7 Confirmation of the Version and Initialization (P74)</u>.

∗New features in the new version of the configuration software are not available in the previous versions.

Contents

SMC

SMC

SMC

SMC

LATCA Series Controller
1. Safety Instructions

These safety instructions are intended to prevent hazardous situations and/or equipment damage.
These instructions indicate the level of potential hazard with the labels of "Caution," "Warning" or "Danger."
They are all important notes for safety and must be followed in addition to International Standards (ISO/IEC)[*1], and other safety regulations.

*1) ISO 4414: Pneumatic fluid power -- General rules relating to systems.
　　ISO 4413: Hydraulic fluid power -- General rules relating to systems.
　　IEC 60204-1: Safety of machinery -- Electrical equipment of machines .(Part 1: General requirements)
　　ISO 10218-1992: Manipulating industrial robots -Safety.
　　etc.

⚠ **Caution**	**Caution** indicates a hazard with a low level of risk which, if not avoided, could result in minor or moderate injury.
⚠ **Warning**	**Warning** indicates a hazard with a medium level of risk which, if not avoided, could result in death or serious injury.
⚠ **Danger**	**Danger** indicates a hazard with a high level of risk which, if not avoided, will result in death or serious injury.

⚠ Warning

1. **The compatibility of the product is the responsibility of the person who designs the equipment or decides its specifications.**
   Since the product specified here is used under various operating conditions, its compatibility with specific equipment must be decided by the person who designs the equipment or decides its specifications based on necessary analysis and test results.
   The expected performance and safety assurance of the equipment will be the responsibility of the person who has determined its compatibility with the product.
   This person should also continuously review all specifications of the product referring to its latest catalog information, with a view to giving due consideration to any possibility of equipment failure when configuring the equipment.

2. **Only personnel with appropriate training should operate machinery and equipment.**
   The product specified here may become unsafe if handled incorrectly.
   The assembly, operation and maintenance of machines or equipment including our products must be performed by an operator who is appropriately trained and experienced.

3. **Do not service or attempt to remove product and machinery/equipment until safety is confirmed.**
   1. The inspection and maintenance of machinery/equipment should only be performed after measures to prevent falling or runaway of the driven objects have been confirmed.
   2. When the product is to be removed, confirm that the safety measures as mentioned above are implemented and the power from any appropriate source is cut, and read and understand the specific product precautions of all relevant products carefully.
   3. Before machinery/equipment is restarted, take measures to prevent unexpected operation and malfunction.

4. **Contact SMC beforehand and take special consideration of safety measures if the product is to be used in any of the following conditions.**
   1. Conditions and environments outside of the given specifications, or use outdoors or in a place exposed to direct sunlight.
   2. Installation on equipment in conjunction with atomic energy, railways, air navigation, space, shipping, vehicles, military, medical treatment, combustion and recreation, or equipment in contact with food and beverages, emergency stop circuits, clutch and brake circuits in press applications, safety equipment or other applications unsuitable for the standard specifications described in the product catalog.
   3. An application which could have negative effects on people, property, or animals requiring special safety analysis.
   4. Use in an interlock circuit, which requires the provision of double interlock for possible failure by using a mechanical protective function, and periodical checks to confirm proper operation.

SMC

⚠ LATCA Series Controller
1. Safety Instructions

⚠ **Caution**

The product is provided for use in manufacturing industries.
    The product herein described is basically provided for peaceful use in manufacturing industries.
    If considering using the product in other industries, consult SMC beforehand and exchange specifications
    or a contract if necessary.
    If anything is unclear, contact your nearest sales branch.

Limited warranty and Disclaimer/Compliance Requirements

The product used is subject to the following "Limited warranty and Disclaimer" and "Compliance Requirements".
Read and accept them before using the product.

Limited warranty and Disclaimer

1. The warranty period of the product is 1 year in service or 1.5 years after the product is delivered, whichever is first.*2)
    Also, the product may have specified durability, running distance or replacement parts. Please consult your nearest sales branch.
 	
2. For any failure or damage reported within the warranty period which is clearly our responsibility, a replacement product or necessary parts will be provided.
    This limited warranty applies only to our product independently, and not to any other damage incurred due to the failure of the product.
 	
3. Prior to using SMC products, please read and understand the warranty terms and disclaimers noted in the specified catalog for the particular products.
 	
    *2) Vacuum pads are excluded from this 1 year warranty.
        A vacuum pad is a consumable part, so it is warranted for a year after it is delivered.
        Also, even within the warranty period, the wear of a product due to the use of the vacuum pad or failure due to the deterioration of rubber material are not covered by the limited warranty.

Compliance Requirements

1.   The use of SMC products with production equipment for the manufacture of weapons of mass destruction (WMD) or any other weapon is strictly prohibited. 2.   The exports of SMC products or technology from one country to another are governed by the relevant security laws and regulations 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.

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

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2 Product Overview

2.1 Features

This controller actuates a connected Card Motor based on parallel I/O signals or pulse train signals from a PLC or similar control device. In addition, the controller outputs signals such as the Card Motor table position and operation complete back to the PLC. Detailed features and functions of this product are listed below.

[Common functions]

    (1)   Selection of control signal type

        The following control signal types can be selected. The dedicated "LATC Configurator" software is adapted to each control signal type.

        i.   Step data input type
        The required Card Motor positions and operation patterns are initially set and stored as "Step Data" in the controller using the configuration software. The controller drives the Card Motor table based on the Step Data. Each Step Data is instigated by parallel input signals determined based on the Step Data number.

        ii.   Pulse input type
        The controller drives the Card Motor controlled by pulse train signals from a PLC or similar control device.

    (2)   Applicable to all Card Motor models

        This controller can be used with all Card Motor models regardless of the encoder resolution or stroke. The parameters of the selected Card Motor are automatically stored in the controller by selecting the appropriate Card Motor model to be connected using the dedicated "LATC Configurator" software.

    (3)   Encoder signal output

        The linear encoder signal, which detects the Card Motor table position, can be output to an external signal reading device. Thus, the table position can be displayed and monitored in real time using an external device.

    (4)   Workpiece measurement and evaluation using the AREA output function

        The size of a workpiece can be measured by driving the Card Motor table using a pushing operation against the workpiece, and the position where the table stopped can be output and displayed.
        Workpiece identification and evaluation of a good and bad workpiece is possible using the AREA parallel output signals. The AREA output signal range corresponds to table positions, which can be preset.

    (5)   Parallel I/O connection and signal status function

        The status of the parallel input signals can be checked and the parallel output signals can be manually switched via a PC using the dedicated "LATC Configurator" software. Correct wiring and the function of I/O signals between this controller and a master control device, such as a PLC, can be verified.

    (6) Test operation using a computer

        At the time of starting, the card motor can be driven using a personal computer with the configuration software installed as follows, without using an upper level device such as a PLC.
        i. Jogging and inching a set distance
        ii. Operation of step data
        iii. Continuous operation of step data.

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(7)   Monitoring the card motor condition with a PC.

When the product is powered, based on the parallel I/O signal and pulse train signal input from PLC, etc., the following operation status of the operating card motor can be checked.

i. Current table position

ii. Parallel I/O signal input/ output status.

iii. Alarm status, etc.

[Step data input type]

The following functions can be used in Step Data Input type.

(8)   Easy configuring of Step Data using Cycle Time Entry Method.

The positioning and pushing operation can be selected. After the target position, positioning time and pushing force have been set, the positioning and pushing operation can be performed.

(9)   15 Step Data patternscan be configured.

The Card Motor is operated according to the Step Data in the order specified by the parallel I/O signals.

(10)   Automatic Return to Origin sequence

The actuator can be returned to the Origin position by sending a single signal to a specified terminal.

(11)   Operation with a specified force (Pushing operation)

The pushing force of the Card Motor can be controlled.

[Pulse Input type]

The following functions can be used in Pulse Input mode.

(12)   Operation by pulse input signals

The table actuates according to the number of pulses, and the speed of movement is proportional to the pulse frequency.

(13)   Operation by 3 types of pulse train signals

The controller can be configured to work with the following pulse input signal types by switching the DIP switches integrated into the controller.

ⅰ. Open collector input (pulse signal power supply voltage 24V)

ii. Open collector input (pulse signal power supply voltage 5V)

iii. Differential input (equivalent to line driver 26C31)

(14)   Operation by 3 types of pulse train signals

The following pulse train signal control methods can be selected using the dedicated "LATC Configurator" software.

i. Pulse and Direction input

ii. CW and CCW input

iii. Quadrature input

(15)   Automatic Return to Origin sequence

The actuator can be returned to the Origin position by sending a single signal to a specified terminal.

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(16) Operation with a specified force (Pushing operation)
       The pushing force of the Card Motor can be controlled.
       By switching the TL input on via the parallel I/O, the actuator moves at 6 mm/s and pushes
       the workpiece with the force stored in the Step Data.

(17) Operation by 4 configurable (PID) control parameter （step data） patterns.
       Four different control parameter patterns can be configured to suit the Load Mass and Thrust
       Setting values. The actuator performance can be configured by tuning these control parameters
       according to the specific work load. The Card Motor can perform a pushing operation by
       selecting one of 4 modes of pushing force.

[Serial communication]
The following functions are available via the RS485 serial interface.
   (18) The controller can be used with the following communication protocols (automatic
        recognition).
      i. Modbus RTU
     ii. Modbus ASCII
     iii. LATC original protocol

(19) Multiple controllers can be accessed and controlled via one interface.
       A master PLC can communicate with up to 16 devices via the RS485 serial interface.

(20) Configuration of Step Data
       The Step Data values can be configured.
       (The Step Data values can only be configured when the Card Motor power supply is OFF for
        safety reasons.)

(21) Step Data operation
       The actuator can be commanded to operate according to Step Data stored in the controller.

(22) Direct operation
       The actuator can be commanded to operate by setting the target position and positioning
       time (or target position, speed and acceleration).
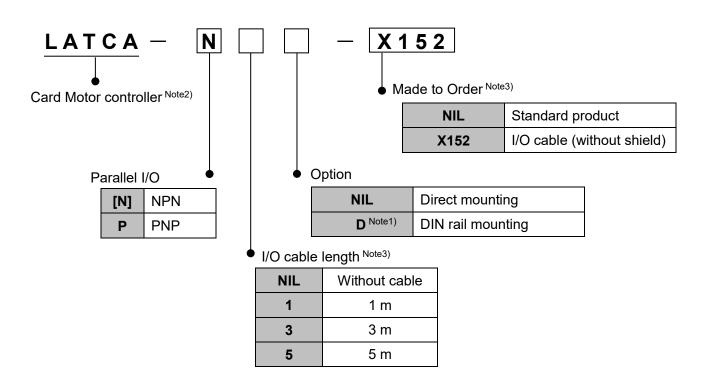
(23) Output of the table position
       The table position can be output and read externally.

(24) Switching and monitoring of parallel I/O signals
       The parallel I/O signals can be switched and the output signals monitored.

⚠ **Caution**
When the device is set up or when failure occurs, refer to the operation manual of the actuator as well as to this operation manual.
∗Keep this operation manual accessible for reference when necessary.

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How to order is shown below.
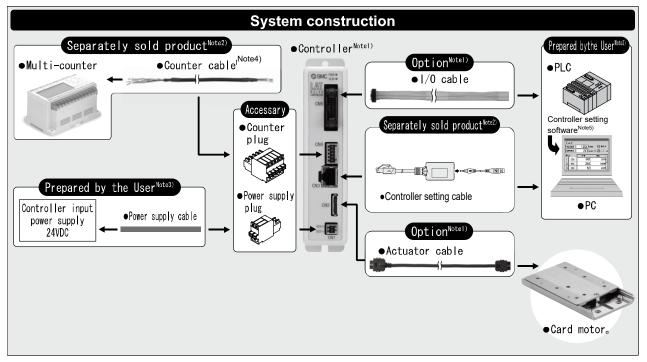
Note 1) The DIN rail is not included, this must be ordered separately.

Note 2) Step Data Input type or Pulse Input type can be selected using the configuration software.

Note 3) When the I/O cable option is selected, the I/O cable (LATH5-∗) with shield is included.
When made to order option (X152) is selected, the I/O cable provided can be changed to (LATH2-∗) without shield.

2.3 Structure of the product

An example of the controller structure is shown below.

Note 1) It is possible to specify the controller and the actuator and I/O cables with the Card Motor part number.

Only the I/O cable can be specified with the controller part number.

Note 2) It is not possible to order the accessories with the Card Motor part number. Refer to section **15. Option (P.80)** and order it separately.

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

Note 4) These items are used to display and output the table position and active preset positions to external devices via digital outputs when length is measured.

Note 5) Download from SMC's website.

https://www.smcworld.com/products/pickup/en-jp/electric_actuator/download.html

⚠ **Caution**
Refer to section **4. External Connection (P.20)** for wiring.
Refer to section **17. Controller and Peripheral Devices Specific Precautions (P.87)** when handling the wiring and cables.

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2.4 Start up procedure

Refer to the following procedure for installation, wiring, setting and operating the controller when the product is to be used for the first time.

(1) Check the contents of the package

Before using this controller, please check the contents supplied are as ordered.

Product name	Quantity
Controller (LATCA-∗∗∗)	1 pc.
Power supply plug	1 pc.
Counter plug	1 pc.

Controller

Power supply plug

Counter plug

∗If any parts are missing or damaged, please contact your distributor.

(2) Setup of pulse train input signal switch
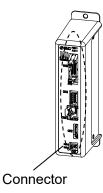
Setup the pulse train input signal switch installed in the controller so as to correspond to the pulse train input signal to be entered to the controller.   Regarding the setup of the pulse input signal switch, refer to section **8. Pulse Input Signal Switch (P. 39).**

(3)Mounting the controller

Refer to section **3.4 Mounting (P. 18)** for instructions on how to mount the controller.
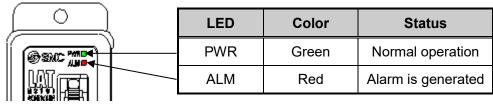
(4) Wiring and connection

Connect the cables to the controller (CN1 to CN5).

Refer to section **4 External Connections (P. 20)** for the wiring of the connectors.

Connector

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(5) Power supply ON and alarm check

Ensure that the wires are connected correctly and then turn on the 24 VDC power supply.

LED	Color	Status
PWR	Green	Normal operation
ALM	Red	Alarm is generated

Controller

If the [PWR] LED on the front of the controller is green, the controller is in the normal condition.

If the [ALM] LED on the front of the controller is ON or flashing red, an alarm has been generated.

⚠ Caution

When an alarm is generated

The type of the alarm can be checked by a combination of the ALARM and POWER LED's ON or flashing.

Check the type of alarm and remove the cause while referring to section **16. Alarm Detection (P. 91).**

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(6) Basic parameter setup and Step Data setup

Select the step Data Input type or Pulse Input type with a PC (controller configuration software) and set up the basic settings, such as the Card Motor model to be connected to the controller. In addition, set up the target position and positioning time in the step data for the step data input type, and set up the work load and pushing force set value in the step data for the pulse input type.

∗ Personal computer (Controller configuration software, Pulse input type)

Refer to section **9. Controller Set Up (P.42)** and **14. Card Motor Controller Configuration software (P. 70)** for instructions on how to setup.

(7) Test operation

Refer to section **10. Monitor and Test Mode of the Controller (P.50)** and **14.5 Monitor/Test window (P. 80)** for instructions on operating instruction of test operation

3. Controller Specifications

3.1 Basic specifications

Basic specifications of the product.
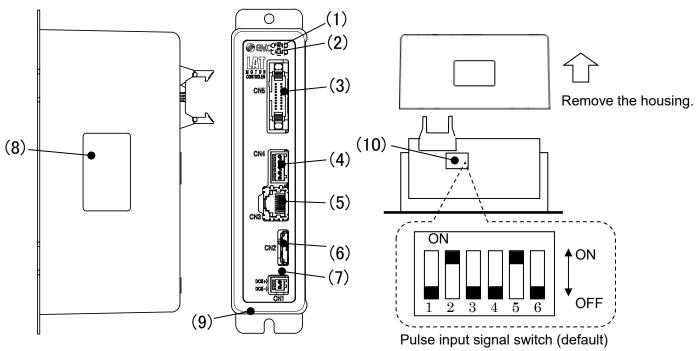
Item	Specifications		
Input type [Note1)]	Step data input type	Pulse input type	
Compatible motor	LAT3 series		
Number of axis per controller	Single axis		
Control method	Closed-loop control with encoder feedback signal		
Power supply specifications [Note 2)]	Power supply voltage: 24 VDC +/-10% Current consumption: 2 A (Maximum 3 A) [Note 3)] Power consumption: 48 W (Maximum 72 W) [Note 3)]		
Operation patterns	Positioning operation Pushing operation Automatic return to origin	Pulse sequence operation Pushing operation Automatic return to origin	
Number of step data	15	4	
Parallel input	6 inputs (Optically isolated. Pulse input terminals and COM terminal are excluded.)		
Parallel output	4 outputs (optically isolated, open collector)		
Pulse input mode	—	Open collector input	Differential input
Power supply voltage for pulse input signal		24V 5V	-
Maximum pulse frequency		100 kHz	200 kHz
Pulse input mode		Pulse and Direction CW and CCW Quadrature	
Serial communication	RS485 (Modbus protocol), RS485 (original protocol)		
Communication speed	2,400 bps, 9,600 bps, 19,200 bps, 38,400 bps, 57,600 bps		
Position display output [Note 4)]	A-phase and B-phase pulse signals, RESET signal (NPN open collector output)		
LED display	2 LED's (Green and Red)		
Operating temperature range	0 to 40oC (no condensation)		
Operating humidity range:	90 % or less (no condensation)		
Storage temperature range (oC)	-10 to 60oC (No condensation, no freezing)		
Storage humidity range	90% or less (no condensation)		
Insulation resistance	50 MΩ (500 VDC) between FG and case		
Weight [Note 5)]	130 g (direct mounting type) 150 g (DIN rail mounting type)		

Note 1) Step data input type or pulse input type can be selected using the configuration software.
Note 2) The controller should use a power supply which satisfies the maximum current consumption and maximum power consumption. Do not use an inrush current suppression type power supply.
Note 3) Rated current: Current consumption when continuous thrust is generated.
        Peak current: Current consumption when maximum instantaneous thrust is generated.
Note 4) Specification for the connection of the CEU5 Multi-counter (supplied separately).
Note 5) Cables are not included.

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3.2 Parts description
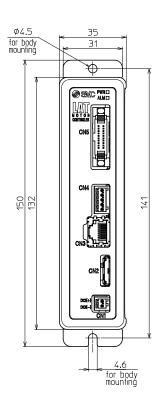
Details of the parts of the controller.

Remove the housing.

Pulse input signal switch (default)
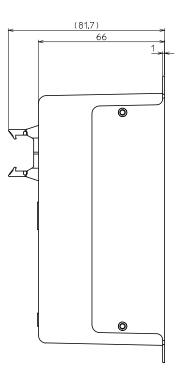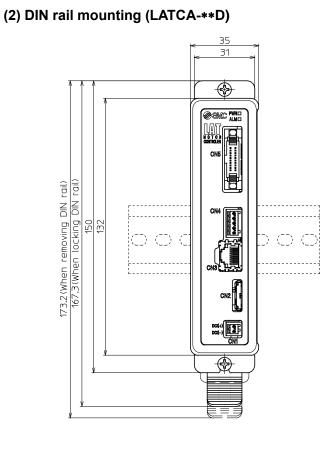
No.	Display	Name	Details
1	PWR	Power supply and alarm LED (Green)	Normal operation: Green is ON If the PWR and ALM LED's are ON or flashing simultaneously, an alarm has been generated.
2	ALM	Alarm LED (Red)	In alarm condition: Red is ON or flashing Red. The combination of when the ALM and PWR LED's are ON or flashing indicates an alarm.
3	CN5	Parallel I/O connector (20 pins)	Connection to a PLC using the LATH2-□ I/O cable.
4	CN4	Counter connector (5 pins)	Connection to the CEU5 Multi-counter using the LATH3-□ counter cable.
5	CN3	Serial I/O connector (9 pins)	Connection to a PC using the Controller Setting cable.
6	CN2	Motor Connector (18 pins)	Connection to the Card Motor using the LATH1-□ actuator cable.
7	CN1	Power Supply Connector (2 pins)	24 VDC power supply connection to the controller using the power supply plug. The power supply cable should be prepared by the user.
8	-	Controller part number label	Label indicating the controller part number.
9	-	FG	Connection to Frame ground (Connect the grounding cable to the controller mounting, and fasten it with the controller mounting screw).
10	-	Pulse input signal switch	Switch to select the type of pulse input signal.

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3.3 External dimensions
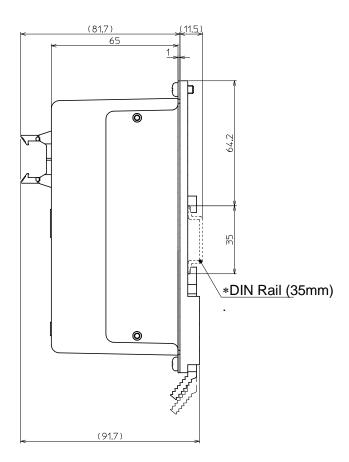
Controller external dimensions

(1) Direct mounting (LATCA-∗∗)

(2) DIN rail mounting (LATCA-∗∗D)

∗DIN Rail (35mm)

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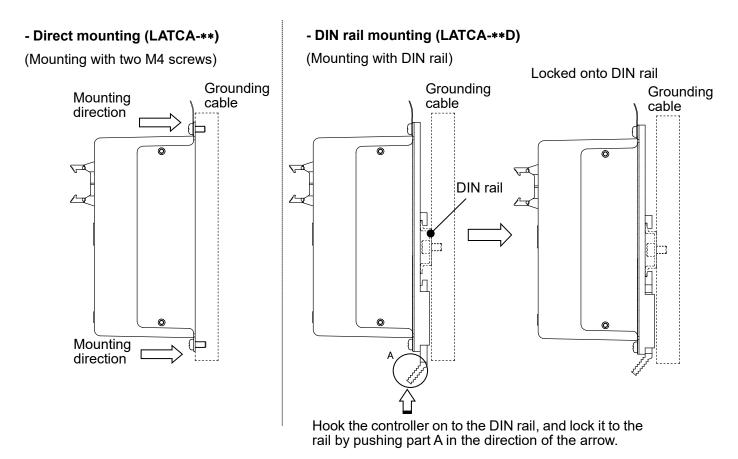
3.4 Mounting

(1) Mounting
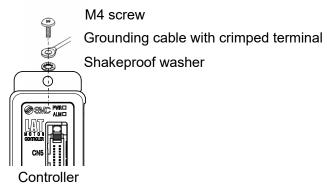
The controller can be direct mounted using screws or mounted on a DIN rail.
Details of the controller mounting options are shown below.

- Direct mounting (LATCA-∗∗)

(Mounting with two M4 screws)

- DIN rail mounting (LATCA-∗∗D)

(Mounting with DIN rail)

Hook the controller on to the DIN rail, and lock it to the rail by pushing part A in the direction of the arrow.
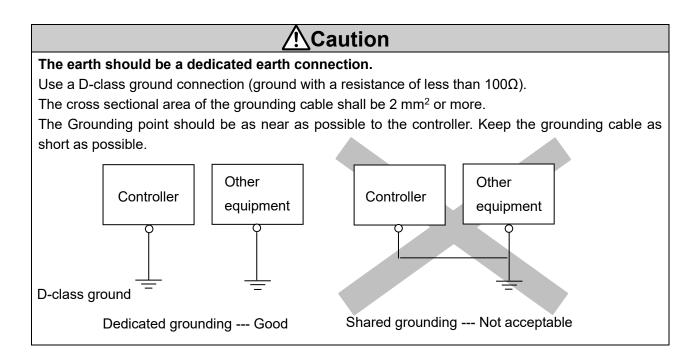
(2) Connection to ground

Place the grounding cable with crimped terminal between the M4 screw and shakeproof washer as shown below and tighten the screw.
The M4 screw, cable with crimped terminal and shakeproof washer must be prepared by the user.

M4 screw

Grounding cable with crimped terminal

Shakeproof washer

Controller

⚠️Caution

The earth should be a dedicated earth connection.

Use a D-class ground connection (ground with a resistance of less than 100Ω).

The cross sectional area of the grounding cable shall be 2 mm^2 or more.

The Grounding point should be as near as possible to the controller. Keep the grounding cable as short as possible.

Controller	Other equipment

D-class ground

Dedicated grounding --- Good

Controller	Other equipment

Shared grounding --- Not acceptable

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(3) Mounting location

Design the size of the control panel and the installation type so that the temperature surrounding the controller is 40oC or less.

Mount the controller vertically on the wall with at least 30 mm (direct mounting) or 50 mm (DIN rail mounting) of space at the top and bottom of the controller as shown below.

Allow 60 mm or more space between the front of the controller and the enclosure cover (lid) for inserting and removing the connectors.

Enough space must be allowed around the controller so that the operating temperature of the controller stays within the specification range.

Avoid mounting the controller near a vibration source, such as a large electromagnetic contactor or circuit fuse breaker on the same panel, or keep it away from the controller.
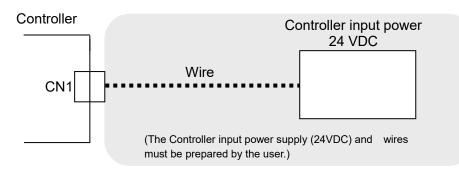
10 mm or more

30 mm or more

Door (Lid)

Controller

Controller

30 mm or more (Direct mounting)
50 mm or more (DIN rail mount)

60 mm or more

⚠️ Caution

The controller should be installed on a flat surface.

If the mounting surface is distorted or not flat, excessive force may be applied to the housing, etc.

causing malfunction.

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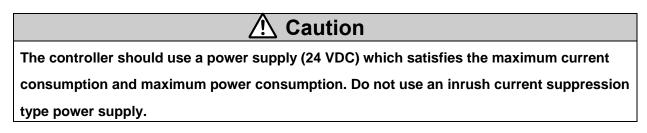
4. External Connections

An example of standard wiring of the controller is shown for each connector (CN1 to CN5).

4.1 CN1: Power supply connector

(The Controller input power supply (24VDC) and wires must be prepared by the user.)
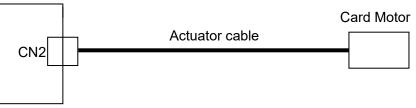
Refer to section **5. CN1: Power supply plug (P.22)** for wiring details.

⚠ **Caution**
The controller should use a power supply (24 VDC) which satisfies the maximum current consumption and maximum power consumption. Do not use an inrush current suppression type power supply.

4.2 CN2: Motor connector
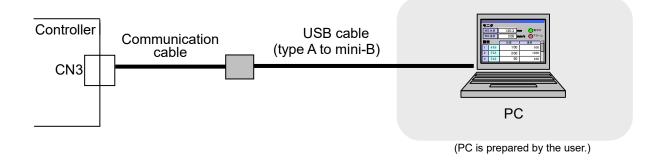
Connect the controller and the Card Motor using the actuator cable (LATH1-∗).
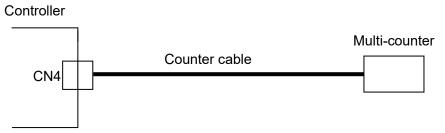
4.3 CN3: Serial I/O connector

Connect the controller to the personal computer (PC) using the communication cable and USB cable.
To connect the controller to a PLC, refer to the operation manual "Card Motor Controller (Serial Communication edition)" or "Card Motor Controller (MODBUS Communication edition)".

(PC is prepared by the user.)

4.4 CN4: Counter connector (option)
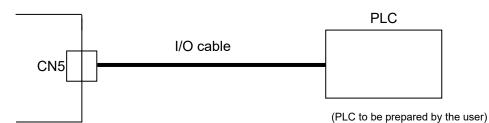
Connect the controller to the Multi-counter (CEU5) using the counter cable (LATH3-∗).

Controller

CN4 ———— Counter cable ———— Multi-counter
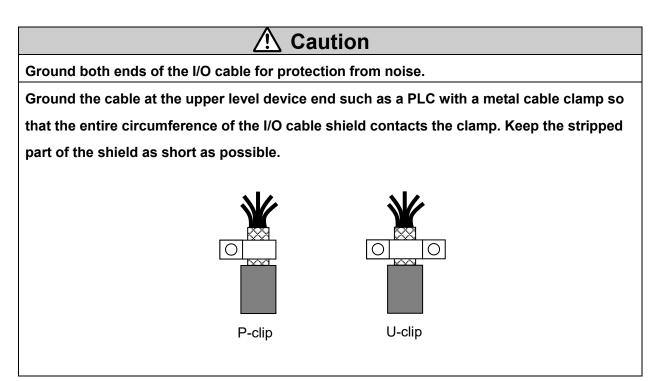
Refer to section **6.2 Counter plug wiring (P.24).**

4.5 CN5: Parallel I/O connector

Connect the controller to a PLC using the I/O cable (shielded type LATH5-∗ or not shielded type LATH2-∗)
When using the pulse input method, the use of I/O cable (shielded type LATH5-∗) is recommended.

CN5 ———— I/O cable ———— PLC

(PLC to be prepared by the user)

Refer to section **7.4 Parallel I/O signals (P.29)** for details of the parallel I/O signals .
Refer to section **7.6 Parallel I/O connector wiring (P.35)** for wiring.

⚠ **Caution**
Ground both ends of the I/O cable for protection from noise.
Ground the cable at the upper level device end such as a PLC with a metal cable clamp so that the entire circumference of the I/O cable shield contacts the clamp. Keep the stripped part of the shield as short as possible. P-clip   U-clip

5. CN1: Power Supply Plug

5.1 Power supply plug specifications

The specifications of the power supply plug supplied with the controller are shown below.

Name	Part No.
Power supply plug	LATC4P-020S

Power supply plug

DC1 (-)
DC1 (+)

Terminal	Function	Functional explanation
DC1 (-)	Power supply (-)	Power supply negative (-) supplied to the controller. The power supply (-) is also supplied to the Card Motor via the internal circuit of the controller and the actuator cable.
DC1 (+)	Power supply (+)	Power supply positive (+) supplied to the controller. The power supply (+) is also supplied to the Card Motor via the internal circuit of the controller and the actuator cable.
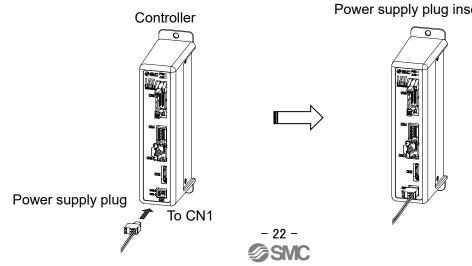
5.2 Electrical wiring specifications

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

Item	Specifications
Applicable wire size	20 AWG / 0.5 mm^2 Use a single multi-strand wire in each terminal. Strip the ends as shown below and twist the strands together. ∗ The rated temperature of the insulation coating should be 60ºC or more.
Stripped wire length	8mm

⚠ Caution

Do not connect multiple wires to one terminal.
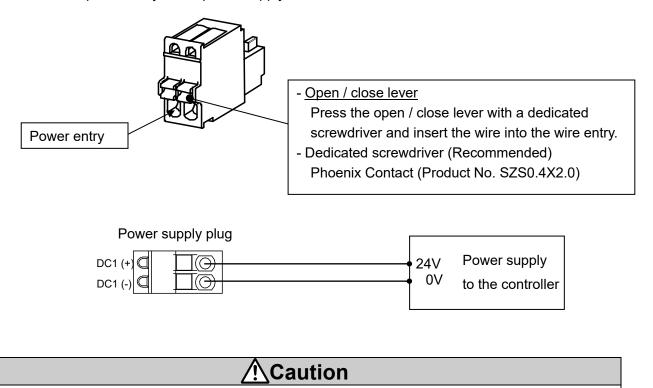
After wiring the power supply plug, connect it to CN1 power connector of the controller.
Refer to section **5.3 Power supply plug wiring (P.23)** for wiring.

Controller

Power supply plug inserted into CN1

Power supply plug

To CN1

SMC

5.3 Power supply plug wiring
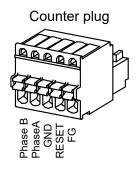
Connect the power supply plug included as an accessory to 24 VDC power supply of the controller and connect it to the power entry of the power supply connector.

Power entry

- Open / close lever
  Press the open / close lever with a dedicated screwdriver and insert the wire into the wire entry.
- Dedicated screwdriver (Recommended)
  Phoenix Contact (Product No. SZS0.4X2.0)

Power supply plug

DC1 (+)
DC1 (-)

24V
0V
Power supply to the controller

⚠Caution

The controller should use a power supply (24 VDC) which satisfies the maximum current consumption and maximum power consumption. Do not use an inrush current suppression type power supply.

SMC

6. CN4: Counter Plug

6.1 Counter plug specifications

The specifications for the counter plug supplied with the controller are shown below.

Counter plug
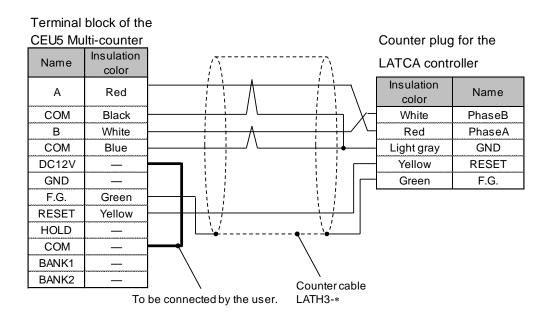
Name	Part no.
Counter plug	LATC4P-050S

Name	Description	Wire colour
Phase B	B-phase pulse signal is output. Connect to Phase B of the counter cable.	White
Phase A	A-phase pulse signal is output. Connect to Phase A of the counter cable.	Red
GND	Sensor input common. Connect to GND of the counter cable.	Light Grey
RESET	Reset signal is output. Connect to RESET of the counter cable.	Yellow
FG	FG terminal. Connect to FG of the counter cable.	Green

6.2 Counter plug wiring

The wiring of the counter cable (LATH3-∗) and Multi-counter (CEU5) is shown below.
Refer to the Multi-counter (CEU5) operation manual for further details.

Terminal block of the
CEU5 Multi-counter

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

Counter plug for the
LATCA controller

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

To be connected by the user.

Counter cable
LATH3-∗

Note 1) Connect the control input common terminal (COM) to the sensor power supply output terminal (12 VDC).
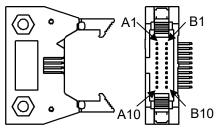
Note 2) Refer to section **15.5 Multi-counter CEU5 (P. 88)** for the Multi-counter settings (CEU5).

SMC

7. CN5: Parallel I/O Connector

7.1 Parallel I/O connector specifications

The Parallel I/O connector specifications are shown below.

Refer to section **7.5 Parallel I/O signal cable (P.34)** for correspondence of terminal numbers and I/O signals.

Item	Part No.
Controller side I/O connector	HIF6-20PA-1.27DS

∗ Cable: Hirose Electric HIF6-20D-1.27R or equivalent

7.2 Parallel I/O specifications

- Input specifications
  (NPN and PNP common,
   pulse input terminal is excluded)

Item	Specifications
Input circuit	Optically isolated open collector output
Number of inputs	6
Power supply	24 VDC ±10%
Input current at ON state	2.4 mA ±20% (at 24 VDC)
Input current / voltage at OFF state	1.5 mA or less 15 V or less

- Output specifications
  (NPN, PNP common)
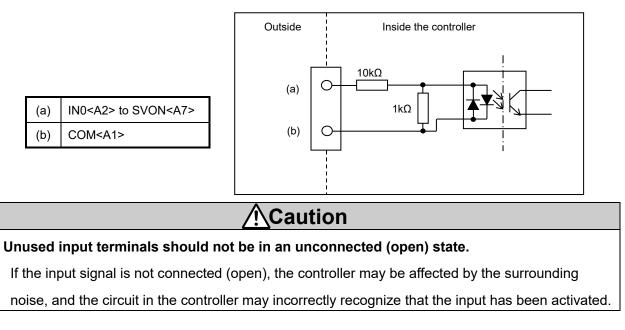
Item	Specifications
Output circuit	Optically isolated open collector output
Number of outputs	4
Maximum voltage between terminals	30 VDC
Maximum output current	10 mA
Saturation voltage between terminals	2.0 V (Max.)

7.3 Parallel I/O circuit (NPN, PNP)

This controller is available with NPN type (LATCA-N) and PNP type (LATCA-P) parallel I/O (The controller is different for NPN type and PNP type).

(1) Parallel I/O input circuit
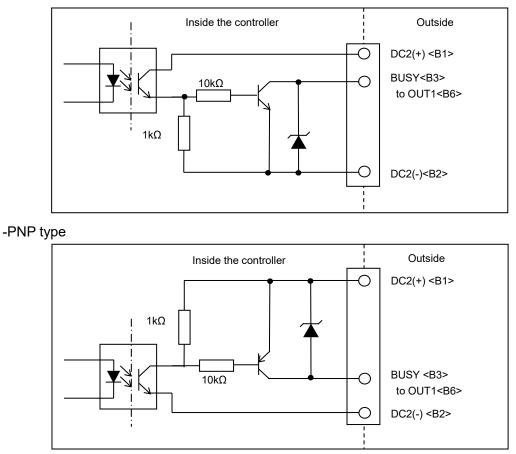
Parallel I/O input circuit is shown below (NPN and PNP common, pulse input is excluded.).

(a)	IN0<A2> to SVON<A7>
(b)	COM<A1>

⚠Caution

Unused input terminals should not be in an unconnected (open) state.

If the input signal is not connected (open), the controller may be affected by the surrounding

noise, and the circuit in the controller may incorrectly recognize that the input has been activated.

SMC
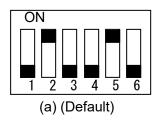
(2) Parallel I/O output circuit

-NPN type

Inside the controller | Outside

10kΩ

1kΩ

DC2(+) <B1>

BUSY<B3>
to OUT1<B6>

DC2(-)<B2>

-PNP type

Inside the controller | Outside

1kΩ

10kΩ

DC2(+) <B1>

BUSY <B3>
to OUT1<B6>

DC2(-) <B2>

(3) Pulse train signal input circuit

The pulse signal input can be selected from the open collector input type and differential input type.   In addition, the pulse train voltage can be selected from 24V and 5V in the open collector input type.

Open collector input (24V) is set as default as shown below. Change the pulse signal input mode with the pulse signal input switch.   When the pulse signal input switch is switched, the value of current control resistance R in the controller is switched.

ON

1 2 3 4 5 6

(a) (Default)
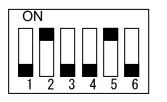
i. Open collector input

The setting of pulse train signal input switch should conform to the pulse train signal voltage (see the figure below).

Power supply voltage for pulse train signal	Pulse train signal input switch setting	Current limit resistor R
24 VDC +/- 10%	Turn ON No.2 and No.5	1.5 kΩ
5 VDC+/-5%	Turn ON No.1 and No.4	220 Ω
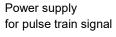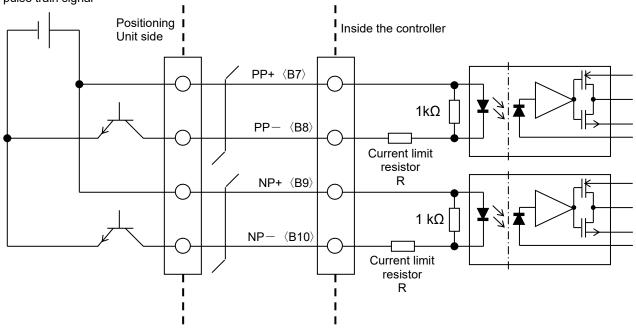
(a) Open collector input (24V)   (b) Open collector input (5V)
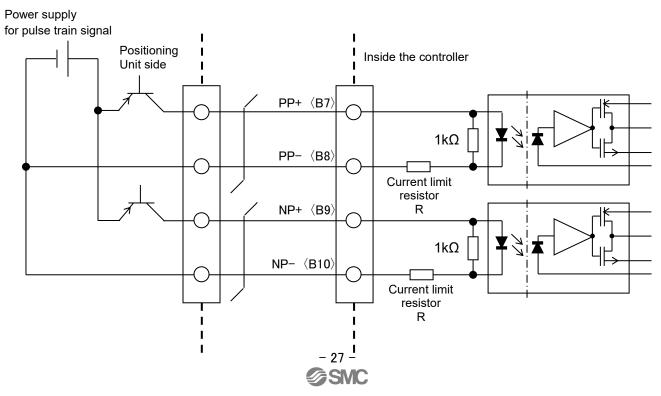
(a) Upper level equipment is NPN type

Power supply
for pulse train signal

Positioning
Unit side

Inside the controller

PP+ 〈B7〉

PP− 〈B8〉

1kΩ

Current limit
resistor
R

NP+ 〈B9〉

NP− 〈B10〉

1 kΩ

Current limit
resistor
R

(b) Upper level equipment is PNP type

Power supply
for pulse train signal

Positioning
Unit side

Inside the controller

PP+ 〈B7〉

PP− 〈B8〉

1kΩ

Current limit
resistor
R

NP+ 〈B9〉

NP− 〈B10〉

1kΩ

Current limit
resistor
R

SMC
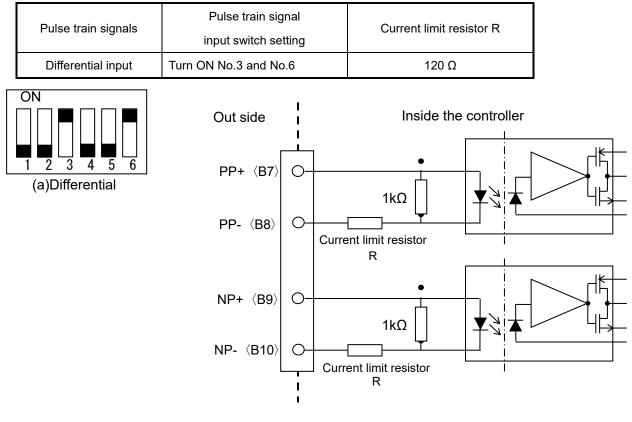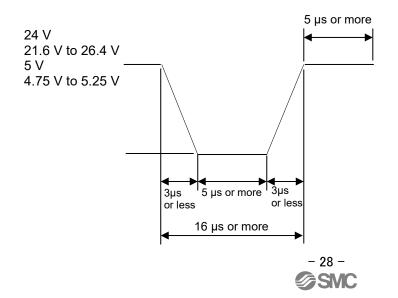
ii. Differential input

Connect the differential output terminal of the upper level equipment to the PP+ terminal (or NP+ terminal) directly and set up the pulse input signal switch (See the figure below).

Pulse train signals	Pulse train signal input switch setting	Current limit resistor R
Differential input	Turn ON No.3 and No.6	120 Ω

(a)Differential

⚠ Caution

For differential input, connect the upper level device such as positioning unit using the line driver which is equivalent to DS26C31.

Please match the controller upstream devices, such as a PLC, with the pulse input signal type.

When using the upstream devices with a differential output and the controller as an open collector input, the Card Motor may travel twice as fast as the output pulse of the upstream devices.

---

iii. Pulse train signal specifications (Open collector input and differential input are common)

24 V
21.6 V to 26.4 V
5 V
4.75 V to 5.25 V

5 μs or more

3μs or less   5 μs or more   3μs or less

16 μs or more

SMC

7.4 Parallel I/O signals (Pulse Input Type)

(1) Input side (Pulse input type)

Function	Description
COM	Common terminal for the input signal power supply. Connect the power supply + side (+ common) or power supply - side (- common) in accordance with the wiring specifications.
IN0	Step data Bit No. is assigned (Input using a combination of IN0 to IN1) for the positioning or pushing operation. A change in the step data will be accepted when the following conditions are satisfied: - The BUSY signal is off. - No pulse signal input for 10 ms
IN1	When IN0 and IN1 are turned OFF, the return to origin operation will not be performed, but the step data No.0 will be used. e.g. (Step data No.2 has been assigned) | IN1	IN0
ON	ON
1	0 | ← 2 Binary code
SETUP	If the SETUP signal is turned ON while the SVON signal is ON, the Card Motor will automatically return to the Origin Position preset in the controller. **⚠ Caution** **When the SETUP signal is turned OFF while the Card Motor is returning to origin, the positioning operation will stop immediately. When the SETUP signal is turned ON again, the Card Motor will restart the return to origin operation.** When a pulse signal is input while the SETUP signal is turned ON, a return to origin error will occur.
CLR	CLR is the deviation reset signal. When the CLR signal is turned ON, the commanded operation (table target value) is overwritten at the table position, and the deviation is cleared. Perform the return to origin position operation after turning the CLR signal OFF. If the pulse input signal is performed without performing a return to origin position, a "return to origin position not executed" error (P.82) will occur. Use the CLR signal when the table needs to be immediately stopped. **⚠ Caution** **The CLR signal will not operate when the SVON signal is OFF or during a return to origin operation.** The pulse input signal will not be accepted when the CLR signal is ON.
TL	When the TL signal is turned ON, pushing operation will start. Refer to **11.3 Pushing Operation (P. 55)** for details of the pushing operation.
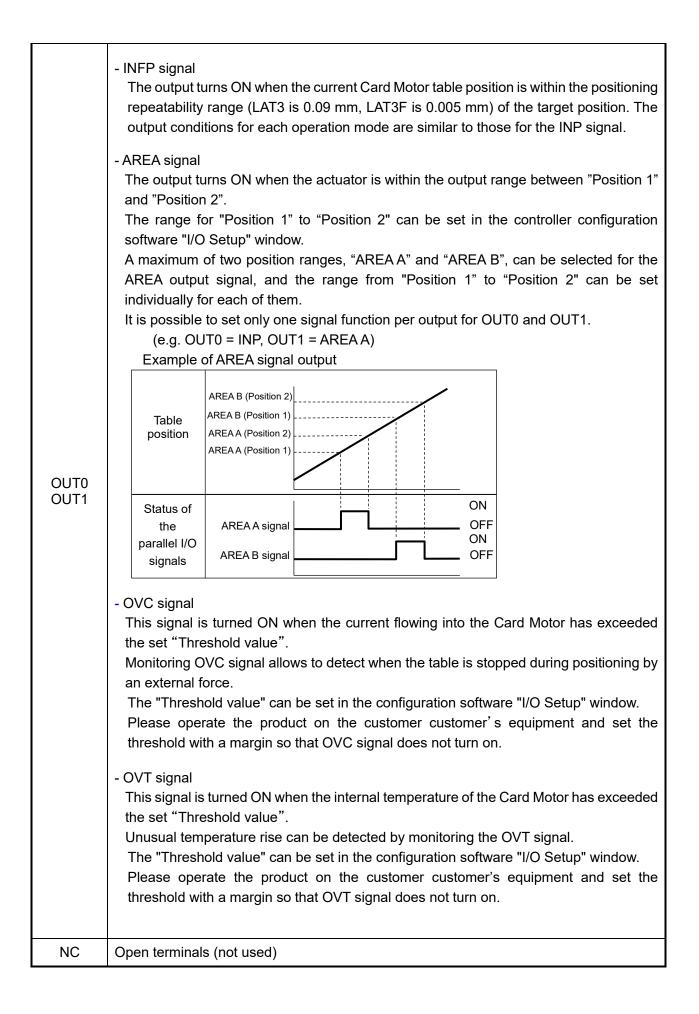
SVON	When the SVON signal is ON, the Card Motor is energized. Be sure to perform a return to origin operation after turning ON the SVON signal. If it is necessary to keep the servo motor energized, the SVON signal should remain ON. When the SVON signal is turned OFF, the Card Motor is not energized, therefore the table is not controlled and is free to be moved by external forces. It is possible to clear an alarm (SVON reset) by resetting the SVON signal (ON to OFF to ON).
NC	Open terminals (not used)

PP+,PP-
NP+,NP-
	These are the pulse input signals for operation command (table target value).
	
	The operation command (table target value) can be obtained by multiplying the sensor resolution by the accumulated value of the number of pulses.
	
	The function assignment varies depending on the pulse signal input mode.
	
	Refer to "**9.3 Basic Parameter Setup (P. 43)** " for details.
	
	Sensor resolution LAT3---30 μm
	            LAT3M---5μm
	            LAT3F---1.25 μm
	
	Note) A Pulse input signal should be input earliest after 10 ms or more after changing the IN0, IN1 setting.
	
	<table><tr><td>⚠ **Caution**</td></tr><tr><td>If a large number of pulse input signals is input and the Target Position of the table is outside the stroke range, the table will stop at the stroke end. Following this, by inputting pulse input signals in the opposite direction, the table is positioned at the Target Position after that the Target Position is within the stroke range.</td></tr></table>

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(2) Output side (Step Data input type)

Function	Description
DC2(+)	Connect the 24 V terminal of the power supply (24 VDC) for the input/output signals.
DC2(-)	Connect the 0 V terminal of the power supply (24 VDC) for the input/output signals.
BUSY	The BUSY output signal will be ON when the Card Motor is moving (during the Return to Origin, positioning and pushing operations). When the pulse input signal is being input, the BUSY signal will be ON although the Card Motor is stopped. The function of the BUSY output signal can be changed, or the BUSY function can also be assigned to other outputs in the "I/O Setup" window in the controller configuration software. ⚠ **Caution** **If the Card Motor is stopped during the pushing operation (no movement but the actuator is generating a pushing thrust), the BUSY signal will be OFF.** Also, if the Card Motor operates at a speed slower than 5 mm/s, the BUSY signal may not turn ON at all.
ALARM	ON when there are no alarms. OFF in alarm condition.
	The function of the OUT0 and OUT1 output signals can be changed to the functions listed below in the controller configuration software "I/O Setup" window . The INP signal function is set as a default for OUT0, and INF for OUT1. -INP signal Operation completion signal - During the return to origin The INP output turns ON after the return to origin operation is completed. - During positioning operation When the pulse input signal is input, the OUT0 and OUT1 signals turn off. If the pulse input signal is not input for 10 ms after the Card Motor moves near to the target value, the output will turn ON. - During pushing operation The INP signal will turn OFF during the pushing operation. ⚠ **Caution** If the Target Position of the table is outside the stroke range, the table will stop at the stroke end, but the INP signal will not be turned ON. -INF signal The INF output turns ON when the pushing force generated has exceeded the set "Threshold Force Value" after the TL signal is input and the pushing operation has started. When the TL signal is turned OFF, the INF signal also turns OFF. The "Threshold Force Value" can be set in the controller configuration software "I/O Setup" window . ⚠ **Caution** **The "Threshold Force Value" is set in the "I/O Setup" window as a general value for all pushing operation Step Data, but the "Thrust Setting Value" can be set individually for each Step Data.** Therefore the INF output may be activated when the pushing force differs from the set "Thrust Setting Value".

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OUT0
OUT1
	- INFP signal
	The output turns ON when the current Card Motor table position is within the positioning repeatability range (LAT3 is 0.09 mm, LAT3F is 0.005 mm) of the target position. The output conditions for each operation mode are similar to those for the INP signal.
	
	- AREA signal
	The output turns ON when the actuator is within the output range between "Position 1" and "Position 2".
	The range for "Position 1" to "Position 2" can be set in the controller configuration software "I/O Setup" window.
	A maximum of two position ranges, "AREA A" and "AREA B", can be selected for the AREA output signal, and the range from "Position 1" to "Position 2" can be set individually for each of them.
	It is possible to set only one signal function per output for OUT0 and OUT1.
	    (e.g. OUT0 = INP, OUT1 = AREA A)
	  Example of AREA signal output
	
	- OVC signal
	This signal is turned ON when the current flowing into the Card Motor has exceeded the set "Threshold value".
	Monitoring OVC signal allows to detect when the table is stopped during positioning by an external force.
	The "Threshold value" can be set in the configuration software "I/O Setup" window.
	Please operate the product on the customer customer's equipment and set the threshold with a margin so that OVC signal does not turn on.
	
	- OVT signal
	This signal is turned ON when the internal temperature of the Card Motor has exceeded the set "Threshold value".
	Unusual temperature rise can be detected by monitoring the OVT signal.
	The "Threshold value" can be set in the configuration software "I/O Setup" window.
	Please operate the product on the customer customer's equipment and set the threshold with a margin so that OVT signal does not turn on.

NC	Open terminals (not used)

⚠ Caution

Ensure that the power supply has been turned ON and that the ALARM signal is ON before activating any input signals.

If input signals are ON before that, a "return to origin position not executed" error will occur. Turn ON the input signal again after turning OFF SVON signal.

Furthermore ensure the same I/O signal sequence, and turn OFF and ON again all input signals, when operating the Card Motor with parallel I/O signals, after communicating with the controller configuration software.

Each threshold value is a reference.

Check the operating conditions before setting and using the card motor.

The table below shows the changes in the output signal with respect to controllers state.

Output signal / State	BUSY	ALARM	OUT0,OUT1					
			INP	INF	INFP	AREA	OVC	OVT
Servo is OFF when the motor is not operating after the controller is powered and CLR signal is ON.	OFF	ON	OFF	OFF	OFF	OFF	OFF	OFF
Servo is ON when the motor is not operating after the controller is powered and CLR signal is ON.	OFF	ON	OFF	OFF	OFF	OFF	OFF	OFF
Return to origin is in operation.	ON	ON	OFF	OFF	OFF	OFF	OFF	OFF
Return to origin completed.	OFF	ON	ON	OFF	ON	OFF	OFF	OFF
Movement by positioning in operation after return to origin.	ON	ON	OFF	OFF	OFF	ON	ON	ON
Positioning after return to origin completed (within positioning range).	OFF	ON	ON	OFF	ON	ON	ON	ON
Movement by pushing in operation after return to origin.	ON	ON	OFF	OFF	OFF	ON	ON	ON
Target position for pushing has been reached after return to origin.	OFF	ON	ON	OFF	ON	ON	ON	ON
The force for pushing operation is generated after return to origin.	OFF	ON	OFF	ON	OFF	ON	ON	ON
Deviation cleared (CLR signal is ON) after return to origin.	OFF	ON	OFF	OFF	OFF	OFF	OFF	OFF
Servo is OFF after return to origin.	OFF	ON	OFF	OFF	OFF	ON	ON	ON
Alarm is generated.	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF

Note 1) "ON" is achieved when the output condition of each signal is satisfied.

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7.5 Parallel I/O signal cable (Pulse Input Type)

(1) I/O cable (without shield) LATH2-*

(2) I/O cable (with shield) LATH5-*

Input/Output	Terminal number	Function (Step Data input)	LATH2-* Insulator color	LATH5- Insulator color	LATH5- Dot mark	LATH5- Dot color
Input	A1	COM	Red	Light brown		Red
	A2	IN0	Grey		■	Black
	A3	IN1	Grey	Yellow		Red
	A4	SETUP	Grey		■	Black
	A5	CLR	Green	Light green		Red
	A6	TL	Grey		■	Black
	A7	SVON	Grey	Grey		Red
	A8	NC	Grey		■	Black
	A9	NC	Grey	White		Red
	A10	NC	Green		■	Black
Output	B1	DC2(+)	Red	Light brown		Red
	B2	DC2(-)	Grey		■ ■	Black
	B3	BUSY	Grey	Yellow		Red
	B4	ALARM	Grey		■ ■	Black
	B5	OUT0	Green	Light green		Red
	B6	OUT1	Grey		■ ■	Black
	B7 Note 1)	PP+	Grey	Grey		Red
	B8 Note 1)	PP-	Grey		■ ■	Black
	B9 Note 1)	NP+	Grey	White		Red
	B10 Note 1)	NP-	Green		■ ■	Black

Note 1) When using the step data input method, do not wire to the terminals B7 to B10.
These input terminals incorporate an internal circuit for pulse input signal, so this may lead to failure.

Note 2) If step data entry type is selected for the controller input type, the function of the terminals will be different from those in the table above. If the controller is used with the step data input type, refer to the operation manual [Card Motor Controller (Step Data Input version)].

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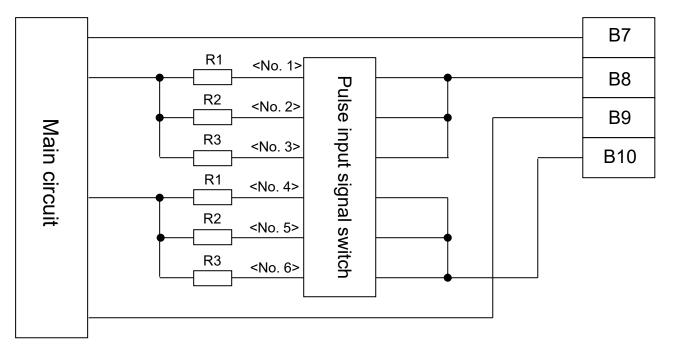
7.6 Parallel I/O connector wiring (example)

Use an I/O cable (LATH2-* or LATH5-*) for connecting the controller CN5 parallel I/O connector to a PLC.
The wiring depends on the parallel input/output of the controller (NPN, PNP type).
Wire the product while referring to the wiring diagram below.

(1) NPN type

(2)PNP type
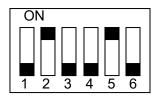
Note 1) When the step data input method is used , do not connect wires to the terminals B7 to B10. Internal circuits are included which are used as pulse input signal terminals.

⚠Caution

Prepare 2 separate 24 VDC power supplies for the CN1 controller power supply and CN5 input / output signal power supply.

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(3) Pulse input internal circuit
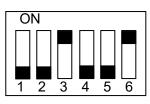
	Input signal method	Power supply voltage for pulse input signal	Pulse input signal switch setting	Current limiting resistor R
(a)	Open collector input	24 VDC +/- 10%	Turn ON No. 2 and No. 5, and turn OFF the others.	R2 = 1.5 kΩ
(b)		5 VDC+/- 5%	Turn ON No. 1 and No. 4, and turn OFF the others.	R1 = 220 Ω
(c)	Differential input	-	Turn ON No. 3 and No. 6, and turn OFF the others.	R3 = 120 Ω

(a) Open collector input (24 V)

(b) Open collector input (5 V)

(c) Differential input

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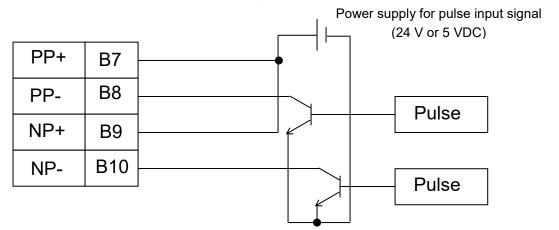
(4) Pulse input circuit example
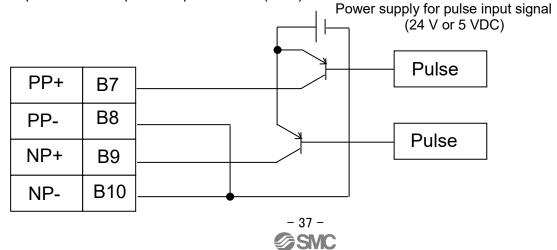
    i. Open collector input for 1-pulse mode (Pulse and Direction)

Power supply for pulse input signal
(24 V or 5 VDC)

PP+	B7
PP-	B8
NP+	B9
NP-	B10

Pulse

Direction

    ii. Open collector input for 2-pulse mode (CW and CCW or Quadrature)

Power supply for pulse input signal
(24 V or 5 VDC)

PP+	B7
PP-	B8
NP+	B9
NP-	B10

Pulse
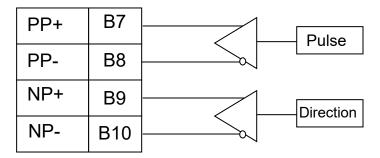
Pulse
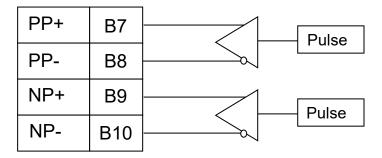
    iii. Open collector input for 1-pulse mode (PNP)

Power supply for pulse input signal
(24 V or 5 VDC)

Pulse

PP+	B7
PP-	B8
NP+	B9
NP-	B10

Direction

    iV. Open collector input for 2-pulse mode (PNP)

Power supply for pulse input signal
(24 V or 5 VDC)

Pulse

PP+	B7
PP-	B8
NP+	B9
NP-	B10

Pulse

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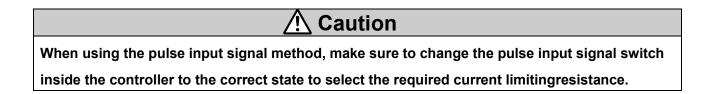
v. Differential input of 1-pulse mode (Pulse and Direction)

PP+	B7
PP-	B8
NP+	B9
NP-	B10

Pulse

Direction

vi. Differential input of 2-pulse mode (CW and CCW or Quadrature)

PP+	B7
PP-	B8
NP+	B9
NP-	B10

Pulse

Pulse

⚠ **Caution**
When using the pulse input signal method, make sure to change the pulse input signal switch inside the controller to the correct state to select the required current limitingresistance.

⌾SMC
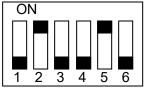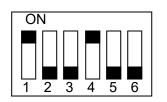
8. Details of Pulse Input Signal Switch

Set the Pulse Input Switch inside the controller in accordance with the pulse input signal method being used.

8.1 Setting of Pulse Input Signal Switch

(a) Open collector input (24 V)   (b) Open collector input (5 V)   (c) Differential input
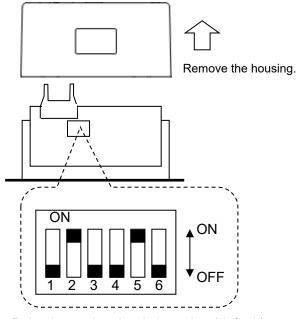
8.2 Changing the Pulse Input Signal Switch

(1) Remove the controller housing.

(2) Switch the pulse input signal switches on the PCB.

   Set the switch positions in accordance with the pulse input signal.

(3) Operate the switches :

   - with a load not more than 9.8 N.

   - Apply a load to the switches only in the horizontal direction.

   Do not apply load from the top or in the diagonal direction.

   - Use a suitable small screwdriver to operate the switches.

Remove the housing.

Pulse input signal switch setting (default)
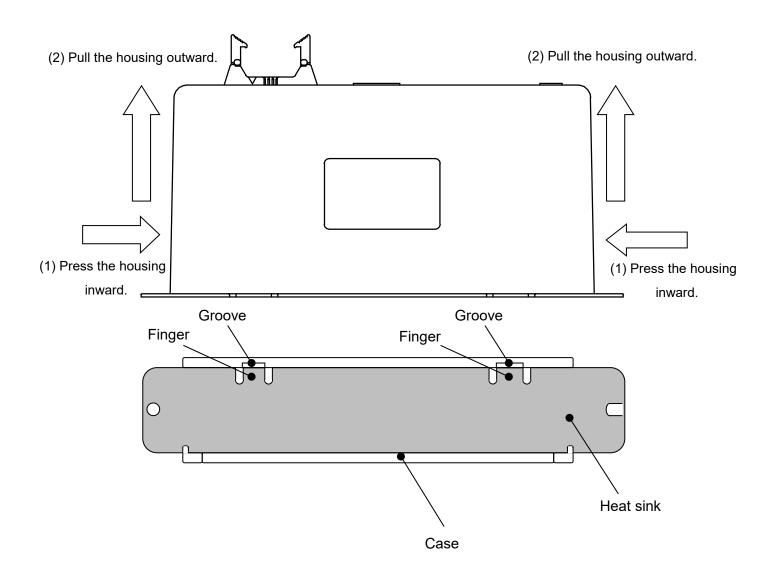
⚠ Caution
Be sure to remove all connectors before removing the housing.
When handling the controller with the housing removed, observe precautions against static electricity and ensure operators are connected to ground using a wrist strap, etc. When removing/connecting the connectors, make sure that the power supply is OFF in advance.

SMC
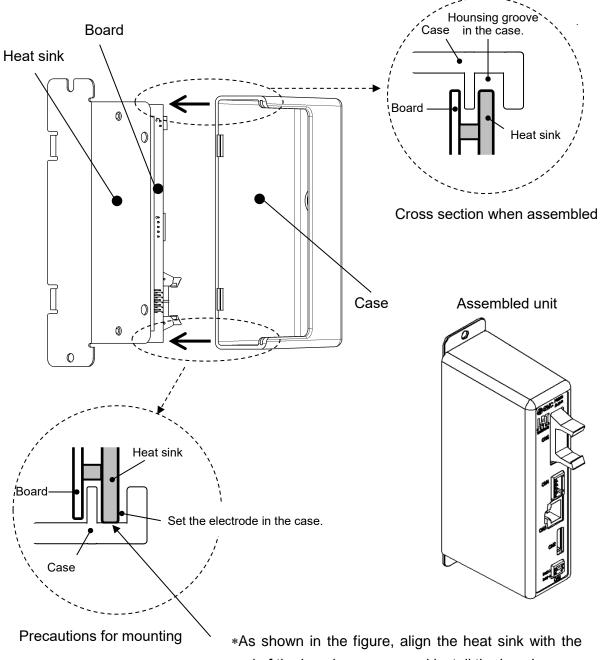
* Removal of the housing

Press the housing from both sides to disconnect the fingers (2 pieces) of the heat sink and pull the housing away from the heat sink.

(2) Pull the housing outward.

(2) Pull the housing outward.

(1) Press the housing inward.

(1) Press the housing inward.

Groove

Finger

Groove

Finger

Heat sink

Case

SMC

4) Mounting of the housing

Place the heat sink in the groove of the housing and insert the housing until it is locked.

Heat sink

Board

Case

Housing groove in the case.

Case

Board

Heat sink

Cross section when assembled

Assembled unit

Heat sink

Board

Set the electrode in the case.

Case

Precautions for mounting

*As shown in the figure, align the heat sink with the end of the housing groove and install the housing.

9. Controller Set Up

Before the controller can be operated in order to move the Card Motor to a specified position, it is necessary to program the items shown below in the controller using a PC with the controller configuration software installed. The data entered using the controller configuration software will be stored in the memory of the controller.

See **14. Controller Configuration Software** for details of the configuration software.

9.1 Communication Speed and Controller ID's

After selecting the communication speed for the serial communication (RS485), the controller configuration software will search the ID of the controller connected to the serial communication port (RS-485).

Selection of the communication speed

Name	Description
Communication speed	Communication speed is selected. Select a communication speed that matches the communication speed set on the controller (default value: 19200 bps).

Search and Selection of Controller ID

Name	Description
Start Search	Specifies the ID range for searching [Note 1], and searches for the connected controller ID within the specified range.
Connect	Starts communication with the controller of the selected controller ID.

Note 1) Specify the controller ID search range to find the controller connected to the PC (Default searching range: 1 to 1).

If the search range is large, this may take several minutes for searching.

9.2 Selection of the input type

Select the controller input type from "Step Data Input type" or "Pulse Input type" in accordance with the host PLC.

The Input type can be changed by initializing the controller. However, initialization resets all of the settings, so the settings will be required again. (Refer to **14.6 Confirmation of the version and initialization (P. 82)**)

Details of input type selection

Name	Description
Step Data Input type	The Card Motor is operated by selecting Step Data preset in the controller using parallel I/O signals.
Pulse Input type	The Card Motor is operated according to the number of pulses entered into the controller at a speed proportional to the pulse frequency entered into the controller.

SMC
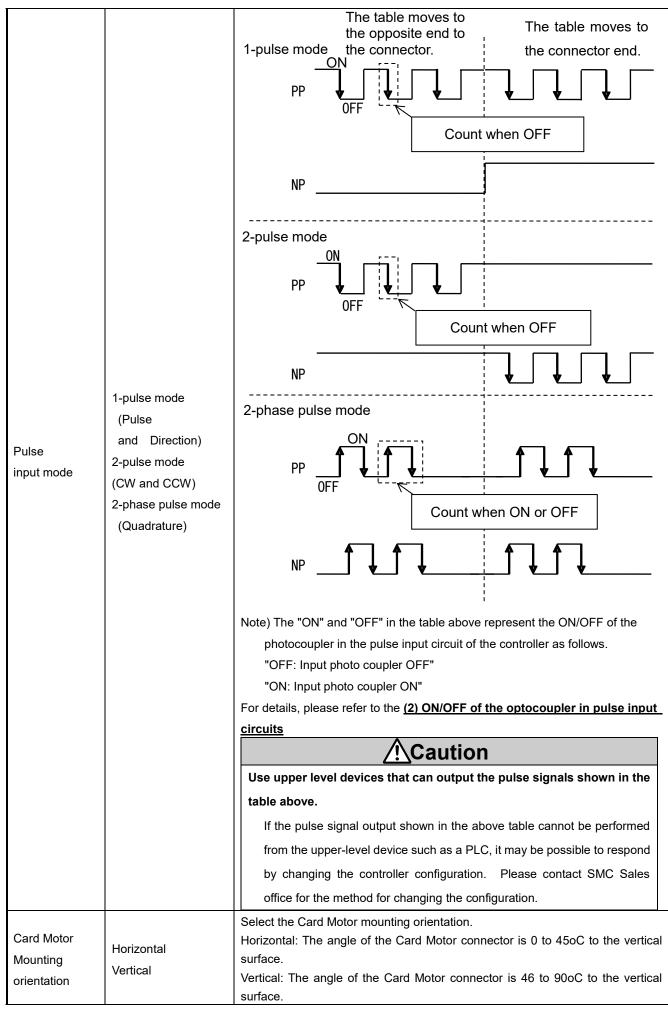
9.3 Basic parameter setup

The connected Card Motor product number connected to the controller and the operating conditions must be specified.

(1) Details
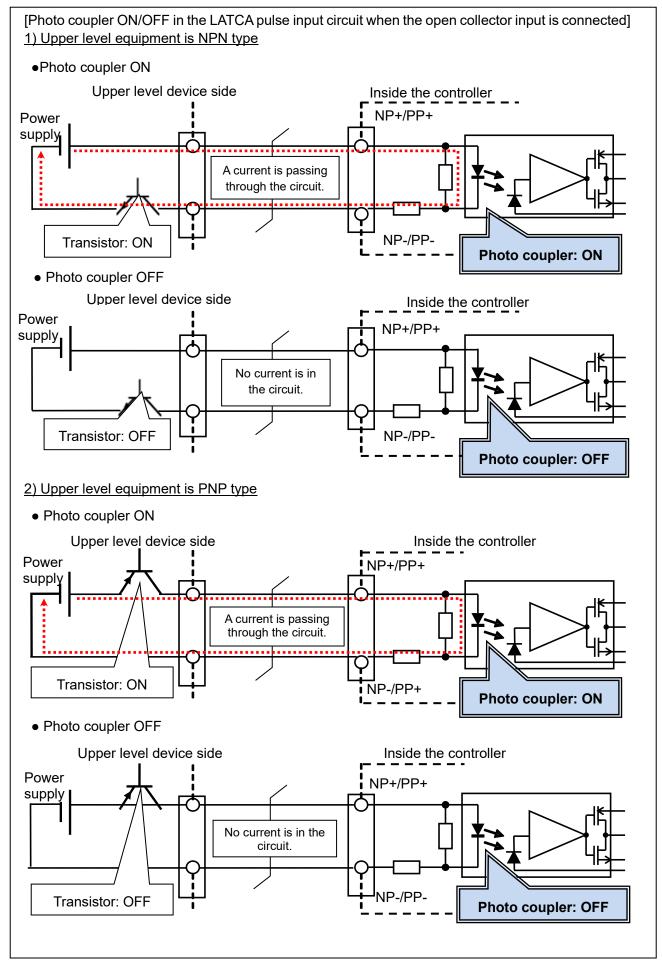
Basic parameter setup

Name	Input range	Description
Card Motor Product Number	8 options (Refer to the table on the right)	Select the Card Motor product number that is connected to the controller. **Product No.** / **Specifications** LAT3-10 / Stroke 10 mm, Resolution 30 µm LAT3-20 / Stroke 20 mm, Resolution 30 µm LAT3-30 / Stroke 30 mm, Resolution 30 µm LAT3M-50 / Stroke 50 mm, Resolution 5 µm LAT3F-10 / Stroke 10 mm, Resolution 1.25 µm LAT3F-20 / Stroke 20 mm, Resolution 1.25 µm LAT3F-30 / Stroke 30 mm, Resolution 1.25 µm LAT3F-50 / Stroke 50 mm, Resolution 1.25 µm
Return to Origin Method	3 options (Refer to the table on the right)	Select the operating direction at return to origin position. Refer to **12.1 Return to Origin example (P. 56)** for further details. **Method to return to origin position** Retracted End Position (connector side) The table moves towards the connector end and sets the origin position. Extended End Position The table moves towards the end opposite to the connector and sets the origin position. Sensor Origin The table moves to the linear encoder origin position and sets the origin position at this point.

SMC

| Pulse input mode | 1-pulse mode
(Pulse
and Direction)
2-pulse mode
(CW and CCW)
2-phase pulse mode
(Quadrature) | 1-pulse mode
The table moves to the opposite end to the connector.　　The table moves to the connector end.

ON
PP
OFF
Count when OFF

NP

2-pulse mode
ON
PP
OFF
Count when OFF
NP

2-phase pulse mode
ON
PP
OFF
Count when ON or OFF
NP |

Note) The "ON" and "OFF" in the table above represent the ON/OFF of the photocoupler in the pulse input circuit of the controller as follows.

"OFF: Input photo coupler OFF"

"ON: Input photo coupler ON"

For details, please refer to the **(2) ON/OFF of the optocoupler in pulse input circuits**

⚠Caution

Use upper level devices that can output the pulse signals shown in the table above.

If the pulse signal output shown in the above table cannot be performed from the upper-level device such as a PLC, it may be possible to respond by changing the controller configuration.　Please contact SMC Sales office for the method for changing the configuration.

| Card Motor Mounting orientation | Horizontal
Vertical | Select the Card Motor mounting orientation.
Horizontal: The angle of the Card Motor connector is 0 to 45oC to the vertical surface.
Vertical: The angle of the Card Motor connector is 46 to 90oC to the vertical surface. |

Setting	-	The changed value is sent to the controller connected to the PC. ⚠ **Caution** **To complete the setting, execute the controller reset operation before operating the Card Motor.** A message will appear in the controller configuration software window instructing the user to perform a reset operation.
Comm (Communication)	-	If the communication is interrupted whilst the controller configuration software is running, the communication can be restored by clicking the [Comm] button. However, the communication cannot be completely restored unless the cause of the communication disconnection is solved.

SMC

(2) ON/OFF of the optocoupler in pulse input circuits

[Photo coupler ON/OFF in the LATCA pulse input circuit when the open collector input is connected]
1) Upper level equipment is NPN type

● Photo coupler ON

Upper level device side

Inside the controller

NP+/PP+

Power supply

A current is passing through the circuit.

Transistor: ON

NP-/PP-

Photo coupler: ON

● Photo coupler OFF

Upper level device side

Inside the controller

NP+/PP+

Power supply

No current is in the circuit.

Transistor: OFF

NP-/PP-

Photo coupler: OFF

2) Upper level equipment is PNP type

● Photo coupler ON

Upper level device side

Inside the controller

NP+/PP+

Power supply

A current is passing through the circuit.

Transistor: ON

NP-/PP+

Photo coupler: ON

● Photo coupler OFF

Upper level device side

Inside the controller

NP+/PP+

Power supply

No current is in the circuit.

Transistor: OFF

NP-/PP-

Photo coupler: OFF

SMC

[About the photo coupler ON/OFF in the LATCA pulse input circuit during differential input connection]

● Photo coupler ON

Upper level device side

Command pulse signal

High

Low

Line driver

Inside the controller

NP+/PP+

A current is passing through the circuit.

NP−/PP−

Photo coupler: ON

● Photo coupler OFF

Upper level device side

Command pulse signal

Low

High

Line drive

Inside the controller

NP+/PP+

No current is in the circuit.

NP−/PP−

Photo coupler: OFF

9.4 Movement Profile Recommended for Pulse Input Type

There is a movement profile recommended for operation of the Card Motor in pulse input mode.

(1) Positioning time

Use the positioning time of the Card Motor according to the graphs shown below as reference for designing a circuit for pulse input mode.
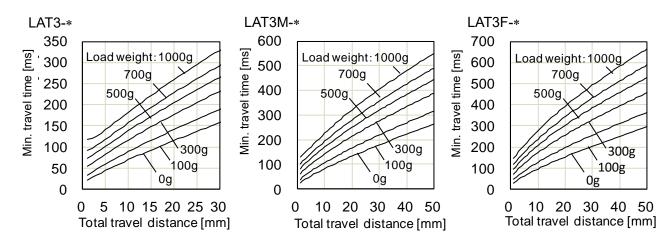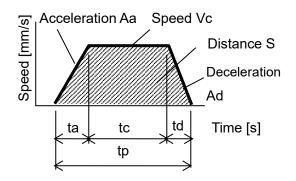

(2) Recommended movement profile
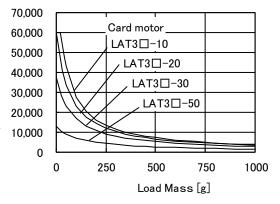
To obtain the total travel distance S [mm] in absolute positioning mode, calculate the difference between the position from which the table travel starts to the target position. The table will move to the Target Position according to a trapezoidal movement profile as shown in the diagram on the right, based on the set speed Vc [mm/s], acceleration Aa [mm/s^2] and deceleration Ad [mm/s^2].

Refer to the equations below for the acceleration time, constant velocity time and travel distance.

Acceleration time: ta =Vc/Aa [s]

Deceleration time: td=Vc/Ad [s]

Acceleration distance: Sa = 0.5 X Aa X ta^2 [mm]

Deceleration distance: Sd = 0.5 X Ad X ta^2 [mm]

Travel distance with constant velocity: Sc = S – Sa - Sd [mm]

Travel time with constant velocity: tc = Sc / Vc [s]

Positioning time: tp = ta + tc + td [s]

(Add settling time to the Positioning time to get the total positioning time).

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

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9.5 I/O setup

Settings for parallel I/O signals:

Name	Input range	Description
I/O Status	-	Displays the current input and output signals status. Green/Red: ON, Black: OFF Refer to **7.4 Parallel I/O Signals (P.29)** for details of the I/O signals.
Manual Output	ON OFF	Each output signal can be turned ON and OFF manually regardless of their current status, to check the connection. Normally the ALARM output is OFF when an alarm has been generated, but the ALARM output can be turned ON/OFF manually by pressing the ALARM button. Manual outputs are cancelled when another window is selected.
Area Range	Refer to the table on the right.	Input the table positioning range where the AREA signal turns ON. (Unit: mm) Separate position ranges can be set for up to two outputs: "AREA A" and "AREA B". The position ranges should be set as follows: Position 1 ≤ Position 2. | Part No.	Range	Resolution
LAT3-10	0 to 10	0.03
LAT3-20	0 to 20	
LAT3-30	0 to 30	
LAT3M-50	0 to 50	0.005
LAT3F-10	0 to 10	
LAT3F-20	0 to 20	
LAT3F-30	0 to 30	
LAT3F-50	0 to 50		
Threshold value [INF]	0.5 to 5.0 (in 0.1 increments)	This determines the condition for when the INF signal is activated. The INF signal turns ON when the pushing force generated by the Card Motor exceeds the set value. The "Threshold Force Value" and the "Threshold Setting Value" in the Step Data are independent of each other. The INF output will not be activated if the "Threshold Force Value" is larger than the "Threshold Setting Value" in the step data, because the "Threshold Force" will never be reached.
Threshold value [OVC]	1.5 to 3.0 (in 0.1 increments)	This determines the condition for when the OVC signal is output. This OVC signal is turned ON when the current flowing into the Card Motor has exceeded the set "threshold value".
Threshold value [OVT]	40 to 70 (in 10 increments)	This determines the condition for when the OVT signal is activated. This OVT signal is turned ON when the internal temperature of the Card Motor has exceeded the set "threshold value".
Configuration of Output Signal	9 types	The function of the parallel I/O signals OUT0 and OUT1 can be selected. Another signal function can also be assigned to the BUSY output terminal. It is possible to use the same function for more than one output terminal. Refer to section **7.4 Parallel I/O Signals (P.29)** for details of the I/O signals.

⚠️Caution

Each threshold value is a reference.

Check the operating conditions before setting and using the card motor.

SMC

9.6 Step Data setup

A "Step Data" is the preset data describing the required movement of the Card Motor. A total of 4 Step Data can be handled by the controller.

Step Data details

Name	Input scope	Description
Editing of Step Data	Cut Copy Paste	Cut: Cuts the selected step data. Copy: Copies the selected step data. Paste: The copied or cut data is pasted to the selected step data.
File operation	Save Open	Save: Saves the step data in a file on the PC. Open: Reads the step date from a file on the PC.
Up / Download to controller	Upload Download	Upload: Displays the data from the controller within the configuration software (PC). Download: Writes to the controller from the configuration software with the data displayed within the configuration software (PC).
No.	0 to 3	Specifies the step data number
Thrust Setting Value	1 to 5 1 to 4.8 1 to 3.9 1 to 2.0	Set the maximum force for the pushing operation. ⚠️**Caution** **The thrust setting value is a nominal value, therefore calibrate the thrust setting value according to the application and check the operation sufficiently when setting and before using the Card Motor and controller.**
Load Mass	0 to 1000	Select the load mass to be mounted on the Card Motor (unit: g). The load mass setting of Step data No. 0 is common with the return to origin operation and jog operation. Therefore operate the Card Motor under the same load conditions for the return to origin operation and Step Data No.0. Set the load mass in Step data No.0 when the Card Motor is jogged with a load mounted. ⚠️**Caution** **Therefore operate the Card Motor under the same load conditions for the return to origin operation and Step Data No.0.** **Set the Load Mass in Step Data No.0 when the Card Motor is jogged with a load mounted.** **The selected load mass is a guideline only, therefore be sure to check the operation sufficiently when setting and before using the Card Motor and controller.**

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10. Monitor and Test Mode of the Controller

In the "Monitor / Test" window the Card Motor status can be monitored and the performance tested.

Monitor mode: The Card Motor status can be monitored from a PC when the Card Motor is operated by pulse inputs from the PLC. After selecting the Monitor Mode, execute the return to origin operation, using the parallel I/O signals, before operating the Card Motor in Monitor Mode.

Test mode: A test operation can be performed by controlling the Card Motor from the connected PC. the following two operation modes [Jogging] and [Inching] can be performed in test mode.

Test and Monitor operation details

Name	Description
Status	Displays the current parallel I/O status.
Current alarm	Displays the current alarm status.
Alarm history	Displays the alarm history.
Alarm reset	Displays the alarm history stored in the controller, and the alarm history can be reset.
Step Data No.	Displays the Step Data number that is currently being executed.
Target position	Displays the target position according to the pulse input (when operating in pulse input type).
Position	Displays the current position of the Card Motor table.
Speed	Displays the current speed of the Card Motor table.
Force	Displays the current pushing force of the Card Motor.
Test Mode / Monitor Mode	Switches between Test mode and Monitor mode.
Servo	When this is clicked a signal is sent to the controller to send an energizing command to the Card Motor. When this is clicked once again a signal is sent to the controller to send an energizing cancel command to the Card Motor.
Return to origin	A return to origin position command is sent to the controller immediately when this button is clicked. After the return to origin position is completed, the requirement to execute this function again is cancelled automatically. Select the method for the return to origin position operation from the [Return to Origin Method] menu in the Basic Parameter Set up window. The load mass setting for "Step Data No. 0" is used for the operation. Note that the controller needs to be restarted when the [Return to Origin Method] has been changed, and the [Setup] button must be clicked for the change to take effect.
Jog	← → The table moves in the direction of the arrow while the Jogging button is pressed. The table movement stops when the button is released. The table movement stops when the button is released. When the table has reached the stroke end of the Card Motor, the table movement stops even if the button is still pressed. The table moves at the speed set in the "Speed" text box. The acceleration and deceleration are fixed, and cannot be changed. The load mass setting for "Step Data No.0" is used for the jogging operation.
Speed	Selects the speed for jogging and inching. Setting range: from 1 to 100 mm/s. (The set speed may not be achieved, depending on the operating conditions).
Inching	When either the "+" button or "-" button is pressed, the table moves the preset travel distance. The position is held after the transfer motion has been completed. The table will stop when it reaches the end of the Card Motor stroke range, . The table moves at the speed set in the "Speed" text box in the "Jog" section. The acceleration and deceleration are fixed, and cannot be changed. The Load Mass setting for "Step Data No.0" is used for the inching operation.

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Travel distance	Sets the range and minimum distances for inching.
	LAT3-∗: 0.09 mm to maximum stroke [mm] (in increments of: 0.03 mm)
	LAT3M-∗: 0.01 mm to maximum stroke [mm] (in increments of: 0.005 mm)
	LAT3F-∗: 0.005 mm to maximum stroke [mm] (in increments of: 0.001 mm)
	⚠**Caution**
	For LAT3F, the set value will be rounded off to the nearest decimal of the positioning resolution of 0.00125 mm.
Operation Start	Starts the selected step data operation.

⚠ **Caution**
Check the operation by testing sufficiently before using the product.
If the Step Data settings are not appropriate, the operation may not be executed, In such a case, the controller may not operate as required, or because an alarm has been generated.
Terminate other softwares running on the PC before starting a test operation.
Some functions of other software running simultaneously on the PC, may cause the CPU of the PC to overload during communication between the controller and the PC, which may cause the Card Motor to malfunction and not operate according to the settings.
At the end of the operation of the configuration software and when switching between test mode and monitor mode, the motor is turned off.

SMC

11. Operation

11.1 Return to origin position

The Card Motor uses an incremental type sensor (linear encoder) to detect the table position.
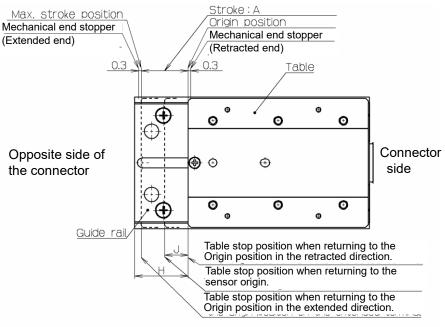
Therefore, it is necessary to return the table to the origin position after the power supply has been turned onto set the origin position.

There are three [Return to origin position] methods as described below.

In any of the methods, the origin position (0) will be set in the controller at the connector end. When the table moves toward the opposite end, after the [Return to origin] operation, the position of the table registered in the controller will be added (incremental positive direction).
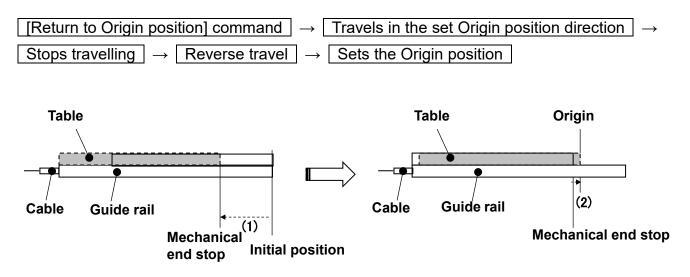
Name	Description
Retracted End Position (Connector end) (Recommended)	The default origin position is set the end on connector side [Retracted End Position] The table is moved to the connector side, returns toward the side opposite the connector side by 0.3 mm from the end, and stops. The stop position is set as 0 (the origin position).
Extended End Position	An external jig is used to stop the table of the Card Motor when the [Return to Origin Position] is performed. The table is moved to the side opposite the connector side, returns toward the connector side by 0.3 mm from the end, and stops. The origin position (0) is set at an A mm stroke away from the stopping position toward the connector side.
Sensor Origin	This method is used to achieve high positioning repeatability accuracy of the origin position. Only the LAT3M-* and LAT3F-*, which feature an integrated sensor equipped with an origin position signal, can use this method. The table is moved to the connector side, and while returning toward the side opposite the connector side from the end it stops at the position where the the sensor's origin position signal is detected. The origin position (0) is set at a certain distance (J) away from the stopping position toward the connector side.

If the table is returned to the origin position by the mechanical end stopper installed in the Card Motor, the origin position will be set to the position shown beleow.

Model	A	H	J[note]
LAT3*-10	10	10.5	5
LAT3*-20	20	20.5	5
LAT3*-30	30	30.5	15
LAT3*-50	50	70	25

Note) LAT3M-* and LAT3F-* only

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Return to Origin position reference example

[Return to Origin position] command → Travels in the set Origin position direction →
Stops travelling → Reverse travel → Sets the Origin position

∗ The controller uses the "Load Mass" value set in "Step Data No.0" for the "Return to Origin" operation. Therefore confirm that the "Load Mass" value for "Step Data No. 0" corresponds to the applied load for the "Return to Origin" operation.

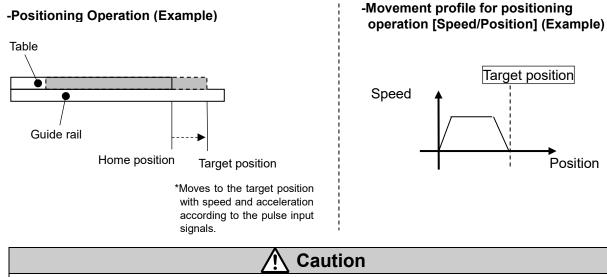| ⚠Caution |
|---|
| **Use a power supply with sufficient capacity.**
 The maximum current may flow instantaneously, such as when returning to the origin. When the power supply is inadequate, the voltage drops, and when the controller is powered back on, the motor is powered off. An error may occur.
 When using multiple controllers on a common power supply, make sure that the number of connections is sufficient. |
| **Do not set the target position in the step data outside of the Card Motor travel range.**
 If the Return to origin Position is performed using an external jig or work piece to stop the table, the target positions must not be set outside of the Card Motor travel range.
 This may damage the work piece and the Card Motor. |
| **The direction and the position of the card motor's origin varies depending on the setting.**
 Set the operating conditions according to the requirements of the actual application. |
| **The Sensor Origin position varies depending on the stroke.**
 Only with the LAT3M and LAT3F series, it is possible to return to the Sensor Origin.
 Refer to the Card Motor specifications for details. |

SMC

11.2 Positioning operation

The table moves to the position according to the pulse input signals. When no pulse input signals are received, the table maintains its position.

-Positioning Operation (Example)

Table

Guide rail

Home position   Target position

*Moves to the target position with speed and acceleration according to the pulse input signals.

-Movement profile for positioning operation [Speed/Position] (Example)

Speed

Target position

Position

⚠ **Caution**
The travel distance, speed and acceleration/ deceleration commands from the upper level device must not exceed the specifications of the actuator. Operation exceeding the specifications could lead to an alarm and/or malfunction.
When changing the Step Data No., wait at least 10 ms before inputting a pulse input signal after changing IN0 and IN1 signals.

11.3. Pushing operation

When the following conditions are met, operation is switched to the pushing operation.

(i) Return to Origin operation has been completed.

(ii) Pulse input signals with a target position ahead of the workpiece to be pushed have been entered.
By turning the TL signal ON while the table is moving with the pulse input signals entered will keep moving the table at the pushing speed of 6 mm/s. (When the pulse input signals are 6 mm/s or less, the speed will be the same as the pulse input signals.)
Once the controller has recognized that the table has reached the workpiece, the table pushes the workpiece with the pushing force Note 1)set in the "Step Data" [Thrust Setting Value]. Four [Thrust Setting Value] levels can be configured in the "Step Data Setup" window and the Step Data can be selected by the IN0 and IN1 signals.

(iii)The TL signal has been turned ON.

In a pushing operation, the INF signal turns ON when a current equal to or higher than the "Threshold Force Value" current set in the controller is applied. When the TL signal is turned OFF, the INF signal will also turn OFF and the position will be held.

Note1) The set pushing force [Thrust Setting Value] must be adjusted by the user as required.
The pushing force varies depending on the operating environment, pushing direction and table position.
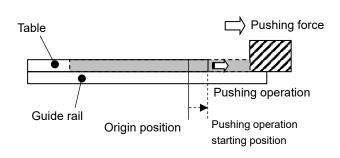The pushing force [Thrust Setting Value] set in the Step Data is a nominal value only.

Note2) When the TL signal is ON, the table will stop when it reaches the stroke end, or when the pulse signal input stops.
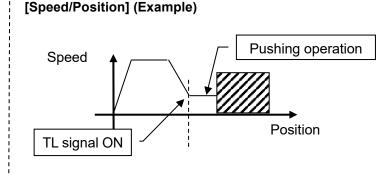
⊘SMC

(1) Successful pushing operation

The table will keep pushing the workpiece after reaching the workpiece.
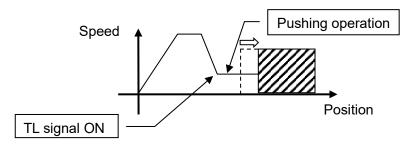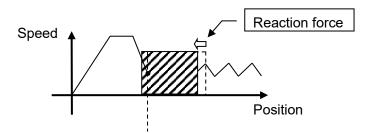
- Pushing operation (Example)

Table

Pushing force

Guide rail

Origin position

Pushing operation

Pushing operation starting position

- Movement profile for pushing operation [Speed/Position] (Example)

Speed

Pushing operation

TL signal ON

Position

(2) When the workpiece moves

(i) The workpiece moves in the pushing direction.

If the reaction force from the workpiece becomes smaller and the actuator moves with a force smaller than that specified in the [Step data] - [Thrust setting value] after the table has reached the workpiece, it continues pushing the workpiece until the specified pushing force is generated.

Speed

Pushing operation

TL signal ON

Position

(ii) If the workpiece moves in the opposite direction to the pushing force (If it is returned due to a large reaction force from the work piece) or if the reaction force from the work piece becomes larger and the actuator is pushed back after the table has reached the work piece, it continues to be pushed back until the reaction force and pushing force are balanced (The actuator is pushed back in the pushing start direction).

Speed

Reaction force

Position

(3) Pushing operation without table moving to the Target Position

When inputting a pulse input signal after turning ON the TL signal while the Card Motor is stopped, the table will start moving in the direction instructed by the pulse input signal with a pushing speed of 6 mm/s.

(When the pulse input signal is 6 mm/s or less, the speed will be the same as the pulse train signals).

Once the controller has recognized that the table has reached the workpiece, the table will push the workpiece with the pushing force set in the "Step Data" [Thrust Setting Value].

SMC

⚠Caution
When the TL signal is turned ON, the pushing force generated will be according to the force set in the "Step Data" [Thrust Setting Value] which has been selected by IN0 and IN1 signals.

(4) Return from pushing operation to positioning operation

    To return from the pushing operation to the positioning operation, follow the instructions given below:

     i. Turn the TL input OFF.

     ii.Input pulse signals in the opposite direction to the pushing operation direction.

    When the Card Motor's current table position equals the target position input by the pulse signal, the Card Motor transitions from the pushing operation to positioning operation.

11.4 Response time for the controller input signals

The controller input signal response delay, other than pulse input signals, includes the following factors:

  (1) Controller input signal scan delay

  (2) Delay due to input signal analysis

  (3) Delay of command analysis

Both the PLC and the controller processing cause delays. Ensure an interval of 2 msec or more is allowed between input signals, and maintain the signal state for at least 2 msec.

Time the input signal conditions according to the response output signals

11.5 Methods of interrupting operation

There are two methods of interrupting the operation and stopping the actuator during both positioning operation and pushing operation, as shown below.

The state after stopping is different, therefore use the method appropriate to the application.

- Stopped using the CLR signal

   Turning the CLR signal ON during operation will clear the position deviation and will stop the table with the pulse input rejected, and will maintain the table position where the table stops. Perform the Return to Origin Position operation after turning the CLR signal OFF. If the pulse input signal is entered without performing the Return to Origin Position, a "Return to Origin Position not executed" error (P.81) will occur.

- Stopped by the SVON signal

   If the SVON signal is turned OFF during operation, the power supplied to the actuator is cut off and the table will move freely.

⚠Warning

Consider possible unexpected movements of the Card Motor in the event of an emergency stop, alarm or power failure.
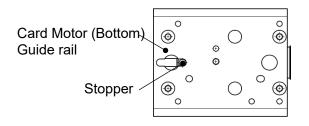
   The table will not be held in place and may be moved by external forces if the power supply to the Card Motor is switched off due to an emergency stop or if the SVON signal is turned OFF, in the event of an alarm (when the temperature of the Card Motor exceeds 70°C) or at power failure. If the Card Motor is mounted vertically or at an angle, the table will drop.

   Design the Card Motor application to avoid injury and equipment damage caused by unexpected table movements.

⚠Caution

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

   The Card Motor is equipped with a stopper to prevent the table from coming off and to take light impacts generated when returning to the 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, the target position must be set at least 1 mm away from the position where the table or the pushing tool comes into contact with the workpiece.

   Otherwise, the table may hit the work piece at a speed in excess of 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 operation. Take the following countermeasures if the temperature of the Card Motor rises high enough to generate a temperature alarm:

- Reduce the Thrust 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 **16. Alarm Detection" (P.91)** for further details).

Remove any obstacles within the Card Motor travel range.

The obstacles will interfere with the Card Motor, resulting in damage to the Card Motor

Interference with obstacles may cause overcurrent to the Card Motor, which may cause overheating.

Ensure that there are no obstacles before starting operation

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, calibrate the "Thrust Setting Value" according to the application under real conditions.
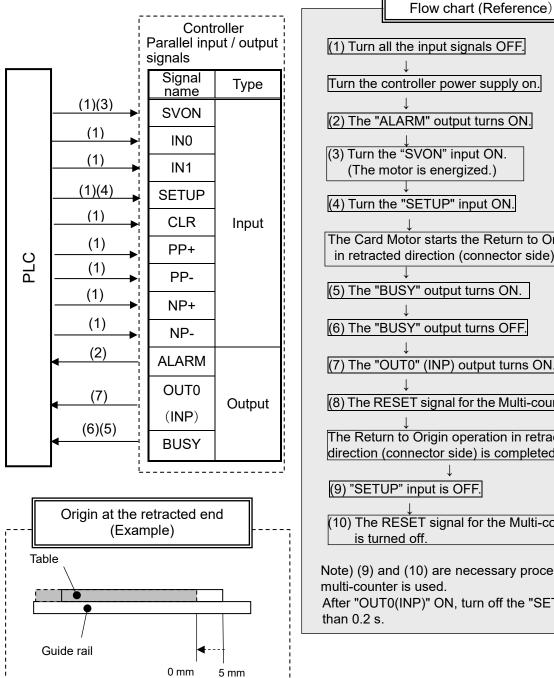
12 Operation Examples and Procedures

12.1 Return to origin example

Example: After power has been supplied, the table is returned to origin from its initial position 5 mm away from the retracted end without load.
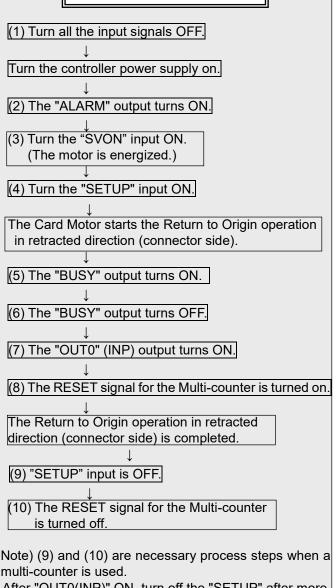
- Basic setting example

Return to origin method
Origin at the retracted end

Controller Parallel input / output signals

Signal name	Type
SVON	Input
IN0	
IN1	
SETUP	
CLR	
PP+	
PP-	
NP+	
NP-	
ALARM	Output
OUT0 (INP)	
BUSY	

PLC signals:
- SVON — (1)(3)
- IN0 — (1)
- IN1 — (1)
- SETUP — (1)(4)
- CLR — (1)
- PP+ — (1)
- PP- — (1)
- NP+ — (1)
- NP- — (1)
- ALARM — (2)
- OUT0 (INP) — (7)
- BUSY — (6)(5)

Flow chart (Reference)

(1) Turn all the input signals OFF.
↓
Turn the controller power supply on.
↓
(2) The "ALARM" output turns ON.
↓
(3) Turn the "SVON" input ON.
(The motor is energized.)
↓
(4) Turn the "SETUP" input ON.
↓
The Card Motor starts the Return to Origin operation in retracted direction (connector side).
↓
(5) The "BUSY" output turns ON.
↓
(6) The "BUSY" output turns OFF.
↓
(7) The "OUT0" (INP) output turns ON.
↓
(8) The RESET signal for the Multi-counter is turned on.
↓
The Return to Origin operation in retracted direction (connector side) is completed.
↓
(9) "SETUP" input is OFF.
↓
(10) The RESET signal for the Multi-counter is turned off.

Note) (9) and (10) are necessary process steps when a multi-counter is used.
After "OUT0(INP)" ON, turn off the "SETUP" after more than 0.2 s.

Origin at the retracted end (Example)

Table

Guide rail

0 mm   5 mm
Origin

12.2 Positioning operation example

Example:

Step 1: The table of LAT3-10 has to move to absolute position 9 mm (target position 1) from the retracted end within 0.2 seconds without a load.

Step 2: The table has to move from absolute position 9 mm from the retracted end (target position 1) to absolute position 3 mm from the retracted end (target position 2) within 0.15 seconds.

i.Setting example of pulse input signals

Card Motor encoder resolution: 30 µm/pulse

2-pulse input mode:

Target position 1: Travel distance 9 mm, Travel speed 20 mm/s,
Acceleration 80 mm/s2, Deceleration 80 mm/s2

Target position 2: Travel distance 5 mm, Travel speed 20 mm/s,
Acceleration 80 mm/s2, Deceleration 80 mm/s2

ii.Calculation example

Travel distance [Number of pulses (pulse)] = Travel distance (mm) ÷ Encoder resolution (µm/pulse)

Travel speed [Pulse frequency (pulse/s)] = Travel speed (mm/s) ÷ Encoder resolution (µm/pulse)
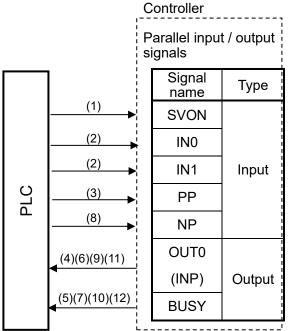
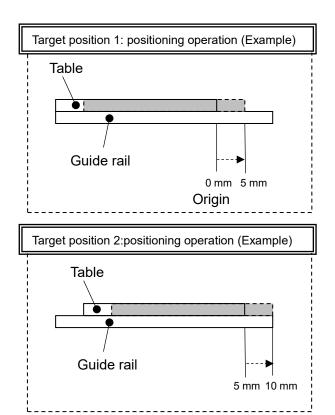Acceleration and Deceleration time [s] =Travel speed (mm/s) / Deceleration (or acceleration) (mm/s 2)

[Calculation example: Target position 1]
Travel distance: $9 \div (30 \times 10\text{-}3) = 300$ [pulses]
Travel speed: $60 \div (30 \times 10\text{-}3) = 2000$ [pulses/s]
Acceleration time: $60 \div 1500 = 40$ [ms]
Deceleration time: $60 \div 1000 = 60$ [ms]

[Calculation example: Target position 2]
Travel distance: $6 \div (30 \times 10\text{-}6) = 200$ [pulses] (in the reverse direction)
Travel speed: $60 \div (30 \times 10\text{-}3) = 2000$ [pulses/s]
Acceleration time: $60 \div 1500 = 40$ [ms]
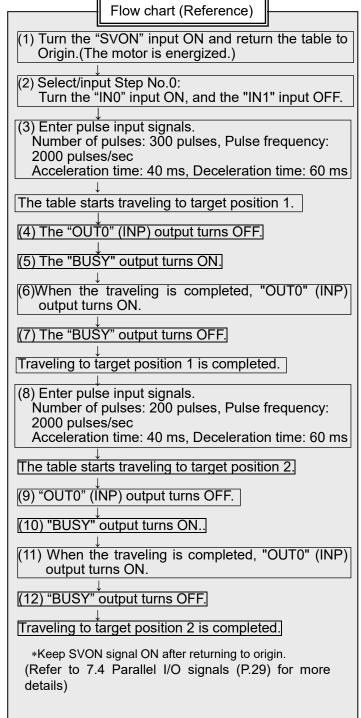Deceleration time: $60 \div 1000 = 60$ [ms]

- Step Data setting example

No.	Thrust setting value	Load mass (g)
0	1	0

Controller

Parallel input / output signals

PLC

Signal name	Type
SVON	
IN0	
IN1	Input
PP	
NP	
OUT0 (INP)	Output
BUSY	

(1) SVON
(2) IN0
(2) IN1
(3) PP
(8) NP
(4)(6)(9)(11) OUT0 (INP)
(5)(7)(10)(12) BUSY

Target position 1: positioning operation (Example)

Table

Guide rail

0 mm   5 mm

Origin

Target position 2:positioning operation (Example)

Table

Guide rail

5 mm   10 mm

Flow chart (Reference)

(1) Turn the "SVON" input ON and return the table to Origin.(The motor is energized.)

↓

(2) Select/input Step No.0:
Turn the "IN0" input ON, and the "IN1" input OFF.

↓

(3) Enter pulse input signals.
Number of pulses: 300 pulses, Pulse frequency: 2000 pulses/sec
Acceleration time: 40 ms, Deceleration time: 60 ms

↓

The table starts traveling to target position 1.

↓

(4) The "OUT0" (INP) output turns OFF.

↓

(5) The "BUSY" output turns ON.

↓

(6)When the traveling is completed, "OUT0" (INP) output turns ON.

↓

(7) The "BUSY" output turns OFF.

↓

Traveling to target position 1 is completed.

↓

(8) Enter pulse input signals.
Number of pulses: 200 pulses, Pulse frequency: 2000 pulses/sec
Acceleration time: 40 ms, Deceleration time: 60 ms

↓

The table starts traveling to target position 2.

↓

(9) "OUT0" (INP) output turns OFF.

↓

(10) "BUSY" output turns ON..

↓

(11) When the traveling is completed, "OUT0" (INP) output turns ON.

↓

(12) "OUT0" (INP) output turns OFF.

↓

(12) "BUSY" output turns OFF.

↓

Traveling to target position 2 is completed.

∗Keep SVON signal ON after returning to origin.
(Refer to 7.4 Parallel I/O signals (P.29) for more details)

SMC

12.3 Pushing operation example

Example: The table travels to the position 9 mm from the origin within 1 second with a 500 grams load, and starts pushing the workpiece at the position of 9 mm from the origin.

The table decelerates to 6 mm/s when the TL signal is turned ON while moving, and it begins to perform pushing operation with the set pushing force when it reaches the workpiece.

i. Setting example of pulse input signals

Card Motor encoder resolution: 1.25 μm

2-pulse input method:

Target position 1: Travel distance 5 mm, Travel speed 20 mm/s, Acceleration 80 mm/s2, Deceleration 80 mm/s2

* Set a travel distance approximately 1 mm past the workpiece position. (However if the travel distance is too long, returning will take longeras the Card Motor has to catch up deviant pulses.)
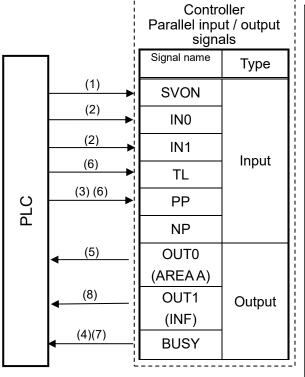
ii. Calculation example

Travel distance [Number of pulses (pulse)] = Travel distance (mm) ÷ Encoder resolution (μm/pulse)

Travel speed [Pulse frequency (pulse/s)] = Travel speed (mm/s) ÷ Encoder resolution (μm/pulse)

Acceleration and Deceleration time [s] = Travel speed (mm/s) / Deceleration (or acceleration) (mm/s 2)

[Calculation example: Target position]
Travel distance: $10 \div (1.25 \times 10\text{-}3) = 8000$ [pulses]
Travel speed: $12 \div (1.25 \times 10\text{-}3) = 9600$ [pulses/s]
Acceleration time: $12 \div 120 = 100$ [ms]
Deceleration time: $12 \div 60 = 200$ [ms)

- Step Data setting example

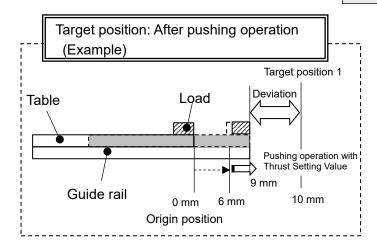| Step No.	Thrust setting value	Load mass (g)
0	2	500

- I/O output setting example

Signal name	Description	Value
OUT0	AREA A	6 to 10
OUT1	INF	1.4

Controller Parallel input / output signals

Signal name	Type
SVON	Input
IN0	Input
IN1	Input
TL	Input
PP	Input
NP	Input
OUT0 (AREA A)	Output
OUT1 (INF)	Output
BUSY	Output

PLC

(1) → SVON
(2) → IN0
(2) → IN1
(6) → TL
(3) (6) → PP
NP
(5) ← OUT0 (AREA A)
(8) ← OUT1 (INF)
(4)(7) ← BUSY

Flow chart (Reference)

(1) Turn "SVON" input ON and return the table to Origin. (Energizingthe Card Motor.)
↓
(2) Select Step Data No. 0. (Turn "IN0" input and "IN1"input OFF.)
↓
(3) Input pulse input signals. Number of pulses: 8000 pulses, Pulse frequency: 9600 pulses/sec Acceleration time: 100 ms, Deceleration time: 200 ms
↓
The table travels to the target position.
↓
(4) "BUSY" signal turns ON.
↓
(5) When the table has reached to the position 6 mm from the Origin, "OUT0" (AREA A) output turns ON.
↓
(6) Turn "TL" signal ON. (Pushing operation starts.) Input pulses for a target position past the position where the Card Motor hits the workpiece.
↓
The table travels at a speed of 6 mm/s.
↓
The Card Motor pushes the workpiece with the pushing force specified by the Thrust Setting Value.
↓
(7) "BUSY" signal turns OFF.
↓
(8) "OUT1" (INF) output turns ON.
↓
Pushing operation completed.
↓
The move to the position set in Step No.2 is completed.

*Keep SVON signal ON after returning to origin. (Refer to 7.4 Parallel I/O signals (P. 29) for more details)

Target position: After pushing operation (Example)

Target position 1
Deviation

Table
Load
Guide rail

Pushing operation with Thrust Setting Value

9 mm

0 mm   6 mm   10 mm
Origin position

⚠ **Caution**

Input the TL signal after reducing the speed sufficiently.

Inputting the TL signal before reducing the speed may cause vibration.

SMC

12.4 Operation after Pushing Operation

Example: Continuing from the operation example in section "12.3 Pushing Operation", the table moves to the target position 2, which is 4 mm from the Origin position, within 0.5 seconds.

 i. Setting example of pulse input signals

  Card Motor encoder resolution: 1.25 μm/pulse
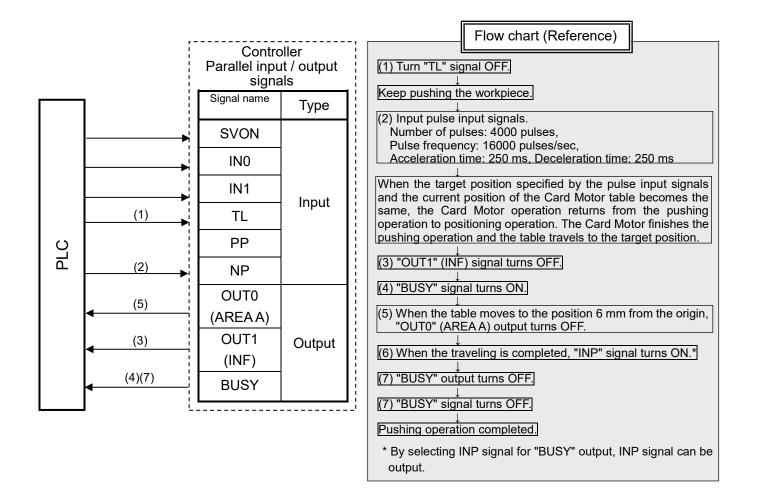
  2-pulse input method:

  Target position 2: Travel distance 5 mm, Travel speed 20 mm/s,

       Acceleration 80 mm/s2, Deceleration 80 mm/s2

 ii. Calculation example

  Travel distance [Number of pulses (pulse)] = Travel distance (mm) ÷ Encoder resolution (μm/pulse)

  Travel speed [Pulse frequency (pulse/s)] = Travel speed (mm/s) ÷ Encoder resolution (μm/pulse)

  Acceleration and Deceleration time [s] = Travel speed (mm/s) / Deceleration (or acceleration) (mm/s 2)

> [Calculation example: Target position]
> Travel distance: $5 \div (1.25 \times 10\text{-}3) = 4000$ [pulses]
> Travel speed: $20 \div (1.25 \times 10\text{-}3) = 16000$ [pulses/s]
> Acceleration time: $20 \div 80 = 250$ [ms]
> Deceleration time: $20 \div 80 = 250$ [ms]

Flow chart (Reference)

(1) Turn "TL" signal OFF.

Keep pushing the workpiece.

(2) Input pulse input signals.
 Number of pulses: 4000 pulses,
 Pulse frequency: 16000 pulses/sec,
 Acceleration time: 250 ms, Deceleration time: 250 ms

When the target position specified by the pulse input signals and the current position of the Card Motor table becomes the same, the Card Motor operation returns from the pushing operation to positioning operation. The Card Motor finishes the pushing operation and the table travels to the target position.

(3) "OUT1" (INF) signal turns OFF.

(4) "BUSY" signal turns ON.

(5) When the table moves to the position 6 mm from the origin, "OUT0" (AREA A) output turns OFF.

(6) When the traveling is completed, "INP" signal turns ON.*

(7) "BUSY" output turns OFF.

(7) "BUSY" signal turns OFF.

Pushing operation completed.

 * By selecting INP signal for "BUSY" output, INP signal can be output.

13. Operation Instructions

13.1 Overview of the operation instructions

Load mass and pushing force are preset in the Step Data, and the Step Data is assigned using the parallel I/O signals.

Card Motor is operated by inputting the pulses to the controller.

Switch to Monitor Mode In the Monitor/Test window, which will terminate the Controller Configuration Software, to use parallel I/O signals and pulse input signals for controlling the Card Motor.

To avoid accidents, any active parallel I/O signals or pulse input signals are ignored when the Controller Configuration Software is started (except when it has been switched to Monitor Mode), or when turning the power ON to the controller.

13.2 Operation procedure of pulse input signal

Refer to the following "Procedures" and "Timing charts" for details of the Return to Origin, operation mode procedures and the signal timing.
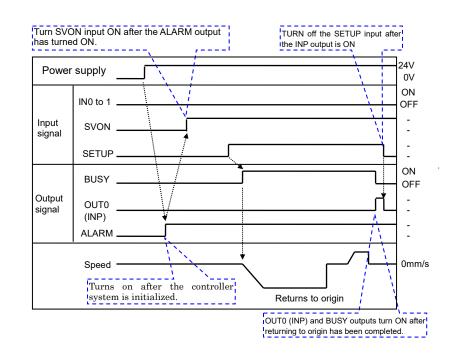
(1) Power on and return to origin position

- Procedure

(when the Multi-counter is not used)-
  i. Turn all of the input signals OFF.
        ↓
  ii. Switch the power supply on.
        ↓
  iii. The "ALARM" output turns ON.
        ↓
  iv. Turn the "SVON" input ON.
        ↓
  v. Turn SETUP input ON.
     Step Data No. (IN0, IN1) are
     read by the controller.
     Return to origin starts.
     The BUSY output turns ON.
        ↓
  vi. When the "OUT0" (INP) output
     turns ON and the "BUSY" output turns
     OFF, the Return to Origin position
     operation has been completed.
        ↓
  (ii) Turn the "SETUP" input OFF.

-Timing chart-

Turn SVON input ON after the ALARM output has turned ON.

TURN off the SETUP input after the INP output is ON

Turns on after the controller system is initialized.

Returns to origin

OUT0 (INP) and BUSY outputs turn ON after returning to origin has been completed.

⚠Caution

After supplying power, ensure that no operation command input signals are activated before the ALARM output has turned ON.

The controller will be initializing from when the power supply is turned ON until the ALARM output has turned ON.

Make sure to turn off the SVON and SETUP signals before supplying power to the controller.

If power is supplied while the SVON and SETUP signals are ON, it may cause a return to origin error.

Pulse input signals should not be input before the SETUP signal has been turned OFF. Pulse input signals input while the SETUP signal is ON are discarded.
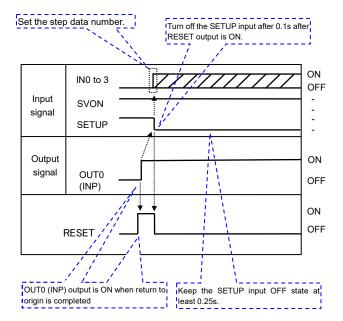
- Procedure (when the Multi-counter is used)-

Perform the step (i) to (vi) of the Procedure (when the Multi-counter is not used).

↓

(vii) When the "OUT0" (INP) output turns ON and the "BUSY" output turns OFF, the Return to Origin position operation has been completed.
At the same time, RESET output is ON

↓

(viii) Keep the SETUP input ON state while the multi-counter performs the reset operation (0.1s).

↓

(ix) Turn off "SETUP" input.

↓

(x) Keep the pulse input signal OFF while the multi-counter completes the reset process (0.25 seconds).

↓

(xi) Set the step from IN0 to IN1.
(Select the corresponding combination of high and low status for the Step Data No. inputs (IN0 to IN1).)

↓
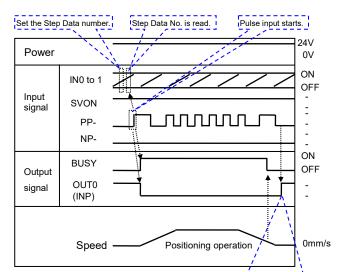
For the rest, refer to the procedure from step (ii) of origin position procedure.

Set the step data number.

Turn off the SETUP input after 0.1s after RESET output is ON.

OUT0 (INP) output is ON when return to origin is completed

Keep the SETUP input OFF state at least 0.25s.

(2) Positioning operation

- Procedure -

i. Select the Step Data No. by inputs (IN0, IN1).

↓

ii. Send the pulse input signals.
(The controller reads Step Data No. (IN0, IN1), and the positioning movement starts.)

↓

iii. OUT0 (INP) output is turned OFF.

↓

iv. When the Card Motor startsthe operation, the BUSY output turns ON.

↓

v. BUSY output turns OFF
when the pulse input signal is not input for at least 10[ms] and Card Motor speed is reduced to the specified speed of 2 mm/sec or less.

↓

vi. If a pulse input signal is not received for 10 ms or longer, OUT0 (INP) output turns ON when the difference becomes smaller than the "positioning width".

-Timing chart-

Set the Step Data number.

Step Data No. is read.

Pulse input starts.

OUT0 (INP) output is turned ON when the pulse train signals are not input for 10 ms or more and when the deviation with the target position becomes larger than the positioning width.

SMC

⚠ Caution

While the product is being operated in 2-pulse (CW and CCW) mode, do not input the pulse input signals to PP and NP at the same time.
Maintain 10 ms or more interval before inputting reversed pulse signal when changing the actuator moving direction. The minimum interval depends on the operating speed and load. * It should not be shortened more than necessary.
Select the step data No. (IN0, IN1) when the BUSY signal is turned OFF. If a pulse input signal is input or the step data No. (IN0, IN1) is changed while the BUSY signal is ON, the selection will be invalid.
After changing the IN0 or IN1 signals, wait for 10 ms or more before inputting pulse input signals.
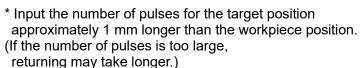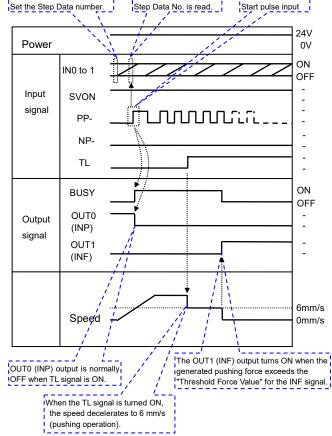
(3) Pushing operation

- Procedure -   **-Timing chart-**

i. Assign the Step Data No. (IN0, IN1) according to the required pushing force and applied load mass that have been set in the Step Data.

↓

ii. Input pulse signals.*

↓

iii. Turn the "TL" signal ON.
The table starts travelling at a speed of 6 mm/s when the TL signal is turned ON.

↓

iv. The OUT0 (INP) output turns OFF.

↓

v. The BUSY output turns ON.

↓

vi. Pushing is completed when the INF output turns ON

* Input the number of pulses for the target position approximately 1 mm longer than the workpiece position.
(If the number of pulses is too large, returning may take longer.)

Set the Step Data number.   Step Data No. is read.   Start pulse input

OUT0 (INP) output is normally OFF when TL signal is ON.

The OUT1 (INF) output turns ON when the generated pushing force exceeds the "Threshold Force Value" for the INF signal.

When the TL signal is turned ON, the speed decelerates to 6 mm/s (pushing operation).

⚠ Caution

In order to stop the table, input the number of pulses so that the Target Position becomes the required stopping position. Even if the TL signal is turned OFF, pushing operation will continue until the target position of the pulse input and the table position will match, and the table will continue to move to this position if the workpiece is removed.
When moving from the pushing operation to the next operation, follow the steps in (4) Pushing operation completed on the next page. If the table stops while pushing the workpiece, the pushing operation is maintained even though the TL signal is turned OFF.

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(4) Pushing operation completed.

- Procedure -

i. Turn TL signal OFF.

↓
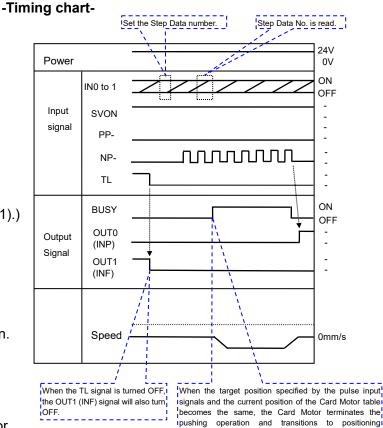
ii. INF signal turns OFF.

↓

iii. Assign the Step Data No. (IN0, IN1)
according to the applied load mass that
has been set in the Step Data.

↓

iv. Enter pulse input signals for the reverse
direction to the pushing operation direction.
(The controller reads Step Data No. (IN0, IN1).)

↓

v. When the target position specified by the
pulse input signals and the current position
of the Card Motor table becomes the same,
the Card Motor terminates the pushing
operation and starts the positioning operation.

↓

vi. When the Card Motor starts the operation,
the BUSY output turns ON.

↓

vii. BUSY output turns OFF when the Card Motor
speed is reduced to the specified speed of 2 mm/sec or less.

↓

viii. If a pulse input signal is not received for
10 ms or longer, the OUT0 (INP) signal turns ON
when the deviation becomes the same as
"positioning width" or smaller.

-Timing chart-

Set the Step Data number.

Step Data No. is read.

When the TL signal is turned OFF, the OUT1 (INF) signal will also turn OFF.

When the target position specified by the pulse input signals and the current position of the Card Motor table becomes the same, the Card Motor terminates the pushing operation and transitions to positioning operation.
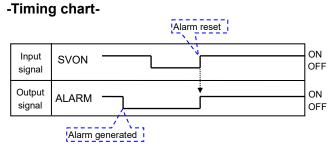
(5) Alarm reset

- Procedure -

(i) An alarm has been generated.
(The "ALARM" output is OFF.)

↓

(ii) Turn the "SVON" input OFF.

↓

(iii) Turn the "SVON" input ON.

↓

(iv) The "ALARM" output is turned ON.

-Timing chart-

Alarm reset

Alarm generated

∗ ALARM is displayed in negative logic.

⚠ **Caution**

Use a 2 msec interval or more between input signals, and maintain the signal state for
at least 2 msec.
Refer to section **11.4 Response time for the controller input signal (P.57)**for details.

SMC

14. Card Motor Controller Configuration software

14.1 Setup

Describes how to set up the configuration software and communicate to the controller.

Connect the controller to the computer using a configuration cable (4. External connection for wiring) to power on the controller.

When performing testing or monitoring, connect the card motor to the controller and turn on the power to the controller.

(1) Install the configuration software

   After installing the USB driver for the configuration cable, copy the execution file to your PC's desktop. Refer to the installation manual for details.

(2) Start-up

   Double-click the icon shown below. Then the screen shifts to the COM port number and communication speed selection screen.

LATC_Configurator.exe

(3) Select the COM port and communication speed

   Select the COM port number of the computer to which you have connected the configuration cable and the communication speed that you have set for the controller, and click Next.

   ∗Default communication speed of the controller is 19200.

The COM port of the computer to which the configuration cable is connected is displayed.

Available from the configuration software Ver2.2.

[COM port number and communication speed selection screen]

After a successful connection, the same COM port and the same communication speed will be selected automatically at each start up.

(COM port number and communication speed configuration screen is not displayed.)

- When the COM port is not found, "COM port not found" is displayed.
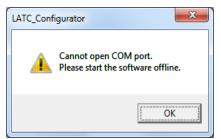
Check that the connection of the cables and installation of the USB driver.

(Refer to the Installation Manual).

SMC

When you click "Next" while "COM port not found" is displayed, the following message is displayed, and the configuration software starts in off-line mode.
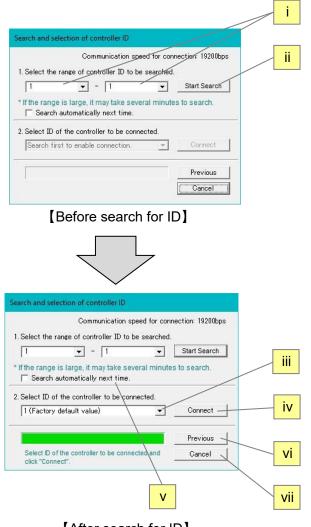
Only [Step Data Setup], [Save] and [Open] can be carried out in offline mode.

(4) Assignment of controller ID

The ID is stored in the controller. (Default is 1.)

Click [Start Search] to search the ID of the controller connected to the PC. Select the ID of the controller to be connected after the search operation has been completed and click [Connect].

【Before search for ID】

【After search for ID】

i. **Search range of the controller**
Specify the range of IDs to be searched.
When the ID of the controller to be connected is already known, specify the numbers, for example from 1 to 1.
   ＊ When the range is specified, for example from 1 to 3, the ID of the controllers which are connected to the PC is searched in the range of 1 to 3.

ii. **Start Search**
ID of the controller connected to the PC is searched, and the result is shown in

iii. **ID of the controller to be connected**
Specify the ID of the controller to be connected.

iv. **Connect**
Connects to the controller with the selected ID.

v. **Search automatically from the next time.**
Once this box is checked, the selected range is automatically searched from the next time after selecting the COM port.

vi. **Return**
Returns to the COM port number and communication speed selection screen

vii. **Cancel**
When this button is pressed during search, the search is cancelled.
When this button is pressed except when searching, the connection is cancelled and the configuration software will start up with the controller unconnected.

In the following situations, the controller ID is not displayed in (4)iii. because the controller cannot be connected and the controller cannot be found.

1. The controller is powered off.

2. The configuration cable is not fully connected.
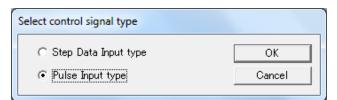
3. Communication speed set in the controller and the communication speed selected in [COM port number and communication speed selection screen] do not match.

In such a case, power up the controller, connect the configuration cable, and check the communication speed, and then search again.

(5) Selection of the input type

When the "Select control signal type" dialog box appears, select Pulse Input type.
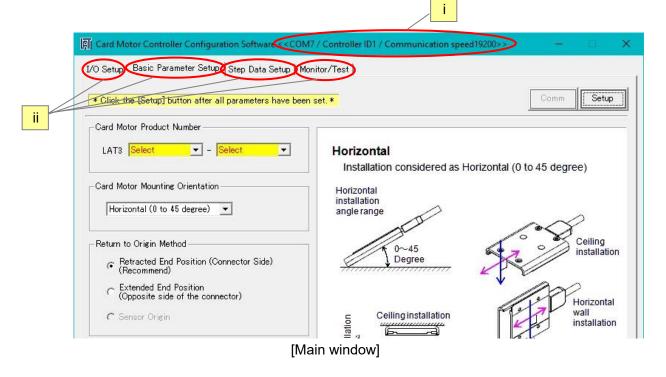
∗If the input type of the controller is already setup, the screen will not be displayed.

When the input type must be changed, initialize the controller and supply power again with reference to section **14.6 Confirmation of the version and Initialization (P.82).**

(6) Main window

i. The main window will be displayed. The connected COM port number, controller ID and communication speed will be displayed in the title bar.

ii. Select a tab according to the application situation.

[Main window]

⚠Caution
Do not turn off the power supply to the controller and do not connect or disconnect the controller setting cable whilst the Controller Configuration software is running.   Turn off the power supply to the controller when disconnecting the controller setting cable.   If the power supply to the controller is turned off whilst the Controller Configuration software is running, turn on the power supply immediately to recover.   If the cable is disconnected, restart the Controller Configuration software after reconnecting the cable.
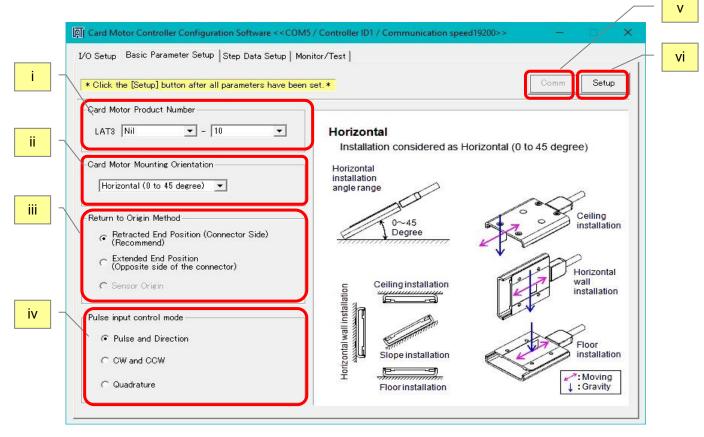
14.2 Basic Parameter Setup window

Register the basic parameter set up of the actuator (Card Motor).

If the controller is connected normally, the data registered in the controller will be displayed in the "Basic Parameter Set up" window immediately after the software starts up.

If the [Setup] button is selected after any of the parameters have been changed, the setting values are saved to the controller connected to the PC.

[Basic Parameter Setup window]

i. Card Motor Product Number

   Select the product number of the Card Motor connected to the controller.

ii. Card Motor Mounting Orientation

   Select horizontal or vertical Card Motor orientation.

iii. Return to Origin Method

   Select the method for returning to home position (Sensor origin can only be selected for the LAT3M-∗ and LAT3F-∗)

iv. Pulse Input Control Mode

   Select the pulse input control method .

   (Refer to the section **9.3 Basic Parameter Setup (P.43)** for details.)

   Pulse and Direction: The actuator can be operated   by inputting 1 pulse signal and 1 direction signal.

   CW and CCW: The actuator can be operated by inputting 2 pulse signals.

   The operation direction is determined based on which pulse input receives the pulse signals.

   Quadrature: The operation direction is specified by the order of 2 pulse input signals.

   - Extended direction --> PP+/PP- leads NP+/NP- 90 degree.
   - Retracted direction --> PP+/PP- lags NP+/NP- 90 degree.

v. Comm (Communication)

If the communication is disconnected whilst the Controller Configuration software is running, the communication can be restored by clicking the "Communication" button.

However, communication cannot be restored unless the cause of the communication disconnection is solved.

vi. Setup

The set Basic Parameters are sent to the controller connected to the PC.

⚠**Caution**
To finalize the settings, execute the controller reset operation as shown below before operating the Card Motor. [Controller reset confirmation message]
If the communication is discontinued during the transmission of the Basic Parameters, the data may not be stored correctly. Disconnect and supply the power to the controller and set and store the data again. If this happens, it may appear that the data has been stored correctly, when the software is restarted and the set data is read from the controller to the software, but the data has actually not been stored to the controller.

SMC

14.3 I/O Setup window

Parallel I/O signals can be checked and output signal functions can be configured.

[I/O Setup window]

i. Input/Output

Displays the current input and output signals status.

Confirm that input signals turn on and off according to the signals output from the device connected to the parallel I/O connector. The PLS indicator changes to green when a pulse signal is input to the controller.

ii. Manual Output

Each output signal can be turned ON and OFF manually regardless of their current status, to check and verify the connections between the controller and a master control device such as a PLC.

Normally the ALARM output is OFF when an alarm has been generated, but the ALARM output can be turned ON manually by pressing the ALARM button.

Manual outputs are cancelled when another window is selected.

Confirm that the input signals of the device connected to the parallel I/O connector turn on and off according to the output signals.

SMC

iii. AREA range

The position ranges for the AREA output signals can be configured.

The setting range is 0-10 mm, 0-20 mm, 0-30 mm or 0-50 mm depending on the stroke of the Card Motor.

Individual position ranges can be set for up to two outputs: "AREA A" and "AREA B".

The resolution for the "Position 1" and "Position 2" settings varies depending on the Card Motor models.

Card Motor type	Resolution
LAT3-∗	0.03 mm
LAT3M-∗	0.005 mm
LAT3F-∗	0.005 mm

The position ranges should be set as follows: Position 1 ≤ Position 2.

The current table position of the Card Motor can be read by pressing the $\boxed{P}$ button after the return to origin has been completed.

∗ If the Card Motor Product Number is changed and downloaded to the controller in the Basic Parameter Setup window then the current Area Range settings will be cancelled.

When a different Card Motor product number is entered, the Area Range values must be set again.

iv. Threshold Force Value

Condition for when the INF, OVC and OVT signals are output.

Settable range - INF: 1 to 5, 1 to 4.8, 1 to 3.9 or 1 to 2.0 depending on the stroke of the Card Motor (increment of 0.1), OVC: 1.5 to 3.0 (increment of 0.1), OVT: 40 to 70 (increment of 10)

The INF signal turns on when the thrust generated has exceeded the threshold value.

The OVC signal turns on when the motor current has exceeded the threshold value.

The OVT signal turns on when the temperature has exceeded the threshold value.

The INF signal can be set regardless of the set thrust value in the step data, so if it is set to a value greater than the set thrust value, it will not be turned ON.

When the Card Motor part number is changed on the Basic Parameter Setup window, each threshold value will be changed to the default value (INF: 0.7, OVC: 2.0, OVT: 70). After changing the Card Motor Product Number, please set the Threshold Force Value again in the I/O Setup window.

⚠Caution
Threshold value is a reference. Check the operating conditions before setting the card motor.

v. Configuration of Output Signals

The function of the parallel I/O output signals OUT0 and OUT1 can be selected.

Another signal function can also be assigned to the BUSY output terminal. It is possible to use the same function for more than one output terminal.

Refer to **7.4 Parallel I/O Signals (Pulse Input Type) (P.29)** for details of the output signals.

vi. Comm (Communication)

If the communication is interrupted whilst the Controller Configuration Software is running, the communication can be restored by clicking the "Comm" button.

However, the communication may not be completely restored unless the cause of the communication disconnection is solved.

vii. Setup

Changed values are sent to the controller connected to the PC.

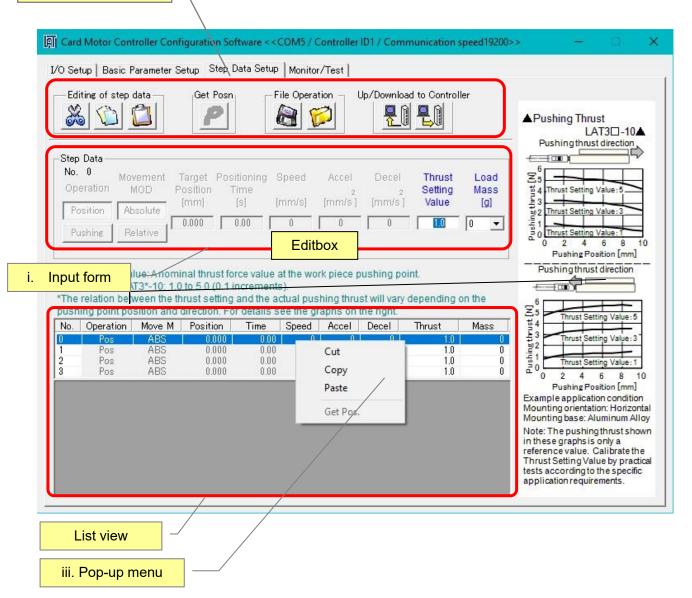However, the Manual Output status will not be saved.

14.4 Step Data Setup window

The actuator (Card Motor) operation can be registered with up to 4 operations (steps).

When [Upload] 🖥️ is executed, the applicable data registered in the controller is displayed in the List view.

If [Download] 🖥️ is executed after the settings have been changed, the setting values are sent to the controller connected to the PC.

[Step Data Set up window]

i. List view and Input form

When an item in the List view is selected, the content can be edited in the input form (i).

Other step data lines can be selected and edited using one of the following methods:

a)Select the step data line in the List view.

b) Press the Enter keyto skip to the next data line in List view or Input form.

c) Press the up or down arrow keys (↑↓) in List view or Input form.

Store the content of the changed step data to the controller by selecting the download 🖥️ button in the Command buttons area (ii). Data in the Input form can be cancelled by pressing the Esc key.

a) Thrust Setting Value (Thrust)

Set the maximum force for the pushing operation. The setting range is 1 to 5, 1 to 4.8, 1 to 3.9 or 1 to 2.0 depending on the stroke of the Card Motor.

The Thrust Setting Value can be selected when [Pushing] has been selected in [Operation] in the "Basic Parameter Set up" window.

The Thrust Setting Value can be set in increments of 0.1.

∗ The Thrust Setting Value should be less than the allowable thrust setting force of the Card Motor used.

Refer to the LAT3 series (Card Motor) operation manual for the allowable thrust force setting values.

b) Load Mass (Mass)

Set the load mass of the work piece mounted on the Card Motor. The setting ranges from 0 to 1000 g in increments of 50 g.

∗ The selected load mass is a nominal value, therefore check the operation sufficiently before setting and using the Card Motor and controller.

∗ The controller uses the load mass value set for "Step Data No.1" for the Return to Origin operation, and for Jogging and Inching. Confirm that the load mass set for "Step Data No.1" corresponds to the Return to Origin and/or Jogging and Inching operations.

⚠ Caution

Set the "load mass" value for the Step Data as close as possible to the load mass mounted onto the table. Avoid changing the load mass whilst the table is moving.

The table may vibrate if there is a large difference between the "load mass" set in the Step Data and the load mass mounted on the table.

---

ii. Command buttons

✂ Cut

Cut the selected step data.

☐ It is possible to cut the step data in the list view by right-clicking and selecting [Cut] from the pop-up menu.

📄 Copy

Copy the selected step data.

☐ It is possible to copy the step data in the list view by right-clicking and selecting [Copy] from the pop-up menu.

📋 Paste

The copied or cut data can be pasted to the selected step data.

☐ It is possible to paste the step data in the list view by right-clicking and selecting [Paste] from the pop-up menu.

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 Save

Save the step data as a text file to the PC.

 Open

Read the Step Data from the stored text file and display it in the List view (i).

 Upload

Upload the data stored in the controller to the Seting software (PC),and display it in the Configuration software window (Controller -> PC).

 Download

Download the data in the configuration software to the controller (PC -> controller).

⚠ **Caution**
If the process is interrupted whilst uploading data from the controller, the data may not appear correctly in the controller configuration software. In this case, upload the data again. Disconnect and supply the power to the controller and set and store the data again. Disconnect and supply the power to the controller and set and store the data again. If this happens, it will appear as if the data has been stored correctly when the software is restarted and the set data is read from the controller, but the data has actually not been stored to the controller.

iii. Pop-up menu

When right-clicking the List view, the pop-up menu will be displayed.

14.5 Monitor/Test window

This screen is used to monitor the input and output status of the controller when it is connected to the PLC and to perform operation tests of the Card Motor by using the set step data.

[Monitor/Test window]

i. Status display

Current parallel I/O status, current step data No., position, speed and pushing force are displayed on the computer (after the Return to Origin operation has been performed). All values shown in this display are reference values only.

* After return to origin, the step data number is indicated as "99" until the product is operated by the next step data.

ii. Alarm window

The latest alarm status or alarm history can be checked. The current alarm status can be displayed by pressing the [Current] button. The alarm history can be monitored by pressing the [History] button. The background is usually gray, but in case of error, it is changed to red, showing the current alarm status. When the background is gray, the error history is displayed until the alarm history is cleared.

The alarm history can be cleared by pressing the [Alarm reset] button below it.

∗The alarm history is not reset by turning off the power. Please reset the history after releasing the alarm once after generating the alarm. (Refer to section **16. Alarm Detection (P.91)**.)

iii. Test mode/Monitor mode

By switching to Monitor Mode the Card Motor can be operated with external parallel I/O signals, and the operating status can be monitored. (In Monitor Mode, it is not possible to control the operation using the controller configuration software).

Turn OFF all input signals before switching to Monitor Mode.

Once the mode is changed to Monitor Mode, perform Return to Origin position by PLC before use.

Note that every control function is cancelled when switching between Monitor Mode and Test Mode.

SMC

iv. Servo

When this button is clicked, a command to energize the Card Motor is sent to the controller.
When this button is clicked again, a command to de-energize the Card Motor is sent to the controller.
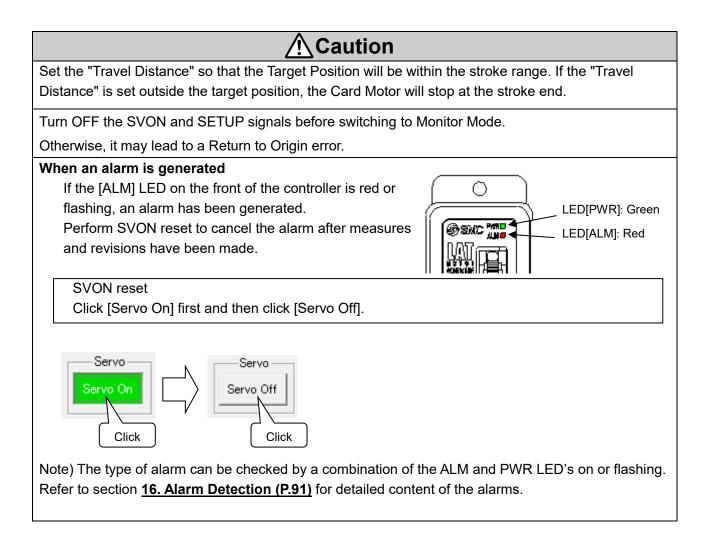
v. Return to Origin

When this button is clicked, a return to origin command is immediately sent to the controller.
After the return origin operation has been completed, this button is cancelled automatically.
Select the method for the Return to Origin operation from the [Return to Origin Method] menu in the "Basic Parameter Setup" window.

vi. Jog

Whilst the Jogging button is pressed, the Card Motor table moves at the speed set in the "Speed" list box or with the slide button. When this button is released, the Card Motor table stops operating. The button on the right is the + direction (opposite side to the connector), and the button on the left is the - direction (connector side).

vii. Inching

By clicking this Inching (Move) button the Card Motor table moves the distance set in the "Move Distance" list box. Moves to + direction (opposite side to the connector) by pressing the + button. - direction (connector side) by pressing the - button.

⚠ Caution
Set the "Travel Distance" so that the Target Position will be within the stroke range. If the "Travel Distance" is set outside the target position, the Card Motor will stop at the stroke end.
Turn OFF the SVON and SETUP signals before switching to Monitor Mode. Otherwise, it may lead to a Return to Origin error.

When an alarm is generated
 	
    If the [ALM] LED on the front of the controller is red or flashing, an alarm has been generated.
    Perform SVON reset to cancel the alarm after measures and revisions have been made.
 	
LED[PWR]: Green
LED[ALM]: Red
 	
    SVON reset
    Click [Servo On] first and then click [Servo Off].
 	
Note) The type of alarm can be checked by a combination of the ALM and PWR LED's on or flashing. Refer to section **16. Alarm Detection (P.91)** for detailed content of the alarms.

14.6. Controller ID / communication setting

The following describes how to set the controller ID, communication speed, and minimum communication delay time.

(1) From the title menu (right-click the icon in the upper left), select ID and Communication configuration.
(2) Enter bps in the input dialogue and click OK. ("***" will be displayed.)

Input dialogue

(3) ID and Communication speed configuration screen is displayed.

Click i for changing the configuration.

i. Check the box for confirmation of configuration changes

Click to check when changing the Controller ID and communication configuration.

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ii. Controller ID settings (setting range 1-16)

The Controller ID can be changed.

∗Default controller ID: 1

⚠ Caution

There should be only one controller with the selected controller ID.

If the controller ID is the same as that of another connected controller, the response data may

get jammed as the following settings will be transmitted to all the same controller IDs.

---

iii. Communication speed

Specifies the communication speed of the controller
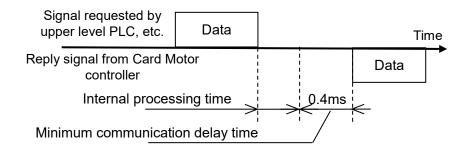
Set value [bps]:2400,9600,19200,38400,57600

∗Default communication speed of the controller[bps]: 19200

iv. Minimum communication delay time

Sets the delay time (shown below) between when the controller receives communication from

the upper PLC, etc. and starts communication of the response.

Setting range [ms]: 0.1 to 10.2 (0.1 ms increments)

∗Default minimum communication delay time of the controller[ms]: 1.0

v. Setting

Set from ii to iv to the controller connected to the PC.

Finish the configuration software and turn off the controller power supply again.

⚠ Caution

Store the ID and communication speed of the modified controller with care, for example, by printing.

If the ID and communication speed of the controller become unknown, communication with the

controller may not be possible.

Set the controller ID to a value of 16 or less that does not overlap with other controllers.
It can be set from 1 to 255, but if a large value is set, the ID search range of the configuration
software will expand, so the search may take a long time.

If the ID and communication speed settings are changed, be sure to keep a record of the settings after the change (for example by printing).
If the communication settings of the upper level device do not match the ID and communication
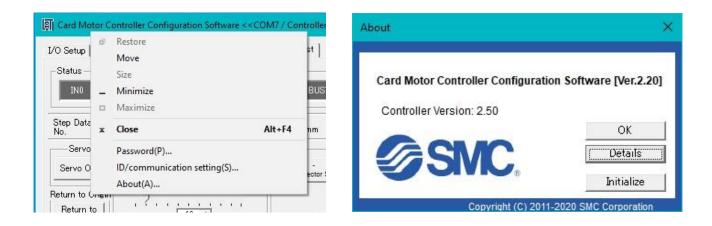speed set on the controller, communication cannot be performed.

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14.7 Confirmation of the version and initialization

The version of the configuration software can be checked by clicking the icon in the upper left corner of the title bar, and then selecting "About(A)...". The version information window will be displayed.

The controller version will be displayed by clicking the "Details" button.

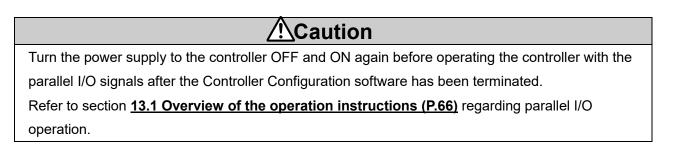When the [Initialize] button is clicked, the controller will be initialized to default settings.

[Pop-up menu]

[Version information window]

14.8 Closing the software

The software can be closed by clicking the [Close] button on the top right of the window or from the title menu (by clicking the icon on the top left and then selecting "Close").
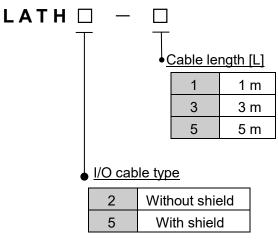

⚠Caution

Turn the power supply to the controller OFF and ON again before operating the controller with the parallel I/O signals after the Controller Configuration software has been terminated.

Refer to section **13.1 Overview of the operation instructions (P.66)** regarding parallel I/O operation.

∗ An operation test of this controller and configuration software can be performed by using only the controller and the configuration software with the following minimum requirements: [CPU speed 2.53 GHz, 2 GB RAM, Windows 7 Professional operating system], [CPU speed 1.6 GHz, 2 GB RAM, Windows 8.1 operating system], [CPU speed 2.4 GHz, 8 GB RAM, Windows 10 Professional operating system]. Note that depending on the specifications of the used PC and the operating conditions, the Card Motor may not operate in accordance with the set time, even if the test operation time is set to minimum.

∗ Windows®7, Windows®8.1, Windows®10 are registered trademarks of the United States Microsoft Corporation.

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15. Options

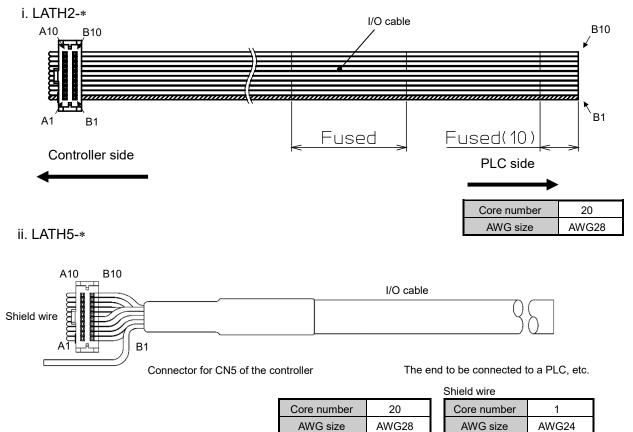## 15.1 I/O cable

(1) How to Order the I/O cable

L A T H □ ─ □

Cable length [L]

1	1 m
3	3 m
5	5 m

I/O cable type

2	Without shield
5	With shield

(2) Parallel I/O cable connector terminals

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

∗Refer to section 7.6 Parallel I/O connector wiring for details of the wiring.

(3) Dimensions of the I/O cable

i. LATH2-∗

Controller side

Fused   Fused(10)

PLC side

Core number	20
AWG size	AWG28

ii. LATH5-∗

Shield wire

Connector for CN5 of the controller

The end to be connected to a PLC, etc.

Core number	20
AWG size	AWG28

Shield wire

Core number	1
AWG size	AWG24

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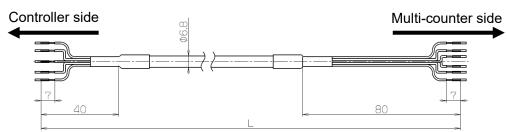
15.2 Counter cable

(1) How to Order

L A T H 3 - 1

● Cable length (L)

1	1m
3	3m
5	5m

(2) Dimensions

Controller side ←   φ6.8   → Multi-counter side

7   40   L   80   7

(3) Wiring diagram

Counter plug

Phase B
Phase A
GND
RESET
FG

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

White
Blue
Red
Black

Yellow
Brown

Green
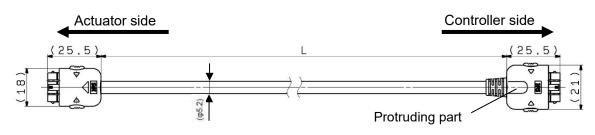
15.3 Actuator cable

(1) How to Order

L A T H 1 - 1

● Cable length (L)

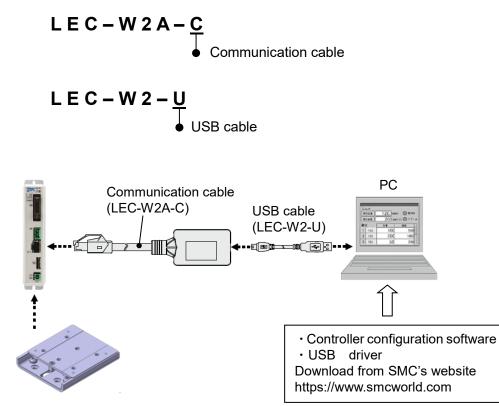| 1	1m
3	3m
5	5m

Note) There is direction for the actuator cable.

Connect the actuator side to the card motor.

There is a raised part on the controller side.

(2) Dimensions

Actuator side ←   Controller side →

(25.5)   L   (25.5)

(18)   (φ5.2)   (21)

Protruding part

15.4 Controller setting cable

(1) **How to Order**

L E C – W 2 A – C

● Communication cable

L E C – W 2 – U

● USB cable

Communication cable
(LEC-W2A-C)

USB cable
(LEC-W2-U)

PC

・Controller configuration software
・USB　driver
Download from SMC's website
https://www.smcworld.com

(2) **Operating environment**

IBM PC/AT converter with Windows®7, Windows®8.1 or Windows®10 with USB1,1 or USB2.0 port.

Windows®7, Windows®8.1, Windows®10 are registered trademarks of the United States Microsoft Corporation.

SMC

15.5 Multi-counter CEU5

Please refer to the operation manual for the CEU5 series Multi-counter for further details.
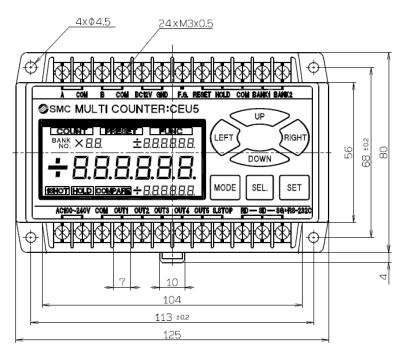
(1) How to Order the Multi-counter

C E U 5 □ □ — □
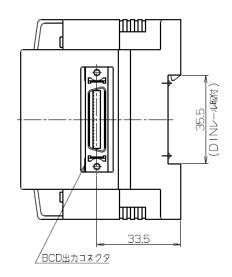
Power supply voltage

NIL	100 VAC to 240 VAC
D	24 VDC

External output

NIL	RS-232C
B	RS-232C + BCD

Output transistor type

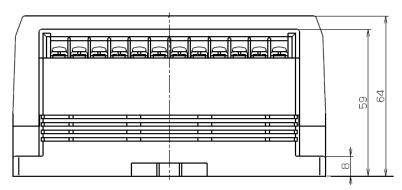| NIL	NPN open collector output
P	PNP open collector output

(2) Multi-counter type

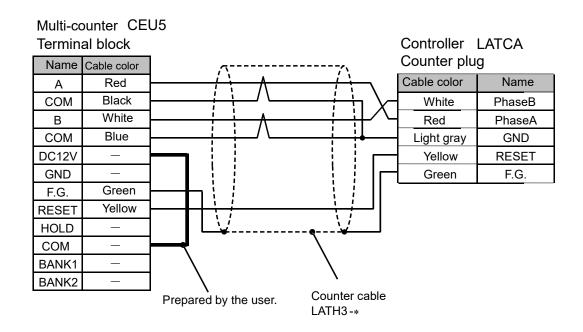| Model No.	CEU5∗∗-∗
Mounting direction	Surface mounting (Fixed by DIN rail or screws)
Operation mode	Operating mode, data setting mode, function setting mode
Display type:	LCD (with back light)
Number of digits	6 digits
Counting speed (kHz)	100
Insulation resistance (MΩ)	Between the housing and AC line: more than 500 VDC and 50 MΩ or more
Ambient temperature (°C)	0 to 50°C (no freezing)
Operating ambient humidity (%RH)	35 to 85 (no freezing)
Weight [g]	350 or less

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(3) Multi-counter dimensions

4xΦ4.5 24xM3x0.5

SMC MULTI COUNTER:CEU5

A COM B COM DC12V GND F.G. RESET HOLD COM BANK1 BANK2

COUNT PRESET FUNC

BANK NO.

UP
LEFT RIGHT
DOWN

MODE SEL. SET

1SHOT HOLD COMPARE

AC100~240V COM OUT1 OUT2 OUT3 OUT4 OUT5 S.STOP RD SD SG RS-232C

7 10
104
113 ±0.2
125

56
68 ±0.2
80
4

35.5 (DINレール取付)

33.5

BCD出力コネクタ

59 64
8

(4) Multi counter wiring example

Multi-counter CEU5
Terminal block

Controller LATCA
Counter plug

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

Cable color	Name
White	PhaseB
Red	PhaseA
Light gray	GND
Yellow	RESET
Green	F.G.

Prepared by the user.

Counter cable
LATH3 -∗

(5) How to operate

When executing Step data No. 0 (Return to Origin Position), the RESET signal is output from the controller after the [Return to Origin Position] operation has been completed. With this operation, the CEU5 is reset and the position is set to zero, both in the controller and Multi-counter.

When [Sensor Origin] is selected as the [Return to Origin Method] in the "Basic Parameter Set up" window, the sensor origin position is set to zero. When [Extended End Position] is set as the origin position, the position after full-stroke is set to zero. Therefore, an offset in the counter position adjustment function must be added as required.

When returning to the origin (at the retracted end and extended end), a reset is performed at the position 0.3mm from the end position at which it hits.

If the position where the table comes into contact with the external workpiece needs to reset the counter, reset the counter separately using the PLC etc. with the table pushed up against the workpiece.

⚠ Caution

CEU5 Multi-counter parameter settings:

Switch the CEU5 Multi-counter to Function mode [FUNC.] and set the Pre-scale [PRESCL] parameters to match the connected Card Motor model according to the specifications in the table below.

	LATH3-∗	LAT3M-∗	LAT3F-∗		
Encoder resolution (µm)	30	5	5	2.5	1.25 [Note 1]
Connected model	MANUAL				
Multiplier factor	X4	X4	X1	X2	X4
Value per 1 pulse	00.0300	00.0050	00.0050	00.0025	0.00125
Decimal point position	**.****				*.*****
Input type	2PHASE				

Note 1) Since the CEU5 Multi-counter has a 6-digit display, the tens of digits 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 when the Card Motor travels at high speed.

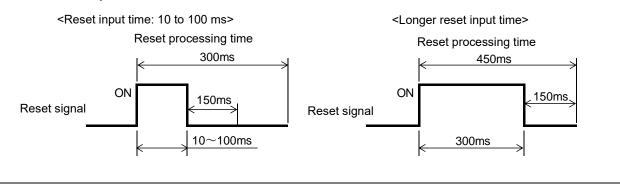Refer to the CEU5 Multi-counter operation manual for setting details.

The reset processing time is approximately 300 ms after reset is input. The count operation should be performed after 350 ms or more has lapsed after the reset.

If the reset signal is input from a PLC, the input time should be 10 to 100 ms.

For a longer reset input time, the processing time takes approximately 150 ms from startup of the reset signal, and this will increase the total reset processing time.

If the table moves before the counter reset process is complete, the display value of the multi-counter may be shifted.

<Reset input time: 10 to 100 ms>

Reset processing time
300ms

Reset signal ON
150ms
10～100ms

<Longer reset input time>

Reset processing time
450ms

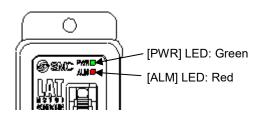Reset signal ON
150ms
300ms

16. Alarm Detection

It is possible to check the type of an alarm by a combination of the ALM and PWR LED's on or flashing. When an alarm is generated, de-activate the alarm after troubleshooting and correct the error with reference to section **16.2 Alarms and countermeasures (P.92)**.

Alarms are divided into two types. One alarm type can be cleared by resetting the SVON input signal (ON-OFF-ON). The other type cannot be cleared unless the power supply to the controller is turned off.

16.1 Alarm LED display

The controller uses an LED display to indicate the type of alarm when an alarm is generated.

Content of alarm	LED		
	PWR	**ALM**	**Flashing type**
Memory error	Flashing	Flashing	Flashing alternately at 0.5 seconds
Actuator cable disconnected.	Flashing	Flashing	Flashing alternately at 1 s seconds
Temperature error	Flashing	Flashing	Flashing simultaneously at 0.5 seconds
Over current error	Flashing	ON	PWR flashing at 0.5 seconds
Pulse input error	ON	Flashing	ALM flashing at 1 seconds
Parameter error	ON	Flashing	ALM flashing at 0.5 seconds
Return to origin position not executed error	ON	ON	-

[PWR] LED: Green

[ALM] LED: Red

16.2 Alarms and countermeasures

Alarm name	Recovery method	Content / Countermeasure
Memory error	—	**<Content of error>** Internal memory failure. Check if the conditions described below have occurred. (1) Power supply disconnected during data storing. (2) Disconnection of the power supply voltage. (3) Noise due to crossing of cables and power lines. **<Countermeasure>** Please contact your SMC sales representative.
Actuator cable disconnected	Turn off the power and then turn in on again after connecting the Card Motor	**<Content>** When operation signal is input to the controller with Card Motor unconnected to the controller, this error occurs. **<Countermeasure>** Check the connection of the Card Motor and actuator cable. After the power is off, connect the Card Motor to the controller via an actuator cable, and start the operation again after turning on power or turning off the SVON signal.
Temperature error	Turn the power off and on again or reset using the SVON input.	**<Content of error>** The rated temperature has been exceeded due to increase in the temperature of the motor. Check if the conditions described below have occurred. (1) The product is used in a location where the specified ambient temperature is exceeded. (2) There is a heat generating source near the Card motor. (3) The product is used with a force exceeding the allowable thrust setting value. **<Countermeasure>** Review the ambient temperature and check the operation after supplying power again or after turning the SVON input signal OFF temporarily. ⚠**Caution** 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, a temperature error can be generated due to unstable temperature information. Check the Card Motor and controller connection.
Over current error (Motor overload error) (Over current error)	Turn the power off and on again or reset using the SVON input.	**<Content of error>** This alarm is generated when the Card Motor has been overloaded causing an overcurrent to flow through the Card Motor, or when overcurrent flows through the parallel output terminals. Check if the conditions described below have occurred. (1) Motor overload error - The Card Motor cannot reach the target position during positioning due to obstacles. (2) Over current error - The connection of the output signal is not correct. **<Countermeasure>** Check the Card Motor type and rated value. Turn the power off and on again. Check the operation again after turning the SVON input signal OFF.

SMC

Pulse input error (Pulse frequency error) (Pulse overflow error)	Turn the power off and on again or reset using the SVON input.	**<Content of error>** This error occurs when the input of the pulse input signals is incorrect. Confirm whether any of the conditions described below have occurred. (1) Pulse frequency error This error occurs when the pulse signal frequency exceeds the specified value. (2) Pulse overflow error This error occurs when the pulse counter in the controller overflows. **<Countermeasure>** Check the pulse signal. Turn off and on the power supply or the SVON input signal and use within the specifications.
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.	**<Content of error>** [Card Motor product number] has not been selected. **<Countermeasure>** After selecting [Card Motor product number], check the operation again after turning off and on the power supply or turning the SVON input signal OFF.
Return to origin position non-execution error	Turn the power off and on again or reset using the SVON input.	**<Content of error>** This error occurs when the DRIVE signal turns on while SVON signal is on before the controller system is initialized (ALARM output turning on) or the operation instruction is executed when the return to origin position has not been executed. **<Countermeasure>** Power on again or turn off the SVON signal once before performing a return to origin.

SMC

17. Controller and Peripheral Devices Specific Precautions

17.1 Design and selection

⚠ **Warning**

1. The specified voltage must be used.

Otherwise, malfunction and damage to the controller may result.

If the applied voltage is lower than the specified voltage, it is possible that the load cannot be moved due to an internal voltage drop. Check the operating voltage before use. If the current supplied is too low, it may not be able to achieve the maximum force or may cause a malfunction.

2. Do not operate beyond the specifications.

Fire, malfunction, or damage to the product can result. Check the specifications before use.

3. Install an emergency stop circuit.

Install an emergency stop outside of the enclosure so that the system operation can be stopped immediately and the power supply disconnected.

4. In order to prevent danger and damage due to the breakdown and the malfunction of this product, which may occur at a certain probability, a backup system should be established in advance by providing a multiple-layered structure or a fail-safe design to the equipment, etc.

5. If a fire or personal injury is expected due to abnormal heat generation, ignition, smoke from the product, etc, disconnect the power supply to the product and the system immediately.

⚠ **Caution**

1. SMC products are not intended for use as instruments for legal metrology.

Measurement instruments that SMC manufactures or sells have not been qualified by type approval tests relevant to the metrology (measurement) laws of each country.

Therefore, SMC products cannot be used for business or certification ordained by the metrology (measurement) laws of each country.

17.2 Handling Precautions

⚠ **Warning**

1. Never touch the inside of the controller/driver.

It may cause an electric shock or damage to the controller.

2. Do not perform operation or setting of this equipment with wet hands.

It may cause an electric shock.

3. A product that is damaged or missing any components should not be used.

Electric shock, fire, and injury can result.

4. Do not connect the controller to actuators other than the Card Motor.

It may cause damage to the controller or the actuator.

5. Be careful not to be caught or hit by the workpiece while the actuator is moving.

It may cause an injury.

6. Do not connect the power supply or power to the product until it is confirmed that the area where the workpiece moves is safe.
The movement of the workpiece may cause an accident.

7. Do not touch the product when it is energized and for some time after power has been disconnected, as it is very hot.
It may cause burns due to the high temperature.

8. Check the voltage using a tester at least 5 minutes after power-off when performing installation, wiring and maintenance.
Electric shock, fire, and injury can result.

9. Incorrect wiring can cause malfunction or damage the product. Do not touch the controller while power is supplied to it.
Take safety measures against static electricity when it is necessary to touch the controller during maintenance.

⚠ **Caution**

1. When the multi-counter is not used, mount the counter plug (supplied) to the counter connector.
If foreign matter such as metal fragments enters the counter connector, short-circuit may occur.

2. Be sure to perform a return to origin position operation before operating the actuator.
If the origin position is not set, the product will not operate even if a step data command has been selected.

3. The positioning time set and entered in the Controller configuration software is a nominal target value for operation. The positioning time is not guaranteed.
The operation may not have been completed even if the set positioning time has passed. In such a case, detect that the operation has been completed by monitoring the BUSY and INP signals.

4. Set the approximate weight of jigs or workpieces mounted on the Card Motor as the Load Mass in the controller configuration software.
If the value selected in the controller configuration software and the weight of the workpieces are different, the product may vibrate or the positioning accuracy may decrease.

5. The Card Motor may continuously hunt for the target position (vibrate) within the positioning accuracy range, depending on the operating conditions.
Please contact an SMC sales representative for how to improve it.

6. BUSY output signal
The BUSY output signal turns ON when the Card Motor begins to operate, and it turns OFF when the operating speed reaches 2 mm/s or less.
However, when the Card Motor operates at a slower speed than 5 mm/s, the BUSY signal may not turn ON at all.

7. INP output signal
Both in positioning operation and pushing operation, if the specified INP positioning range of the set Target Position is reached, the INP signal will turn ON.
In pushing operation, if the table passes the INP range of the Target Position and stays outside the specified INP positioning range, the signal will turn OFF again.

INP signal output range

Model	Output range (mm)
LAT3F-∗	+/-0.05
LAT3M-∗	+/-0.1
LAT3-∗	+/-0.3

SMC

17.3 Installation

⚠ **Warning**

1. The controller and its peripheral devices should be installed on a fire-proof material.
Direct installation on or near a flammable material may cause fire.

2. Do not install this product in a place subject to vibration and impact.
A failure and malfunction can result.

3. Do not mount this controller and its peripheral devices near to a large electromagnetic contactor or no-fuse breaker which generates vibration on the same panel. Mount them on different panels, or keep the controller and its peripheral devices away from such a vibration source.
A failure and malfunction can result.

4. This controller and its peripheral devices should be installed on a flat surface.
If the mounting surface is distorted or not flat, excessive force may be applied to the housing, etc. causing malfunction.

17.4 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 should be separated between the controller power and the I/O signal power and both Power supplies must not be of the "in-rush current limiting type".
If the power supply is of the "in-rush current limiting type", a voltage drop may occur during the acceleration 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 for the direct current (DC) power supply.
a) Limited voltage current circuit in accordance with UL 508.
A circuit to which power is supplied by a secondary coil of a 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]	100 / Peak voltage

b) Circuit (class 2) with maximum 30 Vrms (42.4 V peak) or less, which uses a class 2 power supply unit in accordance with UL1310 or class 2 transformer in accordance with UL 1585 as the power supply

17.5 Grounding

⚠ **Warning**

1. Make sure the product is connected to ground to ensure the noise resistance of the controller.
Otherwise it may cause malfunction, damage, an electric shock or fire.
Do not share the ground connection with equipment that generates a strong electromagnetic noise.

SMC

2. A dedicated Ground connection must be used.
  Grounding should be to a D-class ground connection. (Ground resistance 100 Ω or less)

3. The Ground connection should be as close as possible to the controller, and the ground wire kept as short as possible.

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

17.6 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 wires and power supply cables together.
  Malfunction due to noise may occur if the digital I/O signal and power cables are routed together.

3. Confirm proper wiring before turning the power on.
  Incorrect wiring will lead to malfunction or may damage the controller or its peripheral devices depending on the seriousness of the wiring error.
  Confirm that there is no mis-wiring before turning 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 is avoided.

17.7 Operating environment

⚠ **Caution**

1. Do not use the product in an area where it could be exposed to dust, metallic powder, machining chips, or splashes of water, oil or chemicals.
  A failure or malfunction can result.

2. Do not use the product in an area where a magnetic field is generated.
  It will cause failure or malfunction.

3. Do not install the product in an environment where flammable gas, explosive or corrosive gas, liquids or other substances are present.
  It could lead to fire, explosion and corrosion.

4. Avoid radiant heat from large heat sources such as direct sunlight or hot furnaces.
  It will cause failure of the controller or its peripheral devices.

5. Do not use the product in an environment subjected to cyclic temperature changes.
  It will cause failure of the controller or its peripheral devices.

SMC

6. Do not use in a place where surges are generated.

When there are units that generate a large amount of surge around the product (for example solenoid type lifters, high frequency induction furnaces, motors, etc.), this may cause deterioration or damage to the product's internal circuit. Avoid surge generation and crossed lines.

7. Neither the Card Motor nor the controllers have the tolerance to the thunder surge.

8. Do not install this product in an environment subjected to vibration and impact.

It will cause failure or malfunction.

9. If this product is used in conjunction with a relay or solenoid valve, use a type with a surge absorbing element built-in.

10. Do not expose the product to a strong light source 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 occur. In such a case, install a light shielding plate

17.8 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 completing maintenance.

In case of any abnormalities (if the actuator does not move, etc.), stop the operation of the system.
Otherwise, an unexpected malfunction may occur and it will become impossible to ensure safety.
Conduct an emergency stop test instruction to confirm safety of the equipment.

3. Do not disassemble, modify or repair this controller or the peripheral devices.

4. Do not put anything conductive or flammable inside of this controller.

Burning or explosion can result.

5. Do not perform an insulation resistance test or insulation withstand voltage test.

⚠ **Caution**

1. Ensure sufficient space for maintenance.

Design the system that allows the required space for maintenance.

18. 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.

18.1 Operation errors

Problems	Possible causes	Investigation method and location of possible causes	Countermeasures
Does not operate at all.	Power supply failure.	Is the green LED in the controller ON?	Check the voltage and current supplied to the controller. → 4. External Connections (P.20) → 5. CN1: Power Supply Plug (P.22)
	External equipment failure	Check that the PLC connected to the controller operates correctly? Test the operation of the controller, using the controller seting software.	Refer to the controller operation manual and take appropriate measures. → 7.4 Parallel I/O signals (P.29)
	Incorrect wiring	Check that the wiring is correct. Refer to the wiring instructions in the controller operation manual and check the wiring for broken wires and short-circuits.	Correct the wiring and check that the input/output connection of each signal is correct. Separate the power supply for the CN1 controller and the CN5 I/O signal power supply. → 4. External Connections (P.20) →7.6 Parallel I/O Connector wiring (example) (P.35)
	Alarm generated	Check if the controller has generated an alarm? Check the type of alarm. Refer to the controller operation manual, and take appropriate measures. When a temperature error has been generated without the Card Motor being heated too much, check the wiring of the Card Motor.	Refer to the controller operation manual and take appropriate measures. → 16. Alarm Detection (P.91) → 4. External Connections (P.20)
	Incorrect specification	Check that the Basic Parameter Setup in the controller (Card Motor product number and mounting orientation) are correct.	Set or correct the product number and mounting orientation of the connected Card Motor. → 14.2 Basic Parameter Setup window (P.73)
	Duplicated operation commands	The parallel I/O signals are activated in "Test Mode" whilst the Controller Configuration software is being started.	Select "Monitor Mode" in the Monitor/Test window of the Controller Configuration software, or terminate the configuration software. → 13.1 Overview of the Operation Instructions (P.66) → 14.5 Monitor/Test window (P.80)
	Signal timing	Confirm whether the parallel I/O signals have been activated after the power supply has been turned on and before the ALARM output has turned ON. Confirm whether the SETUP signal has been turned ON during operation (except when the Card Motor is performing a Return to Origin operation).	Enter the parallel I/O signals after the power supply is turned on and the ALARM signal has been turned ON. When the SETUP signal is turned OFF, the Card Motor table stops, and maintains its current position. Do not turn the SETUP signal OFF until the operation has been completed. →13.2 Operation procedure of pulse input signal(P.66) →7.4 Parallel I/O signals (P.29)
	Incorrect Signal Input	Confirm whether the SETUP signal and CLR signal are turned ON.	If either the SETUP signal or CLR signal is turned ON after Return to Origin position, the pulse input signal will be cancelled. Pulse input signal should not be entered before the SETUP and CLR signals have been turned OFF.

	Non-matching input types	Confirm whether the controller is set to Step Data Input type.	Initialize the controller, and set it to Pulse Input type. → 9.2 Selection of the input type (P.42) → 14.6 Confirmation of the version and initialization (P.82)
	Incorrect parameters	Confirm that the pulse input signal input method is correct. Confirm that the pulse input signal switch setting is correct.	Set the input method in accordance with the pulse input signal and pulse input signal switch setting. → 9.3 Basic parameter setup (P.43) → 8 Details of Pulse Input Signal Switch (P.39)
	Actuator cable disconnected	"Actuator cable disconnected" is displayed in the error window.	Connect the Card Motor to the controller via an actuator cable, and start the operation again after turning off the power to the controller.
	Mismatch of pulse input signals	Do the pulse input signal and controller configuration (voltage, pulse input switch, input mode) match?	Please match the controller setting with the pulse input signal. → 8 Details of Pulse Input Signal Switch (P.39) → 7.3(3) Input circuit of pulse input signal (P27) → Pulse input mode (P44)
Moved normally, but stopped working	Alarm generated	Check if the controller has generated an alarm? Check the type of alarm.	Refer to the controller operation manual and take appropriate measures. → 16. Alarm Detection (P.91)
	Incorrect wiring	Check that the wiring is correct. Refer to the controller operation manual to confirm wiring, and check for broken wires and short-circuits.	Correct the wiring and check that the input / output connection of each signal is correct. Separate the power supply for the CN1controller and the CN5 I/O signal power supply. → 4. External Connections (P.20) →7.6 Parallel I/O connector wiring (example) (P.35)
	Noise	Connect to Ground correctly. Avoid bundling the cables.	Refer to the controller operation manual and take appropriate measures. → 3.4 Mounting (P.18)
	Incorrect Parameter input	Check that the parameter values are correct. Reconfirm if an appropriate controller is used for the actuator.	Modify the parameters and test the operation. → 9.3 Basic parameter set up (P.43)
	Voltage drop	Temporary voltage drop in the power supply.	Check for the possibility of momentary voltage drop due to an inadequate power supply capacity, or that the power supply is an in-rush current limited type. → 3. Controller Specifications (P.15)
	Unsuitable specification	Check that the Basic Parameter Setup in the controller (Card Motor product number and mounting orientation) are correct.	Set or correct the product number and mounting orientation of the connected Card Motor. → 14.2 Basic Parameter Setup window (P.73)
	Signal timing	Check the timing of the signals from the PLC to the controller.	PLC processing delay and controller scan delay are generated. Ensure an interval of 2 msec or more between input signals, and maintain the signal state for at least 2 msec. → 11.4 Response time for controller input signal (P.57)
The Card Motor vibrates.	Unsuitable specification	Check that the Basic Parameter Setup in the controller (Card Motor product number and mounting orientation) are correct.	Set or correct the product number and mounting orientation of the connected Card Motor. → 14.2 Basic Parameter Setup window (P.73)

		Incorrect parameter input	Check that the parameter values are appropriate and that the program is correct. Check and confirm that the load mass value is 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 and switch it on again. Modify the parameters as appropriate and test the operation. → 9.6 Step Data setup (P.50)
		The Card Motor or the workpiece is loose	Check if something has worked loose and confirm that the Card Motor is mounted correctly , and that the workpiece is mounted correctly to the Card Motor table.	Tighten the Card Motor and the workpiece mounting securely. Refer to the LAT3 Card Motor operation manual for details of tightening torques and fixing details.
	Communication with the controller cannot be established. （Controller Configuration software）	The USB driver is not installed	Check that the USB driver is installed.	If the USB driver has not been installed, the driver installation will start automatically when the configuration cable is connected to the PC. For details of the installation procedure refer to the "LATC Configurator Configuration Software Installation Manual". ∗ The USB driver must be installed individually for each COM port. ∗If the installation does not start when the configuration cable is connected to the PC, the USB driver may have already been installed. A specific COM port number is assigned to each configuration cable. Check that the COM port number with the configuration cable connected. 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 Configurator Configuration Software Installation Manual".
		Incorrect COM port setting	Check that the correct COM port is set in the Controller Configuration software.	The COM port assigned to the configuration cable is different depending on the PC. Confirm the COM port number with the configuration cable connected. The COM port number can be checked using the Device Manager of the PC. For details of the COM port checking and setting methods refer to the "LATC Configurator Configuration Software Installation Manual".

SMC

	Connection failure	Confirm the connection status.	Check that the LATCA controller, communication cable, USB cable, and PC are connected correctly. For example, communication cannot be established if the connector has been damaged. Check that the power supply to the controller (LATCA) has been turned on. Communication cannot be established if the power supply is off. If any external equipment (PLC and measurement hardware), other than the LATCA controller, are connected to the PC, disconnect them. (There is a possibility that the other equipment may interfere with the communication.)
	Communication speed is not stable.	Does the communication speed selected in the configuration software match the communication speed set on the controller?	Select a communication speed that matches the communication speed set on the controller.
	The CPU of the PC is busy or overloaded	Confirm that no other applications other than the Card Motor Controller Configuration software are running, and check that the CPU of the PC is not overloaded.	Terminate all other applications except the Card Motor Controller Configuration software.

18.2 Position-Speed-Pushing Force errors

Problems	Possible causes	Investigation method and location of possible causes	Countermeasures
The actuator is displaced from the Origin position	Incorrect Origin position	Check if the Card Motor table can complete the travel to the Origin position when executing the Return to Origin position operation in both extended and retracted direction? Perform the Return to Origin position operation several times to check the Origin position.	Check the actuator's operation (check for foreign matter etc.inside the product).
	Incorrect parameters	Check that the parameter values are appropriate and the program is correct. Check and confirm that the Load Mass value is correct.	Modify all parameters as appropriate and test the operation. → 9. Controller Set Up (P.42)
	Unsuitable specification	Check that the Basic Parameter Setup in the controller (Card Motor product number and mounting orientation) are correct.	Set or correct the product number and mounting orientation of the Card Motor. → 14.2 Basic Parameter Setup window (P.73)
	Operating 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.
	Incorrect pulse input	Confirm that the input pulse is correct.	Modify the pulse and test the operation. →7.4 Parallel I/O signals (Pulse Input Type) (P.29) →12.2 Positioning operation example (P.61)
	Incorrect signal input	Is the CLR signal turned ON?	If the CLR signal is entered, the deviation will be set to 0, and the Card Motor will stop at that position with a different number of pulses. In order to move the table to the target position, ensure that the CLR signal is not turned ON while moving. →7.4 Parallel I/O signals (Pulse Input Type) (P.29)
The Card Motor does not move to the correct position	Incorrect wiring	Check that the wiring is correct. Refer to the controller operation manual to confirm wiring, and check for broken wires and short-circuits.	Correct the wiring and check that the input/output of each signal is correct. Separate the power supply for the CN1controller and the CN5 I/O signal power supply. → 4. External Connections (P.20) →7.6 Parallel I/O connector wiring (example) (P.35)
	Unsuitable specification	Check that the Basic Parameter Setup in the controller (Card Motor product number and mounting orientation) are correct.	Set or correct the product number and mounting orientation of the Card Motor → 14.2 Basic Parameter Setup window (P.73)
	Signal timing	Check the timing of the signals from the PLC to the controller.	A PLC processing delay and controller scan delay are generated. Please ensure an interval of 2 msec or more between input signals, and maintain the signal state. → 11.4 Response time for controller input signals (P.57) → 7.4 Parallel I/O signals (P.29)
	Data not stored correctly	Check that the data (step data, parameter) is stored correctly. Do not turn off the controller power supply or remove the cable while data is being stored.	Turn the power OFF and ON again. Input the correct data (step data, parameter) again and check the operation. → 3.2 Parts Description (P.16) → 9. Controller Set Up (P.42) → 14.4. Step Data Setup window (P.74)
	Incorrect pulse input	Confirm whether the target position of the pulse input signal is outside the stroke.	Modify the pulse signal and test the operation again. → 9.3 Basic parameter set up (P.43)

SMC

	Pulse input mode setting failure	Check that the pulse input signal and controller configuration (voltage, pulse input switch, input mode) match.	Please match the controller setting with the pulse input signal. → 8 Details of Pulse Input Signal Switch (P.39) → 7.3(3) Pulse train signal input circuit (P27) ⇒ Pulse input mode (p44)
	Incorrect signal input	Confirm whether the CLR signal is turned ON.	If the CLR signal is entered, the deviation will be set to 0, and the Card Motor will stop at that position with a different number of pulses. In order to move the table to the target position, ensure that the CLR signal is not turned ON while moving. → 7.4 Parallel I/O signals (P.29)
Card Motor does not reach the required speed.	Incorrect parameters	Check that the parameter values are correct. Check and confirm that the load mass value is correct	Modify the parameters as appropriate and test the operation. → 9.6 Step Data setup (P.50)
	Unsuitable specification	Check that the Basic Parameter Setup in the controller (Card Motor product number and mounting orientation) are correct.	Set or correct the product number and mounting orientation of the Card Motor → 14.2 Basic Parameter Setup window (P.73)
	Voltage drop	Temporary voltage drop in the power supply.	Check for the possibility of momentary voltage drop due to an inadequate power supply capacity, or that the power supply is an in-rush current limited type. → 3. Controller Specifications (P.15)
	Incorrect pulse input	Confirm that pulse input signal frequency is correct.	Modify the pulse signal and test the operation again. →7.4 Parallel I/O signals (Pulse Input Type) (P.29) →12.2 Positioning operation example (P.61)
	Incorrect signal input	Confirm that the Card Motor is in the pushing operation (TL signal is turned ON).	Speed is restricted to 6 mm/s during pushing operation. Stop the pushing operation and check the movement. →12.4 Operation after Pushing Operation (P.61) →13.2(4) Pushing operation completed (P.69)
The Pushing thrust does not reach the thrust setting value.	Incorrect parameters	Check that the parameter values are set correctly for a pushing operation in the Step Data. Confirm that TL signal is turned ON.	Modify all parameters as appropriate and test the operation. Set the speed to be 1 mm/s or more for the pushing operation. → 9.6 Step Data setup (P.50) → 11.3 Pushing operation (P.55)
	Unsuitable specification	Check that the Basic Parameter Setup in the controller (Card Motor Product Number and Mounting Orientation) are correct.	Set or correct the product number and mounting orientation of the Card Motor → 14.2 Basic Parameter Setup window (P.73)
	Voltage drop	Momentary voltage drop in the power supply.	Check for the possibility of momentary voltage drop due to an inadequate power supply capacity, or the power supply is an in-rush current limited type. → 3. Conroller Specifications (P.15)
	Incorrect pulse input	Confirm that the number of pulses of the pulse input signal is correct.	Set the pulse input signal so that the Target Position of the pulse input signal is approximately 1 mm longer than the workpiece position. → 11.3 Pushing operation (P.55) → 12.3 Pushing operation example (P.63)

SMC

18.3 Configuration software

Problem	Possible cause of the trouble	Investigation method and location of possible causes	Countermeasures
COM port disabled orCOM port cannot be opened.	Communication cable is not connected to the PC.	Check that the communication cable is connected to the PC.	Connect the controller and PC with the controller setting cable and USB cable and restart the configuration software.
Unsupported controller is connected.	The controller version and the configuration software version do not match.	The configuration software version corresponds to the controller version?	Use a configuration software version which matches the version of the controller. → P.1 Correspondence table for controller version and configuration software version
No controller is available for communication or there is no response from the controller.	The controller is not turned on.	Is the green LED in the controller ON?	Check the power is supplied to the controller. → 4. External Connections (P.20) → 5.CN1: Power Supply Plug (P.22)
	Configuration cable is not connected to the controller.	Check that the configuration cable is connected to the controller.	Connect the configuration cable to CN3 of the controller. →/P.12 2.3. Product structure
	Communication speed is not stable.	Does the communication speed selected in the configuration software match the communication speed set on the controller?	Select a communication speed that matches the communication speed set on the controller.
	Controller ID is not in the range of search.	Check that the controller ID is included in the search range of the configuration software.	Specify the search range of the configuration software so that controller ID is included.
	The controller version and the configuration software version do not match.	The configuration software version corresponds to the controller version?	Use a configuration software version which matches the version of the controller. → P.1 Correspondence table for controller version and configuration software version
	COM port of the PC to which the configuration cable is connected is incorrect.	Check that the configuration cable is connected to the correct COM port selected by the configuration software.	Select the COM port to which the communication cable is connected in the configuration software.

SMC

19. Reference Information

19.1 Check the pulse signal

The method of how the controller recognizes the pulse signal input to the controller from the upper level equipment such as a PLC can be checked.   Follow the instructions shown below:

(1) Starting the controller and controller configuration software

Connect a PC, card motor, and the upper level equipment to the controller to power on the controller while referring to **4. External connection for wiring.** See **14. Controller Configuration Software** for details of the configuration software.

(2) Shift to Monitor mode

After verifying that the basic configuration is correct, go to the monitor test screen and set the monitor mode.

Move the centre button to the right.

(3) Execution of Return to Origin

After turning on the "SVON" signal with the upper level equipment, enter the "SETUP" signal and perform a return to origin.
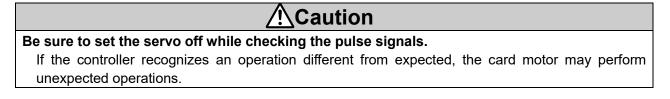
When the controller recognizes the "SVON" and the "SETUP" signal as ON, (1) and (2) will be green.

(3) Target position will be displayed after returning to origin is completed.

(4) Servo OFF

Turn off the "SVON" signal and set the servo off.

⚠️Caution

Be sure to set the servo off while checking the pulse signals.
If the controller recognizes an operation different from expected, the card motor may perform unexpected operations.
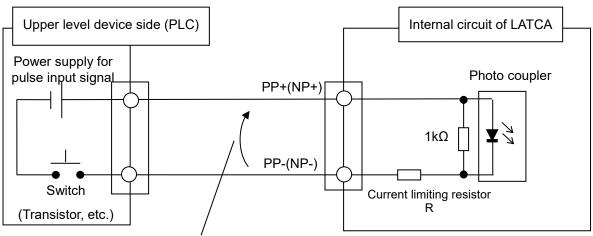
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(5) Check the pulse input signal

When a pulse signal is entered from an upper level equipment such as PLC, the value recognized by the controller is displayed in (3) Target position of the configuration software. If the display value is different from the expected value, check the wiring and controller configuration.   Refer to **19.2 Pulse signal check** for wiring.

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19.2 Pulse signal check

If the value of the pulse signal input from the upper level equipment such as a PLC is different between the expected value and value recognized by the controller, check the potential difference between the terminals of the pulse input circuit with a tester, etc., and check the optocoupler ON/OFF of the pulse input circuit
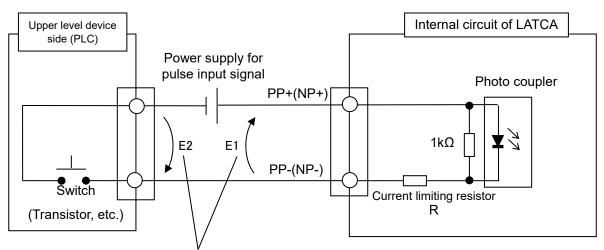
(1) Open collector input

E1 : Potential difference between PP- and PP+

Name	Switch status of the upper level equipment	Potential difference between PP- and PP+ (NP- and NP+)	LATCA optocoupler operation
Status	ON	5V or 24V	ON
	OFF	0	OFF

Note) If the pulse train signal power supply is as follows, the potential difference may not be measured correctly depending on the measurement location.
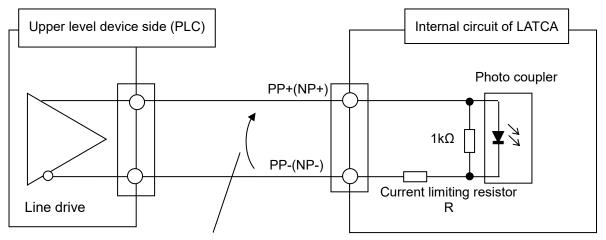Refer to the figure below to measure the potential difference between PP-to-PP+, NP- to NP.

E1 : Potential difference between PP- and PP+　（NP- and NP+）

E2 : Potential difference between PP-(NP-) and pulse signal power

Descri ption	Switch status of the upper level equipment	E1	E2	LATCA optocoupler operation
Status	ON	5V or 24V	0V	ON
	OFF	0V	5V or 24V	OFF

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2) Differential input

E1 : Potential difference between PP- and

Item	Potential difference between PP- and PP+ (NP- and NP+)*	LATCA optocoupler operation
Status	+5V*	ON
	-5V*	OFF

* The value of the potential difference depends on the output circuit of the upper level equipment.

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