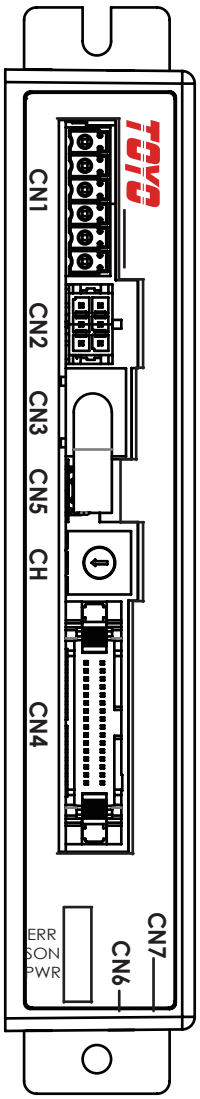
User's Manual

TOYO Servo Cylinder Controller

English User's Manual

V2501

TC100 Series



About the product

About the product

- We are not liable for damages due to the infringement of third party patents, intellectual rights, or other rights, in connection with the use of the products manufactured by this product.
- This product is intended for general-purpose industrial equipment. It is not intended for the equipment (such as atomic energy control equipment, aerospace equipment, transmission equipment, traffic signal equipment, combustion control, medical life support equipment, various safety devices, etc.) which requires extremely high quality and reliability, and may cause direct physical injuries or property damage. The warranty does not apply to damage resulting from the use of this product for a purpose other than the intended purpose (hereinafter referred as to "specific-purpose"). The customer is solely responsible for using this product for particular purpose.
- This Manual does not constitute a guarantee of the implementation of other rights, such as industrial ones, or a commitment to licenses.

In addition, we are not liable for any problem associated with industrial rights arising out of the contents on this Manual.

Foreword

Thank you for using this product. This User's Manual provides the information about the TC100 Series Controller.

It includes:

- Installation and inspection of the step controller and step motor
- Overview of the step controller components
- Commissioning steps
- Overview of the control functions and adjustment methods of the step controller
- Description of all parameters
- Protocol description
- Inspection and maintenance
- Troubleshooting

This User's Manual is suitable for the following users:

- Designers of mechanical systems
- Installation or wiring personnel
- Commissioning personnel
- maintenance or inspection personnel

Before use the product, carefully read this Manual to ensure correct use. In addition, keep it in a safe place for future reference. Always follow the points below before finishing reading this Manual:

- The environment where the product will be installed should be dry without any corrosive and flammable gases.
- Grounding should be done properly.
- When powering on, do not disassemble the controller, motor or change the wiring.
- Before energized and operation, make sure that the emergency stop device functions properly.

If you still have any problem with the use, contact the dealer or our Customer Service Center.

Safety precautions

Before the installation, operation, maintenance, and inspection of this product, carefully read this User's Manual, and the instructions and related documents of any other equipment and axillary devices connected to it, to ensure correct use. Such operations should be performed only by the specialists with the knowledge of safety and equipment. The following notes are intended to ensure safety and correct use of this product to avoid physical injuries and property damage.

During the installation, wiring, operation, maintenance, and inspection, be aware of the following safety precautions. In this Manual, the safety precautions are categorized as "Danger," "Warning," "Caution," and "Tip."

⚠Danger	Incorrect operations will threaten life or cause serious injuries.
⚠Warning	Incorrect operations will cause death or serious injuries.
⚠Caution	Incorrect operations will cause injuries or property damages.
⚠Tip	While there is no possibility of injuries, you have to follow these tips for proper use of this product.

Failure to follow cautions or tips may result in serious consequences in some situations. The recorded contents are important. Carefully use the product after reading the Manual. This User's Manual should be kept in a readily accessible place and should be given to the end user.

⚠Danger

[General]

- Do not use the product for the following purposes.
  1. Any medical apparatus involving life and health maintenance and management.
  2. The equipment and mechanical devices intended for the movement or transportation of persons.
  3. The important safety parts of mechanical parts.

The product is not planned and designed for the usage that requires high degree of safety. We do not guarantee the product if it is used for any life support purpose. The guarantee only covers the product delivered.

[Installation]

- Do not use the product in a place with dangerous goods, such as flammable or combustible ones. Otherwise, it may cause fire or explosion.
- The main unit and controller should not be used in a place with water or oil droplets.
- Do not cut and re-connect cables to extend or reduce the length of cables for the products. Fire may occur.

[Operation]

- This product should not be come contact with water. Contact with water or washing may result in abnormal operations, leading to injuries, electric shock or fire.

[Maintenance, inspection, and repair]

- Do not modify the product. Otherwise, it may cause injuries, electric shock or fire due to abnormal operations.
- Do not assemble or disassemble the product. Otherwise, it may cause injuries, electric shock or fire.

Safety precautions

Warning

[General]

- Dot not operate the product beyond its specifications. If it is operated beyond its specifications, malfunction, failure or damage may occur In addition, the product may be shortened obviously. In particular, you should observe the maximum load and speed limits.

[Installation]

- Design a safety circuit or device to prevent device damages or physical injuries when the machine stops operating during an emergency stop or power failure.
- The drive shaft and controller must be grounded by a D-type grounding construction (the former third type grounding construction; grounding resistance under 100 Ω). Electric leakage may result in electric shock or false action.
- Before supplying electricity to or operating the products, always confirm safety of a surrounding area. If electricity is improperly supplied to the products, it may cause electric shocks or injuries by contacting operating parts.
- Avoid improper wiring by confirming proper wiring of the products with the "Operating Manual." A cable and a connector must be connected tightly. Otherwise, it may cause abnormal product operations or fire.

[Operation]

- Do not touch the terminal block and various switches when energized. Otherwise, it may cause electric shock or abnormal operations.
- Do not damage cables. If cables are damaged, forcefully bent, pulled, wound, or placed under a heavy object, they may cause fire, electric shock, or abnormal operations due to electric leakage or defective continuity.
- If the product generates abnormal heat, smoke, or smell, turn off power immediately. If you continue using the product, damages or fire to the product may occur.
- If a protection device (alarm) of the product goes off, disconnect power immediately. Otherwise, abnormal operations of the product may cause injuries, break down of or damages to the product. After turning off power, investigate the cause of the alarm, eliminate the cause, and turn on the power supply.
- Turn off power immediately if the LED of the product is not lit after turning on the power. The protective device (fuse, etc.) on the live side may remain active. Request repair to our sales office from which you purchased the product.

[Maintenance, inspection, and repair]

- The power supply must be completely off before maintenance inspection, adjustment, or replacement work begins on the product. Follow the instructions below during maintenance work.
  1. Post a sign such as, "Work in progress." or "Do not turn on power." in a visible place to prevent a third person from carelessly turning on power.
  2. When more than one person is doing a maintenance inspection, always confirm everyone's safety by vocally warning turning on and off the power switch.

[Disposal]

- Do not dispose the products in fire. Otherwise, the product may explode or generate toxic gas.

Safety precautions

Caution

[Installation]

- Do not expose the product to direct sunlight (ultraviolet rays), or place it near dust, salt, iron powder, humid environment, or in the atmosphere that contains organic solvent, phosphate ester working oil, sulfurous acid gas, chlorine gas, or acids.
- Do not place the product in an area where excessive vibration or shock (4.9m/s2 or more) occurs. Excessive vibration or shock may cause false actions.
- Place an emergency stop device in a suitable place where suspension can be commanded immediately in case of danger. Otherwise, it may cause injuries.
- Secure an extra space for maintenance when mounting the product. Failure to secure sufficient space disables daily inspection or maintenance and causes suspension of the device or damages to the product.
- Use only our genuine cables when connecting drive shafts and controllers. Always use our genuine accessories for component parts such as drive shafts, controllers, and teaching pendants.
- Before mounting or performing adjustment on the product, please post a sign such as "Work in progress." or "Do not turn on power." to prevent anyone from carelessly turning on the power.

If the power is turned on carelessly, the drive shaft suddenly starts operating and may cause electric shock or injuries.

[Operation]

- Please turn on power in commanding order of devices. Otherwise, the product may suddenly start operating and it may cause injuries or damage to the product.
- Do not insert a finger or an object in an opening part of the product. It may cause fire, electric shock, or injuries.

[Maintenance, inspection, and repair]

- Do not touch a terminal when performing the insulation resistance test. Otherwise, it may cause electric shock. (Do not perform the dielectric withstand test because the product uses the DC power supply.)

Safety precautions

Tip

[Installation]

- Do not place any obstacles that block air ventilation around the controller. Otherwise, it may cause poor ventilation.
- Do not configure a control circuit that will cause the workpiece to drop in case of power failure. Configure a control circuit that will prevent the bench or workpiece from dropping when the power to the machine is cut off or an emergency stop is actuated

[Installation, operation, and maintenance]

- When using the products, please secure your safety by wearing protective gloves, protective glasses, and safety shoes as required.

[Disposal]

- If the product becomes inoperable, please take an appropriate disposal method for industrial waste.

Other

- We shall not be responsible for your non-compliance with all "safety precautions."

We have made every effort to ensure accuracy and completeness when preparing this Manual, but there may still be errors or omissions. If you find any error, please contact us.

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1. Overview

1.1 Foreword

This product is a controller specially designed for the **CGTH/CGTY/CTH/CY/CCB/CS/CH** Series drive shafts and electric grippers.
It can be controlled by the IO control, communication control and pulse control function (except electric gripper) of the main controller (PLC).
In addition, this product also features the power-saving function to meet the increasing need for energy saving.

The following shows the key features and functions:

- Dedicated Homing Signal
  This signal supports our original homing operation based on push motion at the stroke end.
  With this signal, homing can be performed automatically without using a complex PLC programming controller or external sensor, etc.
- Brake Control Function
  V1 version, the electromagnetic brake power is externally supplied with DC 24V via I/O. The external power should be supplied via I/O if you want to use the Brake Control function.
  V2 version, the power supply of the electromagnetic brake is supplied by the system power supply, without special external power supply from IO.
- Torque Limiting Function
  This controller allows you to limit torque using an external signal. A signal is output when the specified torque is reached. This function enables push-motion operation, press-fit operation, etc.
- Full Servo Control Function
  The step motor is servo-controlled to reduce the holding current.
  Although the exact degree of current reduction varies depending on the drive shaft type and load condition, the holding current decreases to approx. 1/2 to 1/4.

When you perform commissioning or experience any problems, refer to the manuals of the drive shaft, teaching pendant, and/or connection software, in addition to this Manual.

This Manual does not cover all possible abnormal operations or unexpected situations, such as complex signal changes during the critical points.
Therefore, the items not described in this Manual should be regarded as "Not Permitted."

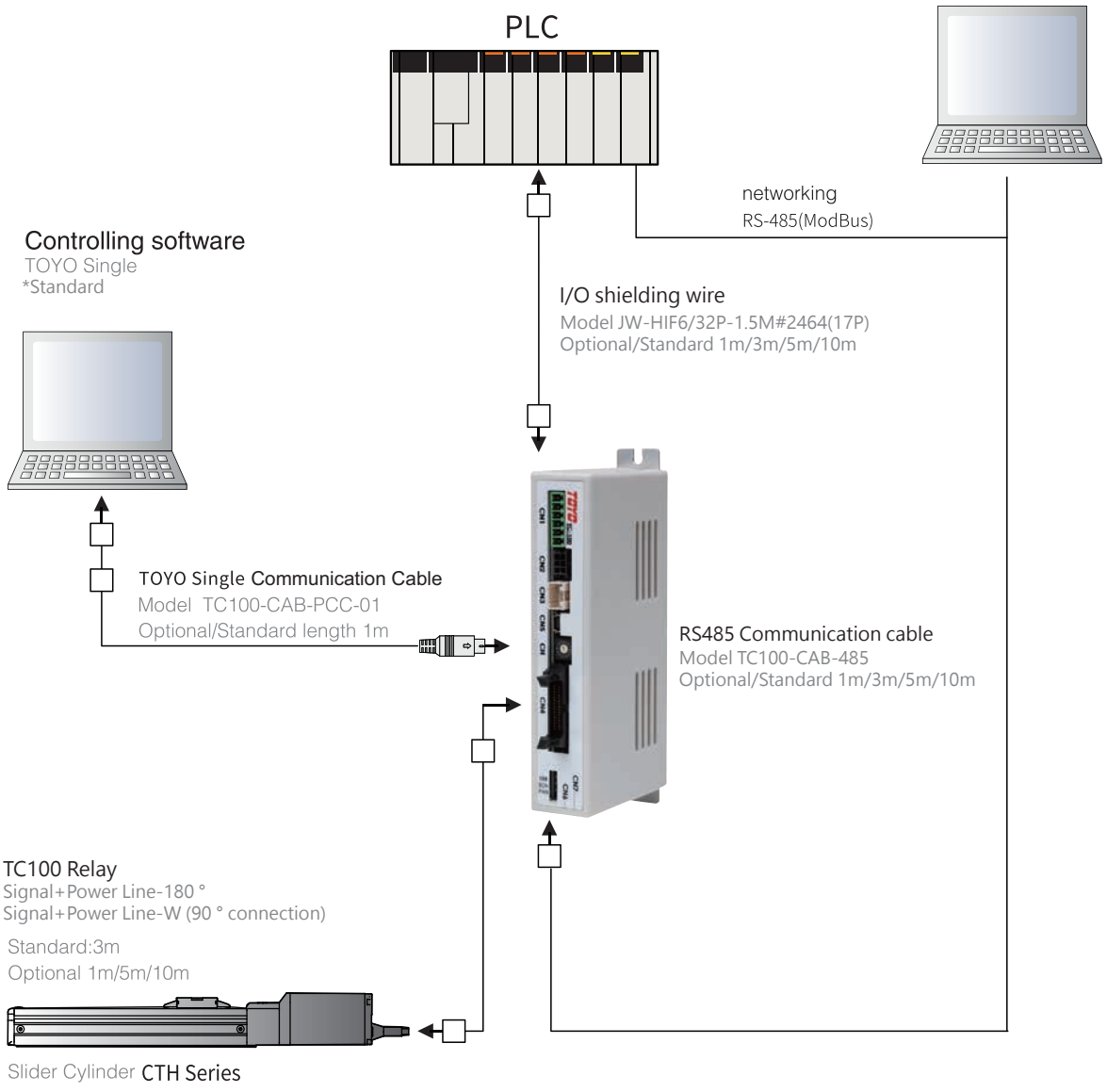
* This Manual has been prepared with the utmost attention to ensure accuracy and completeness. However, there may still be inaccuracies and omissions. If you find any inaccuracies or errors, please contact us.
Keep this Manual in an accessible place for future reference.

1.2 How to read the model specification

TC100 - 01 - N1

- TC100 - Controller model
- 01 - Cable length
  - 01：1m
  - 03：3m
  - 05：5m
  - 10：10m
- N1 - Shielding wire model

1.3 Components of the controller system

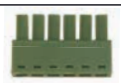


1.4 Steps from unpacking to commissioning

If you are using this product for the first time, refer to the steps below and make sure you have all necessary items and connect all required cables.

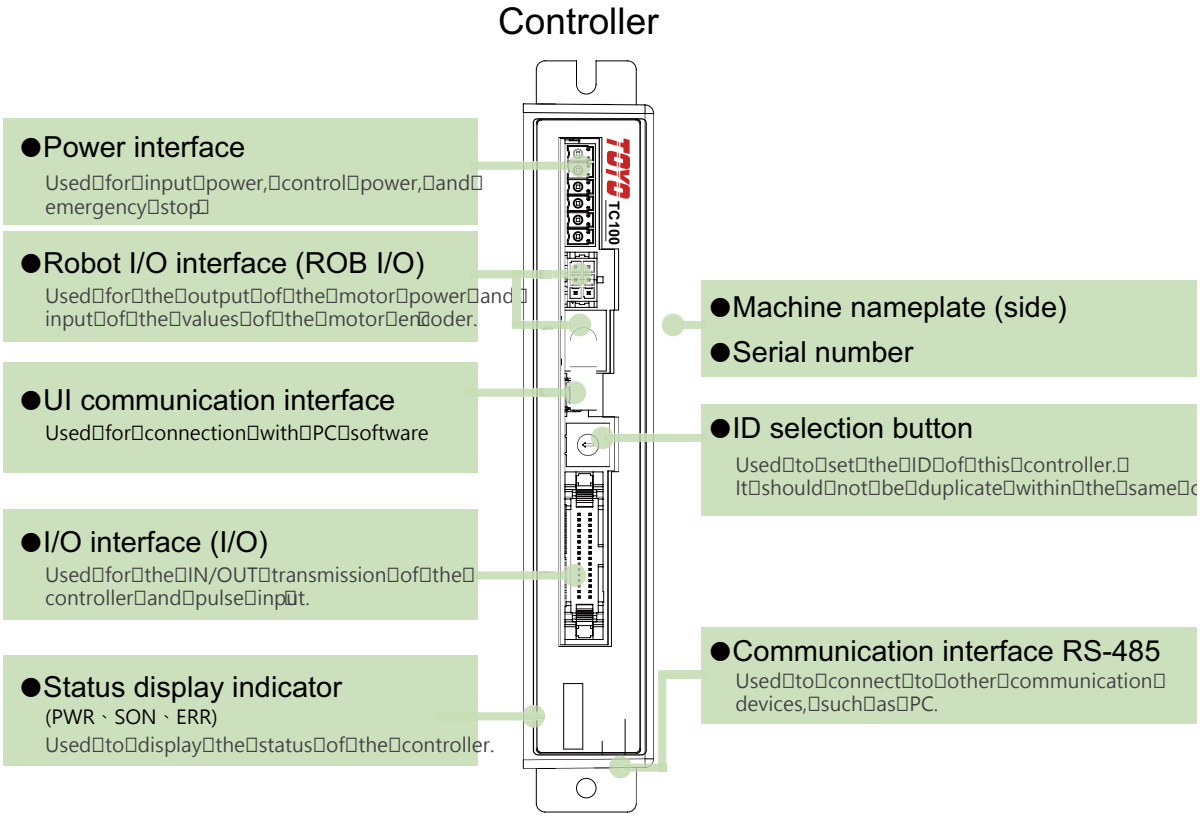
- **Check the items in the package**

If you find any of the following items missing or of a wrong model type, please contact your dealer.

Item name	Quantities	Picture	Model No.
Controller	1		TC100
Drive shaft	1		As per customer request CGTH/CGTY/CY/CS/CH/CGCH/ CGCY
Shielded I/O Cable	1		JW-HIF6/32P-1.5M#2464(17P)
TC100 Relay	1		Signal+Power Line-180 °-* Signal+Power Line-W (90 ° connection)-*
Power connector	1		EC381V-S2236106P

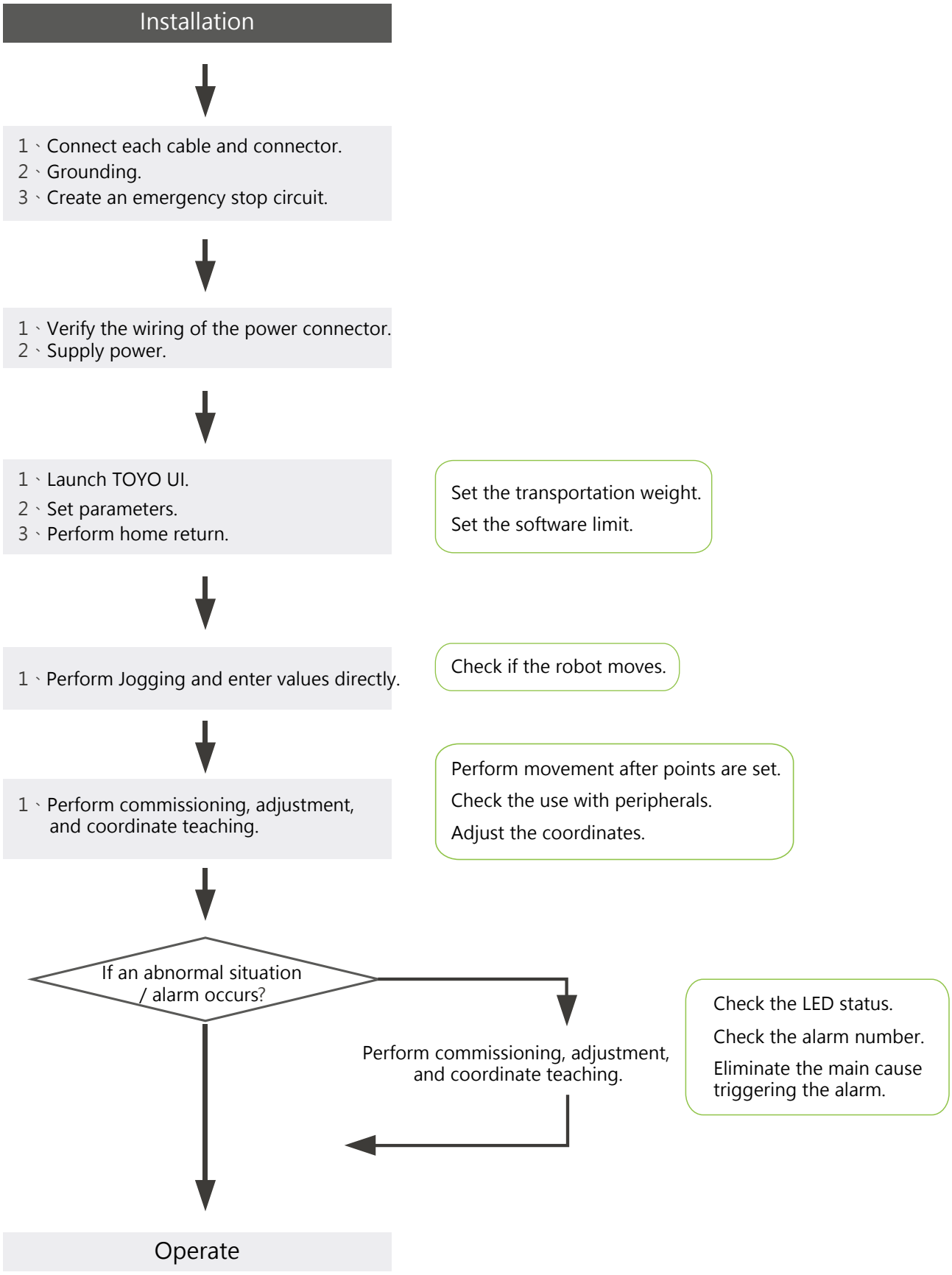
⚠ Caution:
The items in the package carton vary depending on the model you order.

- **Interface overview**



- **Steps**

  The following shows the basic steps from controller installation to operation.



1.5 Warranty period and coverage

The controller you bought is strictly tested prior to shipment.
Its warranty is described as follows:

- **Warranty period**

The warranty period shall be one of the following periods, whichever ends first:

- 18 months after shipment from our factory
- 12 months after delivery to a specified location

- **Scope of warranty**

If an obvious manufacturing defect is found during the above period under normal use, we will repair the defect free of charge. Note that the following items are not covered by this warranty:

- Faded paint or other changes that occur naturally over time.
- Consumable components that wear out with use.
- The unit seems to be noisy or similar impressions that do not affect machinery performance.
- Damage resulting from improper handling by the user or lack of proper maintenance.
- Damage resulting from inappropriate or erroneous maintenance/inspection.
- Damage resulting from the use of a part other than our genuine accessories.
- Any alterations that are not approved by us or our dealers.
- Any damages caused by natural disasters, accidents, or fire.

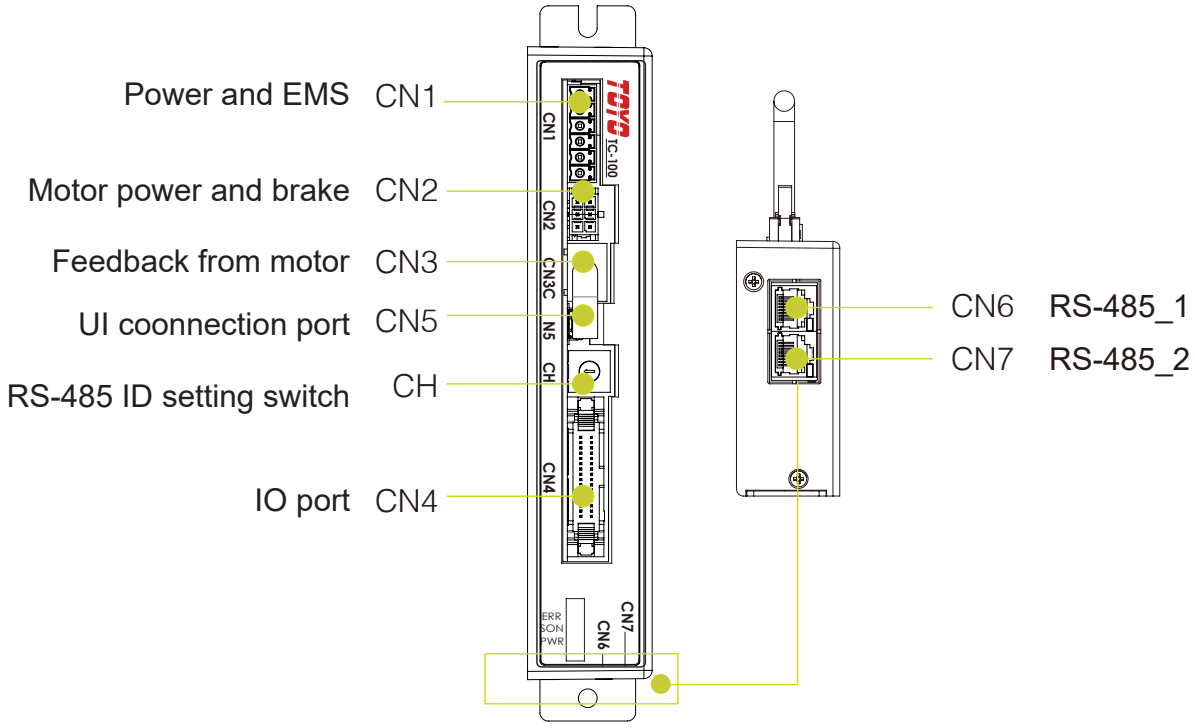
The warranty pertains to the delivered product itself and does not cover any damages that might arise from a breakdown of the product.
Return your defective to the dealer for repair.
The warranty is described as above.

2. Specifications

2.1 Basic specifications

Items		TC100
Input power	Control power	DC 24V (±10%)
	Power supply	DC 24V (±10%) / DC 48V (±10%)
Number of control axes		1 axis
Motor	Applicable motors	2-phase micro step motor
	Dimension	56, 42, 35, 25, 20 Type
	Rated output	2Ao-p (the peak value of sine wave current)
	Peak power output	3Ao-p (the peak value of sine wave current)
Action control mode		ABS operation
		INC operation
		Continuous operation of INC-R Continuous operation of ABS-R
		Thrust operation
Position	Number of points	1~127 points (individual action)
	Point setting method	I/O point teaching for the position of the communication set points
Encoder	Position management	Incremental type
	Position detection	Optical rotary encoder
	Resolution	16000ppr (56, 42 Type) / 10000ppr(35 Type)/9600ppr (25 Type)/1600ppr(20 Type)
Common DI/DO signals		DI (14-point) / DO (10-point) NPN; definitions can be modified through parameters
Brake		Optional (select it before you buy)
Error history		Up to 50 error codes can be stored
Safety circuit		After emergency stop and push-in (Servo is OFF)
Communication		USB (Virtual COM port): mini USB / RS485 (half-duplex): RJ-45
LED status		**PWR:** Power (green): Lights up solid when drive + control power is supplied; when the drive power is turned off, the green indicator is flashing. **SON:** Servo (green): Lights up solid when Servo is ON; when an error occurs, it goes off. **ERR:** Abnormal situation (red): Determine the error message based on the flashing times.
ID settings		Rotary DIP switch (0~F), 16 stations

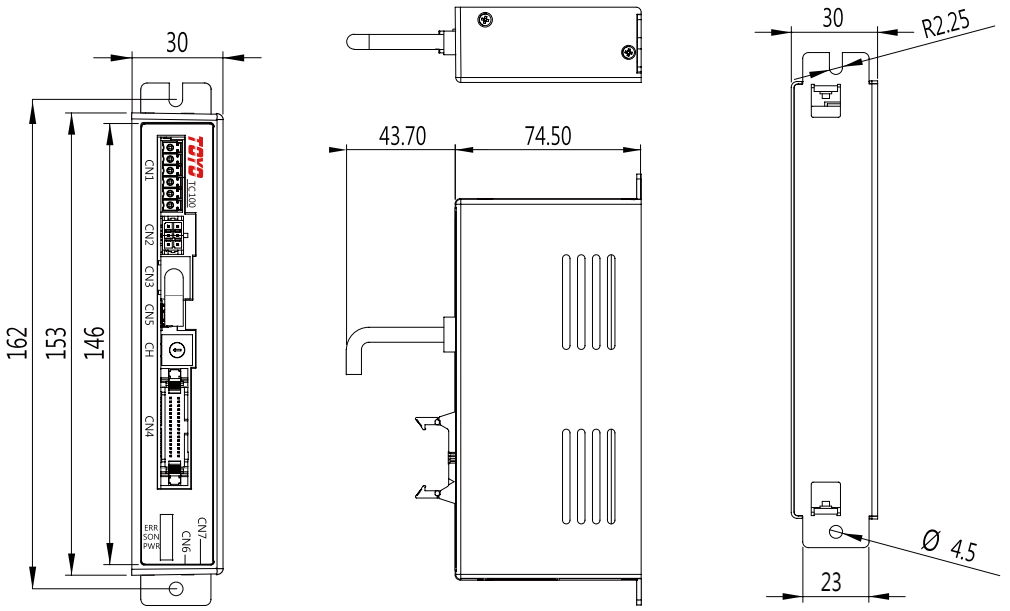
2.2 Name and description of each part of the controller



2.3 Controller size

An external view and dimensions of the product are shown below.

(unit : mm)



3. Installation and wiring

Pay due attention to the installation environment of the controller.

3.1 Installation environment

- When performing installation and wiring of the controller, do not block the ventilation holes for cooling. (Insufficient ventilation not only prevents the controller from operating at full capacity, but also cause breakdown.)
- Prevent foreign matter from entering the controller through the ventilation holes. Since the enclosure of the controller is not dust-proof or waterproof (oil-proof), avoid using the controller in a place subject to significant dust, oil mist or splashes of cutting fluid.
- Do not expose the controller to direct sunlight or radiating heat from a large heat source such as a heat treatment furnace.
- Use the controller in an environment free from corrosive or inflammable gases, under a temperature of 0 ～ 40℃ and humidity of 85% or less (non-condensing).
- Use the controller in an environment where it will not receive any external vibration or shock.
- Prevent electrical noise from entering the controller or its cables.

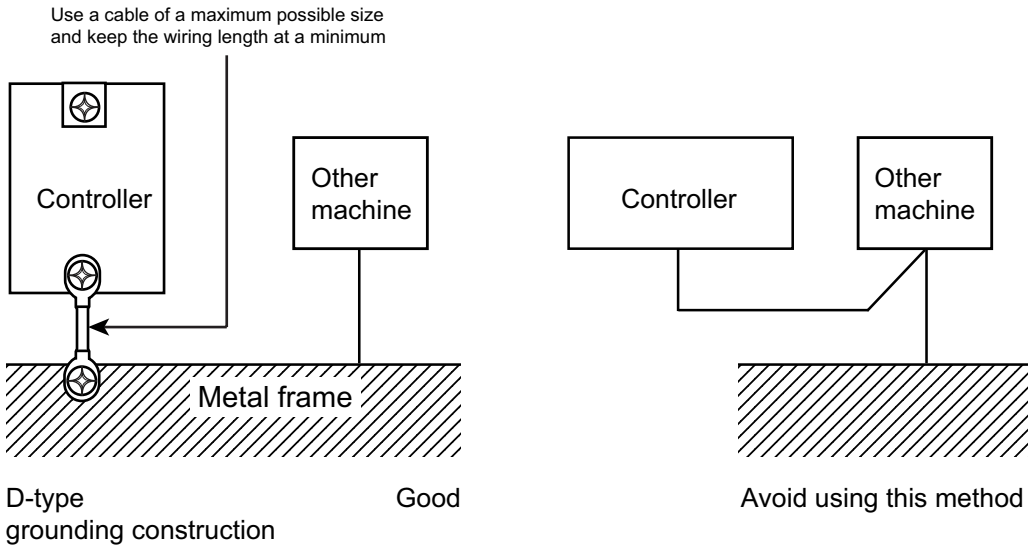
3.2 Power Supply

The power supply specification is DC24V±10%, DC48V±10%.
▲ Only DC24V±10% can be used as control power.

3.3 Noise elimination and grounding

The following describes how to eliminate noise when using of the controller.

- **Wiring and power supply**
  - Perform a D-type grounding construction for grounding.
    Select cables with a size of 2.0 ～ 5.5mm2 for wiring.



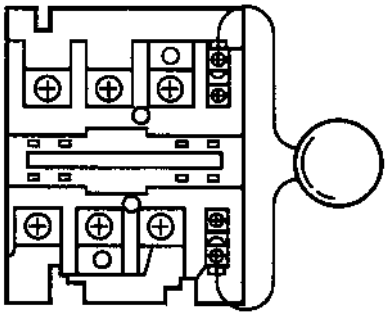
D-type grounding construction — Good

Avoid using this method

- Precautions regarding wiring method
  Use a twisted cable for connection to the DC 24V external power supply.
  Separate the controller cables from high-power lines such as a cable connecting to a power circuit.
  (Do not bundle them together. Do not place them in the same cable duct.)
  When you need a longer motor cable or encoder cable, consult us.

- **Noise sources and elimination**

  Among the numerous noise sources, solenoid valves, magnetic switches and relays are of particular concern when building a system. Noise from these sources can be eliminated by implementing the measures specified below.
  AC solenoid valves, magnet switches and relays are connected in parallel with coils and in parallel with the coil. Install a surge absorber.



← Key point

》Install a surge absorber to each coil over a minimum wiring length.
》Installing a surge absorber to the terminal block will be less effective because of a longer distance from the coil.

3.4 Heat dissipation and installation

When you design the distribution box, controller layout, and cooling method, attention should be paid to the following installation conditions under which the controller operates normally.

■■ Installation position

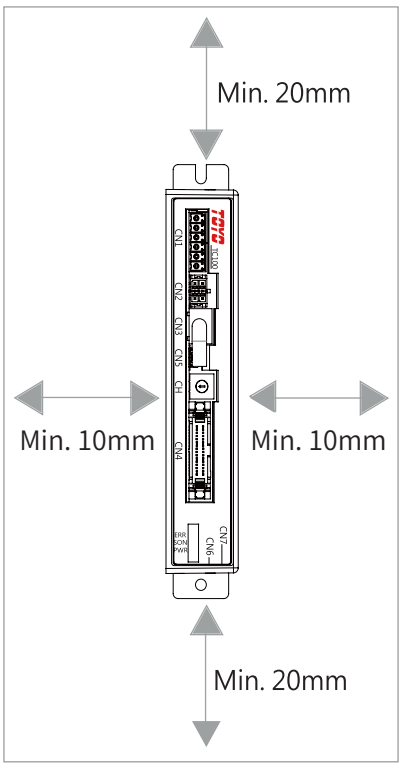
Install the controller to the control panel.

■■ Installation direction

Install the controller vertically on a wall.

■■ Surrounding area

Install the controller in a well-ventilated place and leave enough space around it. (see figure below)



Regardless of whether your system consists of a single controller or multiple controllers, leave sufficient space around each controller so that it can be installed/removed easily.

■■ Temperature and humidity

The temperature and humidity around the controller should meet following criteria.

- Ambient temperature: 0 ～ 50℃ (non-condensing)
- Ambient humidity: 35 ～ 85% RH (non-condensing)

■■ Avoid using in these environments

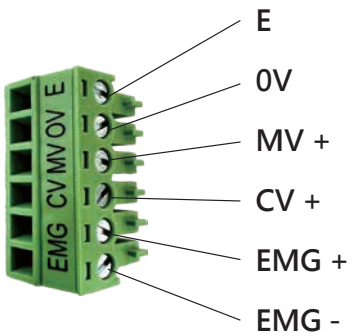
For normal operation of the controller, avoid using in these environments.

- Avoid an environment with sulfuric acid, hydrochloric acid, or corrosive gases, corrosive gases, or flammable gases.
- A dusty place.
- A place where it may be splashed by chips, oil, or water from other devices.
- A place which is exposed to strong vibration.
- A place which is exposed to electromagnetic noise or electrostatic noise.
- A place where it may be exposed to direct sunlight.

3.5 Power wiring diagram

Use the supplied power connector to connect to the power supply.

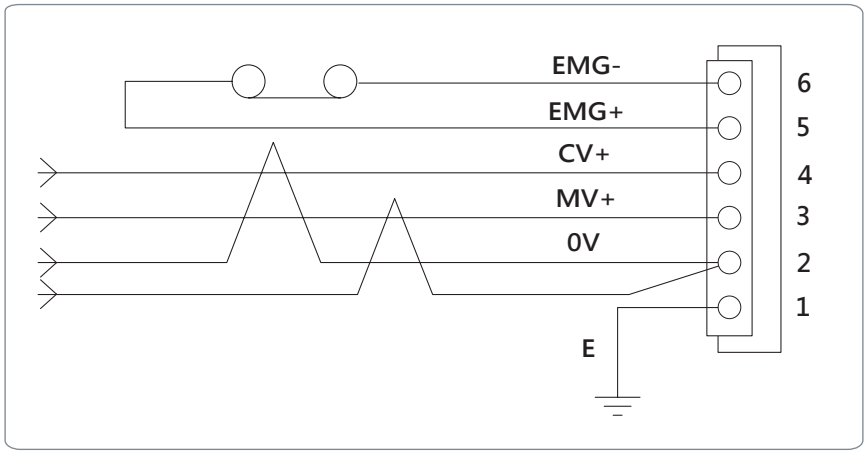
- **The name and functions of the terminals of the power connector**



No.	Signal name	Description
1	E	Grounding (To avoid noise interference which may lead to false action, perform grounding properly.)
2	0 V	GND
3	MV+	Main power: DC 24V/DC 48V, ±10%
4	CV+	Control power: DC 24V, ±10%
5	EMG+	For emergency stop, use B contact (RELAY contact)
6	EMG-	

⚠Caution:
The rated current of the controller is 2A and its max current is 3A. Select a suitable power supply based on this specification.
To avoid false action caused by noise, be sure to connect the grounding terminal to earth ground.

- **Emergency stop and power wiring diagram**



⚠Caution:

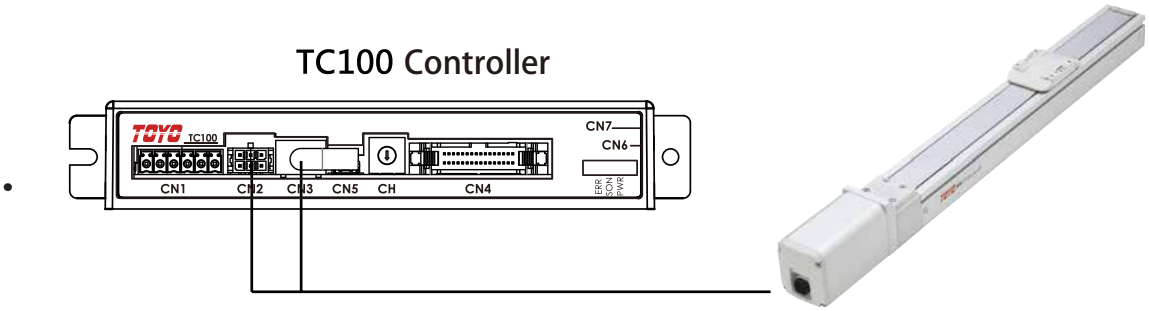
Do not connect the power voltage and terminal incorrectly. Otherwise, it may cause malfunction.

- PIN(E) on the power connector is the grounding terminal which should be connected.
- Use AWG#18(0.75mm2) cables.
- Install a filter at the input of wires to avoid false action caused by noise.
- Use AWG#18(0.75mm2) or above twisted cables and install a surge absorber to the relay or brake circuit.
- Only use DC24V when you perform the CV control power wiring.

3.6 Connection to the robot

Connect the robot cables to the connector interface on the front panel of the controller.

- **Connection method**
-



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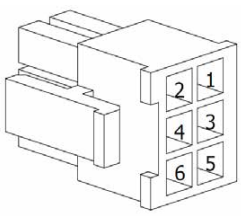
Small electric cylinder series

⚠Caution:

- Be sure to use the dedicated T100 cables to connect the robot.
- Make connections when the power is disconnected.
- Insert cables to the interface and make sure they are fully inserted.
- Do not connect it to a robot other than the specified one.
- When you insert or remove connectors, hold the connector, instead of pulling its cable.

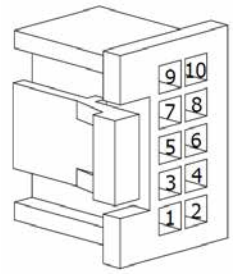
- **Robot connector (motor power and encoder pin assignments)**

Motor power connector



No.	Signal name	Description
1	BK(-)	Brake power output (-)
2	BK(+)	Brake power output (+)
3	/B	Motor /B-phase
4	B	Motor B-phase
5	/A	Motor /A-phase
6	A	Motor A-phase

Motor encoder connector



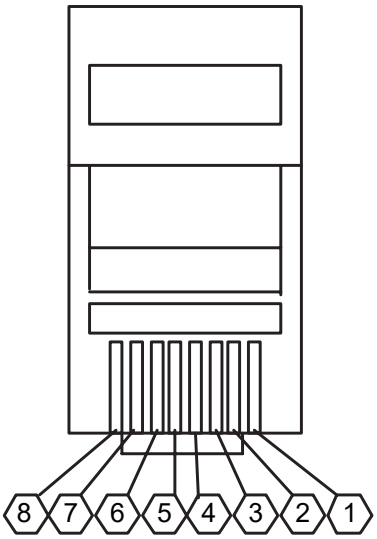
No.	Signal name	Description
1	+5 V	Power output +5 V
2	0V	Power output 0V
3	A+	ENCODER A-phase
4	A-	ENCODER /A-phase
5	B+	ENCODER B-phase
6	B-	ENCODER /B-phase
7	Z+	ENCODER Z-phase
8	Z-	ENCODER /Z-phase
9	---	-----
10	FG	Shielded grounding

3.7 Connection to the communication unit

Use the dedicated cables to connect to communication devices, such as PC.

■■ The name and functions of the terminals of the power connector

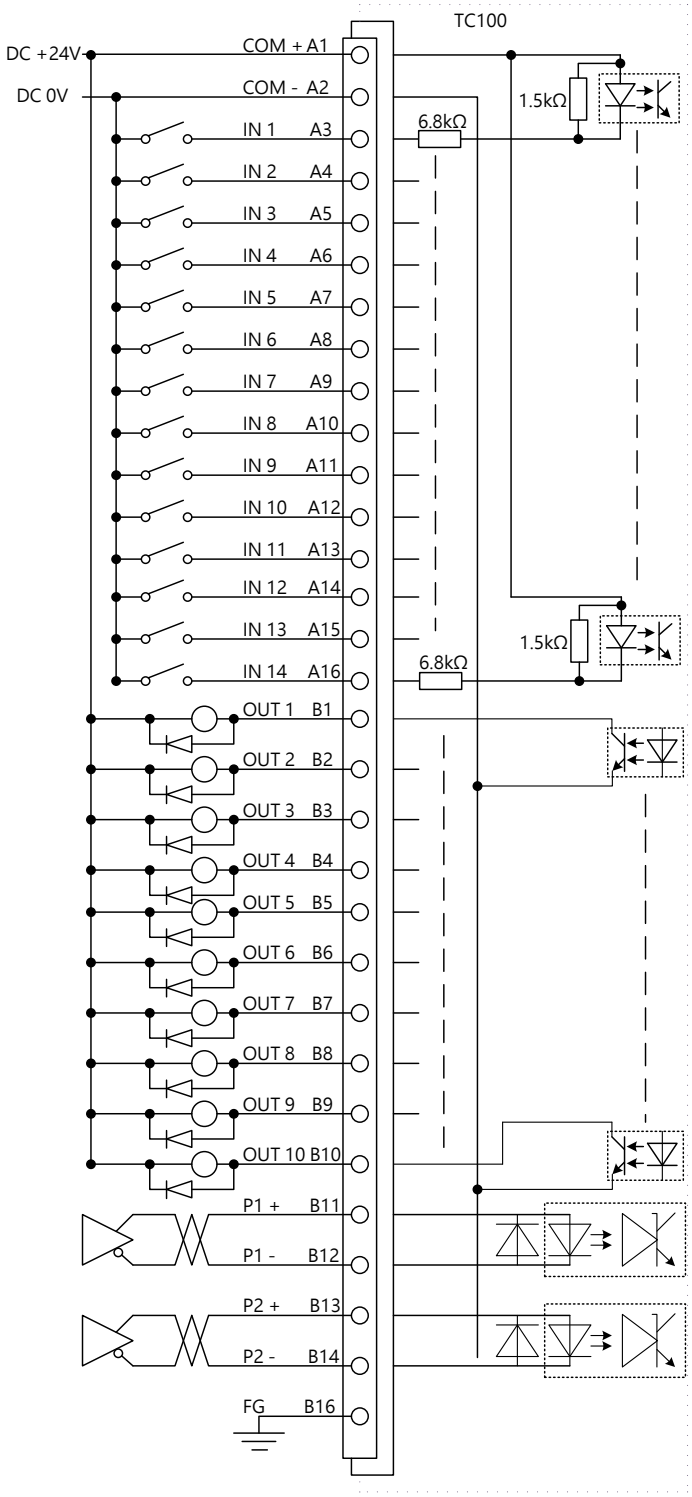
No.	Signal name	Description
1		
2	SG	Signal ground wire (knitted wire mesh)
3	SIG-A	DATA +
4		
5	SG	Signal ground wire (knitted wire mesh)
6	SIG-B	DATA -
7		
8	SG	Signal ground wire (knitted wire mesh)



3.8 IN/OUT signal wiring

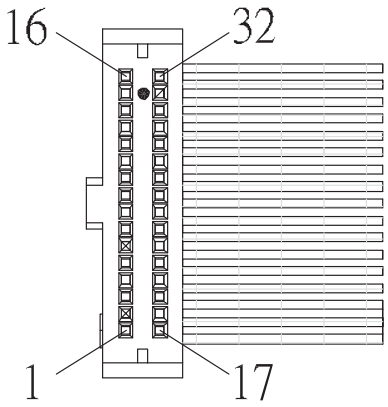
Connect the robot cables to the connector interface on the front panel of the controller.

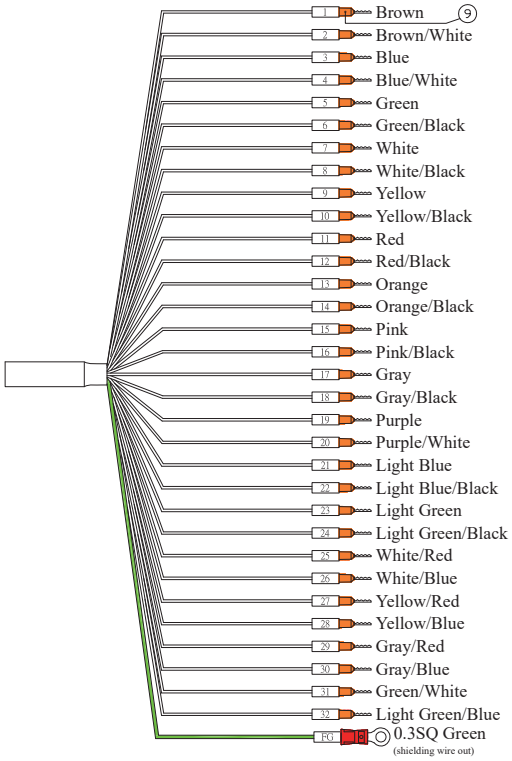
- **Connection method (NPN)**



Use the dedicated cables to connect to communication devices, such as PC

- **The name and functions of the terminals of the power connector**





- **CN-4 IO pin assignments**

NO	Color code	Signal	Content description	NO	Color code	Signal	Content description
1	Brown	COM+	IO power +24V	17	Gray	OUT 1	ORG-S
2	Brown/White	COM-	IO power 0V	18	Gray/Black	OUT 2	INP
3	Blue	IN 1	ORG	19	Purple	OUT 3	READY
4	Blue/White	IN 2	/SERVO	20	Purple/White	OUT 4	SERVO-S
5	Green	IN 3	ALM_REAET	21	Light Blue	OUT 5	PRGSEL0-S
6	Green/Black	IN 4	START	22	Light Blue/Black	OUT 6	PRGSEL1-S
7	White	IN 5	PRGSEL0	23	Light Green	OUT 7	PRGSEL2-S
8	White/Black	IN 6	PRGSEL1	24	Light Green/Black	OUT 8	PRGSEL3-S
9	Yellow	IN 7	PRGSEL2	25	White/Red	OUT 9	PRGSEL4-S
10	Yellow/Black	IN 8	PRGSEL3	26	White/Blue	OUT 10	PRGSEL5-S
11	Red	IN 9	PRGSEL4	27	Yellow/Red	P1+	CCW, B-phase, PULSE
12	Red/Black	IN 10	PRGSEL5	28	Yellow/Blue	P1-	
13	Orange	IN 11	PRGSEL6	29	Gray/Red	P2+	CW, A-phase, DIR
14	Orange/Black	IN 12	LOCK	30	Gray/Blue	P2-	
15	Pink	IN 13	-	31	Green/White	Reserved	-
16	Pink/Black	IN 14	-	32	Light Green/Blue	FG	Knitted wire mesh / grounding
				Reserved	Separation net		

- **Description of I/O functions**

① DI definitions

If you want to use the controller functions, use the default I/O definitions. Do not modify them, or UI may be unavailable.

INPUT Digital Input Signal 12-point / IO functions are configurable / NPN		
NO.	I/O signals	Function description
1	ORG	Homing Start
2	/SERVO	Servo is ON
3	ALM RESET	Error Clear
4	START	Program Start
5	JOG+	Positive Jog Movement
6	JOG-	Negative Jog Movement
7	MANUAL	Manual Mode
8	TEACH	Point Teaching
9	LOCK	Interlocking / Pause
10	ORG_SIG	Homing Sensor Signal
11	BK_OFF	Brake Control (only when SERVO_OFF)
12	PRGSEL 0	Program Selection No.0~No.127 bit 0
13	PRGSEL 1	Program Selection No.0~No.127 bit 1
14	PRGSEL 2	Program Selection No.0~No.127 bit 2
15	PRGSEL 3	Program Selection No.0~No.127 bit 3
16	PRGSEL 4	Program Selection No.0~No.127 bit 4
17	PRGSEL 5	Program Selection No.0~No.127 bit 5
18	PRGSEL 6	Program Selection No.0~No.127 bit 6
19	CONT_MODE	Switch between position mode and torque mode (working when ModeWwitch is 1)
20	FULL_COUNT	Switch FULL-COUNT judgment

② DO definitions

If you want to use the controller functions, use the default I/O definitions. Do not modify them, or UI may be unavailable.

OUTPUT Digital Output Signal 10-point / IO functions are configurable / NPN		
NO.	I/O signals	Function description
1	INP	Inposition Signal
2	ALARM	Error Output
3	READY	Ready to Complete
4	MOVE	In motion
5	ORG-S	Home Return Complete
6	SERVO-S	Servo Status
7	PRGSEL 0-S	Program Selection No.0~No.127 bit 0
8	PRGSEL 1-S	Program Selection No.0~No.127 bit 1
9	PRGSEL 2-S	Program Selection No.0~No.127 bit 2
10	PRGSEL 3-S	Program Selection No.0~No.127 bit 3
11	PRGSEL 4-S	Program Selection No.0~No.127 bit 4
12	PRGSEL 5-S	Program Selection No.0~No.127 bit 5
13	PRGSEL 6-S	Program Selection No.0~No.127 bit 6
14	INRANGE	Input Signal Within the Interval Range
15	TRQLIM	Setting Current Reach Output Signal
16	ERR 0	Error Code Output Display bit0
17	ERR 1	Error Code Output Display bit1
18	ERR 2	Error Code Output Display bit2
19	ERR 3	The error code shows bit3
20	NEAR	Output when moving within the range of the target position, the target position is set by point position operation modes ABS and INC.
21	SOFLMT	Software limit output light

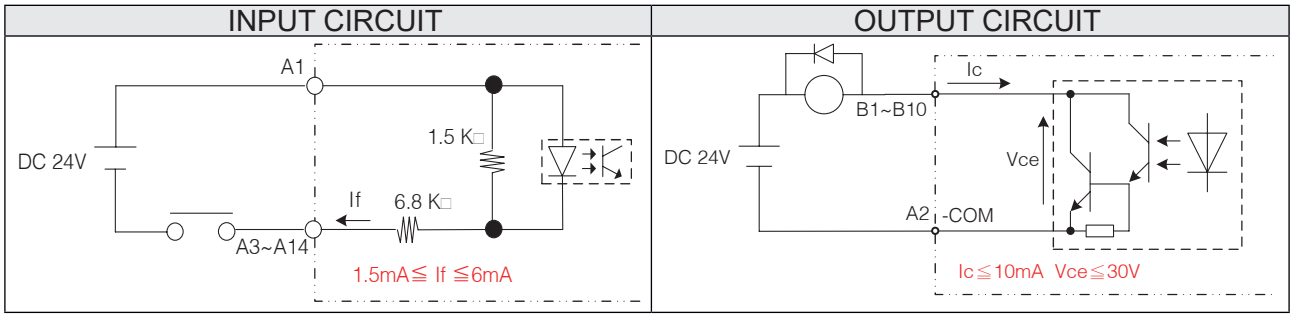
⚠Caution:

During the wiring, do not connect terminals incorrectly to avoid short circuit between them. Wrong wiring may lead to the damage to the controller.

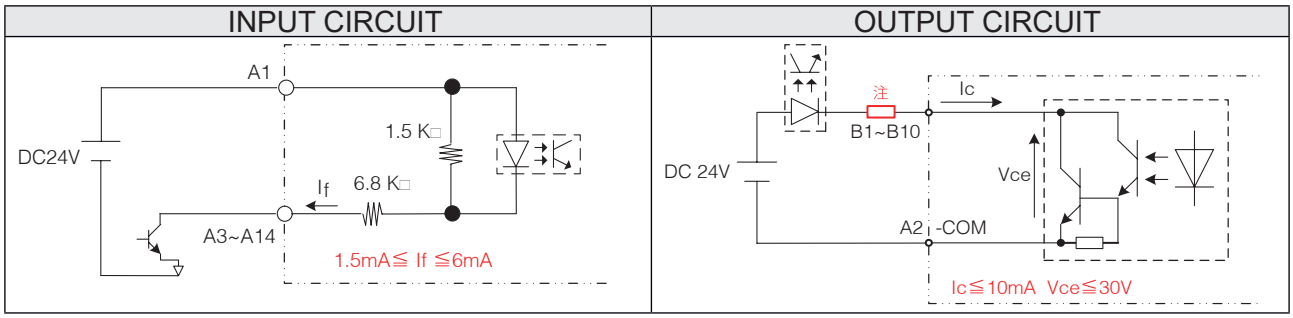
Carefully check the arrangement of terminals during the connection. Do not short circuit terminals.

3.9 Relay contact wiring diagram

- **Wiring of relay contacts**

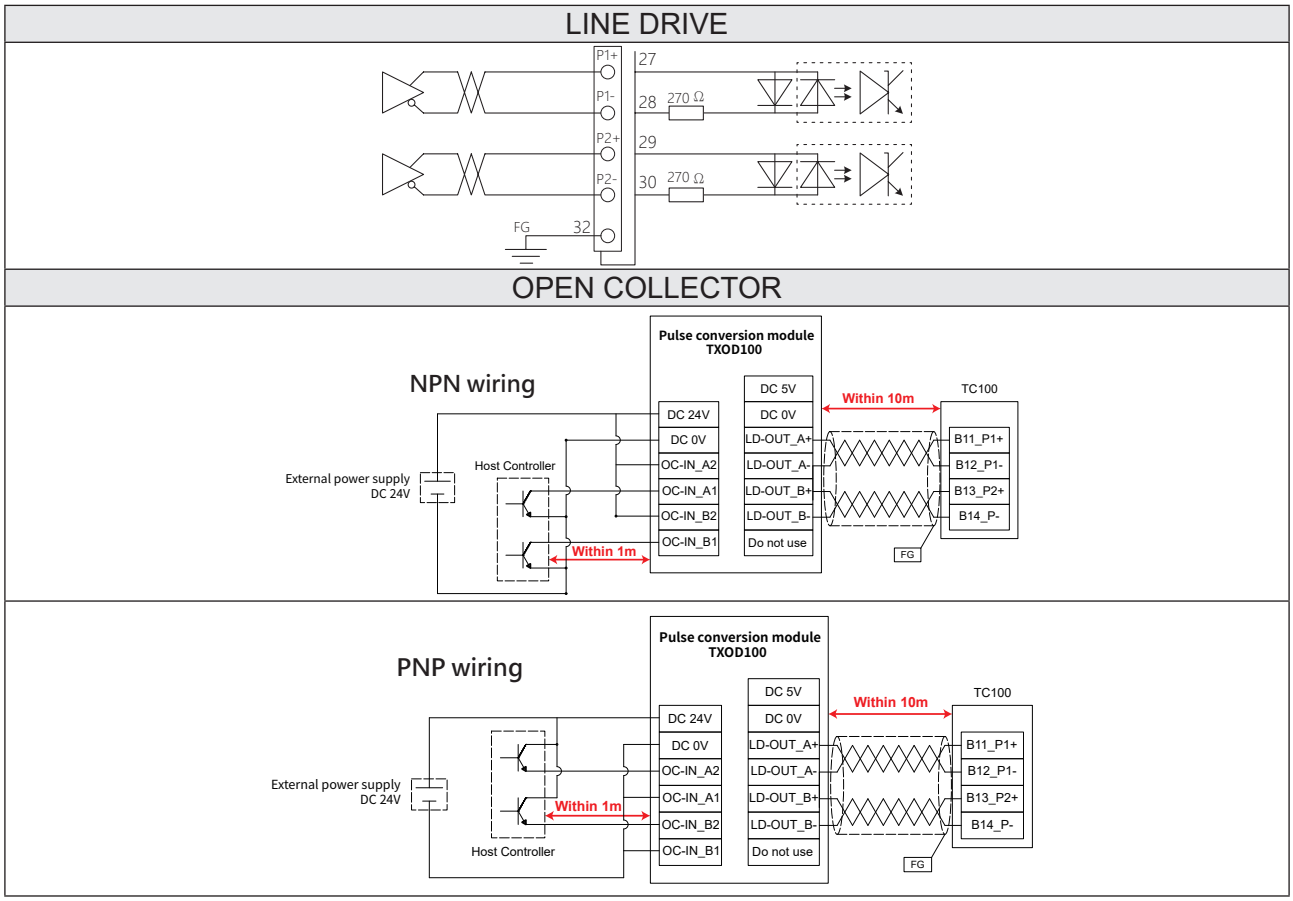


- **Wiring of transistor contacts**



Note) Take the saturated voltage 1V (when the output current is 10mA) of the photo-coupler into account.

- **Pulse input wiring**



Note) In External PULSE Mode, the existing position and current position of the command cannot be cleared to 0. This is normal and the transmission of PULSE will not be affected.

3.10 Precautions when wiring

- **Cable and connector selection guide**

According to the installation requirements of different customers' equipment, the company provides a variety of cable outlet ways for customers to choose.

Please select the direction of the cable outlet according to the installation specifications.

In addition, the types of cable are divided into standard and flexible cables with excellent bending resistance. If the customer plans to install the equipment on the movable part, it is recommended that you choose the bending resistance cable to increase the service life of the cable.

If you have any doubts about the selection of cables, please contact our sales staff.

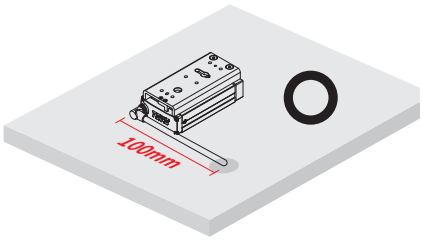
180° Straight Connector	90° Connector outlet (Up Side)	90° Connector outlet (Left Side)	90° Connector outlet (Right Side)	190° Connector outlet (Down Side)
-	WW	WL	WR	WM

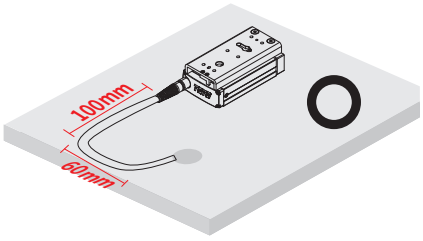
- **Recommended installation method of cable**

Please fix the connector from the back side of the product body so that it cannot be moved. If the installation method will exert an external force on the connector or cable, it may cause damage and cause abnormal use of the product.

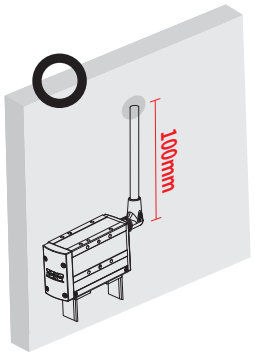
Please follow the minimum bending radius of the cable should not be less than 60mm and the connector outlet space should not be less than 100mm for installation and use.

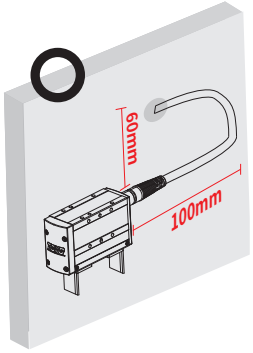
Take CSG As An Example



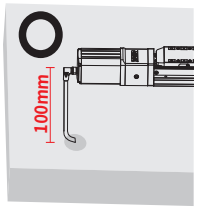


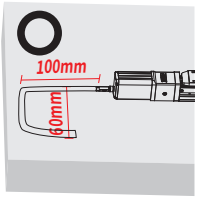
Take CHS2B As An Example





Take CGTH As An Example

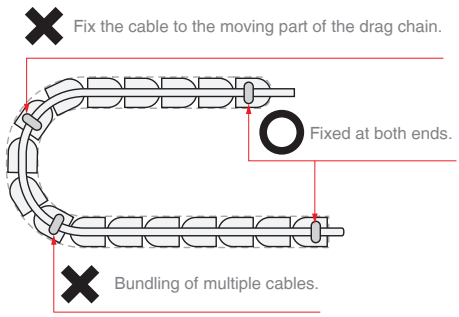




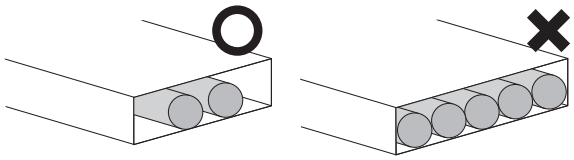
- **Precautions to put cables in tracks**

When the cable is in the tracks, the cable should be properly fixed to avoid pulling and friction during operation. Below is a schematic diagram of the separators and comb plates commonly used in cable tracks Please refer to the specifications of each brand for selection.

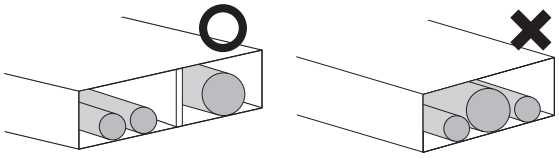
① When the cable is routed inside the tracks, to avoid the cable being pulled into the tracks or snaked. Both ends of the cable should be fixed with a comb-shaped plate. Please do not fix or bundle the cable at the moving and bending part.



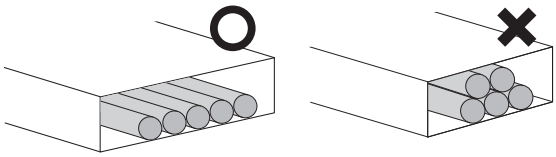
② The occupancy rate in the towline should be reduced as much as possible, and the cables can be freely moved in the carrier.



③ Please avoid mixing cables with a large difference in outer diameter.



④ Please avoid superimposing the installation of the cables and use the partition plate to separate them while keeping them flat.



4. Data setting

If you want to operate a robot with the TC100 Series, you must set the coordinate data and parameter data.

4.1 Overview

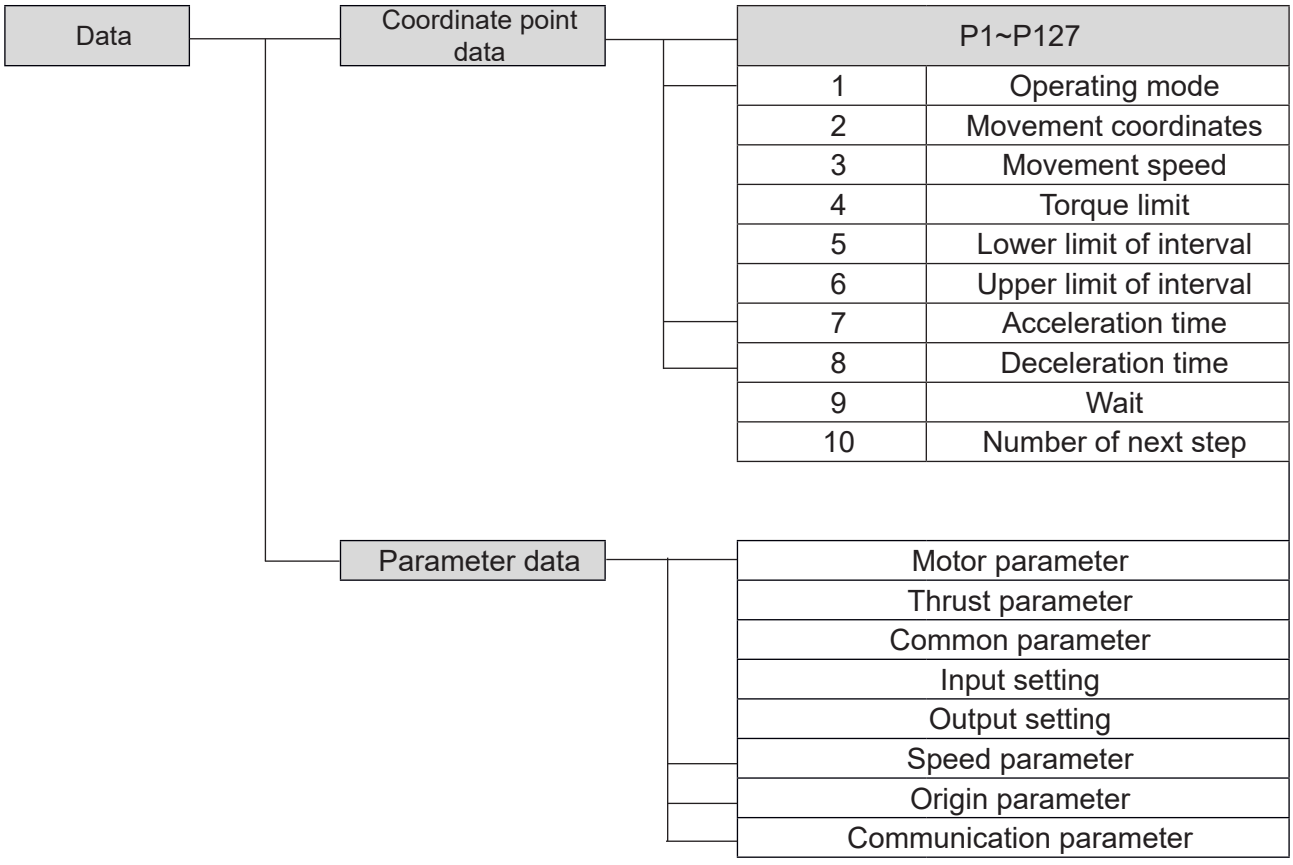
- **Setting of coordinate point data:**

The coordinate point data is used to provide the "standard settings" of the optimum position by specifying the carrying weight. It can also be used for the "customized settings" (such as the speed and acceleration) based on the usage. The coordinate point data used for positioning include "Operating Type," "Position," and "Speed."
127 points can be registered in P1~P127.

- **Parameter data setting:**

Parameter data can be divided into "motor parameter ", "thrust parameter", "common parameter", "input setting", "output setting", "speed parameter", "origin parameter" and "communication parameter".

- **Data consists of:**



- **Coordinate point data:**

P1~P127					
Item		Content	Range	Unit	Initial value
1	Operation mode	Set the type of the position.	9 modes	-	1
2	Movement coordinates	Set the target position or amount of movement.	-9999.99~9999.99	mm	0.00
3	Movement speed	Set the operation speed (%)	1~100	%	100
4	Torque limit	Set the current limit value.	1~1000	0.1%	500
5	Lower limit of interval	Set the output range of "single zone output"	-9999.99~9999.99	mm	0.00
6	Upper limit of interval				
7	Acceleration time *	The time to accelerate to the set speed.	1-30000	msec	300
8	Deceleration time *	The time from set speed to stop.	1-30000	msec	300
9	Wait	The delay time after movement	0 ~ 30000	ms	0
10	Number of next step	The number of the next step after movement.	1 ~ 127	-	-1

*** The acceleration and deceleration time function is supported only in V2.0**

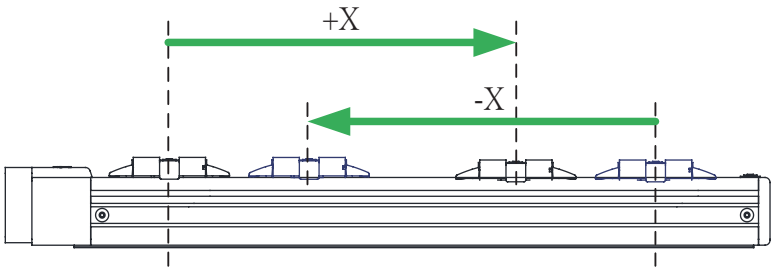
4.2 The detailed description of the coordinate point data

The following gives the detailed description of various aspects of the coordinate point data.

- **Description of each operating mode:**

INC: Relative Position Movement

From the current position, move a specified amount (distance) X and position.



■■ Case 1

Point Position	Operation	Movement	Move Speed (1~100)%	Torque Limit (1~1000) x0.01	Lower limit of range mm	Upper limit of range mm	Acceleration time msec	Deceleration time msec	Wait Time ms	Next step
1	INC	0.00	100	500	0.00	0.00	300	300	0	-1
2	INC	250.00	100	500	0.00	0.00	300	300	0	-1
3	INC	0.00	100	500	0.00	0.00	300	300	0	-1
4	INC	0.00	100	500	0.00	0.00	300	300	0	-1
5	INC	0.00	100	500	0.00	0.00	300	300	0	-1
6	INC	0.00	100	500	0.00	0.00	300	300	0	-1

Action specificatio:
Point P2 moves 250mm positively by "Relative Position" with a movement speed of 100%

■■ **Case 2**

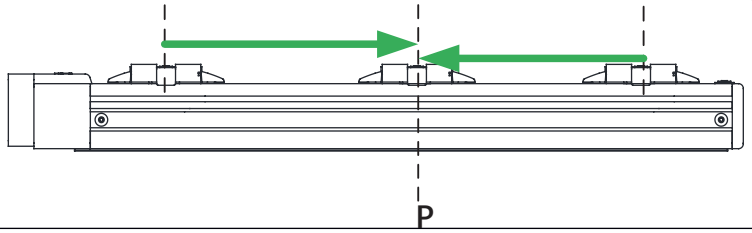
Point Position	Operation	Movement	Move Speed (1~100)%	Torque Limit (1~1000) x0.01	Lower limit of range mm	Upper limit of range mm	Acceleration time msec	Deceleration time msec	Wait Time ms	Next step
1	INC	0.00	100	500	0.00	0.00	300	300	0	-1
2	INC	250.00	100	500	0.00	0.00	300	300	0	-1
3	INC	-128.55	50	823	0.00	0.00	300	300	0	-1
4	INC	0.00	100	500	0.00	0.00	300	300	0	-1
5	INC	0.00	100	500	0.00	0.00	300	300	0	-1
6	INC	0.00	100	500	0.00	0.00	300	300	0	-1

Action specificatio:

Point P3 moves 128.55mm negatively by "relative position" with a movement speed of 50%

ABS: Absolute Position Movement

It moves to the absolute coordinates P with Home as reference and positioning is performed.



■■ **Case 1**

Point Position	Operation	Movement	Move Speed (1~100)%	Torque Limit (1~1000) x0.01	Lower limit of range mm	Upper limit of range mm	Acceleration time msec	Deceleration time msec	Wait Time ms	Next step
1	INC	0.00	100	500	0.00	0.00	300	300	0	-1
2	ABS	250.00	100	500	0.00	0.00	300	300	0	-1
3	INC	0.00	100	500	0.00	0.00	300	300	0	-1
4	INC	0.00	100	500	0.00	0.00	300	300	0	-1
5	INC	0.00	100	500	0.00	0.00	300	300	0	-1
6	INC	0.00	100	500	0.00	0.00	300	300	0	-1

Action specificatio:

Point P2 moves to Position 250mm by "Absolute position" with a movement speed of 100%

■■ **Case 2**

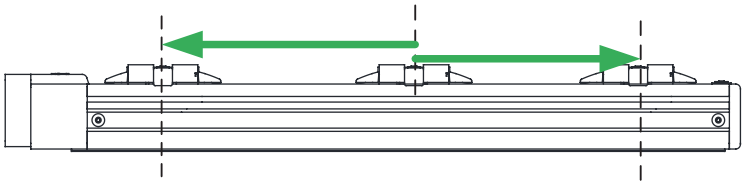
Point Position	Operation	Movement	Move Speed (1~100)%	Torque Limit (1~1000) x0.01	Lower limit of range mm	Upper limit of range mm	Acceleration time msec	Deceleration time msec	Wait Time ms	Next step
1	INC	0.00	100	500	0.00	0.00	300	300	0	-1
2	INC	250.00	100	500	0.00	0.00	300	300	0	-1
3	ABS	128.55	50	823	0.00	0.00	300	300	0	-1
4	INC	0.00	100	500	0.00	0.00	300	300	0	-1
5	INC	0.00	100	500	0.00	0.00	300	300	0	-1
6	INC	0.00	100	500	0.00	0.00	300	300	0	-1

Action specificatio:

Point P3 moves to Position 128.55mm by "Absolute position" with a movement speed of 50%

ORG: Home Return Movement

It moves toward Home from the current position.



ORG: The Home position is based on the parameter settings.
It is classified as "Motor Side" and "Opposite Motor Side."

■■ **Case 1**

Point Posi-tion	Ope-ration	Move-ment	Move Speed (1~100)%	Torque Limit (1~1000) x0.01	Lower limit of range mm	Upper limit of range mm	Acce-leration time msec	Dece-leration time msec	Wait Time ms	Next step
1	INC	0.00	100	500	0.00	0.00	300	300	0	-1
2	ORG	250.00	100	500	0.00	0.00	300	300	0	-1
3	INC	0.00	100	500	0.00	0.00	300	300	0	-1
4	INC	0.00	100	500	0.00	0.00	300	300	0	-1
5	INC	0.00	100	500	0.00	0.00	300	300	0	-1
6	INC	0.00	100	500	0.00	0.00	300	300	0	-1

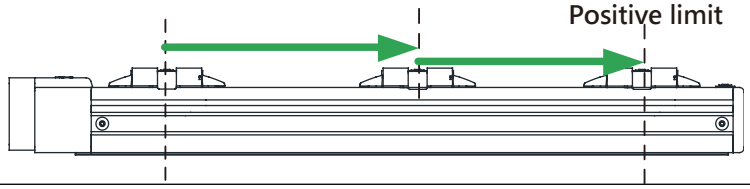
Action specificatio:

Point 2 moves toward Home from any position by "Home Return." During the movement, "ORG-S" OFF; After the movement, "ORG-S" ON.

Note) In ORG mode, the judgment of moving speed, torsion limit and interval is invalid, and the torsion force of the velocity returning to the origin is mainly set by the origin parameter.

+TSL: Positive Torque Search

It starts positive torque search from the current position.



■■ **Case 1**

Point Posi-tion	Ope-ration	Move-ment	Move Speed (1~100)%	Torque Limit (1~1000) x0.01	Lower limit of range mm	Upper limit of range mm	Acce-leration time msec	Dece-leration time msec	Wait Time ms	Next step
1	INC	0.00	100	500	0.00	0.00	300	300	0	-1
2	+TSL	250.00	100	335	0.00	0.00	300	300	0	-1
3	INC	0.00	100	500	0.00	0.00	300	300	0	-1
4	INC	0.00	100	500	0.00	0.00	300	300	0	-1
5	INC	0.00	100	500	0.00	0.00	300	300	0	-1
6	INC	0.00	100	500	0.00	0.00	300	300	0	-1

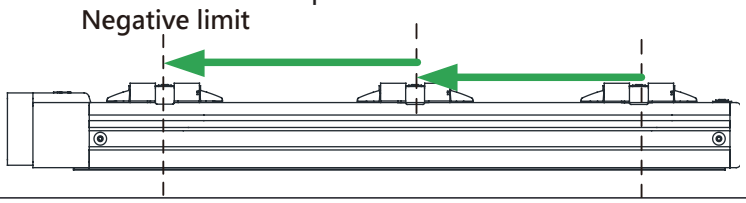
Action specificatio:

Point 2 moves to the positive limit from any position by "Positive Torque Search." It stops until the torque 33.5% is reached. If no torque is detected, it stops at the "Limit" position.

Note) The Coordinate Movement parameter is invalid. This is based on the speed and torque and the parameter can be added with a signal indicating the torque is reached.

-TSL: Negative Torque Search

It starts negative torque search from the current position.



■■ Case 1

Point Position	Operation	Movement	Move Speed (1~100)%	Torque Limit (1~1000) x0.01	Lower limit of range mm	Upper limit of range mm	Acceleration time msec	Deceleration time msec	Wait Time ms	Next step
1	INC	0.00	100	500	0.00	0.00	300	300	0	-1
2	-TSL	250.00	100	445	0.00	0.00	300	300	0	-1
3	INC	0.00	100	500	0.00	0.00	300	300	0	-1
4	INC	0.00	100	500	0.00	0.00	300	300	0	-1
5	INC	0.00	100	500	0.00	0.00	300	300	0	-1
6	INC	0.00	100	500	0.00	0.00	300	300	0	-1

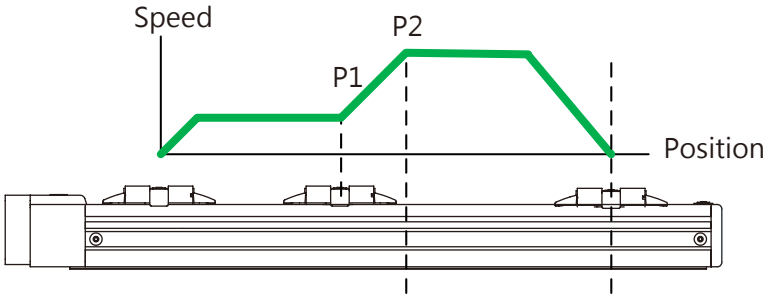
Action specificatio:

Point 2 moves to the negative limit from any position by "Negative Torque Search." It stops until the torque 44.5% is reached; if no torque is detected, it stops at "Limit" position.

Note) The Coordinate Movement parameter is invalid. This is based on the speed and torque and the parameter can be added with a signal indicating the torque is reached.

ABS-R: Continuous Operation

Change the speed without stopping and operations are performed for several coordinate points.



Point P1 and Point P2 use the absolute coordinate system with Home as reference.
(1) It accelerates to the speed specified by Coordinate Point 2
(2) After P1 is reached, it continuously moves toward P2 without stopping.

■■ Case 1

Point Position	Operation	Movement	Move Speed (1~100)%	Torque Limit (1~1000) x0.01	Lower limit of range mm	Upper limit of range mm	Acceleration time msec	Deceleration time msec	Wait Time ms	Next step
1	ABS-R	100.00	30	1000	0.00	0.00	300	300	0	2
2	ABS-R	250.00	100	1000	0.00	0.00	300	300	0	-1
3	INC	0.00	100	500	0.00	0.00	300	300	0	-1
4	INC	0.00	100	500	0.00	0.00	300	300	0	-1
5	INC	0.00	100	500	0.00	0.00	300	300	0	-1
6	INC	0.00	100	500	0.00	0.00	300	300	0	-1

Action specificatio:

It moves to Point P1 from Home and accelerates (decelerates) to Point P2. (Non-stop between Point P1 and Point P2)

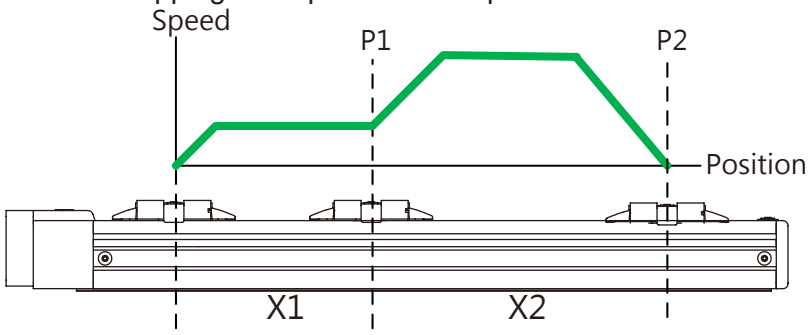
■■ Case 2

Point Posi-tion	Ope-ration	Move-ment	Move Speed (1~100)%	Torque Limit (1~1000) x0.01	Lower limit of range mm	Upper limit of range mm	Acce-leration time msec	Dece-leration time msec	Wait Time ms	Next step
1	ABS-R	210.00	100	500	0.00	0.00	300	300	0	2
2	ABS-R	250.00	20	200	0.00	0.00	300	300	0	-1
3	ABS	200.00	50	823	0.00	0.00	300	300	0	-1
4	INC	0.00	100	500	0.00	0.00	300	300	0	-1
5	INC	0.00	100	500	0.00	0.00	300	300	0	-1
6	INC	0.00	100	500	0.00	0.00	300	300	0	-1

Action specificatio:
With "Relative Position," Speed 100%, and Torque Limit 50%, it moves to Position 210mm. Afterwards, with "Absolute Position," Speed 20%, and Torque Limit 20%, it moves to Position 250mm. (Non-stop between Point P1 and Point P2)

INC-R: Continuous Operation

Change the speed without stopping and operations are performed for several coordinate points.



Several values of movement amount (distance) are specified for movement from the current position.
(1) It moves the specified amount of movement (X1)
(2) After the specified amount is reached for X1, it accelerates (decelerates) to the speed specified by Point P2 and moves to P2 the specified amount of movement X2.

■■Case 1

Point Posi-tion	Ope-ration	Move-ment	Move Speed (1~100)%	Torque Limit (1~1000) x0.01	Lower limit of range mm	Upper limit of range mm	Acce-leration time msec	Dece-leration time msec	Wait Time ms	Next step
1	INC-R	100.00	30	1000	0.00	0.00	300	300	0	2
2	INC-R	250.00	100	1000	0.00	0.00	300	300	0	-1
3	INC	0.00	100	500	0.00	0.00	300	300	0	-1
4	INC	0.00	100	500	0.00	0.00	300	300	0	-1
5	INC	0.00	100	500	0.00	0.00	300	300	0	-1
6	INC	0.00	100	500	0.00	0.00	300	300	0	-1

Action specificatio:
It moves the amount of movement from any point to Point P1 without stopping. (Non-stop between Point P1 and Point P2)

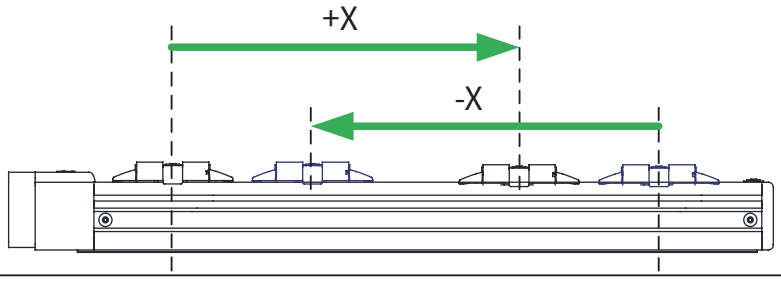
■■ **Case 2**

Point Position	Operation	Movement	Move Speed (1~100)%	Torque Limit (1~1000) x0.01	Lower limit of range mm	Upper limit of range mm	Acceleration time msec	Deceleration time msec	Wait Time ms	Next step
1	INC-R	210.00	100	500	0.00	0.00	300	300	0	2
2	INC-R	50.00	20	200	0.00	0.00	300	300	0	-1
3	ABS	200.00	50	823	0.00	0.00	300	300	0	-1
4	INC	0.00	100	500	0.00	0.00	300	300	0	-1
5	INC	0.00	100	500	0.00	0.00	300	300	0	-1
6	INC	0.00	100	500	0.00	0.00	300	300	0	-1

Action specificatio:
With "Relative Position," Speed 100%, and Torque Limit 50%, it moves to Position 210mm. Afterwards, with "Absolute Position," Speed 20%, and Torque Limit 20%, it moves to Position 250mm. (Non-stop between Point P1 and Point P2)

INC-T : Movement In Relative Position

Position by moving a specified amount(distance) X from the current position.



■■ **Case 1**

Point Position	Operation	Movement	Move Speed (1~100)%	Torque Limit (1~1000) x0.01	Lower limit of range mm	Upper limit of range mm	Acceleration time msec	Deceleration time msec	Wait Time ms	Next step
1	INC-T	0.00	100	500	0.00	0.00	300	300	0	-1
2	INC-T	250.00	100	500	0.00	0.00	300	300	0	-1
3	INC-T	0.00	100	500	0.00	0.00	300	300	0	-1
4	INC-T	0.00	100	500	0.00	0.00	300	300	0	-1
5	INC-T	0.00	100	500	0.00	0.00	300	300	0	-1
6	INC-T	0.00	100	500	0.00	0.00	300	300	0	-1

Action specificatio:
Point P2 moves 250mm in the "relative position" in the positive direction with a speed of 100% and a torque of 50%. If the torque is greater than 50%, it stops at 50% and outputs the signal of arrival of torque.

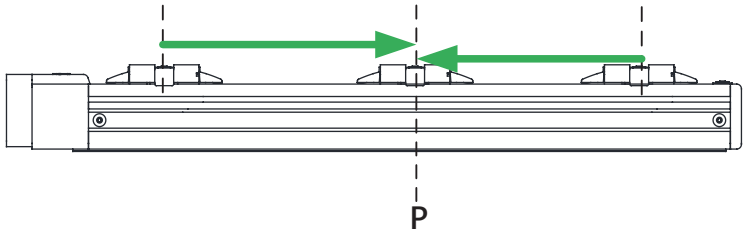
■■ **Case 2**

Point Position	Operation	Movement	Move Speed (1~100)%	Torque Limit (1~1000) x0.01	Lower limit of range mm	Upper limit of range mm	Acceleration time msec	Deceleration time msec	Wait Time ms	Next step
1	INC-T	0.00	100	500	0.00	0.00	300	300	0	-1
2	INC-T	250.00	100	500	0.00	0.00	300	300	0	-1
3	INC-T	-128.55	50	823	0.00	0.00	300	300	0	-1
4	INC-T	0.00	100	500	0.00	0.00	300	300	0	-1
5	INC-T	0.00	100	500	0.00	0.00	300	300	0	-1
6	INC-T	0.00	100	500	0.00	0.00	300	300	0	-1

Action specificatio:
Point P3 moves 128.55mm in the "relative position" in the negative direction with a speed of 50% and a torque of 82.3%. If the torque is greater than 82.3%, it stops at 82.3% and outputs the signal of arrival of torque.

ABS-T : Movement In Absolute Position

Position after moving to the absolute coordinate P based on the origin.



■■ Case 1

Point Position	Operation	Movement	Move Speed (1~100)%	Torque Limit (1~1000) x0.01	Lower limit of range mm	Upper limit of range mm	Acceleration time msec	Deceleration time msec	Wait Time ms	Next step
1	INC-T	0.00	100	500	0.00	0.00	300	300	0	-1
2	ABS-T	250.00	100	500	0.00	0.00	300	300	0	-1
3	INC-T	0.00	100	500	0.00	0.00	300	300	0	-1
4	INC-T	0.00	100	500	0.00	0.00	300	300	0	-1
5	INC-T	0.00	100	500	0.00	0.00	300	300	0	-1
6	INC-T	0.00	100	500	0.00	0.00	300	300	0	-1

Descriptions:
Point P2 moves 250mm towards an "absolute position" with a speed of 100% and a torque of 50%. If the torque is greater than 50%, it will stop at the position of 50% force and outputs the signal of arrival of torque.

■■ Case 2

Point Position	Operation	Movement	Move Speed (1~100)%	Torque Limit (1~1000) x0.01	Lower limit of range mm	Upper limit of range mm	Acceleration time msec	Deceleration time msec	Wait Time ms	Next step
1	INC-T	0.00	100	500	0.00	0.00	300	300	0	-1
2	INC-T	250.00	100	500	0.00	0.00	300	300	0	-1
3	ABS-T	128.55	50	823	0.00	0.00	300	300	0	-1
4	INC-T	0.00	100	500	0.00	0.00	300	300	0	-1
5	INC-T	0.00	100	500	0.00	0.00	300	300	0	-1
6	INC-T	0.00	100	500	0.00	0.00	300	300	0	-1

Action specificatio:
Point P3 moves 128.55mm towards an "absolute position" with a speed of 50% and a torque of 82.3%. If the torque is greater than 82.3%, it will stop at the position of 82.3% force and outputs the signal of arrival of torque.

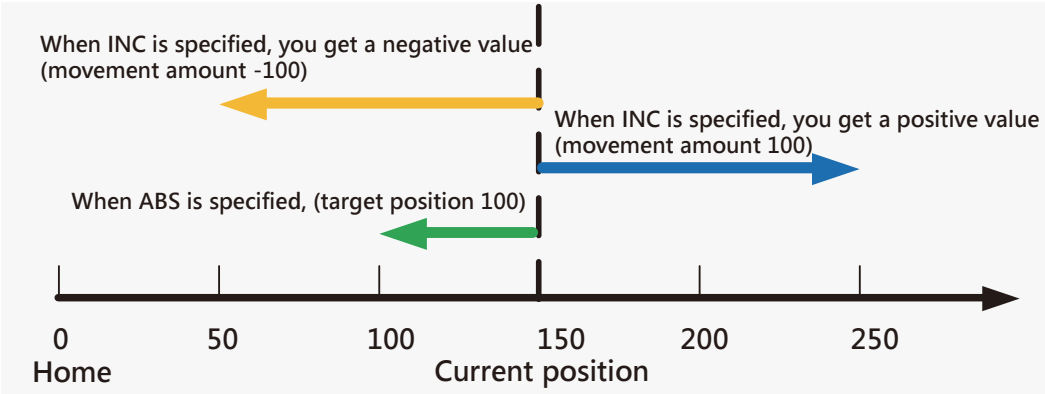
4.3 Movement coordinates

They varies depending on the operating mode.

■■ ABS: Absolute position and the setting value is used as the target position.

■■ INC: Absolute position and the setting value is used as the signed amount of movement.

The figure shows the movement difference when 100 is set for the movement coordinates.



4.4 Movement speed

The speed used for movement setting. It is set based on the percentage (%) of the maximum speed of each robot.

> ⚠**Caution:**
> In Torque Search Mode, reduce the speed to less than 30% to increase the accuracy of the torque reading.

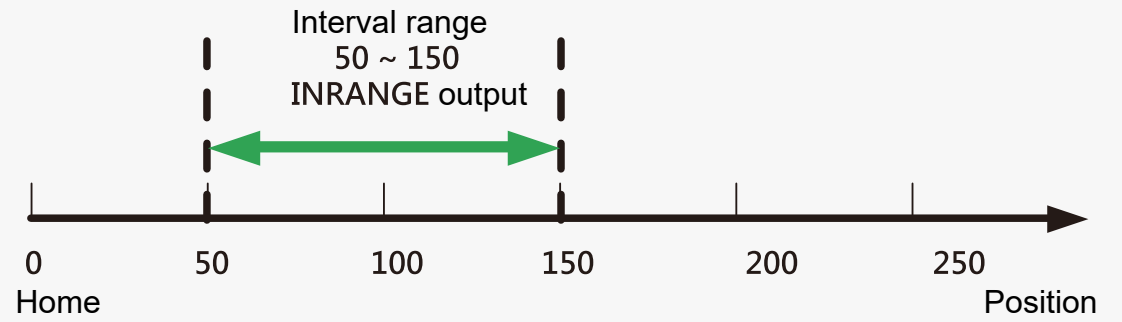
4.5 Torque limit

Set the current limit value for movement. It is set based on the percentage (%) of the rated current of each robot.

> ⚠**Caution:**
> The setting value of the torque limit is measured in 0.1%. Therefore, 1000 represents 100% which indicates the rated current of each robot. For each robot, the current value varies depending on the hardware friction.

4.6 Interval range setting (upper / lower limit)

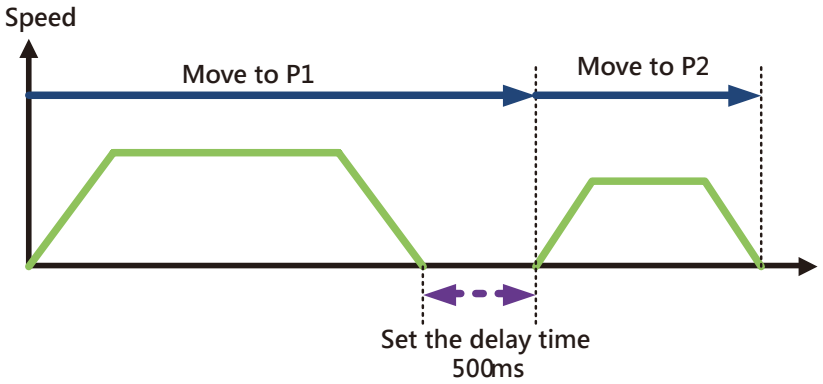
Set the upper limit and lower limit of the interval range. In the interval, the dedicated signal "INRANGE" can be output.
You have to set I/O parameters to be output before the dedicated signal is output.
The figure below shows the setting example of the interval 50~150 from Home of the absolution position.



4.7 Delay

■■ Case 1

Point number	Operating mode	Movement coordinates mm	Movement speed (1~100)%	Torque limit (1~1000)x0.01	Lower limit of the interval range mm	Upper limit of the interval range mm	Delay time ms	Next step no.
1	ABS	0.00	100	500	0.00	0.00	500	2
2	ABS	200	100	500	0.00	0.00	0	-1
3	INC	0.00	100	500	0.00	0.00	0	-1
4	INC	0.00	100	500	0.00	0.00	0	-1



Descriptions: Move Point P1 and move to Point P2 after 500ms.

5. Parameter data

5.1 Motor parameter

NO	Parameter	Number of words	English abbreviation	Description	Remarks	Range	Reboot after modification
1	0108 H	2	FullCountValue	Alarm value of the counter overflow(Pulse)	A FullCount alert is raised when the Pulse value of the difference between the present position and the command position is greater than this value.	-	x
2	010A H	1	InPositionZone	INPOSTION signal location range setting(Pulse)	Signal INPOSTION may be on constantly when the value set is too big or the moving speed is too slow. Signal is normally ON. When the difference between the command position and the present position is less than the set value, the signal is ON.	0~1000	x
3	010B H	1	ElectroGearNum	Electronic gear numerator	Pulse number of encoder when the motor turns once. The encoder pulse number when the initial value of 1 changes = the basic pulse number of encoder ÷(electronic gear numerator ÷ electronic gear denominator), which will be displayed only in pulse mode	1~10000	o
4	010C H	1	ElectroGearDen	Electronic gear denominator		1~10000	o
5	0114 H	1	PosDir	External pulse command, and specified rotary direction	0: Motor operation direction CW 1: Motor operation direction CCW	0~1	o
6	0115 H	1	SelComPulse	External pulse command type	0: CW/CCW (Initial value) 1: PULSE/DIR 2: A-phase / B-phase	0~2	o
7	011D H	1	NearZone	NEAR signal output range setting(Pulse)	When the approaching target is less than the set value, the siginal is on(the initial value is 4)	0~10000 pulse	x

5.2 Thrust parameter

NO	Parameter	Number of words	English abbreviation	Description	Remarks	Range	Reboot after modification
1	0400 H	1	PushTrqRateCw	+ Push in the direction, torque value(0.1% *)	-	0 ~ 1000 ×0.1%	x
2	0401 H	1	PushTrqRateCcw	- Push in the direction, torque value(0.1% *)	-	0 ～ 1000 ×0.1%	x
3	0402 H	1	TrqLmtTime	Torque limit detection time (msec)	-	0 ～ 10000 msec	o
4	0406 H	1	RtnSpdLmtEnable	Select if the position adjustment speed limit is performed	0: Invalid (Initial value) 1: Valid	0~1	x
5	0407 H	1	RtnMaxSpd	Speed limit for position adjustment(rpm)	(Initial value 10)	10~500 rpm	x

5.3 Common parameter

NO	Parameter	Number of words	English abbreviation	Description	Remarks	Range	Reboot after modification
1	0500 H	1	MaxTrqRate	Maximum output torque setting in position mode (x 0.1%)	Maximum value is 2 times of rated torque (initial value 650)	0 ~ 1000 ×0.1%	o
2	0501 H	1	FullTrqTime	Full torque error time detection in position mode(msec)	(Initial value 1000)	500 ~ 0000 msec	o
3	0503 H	1	ModeSwitch	Mode switch under the Pulse control	0: Position mode (initial value) 1: Torque mode	0 ～ 100 %	o
4	0515 H	1	ServoState	Brake On/Off when Servo is OFF	0: Servo ON(initial value) 1: Servo OFF	0 ～ 1	o
5	051B H	1	OrgRetRestrict	Action limits when origin return is not complete, refer to ORG-S	Any action is restricted when the origin return is not complete 0: Unrestricted (origin return is not complete, but actions are allowed) 1: Restricted (actions can be performed only after completing the origin return) (initial value)	0 ～ 1	o
6	051E H	1	UseTotalRev	Switch for the function of specifying the motor to calculate the cumulative number of turns	0: invalid (initial value) 1: valid	0 ～ 1	x

5.4 Input settings

NO	Parameter	Number of words	English abbreviation	Description	Remarks	Reboot after modification
1	0601 H	1	JOG+	JOG + : + JOG movement (working when the MANUAL is ON)	CN4 Interface INPUT No. Setting. effective when set value is 0	o
2	0602 H	1	JOG-	JOG - : - JOG movement (working when the MANUAL is ON)		
3	0603 H	1	MANUAL	Manual mode		
4	0604 H	1	TEACH	TEACH: for saving point position (effective when MANUAL is ON)		
5	0607 H	1	LOCK	Pause/ Interlock		
6	060E H	1	PRGSEL4	Program selection No.0~1 27 Bit4		
7	060F H	1	PRGSEL5	Program selection No.0~1 27 Bit5		
8	0610 H	1	PRGSEL6	Program selection No.0~1 27 Bit6		
9	0611 H	1	ORG_SIG	Signal for detected origin reset		
10	0612 H	1	BK_OFF	BK_OFF: Signal Brake ON/OFF (effective when SERVO is OFF)		
11	0613 H	1	FULL_COUNT	FULL-COUNT: switch FULL-COUNT judgment (initially in effect)		

5.5 Output settings

NO	Parameter	Number of words	English abbreviation	Description	Remarks	Reboot after modification
1	0700 H	1	INPOSITION	Inposition in-place signal	CN4 Interface OUTPUT No. Setting. effective when set value is 0	o
2	0701 H	1	ALARM	Error signal		
3	0702 H	1	READY	Ready to proceed to the next point		
4	0703 H	1	MOVE	On the move		
5	0705 H	1	SERVO-S	SERVO ON status		
6	0706 H	1	PRGSEL0-S	PRGSEL0-S: Program Selection No.0 ～ 127 Bit0		
7	0707 H	1	PRGSEL1-S	PRGSEL1-S: Program Selection No.0 ～ 127 Bit1		
8	0708 H	1	PRGSEL2-S	PRGSEL2-S: Program Selection No.0 ～ 127 Bit2		
9	0709 H	1	PRGSEL3-S	PRGSEL3-S: Program Selection No.0 ～ 127 Bit3		
10	080A H	1	PRGSEL4-S	PRGSEL4-S: Program Selection No.0 ～ 127 Bit4		
11	070B H	1	PRGSEL5-S	PRGSEL5-S: Program Selection No.0 ～ 127 Bit5		
12	070C H	1	PRGSEL6-S	PRGSEL6-S: Program Selection No.0 ～ 127 Bit6		
13	070D H	1	TRQ_LMT	TRQLIM: Torque Limit		
14	070E H	1	ERR0	ERR0: Error Coding Bit0		
15	070F H	1	ERR1	ERR1: Error Coding Bit1		
16	0710 H	1	ERR2	ERR2: Error Coding Bit2		
17	0711 H	1	ERR3	ERR3: Error Coding Bit3		
18	0712 H	1	INRANGE	INRANGE: Output when in the range of an interval		
19	0713 H	1	NEAR	NEAR: Output when moving to the range of the target position .The target position is set by point position operation modes ABS and INC		
20	0714 H	1	SOFTLMT	SOFTLMT: Software limit output indicator.		

5.6 Speed setting parameters

NO	Parameter	Number of words	English abbreviation	Description	Remarks	Range	Reboot after modification
1	0800 H	2	LowSpeed	Activation speed setting(pps)	When the speed is set to 0%, the moving speed is not affected by 0802, just like the idling state when the locomotive is running.	-	x
2	0802 H	2	HighSpeed	Setting of maximum speed during operation (pps)	Rated maximum speed, this value can range from RPM /60*Encoder resolution.	-	x
3	0804 H	1	AccelTim	Acceleration time setting (msec)	Motor acceleration time setting.	1 ～ 30000 msec	x
4	0805 H	1	DecelTime	Deceleration time setting (msec)	Motor deceleration time setting.	1 ～ 30000 msec	x
5	0807 H	2	TrqLimitPress	Torque tolerance setting(Pulse)	Pulse number that will move to the set value after reaching the torque limit in TSL operation mode.	pulse	x

NO	Parameter	Number of words	English abbreviation	Description	Remarks	Range	Reboot after modification
6	080A H	1	MoveSttSet	Set the in-motion status	Set the action status. 0: In-motion status OFF after the specified PULSE is output. 1: Inposition ON and In-motion status OFF after the specified PULSE is output.	0 ～ 1	x
7	080F H	1	JogInchingSpd	Setting of JOG speed when moving (x0.1%)	Used when under I/O control.	1 ～ 1000	x
8	0810 H	2	JogInchingData	Setting of movement amount when JOG is moving(Pulse)	Used when under I/O control.		x
9	0812 H	1	JogInchingWait	Setting of waiting time after JOG moves(msec)	Used when under I/O control.	0~1000 msec	x
10	0813 H	2	PlusSoftLimit	Software limit in + direction(mm)	Setting of software limit in + direction. Invalid when the software limit is 0.	-	x
11	0815 H	2	MinusSoftLimit	Software limit in - direction(mm)	Setting of software limit in - direction. Invalid when the software limit is 0	-	x

5.7 Home setting parameters

NO	Parameter	Number of words	English abbreviation	Description	Remarks	Range	Reboot after modification
1	0900 H	1	OrgMode	The direction of origin return	Set the movement direction for home return. 0: Torque return + direction; 1: Torque return - direction; 2: After torque return + direction, find the Z-phase in an opposite way; 3: Find the Z-phase in an opposite way; 4: Toward + direction, find the ORG_SIG signal; 5: Toward - direction, find the ORG_SIG signal; 6: Toward + direction, find the ORG_SIG signal. After that, find the Z-phase in an opposite way; 7: Toward - direction, find the ORG_SIG signal. After that, find the Z-phase in an opposite way	0~7	x
2	0901 H	1	OrgSpeed	Home return speed	The setting of the speed at which the origin returns, as by torsion. It is recommended that the speed be set below 20%. When the value is from 1% to 100%, the speed is the percentage of the highest speed of 0802 H. When the value is 0%, the speed is the set value of the initial speed of 0800 H.	0 ~ 100%	x
3	0902 H	2	OrgOffset	Set the offset for home return.	The offset shall be moved after the origin returns. The torsion values of 0400h and 0401h are taken into account for this movement.		x

NO	Parameter	Number of words	English abbreviation	Description	Remarks	Range	Reboot after modification
4	0904 H	1	OrgOffsetSpeed	The movement speed for the home return offset	When the torque is returned to the origin, the torque will be detected and then moved in the opposite direction by an offset amount of movement speed. When the value is from 1% to 100%, the speed is the percentage of the highest speed of 0802 H. When the value is 0%, the speed is the set value of the initial speed of 0800 H.	0 ~ 100%	x
5	0905 H	2	OrgData	The data of home return	The data used to set a position after the home return is finished		x
6	0907 H	1	OrgTrqLimit	Torque setting when the origin returns(x 0.1%)	The torque required to hit the hardware limit when the origin returns.	0 ~ 1000 ×0.1 %	x
7	0908 H	2	OrgOffset_Z	The amount of offset (Pluse) before Z is detected	When the origin return hits the hardware limit, offset this value, and then look for the Z phase. This movement refers to the torque values of 0400h and 0401h.	PULSE	x
8	090A H	1	OrgTrqLmtTime	The torque detection time during the home return	If the torque reaches the set time when the torque origin returns, the judgment condition is established.	0~10000	x
9	090B H	1	OrgSpeed_Z1	Z-phase detection speed _1(%)	Speed adjustment of Z phase search during origin return action. (Based on the set value of 0802H at 100%)	1~100 %	x
10	090C H	1	OrgSpeed_Z2	Z-phase detection speed _2(%)	After the Z-phase is found at a speed specified in 090B H, find the Z-phase again in an opposite way at a speed specified in 090C H.	1~100 %	x

5.8 Communication setting parameters

NO	Parameter	Number of words	Abbreviation	Description	Remarks	Range	Reboot after modification
1	0A00 H	1	BaudRate	Communication rate	Set the communication rate 0: 9600bps 1: 19200bps(Initial value) 2: 38400bps 3: 57600bps 4: 115200bps	0~4	o
2	0A01 H	1	DataSize	String data bit setting	Set the number of the data bits in one string. 0: 8bit(Initial value) 1: 7bit	0 ～ 1	o
3	0A02 H	1	Parity	Parity	Parity setting. 0: None(Initial value) 1: Even 2: Odd	0 ～ 2	o
4	0A03 H	1	Broadcast	Broadcast setting	Broadcast setting. The message of the broadcast position will be ignored if it is invalid. 0: Invalid(Initial value) 1: Valid	0 ～ 1	o
5	0A04 H	1	Protocol	Communication protocol	Set the MODBUS protocol of RS485. 0: MODBUS-ASCII(Initial value) 1: MODBUS-RTU	0 ～ 1	o

6. Description of I/O functions

6.1 I/O specifications

TC100 can communication with peripherals with the IO interface.
I/O is interfaced with a 32-pin ribbon cable. You should select the length of your ribbon at the time of purchase.
I/O specifications: Transistor type (NPN).

32-pin ribbon cable {
- 14 IN DC24V, ±10%, 1.5~6mA/point, common anode.
- 10 OUT DC24V, ±10%, less than 10mA/point, common anode.
- PULSE +/-
- DIR +/-

6.2 I/O signal table

NO	Signal name	Content description	Remarks
1	COM+	IO power +24V	+24V ±10%
2	COM-	IO power 0V	
3	IN 1	ORG	Unset parameters: ORG_SIG MANUAL JOG+ JOG- TEACH BK_OFF CONT_MODE FULL_COUNT
4	IN 2	SERVO	
5	IN 3	ALM_REAET	
6	IN 4	START	
7	IN 5	PRGSEL0	
8	IN 6	PRGSEL1	
9	IN 7	PRGSEL2	
10	IN 8	PRGSEL3	
11	IN 9	PRGSEL4	
12	IN 10	PRGSEL5	
13	IN 11	PRGSEL6	
14	IN 12	LOCK	
15	IN 13	-	
16	IN 14	-	
17	OUT 1	ORG-S	Unset parameters: ALARM MOVE PRGSEL6-S TRQLIM ERR0 : ERR3 INRANGE NEAR SOFTLMT
18	OUT 2	INP	
19	OUT 3	READY	
20	OUT 4	SERVO-S	
21	OUT 5	PRGSEL0-S	
22	OUT 6	PRGSEL1-S	
23	OUT 7	PRGSEL2-S	
24	OUT 8	PRGSEL3-S	
25	OUT 9	PRGSEL4-S	
26	OUT 10	PRGSEL5-S	
27	P1+	CCW, B-phase, PULSE	CW/CCW A/B-phase PULSE/DIR
28	P1-		
29	P2+	CW, A-phase, DIR	
30	P2-		
31	Reserved	-	
32	FG	Shielding wire/Grounding	

6.3 Description of input signals

<table>
<tr><th>NO</th><th>Signal name</th><th>Description</th></tr>
<tr><td>1</td><td>ORG</td><td>Point coordinates are valid only when the home return is performed after booting.</td></tr>
<tr><td>2</td><td>ALM_RESET</td><td>When this signal is ON, perform the following steps:
When an alarm occurs, reset it. After the corresponding actions are taken, dismiss the alarm using this signal.</td></tr>
<tr><td>3</td><td>/SERVO</td><td>This signal represents Contact B. It is OFF when Servo is ON. It is ON when Servo is OFF.
Note: When an alarm or emergency stop occurs, the Servo is OFF and cannot be controlled.</td></tr>
<tr><td>4</td><td>/LOCK</td><td>This signal represents Contact B. During the operation, if it is ON, the robot will decelerate and come to a stop. If you want to activate it again, this signal should be OFF.
Note: Interlocking is not a safety switch. Do not use it for safety purposes. The Servo will not be OFF during the interlocking and remain in the current status.</td></tr>
<tr><td>5</td><td>START</td><td>Perform the positioning operation for the coordinate point data specified by the point number selection (PRGSEL0 ~ PRGSEL6).
Note: It is valid only when the Manual Mode (MANUAL) is OFF.</td></tr>
<tr><td>6</td><td>PRGSEL0
~
PRSEL6</td><td>Read the 7-digit point number in binary before using the “START“ or “TEACH“ signal.

PIN6 PIN0
0 1 0 1 0 0 1

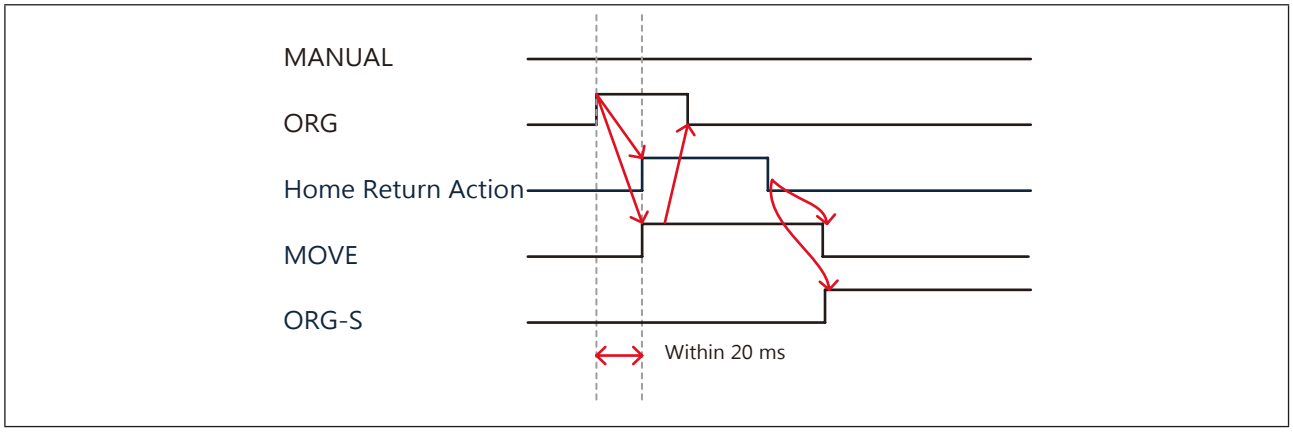
<table>
<tr><th>The sum value when ON</th><th colspan="2">Example</th></tr>
<tr><td>2^0</td><td>1</td><td rowspan="7">Total = 41
(Coordinate point no. 41)</td></tr>
<tr><td>2^1</td><td>0</td></tr>
<tr><td>2^2</td><td>0</td></tr>
<tr><td>2^3</td><td>8</td></tr>
<tr><td>2^4</td><td>0</td></tr>
<tr><td>2^5</td><td>32</td></tr>
<tr><td>2^6</td><td>0</td></tr>
</table>
</td></tr>
<tr><td>7</td><td>JOG+ / JOG-</td><td>In Manual Mode, the motor moves in the specified direction when JOG(+/-) ON, until the signal is OFF or the soft limit is reached.</td></tr>
<tr><td>8</td><td>MANUAL</td><td>When this signal is ON, it enters Manual Mode.
The following actions can be performed in Manual Mode: JOG(+/-), TEACH, PRGSEL 0~PRGSEL 6, etc.</td></tr>
<tr><td>9</td><td>TEACH</td><td>When this signal is ON, the current position value is saved in the specified point position.</td></tr>
<tr><td>10</td><td>CONT_MODE</td><td>Switch between position mode and torque mode(working when ModeWwitch is 1)</td></tr>
<tr><td>11</td><td>BK_OFF</td><td>Brake ON/OFF signal (working when SERVO is OFF)</td></tr>
<tr><td>12</td><td>FULL_COUNT</td><td>Switch FULL-COUNT judgment (initially in effect)</td></tr>
</table>

6.4 Description of output signals

NO	Signal name	Description
1	IN-POSITION	The InPositon signal is ON when the command position is identical to the current position. When the value of parameter InPositionZone is too large or it moves at a slower speed, the InPosition signal may often be ON.
2	ALARM	When there is a problem with the controller, the signal is ON.
3	READY	When the controller is in standby status, and can receive external signals or communication commands, the signal is ON.
4	MOVE	During the movement, the signal is ON.
5	ORG-S	After the home return is finished, the signal is ON. It is OFF during the home return.
6	SERVO-S	After the servo is excited, the signal is ON. If there is an emergency stop or an error, it is OFF.
7	PRGSEL0-S ~ PRGSEL6-S	PIN6 PIN0 0 1 0 1 0 0 1 The sum value when ON: 2^0, 2^1, 2^2, 2^3, 2^4, 2^5, 2^6 Example: 1, 0, 4, 8, 0, 32, 0 Total = 45 (Coordinate point no. 45)
8	TRQ_LMT	When the motor moves, this signal is ON if this current value reaches the set value.
9	ERR0 ~ ERR3	When there is a problem with the controller, the error code is output in binary. It shows 16 error statuses.
10	INRANGE	When the motor operates and enters the set range, this signal is ON.
11	NEAR	Output when moving within the range of the target position, the target position is set by point position operation modes ABS and INC.
12	SOFTLMT	Signal is when the current position moves to the software limit.

7. Action timing

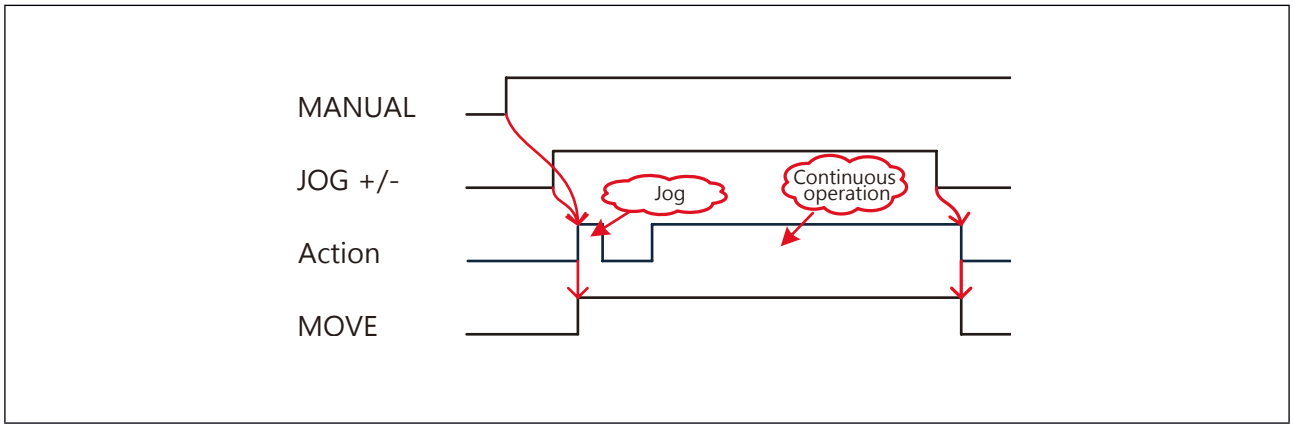
7.1 Home return



Description:

- After normal booting, the servo signal is ON.
- The signal "ORG" will be input and the signal is ON.
- It starts to perform the home return and the "MOVE" signal is ON. Input "ORG" and the signal becomes OFF.
- After the home return is finished, the "MOVE" signal is OFF and the "ORG-S" signal is ON. The home return is finished.

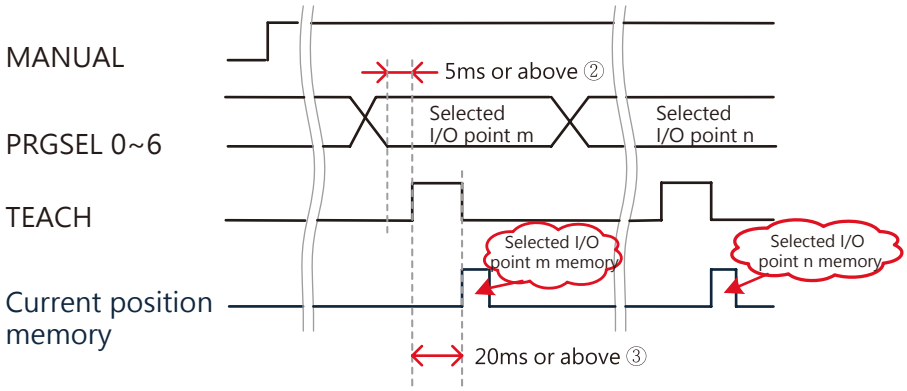
7.2 I/O control JOG action



Description:
It is valid only when the "MANUAL" signal is ON.

- Set the "MANUAL" signal to ON.
- "JOG +/-" signal is ON and the motor starts operation. "MOVE" is ON.
- "JOG +/-" signal is OFF and the motor stops operation. "MOVE" is OFF.

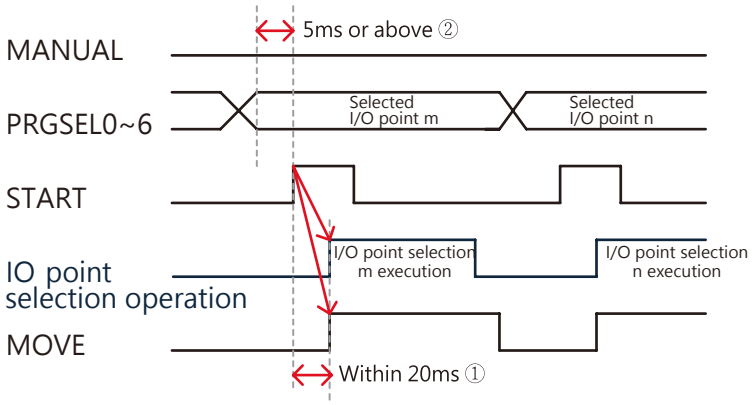
7.3 I/O point teaching



Description:
It is valid only when "MANUAL" is ON.

- Set the "MANUAL" signal to ON.
- Determine and select a point position to be taught based on the signal "PRGSEL0 ～ 6" (in binary code).
- Set the "TEACH" signal to ON and at least 20ms or above. Position memory now is finished.

7.4 I/O point selection operation



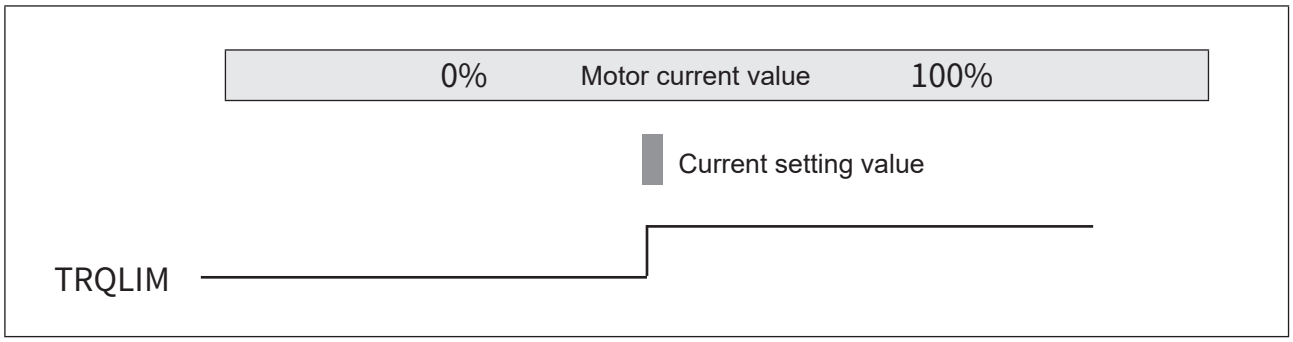
Description:
It is valid only when "MANUAL" is ON.

- Set the "MANUAL" signal to OFF.
- Determine and select a point position to which you want to move based on the signal "PRGSEL0~6" (in binary code).
- Enable the "START" signal to ON and the IO point selection is finished. The motor starts operating and the "MOVE" signal is ON.

Note:

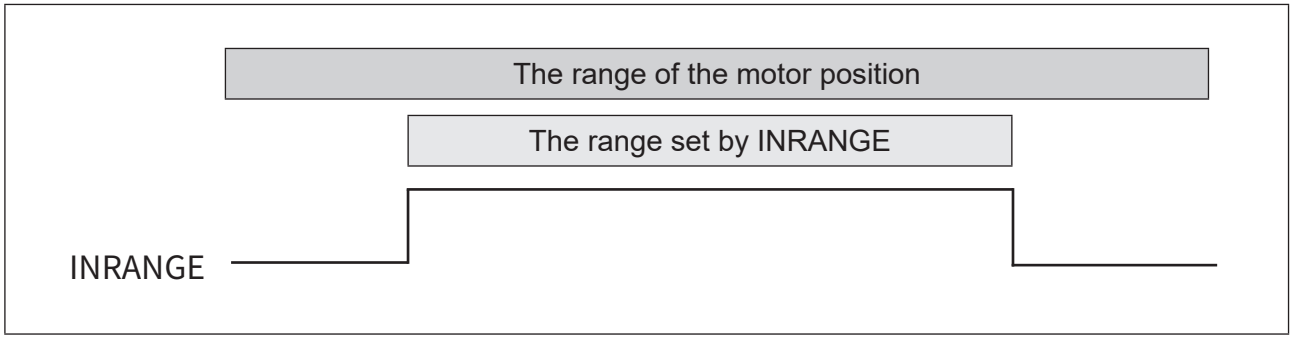
- The minimum period of time which the ORG and START signals accept.
- The time during which the PRGSEL n signal is stable.
- The minimum period of time which the point memory signal accepts.
- During the JOG operation, the fine-tune distance, delay time, and operating time can be set in parameters.

7.5 TRQLIM signal output



7.6 INRANGE signal output

During the setting of a point position, this signal will be output only when the motor moves to the range after the upper limit and lower limit of INRANGE are set.



7.7 The LED display on the controller

LED status	**PWR:** Power (green): Lights up when drive + control power is supplied; when the drive power is turned off, the green indicator is flashing. **SON:** Servo (green): Lights up when Servo is ON; when an error occurs, it goes off. **ERR:** Abnormal situation (red): Determine the error code based on the flashing times.

8. Communication _RS485

8.1 Communication specification

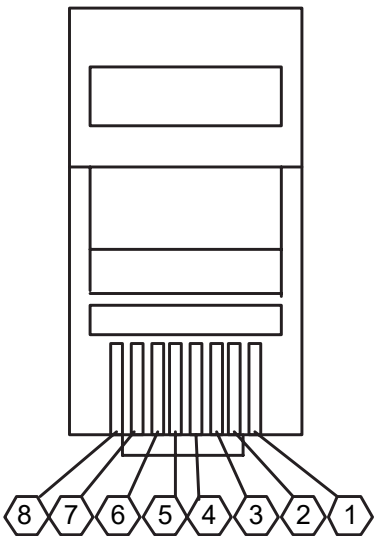
This unit communicates with other devices via MODBUS PROTOCOL.
There are two transfer modes: ASCII or RTU (binary) modes.

Item	ASCII Mode	RTU Mode
Communication protocol	MODBUS ASCII	MODBUS RTU
Communication method	RS-485 2-wire (half-duplex)	
	USB2.0	-
Communication distance	RS-485: Up to 500 meters when combined with cables	
	USB 2.0: 5 meters	-
Connection type	RS-485: One to Multiple (up to 16 units)	
	USB 2.0: One to One	-
Communication speed	9600,19200,38400,57600 and 115200 bps	
Start bit	1 BIT	
Data length	7, 8 BIT	8 BIT
Parity	None, even parity, odd parity	
Stop bit	1 BIT	
Communication code	ASCII	Binary
Start code	" : " (3A H)	None
End code	CR+LF (0D H+0A H)	None
Check code	LRC	CRC-16
Maximum number of units	16 units	

Note) If a UI has to be used to cascade the TC100 controller, it should be in ASCII Mode.

■■ Pins assignments of the CN6 and CN7 (RJ-45) connectors are described as follows:

Pin	Signal name	Description
1		
2	SG	Signal ground wire (knitted wire mesh)
3	SIG-A	DATA +
4		
5	SG	Signal ground wire (knitted wire mesh)
6	SIG-B	DATA -
7		
8	SG	Signal ground wire (knitted wire mesh)



8.2 Data structure

■■ Read status

Position	Number of words	Abbreviation	Description	Remarks	Range / unit
1000 H	1	ActionStatus	Action status	0: Stop 1: Working 2: Abnormal stop	0~2
1001 H	1	InpStatus	Current status of the InPositon signal	0: The current position is not within the set range 1: The current position is within the target range	0~1
1004 H	1	TrqLmtStatus	Torque limit status	0: Not within the set range 1: Within the target range	
1005 H	1	AlarmStatus	Alarm status	0: No alarm 1: Loop error 2: Full Count 3: Over speed 4: Poor gain adjustment 5: Over-voltage 6: Initialization abnormal 7: EEPROM abnormal 8: Low voltage of the main circuit 9: Over-current 10: Regeneration abnormal 11: Emergency stop 12: Motor wire breaks 13: Encoder is disconnected 14: Protection current value 15: Power reinput 17: Action timed out	
1006 H	1	MonSpeed	Motor rotational speed		rpm
1007 H	1	MonCurrent	Motor current value		*0.1%
1008 H	2	CmdNowPos	Current position of the command		
100A H	2	EcdPos	Encoder position		
100C H	1	ServoStatus	Servo Status	0: Servo is OFF 1: Servo is ON	0~1
100D H	1	ErrorStatus	Failure status	0: No error 1: Working, feedback action command 2: Upper limit and lower limit error 3: Position error 4: Format error 5: Control mode error 6: Power off and restart 7: Initialization is not complete 8: Servo ON/OFF error 9: LOCK 10: Software limits 11: Parameter write permission is insufficient 12: Origin return is not complete 13: Brake released	
100E H	1	StepNo	Program selection number	Display the number of the last executed program The program STEP that has never been executed is "-1"	-1~127
1020 H	1	PORT (OUT1~10)	Overall output status	Output bit 0 (OUT 1) ~ bit 9 (OUT 10) 0: OFF 1: ON	0~1023
1021 H	1	PORT (OUT 1)	Independent output status	Output status of OUT 1; 0: OFF 1: ON	0~1
1022 H	1	PORT (OUT 2)	Independent output status	Output status of OUT 2; 0: OFF 1: ON	0~1

Position	Number of words	Abbreviation	Description	Remarks	Range / unit
1023 H	1	PORT (OUT 3)	Independent output status	Output status of OUT 3; 0: OFF 1: ON	0~1
1024 H	1	PORT (OUT 4)	Independent output status	Output status of OUT 4; 0: OFF 1: ON	0~1
1025 H	1	PORT (OUT 5)	Independent output status	Output status of OUT 5; 0: OFF 1: ON	0~1
1026 H	1	PORT (OUT 6)	Independent output status	Output status of OUT 6; 0: OFF 1: ON	0~1
1027 H	1	PORT (OUT 7)	Independent output status	Output status of OUT 7; 0: OFF 1: ON	0~1
1028 H	1	PORT (OUT 8)	Independent output status	Output status of OUT 8; 0: OFF 1: ON	0~1
1029 H	1	PORT (OUT 9)	Independent output status	Output status of OUT 9; 0: OFF 1: ON	0~1
102A H	1	PORT (OUT 10)	Independent output status	Output status of OUT 10; 0: OFF 1: ON	0~1
1040 H	1	PORT (IN1~14)	Overall input status	Input bit 0 (IN 1) ~ bit 13 (IN 14) 0: OFF 1: ON	0~32767
1041 H	1	PORT (IN 1)	Independent input status	Input status of IN 1; 0: OFF 1: ON	0~1
1042 H	1	PORT (IN 2)	Independent input status	Input status of IN 2; 0: OFF 1: ON	0~1
1043 H	1	PORT (IN 3)	Independent input status	Input status of IN 3; 0: OFF 1: ON	0~1
1044 H	1	PORT (IN 4)	Independent input status	Input status of IN 4; 0: OFF 1: ON	0~1
1045 H	1	PORT (IN 5)	Independent input status	Input status of IN 5; 0: OFF 1: ON	0~1
1046 H	1	PORT (IN 6)	Independent input status	Input status of IN 6; 0: OFF 1: ON	0~1
1047 H	1	PORT (IN 7)	Independent input status	Input status of IN 7; 0: OFF 1: ON	0~1
1048 H	1	PORT (IN 8)	Independent input status	Input status of IN 8; 0: OFF 1: ON	0~1
1049 H	1	PORT (IN 9)	Independent input status	Input status of IN 9; 0: OFF 1: ON	0~1
104A H	1	PORT (IN 10)	Independent input status	Input status of IN 10; 0: OFF 1: ON	0~1
104B H	1	PORT (IN 11)	Independent input status	Input status of IN 11; 0: OFF 1: ON	0~1
104C H	1	PORT (IN 12)	Independent input status	Input status of IN 12; 0: OFF 1: ON	0~1
104D H	1	PORT (IN 13)	Independent input status	Input status of IN 13; 0: OFF 1: ON	0~1
104E H	1	PORT (IN 14)	Independent input status	Input status of IN 14; 0: OFF 1: ON	0~1

■■ Read 50 error histories

Position	Number of words	Abbreviation	Description
1060 H	1	AlarmList 01	50 error histories -01
1061 H	1	AlarmList 02	50 error histories -02
1062 H	1	AlarmList 03	50 error histories -03
1063 H	1	AlarmList 04	50 error histories -04
1064 H	1	AlarmList 05	50 error histories -05
1065 H	1	AlarmList 06	50 error histories -06
1066 H	1	AlarmList 07	50 error histories -07
1067 H	1	AlarmList 08	50 error histories -08
1068 H	1	AlarmList 09	50 error histories -09
1069 H	1	AlarmList 10	50 error histories -10
106A H	1	AlarmList 11	50 error histories -11
106B H	1	AlarmList 12	50 error histories -12
106C H	1	AlarmList 13	50 error histories -13
106D H	1	AlarmList 14	50 error histories -14
106E H	1	AlarmList 15	50 error histories -15
106F H	1	AlarmList 16	50 error histories -16
1070 H	1	AlarmList 17	50 error histories -17
1071 H	1	AlarmList 18	50 error histories -18
1072 H	1	AlarmList 19	50 error histories -19
1073 H	1	AlarmList 20	50 error histories -20
1074 H	1	AlarmList 21	50 error histories -21
1075 H	1	AlarmList 22	50 error histories -22
1076 H	1	AlarmList 23	50 error histories -23
1077 H	1	AlarmList 24	50 error histories -24
1078 H	1	AlarmList 25	50 error histories -25
1079 H	1	AlarmList 26	50 error histories -26
107A H	1	AlarmList 27	50 error histories -27
107B H	1	AlarmList 28	50 error histories -28
107C H	1	AlarmList 29	50 error histories -29
107D H	1	AlarmList 30	50 error histories -30
107E H	1	AlarmList 31	50 error histories -31
107F H	1	AlarmList 32	50 error histories -32
1080 H	1	AlarmList 33	50 error histories -33
1081 H	1	AlarmList 34	50 error histories -34
1082 H	1	AlarmList 35	50 error histories -35
1083 H	1	AlarmList 36	50 error histories -36
1084 H	1	AlarmList 37	50 error histories -37
1085 H	1	AlarmList 38	50 error histories -38
1086 H	1	AlarmList 39	50 error histories -39
1087 H	1	AlarmList 40	50 error histories -40
1088 H	1	AlarmList 41	50 error histories -41
1089 H	1	AlarmList 42	50 error histories -42
108A H	1	AlarmList 43	50 error histories -43
108B H	1	AlarmList 44	50 error histories -44
108C H	1	AlarmList 45	50 error histories -45
108D H	1	AlarmList 46	50 error histories -46
108E H	1	AlarmList 47	50 error histories -47
108F H	1	AlarmList 48	50 error histories -48
1090 H	1	AlarmList 49	50 error histories -49
1091 H	1	AlarmList 50	50 error histories -50

■■ Controller message

Position	Number of words	Abbreviation	Description	Remarks
10D0 H	1	MotorType	Motor model	Up to 31 characters (single-byte alphanumeric)
10E0 H	1	Controller	Controller model	"TC-100"
10F0 H	1	FirmwareNo	Firmware version	HEX-ASCII format, 100 means Version 1.00

■■ Action

Position	Number of words	Abbreviation	Description	Remarks	Range / unit
2000 H	2	INCamount	Relative amount of movement	Set the relative movement distance (valid when position control and torque control) (initial value 0)	0.01mm/ 1pulse
2002 H	2	ABSamount	Absolute amount of movement	Set the absolute movement distance (valid when position control and torque control) (initial value 0)	0.01mm/ 1pulse
2005 H	1	TrqStopDir	Torque stop search direction	0: + direction; 1: - direction. Valid when the torque control is performed.	0~1
2006 H	2	PosAmount	Specified position data	Set the command and the current position data value (initial value 0)	0.01mm/ 1pulse
2011 H	1	Servo ON/OFF	Servo is ON/ OFF	0: Servo is ON; 1: Servo is OFF.	0~1
2014 H	1	MovSpeedSet	Position/torque control action speed setting (relative position movement, absolute position movement, JOG)	When the value is 1%~100%, the speed is the set value of a proportion of 0802 H maximum speed. When the value is 0%, the speed is the set value of the initial speed of 0800 H.	0~100%
201E H	1	MovType	Movement types	0: Relative position movement 1: Absolute position movement 2: TSL torque search movement (direction is set by 2005H) 3: ORG return to origin 4: Set command and current position data value 5: Unopened 6: Alarm reset 7: Deviation clear (which makes the command position is the identical to the current position) 8: Decelerates to stop 9: Emergency stop 10:Unopened 11: JOG + 12: JOG -	0~12
2040 H	1		Analog input setting (binary)	The input status changes (IN1-IN14) Bit0: IN1-bit1 3: IN14 After the setting of 0: OFF 1: ON, the current value is the input value of controller io simulation, which is accumulated in binary(bit 0~bit 13)	0~1
2041 H	1		IN1 analog input setting	After the IN1 analog input setting of 0 : OFF ; 1 : ON, the current value is taken as the signal or entity signal received by the controller.	0~1
2042 H	1		IN2 analog input setting	After the IN2 analog input setting of 0 : OFF ; 1 : ON, the current value is taken as the signal or entity signal received by the controller.	0~1
2043 H	1		IN3 analog input setting	After the IN3 analog input setting of 0 : OFF ; 1 : ON, the current value is taken as the signal or entity signal received by the controller.	0~1
2044 H	1		IN4 analog input setting	After the IN4 analog input setting of 0 : OFF ; 1 : ON, the current value is taken as the signal or entity signal received by the controller.	0~1
2045 H	1		IN5 analog input setting	After the IN5 analog input setting of 0 : OFF ; 1 : ON, the current value is taken as the signal or entity signal received by the controller.	0~1
2046 H	1		IN6 analog input setting	After the IN6 analog input setting of 0 : OFF ; 1 : ON, the current value is taken as the signal or entity signal received by the controller.	0~1
2047 H	1		IN7 analog input setting	After the IN7 analog input setting of 0 : OFF ; 1 : ON, the current value is taken as the signal or entity signal received by the controller.	0~1

Position	Number of words	Abbreviation	Description	Remarks	Range / unit
2048 H	1		IN8 analog input setting	After the IN8 analog input setting of 0：OFF：1：ON, the current value is taken as the signal or entity signal received by the controller.	0~1
2049 H	1		IN9 analog input setting	After the IN9 analog input setting of 0：OFF：1：ON, the current value is taken as the signal or entity signal received by the controller.	0~1
204A H	1		IN10 analog input setting	After the IN10 analog input setting of 0：OFF：1：ON, the current value is taken as the signal or entity signal received by the controller.	0~1
204B H	1		IN11 analog input setting	After the IN11 analog input setting of 0：OFF：1：ON, the current value is taken as the signal or entity signal received by the controller.	0~1
204C H	1		IN12 analog input setting	After the IN12 analog input setting of 0：OFF：1：ON, the current value is taken as the signal or entity signal received by the controller.	0~1
204D H	1		IN13 analog input setting	After the IN13 analog input setting of 0：OFF：1：ON, the current value is taken as the signal or entity signal received by the controller.	0~1
204E H	1		IN14 analog input setting	After the IN14 analog input setting of 0：OFF：1：ON, the current value is taken as the signal or entity signal received by the controller.	0~1

■■ Description of the step commands

Position	Number of words	Step	Brief description	Content description	Range / unit
9010 H	1	First step	Movement Mode	Used to set the Movement Mode 0: INC Relative position movement [Position mode] (initial value) 1: ABS Absolute position movement [Position mode] 2: ORG Home return 3: +TSL Positive torque search movement 4: -TSL Negative torque search movement 5: Unopened 6: Unopened 7: Unopened 8: CLR Deviation clear (to make the command position equal to the current position)9: Unopened 10:Unopened 11:Unopened 12: INC-R Relative position movement (continuous) 13: ABS-R Absolute position movement (continuous) 14:Unopened 15:INC-T relative position movement [torque mode] 16:ABS-T absolute position movement [torque mode]	0~16
9011 H	2		Amount of movement / movement position	Set the amount of movement / movement position. Mode definition: ABS = Target position (Move position) INC = Relative Position (amount of movement) ABS-R= Target position (Move position) INC-R = Relative Position (amount of movement) Except for the above, other modes are invalid (initial value 0)	- 2147483648~ 214748648 pulse
9013 H	1		Movement speed	Set a movement speed. When the value is 1% to 100%, the speed is the percentage of the highest speed of 0802 H. When the value is 0%, the speed is the set value of 0800 H starting speed. This function does not work when mobile mode 9000 H is ORG.	0 ~ 100 %
9014 H	1		Torque limit	Except for the signal search mode, other movement modes are affected	0~1000 x0.1%
9015 H	1		Reserved		0
9016 H	2		Range L	The lower limit of the interval range. When the current position is less than the setting value, the I/O specified by INRANGE will output. (Initial value 0)	
9018 H	2		Range H	The upper limit of the interval range. When the current position is more than the setting value, the I/O specified by INRANGE will output. (Initial value 0)	
901A H	1		Acceleration time	Motor acceleration time setting. (Initial value 300)	1~30000 msec
901B H	1		Deceleration time	Motor deceleration time setting. (Initial value 300)	1~30000 msec
901C H	1		Delay time	The delay time after the movement is finished. (Initial value 0)	0~30000 msec
901D H	1		Next step	It skips to the specified program at the end. (Initial value -1)	-1~127-1 end
9020 H ~ 902D H	14	The second step			
∫∫					

■■ Parameter comments and storage

Position	Number of words	Brief description	Content description	Range / unit
9999 H	1	Parameter storage	0: Current parameter; 1: Default parameter	0~1

■■ Open write instruction

Character	:	0	1	1	0	9	9	9	B	0	0	0	4	0	8	4	C	7	6	3	0	3	1	5	4	7	9	5	6	6	7	0	2	CR	LF
Hex	3A	30	31	31	30	39	39	39	42	30	30	30	34	30	38	34	43	37	36	33	30	33	31	35	34	37	39	35	36	36	37	30	32	0D	0A
Start code	Station number controller knob+1		Function code	Write the start position				Write the WORD number				Write the BYTES number		Data of the first WORD				Data of the second WORD				Data of the third WORD				Data of the fourth WORD				Verification Code (LRC)		End Code (CR/LF)	
				Data string																															

■■ Parameter writing process

Open write instruction → Parameter modification instruction (multiple instructions are allowed) → Parameter storage

■■ RTU Mode structure

01	06	20	1E	00	03	A2	0D
ID	Function code	Data				CRC-16	
1	1	2~120				2	
Byte	Byte	Byte				Byte	

■■ ASCII Mode structure

. . (3A H)	0	1	0	6	2	0	1	E	0	0	0	3	B	8	0D	0D
Start code	ID		Function code		Data string								LRC		CR	LF
1	2		2		4~240								2		1	1
Byte	Byte		Byte		Byte								Byte		Byte	Byte

■■ Description of structure content

- **1.ID**

Specify an ID to send data. Only the machine with the same ID will receive the data. Other machines with different IDs will ignore the data.

> ⚠**Caution:**
> The specified ID for communication is the setting value of the CH knob on the controller +1.
> For example, if the value of the external CH is "1," the specified ID will be "2."

- **2.Function code**

Specified function number.

Function code	Function description
03 H	Data reading
06 H	Data writing
10 H	Continuous data writing (more than 1 Word)

- **3.Data**

To run the data required by the specified function code, the data structure varies depending on the specified function code.

Function code	Data structure
03 H	Data position and the pieces of data are read
06 H	Data position and the pieces of data are written
10 H	Data position, and the pieces of data are written as well as the content is written

- **4.Check code**

To make sure that all data are sent and no data is omitted, add confirmation to the end of the data.
RTU: Use the CRC-16 format.
ASCII: Use the LRC format.

8.3 Detailed error message

When an error other than the response conditions is detected, an error code corresponding to the error type is returned.

- **Function code error**

- If the function code entered is wrong, the received function code will respond "function code" + "80 H."

Example:

Character	:	0	1	0	4	2	0	1	E	0	0	0	3	B	A	CR	LF
ASC code	3A	30	31	30	34	32	30	31	45	30	30	30	33	42	41	0D	0A
	Start code	ID Controller knob + 1		Function code		Data position				Data action code				Verification code (LRC)		End code (CR/LF)	
						Data string											

Character	:	0	1	8	4	0	1	7	A	CR	LF
ASC code	3A	30	31	38	34	30	31	37	41	0D	0A
	Start code	ID Controller knob + 1		Function code		Error code		Verification code (LRC)		End code (CR/LF)	

- If the error of the entered function code is more than "80 H," the received "function code" will respond with the original one.

Example:

Character	:	0	1	9	0	2	0	1	E	0	0	0	3	2	E	CR	LF
ASC code	3A	30	31	39	30	32	30	31	45	30	30	30	33	32	45	0D	0A
	Start code	ID Controller knob + 1		Function code		Data position				Data action code				Verification code (LRC)		End code (CR/LF)	
						Data string											

Character	:	0	1	9	0	0	1	6	E	CR	LF
ASC code	3A	30	31	39	30	30	31	36	45	0D	0A
	Start code	ID Controller knob + 1		Function code		Error code		Verification code (LRC)		End code (CR/LF)	

- **Error code**

Error code	Description
01 H	Function code error. Receive any function code other than the specified ones.
02 H	Wrong ID. Read the dedicated writing position. Write the dedicated reading position. Read (or write) a non-existent position
03 H	Wrong data. The data written exceeds the valid range. The pieces of data read exceed the range. Write a parameter position that should not be modified. The data written does not match the specified number.

⚠Caution:

The smaller the value of an error code is, the higher its priority. If there are multiple errors, an error code with a higher priority will be replied first.

Example: When an error in a function code is detected, only "01" will be replied even though there is a data error or ID error.

8.4 RTU request message structure

• WORD data reading

From the start position, read the number of WORDs to continuously read the WORD data.
After reading the WORD data, it is sent from high bytes to low bytes.

■■ Request message structure

ID		01 H~10 H
Function code		03 H
Starting position for reading	High	0000 H ~ FFFF H
	Low	
The number of WORDs read	High	0001 H ~ 0003 H
	Low	
CRC-16	High	0000 H ~ FFFF H
	Low	

■■ Response message structure

ID		01 H~10 H
Function code		03 H
Number of bytes read		02 H ~ 7F H
First WORD data	High	0000 H ~ FFFF H
	Low	
Next WORD data	High	0000 H ~ FFFF H
	Low	
:	:	:
:	:	:
Last WORD data	High	0000 H ~ FFFF H
	Low	
CRC-16	High	0000 H ~ FFFF H
	Low	

■■ Abnormal response message structure

ID		01 H ~ 10 H
Function code		83 H
Error code		01 H ~ 03 H
CRC-16	High	0000 H ~ FFFF H
	Low	

RTU reading example
Status: Read
Data position: 1000 H (action status data)
Number of WORDs: 1 word

Character	01	03	10	00	00	01	80	CA
	ID Controller knob + 1	Function code	Starting position for reading		The number of WORDs read		CRC-16	
			Data string					

- **WORD data writing**

Specify the position to start writing the WORD data.
Send the written WORD data from high bytes to low bytes.

■■ Request message structure

ID		01 H ~ 10 H
Function code		06 H
Starting position for writing	High bytes	0000 H ~ FFFF H
	Low bytes	
Number of WORDs written	High bytes	0000 H ~ FFFF H
	Low bytes	
CRC-16	High bytes	0000 H ~ FFFF H
	Low bytes	

■■ Response message structure

ID		01 H ~ 10 H
Function code		06 H
Starting position for writing	High bytes	0000 H ~ FFFF H
	Low bytes	
Number of WORDs written	High bytes	0000 H ~ FFFF H
	Low bytes	
CRC-16	High bytes	0000 H ~ FFFF H
	Low bytes	

■■ Abnormal response message structure

ID		01 H ~ 10 H
Function code		86 H
Error code		01 H ~ 03 H
CRC-16	High bytes	0000 H ~ FFFF H
	Low bytes	

RTU writing example
Example: Home return
Data position: 201E H
Data action code: 0003 H (home return)

Character								
01	06	20	1E	00	03	A2	0D
ID Controller knob + 1	Function code	Starting position for reading		Read number of WORDs		CRC-16	
		Data string					

• Continuous WORD data writing

The start position to write the number of WORDs and continuously write the WORD data.
Send the WORD data from high bytes to low bytes.

■■ Request message structure

ID		01 H~10 H
Function code		10 H
Starting position for writing	High bytes	0000 H ~ FFFF H
	Low bytes	
Number of WORDs written	High bytes	0001 H ~ 003F H
	Low bytes	
Number of bytes written		02 H ~ 7F H
First WORD data	High bytes	0000 H ~ FFFF H
	Low bytes	
Next WORD data	High bytes	0000 H ~ FFFF H
	Low bytes	
:	:	:
:	:	:
Last WORD data	High bytes	0000 H ~ FFFF H
	Low bytes	
CRC-16	High bytes	0000 H ~ FFFF H
	Low bytes	

■■ Response message structure

ID		01 H ~ 10 H
Function code		10 H
Starting position for writing	High bytes	0000 H ~ FFFF H
	Low bytes	
Number of WORDs written	High bytes	0001 H ~ 003F H
	Low bytes	
CRC-16	High bytes	0000 H ~ FFFF H
	Low bytes	

■■ Abnormal response message structure

ID		01 H ~ 10 H
Function code		86 H
Error code		01 H ~ 03 H
CRC-16	High bytes	0000 H ~ FFFF H
	Low bytes	

RTU continuous writing example
Example: Write relative movement data
Data position: 2000 H (set the relative movement distance)
Number of WORDs: 2 words

Character	01	10	20	00	00	02	04	00	00	00	64	6B	85
	ID Controller knob + 1	Function code	Starting position for writing		Number of WORDs written		Number of bytes written	First WORD data		Second WORD data		CRC-16	
			Data string										

- **The calculation example of CRC-16**

CRC-16 is the error acknowledgment of 2 bytes (16 bits).
CRC-16 performs calculation from the ID position to the end of the data in sequence.

- Declare CRC as FFFF H initial value.
- Perform XOR on CRC and 1 byte in the first message. Substitute the calculated value into CRC.
- Shift the CRC variable 1 bit (next bit) to the right.
- If the carry flag "c_carry" is 1, CRC and A001 H perform "XOR" calculation.
- Repeat step 3 and 4 for the results for 8 cycles.
- XOR is performed on CRC and 1 byte in the first message. Substitute the calculated value into CRC.
- Repeat step 3~6 for the values other than CRC.
- After the last byte is calculated, they are sent from low to high of CRC variables.

■■ Take VB 6.0 for example. Calculate CRC-16:
Variables are declared as follows:

```
Dim CRC As Long
Dim i, j, arry_count As Integer
Dim c_next, c_carry As Long
Dim crc_arry(64) As Integer

i = 0
CRC = 65535
For i = 0 To arry_count
  c_next = crc_arry(i)
  CRC = (CRC Xor c_next) And 65535
  For j = 0 To 7
      c_carry = CRC And 1
      CRC = CRC \ 2
      If c_carry = 1 Then
          CRC = (CRC Xor &HA001) And 65535
      End If
  Next j
Next i
End
```

They are added to the end of error codes and messages. Please pay attention to the order of CRC low bits and high bits.

8.5 ASCII request message structure

• WORD data reading

From the start position, read the number of WORDs to continuously read the WORD data.
After reading the WORD data, it is sent from high bytes to low bytes.

■■ Request message structure

Start code		" : "
ID		"0", "1"~"1", "0"
Function code		"0", "3"
Start position for reading	High	"0", "0"~"F", "F"
	Low	"0", "0"~"F", "F"
Read number of WORDs	High	"0", "0"~"0", '0"
	Low	"0", '0"~"3", "C"
Check code LRC		"0", "0"~"F", "F"
End code		CR, LF

■■ Response message structure

Start code		" : "
ID		"0", "1"~"1", "0"
Function code		"0", "3"
Number of bytes read		"0", "2"~"7", "F"
First WORD data	High	"0", "0"~"F", "F"
	Low	"0", "0"~"F", "F"
Next WORD data	High	"0", "0"~"F", "F"
	Low	"0", "0"~"F", "F"
:	:	:
:	:	:
Last WORD data	High	"0", "0"~"F", "F"
	Low	"0", "0"~"F", "F"
Check code LRC	High	"0", "0"~"F", "F"
End code	Low	CR, LF

■■ Abnormal response message structure

Start code		" : "
ID		"0", "1"~"1", "0"
Function code		"8", "3"
Error code		"0", "1"~"0", "3"
Check code LRC	High	"0", "0"~"F", "F"
End code	Low	CR, LF

ASCII reading example
Status: Reading
Data position: 1000 H (action status data)
Number of WORDs: 1 word

Character	:	0	1	0	3	1	0	0	0	0	0	0	1	E	B	CR	LF
ASC code	3A	30	31	30	33	31	30	30	30	30	30	30	31	45	42	0D	0A
	Start code	ID Controller knob + 1		Function code		Starting position for reading				Read number of WORDs				Verification code (LRC)		End code (CR/LF)	
						Data string											

- **WORD data writing**

Specify the position to start writing the WORD data.
Send the written WORD data from high bytes to low bytes.

■■ Request message structure

Start code		" : "
ID		"0", "1"~"1", "0"
Function code		"0", "6"
Start position for reading	High	"0", "0"~"F", "F"
	Low	"0", "0"~"F", "F"
The number of WORDs read	High	"0", "0"~"F", "F"
	Low	"0", "0"~"F", "F"
Check code LRC		"0", "0"~"F", "F"
End code		CR, LF

■■ Response message structure

Start code		" : "
ID		"0", "1"~"1", "0"
Function code		"0", "6"
Start position for reading	High	"0", "0"~"F", "F"
	Low	"0", "0"~"F", "F"
The number of WORDs read	High	"0", "0"~"F", "F"
	Low	"0", "0"~"F", "F"
Check code LRC		"0", "0"~"F", "F"
End code		CR, LF

■■ Abnormal response message structure

Start code	" : "
ID	"0", "1"~"1", "0"
Function code	"8", "6"
Error code	"0", "1"~"0", "3"
Check code LRC	"0", "0"~"F", "F"
End code	CR, LF

ASCII writing example
Example: Home return
Data position: 201E H
Data action code: 0003 H (home return)

Character	:	0	1	0	6	2	0	1	E	0	0	0	3	B	8	CR	LF
ASC code	3A	30	31	30	36	32	30	31	45	30	30	30	31	42	38	0D	0A
	Start code	ID Controller knob + 1		Function code		Data position				Data action code				Verification code (LRC)		End code (CR/LF)	
						Data string											

- **Continuous WORD data writing**

The start position to write the number of WORDs and continuously write the WORD data.
Send the WORD data from high bytes to low bytes.

■■ Request message structure

Start code		" : "
ID		"0", "1"~"1", "0"
Function code		"1", "0"
Start position for reading	High	"0", "0"~"F", "F"
	Low	"0", "0"~"F", "F"
The number of WORDs read	High	"0", "0"~"0", "0"
	Low	"0", "0"~"3", "C"
Number of bytes written		"0", "2"~"7", "6"
First WORD data	High	"0", "0"~"F", "F"
	Low	"0", "0"~"F", "F"
Next WORD data	High	"0", "0"~"F", "F"
	Low	"0", "0"~"F", "F"
:	:	:
:	:	:
Last WORD data	High	"0", "0"~"F", "F"
	Low	"0", "0"~"F", "F"
Check code LRC		"0", "0"~"F", "F"
End code		CR, LF

■■ Response message structure

Start code		" : "
ID		"0", "1"~"1", "0"
Function code		"1", "0"
Start position for reading	High	"0", "0"~"F", "F"
	Low	"0", "0"~"F", "F"
The number of WORDs read	High	"0", "0"~"0", "0"
	Low	"0", "1"~"3", "B"
Check code LRC		"0", "0"~"F", "F"
End code		CR, LF

■■ Abnormal response message structure

Start code	" : "
ID	"0", "1"~"1", "0"
Function code	"9", "0"
Error code	"0", "1"~"0", "3"
Check code LRC	"0", "0"~"F", "F"
End code	CR, LF

ASCII continuous data writing
Example: Write relative movement data
Data position: 2000 H (set the relative movement distance)
Number of WORDs: 2 words

Character	:	0	1	1	0	2	0	0	0	0	0	0	2	0	4	0	0	0	0	0	0	6	4	6	5	CR	LF
ASC code	3A	30	31	31	30	32	30	30	30	30	30	30	32	30	34	30	30	30	30	30	30	36	34	36	35	0D	0A
	Activation code	ID Controller knob + 1		Function code		Starting position for writing				Number of WORDs written				Number of bytes written		First WORD data				Second WORD data				Verification code (LRC)		End code (CR/LF)	
						Data string																					

- **LRC calculation example:**

For LRC, calculation is performed from ID to the end of data.

- The sum calculation is performed from the beginning of data (ID) to the end of data.
- When the calculated result exceeds FF H, round off "1" if more than 100 H.
  (Example: 153 H=>53 H)
- Calculate the complement for the result (reverse bits) and 1 is added to the result.
- In the lrc_array, two characters are used as one set and its value are converted to decimal form for calculation.
  (Example: 0106201E0003=>01 06 20 1E 00 03)

■■Take VB 6.0 for example. Calculate LRC:

```
Dim LRC As Integer
Dim i As Integer
Dim arry_count As Integer
Dim lrc_arry(128) As Integer

For i = 0 To arry_count
      LRC = (LRC + lrc_arry(i)) And &HFF
Next i
LRC = ((Not LRC) + 1) And &HFF
```

8.6 EtherCAT network settings

- **When OMRON PLC is used, the storage path of ESI file is as follows**

- **When BACKOFF PLC is used, the storage path of ESI file is as follows**

  - 1. Copy the file of TOYO-Device-1Axis.xml to the folder of EtherCAT Master tool
  - 2. Software name
  - 3. Preset path
  - 4. Beckhoff EtherCAT Configuration
  - 5. C:\EtherCAT Configurator\EtherCAT
  - 6. Beckhoff TwinCAT 3.X
  - 7. C:\TwinCAT\3.x\Config\Io\EtherCAT
  - 8. Beckhoff TwinCAT 2.X
  - 9. C:\TwinCAT\Io\EtherCAT

1. WRITE TAG

	EtherCAT網路設定				
節點1	TOYO				
	Output mapping 0_Toyo_CTL0_7000_01		W	UINT	A1_WS0
	Output mapping 0_Toyo_CTL1_7000_02		W	UINT	A1_WS1
	Output mapping 0_Toyo_ORG_7000_03		W	BOOL	A1_ORG
	Output mapping 0_Toyo_SERVO_ON_7000_04		W	BOOL	A1_SERVON
	Output mapping 0_Toyo_ALARM_RESET_7000_05		W	BOOL	A1_ALALRM
	Output mapping 0_Toyo_START_7000_06		W	BOOL	A1_Start
	Output mapping 0_Toyo_PRG0_7000_07		W	BOOL	A1_PG0
	Output mapping 0_Toyo_PRG1_7000_08		W	BOOL	A1_PG1
	Output mapping 0_Toyo_PRG2_7000_09		W	BOOL	A1_PG2
	Output mapping 0_Toyo_PRG3_7000_0A		W	BOOL	A1_PG3
	Output mapping 0_Toyo_PRG4_7000_0B		W	BOOL	A1_PG4
	Output mapping 0_Toyo_PRG5_7000_0C		W	BOOL	A1_PG5
	Output mapping 0_Toyo_PRG6_7000_0D		W	BOOL	A1_PG6
	Output mapping 0_Toyo_ORGSIG_7000_0E		W	BOOL	
	Output mapping 0_Toyo_Revers1_7000_0F		W	BOOL	
	Output mapping 0_Toyo_Revers2_7000_10		W	BOOL	
	Output mapping 0_Toyo_Revers3_7000_11		W	BOOL	
	Output mapping 0_Toyo_Revers4_7000_12		W	BOOL	
	Output mapping 0_Toyo_MovSpeedSet_7000_13		W	UINT	A1_Speed
	Output mapping 0_Toyo_MovType_7000_14		W	UINT	A1_Command
	Output mapping 0_Toyo_ABSamount_7000_15		W	UDINT	A1_ABSamount

2. READ TAG

	Input mapping 0_Toyo_SYS0_6000_01		R	UINT	A1_RS0
	Input mapping 0_Toyo_SYS1_6000_02		R	UINT	A1_RS1
	Input mapping 0_Toyo_ORG_S_6000_03		R	BOOL	A1_ORG_S
	Input mapping 0_Toyo_INP_6000_04		R	BOOL	A1_INP
	Input mapping 0_Toyo_READY_6000_05		R	BOOL	A1_Ready
	Input mapping 0_Toyo_SERVO_S_6000_06		R	BOOL	A1_Serovon_S
	Input mapping 0_Toyo_PRG_0S_6000_07		R	BOOL	A1_PG0_S
	Input mapping 0_Toyo_PRG_1S_6000_08		R	BOOL	A1_PG1_S
	Input mapping 0_Toyo_PRG_2S_6000_09		R	BOOL	A1_PG2_S
	Input mapping 0_Toyo_PRG_3S_6000_0A		R	BOOL	A1_PG3_S
	Input mapping 0_Toyo_PRG_4S_6000_0B		R	BOOL	A1_PG4_S
	Input mapping 0_Toyo_PRG_5S_6000_0C		R	BOOL	A1_PG5_S
	Input mapping 0_Toyo_Rever1_6000_0D		R	BOOL	
	Input mapping 0_Toyo_Rever2_6000_0E		R	BOOL	
	Input mapping 0_Toyo_Rever3_6000_0F		R	BOOL	
	Input mapping 0_Toyo_Rever4_6000_10		R	BOOL	
	Input mapping 0_Toyo_Rever5_6000_11		R	BOOL	
	Input mapping 0_Toyo_Rever6_6000_12		R	BOOL	
	Input mapping 0_Toyo_AlarmStatus_6000_13		R	UINT	A1_Alarm
	Input mapping 0_Toyo_EcdPos_6000_14		R	UDINT	A1_Encoder

READ/WRITE	Data format	TAG	Brief introduction	Description of contents	Scope
READ	BOOL	The same as OUT1~10 define name	Overall output state	Output bit 0(OUT 1)~bit 9(OUT 10) (Set H1020 as the main) 0: OFF 1: ON (default IO definition is as follows) OUT1:ORG-S OUT2:INP OUT3:READY OUT4:SERVO-S OUT5:PRGSEL0-S OUT6:PRGSEL1-S OUT7:PRGSEL2-S OUT8:PRGSEL3-S OUT9:PRGSEL4-S OUT10:PRGSEL5-S	-
READ	UINT	AlarmStatus	Warning state	0：No warning 1：Excessive torque 2：The position deviation is too large 3：Overspeed 4：Gain maladjustment 5：Overvoltage 6：Initial abnormality 7：EEPROM abnormality 8：Main loop power supply undervoltage 9: Overcurrent 10: Recurrent abnormality 11: Emergency stop in progress 12: Motor wire break 13: Encoder disconnection 14: Current value protection 15: Power-off and restart are required	-
READ	DINT	EcdPos	Encoder position	Present position value	-
WRITE	BOOL	同 IN1~14	Input status change	Input bit 0(IN 1)~bit 13(IN 14) Set H2040 as the main 0 ： OFF 1 ： ON (default definitions are as follows) IN1：ORG IN2：SERVO IN3：ALM-RESET IN4：START IN5：PRGSEL0 IN6：PRGSEL1 IN7：PRGSEL2 IN8：PRGSEL3 IN9：PRGSEL4 IN10：PRGSEL5 IN11：PRGSEL6 IN12：ORGSIG	-

READ/WRITE	Data format	TAG	Brief introduction	Description of contents	Scope
WRITE	UINT	MovType	Movement type	1：Absolute position movement 3：Origin return 6：Alarm return 8：Deceleration and stop D：Clear the command	0~f
WRITE	DINT	ABSamount	Absolute amount of movement	Set absolute moving distance (effective under position control and torque control) (initial value 0)	2~2000
WRITE	UINT	MovSpeedSet	Motion speed setting under position/torque control, absolute position movement	Maximum speed (based on the set value of 0802 H) is set to 100% (initial value 100). If the value is set at 0%, it will move at initial speed (0800 H).	0~100%
WRITE	UINT	Toyo_CTL0	System control	Make sure it's set to 1	-

Note)

- 1. The ID knob on TC100/XC100 can only be set to 0.
- 2. The station number of ECAT-TC100 is set by the upper Master.
- 3. EtherCAT IN PORT is CN6
- 4. EtherCAT OUT PORT is CN7

9. TOYO-Single software operation

9.1 Introduction of TOYO-Single

• Introduction

To make our customers use the products manufactured by Toyo Automation Co., Ltd. in a convenient way, we have independently developed TOYO-Single for TC100 for a better user experience.

• Installation and software requirements

Minimum software requirements	
Operating system	Microsoft Windows 2000/XP/Vista/7/8.1/10
CPU	The environment recommended by OS
Memory	The environment recommended by OS
HDD space	More than 20MB free space
Communication port	RS-485, USB
Use with the controller	TC100

9.2. Installation and removal of TOYO-Single software

• Installation

This chapter introduces how to install Toyo-Single. First, open the [Toyo-Single.exe] setup file, as shown in Figure (1).

It is recommended that you execute the installation program as a system administrator to avoid installation exceptions caused by insufficient permissions.

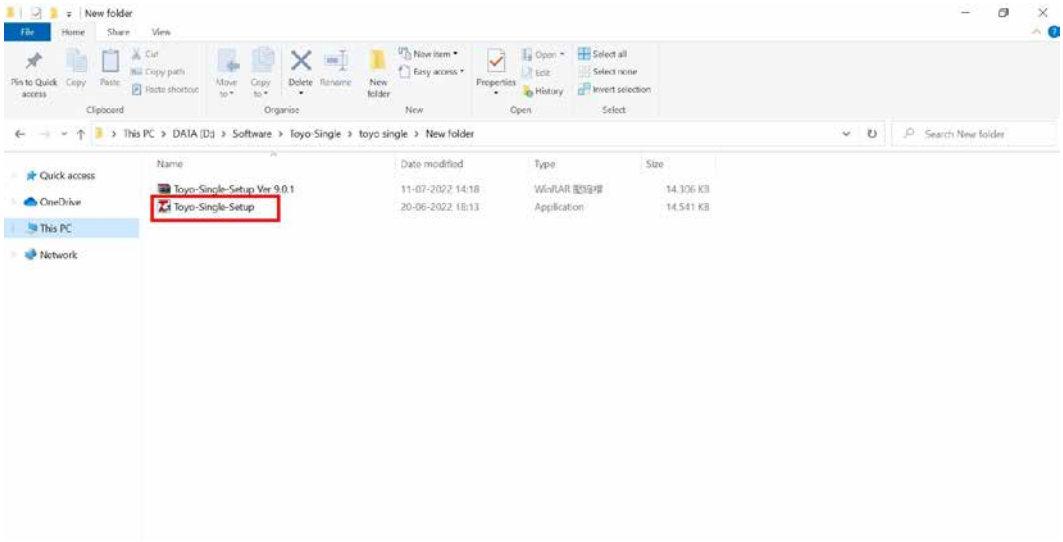


Figure (1) Toyo-Single.exe

① Framework detection

After opening the file, you will be asked to install Microsoft .NET Framework 4, if it is not installed on your PC, as shown Figure (2).

If this screen is not displayed, skip to Section 1.2 and continue the installation procedure. Click [Yes] to download or click [No] to exit the installation procedure. If you do not want to automatically install it, go to Microsoft's official website to download Microsoft .NET Framework 4 to install it.

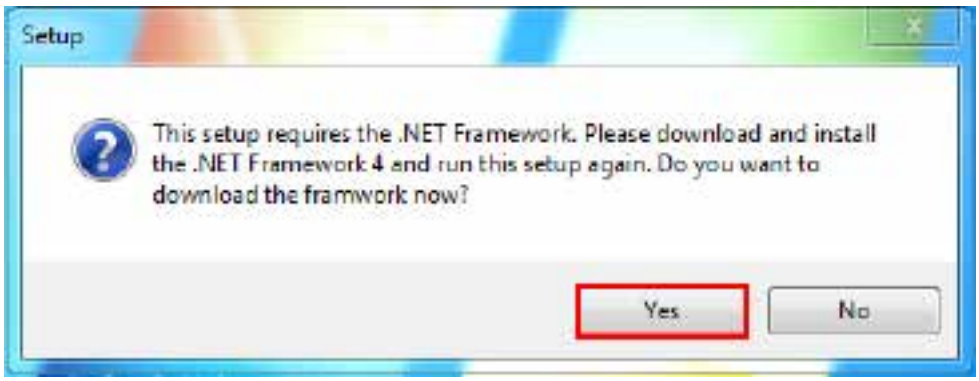


Figure (2) asks you to install Microsoft .NET Framework 4

After opening the setup file, carefully read the license agreement and check "I have read and agree to the license terms" and click [Install], as shown in Figure (3).

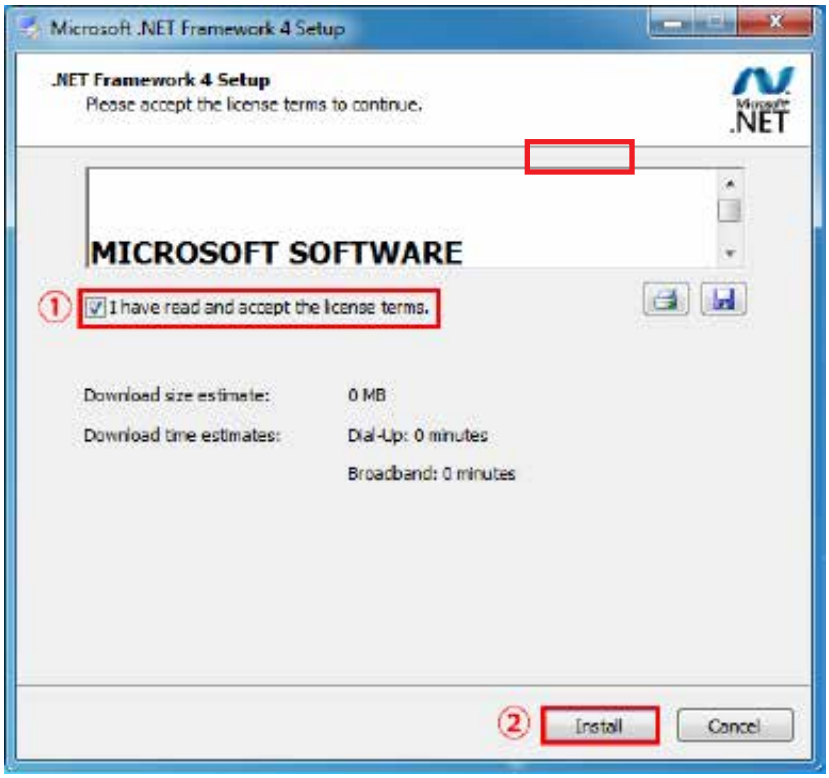


Figure (3) Microsoft .NET Framework 4 Installation Screen

It takes some time to perform the installation procedure. Please be patient, as shown in Figure (4).

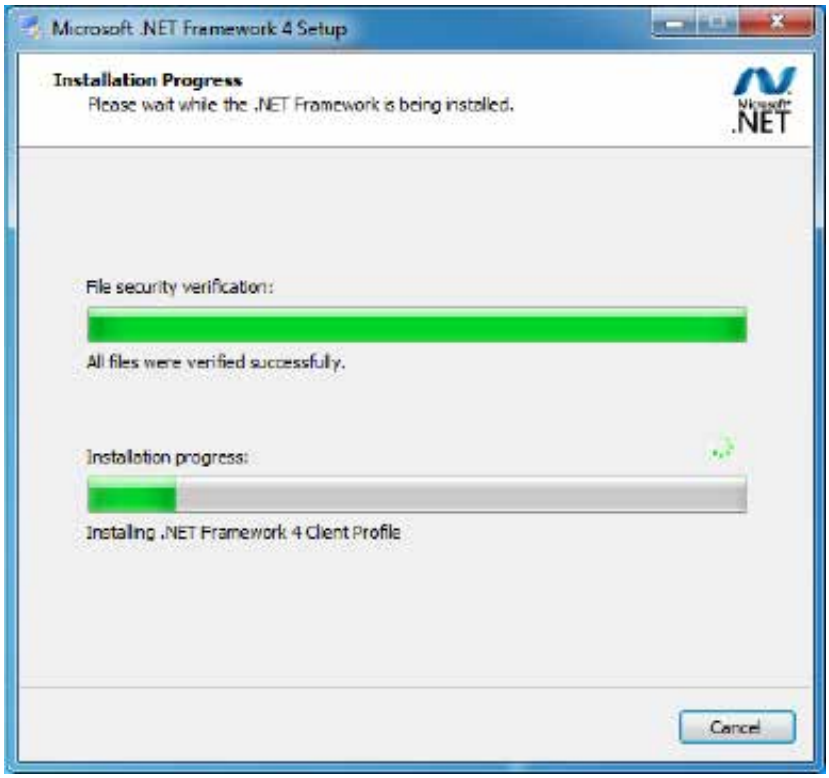


Figure (4) Installation procedure

Click [Finish] to finish the installation procedure, as shown in Figure (5).

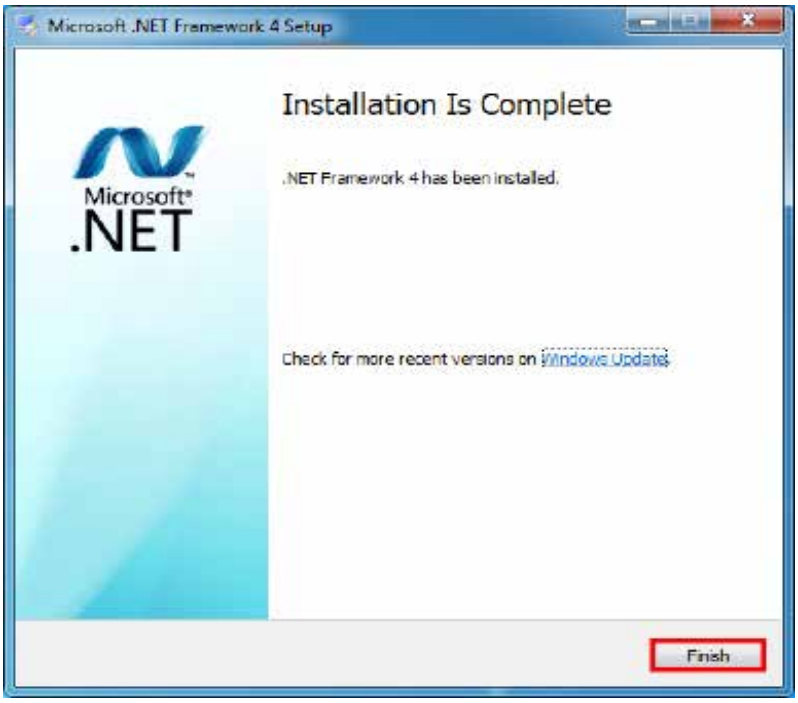


Figure (5) Completion of Framework installation

② Toyo-Single installation procedure

After opening the setup file, you will be asked to select the language that will be used during the installation. It can be switched based on the user preference. Click [OK], as shown in Figure (6).

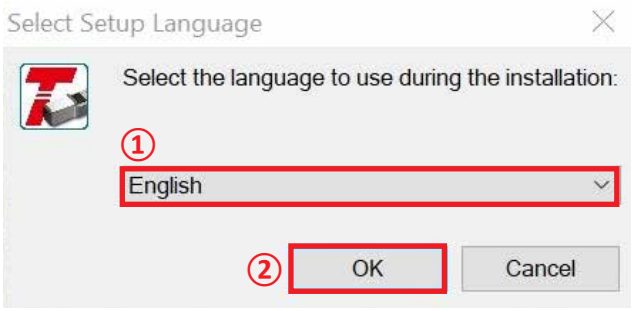


Figure (6) Installation language selection

The information screen is shown. After reading the Toyo Single software copyright notice, click [Next] to proceed with the installation step, as shown in Figure (7).

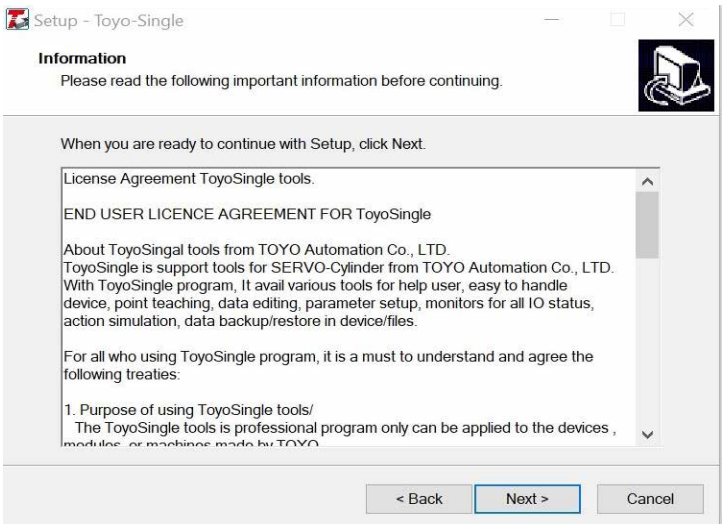


Figure (7) Copyright notice

You will see the screen where you can select an installation position. If you want to select another installation position, click [Browse] to select where you want to install files. It is recommended to use the default path. After selection, click [Next] to proceed with the installation step, as shown in Figure (8).

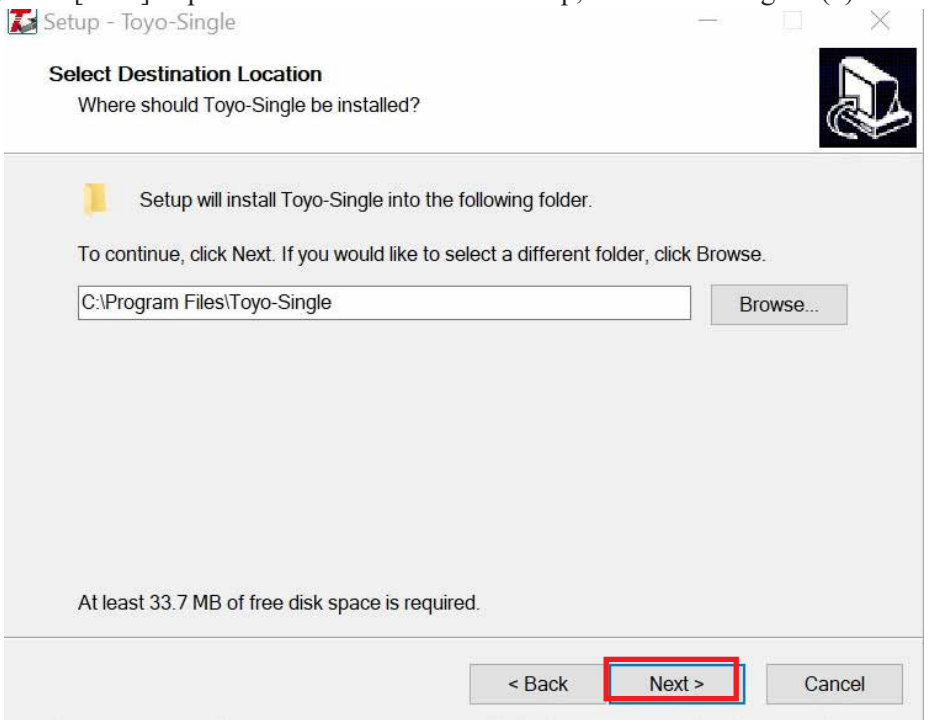


Figure (8) Installation position screen

You will see the screen where you can select an additional task. If no USBDriver is installed, check Install (recommended), or uncheck it. See Section 1.3 for the installation procedure. Next, check [Create desktop icon] if you want to create a desktop shortcut. Otherwise, uncheck it. After the setup and confirmation, click [Next] to proceed with the installation step, as shown in Figure (9).

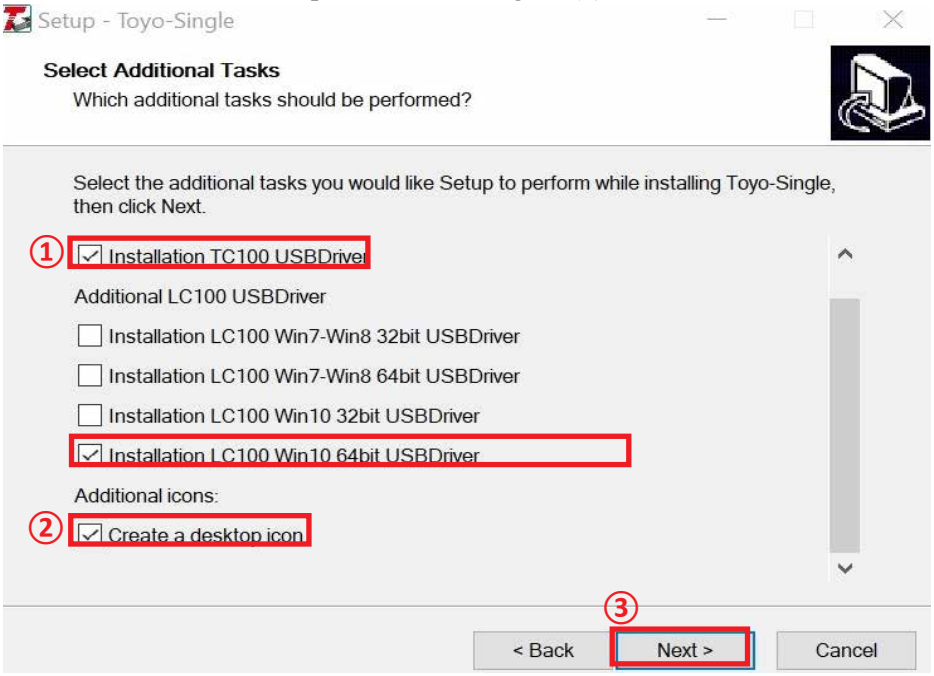


Figure (9) Desktop shortcut creation screen

When you go to the installation confirmation screen, click [Install] after you confirm the installation information, as shown in Figure (10).

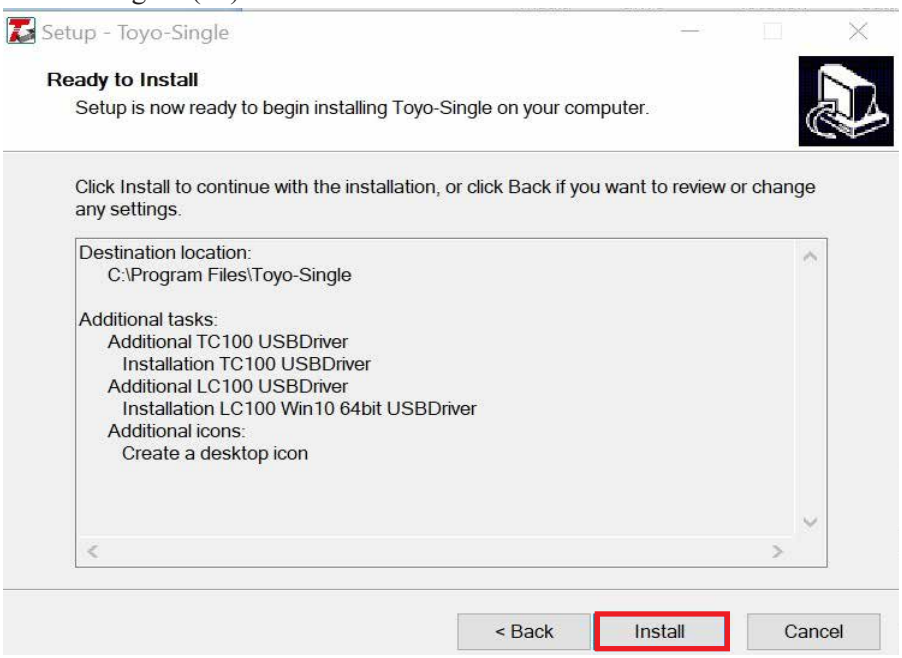


Figure (10) Installation confirmation screen

When you enter the installation completion screen, check [Run TC100] if you want to automatically launch Toyo-Single after installation. Otherwise, uncheck it. Finally, click [Finish] to finish the installation procedure, as shown in Figure (11).

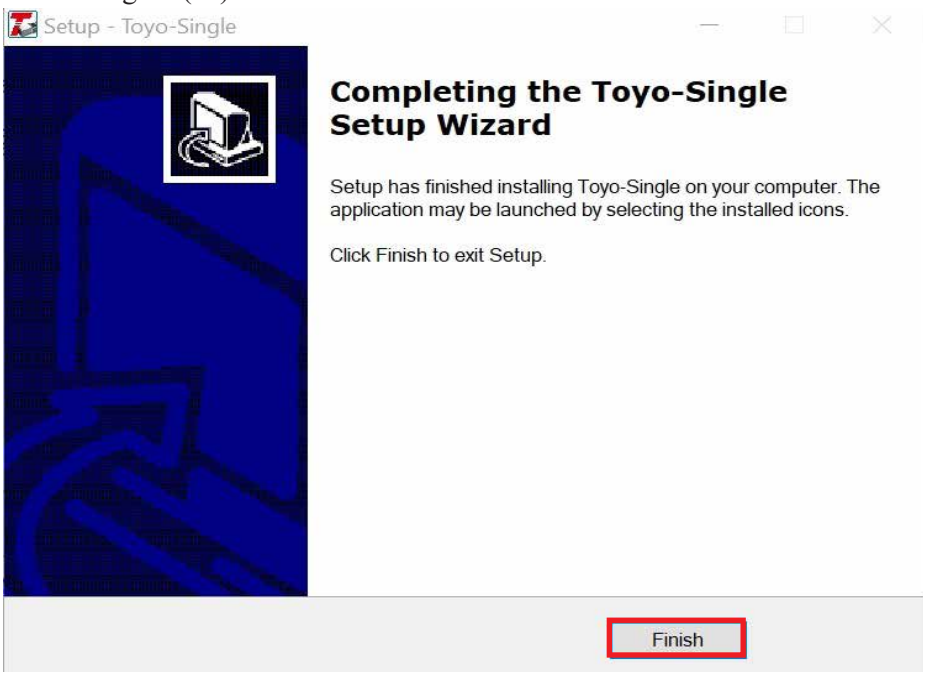


Figure (11) Installation completion screen

③ USBDriver-FTDI

This chapter introduces how to install the FTDI driver. After entering the installation screen, click the [Extract] button, as shown in Figure (12).

Figure (12) Enter the program screen

The driver installation wizard appears and click [Next], as shown in Figure (13).

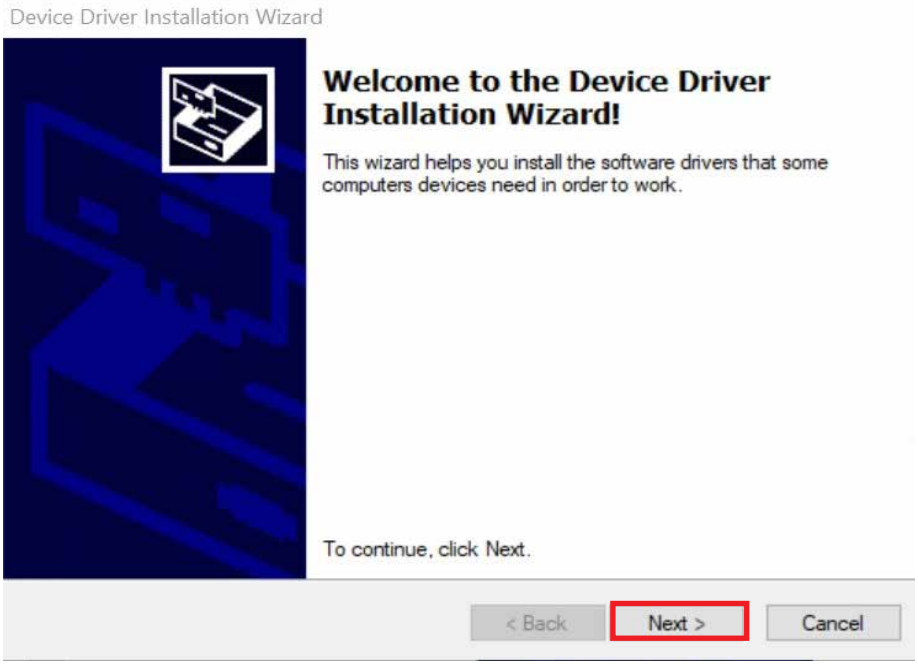


Figure (13) Installation wizard

The license agreement appears and carefully read the agreement. Next, check [I accept this agreement] and click [Next], as shown in Figure (14).

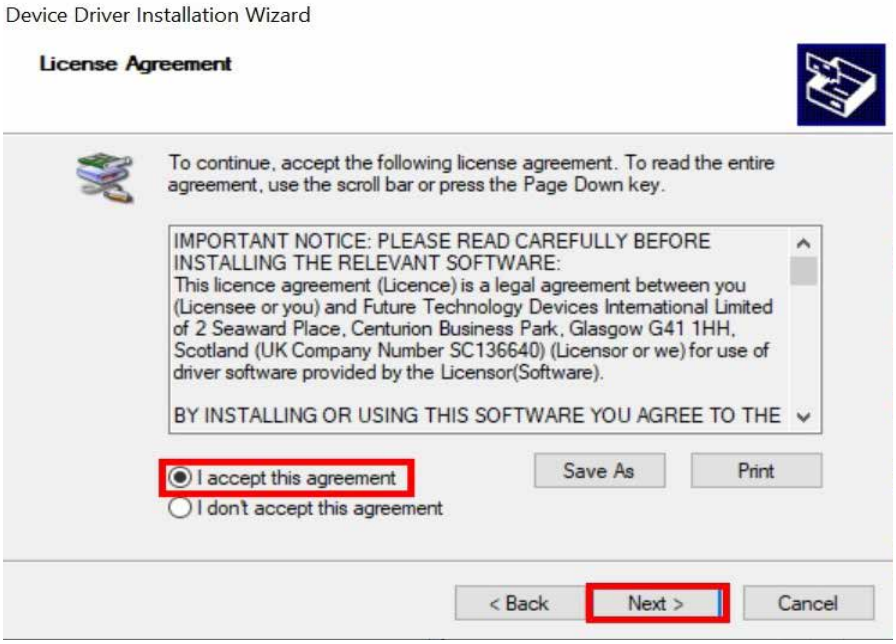


Figure (14) License screen

Finally, after confirming the status of the installation procedure, click the [Finish] button to end the installation procedure, as shown in Figure (15).

Figure (15) Installation completion screen

- **Removal**

This chapter introduces how to remove Toyo-Single software. You can go to [Control Panel]->[Programs]->[Uninstall programs] and click [Uninstall or change a program]. Then select [Toyo-Single-Ver.1.0] to carry out software uninstallation, as shown in Figure (16).

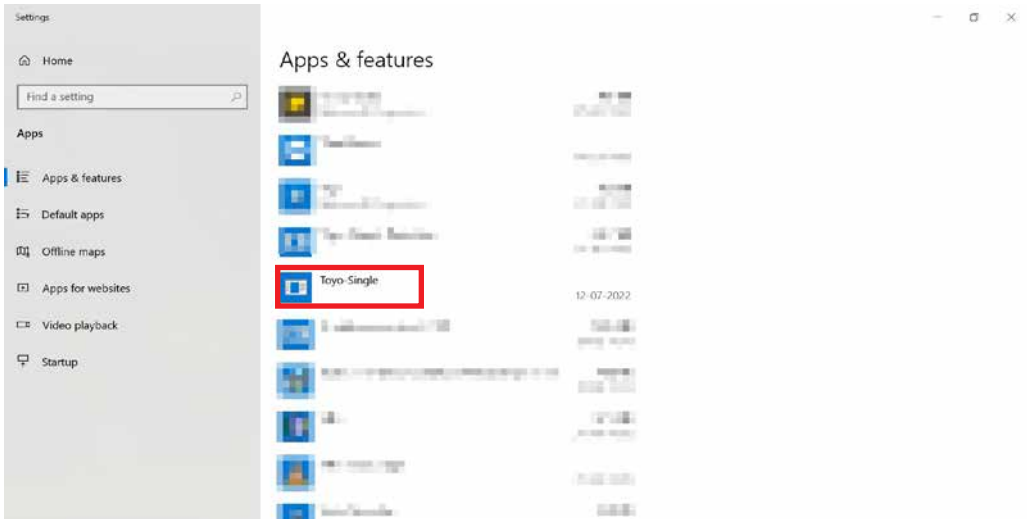


Figure (16) Uninstall or change programs screen

After the un-installation screen appears, the system will ask you whether to delete software or not. If yes, select [Yes] or select [No], as shown in Figure (17).

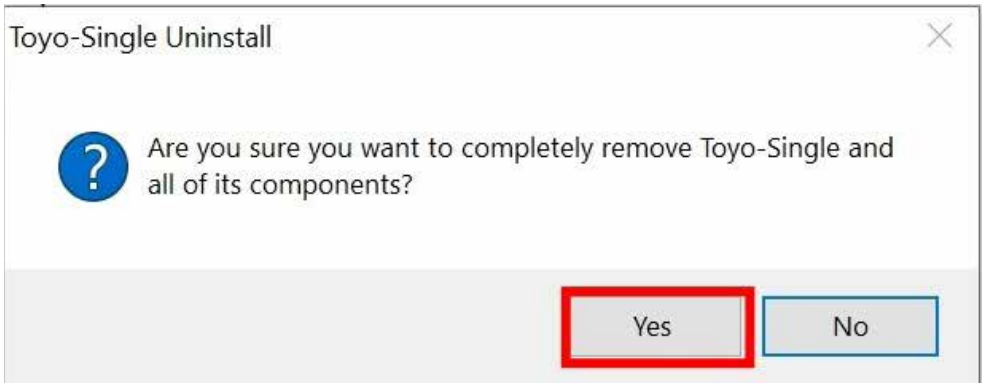


Figure (17) Screen asking whether to remove software

After software is removed, click [OK] to finish un-installation, as shown in Figure (18).

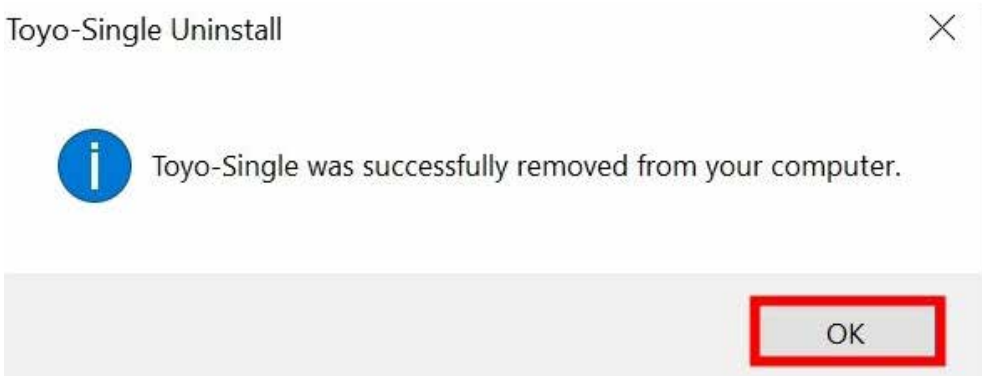


Figure (18) Screen showing successful un-installation of software

9.3 Description of TOYO-Single software interface

- **Initial screen**

This chapter introduces the basic main connection screen as shown in Figure (1) according to different functions.

▼ Basic main connection screen

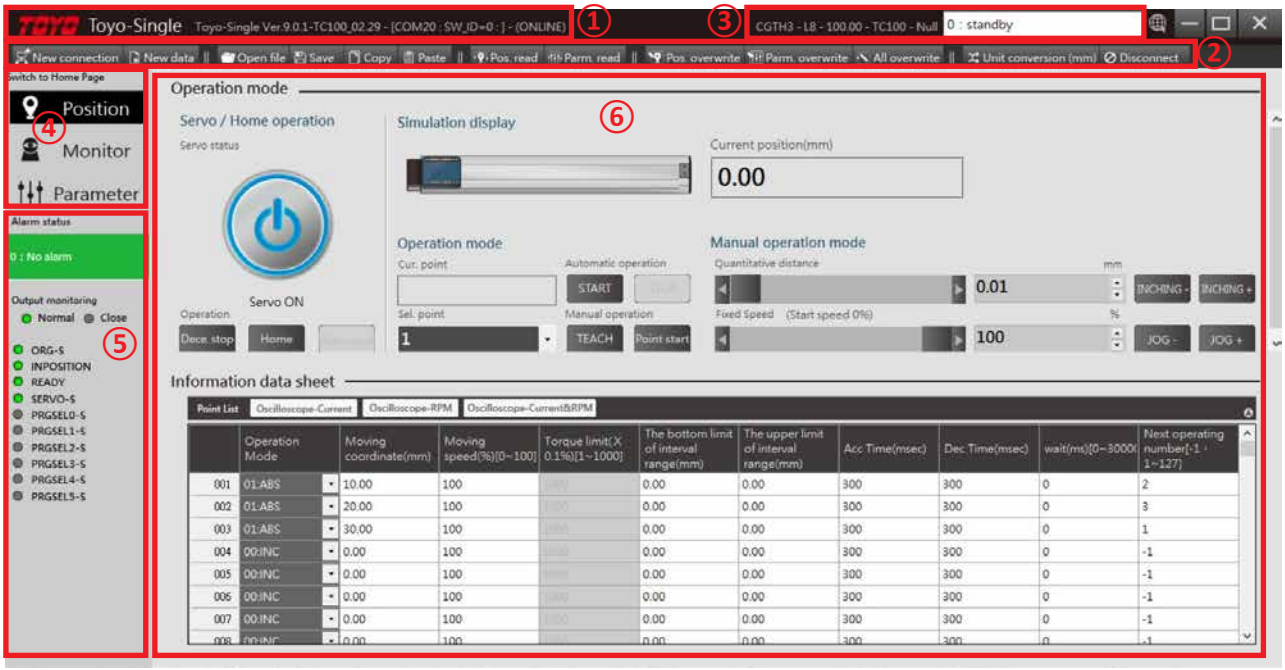


Figure (1) Initial system screen

- **Basic status bar**

Displays the current basic system status. From left to right they are: [Software Name], [Controller Name], [COM], [SW_ID], [Firmware Version], [Software Version], [Connection Status], as shown in Figure (2).

Figure (2) Basic status bar

- **Toolbar**

This area provides basic system functions, as shown in Figure (3). The following describes the individual functions:

- Add connection: This function allows you to perform system connection. During the connection, the point position values and parameter values in the current controller are loaded. After the connection, you can go to the main screen to perform system operations.
- Add data: This function allows you to add data locally. After adding data, you can output file contents for subsequent writing.
- Open files: This function allows you to load the previously saved files for editing.
- Save: This function allows you to save the file contents on the current page. The file contents which this system can save include the point position file (.prg) and parameter file (.par). You can click [Save] from the [Point Position Page] to use point position files or click [Save] from the [Parameter Page] to use parameter files.
- Copy: You can copy the data contents of the currently selected column or multiple columns in the point location data columns, or use shortcut keys (Ctrl + C).
- Paste: Paste: you can paste the data content of the copied column into the data column of the point position, or use the shortcut key (Ctrl + V).

- Point read: this function can be performed to read the point position in the current controller into the point position data columns.
- Parameter reading: this function can be performed to read the parameter values in the current controller to the parameter page.
- Point write-back: the modified point position or all point position values on the current point position data columns can be written to the controller.
- Parameter write-back: You can write the modified parameter values or all parameter values on the current page to the controller.
- Write back all: the modified parameter value and all point position data can be written to the controller.
- Unit conversion: it can be displayed in mm, Pulse and MIL by this function.
- Connection abort: This function allows you to abort the current system connection.

Figure (3) Toolbar

- **Other status bars**

This area shows other statuses of the current system. The current operating mode is shown at the top right corner and the current model specification is shown at the bottom left. From left to right are [Actuator Model], [Lead], [Stroke], [Motor Direction], [Controller], and [Customization Code], as shown in Figure (4).

Figure (4) Other status bars

- **Function page**

This area provides three system functions which can be switched, as shown in Figure (5). The following describes individual functions:

- Point location: this feature page can be controlled by software. Point location content can be edited by software. This feature will be described in detail in the following sections.
- Monitor: This function page allows you to read controller values and monitor each value of the current actuator. The subsequent chapters will detail this function.
- Parameter: This function page allows you to browse the current controller parameters and edit parameter contents. The subsequent chapters will detail this function.

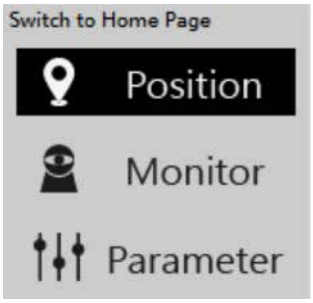


Figure (5) Function page

- **Output monitoring**

This area provides the feedback data of the controller, as shown in Figure (6).

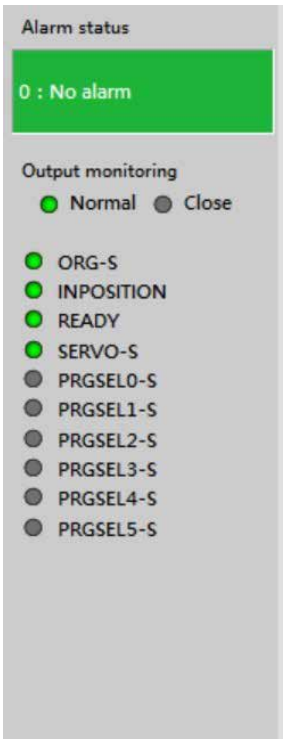


Figure (6) Output monitoring

- **Main operation area**

Users can perform real-time operation, edit point position and parameter value, monitor controller feedback information and other functions., as shown in Figure (7).

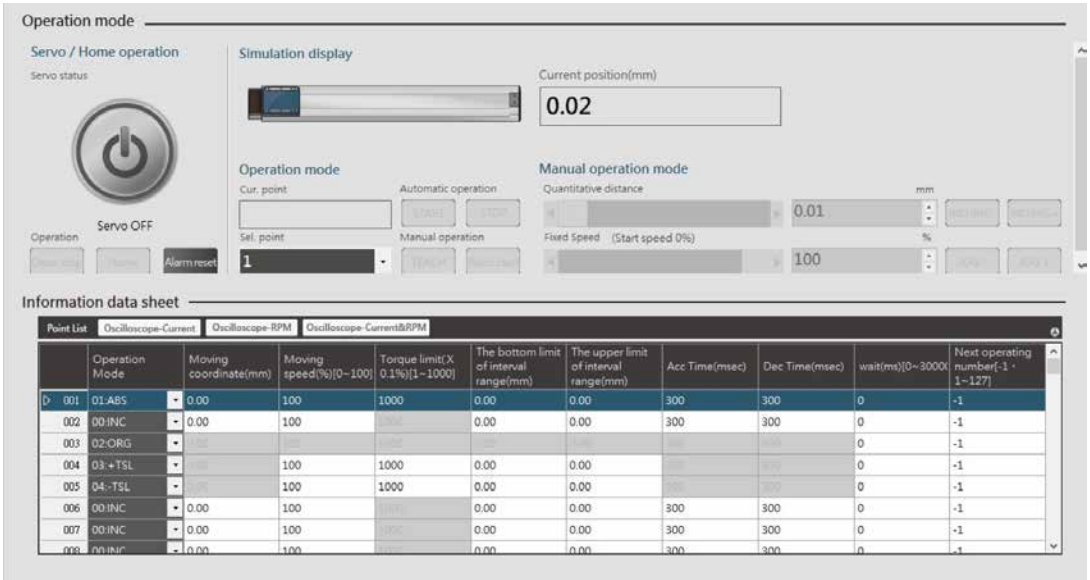


Figure (7) Main operation area

- **Official website hyperlink**

It provides users with a link to TOYO's official website for the latest product news.

Figure (8) Hyperlink button

• Description of the point position page

The point position page is mainly used to teach points of the actuator, as shown in Figure (9).
For your convenience, this system has different operating methods for the user to finish operations quickly. They are [Servo/origin operation], [operation mode], [manual operation mode]. You can edit point positions and switch to the oscilloscope in the bottom. In Local Mode, this page only shows the point position form for the user to edit.

▼ The point teaching screen for the actuator

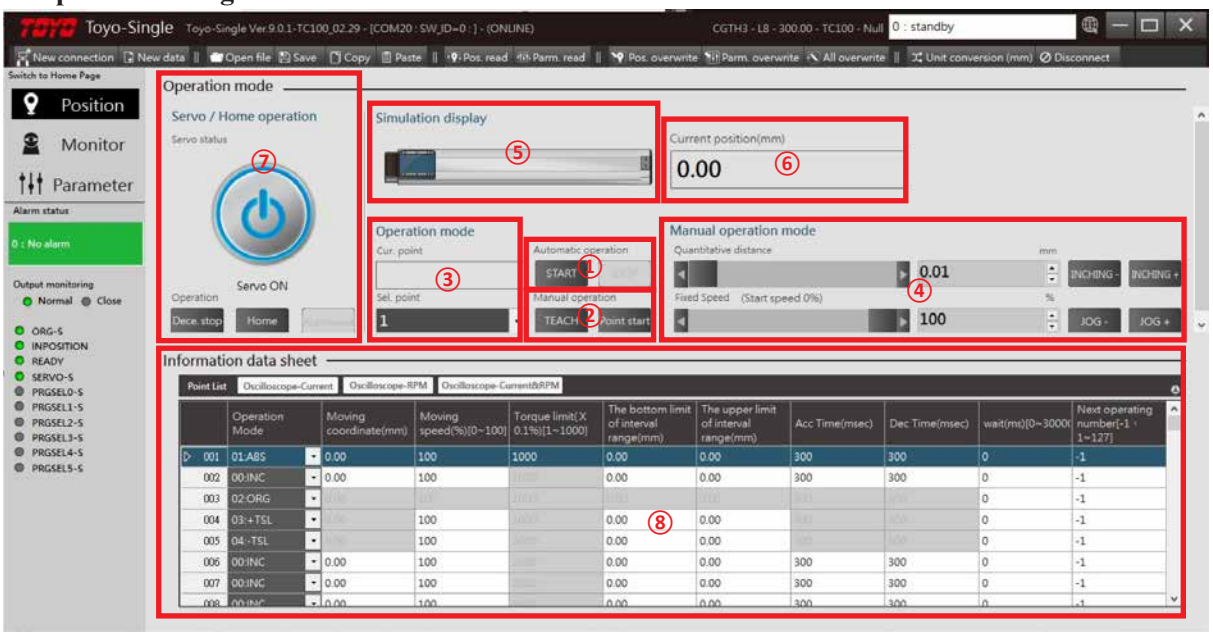


Figure (9) Point position page

• Auto operation

This function allows auto operation based on the operating mode of the currently selected point in the point position form, as shown in Figure (10).

Figure (10) Auto operation

• Manual operation

This area can carry out the [TEACH] function and [point START] function according to the current selected point position, while the point START function only operates in a single point operation mode according to the moving coordinate and moving speed, as shown in Figure (11).

Figure (11) Manual operation

- **Perform points**

This function allows you to display and select currently performed points, as shown in Figure (12).

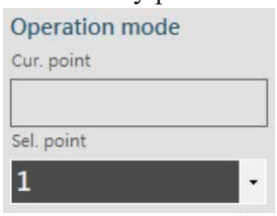


Figure (12) Perform points

- **Manual operation**

This function allows the user to manually perform general operations, as shown in Figure (13).

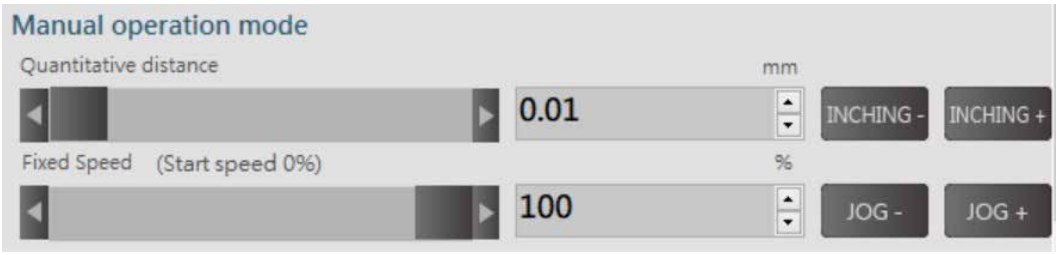


Figure (13) Manual operation

- **Simulated display**

This function enables simulated display of the current position of the physical actuator, and you can manually move the actuator to perform operations, as shown in Figure (14).

Figure (14) Simulated display

- **Current operation**

This function allows you to display the information about the position of the actuator feedback by the controller, as shown in Figure (15).

Figure (15) Current operation

- **Servo / Home operation**

This function allows you to perform Servo ON/OFF, deceleration to stop, home return, and alarm reset, as shown in Figure (16).

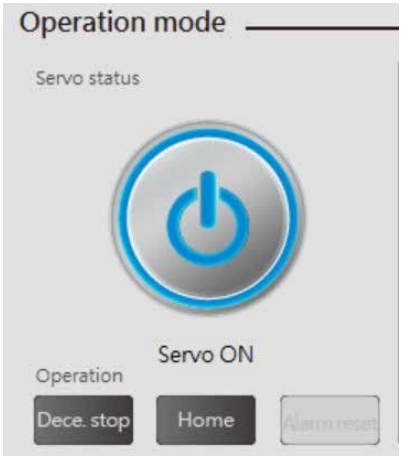


Figure (16) Servo / Home operation

- **Point position form**

Display the data about 127 point positions in TOYO-Single, as shown in Figure (17).
The operating modes include INC, ABS, ORG, +TSL, -TSL, INC-R, and ABS-R, The operation mode of claw system is divided into INC-T, ABS-T, CLOSE, CLOSE-R, OPEN and OPEN-R. The operating conditions of ORG, +TSL, -TSL, CLOSE, CLOSE-R, OPEN and POEN-R do not refer to the items marked in gray. While INC, ABS, INC-R, ABS-R, INC-T and ABS-T refer to all conditions. Attention should be paid to this during settings.

	Operation Mode	Moving coordinate(mm)	Moving speed(%)[0~100]	Torque limit(X 0.1%)[1~1000]	The bottom limit of interval range(mm)	The upper limit of interval range(mm)	Acc Time(msec)	Dec Time(msec)	wait(ms)[0~3000(	Next operating number[-1 · 1~127]
▷ 001	01:ABS	0.00	100	1000	0.00	0.00	300	300	0	-1
002	00:INC	0.00	100	1000	0.00	0.00	300	300	0	-1
003	02:ORG	0.00	100	1000	0.00	0.00	300	300	0	-1
004	03:+TSL	0.00	100	1000	0.00	0.00	300	300	0	-1
005	04:-TSL	0.00	100	1000	0.00	0.00	300	300	0	-1
006	00:INC	0.00	100	1000	0.00	0.00	300	300	0	-1

Figure (17) Point position form

- **Oscilloscope**

This function is used for START and STOP under I/O control, as shown in Figure (18).
Under PULSE control, it shows the Start recording and Stop recording buttons, as shown in Figure (19).

Figure (18) Auto operation

Figure (19) Start recording / stop recording

This function has three display methods:
The first displays the values of the current recorded during the operation of the motor for 1 minute, as shown in Figure (19).
The second displays the RPM recorded during the operation of the motor for 1 minute, as shown in Figure (20).
The third displays the values of current and RPM recorded during the operation of the motor for 1 minute, as shown in Figure (21).
If you have to magnify the chart interval, horizontally drag the desired interval range on the chart. If you want to restore it to the original chart size, click the button at the bottom left corner, as shown in Figure (22).

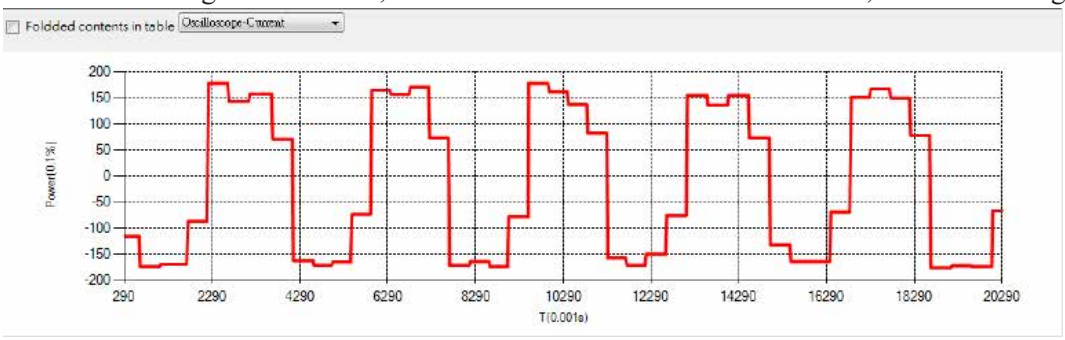


Figure (20) Oscilloscope-Current

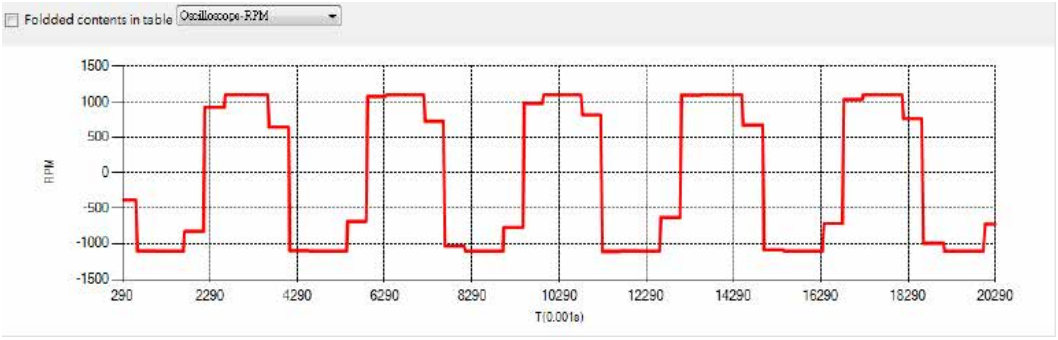


Figure (21) Oscilloscope-RPM

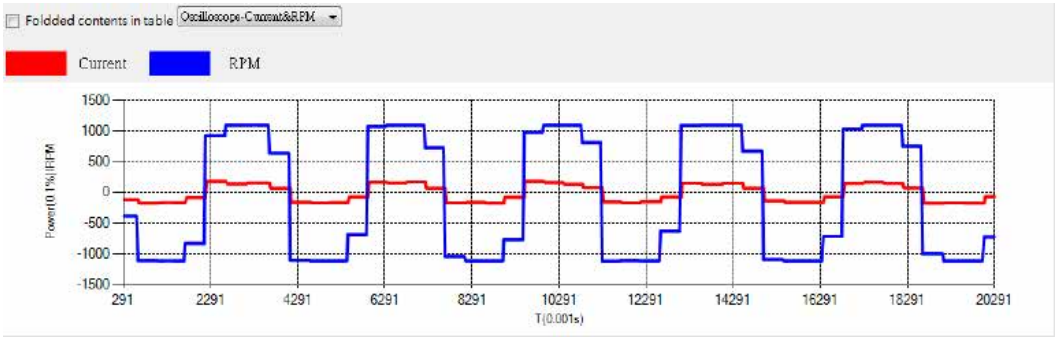


Figure (22) Oscilloscope-Current&RPM

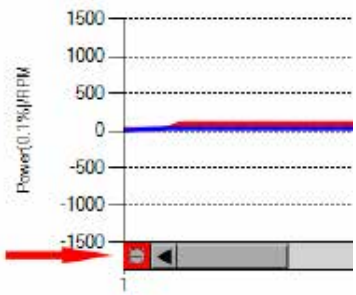


Figure (23) Restore chart button

• Description of the Monitoring page

The Monitoring page is mainly used to monitor the current information about the actuator feedback the controller, and conduct point operations as well as read error messages using the input monitoring, as shown in Figure (24).

▼ Monitoring page

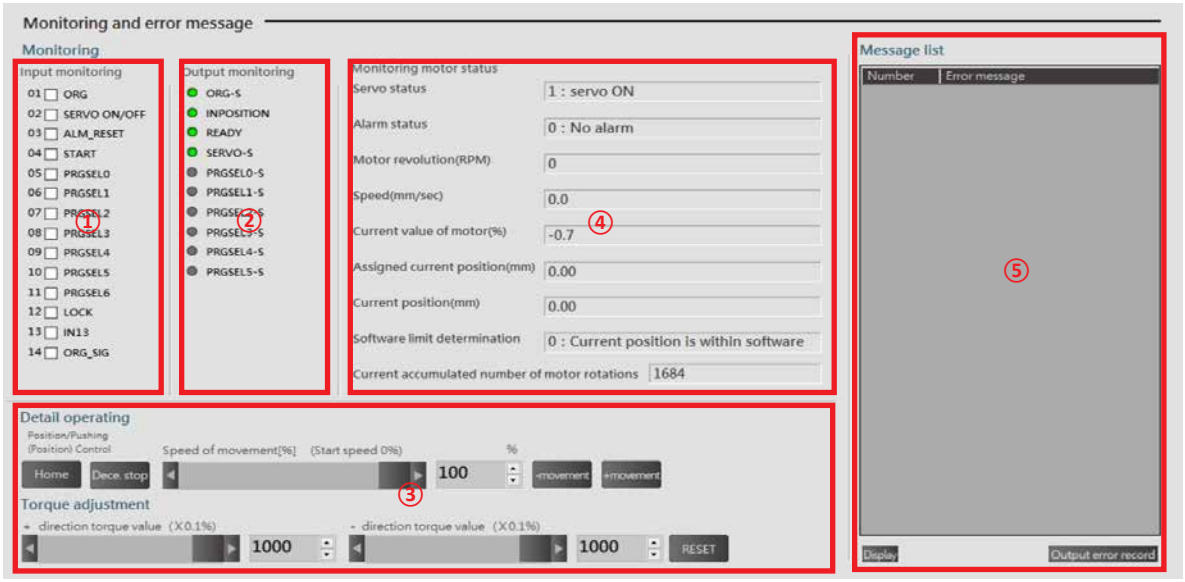


Figure (24) Monitoring page

• Input monitoring

This area allows you to monitor the controller input signals. The signal indicator shows when different communication methods are used. In addition, you can check corresponding functions, as shown in Figure (24).

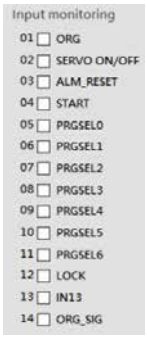


Figure (25) Input monitoring

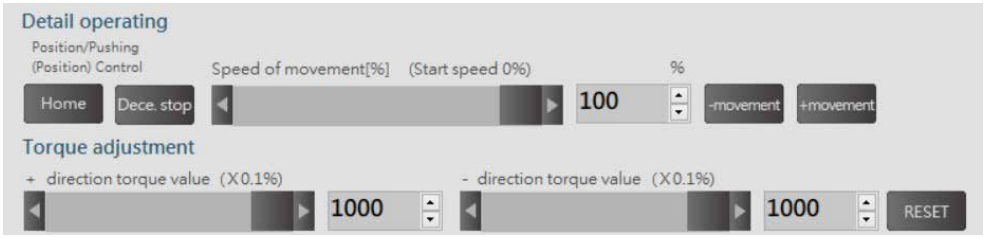
• Output monitoring

This area allows you to monitor the controller output signals. The signal indicator shows when different communication methods are used, as shown in Figure (26).

Figure (26) Output monitoring

- **Detailed operation/torque value adjustment**

This area can perform position/push (position) control, torque value adjustment and other functions, as shown in Figure (27).



Figure(27) Detailed operation/torque value adjustment

- **Motor status monitoring**

This area allows you to display of the information about the actuator feedback by the controller, as shown in Figure (28).

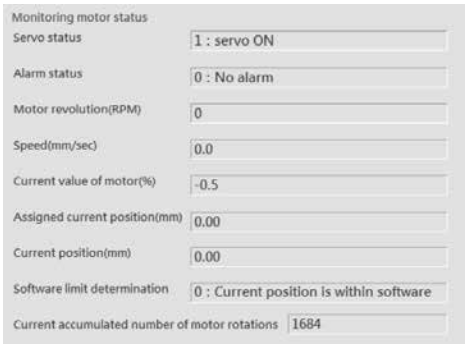


Figure (28) Motor status monitoring

- **Error message list**

This area allows you to check the error messages when there is any error with the controller operations, as shown in Figure (29).

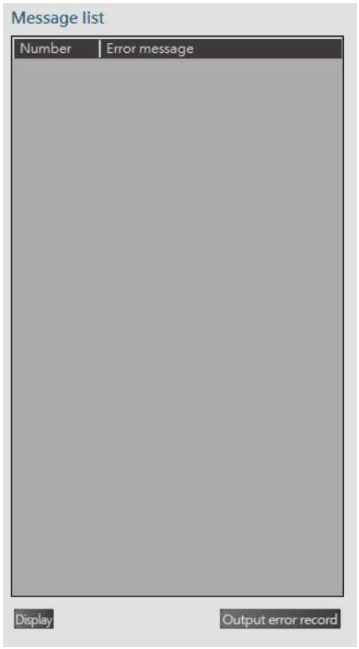


Figure (29) Error message list

• Description of the Parameters page

The Parameters page is mainly used to display and set the relevant controller parameter, as shown in Figure (30).

This page has 8 parameter items. These are [Otor Parameters], [Thrust Parameters], [Common Parameters], [Input Setting], [Output Setting], [Speed Parameters], [Home Return Parameters], [Communication Setting Parameters] which are available for the user to set.

▼ Parameter page

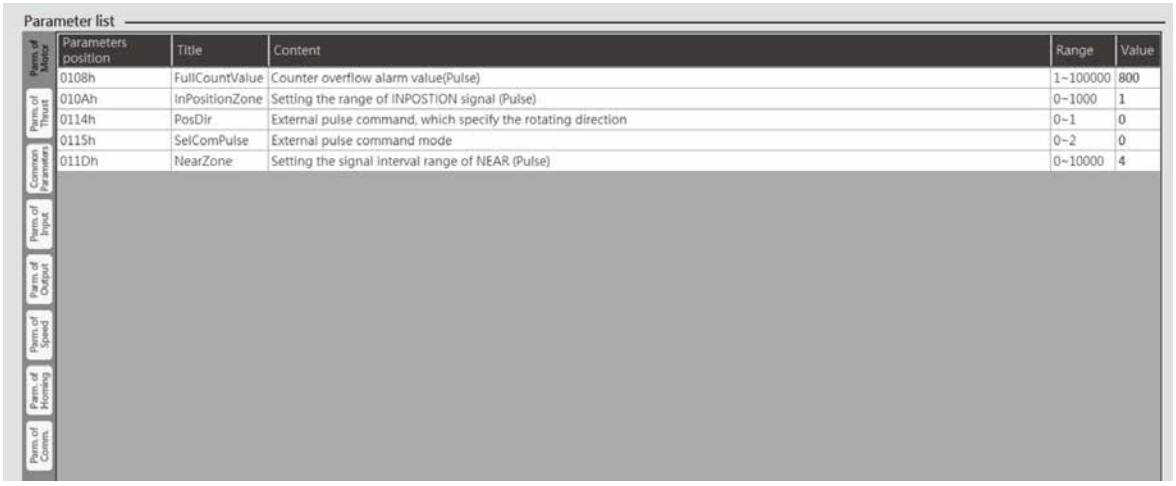


Figure (30) Parameter page

9.4 Uniaxial software operation instructions

• Controller connection

This section introduces how to connect software to the controller.
First, launch TOYO-Single software, as shown in Figure (31).

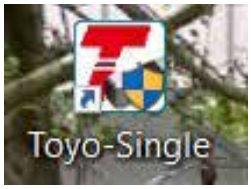


Figure (31) TOYO-Single software

After entering the welcome page, you can set the system, as shown in Figure (32). Some functions are described as follows. After confirming the setting, please select the corresponding system.

Figure (32) Welcome page

① **Select a language**
Users can switch languages.

② **Select a controller**
Users can select the corresponding controller.

③ **Select the mode of use**
Users can select "Add Connection" or "Add Data" to enter the main system.

④ **Select the version**
Users can select the firmware version of the corresponding controller.

⑤ **Select the system**
Users can select the corresponding system.

⑥ **Company information**
Provides links to information about the company.

Please select the use mode [Add Connection] button, as shown in Figure (33), and then select the system of the corresponding using organization to enter the main screen. .

Figure (33) Add connection button

Set the relevant station number, Com port, connection rate and other information, as shown in Figure (34). In addition, the [SEARCH] button below can be used to automatically judge whether there are available connections. After confirming the connection, please press the [Execute Connection] button.

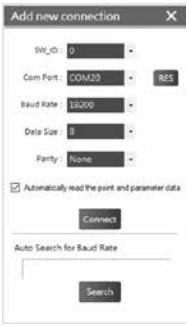


Figure (34) Add connection settings

Confirm the controller connection message, as shown in Figure (35). Click the [OK] button to read the point position values and parameter values.

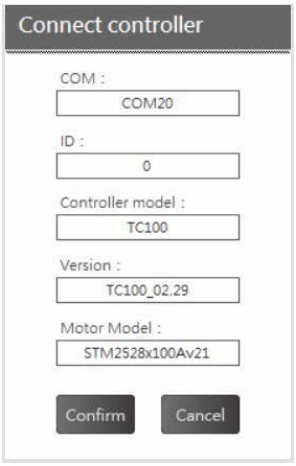


Figure (35) Controller connection message

After reading the point position values and parameter values, the initial system screen appears, as shown in Figure (36).

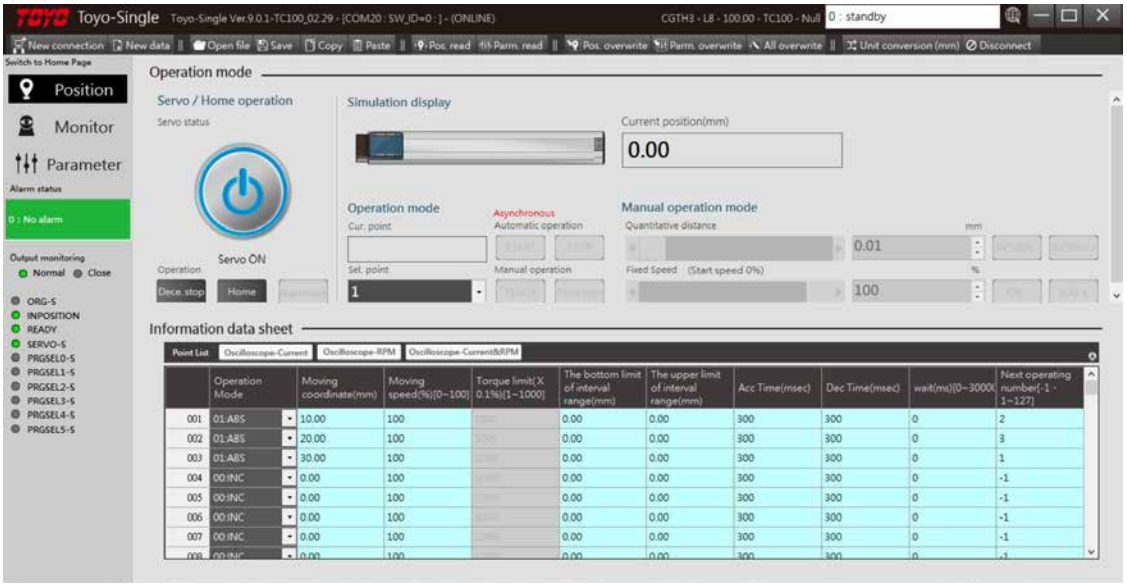
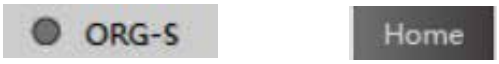


Figure (36) Initial system screen

- **Home return**

Before operation, if the actuator does not return to home, the ORG-S indicator goes off. In this case, you have to perform home return, which will be described in the following.

If the ORG-S indicator to the left is not lit up, you have to perform home return, please press the origin return button to operate, as shown in Figure (37).



(a)ORG-S indicator (b) Home return button

Figure (37) Home return operations

After home return, a message is shown, as shown in Figure (38).

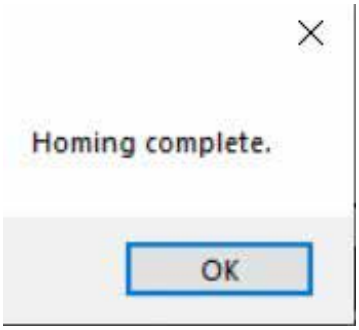


Figure (38) A message showing home return is completed.

After completion, the system screen appears, as shown in Figure (39).

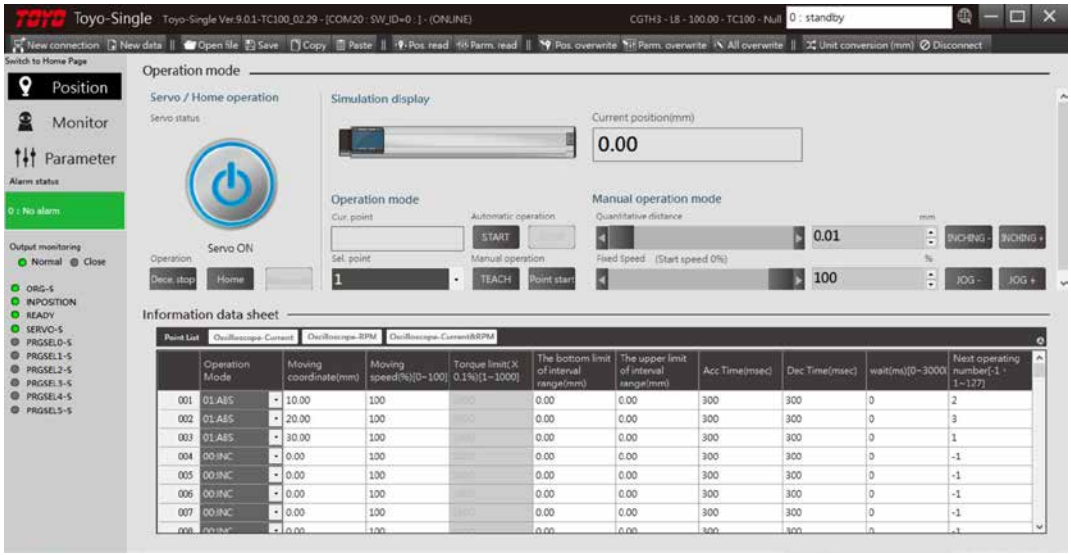


Figure (39) The screen of a completed system

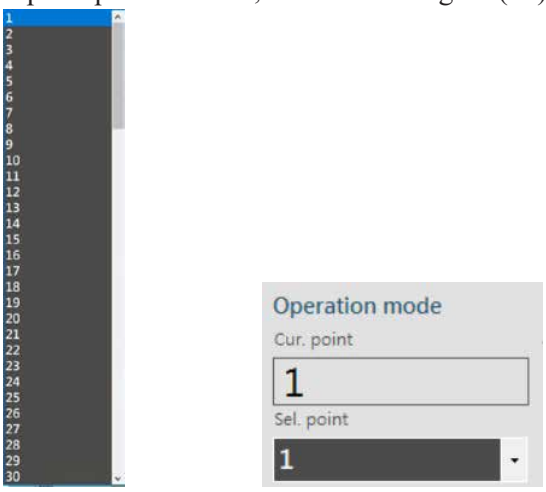
- **Point movement**

Point position movement can be divided into automatic operation and manual operation. Automatic operation can carry out multi-point movement according to the selected point position. Manual operation allows you to move one point based on the selected point. The following describes these operations.

There are two ways to select points:

The first is to drag the scroll bar and select one, as shown in Figure (40).

The second is to directly clock the point position form, as shown in Figure (41).



(a) Before selection (b) After selection

Figure (40) Drag the scroll bar to select

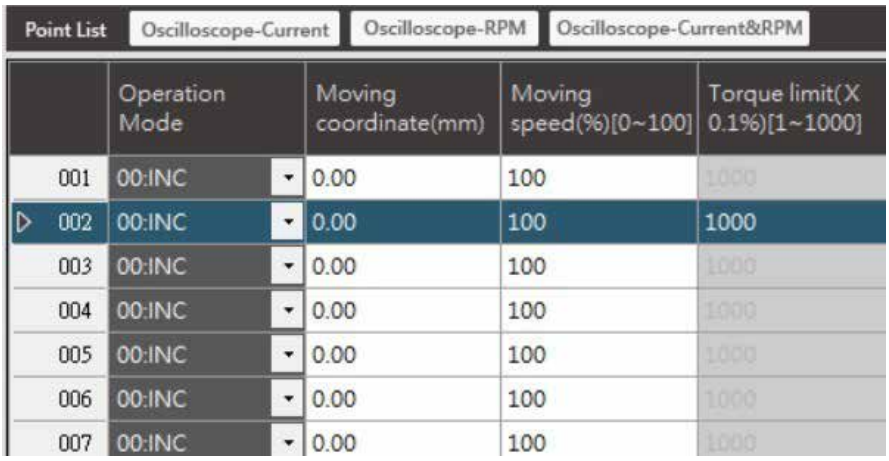


Figure (41) Select on the form

For [Auto Operation], click the [START] button, as shown in Figure (42), to start auto operation of points.

Figure (42) START button

If you want to end the operation, click the [STOP] button, as shown in Figure (43).

Figure (43) STOP button

For [Manual Operation], after you select a point, click the [Point START] button, as shown in Figure (44), to start manual operation of points.

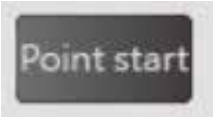


Figure (44) Point START button

- **Manual operation**

Manual operation includes Inch, Jog, and Manual Movement, which will be described in the following.

① Inch

Before performing Inch, you can set the movement distance, as shown in Figure (45).

Figure (45) Constant distance

Next, perform Inch, as shown in Figure (46). Click the button to move as specified by [Constant Distance].

Figure (46) Inch button

② Jog

Before performing Jog, you can set the movement speed, as shown in Figure (47).

Figure (47) Constant speed

Next, perform Jog, as shown in Figure (48). Click the button to move as specified by [Constant Speed].

Figure (48) Jog button

③ Manual
Before performing Manual Movement, you can set the movement speed, as shown in Figure (49).

Figure (49) Constant speed

Next, perform Manual Movement, as shown in Figure (50). Move the actuator manually and it will move as specified by [Constant Speed].

Figure (50) Manual movement

- **Point teaching**

After you finish the manual operation described in 1.3, you can perform point teaching using the TEACH button, which will be described in the following.

Select a point to be taught, as shown in Figure (51).

Figure (51) Select a point

Click the [TEACH] button to perform point teaching, as shown in Figure (52).

Figure (52) TEACH button

The system fill out the movement coordinate of the selected point based on the position value shown in Figure (53) and the operating mode changes to [ABS], as shown in Figure (54).

Figure (53) Current operation

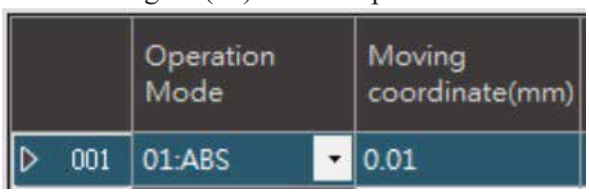


Figure (54) Completion of point teaching

- **Add data**

Initial parameter values of the newly added data can be automatically set according to the product series, moving table model, motor direction and other values selected by the user to reduce the user's inconvenience when setting parameters. The following describes these operations.

First, select the [Add Data] button on the [Toolbar], as shown in Figure (55).

Figure (55) Add Data button

After selection, the [Add Data Settings] window appears, as shown in Figure (56).
The user has to set the relevant initial data in this window to general initialized parameter values. Click the [OK] button after setting.

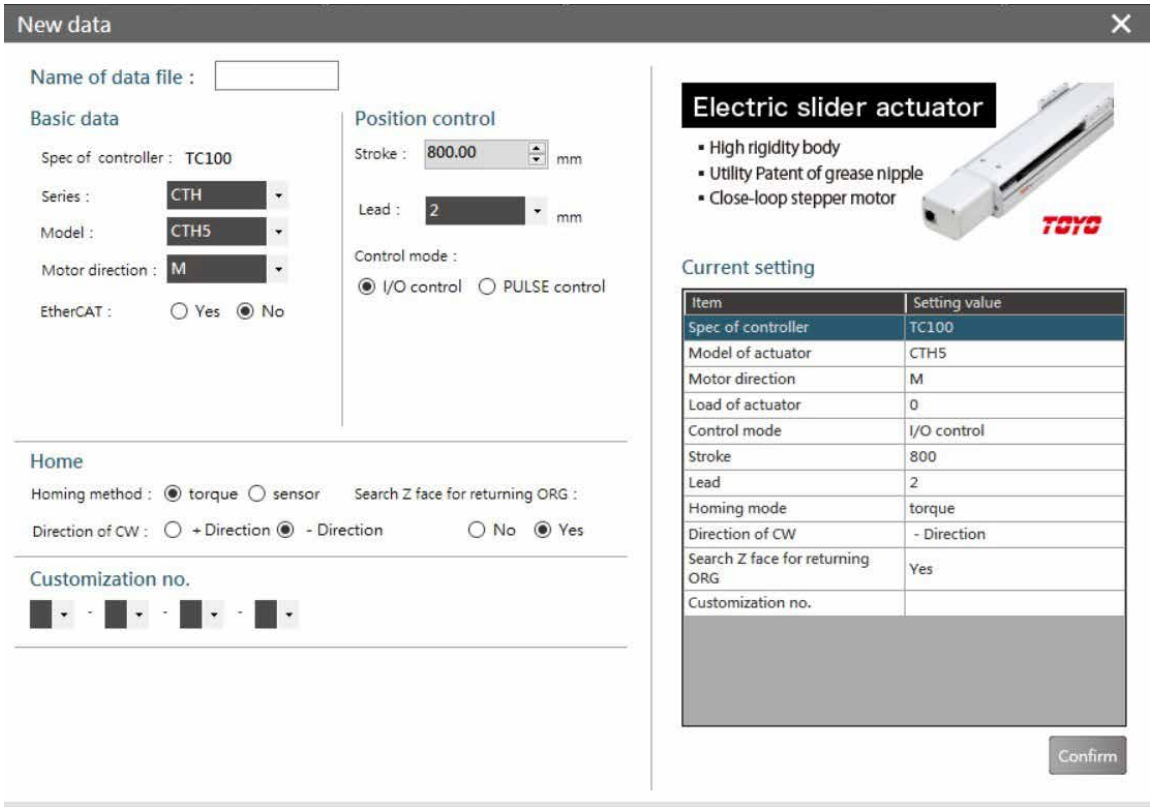


Figure (56) Add Data Settings window

If the user needs PULSE control, please check the corresponding option, as shown in Figure (57).

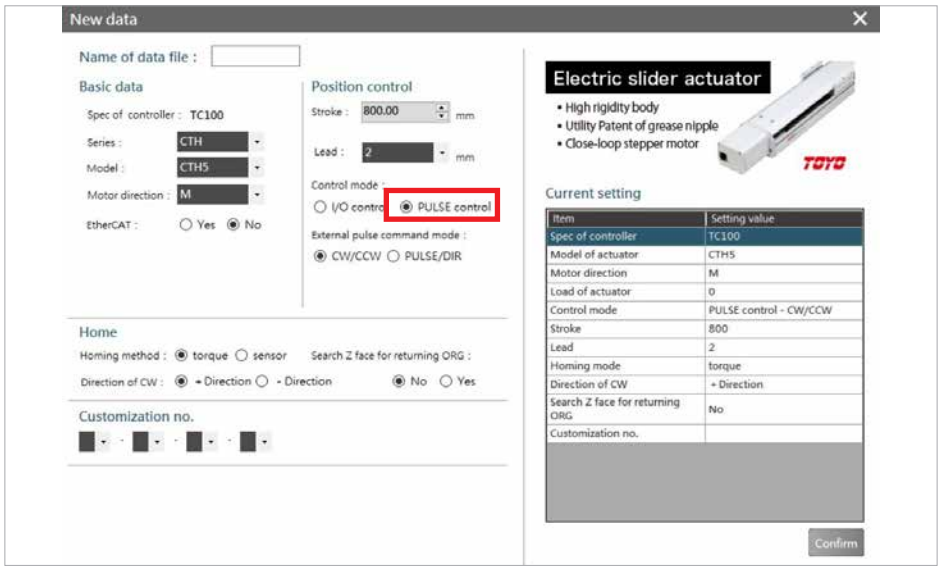


Figure (57) PULSE control options

Users need to set relevant initial data in this window to facilitate the automatic generation of initialized parameter values. After the setting is complete, please Press the [OK] button.

If users choose CGTH series products, the software supports intelligent load adjustment function. Users can add new data according to different load conditions to use the products of the company more stably.

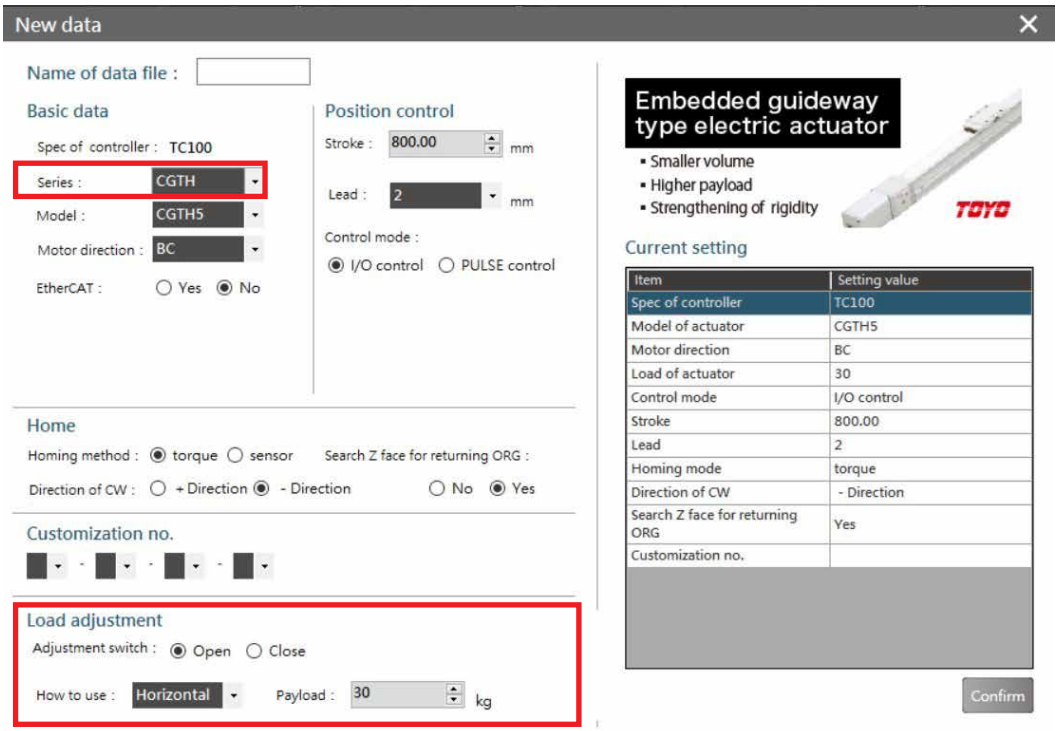


Figure (58) Intelligent load adjustment function

Intelligent load adjustment function will automatically generate the ininitialized point position table and ininitialized parameter values according to the data set in the previous step, as shown in Figure (58).

Point List

	Operation Mode	Moving coordinate(mm)	Moving speed(%)[0~100]	Torque limit(X 0.1%)[1~1000]	The bottom limit of interval range(mm)	The upper limit of interval range(mm)	Acc Time(msec)	Dec Time(msec)	wait(ms)[0~3000(	Next operating number[-1 、1~127]
001	00:INC	0.00	100	1000	0.00	0.00	300	300	0	-1
002	00:INC	0.00	100	1000	0.00	0.00	300	300	0	-1
003	00:INC	0.00	100	1000	0.00	0.00	300	300	0	-1
004	00:INC	0.00	100	1000	0.00	0.00	300	300	0	-1
005	00:INC	0.00	100	1000	0.00	0.00	300	300	0	-1
006	00:INC	0.00	100	1000	0.00	0.00	300	300	0	-1
007	00:INC	0.00	100	1000	0.00	0.00	300	300	0	-1
008	00:INC	0.00	100	1000	0.00	0.00	300	300	0	-1
009	00:INC	0.00	100	1000	0.00	0.00	300	300	0	-1
010	00:INC	0.00	100	1000	0.00	0.00	300	300	0	-1
011	00:INC	0.00	100	1000	0.00	0.00	300	300	0	-1
012	00:INC	0.00	100	1000	0.00	0.00	300	300	0	-1
013	00:INC	0.00	100	1000	0.00	0.00	300	300	0	-1
014	00:INC	0.00	100	1000	0.00	0.00	300	300	0	-1
015	00:INC	0.00	100	1000	0.00	0.00	300	300	0	-1
016	00:INC	0.00	100	1000	0.00	0.00	300	300	0	-1
017	00:INC	0.00	100	1000	0.00	0.00	300	300	0	-1
018	00:INC	0.00	100	1000	0.00	0.00	300	300	0	-1
019	00:INC	0.00	100	1000	0.00	0.00	300	300	0	-1
020	00:INC	0.00	100	1000	0.00	0.00	300	300	0	-1

(a) Initialized point position table

Parm. of Motor | Parm. of Thrust | Common Parameters | Parm. of Input | Parm. of Output | Parm. of Speed | Parm. of Homing | Parm. of Comm.

Parameters position	Title	Content	Range	Value
0108h	FullCountValue	Counter overflow alarm value(Pulse)	1~100000	200
010Ah	InPositionZone	Setting the range of INPOSTION signal (Pulse)	0~1000	80
010Bh	ElectroGearNum	Numerator of electronic gear ratio	1~10000	960
010Ch	ElectroGearDen	Denominator of electronic gear ratio	1~10000	80
0114h	PosDir	External pulse command, which specify the rotating direction	0~1	0
0115h	SelComPulse	External pulse command mode	0~2	0
011Dh	NearZone	Setting the signal interval range of NEAR (Pulse)	0~10000	4

(b) Initialized parameter values

Figure (59) Initialized parameter values

After the parameters are set, the message indicating the motor model is different may appear, as shown in Figure (60), if you want to write parameters.
This is because the system has detected that the motor model of the newly added sliding table is not the same as the motor model in the current controller. If the parameter is written back, it may cause incorrect operation. Therefore, if you want to confirm, you need to modify the sliding table model. Please press the "Confirm" button to write motor data. Otherwise, select the Cancel button.

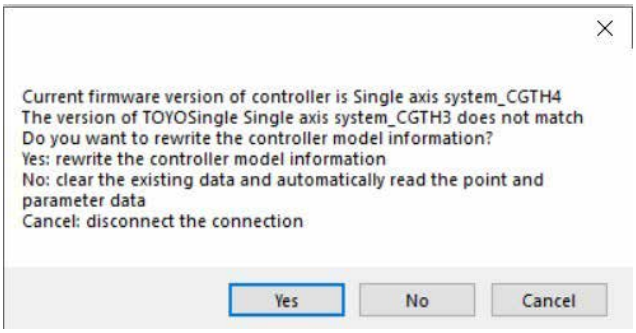


Figure (60) A message indicating unmatched motor model

After you click the [OK] button, disconnect the power and reboot according to the on-screen messages, as shown in Figure (61). After completion, the system continuously performs writing.

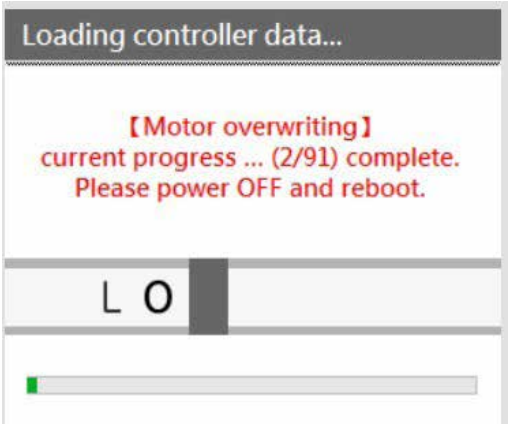


Figure (61) A message indicating disconnection of the power and reboot

Then disconnect the power and reboot according to the on-screen messages, as shown in Figure (62). After completion, the system continuously performs writing.

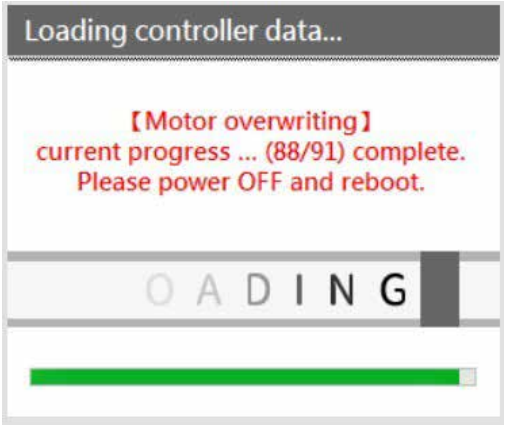


Figure (62) A message indicating disconnection of the power and reboot

The system asks you whether to write back parameters, as shown in Figure (63). If you select [Yes], the system will write all parameters, and write the [model specifications] (which is show in connection mode). If you do not need this, select [No].

Figure (63) Confirmation of parameter write-back

9.5 Claw software operation instructions

This chapter will introduce six motion function modes of claw point position, as shown in Figure (1).

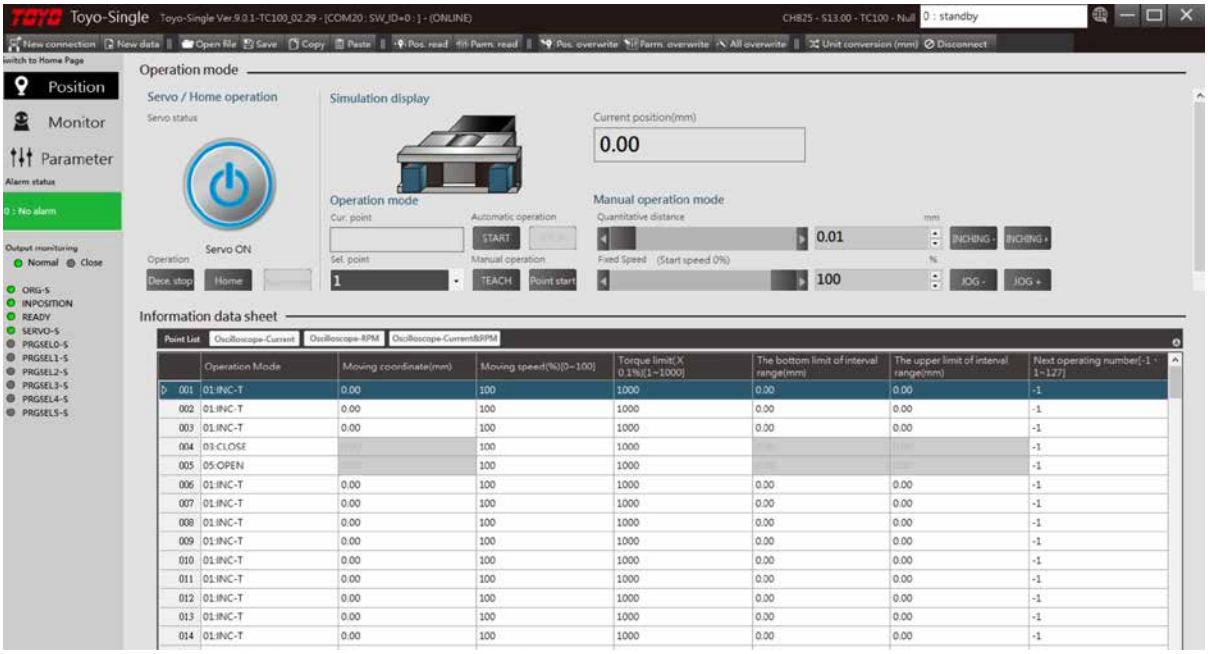


Figure (1) The page of claw point position

- **Introduction to INC-T mode**

The function of relative position and movement controlled by torque refers to moving from the current position to the required relative position. The moving coordinates and torque limit can be set freely, as shown in Figure (2).

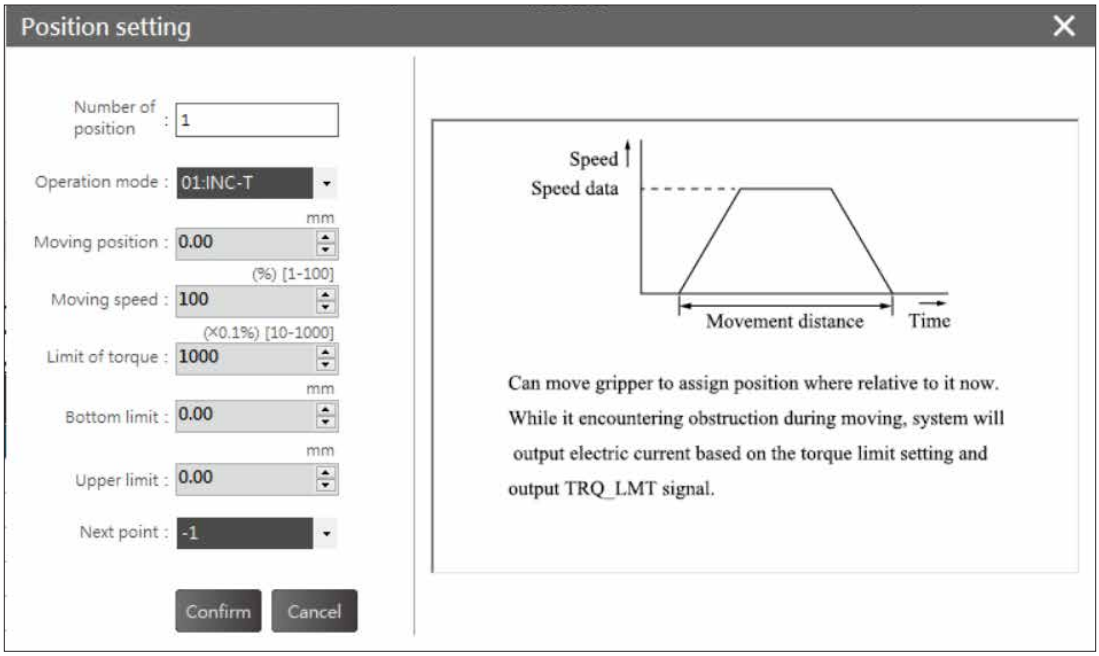


Figure (2) INC-T mode

- **Introduction to ABS-T mode**

The function of absolute position and movement controlled by torque refers to moving from the original point to the required position. The moving coordinates and torque limit can be set freely, as shown in Figure (3).

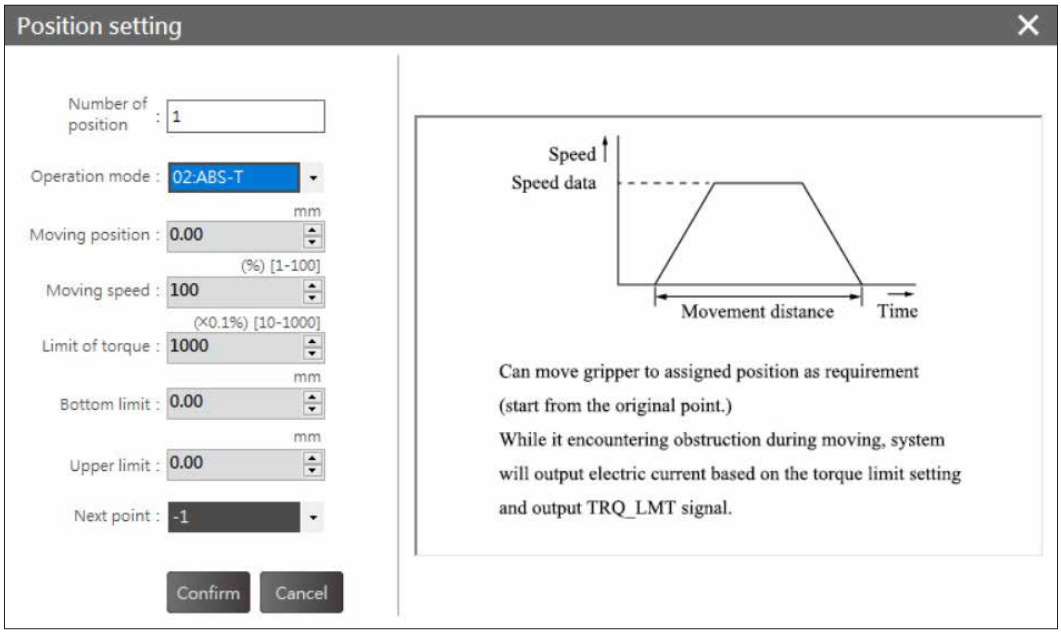


Figure (3) ABS-T mode

- **Introduction to CLOSE mode**

The claw can be closed at the specified speed and torque. In the process of moving, if the object is clamped and TRQ_LMT signal is ON because the set torque condition is reached, it means that the claw has clamped the object, as shown in Figure (4).

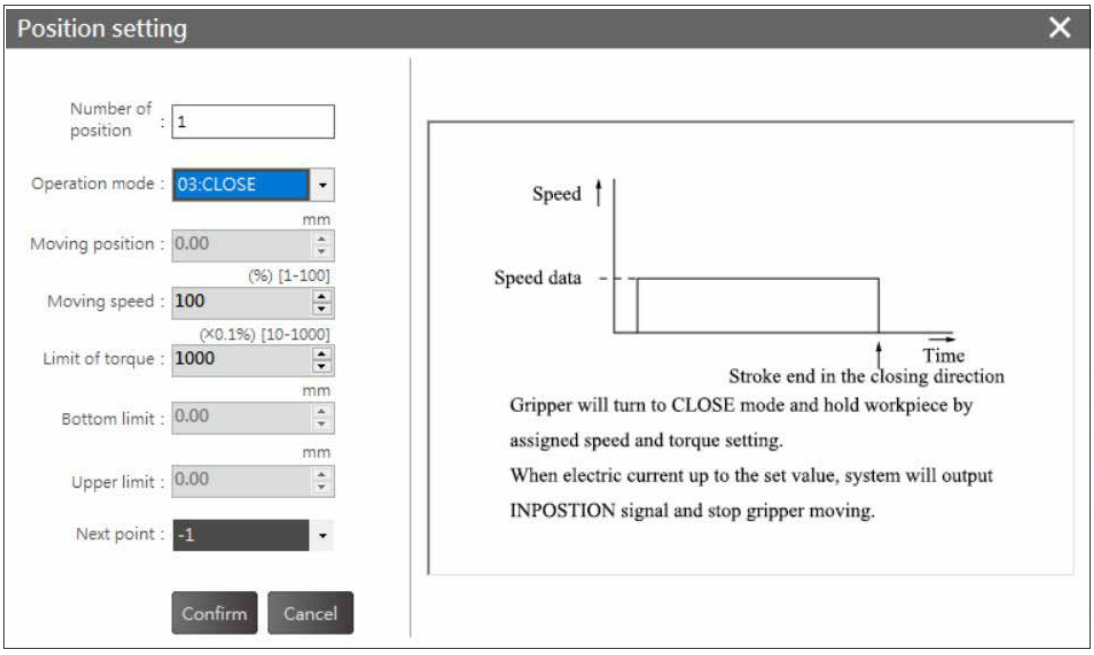


Figure (4) CLOSE mode

- **Introduction to CLOSE-R mode**

The claw can be closed in the set range at the specified speed and torque. In the process of moving, TRQ_LMT signal is on when INRANGE signal is on and the set torque condition is reached, indicating that the gripper has clamped the object and it is within the set position range, as shown in Figure (5).

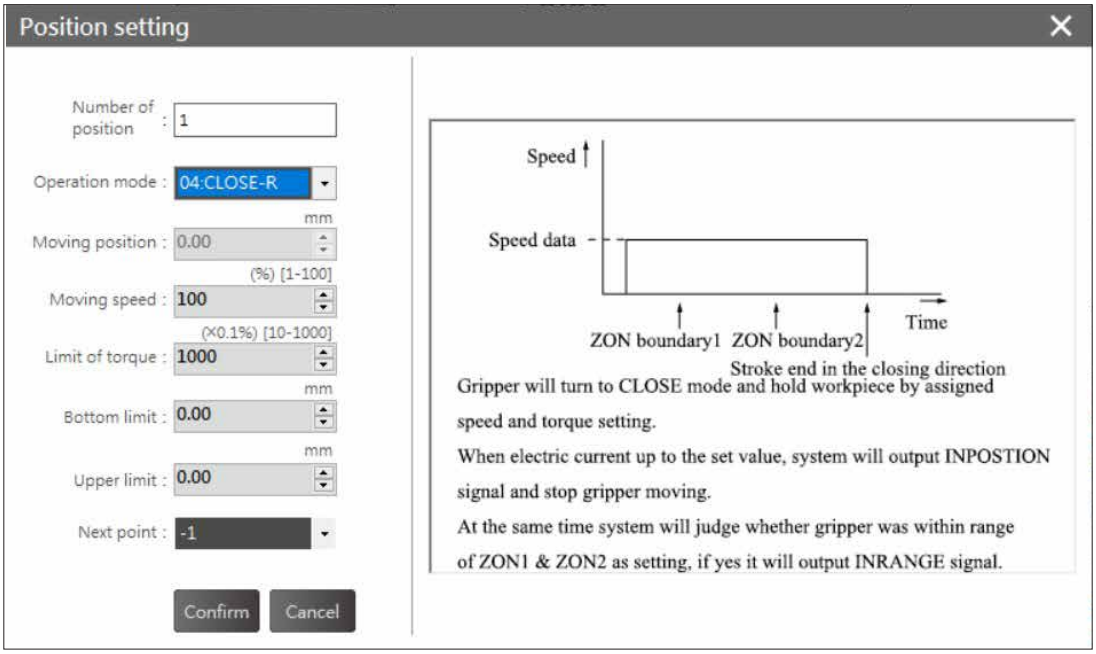


Figure (5) CLOSE-R mode

- **Introduction to OPEN mode**

The claw can be opened at the specified speed and torque. If the claw pushes the object apart and TRQ_LMT signal is ON when the torque condition is reached, it means that the claw has pushed the object apart, as shown in Figure (6).

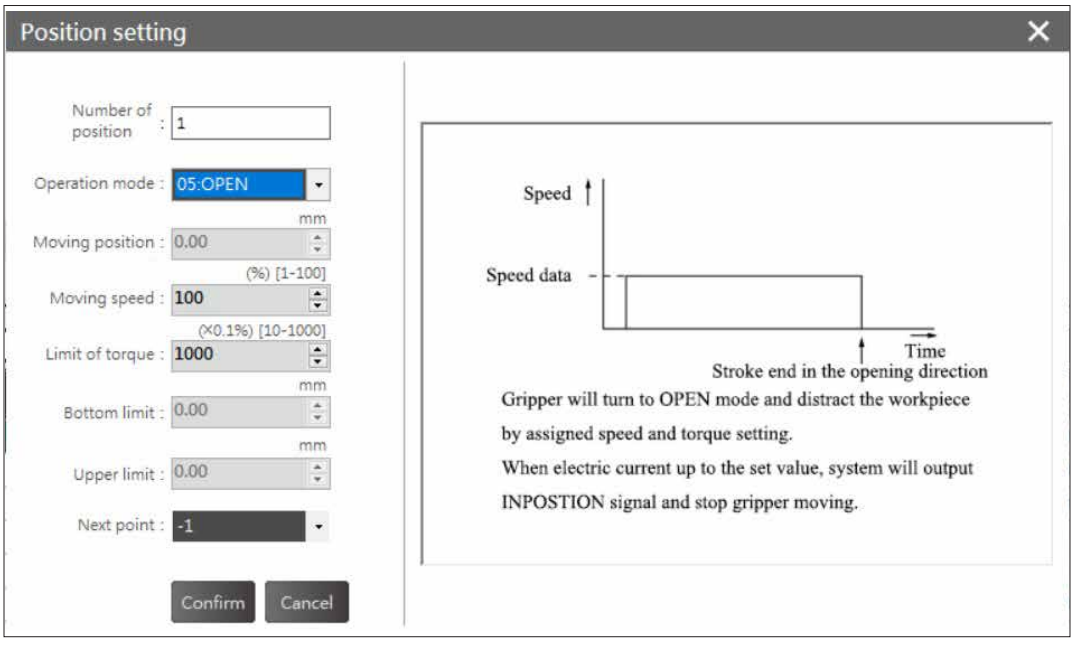


Figure (6) OPEN mode

- **Introduction to OPEN-R mode**

The claw can be opened in the set range at the specified speed and torque. In the process of moving, TRQ_LMT signal is on when INRANGE signal is on and the set torque condition is reached, indicating that the claw has pushed the object apart, as shown in Figure (7).

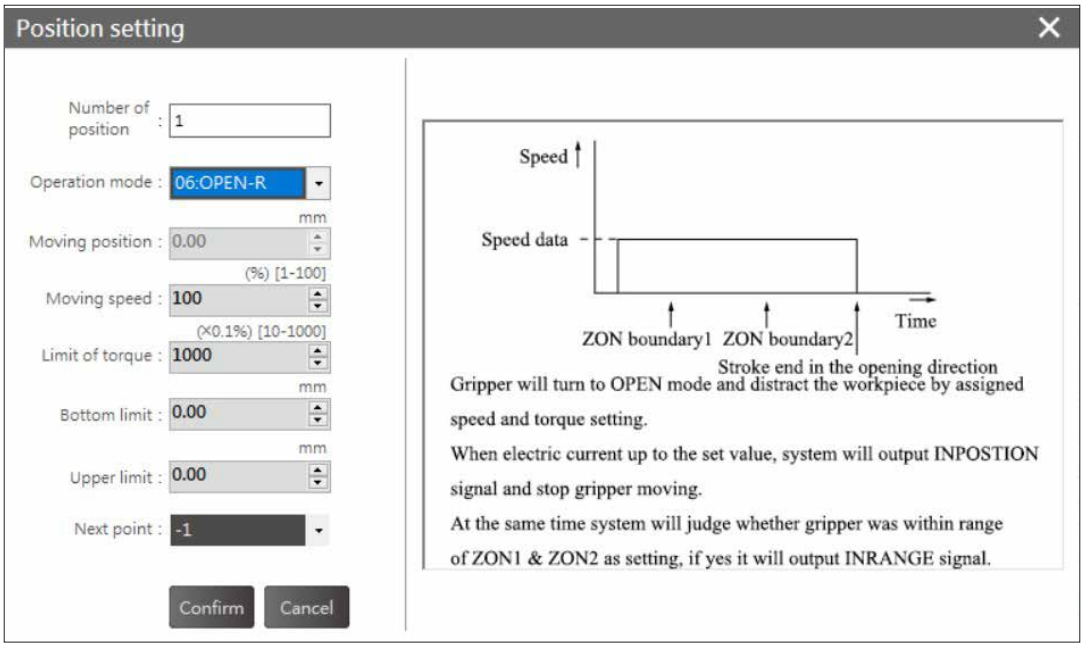


Figure (7) OPEN-R mode

10. Appendix

10.1 Overview of error messages

■■ Overview of controller LED indicators

LED name	Function description	LED colors
PWR	*When the main power and control power are supplied properly, it is lit up. When some parameters are written, it flashes if the power has to be reset.*	Green
SON	*When the servo is ON normally, it is lit up.*	Green
ERR	*When there is a problem with TC100, it is lit up.*	Red
	You can determine the failure cause based on the number of flashes.	
	The failure indicator flashes once per second in a 2-second interval.	

10.2 Alarm exclusion

Flashing lights, number of flickers	Alarm state	Causes	Check / Process
2	Loop error	Excessive load.	Please reduce the load.
		Motor speed does not follow the frequency of the command pulse.	Please set the maximum cycle number of the command pulse below the maximum rated turning speed of the motor.
		Motor wire break.	Please confirm motor wiring.
3	Full Count	Excessive load.	Please increase the acceleration and deceleration time.
		Motor speed does not follow the frequency of the command pulse.	Please set the maximum cycle number of the command pulse below the maximum rated turning speed of the motor.
		Motor wire break.	Please confirm motor wiring.
4	Overspeed	The motor is running too fast.	Please set the maximum cycle number of the command pulse below the maximum rated turning speed of the motor.
5	The gain value is not adjusted properly	Abnormal motor vibration due to poor adjustment.	Reset the gain value.
		Input command pulse without acceleration or deceleration.	Reset acceleration and deceleration.
6	Overvoltage	Due to abnormal rise in internal main circuit voltage.	Please extend the acceleration and deceleration time.
			Reduce load inertia.
			Add the regenerating resistance.
7	Initialization Error	Power on when the load exceeds the rated load.	Please reduce the load.
8	EEPROM Error	EEPROM DATA Error	Please contact the manufacturer or distributor
9	Main loop power supply voltage is insufficient	Below main loop power supply voltage.	Check whether the capacity of the power supply is insufficient. It is recommended to increase the capacity.
10	Overcurrent	Motor coil short circuit.	Change the motor.
		The controller loop is damaged.	Change the controller.
11	Recurrent abnormality	The absorption loop inside the substrate has reached its limit.	Add a new regenerating resistance.
12	Emergency stop	Emergency stop input signal is OFF.	Check the emergency stop circuit or replace the switch.

Flashing lights, number of flickers	Alarm state	Causes	Check / Process
13	Motor wire break	Phase A or phase B of the motor is disconnected.	Please confirm motor wiring.
14	Encoder wire break	Phase A or phase B of the encoder is disconnected.	Please confirm encoder wiring.
15	Protection current value	The set time when the motor current exceeds the set value.	Overloading or touching other hardware on the device.
18	Action timeout	The action cannot finish within the set time.	Check the organization or set a value that fits and does not time out.

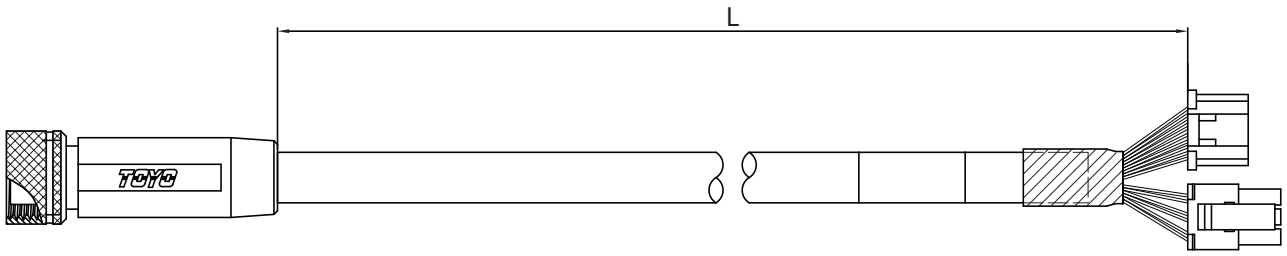
10.3 Troubleshooting

Failure state	Major cause	Solution
Receive action commands in action	· Execute movement commands or program operation during operation · Set parameters for overwrite prohibition during operation · Program data set during program operation	Please execute after the motor stops running and the program stops running.
Upper and lower limitation error	Set an out-of-range value in the parameter	Please set the value within the range
Position error	The word limit is exceeded while reading parameters continuously.	Please communicate within the word limit.
Format error	The word limit is exceeded while writing parameters.	Please communicate within the word limit.
Control mode error	Perform actions of different control modes.	Confirm the setting value of parameter 0503 H and input the set status of CONT_MODE before executing.
Power off and restart	Power on again and rewrite the necessary parameters.	Please turn on the control power again.
Initialization is not complete	Action commands are executed while initialization actions are not finished(IO and communication)	Execute the action command after the initialization action is complete.
Servo ON/OFF error	· Execute action commands in Servo OFF state · Perform alarm reset in Servo ON state	· Please execute the action command in Servo ON state · Reset (201 E H-6) by command alarm in the Servo OFF (201 1 H-1) state
LOCK	· Fore LOCK signal, please execute the action command in the state of ON · LOCK signal is ON during the action	Please adjust the LOCK signal to OFF before executing the action command.
Software limit	Stop after the current position reaches software limit.	Perform the action within the software limits.
Parameter write permission is insufficient	Parameter writing is restricted by permission.	Please increase the parameter write level.
Return-to-origin not completed	To execute an action command or run a program while origin return is incomplete.	Perform the origin return action, or set 0 in OrgRetRestrict (051 B H) to remove the action restriction.
Brake released	Execute servo ON/OFF when the brake release command is in effect.	Invalidate the brake release command.

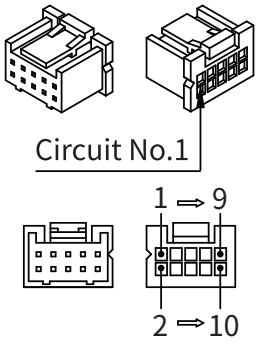
10.4 Wire material data

TC100 Relay Wire				
Part No	Product name	Specification	Line length(L)	Unit
16105-001002-*	TC100 relay line-Standard version-*	Signal+power+(W)-1m	1	M
16105-003002-*	TC100 relay line-Standard version-*	Signal+power+(W)-3m	3	M
16105-005002-*	TC100 relay line-Standard version-*	Signal+power+(W)-5m	5	M
16105-010002-*	TC100 relay line-Standard version-*	Signal+power+(W)-10m	10	M
16105-001003-*	TC100 relay line-Standard version-*	Signal+power+180° -1m	1	M
16105-003003-*	TC100 relay line-Standard version-*	Signal+power+180° -3m	3	M
16105-005003-*	TC100 relay line-Standard version-*	Signal+power+180° -5m	5	M
16105-010003-*	TC100 relay line-Standard version-*	Signal+power+180° -10m	10	M
16105-001005-*	TC100 relay wire-Bending Resistant-*	Signal+power+(W)-1m	1	M
16105-003005-*	TC100 relay wire-Bending Resistant-*	Signal+power+(W)-3m	3	M
16105-005005-*	TC100 relay wire-Bending Resistant-*	Signal+power+(W)-5m	5	M
16105-010005-*	TC100 relay wire-Bending Resistant-*	Signal+power+(W)-10m	10	M
16105-001006-*	TC100 relay wire-Bending Resistant-*	Signal+power+180° -1m	1	M
16105-003006-*	TC100 relay wire-Bending Resistant-*	Signal+power+180° -3m	3	M
16105-005006-*	TC100 relay wire-Bending Resistant-*	Signal+power+180° -5m	5	M
16105-010006-*	TC100 relay wire-Bending Resistant-*	Signal+power+180° -10m	10	M

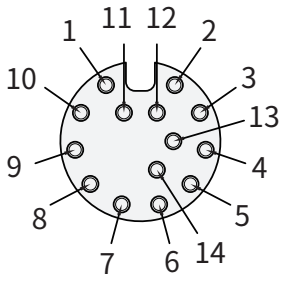
* CGTH/CGTY/CGCH/CGCY/CSG/CHS2B/CHS2C series
* Due to the update and changes in the part number, pease contact the business person before placing an official order



Pudp-10v-S Pin	Standard Cable Colour	Bending Cable Colour	Signal Name	Function	Metal Connector Pin
1	Green	Orange and white	+5V	Power output +5 V	7
2	Green and white	Orange	0V	Power output 0 V	8
3	Brown	Grey and white	a+	ENCODER Phase A	9
4	Brown and white	Grey	a-	ENCODER /A phase	10
5	Orange	Pink and white	b+	ENCODER Phase B	11
6	Orange and white	Pink	b-	ENCODER /B phase	12
7	Blue	Blue and white	z+	ENCODER Phase Z	13
8	Blue and white	Blue	z-	ENCODER /Z phase	14
9					
10	Green	Green	fG	Ground	

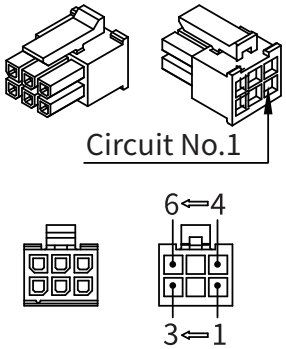


PUDP-10V-S

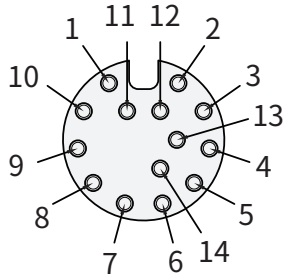


Metal connector

43025-0600 Pin	Standard Cable Colour	Bending Cable Colour	Signal Name	Function	Metal Connector Pin
1	Black	Yellow	BK(-)	Brake power output (-)	2
2	Grey	White	/B	Motor/B phase	3
3	Purple	Green	/A	Motor/A phase	5
4	Red	Brown	BK(+)	Brake power output (+)	1
5	Yellow	Red	B	motor B phase	4
6	Pink	Black	A	Motor/A phase	6



43025-0600

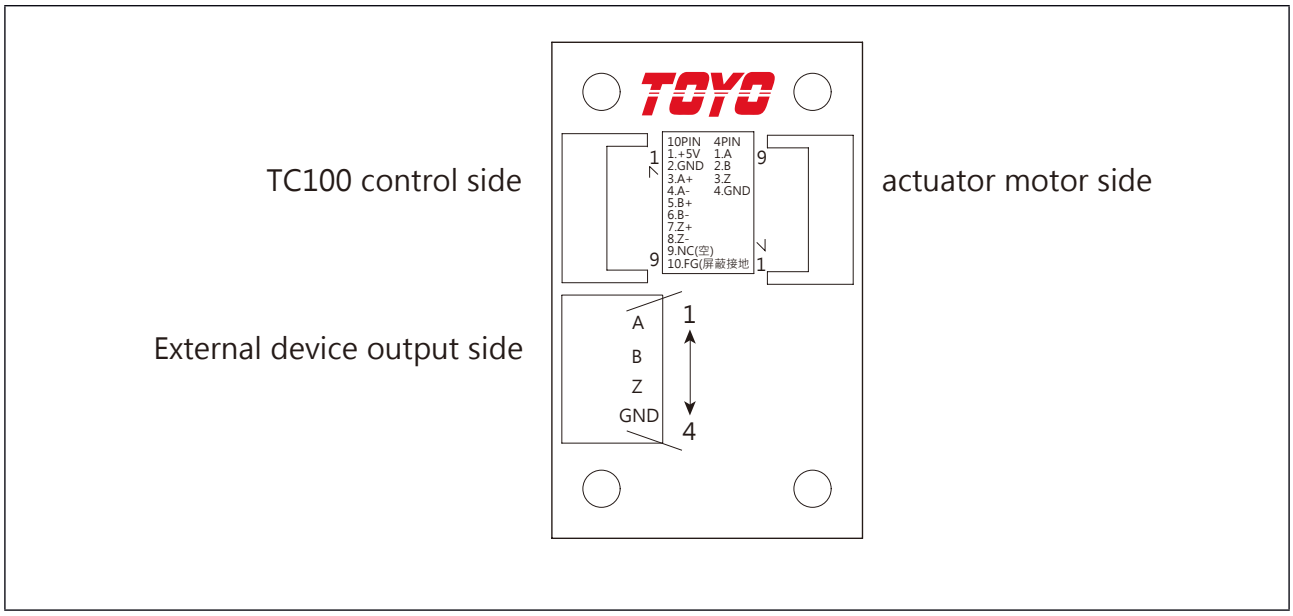


Metal connector

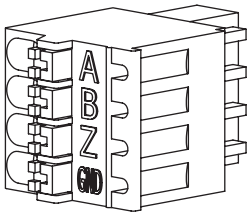
10.5 Expansion module data

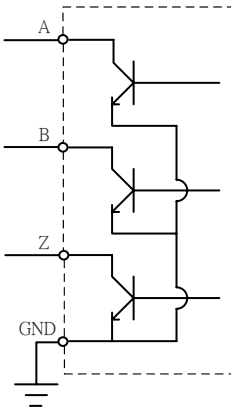
■■ PULSE board - Open Collect

Output module:



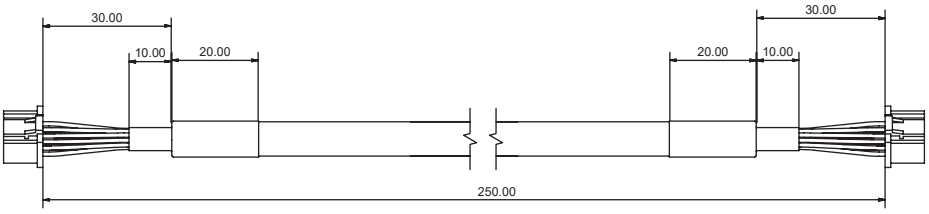
■■ Connector definitions

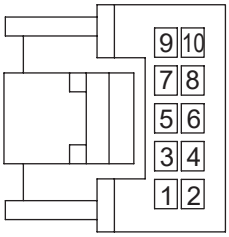
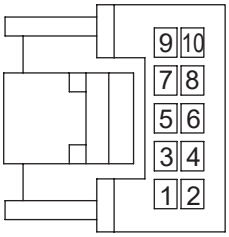




10.6 Expansion module data

■■ PULSE board to counter cable set



Left connector	No.	Signal name	Description	No.	Right connector
 JST: HOUSING: PUDP-10V-S PIN: SPUD-002T-P0.5	1	+5 V	Power output +5 V	1	 JST: HOUSING: PUDP-10V-S PIN: SPUD-002T-P0.5
	2	0V	Power output 0V	2	
	3	A+	ENCODER A-Phase	3	
	4	A-	ENCODER / A-Phase	4	
	5	B+	ENCODER B-Phase	5	
	6	B-	ENCODER /B-phase	6	
	7	Z+	ENCODER Z-phase	7	
	8	Z-	ENCODER /Z-phase	8	
	9			9	
	10	FG	Shielded grounding	10	

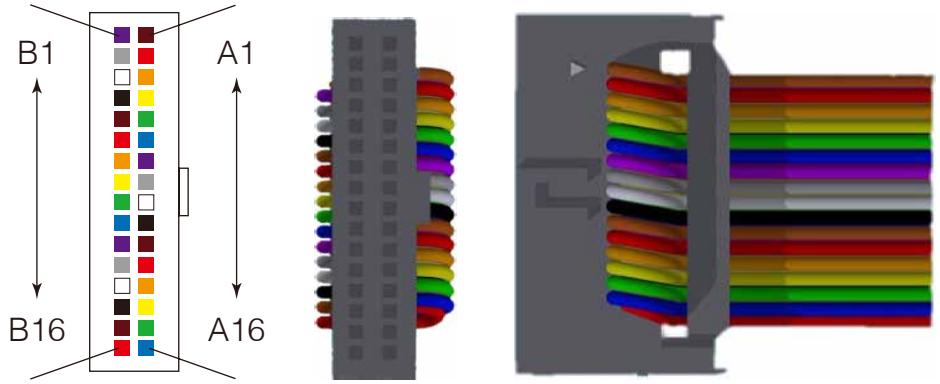
(1,2), (3, 4), (5, 6), and (7, 8) pins are wired to a twisted pair with twisted cables.

10.7 Instruction Servo and I/O Servo state sequential priority table

Command Servo state	ON (fixed)	OFF (fixed)	OFF->ON->OFF	OFF->ON->OFF
I/O Servo state	OFF->ON->OFF	OFF->ON->OFF	ON (fixed)	OFF (fixed)
Actual Servo state of the controller	ON->ON->OFF	OFF->ON->OFF	ON->ON->ON	OFF->ON->OFF

10.8 Legacy IO rainbow wiring pin definitions and functions

Please use a dedicated connection cable when connecting to computer and other communication equipment.



CN-4 IO Pin definitions

NO	Color code	Signal	Content description	NO	Color code	Signal	Content description
A1	Brown	COM+	IO power supply +24V	B1	Purple	OUT 1	ORG-S
A2	Red	COM-	IO power 0V	B2	Grey	OUT 2	INP
A3	Orange	IN 1	ORG	B3	White	OUT 3	READY
A4	Yellow	IN 2	/SERVO	B4	Black	OUT 4	SERVO-S
A5	Green	IN 3	ALM_REAET	B5	Brown	OUT 5	PRGSEL0-S
A6	Blue	IN 4	START	B6	Red	OUT 6	PRGSEL1-S
A7	Purple	IN 5	PRGSEL0	B7	Orange	OUT 7	PRGSEL2-S
A8	Grey	IN 6	PRGSEL1	B8	Yellow	OUT 8	PRGSEL3-S
A9	White	IN 7	PRGSEL2	B9	Green	OUT 9	PRGSEL4-S
A10	Black	IN 8	PRGSEL3	B10	Blue	OUT 10	PRGSEL5-S
A11	Brown	IN 9	PRGSEL4	B11	Purple	P1+	CCW, B phase, pulse
A12	Red	IN 10	PRGSEL5	B12	Grey	P1-	
A13	Orange	IN 11	PRGSEL6	B13	White	P2+	CW, A phase, dir
A14	Yellow	IN 12	ORG-S	B14	Black	P2-	
A15	Green	IN 13	-	B15	Brown	Reserve	-
A16	Blue	IN 14	-	B16	Red	FG	Isolation net / Grounding

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