Doc. no. LEC-OM02804

Operation Manual

PRODUCT NAME

AC Servo Motor Driver (CC-Link Type）

MODEL/ Series

LECSC Series

SMC Corporation

LECSC□-□ Series / Driver
1. Safety Instructions

These safety instructions are intended to prevent hazardous situations and/or equipment damage.
These instructions indicate the level of potential hazard with the labels of “Caution,” “Warning” or “Danger.”
They are all important notes for safety and must be followed in addition to International Standards (ISO/IEC), Japan Industrial Standards (JIS)*1) and other safety regulations*2).

*1) ISO 4414: Pneumatic fluid power -- General rules relating to systems
ISO 4413: Hydraulic fluid power -- General rules relating to systems
IEC 60204-1: Safety of machinery -- Electrical equipment of machines (Part 1: General requirements)
ISO 10218-1992: Manipulating industrial robots -- Safety
JIS B 8370: General rules for pneumatic equipment.
JIS B 8361: General rules for hydraulic equipment.
JIS B 9960-1: Safety of machinery – Electrical equipment for machines. (Part 1: General requirements)
JIS B 8433-1993: Manipulating industrial robots - Safety. etc.

*2) Labor Safety and Sanitation Law, etc.

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

⚠Warning

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

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

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

4. Contact SMC beforehand and take special consideration of safety measures if the product is to be used in any of the following conditions.
1) Conditions and environments outside of the given specifications, or use outdoors or in a place exposed to direct sunlight.
2) Installation on equipment in conjunction with atomic energy, railways, air navigation, space, shipping, vehicles, military, medical treatment, combustion and recreation, or equipment in contact with food and beverages, emergency stop circuits, clutch and brake circuits in press applications, safety equipment or other

applications unsuitable for the standard specifications described in the product catalog.
3) An application which could have negative effects on people, property, or animals requiring special safety analysis.
4) Use in an interlock circuit, which requires the provision of double interlock for possible failure by using a mechanical protective function, and periodical checks to confirm proper operation.

Note that the CAUTION level may lead to a serious consequence according to conditions. Please follow the instructions of both levels because they are important to personnel safety.

What must not be done and what must be done are indicated by the following diagrammatic symbols.

Prohibition	Indicates what must not be done. For example, "No Fire" is indicated by
Compulsion	Indicates what must be done. For example, grounding is indicated by

In this Instruction Manual, instructions at a lower level than the above, instructions for other functions, and so on are classified into "POINT".

After reading this installation guide, always keep it accessible to the operator.

LECSC☐-☐ Series / Driver
1. Safety Instructions

⚠Caution

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

Limited warranty and Disclaimer/Compliance Requirements

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

Limited warranty and Disclaimer

The warranty period of the product is 1 year in service or 1.5 years after the product is delivered.*3)
Also, the product may have specified durability, running distance or replacement parts. Please consult your nearest sales branch.

For any failure or damage reported within the warranty period which is clearly our responsibility, a replacement product or necessary parts will be provided.
This limited warranty applies only to our product independently, and not to any other damage incurred due to the failure of the product.

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

***3) Vacuum pads are excluded from this 1 year warranty.**
A vacuum pad is a consumable part, so it is warranted for a year after it is delivered.
Also, even within the warranty period, the wear of a product due to the use of the vacuum pad or failure due to the deterioration of rubber material are not covered by the limited warranty.

Compliance Requirements

When the product is exported, strictly follow the laws required by the Ministry of Economy, Trade and Industry (Foreign Exchange and Foreign Trade Control Law).

1. To prevent electric shock, note the following

⚠ WARNING

- Before wiring or inspection, turn off the power and wait for 15 minutes or more until the charge lamp turns off. Then, confirm that the voltage between P(＋) and N(－) is safe with a voltage tester and others. Otherwise, an electric shock may occur. In addition, always confirm from the front of the driver, whether the charge lamp is off or not.
- Connect the driver and servo motor to ground.
- Any person who is involved in wiring and inspection should be fully competent to do the work.
- Do not attempt to wire the driver and servo motor until they have been installed. Otherwise, you may get an electric shock.
- Operate the switches with dry hand to prevent an electric shock.
- The cables should not be damaged, stressed, loaded, or pinched. Otherwise, you may get an electric shock.
- During power-on or operation, do not open the front cover of the driver. You may get an electric shock.
- Do not operate the driver with the front cover removed. High-voltage terminals and charging area are exposed and you may get an electric shock.
- Except for wiring or periodic inspection, do not remove the front cover even of the driver if the power is off. The driver is charged and you may get an electric shock.

2. To prevent fire, note the following

⚠ CAUTION

- Install the driver, servo motor and regenerative resistor on incombustible material. Installing them directly or close to combustibles will lead to a fire.
- Always connect a magnetic contactor (MC) between the main circuit power supply and L_1, L_2, and L_3 of the driver, and configure the wiring to be able to shut down the power supply on the side of the driver's power supply. If a magnetic contactor (MC) is not connected, continuous flow of a large current may cause a fire when the driver malfunctions.
- When a regenerative resistor is used, use an alarm signal to switch main power off. Otherwise, a regenerative transistor fault or the like may overheat the regenerative resistor, causing a fire.

3. To prevent injury, note the follow

⚠ CAUTION

- Only the voltage specified in the Instruction Manual should be applied to each terminal, Otherwise, a burst, damage, etc. may occur.
- Connect the terminals correctly to prevent a burst, damage, etc.
- Ensure that polarity (＋, －) is correct. Otherwise, a burst, damage, etc. may occur.
- Take safety measures, e.g. provide covers, to prevent accidental contact of hands and parts (cables, etc.) with the driver heat sink, regenerative resistor, servo motor, etc. since they may be hot while power is on or for some time after power-off. Their temperatures may be high and you may get burnt or a parts may damaged.
- During operation, never touch the rotating parts of the servo motor. Doing so can cause injury.

4. Additional instructions

The following instructions should also be fully noted. Incorrect handling may cause a fault, injury, electric shock, etc.

(1) Transportation and installation

⚠ CAUTION

- Transport the products correctly according to their weights.
- Stacking in excess of the specified number of products is not allowed.
- Do not carry the servo motor by the cables, shaft or encoder.
- Do not hold the front cover to transport the driver. The driver may drop.
- Install the driver in a load-bearing place in accordance with the Instruction Manual.
- Do not climb or stand on servo equipment. Do not put heavy objects on equipment.
- The driver and servo motor must be installed in the specified direction.
- Leave specified clearances between the driver and control enclosure walls or other equipment.
- Do not install or operate the driver and servo motor which has been damaged or has any parts missing.
- Provide adequate protection to prevent screws and other conductive matter, oil and other combustible matter from entering the driver and servo motor.
- Do not drop or strike driver or servo motor. Isolate from all impact loads.
- When you keep or use it, please fulfill the following environmental conditions.

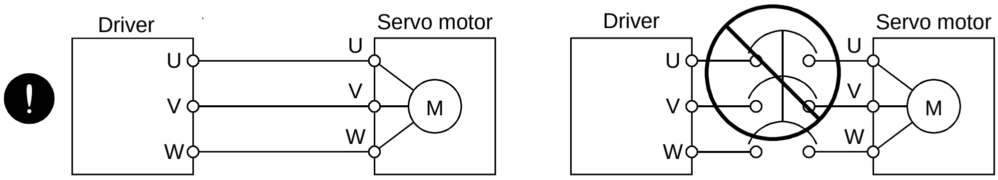
<table>
<tr><th colspan="3" rowspan="2">Environment</th><th colspan="3">Conditions</th></tr>
<tr><th>Driver</th><th colspan="2">Servo motor</th></tr>
<tr><td rowspan="4">Ambient temperature</td><td rowspan="2">In operation</td><td>[°C]</td><td>0 to +55 (non-freezing)</td><td colspan="2">0 to +40 (non-freezing)</td></tr>
<tr><td>[°F]</td><td>32 to 131 (non-freezing)</td><td colspan="2">32 to 104 (non-freezing)</td></tr>
<tr><td rowspan="2">In storage</td><td>[°C]</td><td>−20 to +65 (non-freezing)</td><td colspan="2">−15 to +70 (non-freezing)</td></tr>
<tr><td>[°F]</td><td>−4 to 149 (non-freezing)</td><td colspan="2">5 to 158 (non-freezing)</td></tr>
<tr><td rowspan="2">Ambient humidity</td><td colspan="2">In operation</td><td>90%RH or less (non-condensing)</td><td colspan="2">80%RH or less (non-condensing)</td></tr>
<tr><td colspan="2">In storage</td><td colspan="3">90%RH or less (non-condensing)</td></tr>
<tr><td colspan="3">Ambience</td><td colspan="3">Indoors (no direct sunlight) Free from corrosive gas, flammable gas, oil mist, dust and dirt</td></tr>
<tr><td colspan="3">Altitude</td><td colspan="3">Max. 1000m (3280 ft) above sea level</td></tr>
<tr><td>(Note) Vibration</td><td colspan="2">[m/s^2]</td><td>5.9 or less</td><td>LECS□□-S5
LECS□□-S7
LECS□□-S8
series</td><td>X・Y: 49</td></tr>
</table>

- Securely attach the servo motor to the machine. If attach insecurely, the servo motor may come off during operation.
- The servo motor with a reduction gear must be installed in the specified direction to prevent oil leakage.
- Take safety measures, e.g. provide covers, to prevent accidental access to the rotating parts of the servo motor during operation.
- Never hit the servo motor or shaft, especially when coupling the servo motor to the machine. The encoder may become faulty.
- Do not subject the servo motor shaft to more than the permissible load. Otherwise, the shaft may break.
- When the equipment has been stored for an extended period of time, contact your local sales office.

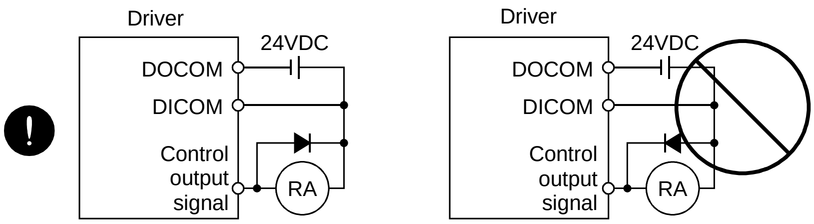
(2) Wiring

⚠ CAUTION

- Wire the equipment correctly and securely. Otherwise, the servo motor may operate unexpectedly.
- Do not install a power capacitor, surge absorber or radio noise filter (FR-BIF-(H) : Mitsubishi Electric Corporation) between the servo motor and driver.
- Connect the wires to the correct phase terminals (U, V, W) of the driver and servo motor.
  Not doing so may cause unexpected operation.
- Connect the servo motor power terminal (U, V, W) to the servo motor power input terminal (U, V, W) directly. Do not let a magnetic contactor, etc. intervene.



- Do not connect AC power directly to the servo motor. Otherwise, a fault may occur.
- The surge absorbing diode installed on the DC output signal relay of the driver must be wired in the specified direction. Otherwise, the forced stop (EMG) and other protective circuits may not operate.



- When the cable is not tightened enough to the terminal block (connector), the cable or terminal block (connector) may generate heat because of the poor contact. Be sure to tighten the cable with specified torque.

(3) Test run adjustment

⚠ CAUTION

- Before operation, check the parameter settings. Improper settings may cause some machines to perform unexpected operation.
- The parameter settings must not be changed excessively. Operation will be insatiable.

(4) Usage

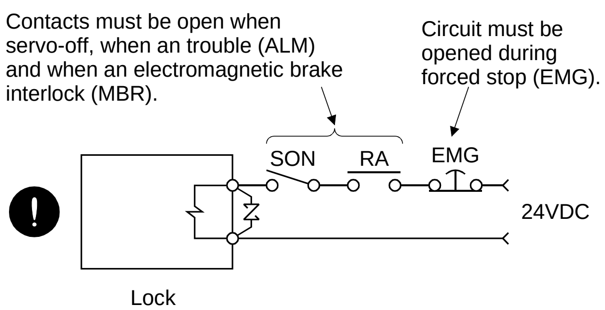
⚠ CAUTION

- Provide an external emergency stop circuit to ensure that operation can be stopped and power switched off immediately.
- Any person who is involved in disassembly and repair should be fully competent to do the work.
- Before resetting an alarm, make sure that the run signal of the driver is off to prevent an accident. A sudden restart is made if an alarm is reset with the run signal on.
- Do not modify the equipment.
- Use a noise filter, etc. to minimize the influence of electromagnetic interference, which may be caused by electronic equipment used near the driver.
- Burning or breaking a driver may cause a toxic gas. Do not burn or break a driver.
- Use the driver with the specified servo motor.
- The lock on the servo motor is designed to hold the motor shaft and should not be used for ordinary braking.
- For such reasons as service life and mechanical structure (e.g. where a ball screw and the servo motor are coupled via a timing belt), the lock may not hold the motor shaft. To ensure safety, install a stopper on the machine side.

(5) Corrective actions

⚠ CAUTION

- When it is assumed that a hazardous condition may take place at the occur due to a power failure or a product fault, use a servo motor with a lock or an external brake mechanism for the purpose of prevention.
- Configure the lock circuit so that it is activated not only by the driver signals but also by an external forced stop (EMG).



- When any alarm has occurred, eliminate its cause, ensure safety, and deactivate the alarm before restarting operation.
- When power is restored after an instantaneous power failure, keep away from the machine because the machine may be restarted suddenly (design the machine so that it is secured against hazard if restarted).

(6) Maintenance, inspection and parts replacement

⚠ CAUTION

- With age, the electrolytic capacitor of the driver will deteriorate. To prevent a secondary accident due to a fault, it is recommended to replace the electrolytic capacitor every 10 years when used in general environment. Please consult our sales representative.

(7) General instruction

・To illustrate details, the equipment in the diagrams of this Specifications and Instruction Manual may have been drawn without covers and safety guards. When the equipment is operated, the covers and safety guards must be installed as specified. Operation must be performed in accordance with this Specifications and Instruction Manual.

● About processing of waste ●

When you discard driver, a battery (primary battery), and other option articles, please follow the law of each country (area).

⚠ FOR MAXIMUM SAFETY

・These products have been manufactured as a general-purpose part for general industries, and have not been designed or manufactured to be incorporated in a device or system used in purposes related to human life.

・Before using the products for special purposes such as nuclear power, electric power, aerospace, medicine, passenger movement vehicles or under water relays, contact your local sales office..

・These products have been manufactured under strict quality control. However, when installing the product where major accidents or losses could occur if the product fails, install appropriate backup or failsafe functions in the system.

⚠ EEP-ROM life

The number of write times to the EEP-ROM, which stores parameter settings, etc., is limited to 100,000. If the total number of the following operations exceeds 100,000, the driver and/or converter unit may fail when the EEP-ROM reaches the end of its useful life.

・Write to the EEP-ROM due to parameter setting changes
・Home position setting in the absolute position detection system
・Write to the EEP-ROM due to device changes
・Write to the EEP-ROM due to point table changes

Precautions for Choosing the Products

SMC will not be held liable for damage caused by factors found not to be the cause of SMC; machine damage or lost profits caused by faults in the SMC products; damage, secondary damage, accident compensation caused by special factors unpredictable by SMC; damages to products other than SMC products; and to other duties.

COMPLIANCE WITH EC DIRECTIVES

1. WHAT ARE EC DIRECTIVES?

The EC directives were issued to standardize the regulations of the EU countries and ensure smooth distribution of safety-guaranteed products. In the EU countries, the machinery directive (effective in January, 1995), EMC directive (effective in January, 1996) and low voltage directive (effective in January, 1997) of the EC directives require that products to be sold should meet their fundamental safety requirements and carry the CE marks (CE marking). CE marking applies to machines and equipment into which drivers have been installed.

(1) EMC directive

The EMC directive applies not to the servo units alone but to servo-incorporated machines and equipment. This requires the EMC filters to be used with the servo-incorporated machines and equipment to comply with the EMC directive. For specific EMC directive conforming methods, refer to the EMC Installation Guidelines (IB(NA)67310).

(2) Low voltage directive

The low voltage directive applies also to servo units alone. Hence, they are designed to comply with the low voltage directive.

This servo is certified by TUV, third-party assessment organization, to comply with the low voltage directive.

(3) Machine directive

Not being machines, the drivers need not comply with this directive.

2. PRECAUTIONS FOR COMPLIANCE

(1) Drivers and servo motors used

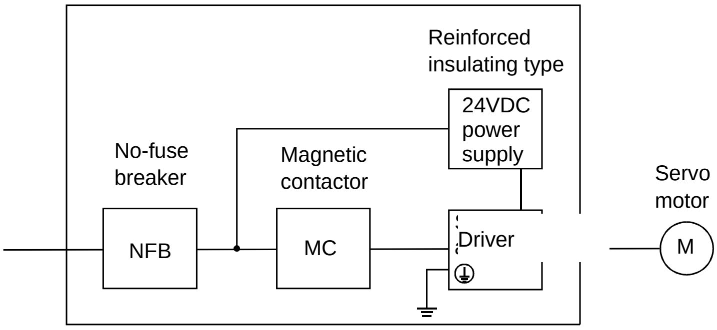
Use the drivers and servo motors which comply with the standard model.

Driver	: LECSC□-□
Servo motor	: LE-S5-□、LE-S6-□、LE-S7-□、LE-S8-□(Note)

Note. For the latest information of compliance, contact your local sales office..

(2) Configuration

The control circuit provide safe separation to the main circuit in the driver.



(3) Environment

Operate the driver at or above the contamination level 2 set forth in IEC60664-1. For this purpose, install the driver in a control box which is protected against water, oil, carbon, dust, dirt, etc. (IP54).

(4) Power supply

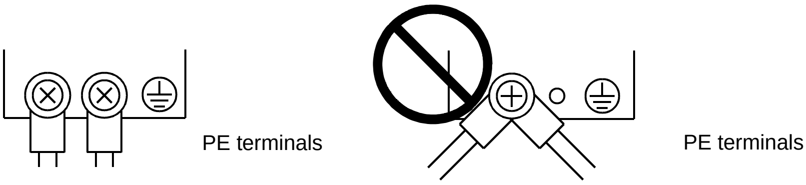
(a) This driver can be supplied from star-connected supply with earthed neutral point of overvoltage category III set forth in IEC60664-1. However, when using the neutral point of 400V class for single-phase supply, a reinforced insulating transformer is required in the power input section.

(b) When supplying interface power from external, use a 24VDC power supply which has been insulation-reinforced in I/O.

(5) Grounding

(a) To prevent an electric shock, always connect the protective earth (PE) terminals (marked ⏚) of the driver to the protective earth (PE) of the control box.

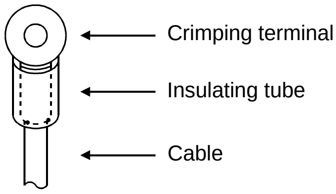
(b) Do not connect two ground cables to the same protective earth (PE) terminal (marked ⏚). Always connect the cables to the terminals one-to-one.



(c) If a leakage current breaker is used to prevent an electric shock, the protective earth (PE) terminals (marked ⏚) of the driver must be connected to the corresponding earth terminals.

(6) Wiring

(a) The cables to be connected to the terminal block of the driver must have crimping terminals provided with insulating tubes to prevent contact with adjacent terminals.



(b) Use the servo motor side power connector which complies with the EN Standard. The EN Standard compliant power connector sets are available from us as options. (Refer to section 14.1)

(7) Auxiliary equipment and options

(a) The no-fuse breaker and magnetic contactor used should be the EN or IEC standard-compliant products of the models described in section 14.10.
Use a type B (Note) breaker. When it is not used, provide insulation between the driver and other device by double insulation or reinforced insulation, or install a transformer between the main power supply and driver.
Note. Type A: AC and pulse detectable
Type B: Both AC and DC detectable

(b) The sizes of the cables described in section 14.9 meet the following requirements. To meet the other requirements, follow Table 5 and Appendix C in EN60204-1.

- Ambient temperature: 40 (104) [°C (°F)]
- Sheath: PVC (polyvinyl chloride)
- Installed on wall surface or open table tray

(c) Use the EMC filter for noise reduction.

(8) Performing EMC tests

When EMC tests are run on a machine/device into which the driver has been installed, it must conform to the electromagnetic compatibility (immunity/emission) standards after it has satisfied the operating environment/electrical equipment specifications.
For the other EMC directive guidelines on the driver, refer to the EMC Installation Guidelines (IB(NA)67310).

CONFORMANCE WITH UL/C-UL STANDARD

(1) Drivers and servo motors used

Use the drivers and servo motors which comply with the standard model.

Driver :LECSC□-□
Servo motor : LE-□-□(Note)

Note. For the latest information of compliance, contact your local sales office..

(2) Installation

Install a fan of 100CFM (2.8m^3/min) air flow 4[in] (10.16[cm]) above the driver or provide cooling of at least equivalent capability to ensure that the ambient temperature conforms to the environment conditions (55℃ or less).

(3) Short circuit rating (SCCR: Short Circuit Current Rating)

Suitable For Use In A Circuit Capable Of Delivering Not More Than 100 kA rms Symmetrical Amperes, 500 Volts Maximum.

(4) Capacitor discharge time

The capacitor discharge time is as listed below. To ensure safety, do not touch the charging section for 15 minutes after power-off.

Driver	Discharge time [min]
LECSB2-S5・ LECSB2-S7	1
LECSB2-S8・LECSB1-S5・LECSB1-S7	2

(5) Options and auxiliary equipment

Use UL/C-UL standard-compliant products.

(6) About wiring protection

For installation in United States, branch circuit protection must be provided, in accordance with the National Electrical Code and any applicable local codes.

For installation in Canada, branch circuit protection must be provided, in accordance with the Canada Electrical Code and any applicable provincial codes.

<<About the manuals>>

This Instruction Manual are required if you use the General-Purpose AC servo LECSC□-□ for the first time. Always purchase them and use the LECSC□-□ safely.

<<About the wires used for wiring>>

Wiring wires mentioned in this instruction manual are selected based on the ambient temperature of 40°C (104℉).

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1. FUNCTIONS AND CONFIGURATION

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1. FUNCTIONS AND CONFIGURATION

1.1 Introduction

The LECSC☐-☐ CC-Link compatible driver can support the CC-Link communication functions. Up to 42 axes of drivers can be controlled/monitored from the programmable PC or PLC...etc side.
As the servo, it has the function to perform positioning operation by merely setting the position data (target positions), servo motor speeds, acceleration and deceleration time constants, etc. to point tables as if setting them in parameters. The driver is the most appropriate to configure a program-free, simple positioning system or to simplify a system, for example.
There are 31 points of point tables to be used when 1 station is occupied and 255 points when 2 stations are occupied.
All servo motors are equipped with an absolute position encoder as standard. An absolute position detection system can be configured by merely adding a battery to the driver. Once the home position has been set, home position return is not required at power on, alarm occurrence, etc.
The LECSC☐-☐ is made easier to use and higher in function by using it with the set up software(MR Configurator).

When setup software (MR Configurator) is used, the selection of the model of LECSC□-□ is needed.
Please select 'MR-J3-T' by "Model selection" - "System settings" - "Setup" - "Project name".

1.1.1 Features of CC-Link communication functions

(1) Fast communication

Fast communication can be made by cyclic transmission of not only bit data but also word data.

(a) The highest communication speed is 10Mbps.

(b) The broadcast polling system ensures as high as 3.9ms to 6.7ms even at the maximum link scan (10Mbps).

(2) Variable communication speed/distance system

Selection of speed/distance allows use in a wide range of areas from a system requiring high speed to a system requiring long distance.

(3) System fault prevention (station separating function)

Because of connection in the bus system, any remote or local station that has become faulty due to power-off or the like does not affect communications with normal remote and local stations.
In addition, use of the two-piece terminal block allows the unit to be changed during data link.

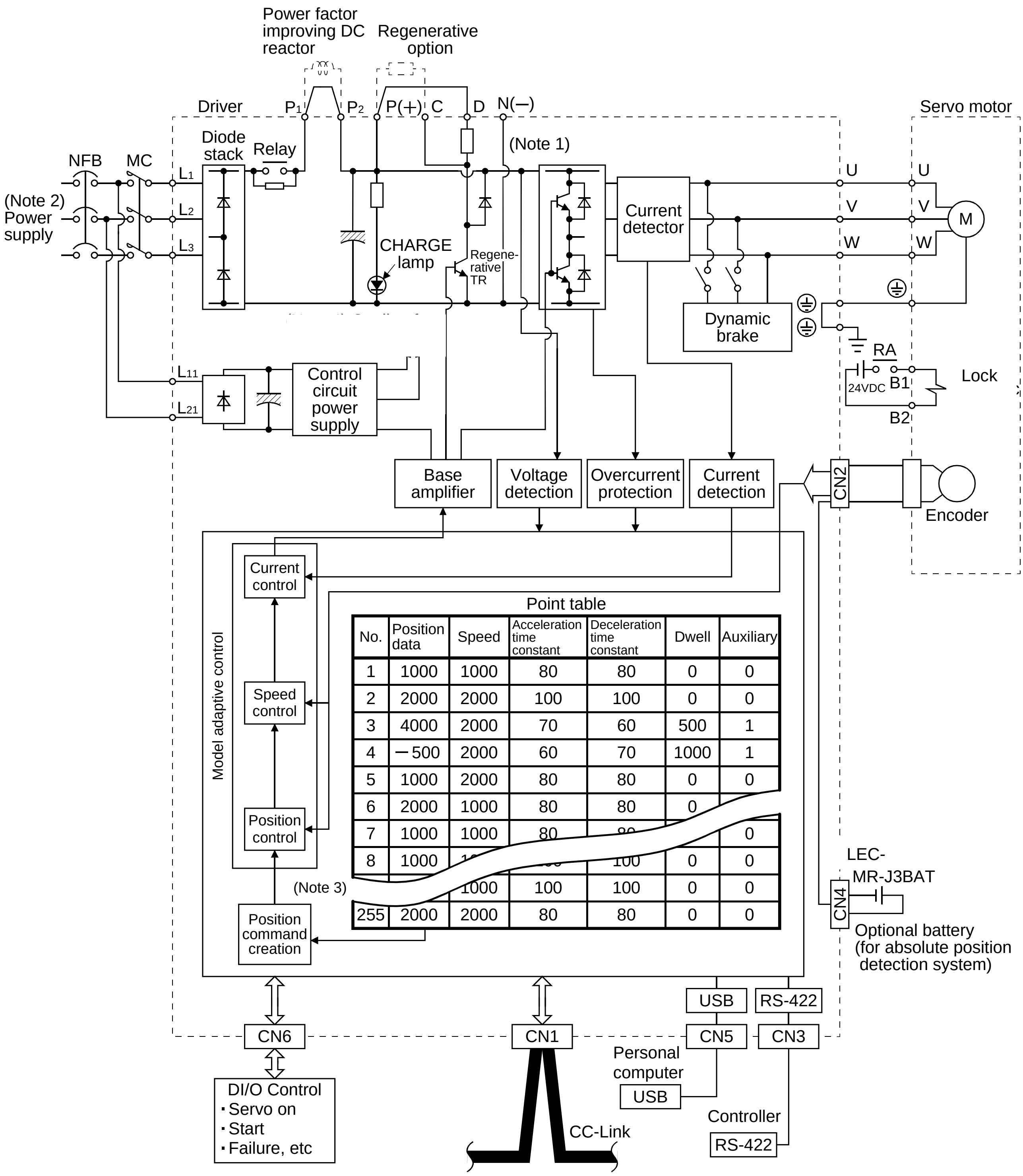
(4) Factory Automation compatible

As the remote device stations of CC-Link, the drivers share a link system and can be controlled/monitored with programmable PC or PLC...etc user programs.
From the programmable PC or PLC...etc side, the running speed, acceleration/deceleration time constant and other settings of servo motors can be changed/checked and the servo motors started and stopped.

1.1.2 Function block diagram

The function block diagram of this servo is shown below.

(1) LECSC□-□



Note 1. The built-in regenerative resistor is not provided for the LECSC□-S5.

2. For 1-phase 200 to 230VAC, connect the power supply to L_1, L_2 and leave L_3 open.
   There is no L_3 for 1-phase 100 to 120VAC power supply. Refer to section 1.2 for the power supply specification.

3. For the case when 2 stations are occupied. When 1 station is occupied, the point table ends at No.31.

1.1.3 System configuration

This section provides operations using this servo.

Use of CC-Link enables you to freely configure any system from a single-axis system to an up to 42-axis system.

Set the following values to the point table.

Name	Setting range	Unit
Position data	−999999 to 999999	×0.001[mm] × 0.01[mm] × 0.1[mm] × 1[mm]
Servo motor speed	0 to max. speed	[r/min]
Acceleration time constant	0 to 20000	[ms]
Deceleration time constant	0 to 20000	[ms]
Dwell	0 to 20000	[ms]
Auxiliary function	0 to 3 (Refer to section 4.2)	

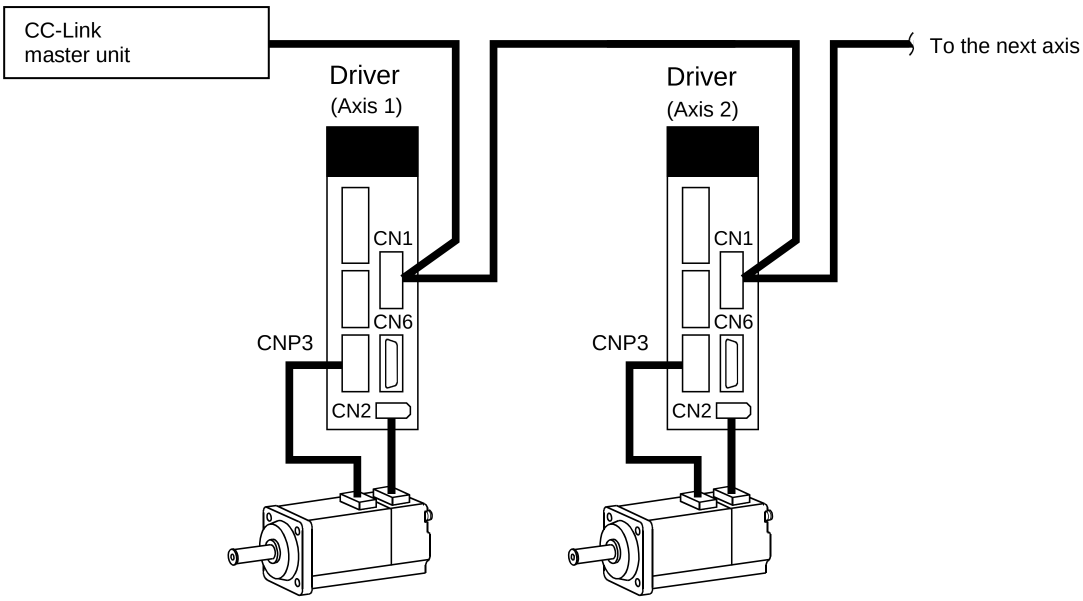
There are 31 points of point tables to be used when 1 station is occupied and 255 points when 2 stations are occupied.

(1) Operation using CC-Link communication functions

(a) Operation

All devices can be controlled by CC-Link communication. Also, each point table setting, point table selection, parameter value change, setting, monitor, servo motor operation and others can be performed.

(b) Configuration

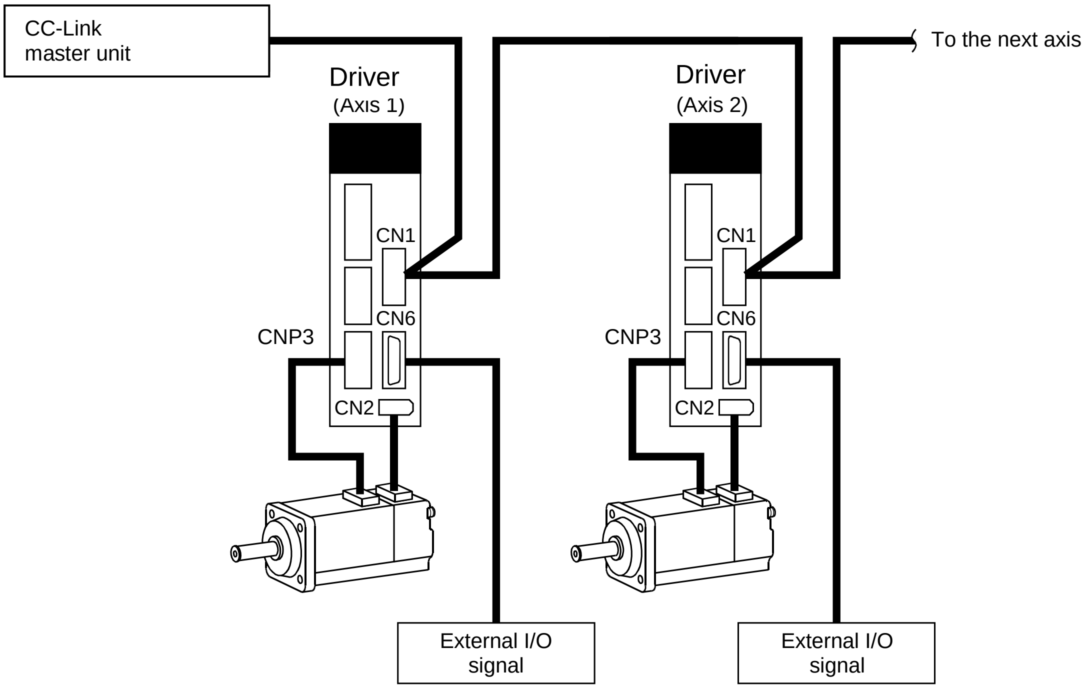


(2) Operation using CC-Link communication functions and external input signals

(a) Operation

Using parameter No.PD06 to PD08 and parameter No.PD12, PD14, input devices can be assigned to the external input devices of CN1A and CN1B. The signals assigned to the external input signals cannot be used with the CC-Link communication functions. Output devices can be used with the CN6 connectors and CC-Link communication functions simultaneously.

(b) Configuration



1.2 Driver standard specifications

(1) 200V class, 100V class

Item		Driver LECSC□-□	S5	S7	S7
Power supply		Voltage/frequency	3-phase or 1-phase 200 to 230VAC, 50/60Hz		
		Permissible voltage fluctuation	3-phase or 1-phase 200 to 230VAC: 170 to 253VAC		
		Permissible frequency fluctuation	Within ±5%		
		Power supply capacity	Refer to section 12.2		
		Inrush current	Refer to section 12.5		
Control circuit power supply		Voltage, frequency	1-phase 200 to 230VAC, 50/60Hz		
		Permissible voltage fluctuation	1-phase 170 to 253VAC		
		Permissible frequency fluctuation	Within ±5%		
		Input	30W		
		Inrush current	Refer to section 12.5		
Interface power supply		Voltage	24VDC±10%		
		Power supply capacity	(Note 1) 150mA		
Control System			Sine-wave PWM control, current control system		
Dynamic brake			Built-in		
Protective functions			Overcurrent shut-off, regenerative overvoltage shut-off, overload shut-off (electronic thermal relay), servo motor overheat protection, encoder error protection, regenerative brake error protection, undervoltage, instantaneous power failure protection, overspeed protection, excessive error protection		
Command system	Point table number input	Operational specifications	Positioning by specifying the point table No. (255 points)		
		Position command input	Set in point table. 1-point feed length setting range: ±1[μm] to ±999.999[mm]		
		Speed command input	Set in point table. Acceleration/deceleration time is set in point table. S-pattern acceleration/deceleration time constant is set in parameter No.PC13.		
		System	Signed absolute value command system, incremental value command system, signed absolute value command/incremental value command specifying system		
	Position command data input (when 2 stations are occupied)	Operational specifications	Remote register setting is used for positioning.		
		Position command input	Remote register is used to set position command data. Feed length input setting range: ±1μm to ±999.999m		
		Speed command input	Remote register is used to make selection from point table. Remote register is used to set speed command data (speed). S-pattern acceleration/deceleration time constant is set in parameter No.PC13.		
		System	Signed absolute value command system, incremental value command system, signed absolute value command/incremental value command specifying system		
Operation mode	Automatic operation mode	Point table	Point table number input, position data input system Positioning operation is performed once in accordance with the position and speed commands.		
		Automatic continuous operation	Varied speed operation (2 to 255 speeds), automatic continuous positioning operation (2 to 255 points)		
	Manual operation mode	Jog	Jog operation is performed in accordance with the parameter-set speed command by contact input or through CC-Link communication function.		
		Manual pulse generator	Manual feed is made by manual pulse generator. Command pulse multiplication: ×1, ×10 or ×100 is selected using parameter.		
	Automatic operation mode	Point table	Point table number input, position data input system Positioning operation is performed once in accordance with the position and speed commands.		

<table>
<tr><td colspan="3">Driver LECSC□-□
Item</td><td>S5</td><td>S7</td><td>S8</td></tr>
<tr><td rowspan="5">Power supply</td><td colspan="2">Voltage/frequency</td><td colspan="3">3-phase or 1-phase 200 to 230VAC, 50/60Hz</td></tr>
<tr><td colspan="2">Permissible voltage fluctuation</td><td colspan="3">3-phase or 1-phase 200 to 230VAC: 170 to 253VAC</td></tr>
<tr><td colspan="2">Permissible frequency fluctuation</td><td colspan="3">Within ±5%</td></tr>
<tr><td colspan="2">Power supply capacity</td><td colspan="3">Refer to section 12.2</td></tr>
<tr><td colspan="2">Inrush current</td><td colspan="3">Refer to section 12.5</td></tr>
<tr><td colspan="2" rowspan="5">Control circuit power supply</td><td>Voltage, frequency</td><td colspan="3">1-phase 200 to 230VAC, 50/60Hz</td></tr>
<tr><td>Permissible voltage fluctuation</td><td colspan="3">1-phase 170 to 253VAC</td></tr>
<tr><td>Permissible frequency fluctuation</td><td colspan="3">Within ±5%</td></tr>
<tr><td>Input</td><td colspan="3">30W</td></tr>
<tr><td>Inrush current</td><td colspan="3">Refer to section 12.5</td></tr>
<tr><td colspan="2" rowspan="2">Interface power supply</td><td>Voltage</td><td colspan="3">24VDC±10%</td></tr>
<tr><td>Power supply capacity</td><td colspan="3">(Note 1) 150mA</td></tr>
<tr><td colspan="3">Control System</td><td colspan="3">Sine-wave PWM control, current control system</td></tr>
<tr><td colspan="3">Dynamic brake</td><td colspan="3">Built-in</td></tr>
<tr><td colspan="3">Protective functions</td><td colspan="3">Overcurrent shut-off, regenerative overvoltage shut-off, overload shut-off (electronic thermal relay), servo motor overheat protection, encoder error protection, regenerative brake error protection, undervoltage, instantaneous power failure protection, overspeed protection, excessive error protection</td></tr>
<tr><td rowspan="8">Command system</td><td rowspan="4">Point table number input</td><td>Operational specifications</td><td colspan="3">Positioning by specifying the point table No. (255 points)</td></tr>
<tr><td>Position command input</td><td colspan="3">Set in point table. 1-point feed length setting range: ±1[μm] to ±999.999[mm]</td></tr>
<tr><td>Speed command input</td><td colspan="3">Set in point table. Acceleration/deceleration time is set in point table.
S-pattern acceleration/deceleration time constant is set in parameter No.PC13.</td></tr>
<tr><td>System</td><td colspan="3">Signed absolute value command system, incremental value command system, signed absolute value command/incremental value command specifying system</td></tr>
<tr><td rowspan="4">Position command data input
(when 2 stations are occupied)</td><td>Operational specifications</td><td colspan="3">Remote register setting is used for positioning.</td></tr>
<tr><td>Position command input</td><td colspan="3">Remote register is used to set position command data.
Feed length input setting range: ±1μm to ±999.999m</td></tr>
<tr><td>Speed command input</td><td colspan="3">Remote register is used to make selection from point table.
Remote register is used to set speed command data (speed).
S-pattern acceleration/deceleration time constant is set in parameter No.PC13.</td></tr>
<tr><td>System</td><td colspan="3">Signed absolute value command system, incremental value command system, signed absolute value command/incremental value command specifying system</td></tr>
<tr><td rowspan="4">Operation mode</td><td rowspan="2">Automatic operation mode</td><td>Point table</td><td colspan="3">Point table number input, position data input system
Positioning operation is performed once in accordance with the position and speed commands.</td></tr>
<tr><td>Automatic continuous operation</td><td colspan="3">Varied speed operation (2 to 255 speeds), automatic continuous positioning operation (2 to 255 points)</td></tr>
<tr><td rowspan="2">Manual operation mode</td><td>Jog</td><td colspan="3">Jog operation is performed in accordance with the parameter-set speed command by contact input or through CC-Link communication function.</td></tr>
<tr><td>Manual pulse generator</td><td colspan="3">Manual feed is made by manual pulse generator.
Command pulse multiplication: ×1, ×10 or ×100 is selected using parameter.</td></tr>
</table>

Item		Driver LECSC□-□	S5	S7	S8
Operation mode	Automatic operation mode	Dog type	Home position return is made starting with Z-phase pulse after passage of proximity dog. Home position address may be set. Home position shift distance may be set. Home position return direction may be selected. Automatic at-dog home position return return/automatic stroke return function.		
		Count type	Home position return is made by counting encoder pulses after contact with proximity dog. Home position address may be set. Home position shift value may be set. Home position return direction may be set. Automatic at-dog home position return return/automatic stroke return function.		
		Data setting type	Home position return is made without dog. Home position may be set at any position by manual operation, etc. Home position address may be set.		
		Stopper type	Home position return is made by pressing machine part against stroke end. Home position address may be set. Home position return direction may be set.		
		Home position ignorance (Servo-on position as home position)	Position where servo-on (RYn0) is switched on is defined as home position. Home position address may be set.		
		Dog type rear end reference	Home position return is made with respect to the rear end of a proximity dog. Home position address may be set. Home position shift value may be set. Home position return direction may be set. Automatic at-dog home position return return/automatic stroke return function.		
		Count type front end reference	Home position return is made with respect to the front end of a proximity dog. Home position address may be set. Home position shift value may be set. Home position return direction may be set. Automatic at-dog home position return return/automatic stroke return function.		
		Dog cradle type	Home position return is made with respect to the front end of a proximity dog by the first Z-phase pulse. Home position address may be set. Home position shift value may be set. Home position return direction may be set. Automatic at-dog home position return return/automatic stroke return function.		
		Dog type last Z-phase reference	Home position return is made with respect to the front end of a proximity dog by the last Z-phase pulse. Home position address may be set. Home position shift value may be set. Home position return direction may be set. Automatic at-dog home position return return/automatic stroke return function.		
		Dog type front end reference	Home position return is made to the dog front end with respect to the front end of a proximity dog. Home position address may be set. Home position shift value may be set. Home position return direction may be set. Automatic at-dog home position return return/automatic stroke return function.		

		Dogless Z-phase reference	Home position return is made with respect to the first Z-phase to the Z-phase. Home position address may be set. Home position shift value may be set. Home position return direction may be set.
	Automatic positioning to home position		High-speed automatic return to a defined home position.

<table>
<tr><td colspan="4">Item \ Driver LECSC□-□</td><td>S5</td><td>S7</td><td>S8</td></tr>
<tr><td colspan="4">Other functions</td><td colspan="3">Absolute position detection, backlash function
Overtravel prevention using external limit switch
Software stroke limit</td></tr>
<tr><td colspan="4">Structure</td><td colspan="3">Self-cooled, open (IP00)</td></tr>
<tr><td colspan="2"></td><td colspan="2">Permissible voltage fluctuation</td><td colspan="3">3-phase or 1-phase 200 to 230VAC: 170 to 253VAC</td></tr>
<tr><td colspan="2"></td><td colspan="2">Permissible frequency fluctuation</td><td colspan="3">Within ±5%</td></tr>
<tr><td colspan="2"></td><td colspan="2">Power supply capacity</td><td colspan="3">Refer to section 12.2</td></tr>
<tr><td colspan="2"></td><td colspan="2">Inrush current</td><td colspan="3">Refer to section 12.5</td></tr>
<tr><td rowspan="9">Environment</td><td rowspan="4">Ambient temperature</td><td rowspan="2">In operation</td><td>[°C]</td><td colspan="3">(Note 2) 0 to +55 (non-freezing)</td></tr>
<tr><td>[°F]</td><td colspan="3">(Note 2) 32 to +131 (non-freezing)</td></tr>
<tr><td rowspan="2">In storage</td><td>[°C]</td><td colspan="3">−20 to +65 (non-freezing)</td></tr>
<tr><td>[°F]</td><td colspan="3">−4 to +149 (non-freezing)</td></tr>
<tr><td rowspan="2">Ambient humidity</td><td colspan="2">In operation</td><td colspan="3" rowspan="2">90%RH or less (non-condensing)</td></tr>
<tr><td colspan="2">In storage</td></tr>
<tr><td colspan="3">Ambient</td><td colspan="3">Indoors (no direct sunlight)
Free from corrosive gas, flammable gas, oil mist, dust and dirt</td></tr>
<tr><td colspan="3">Altitude</td><td colspan="3">Max. 1000m above sea level</td></tr>
<tr><td colspan="3">Vibration</td><td colspan="3">5.9 [m/s²] or less</td></tr>
<tr><td rowspan="2" colspan="2">Mass</td><td colspan="2">[kg]</td><td>0.8</td><td>0.8</td><td>1.0</td></tr>
<tr><td colspan="2">[lb]</td><td>1.76</td><td>1.76</td><td>2.21</td></tr>
</table>

Note 1. 150mA is the value applicable when all I/O signals are used. The current capacity can be decreased by reducing the number of I/O points.

2. When closely mounting the Driver, operate them at the ambient temperatures of 0 to 45°C (32 to 113°F) or at 75% or smaller effective load ratio.

1.3 Function list

The following table lists the functions of this servo. For details of the functions, refer to the reference field.

Function	Description	Reference
Positioning by automatic operation	Select the required ones from among 31 preset point tables and perform operation in accordance with the set values. Use the external input signal or communication function to choose the point tables.	Section 5.4
Varied speed operation	Servo motor speed can be varied continuously until the preset moving distance is reached. (Max. set speeds: 255 speeds)	Section 5.4.2 (4)(b)
Automatic continuous positioning operation	By merely choosing one point table and starting operation, positioning can be executed continuously in accordance with several point tables.	Section 5.4.2 (4)
Home position return	Dog type, count type, data setting type, stopper type, home position ignorance, dog type rear end reference, count type front end reference, dog cradle type	Section 5.6
High-resolution encoder	High-resolution encoder of 262144 pulses/rev is used as a servo motor encoder.	
Absolute position detection system	By merely setting the home position once, home position return need not be done at each power on.	Section 5.7
Gain changing function	You can switch between gains during rotation and gains during stop or use an input device to change gains during operation.	Section 9.6
Advanced vibration suppression control	This function suppresses vibration at the arm end or residual vibration.	Section 9.4
Adaptive filter Ⅱ	Driver detects mechanical resonance and sets filter characteristics automatically to suppress mechanical vibration.	Section 9.2
Low-pass filter	Suppresses high-frequency resonance which occurs as servo system response is increased.	Section 9.5
Machine analyzer function	Analyzes the frequency characteristic of the mechanical system by simply connecting a set up software(MR Configurator) installed personal computer and driver. Set up software(MR Configurator) is necessary for this function.	
Machine simulation	Can simulate machine motions on a personal computer screen on the basis of the machine analyzer results. Set up software(MR Configurator) is necessary for this function.	
Gain search function	Personal computer changes gains automatically and searches for overshoot-free gains in a short time. Set up software(MR Configurator) is necessary for this function.	
Slight vibration suppression control	Suppresses vibration of ±1 pulse produced at a servo motor stop.	Parameters No. PB24
Electronic gear	The electronic gear is used to make adjustment so that the driver setting matches the machine moving distance. Also, changing the electronic gear value allows the machine to be moved at any multiplication ratio to the moving distance using the driver.	Parameter No. PA06, PA07
Auto tuning	Automatically adjusts the gain to optimum value if load applied to the servo motor shaft varies.	Section 8.2
S-pattern acceleration/deceleration time constant	Acceleration/deceleration can be made smoothly.	Parameters No. PC13
Regenerative option	Used when the built-in regenerative resistor of the driver does not have sufficient regenerative capability for the regenerative power generated.	Section 13.2
Brake unit	Used when the regenerative option cannot provide enough regenerative power. Can be used with the driver of 5kW or more.	Section 13.3
Regeneration converter	Used when the regenerative option cannot provide enough regenerative power. Can be used with the driver of 5kW or more.	Section 13.4
Alarm history clear	Alarm history is cleared.	Parameter No. PC18

Function	Description	Reference
I/O signal selection (Device setting)	Any input device such as servo-on (SON) can be assigned to any pin of CN6 connector.	Parameter No. PD06 to PD08 PD12・PD14
Torque limit	Servo motor-torque is limited.	Section 4.6.3 Section 6.1.11
Output signal (DO) forced output	Output signal can be forced on/off independently of the servo status. Use this function for output signal wiring check, etc.	Section 7.7.4
Test operation mode	JOG operation・positioning operation・DO forced output・single - step feed. Set up software(MR Configurator) is necessary for this function.	Section 7.7
Limit switch	The servo motor travel region can be limited using the forward rotation stroke end (LSP)/reverse rotation stroke end (LSN).	
Software limit	The travel region is limited using parameters in terms of address. The function similar to that of a limit switch is limited by parameter.	Section 6.3.6

1.4 Model code definition

(1) Model

LECS C 1 – S5

Driver Type

C	CC-Link type （Absolute encoder）

Motor type

	Type	Capacity	Encoder
S5	AC Servo motor（S5,S6）	50W,100W	Absolute
S7	AC Servo motor（S7）	200W	
S8	AC Servo motor（S8）	400W	

Power supply

1	AC100V～AC120V 50Hz，60Hz
2	AC200V～AC230V 50Hz，60Hz

(2) Option Model

a) Motor cable / Lock cable / Encoder cable

LE – C S M – S 5 A

Motor Type

S	AC Servo motor

Cable Content

M	Motor cable
B	Lock cable
E	Encoder cable

Connector Direction

A	Axis side
B	Opposite axis side

Cable Length (L) [m]

2	2m
5	5m
A	10m

Cable Type

S	Standard cable
R	Robot cable

b) I/O Connector

LE-CSNA

Driver Type

A	LECSC

*LE-CSNA is 10126-3000PE(Connector)/10326-52F0-008（Shell kit）of Sumitomo 3M Limited or equivalent goods.
Applicable wire size: AWG24~30

c) Regenerative options

LEC-MR-RB-032

Regenerative option Type

032	Permissible regenerative power 30W
12	Permissible regenerative power 100W

*MR-RB□ of Mitsubishi Electric Corporation.

d) MR Configurator(Setup software Japanese version)

LEC-MR-SETUP221□

Languag

NIL	Japanese version
E	English version

* MRZJW3-SETUP221 of Mitsubishi Electric Corporation.
Refer to the website of Mitsubishi Electric Corporation for the information of the operating environment and upgrading.
Prepare USB cable should be ordered separately.

e) USB cable(3m)

LEC-MR-J3USB

* MR-J3USBCBL3M of Mitsubishi Electric Corporation.

f) Battery

LEC-MR-J3BAT

* MR-J3BAT of Mitsubishi Electric Corporation.
Battery for replacement.
Absolute position data is maintained by installing the battery to the driver.

g） I/O Connector

LEC-CSNA-1

● Cable length(L)[m]

1	1.5

● Driver Type

A	LECSC

*LEC-CSNA-1 is 10126-3000PE(Connector)/10326-52F0-008(Shell kit) of Sumitomo 3M Limited or equivalent goods.
*Conductor size:AWG24

Wiring

LEC-CSNA-1: Pin no. 1 to 26

Connector pin no.	Pair no. of wire	Insulation color	Dot mark	Dot color
1	1	Orange	■	Red
2			■	Black
3	2	Light gray	■	Red
4			■	Black
5	3	White	■	Red
6			■	Black
7	4	Yellow	■	Red
8			■	Black
9	5	Pink	■	Red
10			■	Black
11	6	Orange	■ ■	Red
12			■ ■	Black
13	7	Light gray	■ ■	Red
14			■ ■	Black
15	8	White	■ ■	Red
16			■ ■	Black
17	9	Yellow	■ ■	Red
18			■ ■	Black

Connector pin no.	Pair no. of wire	Insulation color	Dot mark	Dot color
19	10	Pink	■ ■	Red
20			■ ■	Black
21	11	Orange	■ ■ ■	Red
22			■ ■ ■	Black
23	12	Light gray	■ ■ ■	Red
24			■ ■ ■	Black
25	13	White	■ ■ ■	Red
26			■ ■ ■	Black

1.5 Combination with servo motor

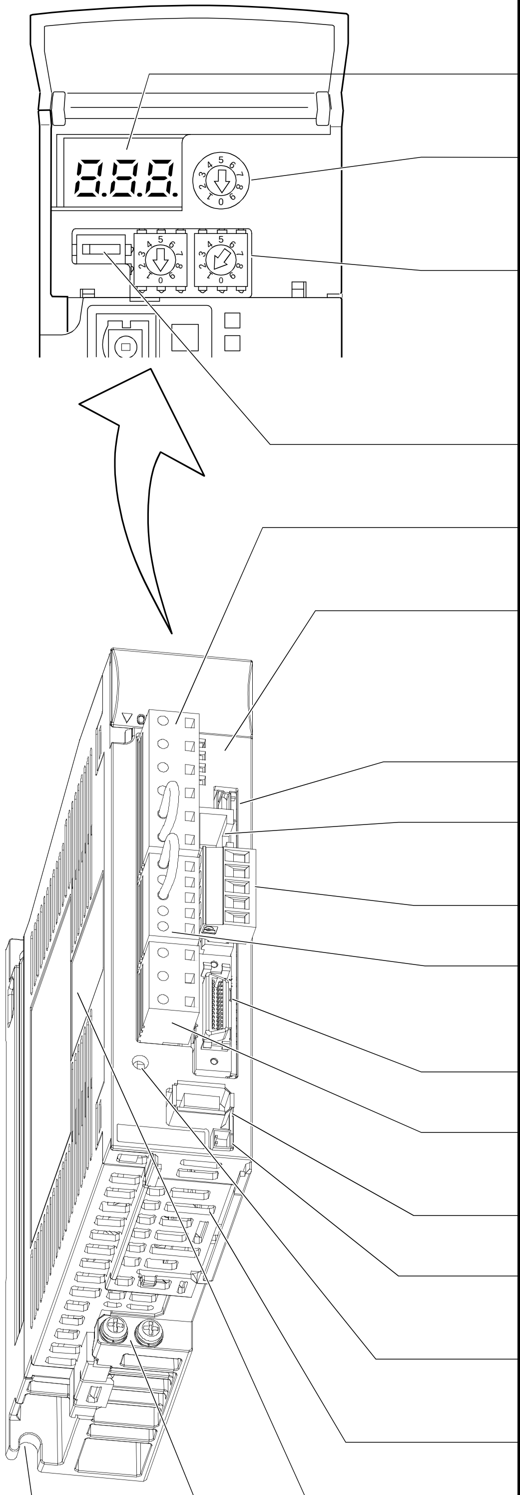
The following table lists combinations of drivers and servo motors. The same combinations apply to the servo motors with a lock and the servo motors with a reduction gear.

Driver	Servo motor
	LE-□-□
LECSC□-S5	S5,S6
LECSC□-S7	S7
LECSC□-S8	S8

1.6 Structure

1.6.1 Parts identification

(1) LECSC□-□



Fixed part
(2 places)

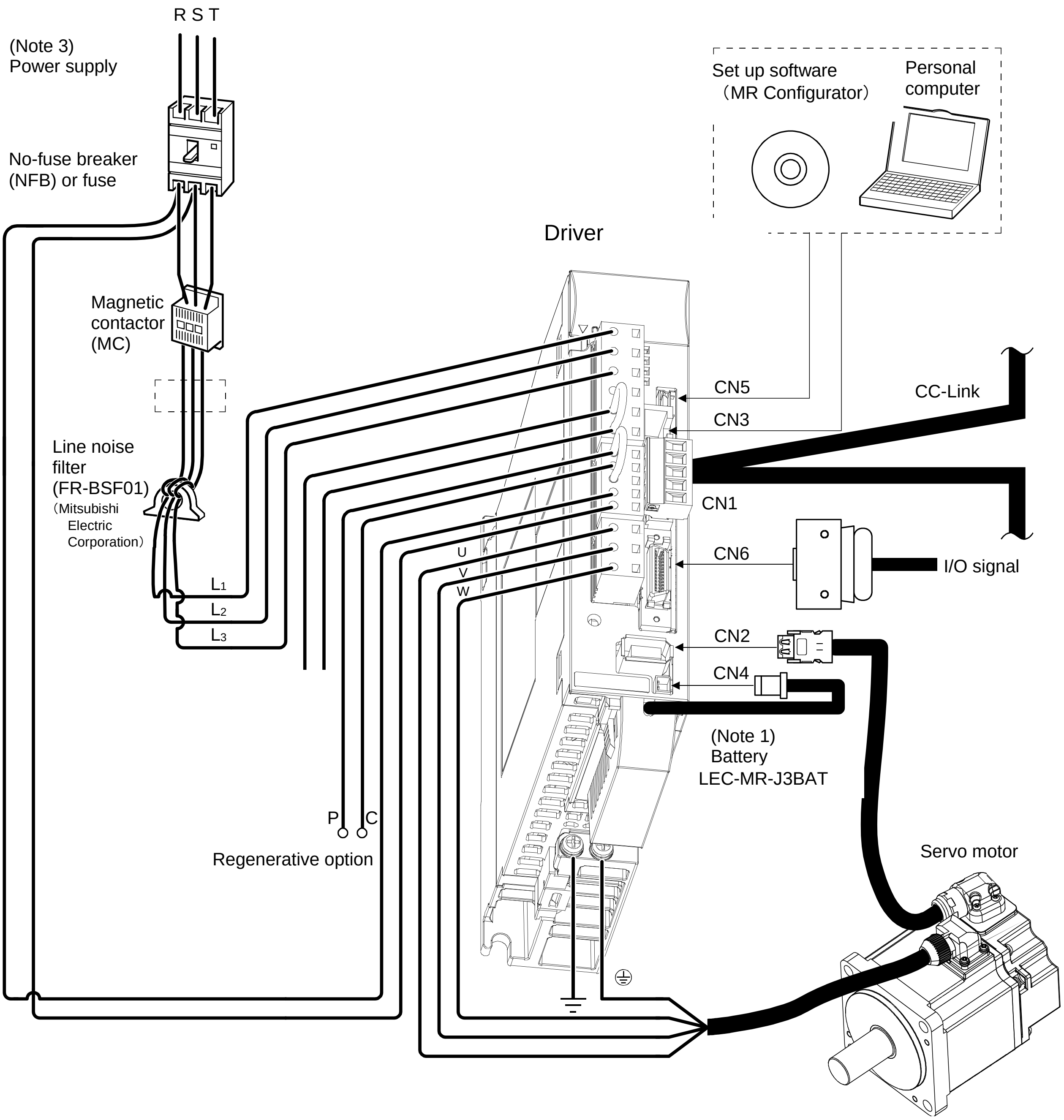
Name/Application	Detailed explanation
Display The 3-digit, seven-segment LED shows the servo status and alarm number.	Section 5.3 Chapter 11
Baud rate switch (MODE) MODE Select the CC-Link communication baud rate.	Section 3.2.4
Station number switches (STATION NO.) Set the station number of the driver. X10 STATION NO. X1 Set the one place. Set the ten place.	Section 3.2.3
Occupied station count switch (SW1) SW1 Set the number of occupied stations.	Section 3.2.5
Main circuit power supply connector (CNP1) Used to connect the input power supply.	Section 4.1 Section 4.3 Section 12.1
Communication alarm display section Indicates alarms in CC-Link communication. ■ L.RUN ■ SD ■ RD ■ L.ERR	Section 11.3
USB communication connector (CN5) Used to connect the personal computer.	Chapter 7
RS-422 communication connector (CN3) Used to connect the MR-PRU03 parameter unit (Mitsubishi Electric Corporation) or PC.	Chapter 7 Chapter 8 Chapter 15
CC-Link connector (CN1) Wire the CC-Link cable.	Section 3.2.2
Control circuit connector (CNP2) Used to connect the control circuit power supply/ regenerative option.	Section 4.1 Section 4.3 Section 12.1 Section 14.2
I/O signal connector (CN6) Used to connect digital I/O signals.	Section 4.2 Section 4.4
Servo motor power connector (CNP3) Used to connect the servo motor.	Section 4.1 Section 4.3 Section 12.1
Encoder connector (CN2) Used to connect the servo motor encoder.	Section 4.10 Section 14.1
Battery connector (CN4) Used to connect the battery for absolute position data backup.	Section 5.8 Section 14.7
Charge lamp Lit to indicate that the main circuit is charged. While this lamp is lit, do not reconnect the cables.	
Battery holder Contains the battery for absolute position data backup.	Section 5.8
Rating plate	Section 1.4
Protective earth (PE) terminal (⏚) Ground terminal.	Section 4.1 Section 4.3 Section 12.1

1.7 Configuration including auxiliary equipment

POINT
・Equipment other than the driver and servo motor are optional or recommended products.

(1) LECSC□-□

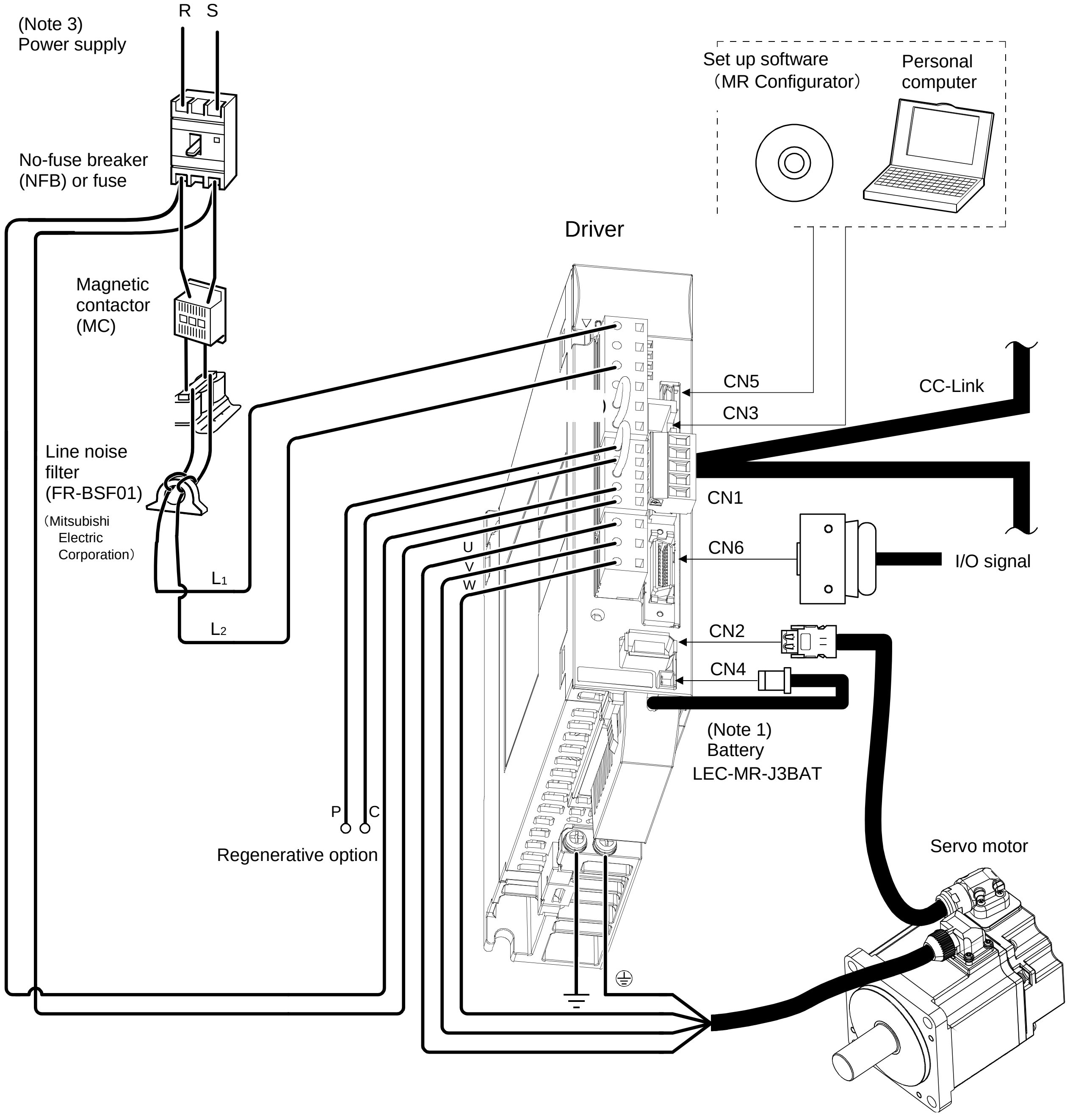
(a) For 3-phase or 1-phase 200V to 230VAC



Note 1. The battery is used for the absolute position detection system in the position control mode.

3. For 1-phase 200V to 230VAC, connect the power supply to L_1 ・ L_2 and leave L_3 open. Refer to section 1.2 for the power supply specification.

(b) For 1-phase 100V to 120VAC



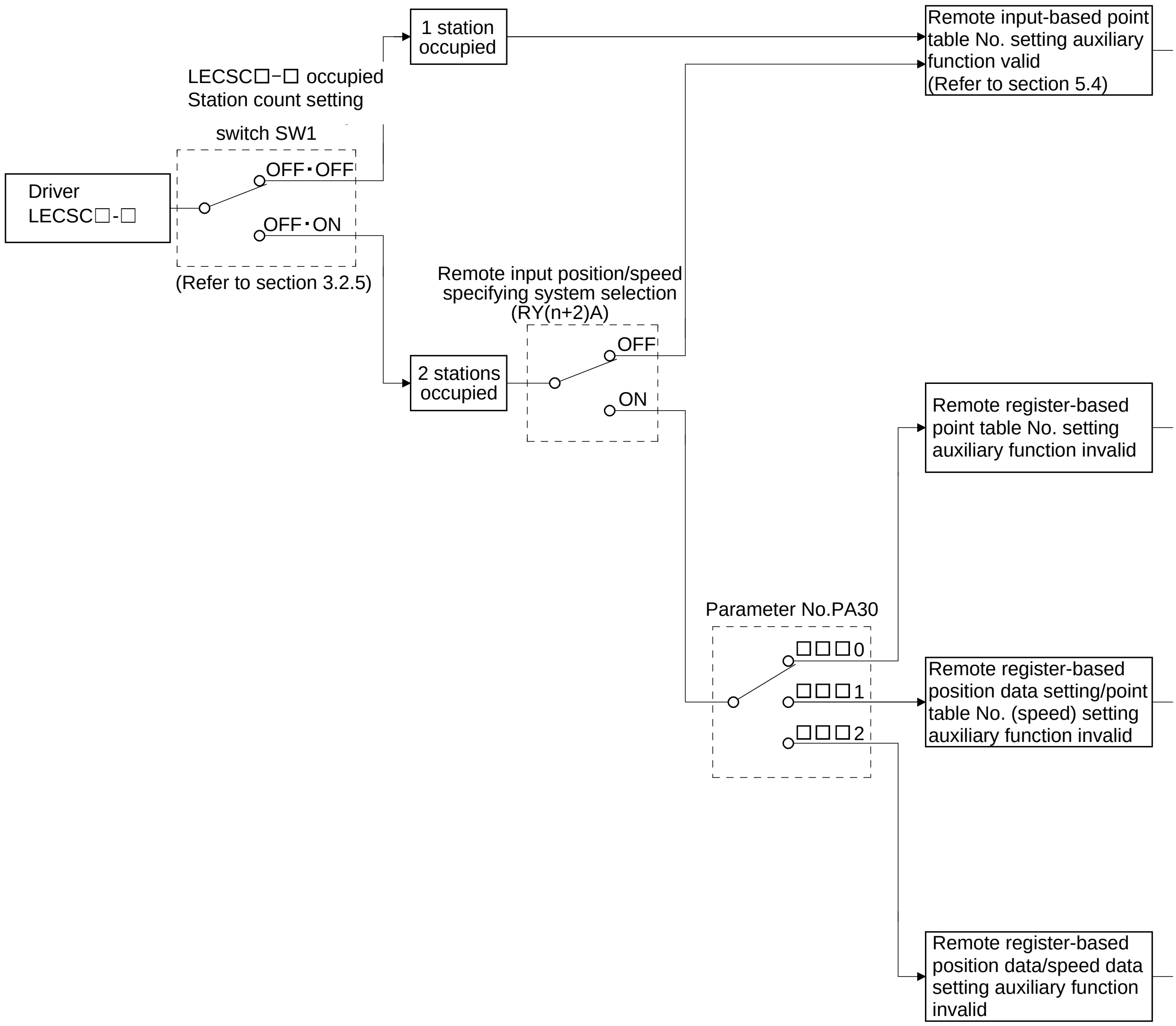
Note 1. The battery is used for the absolute position detection system in the position control mode.

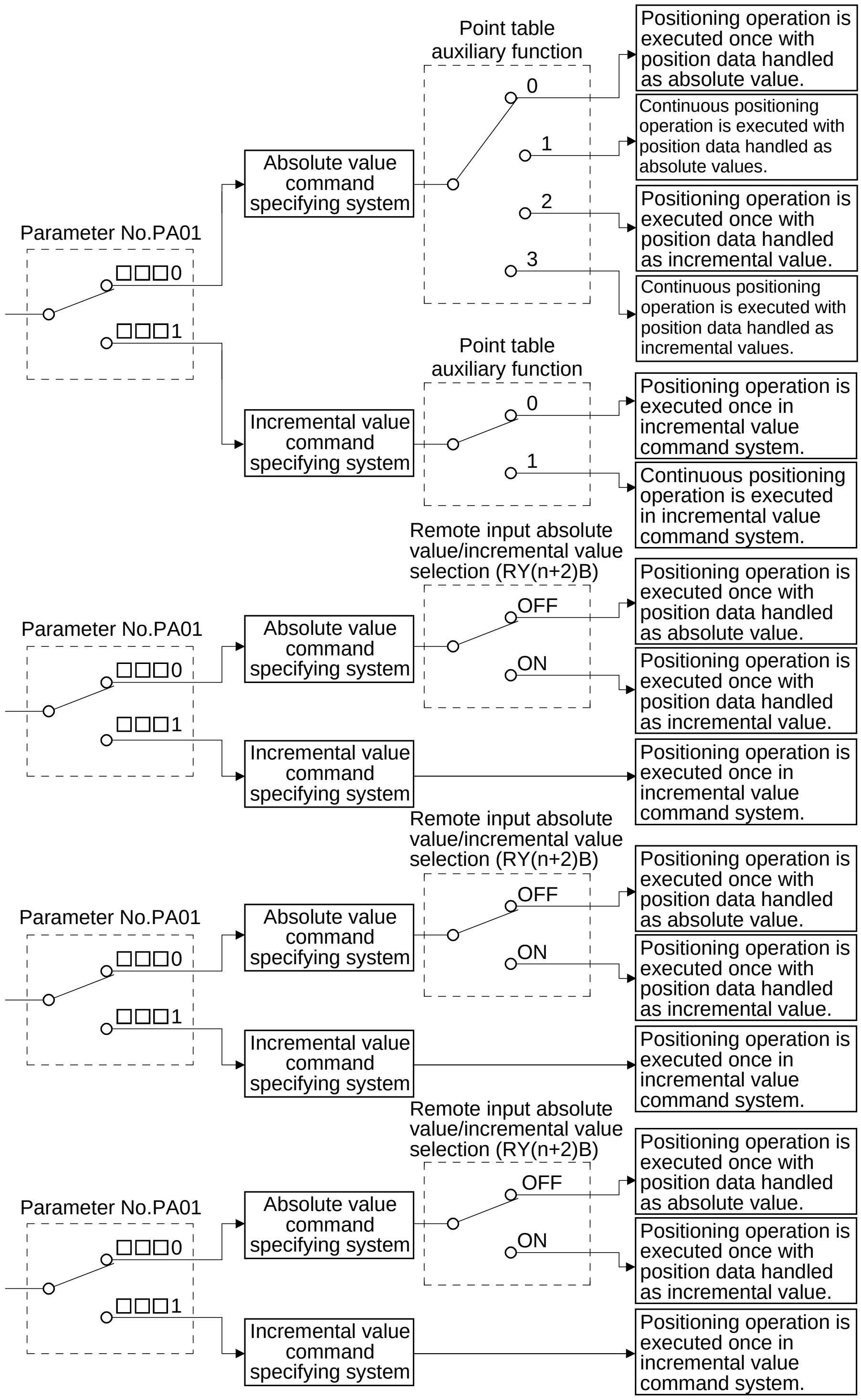
3. Refer to section 1.2 for the power supply specification.

1.8 Selection of operation method

Using the CC-Link communication functions, this servo enables a wide variety of operation methods. The operation method changes depending on the input device, parameter and point table setting.

The flow of the operation method that changes depending on the device and parameter setting status is shown in the chart for your reference.





Reference	Main description
Section 3.8.2 Section 5.4.2 (1)	Positioning is started by making the start signal valid after selection of the point table with the remote input. Using the auxiliary function, automatic continuous operation can be performed with multiple point tables.
Section 3.8.2 Section 5.4.2 (4)(b)1)	
Section 3.8.2 Section 5.4.2 (2)	
Section 3.8.2 Section 5.4.2 (4)(b)1)	
Section 3.8.2 Section 5.4.2 (1)	
Section 3.8.2 Section 5.2.2 (4)(b)2)	
Section 3.6.3 (1) Section 3.7.6 (3)	Positioning is started by making the start signal valid after selection of the point table with the remote register. The auxiliary function cannot be used.
Section 3.6.3 (2)	Set the position data directly with the remote register, and use the settings of the point table selected with the remote register as the servo motor speed and acceleration/deceleration time constants. Positioning is started by making the start signal valid. The auxiliary function cannot be used.
Section 3.6.3(3) Section 3.8.4 Section 5.4.3(1)	Set the position data and servo motor speed directly with the remote register. Use the settings of the point table No.1 as the acceleration/deceleration time constants. Positioning is started by making the start signal valid. The auxiliary function cannot be used.
Section 3.6.3 (3) Section 5.4.3 (2)	
Section 3.6.3(3) Section 3.7.6(2) Section 5.4.3(3)	

2. INSTALLATION

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2.4 Inspection items 5
2.5 Parts having service lives 5

2. INSTALLATION

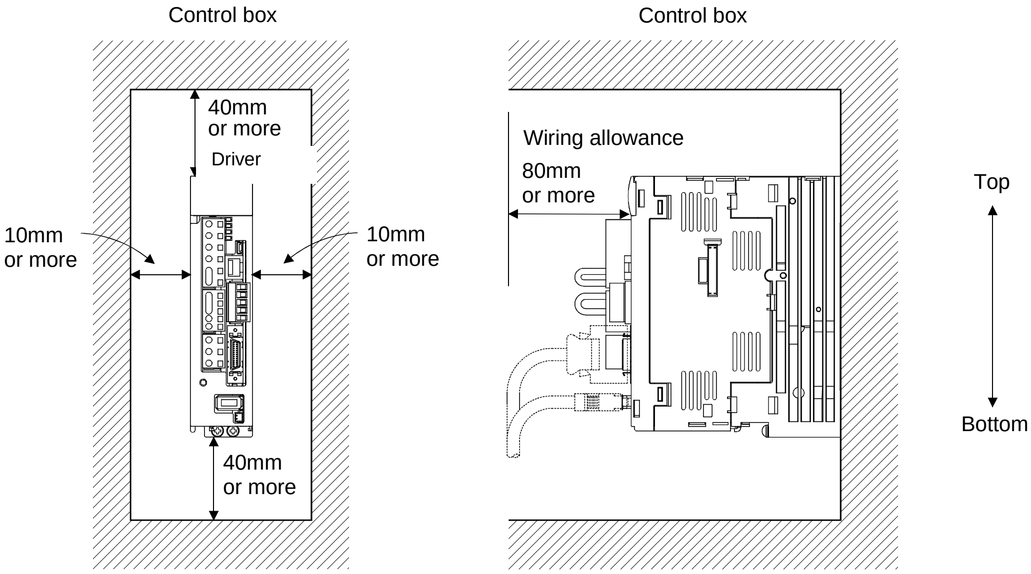
⚠CAUTION	· Stacking in excess of the limited number of products is not allowed. · Install the equipment on incombustible material. Installing them directly or close to combustibles will lead to a fire. · Install the equipment in a load-bearing place in accordance with this Instruction Manual. · Do not get on or put heavy load on the equipment to prevent injury. · Use the equipment within the specified environmental condition range. (For the environmental conditions, refer to section 1.2.) · Provide an adequate protection to prevent screws, metallic detritus and other conductive matter or oil and other combustible matter from entering the driver. · Do not block the intake/exhaust ports of the driver. Otherwise, a fault may occur. · Do not subject the driver to drop impact or shock loads as they are precision equipment. · Do not install or operate a faulty driver. · When the product has been stored for an extended period of time, contact your local sales office. · When treating the driver, be careful about the edged parts such as the corners of the driver.

2.1 Installation direction and clearances

⚠CAUTION	· The equipment must be installed in the specified direction. Otherwise, a fault may occur. · Leave specified clearances between the driver and control box inside walls or other equipment.

(1) LECSC□-□

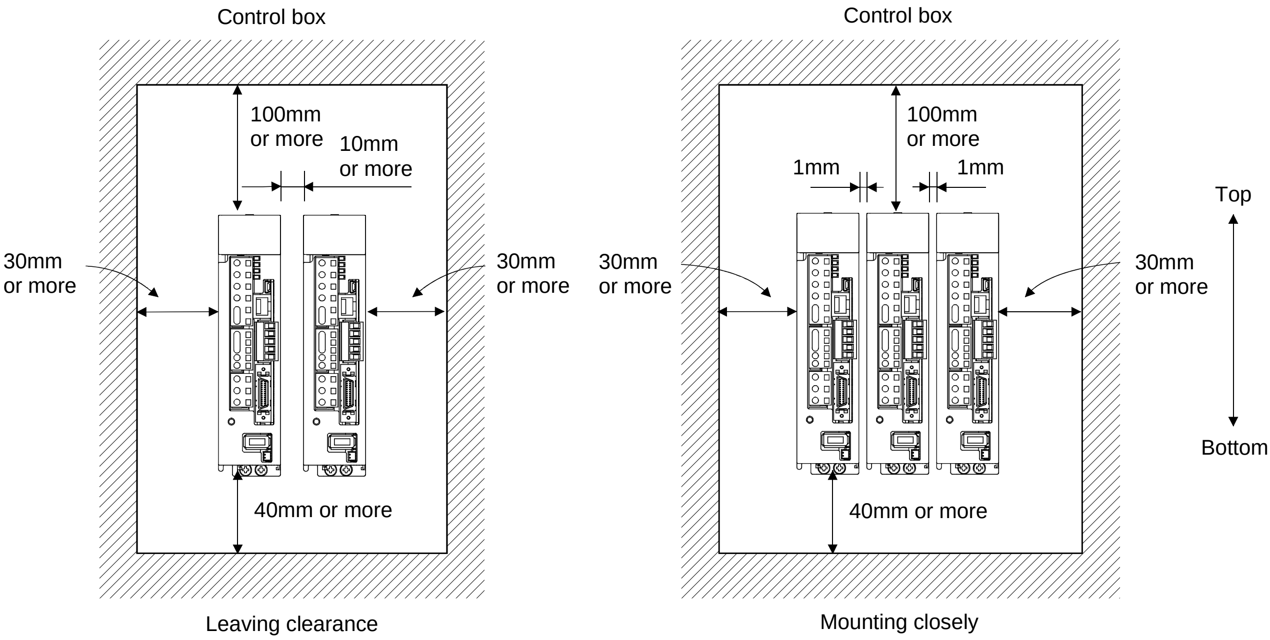
(a) Installation of one driver



(b) Installation of two or more drivers

POINT
・Close mounting is available for the driver of under 3.5kW for 200V class and 400W for 100V class.

Leave a large clearance between the top of the driver and the internal surface of the control box, and install a cooling fan to prevent the internal temperature of the control box from exceeding the environmental conditions.
When installing the drivers closely, leave a clearance of 1mm between the adjacent drivers in consideration of mounting tolerances.
In this case, bring the ambient temperature within 0 to 45℃ (32 to 113℉), or use it at 75% or a smaller effective load ratio.



(2) Others
When using heat generating equipment such as the regenerative option, install them with full consideration of heat generation so that the driver is not affected.
Install the driver on a perpendicular wall in the correct vertical direction.

2.2 Keep out foreign materials

(1) When installing the unit in a control box, prevent drill chips and wire fragments from entering the driver.

(2) Prevent oil, water, metallic dust, etc. from entering the driver through openings in the control box or a cooling fan installed on the ceiling.

(3) When installing the control box in a place where there are much toxic gas, dirt and dust, conduct an air purge (force clean air into the control box from outside to make the internal pressure higher than the external pressure) to prevent such materials from entering the control box.

2.3 Cable stress

(1) The way of clamping the cable must be fully examined so that flexing stress and cable's own weight stress are not applied to the cable connection.

(2) For use in any application where the servo motor moves, fix the cables (encoder, power supply, brake) with having some slack from the connector connection part of the servo motor to avoid putting stress on the connector connection part. Use the optional encoder cable within the flexing life range. Use the power supply and brake wiring cables within the flexing life of the cables.

(3) Avoid any probability that the cable sheath might be cut by sharp chips, rubbed by a machine corner or stamped by workers or vehicles.

(4) For installation on a machine where the servo motor will move, the flexing radius should be made as large as possible. Refer to section 9.4 for the flexing life.

2.4 Inspection items

WARNING	
⚠WARNING	・Before starting maintenance and/or inspection, turn off the power and wait for 15 minutes or more until the charge lamp turns off. Then, confirm that the voltage between P(+) and N(-) is safe with a voltage tester and others. Otherwise, an electric shock may occur. In addition, always confirm from the front of the driver whether the charge lamp is off or not. ・Any person who is involved in inspection should be fully competent to do the work. Otherwise, you may get an electric shock.

POINT

- Do not test the driver with a megger (measure insulation resistance), or it may become faulty.
- Do not disassemble and/or repair the equipment on customer side.

It is recommended to make the following checks periodically.

(1) Check for loose terminal block screws. Retighten any loose screws.

(2) Check the cables and the like for scratches and cracks. Perform periodic inspection according to operating conditions.

2.5 Parts having service lives

The following parts must be changed periodically as listed below. If any part is found faulty, it must be changed immediately even when it has not yet reached the end of its life, which depends on the operating method and environmental conditions.

Part name		Life guideline
Driver	Smoothing capacitor	10 years
	Relay	Number of power-on and number of emergency stop times : 100,000 times
	Cooling fan	10,000 to 30,000hours (2 to 3 years)
	Absolute position battery	Refer to section 5.8

(1) Smoothing capacitor

Affected by ripple currents, etc. and deteriorates in characteristic. The life of the capacitor greatly depends on ambient temperature and operating conditions. The capacitor will reach the end of its life in 10 years of continuous operation in normal air-conditioned environment.

(2) Relays

Their contacts will wear due to switching currents and contact faults occur. Relays reach the end of their life when the cumulative number of power-on and emergency stop times is 100,000, which depends on the power supply capacity.

(3) Driver cooling fan

The cooling fan bearings reach the end of their life in 10,000 to 30,000 hours. Normally, therefore, the cooling fan must be changed in a few years of continuous operation as a guideline.

It must also be changed if unusual noise or vibration is found during inspection.

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3. CC-LINK COMMUNICATION FUNCTIONS

3.1 Communication specifications

POINT

- This servo is equivalent to a remote device station.

For details of the programmable PC or PLC...etc side specifications, refer to the CC-Link system master unit manual.

<table>
<tr><th colspan="3">Item</th><th colspan="5">Specifications</th></tr>
<tr><td colspan="3">Power supply</td><td colspan="5">5VDC supplied from driver</td></tr>
<tr><td rowspan="13">CC-Link</td><td colspan="2">Applicable CC-Link version</td><td colspan="5">Ver.1.10</td></tr>
<tr><td colspan="2">Communication speed</td><td colspan="5">10M/5M/2.5M/625k/156kbps</td></tr>
<tr><td colspan="2">Communication system</td><td colspan="5">Broadcast polling system</td></tr>
<tr><td colspan="2">Synchronization system</td><td colspan="5">Frame synchronization system</td></tr>
<tr><td colspan="2">Encoding system</td><td colspan="5">MRZI</td></tr>
<tr><td colspan="2">Transmission path format</td><td colspan="5">Bus format (conforming to EIA RS485)</td></tr>
<tr><td colspan="2">Error control system</td><td colspan="5">CRC ($X^{16}+X^{12}+X^{5}+1$)</td></tr>
<tr><td colspan="2">Connection cable</td><td colspan="5">CC-Link Ver.1.10-compliant cable (Shielded 3-core twisted pair cable)</td></tr>
<tr><td colspan="2">Transmission format</td><td colspan="5">Conforming to HDLC</td></tr>
<tr><td colspan="2">Remote station number</td><td colspan="5">1 to 64</td></tr>
<tr><td rowspan="3">(Note) Cable length</td><td>Communication speed</td><td>156Kbps</td><td>625Kbps</td><td>2.5Mbps</td><td>5Mbps</td><td>10Mbps</td></tr>
<tr><td>Maximum overall cable length</td><td>1200m</td><td>900m</td><td>400m</td><td>160m</td><td>100m</td></tr>
<tr><td>Inter-station cable length</td><td colspan="5">0.2m or more</td></tr>
<tr><td colspan="3">Number of drivers connected</td><td colspan="5">Max. 42 (when 1 station is occupied by 1 driver), (max. 32 when 2 stations are occupied by 1 driver), when there are only remote device stations. Can be used with other equipment.</td></tr>
</table>

Note. If the system comprises of both CC-Link Ver.1.00- and Ver.1.10-compliant cables, Ver.1.00 specifications are applied to the overall cable length and the cable length between stations. For more information, refer to the CC-Link system master/local unit user's manual.

3.2 System configuration

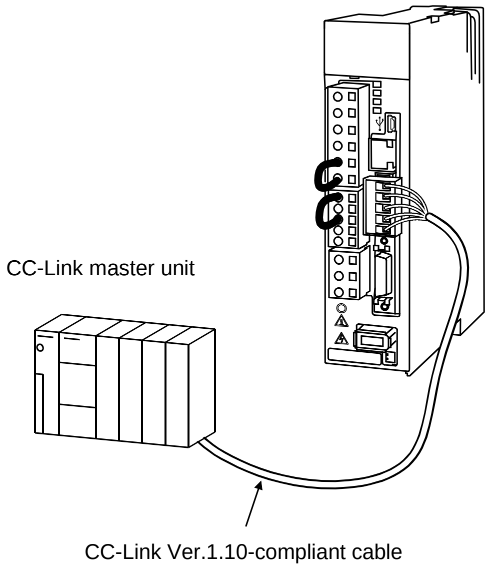
3.2.1 Configuration example

(1) Programmable PC or PLC...etc side

Fit "Type QJ61BT11N", "Type A1SJ61BT11" or "Type A1SJ61QBT11" "Control & Communication Link system master/local module" to the main or extension base unit which is loaded with the programmable PC or PLC...etc CPU used as the master station.

(2) Wiring

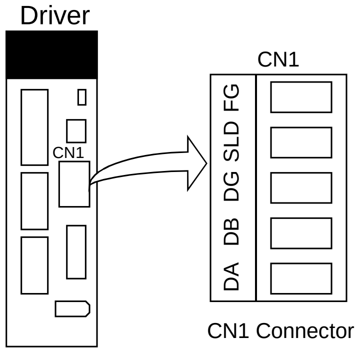
Connect the programmable CC-Link unit master station and the driver by a twisted pair cable (3-wire type).



3.2.2 Wiring method

(1) Communication connector

The pin layout of the communication connector CN10 on the driver unit is shown below.



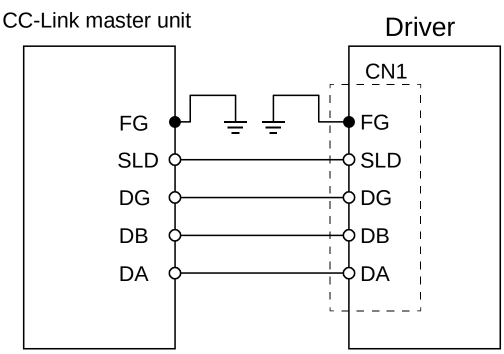
CN1 Connector : Accessory

Manufactured by Mitsubishi Electric System & Service Co., Ltd

Part No : 05A50230600

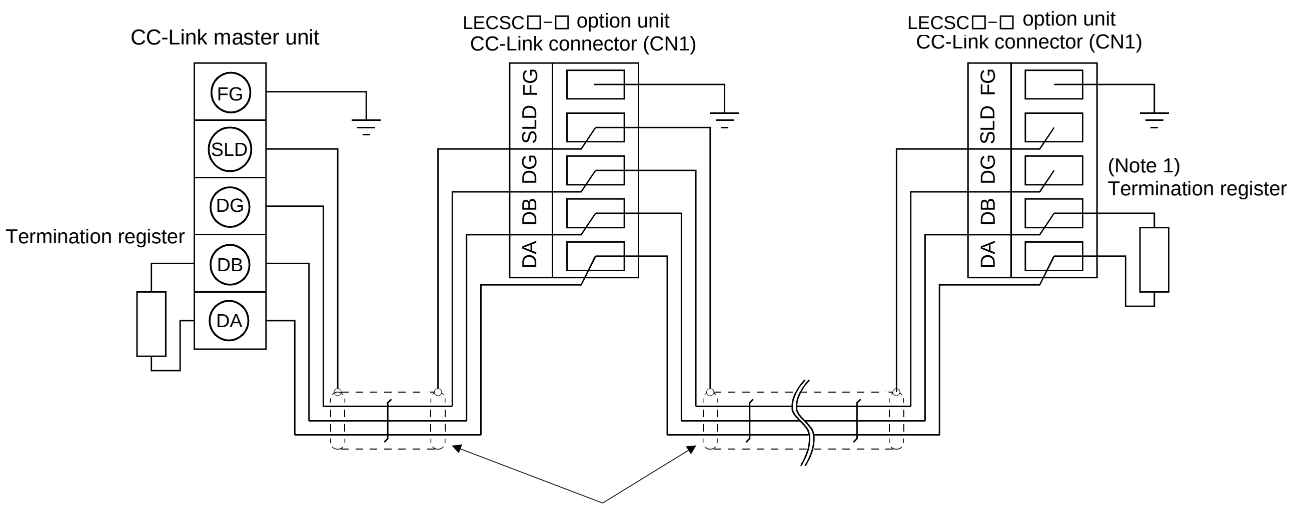
(2) Connection example

The driver and CC-Link master unit are wired as shown below. Refer to section 13.4 (3) for the CC-Link Ver.1.10-compliant cable used for connection.



(3) Example of connecting multiple servo units

As the remote I/O stations of CC-Link, drivers share the link system and can be controlled/monitored using programmable PC or PLC...etc user programs.



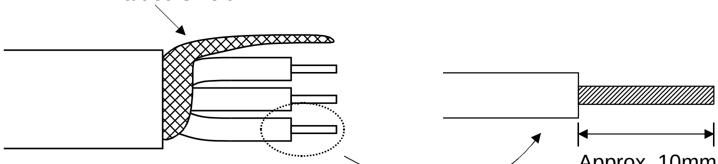
Note 1. Use the termination resistor supplied with the programmable PC or PLC...etc. The resistance of the termination resistor depends on the cable used.

2. Refer to (4) in this section.

(4) How to wire the CC-Link connector (CN1)

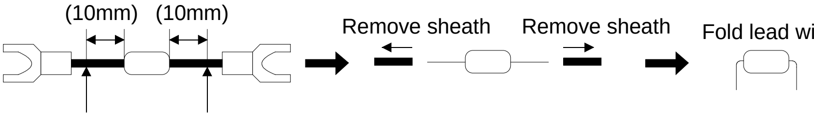
(a) Strip the sheath of the cable and separate the internal wires and braided shield.

(b) Strip the sheaths of the braided shield and internal wires and twist the cores.

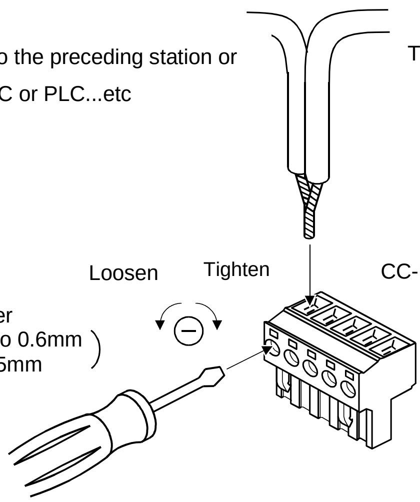


(c) Match and twist the wires and braided shield of the cable connected to the preceding axis or programmable PC or PLC...etc driver and the corresponding wires and braided shield of the cable connected to the subsequent axis.

(d) For the last axis, work the termination resistor supplied to the CC-Link master unit as shown below.



(e) Insert the core of the cable into the opening and tighten it with a flat-blade screwdriver so that it will not come off. (Tightening torque: 0.5 to 0.6N・m) When inserting the wire into the opening, make sure that the terminal screw is fully loose.



POINT

・Do not solder the cores as it may cause a contact fault.

Use of a flat-blade torque screwdriver is recommended to manage the screw tightening torque. The following table indicates the recommended products of the torque screwdriver for tightening torque management and the flat-blade bit for torque screwdriver. When managing torque with a Phillips bit, please consult us.

Product	Model	Manufacturer/Representative
Torque screwdriver	N6L TDK	Nakamura Seisakusho
Bit for torque screwdriver	B-30, flat-blade, H3.5 X 73L	Shiro Sangyo

3.2.3 Station number setting

POINT
・Be sure to set the station numbers within the range of 1 to 64. Do not set the other values.

(1) How to number the stations

Set the servo station numbers before powering on the drivers. Note the following points when setting the station numbers.

(a) Station numbers may be set within the range 1 to 64.

(b) One driver occupies 1 or 2 stations. (One station of programmable PC or PLC...etc remote device station)

(c) Max. number of connected units: 42

Note that the following conditions must be satisfied.

$\{(1\times a) + (2\times b) + (3\times c) + (4\times d)\} \leq 64$

a: Number of 1-station occupying units

b: Number of 2-station occupying units

c: Number of 3-station occupying units (not available for LECSC□-□)

d: Number of 4-station occupying units (not available for LECSC□-□)

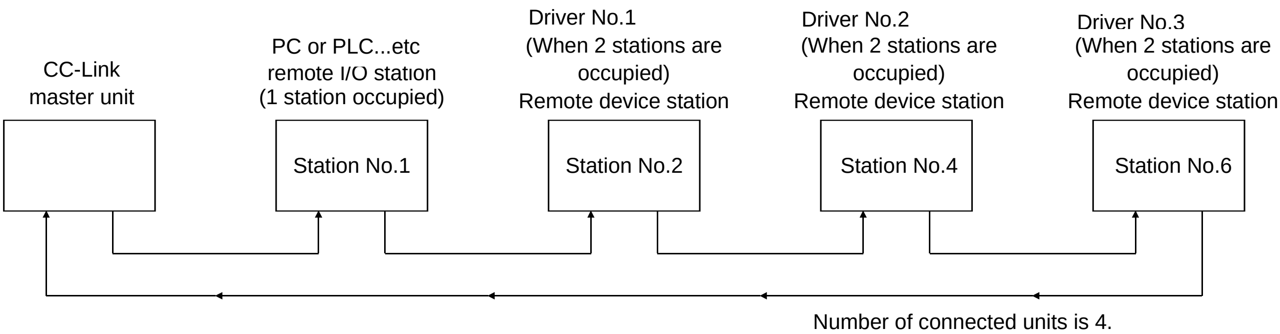
$\{(16\times A) + (54\times B) + (88\times C)\} \leq 2304$

A: Number of remote I/O stations ≤ 64

B: Number of remote device stations ≤ 42

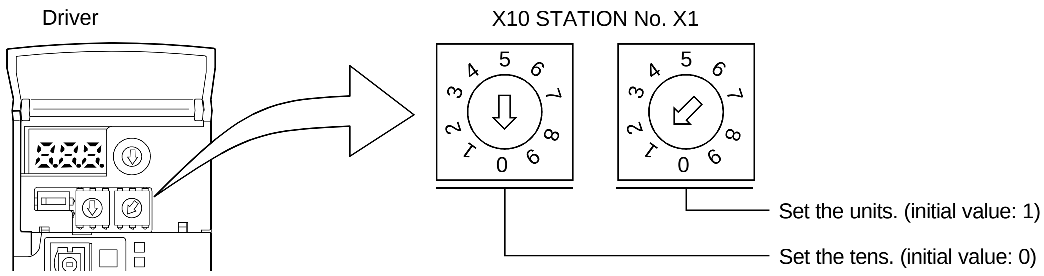
C: Number of local stations ≤ 26

(d) When the number of units connected is 4, station numbers can be set as shown below.



(2) Station number setting method

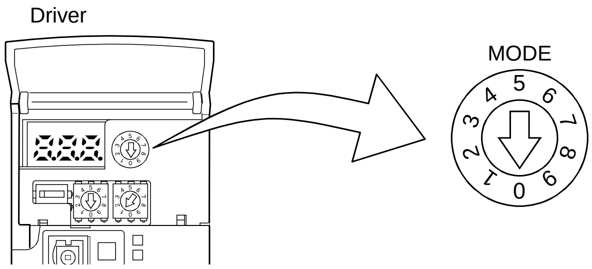
Set the station number with the station number switches (STATION NO.) on the driver front. The station number that may be set is any of 1 to 64 in decimal. In the initial status, the station number is set to station 1.



3.2.4 Communication baud rate setting

Set the transfer baud rate of CC-Link with the transfer baud rate switch (MODE) on the driver front. The initial value is set to 156kbps.

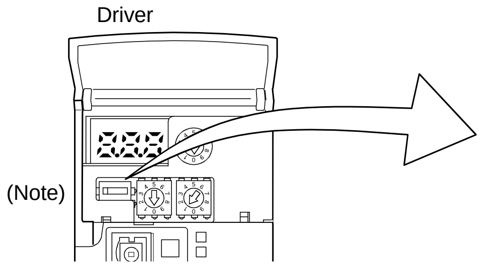
The overall distance of the system changes with the transfer speed setting. For details, refer to the CC-Link system master/local unit user's manual.

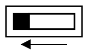
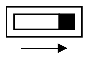


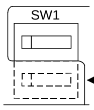
No.	Baud rate
0 (initial value)	156kbps
1	625kbps
2	2.5Mbps
3	5Mbps
4	10Mbps
5 to 9	Not used

3.2.5 Occupied station count setting

Set the number of occupied stations with the occupied station count switch (SW1) on the driver front. The usable I/O device and the number of connectable units change with the set number of occupied stations. Refer to section 3.2.3. In the initial status, the number of stations occupied is set to 1.



SW1 setting	Number of occupied stations
 Initial value	1 station occupied
	2 station occupied

Note. 

This switch hidden under the cover is for manufacturer setting.
Do not change this setting by any means.

3.3 Functions

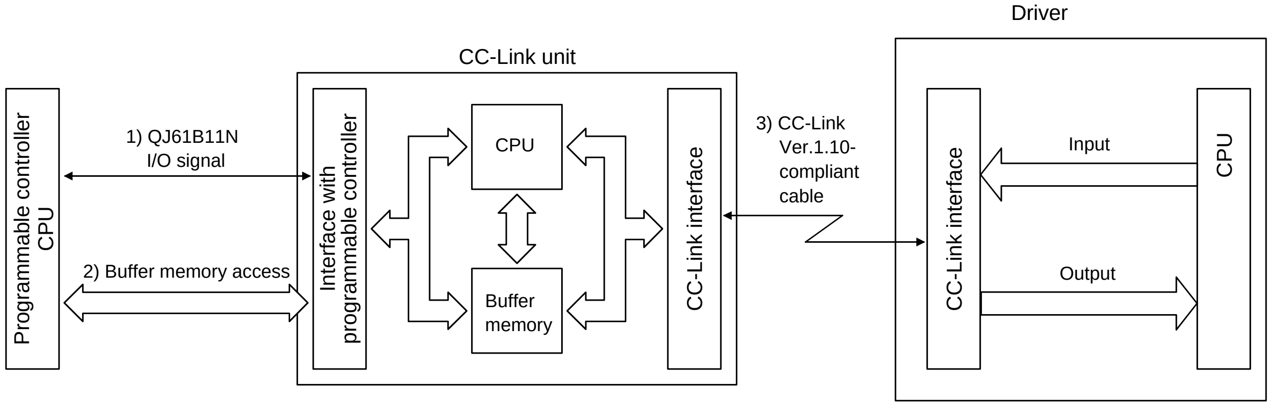
3.3.1 Function block diagram

This section explains the transfer of I/O data to/from the driver in CC-Link, using function blocks.

(1) Between the master station and driver in the CC-Link system, link refresh is normally performed at intervals of 3.5 to 18ms (512 points). The link scan time of link refresh changes with the communication speed. For details, refer to the CC-Link system master/local unit user's manual.

(2) The I/O refresh and master station sequence program are executed asynchronously. Some programmable PC or PLC...etc allow link scans to be synchronized with programmable driver scans.

(3) The FROM instruction from the buffer memory of the CC-Link system master/local unit is used to read data from the driver, and the TO instruction is used to write data. Some programmable PC or PLC...etc allow automatic refresh to be set to omit the FROM and TO instructions.



3.3.2 Functions

The following table lists the functions that may be performed from the programmable PC or PLC...etc in the CC-Link system in the CC-Link operation mode or test operation mode.

Item	Operation mode	
	CC-Link operation mode	Test operation mode
Monitor	○	○
Operation	○	
Parameter write	○	○
Parameter read	○	○
Point table data write	○	○
Point table data read	○	○

3.4 Driver setting

(1) Driver side operation modes

This driver has the following operation modes.

Operation mode	Description
Test operation mode	Personal computer in which set up software(MR Configurator2™) is installed is used to run the servo motor.
CC-Link operation mode	CC-Link communication functions are used to operate the servo with the programmable PC or PLC...etc programs.

(2) Operation mode changing

(a) Operation mode changing conditions

Change the operation mode after making sure that.

1) The servo motor is at a stop.

2) The forward rotation start (RYn1) or reverse rotation start (RYn2) is OFF.

(b) Operation mode changing method

When changing from test operation to CC-Link operation, deselect test operation by switching power OFF/ON.

CC-Link operation mode

Test operation mode is selected using a parameter unit or a personal computer in which Set up software (MR Configurator) is install

← Deselect test operation mode by switching power OFF/ON.

Test operation mode

3.5 I/O signals (I/O devices) transferred to/from the programmable PC or PLC...etc CPU

3.5.1 I/O signals (I/O devices)

The input signals (input devices) may be used as either the CC-Link or CN6 external input signals. Make selection in parameter No.PD06 to PD11, PD12 and PD14. The output signals (output devices) can be used as both the CC-Link・CN6 external output signals.

> **POINT**
>
> - In the factory-shipped status, the forward rotation stroke end (LSP), reverse rotation stroke end (LSN) and proximity dog (DOG) are valid as the CN6 external input signals.

(1) When 1 station is occupied

RYn/RXn: 32 points each, RWrn/RWwn: 4 points each

Programmable PC or PLC...etc → Driver (RYn)			
(Note) Device No.	Signal name	Signal abbreviation	CN6 connector pin No.
RYn0	Servo-on	SON	
RYn1	Forward rotation start	ST1	
RYn2	Reverse rotation start	ST2	
RYn3	Proximity dog	DOG	2
RYn4	Forward rotation stroke end	LSP	3
RYn5	Reverse rotation stroke end	LSN	4
RYn6	Automatic/manual selection	MDO	
RYn7	Temporary stop/Restart	TSTP	
RYn8	Monitor output execution demand	MOR	
RYn9	Instruction code execution demand	COR	
RYnA	Point table No. selection 1	DI0	
RYnB	Point table No. selection 2	DI1	
RYnC	Point table No. selection 3	DI2	
RYnD	Point table No. selection 4	DI3	
RYnE	Point table No. selection 5	DI4	
RYnF	Clear	CR	
RY(n+1)0 to RY(n+1)9	Reserved		
RY(n+1)A	Reset	RES	
RY(n+1)B to RY(n+1)F	Reserved		

Driver → Programmable PC or PLC...etc (RXn)			
(Note) Device No.	Signal name	Signal abbreviation	CN6 connector pin No.
RXn0	Ready	RD	14
RXn1	In position	INP	
RXn2	Rough match	CPO	
RXn3	Home position return completion	ZP	16
RXn4	Limiting torque	TLC	
RXn5	Reserved		
RXn6	Electromagnetic brake interlock	MBR	
RXn7	Temporary stop	PUS	
RXn8	Monitoring	MOF	
RXn9	Instruction code execution completion	COF	
RXnA	Warning	WNG	
RXnB	Battery warning	BWNG	
RXnC	Movement completion	MEND	
RXnD	Dynamic brake interlock	DB	
RXnE	Position range output	POT	
RXnF	Reserved		
RX(n+1)1 to RX(n+1)9	Reserved		
RX(n+1)A	Trouble	ALM	15
RX(n+1)B	Remote station communication ready	CRD	
RX(n+1)C to RX(n+1)F	Reserved		

Programmable PC or PLC...etc → Driver (RWwn)	
Address No.	Signal name
RWwn	Monitor 1
RWwn+1	Monitor 2
RWwn+2	Instruction code
RWwn+3	Writing data

Driver → Programmable PC or PLC...etc (RWrn)	
Address No.	Signal name
RWrn	Monitor 1 data
RWrn+1	Monitor 2 data
RWrn+2	Respond code
RWrn+3	Reading data

Note. "n" depends on the station number setting.

(2) When 2 stations are occupied
RXn/RYn: 64 points each, RWrn/RWwn: 8 points each

Programmable PC or PLC...etc → Driver (RYn)

(Note 1) Device No.	Signal name	Signal abbreviation	CN6 connector pin No.
RYn0	Servo-on	SON	
RYn1	Forward rotation start	ST1	
RYn2	Reverse rotation start	ST2	
RYn3	Proximity dog	DOG	2
RYn4	Forward rotation stroke end	LSP	3
RYn5	Reverse rotation stroke end	LSN	4
RYn6	Automatic/manual selection	MDO	
RYn7	Temporary stop/Restart	TSTP	
RYn8	Monitor output execution demand	MOR	
RYn9	Instruction code execution demand	COR	
RYnA	Point table No. selection 1	DI0	
RYnB	Point table No. selection 2	DI1	
RYnC	Point table No. selection 3	DI2	
RYnD	Point table No. selection 4	DI3	
RYnE	Point table No. selection 5	DI4	
RYnF	Clear	CR	
RY(n+1)0 to RY(n+1)F	Reserved		
RY(n+2)0	Position instruction execution demand (Note)		
RY(n+2)1	Speed instruction execution demand (Note)		
RY(n+2)2	Reserved		
RY(n+2)3	Point table No. selection 6	DI5	
RY(n+2)4	Point table No. selection 7	DI6	
RY(n+2)5	Point table No. selection 8	DI7	
RY(n+2)6	Internal torque limit selection	TL1	
RY(n+2)7	Proportion control	PC	
RY(n+2)8	Gain changing	CDP	
RY(n+2)9	Reserved		
RY(n+2)A	Position/speed specifying system selection		
RY(n+2)B	Absolute value/incremental value selection		
RY(n+2)C to RY(n+2)F	Reserved		
RY(n+3)0 to RY(n+3)9	Reserved		
RY(n+3)A	Reset	RES	
RY(n+3)B to RY(n+3)F	Reserved		

Note. "n" depends on the station number setting.

Driver → Programmable PC or PLC...etc (RXn)

(Note 1) Device No.	Signal name	Signal abbreviation	CN6 connector pin No.
RXn0	Ready	RD	14
RXn1	In position	INP	
RXn2	Rough match	CPO	
RXn3	Home position return completion	ZP	16
RXn4	Limiting torque	TLC	
RXn5	Reserved		
RXn6	Electromagnetic brake interlock	MBR	
RXn7	Temporary stop	PUS	
RXn8	Monitoring	MOF	
RXn9	Instruction code execution completion	COF	
RXnA	Warning	WNG	
RXnB	Battery warning	BWNG	
RXnC	Movement completion	MEND	
RXnD	Dynamic brake interlock	DB	
RXnE	Position range output	POT	
RXnF to RX(n+1)F	Reserved		
RX(n+2)0	Position instruction execution completion		
RX(n+2)1	Speed instruction execution completion		
RX(n+2)2	Point table No. output 1	PT0	
RX(n+2)3	Point table No. output 2	PT1	
RX(n+2)4	Point table No. output 3	PT2	
RX(n+2)5	Point table No. output 4	PT3	
RX(n+2)6	Point table No. output 5	PT4	
RX(n+2)7	Point table No. output 6	PT5	
RX(n+2)8	Point table No. output 7	PT6	
RX(n+2)9	Point table No. output 8	PT7	
RX(n+2)A to RX(n+2)F	Reserved		
RX(n+3)0 to RX(n+3)9	Reserved		
RX(n+3)A	Trouble	ALM	15
RX(n+3)B	Remote station communication ready	CRD	
RX(n+3)C to RX(n+3)F	Reserved		

Programmable PC or PLC...etc → Driver (RWwn)	
(Note 1) Address No.	Signal name
RWwn	(Note 2) Monitor 1
RWwn＋1	(Note 2) Monitor 2
RWwn＋2	Instruction code
RWwn＋3	Writing data
RWwn＋4	(Note 3) Position command data lower 16 bit/Point table No.
RWwn＋5	Position command data upper 16 bit
RWwn＋6	(Note 4) Speed command data/Point table No.
RWwn＋7	Reserved

Driver → Programmable PC or PLC...etc (RWrn)	
(Note 1) Address No.	Signal name
RWrn	Monitor 1 data lower 16 bit
RWwn＋1	Monitor 1 data upper 16 bit
RWwn＋2	Respond code
RWwn＋3	Reading data
RWwn＋4	
RWwn＋5	Monitor 2 data lower 16 bit
RWwn＋6	Monitor 2 data upper 16 bit
RWwn＋7	Reserved

Note 1. "n" depends on the station number setting.

2. Specify the code of the lower 16 bit as the monitor code of 32-bit data.

3. When the parameter No.PC30 setting is "□□□0", specify the point table No. in RWwn＋4. When the parameter No.PC30 setting is "□□□1" or "□□□2", specify the position data in RWwn＋4/RWwn＋5 and turn ON Position instruction execution demand (RY(n＋2)0).

4. When the parameter No.PC30 setting is "□□□1", specify the point table No. in RWwn＋6. When the parameter No.PC30 setting is "□□□2", specify the speed data in RWwn＋6, and turn ON Speed instruction execution demand (RY(n＋2)1). When setting the parameter No.PC30 to "□□□2", always set the acceleration/deceleration time constant in the point table No.1. When the parameter No.PC30 setting is "□□□0", the RWwn＋6 value is not used.

3.5.2 Detailed explanation of I/O signals

(1) Input signals (Input devices)

The note signs in the remarks column indicates the following descriptions.

＊1: Can be used as external input signals of CN6 connector by setting parameters No.PD06 to PD08 and parameter No.PD12 PD14.

＊2: Can be automatic turned ON internally by setting parameters No.PD01 PD04.

The device whose Device No. field has an oblique line cannot be used in CC-Link.

Signal name (Device name)	Description	Device No.		Remarks
		1 station occupied	2 stations occupied	
Servo-on	Turning RYn0 ON powers on the base circuit, making operation ready to start. (Servo on status) Turning it OFF powers off the base circuit, coasting the servo motor. (Servo off status)	RYn0	RYn0	＊1
Forward rotation start	1. In absolute value command system Turning RYn1 ON for automatic operation executes positioning once on the basis of the position data set to the point table. Turning RYn1 ON for a home position return immediately starts a home position return. Keeping RYn1 ON for JOG operation performs rotation in the forward rotation direction. Forward rotation indicates the address increasing direction. 2. In incremental value command system Turning RYn1 ON for automatic operation executes positioning once in the forward rotation direction on the basis of the position data set to the point table. Turning RYn1 ON for a home position return immediately starts a home position return. Keeping RYn1 ON for JOG operation performs rotation in the forward rotation direction. Forward rotation indicates the address increasing direction.	RYn1	RYn1	＊1
Reverse rotation start	Use this device in the incremental value command system. Turning RYn2 ON for automatic operation executes positioning once in the reverse rotation direction on the basis of the position data set to the point table. Keeping RYn2 ON for JOG operation performs rotation in the reverse rotation direction. Reverse rotation indicates the address decreasing direction. Reverse rotation start (RYn2) is also used as the start signal of the high-speed automatic positioning function to the home position.	RYn2	RYn2	＊1

<table>
<tr><th rowspan="2">Signal name</th><th rowspan="2">Description</th><th colspan="2">Device No.</th><th rowspan="2">Remarks</th></tr>
<tr><th>1 station occupied</th><th>2 stations occupied</th></tr>
<tr><td>Proximity dog</td><td>In the shipment status, the proximity dog external input signal (CN6-2) is valid. For use in CC-Link, make it usable in parameter No.PD14. When RYn3 is turned OFF, the proximity dog is detected. The polarity of dog detection can be changed using parameter No.PD16.
<table><tr><th>Parameter No.PD16</th><th>Proximity dog (RYn3) detection polarity</th></tr><tr><td>□0□□ (initial value)</td><td>OFF</td></tr><tr><td>□1□□</td><td>ON</td></tr></table></td><td>RYn3</td><td>RYn3</td><td>＊1</td></tr>
<tr><td>Forward rotation stroke end
Reverse rotation stroke end</td><td>In the factory-shipped status, the forward rotation stroke end is valid as the external input signal (CN6-3) and the reverse rotation stroke end is valid as the external input signal (CN6-4). Before operation, short between CN6-3 and DOCOM, and between CN6-4 and DOCOM. Opening them causes a sudden stop, resulting in servo lock.
For use in CC-Link, make it usable in parameter No.PD12. When starting operation, turn RYn4/RYn5 to ON. Turning it to OFF causes a sudden stop, resulting in servo lock. A stopping method can be changed in parameter No.PD20.
When not using the forward/reverse rotation stroke end, set "Automatic ON" in parameter No.PD01.
<table><tr><th colspan="2">(Note) Input signal</th><th colspan="2">Operation</th></tr><tr><th>RYn4</th><th>RYn5</th><th>CCW direction</th><th>CW direction</th></tr><tr><td>1</td><td>1</td><td>○</td><td>○</td></tr><tr><td>0</td><td>1</td><td></td><td>○</td></tr><tr><td>1</td><td>0</td><td>○</td><td></td></tr><tr><td>0</td><td>0</td><td></td><td></td></tr></table>Note. 0: OFF 1: ON</td><td>RYn4
RYn5</td><td>RYn4
RYn5</td><td>＊1
＊2</td></tr>
<tr><td>Automatic/manual selection</td><td>Turning RYn6 ON selects the automatic operation mode, and turning it OFF selects the manual operation mode.</td><td>RYn6</td><td>RYn6</td><td>＊1</td></tr>
<tr><td>Temporary stop/Restart</td><td>Turning RYn7 ON during automatic operation makes a temporary stop.
Turning RYn7 ON again makes a restart.
Forward rotation start (RYn1) or Reverse rotation start (RYn2) is ignored if it is turned ON during a temporary stop.
When the automatic operation mode is changed to the manual operation mode during a temporary stop, the movement remaining distance is erased.
During a home position return or during JOG operation, Temporary stop/Restart input is ignored.</td><td>RYn7</td><td>RYn7</td><td></td></tr>
</table>

<table>
<tr><th rowspan="2">Signal name</th><th rowspan="2">Description</th><th colspan="2">Device No.</th><th rowspan="2">Remarks</th></tr>
<tr><th>1 station occupied</th><th>2 stations occupied</th></tr>
<tr><td>Monitor output execution demand</td><td>When RYn8 is turned ON, the following data and signals are set. At the same time, RXn8 turns ON. While RYn8 is ON, the monitor values are kept updated.
1) When 1 station is occupied
Remote register RWrn: Data demanded by Monitor 1 (RWwn)
Remote register RWrn＋1: Data demanded by Monitor 2 (RWwn+1)
Remote register RWrn＋2: Respond code indicating normal or error
2) When 2 stations are occupied
Remote register RWrn: Lower 16 bits of data demanded by Monitor 1 (RWwn)
Remote register RWrn＋1: Upper 16 bits of data demanded by Monitor 1 (RWwn)
Remote register RWrn＋5: Lower 16 bits of data demanded by Monitor 2 (RWwn+2)
Remote register RWrn＋6: Upper 16 bits of data demanded by Monitor 2 (RWwn+2)
Remote register RWrn＋2: Respond code indicating normal or error</td><td>RYn8</td><td>RYn8</td><td></td></tr>
<tr><td>Instruction code execution demand</td><td>Turning RYn9 ON executes the processing corresponding to the instruction code stored in remote register RWwn＋2.
After completion of instruction code execution, the respond code indicating normal or error is set to RWrn＋2. At the same time, RXn9 turns ON.
Refer to section 3.5.4 for details.</td><td>RYn9</td><td>RYn9</td><td></td></tr>
<tr><td>Point table No. selection 1</td><td rowspan="8">The point table No. and the home position return are selected by RYnA to RY(n＋2)5.
<table>
<tr><th rowspan="2">Point table No.</th><th colspan="8">(Note 1) Remote input</th></tr>
<tr><th>RY (n+2)5</th><th>RY (n+2)4</th><th>RY (n+2)3</th><th>RYnE</th><th>RYnD</th><th>RYnC</th><th>RYnB</th><th>RYnA</th></tr>
<tr><td>(Note 2)</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td></tr>
<tr><td>1</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>1</td></tr>
<tr><td>2</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>1</td><td>0</td></tr>
<tr><td>3</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>1</td><td>1</td></tr>
<tr><td>4</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>1</td><td>0</td><td>0</td></tr>
<tr><td>⋮</td><td>⋮</td><td>⋮</td><td>⋮</td><td>⋮</td><td>⋮</td><td>⋮</td><td>⋮</td><td>⋮</td></tr>
<tr><td>254</td><td>1</td><td>1</td><td>1</td><td>1</td><td>1</td><td>1</td><td>1</td><td>0</td></tr>
<tr><td>255</td><td>1</td><td>1</td><td>1</td><td>1</td><td>1</td><td>1</td><td>1</td><td>1</td></tr>
</table>
Note 1. 0: OFF 1: ON
2. Home position return is a setting</td><td>RYnA</td><td>RYnA</td><td rowspan="8">＊1
＊2</td></tr>
<tr><td>Point table No. selection 2</td><td>RYnB</td><td>RYnB</td></tr>
<tr><td>Point table No. selection 3</td><td>RYnC</td><td>RYnC</td></tr>
<tr><td>Point table No. selection 4</td><td>RYnD</td><td>RYnD</td></tr>
<tr><td>Point table No. selection 5</td><td>RYnE</td><td>RYnE</td></tr>
<tr><td>Point table No. selection 6</td><td></td><td>RY(n＋2)3</td></tr>
<tr><td>Point table No. selection 7</td><td></td><td>RY(n＋2)4</td></tr>
<tr><td>Point table No. selection 8</td><td></td><td>RY(n＋2)5</td></tr>
<tr><td>Clear</td><td>When the parameter No.PD22 setting is "□□□1", the position control counter droop pulses is cleared at the leading edge of RYnF. The pulse width should be 10ms or more.
When the parameter No.PD22 setting is "□□□2", the pulses are always cleared while RYnF is on.</td><td>RYnF</td><td>RYnF</td><td>＊1
＊2</td></tr>
</table>

Signal name	Description	Device No.		Remarks
		1 station occupied	2 stations occupied	
Position instruction demand	When RY(n＋2)0 is turned ON, the point table No. or position command data set to remote register RWwn＋4/RWwn＋5 is set. When it is set to the driver, the respond code indicating normal or error is set to RWrn＋2. At the same time, RX(n＋2)0 turns ON. Refer to section 3.6.3 for details.		RY(n＋2)0	
Speed instruction demand	When RY(n＋2)1 is turned ON, the point table No. or speed command data set to remote register RWwn＋6 is set. When it is set to the driver, the respond code indicating normal or error is set to RWrn＋2. At the same time, RX(n＋2)1 turns ON. Refer to section 3.6.3 for details.		RY(n＋2)1	
Internal torque limit selection	Turning RY(n＋2)6 OFF makes the torque limit value of parameter No.PA11 (forward rotation torque limit) ･ parameter No.PA12 (reverse rotation torque limit) valid, and turning it ON makes that of parameter No.PC35 (internal torque limit). (Refer to section 4.6.3)		RY(n＋2)6	＊1
Proportion control	When RY(n＋2)7 is turned ON, the speed amplifier is switched from the proportional integral type to the proportional type. If the servo motor at a stop is rotated even one pulse by an external factor, it develops torque in an attempt to compensate for a position shift. When the shaft is locked mechanically after Movement completion (RXnC) is turned OFF, for example, turning Proportion control (RY(n＋2)7) ON as soon as Movement completion (RXnC) turns OFF allows control of unnecessary torque developed in an attempt to compensate for a position shift. When the shaft is to be locked for an extended period of time, turn Internal torque limit selection (RY(n＋2)6) ON simultaneously with Proportion control (RY(n＋2)7) to make the torque not more than the rated torque using Internal torque limit (parameter No.PC35).		RY(n＋2)7	＊1 ＊2
Gain changing	When RY(n＋2)8 is turned ON, the load inertia moment ratio and the corresponding gain values change to the values of parameter No.PB29 to PB32. To change the gain using RY(n＋2)8, make the auto tuning invalid.		RY(n+2)8	＊1
Position/speed specifying system selection	Select how to give a position command/speed command. (Refer to section 3.6.3.) OFF: Remote input-based position/speed specifying system Specifying the point table No. with Point table No. selection (RYnA to RYnE) gives a position command/speed command. ON : Remote register-based position/speed specifying system Setting the instruction code to the remote register (RWwn＋4 to RWwn＋6) gives a position command/speed command. Set the parameter No.PC30 (direct specification selection) to "□□□2".		RY(n＋2)A	

Signal name	Description	Device No.		Remarks
		1 station occupied	2 stations occupied	
Absolute value/incremental value selection	RY(n＋2)B is made valid when the remote register-based position/speed specifying system is selected with Position/speed specifying system selection (RY(n＋2)A) and the absolute value command system is selected in parameter No.PD10. Turn RY(n＋2)B OFF or ON to select whether the set position data is in the absolute value command system or incremental value command system. OFF: Position data is handled as an absolute value. ON : Position data is handled as an incremental value.		RY(n＋2)B	
Reset	Keeping RY(n＋1)A or RY(n＋3)A ON for 50ms or longer allows an alarm to be deactivated. Some alarms cannot be deactivated by Reset RY(n＋1)A or RY(n＋3)A. (Refer to section 10.4.1.) If RY(n＋1)A or RY(n＋3)A is turned ON with no alarm occurring, the base circuit will not be shut off. When "□□1□" is set in parameter No.PD20 (function selection D-1), the base circuit is shut off. This device is not designed to make a stop. Do not turn it ON during operation.	RY(n＋1)A	RY(n＋3)A	＊1
Forced stop	This device is exclusively used as a CN6 external input signal. It cannot be used for CC-Link. Turn EMG off to bring the motor to an forced stop state, in which the base circuit is shut off and the dynamic brake is operated. Turn EMG on in the forced stop state to reset that state.			

(2) Output signals (Output device)

POINT
- The output devices can be used for both the remote output and the external output signals of CN6 connector.

The signal whose Device No. field has an oblique line cannot be used in CC-Link.

Signal name	Description	Device No.	
		1 station occupied	2 stations occupied
Ready	In the factory-shipped status, a ready is assigned to the CN6-14 pin as an external output signal. RXn0 turns ON when the driver is ready to operate after servo-on.	RXn0	RXn0
In position	RXn1 turns ON when the droop pulse value is within the preset in-position range. The in-position range can be changed using parameter No.PA10. Increasing the in-position range may result in a continuous conduction status during low-speed rotation. RXn1 turns ON at servo-on.	RXn1	RXn1
Rough match	RXn2 turns ON when the command remaining distance becomes less than the rough match output range set in the parameter. RXn2 turns ON at servo-on.	RXn2	RXn2
Home position return completion	In the factory-shipped status, the home position return completion is assigned to the CN6-16 pin as an external output signal. RXn3 turns ON when a home position return is completed. RXn3 turns ON at completion of a home position return. In an absolute position detection system, RXn3 turns ON when operation is ready to start, but turns OFF in any of the following cases. 1) Servo-on (RYn0) is turned OFF. 2) Forced stop (EMG) is turned OFF. 3) Reset (RY(n+1)A or RY(n+3)A) is turned ON. 4) Alarm occurs. 5) Forward rotation stroke end (RYn4) or Reverse rotation stroke end (RYn5) is turned OFF. 6) Home position return has not been made after product purchase. 7) Home position return has not been made after occurrence of Absolute position erase (A25) or Absolute position counter warning (AE3). 8) Home position return has not been made after electronic gear change. 9) Home position return has not been made after the absolute position detection system was changed from invalid to valid. 10) Parameter No.PA14 (Rotation direction selection) has been changed. 11) Software limit is valid. 12) While a home position return is being made. When any of 1) to 12) has not occurred and a home position return is already completed at least once, Home position return completion (RXn3) turns to the same output status as Ready (RXn0).	RXn3	RXn3
Limiting torque	RXn4 turns ON when the torque is reached at the time of torque generation.	RXn4	RXn4
Electromagnetic brake interlock	RXn6 turns OFF at servo-off or alarm occurrence. At alarm occurrence, it turns OFF independently of the base circuit status.	RXn6	RXn6
Temporary stop	RXn7 turns ON when deceleration is started to make a stop by Temporary stop/Restart (RYn7). When Temporary stop/Restart (RYn7) is made valid again to resume operation, RXn7 turns OFF.	RXn7	RXn7
Monitoring	Refer to Monitor output execution demand (RYn8).	RXn8	RXn8

<table>
<tr><th rowspan="2">Signal name</th><th rowspan="2">Description</th><th colspan="2">Device No.</th></tr>
<tr><th>1 station occupied</th><th>2 stations occupied</th></tr>
<tr><td>Instruction code execution completion</td><td>Refer to Instruction code execution demand (RYn9).</td><td>RXn9</td><td>RXn9</td></tr>
<tr><td>Warning</td><td>RXnA turns ON when a warning occurs.
When no warning has occurred, RXnA turns OFF within about 1s after power-on.</td><td>RXnA</td><td>RXnA</td></tr>
<tr><td>Battery warning</td><td>RXnB turns ON when Open battery cable warning (A92) or Battery warning (A9F) occurs. When no battery warning has occurred, RXnB turns OFF within about 1s after power-on.</td><td>RXnB</td><td>RXnB</td></tr>
<tr><td>Movement completion</td><td>RXnC turns ON when In position (RXn1) turns ON and the command remaining distance is "0".
RXnC turns ON at servo-on.</td><td>RXnC</td><td>RXnC</td></tr>
<tr><td>Dynamic brake interlock</td><td>RXnD turns off simultaneously when the dynamic brake is operated. When using the external dynamic brake on the driver of 11 kW or more, this device is required. (Refer to section 13.6.) For the driver of 7kw or less, it is not necessary to use this device.</td><td>RXnD</td><td>RXnD</td></tr>
<tr><td>Position range</td><td>RXnE turns ON when the actual current position falls within the range set in the parameter.
It is OFF when a home position return is not yet completed or while the base circuit is off.</td><td>RXnE</td><td>RXnE</td></tr>
<tr><td>Position instruction execution completion</td><td>Refer to Speed instruction execution demand (RY(n+2)0).</td><td></td><td>RX(n+2)0</td></tr>
<tr><td>Speed instruction execution completion</td><td>Refer to Position instruction execution demand (RY(n+2)1). This device is required when using the external dynamic brake with a driver of 11kW or more. (Refer to section 13.6.)
This is not required with drivers of 7kW or less.</td><td></td><td>RX(n+2)1</td></tr>
<tr><td>Point table No. output 1</td><td rowspan="8">As soon as Movement completion (RXnC) turns ON, the point table No. is output in 8-bit code.
<table>
<tr><th rowspan="2">Point table No.</th><th colspan="8">(Note) Remote output</th></tr>
<tr><th>RX (n+2)9</th><th>RX (n+2)8</th><th>RX (n+2)7</th><th>RX (n+2)6</th><th>RX (n+2)5</th><th>RX (n+2)4</th><th>RX (n+2)3</th><th>RX (n+2)2</th></tr>
<tr><td>1</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>1</td></tr>
<tr><td>2</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>1</td><td>0</td></tr>
<tr><td>3</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>1</td><td>1</td></tr>
<tr><td>4</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>1</td><td>0</td><td>0</td></tr>
<tr><td>⋮</td><td>⋮</td><td>⋮</td><td>⋮</td><td>⋮</td><td>⋮</td><td>⋮</td><td>⋮</td><td>⋮</td></tr>
<tr><td>254</td><td>1</td><td>1</td><td>1</td><td>1</td><td>1</td><td>1</td><td>1</td><td>0</td></tr>
<tr><td>255</td><td>1</td><td>1</td><td>1</td><td>1</td><td>1</td><td>1</td><td>1</td><td>1</td></tr>
</table>
Note. 0: OFF 1: ON

RX(n+2)2 to RX(n+2)9 turn OFF in any of the following statuses.
・Power on
・Servo off
・During home position return
・Home position return completion
In any of the following statuses, RX(n+2)2 to RX(n+2)9 maintain their pre-change status (ON/OFF).
・When operation mode is changed
・When Automatic/manual selection (RYn6) is turned from OFF to ON or from ON to OFF to change the operation mode.
・During manual operation
・During execution of automatic positioning to home position</td><td rowspan="8"></td><td>RX(n+2)2</td></tr>
<tr><td>Point table No. output 2</td><td>RX(n+2)3</td></tr>
<tr><td>Point table No. output 3</td><td>RX(n+2)4</td></tr>
<tr><td>Point table No. output 4</td><td>RX(n+2)5</td></tr>
<tr><td>Point table No. output 5</td><td>RX(n+2)6</td></tr>
<tr><td>Point table No. output 6</td><td>RX(n+2)7</td></tr>
<tr><td>Point table No. output 7</td><td>RX(n+2)8</td></tr>
<tr><td>Point table No. output 8</td><td>RX(n+2)9</td></tr>
</table>

Signal name	Description	Device No.	
		1 station occupied	2 stations occupied
Trouble	A trouble is assigned to the CN6-15 pin as an external output signal. RX(n+1)A or RX(n+3)A turns ON when the protective circuit is activated to shut off the base circuit. When no alarm has occurred, RX(n+1)A or RX(n+3)A turns OFF within about 1.5s after power is switched ON.	RX(n+1)A	RX(n+3)A
Remote station communication ready	This signal turns ON at power-on and turns off at a trouble occurrence or in the reset (RY(n+1)A or RY(n+3)A) ON status.	RX(n+1)B	RX(n+3)B

(3) Remote registers

The signal whose Remote Register field has an oblique line cannot be used.

(a) Input (Programmable PC or PLC...etc → Driver)

Remote register		Signal name	Description	Setting range
1 station occupied	2 stations occupied			
RWwn	RWwn	Monitor 1	Demands the status indication data of the driver. 1) When 1 station is occupied Setting the monitor code of the status indication item to be monitored to RWwn and turning RYn8 to ON sets data to RWrn. RXn8 turns on at the same time. 2) When 2 stations are occupied Setting the monitor code of the status indication item to be monitored to RWwn and turning RYn8 to ON sets data to RWrn. RXn8 turns on at the same time. When demanding 32-bit data, specifying the lower 16-bit code No. and turning RYn8 to ON sets the lower 16-bit data to RWwn and the upper 16-bit data to RWrn. Data is stored in the RXn8. RXn8 turns on at the same time. Refer to section 3.5.3 for the item of the monitor code of the status indication.	Refer to section 3.5.3.
RWwn+1	RWwn+1	Monitor 2	Demands the status indication data of the driver. 1) When 1 station is occupied Setting the monitor code of the status indication item to be monitored to RWwn+1 and turning RYn8 to ON sets data to RWrn+1. RXn8 turns on at the same time. 2) When 2 stations are occupied Setting the monitor code of the status indication item to be monitored to RWwn+1 and turning RYn8 to ON sets data to RWrn+5. RXn8 turns on at the same time. When demanding 32-bit data, specifying the lower 16-bit code No. and turning RYn8 to ON sets the lower 16-bit data to RWwn+5 and the upper 16-bit data to RWrn+6. Data is stored in the RXn8. RXn8 turns on at the same time. Refer to section 3.5.3 for the item of the monitor code of the status indication.	Refer to section 3.5.3.

Remote register		Signal name	Description	Setting range
1 station occupied	2 stations occupied			
RWwn+2	RWwn+2	Instruction code	Sets the instruction code used to perform parameter or point table data read and write, alarm reference or the like. Setting the instruction code No. to RWwn+2 and turning RYn9 to ON executes the instruction. RXn9 turns to ON on completion of instruction execution. Refer to section 3.5.4 (1) for instruction code No. definitions.	Refer to section 3.5.4 (1).
RWwn+3	RWwn+3	Writing data	Sets the written data used to perform parameter or point table data write, alarm history clear or the like. Setting the written data to RWwn+3 and turning RYn9 to ON writes the data to the driver. RXn9 turns to ON on completion of write. Refer to section 3.5.4 (2) for written data definitions.	Refer to section 3.5.4 (2).
	RWwn+4	Point table No./Position command data lower 16 bit	Set the point table No. to be executed in the automatic operation mode when 2 stations are occupied. When the point table No. is set to RWwn+4 and RY(n+2)0 is turned ON, the point table No. is set to the driver. On completion of setting, RX(n+2)0 turns ON. When the point table is not used, set the position command data. When the lower 16 bits are set to RWwn+4 and the upper 16 bits to RWwn+5, and RY(n+2)0 is turned ON, the position command data in the upper and lower 16 bits are written. On complete of write, RX(n+2)0 turns ON. Use parameter No.PC30 to select whether point table No. setting or position command data setting will be made. Refer to section 3.6.3 for details of Point table No./Position command data.	Point table No.: 0 to 255 Absolute value command: Position command data: −999999 to 999999 Incremental value command: Position command data: 0 to 999999
	RWwn+5	Position command data upper 16 bit		
	RWwn+6	Point table No./Speed command data	When the point table is not used, set the point table No. to be executed or the speed command data (servo motor speed [r/min]). When the point table No. is set to RWwn+6 and RY(n+2)1 is turned ON, the point table No. or speed command data is set to the driver. On completion of setting, RX(n+2)1 turns ON. Use parameter No.PC30 to select whether point table No. setting or speed command data setting will be made. Refer to section 3.6.3 for details of Point table No./Speed command data. When setting the servo motor speed in this remote register, always set the acceleration/deceleration time constant in the point table No.1.	Point table No.: 0 to 255 Speed command data: 0 to permissible speed

(b) Output (Driver → Programmable PC or PLC...etc)

Note that the data set to RWrn and RWrn+1 depends on whether 1 station or 2 stations are occupied.

If you set inappropriate code No. or data to the remote register input, the error code is set to respond code (RWrn+2). Refer to section 3.5.5 for the error code.

When 1 station is occupied

Remote register	Signal name	Description
RWrn	Monitor 1 data	The data of the monitor code set to RWwn is set.
RWrn+1	Monitor 2 data	The data of the monitor code set to RWwn+1 is set.
RWrn+2	Respond code	"0000" is set when the codes set to RWwn to RWwn+3 are executed normally.
RWrn+3	Reading data	Data corresponding to the read code set to RWwn+2 is set.

When 2 stations are occupied

Remote register	Signal name	Description
RWrn	Monitor 1 data lower 16bit	The lower 16 bits of the data of the monitor code set to RWwn are set.
RWrn+1	Monitor 1 data upper 16bit	The upper 16 bits of the data of the monitor code set to RWwn are set. A sign is set if there are no data in the upper 16 bits.
RWrn+2	Respond code	"0000" is set when the codes set to RWwn to RWwn+6 are executed normally.
RWrn+3	Reading data	Data corresponding to the read code set to RWwn+2 is set.
RWrn+4		
RWrn+5	Monitor 2 data lower 16bit	The lower 16 bits of the data of the monitor code set to RWwn+1 are set.
RWrn+6	Monitor 2 data upper 16bit	The upper 16 bits of the data of the monitor code set to RWwn+1 are set. A sign is set if there are no data in the upper 16 bits.
RWrn+7		

3.5.3 Monitor codes

To demand 32-bit data when 2 stations are occupied, specify the lower 16-bit code No. Use any of the instruction codes 0101 to 011C to read the decimal point position (multiplying factor) of the status indication.
Setting any code No. that is not given in this section will set the error code (□□1□) to respond code (RWrn+2).
At this time, "0000" is set to RWrn, RWrn+1, RWrn+5 and RWrn+6.

Code No.		Monitored item	Answer data (Driver → Programmable PC or PLC...etc)	
1 station occupied	2 stations occupied		Data length	Unit
0000h	0000h			
0001h	0001h	Current position lower 16bit	16bit	$\times 10^{STM}$[mm] or $\times 10^{STM}$[inch]
0002h		Current position upper 16bit	16bit	
0003h	0003h	Command position lower 16bit	16bit	
0004h		Command position upper 16bit	16bit	
0005h	0005h	Command remaining distance lower 16bit	16bit	
0006h		Command remaining distance upper 16bit	16bit	
0007h	0007h			
0008h	0008h	Point table No.	16bit	[No.]
0009h				
000Ah	000Ah	Feedback pulse value lower 16bit	16bit	[pulse]
000Bh		Feedback pulse value upper 16bit	16bit	[pulse]
000Ch				
000Dh				
000Eh	000Eh	Droop pulse value lower 16bit	16bit	[pulse]
000Fh		Droop pulse value upper 16bit	16bit	[pulse]
0010h	0010h			
0011h	0011h	Regenerative load factor	16bit	[%]
0012h	0012h	Effective load factor	16bit	[%]
0013h	0013h	Peak load factor	16bit	[%]
0014h		Instantaneously occurring torque	16bit	[%]
0015h	0015h	ABS counter	16bit	[rev]
0016h	0016h	Motor speed lower 16bit	16bit	×0.1[rev/min]
0017h		Motor speed upper 16bit	16bit	×0.1[rev/min]
0018h	0018h	Bus voltage	16bit	[V]
0019h	0019h	ABS position lower 16bit	16bit	[pulse]
001Ah		ABS position middle 16bit	16bit	[pulse]
001Bh	001Bh	ABS position upper 16bit	16bit	[pulse]
001Ch	001Ch	Within one-revolution position lower 16bit	16bit	[pulse]
001Dh		Within one-revolution position upper 16bit	16bit	[pulse]

3.5.4 Instruction codes (RWwn+2 · RWwn+3)

Refer to section 3.6.2 for the instruction code timing charts.

(1) Read instruction codes

The word data requested to be read with the instruction code 0000h to 0AFFh is read by Read code (RWrn+3).

Set the command code No. corresponding to the item to RWrn+2. The codes and answer data are all 4-digit hexadecimal numbers.

Setting any command code No. that is not given in this section will set the error code (□□1□) to respond code (RWrn+2). At this time, "0000" is set to Reading data (RWrn+3).

Code No.	Item/Function	Reading data (RWrn+3) contents (Driver → Programmable PC or PLC...etc)
0000h	Operation mode Reads the current operation mode.	0000: CC-Link operation mode 0001: Test operation mode
0002h	Travel multiplying factor Reads the multiplying factor of the position data in the point table set in parameter No. PA05.	□□□□ Travel multiplying factor 0300: ×1000 0200: ×100 0100: ×10 0000: ×1
0010h	Current alarm (warning) reading Reads the alarm No. or warning No. occurring currently.	0 0 □□ Occurring alarm No./warning No.
0020h	Alarm number in alarm history (most recent alarm)	0 0 □□ Alarm No. that occurred in past
0021h	Alarm number in alarm history (first recent alarm)	
0022h	Alarm number in alarm history (second recent alarm)	
0023h	Alarm number in alarm history (third recent alarm)	
0024h	Alarm number in alarm history (fourth recent alarm)	
0025h	Alarm number in alarm history (fifth recent alarm)	
0030h	Alarm occurrence time in alarm history (most recent alarm)	□□□□ Occurrence time of alarm that occurred in past
0031h	Alarm occurrence time in alarm history (first recent alarm)	
0032h	Alarm occurrence time in alarm history (second recent alarm)	
0033h	Alarm occurrence time in alarm history (third recent alarm)	
0034h	Alarm occurrence time in alarm history (fourth recent alarm)	
0035h	Alarm occurrence time in alarm history (fifth recent alarm)	

Code No.	Item/Function	Reading data (RWrn+3) contents (Driver → Programmable PC or PLC...etc)
0040h	Input device status 0 Reads the statuses (OFF/ON) of the input devices.	bit 0 to bit F indicate the OFF/ON statuses of the corresponding input devices. Refer to section 3.5.1 for the meanings of the abbreviations. bitF bit0 When 2 stations are occupied, DI0, DI1 and DI2 do not function and therefore they are always "0". bit0: SON bit4: LSP bit8: MOR bitC: DI2 bit1: ST1 bit5: LSN bit9: COR bitD: DI3 bit2: ST2 bit6: MDO bitA: DI0 bitE: DI4 bit3: DOG bit7: TSTP bitB: DI1 bitF: ―――
0041h	Input device status 1 Reads the statuses (OFF/ON) of the input devices.	bit 0 to bit F indicate the OFF/ON statuses of the corresponding input devices. Refer to section 3.5.1 for the meanings of the abbreviations. bitF bit0 bit0: PSR bit4: DI6 bit8: CDP bitC: ――― bit1: SPR bit5: DI7 bit9: ――― bitD: ――― bit2: ――― bit6: TL1 bitA: CSL bitE: ――― bit3: DI5 bit7: PC bitB: INC bitF: ―――
0042h	Input device status 2 Reads the statuses (OFF/ON) of the input devices.	bit 0 to bit F indicate the OFF/ON statuses of the corresponding input devices. Refer to section 3.5.1 for the meanings of the abbreviations. bitF bit0 bit0: ――― bit4: ――― bit8: ――― bitC: ――― bit1: ――― bit5: ――― bit9: ――― bitD: ――― bit2: ――― bit6: ――― bitA: RES bitE: ――― bit3: ――― bit7: ――― bitB: ――― bitF: ―――
0050h	Output device status 0 Reads the statuses (OFF/ON) of the Output devices.	bit 0 to bit F indicate the OFF/ON statuses of the corresponding output devices. Refer to section 3.5.1 for the meanings of the abbreviations. bitF bit0 bit0: RD bit4: TLC bit8: MOF bitC: MEND bit1: INP bit5: ――― bit9: COF bitD: ――― bit2: CPO bit6: MBR bitA: WNG bitE: POT bit3: ZP bit7: PUS bitB: BWNG bitF: ―――
0051h	Output device status 1 Reads the statuses (OFF/ON) of the Output devices.	bit 0 to bit F indicate the OFF/ON statuses of the corresponding output devices. Refer to section 3.5.1 for the meanings of the abbreviations. bitF bit0 bit0: PSF bit4: PT2 bit8: PT6 bitC: ――― bit1: SPF bit5: PT3 bit9: PT7 bitD: ――― bit2: PT0 bit6: PT4 bitA: ――― bitE: ――― bit3: PT1 bit7: PT5 bitB: ――― bitF: ―――

Code No.	Item/Function	Reading data (RWrn+3) contents (Driver → Programmable PC or PLC...etc)
0052h	Output device status 2 Reads the statuses (OFF/ON) of the Output devices.	bit 0 to bit F indicate the OFF/ON statuses of the corresponding output devices. Refer to section 3.5.1 for the meanings of the abbreviations. bitF bit0 bit0: ––– bit4: ––– bit8: ––– bitC: ––– bit1: ––– bit5: ––– bit9: ––– bitD: ––– bit2: ––– bit6: ––– bitA: ALM bitE: ––– bit3: ––– bit7: ––– bitB: CRD bitF: –––
0081h	Energization time Reads the energization time from shipment.	Returns the energization time [h]. Energization time
0082h	Power ON frequency Reads the number of power-on times from shipment.	Returns the number of power-on times. Power ON frequency
00A0h	Ratio of load inertia moment Reads the estimated ratio of load inertia moment to servo motor shaft inertia moment.	Return unit [times]. Ratio of load inertia moment
00B0h	Home position within-1-revolution position lower 16bit (CYC0) Reads the lower 16 bits of the cycle counter value of the absolute home position.	Return unit [pulses]. Cycle counter value
00B1h	Home position within-1-revolution position upper 16bit Reads the upper 16 bits of the cycle counter value of the absolute home position.	Return unit [pulses]. Cycle counter value
00B2h	Home position Multi-revolution data (ABS0) Multi-revolution counter value of absolute home position reading.	Return unit [rev]. Multi-revolution counter value
00C0h	Error parameter No./Point data No. reading Reads the parameter No./point table No. in error.	Parameter No. or point table No. Parameter group 0: Basic setting parameters (No.PA□□) 1: Gain/filter parameters (No.PB□□) 2: Extension setting parameters (No.PC□□) 3: I/O setting parameters (No.PD□□) Type 1: Parameter No. 2: Point table No.

Code No.	Item/Function	Reading data (RWrn+3) contents (Driver → Programmable PC or PLC...etc)
0100h to 011Dh	Monitor multiplying factor Reads the multiplying factor of the data to be read with the monitor code. The instruction codes 0100 to 011D correspond to the monitor codes 0000 to 001D. 0000 applies to the instruction code that does not correspond to the monitor code.	□□□□ Monitor multiplying factor 0003: ×1000 0002: ×100 0001: ×10 0000: ×1
0200h	Parameter group reading Reads the parameter group to be read with code No.8200h to be written.	0 0 0 □ Parameter group 0: Basic setting parameters (No.PA□□) 1: Gain/filter parameters (No.PB□□) 2: Extension setting parameters (No.PC□□) 3: I/O setting parameters (No.PD□□)
0201h to 02FFh	Parameter data reading Reads the set value of each No. of the parameter group read with code No.0200h. The decimal value converted from the 2 lower digits of the code No. corresponds to the parameter No. If the instruction code is set outside the range set in parameter No.PA19, an error code is returned and the data cannot be read.	The value set in the parameter No. corresponding to the requested group name is stored.
0301h to 03FFh	Data form of parameter Reads the data format of each No. of the parameter group read with code No.0200h. The decimal value converted from the 2 lower digits of the code No. corresponds to the parameter No. If the instruction code is set outside the range set in parameter No.PA19, an error code is returned and the data cannot be read.	The value set in the parameter No. corresponding to the requested group name is stored. 0 □□□ Decimal point position 0: Without decimal point 1: First least significant digit (without decimal point) 2: Second least significant digit 3: Third least significant digit 4: Fourth least significant digit Data format 0: Used unchanged as hexadecimal 1: Must be converted into decimal Parameter write type 0: Valid after write 1: Valid when power is switched on again after write
0401h to 04FFh 0501h to 05FFh	Position data of point table No.1 to 255 Reads the point table data of point table No.1 to 255. 0400 to 04FF: Position data in lower 16 bits of point table No.1 to 255 0500 to 05FF: Position data in upper 16 bits of point table No.1 to 255 Example Instruction code 0413: Lower 16 bits of point table No.19 Instruction code 0513: Upper 16 bits of point table No.19	The position data (upper 16 bits or lower 16 bits) set in the requested point table No. is returned.

Code No.	Item/Function	Reading data (RWrn+3) contents (Driver → Programmable PC or PLC...etc)
0601h to 06FFh	Servo motor speed of point table No.1 to 255 The decimal value converted from the 2 lower digits of the code No. corresponds to the point table No.	The servo motor speed set to the requested point table No. is returned. □□□□ Servo motor speed
0701h to 07FFh	Acceleration time constant of point table No.1 to 255 The decimal value converted from the 2 lower digits of the code No. corresponds to the point table No.	The acceleration time constant set to the requested point table No. is returned.
0801h to 08FFh	Deceleration time constant of point table No.1 to 255 The decimal value converted from the 2 lower digits of the code No. corresponds to the point table No.	The deceleration time constant set to the requested point table No. is returned.
0901h to 09FFh	Dwell of point table No.1 to 255 The decimal value converted from the 2 lower digits of the code No. corresponds to the point table No.	The dwell set to the requested point table No. is returned.
0A01h to 0AFFh	Auxiliary function of point table No.1 to 255 The decimal value converted from the 2 lower digits of the code No. corresponds to the point table No.	The Auxiliary function set to the requested point table No. is returned.

(2) Write instruction codes

Set the data, which was requested to be written with the instruction code 8010h to 91FFh.

Set the instruction code No. corresponding to the item to Instruction code (RWwn+2) and the written data to Writing data (RWwn+3). The codes and answer data are all 4-digit hexadecimal numbers.

When the instruction code which has not been described in this section is set, the error code (□□1□) is stored in respond code (RWrn+2).

Code No.	Item	Writing data (RWwn+3) contents (Programmable PC or PLC...etc → Driver)
8010h	Alarm reset command Deactivates the alarm that occurred.	1EA5
8101h	Feedback pulse value display data is clear Resets the display data of the status indication "feedback pulse value" to 0.	1EA5
8200h	Parameter group write command Writes the group of parameters that are written to with codes No.8201h to 82FFh and 8301h to 83FFh. Writes the group of parameters that are read with codes No.0201h to 02FFh and 0301h to 03FFh.	0 0 0 □ Parameter group 0: Basic setting parameters (No.PA□□) 1: Gain/filter parameters (No.PB□□) 2: Extension setting parameters (No.PC□□) 3: I/O setting parameters (No.PD□□)

Code No.	Item	Writing data (RWwn+3) contents (Programmable PC or PLC...etc → Driver)
8201h to 82FFh	Data RAM instruction of parameter Writes the set value of each No. of the parameter group written by code No.8200h to RAM. These values are cleared when power is switched off. The decimal value converted from the 2 lower digits of the code No. corresponds to the parameter No. An error code is returned if an instruction code outside the range set in parameter No. PA19 or a value outside the setting range of the corresponding parameter is written.	Convert the decimal values into hexadecimal before setting.
8301h to 83FFh	Data EEP-ROM instruction of parameter Writes the set value of each No. of the parameter group written with code No.8200h to EEP-ROM. Written to EEP-ROM, these values are held if power is switched off. The decimal value converted from the 2 lower digits of the code No. corresponds to the parameter No. An error code is returned if an instruction code outside the range set in parameter No. PA19 or a value outside the setting range of the corresponding parameter is written.	Convert the decimal values into hexadecimal before setting.
8401h to 84FFh 8501h to 85FFh	Position data RAM command of point table Writes the position data of point table No. 1 to 255 to RAM. These values are cleared when power is switched off.	Convert the values into hexadecimal before setting.
8601h to 86FFh	Motor speed of point table Writes the motor speeds of point table No.1 to 255 to RAM. These values are cleared when power is switched off. The decimal value converted from the 2 lower digits of the code No. corresponds to the point table No.	Convert the values into hexadecimal before setting.
8701h to 87FFh	Acceleration time constant data RAM command of point table Writes the acceleration time constants of point table No.1 to 255 to RAM. These values are cleared when power is switched off. The decimal value converted from the 2 lower digits of the code No. corresponds to the point table No.	Convert the values into hexadecimal before setting.

Point

- A set of the upper and lower bits makes position data. When changing the data, always set the data of both lower and upper bits in order of lower 16-bit data and upper 16-bit data.

  8400h to 84FFh: Position data in lower 16 bits of point table No.1 to 255

  8500h to 85FFh: Position data in upper 16 bits of point table No.1 to 255

  Example

  Instruction code 8413h: Lower 16 bits of point table No.19

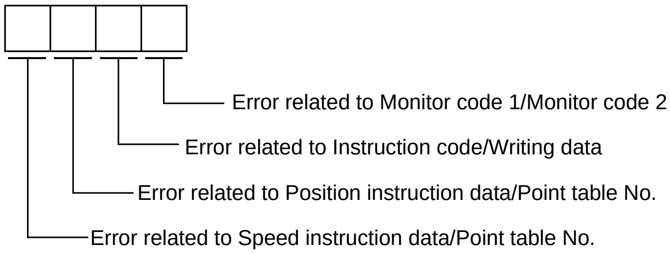
  Instruction code 8513h: Upper 16 bits of point table No.19

Code No.	Item	Writing data (RWwn+3) contents (Programmable PC or PLC...etc → Driver)
8801h to 88FFh	Deceleration time constant data RAM command of point table Writes the deceleration time constants of point table No.1 to 255 to RAM. These values are cleared when power is switched off. The decimal value converted from the 2 lower digits of the code No. corresponds to the point table No.	Convert the values into hexadecimal before setting.
8901h to 89FFh	Dwell data RAM command of point table Writes the dwell data of point table No.0 to 255 to RAM. These values are cleared when power is switched off. The decimal value converted from the 2 lower digits of the code No. corresponds to the point table No.	Convert the values into hexadecimal before setting.
8A01h to 8AFFh	Auxiliary function data RAM command of point table Writes the auxiliary function data of point table No.0 to 31 to RAM. These values are cleared when power is switched off. The decimal value converted from the 2 lower digits of the code No. corresponds to the point table No.	Convert the values into hexadecimal before setting.
8B01h to 8BFFh 8C01h to 8CFFh	Position data EEP-ROM command of point table Writes the position data of point table No.1 to 255 to EEP-ROM. Written to EEP-ROM, these values are held if power is switched off. **Point** ・A set of the upper and lower bits makes position data. When changing the data, always set the data of both lower and upper bits in order of lower 16-bit data and upper 16-bit data. 8B01h to 8BFFh: Position data in lower 16 bits of point table No.1 to 255 8C01h to 8CFFh: Position data in upper 16 bits of point table No.1 to 255 Example Instruction code 8B13h: Lower 16 bits of point table No.19 Instruction code 8C13h: Upper 16 bits of point table No.19	Convert the values into hexadecimal before setting.
8D01h to 8DFFh	Servo motor speed data EEP-ROM command of point table Writes the servo motor speeds of point table No.1 to 255 to EEP-ROM. Written to EEP-ROM, these values are held if power is switched off. The decimal value converted from the 2 lower digits of the code No. corresponds to the point table No.	Convert the values into hexadecimal before setting.

Code No.	Item	Writing data (RWwn+3) contents (Programmable PC or PLC...etc → Driver)
8E01h to 8EFFh	Acceleration time constant data EEP-ROM command of point table Writes the acceleration time constants of point table No.1 to 255 to EEP-ROM. Written to EEP-ROM, these values are held if power is switched off. The decimal value converted from the 2 lower digits of the code No. corresponds to the point table No.	Convert the values into hexadecimal before setting.
8F01h to 8FFFh	Deceleration time constant data EEP-ROM command of point table Writes the deceleration time constants of point table No.1 to 255 to EEP-ROM. Written to EEP-ROM, these values are held if power is switched off. The decimal value converted from the 2 lower digits of the code No. corresponds to the point table No.	Convert the values into hexadecimal before setting.
9001h to 90FFh	Dwell data EEP-ROM command of point table Writes the dwell data of point table No.1 to 255 to EEP-ROM. Written to EEP-ROM, these values are held if power is switched off. The decimal value converted from the 2 lower digits of the code No. corresponds to the point table No.	Convert the values into hexadecimal before setting.
9101h to 91FFh	Auxiliary function data EEP-ROM command of point table Writes the auxiliary function data of point table No.1 to 255 to EEP-ROM. Written to EEP-ROM, these values are held if power is switched off. The decimal value converted from the 2 lower digits of the code No. corresponds to the point table No.	Convert the values into hexadecimal before setting.

3.5.5 Respond codes (RWrn+2)

If any of the monitor codes, instruction codes, position command data/point table Nos., speed command data/point table Nos. set to the remote register is outside the setting range, the corresponding error code is set to respond code (RWwn+2). "0000" is set if they are normal.



Code No.	Error	Details
0	Normal answer	Instruction was completed normally.
1	Code error	▪ The monitor code not in the specifications was set. ▪ Read/write of the point table of No.255 or later was set.
2	Parameter ▪ point table selection error	▪ The parameter No. disabled for reference was set.
3	Write range error	▪ An attempt was made to write the parameter or point table data outside the setting range.

3.5.6 Setting the CN6 external input signals

Using parameter No.PD06 to PD08, PD12 and PD14, you can assign the input devices as the CN6 external input signals. The signals assigned as the CN6 external input devices cannot be used in CC-Link. Refer to section 4.5.1 for the pins to which signals can be assigned.

In the initial status, the forward rotation stroke end, reverse rotation stroke end and proximity dog are preset to be usable as the CN6 external input signals.

Parameter No.PD12

Device name	Initial value BIN	Initial value HEX
	0	0
	0	
Servo-on (SON)	0	
Reset (RES)	0	

Device name	Initial value BIN	Initial value HEX
Proportion control (PC)	0	0
	0	
Clear (CR)	0	
Forward rotation start (ST1)	0	

Device name	Initial value BIN	Initial value HEX
Reverse rotation start (ST2)	0	C
Internal torque limit selection (TL1)	0	
Forward rotation stroke end (LSP)	1	
Reverse rotation stroke end (LSN)	1	

Device name	Initial value BIN	Initial value HEX
	0	0
Gain changing (CDP)	0	
	0	
	0	

BIN 0: Used in CC-Link
BIN 1: Used as CN6 external input signal

Parameter No.PD14

0 □ □ □

Device name	Initial value BIN	Initial value HEX
Automatic/manual selection (MD0)	0	0
	0	
	0	
	0	

Device name	Initial value BIN	Initial value HEX
	0	0
	0	
	0	
Temporary stop/Restart (TSTP)	0	

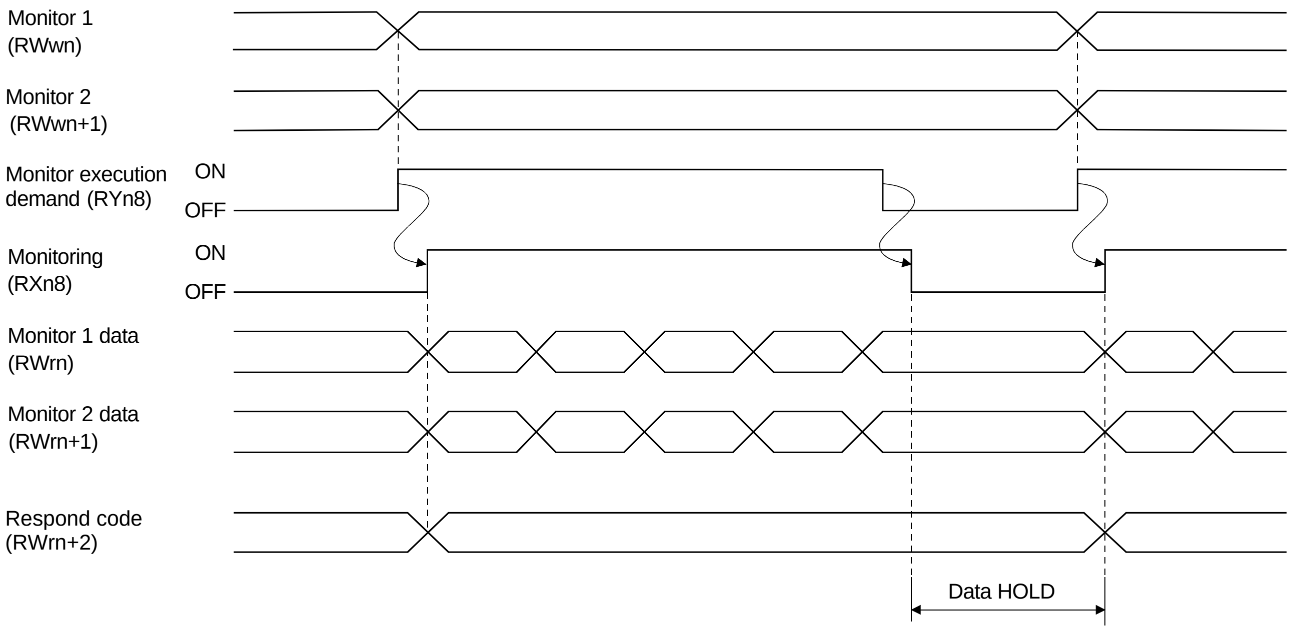
Device name	Initial value BIN	Initial value HEX
	0	8
	0	
	0	
Proximity dog (DOG)	1	

BIN 0: Used in CC-Link
BIN 1: Used as CN6 external input signal

3.6 Data communication timing charts

3.6.1 Monitor codes

(1) When 1 station is occupied

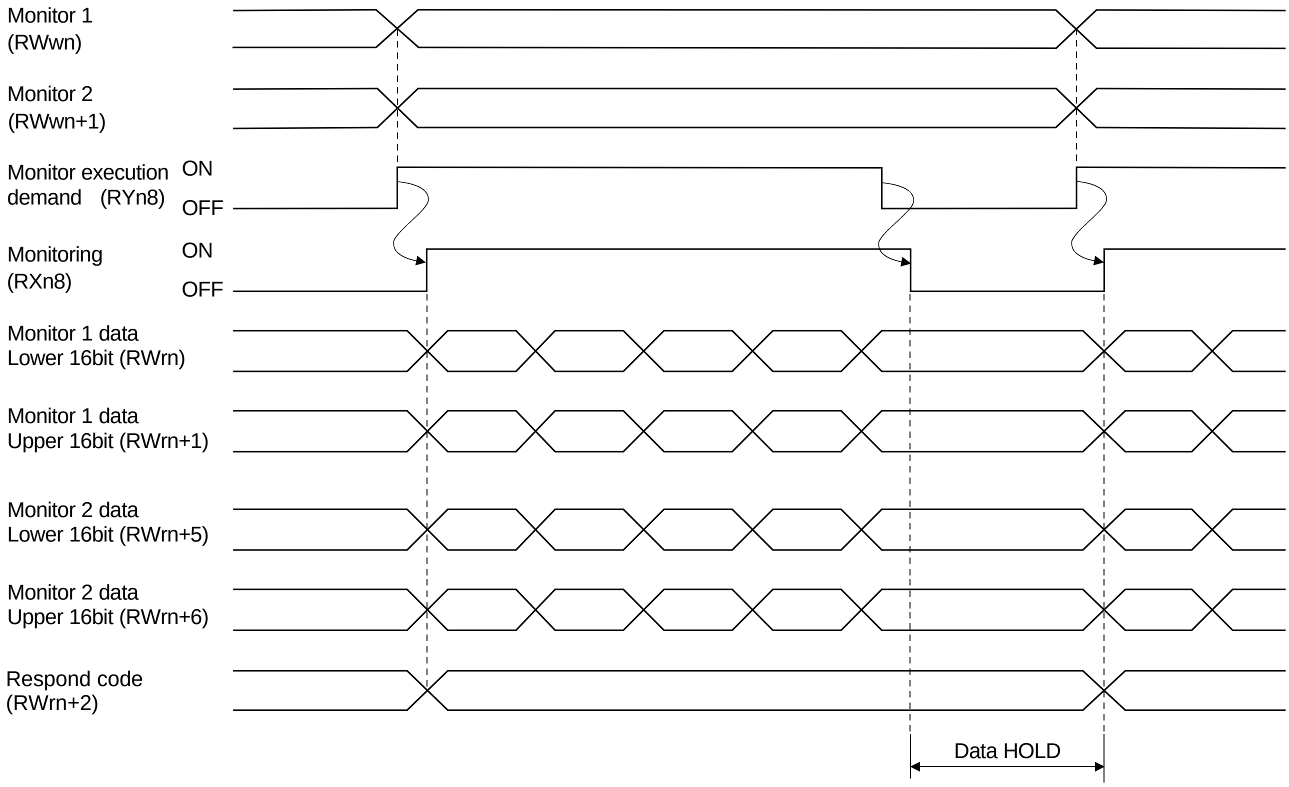


Set the monitor codes (refer to section 3.5.3) to Monitor 1 (RWwn) and Monitor 2 (RWwn+1) and turn Monitor output execution demand (RYn8) to ON. Turning Monitor execution demand (RYn8) to ON sets the next data. Data are all hexadecimal numbers. At this time, Monitoring (RXn8) turns to ON at the same time.

Monitor data 1 (RWrn): Data demanded by Monitor 1 (RWwn)
Monitor data 2 (RWrn+1): Data demanded by Monitor 2 (RWwn+1)

For 32-bit data, set the lower 16 bits of the monitor code to Monitor 1 (RWwn) and the upper 16 bits to Monitor 2 (RWwn+1) and read them simultaneously.
The monitor data set to the remote register are always updated while Monitor execution demand (RYn8) is ON. When Monitoring (RXn8) turns to OFF, the data set to Monitor data RWrn, RWrn+1 are held. If the monitor code not in the specifications is set to either Monitor 1 (RWwn) or Monitor 2 (RWwn+1), the corresponding error code (□□□1) is set to respond code.

(2) When 2 stations are occupied



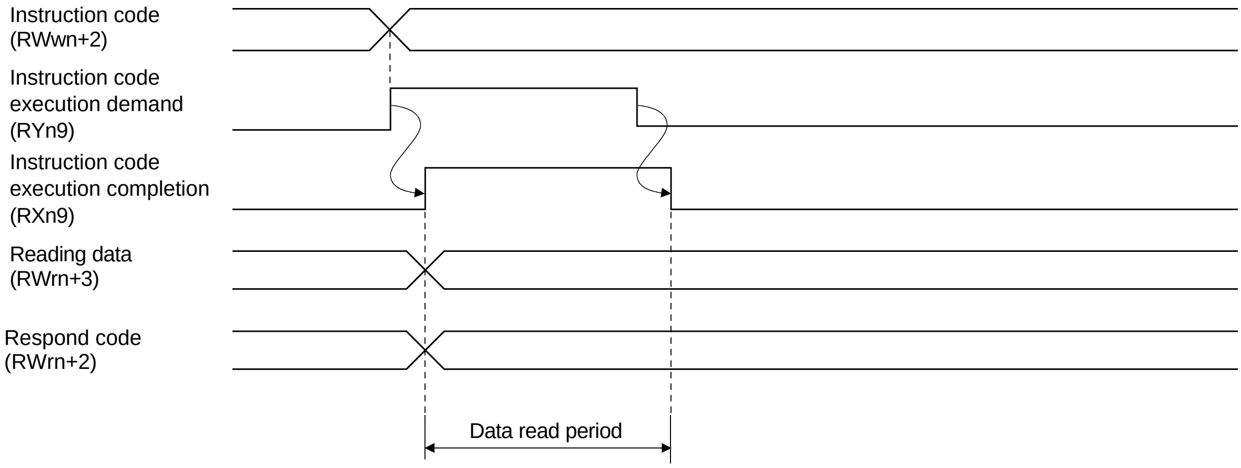
Set the monitor codes (refer to section 3.5.3) to Monitor 1 (RWwn) and Monitor 2 (RWwn+1) and turn Monitor output execution demand (RYn8) to ON. Turning Monitor execution demand (RYn8) to ON sets the next data. 32-bit data are all divided into the upper 16 bits and lower 16 bits, and set to the remote register. Data are all hexadecimal numbers. At this time, Monitoring (RXn8) turns to ON at the same time.

Monitor data 1 lower 16 bit (RWrn): Lower 16 bits of data demanded by Monitor 1 (RWwn)
Monitor data 1 upper 16 bit (RWrn+1): Upper 16 bits of data demanded by Monitor 1 (RWwn)
Monitor data 2 lower 16 bit (RWrn+5): Lower 16 bits of data demanded by Monitor 2 (RWwn+1)
Monitor data 2 upper 16 bit (RWrn+6): Upper 16 bits of data demanded by Monitor 2 (RWwn+1)

A sign is set if data does not exist in RWrn+1 ･ RWrn+6. A "+" sign is indicated by "0000", and "－" by "FFFF".
The monitor data set to the remote register are always updated while Monitoring (RXn8) is ON.
When Monitoring (RXn8) turns to OFF, the data set to Monitor data RWrn, RWrn+1, RWrn+5, RWrn+6 are held.
If the monitor code not in the specifications is set to either Monitor 1 (RWwn) or Monitor 2 (RWwn+1), the corresponding error code (□□□1) is set to respond code.

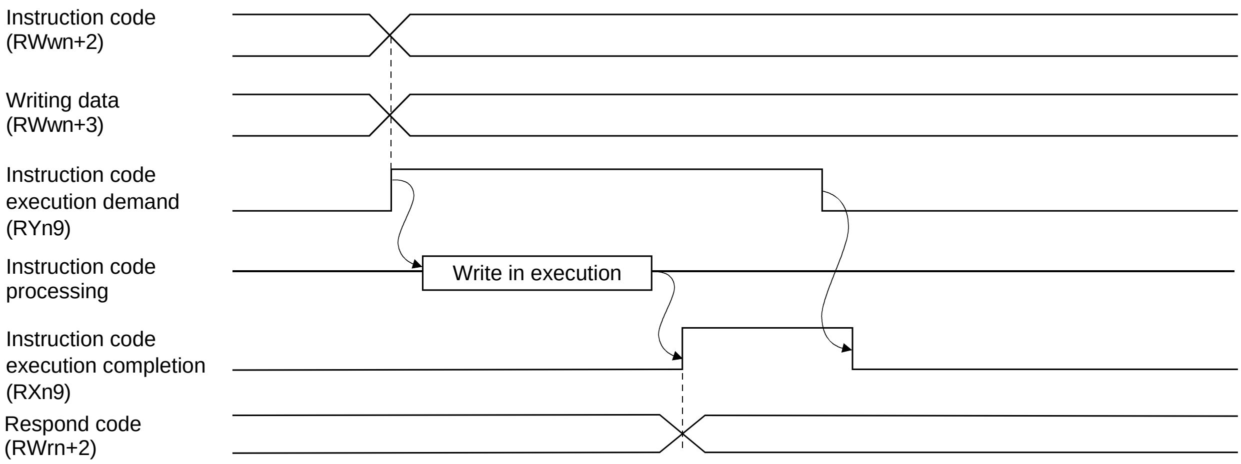
3.6.2 Instruction codes

(1) Read instruction codes (0000h to 0A1Fh)



Set the read instruction code (refer to section 3.5.4 (1)) to Instruction code (RWwn+2) and turn Instruction code execution demand (RYn9) to ON. Turning Instruction code execution demand (RYn9) to ON sets the data corresponding to the preset read code to Reading data (RWrn+3). Data are all hexadecimal numbers. At this time, Instruction code execution completion (RXn9) turns to ON at the same time.
Read the read data set to Reading data (RWrn+3) while Instruction code execution completion (RXn9) is ON. The data set to Reading data (RWrn+3) is held until the next read instruction code is set and Instruction code execution demand (RYn9) is turned to ON.
If the instruction code not in the specifications is set to Instruction code (RWwn+2), the corresponding error code (□□1□) is set to respond code. If any unusable parameter, point table is read, the corresponding error code (□□2□) is set.
Turn Instruction code execution demand (RYn9) to OFF after completion of data read.

(2) Write instruction codes (8000h to 911Fh)



Set the write instruction code (refer to section 3.5.4 (2)) to Instruction code (RWwn+2) and the data to be written (data to be executed) to Writing data (RWwn+3) in hexadecimal, and turn Instruction code execution demand (RYn9) to ON.

Turning instruction code execution completion to ON sets the data set in Wiring data (RWwn+3) to the item corresponding to the write instruction code. When write is executed, Instruction code execution completion (RXn9) turns to ON.

If the instruction code not in the specifications is set to Instruction code (RWwn+2), the corresponding error code (□□1□) is set to respond code.

Turn Instruction code execution demand (RYn9) to OFF after Instruction code execution completion (RXn9) has turned to ON.

3.6.3 Remote register-based position/speed setting

The functions in this section are usable when Position/speed specifying system selection (RY(n+2)A) is ON (remote register-based position/speed specifying system is selected) with 2 stations occupied.

The position command/speed command necessary for positioning can be selected by parameter No.PC30 setting as indicated below.

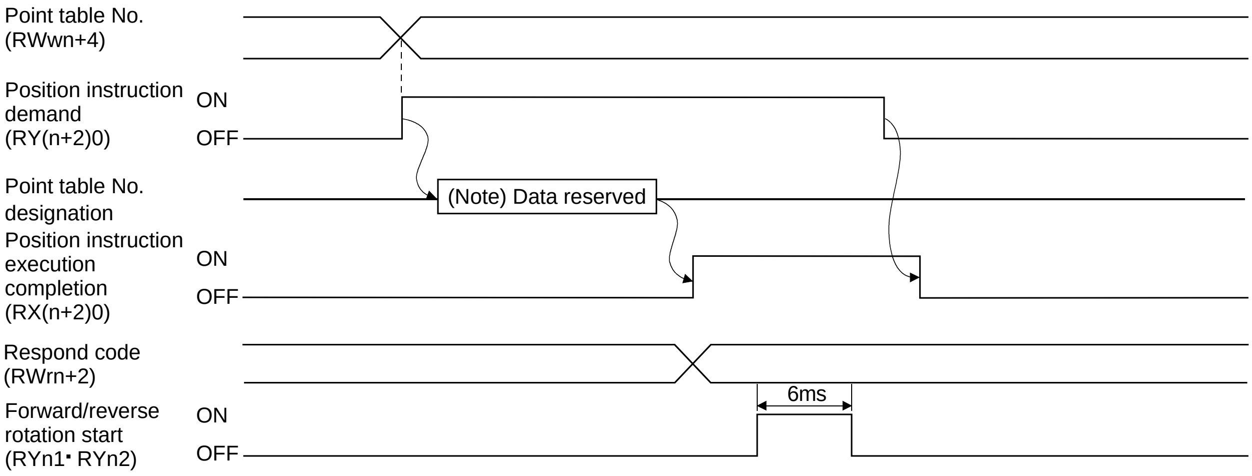
Parameter No.PC30

Set value	Position command	Speed command
0	Specify the point table No.	
1	Set the position data.	Specify the point table No.
2		Set the servo motor speed.

(1) When setting the point table No.

Specify the point table No. stored in the driver and execute positioning.

Preset "□□□0" (initial value) in parameter No.PC30 to enable point table No.-setting operation.



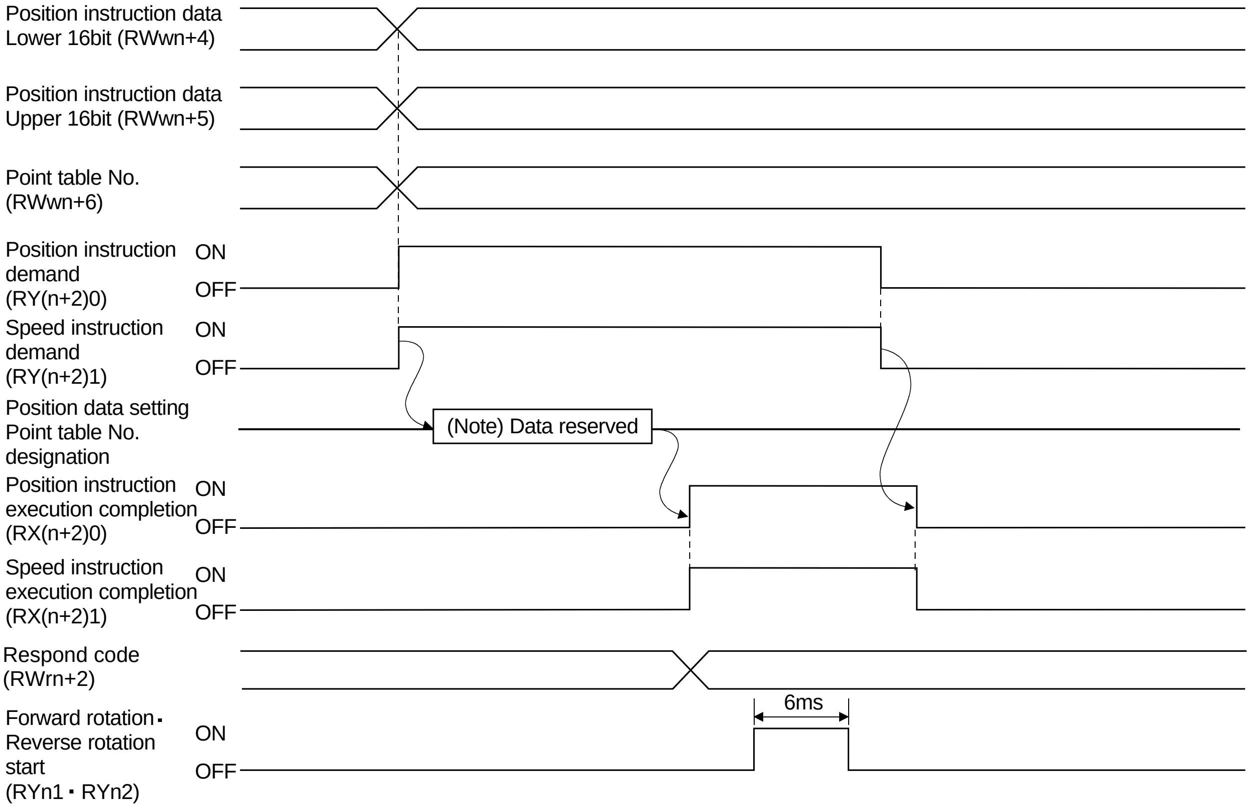
Note. This data is stored into RAM of the driver. Hence, the data is cleared when power is switched off.

Set the point table No. to point table No. (RWwn+4) and turn Position instruction demand (RY(n+2)0) to ON.
Turning RY(n+2)0 to ON stores the position block No. into RAM of the driver.
When the data is stored, Position instruction execution completion (RX(n+2)0) turns to ON.
If data outside the setting range is set to Position block No. (RWwn+4), the error code (refer to section 3.5.5) is set to respond code.
Turn Forward rotation start (RYn1)/Reverse rotation start (RYn2) to ON after Position instruction execution completion (RX(n+2)0) has turned to ON.

(2) When setting the position command data/point table No. (speed command)

Specify the position address with the remote register, and specify the speed command data by specifying the point table No. to use the preset servo motor speed, acceleration time constant and deceleration time constant the speed command data, and execute positioning.

Preset "□□□1" in parameter No.PC30 to enable position command data-set and point table No. (speed instruction)-setting operation.



Note. This data is stored into RAM of the driver. Hence, the data is cleared when power is switched off.

Set the lower 16 bits of the position instruction data to Position instruction data lower 16 bit (RWwn+4), the upper 16 bits of the position instruction data to Position instruction data upper 16 bit (RWwn+5), and point table for speed command No. to point table No. (RWwn+6), and turn Position instruction demand (RY(n+2)0) and Speed instruction demand (RY(n+2)1) to ON.

Turning RY(n+2)0 and RY(n+2)1 to ON stores the position command data and point table No. into RAM of the driver.

When the data are stored, Position instruction execution completion (RX(n+2)0) and Speed instruction execution completion (RX(n+2)1) turn to ON.

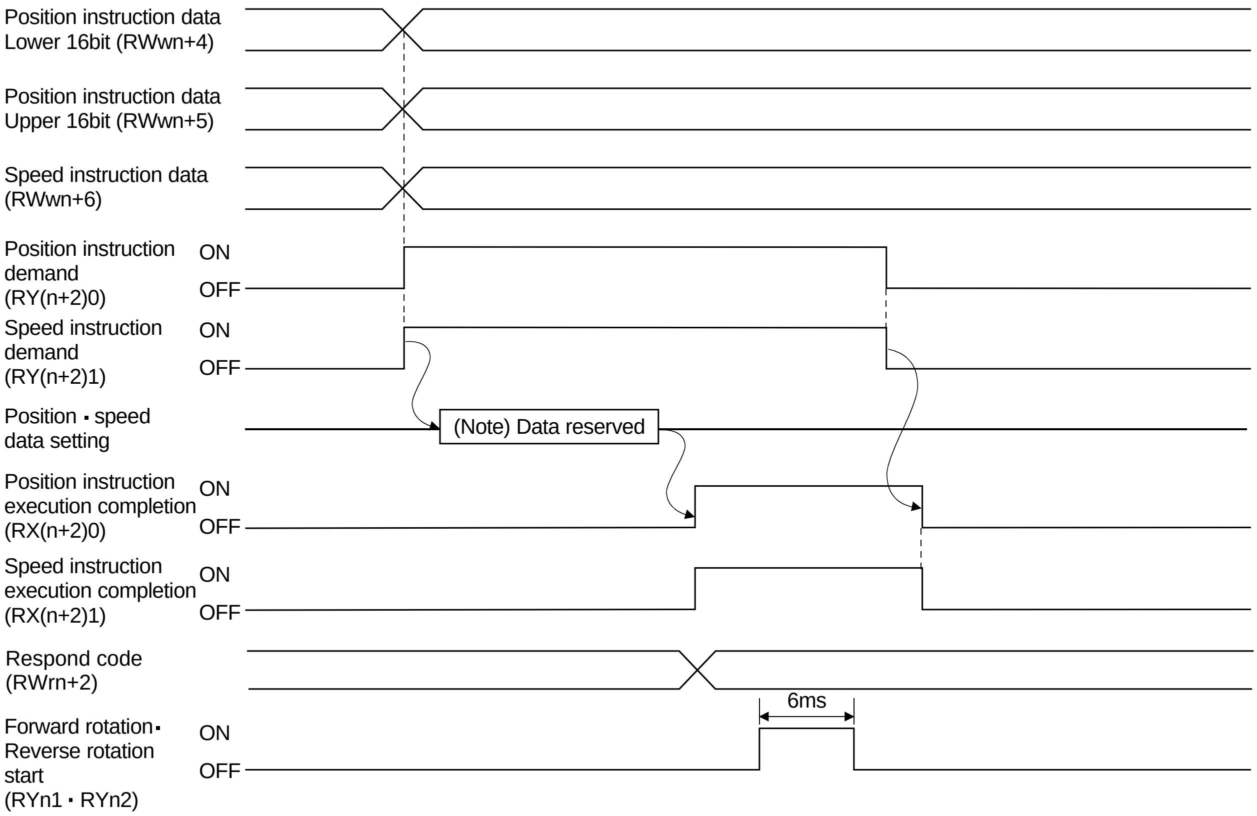
If data outside the setting range is set to any of Position instruction data lower 16 bit (RWwn+4), Position instruction data upper 16 bit (RWwn+5) and point table No. (RWwn+6), the error code (refer to section 3.5.5) is set to respond code.

Turn Forward rotation start (RYn1) ・Reverse rotation start (RYn2) to ON after Position instruction execution completion (RX(n+2)0) and Speed instruction execution completion (RX(n+2)1) have turned to ON.

(3) When setting the position command data and speed command data

Specify the position address and servo motor speed with the remote register, and execute positioning. At this time, use the acceleration time constant and deceleration time constant set in point table No.1.

Preset "□□□2" in parameter No.PC30 to enable position command data- and speed command data-set operation.



Note. This data is stored into RAM of the driver. Hence, the data is cleared when power is switched off.

Set the lower 16 bits of the position instruction data to Position instruction data lower 16 bit (RWwn+4), the upper 16 bits of the position instruction data to Position instruction data upper 16 bit (RWwn+5), and speed instruction data to Speed instruction data (RWwn+6), and turn Position instruction demand (RY(n+2)0) and Speed instruction demand (RY(n+2)1) to ON.

Turning RY(n+2)0 and RY(n+2)1 to ON stores the position command data and speed command data into RAM of the driver.

When the data are stored, Position instruction execution completion (RX(n+2)0) and Speed instruction execution completion (RX(n+2)1) turn to ON.

If data outside the setting range is set to any of Position instruction data lower 16 bit (RWwn+4), Position instruction data upper 16 bit (RWwn+5) and Speed command data (RWwn+6), the error code (refer to section 3.5.5) is set to respond code.

Turn Forward rotation start (RYn1) ▪ Reverse rotation start (RYn2) to ON after Position instruction execution completion (RX(n+2)0) and Speed instruction execution completion (RX(n+2)1) have turned to ON.

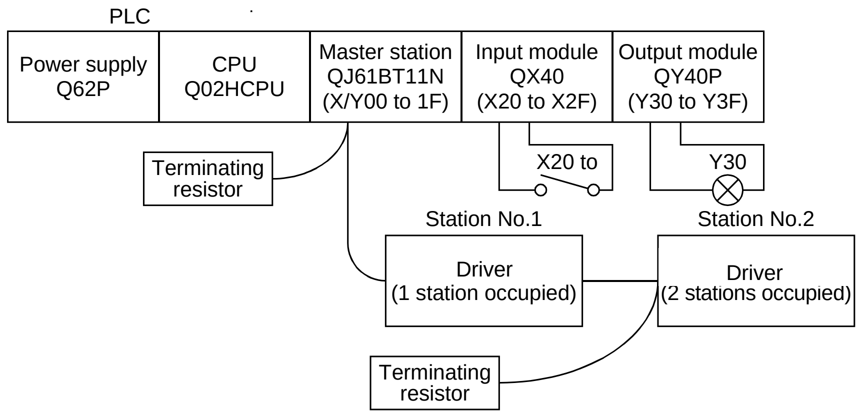
3.7 Function-by-function programming examples

This section explains specific programming examples for servo operation, monitor, parameter read and write, and others on the basis of the equipment makeup shown in section 3.7.1.

3.7.1 System configuration example

As shown below, the CC-Link system master・local unit is loaded to run two drivers (1 station occupied / 2 stations occupied).

(1) System configuration



(2) Master station network parameter setting

In the programming examples, network parameters are set as below.

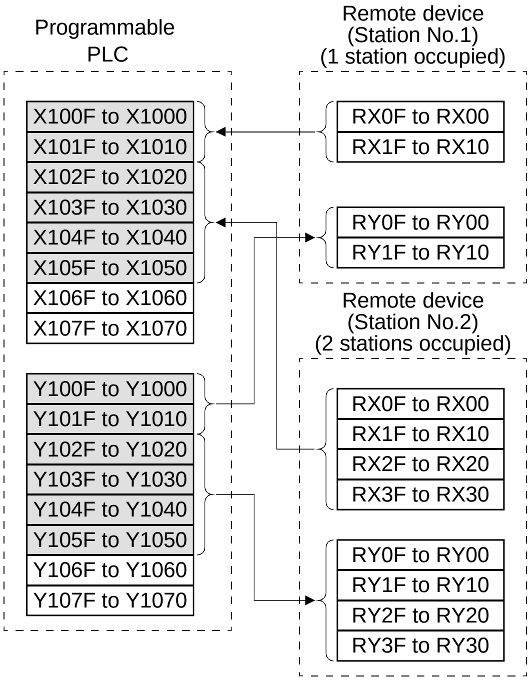
<table>
<tr><th colspan="2">Item</th><th>Setting condition</th></tr>
<tr><td colspan="2">Start I/O No.</td><td>0000</td></tr>
<tr><td rowspan="2">Operational setting</td><td>Data link disorder station settings</td><td>Clear
(No check on "Hold input data")</td></tr>
<tr><td>Case of CPU STOP setting</td><td>Refresh</td></tr>
<tr><td colspan="2">Type</td><td>Master station</td></tr>
<tr><td colspan="2">Mode</td><td>Remote net
(Ver.1 mode)</td></tr>
<tr><td colspan="2">All connect count</td><td>2</td></tr>
<tr><td colspan="2">Remote input (RX)
Refresh device</td><td>X1000</td></tr>
<tr><td colspan="2">Remote output (RY)
Refresh device</td><td>Y1000</td></tr>
</table>

Item	Setting condition
Remote register (RWr) Refresh device	W0
Remote register (RWw) Refresh device	W100
Special relay (SB) Refresh device	SB0
Special relay (SW) Refresh device	SW0
Retry count	3
Automatic reconnection station count	1
CPU down select	Stop
Scan mode setting	Asynchronous

(3) Relationship of remote I/O (RX, RY)

The following shows a relationship between the devices of the programmable PLC CPU and the remote I/Os (RX, RY) of the remote device stations.

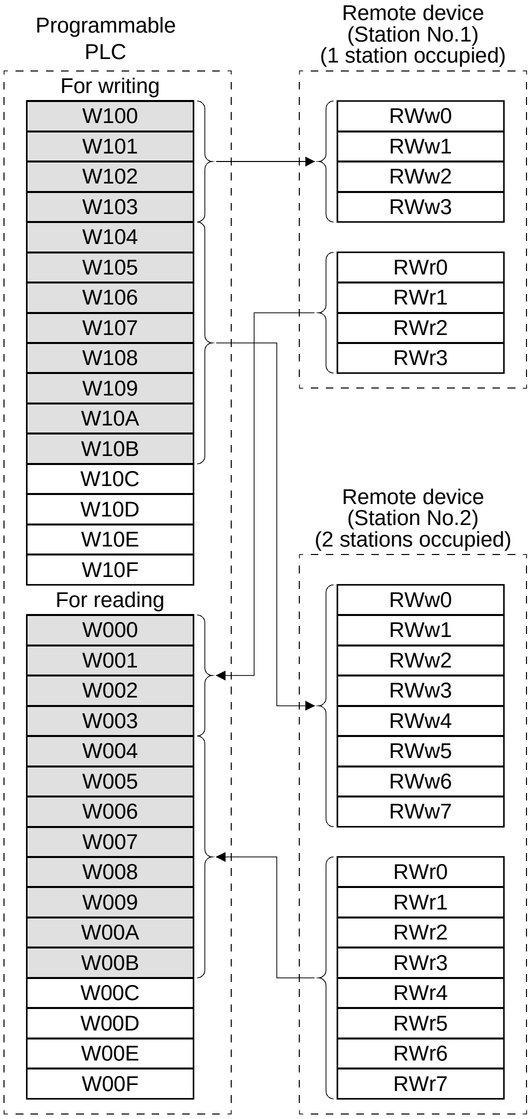
Shaded area shows the devices actually used.



(4) Relationship of remote register (RWw, RWr)

The following shows a relationship between the devices of the programmable driver CPU and the remote registers (RWw, RWr) of the remote device stations.

Shaded area shows the devices actually used.



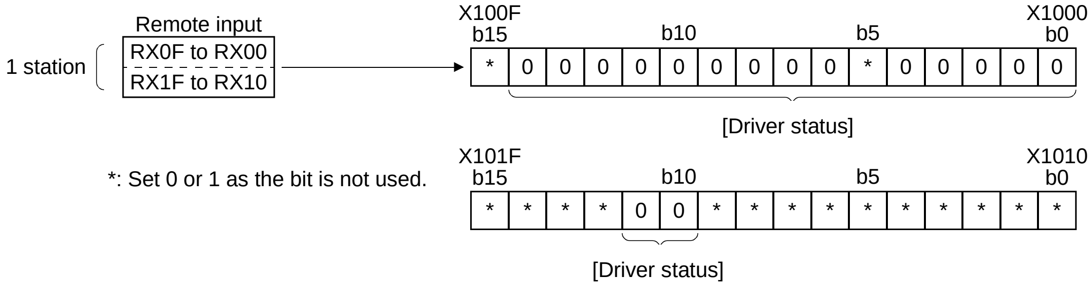
3.7.2 Reading the driver status

When the driver on station number 1 becomes ready for the remote station communication, Y30 of the output module turns on.

The program is for turning on Y30 when CC-Link communication is normal.

Checks data link status of station No.1.

Turns on output module (Y30).

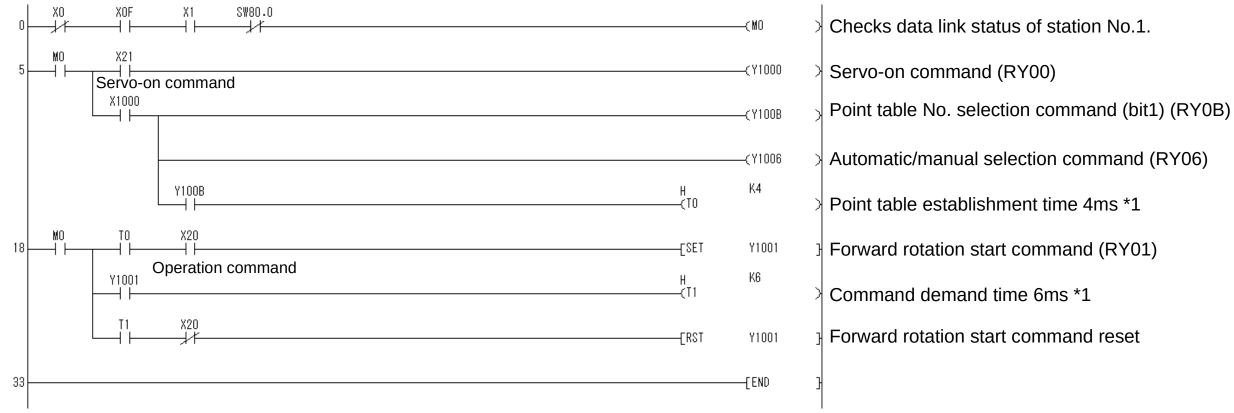


Driver status (1 station occupied)			
X1000: Ready (RD)	X1008: Monitoring (MOF)	X1010: ———	X1018: ———
X1001: In position (INP)	X1009: Instruction code execution completion (COF)	X1011: ———	X1019: ———
X1002: Rough match (CPO)	X100A: Warning (WNG)	X1012: ———	X101A: Trouble (ALM)
X1003: Home position return completion (ZP)	X100B: Battery warning (BWNG)	X1013: ———	X101B: Remote station communication ready (CRD)
X1004: Limiting torque (TLC)	X100C: Movement completion (MEND)	X1014: ———	X101C: ———
X1005: ———	X100D: Dynamic brake interlock (DB)	X1015: ———	X101D: ———
X1006: Electromagnetic brake interlock (MBR)	X100E: Position range (POT)	X1016: ———	X101E: ———
X1007: Temporary stop (PUS)	X100F: ———	X1017: ———	X101F: ———

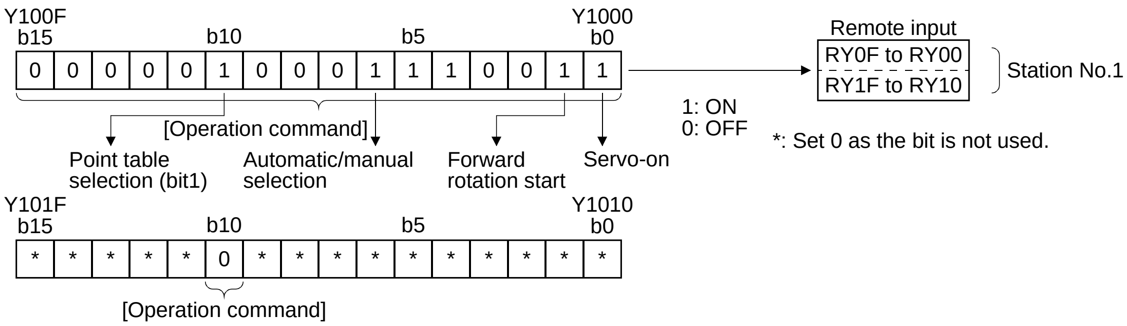
3.7.3 Writing the operation commands

Perform positioning operation of point table No.2 for the driver of station 2.

Start the operation by turning on X20.



*1: This is when the high-speed timer limit is set to 1ms.
Setting time for the timer should be larger than the command processing time or twice the link scan time whichever larger. When the setting time is short, the command cannot be received properly.



Operation commands
(1 station occupied)
Y1000: Servo-on (SON)
Y1001: Forward rotation start (ST1)
Y1002: Reverse rotation start (ST2)
Y1003: Proximity dog (DOG)
Y1004: Forward rotation stroke end (LSP)
Y1005: Reverse rotation stroke end (LSN)
Y1006: Automatic/manual selection (MDO)
Y1007: Temporary stop/Restart (TSTP)
Y1008: Monitor output execution demand (MOR)
Y1009: Instruction code execution demand (COR)
Y100A: Point table No. selection 1 (DI0)
Y100B: Point table No. selection 2 (DI1)
Y100C: Point table No. selection 3 (DI2)
Y100D: Point table No. selection 4 (DI3)
Y100E: Point table No. selection 5 (DI4)
Y100F: Clear (CR)
Y1010: ―――
Y1011: ―――
Y1012: ―――
Y1013: ―――
Y1014: ―――
Y1015: ―――
Y1016: ―――
Y1017: ―――
Y1018: ―――
Y1019: ―――
Y101A: Reset (RES)
Y101B: ―――
Y101C: ―――
Y101D: ―――
Y101E: ―――
Y101F: ―――

3.7.4 Reading the data

Read various data of the driver.

(1) Reading the monitor value

Read the (feedback pulse value) of the driver of station 2 to D1.

Data No.	Description
H000A	Cumulative feedback pulse data (hexadecimal)

Read the cumulative feedback pulse monitor by turning on X20.

Checks data link status of station No.2.

Sets monitor code (H000A) of feedback pulse in RWw4.

Turns on Monitor output execution demand (RY28).

Reads feedback pulse (RWr4, RWr5) to D10 and D11 when monitoring (RX28) turns on.

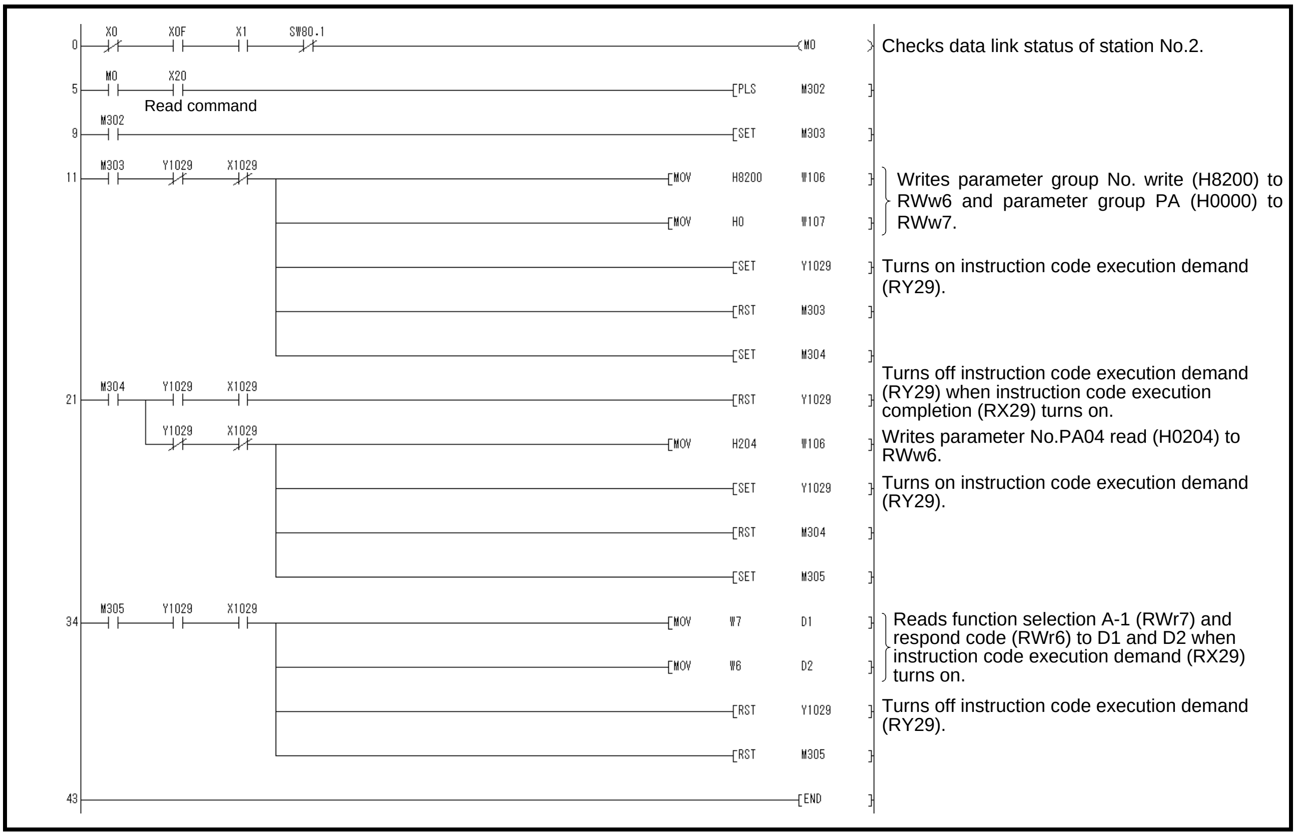
(2) Reading the parameter

Read parameter No.PA04 "Function selection A-1" of the driver of station 2 to D1.

Data No.	Description
H8200	Parameter group selection
H2024	Parameter No.PA04 setting (hexadecimal)

Read the parameter No.PA04 by turning on X20.

The respond code at instruction code execution is set to D2.



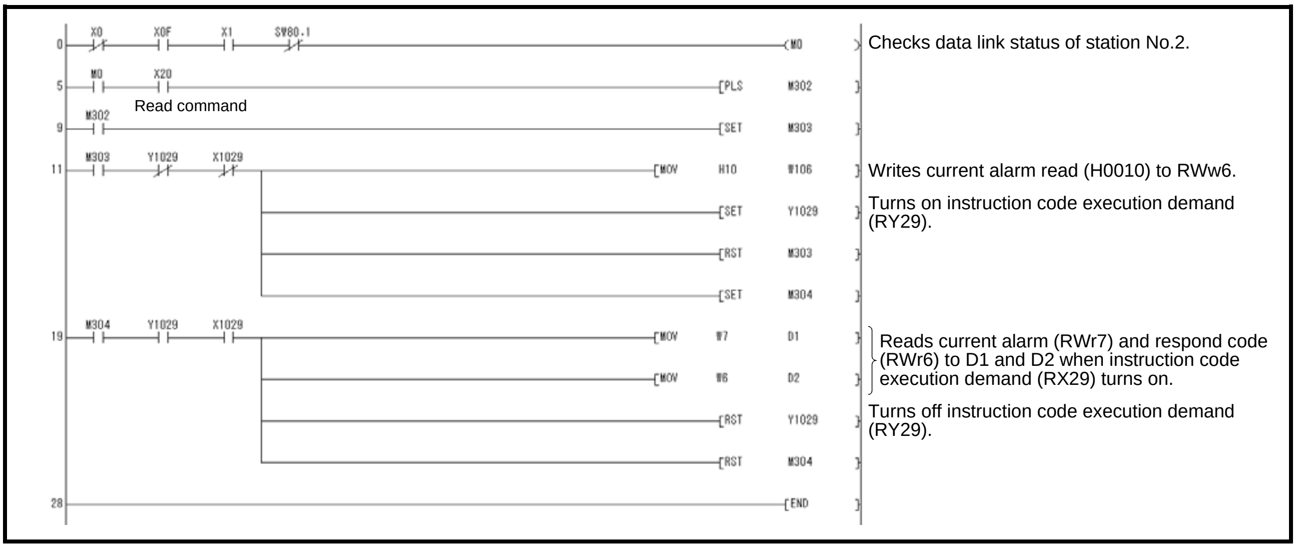
(3) Reading the alarm definition

Read the alarm definition of the driver of station 2 to D1.

Data No.	Description
H0010	Occurring alarm/warning No. (hexadecimal)

Read current alarms by turning on X20.

The respond code at instruction code execution is set to D2.



3.7.5 Writing the data

This section explains the programs for writing various data to the driver.

(1) Writing the servo motor speed data of point table

Change the servo motor speed data in the point table No.1 of the driver of station 2 to "100".

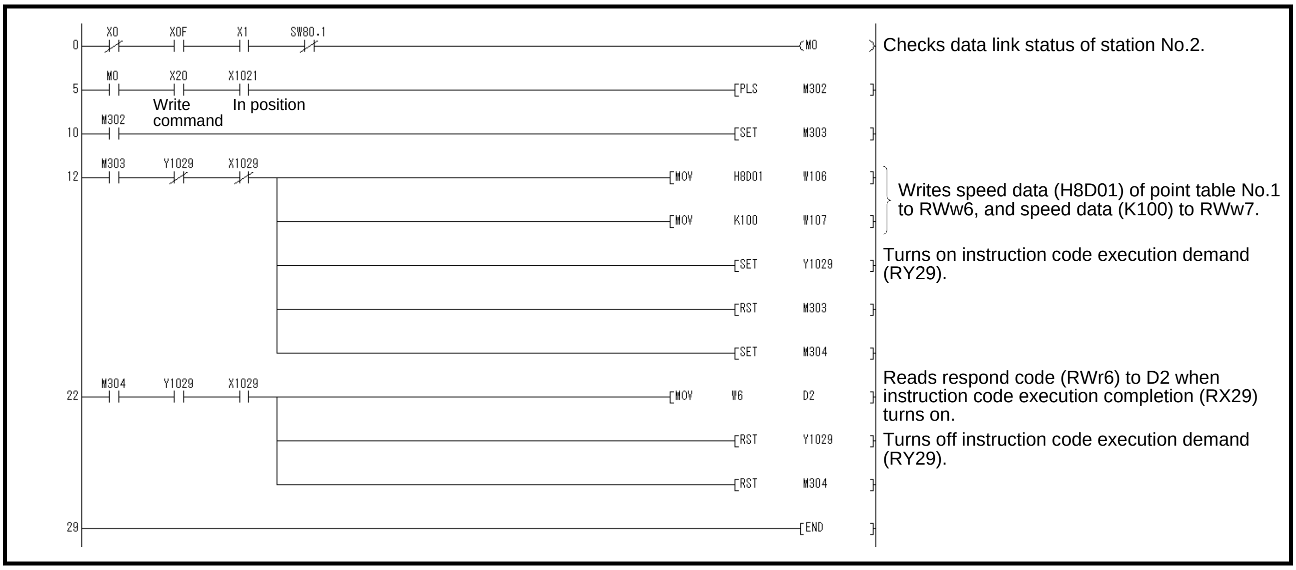
The following shows a program example for writing data to the driver when two stations are occupied. Writing is disabled for the driver when one station is occupied.

Code No.	Description
H8D01	Write of servo motor speed data of point table No.1 (hexadecimal)

Set data	Description
K100	Servo motor speed data of point table No.1 (decimal)

Write the data to the servo motor speed data of point table No.1 by turning on X20.

The respond code at instruction code execution is set to D2.



(2) Writing the parameter

The following shows a program example when two stations are occupied.

Change parameter No.PC12 (JOG speed) of the driver of station 2 to "100".

The parameter group PC is specified as follows.

Code No.	Description
8200h	Parameter group selection

Set data	Description
H0002	Set data (hexadecimal)

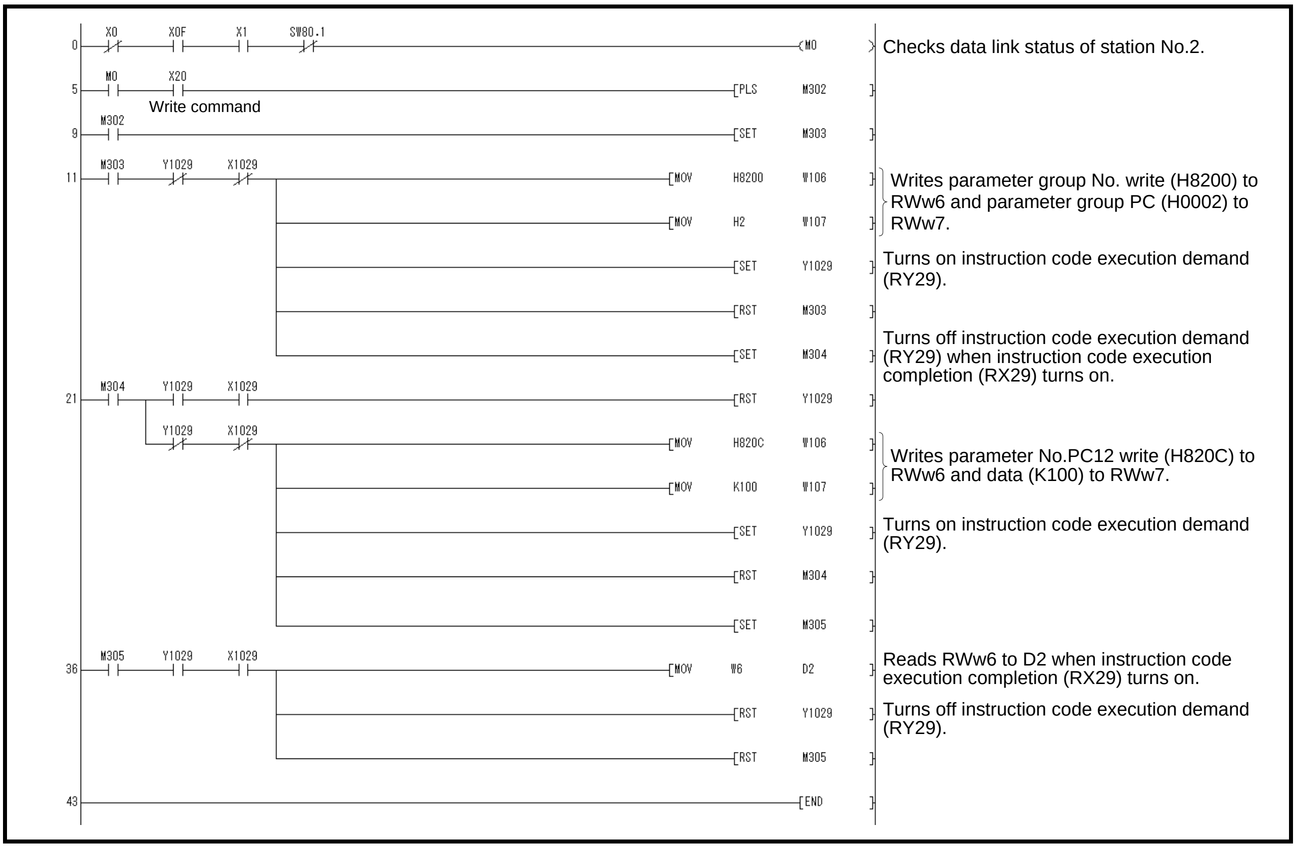
The parameter No.12 is changed to "100" as follows.

Code No.	Description
H820C	Parameter No.PC12 write (hexadecimal)

Set data	Description
K100	Set data (decimal)

Write the data to the parameter No.PC12 by turning on X20.

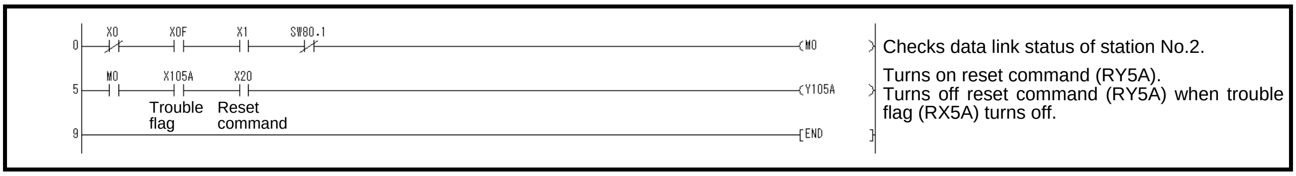
The respond code at instruction code execution is set to D2.



(3) Driver alarm resetting program examples

(a) Deactivate the alarm of the driver of station 2 by issuing a command from the programmable PLC.

Reset the driver on the occurrence of a servo alarm by turning on X20.



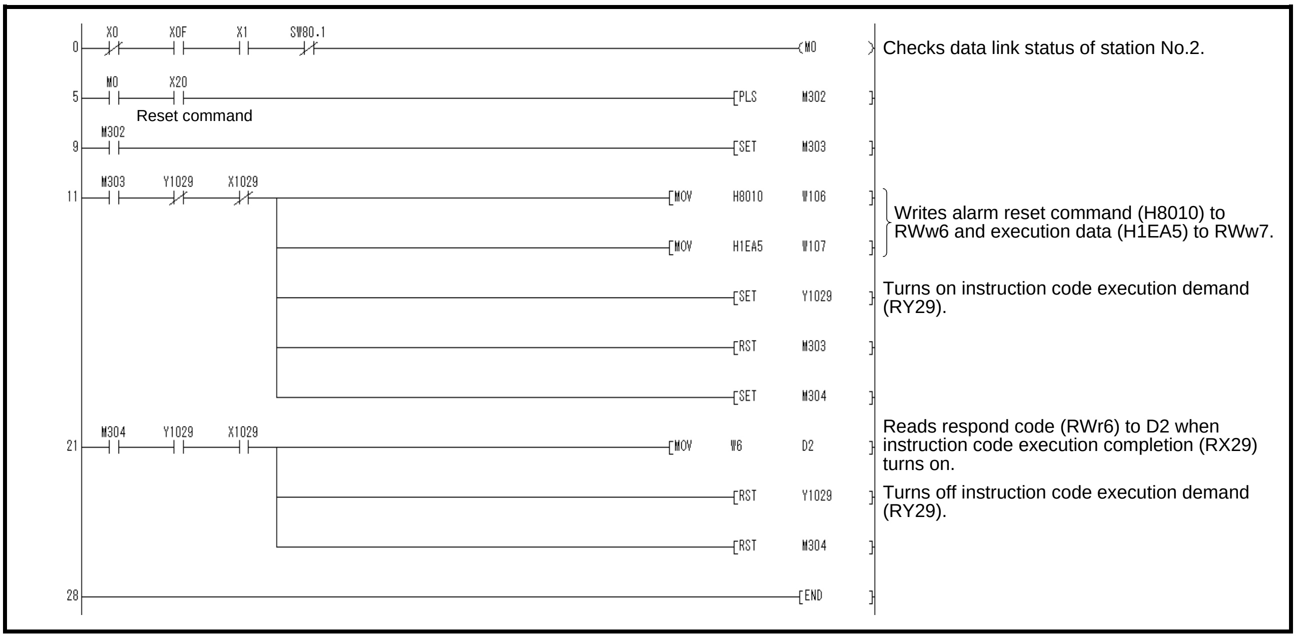
(b) Deactivate the alarm of the driver of station 2 using the instruction code.

Code No.	Description
H8010	Alarm reset command (hexadecimal)

Set data	Description
H1EA5	Execution data (hexadecimal)

Reset the driver by turning on X20.

The respond code at instruction code execution is set to D2.



3.7.6 Operation

This section explains the operation programs of the driver.

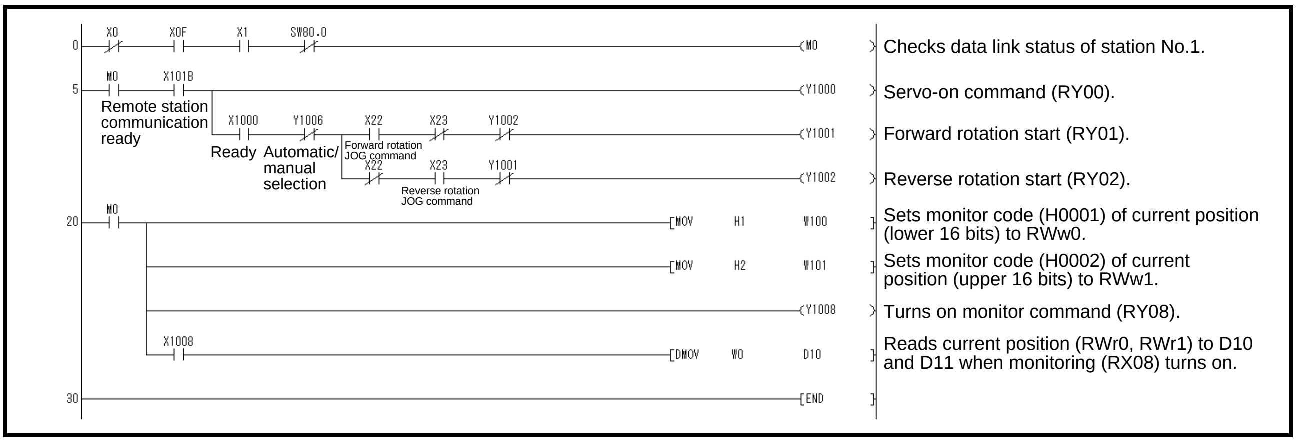
(1) JOG operation

Perform JOG operation of the driver of station 1 and read the "current position" data.

Code No.	Description
H0001	Lower 16-bit data of current position (hexadecimal)
H0002	Upper 16-bit data of current position (hexadecimal)

Start the forward rotation JOG operation by turning on X22.

Start the reverse rotation JOG operation by turning on X23.



(2) Remote register-based position data/speed data setting

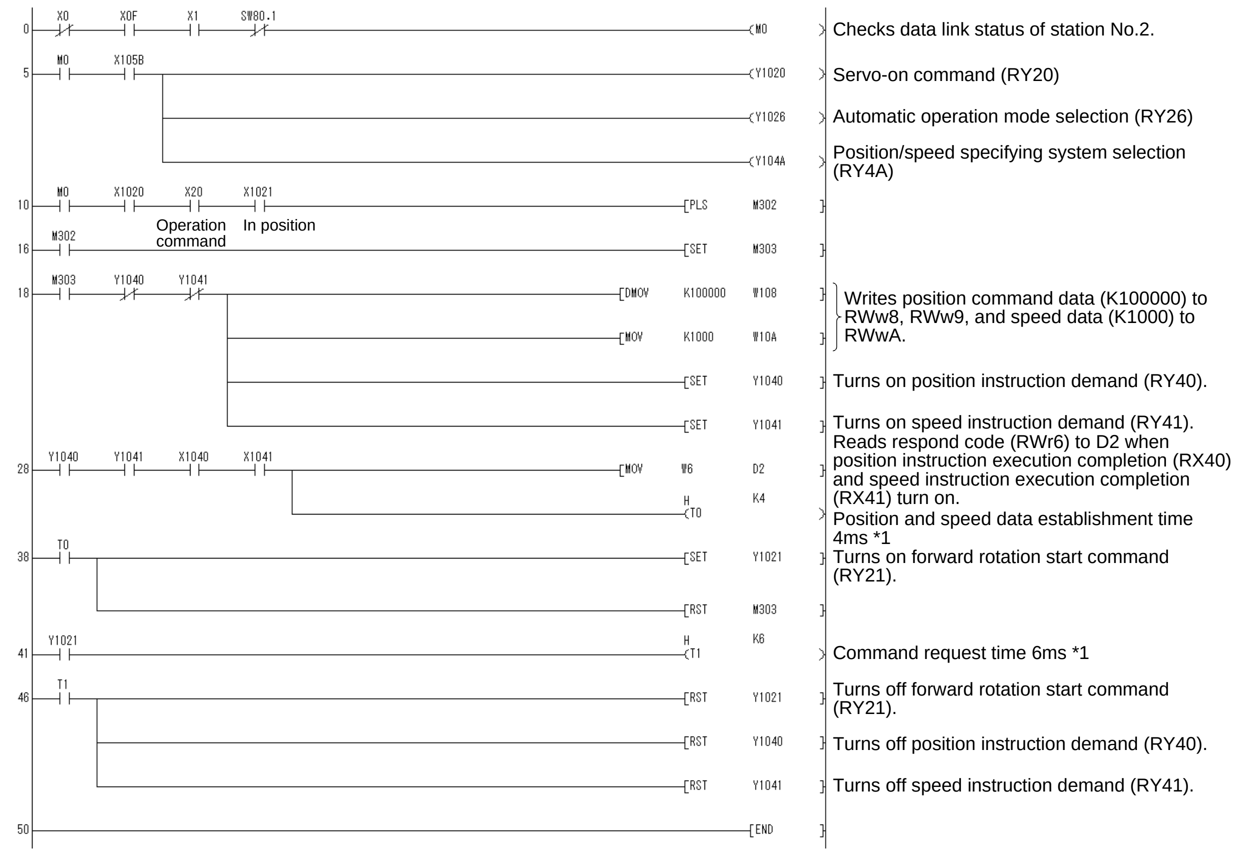
The following program example is only applicable when two stations are occupied.

Operate the driver of station 2 after specifying the position data as "100000" and the speed data as "1000" in the direct specification mode.

Preset "□□□2" in parameter No.PC30.

Set data	Description
K100000	Position command data (decimal)
K1000	Speed command data (decimal)

Execute positioning operation with position and speed settings specified in the remote register by turning on X20.

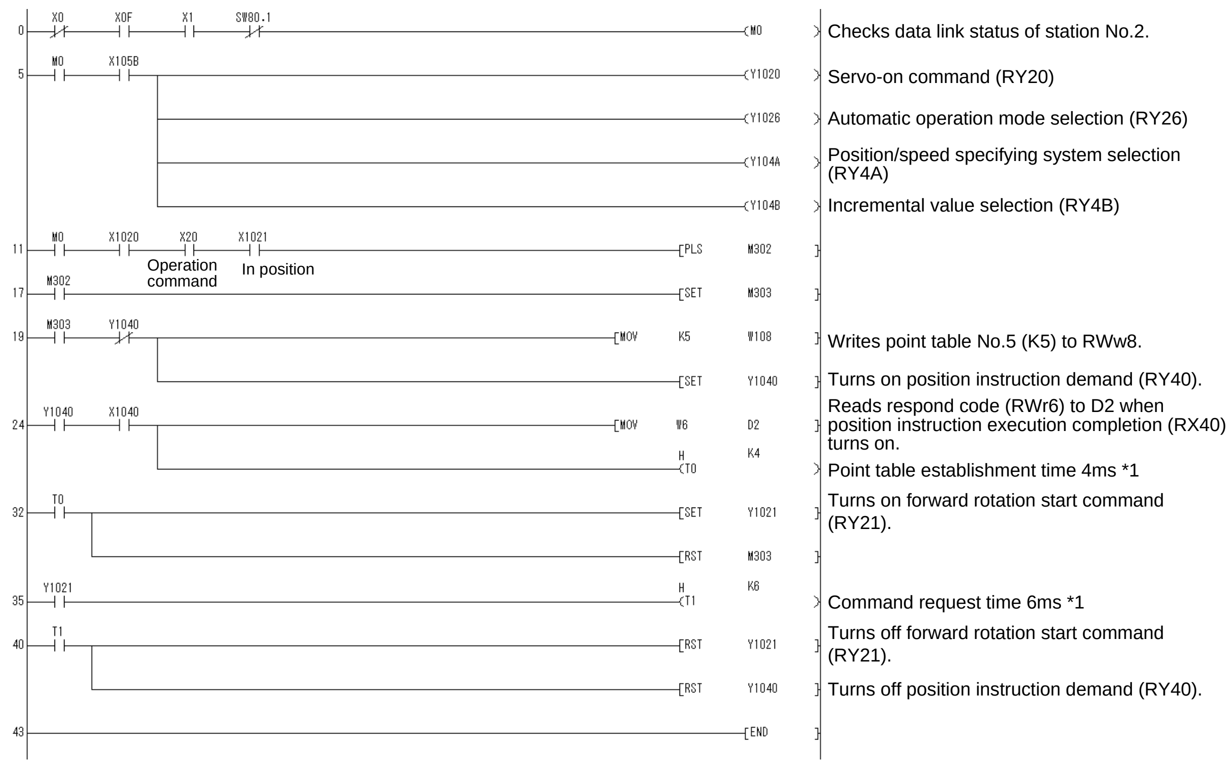


*1: This is when the high-speed timer limit is set to 1ms.
Setting time for the timer should be larger than the command processing time or twice the link scan time whichever larger. When the setting time is short, the command cannot be received properly.

(3) Remote register-based point table No. setting (incremental value command system)
The following program example is only applicable when two stations are occupied.
Operate the driver of station 2 with incremental values after specifying the point table No.5 in the direct specification mode.
Preset "□□□0" in parameter No.PA01 and "□□□0" in parameter No.PA30.

Set data	Description
K5	Point table No. (decimal)

Execute positioning operation to the point table No.5 by turning on X20.



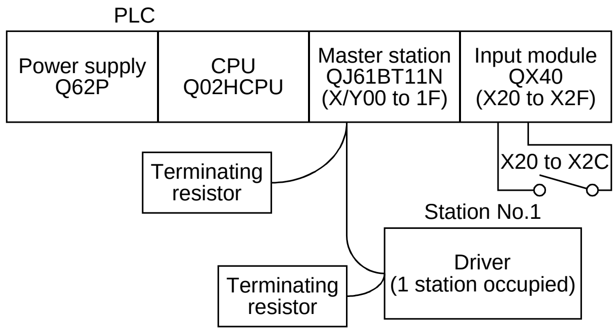
*1: This is when the high-speed timer limit is set to 1ms.
Setting time for the timer should be larger than the command processing time or twice the link scan time whichever larger. When the setting time is short, the command cannot be received properly.

3.8 Continuous operation program example

This section shows a program example which includes a series of communication operations from a servo start. The program will be described on the basis of the equipment makeup shown in section 3.8.1, 3.8.3.

3.8.1 System configuration example when 1 station is occupied

As shown below, the CC-Link system master ▪ local unit is loaded to run one driver (1 station occupied).



Input signal assignment

Input signal	Signal name	General operation when the input is on
X20	Reset command	Resets the driver on an occurrence of a servo alarm.
X21	Servo-on command	Turns on the servo motor. (Servo-on status)
X22	Forward rotation JOG command	Executes a forward JOG operation in the manual operation mode.
X23	Reverse rotation JOG command	Executes a reverse JOG operation in the manual operation mode.
X24	Automatic/manual selection	OFF: Manual operation mode ON: Automatic operation mode
X25	Home position return command	Executes a dog type home position return when home position return is incomplete in the automatic operation mode.
X26	Proximity dog command	OFF: Proximity dog is on. (Note) ON: Proximity dog is off.
X27	Positioning start command	Executes a positioning operation to the point table number specified by X28 to X2C when home position return is incomplete in the automatic operation mode.
X28	No. selection 1	Specifies the position for the point table No. selection 1
X29	No. selection 2	Specifies the position for the point table No. selection 2
X2A	No. selection 3	Specifies the position for the point table No. selection 3
X2B	No. selection 4	Specifies the position for the point table No. selection 4
X2C	No. selection 5	Specifies the position for the point table No. selection 5

Note. This is when the parameter No.PD16 is set to "□□□0 (initial value)" (detects the dog at off).

3.8.2 Program example when 1 station is occupied

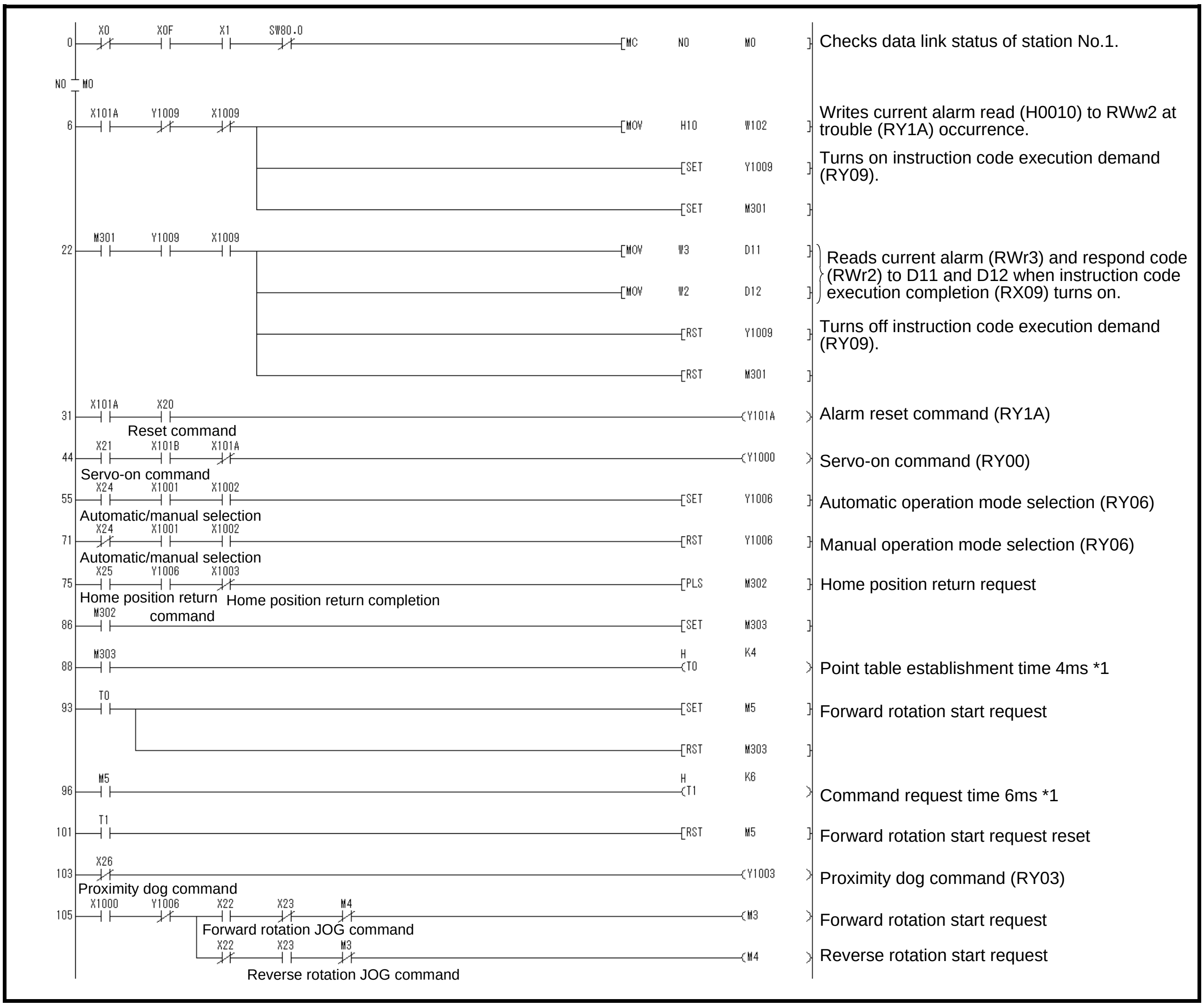
POINT

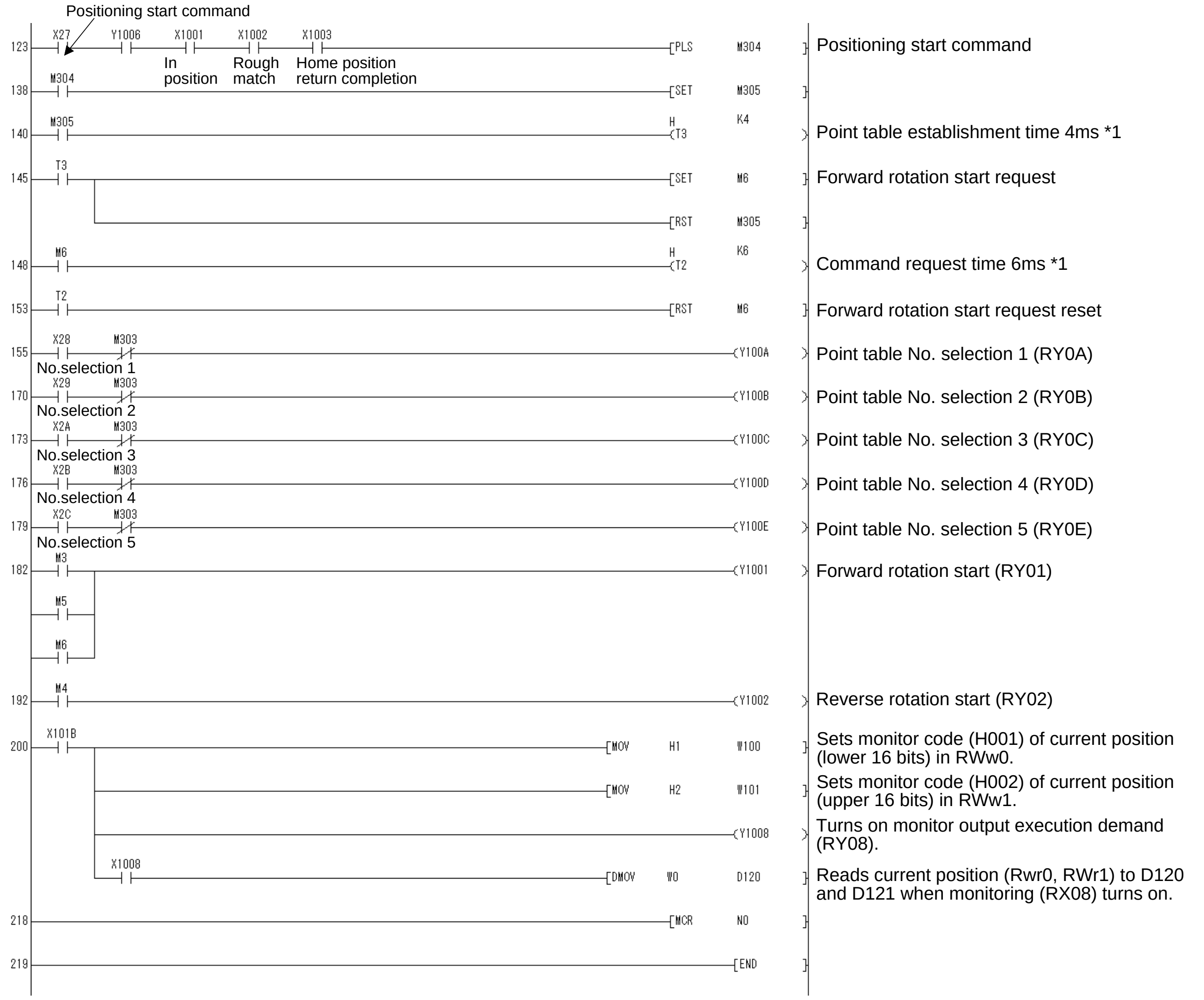
- To execute a dog type home position return with the CC-Link communication functions, set "□0□□" in parameter No.PD14 and use Proximity dog (DOG) with the remote input (RY03) in this example.

Operate the driver of station 1 in the positioning mode and read the "current position" data.

Operation: Alarm reset, dog type home position return, JOG operation, automatic operation under point table command

Code No.	Description
H0001	Lower 16-bit data of current position (hexadecimal)
H0002	Upper 16-bit data of current position (hexadecimal)

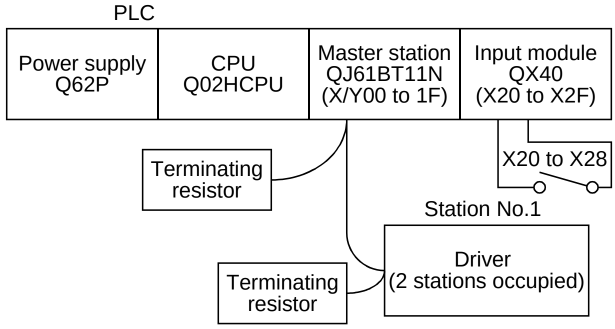




*1: This is when the high-speed timer limit is set to 1ms.
Setting time for the timer should be larger than the command processing time or twice the link scan time whichever larger. When the setting time is short, the command cannot be received properly.

3.8.3 System configuration example when 2 stations are occupied

As shown below, the CC-Link system master・local unit is loaded to run one drivers (2 station occupied).



Input signal assignment

Input signal	Signal name	General operation when the input is on
X20	Reset command	Resets the driver on an occurrence of a servo alarm.
X21	Servo-on command	Turns on the servo motor. (Servo-on status)
X22	Forward rotation JOG command	Executes a forward JOG operation in the manual operation mode.
X23	Reverse rotation JOG command	Executes a reverse JOG operation in the manual operation mode.
X24	Automatic/manual selection	OFF: Manual operation mode ON: Automatic operation mode
X25	Home position return command	Executes a dog type home position return when home position return is incomplete in the automatic operation mode.
X26	Proximity dog command	OFF: Proximity dog is on. (Note) ON: Proximity dog is off.
X27	Positioning start command	Executes a positioning operation with position and speed settings specified in the remote register when home position return is completed in the automatic operation mode.
X28	Position/speed setting system changing command	Changes to position/speed specification by the remote register.

Note. This is when the parameter No.PD16 is set to "□□□0 (initial value)" (detects the dog at off).

3.8.4 Program example when 2 stations are occupied

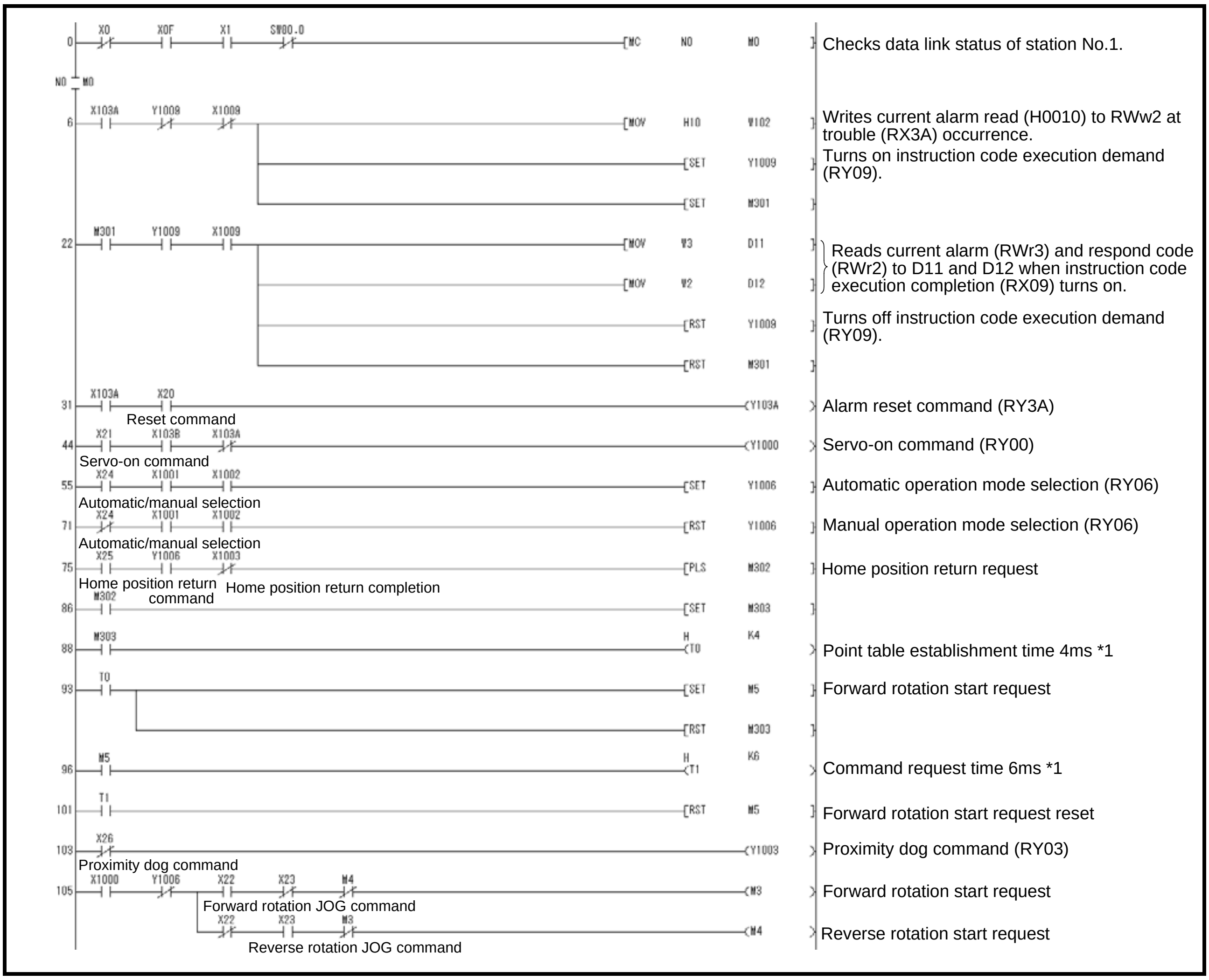
POINT

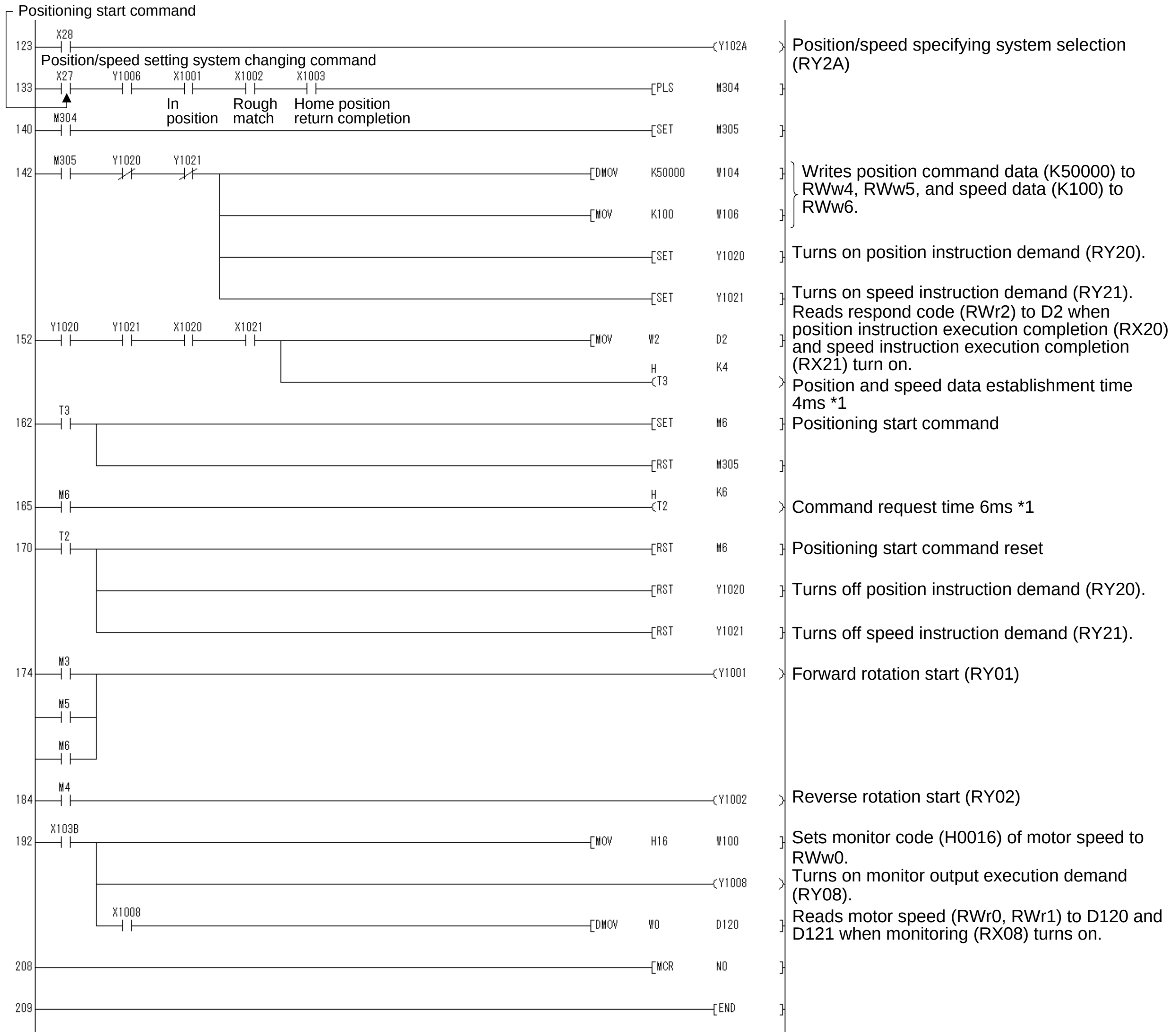
- To execute a dog type home position return with the CC-Link communication functions, set "□0□□" in parameter No.PD14 and use Proximity dog (DOG) with the remote input (RY03) in this example.

Operate the driver of station 1 in the positioning mode and read the "motor speed" data.
Preset the parameter No.PC30 to "□□□2".
Operation: Alarm reset, dog type home position return, JOG operation, automatic operation under point table command

Code No.	Description
H0016	32-bit data of motor speed (hexadecimal)

Code No.	Description
K50000	Position command data (decimal)
K100	Speed command data (decimal)





*1: This is when the high-speed timer limit is set to 1ms.
Setting time for the timer should be larger than the command processing time or twice the link scan time whichever larger. When the setting time is short, the command cannot be received properly.

4. SIGNALS AND WIRING

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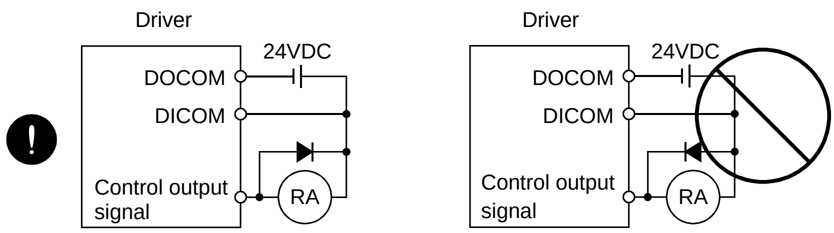
4. SIGNALS AND WIRING

⚠WARNING

- Any person who is involved in wiring should be fully competent to do the work.
- Before wiring, turn off the power and wait for 15 minutes or more until the charge lamp turns off. Then, confirm that the voltage between P(+) and N(−) is safe with a voltage tester and others. Otherwise, an electric shock may occur. In addition, always confirm from the front of the driver whether the charge lamp is off or not.
- Ground the driver and the servo motor securely.
- Do not attempt to wire the driver and servo motor until they have been installed. Otherwise, you may get an electric shock.
- The cables should not be damaged, stressed excessively, loaded heavily, or pinched. Otherwise, you may get an electric shock.

⚠CAUTION

- Wire the equipment correctly and securely. Otherwise, the servo motor may operate unexpectedly, resulting in injury.
- Connect cables to correct terminals to prevent a burst, fault, etc.
- Ensure that polarity (+, −) is correct. Otherwise, a burst, damage, etc. may occur.
- The surge absorbing diode installed to the DC relay designed for control output should be fitted in the specified direction. Otherwise, the signal is not output due to a fault, disabling the forced stop (EMG) and other protective circuits.



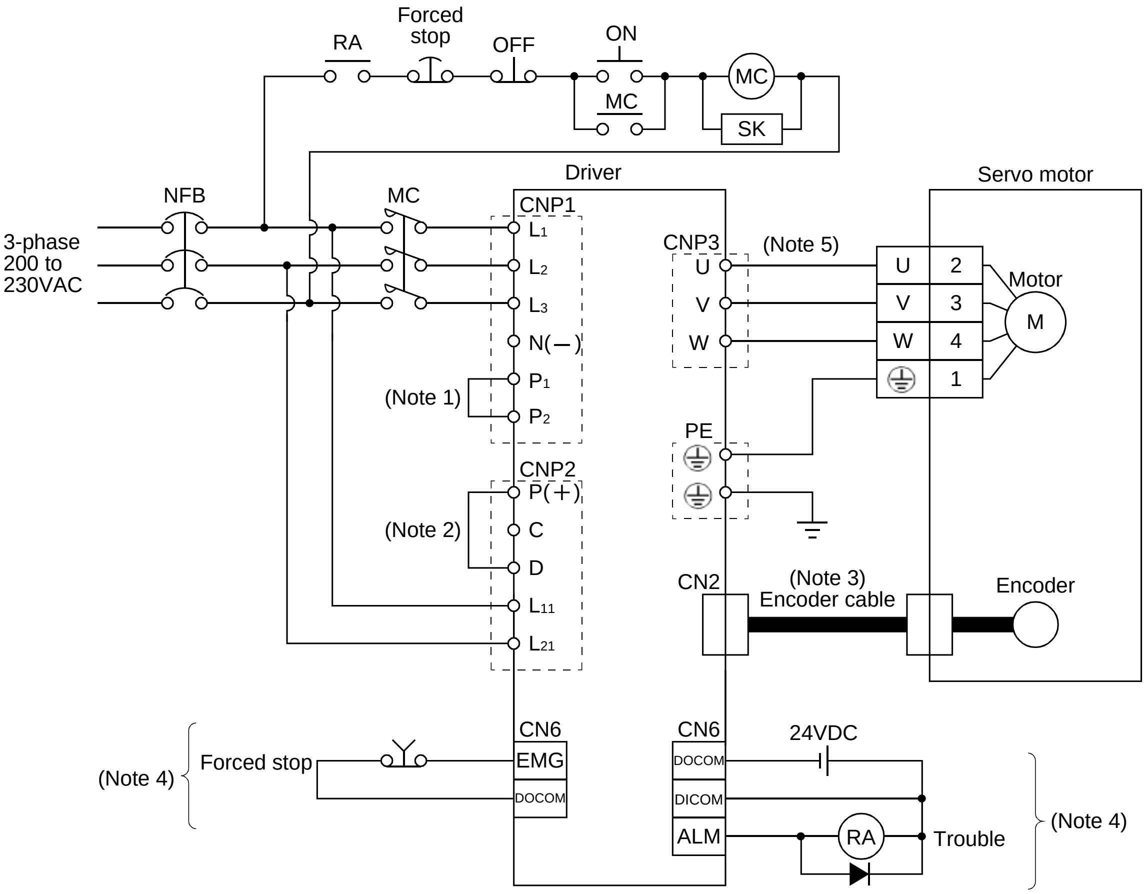
- Use a noise filter, etc. to minimize the influence of electromagnetic interference, which may be given to electronic equipment used near the driver.
- Do not install a power capacitor, surge suppressor or radio noise filter (FR-BIF-(H) :Mitsubishi Electric Corporation) with the power line of the servo motor.
- When using the regenerative resistor, switch power off with the alarm signal. Otherwise, a transistor fault or the like may overheat the regenerative resistor, causing a fire.
- Do not modify the equipment.
- During power-on, do not open or close the motor power line. Otherwise, a malfunction or faulty may occur.

4.1 Input power supply circuit

CAUTION	・Always connect a magnetic contactor (MC) between the main circuit power supply and L_1, L_2, and L_3 of the driver, and configure the wiring to be able to shut down the power supply on the side of the driver's power supply. If a magnetic contactor (MC) is not connected, continuous flow of a large current may cause a fire when the driver malfunctions. ・Use the trouble (ALM) to switch power off. Otherwise, a regenerative transistor fault or the like may overheat the regenerative resistor, causing a fire.

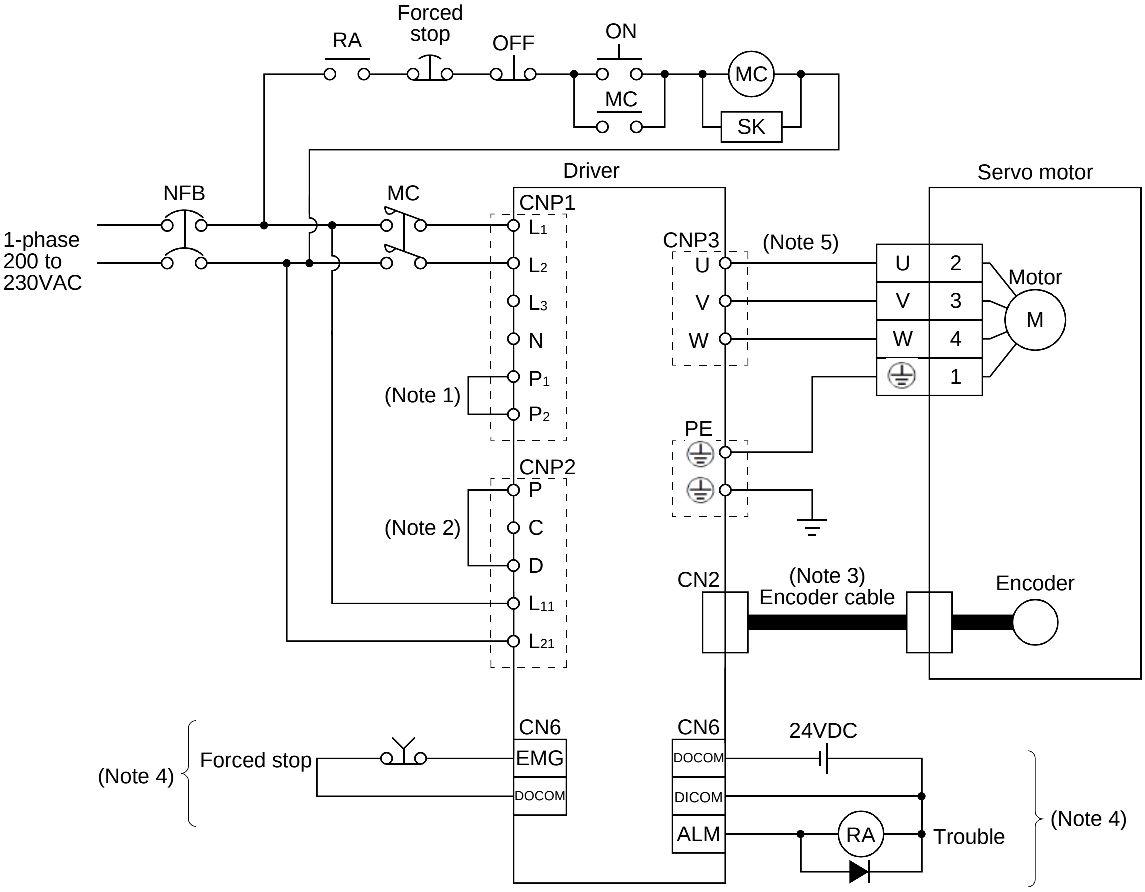
Wire the power supply and main circuit as shown below so that the servo-on (RYn0) turns off as soon as alarm occurrence is detected and power is shut off.
A no-fuse breaker (NFB) must be used with the input cables of the power supply.

(1) For 3-phase 200 to 230VAC power supply to LECSC□-□



Note 1. Always connect P(+) and D. (Factory-wired.) When using the regenerative option, refer to section 13.2.
2. For encoder cable, use of the option cable is recommended. Refer to section 13.1 for selection of the cable.
3. For the sink I/O interface. For the source I/O interface, refer to section 4.8.3.
4. Refer to section 4.10.

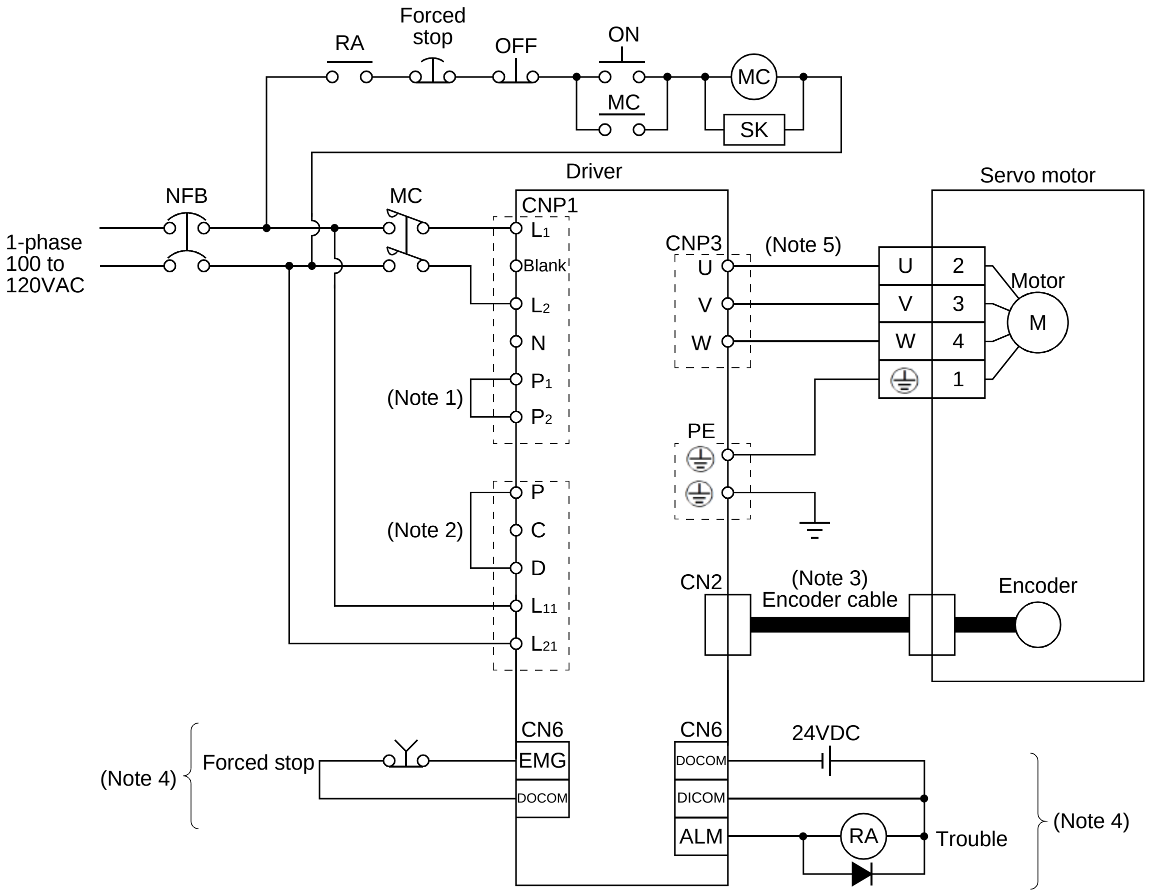
(2) For 1-phase 200 to 230VAC power supply to LECSC□-□



Note 1. Always connect P_1 and P_2. (Factory-wired.)

2. Always connect P and D. (Factory-wired.) When using the regenerative option, refer to section 13.2.
3. For encoder cable, use of the option cable is recommended. Refer to section 13.1 for selection of the cable.
4. For the sink I/O interface. For the source I/O interface, refer to section 4.8.3.
5. Refer to section 4.10.

(3) For 1-phase 100 to 120VAC power supply to LECSC□-□



Note 1. Always connect P_1 and P_2. (Factory-wired.)

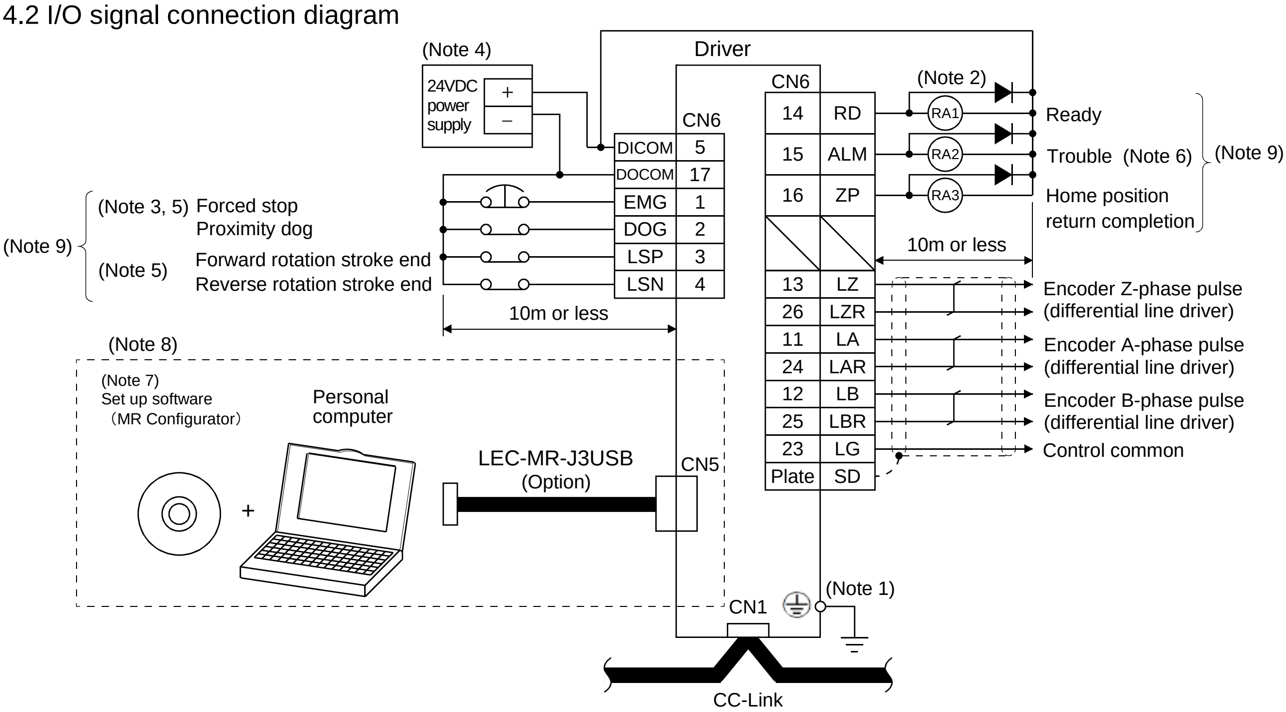
2. Always connect P and D. (Factory-wired.) When using the regenerative option, refer to section 14.2.

3. For encoder cable, use of the option cable is recommended. Refer to section 14.1 for selection of the cable.

4. For the sink I/O interface. For the source I/O interface, refer to section 4.8.3.

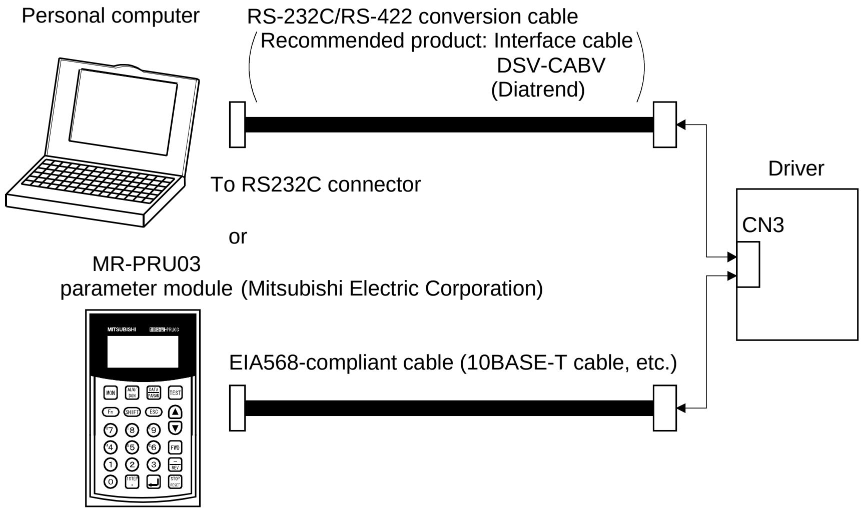
5. Refer to section 4.10.

4.2 I/O signal connection diagram



Note 1. To prevent an electric shock, always connect the protective earth (PE) terminal (terminal marked ⏚) of the driver to the protective earth (PE) of the control box.

2. Connect the diode in the correct direction. If it is connected reversely, the driver will be faulty and will not output signals, disabling the emergency stop (EMG) and other protective circuits.
3. The forced stop switch (normally closed contact) must be installed.
4. Supply 24VDC±10% 150mA current for interfaces from the outside. 150mA is the value applicable when all I/O signals are used. The current capacity can be decreased by reducing the number of I/O points. Refer to section 4.8.2 (1) that gives the current value necessary for the interface.
5. When starting operation, always turn on forced stop (EMG) and Forward/Reverse rotation stroke end (LSP/LSN). (Normally closed contacts)
6. Trouble (ALM) turns on in normal alarm-free condition.
7. Use LEC-MR-SETUP 221E.
8. Personal computers or parameter modules can also be connected via the CN3 connector, enabling RS-422 communication. Note that using the USB communication function (CN5 connector) prevents the RS-422 communication function (CN3 connector) from being used, and vice versa. They cannot be used together.



9. For the sink I/O interface. For the source I/O interface, refer to section 4.8.3.

4.3 Explanation of power supply system

4.3.1 Signal explanations

POINT
・For the layout of connector and terminal block, refer to outline drawings in chapter 12.

<table>
<tr><th>Abbreviation</th><th>Connection target (application)</th><th>Description</th></tr>
<tr><td>L_1
L_2
L_3</td><td>Main circuit power supply</td><td>Supply the following power to L_1, L_2, L_3. For the 1-phase 200 to 230VAC power supply, connect the power supply to L_1, L_2, and keep L_3 open.
<table>
<tr><th>Power supply \ Driver</th><th>LECSC2-S5
LECSC2-S7
LECSC2-S8</th><th>LECSC1-S5
LECSC1-S7
LECSC1-S8</th></tr>
<tr><td>3-phase 200 to 230VAC, 50/60Hz</td><td>L_1 ・ L_2 ・ L_3</td><td></td></tr>
<tr><td>1-phase 200 to 230VAC, 50/60Hz</td><td>L_1 ・ L_2</td><td></td></tr>
<tr><td>1-phase 100 to 120VAC, 50/60Hz</td><td></td><td>L_1 ・ L_2</td></tr>
</table></td></tr>
<tr><td>P
C
D</td><td>Regenerative option</td><td>When using driver built-in regenerative resistor, connect P(+) and D. (Factory-wired)
When using regenerative option, disconnect P(+) and D, and connect regenerative option to P and C.
Refer to section 14.2 to 14.5.</td></tr>
<tr><td>L_{11}
L_{21}</td><td>Control circuit power supply</td><td>Supply the following power to L_{11} ・ L_{21}.
<table>
<tr><th>Power supply \ Driver</th><th>LECSC2-S5
LECSC2-S7
LECSC2-S8</th><th>LECSC1-S5
LECSC1-S7
LECSC1-S8</th></tr>
<tr><td>1-phase 200 to 230VAC, 50/60Hz</td><td>L_{11} ・ L_{21}</td><td></td></tr>
<tr><td>1-phase 100 to 120VAC, 50/60Hz</td><td></td><td>L_{11} ・ L_{21}</td></tr>
</table></td></tr>
<tr><td>U
V
W</td><td>Servo motor power</td><td>Connect to the servo motor power supply terminals (U, V, W). During power-on, do not open or close the motor power line. Otherwise, a malfunction or faulty may occur.</td></tr>
<tr><td>N</td><td>Regenerative converter
Brake unit</td><td>Do not connect to driver.</td></tr>
<tr><td>⏚</td><td>Protective earth (PE)</td><td>Connect to the earth terminal of the servo motor and to the protective earth (PE) of the control box to perform grounding.</td></tr>
</table>

4.3.2 Power-on sequence

(1) Power-on procedure

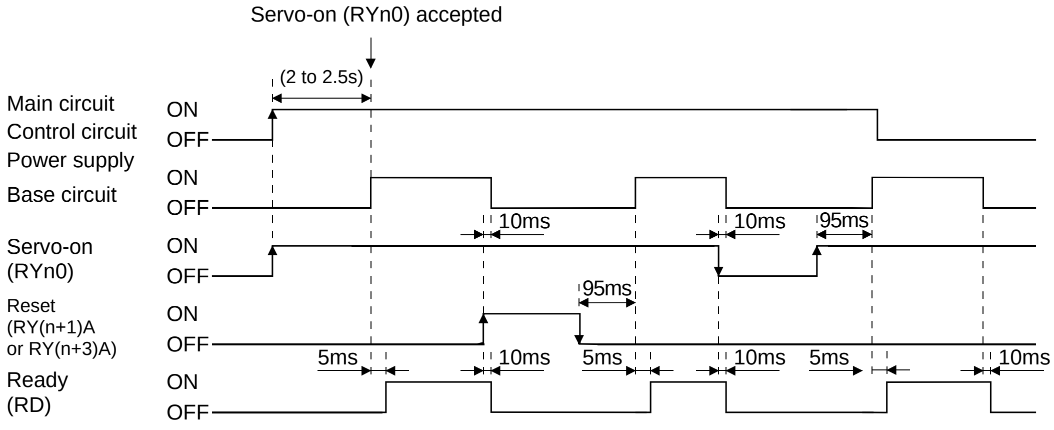
1) Always wire the power supply as shown in above section 4.1 using the magnetic contactor with the main circuit power supply (three-phase: L_1, L_2, L_3, single-phase: L_1, L_2). Configure up an external sequence to switch off the magnetic contactor as soon as an alarm occurs.

2) Switch on the control circuit power supply L_{11}, L_{21} simultaneously with the main circuit power supply or before switching on the main circuit power supply. If the main circuit power supply is not on, the display shows the corresponding warning. However, by switching on the main circuit power supply, the warning disappears and the driver will operate properly.

3) The driver can accept the servo-on (RYn0) about 1 to 2s after the main circuit power supply is switched on. Therefore, when servo-on (RYn0) is switched on simultaneously with the main circuit power supply, the base circuit will switch on in about 1 to 2s, and the ready (RD) will switch on in further about 5ms, making the driver ready to operate. (Refer to paragraph (2) in this section.)

4) When the reset (RY(n+1)A or RY(n+3)A) is switched on, the base circuit is shut off and the servo motor shaft coasts.

(2) Timing chart

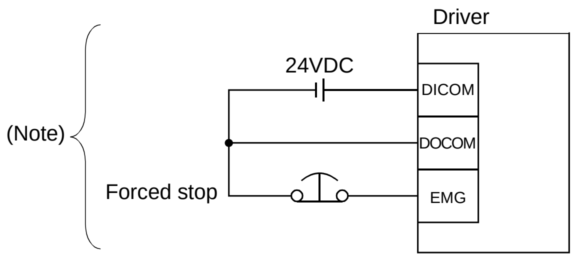


Power-on timing chart

(3) Forced stop

CAUTION	・Provide an external forced stop circuit to ensure that operation can be stopped and power switched off immediately.

Make up a circuit that shuts off main circuit power as soon as EMG is turned off at a forced stop. When EMG is turned off, the dynamic brake is operated to bring the servo motor to a sudden stop. At this time, the display shows the servo forced stop warning (AE6).
During ordinary operation, do not use the external forced stop (EMG) to alternate stop and run.
The driver life may be shortened.
Also, if the forward rotation start (RYn1) and reverse rotation start (RYn2) are on or a pulse train is input during a forced stop, the servo motor will rotate as soon as the warning is reset. During a forced stop, always shut off the run command. Note also that during a forced stop, RYn1 and RYn2 must be off.



Note. For the sink I/O interface. For the source I/O interface, refer to section 4.8.3.

4.3.3 CNP1, CNP2, CNP3 wiring method

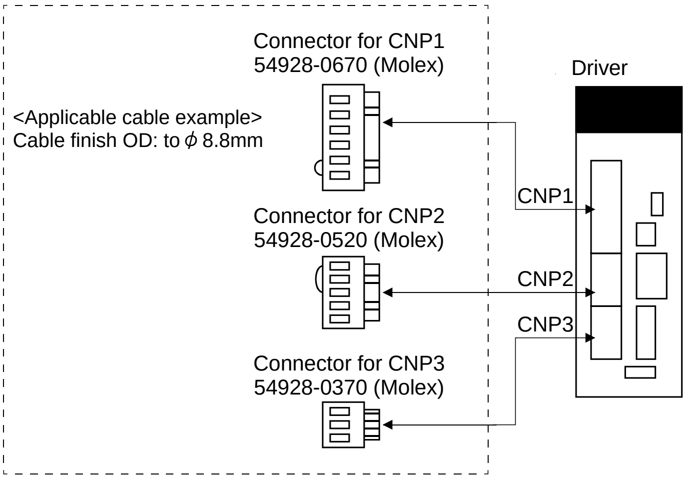
POINT
・Refer to table 13.1 in section 13.9 for the wire sizes used for wiring.

Use the supplied driver power supply connectors for wiring of CNP1, CNP2 and CNP3.

(1) LECSC□-□

(a) Driver power supply connectors

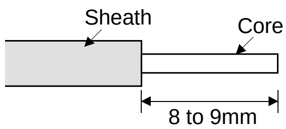
(Note)
Driver power supply connectors



Note. These connectors are of insert type. As the crimping type, the following connectors (Molex) are recommended.
For CNP1: 51241-0600 (connector), 56125-0118 (terminal)
For CNP2: 51240-0500 (connector), 56125-0118 (terminal)
For CNP3: 51241-0300 (connector), 56125-0118 (terminal)
Crimping tool: CNP57349-5300
<Connector applicable cable example>
Cable finish OD: to ϕ3.8mm

(b) Termination of the cables

Solid wire: After the sheath has been stripped, the cable can be used as it is.

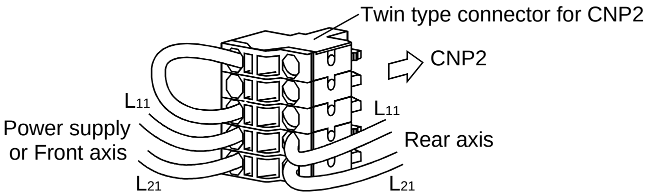


Twisted wire: Use the cable after stripping the sheath and twisting the core. At this time, take care to avoid a short caused by the loose wires of the core and the adjacent pole. Do not solder the core as it may cause a contact fault. Alternatively, a bar terminal may be used to put the wires together.

Cable size		Bar terminal type		Crimping tool (Note 2)
[mm^2]	AWG	For 1 cable (Note 1)	For 2 cable	
1.25/1.5	16	AI1.5-10BK	AI-TWIN2 × 1.5-10BK	Variocrimp 4 206-204
2/2.5	14	AI2.5-10BU		

Note 1. Manufacturer: Phoenix Contact
2. Manufacturer: WAGO

(c) The twin type connector for CNP2 (L_{11}・L_{21}): 721-2105/026-000 (WAGO)
Using this connector enables passing a wire of control circuit power supply.
Refer to appendix 3 for details of connector.



(2) Insertion of cable into Molex and WAGO connectors

Insertion of cable into 54928-0670, 54928-0520, 54928-0370 (Molex) connectors and 721-207/026-000, 721-205/026-000 and 721-203/026-000 (WAGO) connectors are as follows.

The following explains for Molex, however use the same procedures for inserting WAGO connectors as well.

POINT
· It may be difficult for a cable to be inserted to the connector depending on wire size or bar terminal configuration. In this case, change the wire type or correct it in order to prevent the end of bar terminal from widening, and then insert it.

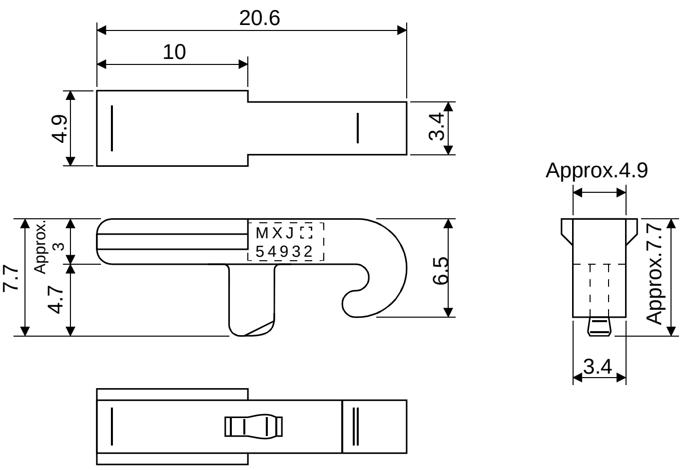
How to connect a cable to the driver power supply connector is shown below.

(a) When using the supplied cable connection lever

1) The driver is packed with the cable connection lever.

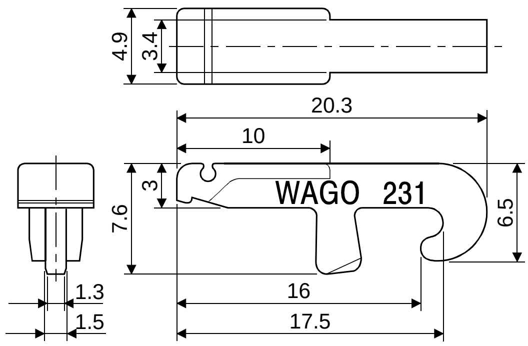
a) 54932-0000 (Molex)

[Unit: mm]

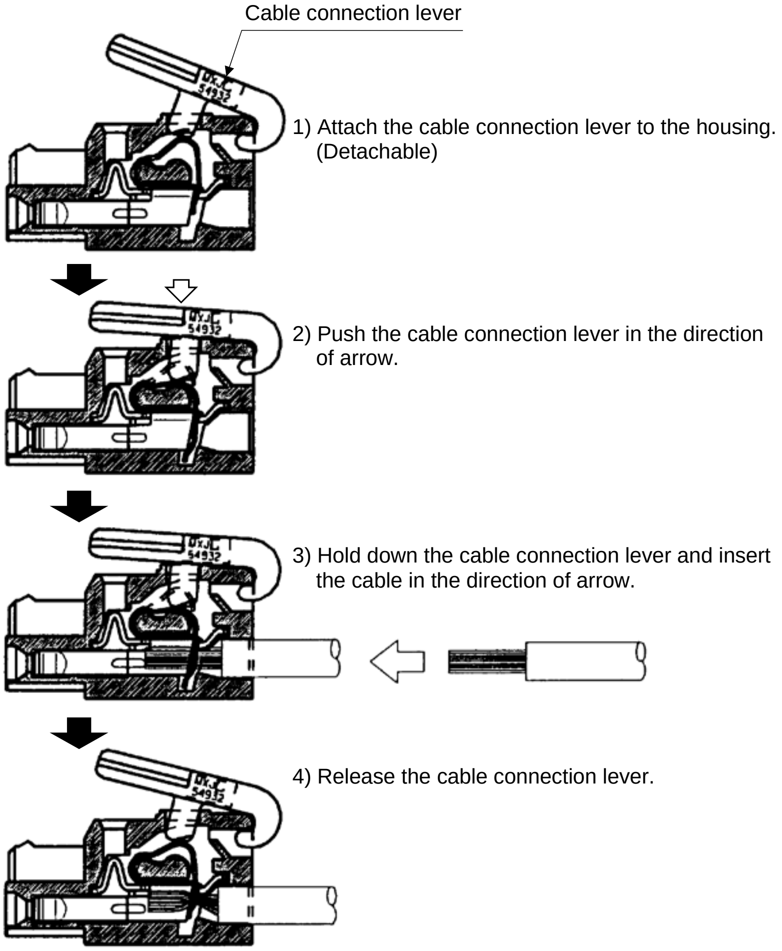


b) 231-131 (WAGO)

[Unit: mm]



2) Cable connection procedure

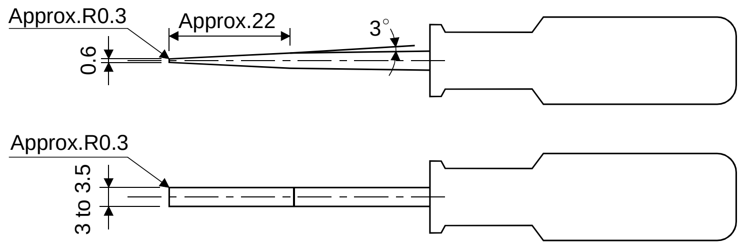


(b) Inserting the cable into the connector

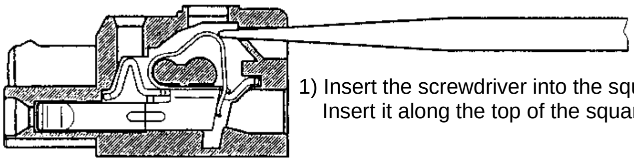
1) Applicable flat-blade screwdriver dimensions

Always use the screwdriver shown here to do the work.

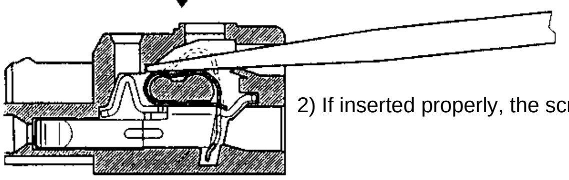
[Unit: mm]



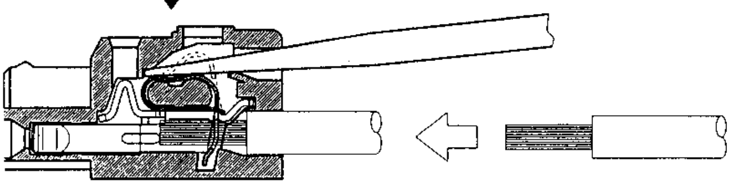
2) When using the flat-blade screwdriver - part 1



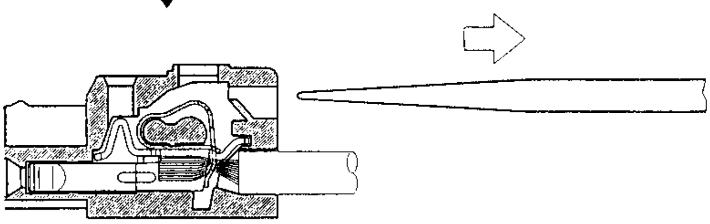
1) Insert the screwdriver into the square hole.
Insert it along the top of the square hole to insert it smoothly.



2) If inserted properly, the screwdriver is held.

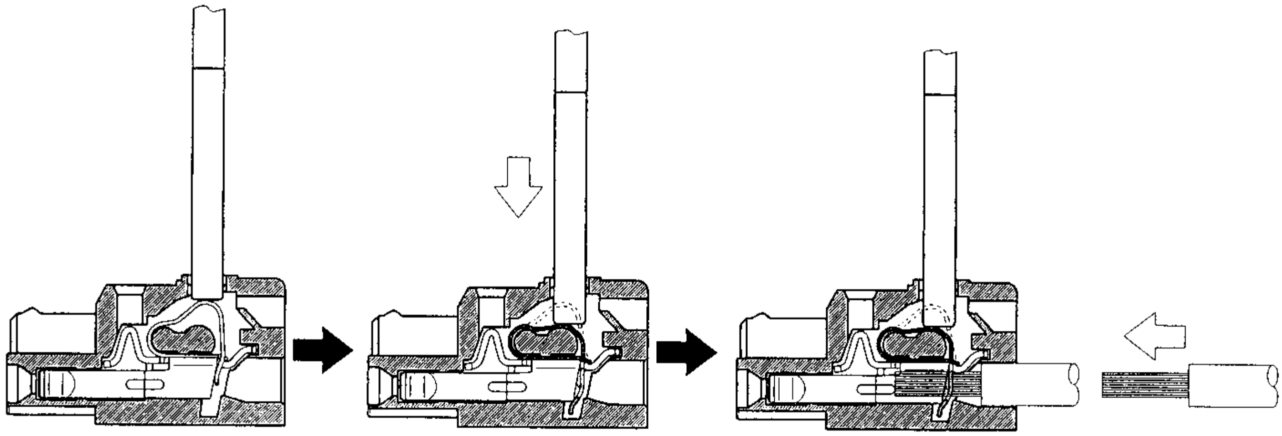


3) With the screwdriver held, insert the cable in the direction of arrow. (Insert the cable as far as it will go.)



4) Releasing the screwdriver connects the cable.

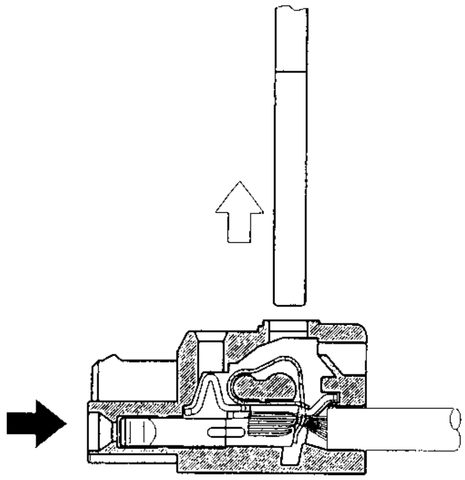
3) When using the flat-blade screwdriver - part 2



1) Insert the screwdriver into the square window at top of the connector.

2) Push the screwdriver in the direction of arrow.

3) With the screwdriver pushed, insert the cable in the direction of arrow. (Insert the cable as far as it will go.)

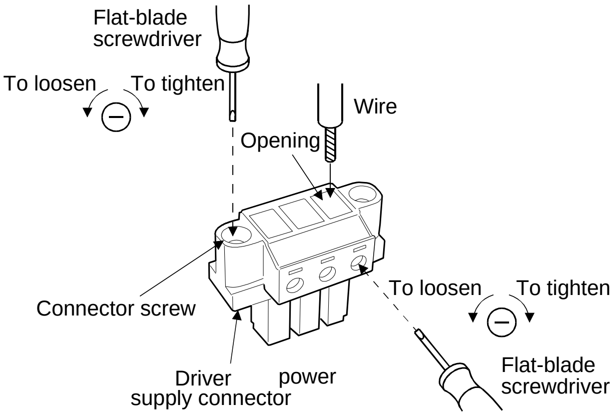


4) Releasing the screwdriver connects the cable.

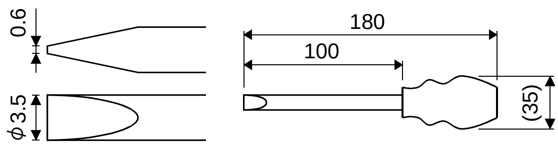
(3) How to insert the cable into Phoenix Contact connector

POINT
・Do not use a precision driver because the cable cannot be tightened with enough torque.

Insertion of cables into Phoenix Contact connector PC4/6-STF-7.62-CRWH or PC4/3-STF-7.62-CRWH is shown as follows.
Before inserting the cable into the opening, make sure that the screw of the terminal is fully loose. Insert the core of the cable into the opening and tighten the screw with a flat-blade screwdriver. When the cable is not tightened enough to the connector, the cable or connector may generate heat because of the poor contact. (When using a cable of 1.5mm^2 or less, two cables may be inserted into one opening.)
Secure the connector to the driver by tightening the connector screw.
For securing the cable and the connector, use a flat-blade driver with 0.6mm blade edge thickness and 3.5mm diameter (Recommended flat-blade screwdriver: Phoenix Contact SZS 0.6×3.5). Apply 0.5 to 0.6 N・m torque to screw.



[Unit: mm]

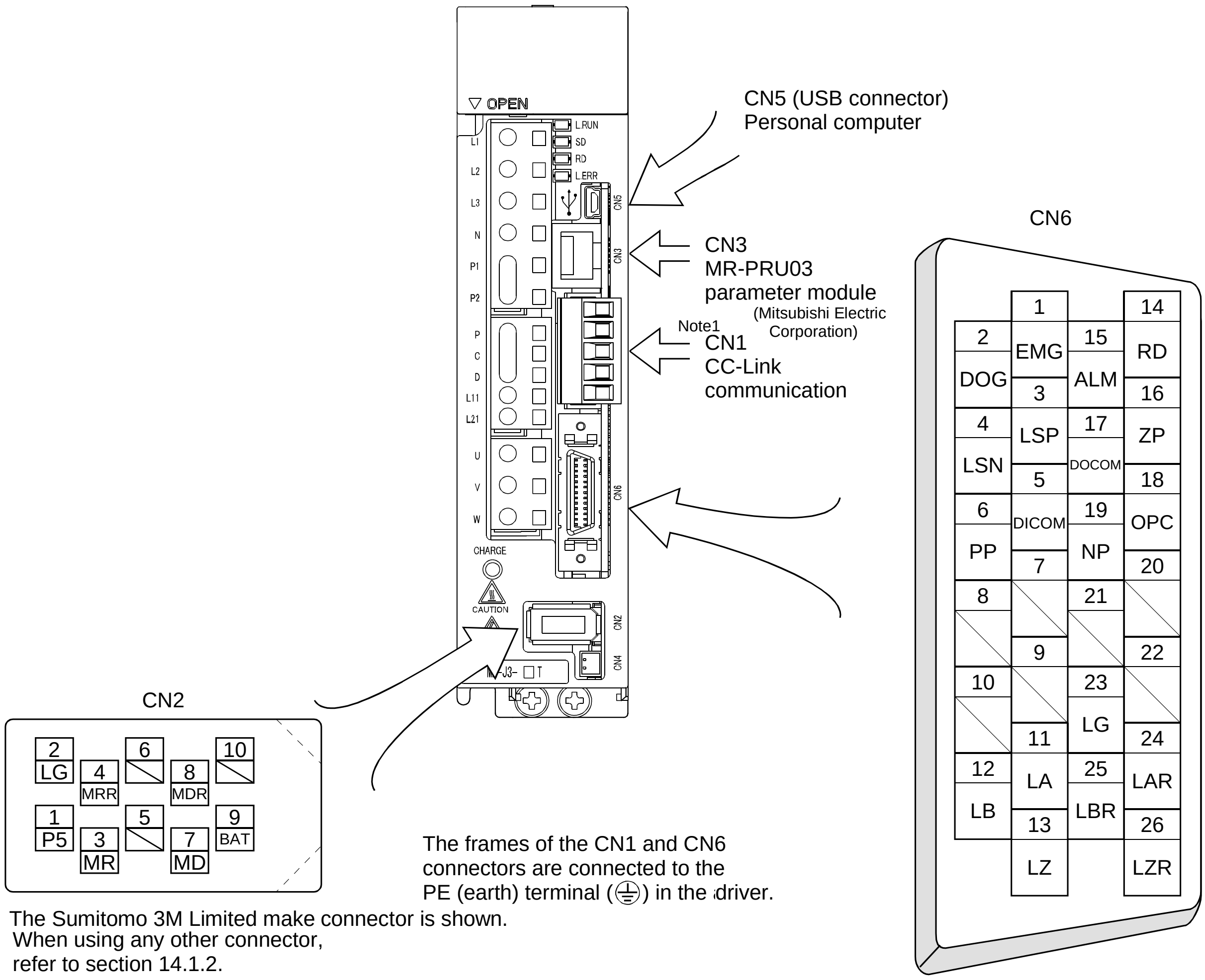


Recommended flat-blade screwdriver dimensions

4.4 Connectors and signal arrangements

POINT
- The pin configurations of the connectors are as viewed from the cable connector wiring section.

The driver front view shown is that of the LECSC□-S5 and LECSC□-S7. Refer to chapter 12 Outline Drawings for the appearances and connector layouts of the LECSC□-S8.



Note1.
CN1 Connector : Accessory
Manufactured by Mitsubishi Electric System & Service Co., Ltd
Part No : 05A50230600

4.5 Signal (device) explanation

4.5.1 I/O devices

The CN6 connector provides three pins for inputs and three other pins for outputs. Devices assigned to these pins are changeable. To make this change, configure parameter settings of Nos. PD06 to PD11, PD12, and PD14. Refer to section 4.8.2 for the I/O interfaces (symbols in the I/O Division field in the table) of the corresponding connector pins.

Pin type	CN6 connector pin No.	I/O division	Device in initial status	Parameter of change target device
Input-only pins	1	DI-1	Forced stop (EMG)	
	2		Proximity dog (DOG)	No.PD06
	3		Forward rotation stroke end (LSP)	No.PD07
	4		Reverse rotation stroke end (LSN)	No.PD08
Output-only pins	14	DO-1	Ready (RD)	No.PD09
	15		Trouble (ALM)	No.PD10
	16		Home position return completion (ZP)	No.PD11

(1) Input device

POINT
· Input devices assigned to the CN6 connector pins cannot be used with the remote input of the CC-Link communication function.

Device	Symbol	Connector pin No.	Functions/Applications
Forced stop	EMG	CN6-1	Forced stop (EMG) is fixed at CN6-1. Assigning this device to any other pin is not allowed. For device details, refer to section 3.5.1 (1).
Servo-on	SON		For device details, refer to section 3.5.1 (1).
Forward rotation start	ST1		
Reverse rotation start	ST2		
Proximity dog	DOG	CN6-2 (Note)	
Forward rotation stroke end	LSP	CN6-3 (Note)	
Reverse rotation stroke end	LSN	CN6-4 (Note)	
Automatic/manual selection	MD0		
Temporary stop/Restart	TSTP		
Internal torque limit selection	TL1		
Proportion control	PC		
Gain changing	CDP		
Reset	RES		
Clear	CR		Turn CR on to clear the position control counter droop pulses on its leading edge. The pulse width should be 10ms or more. When the parameter No.PD22 setting is "□ □ □ 1", the pulses are always cleared while CR is on.

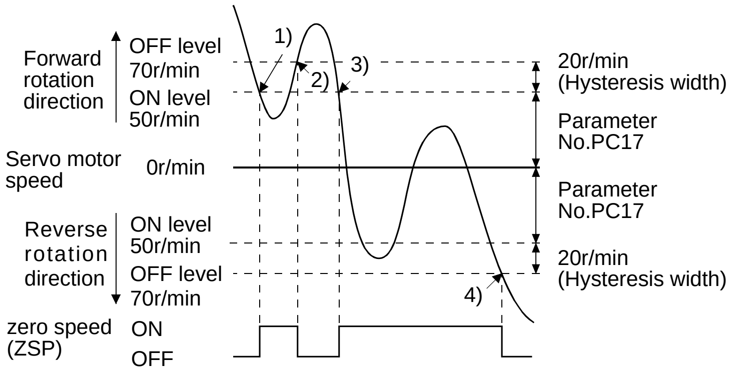
Note. These are pin Nos. assigned at default.

(2) Output device

POINT

- Output devices assigned to the CN6 connector pins can be used with the remote output of the CC-Link communication function.

Device	Symbol	Connector pin No.	Functions/Applications
Ready	RD	CN6-14 (Note)	For device details, refer to section 3.5.1 (2).
Trouble	ALM	CN6-15 (Note)	ALM turns off when power is switched off or the protective circuit is activated to shut off the base circuit. Without alarm occurring, ALM turns on within 1.5s after power-on. The significance of this device is opposite of that of remote output (RX (n＋1)A or RX (n＋3)A).
Home position return completion	ZP	CN6-16 (Note)	For device details, refer to section 3.5.1 (2).
In position	INP		
Rough match	CPO		
Limiting torque	TLC		
Electromagnetic brake interlock	MBR		
Temporary stop	PUS		
Warning	WNG		
Battery warning	BWNG		
Movement completion	MEND		
dynamic brake interlock	DB		
Position range	POT		
Point table No. output 1	PT0		
Point table No. output 2	PT1		
Point table No. output 3	PT2		
Point table No. output 4	PT3		
Point table No. output 5	PT4		
Point table No. output 6	PT5		
Point table No. output 7	PT6		
Point table No. output 8	PT7		
Speed command reached	SA		SA turns on when servo-on (SON) is on and the commanded speed is at the target speed. SA always turns on when servo-on (SON) is on and the commanded speed is 0r/min. SA turns off when servo-on (SON) is off or the commanded speed is in acceleration/deceleration.

Device	Symbol	Connector pin No.	Functions/Applications
Zero speed	ZSP		ZSP turns on when the servo motor speed is zero speed (50r/min) or less. Zero speed can be changed using parameter No.PC17. Example Zero speed is 50r/min  ZSP turns on 1) when the servo motor is decelerated to 50r/min, and ZSP turns off 2) when the servo motor is accelerated to 70r/min again. ZSP turns on 3) when the servo motor is decelerated again to 50r/min, and turns off 4) when the servo motor speed has reached -70r/min. The range from the point when the servo motor speed has reached ON level, and ZSP turns on, to the point when it is accelerated again and has reached OFF level is called hysteresis width. Hysteresis width is 20r/min for this driver.
Variable gain selection	CDPS		CDPS is on during gain changing.

Note. These are pin Nos. assigned at default.

4.5.2 Output signals

Refer to section 4.8.2 for the output interfaces (symbols in the I/O Division field in the table) of the corresponding connector pins.

Signal	Symbol	Connector pin No.	Functions/Applications	I/O division
Encoder A-phase pulse (differential line driver)	LA LAR	CN6-11 CN6-24	Outputs pulses per servo motor revolution set in parameter No.PA15 in the differential line driver system. In CCW rotation of the servo motor, the encoder B-phase pulse lags the encoder A-phase pulse by a phase angle of $\pi/2$. The relationships between rotation direction and phase difference of the A- and B-phase pulses can be changed using parameter No. PC19.	DO-2
Encoder B-phase pulse (differential line driver)	LB LBR	CN6-12 CN6-25		
Encoder Z-phase pulse (differential line driver)	LZ LZR	CN6-13 CN6-26	Outputs the zero-point signal of the encoder in the differential line driver system. One pulse is output per servo motor revolution. This signal turns on when the zero-point position is reached. (Negative logic) The minimum pulse width is about 400μs. For home position return using this pulse, set the creep speed to 100r/min. or less.	DO-2

4.5.3 Power supply

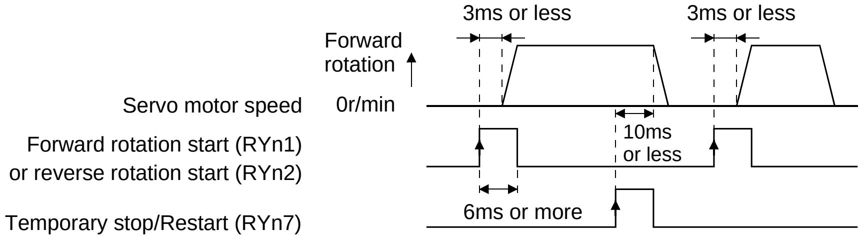
Signal	Symbol	Connector pin No.	Functions/Applications	I/O division
Digital I/F power supply input	DICOM	CN6-5	Used to input 24VDC (24VDC±10% 150mA) for I/O interface. The power supply capacity changes depending on the number of I/O interface points to be used. Connect the plus of 24VDC terminal external power supply for the sink interface.	
Digital I/F common	DOCOM	CN6-17	Common terminal for input signals such as DOG and EMG. Pins are connected internally. Separated from LG. Connect the plus of 24VDC terminal external power supply for the source interface.	
Control common	LG	CN6-23	Common terminal for the differential line driver of the encoder pulses (LA・LAR・LB・LBR・LZ・LZR).	
Shield	SD	Plate	Connect the external conductor of the shield cable.	

4.6 Detailed description of signals (devices)

4.6.1 Forward rotation start・reverse rotation start・temporary stop/restart

(1) A forward rotation start (RYn1) or a reverse rotation start (RYn2) should make the sequence which can be used after the main circuit has been established. These signals are invalid if it is switched on before the main circuit is established.
Normally, it is interlocked with the ready signal (RD).

(2) A start in the driver is made when a forward rotation start (RYn1) or a reverse rotation start (RYn2) changes from OFF to ON. The delay time of the driver's internal processing is max. 3ms. The delay time of other devices is max. 10ms.



(3) The ON time of a forward rotation start (RYn1), a reverse rotation start (RYn2) or temporary start/stop (RYn7) signal should be 6ms or longer to prevent a malfunction.

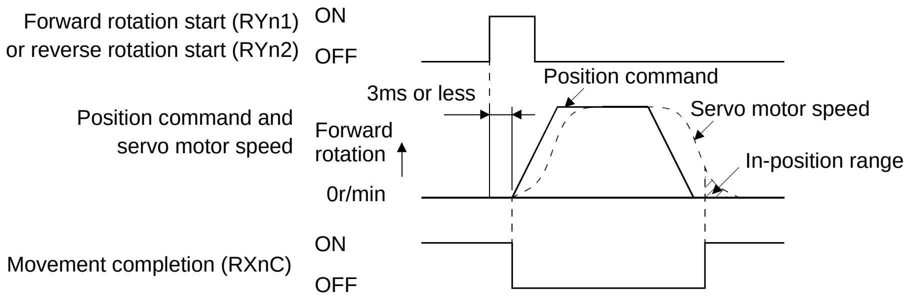
(4) During operation, the forward rotation start (RYn1) or reverse rotation start (RYn2) is not accepted. The next operation should always be started after the rough match (RXn2) is output with the rough match output range set to “0” or after the movement completion (RXnC) is output.

4.6.2 Movement completion・rough match・in position

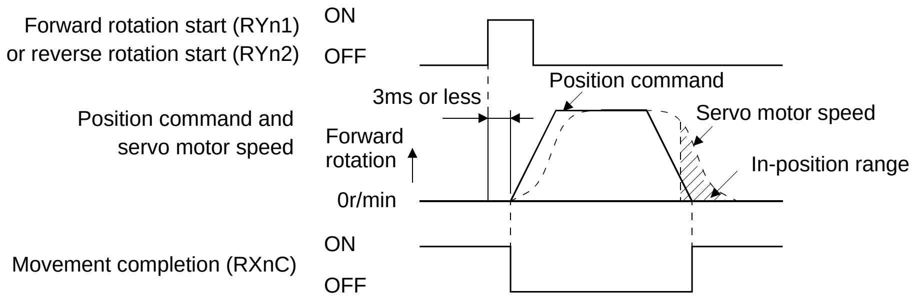
POINT
・If an alarm cause, etc. are removed and servo-on occurs after a stop is made by servo-off, alarm occurrence or Forced stop (EMG) ON during automatic operation, Movement completion (MEND), Rough-match, (CPO) and In position (INP) are turned on. To resume operation, confirm the current position and the selected point table No. for preventing unexpected operation.

(1) Movement completion

The following timing charts show the output timing relationships between the position command generated in the driver and the movement completion (RYnC). This timing can be changed using parameter No.PA10 (in-position range). RYnC turns ON in the servo-on status.



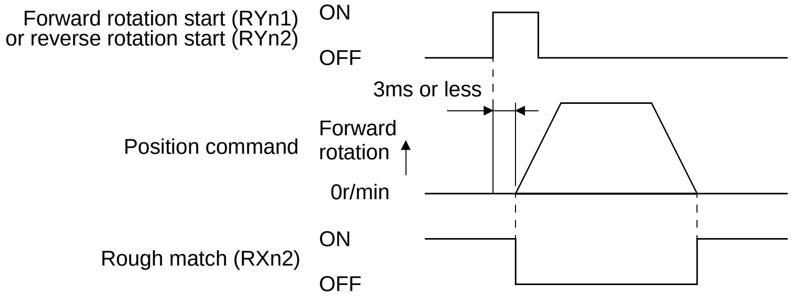
When parameter No.PA10 is small



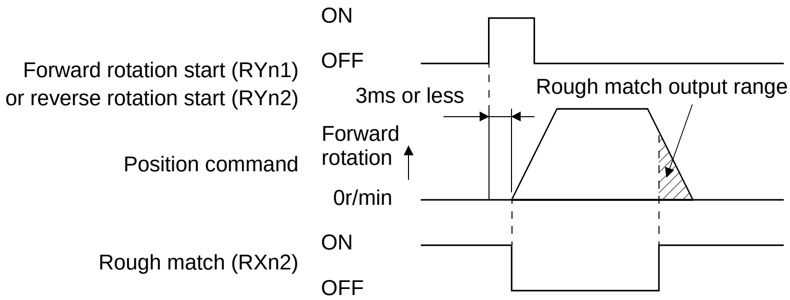
When parameter No.PA10 is large

(2) Rough match

The following timing charts show the relationships between the signal and the position command generated in the driver. This timing can be changed using parameter No.PC11 (rough match output range). RXn2 turns ON in the servo-on status.



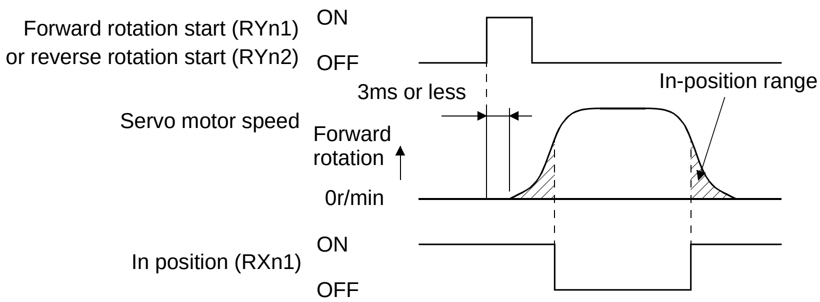
When "0" is set in parameter No.PC11



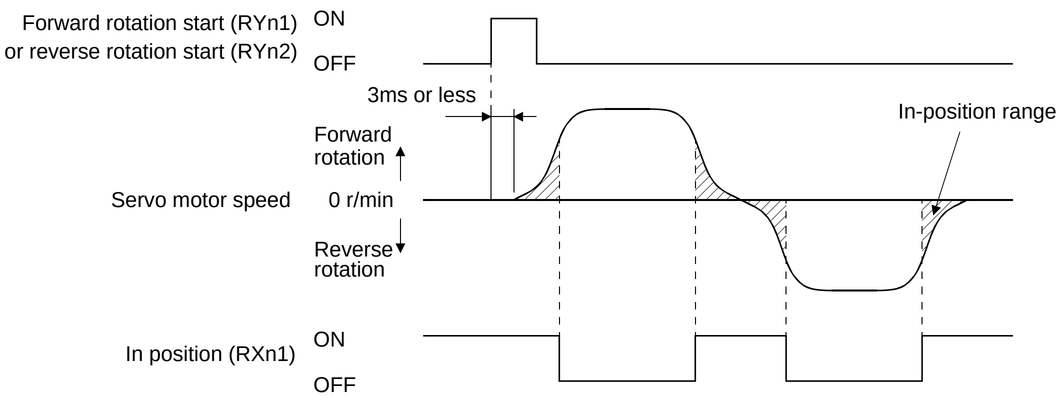
When more than "0" is set in parameter No.PC11

(3) In position

The following timing chart shows the relationship between the signal and the feedback pulse of the servo motor. This timing can be changed using parameter No.PA10 (in-position range). turns on RYn1 in the servo-on status.



When positioning operation is performed once



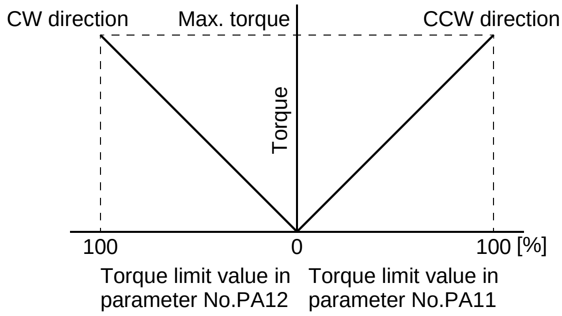
When servo motor reverses rotation direction during automatic continuous operation

4.6.3 Torque limit

CAUTION	• If the torque limit is canceled during servo lock, the servo motor may suddenly rotate according to position deviation in respect to the command position.

(1) Torque limit and torque

By setting parameter No.PA11 (forward rotation torque limit) or parameter No.PA12 (reverse rotation torque limit), torque is always limited to the maximum value during operation. A relationship between the limit value and servo motor torque is shown below.



(2) Torque limit value selection

As shown below, the forward rotation torque limit (parameter No.PA11), reverse rotation torque limit (parameter No.PA12) or internal torque limit 2 (parameter No.PC35) can be chosen using the external torque limit selection (RY(n+2)6).

(Note) RY(n+2) 6	Limit value status			Torque limit to be enabled: CCW driving/CW regeneration	Torque limit to be enabled: CW driving/CCW regeneration
0				Parameter No.PA11	Parameter No.PA12
1	Parameter No.PC35	>	Parameter No.PA11 Parameter No.PA12	Parameter No.PA11	Parameter No.PA12
	Parameter No.PC35	<	Parameter No.PA11 Parameter No.PA12	Parameter No.PC35	Parameter No.PC35

Note. 0: OFF
1: ON

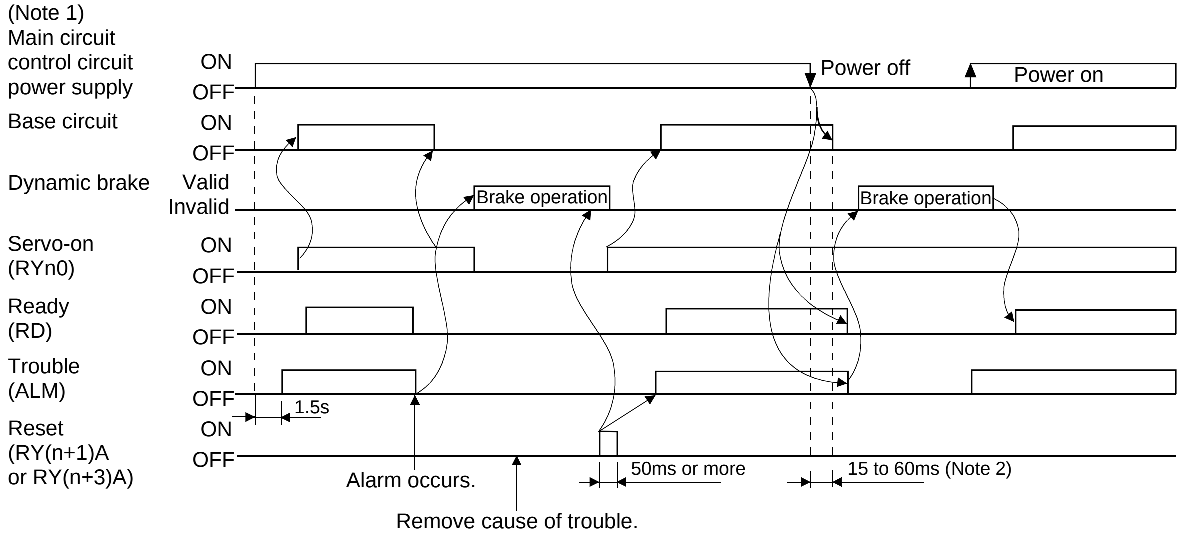
(3) Limiting torque (RXn4)

RXn4 turns on when the servo motor torque reaches the torque limited.

4.7 Alarm occurrence timing chart

⚠CAUTION	・When an alarm has occurred, remove its cause, make sure that the operation signal is not being input, ensure safety, and reset the alarm before restarting operation. ・As soon as an alarm occurs, turn off Servo-on (RYn0) and power off.

When an alarm occurs in the driver, the base circuit is shut off and the servo motor is coated to a stop. Switch off the main circuit power supply in the external sequence. To reset the alarm, switch the control circuit power supply from off to on, press the "SET" button on the current alarm screen, or turn the reset (RY(n+1)A or RY(n+3)A) from off to on. However, the alarm cannot be reset unless its cause is removed.



Note 1. Shut off the main circuit power as soon as an alarm occurs.
2. Changes depending on the operating status.

(1) Overcurrent, overload 1 or overload 2

If operation is repeated by switching control circuit power off, then on to reset the overcurrent (A32), overload 1 (A50) or overload 2 (A51) alarm after its occurrence, without removing its cause, the driver and servo motor may become faulty due to temperature rise. Securely remove the cause of the alarm and also allow about 30 minutes for cooling before resuming operation.

(2) Regenerative alarm

If operation is repeated by switching control circuit power off, then on to reset the regenerative (A30) alarm after its occurrence, the external regenerative resistor will generate heat, resulting in an accident.

(3) Instantaneous power failure

Undervoltage (A10) occurs when the input power is in either of the following statuses.

・A power failure of the control circuit power supply continues for 60ms or longer and the control circuit is not completely off.

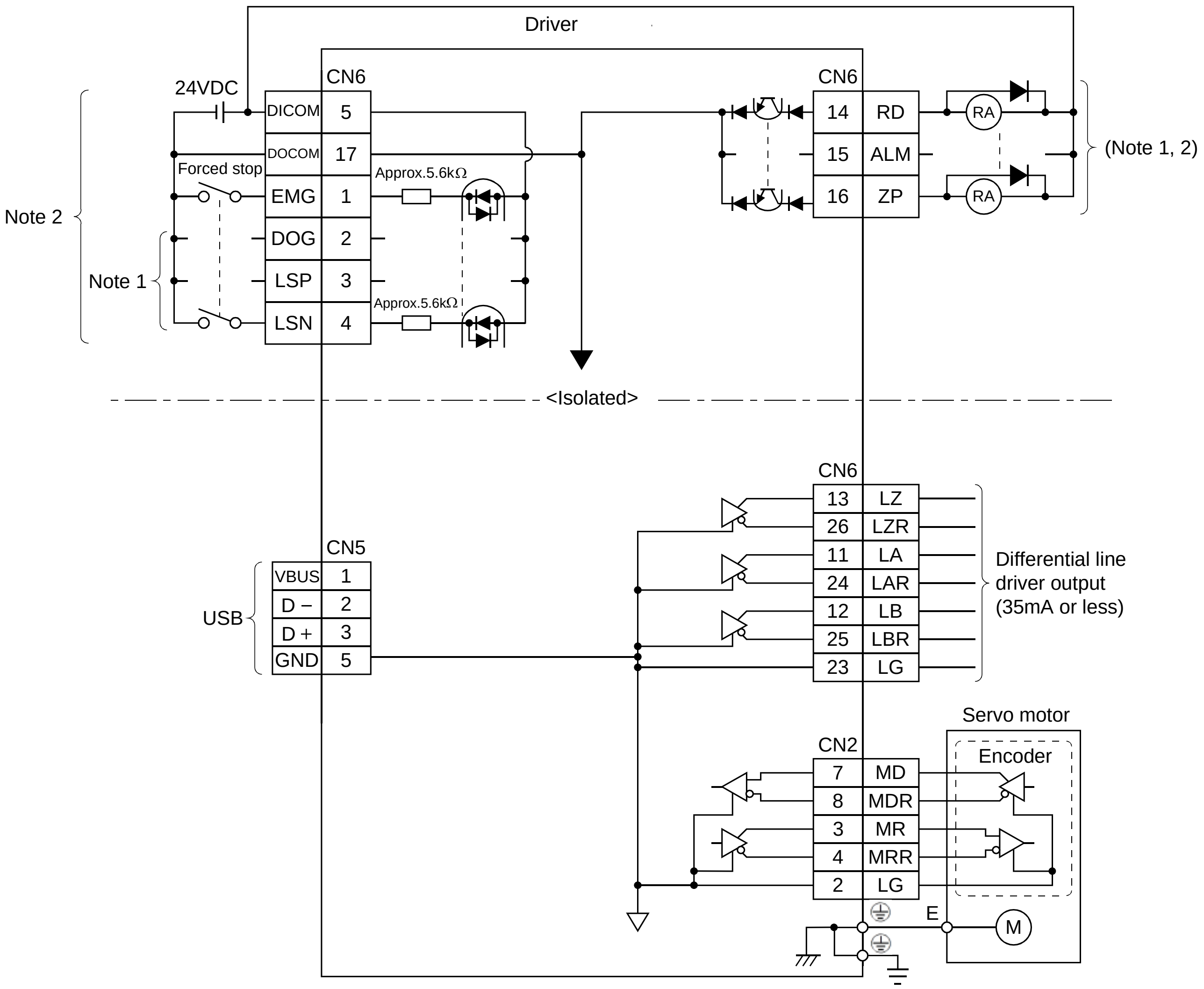
・During the servo-on status, the bus voltage dropped to 200VDC or less for LECSC2-□, 158VDC or less for LECSC1-□.

(4) Incremental system

When an alarm occurs, the home position is lost. When resuming operation after deactivating the alarm, make a home position return.

4.8 Interface

4.8.1 Internal connection diagram



Note 1. Devices assigned to these pins can be changed in the parameter settings.

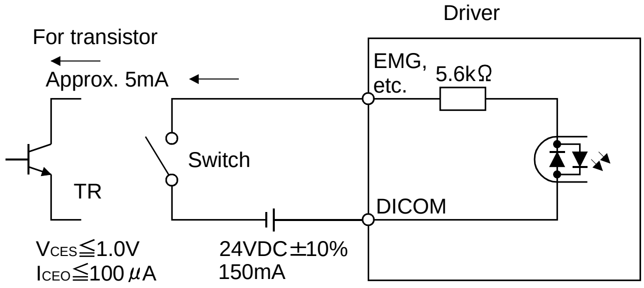
2. For this sink I/O interface. For the source I/O interface, refer to section 4.8.3.

4.8.2 Detailed description of interfaces

This section provides the details of the I/O signal interfaces (refer to the I/O division in the table) given in section 4.5.1. Refer to this section and make connection with the external equipment.

(1) Digital input interface DI-1

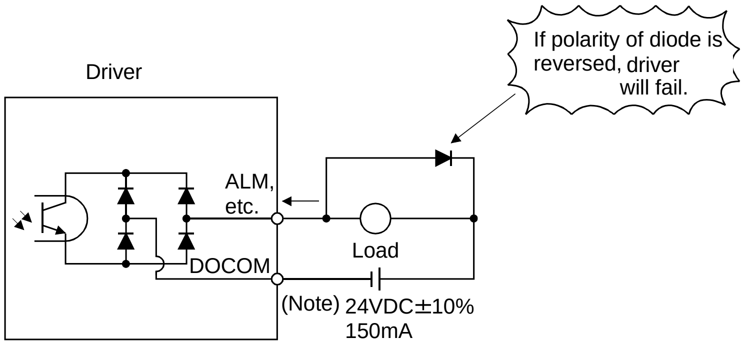
Give a signal with a relay or open collector transistor. Refer to section 4.8.3 for the source input.



(2) Digital output interface DO-1

A lamp, relay or photocoupler can be driven. Install a diode (D) for an inductive load, or install an inrush current suppressing resistor (R) for a lamp load. (Rated current: 40mA or less, maximum current: 50mA or less, inrush current: 100mA or less) A maximum of 2.6V voltage drop occurs in the driver.

Refer to section 4.8.3 for the source output.

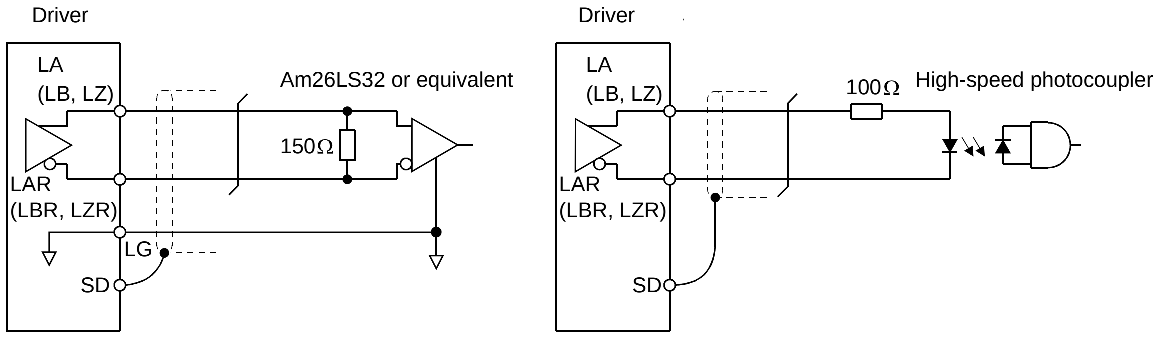


Note. If the voltage drop (maximum of 2.6V) interferes with the relay operation, apply high voltage (up to 26.4V) from external source.

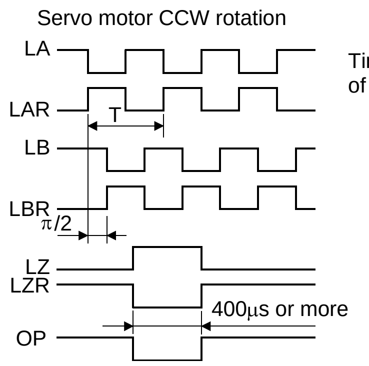
(3) Encoder output pulse DO-2 (Differential line driver system)

(a) Interface

Max. output current: 35mA



(b) Output pulse

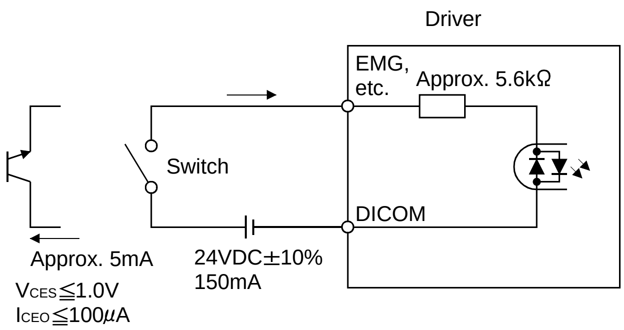


Time cycle (T) is determined by the settings of parameter No.PA15 and PC19.

4.8.3 Source I/O interfaces

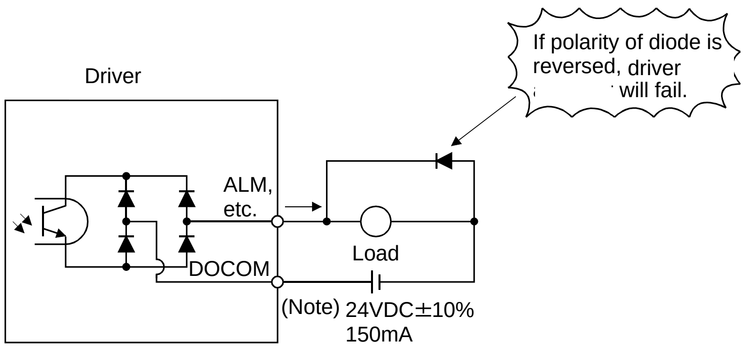
In this driver, source type I/O interfaces can be used. In this case, all DI-1 input signals and DO-1 output signals are of source type. Perform wiring according to the following interfaces.

(1) Digital input interface DI-1



(2) Digital output interface DO-1

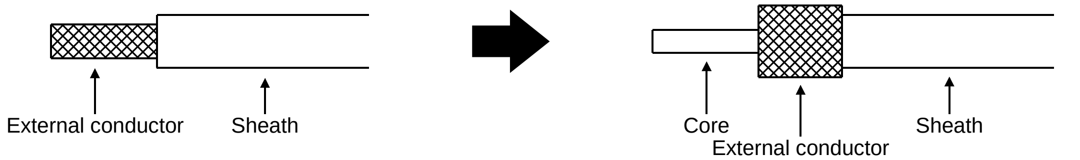
A maximum of 2.6V voltage drop occurs in the driver.



Note. If the voltage drop (maximum of 2.6V) interferes with the relay operation, apply high voltage (up to 26.4V) from external source.

4.9 Treatment of cable shield external conductor

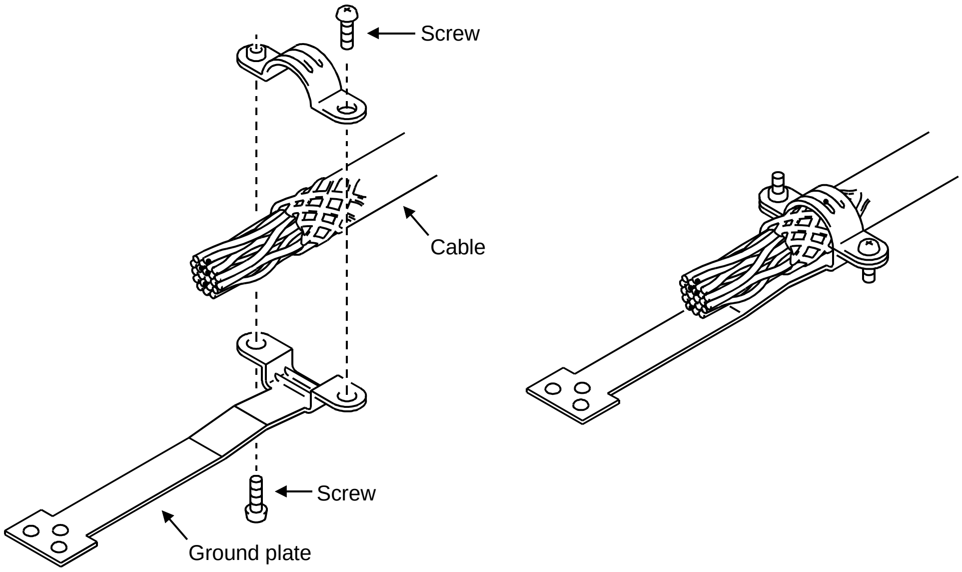
In the case of the CN2 and CN6 connectors, securely connect the shielded external conductor of the cable to the ground plate as shown in this section and fix it to the connector shell.



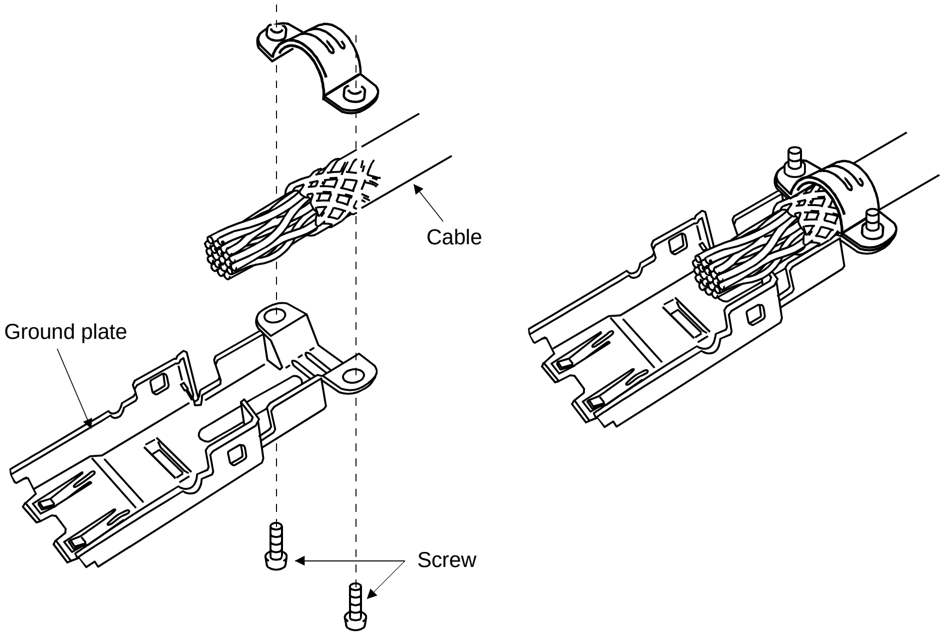
Strip the sheath.

Pull back the external conductor to cover the sheath.

(1) For CN6 connector (Sumitomo 3M Limited connector)



(2) For CN2 connector (Sumitomo 3M Limited or Molex connector)



4.10 Connection of driver and servo motor

WARNING	· During power-on, do not open or close the motor power line. Otherwise, a malfunction or faulty may occur.

4.10.1 Connection instructions

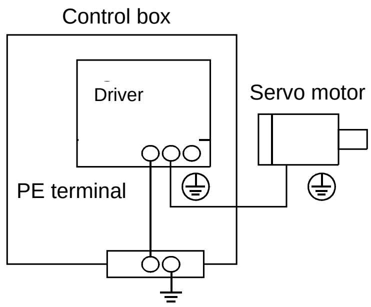
WARNING	· Insulate the connections of the power supply terminals to prevent an electric shock.

CAUTION	· Connect the wires to the correct phase terminals (U, V, W) of the driver and servo motor. Not doing so may cause unexpected operation. · Do not connect AC power supply directly to the servo motor. Otherwise, a fault may occur.

POINT
· Refer to section 13.1 for the selection of the encoder cable.

This section indicates the connection of the servo motor power (U, V, W). Use of the optional cable and connector set is recommended for connection between the driver and servo motor. When the options are not available, use the recommended products. Refer to section 13.1 for details of the options.

(1) For grounding, connect the earth cable of the servo motor to the protective earth (PE) terminal (⏚) of the driver and connect the ground cable of the driver to the earth via the protective earth of the control box. Do not connect them directly to the protective earth of the control panel.

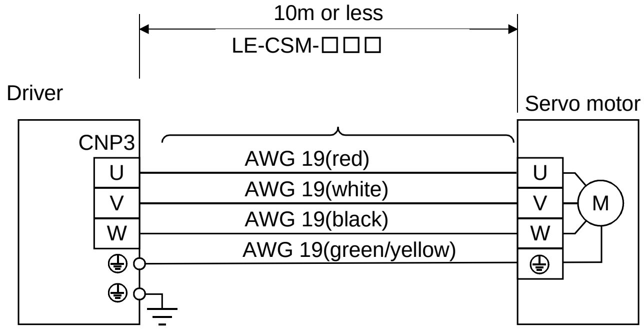


(2) Do not share the 24VDC interface power supply between the interface and lock. Always use the power supply designed exclusively for the lock.

4.10.2 Power supply cable wiring diagrams

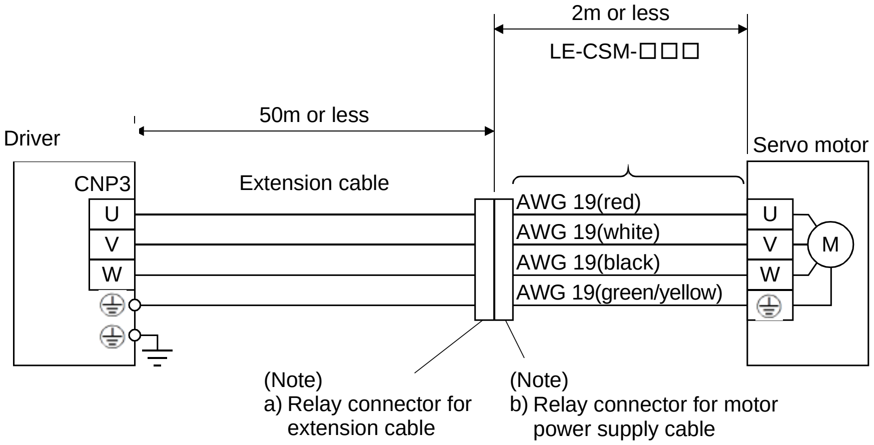
(1) LE-□-□ series servo motor

(a) When cable length is 10m or less



(b) When cable length exceeds 10m

When the cable length exceeds 10m, fabricate an extension cable as shown below. In this case, the motor power supply cable pulled from the servo motor should be within 2m long.
Refer to section 13.4 for the wire used for the extension cable.



Note. Use of the following connectors is recommended when ingress protection (IP65) is necessary.

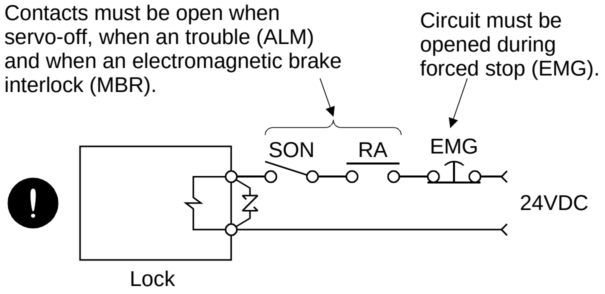
Relay connector	Description	Protective structure
a) Relay connector for extension cable	Connector: RM15WTPZ-4P(71) Cord clamp: RM15WTP-CP(5)(71) (Hirose Electric) └ Numeral changes depending on the cable OD	IP65
b) Relay connector for motor power supply cable	Connector: RM15WTJA-4S(71) Cord clamp: RM15WTP-CP(8)(71) (Hirose Electric) └ Numeral changes depending on the cable OD	IP65

4.11 Servo motor with a lock

4.11.1 Safety precautions

CAUTION

- Configure the lock operation circuit so that it is activated not only by the driver signals but also by an external forced stop signal.



- The lock is provided for holding purpose and must not be used for ordinary braking.
- Before performing the operation, be sure to confirm that the lock operates properly.

POINT

- Refer to section 16 for specifications such as the power supply capacity and operation delay time of the lock.

Note the following when the servo motor equipped with a lock is used.

1) Do not share the 24VDC interface power supply between the interface and lock. Always use the power supply designed exclusively for the lock.

2) The lock will operate when the power (24VDC) switches off.

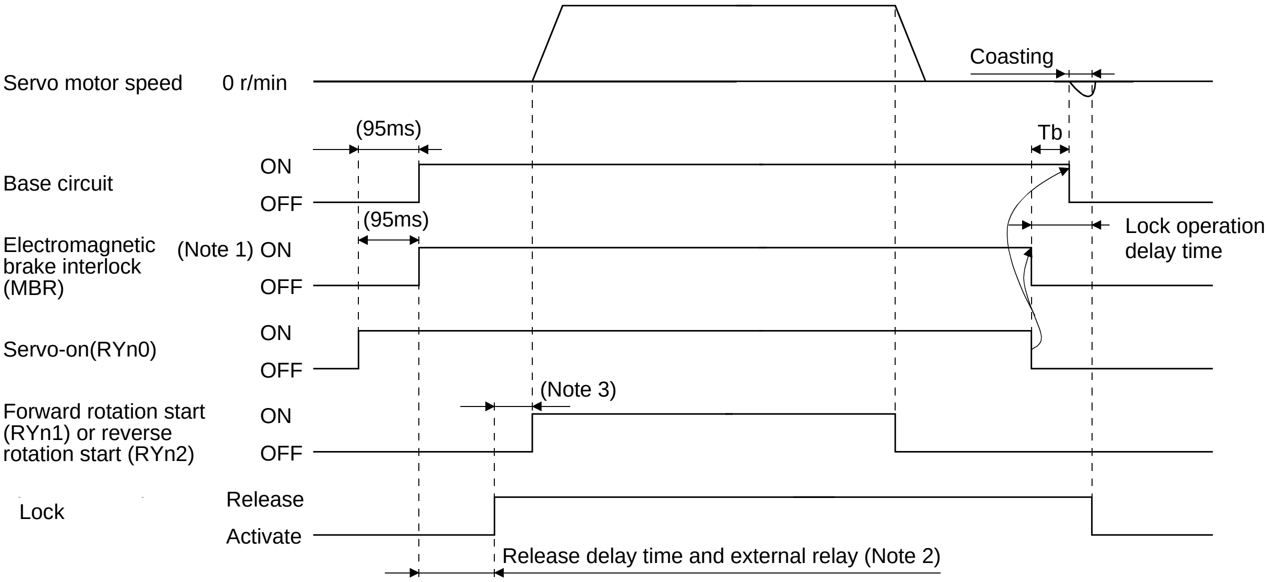
3) Switch off the servo-on (RYn0) after the servo motor has stopped.

Using parameter No.PC16 (electromagnetic brake sequence output), set a time delay (Tb) at servo-off from lock operation to base circuit shut-off as in the timing chart shown in section 4.11.2 in this section.

4.11.2 Timing charts

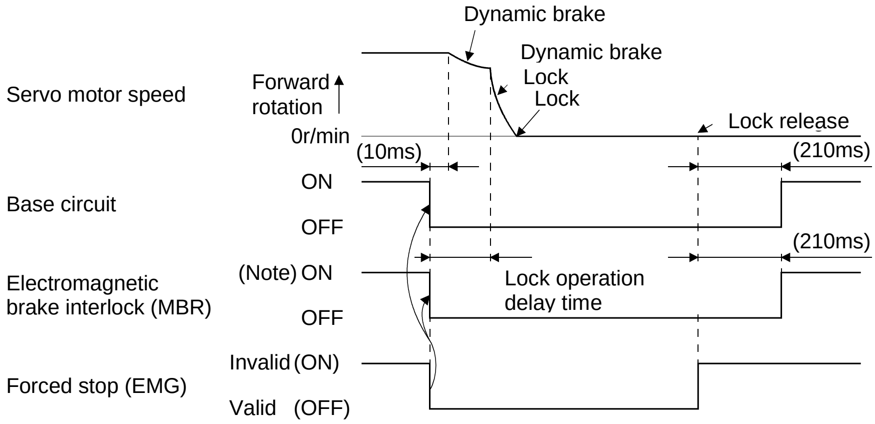
(1) Servo-on (RYn0) command (from driver) ON/OFF

Tb [ms] after the servo-on (RYn0) is switched off, the servo lock is released and the servo motor coasts. If the lock is made valid in the servo lock status, the lock life may be shorter. Therefore, when using the lock in a vertical lift application or the like, set Tb to about the same as the lock operation delay time to prevent a drop.



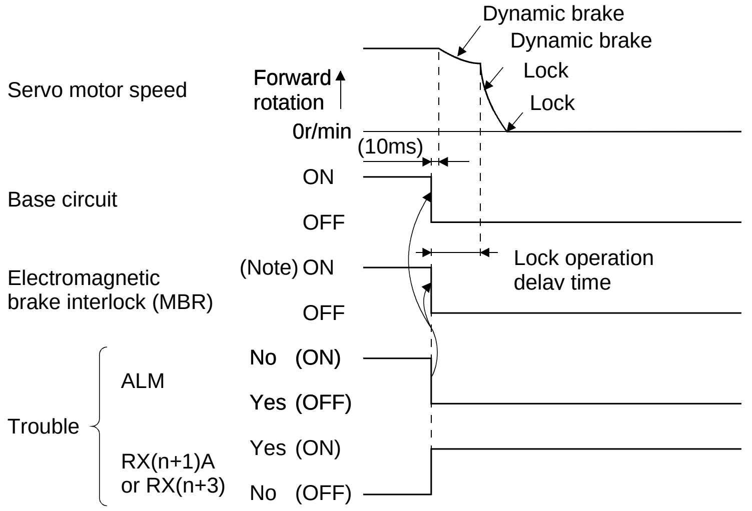
Note 1. ON: Lock is not activated.
OFF: Lock is activated.
2. Lock is released after delaying for the release delay time of lock and operation time of external circuit relay. For the release delay time of lock, refer to chapter 16.
3. After the lock is released, turn ON the RYn1 or RYn2.

(2) Forced stop (EMG) ON/OFF



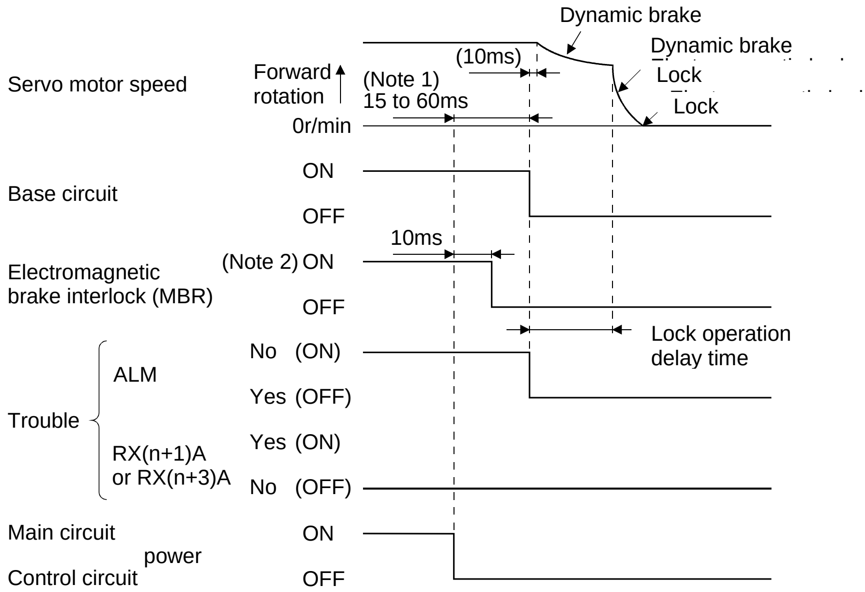
Note. ON: Lock is not activated.
OFF: Lock is activated.

(3) Alarm occurrence



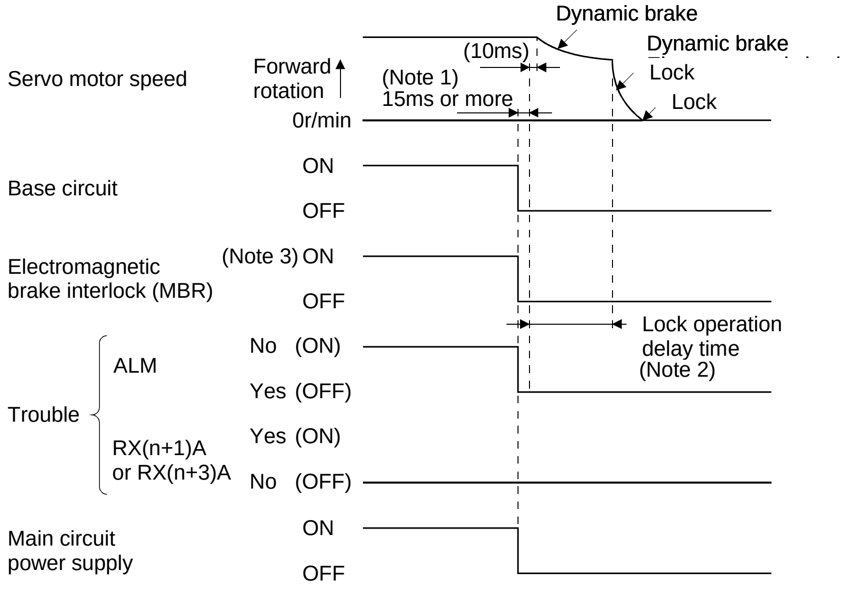
Note. ON: Lock is not activated.
OFF: Lock is activated.

(4) Both main and control circuit power supplies off



Note 1. Changes with the operating status.
2. ON: Lock is not activated.
OFF: Lock is activated.

(5) Only main circuit power supply off (control circuit power supply remains on)



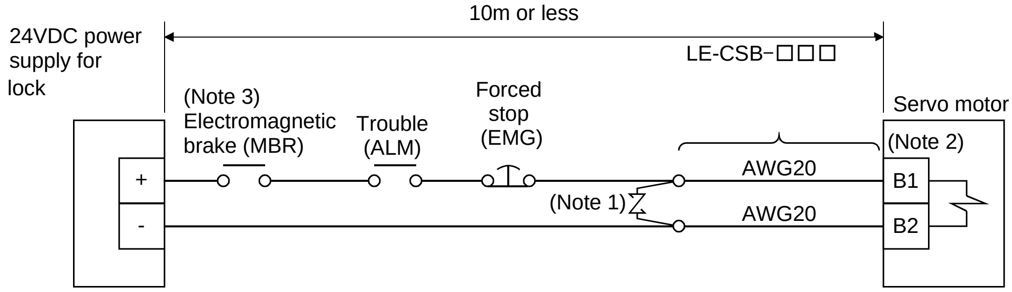
Note 1. Changes with the operating status.

2. When the main circuit power supply is off in a motor stop status, the main circuit off warning (AE9) occurs and the trouble (ALM) does not turn off.

3. ON: Lock is not activated.
   OFF: Lock is activated.

4.11.3 Wiring diagrams (LE-□-□series servo motor)

(1) When cable length is 10m or less



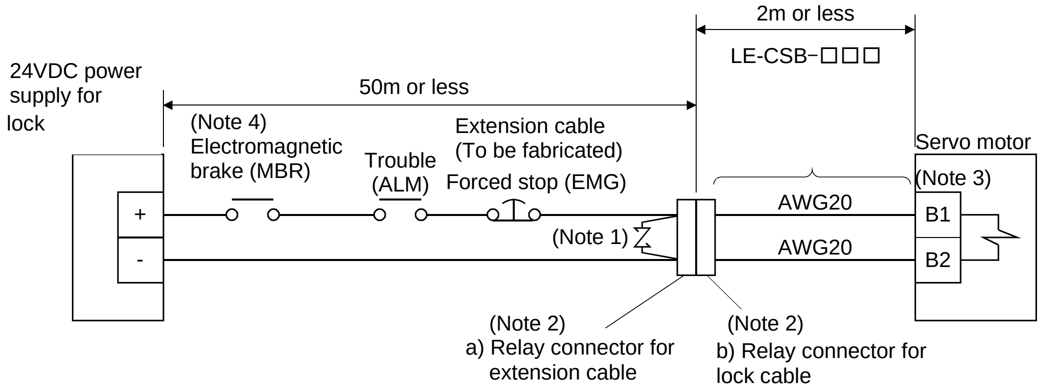
Note 1. Connect a surge absorber as close to the servo motor as possible.
2. There is no polarity in lock terminals (B1 and B2).
3. When using a servo motor with a locke, assign the electromagnetic brake interlock (MBR) to external output signal in the parameters No.PD09 to PD11.

When fabricating the lock cable LE-CSB-R□A, refer to section 13.1.4.

(2) When cable length exceeds 10m

When the cable length exceeds 10m, fabricate an extension cable as shown below on the customer side. In this case, the lock cable should be within 2m long.

Refer to section 13.9 for the wire used for the extension cable.



Note 1. Connect a surge absorber as close to the servo motor as possible.
2. Use of the following connectors is recommended when ingress protection (IP65) is necessary.

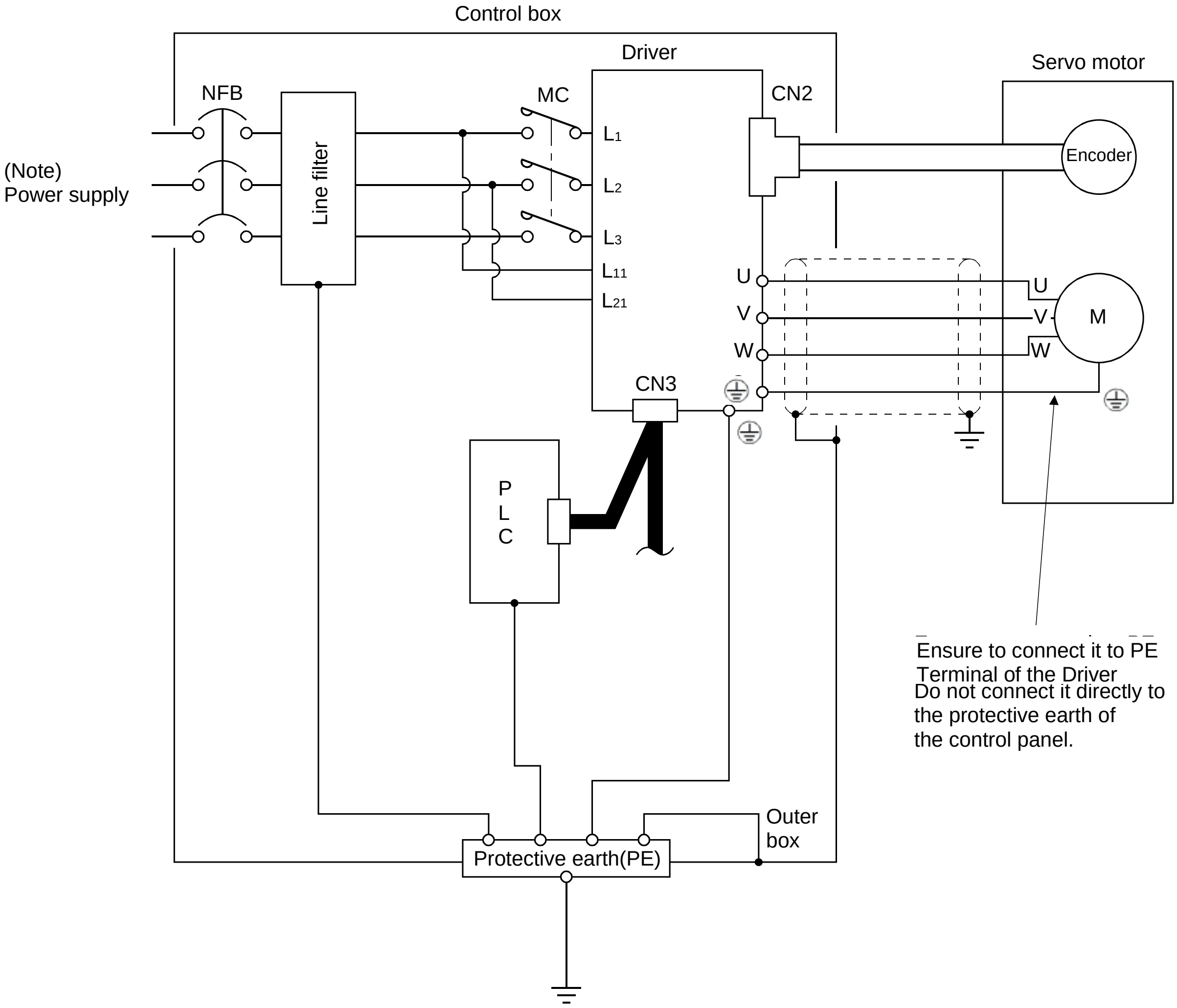
Relay connector	Description	Protective structure
a) Relay connector for extension cable	CM10-CR2P-∗ (DDK) └ Wire size: S, M, L	IP65
b) Relay connector for lock cable	CM10-SP2S-∗ (DDK) └ Wire size: S, M, L	IP65

3. There is no polarity in lock terminals (B1 and B2).
4. When using a servo motor with a lock, assign the electromagnetic brake interlock (MBR) to external output signal in the parameters No.PD09 to PD11.

4.12 Grounding

WARNING	・Ground the driver and servo motor securely. ・To prevent an electric shock, always connect the protective earth (PE) terminal (terminal marked ⏚) of the driver with the protective earth (PE) of the control box.

The driver switches the power transistor on-off to supply power to the servo motor. Depending on the wiring and ground cable routing, the driver may be affected by the switching noise (due to di/dt and dv/dt) of the transistor. To prevent such a fault, refer to the following diagram and always ground.
To conform to the EMC Directive, refer to the EMC Installation Guidelines (IB(NA)67310).



Note. For 1-phase 200 to 230VAC or 1-phase 100 to 120VAC, connect the power supply to L_1・L_2 and leave L_3 open.
There is no L_3 for 1-phase 100 to 120VAC power supply. Refer to section 1.2 for the power supply specification.

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5. OPERATION

⚠ WARNING	· Do not operate the switches with wet hands. You may get an electric shock.

⚠ CAUTION	· Before starting operation, check the parameters. Some machines may perform unexpected operation. · Take safety measures, e.g. provide covers, to prevent accidental contact of hands and parts (cables, etc.) with the driver heat sink, regenerative resistor, servo motor, etc. since they may be hot while power is on or for some time after power-off. Their temperatures may be high and you may get burnt or a parts may damaged. · During operation, never touch the rotating parts of the servo motor. Doing so can cause injury.

5.1 Switching power on for the first time

When switching power on for the first time, follow this section to make a startup.

5.1.1 Startup procedure

Wiring check	Check whether the driver and servo motor are wired correctly using visual inspection, DO forced output function (Section 7.7.4), etc. (Refer to section 5.1.2.)
↓ Surrounding environment check	Check the surrounding environment of the driver and servo motor. (Refer to section 5.1.3.)
↓ Parameter setting	Set the parameters as necessary, such as the used control mode and regenerative option selection with the set up software(MR Configurator). (Refer to chapter 6.)
↓ Test operation of servo motor alone in test operation mode	For the test operation, with the servo motor disconnected from the machine and operated at the speed as low as possible, and check whether the servo motor rotates correctly. (Refer to sections 7.7.)
↓ Test operation of servo motor alone by commands	For the test operation with the servo motor disconnected from the machine and operated at the speed as low as possible, and check whether the servo motor rotates correctly.
↓ Test operation with servo motor and machine connected	Connect the servo motor with the machine, give operation commands from the host command device, and check machine motions.
↓ Gain adjustment	Make gain adjustment to optimize the machine motions. (Refer to chapter 8.)
↓ Actual operation	
↓ Stop	Stop giving commands and stop operation.

5.1.2 Wiring check

(1) Power supply system wiring

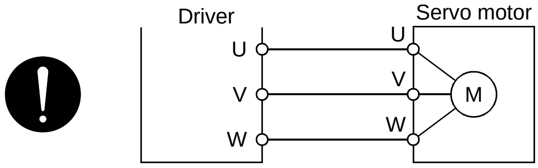
Before switching on the main circuit and control circuit power supplies, check the following items.

(a) Power supply system wiring

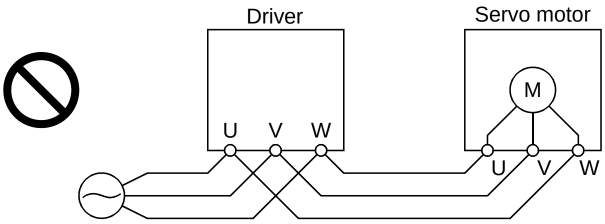
The power supplied to the power input terminals (L1, L2, L3, L11, L21) of the driver should satisfy the defined specifications. (Refer to section 1.2.)

(b) Connection of driver and servo motor

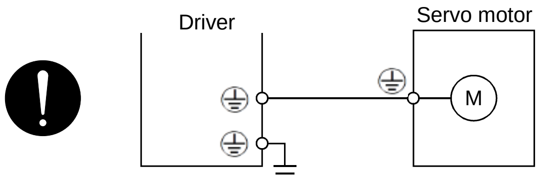
1) The servo motor power supply terminals (U, V, W) of the driver match in phase with the power input terminals (U, V, W) of the servo motor.



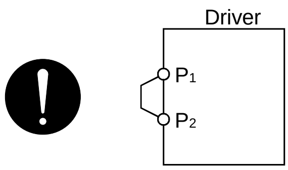
2) The power supplied to the driver should not be connected to the servo motor power supply terminals (U, V, W). To do so will fail the connected driver and servo motor.



3) The earth terminal of the servo motor is connected to the PE terminal of the driver.



4) P1-P2 (For 11kW or more, P1-P) should be connected.



(c) When option and auxiliary equipment are used

1) When regenerative option is used for 200V class

・ The lead between P terminal and D terminal of CNP2 connector should not be connected.

・ The generative brake option should be connected to P terminal and C terminal.

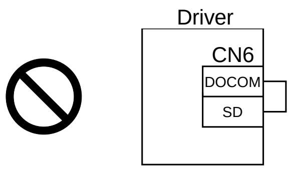
・ A twisted cable should be used. (Refer to section 13.2.)

(2) I/O signal wiring

(a) The I/O signals should be connected correctly.
Use DO forced output to forcibly turn on/off the pins of the CN6 connector. This function can be used to perform a wiring check. (Refer to section 7.7.4.) In this case, switch on the control circuit power supply only.

(b) 24VDC or higher voltage is not applied to the pins of connectors CN6.

(c) SD and DOCOM of connector CN6 is not shorted.



5.1.3 Surrounding environment

(1) Cable routing

(a) The wiring cables are free from excessive force.

(b) The encoder cable should not be used in excess of its flex life. (Refer to section 12.4.)

(c) The connector part of the servo motor should not be strained.

(2) Environment

Signal cables and power cables are not shorted by wire offcuts, metallic dust or the like.

5.2 Startup

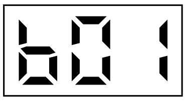
5.2.1 Power on and off procedures

(1) Power-on

Switch power on in the following procedure. Always follow this procedure at power-on.

1) Switch off the servo-on (RYn0).
2) Make sure that the Forward rotation start (RYn1) and Reverse rotation start (RYn2) are off.
3) Switch on the main circuit power supply and control circuit power supply.

When main circuit power/control circuit power is switched on, the driver display shows "b01" (if the driver has the station number of 1).



In the absolute position detection system, first power-on results in the absolute position lost (A25) alarm and the servo system cannot be switched on.
The alarm can be deactivated then switching power off once and on again.
Also in the absolute position detection system, if power is switched on at the servo motor speed of 3000r/min or higher, position mismatch may occur due to external force or the like. Power must therefore be switched on when the servo motor is at a stop.

(2) Power-off

1) Make sure that the Forward rotation start (RYn1) and Reverse rotation start (RYn2) are off.
2) Switch off the Servo-on (RYn0).
3) Switch off the main circuit power supply and control circuit power supply.

5.2.2 Stop

In any of the following statuses, the driver interrupts and stops the operation of the servo motor.
Refer to section 4.11 for the servo motor equipped with a lock.

(a) Servo-on (RYn0) OFF
The base circuit is shut off and the servo motor coasts.

(b) Alarm occurrence
When an alarm occurs, the base circuit is shut off and the dynamic brake is operated to bring the servo motor to a sudden stop.

(c) Forced stop (EMG) OFF
The base circuit is shut off and the dynamic brake is operated to bring the servo motor to a sudden stop. The servo forced stop warning (AE6) occurs.

(d) Forward rotation stroke end (LSP), reverse rotation stroke end (LSN) OFF
The droop pulse value is erased and the servo motor is stopped and servo-locked. It can be run in the opposite direction.

5.2.3 Test operation

Before starting actual operation, perform test operation to make sure that the machine operates normally.
Refer to section 5.2.1 for the power on and off methods of the driver.

Test operation of servo motor alone in JOG operation of test operation mode

In this step, confirm that the driver and servo motor operate normally.
With the servo motor disconnected from the machine, use the test operation mode and check whether the servo motor correctly rotates at the slowest speed. Refer to section 7.7 for the test operation mode.

↓

Test operation of servo motor alone by commands

In this step, confirm that the servo motor correctly rotates at the slowest speed under the commands from the command device.
Make sure that the servo motor rotates in the following procedure.

1) Switch on the Forced stop (EMG) and Servo-on (RYn0). When the driver is put in a servo-on status, the Ready (RD) switches on.
2) Switch on the Forward rotation stroke end (LSP) or Reverse rotation stroke end (LSN).
3) When the point table is designated to switch on the forward rotation start (RYn1) or reverse rotation start (RYn2), the servo motor starts rotating. Give a low speed command at first and check the rotation direction, etc. of the servo motor. If the servo motor does not operate in the intended direction, check the input signal.

↓

Test operation with servo motor and machine connected

In this step, connect the servo motor with the machine and confirm that the machine operates normally under the commands from the command device.
Make sure that the servo motor rotates in the following procedure.

1) Switch on the Forced stop (EMG) and Servo-on (RYn0). When the driver is put in a servo-on status, the Ready (RD) switches on.
2) Switch on the Forward rotation stroke end (LSP) or Reverse rotation stroke end (LSN).
3) When the point table is specified from the command device and the forward rotation start (RYn1) or reverse rotation start (RYn2) is turned ON, the servo motor starts rotating. Give a low speed command at first and check the operation direction, etc. of the machine. If the machine does not operate in the intended direction, check the input signal. In the status display, check for any problems of the servo motor speed, load ratio, etc.
4) Then, check automatic operation with the program of the command device.

5.2.4 Parameter setting

POINT

- The encoder cable LE-CSE-□□□ for the LE-□-□series servo motor requires the parameter No.PC22 setting to be changed depending on its length. Check whether the parameter is set correctly. If it is not set correctly, the encoder error 1 (A16) will occur at power-on.

Encoder cable	Parameter No.PC22 setting
LE-CSE-□2□ LE-CSE-□5□ LE-CSE-□A□	0□□□ (initial value)
Other cable	1□□□

The driver can be used by merely changing the basic setting parameters (No.PA□□) mainly.
As necessary, set the gain filter parameters (No.PB□□), extension setting parameters (No.PC□□) and I/O setting parameters (No.PD□□).

Parameter group	Main description
Basic setting parameter (No.PA□□)	Set the basic setting parameters first. Generally, operation can be performed by merely setting this parameter group. In this parameter group, set the following items. Control mode selection (select the position control mode) Regenerative option selection Absolute position detection system selection Setting of command input pulses per revolution Electronic gear setting Auto tuning selection and adjustment In-position range setting Torque limit setting Command pulse input form selection Servo motor rotation direction selection Encoder output pulse setting
Gain filter parameter (No.PB□□)	If satisfactory operation cannot be achieved by the gain adjustment made by auto tuning, execute in-depth gain adjustment using this parameter group. This parameter group must also be set when the gain changing function is used.
Extension setting parameter (No.PC□□)	This parameter group is unique to LECSC□-□ driver.
I/O setting parameter (No.PD□□)	Used when changing the I/O devices of the driver.

5.2.5 Point table setting

Set necessary items to the point table before starting operation. The following table indicates the items that must be set.

Name	Description
Position data	Set the position data for movement.
Servo motor speed	Set the command speed of the servo motor for execution of positioning.
Acceleration time constant	Set the acceleration time constant.
Deceleration time constant	Set the deceleration time constant.
Dwell	Set the waiting time when performing automatic continuous operation.
Auxiliary function	Set when performing automatic continuous operation.

Refer to section 5.4.2 for details of the point table.

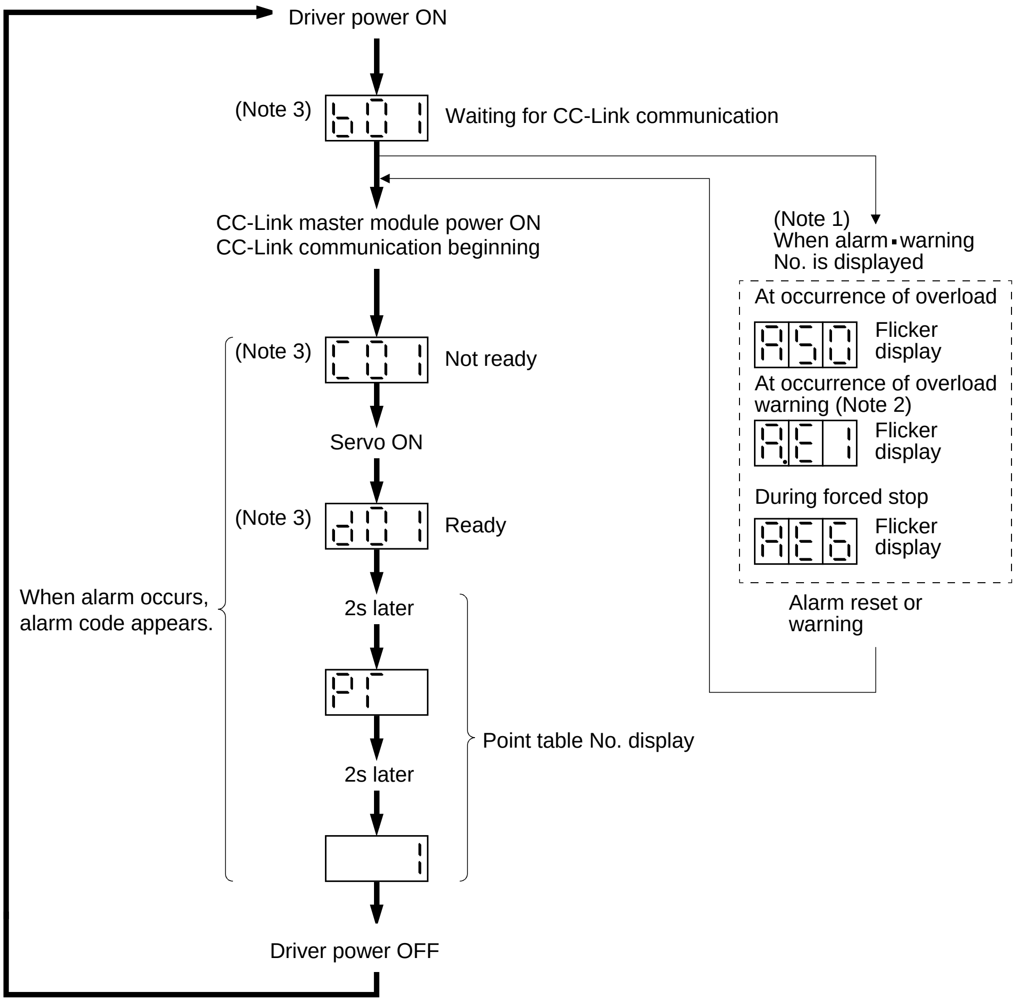
5.2.6 Actual operation

Start actual operation after confirmation of normal operation by test operation and completion of the corresponding parameter settings. Perform a home position return as necessary.

5.3 Driver display

On the driver display (three-digit, seven-segment display), check the status of communication with the CC-Link driver at power-on, check the station number, and diagnose a fault at occurrence of an alarm.

(1) Display sequence

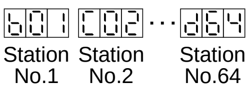


Note 1. Only alarm and warning No. are displayed, but no station No. is displayed.

2. If warning other than AE6 occurs during the servo on, flickering the second place of decimal point indicates that it is during the servo on.

3. The right-hand segments of b01, c02 and d16 indicate the axis number.

(Below example indicates Station No.1)



(2) Indication list

Indication	Status	Description
b##	Waiting for CC-Link communication	・Power of the CC-Link master module was switched on at the condition that the power of CC-Link master module is OFF. ・The CC-Link master module is faulty.
(Note 1) d##	Ready	The servo was switched on after completion of initialization and the driver is ready to operate. (This is indicated for 2 seconds.)
(Note 1) C##	Not ready	The driver is being initialized or an alarm has occurred.
(Note 2) $$$	Ready for operation	Two seconds have passed after the driver is ready to operate by turning ON the servo-on (RYn1).
(Note 3) A＊＊	Alarm・Warning	The alarm No./warning No. that occurred is displayed. (Refer to section 10.4.)
888	CPU error	CPU watchdog error has occurred.
(Note 4) b00.	(Note 4) Test operation mode	JOG operation・positioning operation・programmed operation・DO forced output・single-step feed
(Note 1) d##. C##.		Motor-less operation

Note 1. ## denotes any of numerals 00 to 16 and what it means is listed below.

##	Description
00	Set to the test operation mode.
01	Station number 1
02	Station number 2
03	Station number 3
: :	: :
62	Station number 62
63	Station number 63
64	Station number 64

Note 2. $$$ indicates numbers from 0 to 255, and the number indicates the executing point table number.
3. ＊＊ indicates the warning/alarm No.
4. Requires set up software(MR Configurator) .

5.4 Automatic operation mode

5.4.1 What is automatic operation mode?

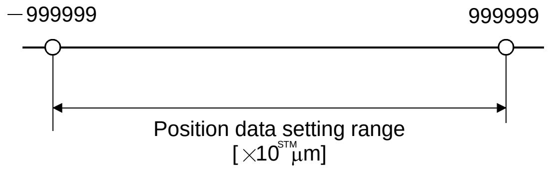
(1) Command system

After selection of preset point tables using the input signals or communication, operation is started by the forward rotation start (RYn1) or reverse rotation start (RYn2). Automatic operation has the absolute value command system, incremental value command system.

(a) Absolute value command system

As position data, set the target address to be reached.

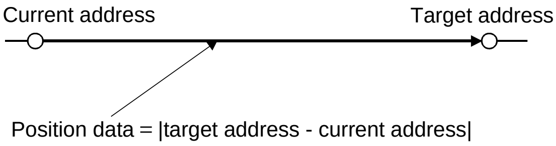
Setting range: −999999 to 999999 [$\times 10^{STM}$ μm] (STM = feed length multiplication parameter No.PA05)



(b) Incremental value command system

As position data, set the moving distance from the current address to the target address.

Setting range: 0 to 999999 [$\times 10^{STM}$ μm] (STM = feed length multiplication parameter No.PA05)



(2) Point table

(a) Point table setting

Up to 255 point tables may be set.

Set the point tables using the set up software(MR Configurator) Software, the CC-Link write instruction code.

The following table lists what to set: Refer to section 5.4.2 for details of the settings.

Name	Description
Position data	Set the position data for movement.
Servo motor speed	Set the command speed of the servo motor for execution of positioning.
Acceleration time constant	Set the acceleration time constant.
Deceleration time constant	Set the deceleration time constant.
Dwell	Set the waiting time when performing automatic continuous operation.
Auxiliary function	Set when performing automatic continuous operation.

(b) Selection of point table

Using the input signal or CC-Link, select the point table No. with the remote input and remote register from the command device (PC or PLC...etc) such as a personal computer.

The following table lists the point table No. selected in response to the remote input. When 2 stations are occupied, the point table No. can be selected by remote register setting. (Refer to section 3.6.3.)

Remote input (0: OFF 1: ON)								Selected point table No.
2 stations occupied			1 station occupied					
RY(n+2)5	RY(n+2)4	RY(n+2)3	RYnE	RYnD	RYnC	RYnB	RYnA	
0	0	0	0	0	0	0	1	1
0	0	0	0	0	0	1	0	2
0	0	0	0	0	0	1	1	3
0	0	0	0	0	1	0	0	4
⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮
1	1	1	1	1	1	1	0	254
1	1	1	1	1	1	1	1	255

5.4.2 Automatic operation using point table

(1) Absolute value command system

(a) Point table

Set the point table values using the set up software(MR Configurator), the or the remote register of CC-Link.

Set the position data, motor speed, acceleration time constant, deceleration time constant, dwell and auxiliary function to the point table. The following table gives a setting example. However, this function cannot be used when the point table No. is selected using the remote register of CC-Link.

Name	Setting range	Unit	Description
Position data	−999999 to 999999	$\times 10^{STM}$μm	(1) When using this point table as absolute value command system Set the target address (absolute value). (2) When using this point table as incremental value command system Set the moving distance. A "-" sign indicates a reverse rotation command.
Motor speed	0 to permissible speed	r/min	Set the command speed of the servo motor for execution of positioning. The setting should be equal to or less than the instantaneous permissible speed of the servo motor.
Acceleration time constant	0 to 20000	ms	Set the time until the rated speed of the servo motor is reached.
Deceleration time constant	0 to 20000	ms	Set the time until the servo motor running at rated speed comes to a stop.
Dwell	0 to 20000	ms	This function is valid when the point table is selected using the input signal or the remote input of CC-Link. It cannot be used when the point table No. is selected using the remote register of CC-Link. Set "0" in the auxiliary function to make the dwell invalid. Set "1" in the auxiliary function and 0 in the dwell to perform continuous operation. When the dwell is set, the position command of the selected point table is completed, and after the set dwell has elapsed, the position command of the next point table is started.
Auxiliary function	0 to 3		This function is valid when the point table is selected using the input signal or the remote input of CC-Link. It cannot be used when the point table No. is selected using the remote register of CC-Link. (1) When using this point table in the absolute value command system 0: Automatic operation is performed in accordance with a single point table chosen. 1: Operation is performed in accordance with consecutive point tables without a stop. (2) When using this point table in the incremental value command system 2: Automatic operation is performed in accordance with a single point table chosen. 3: Operation is performed in accordance with consecutive point tables without a stop. When a different rotation direction is set, smoothing zero (command output) is confirmed and the rotation direction is then reversed. Setting "1" in point table No.255 results in an error. For full information, refer to (4) in this section.

(b) Parameter setting

Set the following parameters to perform automatic operation.

1) Command mode selection (parameter No.PA01)

Select the absolute value command system.

Parameter No.PA01

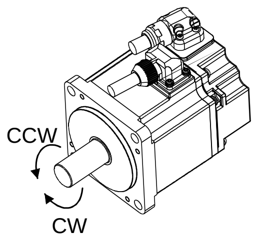
			0

Absolute value command system

2) Rotation direction selection (parameter No.PA14)

Choose the servo motor rotation direction at the time when the forward rotation start (RYn1) is switched on.

Parameter No.PA14 setting	Servo motor rotation direction when forward rotation start (RYn1) is switched on
0	CCW rotation with + position data CW rotation with − position data
1	CW rotation with + position data CCW rotation with − position data



3) Feed length multiplication selection (parameter No.PA05)

Set the unit multiplication factor (STM) of position data.

Parameter No.PA05 setting	Feed unit [μm]	Position data input range [mm]
□□□0	1	−999.999 to +999.999
□□□1	10	−9999.99 to +9999.99
□□□2	100	−99999.9 to +99999.9
□□□3	1000	−999999 to +999999

(c) Operation

Choosing the point table using RYnA to RYnE, RY(n+2)3 to RY(n+2)5 and turning RYn1 ON starts positioning to the position data at the preset speed, acceleration time constant and deceleration time constant. At this time, reverse rotation start (RYn2) is invalid.

Item	Setting method	Description
Automatic operation mode selection	Automatic/manual selection (RYn6)	Turn RYn6 ON.
Point table selection	Point table No. selection 1 (RYnA) Point table No. selection 2 (RYnB) Point table No. selection 3 (RYnC) Point table No. selection 4 (RYnD) Point table No. selection 5 (RYnE) Point table No. selection 6 (RY(n+2)3) Point table No. selection 7 (RY(n+2)4) Point table No. selection 8 (RY(n+2)5)	Refer to section 5.4.1(2).
Start	Forward rotation start (RYn1)	Turn RYn1 ON to start.

(2) Incremental value command system

(a) Point table

Set the point table values using the set up software(MR Configurator), the or the remote register of CC-Link.

Set the position data, motor speed, acceleration time constant, deceleration time constant, dwell and auxiliary function to the point table. The following table gives a setting example.

Name	Setting range	Unit	Description
Position data	0 to 999999	$\times 10^{STM}$ μm	Set the moving distance. The unit can be changed using feed length multiplication factor selection of parameter No.PA05.
Servo motor speed	0 to permissible speed	r/min	Set the command speed of the servo motor for execution of positioning. The setting should be equal to or less than the instantaneous permissible speed of the servo motor.
Acceleration time constant	0 to 20000	ms	Set the time until the rated speed of the servo motor is reached.
Deceleration time constant	0 to 20000	ms	Set the time until the servo motor running at rated speed comes to a stop.
Dwell	0 to 20000	ms	This function is valid when the point table is selected using the input signal or the remote input of CC-Link. It cannot be used when the point table No. is selected using the remote register of CC-Link. Set "0" in the auxiliary function to make the dwell invalid. Set "1" in the auxiliary function and 0 in the dwell to perform continuous operation. When the dwell is set, the position command of the selected point table is completed, and after the set dwell has elapsed, the position command of the next point table is started.
Auxiliary function	0・1		This function is valid when the point table is selected using the input signal or the remote input of CC-Link. It cannot be used when the point table No. is selected using the remote register of CC-Link. 0: Automatic operation is performed in accordance with a single point table chosen. 1: Operation is performed in accordance with consecutive point tables without a stop. When a different rotation direction is set, smoothing zero (command output) is confirmed and the rotation direction is then reversed. Setting "1" in point table No.255 results in an error. For full information, refer to (4) in this section.

(b) Parameter setting

Set the following parameters to perform automatic operation.

1) Command mode selection (parameter No.PA01)

Select the incremental value command system.

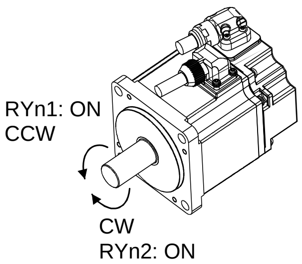
Parameter No.PA01

			1

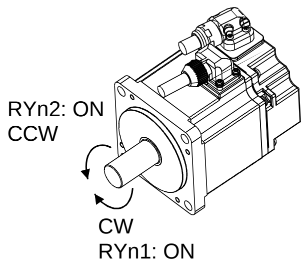
Incremental value command system

2) Forward rotation direction selection (parameter No.PA14)
Choose the servo motor rotation direction at the time when the forward rotation start (RYn1) signal or reverse rotation start (RYn2) signal is switched on.

Parameter No.PA14 setting	Servo motor rotation direction	
	Forward rotation start (RYn1) ON	Reverse rotation start (RYn2) ON
0	CCW rotation (address incremented)	CW rotation (address decremented)
1	CW rotation (address incremented)	CCW rotation (address decremented)



Parameter No.PA14: 0



Parameter No.PA14: 1

3) Feed length multiplication selection (parameter No.PA05)
Set the unit multiplication factor (STM) of position data.

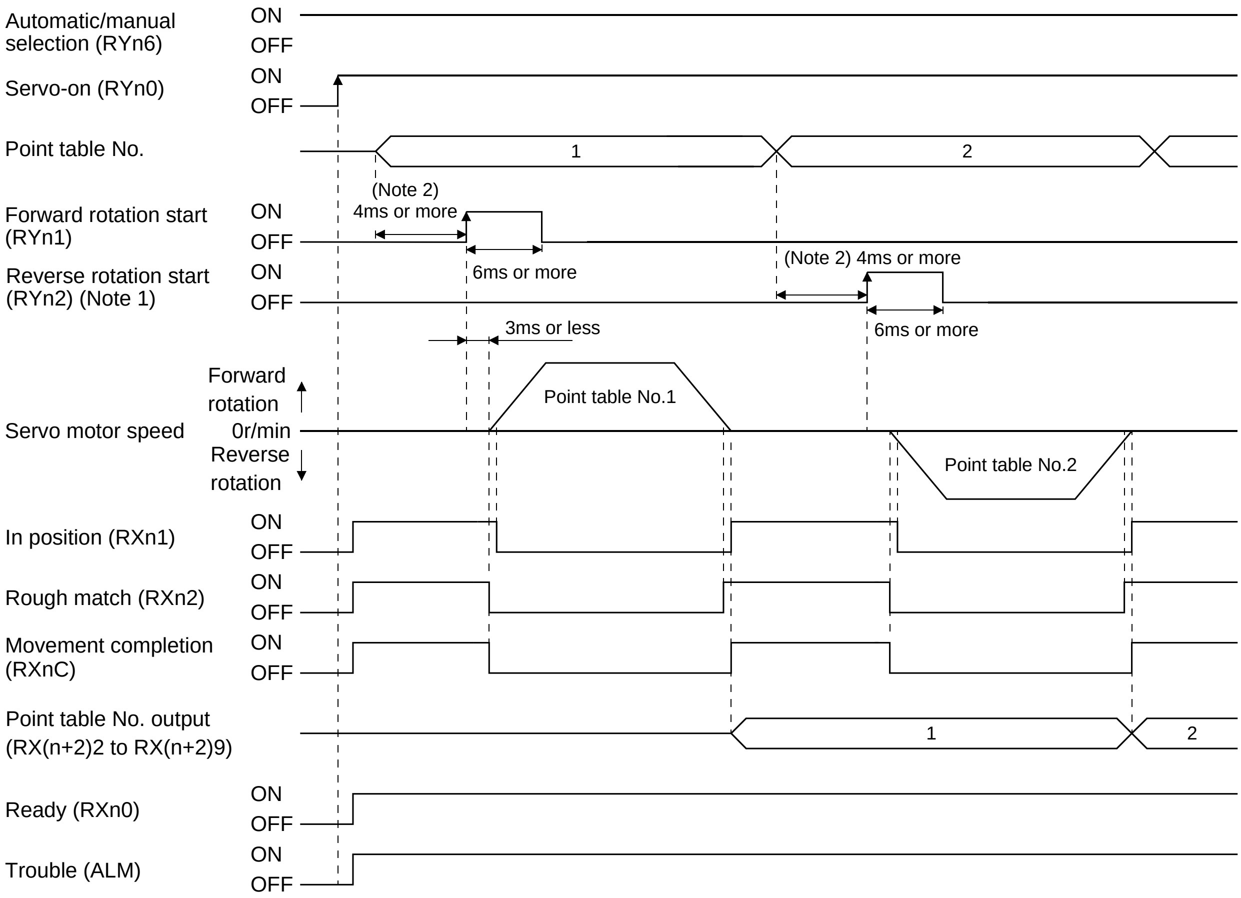
Parameter No.PA05 setting	Feed unit [μm]	Position data input range [mm]
□□□0	1	0 to 999.999
□□□1	10	0 to 9999.99
□□□2	100	0 to 99999.9
□□□3	1000	0 to 999999

(c) Operation
Choosing the point table using RYnA to RYnE, RY(n+2)3 to RY(n+2)5 and turning RYn1 ON starts a motion in the forward rotation direction over the moving distance of the position data at the preset speed and acceleration time constant.
Turning RYn2 ON starts a motion in the reverse rotation direction according to the values set to the selected point table.

Item	Setting method	Description
Automatic operation mode selection	Automatic/manual selection (RYn6)	Turn RYn6 ON.
Point table selection	Point table No. selection 1 (RYnA) Point table No. selection 2 (RYnB) Point table No. selection 3 (RYnC) Point table No. selection 4 (RYnD) Point table No. selection 5 (RYnE) Point table No. selection 6 (RY(n+2)3) Point table No. selection 7 (RY(n+2)4) Point table No. selection 8 (RY(n+2)5)	Refer to section 5.4.1(2).
Start	Forward rotation start (RYn1)	Turn RYn1 ON to start motion in forward rotation direction.
	Reverse rotation start (RYn2)	Turn RYn2 ON to start motion in reverse rotation direction.

(3) Automatic operation timing chart

The timing chart is shown below.



Note 1. Reverse rotation start (RYn2) is invalid in the absolute value command system.

2. Configure a sequence that changes the point table selection earlier, considering the delay time of CC-Link communication.

(4) Automatic continuous operation

POINT

- This function is valid when the point table is selected using the input signal or the remote input of CC-Link. It cannot be used when the point table No. is selected using the remote register of CC-Link.

(a) What is automatic continuous operation?

By merely choosing one point table and making a start (RYn1 or RYn2), operation can be performed in accordance with the point tables having consecutive numbers.

Automatic operation is available in two types: varied speed operation and automatic continuous positioning operation.

Either type may be selected as follows.

1) In absolute value command specifying system

Automatic continuous operation: Speed changing operation / Automatic continuous positioning operation

Point table setting		
Dwell	Auxiliary function	
	When position data is absolute value	When position data is incremental value
0	1	3
1 or more	1	3

2) In incremental value command system

Automatic continuous operation: Speed changing operation / Automatic continuous positioning operation

Point table setting	
Dwell	Auxiliary function
0	1
1 or more	1

(b) Varied speed operation

Speed during positioning operation can be changed by setting the auxiliary function of the point table. Use the number of point tables equal to the number of speeds to be set.

By setting "1" to the auxiliary function, operation is performed at the speed set in the next point table during positioning. The position data valid at this time is the data selected at start and the acceleration and deceleration time constants of the subsequent point tables are made invalid.

By setting "1" to the auxiliary function of up to point table No.254, operation can be performed at a maximum of 255 speeds. Set "0" to the auxiliary function of the last point table.

When performing varied speed operation, always set "0" to the dwell. If "1" or more is set, automatic continuous positioning operation is made valid.

The following table gives a setting example.

Point table No.	Dwell [ms] (Note 1)	Auxiliary function	Variable speed operation
1	0	1	Consecutive point table data
2	0	1	
3	0	0 (Note 2)	
4	0	1	Consecutive point table data
5	0	1	
6	0	1	
7	0	0 (Note 2)	

Note 1. Always set "0".

2. Always set "0" or "2" to the auxiliary function of the last point table among the consecutive point tables.

1) Absolute value command specifying system

This system is an auxiliary function for point tables to perform automatic operation by specifying the absolute value command or incremental value command.

・Positioning in single direction

The operation example given below assumes that the set values are as indicated in the following table. Here, the point table No.1 uses the absolute value command system, the point table No.2 the incremental value command system, the point table No.3 the absolute value system, and the point table No.4 the incremental value command system.

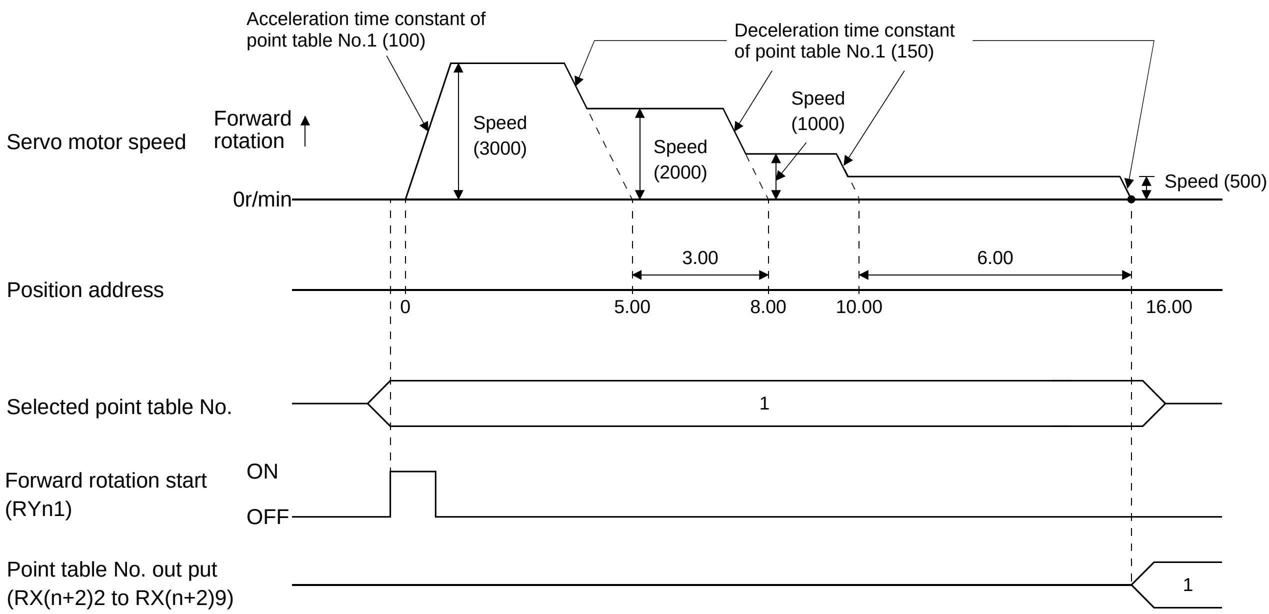
Point table No.	Position data [$\times 10^{STM}\mu m$]	Servo motor speed [r/min]	Acceleration time constant [ms]	Deceleration time constant [ms]	Dwell [ms] (Note 1)	Auxiliary function
1	5.00	3000	100	150	0	1
2	3.00	2000	Invalid	Invalid	0	3
3	10.00	1000	Invalid	Invalid	0	1
4	6.00	500	Invalid	Invalid	0	0 (Note 2)

Note 1. Always set "0".

2. Always set "0" or "2" to the auxiliary function of the last point table among the consecutive point tables.

0: When point table is used in absolute value command system

1: When point table is used in incremental value command system



・Positioning that reverses the direction midway

The operation example given below assumes that the set values are as indicated in the following table. Here, the point table No.1 uses the absolute value command system, the point table No.2 the incremental value command system, and the point table No.3 the absolute value system.

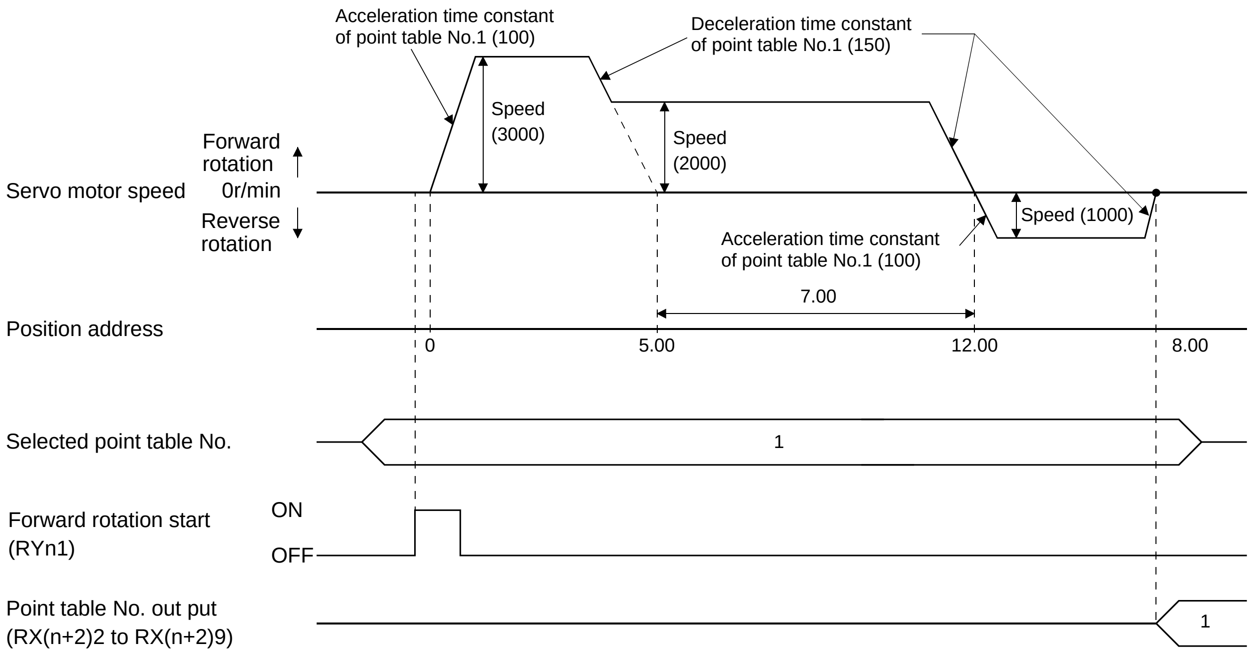
Point table No.	Position data [$\times 10^{STM}\mu m$]	Servo motor speed [r/min]	Acceleration time constant [ms]	Deceleration time constant [ms]	Dwell [ms] (Note 1)	Auxiliary function
1	5.00	3000	100	150	0	1
2	7.00	2000	Invalid	Invalid	0	1
3	8.00	1000	Invalid	Invalid	0	0 (Note 2)

Note 1. Always set "0".

2. Always set "0" or "2" to the auxiliary function of the last point table among the consecutive point tables.

0: When point table is used in absolute value command system

1: When point table is used in incremental value command system



2) Incremental value command system

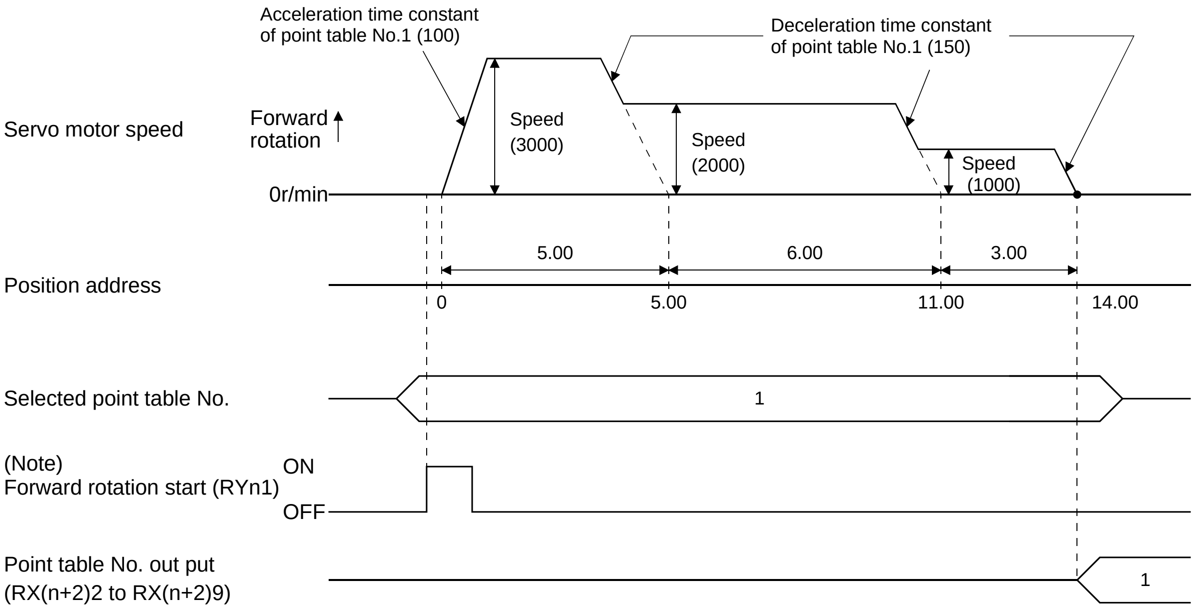
The position data of the incremental value command system is the sum of the position data of the consecutive point tables.

The operation example given below assumes that the set values are as indicated in the following table.

Point table No.	Position data [$\times 10^{STM}\mu m$]	Servo motor speed [r/min]	Acceleration time constant [ms]	Deceleration time constant [ms]	Dwell [ms] (Note 1)	Auxiliary function
1	5.00	3000	100	150	0	1
2	6.00	2000	Invalid	Invalid	0	1
3	3.00	1000	Invalid	Invalid	0	0 (Note 2)

Note 1. Always set "0".

2. Always set "0" to the auxiliary function of the last point table among the consecutive point tables.



Note. Turning on Reverse rotation start (RYn2) starts positioning in the reverse rotation direction.

(c) Temporary stop/restart

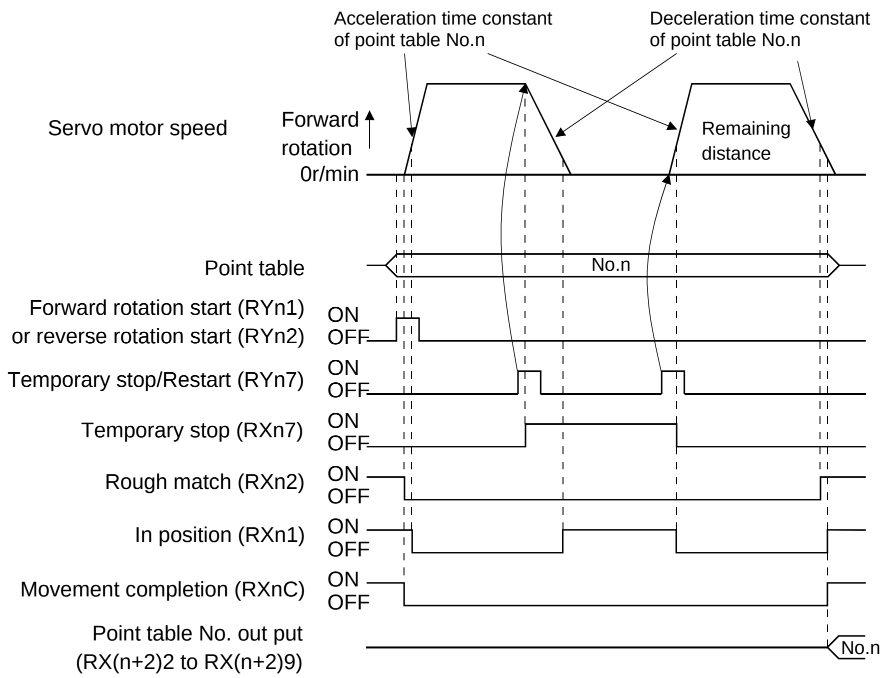
When RYn7 is turned ON during automatic operation, the motor is decelerated to a temporary stop at the deceleration time constant in the point table being executed. When RYn7 is turned ON again, the remaining distance is executed.

If the forward/reverse rotation start signal (RYn1 or RYn2) is ignored if it is switched on during a temporary stop.

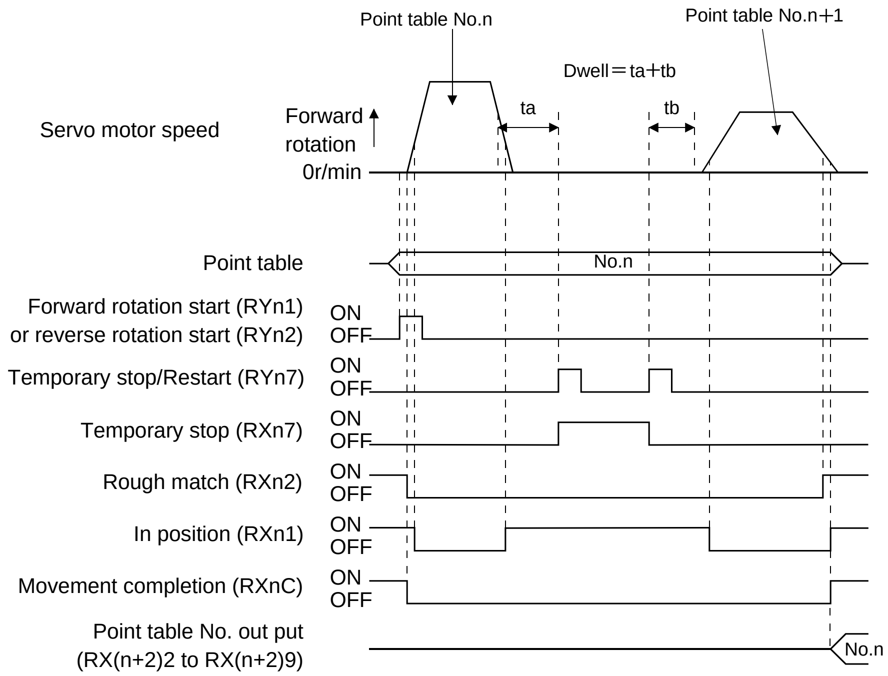
The remaining moving distance is cleared when the operation mode is changed from the automatic mode to the manual mode during a temporary stop.

The temporary stop/restart input is ignored during zeroing and jog operation.

1) When the servo motor is rotating



2) During dwell


Point table No.n
Point table No.n+1
Dwell＝ta+tb
ta
tb
Servo motor speed
Forward rotation
0r/min
Point table
No.n
Forward rotation start (RYn1)
or reverse rotation start (RYn2)
Temporary stop/Restart (RYn7)
Temporary stop (RXn7)
Rough match (RXn2)
In position (RXn1)
Movement completion (RXnC)
Point table No. out put
(RX(n+2)2 to RX(n+2)9)
ON
OFF
No.n

5.4.3 Remote register-based position/speed setting

This operation can be used when 2 stations are occupied. This section explains operation to be performed when the remote register is used to specify the position command data/speed command data.

(1) Absolute value command positioning in absolute value command system

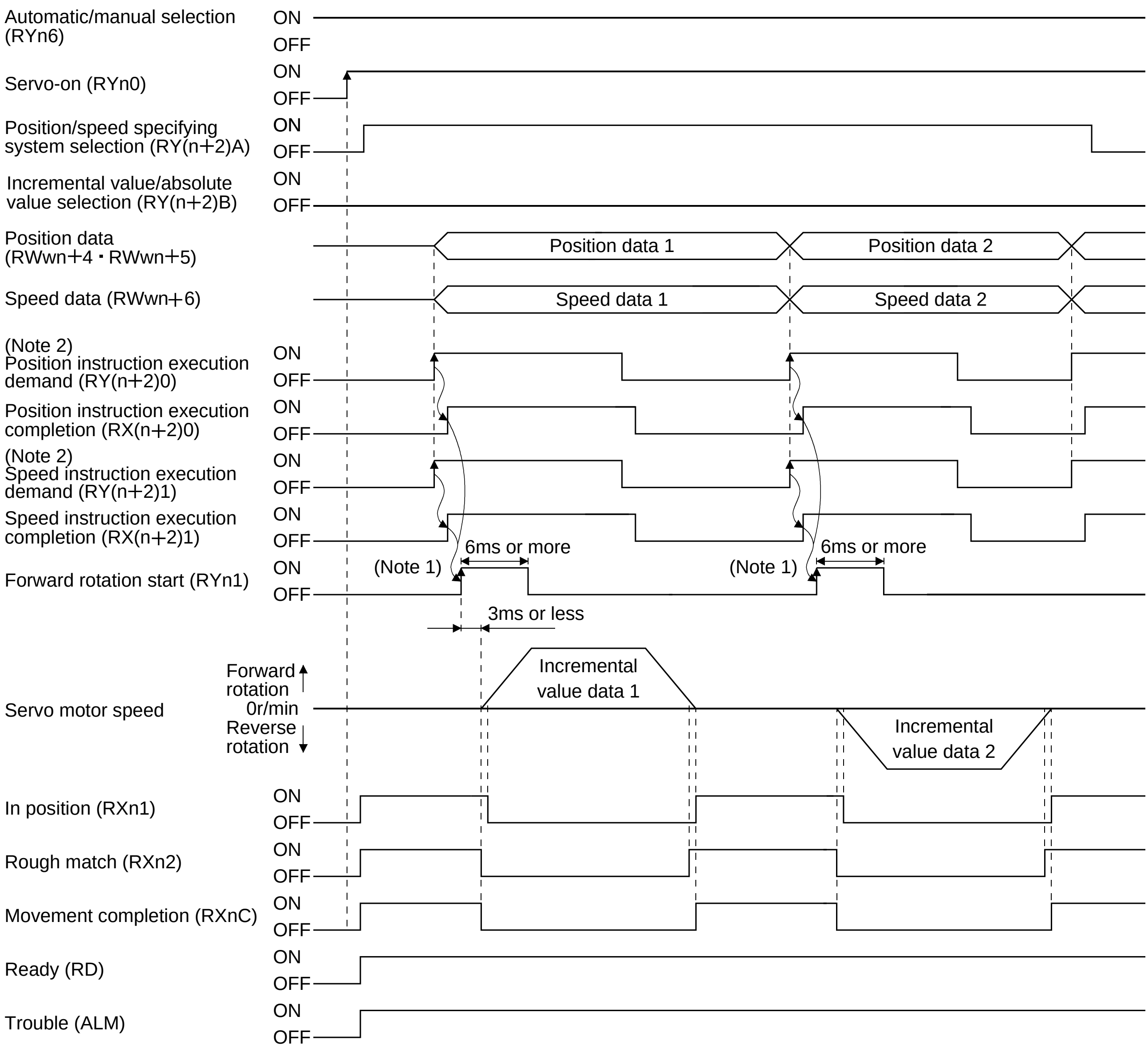
The position data set in the absolute value command system are used as absolute values in positioning. Set the input devices and parameters as indicated below.

Item	Used device/parameter	Description
Automatic operation mode	Automatic/manual selection (RYn6)	Turn RYn6 ON.
Remote register-based position/speed setting	Position/speed specifying system selection (RY(n＋2)A)	Turn RY(n＋2)A ON.
Command system	Parameter No.PA01	□□□0 : Absolute value command system is selected.
Remote register-based position/speed specifying system selection	Parameter No.PC30	□□□2 : Remote register-based position/speed specifying system is selected. In the case, always set an acceleration/deceleration time constant in the point table No.1.
Position data	Position command data lower 16 bit (RWwn＋4)	Set the lower 16 bits of position data to RWwn＋4, and the upper 16 bits to RWwn＋5. Setting range: －999999 to 999999
	Position command data upper 16 bit (RWwn＋5)	
Servo motor speed	Speed command data (RWwn＋6)	Set the servo motor speed.

Set the position data to RWwn＋4/RWwn＋5, and the speed command data to RWwn＋6, and store them into the driver.

In the absolute value command system, Absolute value/incremental value selection (RY(n＋2)B) can be used to select whether the values set to the position data are absolute values or incremental values. The position data set to RWwn＋4/RWwn＋5 are handled as absolute values when RY(n＋2)B is turned OFF or as incremental values when it is turned ON. During operation, how the position data will be handled (absolute values or incremental values) depends on the status of RY(n＋2)B when Forward rotation start (RYn1) is turned ON.

Here, RY(n＋2)B is turned OFF since the position data are handled as absolute values.



Note 1. Configure a sequence that changes the point table selection earlier, considering the delay time of CC-Link communication.

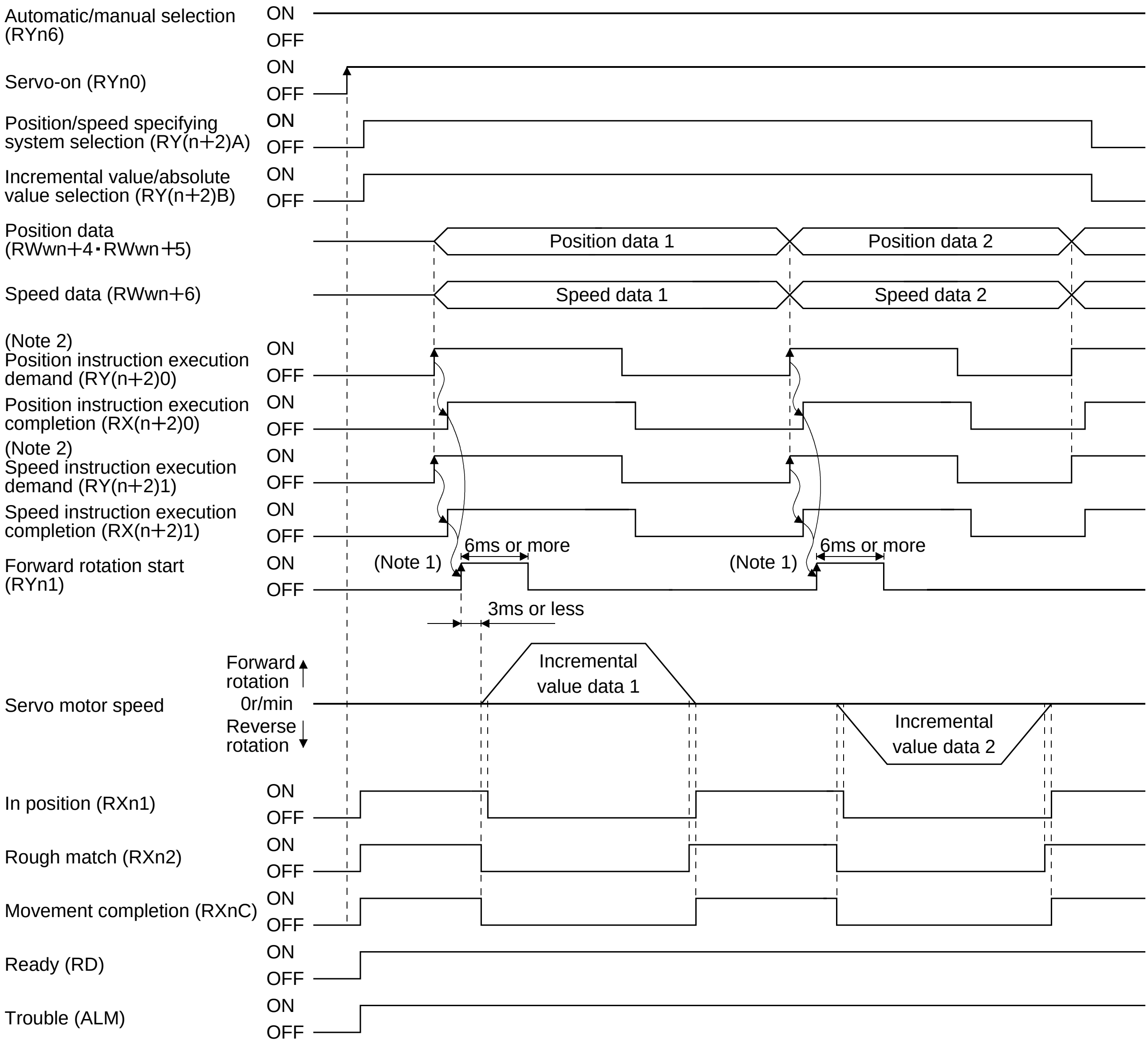
2. For details of the operation timing of RY(n+2)0 and RY(n+2)1, refer to the section 3.6.2 (3).

(2) Incremental value command positioning in absolute value command system

The position data set in the absolute value command system are used as incremental values in positioning. Set the input devices and parameters as indicated below.

<table>
<tr><th>Item</th><th>Used device/parameter</th><th>Description</th></tr>
<tr><td>Automatic operation mode</td><td>Automatic/manual selection (RYn6)</td><td>Turn RYn6 ON.</td></tr>
<tr><td>Remote register-based position/speed setting</td><td>Position/speed specifying system selection (RY(n+2)A)</td><td>Turn RY(n+2)A ON.</td></tr>
<tr><td>Command system</td><td>Parameter No.PA01</td><td>□□□0 : Absolute value command system is selected.</td></tr>
<tr><td>Remote register-based position/speed specifying system selection</td><td>Parameter No.PC30</td><td>□□□2 : Remote register-based position/speed specifying system is selected.</td></tr>
<tr><td rowspan="2">Position data</td><td>Position command data lower 16 bit (RWwn+4)</td><td rowspan="2">Set the lower 16 bits of position data to RWwn+4, and the upper 16 bits to RWwn+5.
Setting range: −999999 to 999999</td></tr>
<tr><td>Position command data upper 16 bit (RWwn+5)</td></tr>
<tr><td>Servo motor speed</td><td>Speed command data (RWwn+6)</td><td>Set the servo motor speed.</td></tr>
</table>

Here, Absolute value/incremental value selection RY(n+2)B is turned ON since the position data are handled as incremental values.



Note 1. Configure a sequence that changes the point table selection earlier, considering the delay time of CC-Link communication.

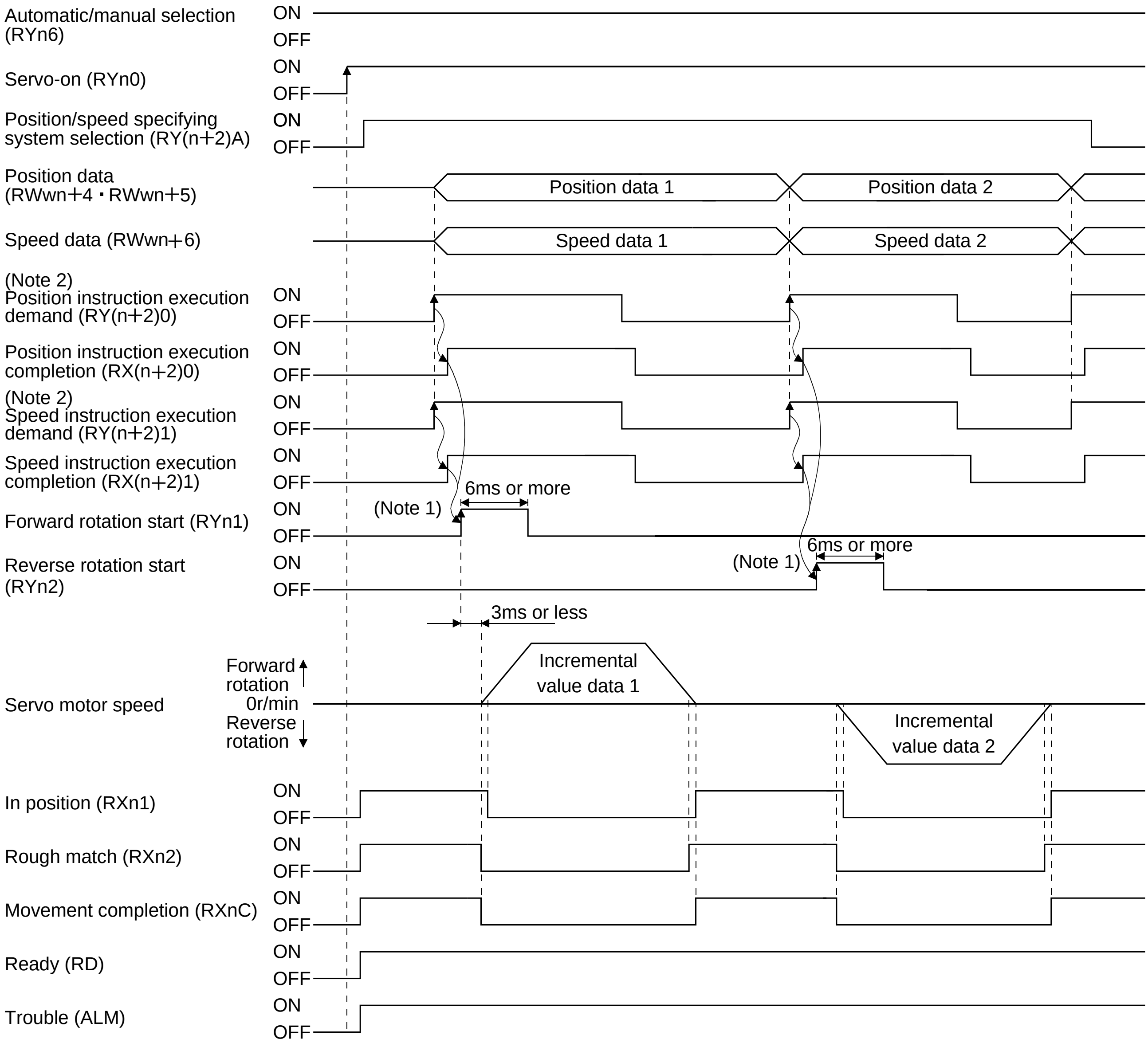
2. For details of the operation timing of RY(n+2)0 and RY(n+2)1, refer to the section 3.6.2 (3).

(3) Positioning in incremental value command system

Execute positioning in the incremental value command system. Set the input signals and parameters as indicated below.

Item	Used device/parameter	Description
Automatic operation mode	Automatic/manual selection (RYn6)	Turn RYn6 ON.
Remote register-based position/speed setting	Position/speed specifying system selection (RY(n+2)A)	Turn RY(n+2)A ON.
Command system	Parameter No.PA01	□□□1 : Incremental value command system is selected.
Remote register-based position/speed specifying system selection	Parameter No.PC30	□□□2 : Remote register-based position/speed specifying system is selected. In the case, always set an acceleration/deceleration time constant in the point table No.1.
Position data	Position command data lower 16 bit (RWwn+4)	Set the lower 16 bits of position data to RWwn+4, and the upper 16 bits to RWwn+5. Setting range: 0 to 999999
	Position command data upper 16 bit (RWwn+5)	
Servo motor speed	Speed command data (RWwn+6)	Set the servo motor speed.

Set "□□□1" in parameter No.PA01 to select the incremental value command system. In the incremental value command system, the position data are handled as incremental values. Hence, Absolute value/incremental value selection (RY(n+2)B) is invalid.



Note 1. Configure a sequence that changes the point table selection earlier, considering the delay time of CC-Link communication.

2. For details of the operation timing of RY(n+2)0 and RY(n+2)1, refer to the section 3.6.2 (3).

5.5 Manual operation mode

For machine adjustment, home position matching, etc., jog operation or a manual pulse generator may be used to make a motion to any position.

5.5.1 JOG operation

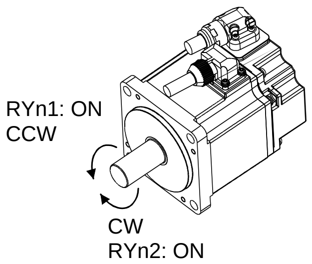
(1) Setting

Set the input device and parameters as follows according to the purpose of use. In this case, the point table No. selection 1 to 8 (RYnA to RYnE, RY(n＋2)3 to RY(n＋2)5) are invalid.

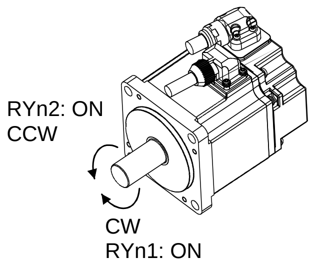
Item	Used device/parameter	Description
Manual operation mode selection	Automatic/manual selection (RYn6)	Turn RYn6 OFF.
Servo motor rotation direction	Parameter No.PA14	Refer to (2) in this section.
Jog speed	Parameter No.PC12	Set the speed of the servo motor.
Acceleration/deceleration time constant	Point table No.1	Use the acceleration/deceleration time constants in point table No.1.

(2) Servo motor rotation direction

Parameter No.PA14 setting	Servo motor rotation direction	
	Forward rotation start (RYn1) ON	Reverse rotation start (RYn2) ON
0	CCW rotation	CW rotation
1	CW rotation	CCW rotation



Parameter No.PA14: 0

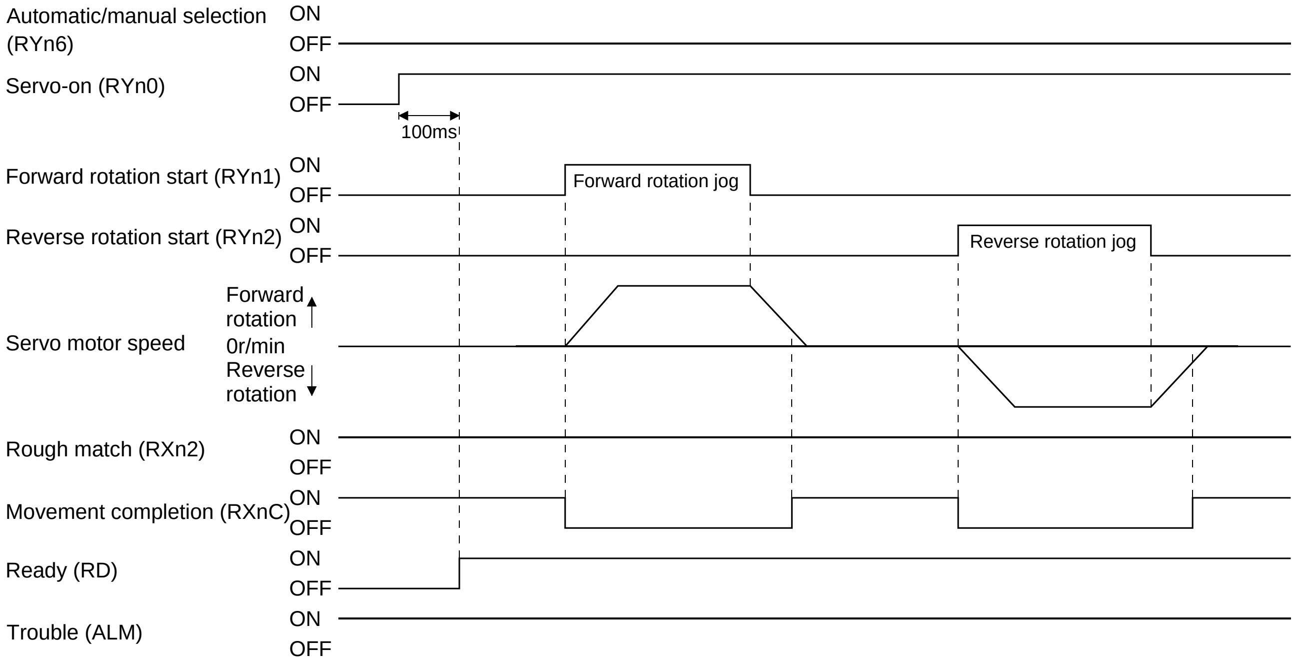


Parameter No.PA14: 1

(3) Operation

By turning RYn1 ON, operation is performed under the conditions of the jog speed set in the parameter and the acceleration and deceleration time constants in set point table No.1. For the rotation direction, refer to (2) in this section. By turning RYn2 ON, the servo motor rotates in the reverse direction to forward rotation start (RYn1).

(4) Timing chart



5.6 Manual home position return mode

5.6.1 Outline of home position return

Home position return is performed to match the command coordinates with the machine coordinates. In the incremental system, home position return is required every time input power is switched on. In the absolute position detection system, once home position return is done at the time of installation, the current position is retained if power is switched off. Hence, home position return is not required when power is switched on again.

This driver has the home position return methods given in this section. Choose the most appropriate method for your machine structure and application.

This driver has the home position return automatic return function which executes home position return by making an automatic return to a proper position if the machine has stopped beyond or at the proximity dog. Manual motion by jog operation or the like is not required.

(1) Home position return types

Choose the optimum home position return according to the machine type, etc.

Type	Home position return method	Features
Dog type home position return	With deceleration started at the front end of a proximity dog, the position where the first Z-phase signal is given past the rear end of the dog or a motion has been made over the home position shift distance starting from the Z-phase signal is defined as a home position.	・General home position return method using a proximity dog. ・Repeatability of home position return is excellent. ・The machine is less burdened. ・Used when the width of the proximity dog can be set greater than the deceleration distance of the servo motor.
Count type home position return	With deceleration started at the front end of a proximity dog, the position where the first Z-phase signal is given after advancement over the preset moving distance after the proximity dog or a motion has been made over the home position shift distance starting from the Z-phase signal is defined as a home position.	・Home position return method using a proximity dog. ・Used when it is desired to minimize the length of the proximity dog.
Data setting type home position return	An arbitrary position is defined as a home position.	・No proximity dog required.
Stopper type home position return	The position where the machine stops when its part is pressed against a machine stopper is defined as a home position.	・Since the machine part collides with the machine be fully lowered. ・The machine and stopper strength must be increased.
Home position ignorance (Servo-on position as home position)	The position where servo is switched on is defined as a home position.	
Dog type rear end reference	The position where the axis, which had started decelerating at the front end of a proximity dog, has moved the after-proximity dog moving distance and home position shift distance after it passed the rear end is defined as a home position.	・The Z-phase signal is not needed.
Count type front end reference	The position where the axis, which had started decelerating at the front end of a proximity dog, has moved the after-proximity dog moving distance and home position shift distance is defined as a home position.	・The Z-phase signal is not needed.
Dog cradle type	The position where the first Z-phase signal is issued after detection of the proximity dog front end is defined as a home position.	
Dog type first Z-phase reference	After the proximity dog front end is detected, the current position moves away from the proximity dog in the reverse direction. In this movement, the home position is defined to be where the first Z-phase signal is issued or the position that is the home position shift distance away from where the first Z-phase signal is issued.	
Dog type front end reference	The home position is the front end of the proximity dog.	・The Z-phase signal is not needed.
Dogless Z-phase reference	The home position is defined to be where the first Z-phase signal is issued or the position that is the home position shift distance away from where the first Z-phase signal is issued.	

(2) Home position return parameter

When performing home position return, set each parameter as follows.

(a) Choose the home position return method with parameter No.PC02 (Home position return type).

Parameter No.PC02

0	0	0	

Home position return method
0: Dog type
1: Count type
2: Data setting type
3: Stopper type
4: Home position ignorance (Servo-on position as home position)
5: Dog type rear end reference
6: Count type front end reference
7: Dog cradle type
8: Dog type first Z-phase reference
9: Dog type front end reference
A: Dogless Z-phase reference

(b) Choose the starting direction of home position return with parameter No.PC03 (Home position return direction). Set "0" to start home position return in the direction in which the address is incremented from the current position, or "1" to start home position return in the direction in which the address is decremented.

Parameter No.PC03

0	0	0	

Home position return direction
0: Address increment direction
1: Address decrement direction

(c) Choose the polarity at which the proximity dog is detected with parameter No.PD16 (Input polarity setting). Set "0" to detect the dog when the proximity dog device (DOG) is OFF, or "1" to detect the dog when the device is ON.

Parameter No.PD16

0	0	0	

Proximity dog input polarity
0: OFF indicates detection of the dog
1: ON indicates detection of the dog

(3) Instructions

1) Before starting home position return, always make sure that the limit switch operates.

2) Confirm the home position return direction. Incorrect setting will cause the machine to run reversely.

3) Confirm the proximity dog input polarity. Not doing so may cause unexpected operation.

5.6.2 Dog type home position return

A home position return method using a proximity dog. With deceleration started at the front end of the proximity dog, the position where the first Z-phase signal is given past the rear end of the dog or a motion has been made over the home position shift distance starting from the Z-phase signal is defined as a home position.

(1) Devices, parameters

Set the input devices and parameters as follows.

Item	Device/Parameter used	Description
Manual home position return mode selection	Automatic/manual selection (RYn6)	Turn RYn6 ON.
	Point table No. selection 1 to 8 (RYnA to RYnE, RY(n+2)3 to RY(n+2)5)	RYnA to RYnE, RY(n+2)3 to RY(n+2)5 are turned off.
Remote register-based position/speed setting (Only when two stations are occupied)	Position/speed specifying system selection (RY(n+2)A)	Turn RY(n+2)A ON.
Dog type home position return	Parameter No.PC02	□□□0 :Dog type home position return is selected.
Home position return direction	Parameter No.PC03	Refer to section 5.6.1 (2) and choose home position return direction.
Dog input polarity	Parameter No.PD16	Refer to section 5.6.1 (2) and choose dog input polarity.
Home position return speed	Parameter No.PC04	Set speed until detection of dog.
Creep speed	Parameter No.PC05	Set speed after detection of dog.
Home position shift distance	Parameter No.PC06	Set when shifting the home position starting at the first Z-phase signal after passage of proximity dog rear end.
Home position return acceleration/deceleration time constants	Point table No.1	Use the acceleration/deceleration time constants of point table No.1.
Home position return position data	Parameter No.PC07	Set the current position at home position return completion.

(2) Length of proximity dog

To ensure that the Z-phase signal of the servo motor is generated during detection of the proximity dog (DOG), the proximity dog should have the length which satisfies formulas (5.1) and (5.2).

$$L_1 \geq \frac{V}{60} \cdot \frac{td}{2} \quad \text{.......... (5.1)}$$

L_1 : Proximity dog length [mm]

V : Home position return speed [mm/min]

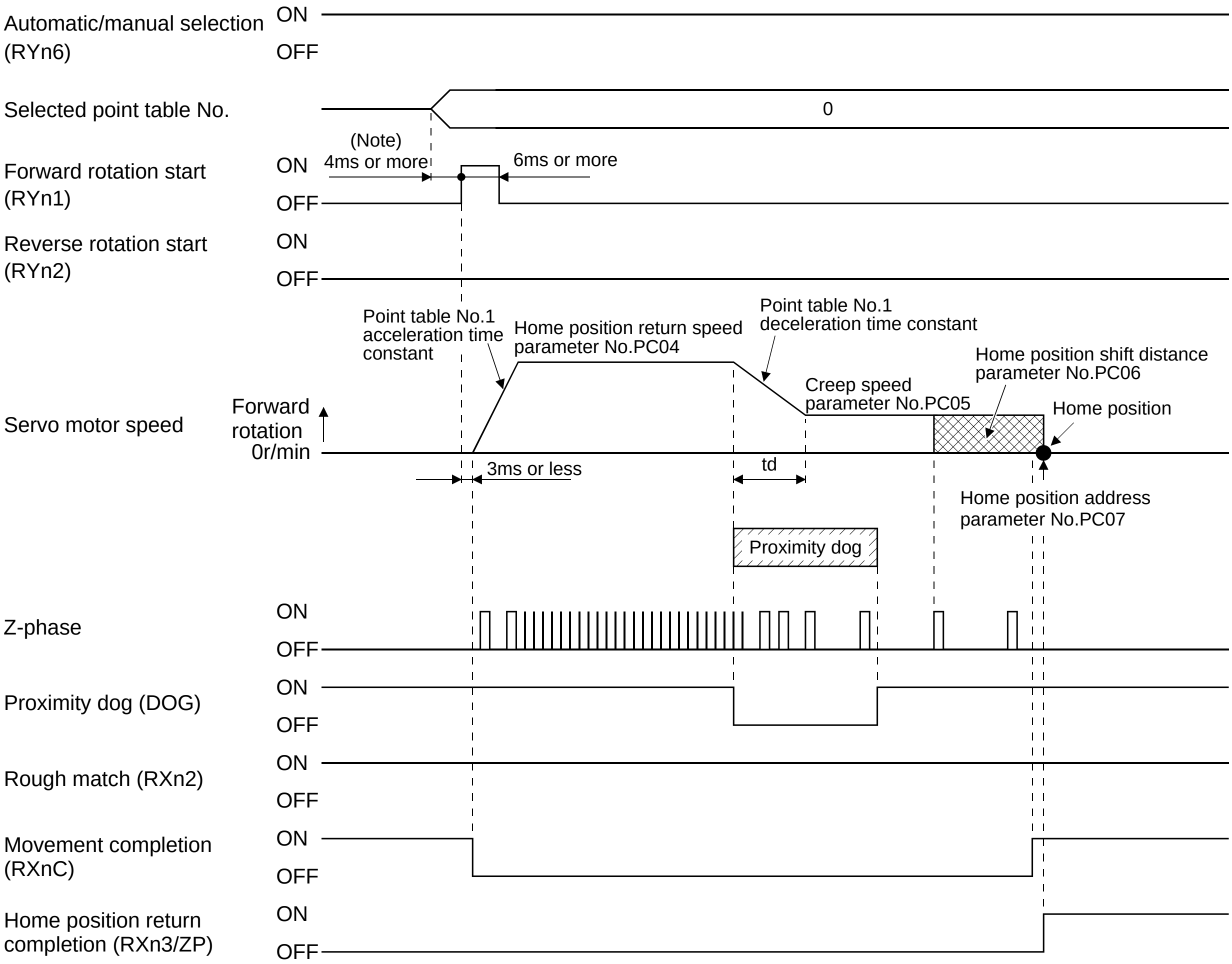
td : Deceleration time [s]

$$L_2 \geq 2 \cdot \Delta S \quad \text{.......... (5.2)}$$

L_2 : Proximity dog length [mm]

ΔS : Moving distance per servo motor revolution [mm]

(3) Timing chart



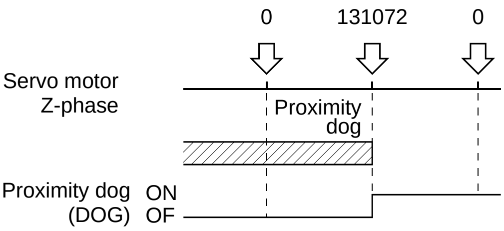
Note. Configure a sequence that changes the point table selection earlier, considering the delay time of CC-Link communication.

The parameter No.PC07 (home position return position data) setting value is the positioning address after the home position return is completed.

(4) Adjustment

In dog type home position return, adjust to ensure that the Z-phase signal is generated during dog detection. Locate the rear end of the proximity dog (DOG) at approximately the center of two consecutive Z-phase signals.

The position where the Z-phase signal is generated can be monitored in "Within one-revolution position" of "Status display" of the set up software(MR Configurator).



5.6.3 Count type home position return

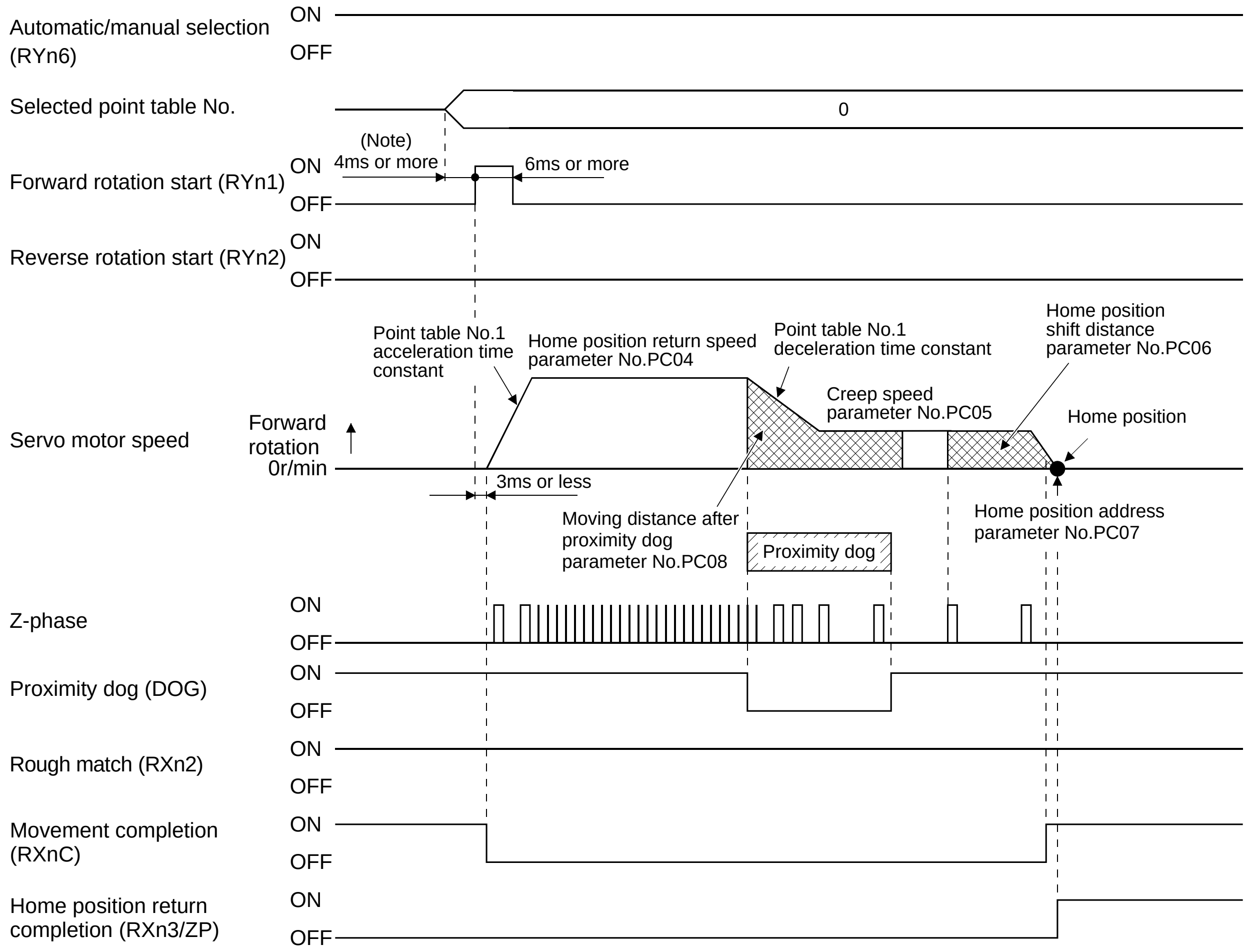
In count type home position return, a motion is made over the distance set in parameter No.PC08 (moving distance after proximity dog) after detection of the proximity dog front end. The position where the first Z-phase signal is given after that is defined as a home position. Hence, if the proximity dog (DOG) is 10ms or longer, there is no restriction on the dog length. This home position return method is used when the required proximity dog length cannot be reserved to use dog type home position return or when the proximity dog (DOG) is entered electrically from a PC or PLC...etc or the like.

(1) Devices, parameters

Set the input devices and parameters as follows.

Item	Device/Parameter used	Description
Manual home position return mode selection	Automatic/manual selection (RYn6)	Turn RYn6 ON.
	Point table No. selection 1 to 8 (RYnA to RYnE, RY(n＋2)3 to RY(n＋2)5)	RYnA to RYnE, RY(n＋2)3 to RY(n＋2)5 are turned off.
Remote register-based position/speed setting (Only when two stations are occupied)	Position/speed specifying system selection (RY(n＋2)A)	Turn RY(n＋2)A ON.
Count type home position return	Parameter No.PC02	□□□1: Count type home position return is selected.
Home position return direction	Parameter No.PC03	Refer to section 5.6.1 (2) and choose home position return direction.
Dog input polarity	Parameter No.PD16	Refer to section 5.6.1 (2) and choose dog input polarity.
Home position return speed	Parameter No.PC04	Set speed until detection of dog.
Creep speed	Parameter No.PC05	Set speed after detection of dog.
Home position shift distance	Parameter No.PC06	Set when shifting the home position, starting at the first Z-phase signal given after passage of the proximity dog front end and movement over the moving distance.
Moving distance after proximity dog	Parameter No.PC08	Set the moving distance after passage of proximity dog front end.
Home position return acceleration/deceleration time constants	Point table No.1	Use the acceleration/deceleration time constants of point table No.1.
Home position return position data	Parameter No.PC07	Set the current position at home position return completion.

(2) Timing chart



Note. Configure a sequence that changes the point table selection earlier, considering the delay time of CC-Link communication.

The parameter No.PC07 (home position return position data) setting value is the positioning address after the home position return is completed.

5.6.4 Data setting type home position return

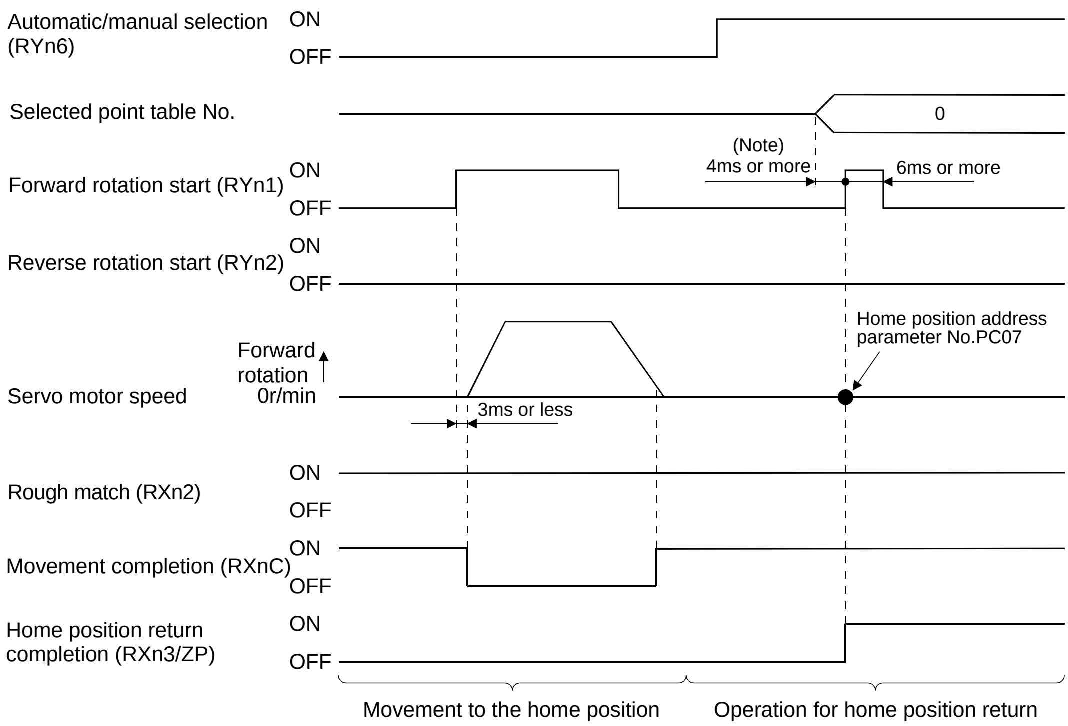
Data setting type home position return is used when it is desired to determine any position as a home position. JOG operation can be used for movement.

(1) Devices, parameters

Set the input devices and parameters as follows.

Item	Device/Parameter used	Description
Manual home position return mode selection	Automatic/manual selection (RYn6)	Turn RYn6 ON.
	Point table No. selection 1 to 8 (RYnA to RYnE, RY(n＋2)3 to RY(n＋2)5)	RYnA to RYnE, RY(n＋2)3 to RY(n＋2)5 are turned off.
Remote register-based position/speed setting (Only when two stations are occupied)	Position/speed specifying system selection (RY(n＋2)A)	Turn RY(n＋2)A ON.
Data setting type home position return	Parameter No.PC02	□□□2: Data setting type home position return is selected.
Home position return position data	Parameter No.PC07	Set the current position at home position return completion.

(2) Timing chart



Note. Configure a sequence that changes the point table selection earlier, considering the delay time of CC-Link communication.

The parameter No.PC07 (home position return position data) setting value is the positioning address after the home position return is completed.

5.6.5 Stopper type home position return

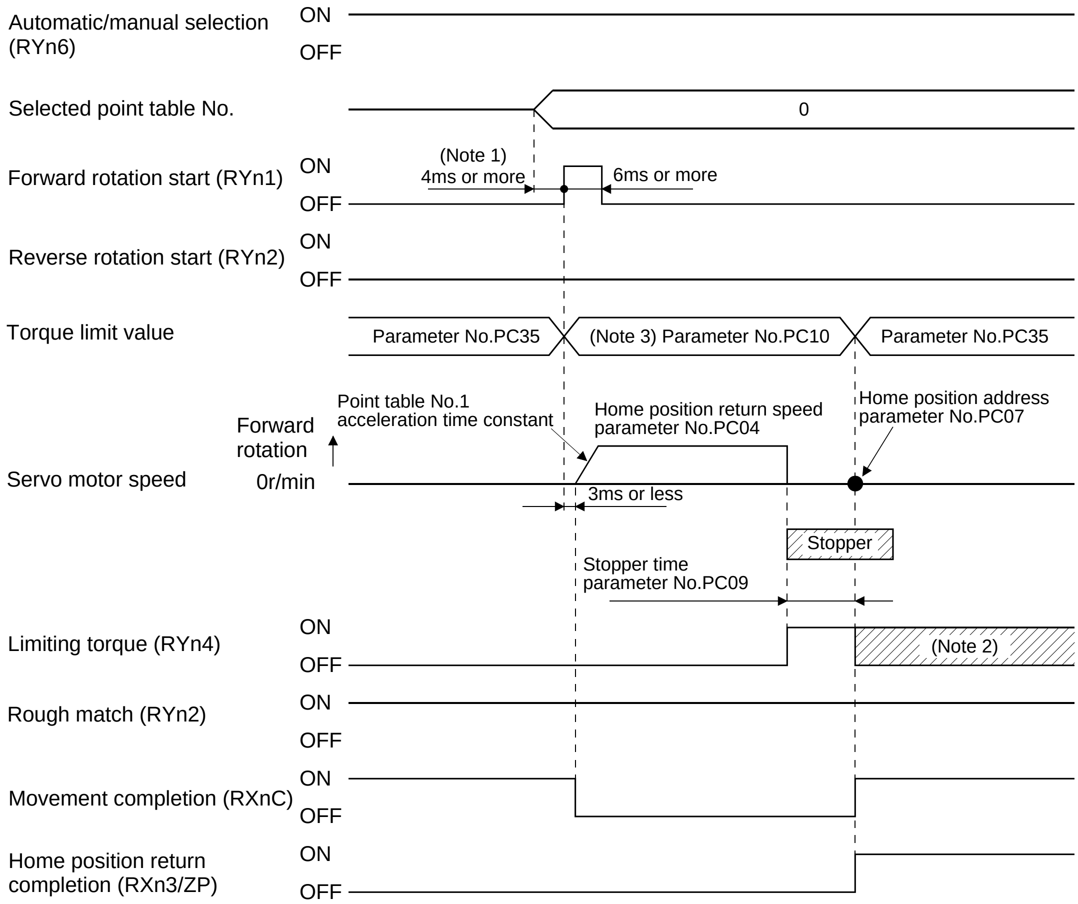
In stopper type home position return, a machine part is pressed against a stopper or the like by jog operation to make a home position return and that position is defined as a home position.

(1) Devices, parameters

Set the input devices and parameters as follows.

Item	Device/Parameter used	Description
Manual home position return mode selection	Automatic/manual selection (RYn6)	Turn RYn6 ON.
	Point table No. selection 1 to 8 (RYnA to RYnE, RY(n+2)3 to RY(n+2)5)	RYnA to RYnE, RY(n+2)3 to RY(n+2)5 are turned off.
Remote register-based position/speed setting (Only when two stations are occupied)	Position/speed specifying system selection (RY(n+2)A)	Turn RY(n+2)A ON.
Stopper type home position return	Parameter No.PC02	□□□3:Stopper type home position return is selected.
Home position return direction	Parameter No.PC03	Refer to section 5.6.1 (2) and choose the home position return direction.
Home position return speed	Parameter No.PC04	Set the speed till contact with the stopper.
Stopper time	Parameter No.PC09	Time from when the part makes contact with the stopper to when home position return data is obtained to output home position return completion (ZP).
Stopper type home position return torque limit value	Parameter No.PC10	Set the servo motor torque limit value for execution of stopper type home position return.
Home position return acceleration time constant	Point table No.1	Use the acceleration time constant of point table No.1.
Home position return position data	Parameter No.PC07	Set the current position at home position return completion.

(2) Timing chart



Note 1. Configure a sequence that changes the point table selection earlier, considering the delay time of CC-Link communication.
2. Turns ON when the torque reaches the value set to Forward rotation torque limit (parameter No.PA11), Reverse rotation torque limit (parameter No.PA12) or Internal torque limit (parameter No.PC35).
3. The torque limit that is enabled at this point is as follows.

(Note) Internal torque limit selection (RY(n+2)6)	Limit value status	Torque limit to be enabled
0		Parameter No.PC10
1	Parameter No.PC35 > Parameter No.PC10	Parameter No.PC10
	Parameter No.PC35 < Parameter No.PC10	Parameter No.PC35

Note. 0: OFF
1: ON

The parameter No.PC07 (home position return position data) setting value is the positioning address after the home position return is completed.

5.6.6 Home position ignorance (servo-on position defined as home position)

The position where servo is switched on is defined as a home position.

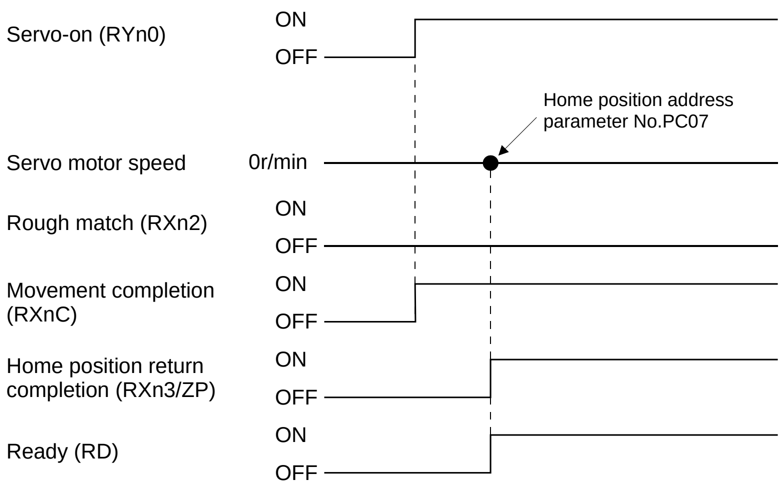
POINT
· When executing this home position return, changing to the home position return mode is not necessary.

(1) Devices, parameter

Set the input devices and parameter as follows.

Item	Device/Parameter used	Description
Home position ignorance	Parameter No.PC02	□□□4: Home position ignorance is selected.
Home position return position data	Parameter No.PC07	Set the current position at home position return completion.

(2) Timing chart



The parameter No.PC07 (home position return position data) setting value is the positioning address after the home position return is completed.

5.6.7 Dog type rear end reference home position return

POINT

- This home position return method depends on the timing of reading Proximity dog (DOG) that has detected the rear end of a proximity dog. Hence, if a home position return is made at the creep speed of 100r/min, an error of ±400 pulses will occur in the home position. The error of the home position is larger as the creep speed is higher.

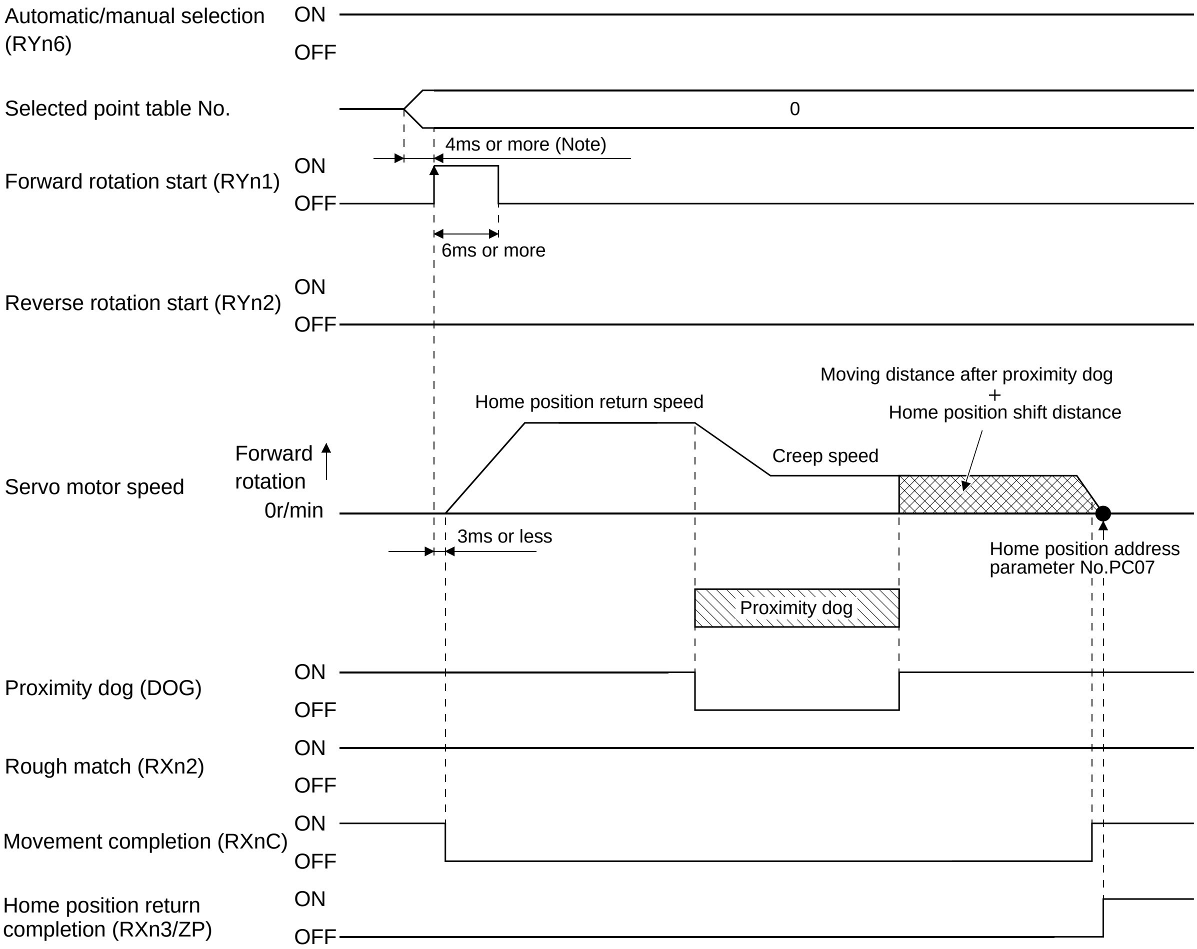
The position where the axis, which had started decelerating at the front end of a proximity dog, has moved the after-proximity dog moving distance and home position shift distance after it passed the rear end is defined as a home position. A home position return that does not depend on the Z-phase signal can be made.

(1) Devices, parameters

Set the input devices and parameters as indicated below.

Item	Device/Parameter used	Description
Manual home position return mode selection	Automatic/manual selection (RYn6)	Turn RYn6 ON.
	Point table No. selection 1 to 8 (RYnA to RYnE, RY(n＋2)3 to RY(n＋2)5)	RYnA to RYnE, RY(n＋2)3 to RY(n＋2)5 are turned off.
Remote register-based position/speed setting (Only when two stations are occupied)	Position/speed specifying system selection (RY(n＋2)A)	Turn RY(n＋+2)A ON.
Dog type rear end reference home position return	Parameter No.PC02	□□□5: Select the dog type rear end reference.
Home position return direction	Parameter No.PC03	Refer to section 5.6.1 (2) and select the home position return direction.
Dog input polarity	Parameter No.PD16	Refer to section 5.6.1 (2) and select the dog input polarity.
Home position return speed	Parameter No.PC04	Set the speed till the dog is detected.
Creep speed	Parameter No.PC05	Set the speed after the dog is detected.
Home position shift distance	Parameter No.PC06	Set when the home position is moved from where the axis has passed the proximity dog rear end.
Moving distance after proximity dog	Parameter No.PC08	Set the moving distance after the axis has passed the proximity dog rear end.
Home position return acceleration/ deceleration time constants	Point table No.1	Use the acceleration/deceleration time constant of point table No.1.
Home position return position data	Parameter No.PC07	Set the current position at home position return completion.

(2) Timing chart



Note. Configure a sequence that changes the point table selection earlier, considering the delay time of CC-Link communication.

The parameter No.PC17 (home position return position data) setting value is the positioning address after the home position return is completed.

5.6.8 Count type front end reference home position return

POINT

- This home position return method depends on the timing of reading Proximity dog (DOG) that has detected the front end of a proximity dog. Hence, if a home position return is made at the home position return speed of 100r/min, an error of ±400 pulses will occur in the home position. The error of the home position is larger as the home position return speed is higher.

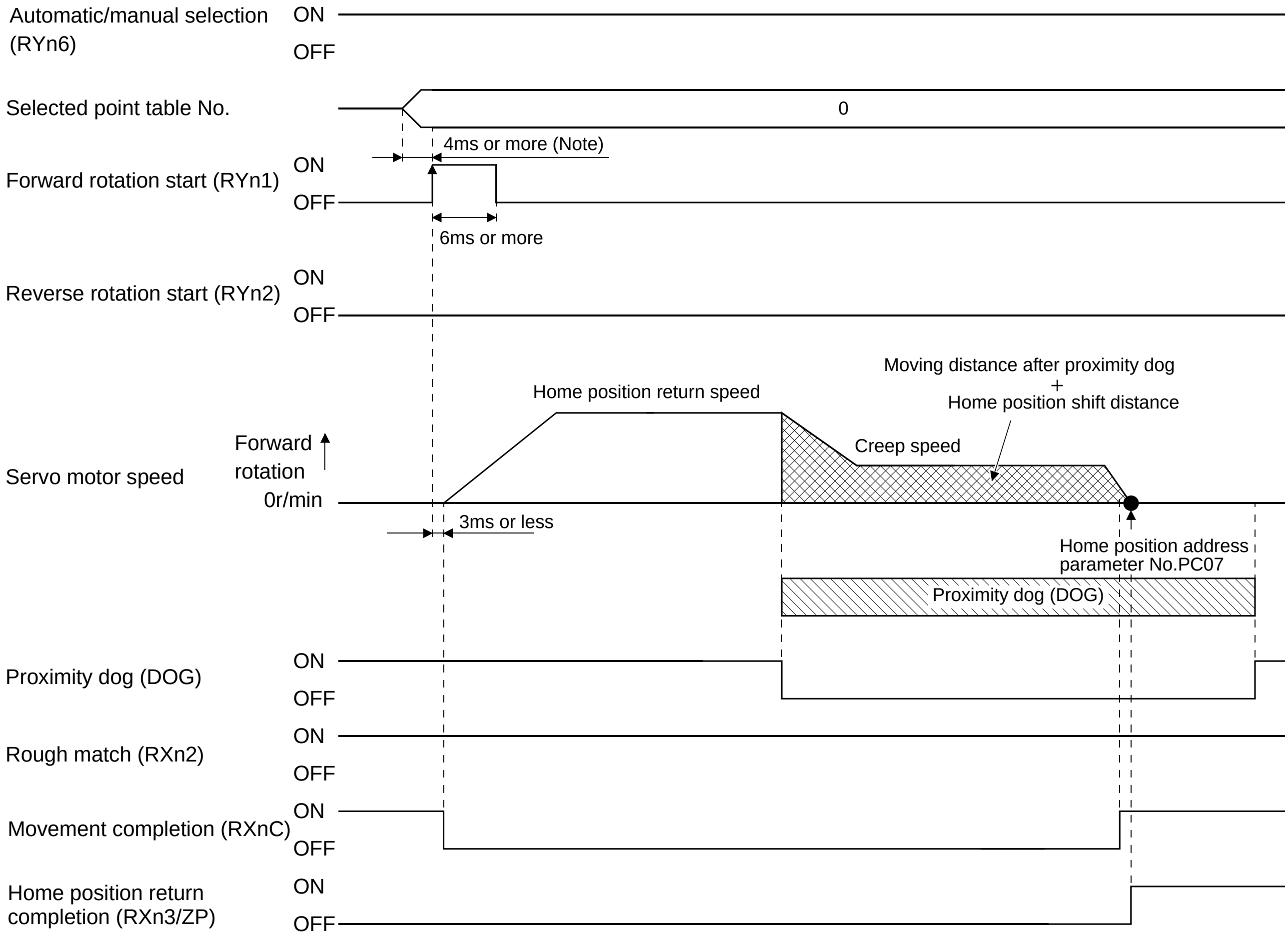
The position where the axis, which had started decelerating at the front end of a proximity dog, has moved the after-proximity dog moving distance and home position shift distance is defined as a home position. A home position return that does not depend on the Z-phase signal can be made. The home position may change if the home position return speed varies.

(1) Devices, parameters

Set the input devices and parameters as indicated below.

Item	Device/Parameter used	Description
Manual home position return mode selection	Automatic/manual selection (RYn6)	Turn RYn6 ON.
	Point table No. selection 1 to 8 (RYnA to RYnE, RY(n+2)3 to RY(n+2)5)	RYnA to RYnE, RY(n+2)3 to RY(n+2)5 are turned off.
Remote register-based position/speed setting (Only when two stations are occupied)	Position/speed specifying system selection (RY(n+2)A)	Turn RY(n+2)A ON.
Count type dog front end reference home position return	Parameter No.PC02	□□□6: Select the count type dog front end reference.
Home position return direction	Parameter No.PC03	Refer to section 5.6.1 (2) and select the home position return direction.
Dog input polarity	Parameter No.PD16	Refer to section 5.6.1 (2) and select the dog input polarity.
Home position return speed	Parameter No.PC04	Set the speed till the dog is detected.
Creep speed	Parameter No.PC05	Set the speed after the dog is detected.
Home position shift distance	Parameter No.PC06	Set when the home position is moved from where the axis has passed the proximity dog rear end.
Moving distance after proximity dog	Parameter No.PC08	Set the moving distance after the axis has passed the proximity dog rear end.
Home position return acceleration/ deceleration time constants	Point table No.1	Use the acceleration/deceleration time constant of point table No.1.
Home position return position data	Parameter No.PC07	Set the current position at home position return completion.

(2) Timing chart



Note. Configure a sequence that changes the point table selection earlier, considering the delay time of CC-Link communication.

The parameter No.PC07 (home position return position data) setting value is the positioning address after the home position return is completed.

5.6.9 Dog cradle type home position return

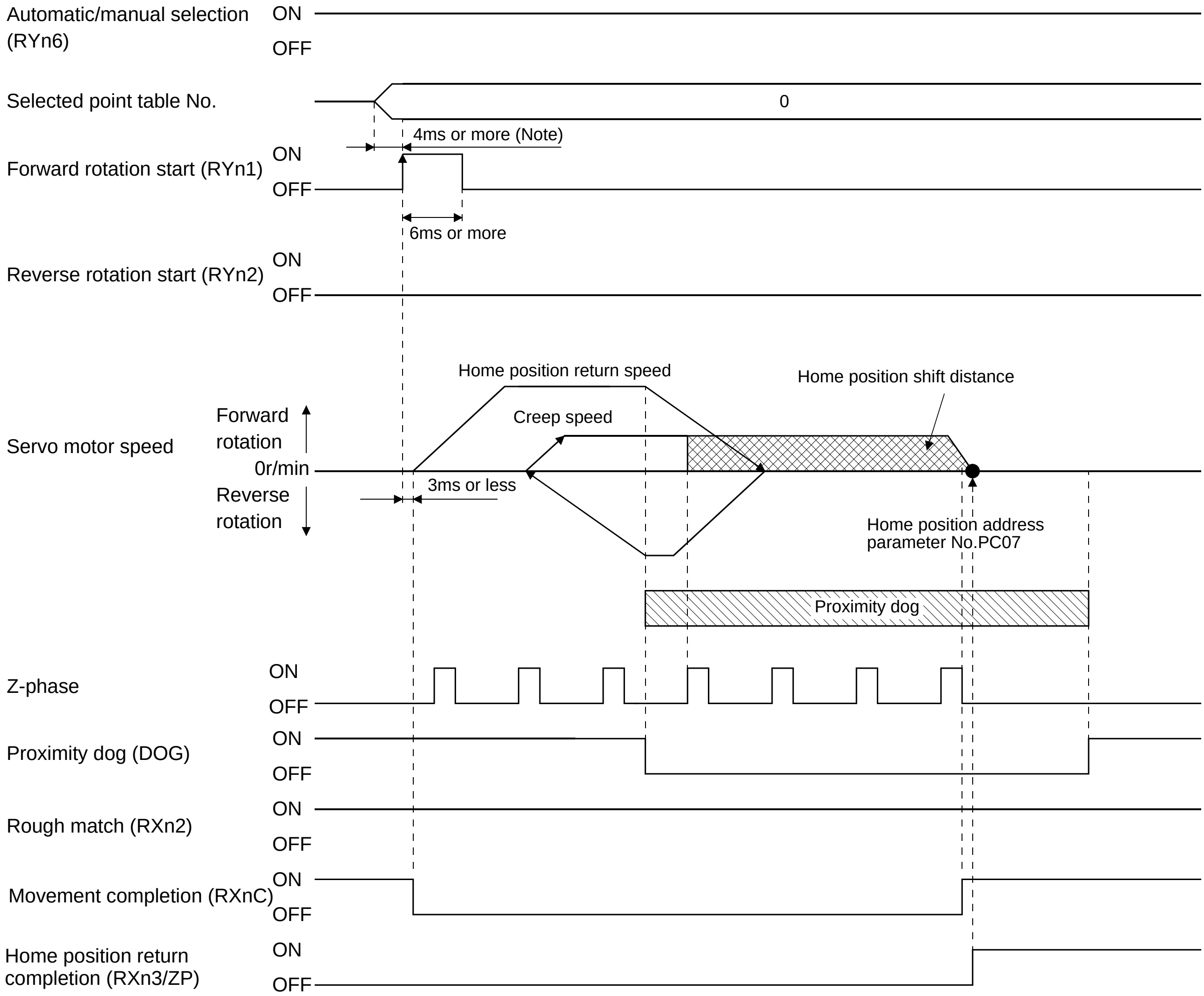
The position where the first Z-phase signal is issued after detection of the proximity dog front end can be defined as a home position.

(1) Devices, parameters

Set the input devices and parameters as indicated below.

Item	Device/Parameter used	Description
Manual home position return mode selection	Automatic/manual selection (RYn6)	Turn RYn6 ON.
	Point table No. selection 1 to 8 (RYnA to RYnE, RY(n＋2)3 to RY(n＋2)5)	RYnA to RYnE, RY(n＋2)3 to RY(n＋2)5 are turned off.
Remote register-based position/speed setting (Only when two stations are occupied)	Position/speed specifying system selection (RY(n＋+2)A)	Turn RY(n＋2)A ON.
Dog cradle type home position return	Parameter No.PC02	□□□7: Select the dog cradle type.
Home position return direction	Parameter No.PC03	Refer to section 5.6.1 (2) and select the home position return direction.
Dog input polarity	Parameter No.PD16	Refer to section 5.6.1 (2) and select the dog input polarity.
Home position return speed	Parameter No.PC04	Set the speed till the dog is detected.
Creep speed	Parameter No.PC05	Set the speed after the dog is detected.
Home position shift distance	Parameter No.PC06	Set when the home position is moved from the Z-phase signal position.
Home position return acceleration/deceleration time constants	Point table No.1	Use the acceleration/deceleration time constant of point table No.1.
Home position return position data	Parameter No.PC07	Set the current position at home position return completion.

(2) Timing chart



Note. Configure a sequence that changes the point table selection earlier, considering the delay time of CC-Link communication.

The parameter No.PC07 (home position return position data) setting value is the positioning address after the home position return is completed.

5.6.10 Dog type first Z-phase reference home position return

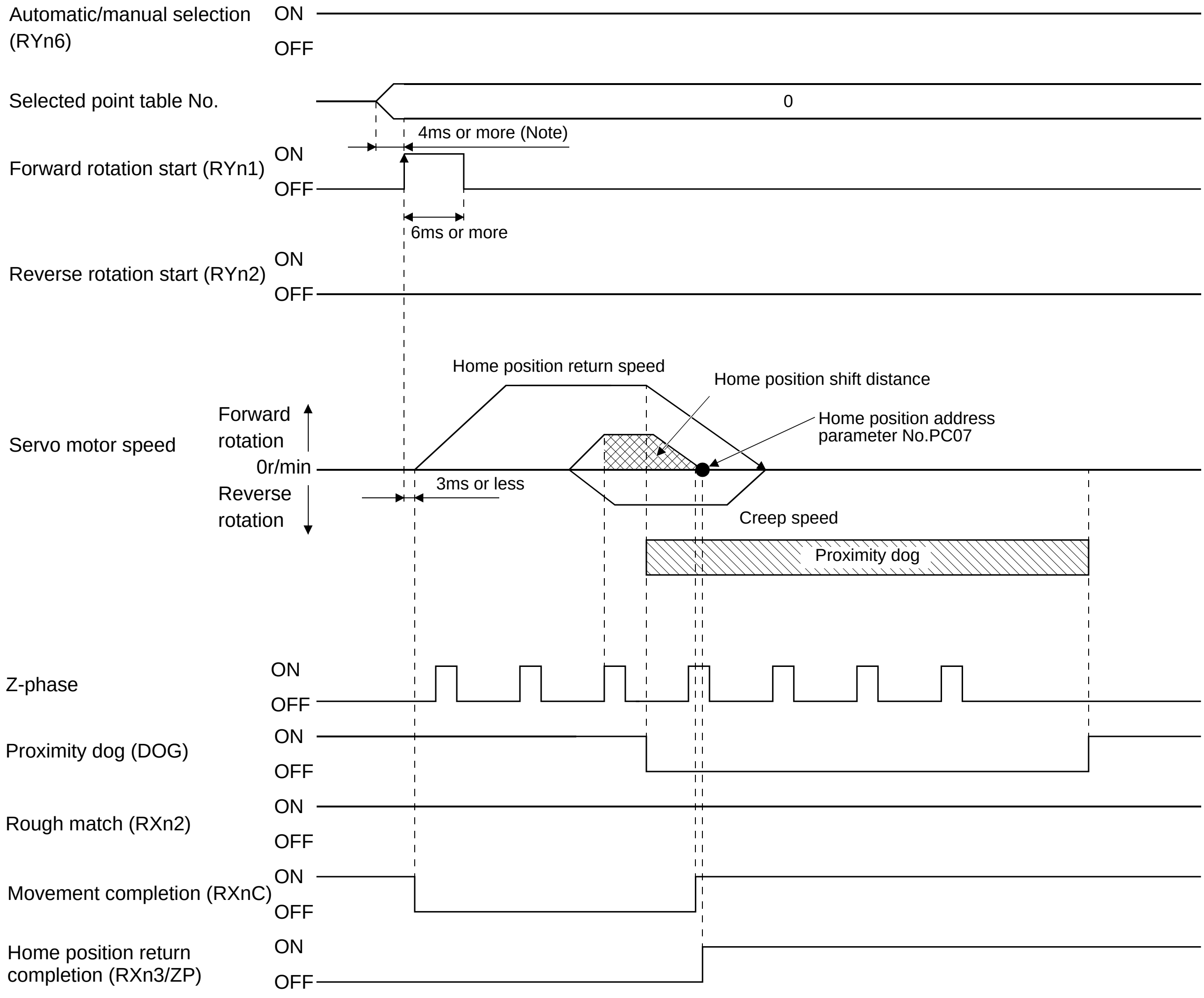
After the proximity dog front end is detected, the current position moves in the reverse direction at creep speed. After this moving away from the proximity dog, the home position is determined to be where the first Z-phase pulse is issued.

(1) Devices, parameters

Set the input devices and parameters as indicated below.

Item	Device/Parameter used	Description
Manual home position return mode selection	Automatic/manual selection (RYn6)	Turn RYn6 ON.
	Point table No. selection 1 to 8 (RYnA to RYnE, RY(n＋2)3 to RY(n＋2)5)	RYnA to RYnE, RY(n＋2)3 to RY(n＋2)5 are turned off.
Remote register-based position/speed setting (Only when two stations are occupied)	Position/speed specifying system selection (RY(n＋2)A)	Turn RY(n＋2)A ON.
Dog cradle type home position return	Parameter No.PC02	□□□8: Select the dog cradle type.
Home position return direction	Parameter No.PC03	Refer to section 5.6.1 (2) and select the home position return direction.
Dog input polarity	Parameter No.PD16	Refer to section 5.6.1 (2) and select the dog input polarity.
Home position return speed	Parameter No.PC04	Set the speed till the dog is detected.
Creep speed	Parameter No.PC05	Set the speed after the dog is detected.
Home position shift distance	Parameter No.PC06	Set when the home position is moved from the Z-phase signal position.
Home position return acceleration/deceleration time constants	Point table No.1	Use the acceleration/deceleration time constant of point table No.1.
Home position return position data	Parameter No.PC07	Set the current position at home position return completion.

(2) Timing chart



Note. Configure a sequence that changes the point table selection earlier, considering the delay time of CC-Link communication.

The parameter No.PC07 (home position return position data) setting value is the positioning address after the home position return is completed.

5.6.11 Dog type front end reference home position return method

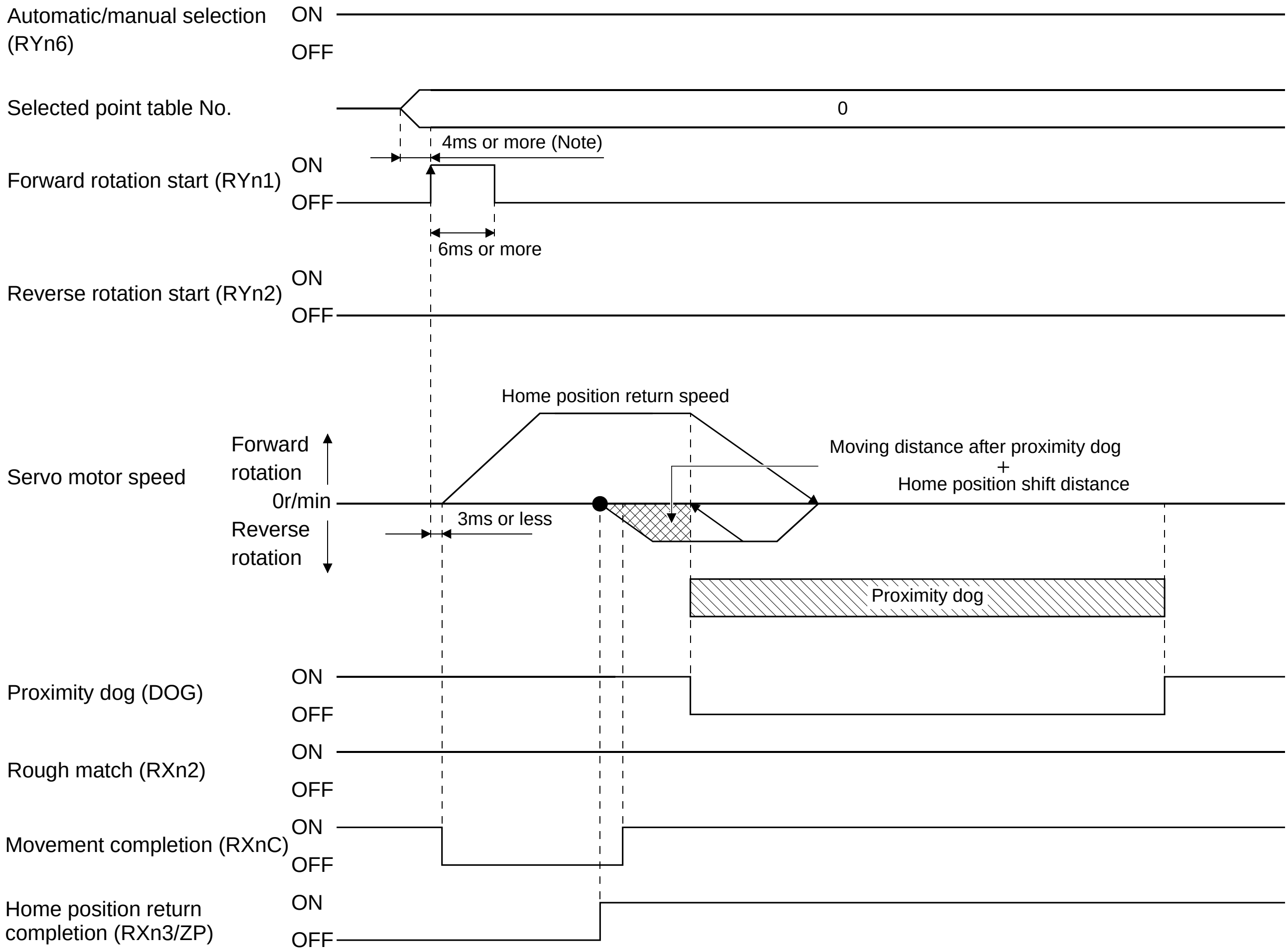
The home position is determined to be the position of the front end of the proximity dog.

(1) Devices, parameters

Set the input devices and parameters as indicated below.

Item	Device/Parameter used	Description
Manual home position return mode selection	Automatic/manual selection (RYn6)	Turn RYn6 ON.
	Point table No. selection 1 to 8 (RYnA to RYnE, RY(n＋2)3 to RY(n＋2)5)	RYnA to RYnE, RY(n＋2)3 to RY(n＋2)5 are turned off.
Remote register-based position/speed setting (Only when two stations are occupied)	Position/speed specifying system selection (RY(n＋2)A)	Turn RY(n＋2)A ON.
Dog cradle type home position return	Parameter No.PC02	□□□9: Select the dog cradle type.
Home position return direction	Parameter No.PC03	Refer to section 5.6.1 (2) and select the home position return direction.
Dog input polarity	Parameter No.PD16	Refer to section 5.6.1 (2) and select the dog input polarity.
Home position return speed	Parameter No.PC04	Set the speed till the dog is detected.
Creep speed	Parameter No.PC05	Set the speed after the dog is detected.
Home position shift distance	Parameter No.PC06	Set when the home position is moved from the Z-phase signal position.
Home position return acceleration/deceleration time constants	Point table No.1	Use the acceleration/deceleration time constant of point table No.1.
Home position return position data	Parameter No.PC07	Set the current position at home position return completion.

(2) Timing chart



Note. Configure a sequence that changes the point table selection earlier, considering the delay time of CC-Link communication.

The parameter No.PC07 (home position return position data) setting value is the positioning address after the home position return is completed.

5.6.12 Dogless Z-phase reference home position return method

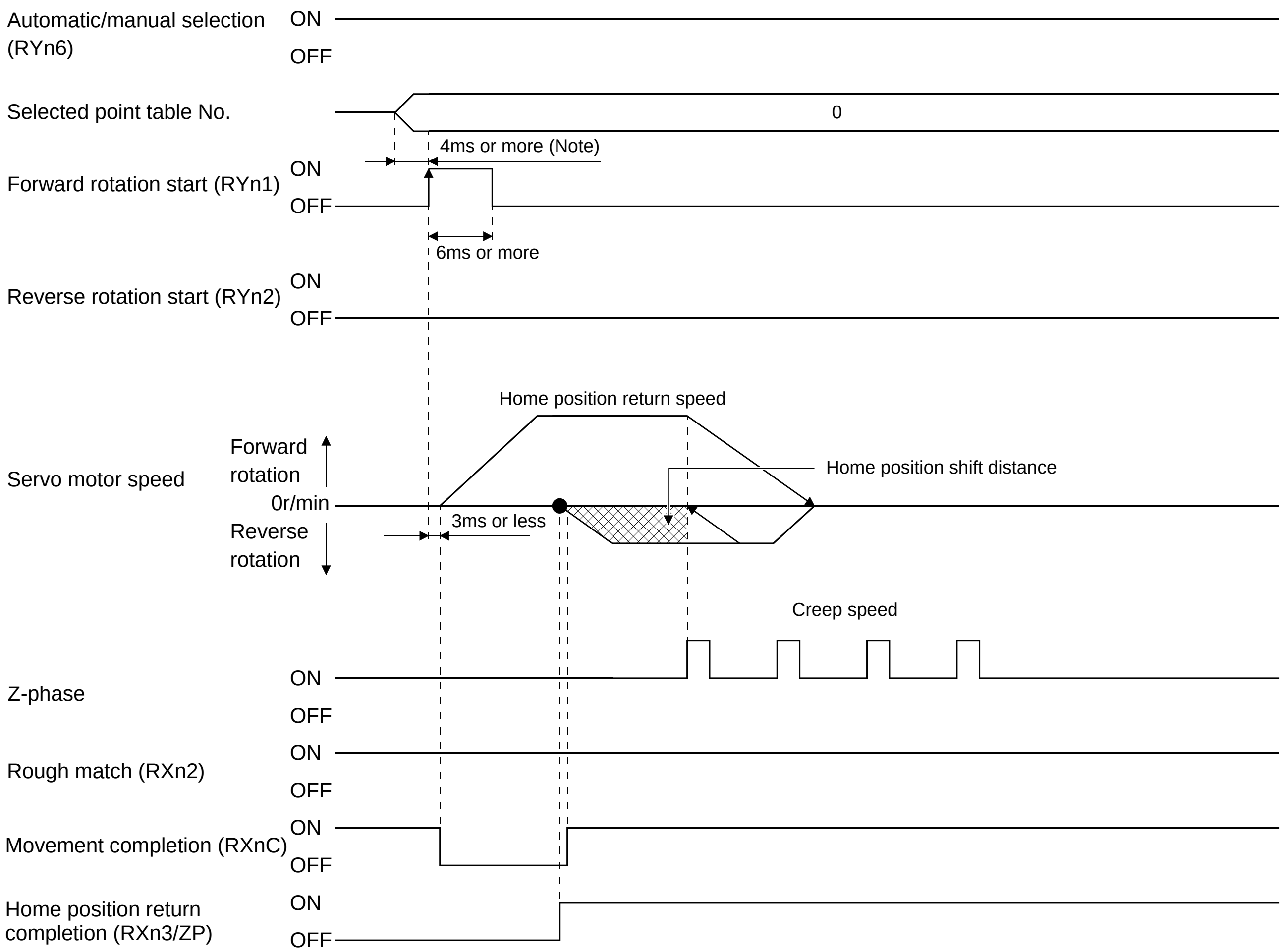
The home position is determined to be where the first Z-phase pulse is issued after the home position return is started.

(1) Devices, parameters

Set the input devices and parameters as indicated below.

Item	Device/Parameter used	Description
Manual home position return mode selection	Automatic/manual selection (RYn6)	Turn RYn6 ON.
	Point table No. selection 1 to 8 (RYnA to RYnE, RY(n＋2)3 to RY(n＋2)5)	RYnA to RYnE, RY(n＋2)3 to RY(n＋2)5 are turned off.
Remote register-based position/speed setting (Only when two stations are occupied)	Position/speed specifying system selection (RY(n＋2)A)	Turn RY(n＋2)A ON.
Dog cradle type home position return	Parameter No.PC02	□□□A: Select the dog cradle type.
Home position return direction	Parameter No.PC03	Refer to section 5.6.1 (2) and select the home position return direction.
Home position return speed	Parameter No.PC04	Set the speed till the dog is detected.
Creep speed	Parameter No.PC05	Set the speed after the dog is detected.
Home position shift distance	Parameter No.PC06	Set when the home position is moved from the Z-phase signal position.
Home position return acceleration/deceleration time constants	Point table No.1	Use the acceleration/deceleration time constant of point table No.1.
Home position return position data	Parameter No.PC07	Set the current position at home position return completion.

(2) Timing chart



Note. Configure a sequence that changes the point table selection earlier, considering the delay time of CC-Link communication.

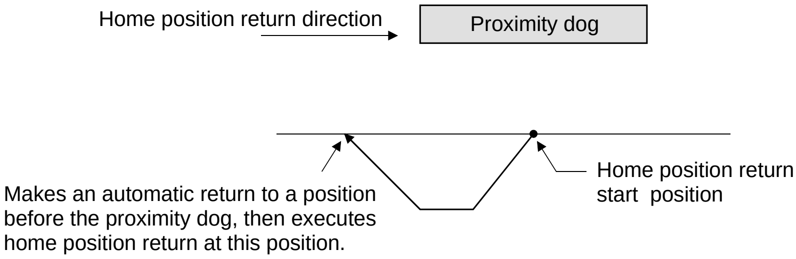
The parameter No.PC07 (home position return position data) setting value is the positioning address after the home position return is completed.

5.6.13 Home position return automatic return function

If the current position is at or beyond the proximity dog in the home position return using the proximity dog, this function starts home position return after making a return to the position where the home position return can be made.

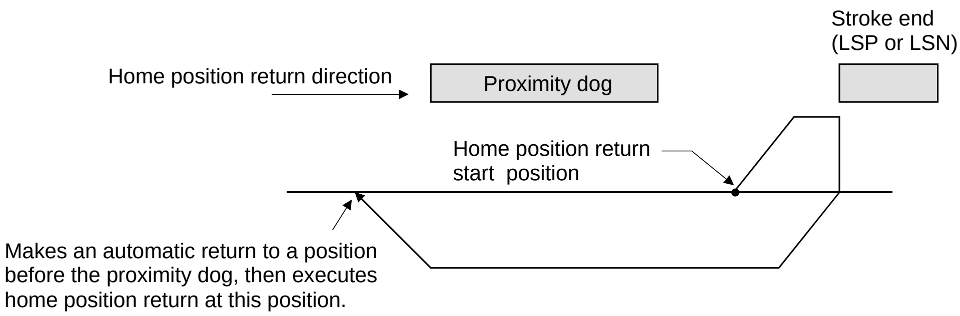
(1) When the current position is at the proximity dog

When the current position is at the proximity dog, an automatic return is made before home position return.



(2) When the current position is beyond the proximity dog

At a start, a motion is made in the home position return direction and an automatic return is made on detection of the stroke end (LSP or LSN). The motion stops past the front end of the proximity dog, and home position return is resumed at that position. If the proximity dog cannot be detected, the motion stops on detection of the LSP or LSN switch and A90 occurs.



Software limit cannot be used with these functions.

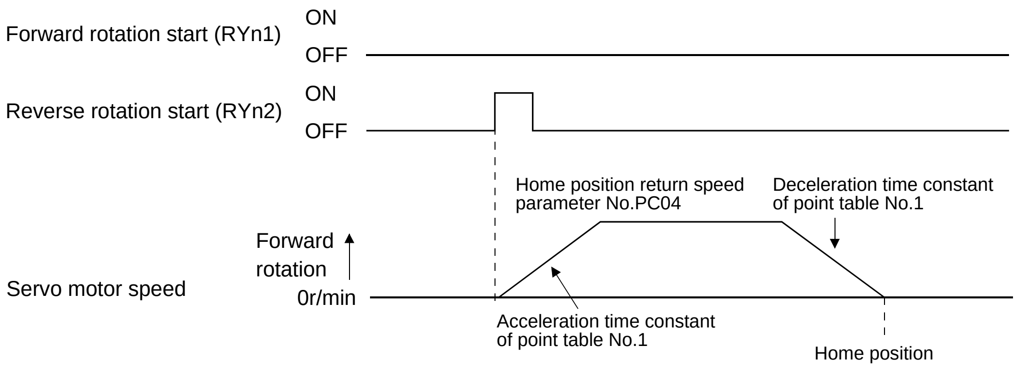
5.6.14 Automatic positioning function to the home position

POINT
・You cannot perform automatic positioning from outside the position data setting range to the home position. In this case, make a home position return again using a manual home position return.

If this function is used when returning to the home position again after performing a manual home position return after a power-on and deciding the home position, automatic positioning can be carried out to the home position at high speed. In an absolute position detection system, manual home position return is not required after power-on.
Please perform a manual home position return beforehand after a power-on.
Set the input signals and parameter as follows.

Item	Device/Parameter used	Description
Manual home position return mode selection	Automatic/manual selection (RYn6)	Turn RYn6 ON.
	Point table No. selection 1 to 8 (RYnA to RYnE, RY(n+2)3 to RY(n+2)5)	RYnA to RYnE, RY(n+2)3 to RY(n+2)5 are turned off.
Home position return speed	Parameter No.PC04	Set the speed till the dog is detected.
Home position return acceleration/deceleration time constants	Point table No.1	Use the acceleration/deceleration time constant of point table No.1.

Set up the home position return speed of the automatic positioning function to the home position by parameter No.PC04. Use the data of point table No.1 to set the acceleration time constant and deceleration time constant. When reverse rotation start (RYn2) is ON, it will position automatically at the home position.



5.7 Roll feed display function in roll feed mode

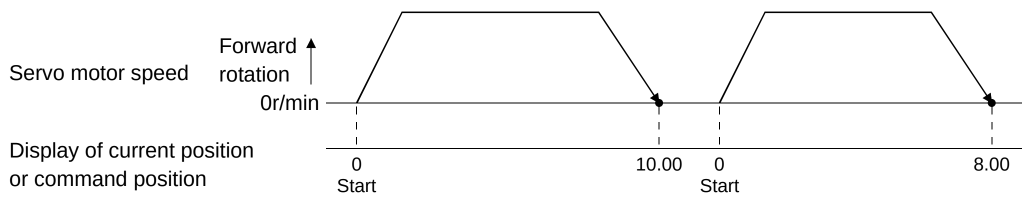
With the roll feed display function, the driver can operate in the roll feed mode. The roll feed mode uses the incremental system.

(1) Parameter settings

No.	Name	Digit to be set	Setting item	Setting value	Description
PA03	Absolute position detection system	□□□■	Operation system	□□□0 (initial value)	Make sure to set the incremental system. The absolute position detection system cannot be used.
PC28	Function selection C-7	□□■□	Selection between current position display and command position display	□□1□	Select roll feed display.

(2) Roll feed display function

At start up, the roll feed display function clears the status display of the current position and command position to zero.



(3) Operation procedure

Changes are made only on the status display of the current position and commanded position. The same operation procedure as that in each operation mode can be used.

Operation procedure		Details
Automatic operation	Automatic operation according to the point table	Section 5.4.2
Manual operation	JOG operation	Section 5.5.1
	Manual pulse generator operation	Section 5.5.2
Home position return mode		Section 5.6

5.8 Absolute position detection system

CAUTION	• If an absolute position erase alarm (A25) or an absolute position counter warning (AE3) has occurred, always perform home position setting again. Not doing so may cause unexpected operation.

POINT

- If the encoder cable is disconnected, absolute position data will be lost in the following servo motor LE-□-□ series. . After disconnecting the encoder cable, always execute home position setting and then positioning operation.
- When the following parameters are changed, the home position is lost when turning on the power after the change. Execute the home position return again when turning on the power.
  - Parameter No.PA06 (Electronic gear numerator)
  - Parameter No.PA07 (Electronic gear denominator)
  - Parameter No.PA14 (Rotation direction selection)
  - Parameter No.PC07 (Home position return position data)

This driver contains a single-axis driver. Also, all servo motor encoders are compatible with an absolute position detection system. Hence, an absolute position detection system can be configured up by merely loading an absolute position data back-up battery and setting parameter values.

(1) Restrictions

An absolute position detection system cannot be built under the following conditions.

1) Stroke-less coordinate system, e.g. rotary shaft, infinite positioning.

2) Operation performed in incremental value command type positioning system.

(2) Specifications

Item	Description
System	Electronic battery backup system.
Battery	1 piece of lithium battery (primary battery, nominal + 3.6V) Type: LEC-MR-J3BAT.
Maximum revolution range	Home position ± 32767 rev.
(Note 1) Maximum speed at power failure	3000r/min
(Note 2) Battery backup time	Approx. 10,000 hours (battery life with power off)
Battery storage period	5 years from date of manufacture.

Note 1. Maximum speed available when the shaft is rotated by external force at the time of power failure or the like.

2. Time to hold data by a battery with power off. It is recommended to replace the battery in three years independently of whether power is kept on or off.

(3) Structure

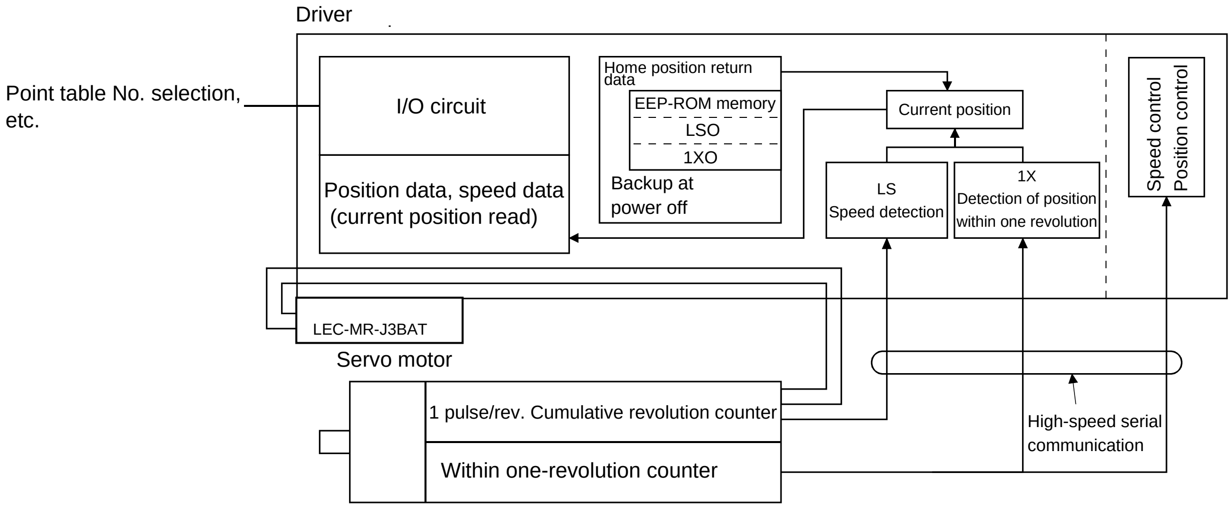
Component	Description
Driver	Use standard models.
Servo motor	
Battery	LEC-MR-J3BAT
Encoder cable	Use a standard model. (Refer to section 13.1.)

(4) Outline of absolute position detection data communication

For normal operation, as shown below, the encoder consists of a detector designed to detect a position within one revolution and a cumulative revolution counter designed to detect the number of revolutions.

The absolute position detection system always detects the absolute position of the machine and keeps it battery-backed, independently of whether the general-purpose programming PC or PLC...etc power is on or off. Therefore, once the home position is defined at the time of machine installation, home position return is not needed when power is switched on thereafter.

If a power failure or a fault occurs, restoration is easy.



(5) Battery installation procedure

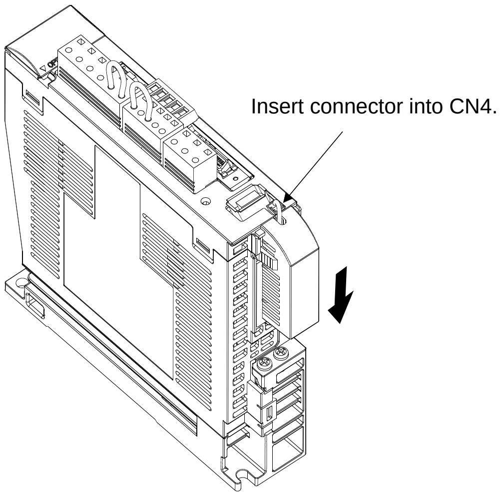
WARNING	・Before installing a battery, turn off the main circuit power while keeping the control circuit power on. Wait for 15 minutes or more until the charge lamp turns off. Then, confirm that the voltage between P(＋) and N(－) is safe with a voltage tester and others. Otherwise, an electric shock may occur. In addition, always confirm from the front of the driver whether the charge lamp is off or not.

POINT

- The internal circuits of the driver may be damaged by static electricity.
  Always take the following precautions.
  - Ground human body and work bench.
  - Do not touch the conductive areas, such as connector pins and electrical parts, directly by hand.
- Before starting battery changing procedure, make sure that the main circuit power is switched OFF with the control circuit power ON. When battery is changed with the control power OFF, the absolute position data is lost.

(a) LECSC□-□

POINT
・For the driver with a battery holder on the bottom, it is not possible to wire for the earth with the battery installed. Insert the battery after executing the earth wiring of the driver.



(b) Parameter setting

Set parameter No.PA03 (Absolute position detection system) as indicated below to make the absolute position detection system valid.

Parameter No.PA03

			1

Selection of absolute position detection system
0: Incremental system
1: Absolute position detection system

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6. PARAMETERS

⚠ CAUTION	・Never adjust or change the parameter values extremely as it will make operation instable.

POINT
・For any parameter whose symbol is preceded by *, set the parameter value and switch power off once, then switch it on again to make that parameter setting valid.

In this driver, the parameters are classified into the following groups on a function basis.

Parameter group	Main description
Basic setting parameters (No.PA □□)	Make basic setting with these parameters. Generally, the operation is possible only with these parameter settings.
Gain/filter parameters (No.PB □□)	Use these parameters when making gain adjustment manually.
Extension setting parameters (No.PC □□)	These parameters are inherent to the LECSC□-□ driver.
I/O setting parameters (No.PD □□)	Use these parameters when changing the I/O devices of the driver.

Mainly setting the basic setting parameters (No.PA□□) allows the setting of the basic parameters at the time of introduction.

6.1 Basic setting parameters (No.PA□□)

6.1.1 Parameter list

No.	Symbol	Name	Initial value	Unit
PA01	*STY	Control mode	0000h	
PA02	*REG	Regenerative option	0000h	
PA03	*ABS	Absolute position detection system	0000h	
PA04	*AOP1	Function selection A-1	0000h	
PA05	*FTY	Feeding function selection	0000h	
PA06	*CMX	Electronic gear numerator	1	
PA07	*CDV	Electronic gear denominator	1	
PA08	ATU	Auto tuning mode	0001h	
PA09	RSP	Auto tuning response	12	
PA10	INP	In-position range	100	μm
PA11	TLP	Forward rotation torque limit	100.0	%
PA12	TLN	Reverse rotation torque limit	100.0	%
PA13		For manufacturer setting	0002h	
PA14	*POL	Rotation direction selection	0	
PA15	*ENR	Encoder output pulses	4000	pulse/rev
PA16		For manufacturer setting	0000h	
PA17			0000h	
PA18			0000h	
PA19	*BLK	Parameter write inhibit	000Ch	

6.1.2 Parameter write inhibit

Parameter			Initial value	Unit	Setting range
No.	Symbol	Name			
PA19	*BLK	Parameter write inhibit	000Ch		Refer to the text.

POINT
- This parameter is made valid when power is switched off, then on after setting.

In the factory setting, this driver allows changes to the basic setting parameter, gain/filter parameter and extension setting parameter settings. With the setting of parameter No.PA19, write can be disabled to prevent accidental changes.

The following table indicates the parameters which are enabled for reference and write by the setting of parameter No.PA19. Operation can be performed for the parameters marked ○ .

Parameter No.PA19 setting	Setting operation	Basic setting parameters No.PA□□	Gain/Filter parameters No.PB□□	Extension setting parameters No.PC□□	I/O setting parameters No.PD□□
0000h	Reference	○			
	Write	○			
000Bh	Reference	○	○	○	
	Write	○	○	○	
000Ch (initial value)	Reference	○	○	○	○
	Write	○	○	○	○
100Bh	Reference	○			
	Write	Parameter No. PA19 only			
100Ch	Reference	○	○	○	○
	Write	Parameter No. PA19 only			

6.1.3 Selection of command system

Parameter			Initial value	Unit	Setting range
No.	Symbol	Name			
PA01	*STY	Control mode	0000h		Refer to the text.

POINT
- This parameter is made valid when power is switched off, then on after setting.

Select the command system.

Parameter No.PA01

0	0	0	

Selection of command system
(Refer to section 5.4)
0: Absolute value command system
1: Incremental value command system

6.1.4 Selection of regenerative option

Parameter			Initial value	Unit	Setting range
No.	Symbol	Name			
PA02	*REG	Regenerative option	0000h		Refer to the text.

POINT
- This parameter is made valid when power is switched off, then on after setting.
- Wrong setting may cause the regenerative option to burn.
- If the regenerative option selected is not for use with the driver, parameter error (A37) occurs.

Set this parameter when using the regenerative option, brake unit, power regeneration converter, or power regeneration common converter.

Parameter No.PA02

0	0		

Selection of regenerative option
00: Regenerative option is not used
- For 100W driver regenerative resistor is not used
- For 200W driver regenerative resistor is used

02: LEC-MR-RB-032
03: LEC-MR-RB-12

6.1.5 Using absolute position detection system

Parameter			Initial value	Unit	Setting range
No.	Symbol	Name			
PA03	*ABS	Absolute position detection system	0000h		Refer to the text.

POINT
- This parameter is made valid when power is switched off, then on after setting.

Set this parameter when using the absolute position detection system.

Parameter No.PA03

0	0	0	

Selection of absolute position detection system (refer to section 5.7)
0: Used in incremental system
1: Used in absolute position detection system

6.1.6 Follow-up for absolute value command system in incremental system

Parameter			Initial value	Unit	Setting range
No.	Symbol	Name			
PA04	*AOP1	Function selection A-1	0000h		Refer to the text.

POINT
- This parameter is made valid when power is switched off, then on after setting.

If this parameter is made valid, the home position is not lost in the servo-off or forced stop state, and the operation can be resumed when the servo-on (RYn0) or forced stop (EMG) is deactivated.

Parameter No.PA04

0	0	0	

Servo-on (RYn0) -off, forced stop (EMG) -off follow-up for absolute value command in incremental system
0: Invalid
1: Valid
Normally, when this driver is used in the absolute value command method of the incremental system, placing it in a servo off or forced stop status will erase the home position.
When "1" is set in this parameter, the home position will not be erased if the driver is placed in a servo-off or forced stop status or if the alarm that can be deactivated by resetting occurs.
The operation can be resumed when the servo-on (RYn0) or forced stop (EMG) is deactivated or an alarm is deactivated by resetting (RES).

6.1.7 Feeding function selection

Parameter			Initial value	Unit	Setting range
No.	Symbol	Name			
PA05	*FTY	Feeding function selection	0000h		Refer to the text.

POINT

- This parameter is made valid when power is switched off, then on after setting.

Select the feed length multiplication and the manual pulse generator input multiplication.

Parameter No.PA05

0 0 □ □

Setting value	Feed length multiplication factor (STM) [times]	Feed unit [μm]	Position data input range [mm]	
			Absolute value command system	Incremental value command system
0	1	1	−999.999 to +999.999	0 to +999.999
1	10	10	−9999.99 to +9999.99	0 to +9999.99
2	100	100	−99999.9 to +99999.9	0 to +99999.9
3	1000	1000	− 999999 to +999999	0 to + 999999

Manual pulse generator multiplication factor
0: 1 time
1: 10 times
2: 100 times

6.1.8 Electronic gear

Parameter			Initial value	Unit	Setting range
No.	Symbol	Name			
PA06	*CMX	Electronic gear numerator	1		0 to 65535
PA07	*CDV	Electronic gear denominator	1		1 to 65535

CAUTION	・False setting will result in unexpected fast rotation, causing injury.

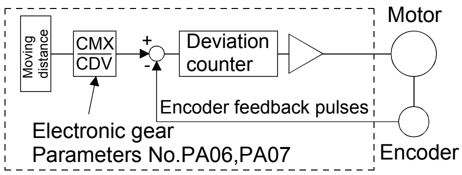
POINT

- This parameter is made valid when power is switched off, then on after setting.
- The range of the electronic gear setting is $\frac{1}{10} < \frac{CMX}{CDV} < 2000$. If you set any value outside this range, a parameter error (A37) occurs.
- Setting "0" in parameter No.PA06 automatically sets the encoder resolution pulse.

(1) Concept of electronic gear

Use the electronic gear (parameters No.PA06, PA07) to make adjustment so that the driver setting matches the moving distance of the machine. Also, by changing the electronic gear value, the machine can be moved at any multiplication ratio to the moving distance on the driver.

$$\frac{CMX}{CDV} = \frac{\text{Parameters No.PA06}}{\text{Parameters No.PA07}}$$



The following examples are used to explain how to calculate the electronic gear value.

POINT

- The following specification symbols are needed for electronic gear calculation.

  Pb : Ball screw lead [mm]

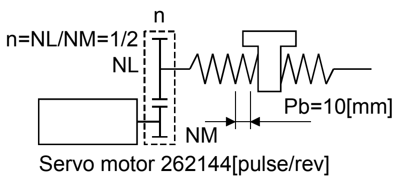
  n : Reduction ratio

  Pt : Servo motor resolution [pulse/rev]

  ΔS : Travel per servo motor revolution [mm/rev]

(a) Ball screw setting example

Machine specifications



Ball screw lead: Pb = 10 [mm]

Reduction ratio: n = 1/2

Servo motor resolution: Pt = 262144 [pulse/rev]

$$\frac{CMX}{CDV} = \frac{p_t}{\Delta S} = \frac{p_t}{n \cdot p_b \cdot 1000} = \frac{262144}{1/2 \cdot 10 \cdot 1000} = \frac{262144}{5000} = \frac{32768}{625}$$

Hence, set 32768 to CMX and 625 to CDV.

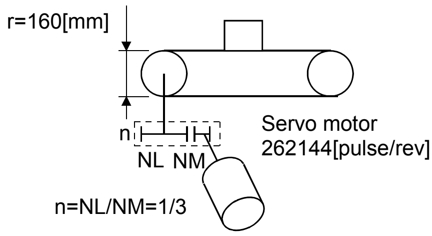
(b) Conveyor setting example

Machine specifications

Pulley diameter: r = 160 [mm]

Reduction ratio: n = 1/3

Servo motor resolution: Pt = 262144 [pulse/rev]



$$\frac{CMX}{CDV} = \frac{p_t}{\Delta S} = \frac{p_t}{n \cdot r \cdot \pi \cdot 1000} = \frac{262144}{1/3 \cdot 160 \cdot \pi \cdot 1000} = \frac{262144}{167551.61} \fallingdotseq \frac{32768}{20944}$$

Reduce CMX and CDV to the setting range or less, and round off the first decimal place.
Hence, set 32768 to CMX and 20944 to CDV.

6.1.9 Auto tuning

Parameter			Initial value	Unit	Setting range
No.	Symbol	Name			
PA08	ATU	Auto tuning mode	0001h		Refer to the text.
PA09	RSP	Auto tuning response	12		1 to 32

Make gain adjustment using auto tuning. Refer to section 8.2 for details.

(1) Auto tuning mode (parameter No.PA08)

Select the gain adjustment mode.

Parameter No.PA08

0	0	0	

Gain adjustment mode setting

Setting	Gain adjustment mode	Automatically set parameter No. (Note)
0	Interpolation mode	PB06 · PB08 · PB09 · PB10
1	Auto tuning mode 1	PB06 · PB07 · PB08 · PB09 · PB10
2	Auto tuning mode 2	PB07 · PB08 · PB09 · PB10
3	Manual mode	

Note. The parameters have the following names.

Parameter No.	Name
PB06	Ratio of load inertia moment to servo motor inertia moment
PB07	Model loop gain
PB08	Position loop gain
PB09	Speed loop gain
PB10	Speed integral compensation

(2) Auto tuning response (parameter No.PA09)

If the machine hunts or generates large gear sound, decrease the set value. To improve performance, e.g. shorten the settling time, increase the set value.

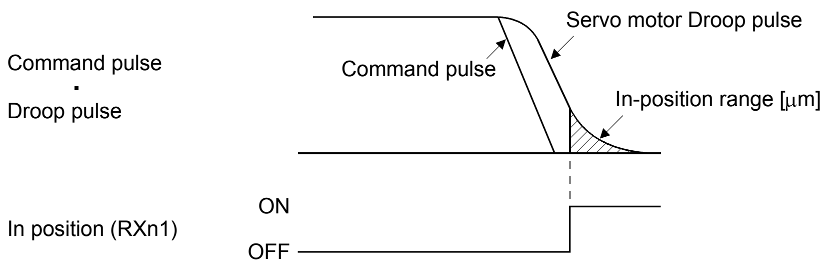
Setting	Response	Guideline for machine resonance frequency [Hz]
1	Low response	10.0
2	↑	11.3
3		12.7
4		14.3
5		16.1
6		18.1
7		20.4
8		23.0
9		25.9
10		29.2
11		32.9
12		37.0
13		41.7
14		47.0
15	↓	52.9
16	Middle response	59.6

Setting	Response	Guideline for machine resonance frequency [Hz]
17	Low response	67.1
18	↑	75.6
19		85.2
20		95.9
21		108.0
22		121.7
23		137.1
24		154.4
25		173.9
26		195.9
27		220.6
28		248.5
29		279.9
30		315.3
31	↓	355.1
32	Middle response	400.0

6.1.10 In-position range

Parameter			Initial value	Unit	Setting range
No.	Symbol	Name			
PA10	INP	In-position range	100	μm	0 to 10000

Set the range, where In position (RXn1) and Movement completion (RXnC) are output, in the command pulse unit before calculation of the electronic gear. With the setting of parameter No.PC24, the range can be changed to the encoder output pulse unit.



6.1.11 Torque limit

Parameter			Initial value	Unit	Setting range
No.	Symbol	Name			
PA11	TLP	Forward rotation torque limit	100.0	%	0 to 100.0
PA12	TLN	Reverse rotation torque limit	100.0	%	0 to 100.0

The torque generated by the servo motor can be limited.

(1) Forward rotation torque limit (parameter No.PA11)
Set this parameter on the assumption that the maximum torque is 100[%]. Set this parameter when limiting the torque of the servo motor in the CCW driving mode or CW regeneration mode. Set this parameter to "0.0" to generate no torque.

(2) Reverse rotation torque limit (parameter No.PA12)
Set this parameter on the assumption that the maximum torque is 100[%]. Set this parameter when limiting the torque of the servo motor in the CW driving mode or CCW regeneration mode. Set this parameter to "0.0" to generate no torque.

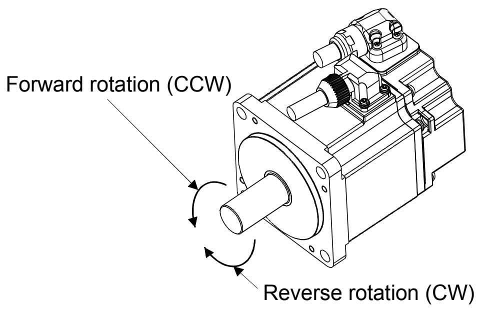
6.1.12 Selection of servo motor rotation direction

Parameter			Initial value	Unit	Setting range
No.	Symbol	Name			
PA14	*POL	Rotation direction selection	0		0・1

POINT
- This parameter is made valid when power is switched off, then on after setting.

Select servo motor rotation direction relative to the input pulse train.

Parameter No.PA14 Setting	Servo Motor Rotation Direction	
	Forward rotation start (Ryn1) ON	Reverse rotation start (Ryn2) ON
0	CCW	CW
1	CW	CCW



6.1.13 Encoder output pulse

Parameter			Initial value	Unit	Setting range
No.	Symbol	Name			
PA15	*ENR	Encoder output pulse	4000	pulse/rev	1 to 65535

POINT
- This parameter is made valid when power is switched off, then on after setting.

Used to set the encoder pulses (A-phase, B-phase) output by the driver.
Set the value 4 times greater than the A-phase or B-phase pulses.
You can use parameter No.PC19 to choose the output pulse setting or output division ratio setting.
The number of A/B-phase pulses actually output is 1/4 times greater than the preset number of pulses.
The maximum output frequency is 4.6Mpps (after multiplication by 4). Use this parameter within this range.

(1) For output pulse designation
Set " □ □ 0 □ " (initial value) in parameter No.PC19.
Set the number of pulses per servo motor revolution.
Output pulse = set value [pulses/rev]
For instance, set "5600" to Parameter No.PA15, the actually output A/B-phase pulses are as indicated below.

$$\text{A}\cdot\text{B-phase output pulses} = \frac{5600}{4} = 1400[\text{pulse}]$$

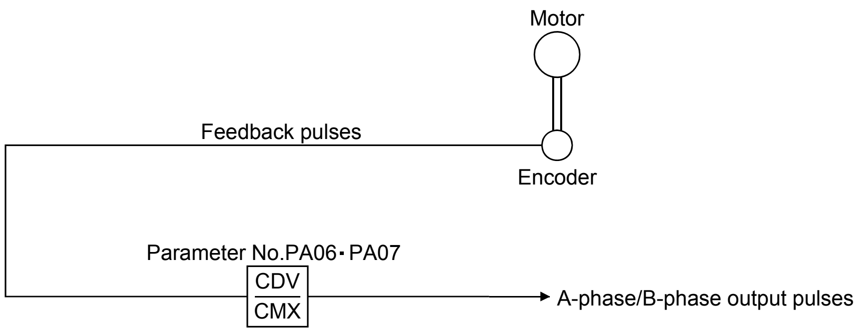
(2) For output division ratio setting
Set " □ □ 1 □ " in parameter No.PC19.
The number of pulses per servo motor revolution is divided by the set value.

$$\text{Output pulse} = \frac{\text{Resolution per servo motor revolution}}{\text{Set value}} \ [\text{pulses/rev}]$$

For instance, set "8" to Parameter No.PA15, the actually output A/B-phase pulses are as indicated below.

$$\text{A}\cdot\text{B-phase output pulses} = \frac{262144}{8}\cdot\frac{1}{4} = 8192[\text{pulse}]$$

(3) When outputting pulse train similar to command pulses
Set parameter No.PC19 to " □ □ 2 □ ". The feedback pulses from the servo motor encoder are processed and output as shown below. The feedback pulses can be output in the same pulse unit as the command pulses.

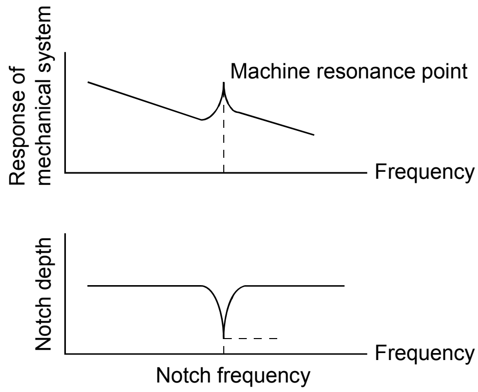


6.2 Gain/filter parameters (No.PB□□)

6.2.1 Parameter list

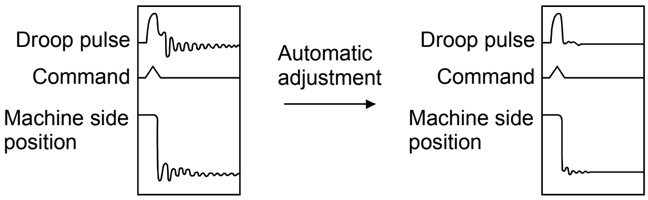
No.	Symbol	Name	Initial value	Unit
PB01	FILT	Adaptive tuning mode (Adaptive filter Ⅱ)	0000h	
PB02	VRFT	Vibration suppression control tuning mode (Advanced vibration suppression control)	0000h	
PB03		For manufacturer setting	0000h	
PB04	FFC	Feed forward gain	0	%
PB05		For manufacturer setting	500	
PB06	GD2	Ratio of load inertia moment to servo motor inertia moment	7.0	Multiplier (×1)
PB07	PG1	Model loop gain	24	rad/s
PB08	PG2	Position loop gain	37	rad/s
PB09	VG2	Speed loop gain	823	rad/s
PB10	VIC	Speed integral compensation	33.7	ms
PB11	VDC	Speed differential compensation	980	
PB12		For manufacturer setting	0	
PB13	NH1	Machine resonance suppression filter 1	4500	Hz
PB14	NHQ1	Notch shape selection 1	0000h	
PB15	NH2	Machine resonance suppression filter 2	4500	Hz
PB16	NHQ2	Notch shape selection 2	0000h	
PB17		Automatic setting parameter		
PB18	LPF	Low-pass filter	3141	rad/s
PB19	VRF1	Vibration suppression control vibration frequency setting	100.0	Hz
PB20	VRF2	Vibration suppression control resonance frequency setting	100.0	Hz
PB21		For manufacturer setting	0.00	
PB22			0.00	
PB23	VFBF	Low-pass filter selection	0000h	
PB24	*MVS	Slight vibration suppression control selection	0000h	
PB25		For manufacturer setting	0000h	
PB26	*CDP	Gain changing selection	0000h	
PB27	CDL	Gain changing condition	10	
PB28	CDT	Gain changing time constant	1	ms
PB29	GD2B	Gain changing ratio of load inertia moment to servo motor inertia moment	7.0	Multiplier (×1)
PB30	PG2B	Gain changing position loop gain	37	rad/s
PB31	VG2B	Gain changing speed loop gain	823	rad/s
PB32	VICB	Gain changing speed integral compensation	33.7	ms
PB33	VRF1B	Gain changing vibration suppression control vibration frequency setting	100.0	Hz
PB34	VRF2B	Gain changing vibration suppression control resonance frequency setting	100.0	Hz
PB35		For manufacturer setting	0.00	
PB36			0.00	
PB37			100	
PB38			0	
PB39			0	
PB40			0	
PB41			1125	
PB42			1125	
PB43			0004h	
PB44			0000h	
PB45			0000h	

6.2.2 Detail list

<table>
<tr><th>No.</th><th>Symbol</th><th>Name and function</th><th>Initial value</th><th>Unit</th><th>Setting range</th></tr>
<tr><td>PB01</td><td>FILT</td><td>Adaptive tuning mode (Adaptive filter Ⅱ)
Select the setting method for filter tuning. Setting this parameter to "□□□1" (filter tuning mode 1) automatically changes the machine resonance suppression filter 1 (parameter No.PB13) and notch shape selection (parameter No.PB14).


0 0 0 □
Filter tuning mode selection
<table>
<tr><th>Setting</th><th>Filter adjustment mode</th><th>Automatically set parameter</th></tr>
<tr><td>0</td><td>Filter OFF</td><td>(Note)</td></tr>
<tr><td>1</td><td>Filter tuning mode</td><td>Parameter No.PB13
Parameter No.PB14</td></tr>
<tr><td>2</td><td>Manual mode</td><td></td></tr>
</table>
Note. Parameter No.PB13 and PB14 are fixed to the initial values.

When this parameter is set to "□□□1", the tuning is completed after positioning is done the predetermined number or times for the predetermined period of time, and the setting changes to "□□□2". When the filter tuning is not necessary, the setting changes to "□□□0". When this parameter is set to "□□□0", the initial values are set to the machine resonance suppression filter 1 and notch shape selection. However, this does not occur when the servo off.</td><td>0000h</td><td></td><td></td></tr>
</table>

<table>
<tr><th>No.</th><th>Symbol</th><th>Name and function</th><th>Initial value</th><th>Unit</th><th>Setting range</th></tr>
<tr><td>PB02</td><td>VRFT</td><td>Vibration suppression control tuning mode (Advanced vibration suppression control)
The vibration suppression is valid when the parameter No.PA08 (auto tuning) setting is "□□□2" or "□□□3". When PA08 is "□□□1", vibration suppression is always invalid.
Select the setting method for vibration suppression control tuning. Setting this parameter to "□□□1" (vibration suppression control tuning mode) automatically changes the vibration suppression control - vibration frequency (parameter No.PB19) and vibration suppression control - resonance frequency (parameter No.PB20) after positioning is done the predetermined number of times.


0 0 0 □
Vibration suppression control tuning mode
<table>
<tr><th>Setting</th><th>Vibration suppression control tuning mode</th><th>Automatically set parameter</th></tr>
<tr><td>0</td><td>Vibration suppression control OFF</td><td>(Note)</td></tr>
<tr><td>1</td><td>Vibration suppression control tuning mode (Advanced vibration suppression control)</td><td>Parameter No.PB19
Parameter No.PB20</td></tr>
<tr><td>2</td><td>Manual mode</td><td></td></tr>
</table>
Note. Parameter No.PB19 and PB20 are fixed to the initial values.

When this parameter is set to "□□□1", the tuning is completed after positioning is done the predetermined number or times for the predetermined period of time, and the setting changes to "□□□2". When the vibration suppression control tuning is not necessary, the setting changes to "□□□0".
When this parameter is set to "□□□0", the initial values are set to the vibration suppression control - vibration frequency and vibration suppression control - resonance frequency. However, this does not occur when the servo off.</td><td>0000h</td><td></td><td></td></tr>
<tr><td>PB03</td><td></td><td>For manufacturer setting
Do not change this value by any means.</td><td>0000h</td><td></td><td></td></tr>
<tr><td>PB04</td><td>FFC</td><td>Feed forward gain
Set the feed forward gain. When the setting is 100%, the droop pulses during operation at constant speed are nearly zero. However, sudden acceleration/deceleration will increase the overshoot. As a guideline, when the feed forward gain setting is 100%, set 1s or more as the acceleration/deceleration time constant up to the rated speed.</td><td>0</td><td>%</td><td>0
to
100</td></tr>
</table>

No.	Symbol	Name and function	Initial value	Unit	Setting range
PB05		For manufacturer setting Do not change this value by any means.	500		
PB06	GD2	Ratio of load inertia moment to servo motor inertia moment Used to set the ratio of the load inertia moment to the servo motor shaft inertia moment. When auto tuning mode 1 and interpolation mode is selected, the result of auto tuning is automatically used. (Refer to section 8.1.1) In this case, it varis between 0 and 100.0.	7.0	Multiplier (×1)	0 to 300.0
PB07	PG1	Model loop gain Set the response gain up to the target position. Increase the gain to improve track ability in response to the command. When auto turning mode 1,2 is selected, the result of auto turning is automatically used.	24	rad/s	1 to 2000
PB08	PG2	Position loop gain Used to set the gain of the position loop. Set this parameter to increase the position response to level load disturbance. Higher setting increases the response level but is liable to generate vibration and/or noise. When auto tuning mode 1,2 and interpolation mode is selected, the result of auto tuning is automatically used.	37	rad/s	1 to 1000
PB09	VG2	Speed loop gain Set this parameter when vibration occurs on machines of low rigidity or large backlash. Higher setting increases the response level but is liable to generate vibration and/or noise. When auto tuning mode 1,2 manual mode and interpolation mode is selected, the result of auto tuning is automatically used.	823	rad/s	20 to 50000
PB10	VIC	Speed integral compensation Used to set the integral time constant of the speed loop. Lower setting increases the response level but is liable to generate vibration and/or noise. When auto tuning mode 1,2 and interpolation mode is selected, the result of auto tuning is automatically used.	33.7	ms	0.1 to 1000.0
PB11	VDC	Speed differential compensation Used to set the differential compensation. Made valid when the proportion control (RY(n+2)7) is switched on.	980		0 to 1000
PB12		For manufacturer setting Do not change this value by any means.	0		
PB13	NH1	Machine resonance suppression filter 1 Set the notch frequency of the machine resonance suppression filter 1. Setting parameter No.PB01 (filter tuning mode 1) to "□□□1" automatically changes this parameter. When the parameter No.PB01 setting is "□□□0", the setting of this parameter is ignored.	4500	Hz	100 to 4500

<table>
<tr><th>No.</th><th>Symbol</th><th>Name and function</th><th>Initial value</th><th>Unit</th><th>Setting range</th></tr>
<tr><td>PB14</td><td>NHQ1</td><td>Notch shape selection 1
Used to selection the machine resonance suppression filter 1.

0 □ □ 0

Notch depth selection
<table>
<tr><th>Setting value</th><th>Depth</th><th>Gain</th></tr>
<tr><td>0</td><td>Deep</td><td>-40dB</td></tr>
<tr><td>1</td><td rowspan="2">to</td><td>-14dB</td></tr>
<tr><td>2</td><td>-8dB</td></tr>
<tr><td>3</td><td>Shallow</td><td>-4dB</td></tr>
</table>
Notch width
<table>
<tr><th>Setting value</th><th>Width</th><th>α</th></tr>
<tr><td>0</td><td>Standard</td><td>2</td></tr>
<tr><td>1</td><td rowspan="2">to</td><td>3</td></tr>
<tr><td>2</td><td>4</td></tr>
<tr><td>3</td><td>Wide</td><td>5</td></tr>
</table>
Setting parameter No.PB01 (filter tuning mode 1) to " □ □ □ 1" automatically changes this parameter.
When the parameter No.PB01 setting is " □ □ □ 0", the setting of this parameter is ignored.</td><td>0000h</td><td></td><td>Refer to name and function column.</td></tr>
<tr><td>PB15</td><td>NH2</td><td>Machine resonance suppression filter 2
Set the notch frequency of the machine resonance suppression filter 2.
Set parameter No.PB16 (notch shape selection 2) to " □ □ □ 1" to make this parameter valid.</td><td>4500</td><td>Hz</td><td>100
to
4500</td></tr>
<tr><td>PB16</td><td>NHQ2</td><td>Notch shape selection 2
Select the shape of the machine resonance suppression filter 2.

0 □ □ □

Machine resonance suppression filter 2 selection
0: Invalid
1: Valid

Notch depth selection
<table>
<tr><th>Setting value</th><th>Depth</th><th>Gain</th></tr>
<tr><td>0</td><td>Deep</td><td>-40dB</td></tr>
<tr><td>1</td><td rowspan="2">to</td><td>-14dB</td></tr>
<tr><td>2</td><td>-8dB</td></tr>
<tr><td>3</td><td>Shallow</td><td>-4dB</td></tr>
</table>
Notch width
<table>
<tr><th>Setting value</th><th>Width</th><th>α</th></tr>
<tr><td>0</td><td>Standard</td><td>2</td></tr>
<tr><td>1</td><td rowspan="2">to</td><td>3</td></tr>
<tr><td>2</td><td>4</td></tr>
<tr><td>3</td><td>Wide</td><td>5</td></tr>
</table></td><td>0000h</td><td></td><td>Refer to name and function column.</td></tr>
<tr><td>PB17</td><td></td><td>Automatic setting parameter
The value of this parameter is set according to a set value of parameter No.PB06 (Ratio of load inertia moment to servo motor inertia moment).</td><td></td><td></td><td></td></tr>
</table>

No.	Symbol	Name and function	Initial value	Unit	Setting range
PB18	LPF	Low-pass filter Set the low-pass filter. Setting parameter No.PB23 (low-pass filter selection) to " □□0□ " automatically changes this parameter. When parameter No.PB23 is set to " □□1□ ", this parameter can be set manually.	3141	rad/s	100 to 18000
PB19	VRF1	Vibration suppression control vibration frequency setting Set the vibration frequency for vibration suppression control to suppress low-frequency machine vibration, such as enclosure vibration. Setting parameter No.PB02 (vibration suppression control tuning mode) to " □□□1" automatically changes this parameter. When parameter No.PB02 is set to " □□□2", this parameter can be set manually.	100.0	Hz	0.1 to 100.0
PB20	VRF2	Vibration suppression control resonance frequency setting Set the resonance frequency for vibration suppression control to suppress low-frequency machine vibration, such as enclosure vibration. Setting parameter No.PB02 (vibration suppression control tuning mode) to " □□□1" automatically changes this parameter. When parameter No.PB02 is set to " □□□2", this parameter can be set manually.	100.0	Hz	0.1 to 100.0
PB21		For manufacturer setting Do not change this value by any means.	0.00		
PB22		For manufacturer setting Do not change this value by any means.	0.00		
PB23	VFBF	Low-pass filter selection Select the low-pass filter. 0 0 □ 0 Low-pass filter selection 0: Automatic setting 1: Manual setting (parameter No.PB18 setting) When automatic setting has been selected, select the filter that has the band width close to the one calculated with $\frac{VG2 \cdot 10}{1 + GD2}$ [rad/s]	0000h		Refer to name and function column.
PB24	*MVS	Slight vibration suppression control selection Select the slight vibration suppression control. When parameter No.PA08 (auto tuning mode) is set to " □□□3", this parameter is made valid. 0 0 0 □ Slight vibration suppression control selection 0: Invalid 1: Valid	0000h		Refer to name and function column.

No.	Symbol	Name and function	Initial value	Unit	Setting range
PB25		For manufacturer setting Do not change this value by any means.	0000h		
PB26	*CDP	Gain changing selection Select the gain changing condition. (Refer to section 9.6.) 0 0 □ □ Gain changing selection Under any of the following conditions, the gains change on the basis of the parameter No.PB29 to PB32 settings. 0: Invalid 1: Gain changing (RX(n+2)8) is ON 2: Command frequency (Parameter No.PB27 setting) 3: Droop pulse value (Parameter No.PB27 setting) 4: Servo motor speed (Parameter No.PB27 setting) Gain changing condition 0: Valid at more than condition (Valid when gain changing (RX(n+2)8) is ON) 1: Valid at less than condition (Valid when gain changing (RX(n+2)8) is OFF)	0000h		Refer to name and function column.
PB27	CDL	Gain changing condition Used to set the value of gain changing condition (command frequency, droop pulses, servo motor speed) selected in parameter No.PB26. The set value unit changes with the changing condition item. (Refer to section 9.6.)	10	kpps pulse r/min	0 to 9999
PB28	CDT	Gain changing time constant Used to set the time constant at which the gains will change in response to the conditions set in parameters No.PB26 and PB27. (Refer to section 9.6.)	1	ms	0 to 100
PB29	GD2B	Gain changing ratio of load inertia moment to servo motor inertia moment Used to set the ratio of load inertia moment to servo motor inertia moment when gain changing is valid. This parameter is made valid when the auto tuning is invalid (parameter No. PA08: □□□3).	7.0	Multiplier (×1)	0 to 300.0
PB30	PG2B	Gain changing position loop gain Set the position loop gain when the gain changing is valid. This parameter is made valid when the auto tuning is invalid (parameter No. PA08: □□□3).	37	rad/s	1 to 2000
PB31	VG2B	Gain changing speed loop gain Set the speed loop gain when the gain changing is valid. This parameter is made valid when the auto tuning is invalid (parameter No. PA08: □□□3). Note. The setting range of 50000 applies to the driver whose software version is A3 or later. The setting range of the driver whose software version is older than A3 is 20 to 20000. When the software version of set up software(MR Configurator) is A3 or earlier, 20001 or more cannot be set. Use the display/operation section of the driver to set 20001 or more.	823	rad/s	20 to 20000
PB32	VICB	Gain changing speed integral compensation Set the speed integral compensation when the gain changing is valid. This parameter is made valid when the auto tuning is invalid (parameter No. PA08: □□□3).	33.7	ms	0.1 to 5000.0

No.	Symbol	Name and function	Initial value	Unit	Setting range
PB33	VRF1B	Gain changing vibration suppression control vibration frequency setting Set the vibration frequency for vibration suppression control when the gain changing is valid. This parameter is made valid when the parameter No.PB02 setting is "□□□2" and the parameter No.PB26 setting is "□□□1". When using the vibration suppression control gain changing, always execute the changing after the servo motor has stopped.	100.0	Hz	0.1 to 100.0
PB34	VRF2B	Gain changing vibration suppression control resonance frequency setting Set the resonance frequency for vibration suppression control when the gain changing is valid. This parameter is made valid when the parameter No.PB02 setting is "□□□2" and the parameter No.PB26 setting is "□□□1". When using the vibration suppression control gain changing, always execute the changing after the servo motor has stopped.	100.0	Hz	0.1 to 100.0
PB35		For manufacturer setting Do not change this value by any means.	0.00		
PB36			0.00		
PB37			100		
PB38			0		
PB39			0		
PB40			0		
PB41			1125		
PB42			1125		
PB43			0004h		
PB44			0000h		
PB45			0000h		

6.3 Extension setting parameters (No.PC□□)

6.3.1 Parameter list

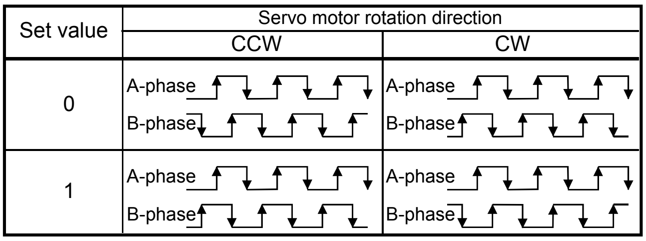
No.	Symbol	Name and function	Initial value	Unit
PC01		For manufacturer setting	0000h	
PC02	*ZTY	Home position return type	0000h	
PC03	*ZDIR	Home position return direction	0001h	
PC04	ZRF	Home position return speed	500	r/min
PC05	CRF	Creep speed	10	r/min
PC06	ZST	Home position shift distance	0	μm
PC07	*ZPS	Home position return position data	0	$\times 10^{STM}$μm
PC08	DCT	Moving distance after proximity dog	1000	$\times 10^{STM}$μm
PC09	ZTM	Stopper type home position return stopper time	100	ms
PC10	ZTT	Stopper type home position return torque limit value	15.0	%
PC11	CRP	Rough match output range	0	$\times 10^{STM}$μm
PC12	JOG	Jog speed	100	r/min
PC13	*STC	S-pattern acceleration/deceleration time constant	0	ms
PC14	*BKC	Backlash compensation	0	pulse
PC15		For manufacturer setting	0000h	
PC16	MBR	Electromagnetic brake sequence output	100	ms
PC17	ZSP	Zero speed	50	r/min
PC18	*BPS	Alarm history clear	0000h	
PC19	*ENRS	Encoder output pulse selection	0000h	
PC20	*SNO	Station number setting	0	station
PC21	*SOP	RS-422 communication function selection	0000h	
PC22	*COP1	Function selection C-1	0000h	
PC23		For manufacturer setting	0000h	
PC24	*COP3	Function selection C-3	0000h	
PC25		For manufacturer setting	0000h	
PC26	*COP5	Function selection C-5	0000h	
PC27		For manufacturer setting	0000h	
PC28	*COP7	Function selection C-7	0000h	
PC29		For manufacturer setting	0000h	
PC30	*DSS	Remote register-based position/speed specifying system selection	0000h	
PC31	LMPL	Software limit +	0	$\times 10^{STM}$μm
PC32	LMPH			
PC33	LMNL	Software limit −	0	$\times 10^{STM}$μm
PC34	LMNH			
PC35	TL2	Internal torque limit 2	100.0	%
PC36		For manufacturer setting	0000h	
PC37	*LPPL	Position range output address +	0	$\times 10^{STM}$μm
PC38	*LPPH			
PC39	*LNPL	Position range output address −	0	$\times 10^{STM}$μm
PC40	*LNPH			
PC41		For manufacturer setting	0000h	
PC42			0000h	
PC43			0000h	
PC44			0000h	
PC45			0000h	
PC46			0000h	
PC47			0000h	
PC48			0000h	

No.	Symbol	Name and function	Initial value	Unit
PC49		For manufacturer setting	0000h	
PC50			0000h	

6.3.2 Detail list

No.	Symbol	Name and function	Initial value	Unit	Setting range
PC01		For manufacturer setting Do not change this value by any means.	0000h		
PC02	*ZTY	Home position return type Used to set the home position return system. (Refer to section 5.6.) 0 0 0 □ Home position return system 0: Dog type 1: Count type 2: Data setting type 3: Stopper type 4: Home position ignorance (Servo-on position as home position) 5: Dog type rear end reference 6: Count type front end reference 7: Dog cradle type 8: Dog type right-before Z-phase reference 9: Dog type front end reference A: Dogless Z-phase reference	0000h		Refer to name and function column.
PC03	*ZDIR	Home position return direction Used to set the home position return direction. 0 0 0 □ Home position return direction 0: Address increment direction 1: Address decrement direction	0001h		Refer to name and function column.
PC04	ZRF	Home position return speed Used to set the servo motor speed for home position return. (Refer to section 5.6.)	500	r/min	0 to permissible speed
PC05	CRF	Creep speed Used to set the creep speed after proximity dog detection. (Refer to section 5.6.)	10	r/min	0 to permissible speed
PC06	ZST	Home position shift distance Used to set the shift distance starting at the Z-phase pulse detection position inside the encoder. (Refer to section 5.6.)	0	μm	0 to 65535
PC07	*ZPS	Home position return position data Used to set the current position on completion of home position return. (Refer to section 5.6.)	0	$\times 10^{STM}$μm	−32768 to 32767
PC08	DCT	Moving distance after proximity dog Used to set the moving distance after proximity dog in count type home position return. (Refer to section 5.6.)	1000	$\times 10^{STM}$μm	0 to 65535
PC09	ZTM	Stopper type home position return stopper time In stopper type home position return, used to set the time from when the machine part is pressed against the stopper and the torque limit set in parameter No.PC10 is reached to when the home position is set. (Refer to section 5.6.5.)	100	ms	5 to 1000

No.	Symbol	Name and function	Initial value	Unit	Setting range
PC10	ZTT	Stopper type home position return torque limit value Used to set the torque limit value relative to the max. torque in [%] in stopper type home position return. (Refer to section 5.6.5.)	15.0	%	1 to 100.0
PC11	CRP	Rough match output range Used to set the command remaining distance range where the rough match (RXn2) is output.	0	$\times 10^{STM}\mu m$	0 to 65535
PC12	JOG	Jog speed Used to set the jog speed command.	100	r/min	0 to permissible speed
PC13	*STC	S-pattern acceleration/deceleration time constant Set when inserting S-pattern time constant into the acceleration/deceleration time constant of the point table. (Refer to section 6.3.3.) This time constant is invalid for home position return.	0	ms	0 to 1000
PC14	*BKC	Backlash compensation Used to set the backlash compensation made when the command direction is reversed. This function compensates for the number of backlash pulses in the opposite direction to the home position return direction. For the home position ignorance (servo-on position as home position), this function compensates for the number of backlash pulses in the opposite direction to the first rotating direction after establishing the home position by switching ON the servo-on (RYn0). In the absolute position detection system, this function compensates for the backlash pulse count in the direction opposite to the operating direction at power-on.	0	pulse	0 to 32000
PC15		For manufacturer setting Do not change this value by any means.	0000h		
PC16	MBR	Electromagnetic brake sequence output Used to set the delay time (Tb) between when the electromagnetic brake interlock (MBR) switches off and when the base circuit is shut off.	100	ms	0 to 1000
PC17	ZSP	Zero speed Used to set the output range of the zero speed (ZSP). Zero speed signal detection has hysteresis width of 20r/min.	50	r/min	0 to 10000
PC18	*BPS	Alarm history clear Used to clear the alarm history. 0 0 0 □ Alarm history clear 0: Invalid 1: Valid When alarm history clear is made valid, the alarm history is cleared at next power-on. After the alarm history is cleared, the setting is automatically made invalid (reset to 0).	0000h		Refer to name and function column.

No.	Symbol	Name and function	Initial value	Unit	Setting range
PC19	*ENRS	Encoder output pulse selection Use to select the, encoder output pulse direction and encoder output pulse setting. 0 0 □ □ Encoder output pulse phase changing Changes the phases of A, B-phase encoder pulses output .  Encoder output pulse setting selection (refer to parameter No.PA15). 0: Output pulse designation 1: Division ratio setting 2: Ratio is automatically set to command pulse unit Setting "2" makes the parameter No.PA15 (encoder output pulse) setting invalid.	0000h		Refer to name and function column.
PC20	*SNO	Station number setting Used to specify the station number for RS-422 serial communication and USB communication. Always set one station to one axis of driver. If one station number is set to two or more stations, normal communication cannot be made.	0	station	0 to 31
PC21	*SOP	RS-422 communication function selection Select the communication I/F and select the RS-422 communication conditions. 0 □ □ 0 RS-422 communication baud rate selection 0: 9600 [bps] 1: 19200 [bps] 2: 38400 [bps] 3: 57600 [bps] 4: 115200[bps] RS-422 communication response delay time 0: Invalid 1: Valid, reply sent after delay time of 800 μs or more	0000h		Refer to name and function column.
PC22	*COP1	Function selection C-1 Select the encoder cable communication system selection. □ 0 0 0 Encoder cable communication system selection 0: Two-wire type 1: Four-wire type The following cables are of 2-wire type. LE-CSE-□2□ LE-CSE-□5□ LE-CSE-□A□ Incorrect settinf will result in an encoder alarm1(A16) or encoder alarm2(A20)	0000h		Refer to the name and function field.

<table>
<tr><th>No.</th><th>Symbol</th><th>Name and function</th><th>Initial value</th><th>Unit</th><th>Setting range</th></tr>
<tr><td>PC23</td><td></td><td>For manufacturer setting
Do not change this value by any means.</td><td>0000h</td><td></td><td></td></tr>
<tr><td>PC24</td><td>*COP3</td><td>Function selection C-3
Select the unit of the in-position range.

0 0 0 □

In-position range unit selection
0: Command input unit
1: Servo motor encoder unit</td><td>0000h</td><td></td><td>Refer to name and function column.</td></tr>
<tr><td>PC25</td><td></td><td>For manufacturer setting
Do not change this value by any means.</td><td>0000h</td><td></td><td></td></tr>
<tr><td>PC26</td><td>*COP5</td><td>Function selection C-5
Select the stroke limit warning (A99).

0 0 0 □

Stroke limit warning (A99) selection
0: Valid
1: Invalid
When this parameter is set to "1", A99 will not occur if the forward rotation stroke end (LSP) or reverse rotation stroke end (LSN) turns OFF.</td><td>0000h</td><td></td><td>Refer to name and function column.</td></tr>
<tr><td>PC27</td><td></td><td>For manufacturer setting
Do not change this value by any means.</td><td>0000h</td><td></td><td></td></tr>
<tr><td>PC28</td><td>*COP7</td><td>Function selection C-7
Select the display method of the current position and command position.

0 0 □ □

Electronic gear fraction clear selection
0: Invalid
1: Valid
By setting it to "1", the fraction of the last command by the electronic gear is cleared when starting automatic operation.

Current position and command position display selection

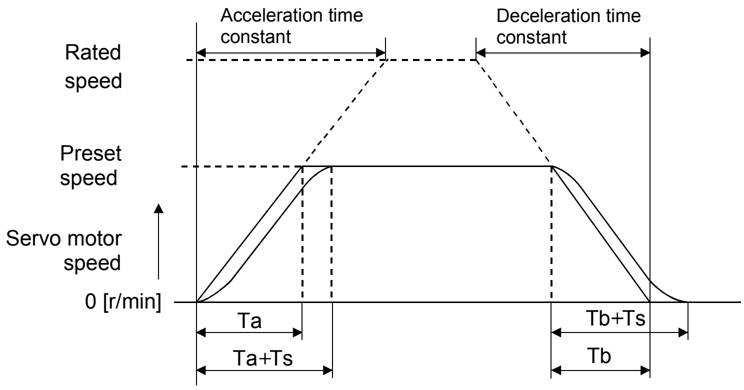
<table>
<tr><th rowspan="2">Setting value</th><th rowspan="2">Display method</th><th rowspan="2">Operation mode</th><th colspan="2">Status display</th></tr>
<tr><th>Current position</th><th>Command position</th></tr>
<tr><td rowspan="2">0</td><td rowspan="2">Positioning display</td><td>Automatic</td><td rowspan="2">The actual current position where the machine home position is assumed as 0 is displayed.</td><td rowspan="2">The command current position where the machine home position is assumed as 0 is displayed.</td></tr>
<tr><td>Manual</td></tr>
<tr><td rowspan="2">1</td><td rowspan="2">Roll feed display</td><td>Automatic</td><td rowspan="2">The actual current position where the automatic operation start position is assumed as 0 is displayed.</td><td>The count starts from 0 when the start signal is turned on, and the command current position to the target position is displayed. During a stop, the command position of the selected point table is displayed.</td></tr>
<tr><td>Manual</td><td>The command position of the selected point table is displayed.</td></tr>
</table>
</td><td>0000h</td><td></td><td>Refer to name and function column.</td></tr>
</table>

<table>
<tr><th>No.</th><th>Symbol</th><th>Name and function</th><th>Initial value</th><th>Unit</th><th>Setting range</th></tr>
<tr><td>PC29</td><td></td><td>For manufacturer setting
Do not change this value by any means</td><td>0000h</td><td></td><td></td></tr>
<tr><td>PC30</td><td>*DSS</td><td>Remote register-based position/speed specifying system selection
This parameter is made valid when Position/speed specification selection (RY(n+2)A) is turned ON with 2 stations occupied. Select how to receive the position command and speed command.
When 1 station is occupied, selection of "0001" or "0002" will result in a parameter error.
0 0 0 □
<table>
<tr><th>Set value</th><th>Position command</th><th>Speed command</th></tr>
<tr><td>0</td><td colspan="2">Specify the point table No.</td></tr>
<tr><td>1</td><td rowspan="2">Set the position data.</td><td>Specify the point table No.</td></tr>
<tr><td>2</td><td>Set the servo motor speed. (Note)</td></tr>
</table>
Note. In the case, always set an acceleration/deceleration time constant in the point table No.1.</td><td>0000h</td><td></td><td>Refer to name and function column.</td></tr>
<tr><td>PC31
PC32</td><td>LMPL
LMPH</td><td>Software limit +
Used to set the address increment side software stroke limit. The software limit is made invalid if this value is the same as in "software limit −".
(Refer to section 6.3.6.)
Set the same sign to parameters No.PC31 and No.PC32. Setting of different signs will result in a parameter error.
Set address: □□□□□□
Upper 3 digits / Lower 3 digits
Lower 3 digits: Parameter No.PC31
Upper 3 digits: Parameter No.PC32
The software limit+ is a set of upper digits and lower digits. To change the value, set in the order of lower digits to upper digits.</td><td>0</td><td>×10^{STM}μm</td><td>−999999
to
999999</td></tr>
<tr><td>PC33
PC34</td><td>LMNL
LMNH</td><td>Software limit −
Used to set the address decrement side software stroke limit. The software limit is made invalid if this value is the same as in "software limit +".
(Refer to section 6.3.6.)
Set the same sign to parameters No.PC33 and PC34. Setting of different signs will result in a parameter error.
Set address: □□□□□□
Upper 3 digits / Lower 3 digits
Lower 3 digits: Parameter No.PC33
Upper 3 digits: Parameter No.PC34
The software limit− is a set of upper digits and lower digits. To change the value, set in the order of lower digits to upper digits.</td><td>0</td><td>×10^{STM}μm</td><td>−999999
to
999999</td></tr>
<tr><td>PC35</td><td>TL2</td><td>Internal torque limit 2
Set this parameter to limit servo motor torque on the assumption that the maximum torque is 100[%].
When 0 is set, torque is not produced.</td><td>100.0</td><td>%</td><td>0
to
100.0</td></tr>
<tr><td>PC36</td><td></td><td>For manufacturer setting
Do not change this value by any means.</td><td>0000h</td><td></td><td></td></tr>
</table>

No.	Symbol	Name and function	Initial value	Unit	Setting range
PC37 PC38	*LPPL *LPPH	Position range output address + Used to set the address increment side position range output address. Set the same sign to parameters No.PC37 and PC38. Setting of different signs will result in a parameter error. In parameters No.PC37 to PC40, set the range where position range (RXnE) turns on. Set address:$\underbrace{\square\square\square}_{\text{Upper 3 digits}}\underbrace{\square\square\square}_{\text{Lower 3 digits}}$ Lower 3 digits: Parameter No.PC37 Upper 3 digits: Parameter No.PC38 Position range output address + is a set of upper digits and lower digits. To change the value, set in the order of lower digits to upper digits.	0	$\times 10^{STM}$ μm	−999999 to 999999
PC39 PC40	*LNPL *LNPH	Position range output address − Used to set the address decrement side position range output address. Set the same sign to parameters No.PC39 and PC40. Setting of different signs will result in a parameter error. Set address:$\underbrace{\square\square\square}_{\text{Upper 3 digits}}\underbrace{\square\square\square}_{\text{Lower 3 digits}}$ Lower 3 digits: Parameter No.PC39 Upper 3 digits: Parameter No.PC40 Position range output address − is a set of upper digits and lower digits. To change the value, set in the order of lower digits to upper digits.	0	$\times 10^{STM}$ μm	−999999 to 999999
PC41		For manufacturer setting Do not change this value by any means.	0000h		
PC42			0000h		
PC43			0000h		
PC44			0000h		
PC45			0000h		
PC46			0000h		
PC47			0000h		
PC48			0000h		
PC49			0000h		
PC50			0000h		

6.3.3 S-pattern acceleration/deceleration

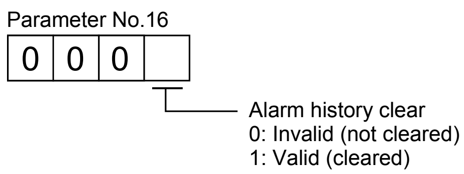
In servo operation, linear acceleration/deceleration is usually made. By setting the S-pattern acceleration/deceleration time constant (parameter No.PC13), a smooth start/stop can be made. When the S-pattern time constant is set, smooth positioning is executed as shown below. Note that the time equivalent to the S-pattern time constant setting increases until positioning (RXnC) is complete.



Ta: Time until preset speed is reached
Tb: Time until stop
Ts: S-pattern acceleration/deceleration time constant (parameter No.PC13)
Setting range 0 to 1000ms

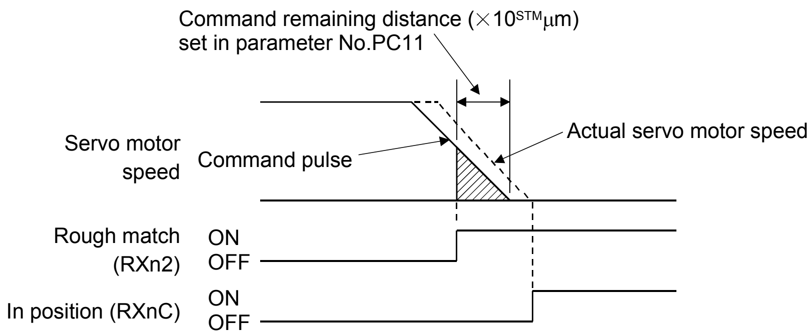
6.3.4 Alarm history clear

The alarm history can be confirmed by using the set up software(MR Configurator). The driver stores one current alarm and five past alarms from when its power is switched on first. To control alarms which will occur during operation, clear the alarm history using parameter No.PC18 (alarm history clear) before starting operation. Clearing the alarm history automatically returns to " □□□ 0".
This parameter is made valid by switching power off, then on after setting.



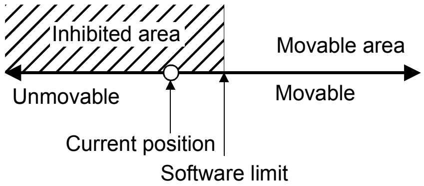
6.3.5 Rough match output

Rough match (RXn2) is output when the command remaining distance reaches the value set in parameter No.PC11 (rough match output range). The setting range is 0 to 65535 [$\times 10^{STM}\mu m$].



6.3.6 Software limit

A limit stop using a software limit (parameter No.PC31 to PC34) is made as in stroke end operation. When a motion goes beyond the setting range, the motor is stopped and servo-locked. This function is made valid at power-on but made invalid during home position return. This function is made invalid when the software limit + setting is the same as the software limit − setting. A parameter error (A37) will occur if the software limit + setting is less than the software limit − setting.



6.4 I/O setting parameters (No.PD □□)

6.4.1 Parameter list

No.	Symbol	Name	Initial value	Unit
PD01	*DIA1	Input signal automatic ON selection 1	0000h	
PD02		For manufacturer setting	0000h	
PD03	*DIA3	Input signal automatic ON selection 3	0000h	
PD04	*DIA4	Input signal automatic ON selection 4	0000h	
PD05		For manufacturer setting	0000h	
PD06	*DI2	Input signal device selection 2 (CN6-2)	002Bh	
PD07	*DI3	Input signal device selection 3 (CN6-3)	000Ah	
PD08	*DI4	Input signal device selection 4 (CN6-4)	000Bh	
PD09	*DO1	Output signal device selection 1 (CN6-14)	0002h	
PD10	*DO2	Output signal device selection 2 (CN6-15)	0003h	
PD11	*DO3	Output signal device selection 3 (CN6-16)	0024h	
PD12	DIN1	External DI function selection 1	0C00h	
PD13		For manufacturer setting	0000h	
PD14	DIN3	External DI function selection 3	0800h	
PD15		For manufacturer setting	0000h	
PD16	*DIAB	Input polarity selection	0000h	
PD17		For manufacturer setting	0000h	
PD18			0000h	
PD19	*DIF	Response level setting	0002h	
PD20	*DOP1	Function selection D-1	0010h	
PD21		For manufacturer setting	0000h	
PD22	*DOP3	Function selection D-3	0000h	
PD23		For manufacturer setting	0000h	
PD24	*DOP5	Function selection D-5	0000h	
PD25		For manufacturer setting	0000h	
PD26			0000h	
PD27			0000h	
PD28			0000h	
PD29			0000h	
PD30			0000h	

6.4.2 Detail list

<table>
<tr><th>No.</th><th>Symbol</th><th>Name and function</th><th>Initial value</th><th>Unit</th><th>Setting range</th></tr>
<tr><td>PD01</td><td>*DIA1</td><td>Input signal automatic ON selection 1
Select the input devices to be automatically turned ON.
(hatched) part is for manufacturer setting. Do not set the value by any means.

<table>
<tr><th rowspan="2">Device name</th><th colspan="2">Initial value</th></tr>
<tr><th>BIN</th><th>HEX</th></tr>
<tr><td></td><td>0</td><td rowspan="4">0</td></tr>
<tr><td></td><td>0</td></tr>
<tr><td>Servo-on (SON)</td><td>0</td></tr>
<tr><td></td><td>0</td></tr>
</table>
<table>
<tr><th rowspan="2">Device name</th><th colspan="2">Initial value</th></tr>
<tr><th>BIN</th><th>HEX</th></tr>
<tr><td>Proportion control (PC)</td><td>0</td><td rowspan="4">0</td></tr>
<tr><td></td><td>0</td></tr>
<tr><td></td><td>0</td></tr>
<tr><td></td><td>0</td></tr>
</table>
<table>
<tr><th rowspan="2">Device name</th><th colspan="2">Initial value</th></tr>
<tr><th>BIN</th><th>HEX</th></tr>
<tr><td></td><td>0</td><td rowspan="4">0</td></tr>
<tr><td></td><td>0</td></tr>
<tr><td>Forward rotation stroke end (LSP)</td><td>0</td></tr>
<tr><td>Reverse rotation stroke end (LSN)</td><td>0</td></tr>
</table>
<table>
<tr><th rowspan="2">Device name</th><th colspan="2">Initial value</th></tr>
<tr><th>BIN</th><th>HEX</th></tr>
<tr><td>Forced stop (EMG)</td><td>0</td><td rowspan="4">0</td></tr>
<tr><td></td><td>0</td></tr>
<tr><td></td><td>0</td></tr>
<tr><td></td><td>0</td></tr>
</table>
BIN 0: Used in CC-Link or as external input signal.
BIN 1: Automatic ON

For example, to turn ON SON, the setting is "□□□4".</td><td>0000h</td><td></td><td>Refer to name and function column.</td></tr>
<tr><td>PD02</td><td></td><td>For manufacturer setting
Do not change this value by any means.</td><td>0000h</td><td></td><td></td></tr>
</table>

<table>
<tr><th>No.</th><th>Symbol</th><th>Name and function</th><th>Initial value</th><th>Unit</th><th>Setting range</th></tr>
<tr><td>PD03</td><td>*DIA3</td><td>Input signal automatic ON selection 3
Select the input devices to be automatically turned ON.
part is for manufacturer setting. Do not set the value by any means.
0 0 0 □
<table>
<tr><th rowspan="2">Device name</th><th colspan="2">Initial value</th></tr>
<tr><th>BIN</th><th>HEX</th></tr>
<tr><td>Automatic/manual selection (MD0)</td><td>0</td><td rowspan="4">0</td></tr>
<tr><td></td><td>0</td></tr>
<tr><td></td><td>0</td></tr>
<tr><td></td><td>0</td></tr>
</table>
BIN 0: Used in CC-Link or as external input signal.
BIN 1: Automatic ON</td><td>0000h</td><td></td><td>Refer to name and function column.</td></tr>
<tr><td>PD04</td><td>*DIA4</td><td>Input signal automatic ON selection 4
Select the input devices to be automatically turned ON.
□ □ 0 0
<table>
<tr><th rowspan="2">Device name</th><th colspan="2">Initial value</th></tr>
<tr><th>BIN</th><th>HEX</th></tr>
<tr><td>Point table No. selection 1 (DI0)</td><td>0</td><td rowspan="4">0</td></tr>
<tr><td>Point table No. selection 2 (DI1)</td><td>0</td></tr>
<tr><td>Point table No. selection 3 (DI2)</td><td>0</td></tr>
<tr><td>Point table No. selection 4 (DI3)</td><td>0</td></tr>
</table>
<table>
<tr><th rowspan="2">Device name</th><th colspan="2">Initial value</th></tr>
<tr><th>BIN</th><th>HEX</th></tr>
<tr><td>Point table No. selection 5 (DI4)</td><td>0</td><td rowspan="4">0</td></tr>
<tr><td>Point table No. selection 6 (DI5)</td><td>0</td></tr>
<tr><td>Point table No. selection 7 (DI6)</td><td>0</td></tr>
<tr><td>Point table No. selection 8 (DI7)</td><td>0</td></tr>
</table>
BIN 0: Used in CC-Link or as external input signal.
BIN 1: Automatic ON</td><td>0000h</td><td></td><td>Refer to name and function column.</td></tr>
<tr><td>PD05</td><td></td><td>For manufacturer setting
Do not change this value by any means.</td><td>0000h</td><td></td><td></td></tr>
</table>

<table>
<tr><th>No.</th><th>Symbol</th><th>Name and function</th><th>Initial value</th><th>Unit</th><th>Setting range</th></tr>
<tr><td>PD06</td><td>*DI2</td><td>Output signal device selection 2 (CN6-2)
Any input device can be assigned to the CN6-2 pin.

0 0
Select the input device of the CN6-2 pin

The devices that can be assigned are indicated in the following table.
<table>
<tr><th rowspan="2">Setting (Note)</th><th colspan="2">Input device</th></tr>
<tr><th>Name</th><th>Abbreviation</th></tr>
<tr><td>00</td><td>No assignment function</td><td></td></tr>
<tr><td>02</td><td>Servo-on</td><td>SON</td></tr>
<tr><td>03</td><td>Reset</td><td>RES</td></tr>
<tr><td>04</td><td>Proportion control</td><td>PC</td></tr>
<tr><td>06</td><td>Clear</td><td>CR</td></tr>
<tr><td>07</td><td>Forward rotation start</td><td>ST1</td></tr>
<tr><td>08</td><td>Reverse rotation start</td><td>ST2</td></tr>
<tr><td>09</td><td>Internal torque limit selection</td><td>TL1</td></tr>
<tr><td>0A</td><td>Forward rotation stroke end</td><td>LSP</td></tr>
<tr><td>0B</td><td>Reverse rotation stroke end</td><td>LSN</td></tr>
<tr><td>0D</td><td>Gain changing</td><td>CDP</td></tr>
<tr><td>20</td><td>Automatic/manual selection</td><td>MD0</td></tr>
<tr><td>24</td><td>Manual pulse generator multiplication 1</td><td>TP0</td></tr>
<tr><td>25</td><td>Manual pulse generator multiplication 2</td><td>TP1</td></tr>
<tr><td>27</td><td>Temporary stop/restart</td><td>TSTP</td></tr>
<tr><td>2B</td><td>Proximity dog</td><td>DOG</td></tr>
</table>
Note. The other setting values than shown in this table are for manufacturer setting.</td><td>002Bh</td><td></td><td>Refer to name and function column.</td></tr>
<tr><td>PD07</td><td>*DI3</td><td>Output signal device selection 3 (CN6-3)
Any input device can be assigned to the CN6-3 pin.
The devices that can be assigned and the setting method are the same as in parameter No.PD06.

0 0
Select the input device of the CN6-3 pin</td><td>000Ah</td><td></td><td>Refer to name and function column.</td></tr>
<tr><td>PD08</td><td>*DI4</td><td>Output signal device selection 4 (CN6-4)
Any input device can be assigned to the CN6-4 pin.
The devices that can be assigned and the setting method are the same as in parameter No.PD06.

0 0
Select the input device of the CN6-4 pin</td><td>000Bh</td><td></td><td>Refer to name and function column.</td></tr>
</table>

<table>
<tr><th>No.</th><th>Symbol</th><th>Name and function</th><th>Initial value</th><th>Unit</th><th>Setting range</th></tr>
<tr><td>PD09</td><td>*DO1</td><td>Output signal device selection 1 (CN6-14)
Any output signal can be assigned to the CN6-14 pin.
0 0 □ □
Select the output device of the CN6-14 pin

The devices that can be assigned are indicated in the following table.
<table>
<tr><th rowspan="2">Setting (Note)</th><th colspan="2">Output device</th></tr>
<tr><th>Name</th><th>Symbol</th></tr>
<tr><td>00</td><td>Always OFF</td><td></td></tr>
<tr><td>02</td><td>Ready</td><td>RD</td></tr>
<tr><td>03</td><td>Trouble</td><td>ALM</td></tr>
<tr><td>04</td><td>In position</td><td>INP</td></tr>
<tr><td>05</td><td>Electromagnetic brake interlock</td><td>MBR</td></tr>
<tr><td>06</td><td>Dynamic brake interlock</td><td>DB</td></tr>
<tr><td>07</td><td>Limiting torque</td><td>TLC</td></tr>
<tr><td>08</td><td>Warning</td><td>WNG</td></tr>
<tr><td>09</td><td>Battery warning</td><td>BWNG</td></tr>
<tr><td>0A</td><td>Speed command reached</td><td>SA</td></tr>
<tr><td>0C</td><td>Zero speed</td><td>ZSP</td></tr>
<tr><td>0F</td><td>Variable gain selection</td><td>CDPS</td></tr>
<tr><td>23</td><td>Rough match</td><td>CPO</td></tr>
<tr><td>24</td><td>Home position return completion</td><td>ZP</td></tr>
<tr><td>25</td><td>Position range</td><td>POT</td></tr>
<tr><td>26</td><td>Temporary stop</td><td>PUS</td></tr>
<tr><td>27</td><td>Movement completion</td><td>MEND</td></tr>
<tr><td>38</td><td>Point table No. output 1</td><td>PT0</td></tr>
<tr><td>39</td><td>Point table No. output 2</td><td>PT1</td></tr>
<tr><td>3A</td><td>Point table No. output 3</td><td>PT2</td></tr>
<tr><td>3B</td><td>Point table No. output 4</td><td>PT3</td></tr>
<tr><td>3C</td><td>Point table No. output 5</td><td>PT4</td></tr>
<tr><td>3D</td><td>Point table No. output 6</td><td>PT5</td></tr>
<tr><td>3E</td><td>Point table No. output 7</td><td>PT6</td></tr>
<tr><td>3F</td><td>Point table No. output 8</td><td>PT7</td></tr>
</table>
Note. The other setting values than shown in this table are for manufacturer setting.</td><td>0002h</td><td></td><td>Refer to name and function column.</td></tr>
<tr><td>PD10</td><td>*DO2</td><td>Output signal device selection 2 (CN6-15)
Any output signal can be assigned to the CN6-15 pin.
The devices that can be assigned and the setting method are the same as in parameter No.PD09.
0 0 □ □
Select the output device of the CN6-15 pin</td><td>0003h</td><td></td><td>Refer to name and function column.</td></tr>
</table>

<table>
<tr><th>No.</th><th>Symbol</th><th>Name and function</th><th>Initial value</th><th>Unit</th><th>Setting range</th></tr>
<tr><td>PD11</td><td>*DO3</td><td>Output signal device selection 3 (CN6-16)
Any output signal can be assigned to the CN6-16 pin.
The devices that can be assigned and the setting method are the same as in parameter No.PD09.

0 0 _ _
Select the output device of the CN6-16 pin</td><td>0024h</td><td></td><td>Refer to name and function column.</td></tr>
<tr><td>PD12</td><td>DIN1</td><td>External DI function selection 1
This function sets any signal imported from the CN6 connector.
▧ part is for manufacturer setting. Do not set the value by any means.
<table>
<tr><th rowspan="2">Device name</th><th colspan="2">Initial value</th></tr>
<tr><th>BIN</th><th>HEX</th></tr>
<tr><td></td><td>0</td><td rowspan="4">0</td></tr>
<tr><td></td><td>0</td></tr>
<tr><td>Servo-on (SON)</td><td>0</td></tr>
<tr><td>Reset (RES)</td><td>0</td></tr>
</table>
<table>
<tr><th rowspan="2">Device name</th><th colspan="2">Initial value</th></tr>
<tr><th>BIN</th><th>HEX</th></tr>
<tr><td>Proportion control (PC)</td><td>0</td><td rowspan="4">0</td></tr>
<tr><td></td><td>0</td></tr>
<tr><td>Clear (CR)</td><td>0</td></tr>
<tr><td>Forward rotation start (ST1)</td><td>0</td></tr>
</table>
<table>
<tr><th rowspan="2">Device name</th><th colspan="2">Initial value</th></tr>
<tr><th>BIN</th><th>HEX</th></tr>
<tr><td>Reverse rotation start (ST2)</td><td>0</td><td rowspan="4">C</td></tr>
<tr><td>Internal torque limit (TL1)</td><td>0</td></tr>
<tr><td>Forward rotation stroke end (LSP)</td><td>1</td></tr>
<tr><td>Reverse rotation stroke end (LSN)</td><td>1</td></tr>
</table>
<table>
<tr><th rowspan="2">Device name</th><th colspan="2">Initial value</th></tr>
<tr><th>BIN</th><th>HEX</th></tr>
<tr><td></td><td>0</td><td rowspan="4">0</td></tr>
<tr><td>Gain changing (CDP)</td><td>0</td></tr>
<tr><td></td><td>0</td></tr>
<tr><td></td><td>0</td></tr>
</table>
BIN 0: Used in CC-Link
BIN 1: Used in CN6 external input signal</td><td>0C00h</td><td></td><td>Refer to name and function column.</td></tr>
<tr><td>PD13</td><td></td><td>For manufacturer setting
Do not change this value by any means.</td><td>0000h</td><td></td><td></td></tr>
</table>

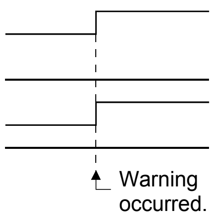
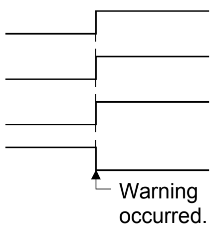
<table>
<tr><th>No.</th><th>Symbol</th><th>Name and function</th><th>Initial value</th><th>Unit</th><th>Setting range</th></tr>
<tr><td>PD14</td><td>DIN3</td><td>External DI function selection 3
This function sets any signal imported from the CN6 connector.
part is for manufacturer setting. Do not set the value by any means.
0 □ □ □
<table>
<tr><th>Device name</th><th>Initial value BIN</th><th>Initial value HEX</th></tr>
<tr><td>Automatic/manual selection (MD0)</td><td>0</td><td rowspan="4">0</td></tr>
<tr><td></td><td>0</td></tr>
<tr><td></td><td>0</td></tr>
<tr><td></td><td>0</td></tr>
</table>
<table>
<tr><th>Device name</th><th>Initial value BIN</th><th>Initial value HEX</th></tr>
<tr><td></td><td>0</td><td rowspan="4">0</td></tr>
<tr><td></td><td>0</td></tr>
<tr><td></td><td>0</td></tr>
<tr><td>Temporary stop/Restart (TSTP)</td><td>0</td></tr>
</table>
<table>
<tr><th>Device name</th><th>Initial value BIN</th><th>Initial value HEX</th></tr>
<tr><td></td><td>0</td><td rowspan="4">8</td></tr>
<tr><td></td><td>0</td></tr>
<tr><td></td><td>0</td></tr>
<tr><td>Proximity dog (DOG)</td><td>1</td></tr>
</table>
BIN 0: Used in CC-Link
BIN 1: Used in CN6 external input signal</td><td>0800h</td><td></td><td>Refer to name and function column.</td></tr>
<tr><td>PD15</td><td></td><td>For manufacturer setting
Do not change this value by any means.</td><td>0000h</td><td></td><td></td></tr>
<tr><td>PD16</td><td>*DIAB</td><td>Input polarity selection
Used to set the proximity dog input polarity. (Refer to section 5.6.)
0 0 0 □
Proximity dog input polarity
0: OFF indicates detection of the dog
1: ON indicates detection of the dog</td><td>0000h</td><td></td><td>Refer to name and function column.</td></tr>
<tr><td>PD17</td><td rowspan="2"></td><td rowspan="2">For manufacturer setting
Do not change this value by any means.</td><td>0000h</td><td rowspan="2"></td><td rowspan="2"></td></tr>
<tr><td>PD18</td><td>0000h</td></tr>
<tr><td>PD19</td><td>*DIF</td><td>Response level setting
Used to select the input.</td><td>0002h</td><td></td><td>Refer to name and function column.</td></tr>
</table>

		0 0 0 □ Input filter If external input signal causes chattering due to noise, etc., input filter is used to suppress it. 0: None 1: 0.88[ms] 2: 1.77[ms] 3: 2.66[ms] 4: 3.55[ms] 5: 4.44[ms]			

No.	Symbol	Name and function	Initial value	Unit	Setting range
PD20	*DOP1	Function selection D-1 Select the stop processing at forward rotation stroke end (LSN)/reverse rotation stroke end (LSN) OFF and the base circuit status at reset (RY(N+1)A or RY(n+3)A) ON. 0 □ □ □ Stopping method used when forward rotation stroke end (LSP), reverse rotation stroke end (LSN) device or software limit is valid 0: Sudden stop (home position erased) 1: Slow stop (home position erased) 2: Slow stop (Deceleration to a stop by deceleration time constant) 3: Sudden stop (Stop by remaining move distance clear) Selection of base circuit status at reset (RY(n+1)A or RY(n+3)A)ON 0: Base circuit not switched off 1: Base circuit switched off Stopping method used when software limit is valid 0: Sudden stop (home position erased) 1: Slow stop (home position erased) 2: Slow stop (Deceleration to a stop by deceleration time constant) 3: Sudden stop (Stop by remaining move distance clear) As in the following parameter settings, when the home position is lost by the forward rotation stroke end, reverse rotation stroke end, or the software limit detection, the home position return completion (ZP) turns on by turning OFF/ON the servo-on (RYn0). In this case, there is no need to perform the home position return again. 1. In absolute position detection system Parameter No.PA03: □□□1 (Select the absolute position detection system) Parameter No.PA01: □□□0 (Select the absolute value command system) 2. In incremental system Parameter No.PA03: □□□0 (Select the incremental system) Parameter No.PA01: □□□0 (Select the absolute value command system) Parameter No.PA04: □□□1 (Follow-up valid)	0010h		Refer to name and function column.
PD21		For manufacturer setting Do not change this value by any means.	0000h		
PD22	*DOP3	Function selection D-3 Set the clear (RYnF). 0 0 0 □ Clear (RYnF) selection 0: Droop pulses are cleared on the leading edge. 1: While on, droop pulses are always cleared.	0000h		Refer to name and function column.
PD23		For manufacturer setting Do not change this value by any means.	0000h		

<table>
<tr><th>No.</th><th>Symbol</th><th>Name and function</th><th>Initial value</th><th>Unit</th><th>Setting range</th></tr>
<tr><td>PD24</td><td>*DOP5</td><td>Function selection D-5
Select the output status of the warning (WNG).

0 0 _ 0
Selection of output device at warning occurrence
Select the warning (RXnA) and trouble (RX(n+1)A or RX(n+3)A) output status at warning occurrence.

<table>
<tr><th>Setting</th><th colspan="3">(Note) Device status</th></tr>
<tr><td rowspan="4">0</td><td rowspan="2">Remote output</td><td>RXnA</td><td rowspan="4">1
0
1
0
ON
OFF
ON
OFF
</td></tr>
<tr><td>RX(n+1)A or RX(n+3)A</td></tr>
<tr><td rowspan="2">Output device</td><td>WNG</td></tr>
<tr><td>ALM</td></tr>
<tr><td rowspan="4">1</td><td rowspan="2">Remote output</td><td>RXnA</td><td rowspan="4">1
0
1
0
ON
OFF
ON
OFF
</td></tr>
<tr><td>RX(n+1)A or RX(n+3)A</td></tr>
<tr><td rowspan="2">Output device</td><td>WNG</td></tr>
<tr><td>ALM</td></tr>
</table>
Note. 0: OFF
1: ON</td><td>0000h</td><td></td><td></td></tr>
<tr><td>PD25</td><td rowspan="6"></td><td rowspan="6">For manufacturer setting
Do not change this value by any means.</td><td>0000h</td><td rowspan="6"></td><td rowspan="6"></td></tr>
<tr><td>PD26</td><td>0000h</td></tr>
<tr><td>PD27</td><td>0000h</td></tr>
<tr><td>PD28</td><td>0000h</td></tr>
<tr><td>PD29</td><td>0000h</td></tr>
<tr><td>PD30</td><td>0000h</td></tr>
</table>

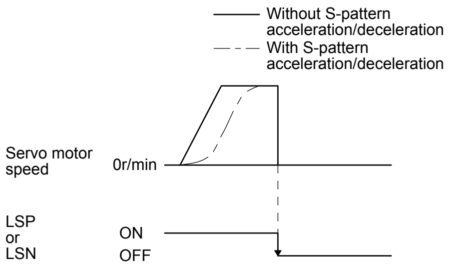
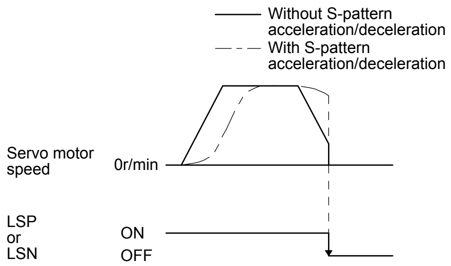
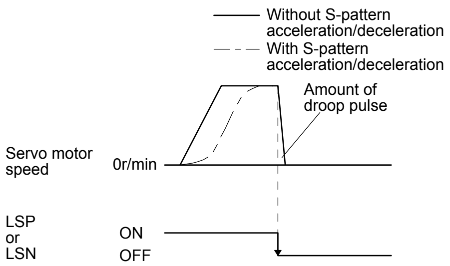
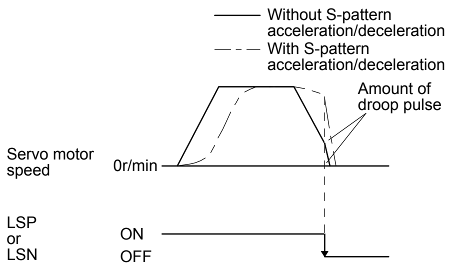
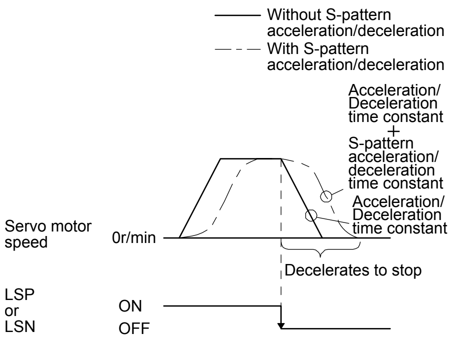
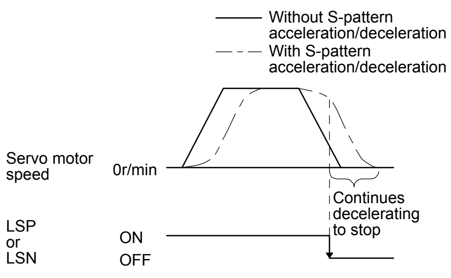
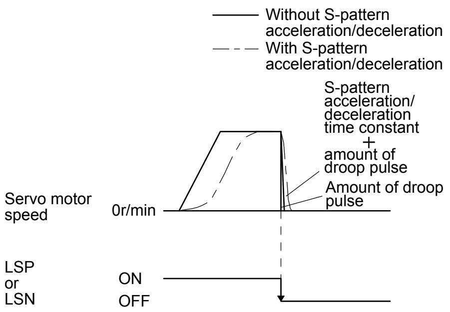
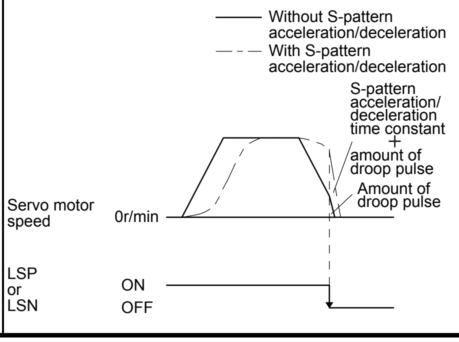
6.4.3 Stopping method when the forward stroke end (LSP) or reverse stroke end (LSN) is valid

The setting of the first digit of parameter No.PD20 enables to select a stopping method of the servo motor when the forward rotation stroke end (LSP) or reverse rotation stroke end (LSN) turns off.

Parameter No.PD20

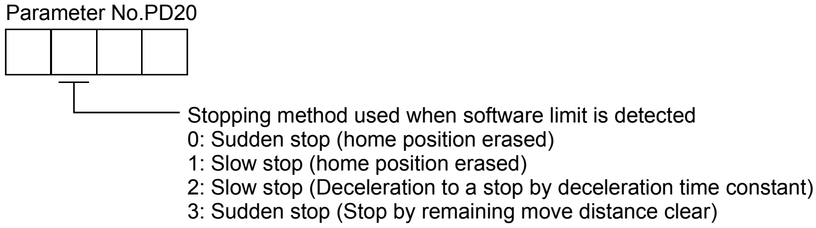
□□□□

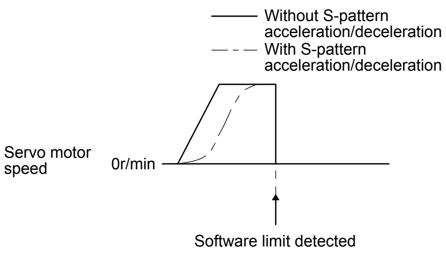
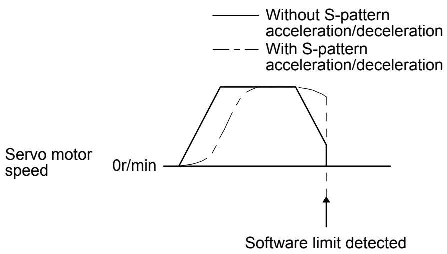
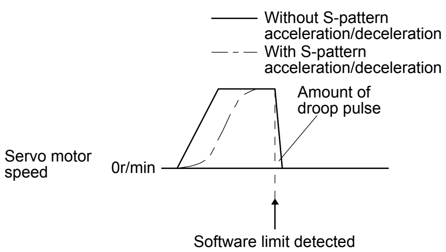
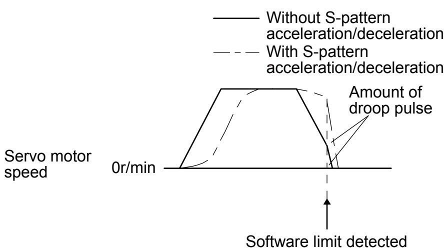
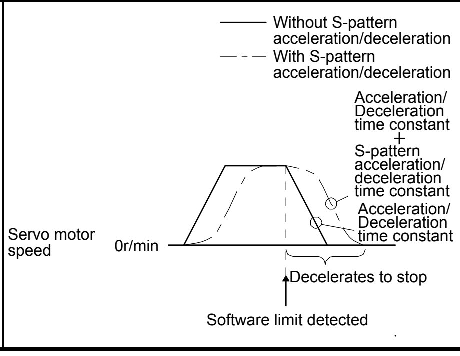
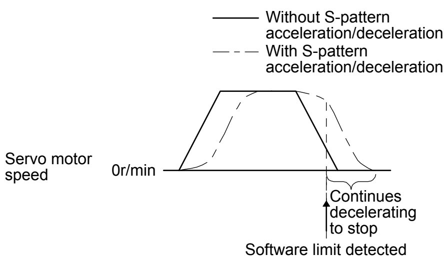
Stopping method used when forward rotation stroke end (LSP) or reverse rotation stroke end (LSN) is valid
0: Sudden stop (home position erased)
1: Slow stop (home position erased)
2: Slow stop (Deceleration to a stop by deceleration time constant)
3: Sudden stop (Stop by remaining move distance clear)

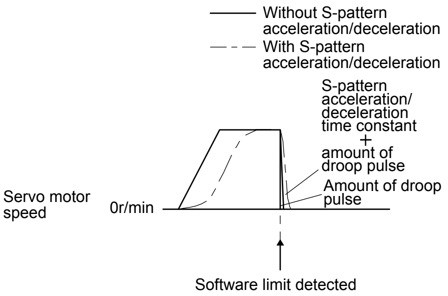
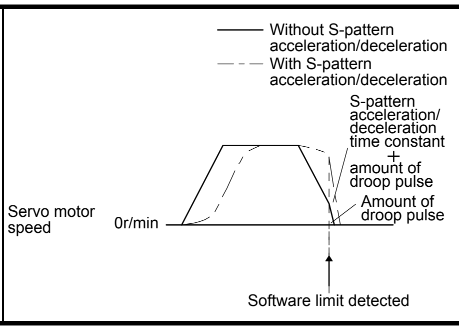
Setting value of parameter No.PD20	Operation status		Remarks
	When rotating at constant speed	When decelerating to stop	
□□□0 (Initial value)			Clears droop pulses and stops. Erases the home position. A difference occurs between the command position and the current position. Execute a home position return again.
□□□1			Moves for the amount of droop pulse and stops. Erases the home position. A difference occurs between the command position and the current position. Execute a home position return again.
□□□2			Decelerates to stop at the deceleration time constant. Continues to rotate for the amount of S-pattern acceleration/decelerati on time constant delay. Keeps the home position.
□□□3			Moves for the amount of droop pulse and stops. Continues to rotate for the amount of S-pattern acceleration/decelerati on time constant delay. Keeps the home position.

6.4.4 Stopping method when a software limit is detected

A stopping method of the servo motor when a software limit (parameter No.PC31 to PC34) is detected can be selected. The software limit imposes a limit on the command position, which is controlled in the driver. Therefore, actual stop position does not reach to the software limit set position.



<table>
<tr><th rowspan="2">Setting value of parameter No.PD20</th><th colspan="2">Operation status</th><th rowspan="2">Remarks</th></tr>
<tr><th>When rotating at constant speed</th><th>When decelerating to stop</th></tr>
<tr><td>□0□□
(Initial value)</td><td></td><td></td><td>Clears droop pulses and stops.
Erases the home position.
A difference occurs between the command position and the current position.
Execute a home position return again.</td></tr>
<tr><td>□1□□</td><td></td><td></td><td>Moves for the amount of droop pulse and stops.
Erases the home position.
A difference occurs between the command position and the current position.
Execute a home position return again.</td></tr>
<tr><td>□2□□</td><td></td><td></td><td>Decelerates to stop at the deceleration time constant. Continues to rotate for the amount of S-pattern acceleration/deceleration time constant delay.
Keeps the home position.</td></tr>
</table>

<table>
<tr>
<td>□3□□</td>
<td>
</td>
<td>
</td>
<td>Moves for the amount of droop pulse and stops. Continues to rotate for the amount of S-pattern acceleration/deceleration time constant delay. Keeps the home position.</td>
</tr>
</table>

7. Setup software(MR Configurator)

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7. Setup software(MR Configurator)

The setup software (MR Configurator :MRZJW3-SETUP□□□E) uses the communication function of the driver to perform parameter setting changes, graph display, test operation, etc. on a personal computer.
When setup software (MR Configurator) is used, the selection of the model of LECSC□-□ is needed.
Please select 'MR-J3-T' by "Model selection" - "System settings" - "Setup" - "Project name".

7.1 Specifications

Item	Description
Compatibility with a driver	The setup software(MR Configurator) software version compatible with the driver is C4 or later.
Baud rate [bps]	115200, 57600, 38400, 19200, 9600
Monitor	Display, I/O interface display, high speed monitor, trend graph
Alarm	Display, history, driver data
Diagnostic	No motor rotation, system information, tuning data, absolute encoder data, Axis name setting.
Parameters	Parameter list, device setting, turning, change list, detailed information
Test operation	Jog operation, positioning operation, motor-less operation, Do forced output, program operation, single-step feed, parameter copy.
Advanced function	Machine analyzer, gain search, machine simulation, Robust disturbance compensation.
Point data	Point table
File operation	Data read, save, delete, print
Others	Automatic demo, help display

7.2 System configuration

(1) Components

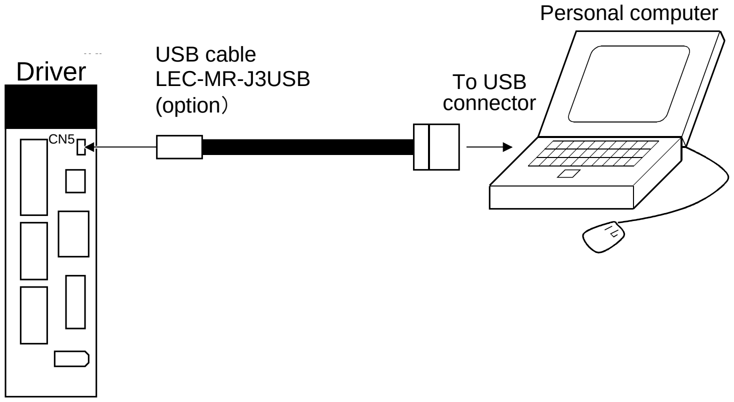
To use this software, the following components are required in addition to the driver and servo motor.

Equipment		(Note 1) Description
(Note 2, 3) Personal computer	OS	IBM PC/AT compatible where the English version of Windows® 98, Windows® Me, Windows® 2000 Professional, Windows® XP Professional, Windows® XP Home Edition, Windows Vista® Home Basic, Windows Vista® Home Premium, Windows Vista® Business, Windows Vista® Ultimate, Windows Vista® Enterprise operates
	Processor	Pentium® 133MHz or more (Windows® 98, Windows® 2000 Professional) Pentium® 150MHz or more (Windows® Me) Pentium® 300MHz or more (Windows® XP Professional, Windows® XP Home Edition) 32-bit (x86) processor of 1GHz or higher (Windows Vista® Home Basic, Windows Vista® Home Premium, Windows Vista® Business, Windows Vista® Ultimate, Windows Vista® Enterprise)
	Memory	24MB or more (Windows® 98) 32MB or more (Windows® Me, Windows® 2000 Professional) 128MB or more (Windows® XP Professional, Windows® XP Home Edition) 512MB or more (Windows Vista® Home Basic) 1GB or more (Windows Vista® Home Premium, Windows Vista® Business, Windows Vista® Ultimate, Windows Vista® Enterprise)
	Hard Disk	130MB or more of free space
Browser		Internet Explorer 4.0 or more
Display		One whose resolution is 800×600 or more and that can provide a high color (16 bit) display. Connectable with the above personal computer.
Keyboard		Connectable with the above personal computer.
Mouse		Connectable with the above personal computer.
Printer		Connectable with the above personal computer.
USB cable		LEC-MR-J3USB
RS-422/232C conversion cable		DSV-CABV (Diatrend) is recommended.

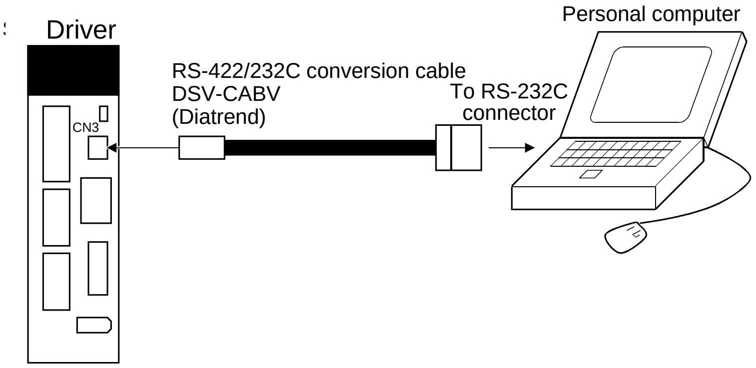
Note 1. Windows and Windows Vista are the registered trademarks of Microsoft Corporation in the United States and other countries.
Pentium is the registered trademarks of Intel Corporation.
2. On some personal computers, setup software(MR Configurator) may not run properly.
3. 64-bit Windows XP and 64-bit Windows Vista are not supported.

(2) Connection with driver

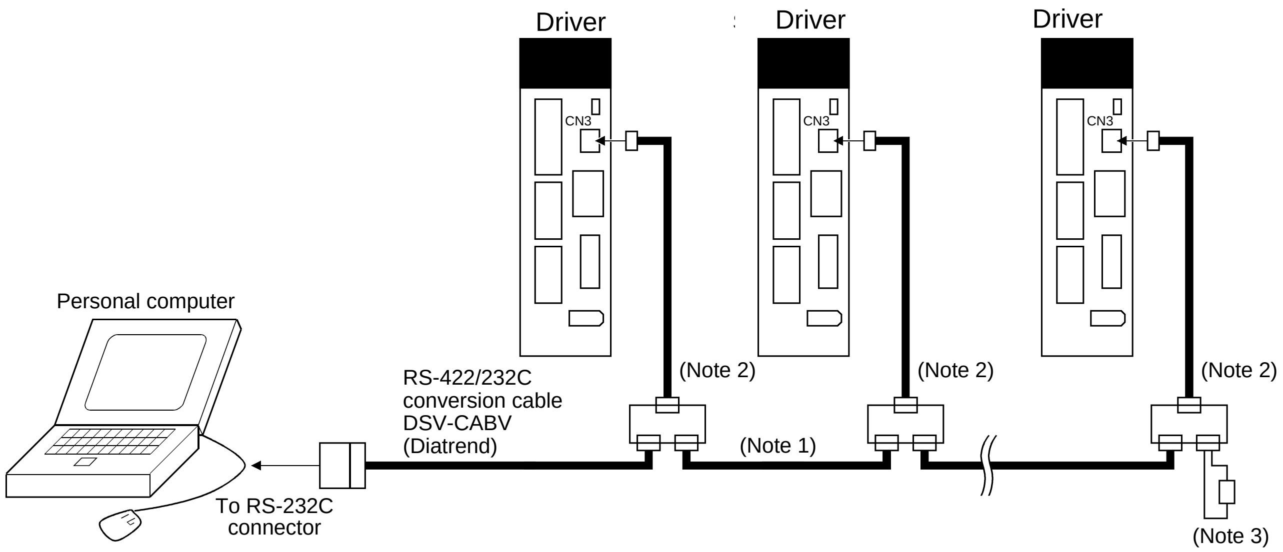
(a) For use of USB



(b) For use of RS-422



(c) For use of RS-422 to make multidrop connection



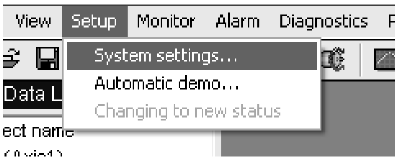
Note 1. Refer to section 141 for cable wiring.

2. The BMJ-8 (Hakko Electric Machine Works) is recommended as the branch connector.

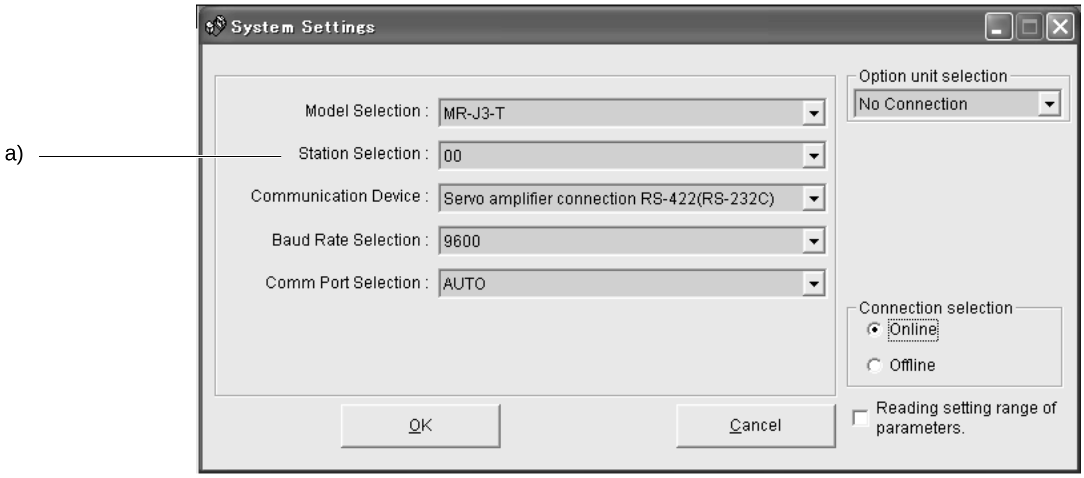
3. The final axis must be terminated between RDP (pin No. 3) and RDN (pin No.6) on the receiving side (driver) with a 150Ω resistor.

7.3 Station selection

Click "Setup" on the menu bar and click "System settings" on the menu.



When the above choices are made, the following window appears.



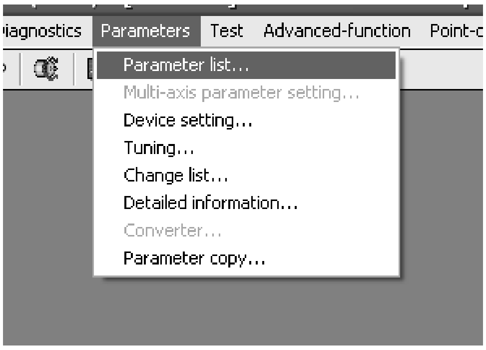
(1) Station number selection
Choose the station number in the combo box (a)).

POINT
・This setting should be the same as the station number which has been set in the parameter (PC20) in the driver used for communication.

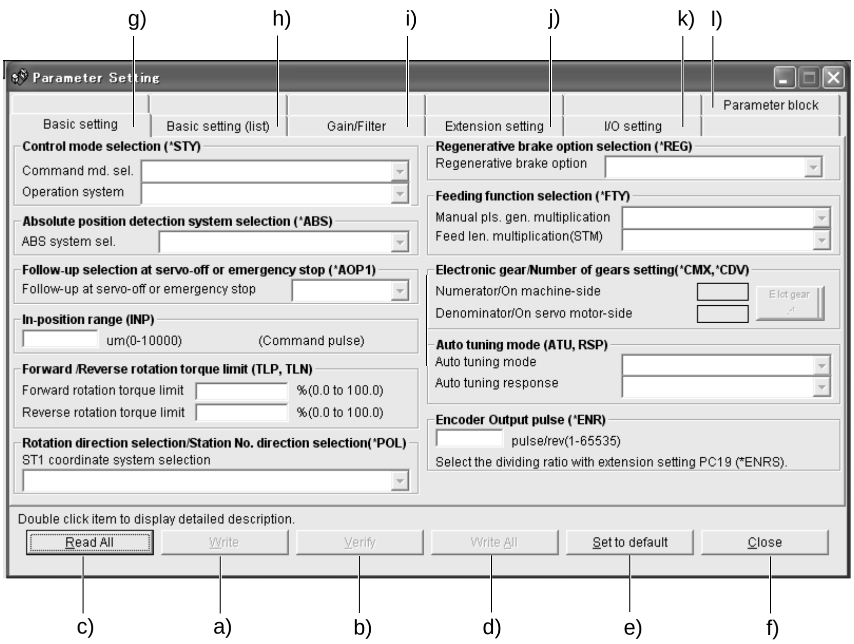
(2) Closing of the station selection window
Click the "OK" button to close the window.

7.4 Parameters

Click "Parameters" on the menu bar and click "Parameter list" on the menu.



When the above choices are made, the following window appears.



(1) Parameter value write (a))

Click the parameter whose setting was changed and press the "Write" button to write the new parameter setting to the driver.

(2) Parameter value verify (b))

Click the "Verify" button to verify all parameter values being displayed and the parameter values of the driver.

(3) Parameter value batch-read (c))

Click the "Read All" button to read and display all parameter values from the driver.

(4) Parameter value batch-write (d))
Click the "Write All" button to write all parameter values to the driver.

(5) Parameter default value indication (e))
Click the "Set to default" button to show the initial value of each parameter.

(6) Basic settings for parameters (g))
Used to make the basic settings such as control mode selection and absolute position detection system selection.

(7) Basic setting parameters (h))
Used to make the basic settings for the driver. Select a parameter to be changed the setting, enter a new value to "Set value" and click "Enter".

(8) Gain/Filter parameters (i))
Used to adjust the gain manually. Select a parameter to be changed, enter a new value to "Set value" and click "Enter".

(9) Extension setting parameters (j))
Used to make the setting unique to LECSC□-□driver. Select a parameter to be changed, enter a new value to "Set value" and click "Enter".

(10) I/O setting parameters (k))
Used to change the I/O device of the driver. Select a parameter to be changed, enter a new value to "Set value" and click "Enter".

(11) Parameter block (l))
Used to set the availability of parameter write.

(12) Parameter data file read
Used to read and display the parameter values stored in the file. Use the "Project" menu on the menu bar to read.

(13) Parameter value storage
Used to store all parameter values being displayed on the window into the specified file. Use the "Project" menu on the menu bar to store.

(14) Parameter data list print
Used to print all parameter values being displayed on the window. Use the "Project" menu on the menu bar to print.

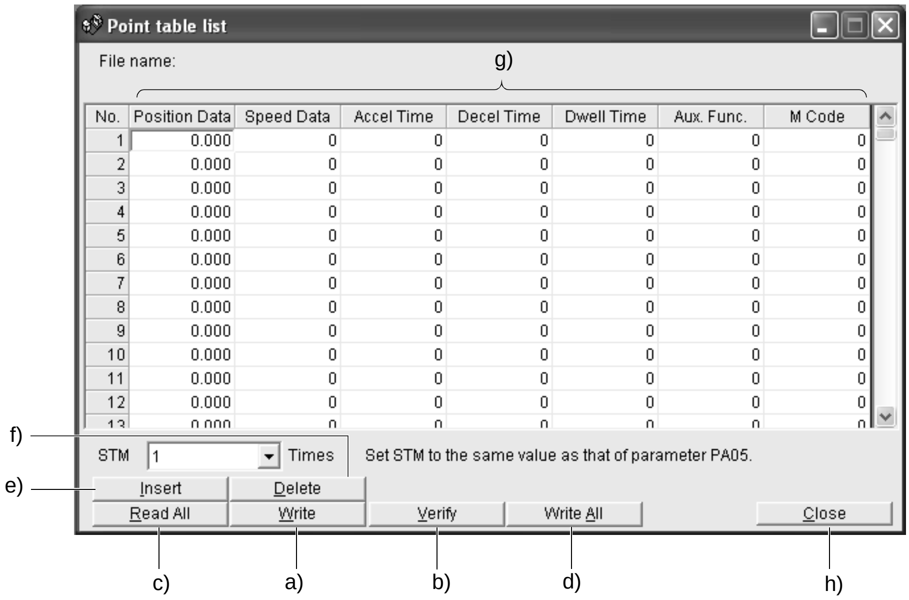
(15) Parameter list window closing (f))
Click the "Close" button to close the window. If the "Close" button is clicked without (1) parameter value write or (4) parameter value batch-write being performed, the parameter value changed is made invalid.

7.5 Point table

POINT
・The value of the parameter No. PA05 set on the parameter setting screen is not engaged with the STM (feed length multiplication) value on the point table list screen. Set the STM (feed length multiplication) value to the same as set in the parameter No. PA05 on the point table list screen.

Click "Point-data" on the menu bar and click "Point table" on the menu.

When the above choices are made, the following window appears.



(1) Point table data write (a))
Click the point table data changed and press the "Write" button to write the new point table data to the driver.

(2) Point table data verify (b))
Click the "Verify" button to verify all data being displayed and the data of the driver.

(3) Point table data batch-read (c))
Click the "Read All" button to read and display all point table data from the driver.

(4) Point table data batch-write (d))
Click the "Write All" button to write all point table data to the driver.

(5) Point table data insertion (e))
Click the "Insert" button to insert one block of data into the position before the point table No. chosen. The blocks after the chosen point table No. are shifted down one by one.

(6) Point table data deletion (f))
Click the "Delete" button to delete all data in the point table No. chosen. The blocks after the chosen point table No. are shifted up one by one.

(7) Point table data change (g))
Click the data to be changed, enter a new value into the "Enter" input field, and press the enter key or Enter Data button.

(8) Point table data file read
Used to read and display the point table data stored in the file. Use the "Project" menu on the menu bar to read.

(9) Point table data storage
Used to store all point table data being displayed on the window into the specified file. Use the "Project" menu on the menu bar to store.

(10) Point table data list print
Used to print all point table data being displayed on the window. Use the "Project" menu on the menu bar to print.

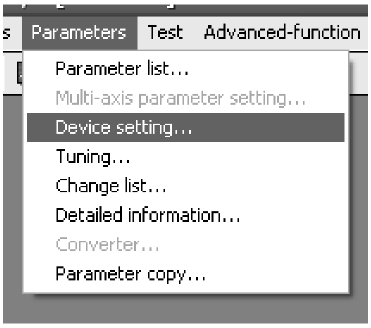
(11) Point table data list window closing (h))
Click the "Close" button to close the window.

7.6 Device assignment method

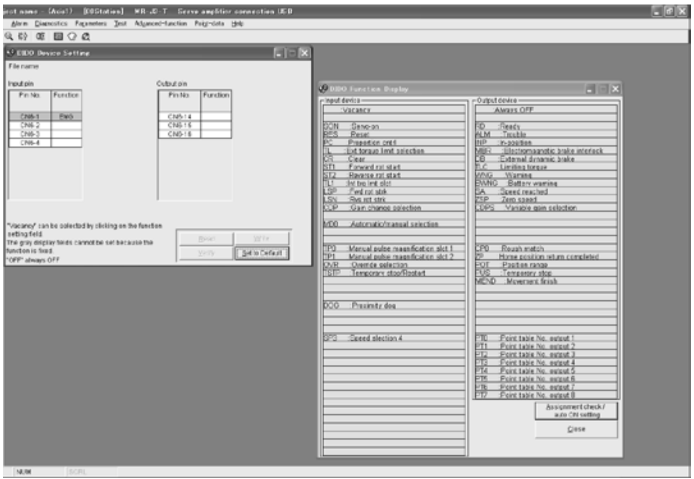
POINT
・To use a device as an external I/O signal, the settings for the parameter No. PD12 and PD14 are required after the device is assigned according to the device setting described below.

(1) How to open the setting screen

Click "Parameters" on the menu bar and click "Device setting" in the menu.



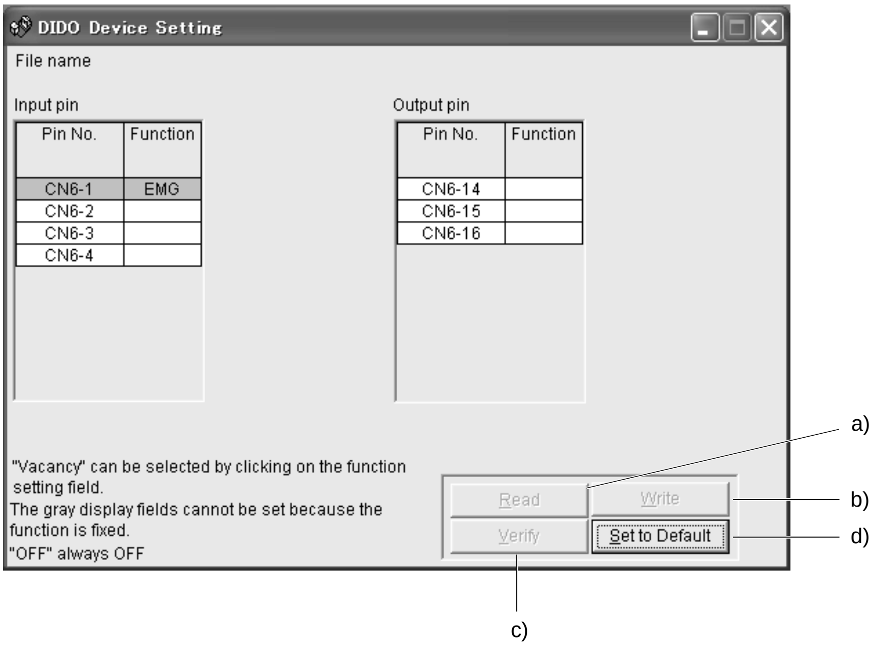
Making selection displays the following window.



(2) Screen explanation

(a) DIDO device setting window screen

This is the device assignment screen of the driver displays the pin assignment status of the driver.



1) Read of function assignment (a))

Click the "Read" button reads and displays all functions assigned to the pins from the driver.

2) Write of function assignment (b))

Click the "Write" button writes all pins that are assigned the functions to the driver.

3) Verify of function assignment (c))

Click the "Verify" button verifies the function assignment in the driver with the device information on the screen.

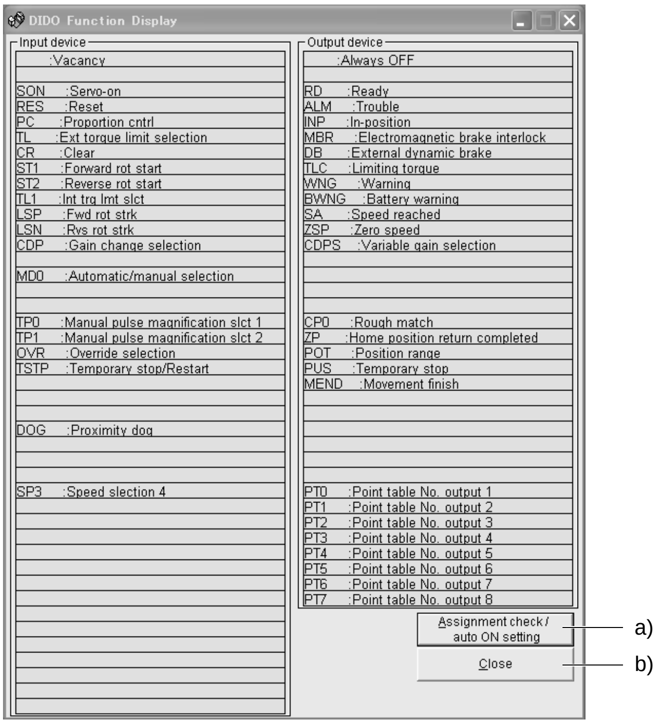
4) Initial setting of function assignment (d))

Click the "Set to Default" button initializes the function assignment.

(b) DIDO function display window screen

This screen is used to select the device assigned to the pins.

The functions displayed below * and * are assignable.



Move the pointer to the place of the function to be assigned. Drag and drop it as-is to the pin you want to assign in the DIDO device setting window.

1) Assignment checking, automatic ON setting (a))

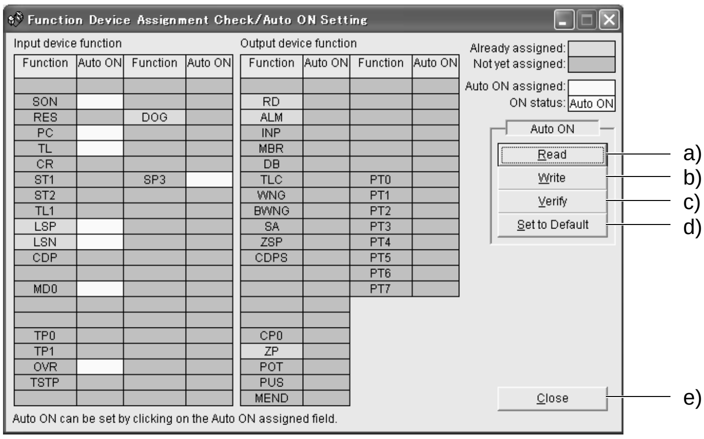
   Press this button to display the screen that shows the assignment list and enables auto ON setting. Refer to (2)(c) in this section for more information.

2) Quitting

   Click "Close" button to exit from the window. (b))

(c) Function device assignment checking auto ON setting display

Click the "Assignment check / auto ON setting" button in the DIDO function display window displays the following window.



The assigned functions are indicated by.

The functions assigned by auto ON are grayed. When you want to set auto ON to the function that is enabled for auto ON, click the corresponding cell. Clicking it again disables auto ON.

1) Auto ON read of function assignment (a))

Click "Read" button reads the functions set for auto ON from the interface unit and extension IO unit.

2) Auto ON write of function assignment (b))

Click "Write" button writes the functions currently set for auto ON to the interface unit and extension IO unit.

3) Auto ON verify of function assignment (c))

Click "Verify" button verifies the current auto ON setting in the interface unit and extension IO unit with the auto ON setting on the screen.

4) Auto ON initial setting of function assignment (d))

Click "Set to Default" button initializes the auto ON setting.

5) Quitting the function device assignment checking/auto ON setting window (e))

Click "Close" button exits from the window.

7.7 Test operation

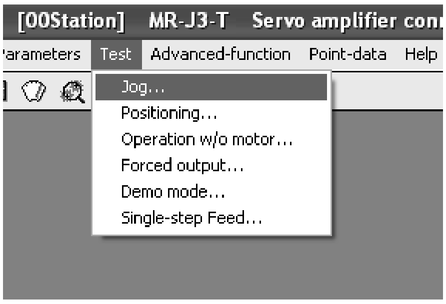
CAUTION	・When confirming the machine operation in the test operation mode, use the machine after checking that the safety mechanism such as the forced stop (EMG) operates. ・If any operational fault has occurred, stop operation using the forced stop (EMG).

7.7.1 Jog operation

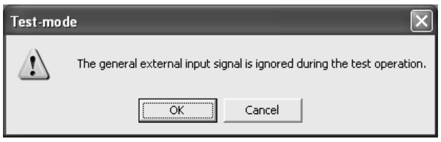
POINT

- For the program operation, refer to the manual of setup software(MR Configurator).
- The servo motor will not operate if the forced stop (EMG), forward rotation stroke end (LSP) and reverse rotation stroke end (LSN) are off. Make automatic ON setting to turn on these devices or make device setting to assign them as external input signals and turn on across these signals and SG. (Refer to section 7.6.)
- When an alarm occurs, the JOG operation is automatically canceled.

Click "Test" on the menu bar and choose "Jog" on the menu.

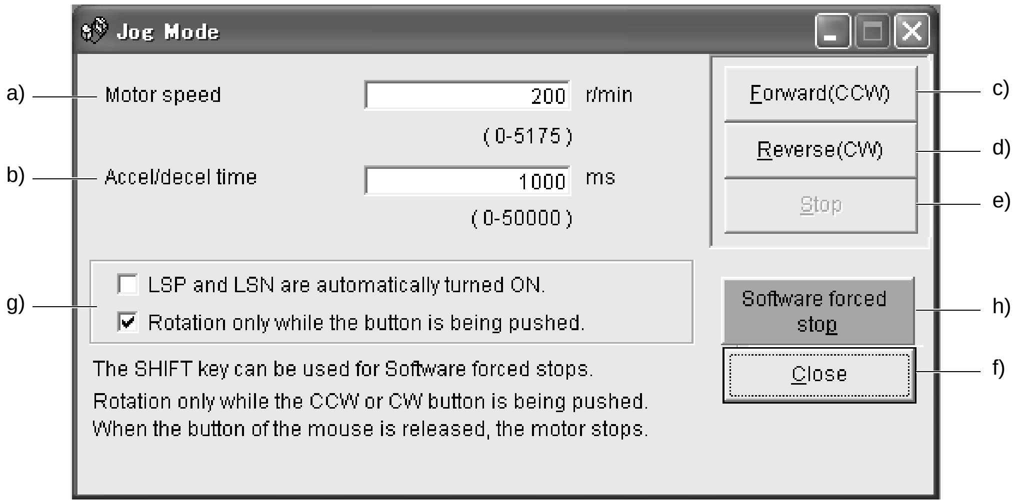


Clicking displays the confirmation window for switching to the test operation mode.



Click the "OK" button to display the setting screen of the Jog operation.
During the servo on, the confirmation window indicating that the next operation is in the stop status is displayed.

Turn the servo off, confirm that the operation is in the stop status, and click the "OK" button to display the setting screen for the Jog operation.



(1) Servo motor speed setting (a))
Enter a new value into the "Motor speed" input field and press the enter key.

(2) Acceleration/deceleration time constant setting (b))
Enter a new value into the "Accel/decel time" input field and press the enter key.

(3) Start button operation selection
Check the check box for operating the servo motor only while pressing the button. Uncheck the check box for stopping the operation by pressing the "Stop" or "Software forced stop" button.

(4) Servo motor start (c), d))
(a) When stopping the operation by pressing the "Stop" or "Software forced stop" button
Click the "Forward" button to rotate the servo motor in the CCW rotation direction.
Click the "Reverse" button to rotate the servo motor in the CW rotation direction.

(b) When operating the servo motor only while pressing the button
While pressing the "Forward" button, the servo motor rotates in the CCW rotation direction.
While pressing the "Reverse" button, the servo motor rotates in the CW rotation direction.

(5) Servo motor stop (e))
(a) When stopping the operation by pressing the "Stop" or "Software forced stop" button
Click the "Stop" button to stop the rotation of the servo motor.

(b) When operating the servo motor only while pressing the button
Release the "Forward" or "Reverse" button to stop the rotation of the servo motor.

(6) LSP/LSN (stroke end) automatic ON setting (g))
Put a check mark in the check box to automatically turn ON LSP/LSN. After selecting the check box, the LSP and the LSN of external signal are ignored.

(7) Servo motor software forced stop (h))
Click the "Software forced stop" button to stop the servo motor rotation immediately. When the "Software forced stop" button is enabled, the "Forward" and "Reverse" buttons cannot be used. Click the "Software forced stop" button again to make the "Forward" and "Reverse" buttons enabled.

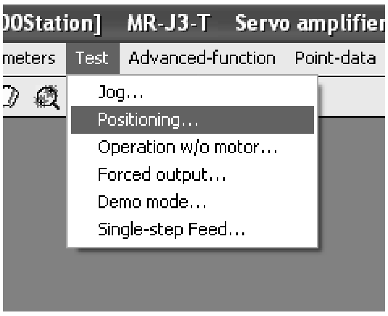
(8) Jog operation window closing (f))
Click the "Close" button to cancel the jog operation mode and close the window.

(9) Switching to CC-Link operation mode
To switch from the test operation mode to the CC-Link operation mode, turn OFF the power of the driver.

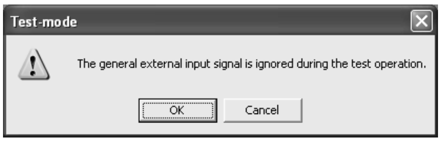
7.7.2 Positioning operation

POINT
・The servo motor will not operate if the forced stop (EMG), forward rotation stroke end (LSP) and reverse rotation stroke end (LSN) are off. Make automatic ON setting to turn on these devices or make device setting to assign them as external input signals and turn on across these signals and DOCOM. (Refer to section 7.6.) ・When an alarm occurs, the positioning operation is automatically canceled.

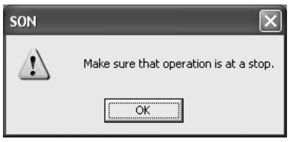
Click "Test" on the menu bar and click "Positioning" on the menu.



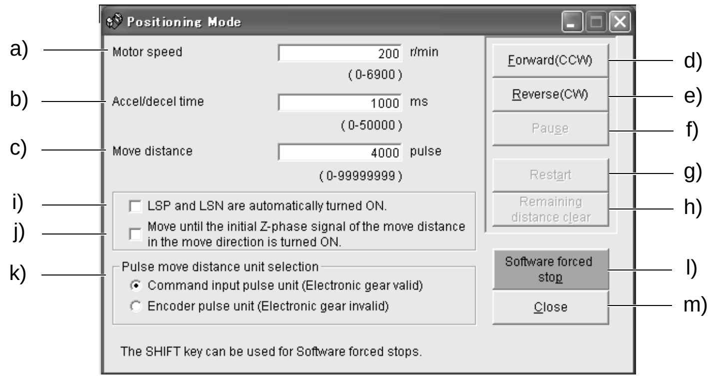
Clicking displays the confirmation window for switching to the test operation mode.



Click the "OK" button to display the setting screen of the Positioning operation.
During the servo on, the confirmation window indicating that the next operation is in the stop status is displayed.



After confirming that the operation is in the stop status, click the "OK" button to display the setting screen for the positioning operation.



(1) Servo motor speed setting (a))
Enter a new value into the "Motor speed" input field and press the enter key.

(2) Acceleration/deceleration time constant setting (b))
Enter a new value into the "Accel/decel time" input field and press the enter key.

(3) Moving distance setting (c))
Enter a new value into the "Move distance" input field and press the enter key.

(4) Servo motor start (d), e))
Click the "Forward" button to rotate the servo motor in the forward rotation direction.
Click the "Reverse" button to rotate the servo motor in the reverse rotation direction.

(5) Temporary stop of servo motor (f))
Click the "Pause" button to stop the servo motor temporarily.

(6) Servo motor restart (g))
Click the "Restart" button during the temporary stop to restart the rotations for the remaining move distance.
Enter a new value into the "Motor speed" input field and press the enter key.

(7) Move distance clear (h))
Click the "Remaining distance clear" during the temporary stop to clear the remaining move distance.

(8) LSP/LSN (stroke end) automatic ON setting (i))
Put a check mark in the check box to automatically turn ON LSP/LSN. After selecting the check box, the LSP and the LSN of external signal are ignored.

(9) Automatic ON setting for the movement to the Z-phase signal (j))
To move to the first Z-phase signal of the move distance + move direction, put a check mark in the check box.

(10) Pulse move distance unit selection (k)
Select with the option buttons whether the moving distance set is in the command input pulse unit or in the encoder pulse unit.

(11) Servo motor software forced stop (1))
Click the "Software forced stop" button to stop the servo motor rotation immediately. When the "Software forced stop" button is enabled, the "Forward" and "Reverse" buttons cannot be used. Click the "Software forced stop" button again to make the "Forward" and "Reverse" buttons enabled.

(12) Positioning operation window closing (m))
Click the "Close" button to cancel the positioning operation mode and close the window.

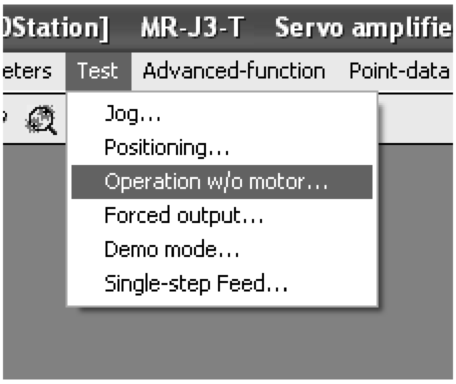
(13) Switching to CC-Link operation mode
To switch from the test operation mode to the CC-Link operation mode, turn OFF the power of the driver.

7.7.3 Motor-less operation

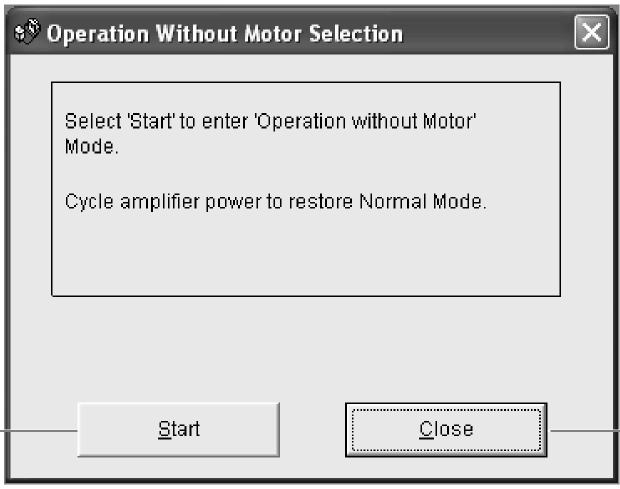
POINT
・When this operation is used in an absolute position detection system, the home position cannot be restored properly.

Without a servo motor being connected, the output signals are provided and the driver display shows the status as if a servo motor is actually running in response to the external I/O signals.
The sequence of the PC or PLC...etc can be checked without connection of a servo motor.

Click "Test" on the menu bar and click "Operation w/o Motor" on the menu.



When the above choices are made, the following window appears.



a)

b)

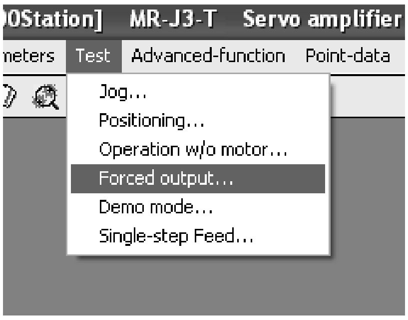
(1) Execution of motor-less operation (a))
Click "Start" to perform motor-less operation.

(2) Termination of motor-less operation (b))
Click "Close" to close the window.
Note that just clicking the "Close" button does not cancel motor-less operation. To cancel motor-less operation, turn ON the power of the driver and switch to the CC-Link operation mode once.

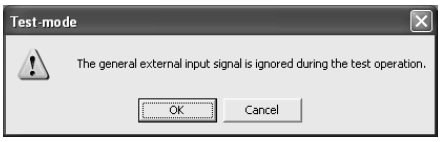
7.7.4 Output signal (DO) forced output

POINT
・When an alarm occurs, the DO forced output is automatically canceled.

Each driver output signal is forcibly switched on/off independently of the output condition of the output signal.
Click "Test" on the menu bar and click "Forced output" on the menu.



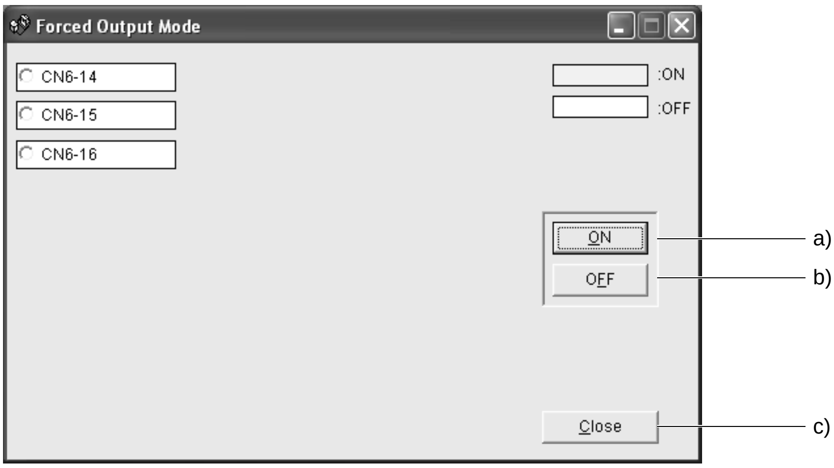
Clicking displays the confirmation window for switching to the test operation mode.



Click the "OK" button to display the setting screen of the DO forced output.
During the servo on, the confirmation window indicating that the next operation is in the stop status is displayed.

After confirming that the operation is in the stop status, click the "OK" button to display the setting screen for the DO forced output.

When the above choices are made, the following window appears.



(1) Signal ON/OFF setting (a), b))
Choose the signal name or pin number and click the "ON" or "OFF" button to write the corresponding signal status to the driver.

(2) DO forced output window closing (c))
Click the "Close" button to cancel the DO forced output mode and close the window.

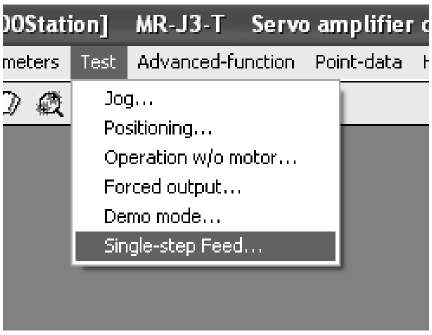
(3) Switching to CC-Link operation mode
To switch from the test operation mode to the CC-Link operation mode, turn OFF the power of the driver.

7.7.5 Single-step feed

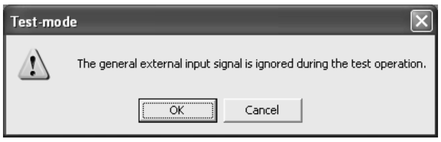
POINT

- The servo motor will not operate if the forced stop (EMG), forward rotation stroke end (LSP) and reverse rotation stroke end (LSN) are off. Make automatic ON setting to turn on these devices or make device setting to assign them as external input signals and turn on across these signals and SG. (Refer to section 7.6.)
- When an alarm occurs, the 1-step feed is automatically canceled.

Operation is performed in accordance with the preset point table No.
Click "Test" on the menu bar and click "Single-step Feed" on the menu.

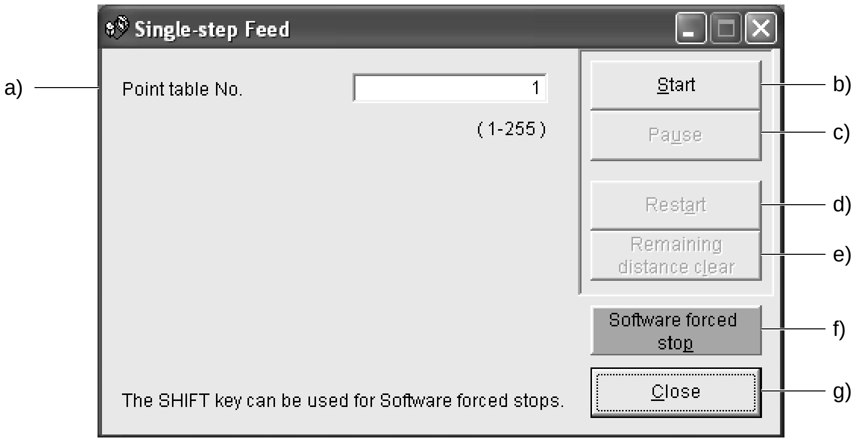


Clicking displays the confirmation window for switching to the test operation mode.



Click the "OK" button to display the setting screen of the Single-step feed.
During the servo on, the confirmation window indicating that the next operation is in the stop status is displayed.

After confirming that the operation is in the stop status, click the "OK" button.



(1) Point table No. setting (a))
Enter the point table No. into the "Point table No." input field and press the enter key.

(2) Servo motor start (b))
Click the "Start" button to rotate the servo motor.

(3) Temporary stop of servo motor (c))
Press the "Pause" button to stop the servo motor temporarily.

(4) Servo motor stop (c))
Click the "Pause" button again during a temporary stop of the servo motor to clear the remaining moving distance.

(5) Servo motor restart (d))
Click the "Restart" button during the temporary stop to restart the rotations for the remaining move distance.

(6) Move distance clear (e))
Click the "Remaining distance clear" during the temporary stop to clear the remaining move distance.

(7) Servo motor software forced stop (f))
Click the "Software forced stop" button to stop the servo motor rotation immediately. When the "Software forced stop" button is enabled, the "Start" button cannot be used. Click the "Software forced stop" button again to make the "Start" button enabled.

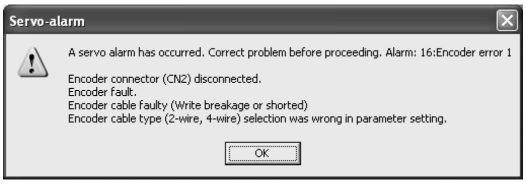
(8) Single-step feed window closing (g))
Click the "Close" button to cancel the single-step feed mode and close the window.

(9) Switching to CC-Link operation mode
To switch from the test operation mode to the CC-Link operation mode, turn OFF the power of the driver.

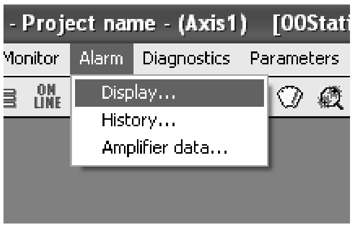
7.8 Alarm

7.8.1 Alarm display

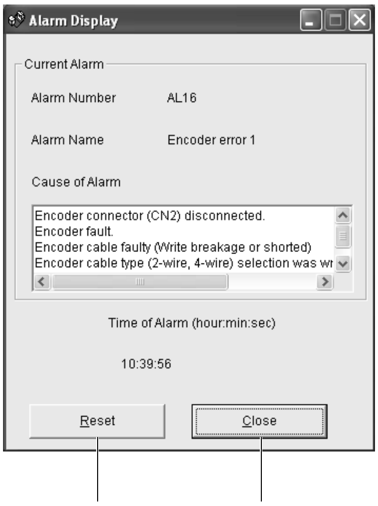
POINT
・If a menu is clicked or any other operation is performed during alarm occurrence, the following message window appears. The example given here is the window that indicates an occurrence of Encoder error 1 (A16).



The current alarm can be displayed.
To display the current alarm, click "Alarm" on the menu bar and click "Display" on the menu.



When the above choices are made, the following window appears.



a) b)

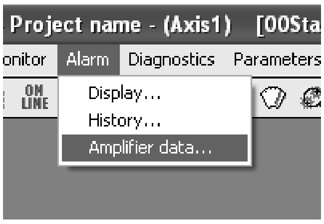
(1) Current alarm display
The window shows the alarm number, name, cause and occurrence time.
The following example is the window that indicates an occurrence of Encoder error 1 (A16).

(2) Alarm reset (a))
Click the "Reset alarm" button to reset the current alarm and clear alarms on the window. The alarm at this time is stored as the latest alarm.

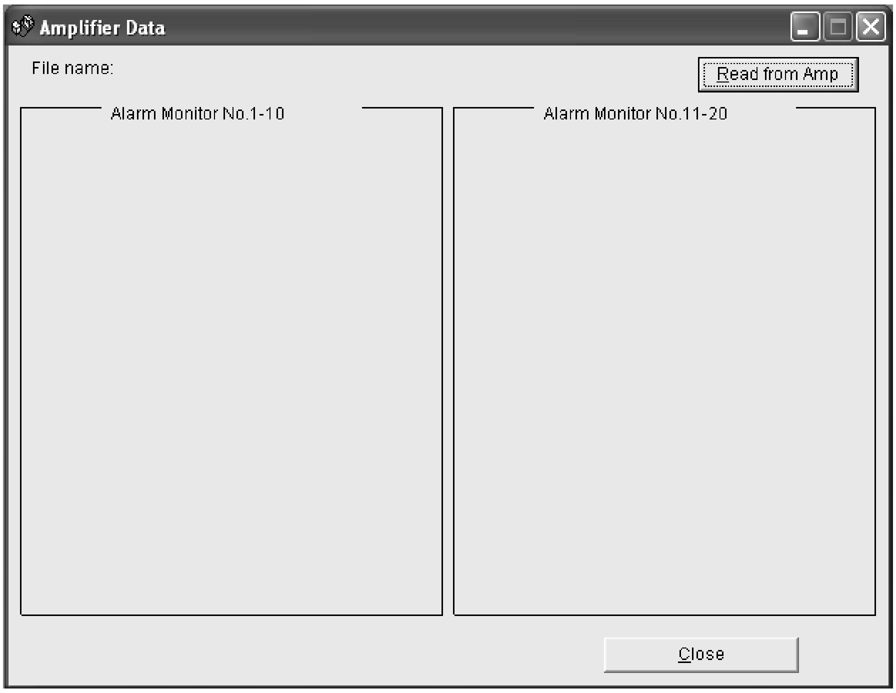
(3) Closing the current alarm window (b))
Click the "Close" button to close the window.

7.8.2 Batch display of data at alarm occurrence

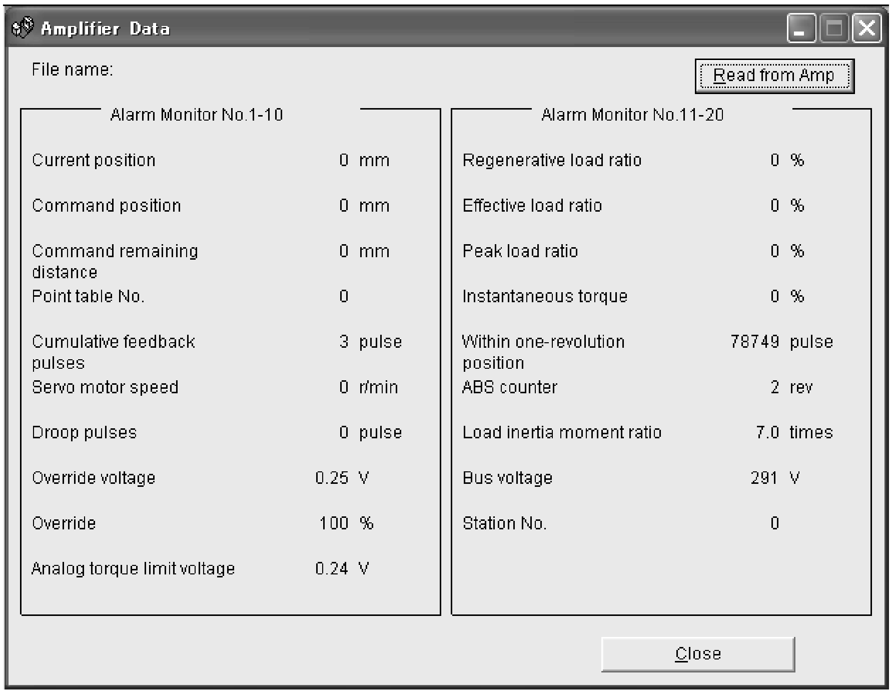
Monitor data during alarm occurrence is displayed.
To display monitor data, click "Alarm" on the menu bar and click "Amplifier data" on the menu.



When the above choices are made, the following window appears.

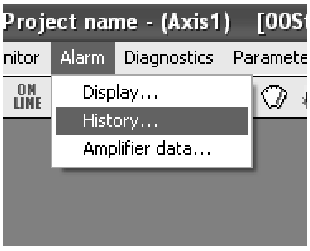


Click the "Read" button to read the monitor data at error occurrence from the driver. Read results are displayed as follows.

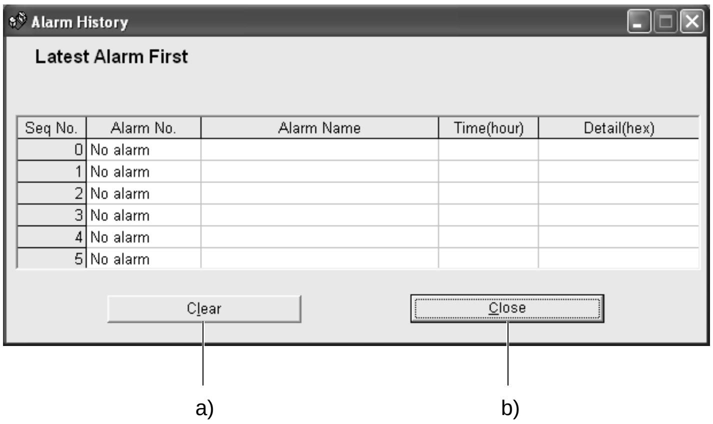


7.8.3 Alarm history

Click "Alarm" on the menu bar and click "History" on the menu.



When the above choices are made, the following window appears.



(1) Alarm history display

The most recent six alarms are displayed. The smaller numbers indicate newer alarms.

(2) Alarm history clear (a))

Click the "Clear" button to clear the alarm history stored in the driver.

(3) Closing of alarm history window (b))

Click the "Close" button to close the window.

8. GENERAL GAIN ADJUSTMENT 2
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8. GENERAL GAIN ADJUSTMENT

8.1 Different adjustment methods

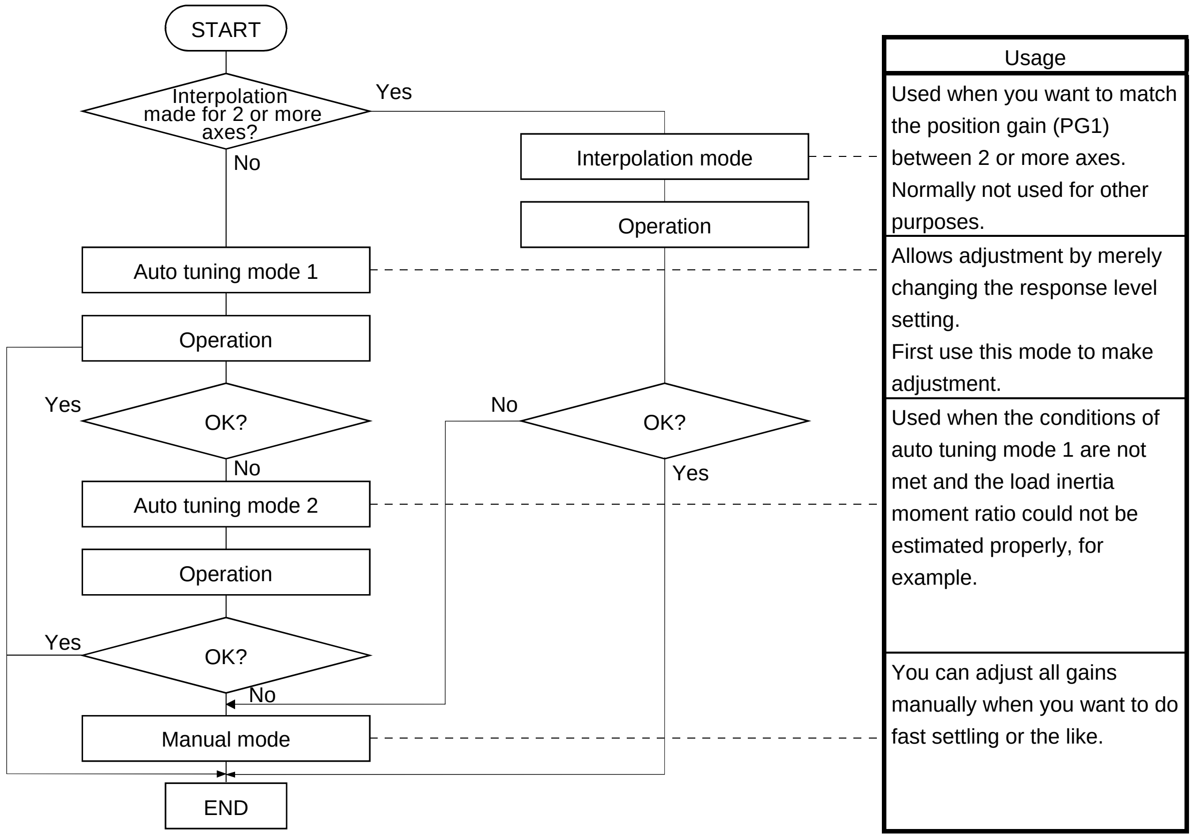
8.1.1 Adjustment on a single driver

The gain adjustment in this section can be made on a single driver. For gain adjustment, first execute auto tuning mode 1. If you are not satisfied with the results, execute auto tuning mode 2 and manual mode in this order.

(1) Gain adjustment mode explanation

Gain adjustment mode	Parameter No. PA08 setting	Estimation of load inertia moment ratio	Automatically set parameters	Manually set parameters
Auto tuning mode 1 (initial value)	0001	Always estimated	GD2 (parameter No.PB06) PG2 (parameter No.PB08) PG1 (parameter No.PB07) VG2 (parameter No.PB09) VIC (parameter No.PB10)	Response level setting of parameter No.2
Auto tuning mode 2	0002	Fixed to parameter No. PB06 value	PG2 (parameter No.PB08) PG1 (parameter No.PB07) VG2 (parameter No.PB09) VIC (parameter No.PB10)	GD2 (parameter No.PB06) Response level setting of parameter No.PA09
Manual mode	0003			PG1 (parameter No.PB07) GD2 (parameter No.PB06) VG2 (parameter No.PB09) VIC (parameter No.PB10)
Interpolation mode	0000	Always estimated	GD2 (parameter No.PB06) PG2 (parameter No.PB08) VG2 (parameter No.PB09) VIC (parameter No.PB10)	PG1 (parameter No.PB07)

(2) Adjustment sequence and mode usage



8.1.2 Adjustment using set up software (MR Configurator)

This section gives the functions and adjustment that may be performed by using the driver with the set up software (MR Configurator) which operates on a personal computer.

Function	Description	Adjustment
Machine analyzer	With the machine and servo motor coupled, the characteristic of the mechanical system can be measured by giving a random vibration command from the personal computer to the servo and measuring the machine response.	· You can grasp the machine resonance frequency and determine the notch frequency of the machine resonance suppression filter. · You can automatically set the optimum gains in response to the machine characteristic. This simple adjustment is suitable for a machine which has large machine resonance and does not require much settling time.
Gain search	Executing gain search under to-and-fro positioning command measures settling characteristic while simultaneously changing gains, and automatically searches for gains which make settling time shortest.	· You can automatically set gains which make positioning settling time shortest.
Machine simulation	Response at positioning settling of a machine can be simulated from machine analyzer results on personal computer.	· You can optimize gain adjustment and command pattern on personal computer.

8.2 Auto tuning

8.2.1 Auto tuning mode

The driver has a real-time auto tuning function which estimates the machine characteristic (load inertia moment ratio) in real time and automatically sets the optimum gains according to that value. This function permits ease of gain adjustment of the driver.

(1) Auto tuning mode 1

The driver is factory-set to the auto tuning mode 1.

In this mode, the load inertia moment ratio of a machine is always estimated to set the optimum gains automatically.

The following parameters are automatically adjusted in the auto tuning mode 1.

Parameter No.	Abbreviation	Name
PB06	GD2	Ratio of load inertia moment to servo motor inertia moment
PB07	PG1	Model loop gain
PB08	PG2	Position loop gain
PB09	VG2	Speed loop gain
PB10	VIC	Speed integral compensation

POINT

- The auto tuning mode 1 may not be performed properly if the following conditions are not satisfied.
- Time to reach 2000r/min is the acceleration/deceleration time constant of 5s or less.
- Speed is 150r/min or higher.
- The ratio of load inertia moment to servo motor inertia moment is 100 times or less.
- The acceleration/deceleration torque is 10% or more of the rated torque.
- Under operating conditions which will impose sudden disturbance torque during acceleration/deceleration or on a machine which is extremely loose, auto tuning may not function properly, either. In such cases, use the auto tuning mode 2 or manual mode to make gain adjustment.

(2) Auto tuning mode 2

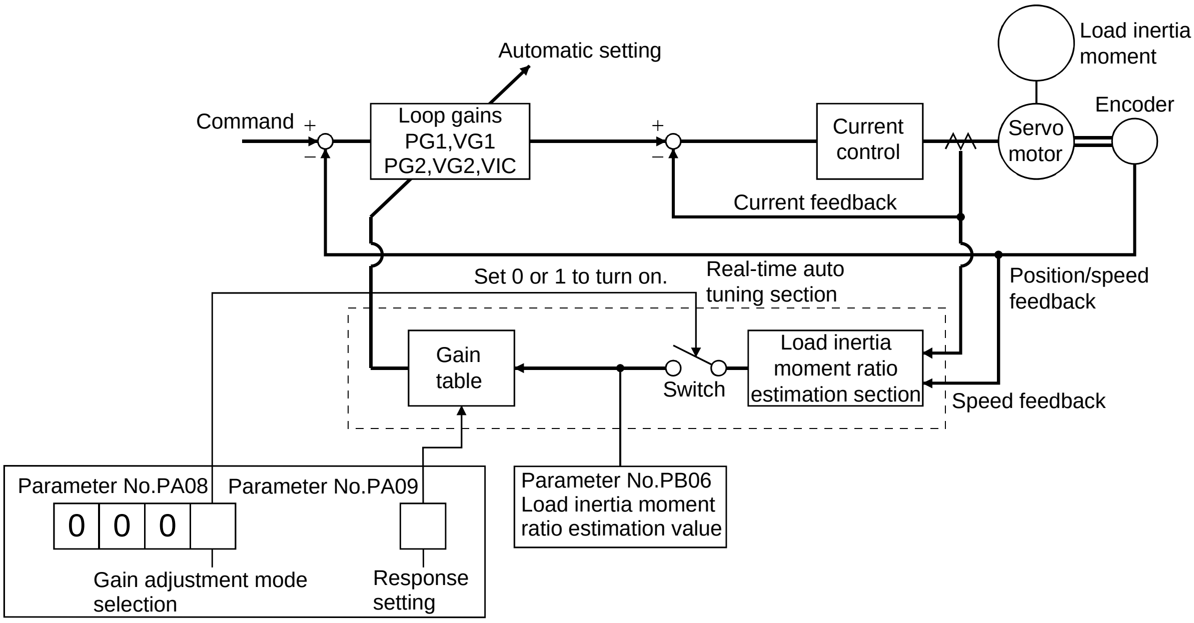
Use the auto tuning mode 2 when proper gain adjustment cannot be made by auto tuning mode 1. Since the load inertia moment ratio is not estimated in this mode, set the value of a correct load inertia moment ratio (parameter No.PB06).

The following parameters are automatically adjusted in the auto tuning mode 2.

Parameter No.	Abbreviation	Name
PB07	PG1	Model loop gain
PB08	PG2	Position loop gain
PB09	VG2	Speed loop gain
PB10	VIC	Speed integral compensation

8.2.2 Auto tuning mode operation

The block diagram of real-time auto tuning is shown below.



When a servo motor is accelerated/decelerated, the load inertia moment ratio estimation section always estimates the load inertia moment ratio from the current and speed of the servo motor. The results of estimation are written to parameter No.PB06 (the ratio of load inertia moment to servo motor). These results can be confirmed on the status display screen of the set up software (MR Configurator) section.

If the value of the load inertia moment ratio is already known or if estimation cannot be made properly, chose the "auto tuning mode 2" (parameter No.PA08: 0002) to stop the estimation of the load inertia moment ratio (Switch in above diagram turned off), and set the load inertia moment ratio (parameter No.34) manually.

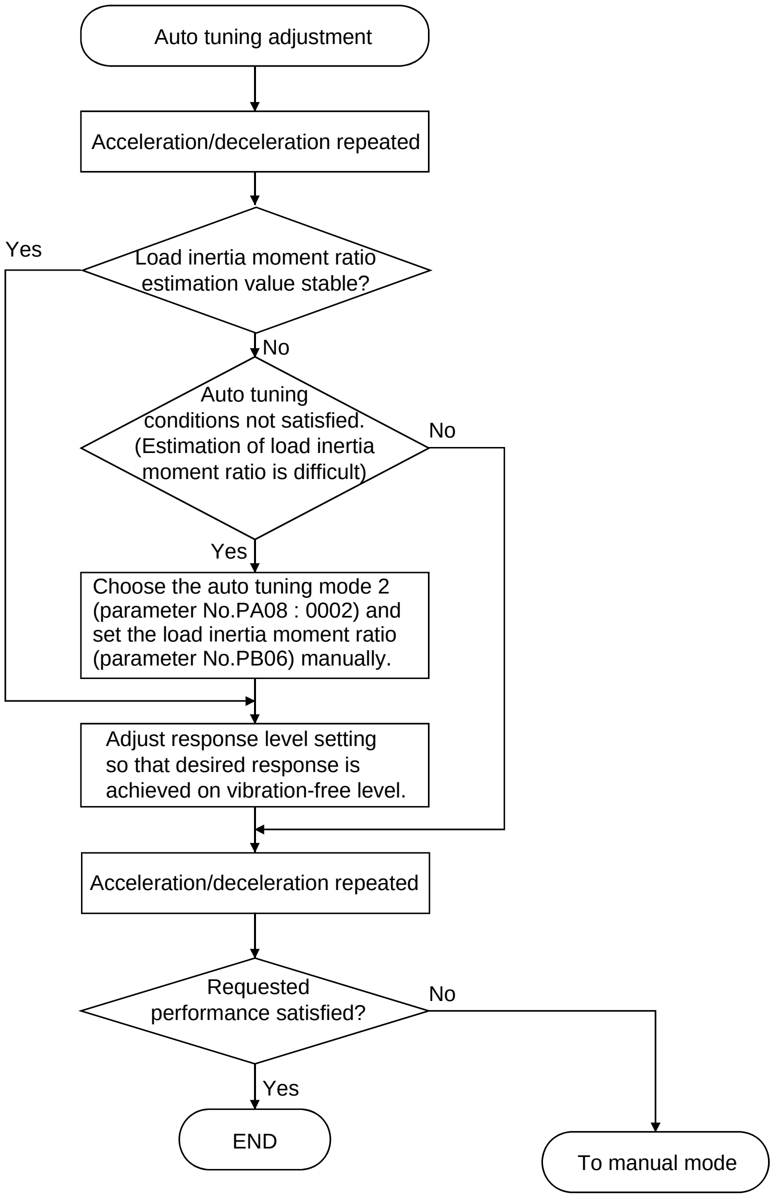
From the preset load inertia moment ratio (parameter No.PB06) value and response level (parameter No.PA09), the optimum loop gains are automatically set on the basis of the internal gain tale.

The auto tuning results are saved in the EEP-ROM of the driver every 60 minutes since power-on. At power-on, auto tuning is performed with the value of each loop gain saved in the EEP-ROM being used as an initial value.

POINT
・If sudden disturbance torque is imposed during operation, the estimation of the inertia moment ratio may malfunction temporarily. In such a case, choose the "auto tuning mode 2" (parameter No.PA08: 0002) and set the correct load inertia moment ratio in parameter No.PB06. ・When any of the auto tuning mode 1 and auto tuning mode settings is changed to the manual mode 2 setting, the current loop gains and load inertia moment ratio estimation value are saved in the EEP-ROM.

8.2.3 Adjustment procedure by auto tuning

Since auto tuning is made valid before shipment from the factory, simply running the servo motor automatically sets the optimum gains that match the machine. Merely changing the response level setting value as required completes the adjustment. The adjustment procedure is as follows.



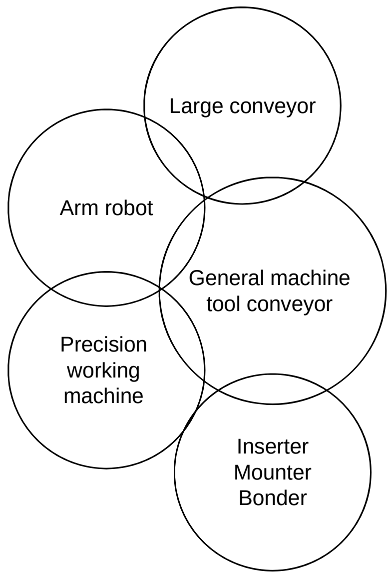
8.2.4 Response level setting in auto tuning mode

Set the response (The first digit of parameter No.PA09) of the whole servo system. As the response level setting is increased, the track ability and settling time for a command decreases, but a too high response level will generate vibration. Hence, make setting until desired response is obtained within the vibration-free range.

If the response level setting cannot be increased up to the desired response because of machine resonance beyond 100Hz, filter tuning mode (parameter No.PB01) or machine resonance suppression filter (parameter No.PB13 to PB16) may be used to suppress machine resonance. Suppressing machine resonance may allow the response level setting to increase. Refer to section 9.3 for filter tuning mode and machine resonance suppression filter.

Setting of parameter No.PA09

Response level setting	Machine characteristic		
	Machine rigidity	Machine resonance frequency guideline	Guideline of corresponding machine
1	Low	10.0	
2		11.3	
3		12.7	
4		14.3	
5		16.1	
6		18.1	
7		20.4	
8		23.0	
9		25.9	
10		29.2	
11		32.9	
12		37.0	
13		41.7	
14		47.0	
15		52.9	
16	Middle	59.6	
17		67.1	
18		75.6	
19		85.2	
20		95.9	
21		108.0	
22		121.7	
23		137.1	
24		154.4	
25		173.9	
26		195.9	
27		220.6	
28		248.5	
29		279.9	
30		315.3	
31		355.1	
32	High	400.0	



8.3 Manual mode 1 (simple manual adjustment)

If you are not satisfied with the adjustment of auto tuning, you can make simple manual adjustment with three parameters.

POINT
· If machine resonance occurs, filter tuning mode (parameter No.PB01) or machine resonance suppression filter (parameter No.PB13 to PB16) may be used to suppress machine resonance. (Refer to section 9.1.)

(1) For speed control

(a) Parameters

The following parameters are used for gain adjustment.

Parameter No.	Abbreviation	Name
PB06	GD2	Ratio of load inertia moment to servo motor inertia moment
PB07	PG1	Model loop gain
PB09	VG2	Speed loop gain
PB10	VIC	Speed integral compensation

(b) Adjustment procedure

Step	Operation	Description
1	Brief-adjust with auto tuning. Refer to section 8.2.3.	
2	Change the setting of auto tuning to the manual mode (Parameter No.PA08: 0003).	
3	Set an estimated value to the ratio of load inertia moment to servo motor inertia moment. (If the estimate value with auto tuning is correct, setting change is not required.)	
4	Set a slightly smaller value to the model loop gain Set a slightly larger value to the speed integral compensation.	
5	Increase the speed loop gain within the vibration- and unusual noise-free range, and return slightly if vibration takes place.	Increase the speed loop gain.
6	Decrease the speed integral compensation within the vibration-free range, and return slightly if vibration takes place.	Decrease the time constant of the speed integral compensation.
7	Increase the model loop gain, and return slightly if overshooting takes place.	Increase the model loop gain.
8	If the gains cannot be increased due to mechanical system resonance or the like and the desired response cannot be achieved, response may be increased by suppressing resonance with filter tuning mode or machine resonance suppression filter and then executing steps 2 and 3.	Suppression of machine resonance. Refer to section 9.2, 9.3.
9	While checking the settling characteristic and rotational status, fine-adjust each gain.	Fine adjustment

(c) Adjustment description

1) Speed loop gain (parameter No.PB09)

This parameter determines the response level of the speed control loop. Increasing this value enhances response but a too high value will make the mechanical system liable to vibrate. The actual response frequency of the speed loop is as indicated in the following expression.

$$\text{Speed loop response frequency(Hz)} = \frac{\text{Speed loop gain setting}}{(1+\text{ratio of load inertia moment to servo motor inertia moment}) \times 2\pi}$$

2) Speed integral compensation (VIC: parameter No.PB10)

To eliminate stationary deviation against a command, the speed control loop is under proportional integral control. For the speed integral compensation, set the time constant of this integral control. Increasing the setting lowers the response level. However, if the load inertia moment ratio is large or the mechanical system has any vibratory element, the mechanical system is liable to vibrate unless the setting is increased to some degree. The guideline is as indicated in the following expression.

$$\text{Speed integral compensation setting(ms)} \geq \frac{\text{2000 to 3000}}{\text{Speed loop gain setting/}(1+\text{ratio of load inertia moment to servo motor inertia moment setting}\times 0.1)}$$

3) Model loop gain (PG1: Parameter No.PB07)

This parameter determines the response level to a position command. Increasing the model loop gain improves track ability to a position command, but a too high value will make overshooting liable to occur at the time of setting.

$$\text{Model loop gain guideline} \leq \frac{\text{Speed loop gain setting}}{(1+\text{ratio of load inertia moment to servo mortar inertia moment})} \times \left(\frac{1}{4}\text{ to }\frac{1}{8}\right)$$

(2) For position control

(a) Parameters

The following parameters are used for gain adjustment.

Parameter No.	Abbreviation	Name
PB06	GD2	Ratio of load inertia moment to servo motor inertia moment
PB07	PG1	Model loop gain
PB08	PG2	Position loop gain
PB09	VG2	Speed loop gain
PB10	VIC	Speed integral compensation

(b) Adjustment procedure

Step	Operation	Description
1	Brief-adjust with auto tuning. Refer to section 8.2.3.	
2	Change the setting of auto tuning to the manual mode (Parameter No.PA08: 0003).	
3	Set an estimated value to the ratio of load inertia moment to servo motor inertia moment. (If the estimate value with auto tuning is correct, setting change is not required.)	
4	Set a slightly smaller value to the model loop gain and the position loop gain. Set a slightly larger value to the speed integral compensation.	
5	Increase the speed loop gain within the vibration- and unusual noise-free range, and return slightly if vibration takes place.	Increase the speed loop gain.
6	Decrease the speed integral compensation within the vibration-free range, and return slightly if vibration takes place.	Decrease the time constant of the speed integral compensation.
7	Increase the position loop gain, and return slightly if vibration takes place.	Increase the position loop gain.
8	Increase the model loop gain, and return slightly if overshooting takes place.	Increase the position loop gain.
9	If the gains cannot be increased due to mechanical system resonance or the like and the desired response cannot be achieved, response may be increased by suppressing resonance with filter tuning mode or machine resonance suppression filter and then executing steps 3 to 5.	Suppression of machine resonance. Refer to section 9.2・9.3.
10	While checking the settling characteristic and rotational status, fine-adjust each gain.	Fine adjustment.

(c) Adjustment description

1) Speed loop gain (VG2: parameter No.PB09)

This parameter determines the response level of the speed control loop. Increasing this value enhances response but a too high value will make the mechanical system liable to vibrate. The actual response frequency of the speed loop is as indicated in the following expression.

$$\text{Speed loop response frequency(Hz)} = \frac{\text{Speed loop gain 2 setting}}{(1+\text{ratio of load inertia moment to servo motor inertia moment})\times 2\pi}$$

2) Speed integral compensation (VIC: parameter No.PB10)

To eliminate stationary deviation against a command, the speed control loop is under proportional integral control. For the speed integral compensation, set the time constant of this integral control. Increasing the setting lowers the response level. However, if the load inertia moment ratio is large or the mechanical system has any vibratory element, the mechanical system is liable to vibrate unless the setting is increased to some degree. The guideline is as indicated in the following expression.

$$\text{Speed integral compensation setting(ms)} \geq \frac{\text{2000 to 3000}}{\text{Speed loop gain 2 setting}/(1+\text{ratio of load inertia moment to servo motor inertia moment 2 setting})}$$

3) Model loop gain (PG1: Parameter No.PB07)

This parameter determines the response level to a position command. Increasing the model loop gain improves track ability to a position command, but a too high value will make overshooting liable to occur at the time of setting.

$$\text{Model control gain guideline} \leq \frac{\text{Speed loop gain setting}}{(1+\text{ratio of load inertia moment to servo mortar inertia moment})}\times\left(\frac{1}{4}\text{ to }\frac{1}{8}\right)$$

4) Model loop gain (PG1: parameter No.PB07)

This parameter determines the response level to a position command. Increasing model loop gain improves track ability to a position command but a too high value will make overshooting liable to occur at the time of settling.

$$\text{Model loop gain guideline} \leq \frac{\text{Speed loop gain 2 setting}}{(1+\text{ratio of load inertia moment to servo motor inertia moment})}\times\left(\frac{1}{4}\text{ to }\frac{1}{8}\right)$$

8.4 Interpolation mode

The interpolation mode is used to match the position loop gains of the axes when performing the interpolation operation of servo motors of two or more axes for an X-Y table or the like. In this mode, manually set the model loop gain that determines command track ability. Other parameters for gain adjustment are set automatically.

(1) Parameter

(a) Automatically adjusted parameters

The following parameters are automatically adjusted by auto tuning.

Parameter No.	Abbreviation	Name
PB06	GD2	Ratio of load inertia moment to servo motor inertia moment
PB08	PG2	Position loop gain
PB09	VG2	Speed loop gain
PB10	VIC	Speed integral compensation

(b) Manually adjusted parameters

The following parameters are adjustable manually.

Parameter No.	Abbreviation	Name
PB07	PG1	Model loop gain

(2) Adjustment procedure

Step	Operation	Description
1	Set to the auto tuning mode.	Select the auto tuning mode 1.
2	During operation, increase the response level setting (parameter No.PA09), and return the setting if vibration occurs.	Adjustment in auto tuning mode 1.
3	Check the values of model loop gain.	Check the upper setting limits.
4	Set the interpolation mode (parameter No.PA08: 0000).	Select the interpolation mode.
5	Set the model loop gain of all the axes to be interpolated to the same value. At that time, adjust to the setting value of the axis, which has the smallest model loop gain.	Set position loop gain.
6	Looking at the interpolation characteristic and rotation status, fine-adjust the gains and response level setting.	Fine adjustment.

(3) Adjustment description

(a) Model loop gain (parameter No.PB07)

This parameter determines the response level of the position control loop. Increasing model loop gain improves track ability to a position command but a too high value will make overshooting liable to occur at the time of settling. The droop pulse value is determined by the following expression.

$$\text{Droop pulse value (pulse)} = \frac{\dfrac{\text{Rotation speed (r/min)}}{60} \times 262144\text{(pulse)}}{\text{Model loop gain setting}}$$

9. SPECIAL ADJUSTMENT FUNCTIONS

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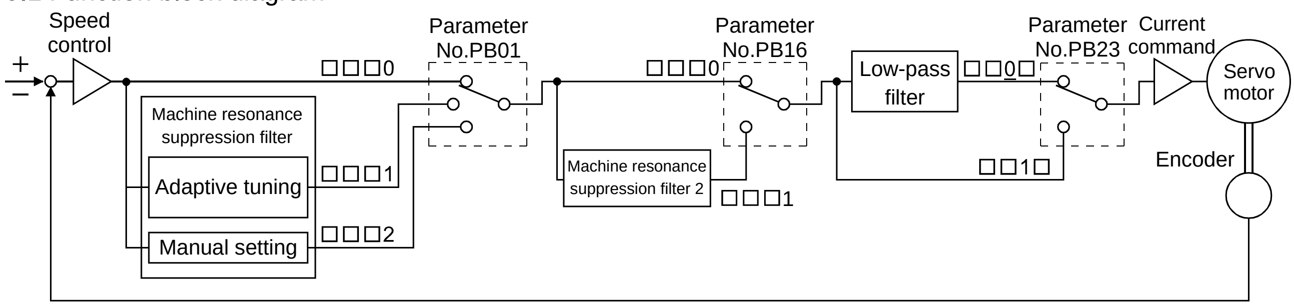
9. SPECIAL ADJUSTMENT FUNCTIONS

POINT

- The functions given in this chapter need not be used generally. Use them if you are not satisfied with the machine status after making adjustment in the methods in chapter 8.

If a mechanical system has a natural resonance point, increasing the servo system response level may cause the mechanical system to produce resonance (vibration or unusual noise) at that resonance frequency.
Using the machine resonance suppression filter and adaptive tuning can suppress the resonance of the mechanical system.

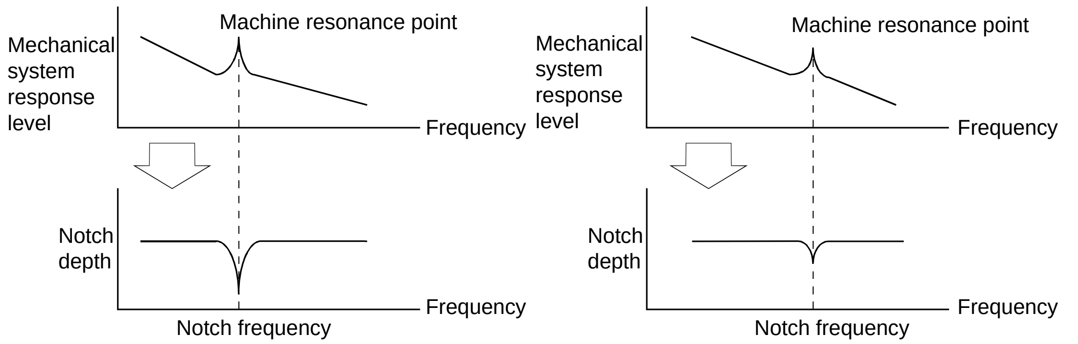
9.1 Function block diagram



9.2 Adaptive filter Ⅱ

(1) Function

Adaptive filter Ⅱ (adaptive tuning) is a function in which the driver detects machine vibration for a predetermined period of time and sets the filter characteristics automatically to suppress mechanical system vibration. Since the filter characteristics (frequency, depth) are set automatically, you need not be conscious of the resonance frequency of a mechanical system.



When machine resonance is large and frequency is low   When machine resonance is small and frequency is high

POINT

- The machine resonance frequency which adaptive tuning mode can respond to is about 100 to 2.25kHz. Adaptive vibration suppression control has no effect on the resonance frequency outside this range.
- Adaptive vibration suppression control may provide no effect on a mechanical system which has complex resonance characteristics.

(2) Parameters

The operation of adaptive tuning mode (parameter No.PB01).

Parameter No.PB01

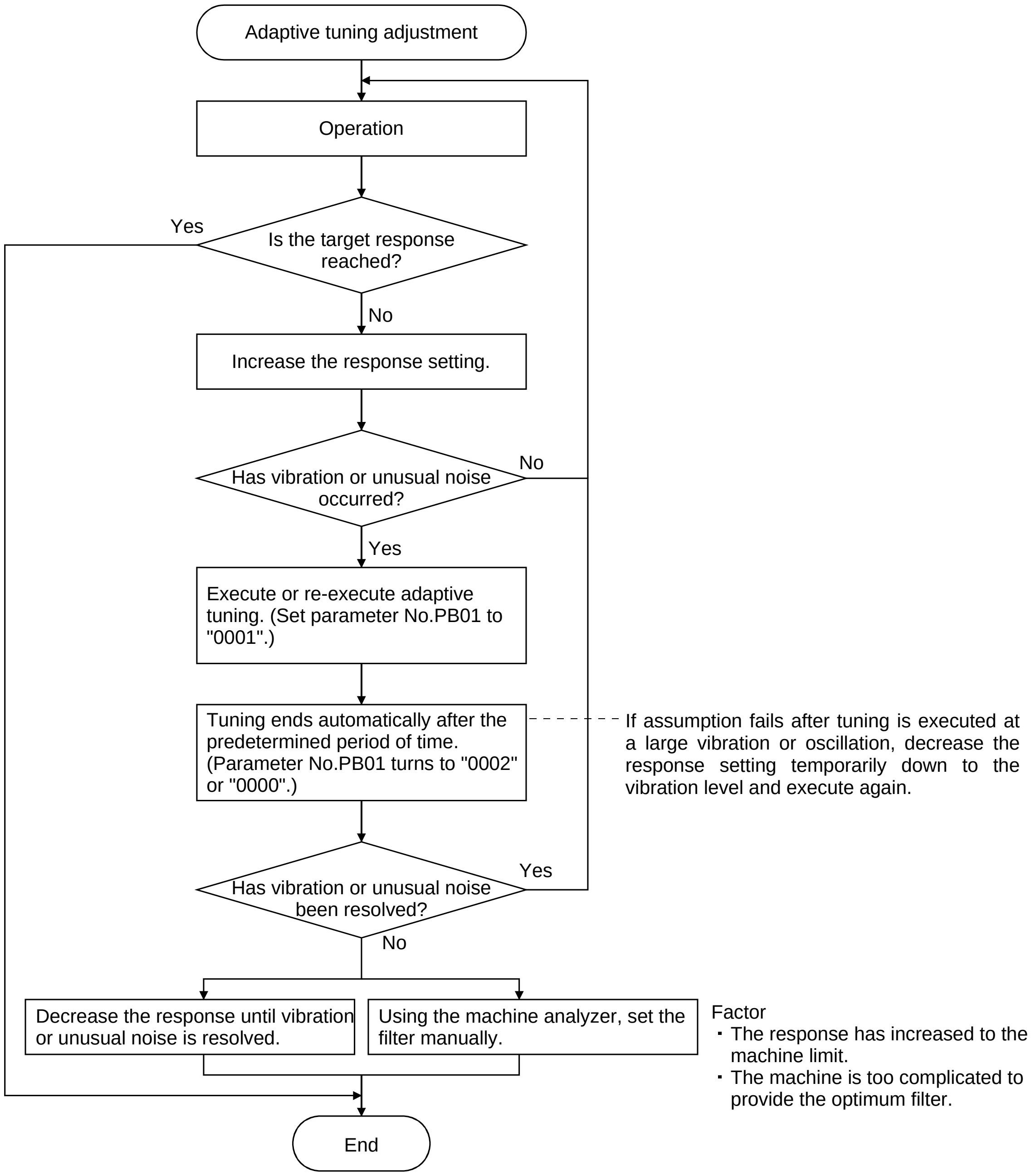
0	0	0	

Filter tuning mode selection

Setting	Filter adjustment mode	Automatically set parameter
0	Filter OFF	(Note)
1	Filter tuning mode	Parameter No.PB13 Parameter No.PB14
2	Manual mode	

Note. Parameter No.PB19 and PB20 are fixed to the initial values.

(3) Adaptive tuning mode procedure



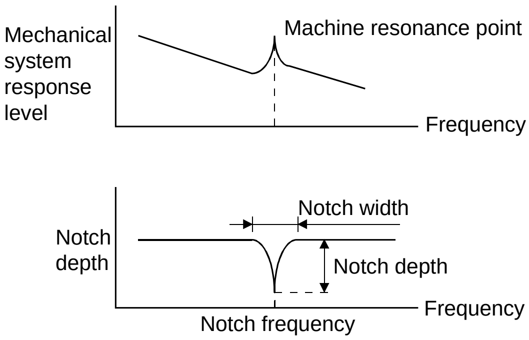
POINT

- "Filter OFF" enables a return to the factory-set initial value.
- When adaptive tuning is executed, vibration sound increases as an excitation signal is forcibly applied for several seconds.
- When adaptive tuning is executed, machine resonance is detected for a maximum of 10 seconds and a filter is generated. After filter generation, the adaptive tuning mode automatically shifts to the manual mode.
- Adaptive tuning generates the optimum filter with the currently set control gains. If vibration occurs when the response setting is increased, execute adaptive tuning again.
- During adaptive tuning, a filter having the best notch depth at the set control gain is generated. To allow a filter margin against machine resonance, increase the notch depth in the manual mode.

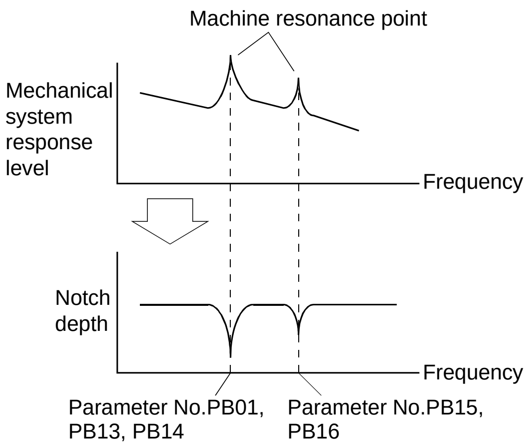
9.3 Machine resonance suppression filter

(1) Function

The machine resonance suppression filter is a filter function (notch filter) which decreases the gain of the specific frequency to suppress the resonance of the mechanical system. You can set the gain decreasing frequency (notch frequency), gain decreasing depth and width.



You can use the machine resonance suppression filter 1 (parameter No.PB13, PB14) and machine resonance suppression filter 2 (parameter No.PB15, PB16) to suppress the vibration of two resonance frequencies. Execution of adaptive tuning in the filter tuning mode automatically adjusts the machine resonance suppression filter. When adaptive tuning is ON, the adaptive tuning mode shifts to the manual mode after the predetermined period of time. The manual mode enables manual setting using the machine resonance suppression filter 1.



(2) Parameters

(a) Machine resonance suppression filter 1 (parameter No.PB13, PB14)

Set the notch frequency, notch depth and notch width of the machine resonance suppression filter 1 (parameter No.PB13, PB14)

When you have made adaptive filter tuning mode (parameter No.PB01) "manual mode", set up the machine resonance suppression filter 1 becomes effective.

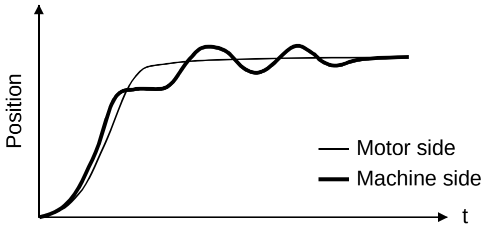
POINT

- The machine resonance suppression filter is a delay factor for the servo system. Hence, vibration may increase if you set a wrong resonance frequency or a too deep notch.
- If the frequency of machine resonance is unknown, decrease the notch frequency from higher to lower ones in order. The optimum notch frequency is set at the point where vibration is minimal.
- A deeper notch has a higher effect on machine resonance suppression but increases a phase delay and may increase vibration.
- A deeper notch has a higher effect on machine resonance suppression but increases a phase delay and may increase vibration.
- The machine characteristic can be grasped beforehand by the machine analyzer on the set up software(MR Configurator). This allows the required notch frequency and depth to be determined.

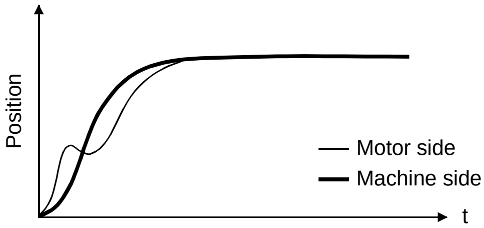
9.4 Advanced vibration suppression control

(1) Operation

Vibration suppression control is used to further suppress machine side vibration, such as workpiece end vibration and base shake. The motor side operation is adjusted for positioning so that the machine does not shake.



Vibration suppression control OFF
(Nomal control)



Vibration suppression control ON

When the advanced vibration suppression control (vibration suppression control tuning mode parameter No.PB02) is executed, the vibration frequency at machine side can automatically be estimated to suppress machine side vibration.

In the vibration suppression control tuning mode, this mode shifts to the manual mode after operation is performed the predetermined number of times. The manual mode enables manual setting using the vibration suppression control vibration frequency setting (parameter No.PB19) and vibration suppression control resonance frequency setting (parameter No.PB20).

(2) Parameter

Select the operation of the vibration suppression control tuning mode (parameter No.PB02).

Parameter No.PB02

0	0	0	

Vibration suppression control tuning mode

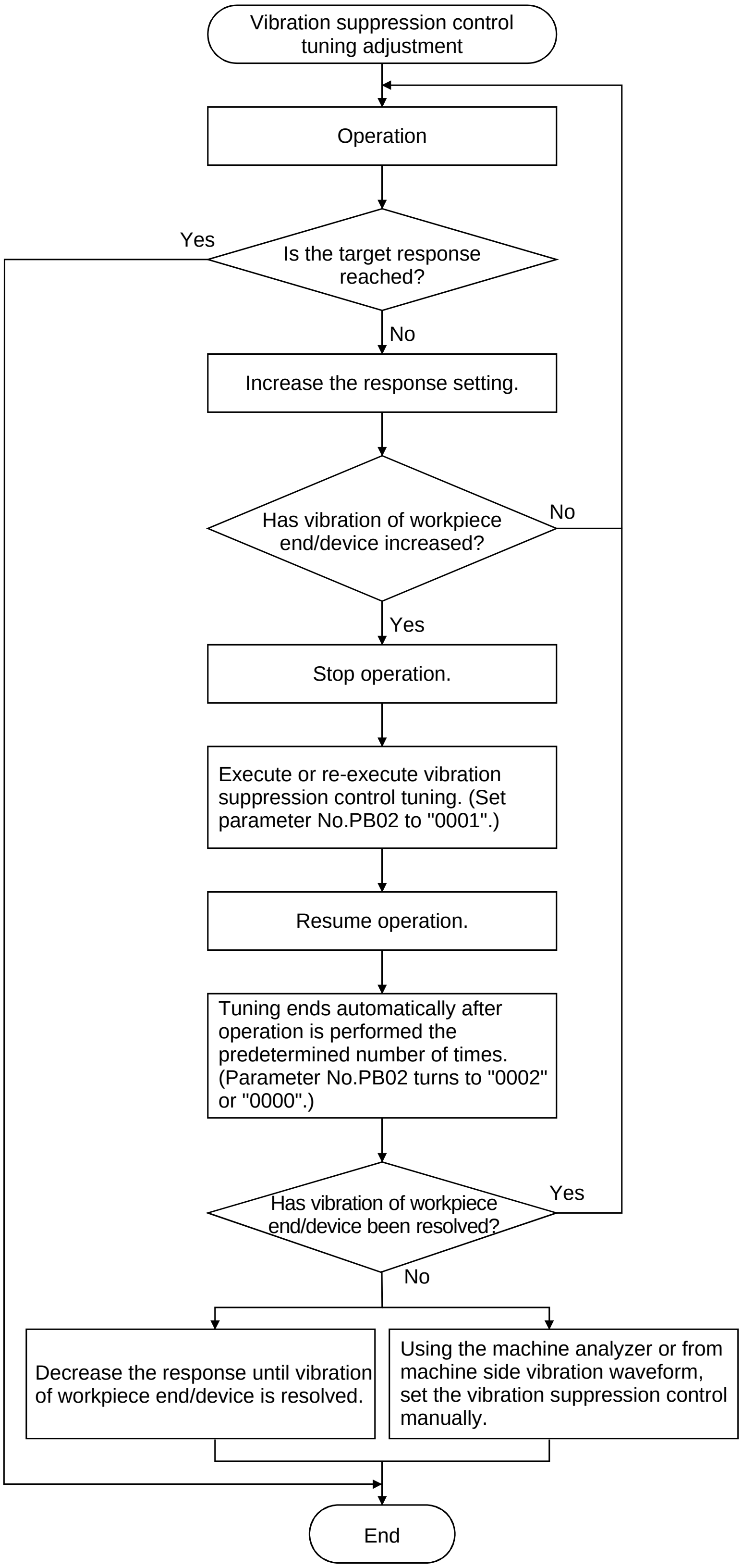
Setting	Vibration suppression control tuning mode	Automatically set parameter
0	Vibration suppression control OFF	(Note)
1	Vibration suppression control tuning mode (Advanced vibration suppression control)	Parameter No.PB19 Parameter No.PB20
2	Manual mode	

Note. Parameter No.PB19 and PB20 are fixed to the initial values.

POINT

- The function is made valid when the auto tuning mode (parameter No.PA08) is the auto tuning mode 2 ("0002") or manual mode ("0003").
- The machine resonance frequency supported in the vibration suppression control tuning mode is 1.0Hz to 100.0Hz. The function is not effective for vibration outside this range.
- Stop the motor before changing the vibration suppression control-related parameters (parameter No.PB02, PB19, PB20, PB33, PB34). A failure to do so will cause a shock.
- For positioning operation during execution of vibration suppression control tuning, provide a stop time to ensure a stop after full vibration damping.
- Vibration suppression control tuning may not make normal estimation if the residual vibration at the motor side is small.
- Vibration suppression control tuning sets the optimum parameter with the currently set control gains. When the response setting is increased, set vibration suppression control tuning again.

(3) Vibration suppression control tuning mode procedure

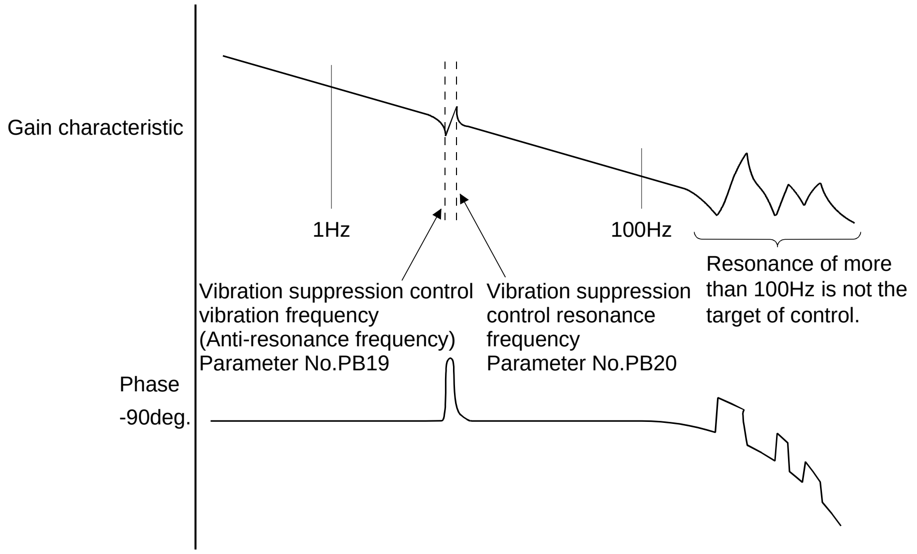


Factor
- Estimation cannot be made as machine side vibration has not been transmitted to the motor side.
- The response of the model loop gain has increased to the machine side vibration frequency (vibration suppression control limit).

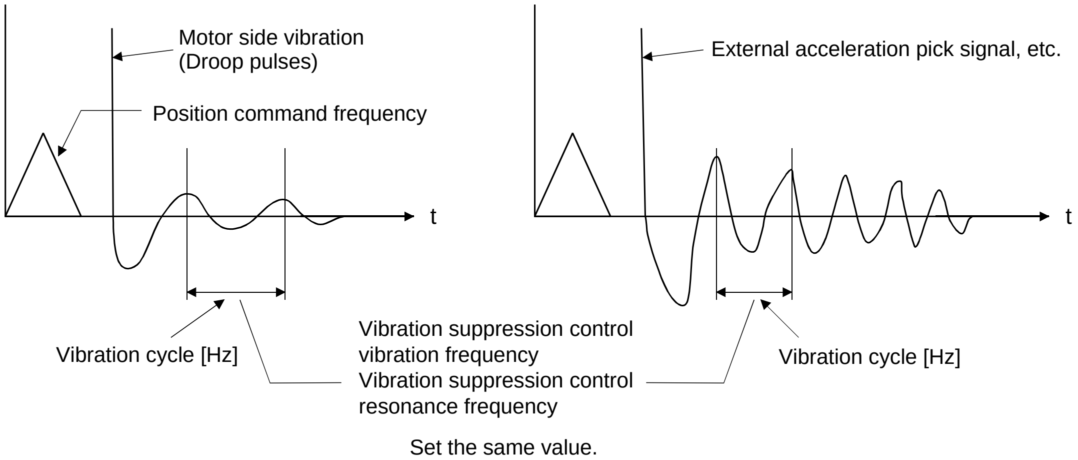
(4) Vibration suppression control manual mode

Measure work side vibration and device shake with the machine analyzer or external measuring instrument, and set the vibration suppression control vibration frequency (parameter No.PB19) and vibration suppression control resonance frequency (parameter No.PB20) to set vibration suppression control manually.

(a) When a vibration peak can be confirmed using set up software (MR Configurator), machine analyzer or external FFT equipment



(b) When vibration can be confirmed using monitor signal or external sensor



POINT

- When machine side vibration does not show up in motor side vibration, the setting of the motor side vibration frequency does not produce an effect.
- When the anti-resonance frequency and resonance frequency can be confirmed using the machine analyzer or external FFT device, do not set the same value but set different values to improve the vibration suppression performance.
- A vibration suppression control effect is not produced if the relationship between the model loop gain (parameter No.PB07) value and vibration frequency is as indicated below. Make setting after decreasing PG1, e.g. reduce the response setting.

$$\frac{1}{2\pi}(1.5 \times PG1) > \text{vibration frequency}$$

9.5 Low-pass filter

(1) Function

When a ball screw or the like is used, resonance of high frequency may occur as the response level of the servo system is increased. To prevent this, the low-pass filter is factory-set to be valid for a torque command. The filter frequency of this low-pass filter is automatically adjusted to the value in the following expression.

$$\text{Filter frequency(rad/s)} = \frac{\text{VG2}}{1 + \text{GD2}} \times 10$$

When parameter No.PB23 is set to " □□1□ ", manual setting can be made with parameter No.PB18.

(2) Parameter

Set the operation of the low-pass filter selection (parameter No.PB23.)

Parameter No.PB23

Low-pass filter selection
0: Automatic setting (initial value)
1: Manual setting (parameter No.PB18 setting)

9.6 Gain changing function

This function can change the gains. You can change between gains during rotation and gains during stop or can use an input device to change gains during operation.

9.6.1 Applications

This function is used when.

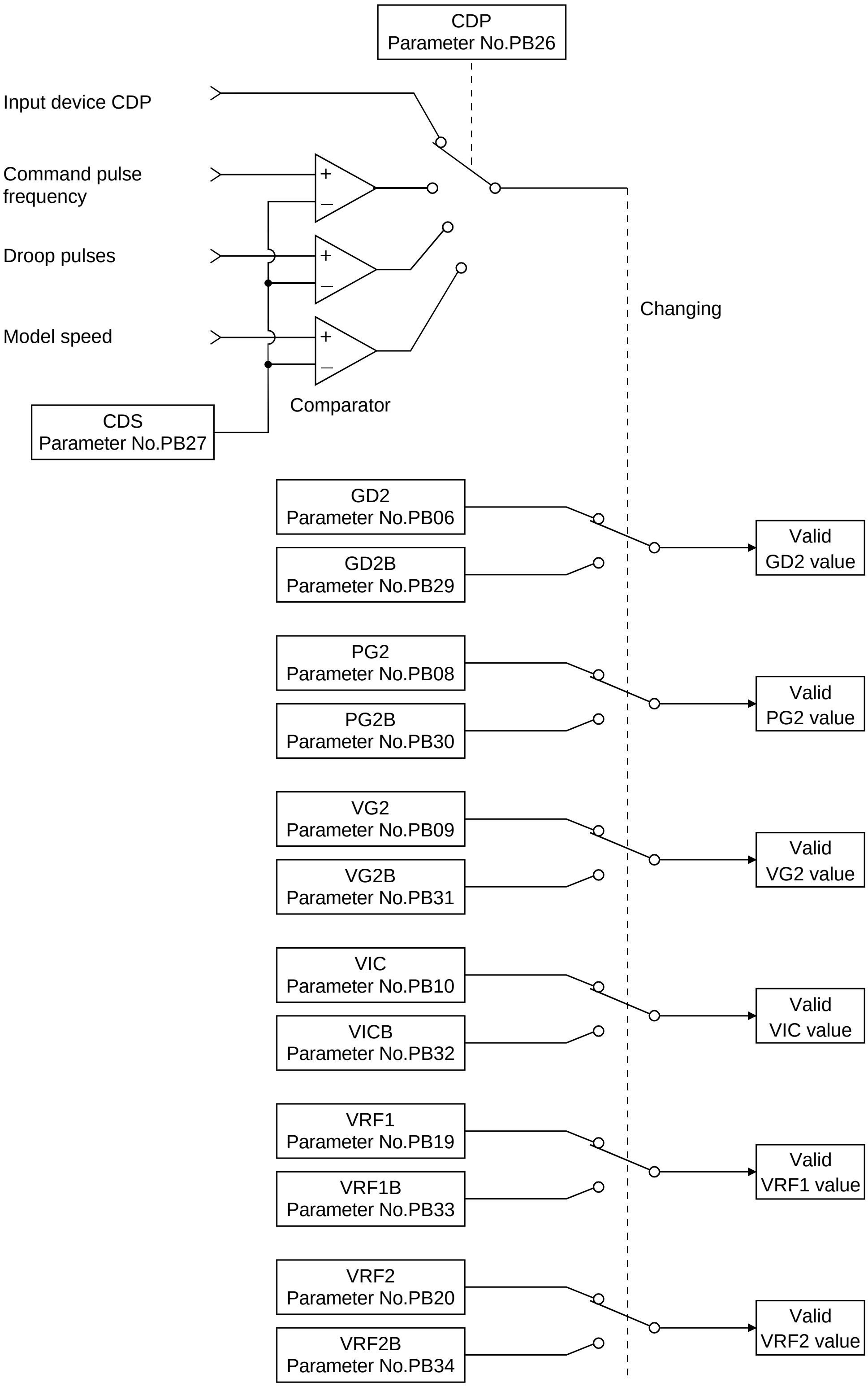
(1) You want to increase the gains during servo lock but decrease the gains to reduce noise during rotation.

(2) You want to increase the gains during settling to shorten the stop settling time.

(3) You want to change the gains using an input device to ensure stability of the servo system since the load inertia moment ratio varies greatly during a stop (e.g. a large load is mounted on a carrier).

9.6.2 Function block diagram

The valid loop gains PG2, VG2, VIC and GD2 of the actual loop are changed according to the conditions selected by gain changing selection CDP (parameter No.PB26) and gain changing condition CDS (parameter No.PB27).



9.6.3 Parameters

When using the gain changing function, always set "□□□3" in parameter No.PA08 (auto tuning) to choose the manual mode of the gain adjustment modes. The gain changing function cannot be used in the auto tuning mode.

Parameter No.	Abbreviation	Name	Unit	Description
PB06	GD2	Ratio of load inertia moment to servo motor inertia moment	Multi-plier (×1)	Control parameters before changing.
PB07	PG1	Model loop gain	rad/s	Position and speed gains of a model used to set the response level to a command. Always valid.
PB08	PG2	Position loop gain	rad/s	
PB09	VG2	Speed loop gain	rad/s	
PB10	VIC	Speed integral compensation	ms	
PB29	GD2B	Gain changing ratio of load inertia moment to servo motor inertia moment	Multi-plier (×1)	Used to set the ratio of load inertia moment to servo motor inertia moment after changing.
PB30	PG2B	Gain changing position loop gain	rad/s	Used to set the value of the after-changing position loop gain.
PB31	VG2B	Gain changing speed loop gain	rad/s	Used to set the value of the after-changing speed loop gain.
PB32	VICB	Gain changing speed integral compensation	ms	Used to set the value of the after-changing speed integral compensation.
PB26	CDP	Gain changing selection		Used to select the changing condition.
PB27	CDS	Gain changing condition	kpps pulse r/min	Used to set the changing condition values.
PB28	CDT	Gain changing time constant	ms	You can set the filter time constant for a gain change at changing.
PB33	VRF1B	Gain changing vibration suppression control vibration frequency setting	Hz	Used to set the value of the after-changing vibration suppression control vibration frequency setting.
PB34	VRF2B	Gain changing vibration suppression control resonance frequency setting	Hz	Used to set the value of the after-changing vibration suppression control resonance frequency setting.

(1) Parameters No.PB06 to PB10
These parameters are the same as in ordinary manual adjustment. Gain changing allows the values of ratio of load inertia moment to servo motor inertia moment, position loop gain, speed loop gain and speed integral compensation to be changed.

(2) Gain changing ratio of load inertia moment to servo motor inertia moment (GD2B: parameter No.PB29)
Set the ratio of load inertia moment to servo motor inertia moment after changing. If the load inertia moment ratio does not change, set it to the same value as ratio of load inertia moment to servo motor inertia moment (parameter No.PB06).

(3) Gain changing position loop gain (parameter No.PB30), Gain changing speed loop gain (parameter No.PB31), Gain changing speed integral compensation (parameter No.PB32)
Set the values of after-changing position loop gain, speed loop gain and speed integral compensation.

(4) Gain changing selection (parameter No.PB26)
Used to set the gain changing condition. Choose the changing condition in the first digit and second digit. If you set "1" in the first digit here, you can use the gain changing (RY(n＋2)) input device for gain changing.

0	0		

Gain changing selection
Under any of the following conditions, the gains change on the basis of the parameter No.PB29 to PB32 settings.
0: Invalid
1: Gain changing (RY(n+2)) is ON
2: Command frequency (Parameter No.PB27 setting)
3: Droop pulse value (Parameter No.PB27 setting)
4: Servo motor speed (Parameter No.PB27 setting)

Gain changing condition
0: Valid at more than condition (Valid when gain changing (RY(n+2) is ON)
1: Valid at less than condition (Valid when gain changing (RY(n+2) is OFF)

(5) Gain changing condition (parameter No.PB27)
When you selected "command frequency", "droop pulses" or "servo motor speed" in gain changing selection (parameter No.PB26), set the gain changing level.
The setting unit is as follows.

Gain changing condition	Unit
Command frequency	kpps
Droop pulses	pulse
Servo motor speed	r/min

(6) Gain changing time constant (parameter No.PB28)
You can set the primary delay filter to each gain at gain changing. This parameter is used to suppress shock given to the machine if the gain difference is large at gain changing, for example.

9.6.4 Gain changing operation

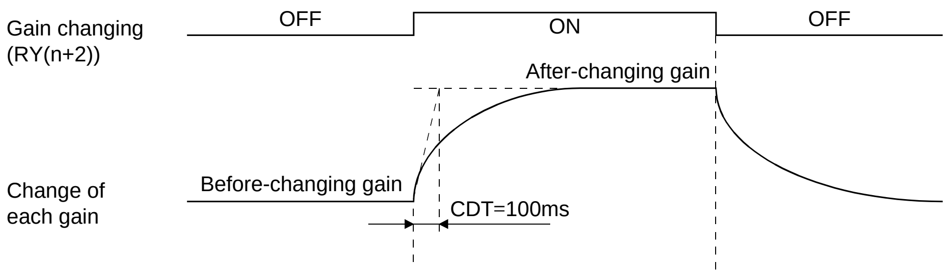
This operation will be described by way of setting examples.

(1) When you choose changing by input device

(a) Setting

Parameter No.	Abbreviation	Name	Setting	Unit
PB07	PG1	Model loop gain	100	rad/s
PB06	GD2	Ratio of load inertia moment to servo motor inertia moment	4.0	Multiplier (×1)
PB08	PG2	Position loop gain	120	rad/s
PB09	VG2	Speed loop gain	3000	rad/s
PB10	VIC	Speed integral compensation	20	ms
PB29	GD2B	Gain changing ratio of load inertia moment to servo motor inertia moment	10.0	Multiplier (×1)
PB30	PG2B	Gain changing position loop gain	84	rad/s
PB31	VG2B	Gain changing speed loop gain	4000	rad/s
PB32	VICB	Gain changing speed integral compensation	50	ms
PB26	CDP	Gain changing selection	0001 (Changed by ON/OFF of Input device)	
PB28	CDT	Gain changing time constant	100	ms
PB33	VRF1B	Gain changing vibration suppression control vibration frequency setting	Used to set the value of the after-changing vibration suppression control vibration frequency setting.	Hz
PB34	VRF2B	Gain changing vibration suppression control resonance frequency setting	Used to set the value of the after-changing vibration suppression control resonance frequency setting.	Hz

(b) Changing operation



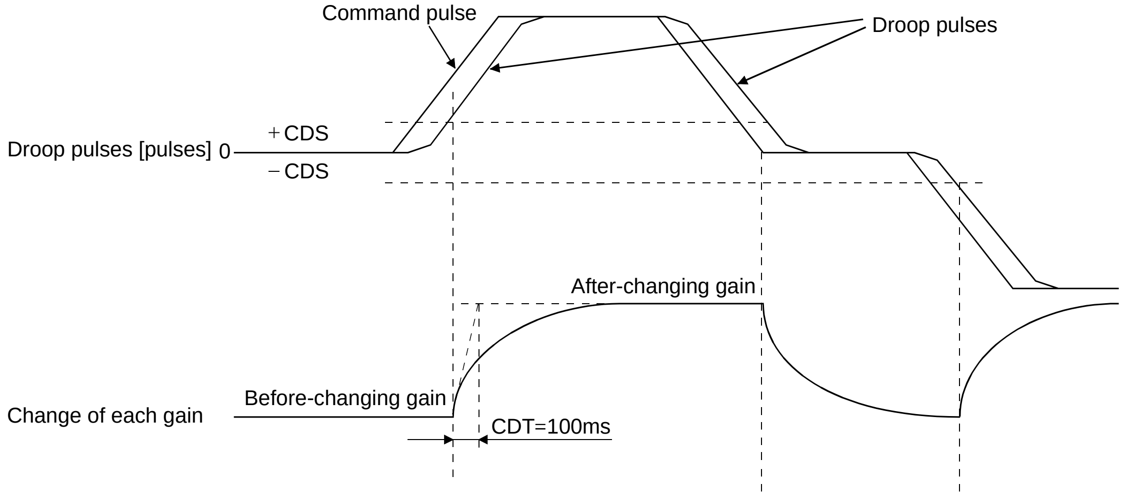
Model loop gain 1	100				
Ratio of load inertia moment to servo motor inertia moment	4.0	→	10.0	→	4.0
Position loop gain	120	→	84	→	120
Speed loop gain	3000	→	4000	→	3000
Speed integral compensation	20	→	50	→	20

(2) When you choose changing by droop pulses

(a) Setting

Parameter No.	Abbreviation	Name	Setting	Unit
PB07	PG1	Model loop gain	100	rad/s
PB06	GD2	Ratio of load inertia moment to servo motor inertia moment	4.0	Multiplier (×1)
PB08	PG2	Position loop gain	120	rad/s
PB09	VG2	Speed loop gain	3000	rad/s
PB10	VIC	Speed integral compensation	20	ms
PB29	GD2B	Gain changing ratio of load inertia moment to servo motor inertia moment	10.0	Multiplier (×1)
PB30	PG2B	Gain changing position loop gain	84	rad/s
PB31	VG2B	Gain changing speed loop gain	4000	rad/s
PB32	VICB	Gain changing speed integral compensation	50	ms
PB26	CDP	Gain changing selection	0003 (Changed by droop pulses)	
PB27	CDS	Gain changing condition	50	pulse
PB28	CDT	Gain changing time constant	100	ms

(b) Changing operation



Model loop gain	100						
Ratio of load inertia moment to servo motor inertia moment	4.0	→	10.0	→	4.0	→	10.0
Position loop gain	120	→	84	→	120	→	84
Speed loop gain	3000	→	4000	→	3000	→	4000
Speed integral compensation	20	→	50	→	20	→	50

10. TROUBLESHOOTING

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10. TROUBLESHOOTING

10.1 Trouble at start-up

⚠ CAUTION

- Excessive adjustment or change of parameter setting must not be made as it will make operation instable.

POINT

- Using the set up software(MR Configurator), you can refer to unrotated servo motor reasons, etc.

The following faults may occur at start-up. If any of such faults occurs, take the corresponding action.

No.	Start-up sequence	Fault	Investigation	Possible cause	Reference
1	Power on	・LED is not lit. ・LED flickers.	Not improved if connectors CN2, CN3 and CN6 are disconnected.	1. Power supply voltage fault 2. Driver is faulty.	
			Improved when connectors CN6 is disconnected.	Power supply of CN6 cabling is shorted.	
			Improved when connector CN2 is disconnected.	1. Power supply of encoder cabling is shorted. 2. Encoder is faulty.	
			Improved when connector CN3 is disconnected.	Power supply of CN3 cabling is shorted.	
		Alarm occurs.	Refer to section 14.4 and remove cause.		Section 10.4
2	Switch on servo-on (RYn0) signal.	Alarm occurs.	Refer to section 14.4 and remove cause.		Section 10.4
		Servo motor shaft is not servo-locked (is free).	1. Check the display to see if the driver is ready to operate. 2. Check the external I/O signal indication to see if the servo-on (RYn0) signal is ON.	1. Servo-on (RYn0) is not input. (Wiring mistake) 2. 24VDC power is not supplied to DICOM.	
3	Gain adjustment	Rotation ripples (speed fluctuations) are large at low speed.	Make gain adjustment in the following procedure. 1. Increase the auto tuning response level. 2. Repeat acceleration and deceleration several times to complete auto tuning.	Gain adjustment fault	Chapter 8
		Large load inertia moment causes the servo motor shaft to oscillate side to side.	If the servo motor may be run with safety, repeat acceleration and deceleration several times to complete auto tuning.	Gain adjustment fault	Chapter 8
4	Cyclic operation	Position shift occurs	Confirm the cumulative command pulses, cumulative feedback pulses and actual servo motor position.	Pulse counting error, etc. due to noise.	

10.2 Operation at error occurrence

An error occurring during operation will result in any of the statuses indicated in the following table.

Error location	Description	Operation mode	
		Test operation	CC-Link operation
Servo side alarm occurrence	Servo operation	Stop	Stop
	CC-Link data communication	Continued	Continued
Option unit communication error	Servo operation	Stop	Stop
	CC-Link data communication	Stop	Stop
CC-Link communication error	Servo operation	Stop	Stop
	CC-Link data communication	Stop	Stop
PC or PLC error/STOP	Servo operation	Continued	Stop
	CC-Link data communication	Stop	Stop
Servo side warning occurrence	Servo operation	Stop	Continued
	CC-Link data communication	Continued	Continued

10.3 CC-Link communication error

This section gives the definitions of the indications given in the communication alarm display section.
The driver has four LED indications.

L.RUN : Lit at normal receive of refresh data. Extinguished when data is not received for a given period of time.
SD : Lit when send data is "0".
RD : Lit when the carrier of receive data is detected.
L.ERR : Lit when the data addressed to the host is in CRC or abort error.

(Note) Communication alarm display LED				Operation
L.RUN	SD	RD	L.ERR	
○	◎	◎	◎	Normal communication is made, but a CRC error sometimes occurs due to noise.
○	◎	◎	●	Normal communication
○	◎	●	◎	Hardware fault
○	◎	●	●	Hardware fault
○	●	◎	◎	Receive data results in CRC error, disabling a response.
○	●	◎	●	Data does not reach the host.
○	●	●	◎	Hardware fault
○	●	●	●	Hardware fault
●	◎	◎	◎	Polling response is made, but refresh receive is in CRC error.
●	◎	◎	●	Hardware fault
●	◎	●	◎	Hardware fault
●	◎	●	●	Hardware fault
●	●	◎	◎	Data addressed to the host resulted in CRC error.
●	●	◎	●	Data does not reach the host, or the data addressed to the host cannot be received due to noise.
●	●	●	◎	Hardware fault
●	●	●	○	Baud rate setting illegal
●	●	○	○	Station number setting illegal
●	○	○	◎	Baud rate or station number setting changed midway (ERROR flickers for about 4s)
●	●	●	●	Data cannot be received due to power-off, power supply failure, open cable, etc. WDT error occurrence (hardware fault)

Note. ○ : Lit ● : Extinguished ◎ : Flicker

10.4 When alarm or warning has occurred

POINT
・Configure up a circuit which will detect the trouble (ALM) signal and turn off the servo-on (RYn0) at occurrence of an alarm.

10.4.1 Alarms and warning list

When a fault occurs during operation, the corresponding alarm or warning is displayed. If any alarm or warning has occurred, refer to section 10.4.2 or 10.4.3 and take the appropriate action. When an alarm occurs, ALM turns off.

After its cause has been removed, the alarm can be deactivated in any of the methods marked ○ in the alarm deactivation column.

	Display	Name	Alarm deactivation: Power OFF→ON	Alarm deactivation: (Note3) MR Configurator parameter unit	Alarm deactivation: (Note2) Alarm reset (RES)
Alarms	A10	Undervoltage	○	○	○
	A12	Memory error 1 (RAM)	○		
	A13	Clock error	○		
	A15	Memory error 2 (EEP-ROM)	○		
	A16	Encoder error 1 (At power on)	○		
	A17	Board error	○		
	A19	Memory error 3 (Flash-ROM)	○		
	A1A	Motor combination error	○		
	A20	Encoder error 2 (during runtime)	○		
	A21	Encoder error 3 (during runtime)	○		
	A24	Main circuit error	○	○	○
	A25	Absolute position erase	○		
	A30	Regenerative error	(Note 1) ○	(Note 1) ○	(Note 1) ○
	A31	Overspeed	○	○	○
	A32	Overcurrent	○		
	A33	Overvoltage	○	○	○
	A35	Command pulse frequency alarm	○	○	○
	A37	Parameter error	○		
	A45	Main circuit device overheat	(Note 1) ○	(Note 1) ○	(Note 1) ○
	A46	Servo motor overheat	(Note 1) ○	(Note 1) ○	(Note 1) ○
	A47	Cooling fan alarm	○		
	A50	Overload 1	(Note 1) ○	(Note 1) ○	(Note 1) ○
	A51	Overload 2	(Note 1) ○	(Note 1) ○	(Note 1) ○
	A52	Error excessive	○	○	○
	A61	Operation alarm	○	○	○
	A8A	Serial communication time-out	○	○	○
	A8D	CC-Link alarm	○	○	○
	A8E	Serial communication error	○	○	○
	888	Watchdog	○		

	Display	Name
Warnings	A90	Home positioning incomplete warning
	A92	Open battery cable warning
	A96	Home position setting error
	A98	Software limit warning
	A99	Stroke limit warning
	A9D	CC-Link warning 1
	A9E	CC-Link warning 2
	A9F	Battery warning
	AE0	Excessive regeneration warning
	AE1	Overload warning 1
	AE3	Absolute position counter warning
	AE6	Servo emergency stop warning
	AE8	Cooling fan speed reduction warning
	AE9	Main circuit off warning
	AEC	Overload warning 2
	AED	Output watt excess warning

Note 1. Deactivate the alarm about 30 minutes of cooling time after removing the cause of occurrence.
2. Turns on RY(n+1)A or RY(n+3)A.
3. Clicking the "Alarm reset" button on the "Alarm display" screen of set up software (MR Configurator) allows an alarm to be deactivated. Pressing the "STOP RESET" key of the parameter unit allows an alarm to be deactivated.

10.4.2 Remedies for alarms

⚠ CAUTION	・When any alarm has occurred, eliminate its cause, ensure safety, then reset the alarm, and restart operation. Otherwise, injury may occur. ・If an absolute position erase (A25) occurred, always make home position setting again. Not doing so may cause unexpected operation. ・As soon as an alarm occurs, turn off Servo-on (RYn0) and power off.

POINT

- When any of the following alarms has occurred, do not deactivate the alarm and resume operation repeatedly. To do so will cause the driver/servo motor to fail. Remove the cause of occurrence, and leave a cooling time of more than 30 minutes before resuming operation.
  - Regenerative error (A30)
  - Overload 1 (A50)
  - Overload 2 (A51)
- For the alarm deactivation method, refer to section 10.4.1.

When an alarm occurs, the trouble (ALM) switches off and the dynamic brake is operated to stop the servo motor. At this time, the display indicates the alarm No.
The servo motor comes to a stop. Remove the cause of the alarm in accordance with this section. Use the set up software (MR Configurator) to refer to a factor of alarm occurrence.

Display	Name	Definition	Cause	Action
A10	Undervoltage	Power supply voltage dropped. LECSC2-□: 160VAC or less LECSC1-□: 83VAC or less	1. Power supply voltage is low.	Check the power supply.
			2. There was an instantaneous control power failure of 60ms or longer.	
			3. Shortage of power supply capacity caused the power supply voltage to drop at start, etc.	
			4. The bus voltage dropped to the following value or less. LECSC2-□ 200VDC LECSC1-□: 158VDC	
			5. Faulty parts in the driver. Checking method Alarm (A10) occurs if power is switched on after disconnection of all cables but the control circuit power supply cables.	Change the driver.
A12	Memory error 1 (RAM)	RAM, memory fault	Faulty parts in the driver. Checking method Alarm (any of A12 and A13) occurs if power is switched on after disconnection of all cables but the control circuit power supply cables.	Change the driver.
A13	Clock error	Printed board fault		

Display	Name	Definition	Cause	Action
A15	Memory error 2 (EEP-ROM)	EEP-ROM fault	1. Faulty parts in the driver Checking method Alarm (A15) occurs if power is switched on after disconnection of all cables but the control circuit power supply cables.	Change the driver.
			2. The number of write times to EEP-ROM exceeded 100,000.	
A16	Encoder error 1 (At power on)	Communication error occurred between encoder and driver.	1. Encoder connector (CN2) disconnected.	Connect correctly.
			2. Encoder fault	Change the servo motor.
			3. Encoder cable faulty (Wire breakage or shorted)	Repair or change the cable.
			4. Encoder cable type (2-wire, 4-wire) selection was wrong in parameter setting.	Correct the setting in the fourth digit of parameter No.PC22.
A17	Board error	CPU/parts fault	Faulty parts in the driver Checking method Alarm (A17 or A19) occurs if power is switched on after disconnection of all cables but the control circuit power supply cable.	Change the driver.
A19	Memory error 3 (Flash ROM)	ROM memory fault		
A1A	Motor combination error	Wrong combination of driver and servo motor.	Wrong combination of driver and servo motor connected.	Use correct combination.
A20	Encoder error 2 (during runtime)	Communication error occurred between encoder and driver.	1. Encoder connector (CN2) disconnected.	Connect correctly.
			2. Encoder cable faulty (Wire breakage or shorted)	Repair or change the cable.
			3. Encoder fault	Change the servo motor.
A21	Encoder error 3 (during runtime)	Error occurred in encoder.	1. Excessive acceleration is detected by oscillation, etc.	Operate with the loop gain decreased. Operate with the auto tuning response.
			2. Detection circuit error in encoder.	Change the servo motor.
A24	Main circuit error	Ground fault occurred at the servo motor power (U,V and W phases) of the driver.	1. Power input wires and servo motor power wires are in contact.	Connect correctly.
			2. Sheathes of servo motor power cables deteriorated, resulting in ground fault.	Change the cable.
			3. Main circuit of driver failed. Checking method Alarm (A24) occurs if the servo is switched on after disconnecting the U, V, W power cables from the driver.	Change the driver.
A25	Absolute position erase	Absolute position data in error	1. Voltage drop in encoder (Battery disconnected.)	After leaving the alarm occurring for a few minutes, switch power off, then on again. Always make home position setting again.
			2. Battery voltage low	Change the battery. Always make home position setting again.
			3. Battery cable or battery is faulty.	
		Power was switched on for the first time in the absolute position detection system.	4. Home position not set.	After leaving the alarm occurring for a few minutes, switch power off, then on again. Always make home position setting again.

Display	Name	Definition	Cause	Action
A30	Regenerative error	Permissible regenerative power of the built-in regenerative resistor or regenerative option is exceeded.	1. Wrong setting of parameter No. PA02	Set correctly.
			2. Built-in regenerative resistor or regenerative option is not connected.	Connect correctly
			3. High-duty operation or continuous regenerative operation caused the permissible regenerative power of the regenerative option to be exceeded. Checking method Call the status display and check the regenerative load ratio.	1. Reduce the frequency of positioning. 2. Use the regenerative option of larger capacity. 3. Reduce the load.
			4. Power supply voltage is abnormal. LECSC2-□:260VAC or more LECSC1-□:More than 135VAC	Check the power supply
			5. Built-in regenerative resistor or regenerative option faulty.	Change the driver or regenerative option.
		Regenerative transistor fault	6. Regenerative transistor faulty. Checking method 1) The regenerative option has overheated abnormally. 2) The alarm occurs even after removal of the built-in regenerative resistor or regenerative option.	Change the driver.
A31	Overspeed	Speed has exceeded the instantaneous permissible speed.	1. Input command pulse frequency exceeded the permissible instantaneous speed frequency.	Set command pulses correctly.
			2. Small acceleration/deceleration time constant caused overshoot to be large.	Increase acceleration/deceleration time constant.
			3. Servo system is instable to cause overshoot.	1. Re-set servo gain to proper value. 2. If servo gain cannot be set to proper value. 1) Reduce load inertia moment ratio; or 2) Reexamine acceleration/ deceleration time constant.
			4. Electronic gear ratio is large (parameters No.PA06, PA07)	Set correctly.
			5. Encoder faulty.	Change the servo motor.

Display	Name	Definition	Cause	Action
A32	Overcurrent	Current that flew is higher than the permissible current of the driver. (If the alarm (A32) occurs again when turning ON the servo after resetting the alarm by turning OFF/ON the power when the alarm (A32) first occurred, the transistor (IPM, IGBT) of the driver may be at fault. In the case, do not repeat to turn OFF/ON the power. Check the transistor with the checking method of "Cause 2".)	1. Short occurred in servo motor power (U, V, W).	Correct the wiring.
			2. Transistor (IPM, IGBT) of the driver faulty. Checking method Alarm (A32) occurs if power is switched on after U,V and W are disconnected.	Change the driver.
			3. Ground fault occurred in servo motor power (U, V, W).	Correct the wiring.
			4. External noise caused the overcurrent detection circuit to misoperate.	Take noise suppression measures.
A33	Overvoltage	The following shows the input value of converter bus voltage. LECSC□-□: 400VDC or more	1. Regenerative option is not used.	Use the regenerative option.
			2. Though the regenerative option is used, the parameter No.PA02 setting is "□□ 00 (not used)".	Set correctly.
			3. Lead of built-in regenerative resistor or regenerative option is open or disconnected.	1. Change the lead. 2. Connect correctly.
			4. Regenerative transistor faulty.	Change the driver
			5. Wire breakage of built-in regenerative resistor or regenerative option.	1. For wire breakage of built-in regenerative resistor, change the driver. 2. For wire breakage of regenerative option, change the regenerative option.
			6. Capacity of built-in regenerative resistor or regenerative option is insufficient.	Add regenerative option or increase capacity.
			7. Power supply voltage high.	Check the power supply.
			8. Ground fault occurred in servo motor power (U, V, W).	Correct the wiring.
A35	Command pulse frequency error	Input pulse frequency of the command pulse is too high.	1. Pulse frequency of the manual pulse generator is too high.	Change the pulse frequency to a proper value.
			2. Noise entered the pulses of the manual pulse generator.	Take action against noise.
			3. Manual pulse generator failure.	Change the manual pulse generator.

Display	Name	Definition	Cause	Action
A37	Parameter error	Parameter setting is wrong.	1. Driver fault caused the parameter setting to be rewritten.	Change the driver.
			2. Regenerative option not used with driver was selected in parameter No.PA02.	Set parameter No.PA02 correctly.
			3. Value outside setting range has been set in electronic gear.	Set parameters No.PA06, PA07 correctly.
			4. Opposite sign has been set in software limit increasing side (parameters No.PC31, PC32). Similarly, opposite sign has been set in software limit decreasing side (parameters No.PC33, PC34).	Set parameters No.PC31 to PC34 correctly.
			5. Opposite sign has been set in position range output address increasing side (parameters No. PC37, PC38). Similarly, opposite sign has been set in position range output address decreasing side (parameters No.PC39, PC40).	Set parameters No.PC37 to PC40 correctly.
			6. The number of write times to EEP-ROM exceeded 100,000 due to parameter write, etc.	Change the driver.
			7. The torque limit switching dog system or torque limit switching data set system is selected for home position return in the point table positioning operation. (Parameter No.PC02)	These home position return types cannot be used. Set the parameter No.PC02 correctly.
		Point table setting is wrong.	8. Setting value is out of the setting range.	Set it correctly.
A45	Main circuit device overheat	Main circuit device overheat.	1. Driver faulty.	Change the driver.
			2. The power supply was turned on and off continuously by overloaded status.	The drive method is reviewed.
			3. Ambient temperature of servo motor is over 55℃ (131°F).	Check environment so that ambient temperature is 0 to 55℃ (32 to 131°F).
			4. Used beyond the specifications of close mounting.	Use within the range of specifications.
A46	Servo motor overheat	Servo motor temperature rise actuated the thermal sensor.	1. Ambient temperature of servo motor is over 40℃ (104°F).	Check environment so that ambient temperature is 0 to 40℃ (32 to 104°F).
			2. Servo motor is overloaded.	1. Reduce load. 2. Check operation pattern. 3. Use servo motor that provides larger output.
			3. Thermal sensor in encoder is faulty.	Change the servo motor.
A47	Cooling fan alarm	The cooling fan of the driver stopped, or its speed decreased to or below the alarm level.	1. Cooling fan life expiration (Refer to section 2.5.)	Change the cooling fan of the driver.
			2. Foreign matter caught in the cooling fan stopped rotation.	Remove the foreign matter.
			3. The power supply of the cooling fan failed.	Change the driver.

Display	Name	Definition	Cause	Action
A50	Overload 1	Load exceeded overload protection characteristic of driver.	1. Driver is used in excess of its continuous output current.	1. Reduce load. 2. Check operation pattern. 3. Use servo motor that provides larger output.
			2. Servo system is instable and hunting.	1. Repeat acceleration/deceleration to execute auto tuning. 2. Change auto tuning response setting. 3. Set auto tuning to OFF and make gain adjustment manually.
			3. Machine struck something.	1. Check operation pattern. 2. Install limit switches.
			4. Wrong connection of servo motor. Driver's output terminals U, V, W do not match servo motor's input terminals U, V, W.	Connect correctly.
			5. Encoder faulty. Checking method When the servo motor shaft is rotated with the servo off, the cumulative feedback pulses do not vary in proportion to the rotary angle of the shaft but the indication skips or returns midway.	Change the servo motor.
			6. After Overload 2 (A51) occurred, turn OFF/ON the power supply to clear the alarm. Then the overload operation is repeated.	1. Reduce load. 2. Check operation pattern. 3. Use servo motor that provides larger output.
A51	Overload 2	Machine collision or the like caused max. For the time of the alarm occurrence, refer to the section 12.1.	1. Machine struck something.	1. Check operation pattern. 2. Install limit switches.
			2. Wrong connection of servo motor. Driver's output terminals U, V, W do not match servo motor's input terminals U, V, W.	Connect correctly.
			3. Servo system is instable and hunting.	1. Repeat acceleration/deceleration to execute auto tuning. 2. Change auto tuning response setting. 3. Set auto tuning to OFF and make gain adjustment manually.
			4. Encoder faulty. Checking method When the servo motor shaft is rotated with the servo off, the cumulative feedback pulses do not vary in proportion to the rotary angle of the shaft but the indication skips or returns midway.	Change the servo motor.

Display	Name	Definition	Cause	Action
A52	Error excessive	The difference between the model position and the actual servo motor position exceeds three rotations. (Refer to the function block diagram in section 1.1.2.)	1. Acceleration/deceleration time constant is too small.	Increase the acceleration/deceleration time constant.
			2. Forward rotation torque limit (parameter No.PA11) or reverse rotation torque limit (parameter No.PA12) are too small.	Increase the torque limit value.
			3. Motor cannot be started due to torque shortage caused by power supply voltage drop.	1. Check the power supply capacity. 2. Use servo motor which provides larger output.
			4. Position loop gain (parameter No.PB08) value is small.	Increase set value and adjust to ensure proper operation.
			5. Servo motor shaft was rotated by external force.	1. When torque is limited, increase the limit value. 2. Reduce load. 3. Use servo motor that provides larger output.
			6. Machine struck something.	1. Check operation pattern. 2. Install limit switches.
			7. Encoder faulty.	Change the servo motor.
			8. Wrong connection of servo motor. Driver's output terminals U, V, W do not match servo motor's input terminals U, V, W.	Connect correctly.
A61	Operation alarm	Setting mistake of auxiliary function.	"1" or "3" is set for the auxiliary function of point table No.255.	Set "0" or "2" for the value of auxiliary function.
A8A	Serial communication time-out error	Communication stopped for longer than the specified time.	1. Communication cable breakage.	Repair or change the communication cable.
			2. Communication cycle longer than regulated time.	Shorten the communication cycle.
			3. Wrong protocol.	Correct protocol.
A8D	CC-Link alarm	Normal communication with the master station cannot be made.	1. The station number switch (STATION NO.) setting is 0 or not less than 65.	Set the station number to within the range 1 to 64, and switch power on.
			2. The baud rate switch (MODE) setting is outside the range 0 to 4.	Set the baud rate switch (MODE) to within the range 0 to 4.
			3. The transmission status is abnormal.	Reexamine the wiring.
			4. CC-Link twisted cable wiring incorrect.	1. Repair or change the CC-Link twisted cable. 2. Connect the cable or connector correctly.
			5. CC-Link twisted cable faulty.	
			6. The CC-Link connector has come off.	
			7. The terminating resistor is not connected.	Connect the terminating resistor correctly.
			8. Noise entered the CC-Link twisted cable.	
			9. The programmable driver CC-Link master unit was reset.	
A8E	Serial communication error	Serial communication error occurred between driver and communication device (e.g. personal computer).	1. Communication cable fault (Open cable or short circuit).	Repair or change the cable.
			2. Communication device (e.g. personal computer) faulty.	Change the communication device (e.g. personal computer).

Display	Name	Definition	Cause	Action
(Note) 888	Watchdog	CPU, parts faulty.	Fault of parts in driver. Checking method Alarm (888) occurs if power is switched on after disconnection of all cables but the control circuit power supply cable.	Change the driver.

Note. At power-on, "888" appears instantaneously, but it is not an error.

10.4.3 Remedies for warnings

CAUTION
- If an absolute position counter warning (AE3) occurred, always make home position setting again. Not doing so may cause unexpected operation.

POINT
- When any of the following alarms has occurred, do not resume operation by switching power of the driver OFF/ON repeatedly. The driver and servo motor may become faulty. If the power of the driver is switched OFF/ON during the alarms, allow more than 30 minutes for cooling before resuming operation.
  - Excessive regenerative warning (AE0)
  - Overload warning 1 (AE1)

If AE6 occur, the servo off status is established. If any other warning occurs, operation can be continued but an alarm may take place or proper operation may not be performed.
Remove the cause of warning according to this section. Use the set up software(MR Configurator) to refer to a factor of warning occurrence.

Display	Name	Definition		Cause	Action
A90	Home position return incomplete	In incremental system	Positioning operation was performed without home position return.	1. Positioning operation was performed without home position return.	Perform home position return.
			Home position return ended abnormally.	2. Home position return speed could not be decreased to creep speed. 3. Limit switch was actuated during home position return starting at other than position beyond dog.	Check home position return speed/creep speed/moving distance after proximity dog.
		In absolute position detection system	Positioning operation was performed without home position setting.	1. Positioning operation was performed without home position setting.	Perform home position setting.
			Home position setting ended abnormally.	2. Home position setting speed could not be decreased to creep speed. 3. Limit switch was actuated during home position setting starting at other than position beyond dog.	Check home position setting speed/creep speed/moving distance after proximity dog.
			Operation was performed without making home position setting while an absolute position erase (A25) is being occurred.	4. Voltage drop in encoder (Battery disconnected.)	After leaving the alarm occurring for a few minutes, switch power off, then on again. Always make home position setting again.
				5. Battery voltage low	Change the battery. Always make home position setting again.
				6. Battery cable or battery is faulty.	

Display	Name	Definition	Cause	Action
A92	Open battery cable warning	Absolute position detection system battery voltage is low.	1. Battery cable is open.	Repair cable or changed.
			2. Battery voltage supplied from the driver to the encoder fell to about 3V or less. (Detected with the encoder)	Change the battery.
A96	Home position setting warning	Home position setting could not be made.	1. Droop pulses remaining are greater than the in-position range setting.	Remove the cause of droop pulse occurrence
			2. Command pulse entered after clearing of droop pulses.	Do not enter command pulse after clearing of droop pulses.
			3. Creep speed high.	Reduce creep speed.
A98	Software limit warning	Software limit set in parameter is reached.	1. Software limit was set within actual operation range.	Set parameter No.PC31 to PC34 correctly.
			2. Point table of position data in excess of software limit was executed.	Set point table correctly.
			3. Software limit was reached during JOG operation or manual pulse generator operation.	Perform operation within software limit range.
A99	Stroke limit warning	The limit switch become valid.	The stroke end (LSP or LSN) of the direction which gave instructions was turned off.	Reexamine the operation pattern to turn LSP/LSN ON.
A9D	CC-Link warning 1	The station number switch or baud rate switch position was changed from the setting at power-on.	1. The station number switch position was changed from the setting at power-on.	Return to the setting at power-on.
			2. The baud rate switch position was changed from the setting at power-on.	
			3. The occupied station count switch position was changed from the setting at power-on.	
A9E	CC-Link warning 2	Communication error of cable.	1. The transmission status is abnormal.	Take measures against noise.
			2. CC-Link twisted cable wiring incorrect.	1. Change the CC-Link twisted cable. 2. Connect the cable or connector correctly.
			3. CC-Link twisted cable faulty.	
			4. The CC-Link connector has come off.	
			5. The terminating resistor is not connected.	Connect the terminating resistor correctly.
			6. Noise entered the CC-Link twisted cable.	
A9F	Battery warning	Voltage of battery for absolute position detection system reduced.	Battery voltage fell to 3.2V or less. (Detected with the driver)	Change the battery.
AE0	Excessive regenerative warning	There is a possibility that regenerative power may exceed permissible regenerative power of built-in regenerative resistor or regenerative option.	Regenerative power increased to 85% or more of permissible regenerative power of built-in regenerative resistor or regenerative option. Checking method Call the status display and check regenerative load ratio.	1. Reduce frequency of positioning. 2. Change the regenerative option for the one with larger capacity. 3. Reduce load.
AE1	Overload warning 1	There is a possibility that overload alarm 1 or 2 may occur.	Load increased to 85% or more of overload alarm 1 or 2 occurrence level. Cause, checking method Refer to A50, A51.	Refer to A50, A51.
AE3	Absolute position counter warning	Absolute position encoder pulses faulty.	1. Noise entered the encoder.	Take noise suppression measures.
			2. Encoder faulty.	Change the servo motor.
		The multi-revolution counter value of the absolute position encoder exceeded the maximum revolution range.	3. The movement amount from the home position exceeded a 32767 rotation or 37268 rotation in succession.	Make home position setting again.
AE6	Servo forced stop warning	EMG is off.	External forced stop was made valid. (EMG was turned off.)	Ensure safety and deactivate forced stop.

Display	Name	Definition	Cause	Action
AE8	Cooling fan speed reduction warning	The speed of the driver decreased to or below the warning level.	Cooling fan life expiration (Refer to section 2.5.)	Change the cooling fan of the driver.
			The power supply of the cooling fan is broken.	Change the driver.
AE9	Main circuit off warning	Servo-on (SON) was switched on with main circuit power off.		Switch on main circuit power.
AEC	Overload warning 2	Operation, in which a current exceeding the rating flew intensively in any of the U, V and W phases of the servo motor, was repeated.	During a stop, the status in which a current flew intensively in any of the U, V and W phases of the servo motor occurred repeatedly, exceeding the warning level.	1. Reduce the positioning frequency at the specific positioning address. 2. Reduce the load. 3. Replace the driver/ servo motor with the one of larger capacity.
AED	Output watt excess warning	The status, in which the output wattage (speed × torque) of the servo motor exceeded the rated output, continued steadily.	Continuous operation was performed with the output wattage (speed × torque) of the servo motor exceeding 150% of the rated output.	1. Reduce the servo motor speed. 2. Reduce the load.

10.5 Point table error

When a point table error occurs, the parameter error (A37) occurs. After the parameter No. of parameter error (A37), the point table error details are displayed.

```
 AL37        #00
PB10    PB11
PB12    PB16
Pos001
```

Point table error details
For the point table No.1 position data error

Pos001

Point table No. with error

Error item
・Pos: position data
・Spd: speed
・Acc: acceleration time constant
・Dec: deceleration time constant
・Dwl: dwell
・Aux: auxiliary function

11. OUTLINE DRAWINGS

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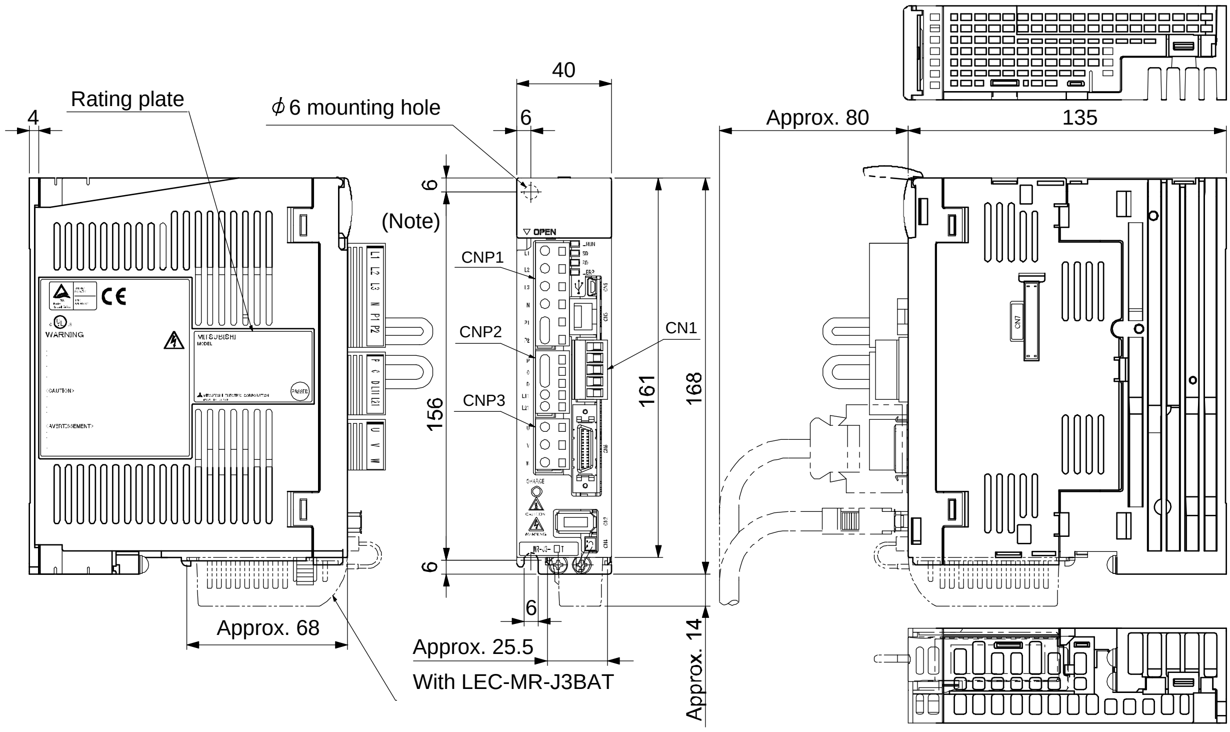
11. OUTLINE DRAWINGS

11.1 Driver

(1) LECSC□-S5
LECSC□-S7

[Unit: mm]



Note. This data applies to the 3-phase or 1-phase 200 to 230VAC power supply models.
For a single-phase、 100 to 120VAC power supply, refer to the terminal signal layout.

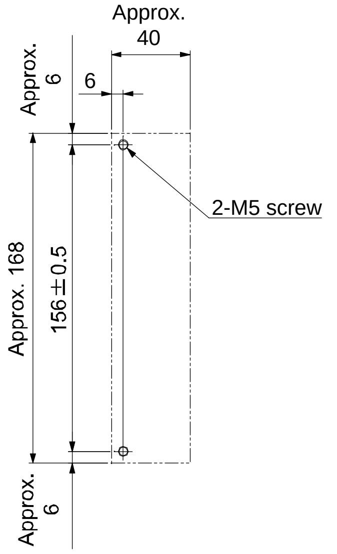
Mass: 0.8 [kg] (1.76 [lb])

Terminal signal layout

	For 1-phase 100 to 120VAC		For 3-phase or 1-phase 200 to 230VAC
CNP1	L_1	CNP1	L_1
			L_2
	L_2		L_3
	N		N
	P_1		P_1
	P_2		P_2
CNP2	P	CNP2	P
	C		C
	D		D
	L_{11}		L_{11}
	L_{21}		L_{21}
CNP3	U	CNP3	U
	V		V
	W		W

PE terminal

Screw size: M4
Tightening torque: 1.2 [N・m] (10.6 [lb・in])

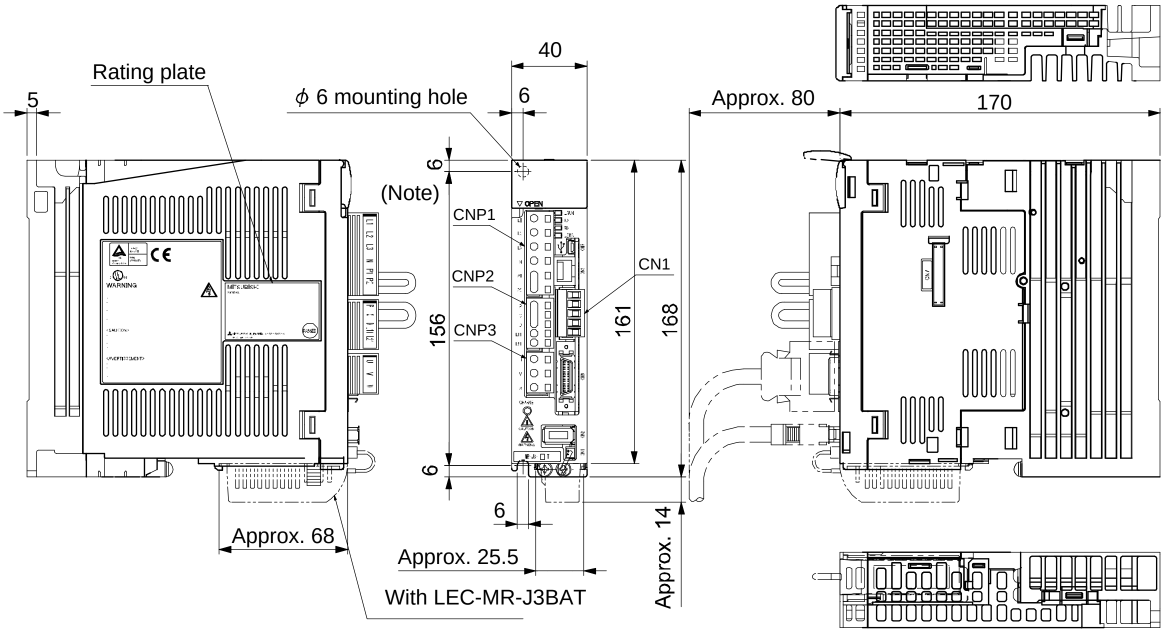


Mounting hole process drawing

Mounting screw
Screw size: M5
Tightening torque: 3.24[N・m] (28.7[lb・in])

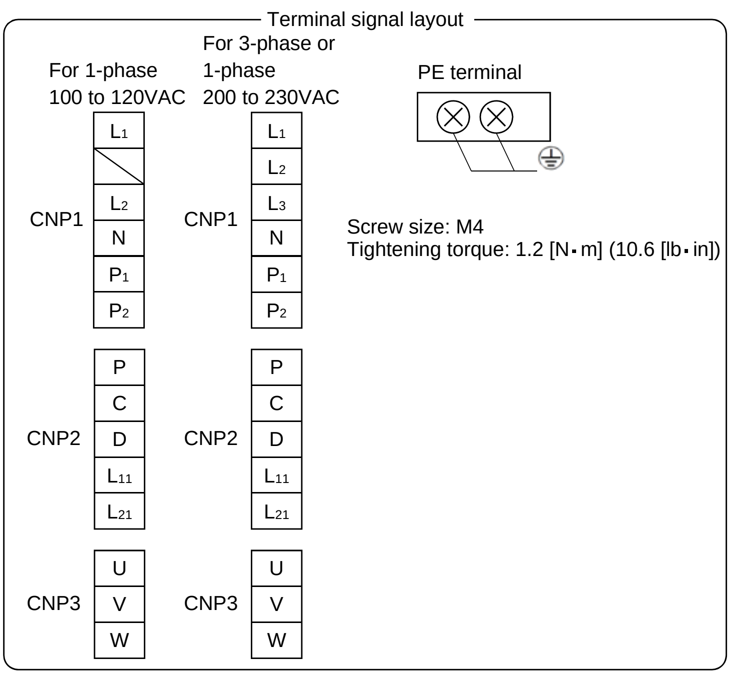
(2) LECSC□-S8

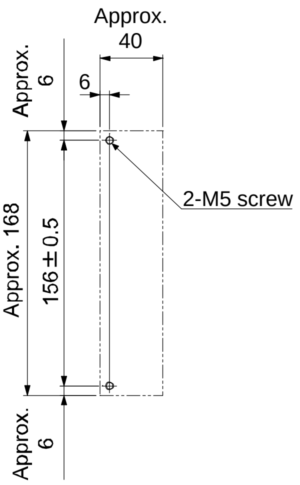
[Unit: mm]



Note. This data applies to the 3-phase or 1-phase 200 to 230VAC power supply models.
For a single-phase, 100 to 120VAC power supply, refer to the terminal signal layout.

Mass: 1.0 [kg] (2.21 [lb])





Mounting hole process drawing

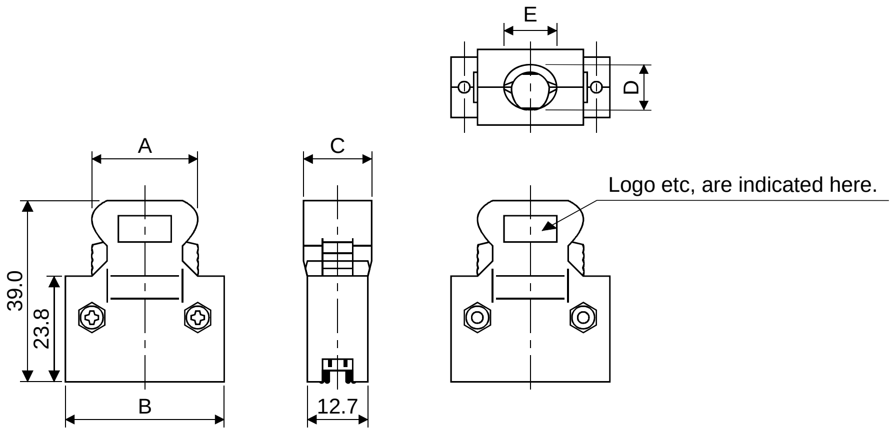
Mounting screw
Screw size: M5
Tightening torque: 3.24[N▪m] (28.7[lb▪in])

11.2 Connector

(1) Miniature delta ribbon (MDR) system (Sumitomo 3M Limited)

(a) One-touch lock type

[Unit: mm]



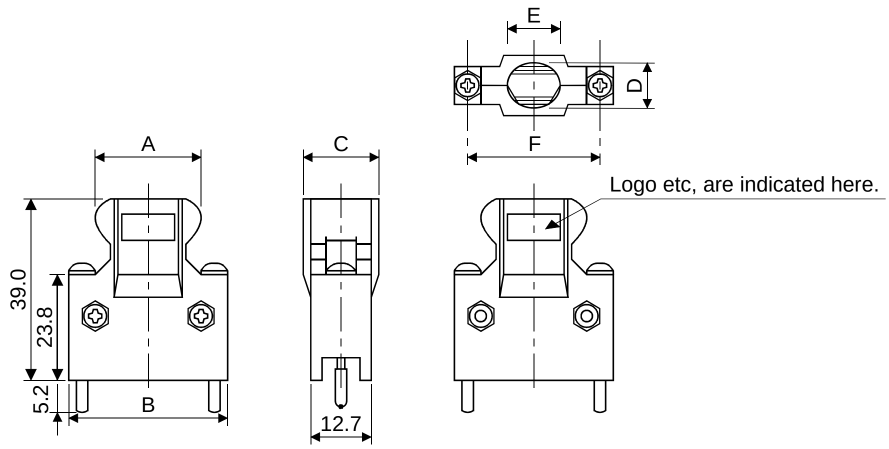
Connector	Shell kit	Each type of dimension				
		A	B	C	D	E
10150-3000PE	10350-52F0-008	41.1	52.4	18.0	14.0	17.0

Applicable wire size: AWG24~30

(b) Jack screw M2.6 type

This is not available as option.

[Unit: mm]

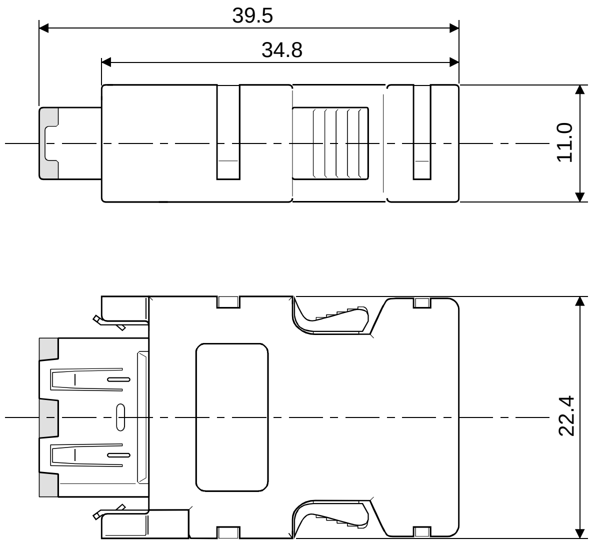


Connector	Shell kit	Each type of dimension					
		A	B	C	D	E	F
10150-3000PE	10350-52A0-008	41.1	52.4	18.0	14.0	17.0	46.5

Applicable wire size: AWG24~30

(2) SCR connector system (Sumitomo 3M Limited)

Receptacle: 36210-0100PL
Shell kit : 36310-3200-008



12. CHARACTERISTICS

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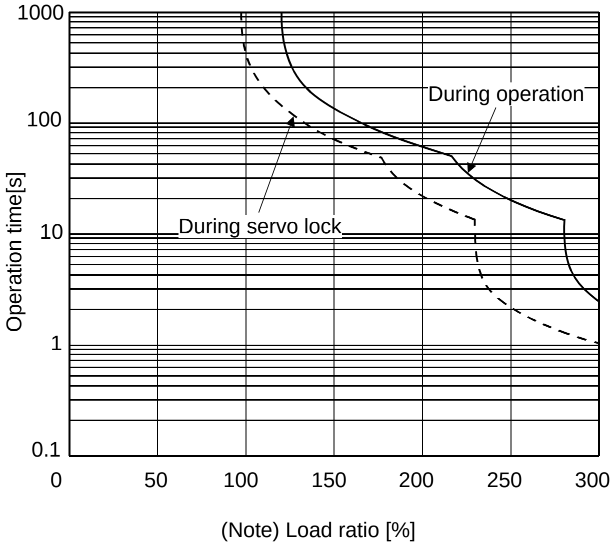
12. CHARACTERISTICS

12.1 Overload protection characteristics

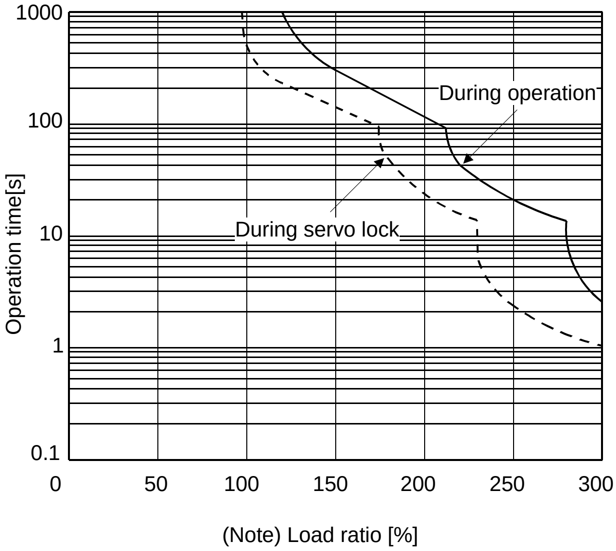
An electronic thermal relay is built in the driver to protect the servo motor and driver from overloads. Overload 1 alarm (A50) occurs if overload operation performed is above the electronic thermal relay protection curve shown in any of Figs 12.1. Overload 2 alarm (A51) occurs if the maximum current flew continuously for several seconds due to machine collision, etc. Use the equipment on the left-hand side area of the continuous or broken line in the graph.

In a machine like the one for vertical lift application where unbalanced torque will be produced, it is recommended to use the machine so that the unbalanced torque is 70% or less of the rated torque.

When you carry out adhesion mounting of the driver, make circumference temperature into 0 to 45℃ (32 to 113℉), or use it at 75% or smaller effective load ratio.



LECSC□-S5



LECSC□-S7, LECSC□-S8

Note. If operation that generates torque more than 100% of the rating is performed with an abnormally high frequency in a servo motor stop status (servo lock status) or in a 30r/min or less low-speed operation status, the driver may fail even when the electronic thermal relay protection is not activated.

Fig 12.1 Electronic thermal relay protection characteristics

12.2 Power supply equipment capacity and generated loss

(1) Amount of heat generated by the driver

Table 12.1 indicates drivers' power supply capacities and losses generated under rated load. For thermal design of an enclosure, use the values in Table 12.1 in consideration for the worst operating conditions. The actual amount of generated heat will be intermediate between values at rated torque and servo off according to the duty used during operation. When the servo motor is run at less than the maximum speed, the power supply capacity will be smaller than the value in the table, but the driver's generated heat will not change.

Table 12.1 Power supply capacity and generated heat per driver at rated output

Driver	Servo motor	(Note 1) Power supply capacity [kVA]	(Note 2) Driver-generated heat [W]		Area required for heat dissipation [m²]
			At rated torque	With servo off	
LECSC□-S5	LE-S5-□ LE-S6-□	0.3	25	15	0.5
LECSC□-S7	LE-S7-□	0.5	25	15	0.5
LECSC□-S8	LE-S8-□	0.9	35	15	0.7

Note 1. Note that the power supply capacity will vary according to the power supply impedance. This value is applicable when the power factor improving AC reactor or power factor improving DC reactor is not used.

2. Heat generated during regeneration is not included in the driver-generated heat.

(2) Heat dissipation area for enclosed driver

The enclosed control box (hereafter called the control box) which will contain the driver should be designed to ensure that its temperature rise is within +10℃ (+50°F) at the ambient temperature of 40℃ (104°F). (With a 5℃ (41°F) safety margin, the system should operate within a maximum 55℃ (131°F) limit.) The necessary enclosure heat dissipation area can be calculated by Equation 12.1.

$$A = \frac{P}{K \cdot \Delta T} \qquad (12.1)$$

where, A : Heat dissipation area [m^2]
P : Loss generated in the control box [W]
ΔT : Difference between internal and ambient temperatures [℃]
K : Heat dissipation coefficient [5 to 6]

When calculating the heat dissipation area with Equation 12.1, assume that P is the sum of all losses generated in the enclosure. Refer to Table 12.1 for heat generated by the driver. "A" indicates the effective area for heat dissipation, but if the enclosure is directly installed on an insulated wall, that extra amount must be added to the enclosure's surface area.

The required heat dissipation area will vary wit the conditions in the enclosure. If convection in the enclosure is poor and heat builds up, effective heat dissipation will not be possible. Therefore, arrangement of the equipment in the enclosure and the use of a cooling fan should be considered.

Table 12.1 lists the enclosure dissipation area for each driver when the driver is operated at the ambient temperature of 40℃ (104°F) under rated load.

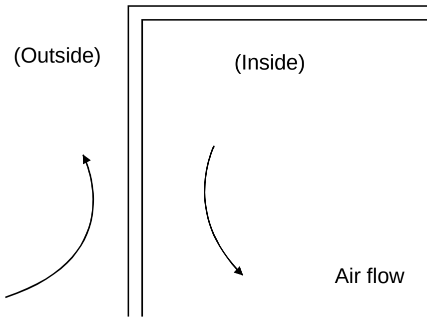


Fig. 12.2 Temperature distribution in enclosure

When air flows along the outer wall of the enclosure, effective heat exchange will be possible, because the temperature slope inside and outside the enclosure will be steeper.

12.3 Dynamic brake characteristics

12.3.1 Dynamic brake operation

(1) Calculation of coasting distance

Fig. 13.3 shows the pattern in which the servo motor comes to a stop when the dynamic brake is operated. Use Equation 12.2 to calculate an approximate coasting distance to a stop. The dynamic brake time constant τ varies with the servo motor and machine operation speeds. (Refer to (2)(a), (b) in this section.)

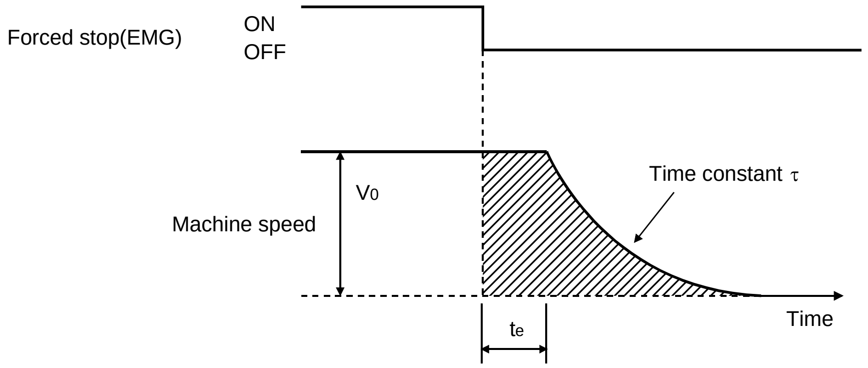


Fig. 12.3 Dynamic brake operation diagram

$$L_{max} = \frac{V_0}{60} \cdot \left\{ t_e + \tau \left(1 + \frac{J_L}{J_M} \right) \right\} \quad \text{(12.2)}$$

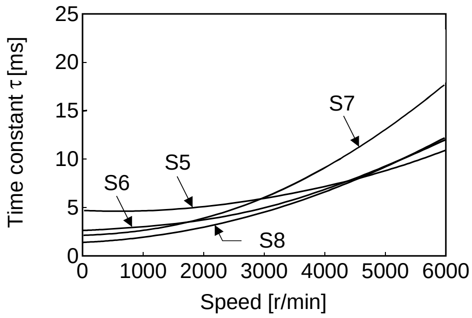
L_{max} : Maximum coasting distance .... [mm][in]
V_o : Machine rapid feed rate .... [mm/min][in/min]
J_M : Servo motor inertial moment .... [kg・cm^2][oz・in^2]
J_L : Load inertia moment converted into equivalent value on servo motor shaft .... [kg・cm^2][oz・in^2]
τ : Brake time constant .... [s]
t_e : Delay time of control section .... [s]

For 7kW or less servo, there is internal relay delay time of about 30ms. For 11k to 22kW servo, there is delay time of about 100ms caused by a delay of the external relay and a delay of the magnetic contactor built in the external dynamic brake.

(2) Dynamic brake time constant

The following shows necessary dynamic brake time constant τ for the equations (12.2).

(a) 200V class servo motor



LE-□−□series

12.3.2 The dynamic brake at the load inertia moment

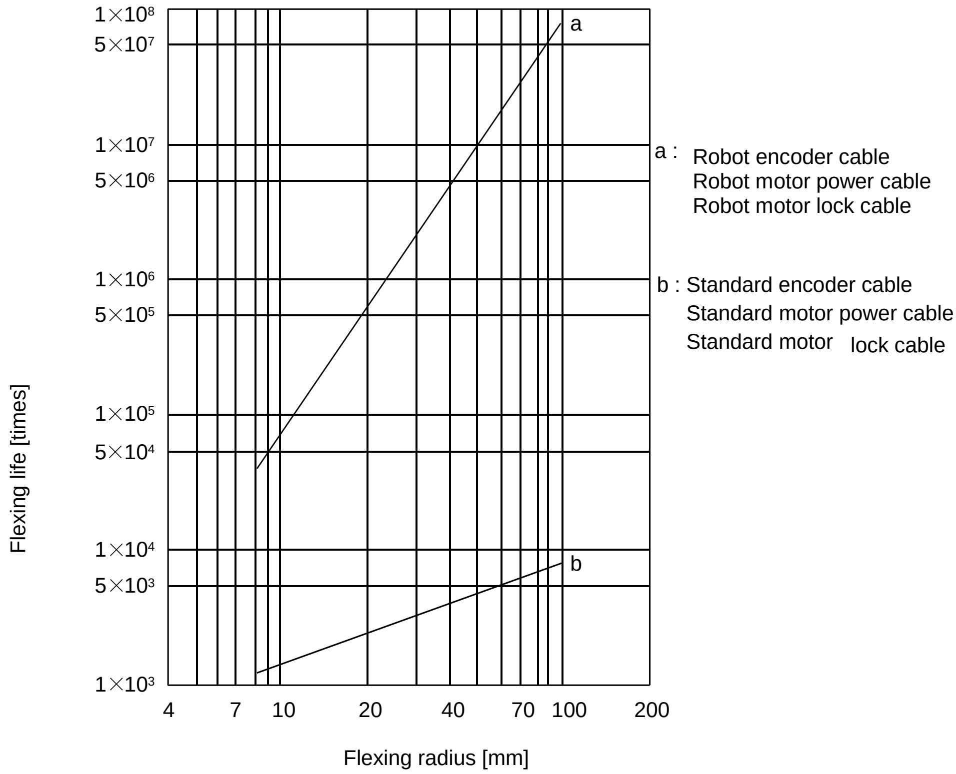
Use the dynamic brake under the load inertia moment ratio indicated in the following table. If the load inertia moment is higher than this value, the built-in dynamic brake may burn. If there is a possibility that the load inertia moment may exceed the value, contact your local sales office.

The values of the load inertia moment ratio in the table are the values at the maximum rotation speed of the servo motor.

Driver	Servo motor
	LE−□−□
LECSC□−□	30

12.4 Cable flexing life

The flexing life of the cables is shown below. This graph calculated values. Since they are not guaranteed values, provide a little allowance for these values.



12.5 Inrush currents at power-on of main circuit and control circuit

The following table indicates the inrush currents (reference data) that will flow when the maximum permissible voltage (200V class: 253VAC, 400V class: 528VAC) is applied at the power supply capacity of 2500kVA and the wiring length of 1m.

Driver	Inrush currents (A_{0-p})	
	Main circuit power supply (L_1, L_2, L_3)	Control circuit power supply (L_{11}, L_{21})
LECSC1-□	38A (Attenuated to approx. 14A in 10ms)	20 to 30A (Attenuated to approx. 0A in 1 to 2ms)
LECSC2-□	30A (Attenuated to approx. 5A in 10ms)	

Since large inrush currents flow in the power supplies, always use no-fuse breakers and magnetic contactors. (Refer to section 13.5.)

When circuit protectors are used, it is recommended to use the inertia delay type that will not be tripped by an inrush current.

13. OPTIONS AND AUXILIARY EQUIPMENT 2
13.1 Cable/connector sets 2
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13.1.2 Encoder cable/connector sets 5
13.1.3 Motor cables 7
13.1.4 Lock cables 9
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13.3 Battery LEC-MR-J3BAT 13
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13.7 Leakage current breaker 27
13.8 EMC filter (recommended) 29

13. OPTIONS AND AUXILIARY EQUIPMENT

⚠WARNING	・Before connecting any option or peripheral equipment, turn off the power and wait for 15 minutes or more until the charge lamp turns off. Then, confirm that the voltage between P(+) and N(−) is safe with a voltage tester and others. Otherwise, an electric shock may occur. In addition, always confirm from the front of the driver whether the charge lamp is off or not.

⚠CAUTION	・Use the specified auxiliary equipment and options. Unspecified ones may lead to a fault or fire.

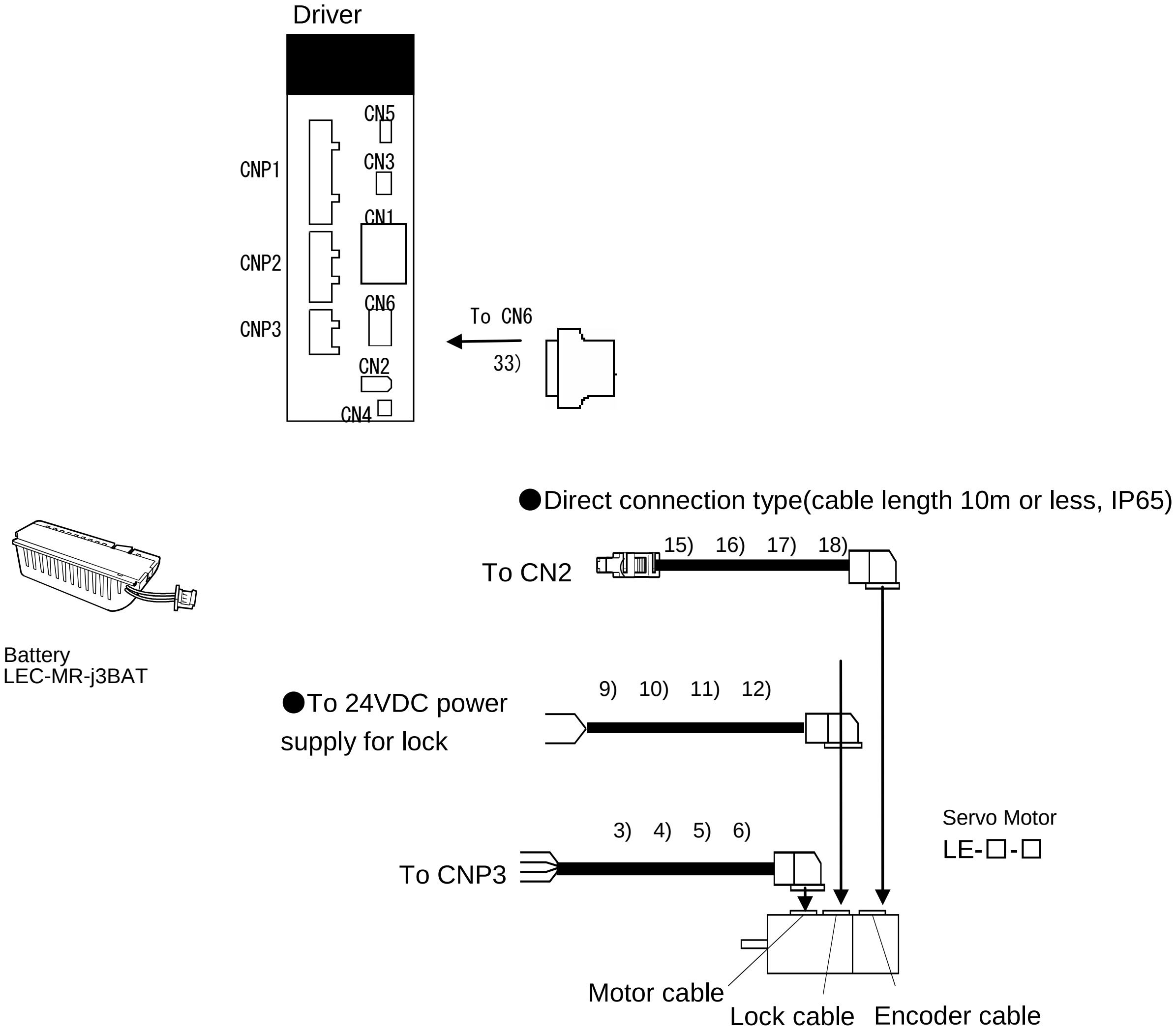
13.1 Cable/connector sets

POINT

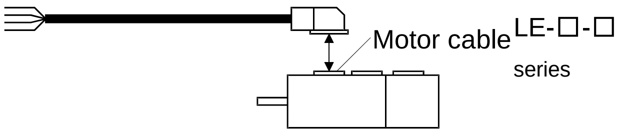
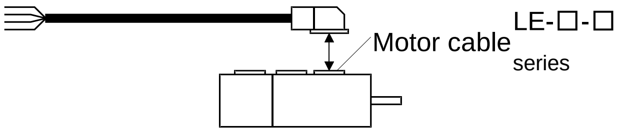
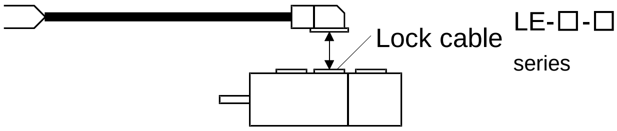
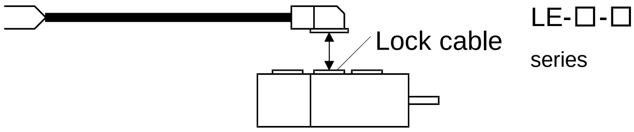
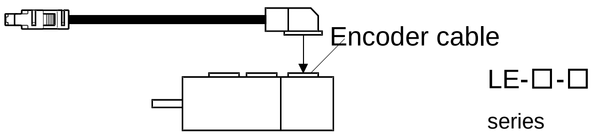
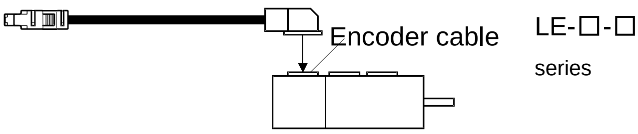
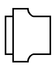
・Protective structure indicated for cables and connecters is for a cable or connector alone. When the cables and connectors are used to connect the driver and servo motor, and if protective structures of the driver and servo motor are lower than that of the cable and connector, specifications of the driver and servo motor apply.

As the cables and connectors used with this servo, purchase the options indicated in this section.

13.1.1 Combinations of cable/connector sets



Note. Connectors for 3.5kW or less For 5kW or more, terminal blocks

No.	Product	Model	Description	Application
3)	Motor cable	LE-CSM-S□A Cable length: 2・5・10m	 Refer to section 13.1.3 for details.	IP65 Axis side lead
4)	Motor cable	LE-CSM-R□A Cable length: 2・5・10m		IP65 Axis side lead Robot cable
5)	Motor cable	LE-CSM-S□B Cable length: 2・5・10m	 Refer to section 13.1.3 for details.	IP65 Counter axis side lead
6)	Motor cable	LE-CSM-R□B Cable length: 2・5・10m		IP65 Counter axis side lead Robot cable
9)	Lock cable	LE-CSB-S□A Cable length: 2・5・10m	 Refer to section 13.1.4 for details.	IP65 Axis side lead
10)	Lock cable	LE-CSB-R□A Cable length: 2・5・10m		IP65 Axis side lead Robot cable
11)	Lock cable	LE-CSB-S□B Cable length: 2・5・10m	 Refer to section 13.1.4 for details.	IP65 Counter axis side lead
12)	Lock cable	LE-CSB-R□B Cable length: 2・5・10m		IP65 Counter axis side lead Robot cable
15)	Encoder cable	LE-CSE-S□A Cable length: 2・5・10m	 Refer to section 13.1.2 (1) for details.	IP65 Axis side lead
16)	Encoder cable	LE-CSE-R□A Cable length: 2・5・10m		IP65 Axis side lead Robot cable
17)	Encoder cable	LE-CSE-S□B Cable length: 2・5・10m	 Refer to section 13.1.2 (1) for details.	IP65 Counter axis side lead
18)	Encoder cable	LE-CSE-R□B Cable length: 2・5・10m		IP65 Counter axis side lead Robot cable
33)	Connector set	LE-CSNA	 Connector: 10126-3000PE Shell kit: 10326-52F0-008(Sumitomo 3M Limited or equivalent)	

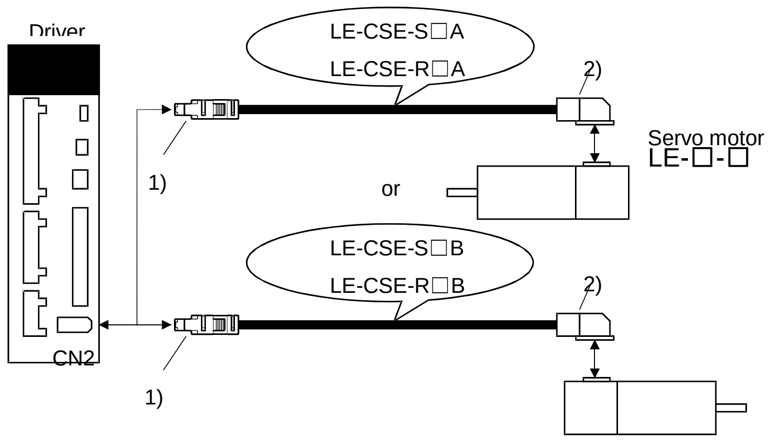
13.1.2 Encoder cable/connector sets

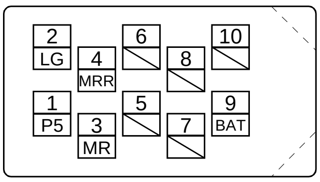
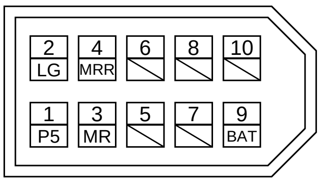
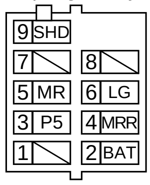
(1) LE-CSE-□□A・LE-CSE-□□B

These cables are encoder cables for the, LE-□-□ series servo motors. The numerals in the Cable Length field of the table are the symbols entered in the □ part of the cable model. The cables of the lengths with the symbols are available.

Cable model	Cable length 2m	Cable length 5m	Cable length 10m	Protective structure	Flex life	Application
LE-CSE-S□A	2	5	A	IP65	Standard	For LE-□-□ servo motor Axis side lead
LE-CSE-R□A	2	5	A	IP65	Robot cable	
LE-CSE-S□B	2	5	A	IP65	Standard	For LE-□-□ servo motor Counter axis side lead
LE-CSE-R□B	2	5	A	IP65	Robot cable	

(a) Connection of driver and servo motor

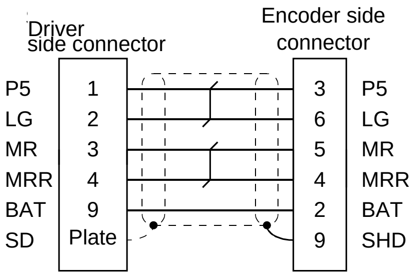


Cable model	1) For CN2 connector	2) For encoder connector
LE-CSE-S□A LE-CSE-R□A LE-CSE-S□B LE-CSE-R□B	Receptacle: 36210-0100PL Shell kit: 36310-3200-008 (Sumitomo 3M Limited) (Note) Signal layout  View seen from wiring side. or Connector set: 54599-1019 (Molex) (Note) Signal layout  View seen from wiring side. Note. Keep open the pins shown with ⍂. Especially, pin 10 is provided for manufacturer adjustment. If it is connected with any other pin, the driver cannot operate normally.	Connector: 1674320-1 Crimping tool for ground clip: 1596970-1 Crimping tool for receptacle contact: 1596847-1 (Tyco Electronics) (Note) Signal layout  View seen from wiring side. Note. Keep open the pin shown with an ⍂.

(b) Cable internal wiring diagram

LE-CSE-S□A LE-CSE-R□A

LE-CSE-S□B LE-CSE-R□B

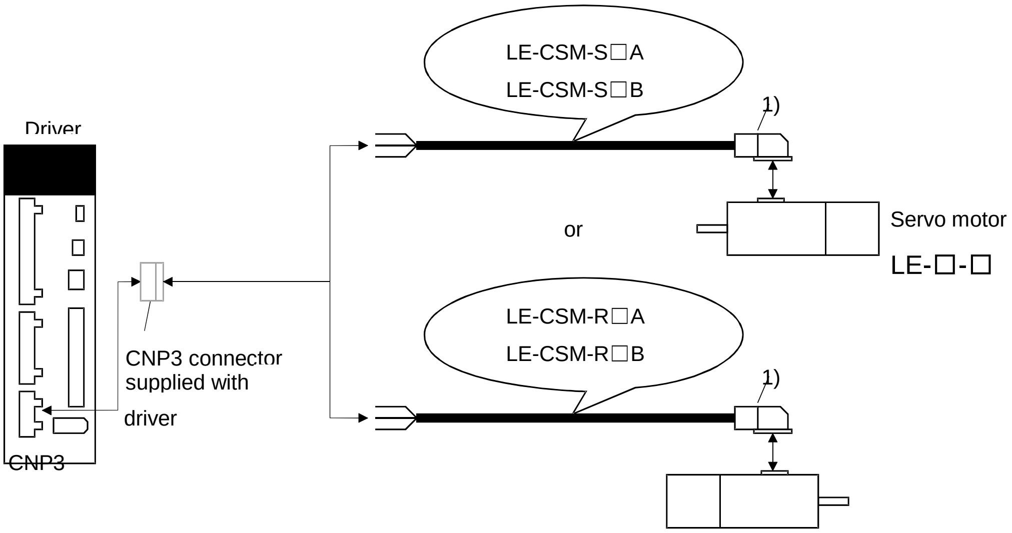


13.1.3 Motor cables

These cables are motor power supply cables for the LE-□-□ series servo motors. The numerals in the Cable Length field of the table are the symbols entered in the □ part of the cable model. The cables of the lengths with the symbols are available.
Refer to section 4.10 when wiring.

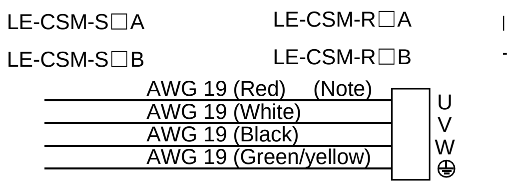
Cable model	Cable length			IP rating	Cable type	Application
	2m	5m	10m			
LE-CSMS□A	2	5	A	IP65	Standard	For LE-□-□ servo motor Axis side lead
LE-CSM-S□B	2	5	A	IP65	Standard	For LE-□-□ servo motor Counter axis side lead
LE-CSM-R□A	2	5	A	IP65	Robot cable	For LE-□-□ servo motor Axis side lead
LE-CSM-R□B	2	5	A	IP65	Robot cable	For LE-□-□ servo motor Counter axis side lead

(1) Connection of driver and servo motor



Cable model	1) For motor power supply connector	
LE-CSM−S□A LE-CSM-−S□B LE-CSM−R□A LE-CSM−R□B	Connector: JN4FT04SJ1-R Hood, socket insulator Bushing, ground nut Contact: ST-TMH-S-C1B-100-(A534G) Crimping tool: CT160-3-TMH5B (Japan Aviation Electronics Industry)	Signal layout 1 ⏚ 2 U 3 V 4 W View seen from wiring side.

(2) Internal wiring diagram



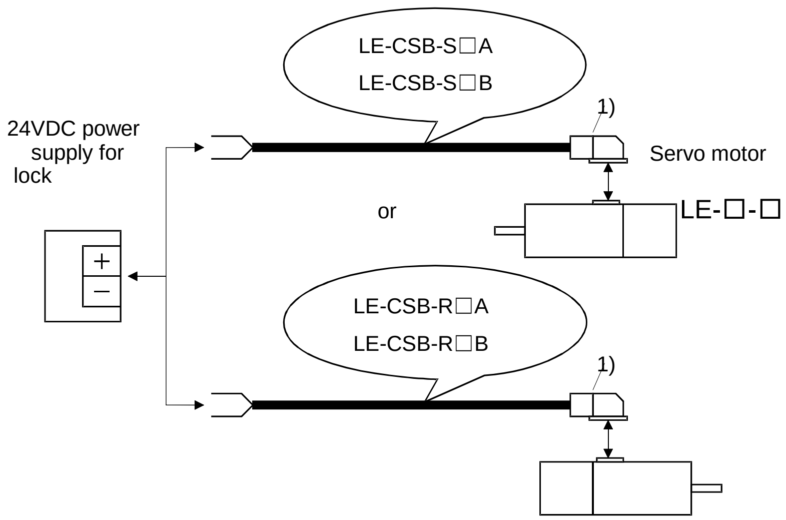
Note. These are not shielded cables.

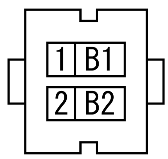
13.1.4 Lock cables

These cables are motor brake cables for the LE-□-□ series servo motors. The numerals in the Cable Length field of the table are the symbols entered in the □ part of the cable model. The cables of the lengths with the symbols are available.
Refer to section 4.11 when wiring.

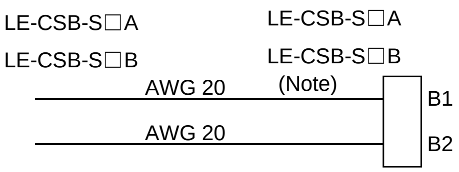
Cable model	Cable length			Protective structure	Flex life	Application
	2m	5m	10m			
LE-CSB-S□A	2	5	A	IP65	Standard	For LE-□-□ servo motor Axis side lead
LE-CSB-S□B	2	5	A	IP65	Standard	For LE-□-□ servo motor Counter axis side lead
LE-CSB-R□A	2	5	A	IP65	Robot cable	For LE-□-□ servo motor Axis side lead
LE-CSB-R□B	2	5	A	IP65	Robot cable	For LE-□-□ servo motor Counter axis side lead

(1) Connection of power supply for lock and servo motor



Cable model	1) For motor power supply connector	
LE-CSM−S□A	Connector: JN4FT04SJ1-R Hood, socket insulator Bushing, ground nut Contact: ST-TMH-S-C1B-100-(A534G) Crimping tool: CT160-3-TMH5B (Japan Aviation Electronics Industry)	Signal layout  View seen from wiring side.
LE-CSM-−S□B		
LE-CSM−R□A		
LE-CSM−R□B		

(2) Internal wiring diagram



Note. These are not shielded cables.

13.2 Regenerative options

⚠CAUTION	・The specified combinations of regenerative options and drivers may only be used. Otherwise, a fire may occur.

(1) Combination and regenerative power

The power values in the table are resistor-generated powers and not rated powers.

Driver	Regenerative power [W]		
	Built-in regenerative resistor	LEC-MR-RB-032 [40Ω]	LEC-MR-RB-12 [40Ω]
LECSC□-S5		30	
LECSC□-S7	10	30	100
LECSC□-S8	10	30	100

Note 1. Always install a cooling fan.

2. Values in parentheses assume the installation of a cooling fan.

(2) Parameter setting

Set parameter No.PA02 according to the option to be used.

Parameter No.PA02

0	0		

Selection of regenerative option

00: Regenerative option is not used

・For 100W driver regenerative resistor is not used

・For 200W / 400W driver regenerative resistor is used

02: LEC-MR-RB-032

03: LEC-MR-RB-12

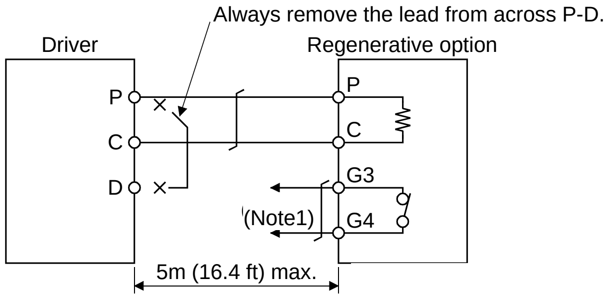
(3) Connection of the regenerative option

POINT
・For the sizes of wires used for wiring, refer to section 13.4.

The regenerative option will cause a temperature rise of ＋100℃ relative to the ambient temperature. Fully examine heat dissipation, installation position, used cables, etc. before installing the option. For wiring, use flame-resistant cables and keep them clear of the regenerative option body. Always use twisted cables of max. 5m length for connection with the driver.

(a) LECSC□−□

Always remove the wiring from across P-D and fit the regenerative option across P-C.
The G3 and G4 terminals act as a thermal sensor. G3-G4 is disconnected when the regenerative option overheats abnormally.

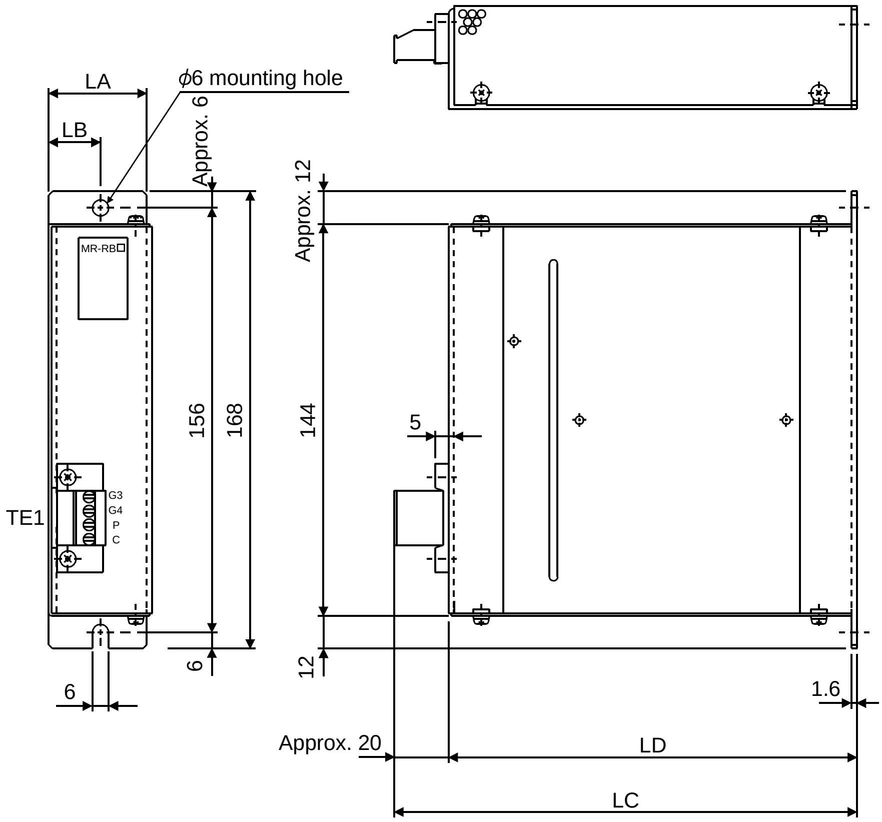


Note 1. Make up a sequence which will switch off the magnetic contactor (MC) when abnormal heating occurs.
G3-G4 contact specifications
Maximum voltage: 120V AC/DC
Maximum current: 0.5A/4.8VDC
Maximum capacity: 2.4VA

(4) Outline dimension drawings

(a) LEC-MR-RB-032・LEC-MR-RB-12

[Unit: mm (in)]



・TE1

Terminal block

G3
G4
P
C

Terminal screw: M3

Tightening torque: 0.5 to 0.6 [N・m] (4 to 5 [lb・in])

・Mounting screw

Screw size: M5

Tightening torque: 3.24 [N・m] (28.7 [lb・in])

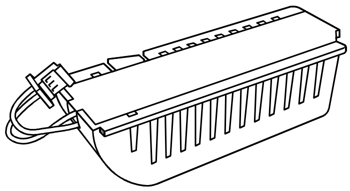
Regenerative option	Variable dimensions				Mass	
	LA	LB	LC	LD	[kg]	[lb]
LEC-MR-RB-032	30	15	119	99	0.5	1.1
LEC-MR-RB-12	40	15	169	149	1.1	2.4

13.3 Battery LEC-MR-J3BAT

POINT
・The revision (Edition 44) of the Dangerous Goods Rule of the International Air Transport Association (IATA) went into effect on January 1, 2003 and was enforced immediately. In this rule, "provisions of the lithium and lithium ion batteries" were revised to tighten the restrictions on the air transportation of batteries. However, since this battery is non-dangerous goods (non-Class 9), air transportation of 24 or less batteries is outside the range of the restrictions. Air transportation of more than 24 batteries requires packing compliant with the Packing Standard 903. When a self-certificate is necessary for battery safety tests, contact our branch or representative. For more information, consult our branch or representative. (As of Jun, 2008).

(1) Purpose of use for LEC-MR-J3BAT

This battery is used to construct an absolute position detection system. Refer to section 5.7 for the fitting method, etc.



(2) Year and month when LEC-MR-J3BAT is manufactured

The year and month when LEC-MR-J3BAT is manufactured are written down in Serial No. on the rating plate of the battery back face.

The year and month of manufacture are indicated by the last one digit of the year and 1 to 9, X(10), Y(11), Z(12).

For October 2004, the Serial No. is like, "SERIAL □ 4X □□□□□□".

13.4 Selection example of wires

POINT

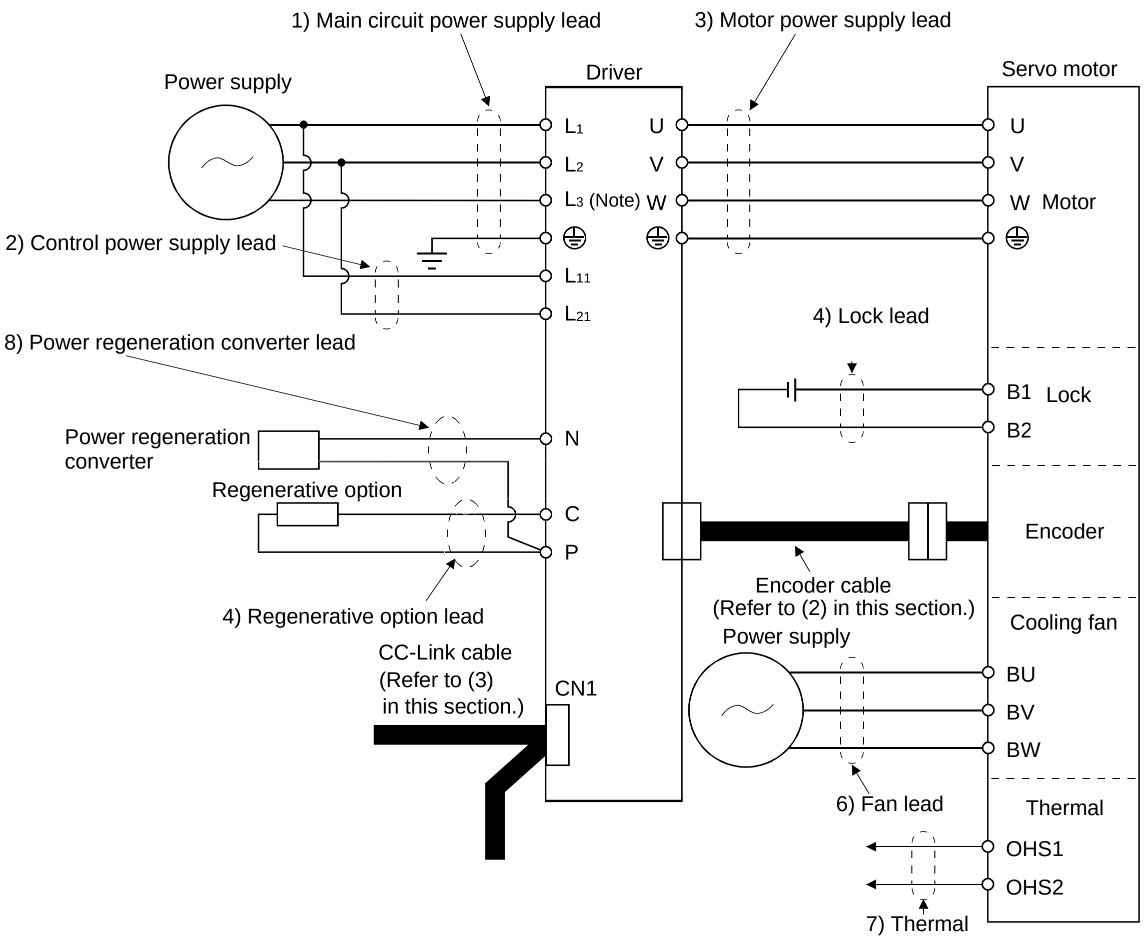
- Wires indicated in this section are separated wires. When using a cable for power line (U, V, and W) between the driver and servo motor, use a 600V grade EP rubber insulated chloroprene sheath cab-tire cable (2PNCT). For selection of cables, refer to appendix 6.
- To comply with the UL/C-UL (CSA) Standard, use UL-recognized copper wires rated at 60℃ (140°F) or more for wiring. To comply with other standards, use a wire that is complied with each standard
- Selection condition of wire size is as follows.

  Construction condition: One wire is constructed in the air

  Wire length: 30m or less

(1) Wires for power supply wiring

The following diagram shows the wires used for wiring. Use the wires given in this section or equivalent.



Note. There is no L3 for 1-phase 100 to 120VAC power supply.

(a) When using the 600V Polyvinyl chloride insulated wire (IV wire)
Selection example of wire size when using IV wires is indicated below.

Table 13.1 Wire size selection example 1 (IV wire)

Driver	Wires [mm^2] (Note 1, 2)						
	1) L_1 ・ L_2 ・ L_3 ・ ⏚	2) L_{11} ・ L_{21}	3) U ・ V ・ W ・ ⏚	4) P ・ C	5) B1 ・ B2	6) BU ・ BV ・ BW	7) OHS1 ・ OHS2
LECSC□-S5	2(AWG14)	1.25(AWG16)	1.25(AWG16)	2(AWG14)	1.25(AWG16)		
LECSC□-S7							
LECSC□-S8							

Note 1. Alphabets in the table indicate crimping tools. For crimping terminals and applicable tools, refer to (1) (c) in this section.
2. Wires are selected based on the highest rated current among combining servo motors.

Use wires 8) of the following sizes with the power regeneration converter (FR-RC-(H) :Mitsubishi Electric Corporation).

Model	Wires[mm^2]
FR-RC-15K	14(AWG6)
FR-RC-30K	14(AWG6)
FR-RC-55K	22(AWG4)
FR-RC-H15K	14(AWG6)
FR-RC-H30K	14(AWG6)
FR-RC-H55K	14(AWG6)

(b) When using the 600V Grade heat-resistant polyvinyl chloride insulated wire (HIV wire)
Selection example of wire size when using HIV wires is indicated below. For the wire (8)) for power regeneration converter (FR-RC-(H) :Mitsubishi Electric Corporation), use the IV wire indicated in (1) (a) in this section.

Table 13.2 Wire size selection example 2 (HIV wire)

Driver	Wires [mm^2] (Note 1, 2)						
	1) L_1 ・ L_2 ・ L_3 ・ ⏚	2) L_{11} ・ L_{21}	3) U ・ V ・ W ・ ⏚	4) P ・ C	5) B1 ・ B2	6) BU ・ BV ・ BW	7) OHS1 ・ OHS2
LECSC□-S5	2(AWG14)	1.25(AWG16)	1.25(AWG16)	2(AWG14)	1.25(AWG16)		
LECSC□-S7							
LECSC□-S8							

Note 1. Alphabets in the table indicate crimping tools. For crimping terminals and applicable tools, refer to (1) (c) in this section.
2. Wires are selected based on the highest rated current among combining servo motors.

(c) Selection example of crimping terminals

Selection example of crimping terminals for the driver terminal box when using the wires mentioned in (1) (a) and (b) in this section is indicated below.

<table>
<tr><th rowspan="3">Symbol</th><th colspan="5">Driver side crimping terminals</th></tr>
<tr><th rowspan="2">(Note 2)
Crimping terminal</th><th colspan="3">Applicable tool</th><th rowspan="2">Manufacturer</th></tr>
<tr><th>Body</th><th>Head</th><th>Dice</th></tr>
<tr><td>a</td><td>FVD5.5-4</td><td>YNT-1210S</td><td rowspan="2"></td><td rowspan="2"></td><td rowspan="18">Japan Solderless Terminal</td></tr>
<tr><td>(Note 1)b</td><td>8-4NS</td><td>YHT-8S</td></tr>
<tr><td>c</td><td>FVD14-6</td><td rowspan="2">YF-1・E-4</td><td rowspan="2">YNE-38</td><td>DH-112・DH122</td></tr>
<tr><td>d</td><td>FVD22-6</td><td>DH-113・DH123</td></tr>
<tr><td rowspan="2">(Note 1)e</td><td rowspan="2">38-6</td><td>YPT-60-21</td><td></td><td rowspan="2">TD-112・TD-124</td></tr>
<tr><td>YF-1・E-4</td><td>YET-60-1</td></tr>
<tr><td rowspan="2">(Note 1)f</td><td rowspan="2">R60-8</td><td>YPT-60-21</td><td></td><td rowspan="2">TD-113・TD-125</td></tr>
<tr><td>YF-1・E-4</td><td>YET-60-1</td></tr>
<tr><td>g</td><td>FVD2-4</td><td rowspan="2">YNT-1614</td><td rowspan="4"></td><td rowspan="4"></td></tr>
<tr><td>h</td><td>FVD2-M3</td></tr>
<tr><td>j</td><td>FVD5.5-6</td><td rowspan="2">YNT-1210S</td></tr>
<tr><td>k</td><td>FVD5.5-8</td></tr>
<tr><td>l</td><td>FVD8-6</td><td rowspan="3">YF-1・E-4</td><td rowspan="3">YNE-38</td><td>DH-111・DH121</td></tr>
<tr><td>m</td><td>FVD14-8</td><td>DH-112・DH122</td></tr>
<tr><td>n</td><td>FVD22-8</td><td>DH-113・DH123</td></tr>
<tr><td rowspan="2">(Note 1)p</td><td rowspan="2">R38-8</td><td>YPT-60-21</td><td></td><td rowspan="2">TD-112・TD-124</td></tr>
<tr><td>YF-1・E-4</td><td>YET-60-1</td></tr>
<tr><td>q</td><td>FVD2-6</td><td>YNT-1614</td><td></td><td></td></tr>
</table>

Note 1. Coat the part of crimping with the insulation tube.

2. Some crimping terminals may not be mounted depending on the size. Make sure to use the recommended ones or equivalent ones.

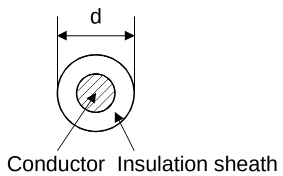
(2) Wires for cables

When fabricating a cable, use the wire models given in the following table or equivalent.

Table 13.3 Wires for option cables

TypeEncoder cable	Model	Length [m]	Core size [mm^2]	Number of Cores	Characteristics of one core			(Note 3) Finishing OD [mm]	Wire model
					Structure [Wires/mm]	Conductor resistance [Ω/mm]	Insulation coating OD d [mm] (Note 1)		
Encoder Cable	LE-CSE−S□A	2 to 10	AWG22	6 (3 pairs)	7/0.26	53 or less	1.2	7.1±0.3	(Note 3) VSVP 7/0.26 (AWG#22 or equivalent)-3P Ban-gi-shi-16823
	LE-CSE−S□B								
	LE-CSE−R□A	2 to 10	AWG22	6 (3 pairs)	70/0.08	56 or less	1.2	7.1±0.3	(Note 3) ETFE SVP 70/0.08 (AWG#22 or equivalent)-3P Ban-gi-shi-16824
	LE-CSE−R□B								
Motor cable	LE-CSM−S□A	2 to 10	AWG18	4	34/0.18	21.8 or less	1.71	62±0.3	HRZFEV-A(CL3) AWG18 4-cores
	LE-CSM−S□B	2 to 10							
	LE-CSM−R□A	2 to 10	(Note 5) AWG19 (0.75mm^2)	4	150/0.08	29.1 or less	1.63	5.7±0.5	(Note 4) RMFES-A(CL3X) AWG19 4-cores
	LE-CSM−R□B	2 to 10							
Lock cable	LE-CSB−S□A	2 to 10	AWG20	2	21/0.18	34.6 or less	1.35	4.7±0.1	(Note 4) HRZFEV-A(CL3) AWG20 2-cores
	LE-CSB−S□B	2 to 10							
	LE-CSB−R□A	2 to 10	(Note 5) AWG20 (0.75mm^2)	2	110/0.08	39.0 or less	1.37	4.5±0.3	RMFES-A(CL3X) AWG20 2-cores
	LE-CSB−R□B	2 to 10							

Note 1. d is as shown below.



2. Purchased from Toa Electric Industry
3. Standard OD. Max. OD is about 10% greater.
4. Kurabe
5. These wire sizes assume that the UL-compliant wires are used at the wiring length of 10m.

(3) CC-Link twisted cable

POINT
・For the cables other than the one indicated here, refer to the open field network CC-Link catalog (L(NA)74108143).

The specifications of the twisted cable usable in CC-Link and the recommended cable are indicated below. If the cable used is other than the recommended cable indicated in the following table, we cannot guarantee the performance of CC-Link. For inquiries on CC-Link compatible cables, contact the nearest SMC.

Item	Specifications
Model	FANC-110SBH
Manufacturer	Kuramo Electric
Application	For fixed parts
Size	20AWG×3
Insulator material	Polyethylene foam
Insulator color	Blue, white, and yellow
Sheath material	Oil resistant vinyl
Sheath color	Brown
Operating temperature range (Note)	0 to 75 ℃ (32 to 167°F)
Tensile strength	49N
Minimum bend radius	35mm
Outline dimension	Approx. 7.6mm
Approximate mass	70kg/km
Conductor resistance (20℃)	34.5Ω/km or lower
Characteristic impedance	110±15Ω
Applicable specification	UL AWM Style 2464
	CAN/CSA-C22.2
	No.210.2-M90(cUL)

Note. An upper limit of the operating temperature range shows a heat-resistant temperature of the cable material.
In high-temperature environment, the transmittable distance may be reduced.

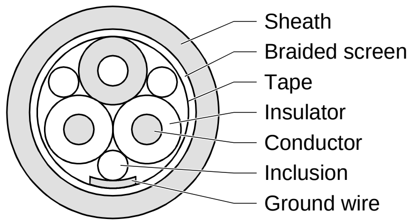


Fig. 13.1 Structure

13.5 No-fuse breakers, fuses, magnetic contactors

Always use one no-fuse breaker and one magnetic contactor with one driver. When using a fuse instead of the no-fuse breaker, use the one having the specifications given in this section.

Driver	No-fuse breaker		Fuse			Magnetic contactor
	Not using power factor improving reactor	Using power factor improving reactor	(Note) Class	Current [A]	Voltage AC [V]	
LECSC□-S5	30A frame 5A	30A frame 5A	T	10	250	S-N10 (Mitsubishi Electric Corporation)
LECSC2-S7	30A frame 5A	30A frame 5A		10		
LECSC1-S7	30A frame 10A	30A frame 10A		15		
LECSC2-S8	30A frame 10A	30A frame 5A		15		

Note. When not using the driver as a UL/C-UL Standard compliant product, K5 class fuse can be used.

13.6 Noise reduction techniques

Noises are classified into external noises which enter the driver to cause it to malfunction and those radiated by the driver to cause peripheral devices to malfunction. Since the driver is an electronic device which handles small signals, the following general noise reduction techniques are required.
Also, the driver can be a source of noise as its outputs are chopped by high carrier frequencies. If peripheral devices malfunction due to noises produced by the driver, noise suppression measures must be taken. The measures will vary slightly with the routes of noise transmission.

(1) Noise reduction techniques

(a) General reduction techniques

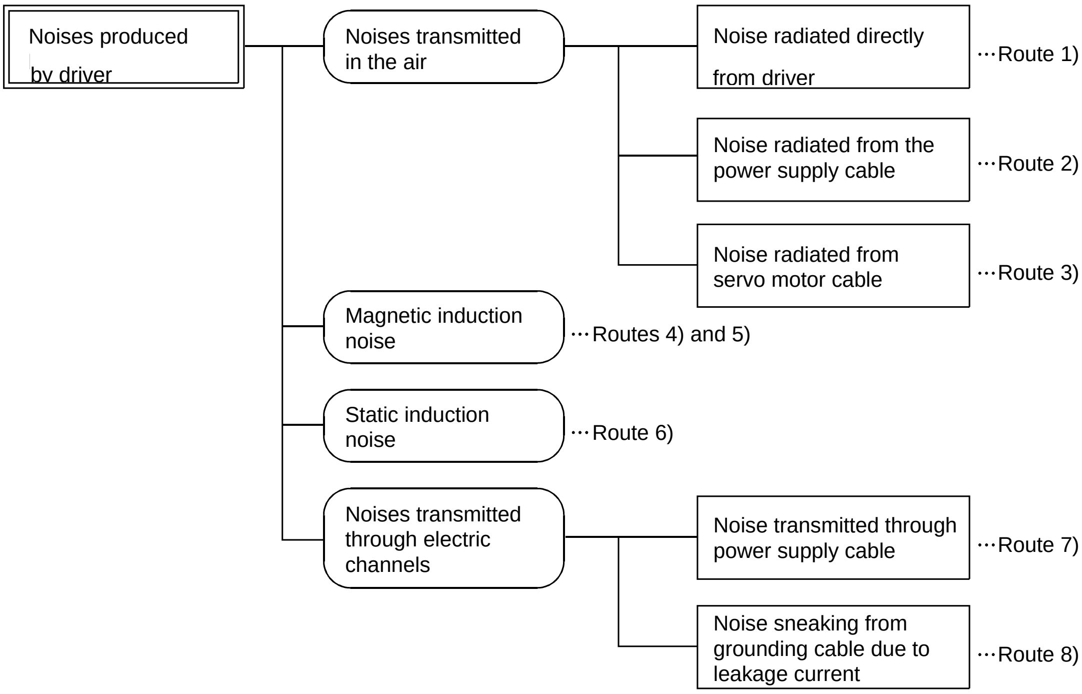
- Avoid laying power lines (input and output cables) and signal cables side by side or do not bundle them together. Separate power lines from signal cables.
- Use shielded, twisted pair cables for connection with the encoder and for control signal transmission, and connect the shield to the SD terminal.
- Ground the driver, servo motor, etc. together at one point (refer to section 4.12).

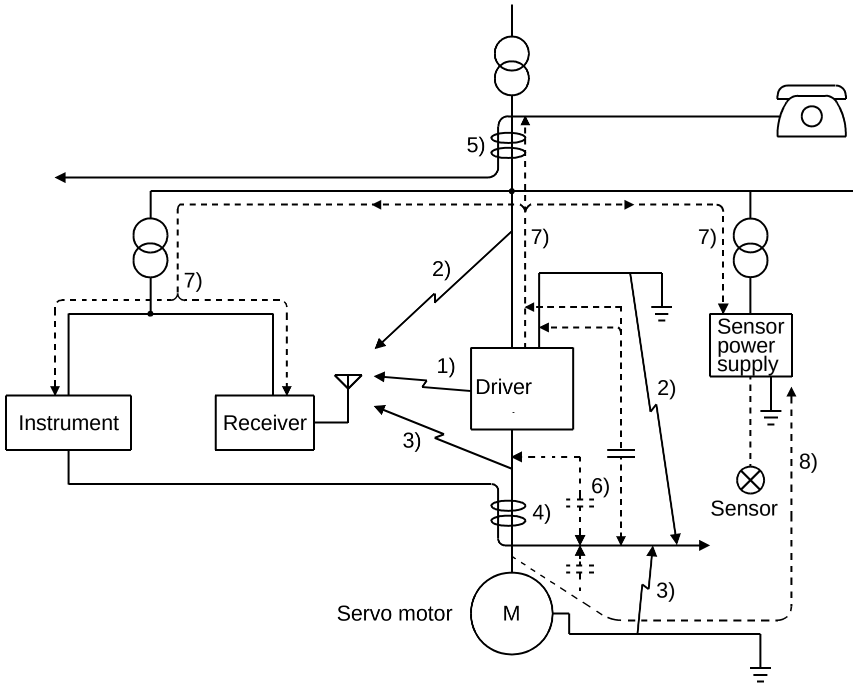
(b) Reduction techniques for external noises that cause the driver to malfunction

If there are noise sources (such as a magnetic contactor, a lock, and many relays which make a large amount of noise) near the driver and the driver may malfunction, the following countermeasures are required.

- Provide surge absorbers on the noise sources to suppress noises.
- Attach data line filters to the signal cables.
- Ground the shields of the encoder connecting cable and the control signal cables with cable clamp fittings.
- Although a surge absorber is built into the driver, to protect the driver and other equipment against large exogenous noise and lightning surge, attaching a varistor to the power input section of the equipment is recommended.

(c) Techniques for noises radiated by the driver that cause peripheral devices to malfunction Noises produced by the driver are classified into those radiated from the cables connected to the driver and its main circuits (input and output circuits), those induced electromagnetically or statically by the signal cables of the peripheral devices located near the main circuit cables, and those transmitted through the power supply cables.





Noise transmission route	Suppression techniques
1) 2) 3)	When measuring instruments, receivers, sensors, etc. which handle weak signals and may malfunction due to noise and/or their signal cables are contained in a control box together with the driver or run near the driver, such devices may malfunction due to noises transmitted through the air. The following techniques are required. 1. Provide maximum clearance between easily affected devices and the driver. 2. Provide maximum clearance between easily affected signal cables and the I/O cables of the driver. 3. Avoid laying the power lines (Input cables of the driver) and signal cables side by side or bundling them together. 4. Insert a line noise filter to the I/O cables or a radio noise filter on the input line. 5. Use shielded wires for signal and power cables or put cables in separate metal conduits.
4) 5) 6)	When the power lines and the signal cables are laid side by side or bundled together, magnetic induction noise and static induction noise will be transmitted through the signal cables and malfunction may occur. The following techniques are required. 1. Provide maximum clearance between easily affected devices and the driver. 2. Provide maximum clearance between easily affected signal cables and the I/O cables of the driver. 3. Avoid laying the power lines (I/O cables of the driver) and signal cables side by side or bundling them together. 4. Use shielded wires for signal and power cables or put the cables in separate metal conduits.
7)	When the power supply of peripheral devices is connected to the power supply of the driver system, noises produced by the driver may be transmitted back through the power supply cable and the devices may malfunction. The following techniques are required. 1. Insert the radio noise filter (FR-BIF:Mitsubishi Electric Corporation) on the power cables (Input cables) of the driver. 2. Insert the line noise filter (FR-BSF01・FR-BLF:Mitsubishi Electric Corporation) on the power cables of the driver.
8)	When the cables of peripheral devices are connected to the driver to make a closed loop circuit, leakage current may flow to malfunction the peripheral devices. If so, malfunction may be prevented by disconnecting the grounding cable of the peripheral device.

(2) Noise reduction products

(a) Data line filter (Recommended)

Noise can be prevented by installing a data line filter onto the encoder cable, etc.

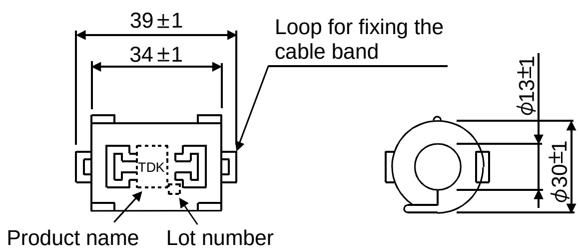
For example, the ZCAT3035-1330 of TDK and the ESD-SR-25 of NEC TOKIN make are available as data line filters.

As a reference example, the impedance specifications of the ZCAT3035-1330 (TDK) are indicated below.

This impedance is reference values and not guaranteed values.

Impedance[Ω]	
10 to 100MHz	100 to 500MHz
80	150

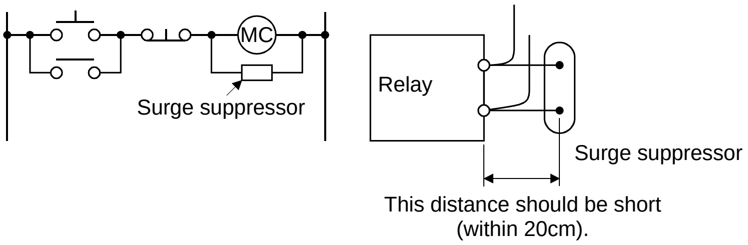
[Unit: mm]



Outline drawing (ZCAT3035-1330)

(b) Surge suppressor

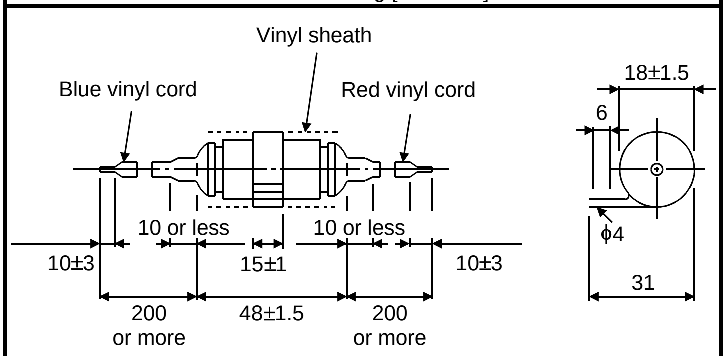
The recommended surge suppressor for installation to an AC relay, AC valve, or the like near the driver is shown below. Use this product or equivalent.



(Ex.) 972A.2003 50411
(Matsuo Electric Co.,Ltd.―200VAC rating)

Rated voltage AC[V]	C [μF]	R [Ω]	Test voltage AC[V]
200	0.5	50 (1W)	Across T-C 1000(1 to 5s)

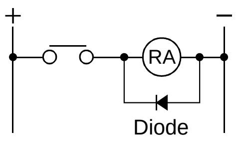
Outline drawing [Unit: mm]



Note that a diode should be installed to a DC relay, DC valve or the like.

Maximum voltage: Not less than 4 times the drive voltage of the relay or the like

Maximum current: Not less than twice the drive current of the relay or the like

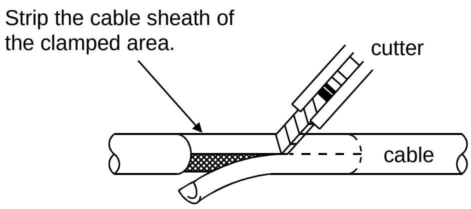


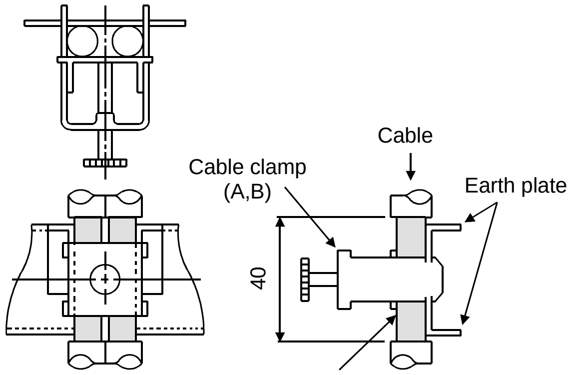
(c) Cable clamp fitting AERSBAN-☐SET

Generally, the earth of the shielded cable may only be connected to the connector's SD terminal. However, the effect can be increased by directly connecting the cable to an earth plate as shown below. Install the earth plate near the driver for the encoder cable. Peel part of the cable sheath to expose the external conductor, and press that part against the earth plate with the cable clamp. If the cable is thin, clamp several cables in a bunch.

The clamp comes as a set with the earth plate.

[Unit: mm]



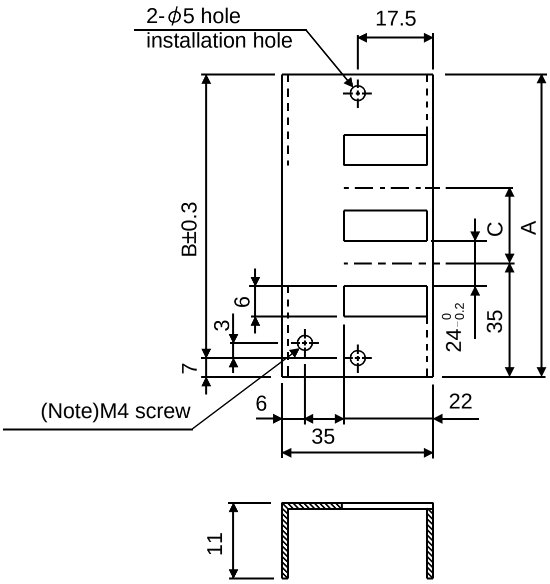


Clamp section diagram

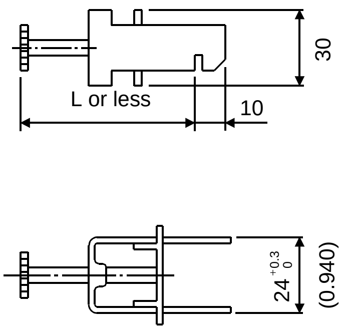
・Outline drawing

[Unit: mm]

Earth plate



Clamp section diagram



Note. Screw hole for grounding. Connect it to the earth plate of the control box.

Type	A	B	C	Accessory fittings
AERSBAN-DSET	100	86	30	clamp A: 2pcs.
AERSBAN-ESET	70	56		clamp B: 1pc.

Clamp fitting	L
A	70
B	45

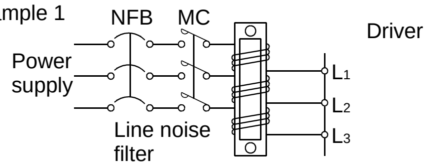
(d) Line noise filter (FR-BSF01, FR-BLF:Mitsubishi Electric Corporation)

This filter is effective in suppressing noises radiated from the power supply side and output side of the driver and also in suppressing high-frequency leakage current (zero-phase current) especially within 0.5MHz to 5MHz band.

Connection diagram

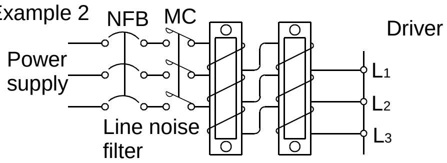
Use the line noise filters for wires of the main power supply ($L_1 \cdot L_2 \cdot L_3$) and of the motor power supply (U・V・W). Pass each of the 3-phase wires through the line noise filter an equal number of times in the same direction. For the main power supply, the effect of the filter rises as the number of passes increases, but generally four passes would be appropriate. For the motor power supply, passes must be four times or less. Do not pass the grounding (earth) wire through the filter, or the effect of the filter will drop. Wind the wires by passing through the filter to satisfy the required number of passes as shown in Example 1. If the wires are too thick to wind, use two or more filters to have the required number of passes as shown in Example 2. Place the line noise filters as close to the driver as possible for their best performance.

Example 1



(Number of turns: 4)

Example 2

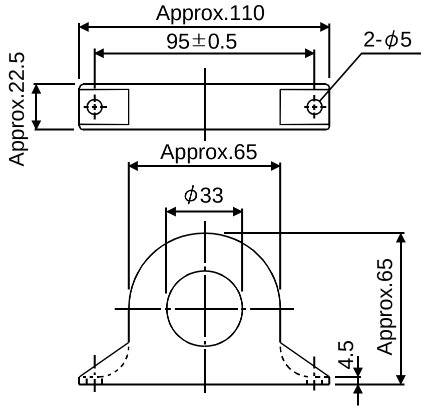


Two filters are used
(Total number of turns: 4)

Outline drawing [Unit: mm]

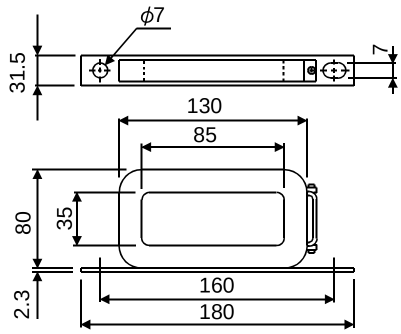
FR-BSF01 :Mitsubishi Electric Corporation

(for wire size 3.5mm² (AWG12) or less)



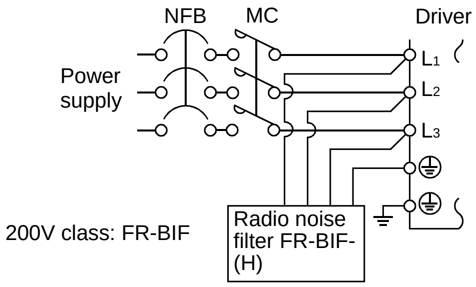
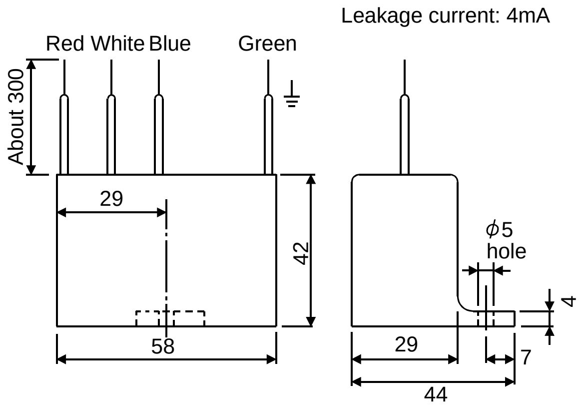
FR-BLF:Mitsubishi Electric Corporation

(for wire size 5.5mm² (AWG10) or more)



(e) Radio noise filter (FR-BIF-(H):Mitsubishi Electric Corporation)

This filter is effective in suppressing noises radiated from the power supply side of the driver especially in 10MHz and lower radio frequency bands. The FR-BIF-(H) is designed for the input only.

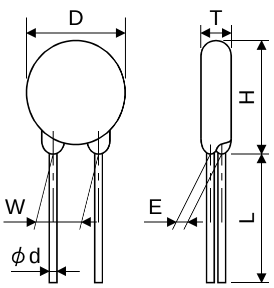
Connection diagram	Outline drawing (Unit: mm)
Make the connection cables as short as possible. Grounding is always required. When using the FR-BIF with a single-phase power supply, always insulate the wires that are not used for wiring. 	

(f) Varistors for input power supply (Recommended)

Varistors are effective to prevent exogenous noise and lightning surge from entering the driver. When using a varistor, connect it between each phase of the input power supply of the equipment. For varistors, the TND20V-431K, TND20V-471K and TND20V-102K, manufactured by NIPPON CHEMI-CON, are recommended. For detailed specification and usage of the varistors, refer to the manufacturer catalog.

Power supply voltage	Varistor	Maximum rating					Maximum limit voltage		Static capacity (reference value)	Varistor voltage rating (range) V1mA
		Permissible circuit voltage		Surge current immunity	Energy immunity	Rated pulse power				
		AC[Vrms]	DC[V]	8/20µs[A]	2ms[J]	[W]	[A]	[V]	[pF]	[V]
100V class	TND20V-431K	275	350	10000/1 time	195	1.0	100	710	1300	430(387 to 473)
200V class	TND20V-471K	300	385	7000/2 time	215			775	1200	470(423 to 517)

[Unit: mm]



Model	D Max.	H Max.	T Max.	E ±1.0	(Note)L min.	ϕd ±0.05	W ±1.0
TND20V-431K	21.5	24.5	6.4	3.3	20	0.8	10.0
TND20V-471K			6.6	3.5			
TND20V-102K	22.5	25.5	9.5	6.4			

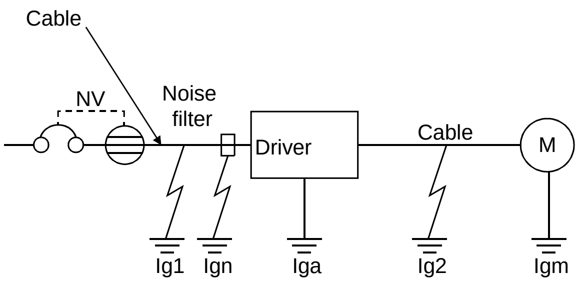
Note. For special purpose items for lead length (L), contact the manufacturer.

13.7 Leakage current breaker

(1) Selection method

High-frequency chopper currents controlled by pulse width modulation flow in the AC servo circuits.
Leakage currents containing harmonic contents are larger than those of the motor which is run with a commercial power supply.
Select a leakage current breaker according to the following formula, and ground the driver, servo motor, etc. securely.
Make the input and output cables as short as possible, and also make the grounding cable as long as possible (about 30cm) to minimize leakage currents.

Rated sensitivity current $\geq$ 10 · {Ig1+Ign+Iga+K · (Ig2+Igm)} [mA]   (14.1)



K: Constant considering the harmonic contents

Leakage current breaker Type	Products	K
Models provided with harmonic and surge reduction techniques	NV-SP NV-SW NV-CP NV-CW NV-L	1
General models	BV-C1 NFB NV-L	3

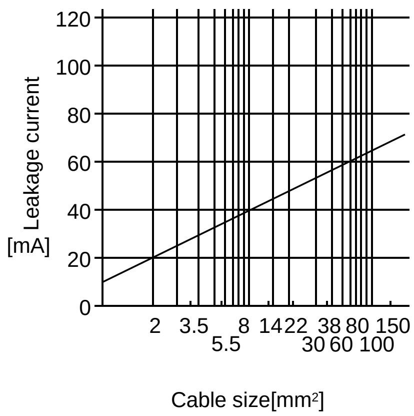
Ig1: Leakage current on the electric channel from the leakage current breaker to the input terminals of the driver (Found from Fig. 13.4.)

Ig2: Leakage current on the electric channel from the output terminals of the driver to the servo motor (Found from Fig. 13.4.)

Ign: Leakage current when a filter is connected to the input side (4.4mA per one FR-BIF-(H) :Mitsubishi Electric Corporation)

Iga: Leakage current of the driver (Found from Table 13.5.)

Igm: Leakage current of the servo motor (Found from Table 13.4.)



a. 200V class

Fig. 13.4 Leakage current example (lg1, lg2) for CV cable run in metal conduit

Table 13.4 Servo motor’s leakage current example (Igm)

Servo motor output [kW]	Leakage current [mA]
0.05 to 1	0.1

Table 13.5 Driver's leakage current example (Iga)

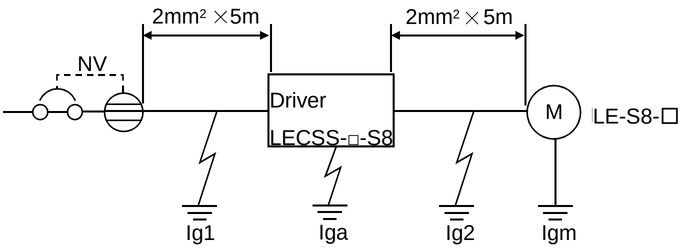
Driver capacity [kW]	Driver capacity [kW]
0.1 to 0.6	0.1 to 0.6

Table 13.6 Leakage circuit breaker selection example

Driver	Driver
LECSC2-□ LECSC1-□	15

(2) Selection example

Indicated below is an example of selecting a leakage current breaker under the following conditions.



Use a leakage current breaker generally available.
Find the terms of Equation (13.1) from the diagram.

$$Ig1 = 20 \cdot \frac{5}{1000} = 0.1 \text{ [mA]}$$

$$Ig2 = 20 \cdot \frac{5}{1000} = 0.1 \text{ [mA]}$$

Ign = 0 (not used)

Iga = 0.1 [mA]

Igm = 0.1 [mA]

Insert these values in Equation (13.1).

$$Ig \geq 10 \cdot \{0.1+0+0.1+1 \cdot (0.1+0.1)\}$$
$$\geq 4.0 \text{ [mA]}$$

According to the result of calculation, use a leakage current breaker having the rated sensitivity current (Ig) of 4.0[mA] or more. A leakage current breaker having Ig of 15[mA] is used with the NV-SP/SW/CP/CW/HW series.

13.8 EMC filter (recommended)

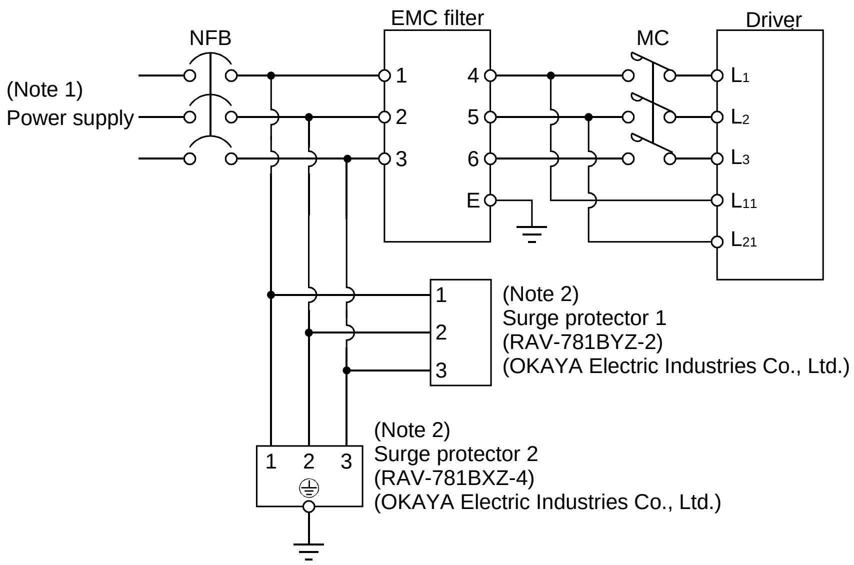
For compliance with the EMC directive of the EN Standard, it is recommended to use the following filter. Some EMC filters are large in leakage current.

(1) Combination with the driver

Driver	Recommended filter (Soshin Electric)		Mass [kg]([lb])
	Model	Leakage current [mA]	
LECSC2-□ LECSC1-□	(Note) HF3010A-UN	5	3 (6.61)

Note. A surge protector is separately required to use any of these EMC filters.

(2) Connection example



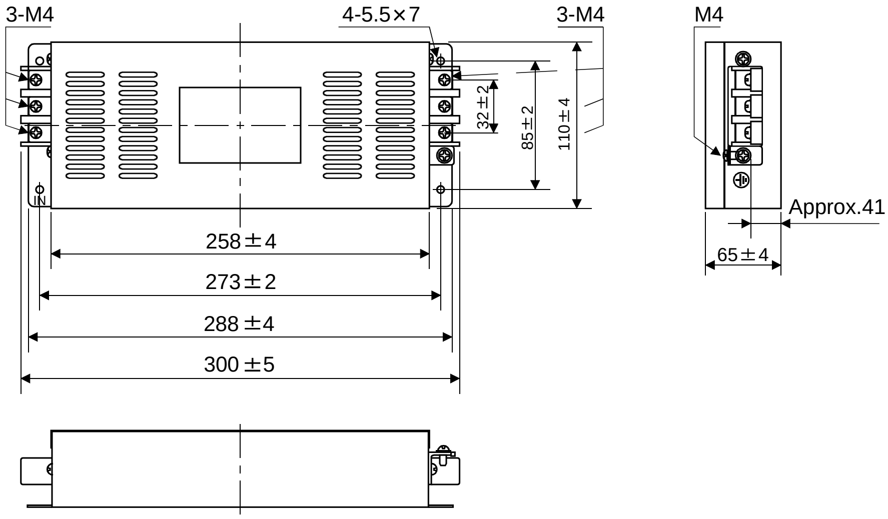
Note 1. For 1-phase 200V to 230VAC power supply, connect the power supply to L_1,L_2 and leave L_3 open.
There is no L_3 for 1-phase 100 to 120VAC power supply. Refer to section 1.3 for the power supply specification.
2. The example is when a surge protector is connected.

(3) Outline drawing

(a) EMC filter

HF3010A-UN

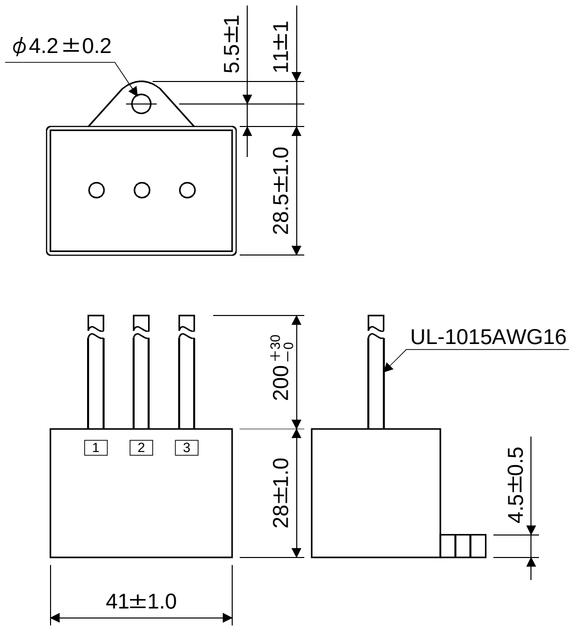
[Unit: mm]

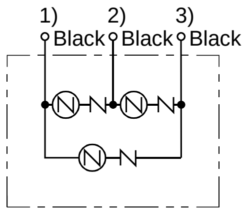


(b) Surge protector

RAV-781BYZ-2

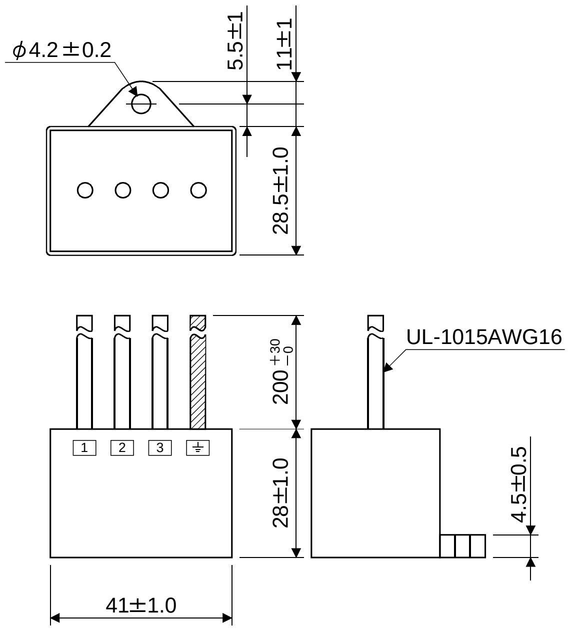
[Unit: mm]

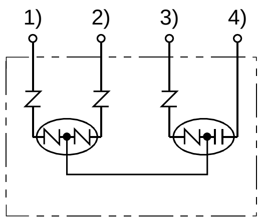




RAV-781BXZ-4

[Unit: mm]





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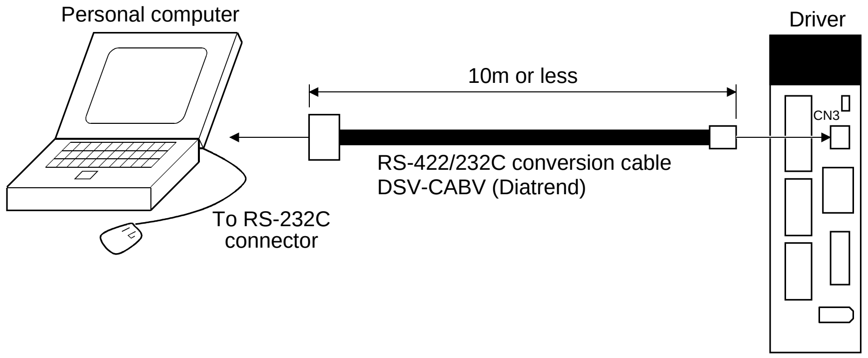
14. COMMUNICATION FUNCTION

Using the serial communication function of RS-422, this driver enables servo operation, parameter change, monitor function, etc.

14.1 Configuration

(1) Single axis

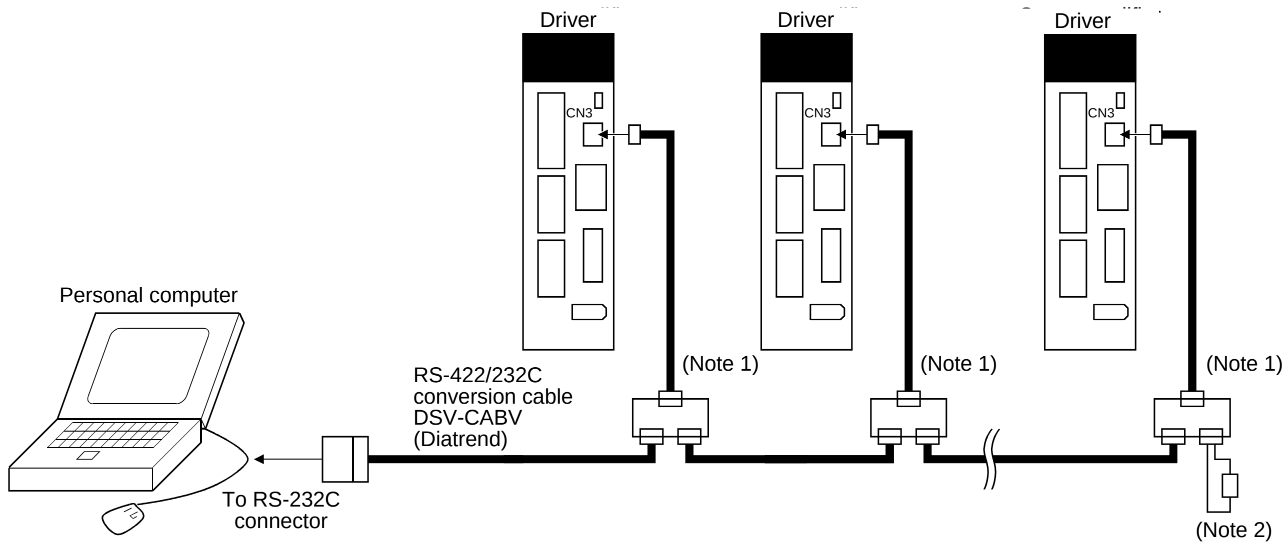
Operate the single-axis driver. It is recommended to use the following cable.



(2) Multidrop connection

(a) Diagrammatic sketch

Up to 32 axes of drivers from stations 0 to 31 can be operated on the same bus.

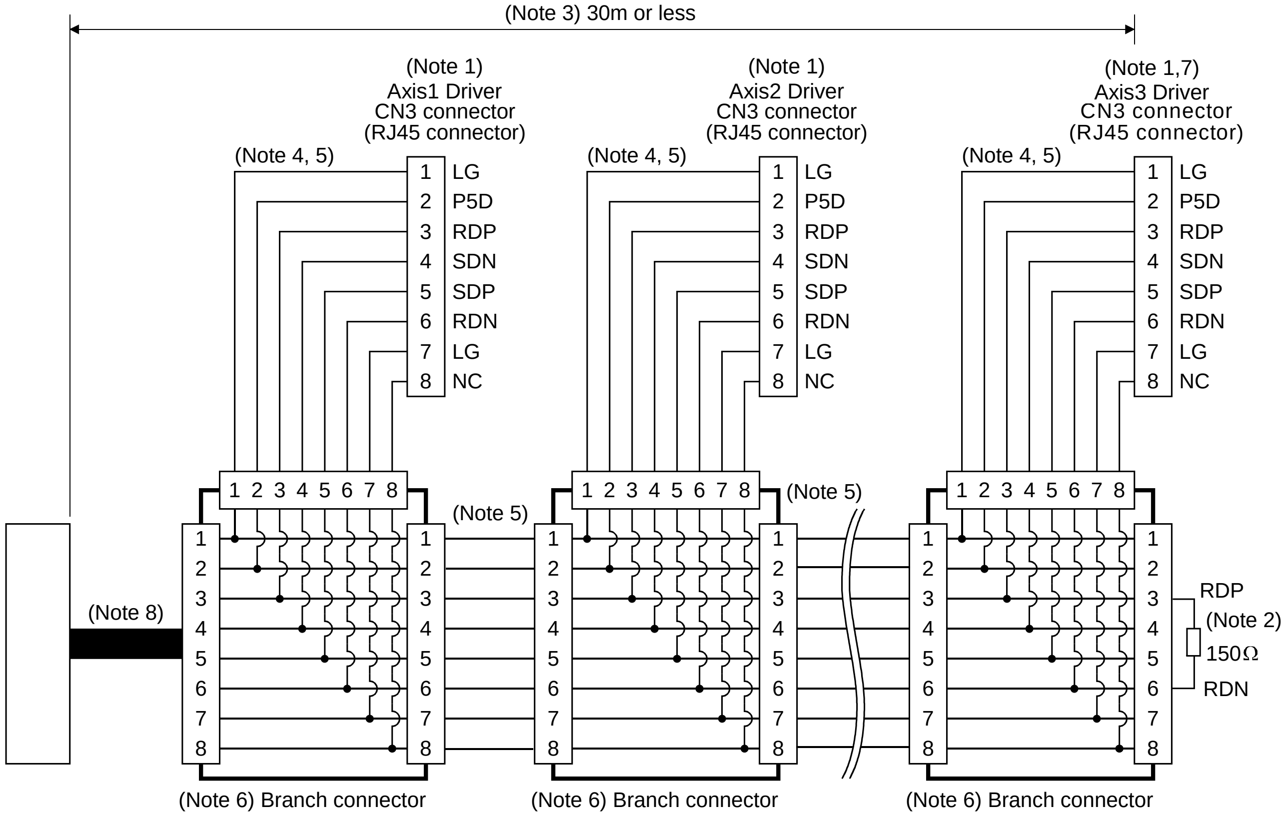


Note 1. The BMJ-8 (Hakko Electric Machine Works) is recommended as the branch connector.

2. The final axis must be terminated between RDP (pin No.3) and RDN (pin No.6) on the receiving side (driver) with a 150Ω resistor.

(b) Cable connection diagram

Wire the cables as shown below.



Note 1. Recommended connector (Hirose Electric)

Plug: TM10P-88P

Connection tool: CL250-0228-1

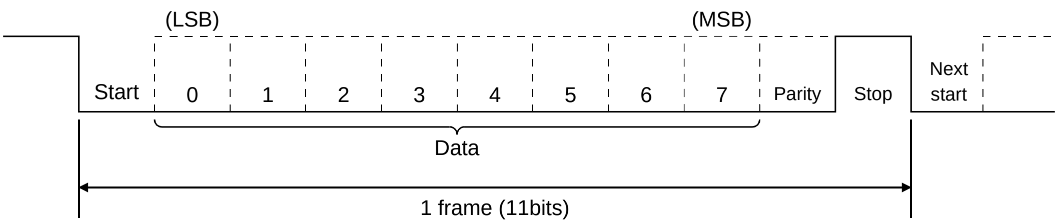
2. The final axis must be terminated between RDP (pin No.3) and RDN (pin No.6) on the receiving side (driver) with a 150Ω resistor.
3. The overall length is 30m or less in low-noise environment.
4. The wiring between the branch connector and driver should be as short as possible.
5. Use the EIA568-compliant cable (10BASE-T cable, etc.).
6. Recommended branch connector: BMJ-8 (Hakko Electric Machine Works)
7. n ≤ 32 (Up to 32 axes can be connected.)
8. RS-422/232C conversion cable DSV-CABV (Diatrend).

14.2 Communication specifications

14.2.1 Communication overview

This driver is designed to send a reply on receipt of an instruction. The device which gives this instruction (e.g. personal computer) is called a master station and the device which sends a reply in response to the instruction (driver) is called a slave station. When fetching data successively, the master station repeatedly commands the slave station to send data.

Item	Description
Baud rate	9600/19200/38400/57600/115200 asynchronous system
Transfer code	Start bit : 1 bit Data bit : 8 bits Parity bit : 1 bit (even) Stop bit : 1 bit
Transfer protocol	Character system, half-duplex communication system



14.2.2 Parameter setting

When the USB/RS-422 communication function is used to operate the driver, set the communication specifications of the driver in the corresponding parameters.
After setting the values of these parameters, they are made valid by switching power off once, then on again.

(1) Serial communication baud rate

Choose the communication speed. Match this value to the communication speed of the sending end (master station).

Parameter No.PC21

Communication baud rate
0: 9600[bps]
1: 19200[bps]
2: 38400[bps]
3: 57600[bps]
4: 115200[bps]

(2) RS-422 communication response delay time

Set the time from when the driver (slave station) receives communication data to when it sends back data. Set "0" to send back data in less than 800μs or "1" to send back data in 800μs or more.

Parameter No.PC21

RS-422 communication response delay time
0: Invalid
1: Valid, reply sent in 800μs or more

(3) Station number setting

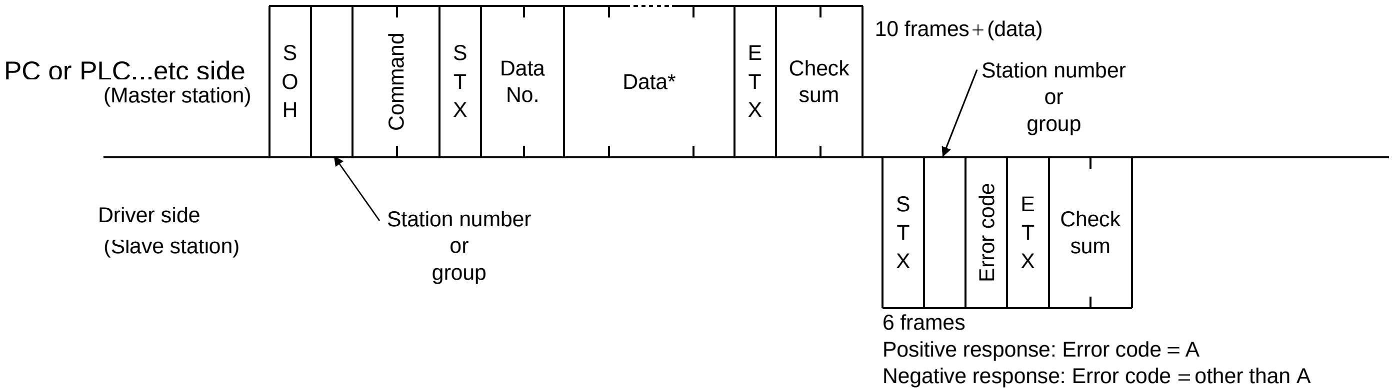
Set the station number of the driver in parameter No.PC20. The setting range is station 0 to 31.

14.3 Protocol

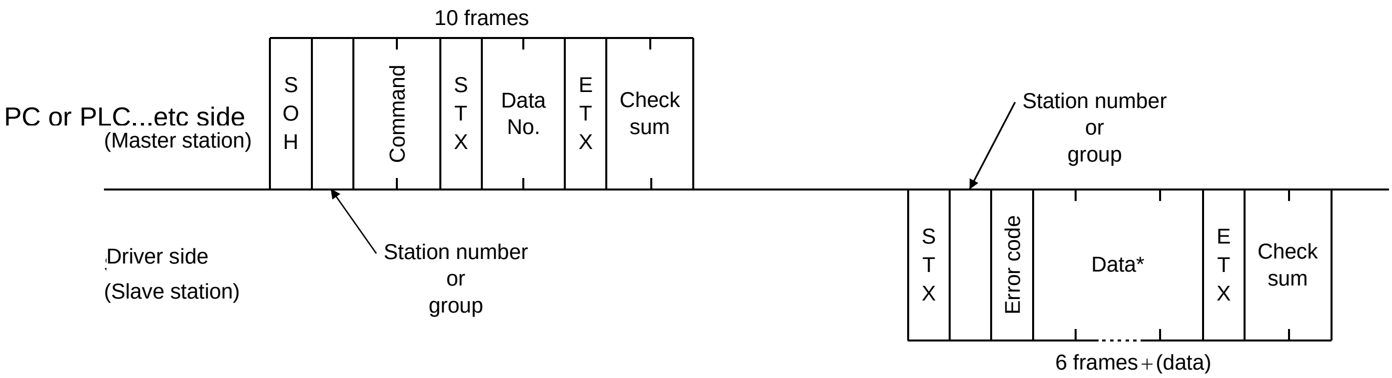
14.3.1 Transmission data configuration

Since up to 32 axes may be connected to the bus, add a station number or group to the command, data No., etc. to determine the destination driver of data communication. Set the station number to each driver using the parameter and set the group to each station using the communication command. Transmission data is valid for the driver of the specified station number or group.
When "*" is set as the station number added to the transmission data, the transmission data is made valid for all drivers connected. However, when return data is required from the driver in response to the transmission data, set "0" to the station number of the driver which must provide the return data.

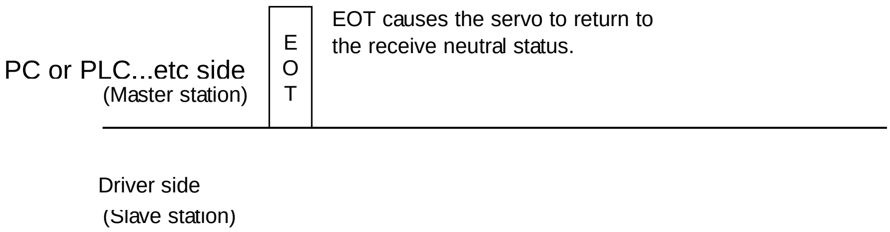
(1) Transmission of data from the PC or PLC...etc to the driver



(2) Transmission of data request from the PC or PLC...etc to the driver



(3) Recovery of communication status by time-out



(4) Data frames

The data length depends on the command.

Data	or	Data	or 12 frames or 16 frames
4 frames		8 frames	

14.3.2 Character codes

(1) Control codes

Code name	Hexadecimal (ASCII code)	Description	Personal computer terminal key operation (General)
SOH	01H	start of head	ctrl + A
STX	02H	start of text	ctrl + B
ETX	03H	end of text	ctrl + C
EOT	04H	end of transmission	ctrl + D

(2) Codes for data

ASCII codes are used.

b_8	0	0	0	0	0	0	0	0
b_7	0	0	0	0	1	1	1	1
b_6	0	0	1	1	0	0	1	1
b_5	0	1	0	1	0	1	0	1

b_8 to b_5	b_4	b_3	b_2	b_1	R \ C	0	1	2	3	4	5	6	7
	0	0	0	0	0	NUL	DLE	Space	0	@	P	`	p
	0	0	0	1	1	SOH	DC_1	!	1	A	Q	a	q
	0	0	1	0	2	STX	DC_2	“	2	B	R	b	r
	0	0	1	1	3	ETX	DC_3	#	3	C	S	c	s
	0	1	0	0	4			$	4	D	T	d	t
	0	1	0	1	5			%	5	E	U	e	u
	0	1	1	0	6			&	6	F	V	f	v
	0	1	1	1	7			‘	7	G	W	g	w
	1	0	0	0	8			(	8	H	X	h	x
	1	0	0	1	9			)	9	I	Y	i	y
	1	0	1	0	10			*	:	J	Z	j	z
	1	0	1	1	11			+	;	K	[	k	{
	1	1	0	0	12			,	<	L	¥	l		
	1	1	0	1	13			−	=	M	]	m	}
	1	1	1	0	14			.	>	N	^	n	‾
	1	1	1	1	15			/	?	O	_	o	DEL

(3) Station numbers

You may set 32 station numbers from station 0 to station 31 and the ASCII unit codes are used to specify the stations.

Station number	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
ASCII code	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F

Station number	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
ASCII code	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V

For example, "30H" is transmitted in hexadecimal for the station number of "0" (axis 1).

(4) Group

Group	a	b	c	d	e	f	All group
ASCII code	a	b	c	d	e	f	*

For example, "61H" is transmitted in hexadecimal for group a.

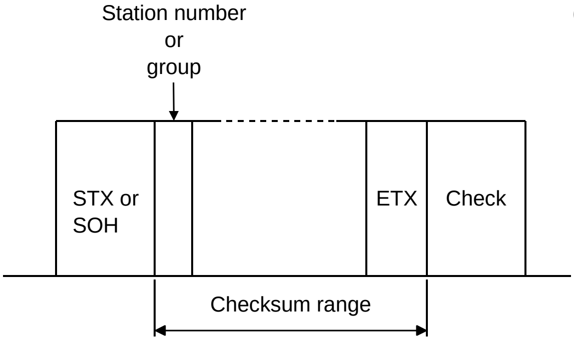
14.3.3 Error codes

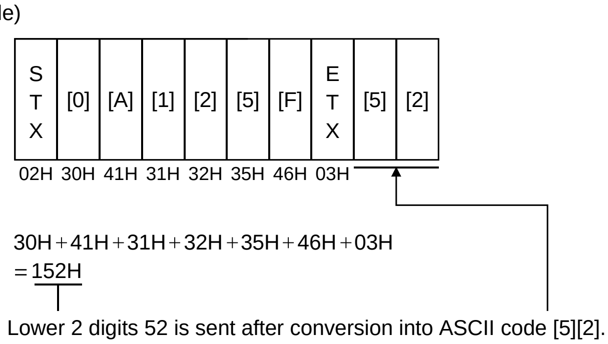
Error codes are used in the following cases and an error code of single-code length is transmitted.
On receipt of data from the master station, the slave station sends the error code corresponding to that data to the master station.
The error code sent in upper case indicates that the driver is normal and the one in lower case indicates that an alarm occurred.

Error code		Error name	Description	Remarks
Driver normal	Driver alarm			
[A]	[a]	Normal operation	Data transmitted was processed properly.	Positive response
[B]	[b]	Parity error	Parity error occurred in the transmitted data.	Negative response
[C]	[c]	Checksum error	Checksum error occurred in the transmitted data.	
[D]	[d]	Character error	Character not existing in the specifications was transmitted.	
[E]	[e]	Command error	Command not existing in the specifications was transmitted.	
[F]	[f]	Data No. error	Data No. not existing in the specifications was transmitted.	

14.3.4 Checksum

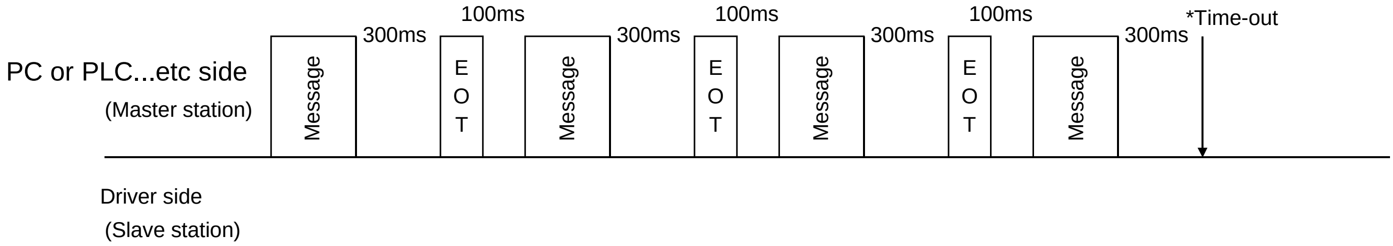
The checksum is a ASCII-coded hexadecimal representing the lower two digits of the sum of ASCII-coded hexadecimal numbers up to ETX, with the exception of the first control code (STX or SOH).





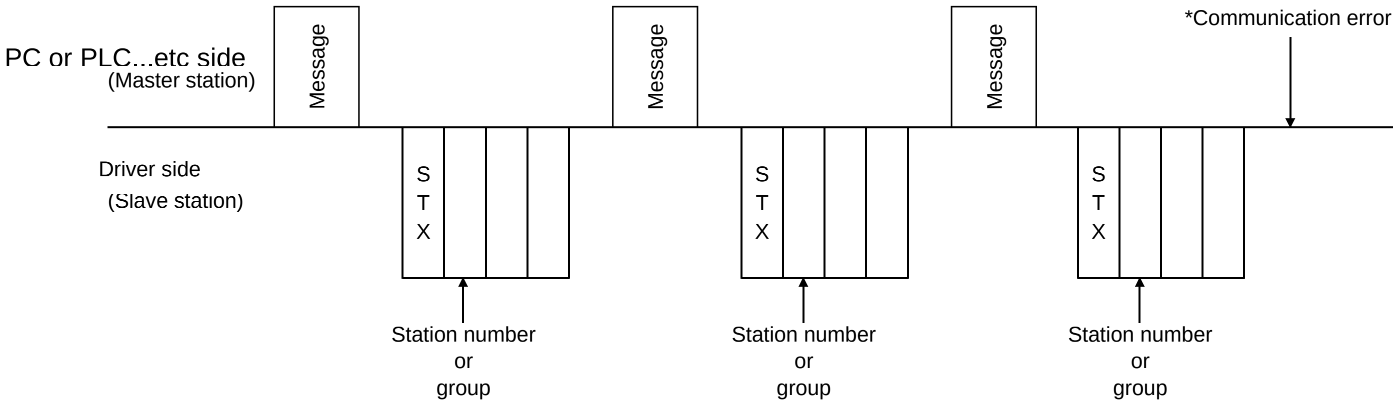
14.3.5 Time-out operation

The master station transmits EOT when the slave station does not start reply operation (STX is not received) 300ms after the master station has ended communication operation. 100ms after that, the master station retransmits the message. Time-out occurs if the slave station does not answer after the master station has performed the above operation three times. (Communication error)



14.3.6 Retry operation

When a fault occurs in communication between the master and slave stations, the error code in the response data from the slave station is a negative response code ([B] to [F], [b] to [f]). In this case, the master station retransmits the message which was sent at the occurrence of the fault (Retry operation). A communication error occurs if the above operation is repeated and results in the error three or more consecutive times.



Similarly, when the master station detects a fault (e.g. checksum, parity) in the response data from the slave station, the master station retransmits the message which was sent at the occurrence of the fault. A communication error occurs if the retry operation is performed three times.

14.3.7 Initialization

After the slave station is switched on, it cannot reply to communication until the internal initialization processing terminates. Hence, at power-on, ordinary communication should be started after.

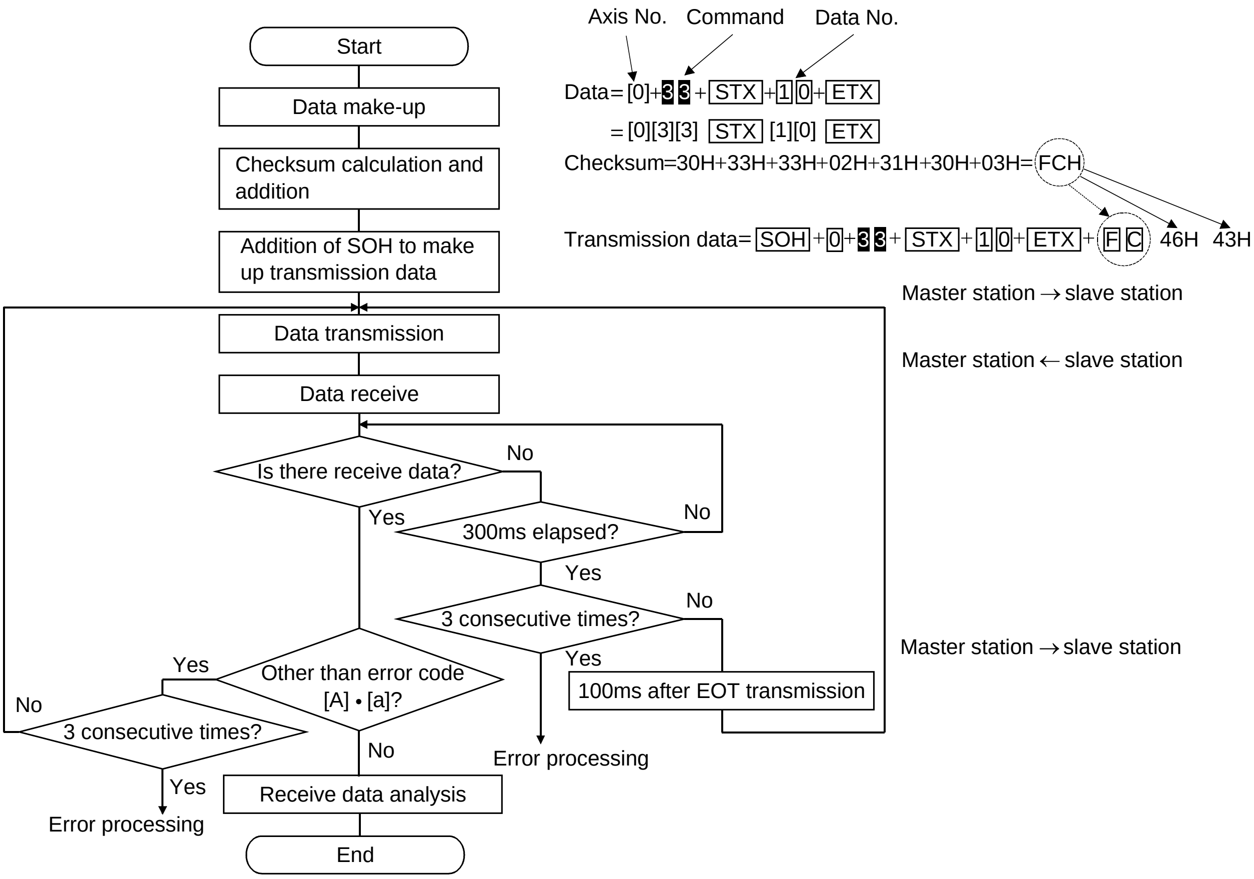
(1) 1s or more time has elapsed after the slave station is switched on; and

(2) Making sure that normal communication can be made by reading the parameter or other data which does not pose any safety problems.

14.3.8 Communication procedure example

The following example reads the set value of alarm history (last alarm) from the driver of station 0.

Data item	Value	Description
Station number	0	Driver station 0
Command	33	Read command
Data No.	10	Alarm history (last alarm)



14.4 Command and data No. list

POINT
・If the command and data No. are the same, the description may be different depending on models of drivers.

14.4.1 Read commands

(1) Status display (Command [0][1])

Command	Data No.	Description	Display item	Frame length
[0] [1]	[0] [0]	Status display name and unit	Current position	16
	[0] [1]		Command position	
	[0] [2]		Command remaining distance	
	[0] [3]		Point table No.	
	[0] [4]		Cumulative feedback pulses	
	[0] [5]		Driver motor speed	
	[0] [6]		Droop pulses	
	[0] [7]			
	[0] [8]			
	[0] [9]			
	[0] [A]		Regenerative load ratio	
	[0] [B]		Effective load ratio	
	[0] [C]		Peak load ratio	
	[0] [D]		Instantaneous torque	
	[0] [E]		Within one-revolution position	
	[0] [F]		ABS counter	
	[1] [0]		Load inertia moment ratio	
	[1] [1]		Bus voltage	
	[8] [0]	Status display data value and processing information	Current position	12
	[8] [1]		Command position	
	[8] [2]		Command remaining distance	
	[8] [3]		Point table No.	
	[8] [4]		Cumulative feedback pulses	
	[8] [5]		Servo motor speed	
	[8] [6]		Droop pulses	
	[8] [7]			
	[8] [8]			
	[8] [9]			
	[8] [A]		Regenerative load ratio	
	[8] [B]		Effective load ratio	
	[8] [C]		Peak load ratio	
	[8] [D]		Instantaneous torque	
	[8] [E]		Within one-revolution position	
	[8] [F]		ABS counter	
	[9] [0]		Load inertia moment ratio	
	[9] [1]		Bus voltage	

(2) Parameters (Command [0][4] · [0][5] · [0][6] · [0][7] · [0][8] · [0][9])

Command	Data No.	Description	Frame length
[0] [4]	[0] [1]	Parameter group read 0000: Basic setting parameter (No.PA□□) 0001: Gain filter parameter (No.PB□□) 0002: Extension setting parameter (No.PC□□) 0003: I/O setting parameter (No.PD□□)	4
[0] [5]	[0] [1] to [F] [F]	Current values of parameters Reads the current values of the parameters in the parameter group specified with the command [8][5] + data No. [0][0]. Before reading the current values, therefore, always specify the parameter group with the command [8][5] + data No. [0][0]. The decimal equivalent of the data No. value (hexadecimal) corresponds to the parameter number.	8
[0] [6]	[0] [1] to [F] [F]	Upper limit values of parameter setting ranges Reads the permissible upper limit values of the parameters in the parameter group specified with the command [8][5] + data No. [0][0]. Before reading the upper limit values, therefore, always specify the parameter group with the command [8][5] + data No. [0][0]. The decimal equivalent of the data No. value (hexadecimal) corresponds to the parameter number.	8
[0] [7]	[0] [1] to [F] [F]	Lower limit values of parameter setting ranges Reads the permissible lower limit values of the parameters in the parameter group specified with the command [8][5] + data No. [0][0]. Before reading the lower limit values, therefore, always specify the parameter group with the command [8][5] + data No. [0][0]. The decimal equivalent of the data No. value (hexadecimal) corresponds to the parameter number.	8
[0] [8]	[0] [1] to [F] [F]	Abbreviations of parameters Reads the abbreviations of the parameters in the parameter group specified with the command [8][5] + data No. [0][0]. Before reading the abbreviations, therefore, always specify the parameter group with the command [8][5] + data No. [0][0]. The decimal equivalent of the data No. value (hexadecimal) corresponds to the parameter number.	12
[0] [9]	[0] [1] to [F] [F]	Write enable/disable of parameters Reads write enable/disable of the parameters in the parameter group specified with the command [8][5] + data No. [0][0]. Before reading write enable/disable, therefore, always specify the parameter group with the command [8][5] + data No. [0][0]. 0000: Write enabled 0001: Write disabled	4

(3) External I/O signals (Command [1][2])

Command	Data No.	Description	Frame length
[1] [2]	[0] [0]	Input device status	8
	[0] [1]		
	[4] [0]	External input pin status	
	[6] [0]	Status of input device turned ON by communication	
	[6] [1]		
	[8] [0]	Output device status	
	[8] [1]		
	[C] [0]	External output pin status	

(4) Alarm history (Command [3][3])

Command	Data No.	Description	Alarm occurrence sequence	Frame length
[3] [3]	[1] [0]	Alarm number in alarm history	most recent alarm	4
	[1] [1]		first alarm in past	
	[1] [2]		second alarm in past	
	[1] [3]		third alarm in past	
	[1] [4]		fourth alarm in past	
	[1] [5]		fifth alarm in past	
	[2] [0]	Alarm occurrence time in alarm history	most recent alarm	8
	[2] [1]		first alarm in past	
	[2] [2]		second alarm in past	
	[2] [3]		third alarm in past	
	[2] [4]		fourth alarm in past	
	[2] [5]		fifth alarm in past	

(5) Current alarm (Command [0][2], [3][5])

Command	Data No.	Description		Frame length
[0] [2]	[0][0]	Current alarm number		4
[3] [5]	[0][0]	Status display name and unit at alarm occurrence	Current position	16
	[0][1]		Command position	
	[0][2]		Command remaining distance	
	[0][3]		Point table No.	
	[0][4]		Cumulative feedback pulses	
	[0][5]		Servo motor speed	
	[0][6]		Droop pulses	
	[0][7]			
	[0][8]			
	[0][9]			
	[0][A]		Regenerative load ratio	
	[0][B]		Effective load ratio	
	[0][C]		Peak load ratio	
	[0][D]		Instantaneous torque	
	[0][E]		Within one-revolution position	
	[0][F]		ABS counter	
	[1][0]		Load inertia moment ratio	
	[1][1]		Bus voltage	
	[0][0]	Status display data value and processing information at alarm occurrence	Current position	12
	[0][1]		Command position	
	[0][2]		Command remaining distance	
	[0][3]		Point table No.	
	[0][4]		Cumulative feedback pulses	
	[0][5]		Servo motor speed	
	[0][6]		Droop pulses	
	[0][7]			
	[0][8]			
	[0][9]			
	[0][A]		Regenerative load ratio	
	[0][B]		Effective load ratio	
	[0][C]		Peak load ratio	
	[0][D]		Instantaneous torque	
	[0][E]		Within one-revolution position	
	[0][F]		ABS counter	
	[1][0]		Load inertia moment ratio	
	[1][1]		Bus voltage	

(6) Point table/position data (Command [4][0])

Command	Data No.	Description	Frame length
[4][0]	[0][1] to [F][F]	Position data read The decimal equivalent of the data No. value (hexadecimal) corresponds to the Point table No.	8

(7) Point table/speed data (Command [5][0])

Command	Data No.	Description	Frame length
[5][0]	[0][1] to [F][F]	Speed data read The decimal equivalent of the data No. value (hexadecimal) corresponds to the Point table No.	8

(8) Point table/acceleration time constant (Command [5][4])

Command	Data No.	Description	Frame length
[5][4]	[0][1] to [F][F]	Acceleration time constant read The decimal equivalent of the data No. value (hexadecimal) corresponds to the Point table No.	8

(9) Point table/deceleration time constant (Command [5][8])

Command	Data No.	Description	Frame length
[5][8]	[0][1] to [F][F]	Deceleration time constant read The decimal equivalent of the data No. value (hexadecimal) corresponds to the Point table No.	8

(10) Point table/dwell (Command [6][0])

Command	Data No.	Description	Frame length
[6][0]	[0][1] to [F][F]	Dwell read The decimal equivalent of the data No. value (hexadecimal) corresponds to the Point table No.	8

(11) Point table/auxiliary function (Command [6][4])

Command	Data No.	Description	Frame length
[6][4]	[0][1] to [F][F]	Auxiliary function read The decimal equivalent of the data No. value (hexadecimal) corresponds to the Point table No.	8

(12) Group setting (Command [1][F])

Command	Data No.	Description	Frame length
[1][F]	[0][0]	Reading of group setting value	4

(13) Test operation mode (Command [0][0])

Command	Data No.	Description	Frame length
[0] [0]	[1] [2]	Test operation mode read 0000: Normal mode (not test operation mode) 0001: JOG operation 0002: Positioning operation 0003: Motorless operation 0004: Output signal (DO) forced output 0005: Single-step feed	4

(14) Others

Command	Data No.	Description	Frame length
[0] [2]	[9] [0]	Servo motor side pulse unit absolute position	8
	[9] [1]	Command unit absolute position	8
	[7] [0]	Software version	16

14.4.2 Write commands

(1) Status display (Command [8][1])

Command	Data No.	Description	Setting range	Frame length
[8] [1]	[0] [0]	Status display data erasure	1EA5	4

(2) Parameters (Command [8][4] · [8][5])

Command	Data No.	Description	Setting range	Frame length
[8] [4]	[0][1] to [F][F]	Write of parameters Writes the values of the parameters in the parameter group specified with the command [8][5] + data No. [0][0]. Before writing the values, therefore, always specify the parameter group with the command [8][5] + data No. [0][0]. The decimal equivalent of the data No. value (hexadecimal) corresponds to the parameter number.	Depending on the parameter	8
[8] [5]	[0] [0]	Parameter group write 0000: Basic setting parameter (No.PA□□) 0001: Gain filter parameter (No.PB□□) 0002: Extension setting parameter (No.PC□□) 0003: I/O setting parameter (No.PD□□)	0000 to 0003	4

(3) External I/O signal (Command [9][2])

Command	Data No.	Description	Setting range	Frame length
[9] [2]	[6] [0] [6] [1]	Communication input device signal	Refer to section 14.5.5	8

(4) Alarm history (Command [8][2])

Command	Data No.	Description	Setting range	Frame length
[8] [2]	[2] [0]	Alarm history erasure	1EA5	4

(5) Current alarm (Command [8][2])

Command	Data No.	Description	Setting range	Frame length
[8] [2]	[0] [0]	Alarm erasure	1EA5	4

(6) Point table/position data (Command [C][0])

Command	Data No.	Description	Setting range	Frame length
[C][0]	[0][1] to [F][F]	Position data write The decimal equivalent of the data No. value (hexadecimal) corresponds to the Point table No.	−999999 to 999999	8

(7) Point table/speed data (Command [C][6])

Command	Data No.	Description	Setting range	Frame length
[C][6]	[0][1] to [F][F]	Speed data write The decimal equivalent of the data No. value (hexadecimal) corresponds to the Point table No.	0 to Permissible instantaneous speed	8

(8) Point table/acceleration time constant (Command [C][7])

Command	Data No.	Description	Setting range	Frame length
[C][7]	[0][1] to [F][F]	Acceleration time constant write The decimal equivalent of the data No. value (hexadecimal) corresponds to the Point table No.	0 to 20000	8

(9) Point table/deceleration time constant (Command [C][8])

Command	Data No.	Description	Setting range	Frame length
[C][8]	[0][1] to [F][F]	Deceleration time constant write The decimal equivalent of the data No. value (hexadecimal) corresponds to the Point table No.	0 to 20000	8

(10) Point table/dwell (Command [C][A])

Command	Data No.	Description	Setting range	Frame length
[C][A]	[0][1] to [F][F]	Dwell write The decimal equivalent of the data No. value (hexadecimal) corresponds to the Point table No.	0 to 20000	8

(11) Point table/auxiliary function (Command [C][B])

Command	Data No.	Description	Setting range	Frame length
[C][B]	[0][1] to [F][F]	Auxiliary function write The decimal equivalent of the data No. value (hexadecimal) corresponds to the Point table No.	0 to 3	8

(12) External input signal disable (Command [9][0])

Command	Data No.	Description	Setting range	Frame length
[9][0]	[0][0]	Turns off the input devices, external analog input signals and pulse train inputs with the exception of EMG, LSP and LSN, independently of the external ON/OFF statuses.	1EA5	4
[9][0]	[0][3]	Disables all output devices (DO).	1EA5	4
[9][0]	[1][0]	Enables the disabled input devices (DI), external analog input signals and pulse train inputs with the exception of EMG, LSP and LSN.	1EA5	4
[9][0]	[1][3]	Enables the disabled output devices (DO).	1EA5	4

(13) Operation mode selection (Command [8][B])

Command	Data No.	Description	Setting range	Frame length
[8] [B]	[0] [0]	Operation mode switching 0000: Test operation mode cancel 0001: JOG operation 0002: Positioning operation 0003: Motorless operation 0004: Output signal (DO) forced output 0005: Single-step feed	0000 to 0005	4

(14) Test operation mode data (Command [9][2] · [A][0])

Command	Data No.	Description	Setting range	Frame length
[9] [2]	[0] [0]	Input signal for test operation	Refer to section 14.5.7.	8
	[0] [1]			
	[A] [0]	Forced output of signal pin	Refer to section 14.5.9.	8
[A] [0]	[1] [0]	Writes the speed in the test operation mode (JOG operation, positioning operation).	0000 to 7FFF	4
	[1] [1]	Writes the acceleration/deceleration time constant in the test operation mode (JOG operation, positioning operation).	00000000 to 7FFFFFFF	8
	[2] [0]	Sets the moving distance in the test operation mode (JOG operation, positioning operation).	00000000 to 7FFFFFFF	8
	[2] [1]	Selects the positioning direction of test operation (positioning operation). 0 □ 0 □ 0: Forward rotation direction 1: Reverse rotation direction 0: Command pulse unit 1: Encoder pulse unit	0000 to 0001	4
	[4] [0]	Test operation (positioning operation) start command.	1EA5	4
	[4] [1]	Used to make a temporary stop during test operation (positioning operation). □in the data indicates a blank. STOP: Temporary stop G0□□: Restart for remaining distance CLR□: Remaining distance clear.	STOP G0□□ CLR□	4

(15) Group setting (Command [9][F])

Command	Data No.	Description	Setting range	Frame length
[9] [F]	[0] [0]	Setting of group	a to f	4

14.5 Detailed explanations of commands

14.5.1 Data processing

When the master station transmits a command + data No. or a command + data No. + data to a slave station, the driver returns a reply or data according to the purpose.
When numerical values are represented in these send data and receive data, they are represented in decimal, hexadecimal, etc.
Therefore, data must be processed according to the application.
Since whether data must be processed or not and how to process data depend on the monitoring, parameters, etc., follow the detailed explanation of the corresponding command.
The following methods are how to process send and receive data when reading and writing data.

(1) Processing the read data

When the display type is 0, the eight-character data is converted from hexadecimal to decimal and a decimal point is placed according to the decimal point position information.
When the display type is 1, the eight-character data is used unchanged.

The following example indicates how to process the receive data "003000000929" given to show.
The receive data is as follows.

0	0	3	0	0	0	0	0	0	9	2	9

Data 32-bit length (hexadecimal representation)
(Data conversion is required as indicated in the display type)

Display type
0: Data must be converted into decimal.
1: Data is used unchanged in hexadecimal.

Decimal point position
0: No decimal point
1: First least significant digit (normally not used)
2: Second least significant digit
3: Third least significant digit
4: Forth least significant digit
5: Fifth least significant digit
6: Sixth least significant digit

Since the display type is "0" in this case, the hexadecimal data is converted into decimal.
00000929H→2345
As the decimal point position is "3", a decimal point is placed in the third least significant digit.
Hence, "23.45" is displayed.

(2) Writing the processed data

When the data to be written is handled as decimal, the decimal point position must be specified. If it is not specified, the data cannot be written. When the data is handled as hexadecimal, specify "0" as the decimal point position.

The data to be sent is the following value.

0							

Data is transferred in hexadecimal.

Decimal point position
0: No decimal point
1: First least significant digit
2: Second least significant digit
3: Third least significant digit
4: Forth least significant digit
5: Fifth least significant digit

By way of example, here is described how to process the set data when a value of "15.5" is sent.

Since the decimal point position is the second digit, the decimal point position data is "2".

As the data to be sent is hexadecimal, the decimal data is converted into hexadecimal.

155→9B

Hence, "0200009B" is transmitted.

14.5.2 Status display

(1) Reading the status display name and unit

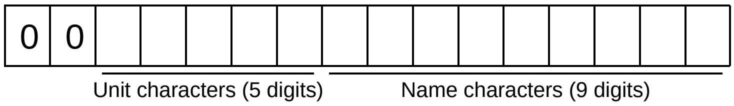
Read the status display name and unit.

(a) Transmission

Transmit command [0][1] and the data No. corresponding to the status display item to be read, [0][0] to [0][E]. (Refer to section 14.4.1.)

(b) Reply

The slave station sends back the status display name and unit requested.



(2) Status display data read

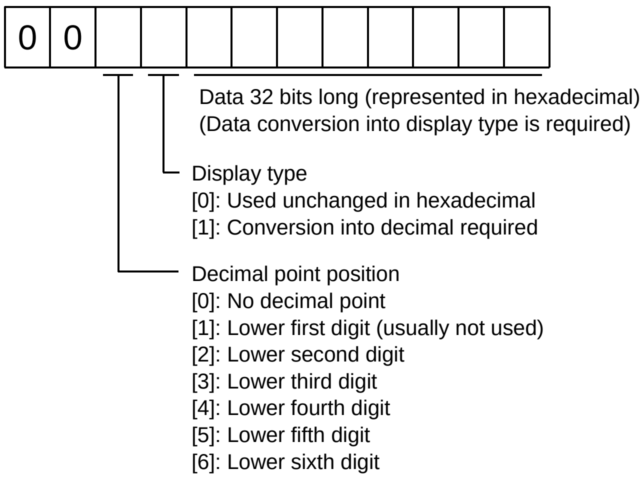
Read the status display data and processing information.

(a) Transmission

Transmit command [0][1] and the data No. corresponding to the status display item to be read.
Refer to section 14.4.1.

(b) Reply

The slave station sends back the status display data requested.



(3) Status display data clear

The cumulative feedback pulse data of the status display is cleared. Send this command immediately after reading the status display item. The data of the status display item transmitted is cleared to zero.

Command	Data No.	Data
[8][1]	[0][0]	[1][E][A][5]

For example, after sending command [0][1] and data No. [8][0] and receiving the status display data, send command [8][1], data No. [0][0] and data [1EA5] to clear the cumulative feedback pulse value to zero.

14.5.3 Parameters

(1) Specify the parameter group

The group of the parameters to be operated must be specified in advance to read or write the parameter settings, etc. Write data to the driver as described below to specify the parameter group to be operated.

Command	Data No.	Transmission data	Parameter group
[8] [5]	[0] [0]	0000	Basic setting parameter (No.PA□□)
		0001	Gain filter parameter (No.PB□□)
		0002	Extension setting parameter (No.PC□□)
		0003	I/O setting parameter (No.PD□□)

(2) Reading the parameter group

Read the parameter group.

(a) Transmission

Send command [0][4] and data No.[0][1].

Command	Data No.
[0] [4]	[0] [1]

(b) Reply

The slave station sends back the preset parameter group.

0	0	0	

Parameter group
0: Basic setting parameter (No.PA□□)
1: Gain filter parameter (No.PB□□)
2: Extension setting parameter (No.PC□□)
3: I/O setting parameter (No.PD□□)

(3) Reading the symbol

Read the parameter name. Specify the parameter group in advance (refer to (1) in this section).

(a) Transmission

Transmit command [0][8] and the data No. corresponding to the parameter No., [0][0] to [F][F]. (Refer to section 14.4.1.)

The data No. is expressed in hexadecimal. The decimal equivalent of the data No. value corresponds to the parameter number.

(b) Reply

The slave station sends back the name of the parameter No. requested.

0	0	0									

Name characters (9 digits)

(4) Reading the setting

Read the parameter setting. Specify the parameter group in advance (refer to (1) in this section).

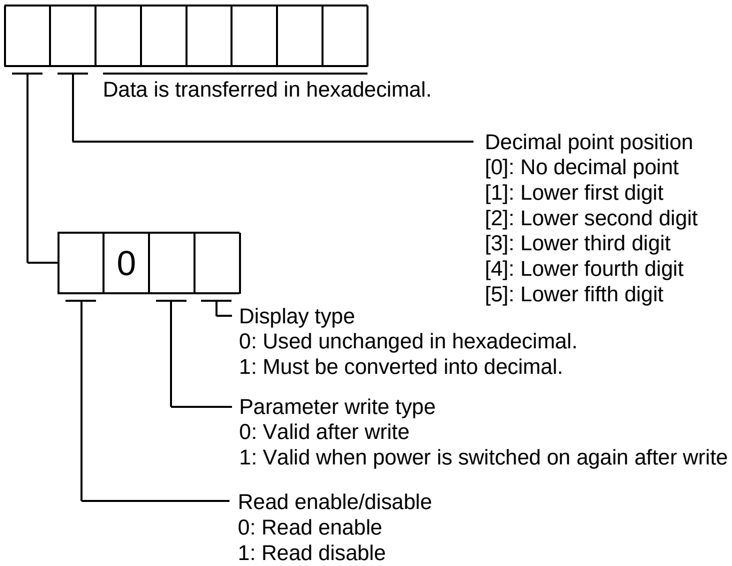
(a) Transmission

Transmit command [0][5] and the data No. corresponding to the parameter No., [0][0] to [F][F]. (Refer to section 14.4.1.)

The data No. is expressed in hexadecimal. The decimal equivalent of the data No. value corresponds to the parameter number.

(b) Reply

The slave station sends back the data and processing information of the parameter No. requested.



For example, data "1200270F" means 999.9 (decimal display format) and data "0003ABC" means 3ABC (hexadecimal display format).

When the display type is "0" (hexadecimal) and the decimal point position is other than 0, the display type is a special hexadecimal display format and "F" of the data value is handled as a blank. Data "01FFF053" means 053 (special hexadecimal display format).

"1 (Read disable)" is transferred to the "Read enable/disable" section and "000000" is transferred to the data section when the parameter that was read is the one inaccessible for write/reference in the parameter write disable setting of parameter No.PA19.

(5) Reading the setting range

Read the parameter setting range. Specify the parameter group in advance (refer to (1) in this section).

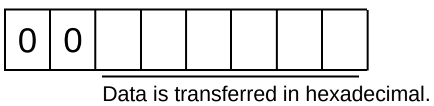
(a) Transmission

When reading the upper limit value, transmit command [0][6] and the data No. corresponding to the parameter No., [0][0] to [F][F]. When reading the lower limit value, transmit command [0][7] and the data No. corresponding to the parameter No., [0][0] to [F][F]. (Refer to section 15.4.1.)

The data No. is expressed in hexadecimal. The decimal equivalent of the data No. value corresponds to the parameter number.

(b) Reply

The slave station sends back the data and processing information of the parameter No. requested.



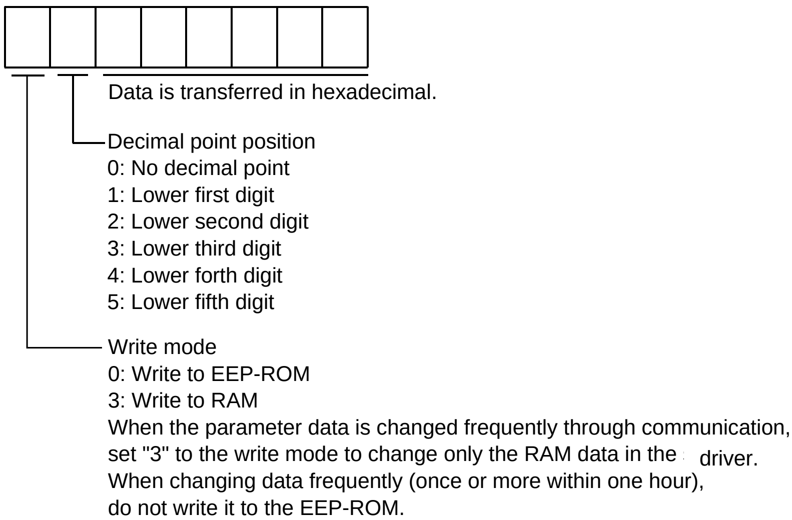
For example, data "10FFFFEC" means -20.

(6) Parameter write

POINT
・If setting values need to be changed with a high frequency (i.e. one time or more per one hour), write the setting values to the RAM, not the EEP-ROM. The EEP-ROM has a limitation in the number of write times and exceeding this limitation causes the driver to malfunction. Note that the number of write times to the EEP-ROM is limited to approximately 100, 000.

Write the parameter setting into EEP-ROM of the driver. Specify the parameter group in advance (refer to (1) in this section).
Write the value within the setting enabled range. For the setting enabled range, refer to chapter 6 or read the setting range by performing operation in (3) in this section.
Transmit command [8][4], the data No. , and the set data.
The data No. is expressed in hexadecimal. The decimal equivalent of the data No. value corresponds to the parameter number.
When the data to be written is handled as decimal, the decimal point position must be specified. If it is not specified, data cannot be written. When the data is handled as hexadecimal, specify 0 as the decimal point position.
Write the data after making sure that it is within the upper/lower limit value range.
Read the parameter data to be written, confirm the decimal point position, and create transmission data to prevent error occurrence. On completion of write, read the same parameter data to verify that data has been written correctly.

Command	Data No.	Set data
[8][4]	[0][1] to [F][F]	See below.



14.5.4 External I/O signal statuses (DIO diagnosis)

(1) Reading of input device statuses

Read the statuses of the input devices.

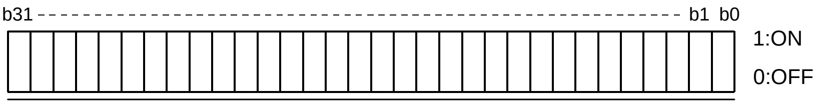
(a) Transmission

Transmit command [1][2] and the data No. corresponding to the input device.

Command	Data No.
[1][2]	[0][0]
	[0][1]

(b) Reply

The slave station sends back the statuses of the input pins.



Command of each bit is transmitted to the master station as hexadecimal data.

bit	Data No. [0][0]		Data No. [0][1]	
	Device name	Symbol	Device name	Symbol
0	Servo-on	SON		
1	Forward rotation stroke end	LSP		
2	Reverse rotation stroke end	LSN		
3				
4	Internal torque limit selection	TL1		
5	Proportion control	PC		
6	Reset	RES		
7	Clear	CR		
8				
9				
10				
11	Forward rotation start	ST1		
12	Reverse rotation start	ST2		
13				
14				
15				
16				
17	Automatic/manual selection	MD0		
18	Proximity dog	DOG		
19				
20				
21				
22				
23	Override selection	OVR		
24	Temporary stop/Restart	TSTP	Point table No. selection 1	DI0
25			Point table No. selection 2	DI1
26			Point table No. selection 3	DI2
27	Gain changing	CDP	Point table No. selection 4	DI3
28			Point table No. selection 5	DI4
29			Point table No. selection 6	DI5
30			Point table No. selection 7	DI6
31			Point table No. selection 8	DI7

(2) External input pin status read

Read the ON/OFF statuses of the external output pins.

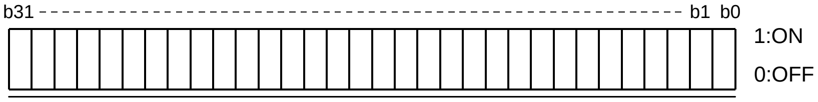
(a) Transmission

Transmit command [1][2] and data No. [4][0].

Command	Data No.
[1][2]	[4][0]

(b) Reply

The ON/OFF statuses of the input pins are sent back.



Command of each bit is transmitted to the master station as hexadecimal data.

bit	CN6 connector pin
0	1
1	2
2	3
3	4
4	
5	
6	
7	

bit	CN6 connector pin
8	
9	
10	
11	
12	
13	
14	
15	

bit	CN6 connector pin
16	
17	
18	
19	
20	
21	
22	
23	

bit	CN6 connector pin
24	
25	
26	
27	
28	
29	
30	
31	

(3) Read of the statuses of input devices switched on through communication

Read the ON/OFF statuses of the input devices switched on through communication.

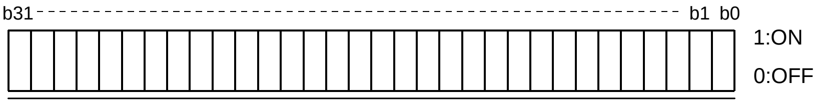
(a) Transmission

Transmit command [1][2] and the data No. corresponding to the input device.

Command	Data No.
[1][2]	[6][0]
	[6][1]

(b) Reply

The slave station sends back the statuses of the input pins.



Command of each bit is transmitted to the master station as hexadecimal data.

bit	Data No. [6][0]		Data No. [6][1]	
	Device name	Symbol	Device name	Symbol
0	Servo-on	SON		
1	Forward rotation stroke end	LSP		
2	Reverse rotation stroke end	LSN		
3				
4	Internal torque limit selection	TL1		
5	Proportion control	PC		
6	Reset	RES		
7	Clear	CR		
8				
9				
10				
11	Forward rotation start	ST1		
12	Reverse rotation start	ST2		
13				
14				
15				
16				
17	Automatic/manual selection	MD0		
18	Proximity dog	DOG		
19				
20				
21				
22				
23	Override selection	OVR		
24	Temporary stop/Restart	TSTP	Point table No. selection 1	DI0
25			Point table No. selection 2	DI1
26			Point table No. selection 3	DI2
27	Gain changing	CDP	Point table No. selection 4	DI3
28			Point table No. selection 5	DI4
29			Point table No. selection 6	DI5
30			Point table No. selection 7	DI6
31			Point table No. selection 8	DI7

(4) External output pin status read

Read the ON/OFF statuses of the external output pins.

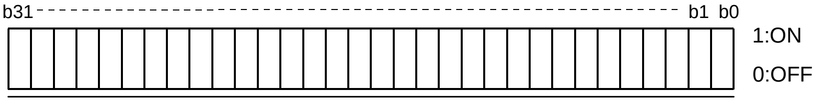
(a) Transmission

Transmit command [1][2] and data No. [C][0].

Command	Data No.
[1][2]	[C][0]

(b) Reply

The slave station sends back the ON/OFF statuses of the output pins.



Command of each bit is transmitted to the master station as hexadecimal data.

bit	CN6 connector pin
0	14
1	15
2	16
3	
4	
5	
6	
7	

bit	CN6 connector pin
8	
9	
10	
11	
12	
13	
14	
15	

bit	CN6 connector pin
16	
17	
18	
19	
20	
21	
22	
23	

bit	CN6 connector pin
24	
25	
26	
27	
28	
29	
30	
31	

(5) Read of the statuses of output devices

Read the ON/OFF statuses of the output devices.

(a) Transmission

Transmit command [1][2] and the data No. corresponding to the output device.

Command	Data No.
[1][2]	[8][0]
	[8][1]

(b) Reply

The slave station sends back the statuses of the output devices.

b31 -- b1 b0

1:ON

0:OFF

Command of each bit is transmitted to the master station as hexadecimal data.

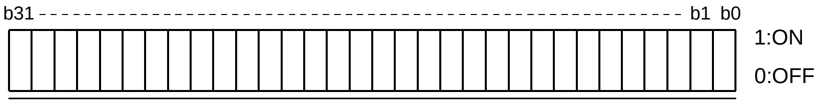
bit	Data No. [8][0]		Data No. [8][1]	
	Device name	Symbol	Device name	Symbol
0	Ready	RD		
1				
2	Zero speed	ZSP		
3	Limiting torque	TLC		
4				
5	In position	INP		
6				
7	Warning	WNG		
8	Trouble	ALM		
9				
10	Electromagnetic brake interlock	MBR		
11	dynamic brake interlock	DB		
12				
13				
14				
15	Battery warning	BWNG		
16	Rough match	CPO		
17	Home position return completion	ZP		
18	Position range output	POT		
19	Temporary stop	PUS		
20				
21				
22				
23				
24			Point table No. output 1	PT0
25	Variable gain selection	CDPS	Point table No. output 2	PT1
26			Point table No. output 3	PT2
27			Point table No. output 4	PT3
28	Movement completion	MEND	Point table No. output 5	PT4
29			Point table No. output 6	PT5
30			Point table No. output 7	PT6
31			Point table No. output 8	PT7

14.5.5 Device ON/OFF

POINT
・The ON/OFF states of all devices in the driver are the states of the data received last. Hence, when there is a device which must be kept ON, send data which turns that device ON every time.

Each input device can be switched on/off. However, when the device to be switched off exists in the external input signal, also switch off that input signal.
Send command [9][2], data No. corresponding to the input device and data.

Command	Data No.	Set data
[9][2]	[6][0]	See below.
	[6][1]	



Command of each bit is transmitted to the slave station as hexadecimal data.

bit	Data No. [6][0]		Data No. [6][1]	
	Device name	Symbol	Device name	Symbol
0	Servo-on	SON		
1	Forward rotation stroke end	LSP		
2	Reverse rotation stroke end	LSN		
3				
4	Internal torque limit selection	TL1		
5	Proportion control	PC		
6	Reset	RES		
7	Clear	CR		
8				
9				
10				
11	Forward rotation start	ST1		
12	Reverse rotation start	ST2		
13				
14				
15				
16				
17	Automatic/manual selection	MD0		
18	Proximity dog	DOG		
19				
20				
21				
22				
23	Override selection	OVR		
24	Temporary stop/Restart	TSTP	Point table No. selection 1	DI0
25			Point table No. selection 2	DI1
26			Point table No. selection 3	DI2
27	Gain changing	CDP	Point table No. selection 4	DI3
28			Point table No. selection 5	DI4
29			Point table No. selection 6	DI5
30			Point table No. selection 7	DI6
31			Point table No. selection 8	DI7

14.5.6 Disable/enable of I/O devices (DIO)

Inputs can be disabled independently of the I/O devices ON/OFF. When inputs are disabled, the input signals (devices) are recognized as follows. Among the input devices, EMG, LSP and LSN cannot be disabled.

Signal	Status
Input devices (DI)	OFF

(1) Disabling/enabling the input devices (DI), external analog input signals and pulse train inputs with the exception of EMG, LSP and LSN.

Transmit the following communication commands.

(a) Disable

Command	Data No.	Data
[9][0]	[0][0]	1EA5

(b) Enable

Command	Data No.	Data
[9][0]	[1][0]	1EA5

(2) Disabling/enabling the output devices (DO)

Transmit the following communication commands.

(a) Disable

Command	Data No.	Data
[9][0]	[0][3]	1EA5

(b) Enable

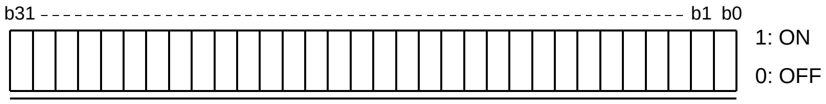
Command	Data No.	Data
[9][0]	[1][3]	1EA5

14.5.7 Input devices ON/OFF (test operation)

Each input devices can be turned on/off for test operation. when the device to be switched off exists in the external input signal, also switch off that input signal.

Send command [9] [2], data No. corresponding to the input device and data.

Command	Data No.	Set data
[9][2]	[0][0]	See below
	[0][1]	



Command of each bit is transmitted to the slave station as hexadecimal data.

bit	Data No. [0][0]		Data No. [0][1]	
	Device name	Symbol	Device name	Symbol
0	Servo-on	SON		
1	Forward rotation stroke end	LSP		
2	Reverse rotation stroke end	LSN		
3				
4	Internal torque limit selection	TL1		
5	Proportion control	PC		
6	Reset	RES		
7	Clear	CR		
8				
9				
10				
11	Forward rotation start	ST1		
12	Reverse rotation start	ST2		
13				
14				
15				
16				
17	Automatic/manual selection	MD0		
18	Proximity dog	DOG		
19				
20				
21				
22				
23	Override selection	OVR		
24	Temporary stop/Restart	TSTP	Point table No. selection 1	DI0
25			Point table No. selection 2	DI1
26			Point table No. selection 3	DI2
27	Gain changing	CDP	Point table No. selection 4	DI3
28			Point table No. selection 5	DI4
29			Point table No. selection 6	DI5
30			Point table No. selection 7	DI6
31			Point table No. selection 8	DI7

14.5.8 Test operation mode

POINT

- The test operation mode is used to confirm operation. Do not use it for actual operation.
- If communication stops for longer than 0.5s during test operation, the driver decelerates to a stop, resulting in servo lock. To prevent this, continue communication all the time, e.g. monitor the status display.
- Even during operation, the driver can be put in the test operation mode.
- In this case, as soon as the test operation mode is selected, the base circuit is shut off, coasting the driver.

(1) Preparation and cancel of test operation mode

(a) Preparation of test operation mode

Set the test operation mode type in the following procedure.

Send the command [8][B] + data No. [0][0] to select the test operation mode.

Command	Data No.	Transmission Data	Test Operation Mode Selection
[8][B]	[0][0]	0001	JOG operation
		0002	Positioning operation
		0003	Motorless operation
		0004	DO forced output
		0005	Single-step feed

2) Confirmation of test operation mode

Read the test operation mode set for the slave station, and confirm that it is set correctly.

a. Transmission

Send the command [0][0] + data No. [1][2].

Command	Data No.
[0][0]	[1][2]

b. Return

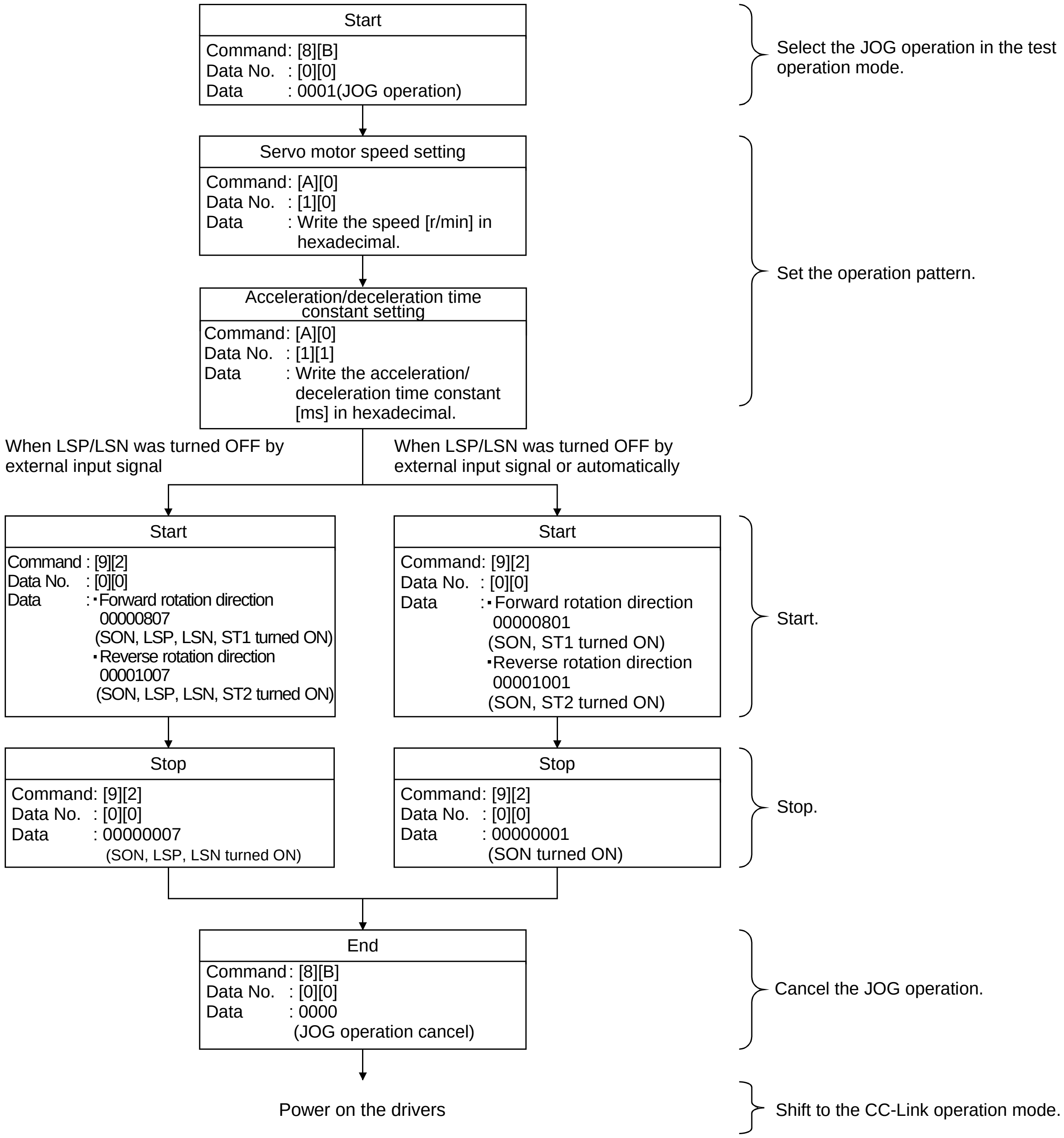
The slave station returns the set test operation mode.

0	0	0	

Test operation mode read
0: Normal mode (not test operation mode)
1: JOG operation
2: Positioning operation
3: Motorless operation
4: DO forced output
5: Single-step feed

(2) JOG operation

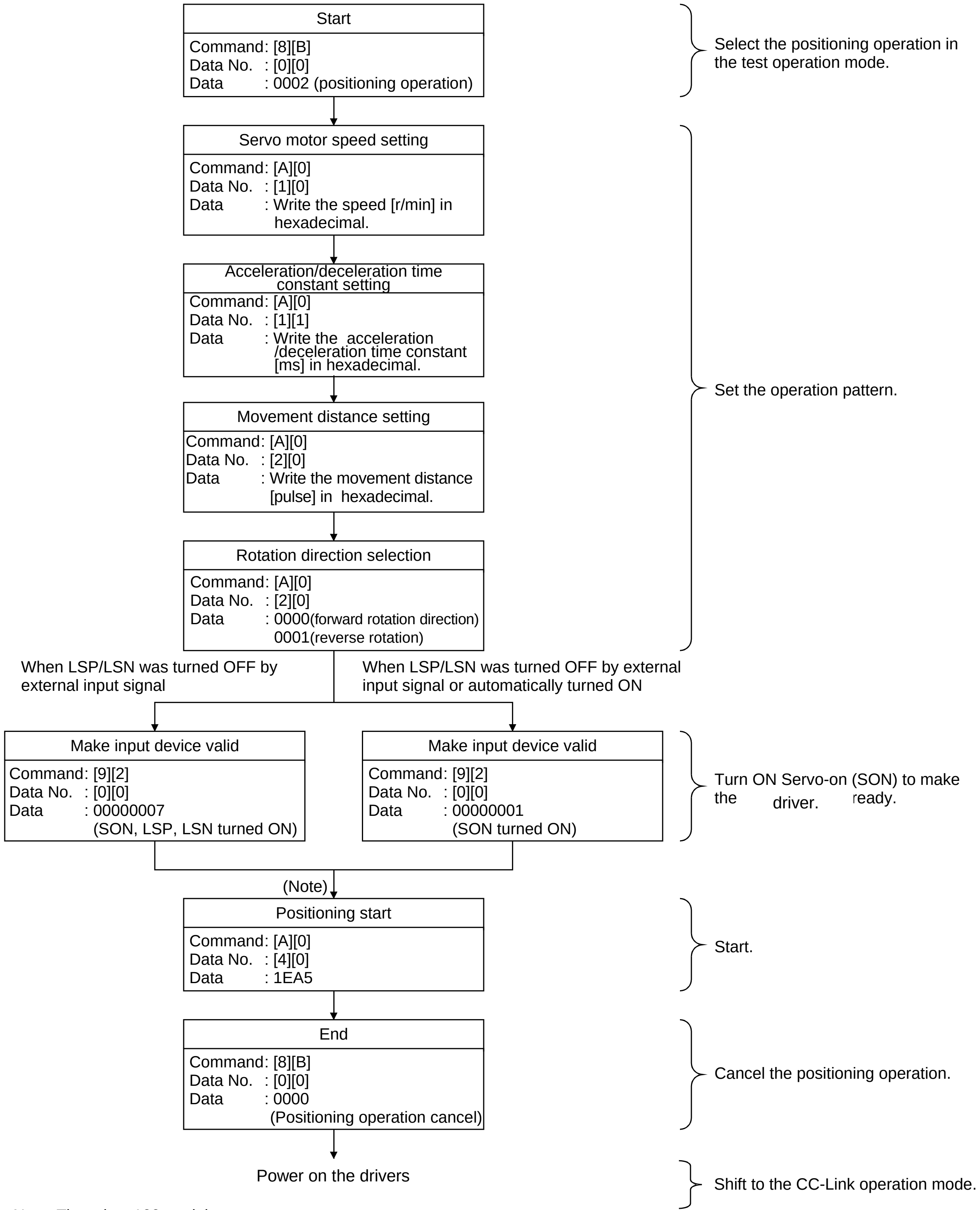
Send the command, data No. and data as indicated below to execute JOG operation.



(3) Positioning operation

(a) Operation procedure

Send the command, data No. and data as indicated below to execute positioning operation.



Note. There is a 100ms delay.

(b) Temporary stop/restart/remaining distance clear

Send the following command, data No. and data during positioning operation to make deceleration to a stop.

Command	Data No.	Data
[A][0]	[4][1]	STOP

Send the following command, data No. and data during a temporary stop to make a restart.

Command	Data No.	(Note) Data
[A][0]	[4][1]	GO □□

Note. □ indicates a blank.

Send the following command, data No. and data during a temporary stop to stop positioning operation and erase the remaining movement distance.

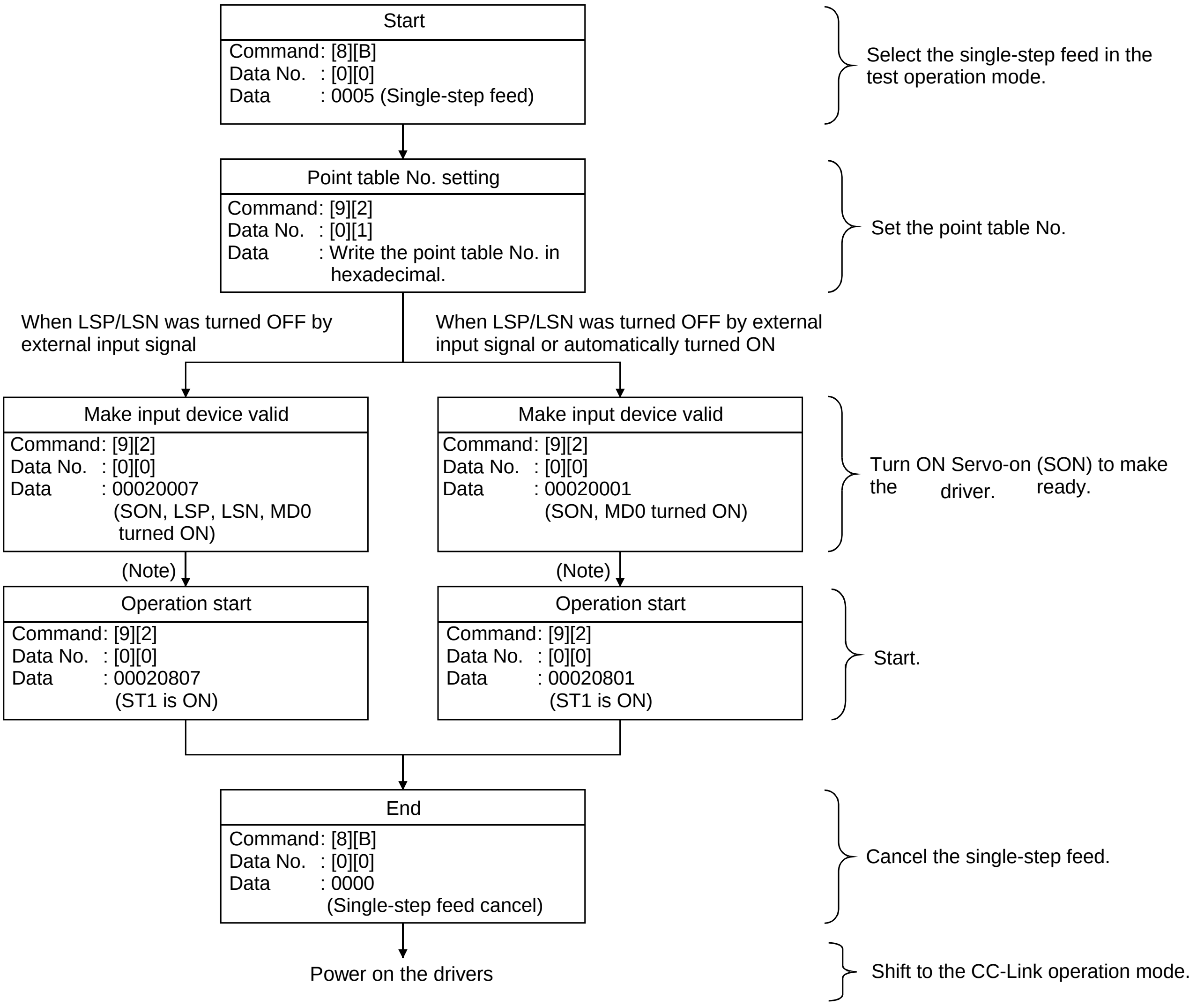
Command	Data No.	(Note) Data
[A][0]	[4][1]	CLR □

Note. □ indicates a blank.

(4) Single-step feed

Set necessary items to the point table before starting the single-step feed.

Send the command, data No. and data as indicated below to execute single-step feed.



Note. Start operation after home position return completion (ZP) is confirmed. Refer to 17th bit of the data read with command [1][2] and data No.[8][0].

(5) Output signal pin ON/OFF output signal (DO) forced output

In the test operation mode, the output signal pins can be turned on/off independently of the servo status. Using command [9][0], disable the output signals in advance.

(a) Choosing DO forced output in test operation mode

Transmit command [8][B] + data No. [0][0] + data "0004" to choose DO forced output.

0	0	0	4

Selection of test operation mode
4: DO forced output (output signal forced output)

(b) External output signal ON/OFF

Transmit the following communication commands.

Command	Data No.	Setting data
[9][2]	[A][0]	See below.

b31 - - - b1 b0

1: ON
0: OFF

Command of each bit is sent to the slave station in hexadecimal.

bit	CN6 connector pin	bit	CN6 connector pin	bit	CN6 connector pin	bit	CN6 connector pin
0	14	8		16		24	
1	15	9		17		25	
2	16	10		18		26	
3		11		19		27	
4		12		20		28	
5		13		21		29	
6		14		22		30	
7		15		23		31	

(c) Canceling DO forced output

Transmit command [8][B] + data No. [0][0] + data to cancel DO forced output.

Command	Data No.	Transmission data	Description
[8][B]	[0][0]	0000	Cancel DO forced output

(6) Motorless operation

(a) Performing motorless operation

Transmit command [8][B] + data No. [0][0] + data "0003" to perform motorless operation.

0	0	0	3

Selection of test operation mode
3: Motorless operation

To perform operation after performing the motorless operation, issue a command from the host PC or PLC...etc.

(b) Canceling motorless operation

The motorless operation cannot be canceled in the same way as the test operation mode (transmit command [8][B] + data No. [0][0] + data "0000"). To cancel the motorless operation, power on the driver and shift to the CC-Link operation mode beforehand.

14.5.9 Alarm history

(1) Alarm No. read

Read the alarm No. which occurred in the past. The alarm numbers and occurrence times of No. 0 (last alarm) to No. 5 (sixth alarm in the past) are read.

(a) Transmission

Send command [3][3] and data No. [1][0] to [1][5]. Refer to section 14.4.1.

(b) Reply

The alarm No. corresponding to the data No. is provided.

0	0		

Alarm No. is transferred in hexadecimal.

For example, "0032" means A32 and "00FF" means A_ _ (no alarm).

(2) Alarm occurrence time read

Read the occurrence time of alarm which occurred in the past.

The alarm occurrence time corresponding to the data No. is provided in terms of the total time beginning with operation start, with the minute unit omitted.

(a) Transmission

Send command [3][3] and data No. [2][0] to [2][5].

Refer to section 14.4.1.

(b) Reply

The alarm occurrence time is transferred in hexadecimal.
Hexadecimal must be converted into decimal.

For example, data "01F5" means that the alarm occurred in 501 hours after start of operation.

(3) Alarm history clear

Erase the alarm history.

Send command [8][2] and data No. [2][0].

Command	Data No.	Data
[8][2]	[2][0]	1EA5

14.5.10 Current alarm

(1) Current alarm read

Read the alarm No. which is occurring currently.

(a) Transmission

Send command [0][2] and data No. [0][0].

Command	Data No.
[0][2]	[0][0]

(b) Reply

The slave station sends back the alarm currently occurring.

0	0		

Alarm No. is transferred in hexadecimal.

For example, "0032" means A32 and "00FF" means A_ _ (no alarm).

(2) Read of the status display at alarm occurrence

Read the status display data at alarm occurrence. When the data No. corresponding to the status display item is transmitted, the data value and data processing information are sent back.

(a) Transmission

Send command [3][5] and any of data No. [8][0] to [8][E] corresponding to the status display item to be read. Refer to section 15.4.1.

(b) Reply

The slave station sends back the requested status display data at alarm occurrence.

0	0										

Data 32 bits long (represented in hexadecimal)
(Data conversion into display type is required)

Display type
0: Conversion into decimal required
1: Used unchanged in hexadecimal

Decimal point position
0: No decimal point
1: Lower first digit (usually not used)
2: Lower second digit
3: Lower third digit
4: Lower fourth digit
5: Lower fifth digit
6: Lower sixth digit

(3) Current alarm clear

As by the reset (RES) on, reset the driver alarm to make the driver ready to operate. After removing the cause of the alarm, reset the alarm with no command entered.

Command	Data No.	Data
[8][2]	[0][0]	1EA5

14.5.11 Point table

(1) Data read

(a) Position data

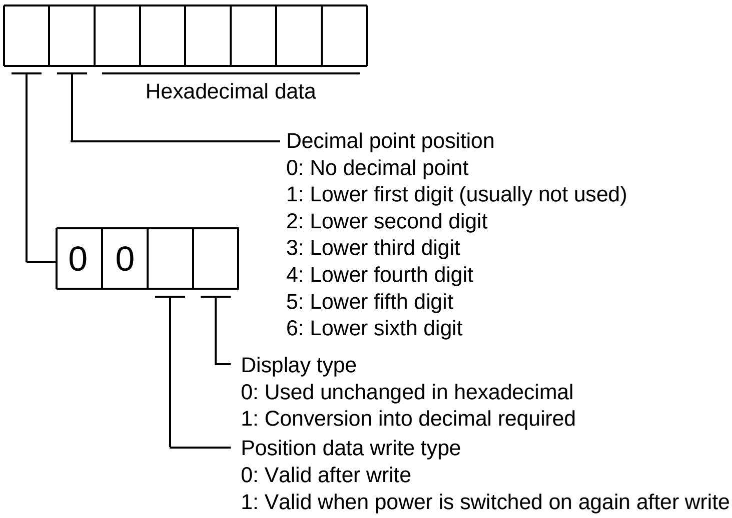
Read the position data of the point table.

1) Transmission

Transmit command [4][0] and any of data No. [0][1] to [F][F] corresponding to the point table to be read. Refer to section 14.4.1.

2) Reply

The slave station sends back the position data of the requested point table.



(b) Speed data

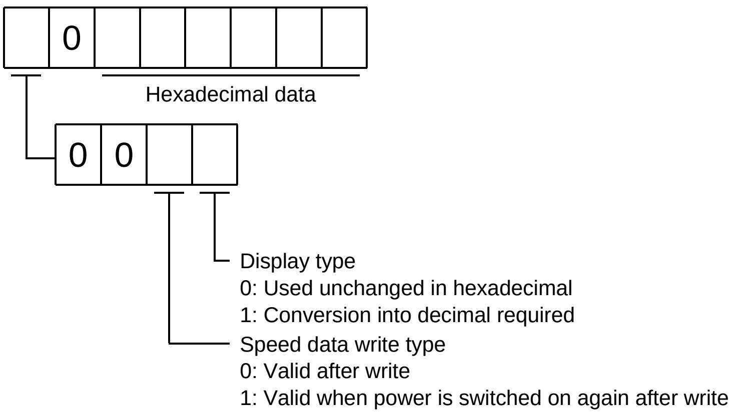
Read the speed data of the point table.

1) Transmission

Transmit command [5][0] and any of data No. [0][1] to [F][F] corresponding to the point table to be read. Refer to section 14.4.1.

2) Reply

The slave station sends back the speed data of the requested point table.



(c) Acceleration time constant

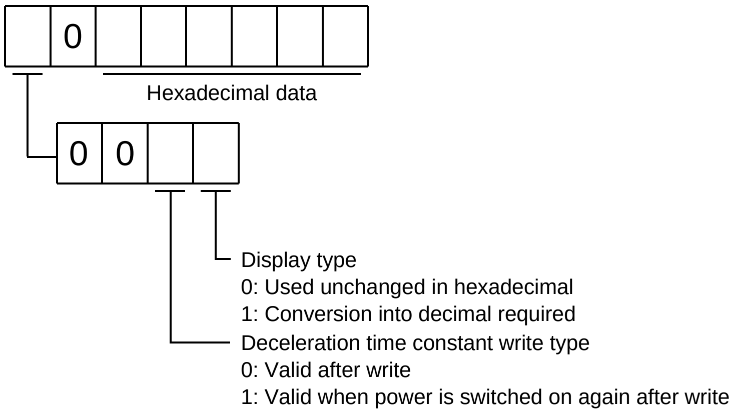
Read the acceleration time constant of the point table.

1) Transmission

Transmit command [5][4] and any of data No. [0][1] to [F][F] corresponding to the point table to be read. Refer to section 14.4.1.

2) Reply

The slave station sends back the acceleration time constant of the requested point table.



(d) Deceleration time constant

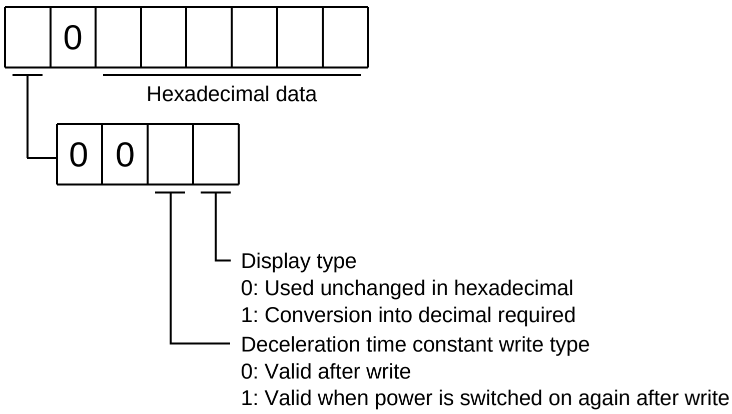
Read the deceleration time constant of the point table.

1) Transmission

Transmit command [5][8] and any of data No. [0][1] to [F][F] corresponding to the point table to be read. Refer to section 14.4.1.

2) Reply

The slave station sends back the deceleration time constant of the requested point table.



(e) Dwell

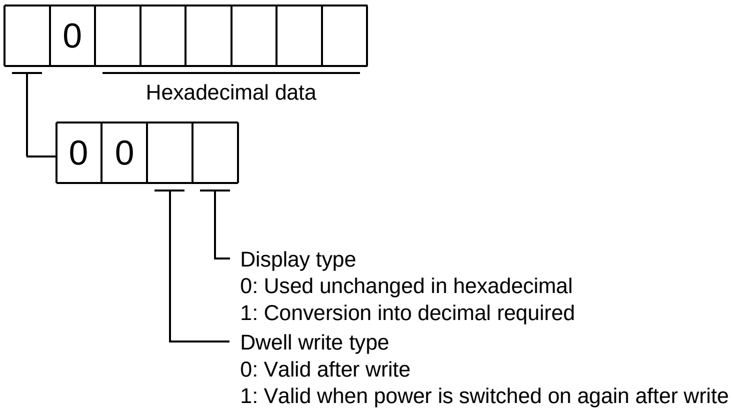
Read the dwell of the point table.

1) Transmission

Transmit command [6][0] and any of data No. [0][1] to [F][F] corresponding to the point table to be read. Refer to section 14.4.1.

2) Reply

The slave station sends back the dwell of the requested point table.



(f) Auxiliary function

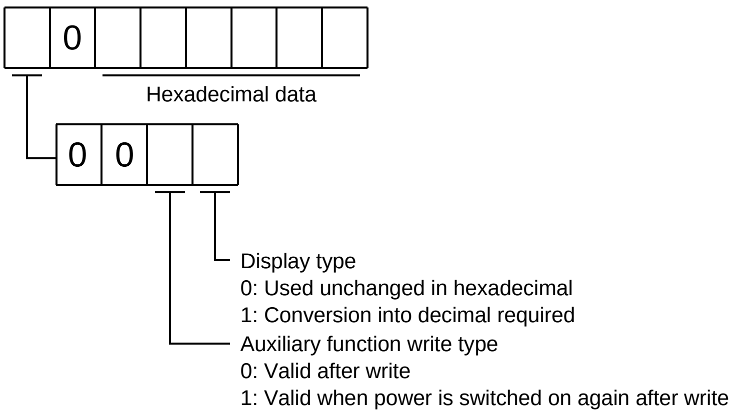
Read the auxiliary function of the point table.

1) Transmission

Transmit command [6][4] and any of data No. [0][1] to [F][F] corresponding to the point table to be read. Refer to section 14.4.1.

2) Reply

The slave station sends back the auxiliary function of the requested point table.



(2) Data write

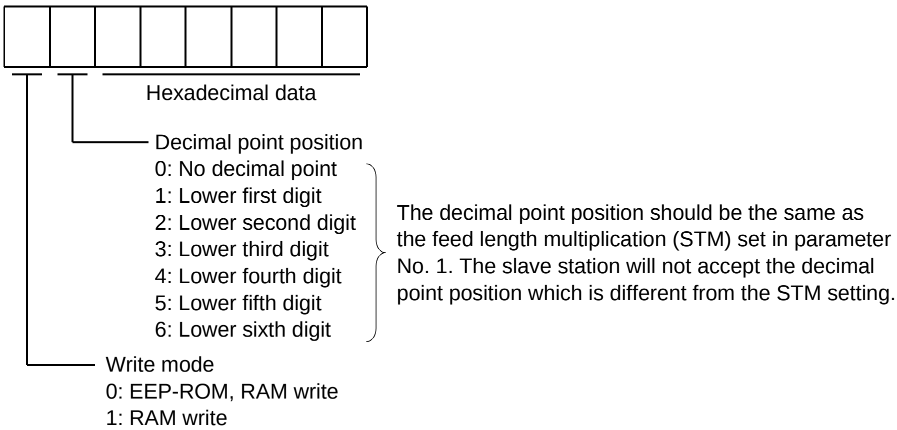
POINT
・If setting values need to be changed with a high frequency (i.e. one time or more per one hour), write the setting values to the RAM, not the EEP-ROM. The EEP-ROM has a limitation in the number of write times and exceeding this limitation causes the driver to malfunction. Note that the number of write times to the EEP-ROM is limited to approximately 100, 000.

(a) Position data

Write the position data of the point table.

Transmit command [C][0], any of data No. [0][1] to [F][F] corresponding to the point table to be written to, and the data. Refer to section 14.4.2.

Command	Data No.	Data
[C][0]	[0][1] to [F][F]	See below.



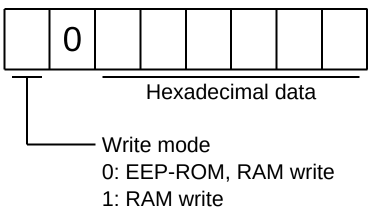
When the position data is changed frequently through communication, set "1" to the write mode to change only the RAM data in the driver. When changing data frequently (once or more within one hour), do not write it to the EEP-ROM.

(b) Speed data

Write the speed data of the point table.

Transmit command [C][6], any of data No. [0][1] to [F][F] corresponding to the point table to be written to, and the data. Refer to section 14.4.2.

Command	Data No.	Data
[C][6]	[0][1] to [F][F]	See below.



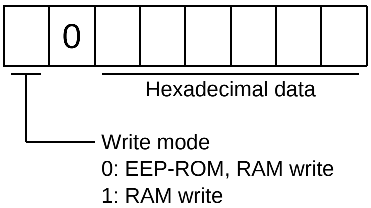
When the speed data is changed frequently through communication, set "1" to the write mode to change only the RAM data in the driver. When changing data frequently (once or more within one hour), do not write it to the EEP-ROM.

(c) Acceleration time constant

Write the acceleration time constant of the point table.

Transmit command [C][7], any of data No. [0][1] to [F][F] corresponding to the point table to be written to, and the data. Refer to section 14.4.2.

Command	Data No.	Data
[C][7]	[0][1] to [F][F]	See below.



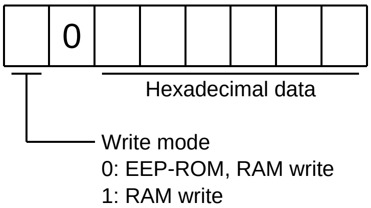
When the acceleration time constant is changed frequently through communication, set "1" to the write mode to change only the RAM data in the driver.
When changing data frequently (once or more within one hour), do not write it to the EEP-ROM.

(d) Deceleration time constant

Write the deceleration time constant of the point table.

Transmit command [C][8], any of data No. [0][1] to [F][F] corresponding to the point table to be written to, and the data. Refer to section 14.4.2.

Command	Data No.	Data
[C][8]	[0][1] to [F][F]	See below.



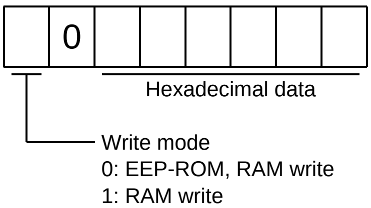
When the deceleration time is changed frequently through communication, set "1" to the write mode to change only the RAM data in the driver.
When changing data frequently (once or more within one hour), do not write it to the EEP-ROM.

(e) Dwell

Write the dwell of the point table.

Transmit command [C][A], any of data No. [0][1] to [F][F] corresponding to the point table to be written to, and the data. Refer to section 14.4.2.

Command	Data No.	Data
[C][A]	[0][1] to [F][F]	See below.



When the dwell constant is changed frequently through communication, set "1" to the write mode to change only the RAM data in the driver.
When changing data frequently (once or more within one hour), do not write it to the EEP-ROM.

(f) Auxiliary function

Write the auxiliary function of the point table.

Transmit command [C][B], any of data No. [0][1] to [F][F] corresponding to the point table to be written to, and the data. Refer to section 14.4.2.

Command	Data No.	Data
[C][B]	[0][1] to [F][F]	See below.

	0						

Hexadecimal data

Write mode
0: EEP-ROM, RAM write
1: RAM write

When the auxiliary function constant is changed frequently through communication, set "1" to the write mode to change only the RAM data in the driver.
When changing data frequently (once or more within one hour), do not write it to the EEP-ROM.

14.5.12 Driver group designation

With group setting made to the slave stations, data can be transmitted simultaneously to two or more slave stations set as a group.

(1) Group setting write

Write the group designation value to the slave station.

(a) Transmission

Transmit command [9][F], data No. [0][0] and data.

Command	Data No.	Data
[9][F]	[0][0]	See below.

0		0	

Group designation
0: No group designation
1: Group a
2: Group b
3: Group c
4: Group d
5: Group e
6: Group f

Response command enable
Set whether data can be sent back or not in response to the read command of the master station.
0: Response disable
Data cannot be set back.
1: Response enable
Data can be set back.

(2) Group setting read

Read the set group designation value from the slave station.

(a) Transmission

Transmit command [1][F] and data No. [0][0].

Command	Data No.
[1][F]	[0][0]

(b) Reply

The slave station sends back the group setting of the point table requested.

0		0	

Group designation
0: No group designation
1: Group a
2: Group b
3: Group c
4: Group d
5: Group e
6: Group f

Response command enable
0: Response disable
1: Response enable

14.5.13 Other commands

(1) Servo motor side pulse unit absolute position

Read the absolute position in the servo motor side pulse unit.

Note that overflow will occur in the position of 8192 or more revolutions from the home position.

(a) Transmission

Send command [0][2] and data No. [9][0].

Command	Data No.
[0][2]	[9][0]

(b) Reply

The slave station sends back the requested servo motor side pulses.

Absolute value is sent back in hexadecimal in the servo motor side pulse unit.
(Must be converted into decimal)

For example, data "000186A0" is 100000 [pulse] in the motor side pulse unit.

(2) Command unit absolute position

Read the absolute position in the command unit.

(a) Transmission

Send command [0][2] and data No. [9][1].

Command	Data No.
[0][2]	[9][1]

(b) Reply

The slave station sends back the requested command pulses.

Absolute value is sent back in hexadecimal in the command unit.
(Must be converted into decimal)

For example, data "000186A0" is 100000 [pulse] in the command unit.

(3) Software version

Reads the software version of the driver.

(a) Transmission

Send command [0][2] and data No.[7][0].

Command	Data No.
[0][2]	[7][0]

(b) Reply

The slave station returns the software version requested.

Space

Software version (15 digits)

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15 INDEXER POSITIONING OPERATION

POINT
・To execute the indexer positioning operation, parameter needs to be changed. Set the parameter No.PA01 to "1□□□".

This chapter provides the indexer positioning operation method using LECSC□-□ driver. Any matters not described in this chapter are the same as those of the point table positioning operation. For more information, refer to chapters up to 14.

15.1 Function

15.1.1 Overview

Using the next station selection 1 (RYnA) to the next station selection 8 (RY(n＋2)5) devices, stations from No.0 to No.254 can be specified.
Settings of servo motor speed and acceleration/deceleration time constant are carried out by specifying the point table number from 1 to 8 using the speed selection 1 (RY(n＋2)C) to the speed selection 3 (RY(n＋2)E) devices. Speed command data can be directly specified by using the remote register when two stations are occupied.

15.1.2 Driver standard specifications (functions only)

Item			Description
Command system	Station command input		Available with CC-Link communication CC-Link communication (1 station occupied): 31 stations CC-Link communication (2 stations occupied): 255 stations
	Speed command input	Remote register	Available with CC-Link communication (2 stations occupied) Set the speed command data (speed) by the remote register.
		Speed No. input	Select a speed and acceleration/deceleration time constant by the point table
Operation mode	Automatic operation mode	Rotation direction specifying indexer	Positioning operation is executed to the set station. Rotation direction can be specified.
		Shortest rotating indexer	Positioning operation is executed to the set station. The servo motor rotates in the closest direction from current position.
	Manual operation mode	Indexer JOG operation	Turning on the start signal (RYn1) makes the servo motor rotate in the direction specified by the rotation direction specifying. Turning off the start signal (RYn1) makes the servo motor perform positioning operation to the closest station where the motor can decelerate to stop.
		JOG operation	In accordance with the speed data set in parameters, JOG operation is performed by using CC-Link communication
	Home position return mode	Torque limit changing dog type	Home position return is performed by the Z-phase pulse count after passing proximity dog. Home position address may be set. Home position shift distance may be set. Home position return direction may be selected. Automatic at-dog home position return return/automatic stroke return function. Automatic torque limit changing function
		Torque limit changing data setting type	Home position return is made without dog. Home position may be set at any position by manual operation, etc. Home position address may be set. Automatic torque limit changing function
	Automatic positioning to home position		High-speed automatic return to a defined home position.

15.1.3 Function list

The following table lists the functions of this servo. For details of the functions, refer to the reference field.

Function	Description	Reference
Automatic operation mode 1 (Rotation direction specifying indexer)	In this operation mode, the servo motor rotates in the specified direction and performs a positioning operation to the next station divided in 2 to 255.	Section 15.7.2
Automatic operation mode 2 (Shortest rotating indexer)	In this operation mode, the servo motor rotates in the shortest direction and performs a positioning operation to the next station divided in 2 to 255.	Section 15.7.3
Manual operation mode	1. Indexer JOG operation When stopping, this JOG operation enables the servo motor to perform positioning to the station where the servo motor can decelerate to stop. 2. JOG operation When stopping, this JOG operation enables the servo motor to decelerate to stop regardless of stations.	Section 15.8
Home position return	Torque limit changing dog type, torque limit changing data setting type	Section 15.9
High-resolution encoder	High-resolution encoder of 262144 pulses/rev is used as a servo motor encoder.	
Absolute position detection system	By merely setting the home position once, home position return need not be done at each power on.	Section 15.10
Gain changing function	You can switch between gains during rotation and gains during stop or use an input device to change gains during operation.	Section 9.6
Advanced vibration suppression control	This function suppresses vibration at the arm end or residual vibration.	Section 9 .4
Adaptive filter Ⅱ	Driver detects mechanical resonance and sets filter characteristics automatically to suppress mechanical vibration.	Section 9 .2
Low-pass filter	Suppresses high-frequency resonance which occurs as servo system response is increased.	Section 9 .5
Machine analyzer function	Analyzes the frequency characteristic of the mechanical system by simply connecting a set up software(MR Configurator) installed personal computer and driver. Set up software(MR Configurator) is necessary for this function.	
Machine simulation	Can simulate machine motions on a personal computer screen on the basis of the machine analyzer results. Set up software(MR Configurator) is necessary for this function.	
Gain search function	Personal computer changes gains automatically and searches for overshoot-free gains in a short time. Set up software(MR Configurator) is necessary for this function.	
Slight vibration suppression control	Suppresses vibration of ±1 pulse produced at a servo motor stop.	Parameters No. PB24
Electronic gear	The electronic gear is used to make adjustment so that the driver setting matches the machine moving distance. Also, changing the electronic gear value allows the machine to be moved at any multiplication ratio to the moving distance using the driver.	Parameter No. PA06, PA07
Auto tuning	Automatically adjusts the gain to optimum value if load applied to the servo motor shaft varies.	Section 8.2
Regenerative option	Used when the built-in regenerative resistor of the driver does not have sufficient regenerative capability for the regenerative power generated.	Section 13.2
Brake unit	Used when the regenerative option cannot provide enough regenerative power. Can be used with the driver of 5kW or more.	Section 13.3
Regeneration converter	Used when the regenerative option cannot provide enough regenerative power. Can be used with the driver of 5kW or more.	Section 13.4
Alarm history clear	Alarm history is cleared.	Parameter No. PC18

Function	Description	Reference
Torque limit	Servo motor-torque is limited.	Section 15.3.2 (3) Section 15.11.1 (9)
Output signal (DO) forced output	Output signal can be forced on/off independently of the servo status. Use this function for output signal wiring check, etc.	Section 7.7.4
Test operation mode	JOG operation ･ positioning operation ･ DO forced output. Set up software(MR Configurator) is necessary for this function.	Section 7.7
Limit switch	The servo motor travel region can be limited using the forward rotation stroke end (LSP)/reverse rotation stroke end (LSN).	

15.2 I/O signals (I/O devices) transferred to/from the PC or PLC...etc

15.2.1 I/O signals (I/O devices)

(1) When 1 station is occupied

RYn/RXn: 32 points each, RWrn/RWwn: 4 points each

PC or PLC...etc → Driver (RYn)	
(Note) Device No.	Device name
RYn0	Servo-on
RYn1	Start
RYn2	Rotation direction specifying
RYn3 to RYn5	Not available
RYn6	Operation mode selection 1
RYn7	Operation mode selection 2
RYn8	Monitor output execution demand
RYn9	Instruction code execution demand
RYnA	Next station selection 1
RYnB	Next station selection 2
RYnC	Next station selection 3
RYnD	Next station selection 4
RYnE	Next station selection 5
RYnF to RY(n＋1)9	Not available
RY(n＋1)A	Reset
RY(n＋1)B to RY(n＋1)F	Not available

Driver → PC or PLC...etc (RXn)	
(Note) Device No.	Device name
RXn0	Ready
RXn1	In position
RXn2	Rough match
RXn3	Home position return completion
RXn4	Limiting torque
RXn5	Not available
RXn6	Electromagnetic brake interlock
RXn7	Temporary stop
RXn8	Monitoring
RXn9	Instruction code execution completion
RXnA	Warning
RXnB	Battery warning
RXnC	Movement completion
RXnD	Dynamic brake interlock
RXnE to RX(n＋1)9	Not available
RX(n＋1)A	Trouble
RX(n＋1)B	Remote station communication ready
RX(n＋1)C to RX(n＋1)F	Not available

PC or PLC...etc → Driver (RWwn)	
Address No.	Signal
RWwn	Monitor 1
RWwn＋1	Monitor 2
RWwn＋2	Instruction code
RWwn＋3	Writing data

Driver → PC or PLC...etc (RWrn)	
Address No.	Signal
RWrn	Monitor 1 data
RWrn＋1	Monitor 2 data
RWrn＋2	Respond code
RWrn＋3	Reading data

Note. "n" depends on the station number setting.

(2) When 2 stations are occupied

RXn/RYn: 64 points each, RWrn/RWwn: 8 points each

PC or PLC...etc → Driver (RYn)	
(Note) Device No.	Device name
RYn0	Servo-on
RYn1	Start
RYn2	Rotation direction specifying
RYn3 to RYn5	Not available
RYn6	Operation mode selection 1
RYn7	Operation mode selection 2
RYn8	Monitor output execution demand
RYn9	Instruction code execution demand
RYnA	Next station selection 1
RYnB	Next station selection 2
RYnC	Next station selection 3
RYnD	Next station selection 4
RYnE	Next station selection 5
RYnF to RY(n+1)F	Not available
RY(n+2)0	Position instruction execution demand
RY(n+2)1	Speed instruction execution demand
RY(n+2)2	Not available
RY(n+2)3	Next station selection 6
RY(n+2)4	Next station selection 7
RY(n+2)5	Next station selection 8
RY(n+2)6	Internal torque limit selection
RY(n+2)7	Proportion control
RY(n+2)8	Gain changing
RY(n+2)9	Not available
RY(n+2)A	Position/speed specifying system selection
RY(n+2)B	Not available
RY(n+2)C	Speed selection 1
RY(n+2)D	Speed selection 2
RY(n+2)E	Speed selection 3
RY(n+2)F to RY(n+3)9	Not available
RY(n+3)A	Reset
RY(n+3)B to RY(n+3)F	Not available

Driver → PC or PLC...etc (RXn)	
(Note) Device No.	Device name
RXn0	Ready
RXn1	In position
RXn2	Rough match
RXn3	Home position return completion
RXn4	Limiting torque
RXn5	Not available
RXn6	Electromagnetic brake interlock
RXn7	Temporary stop
RXn8	Monitoring
RXn9	Instruction code execution completion
RXnA	Warning
RXnB	Battery warning
RXnC	Movement completion
RXnD	Dynamic brake interlock
RXnE to RX(n+1)F	Not available
RX(n+2)0	Position instruction execution completion
RX(n+2)1	Speed instruction execution completion
RX(n+2)2	Station output 1
RX(n+2)3	Station output 2
RX(n+2)4	Station output 3
RX(n+2)5	Station output 4
RX(n+2)6	Station output 5
RX(n+2)7	Station output 6
RX(n+2)8	Station output 7
RX(n+2)9	Station output 8
RX(n+2)A to RX(n+3)9	Not available
RX(n+3)A	Trouble
RX(n+3)B	Remote station communication ready
RX(n+3)C to RX(n+3)F	Not available

Note. "n" depends on the station number setting.

PC or PLC...etc → Driver (RWwn)	
(Note 1) Address No.	Signal
RWwn	Monitor 1 (Note 2)
RWwn+1	Monitor 2 (Note 2)
RWwn+2	Instruction code
RWwn+3	Writing data
RWwn+4	Next station
RWwn+5	
RWwn+6	Point table No./Speed command data (Note 3)
RWwn+7	Not available

Driver → PC or PLC...etc (RWrn)	
(Note 1) Address No.	Signal
RWrn	Monitor 1 data lower 16 bit
RWwn+1	Monitor 1 data upper 16 bit
RWwn+2	Respond code
RWwn+3	Reading data
RWwn+4	
RWwn+5	Monitor 2 data lower 16 bit
RWwn+6	Monitor 2 data upper 16 bit
RWwn+7	Not available

Note 1. "n" depends on the station number setting.

2. Specify the code of the lower 16 bit as the monitor code of 32-bit data.

3. When the parameter No.PC30 setting is "□□0□", specify the point table No. in RWwn+6. When the parameter No.PC30 setting is "□□1□", specify the speed data in RWwn+6, and turn ON Speed instruction execution demand (RY(n+2)1). When setting the parameter No.PC30 to "□□1□", always set the acceleration/deceleration time constant in the point table No.1.

15.2.2 Detailed explanation of I/O signals

(1) Input signals (Input devices)

The note signs in the remarks column indicates the following descriptions.

*: Can be automatic turned ON internally by setting parameters No.PD01.

Signal name (Device name)	Description	Device No.		Remarks
		1 station occupied	2 stations occupied	
Servo-on	Turning RYn0 ON powers on the base circuit, making operation ready to start. (Servo on status) Turning it OFF powers off the base circuit, coasting the servo motor. (Servo off status)	RYn0	RYn0	*
Start	1. Automatic operation mode 1 and 2 Turning on RYn1 performs positioning operation once to the specified station number. 2. Manual operation mode Turning on RYn1 in the indexer JOG operation makes the servo motor rotate in the RYn2 specified direction only while RYn1 is on. Turning it off makes the servo motor perform positioning to the station where the servo motor can decelerate to stop. Turning on RYn1 in JOG operation makes the servo motor rotate in the RYn2 specified direction only while RYn1 is on. Turning it off makes the servo motor decelerate to stop regardless of stations. 3. Home position return mode Turning on RYn1 immediately starts a home position return.	RYn1	RYn1	

<table>
<tr><th rowspan="2">Signal name
(Device name)</th><th rowspan="2">Description</th><th colspan="2">Device No.</th><th rowspan="2">Remarks</th></tr>
<tr><th>1 station occupied</th><th>2 stations occupied</th></tr>
<tr><td>Rotation direction specifying</td><td>Turning on/off RYn2 specifies the rotation direction at start.
1. Automatic operation mode 1
Rotation direction changes according to the parameter No.PA14 setting. RYn2 is used only for the automatic operation mode 1 (Rotation direction specifying indexer). It is not used for the automatic operation mode 2 (Shortest rotating indexer).
<table>
<tr><th>(Note) RYn2</th><th>Parameter No.PA14</th><th>Servo motor rotation direction</th></tr>
<tr><td rowspan="2">0</td><td>0</td><td>CCW</td></tr>
<tr><td>1</td><td>CW</td></tr>
<tr><td rowspan="2">1</td><td>0</td><td>CW</td></tr>
<tr><td>1</td><td>CCW</td></tr>
</table>
Note. 0: OFF
1: ON

2. Manual operation mode
It is not affected by the parameter No.PA14.
<table>
<tr><th>(Note) RYn2</th><th>Parameter No.PA14</th><th>Servo motor rotation direction</th></tr>
<tr><td rowspan="2">0</td><td>0</td><td rowspan="2">CCW</td></tr>
<tr><td>1</td></tr>
<tr><td rowspan="2">1</td><td>0</td><td rowspan="2">CW</td></tr>
<tr><td>1</td></tr>
</table>
Note. 0: OFF
1: ON

3. Home position return mode
RYn2 is invalid. Specify the rotation direction in the home position return mode by using the parameter No.PC03.</td><td>RYn2</td><td>RYn2</td><td></td></tr>
<tr><td>Operation mode selection 1</td><td rowspan="2">Select the operation mode.
<table>
<tr><th colspan="2">(Note)
Remote input</th><th rowspan="2">Operation mode</th></tr>
<tr><th>Ryn7</th><th>Ryn6</th></tr>
<tr><td>0</td><td>0</td><td>Home position return mode</td></tr>
<tr><td>0</td><td>1</td><td>Manual operation mode</td></tr>
<tr><td>1</td><td>0</td><td>Automatic operation mode 1
(Rotation direction specifying indexer)</td></tr>
<tr><td>1</td><td>1</td><td>Automatic operation mode 2
(Shortest rotating indexer)</td></tr>
</table>
Note. 0: OFF
1: ON</td><td>RYn6</td><td>RYn6</td><td></td></tr>
<tr><td>Operation mode selection 2</td><td>RYn7</td><td>RYn7</td><td></td></tr>
</table>

Signal name (Device name)	Description	Device No. 1 station occupied	Device No. 2 stations occupied	Remarks
Monitor output execution demand	When RYn8 is turned ON, the following data and signals are set. At the same time, RXn8 turns ON. While RYn8 is ON, the monitor values are kept updated. 1) When 1 station is occupied Remote register RWrn: Data demanded by Monitor 1 (RWwn) Remote register RWrn+1: Data demanded by Monitor 2 (RWwn+1) Remote register RWrn+2: Respond code indicating normal or error 2) When 2 stations are occupied Remote register RWrn: Lower 16 bits of data demanded by Monitor 1 (RWwn) Remote register RWrn+1: Upper 16 bits of data demanded by Monitor 1 (RWwn) Remote register RWrn+5: Lower 16 bits of data demanded by Monitor 2 (RWwn+2) Remote register RWrn+6: Upper 16 bits of data demanded by Monitor 2 (RWwn+2) Remote register RWrn+2: Respond code indicating normal or error	RYn8	RYn8	
Instruction code execution demand	Turning RYn9 ON executes the processing corresponding to the instruction code stored in remote register RWwn+2. After completion of instruction code execution, the respond code indicating normal or error is set to RWrn+2. At the same time, RXn9 turns ON. Refer to section 15.2.4 for details.	RYn9	RYn9	
Next station selection 1	Select the station number by using RYnA to RY(n+2)5. (See the table below.)	RYnA	RYnA	
Next station selection 2		RYnB	RYnB	
Next station selection 3		RYnC	RYnC	
Next station selection 4		RYnD	RYnD	
Next station selection 5		RYnE	RYnE	
Next station selection 6			RY(n+2)3	
Next station selection 7			RY(n+2)4	
Next station selection 8			RY(n+2)5	

Station No.	(Note 1) Remote input RY(n+2)5	RY(n+2)4	RY(n+2)3	RYnE	RYnD	RYnC	RYnB	RYnA
0	0	0	0	0	0	0	0	0
1	0	0	0	0	0	0	0	1
2	0	0	0	0	0	0	1	0
3	0	0	0	0	0	0	1	1
4	0	0	0	0	0	1	0	0
⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮
254	1	1	1	1	1	1	1	0
(Note 2)	1	1	1	1	1	1	1	1

Note 1. 0: OFF
1: ON
2. When setting "1" for all RYnA to RYnE and RY(n+2)3 to RY(n+2)5, the station warning (A97) occurs.

Signal name (Device name)	Description	Device No.		Remarks
		1 station occupied	2 stations occupied	
Position instruction execution demand	When RY(n+2) is turned on, the next station number set in the remote register RWwn+4 is set. When it is set to the driver, the respond code indicating normal or error is set to RWrn+2. At the same time, RX(n+2)0 turns ON. Refer to section 3.6.3 for details.		RY(n+2)0	
Speed instruction demand	When RY(n+2)1 is turned ON, the point table No. or speed command data set to remote register RWwn+6 is set. When it is set to the driver, the respond code indicating normal or error is set to RWrn+2. At the same time, RX(n+2)1 turns ON. Refer to section 3.6.3 for details.		RY(n+2)1	
Internal torque limit selection	Turning RY(n+2)6 OFF makes the torque limit value of parameter No.PA11 (forward rotation torque limit) ・ parameter No.PA12 (reverse rotation torque limit) valid, and turning it ON makes that of parameter No.PC35 (internal torque limit). (Refer to section 15.3.2 (3))		RY(n+2)6	
Proportion control	When RY(n+2)7 is turned ON, the speed amplifier is switched from the proportional integral type to the proportional type. If the servo motor at a stop is rotated even one pulse by an external factor, it develops torque in an attempt to compensate for a position shift. When the shaft is locked mechanically after Movement completion (RXnC) is turned OFF, for example, turning Proportion control (RY(n+2)7) ON as soon as Movement completion (RXnC) turns OFF allows control of unnecessary torque developed in an attempt to compensate for a position shift. When the shaft is to be locked for an extended period of time, turn Internal torque limit selection (RY(n+2)6) ON simultaneously with Proportion control (RY(n+2)7) to make the torque not more than the rated torque using Internal torque limit (parameter No.PC35).		RY(n+2)7	*
Gain changing	When RY(n+2)8 is turned ON, the load inertia moment ratio and the corresponding gain values change to the values of parameter No.PB29 to PB32. To change the gain using RY(n+2)8, make the auto tuning invalid.		RY(n+2)8	
Position/speed specifying system selection	Select how to give a speed command. (Refer to section 3.6.3.) OFF: Remote input-based speed specifying system Specifying the point table No. with Point table No. selection (RYnA to RYnE) gives a speed command. ON : Remote register-based speed specifying system Setting the instruction code to the remote register (RWwn+4 to RWwn+6) gives a speed command. Set the parameter No.PC30 (direct specification selection) to "□□□2".		RY(n+2)A	

<table>
<tr><th rowspan="2">Signal name
(Device name)</th><th rowspan="2">Description</th><th colspan="2">Device No.</th><th rowspan="2">Remarks</th></tr>
<tr><th>1 station occupied</th><th>2 stations occupied</th></tr>
<tr><td>Speed selection 1</td><td rowspan="3">Set the servo motor speed, acceleration time constant, and deceleration time constant for positioning operation by selecting the point table number from 1 to 8 using RY(n＋2)C, RY(n＋2)D, and RY(n＋2)E.

<table>
<tr><th colspan="3">(Note) Remoto input</th><th rowspan="2">Point table No.</th></tr>
<tr><th>RY(n＋2)E</th><th>RY(n＋2)D</th><th>RY(n＋2)C</th></tr>
<tr><td>0</td><td>0</td><td>0</td><td>1</td></tr>
<tr><td>0</td><td>0</td><td>1</td><td>2</td></tr>
<tr><td>0</td><td>1</td><td>0</td><td>3</td></tr>
<tr><td>0</td><td>1</td><td>1</td><td>4</td></tr>
<tr><td>1</td><td>0</td><td>0</td><td>5</td></tr>
<tr><td>1</td><td>0</td><td>1</td><td>6</td></tr>
<tr><td>1</td><td>1</td><td>0</td><td>7</td></tr>
<tr><td>1</td><td>1</td><td>1</td><td>8</td></tr>
</table>
Note. 0: OFF
1: ON</td><td></td><td>RY(n＋2)C</td><td></td></tr>
<tr><td>Speed selection 2</td><td></td><td>RY(n＋2)D</td><td></td></tr>
<tr><td>Speed selection 3</td><td></td><td>RY(n＋2)E</td><td></td></tr>
<tr><td>Reset</td><td>Keeping RY(n＋1)A or RY(n＋3)A ON for 50ms or longer allows an alarm to be deactivated.
Some alarms cannot be deactivated by Reset RY(n＋1)A or RY(n＋3)A. (Refer to section 15.12.4 (1))
If RY(n＋1)A or RY(n＋3)A is turned ON with no alarm occurring, the base circuit will not be shut off. When "□□1□" is set in parameter No.PD20 (function selection D-1), the base circuit is shut off.
This device is not designed to make a stop. Do not turn it ON during operation.</td><td>RY(n＋1)A</td><td>RY(n＋3)A</td><td></td></tr>
</table>

(2) Output signals (Output device)

POINT
・The output devices can be used for both the remote output and the external output signals of CN6 connector.

The signal whose Device No. field has an oblique line cannot be used in CC-Link.

Signal name (Device name)	Description	Device No.	
		1 station occupied	2 stations occupied
Ready	A ready is assigned to the CN6-14 pin as an external output signal. RXn0 turns ON when the driver is ready to operate after servo-on.	RXn0	RXn0
In position	RXn1 turns ON when the droop pulse value is within the preset in-position range. The in-position range can be changed using parameter No.PA10. Increasing the in-position range may result in a continuous conduction status during low-speed rotation. RXn1 turns ON at servo-on.	RXn1	RXn1
Rough match	RXn2 turns ON when the command remaining distance becomes less than the rough match output range set in the parameter. RXn2 turns ON at servo-on.	RXn2	RXn2
Home position return completion	The home position return completion is assigned to the CN6-16 pin as an external output signal. RXn3 turns ON when a home position return is completed. RXn3 turns ON at completion of a home position return. In an absolute position detection system, RXn3 turns ON when operation is ready to start, but turns OFF in any of the following cases. 1) Servo-on (RYn0) is turned OFF. 2) Forced stop (EMG) is turned OFF. 3) Reset (RY(n＋1)A or RY(n＋3)A) is turned ON. 4) Alarm occurs. 5) Forward rotation stroke end (RYn4) or Reverse rotation stroke end (RYn5) is turned OFF. 6) Home position return has not been made after product purchase. 7) Home position return has not been made after occurrence of Absolute position erase (A25) or Absolute position counter warning (AE3). 8) Home position return has not been made after electronic gear change. 9) Home position return has not been made after the absolute position detection system was changed from invalid to valid. 10) Parameter No.PA14 (Station No. direction selection) has been changed. 11) While a home position return is being made. When any of 1) to 11) has not occurred and a home position return is already completed at least once, Home position return completion (RXn3) turns to the same output status as Ready (RXn0).	RXn3	RXn3
Limiting torque	RXn4 turns ON when the torque is reached at the time of torque generation.	RXn4	RXn4
Electromagnetic brake interlock	RXn6 turns OFF at servo-off or alarm occurrence. At alarm occurrence, it turns OFF independently of the base circuit status.	RXn6	RXn6
Monitoring	Refer to Monitor output execution demand (RYn8).	RXn8	RXn8
Instruction code execution completion	Refer to Instruction code execution demand (RYn9).	RXn9	RXn9

<table>
<tr><th rowspan="2">Signal name
(Device name)</th><th rowspan="2">Description</th><th colspan="2">Device No.</th></tr>
<tr><th>1 station occupied</th><th>2 stations occupied</th></tr>
<tr><td>Warning</td><td>RXnA turns ON when a warning occurs.
When no warning has occurred, RXnA turns OFF within about 1s after power-on.</td><td>RXnA</td><td>RXnA</td></tr>
<tr><td>Battery warning</td><td>RXnB turns ON when Open battery cable warning (A92) or Battery warning (A9F) occurs. When no battery warning has occurred, RXnB turns OFF within about 1s after power-on.</td><td>RXnB</td><td>RXnB</td></tr>
<tr><td>Movement completion</td><td>RXnC turns ON when In position (RXn1) turns ON and the command remaining distance is "0".
RXnC turns ON at servo-on.</td><td>RXnC</td><td>RXnC</td></tr>
<tr><td>Dynamic brake interlock</td><td>RXnD turns off simultaneously when the dynamic brake is operated. When using the external dynamic brake on the driver of 11kW or more, this device is required. (Refer to section 13.6.) For the driver of 7kw or less, it is not necessary to use this device.</td><td>RXnD</td><td>RXnD</td></tr>
<tr><td>Position instruction execution completion</td><td>Refer to Speed instruction execution demand (RY(n+2)0).</td><td></td><td>RX(n+2)0</td></tr>
<tr><td>Speed instruction execution completion</td><td>Refer to Position instruction execution demand (RY(n+2)1).</td><td></td><td>RX(n+2)1</td></tr>
<tr><td>Station output 1</td><td rowspan="8">As soon as the movement completion (RXnC) turns on, the station number is output in 8-bit code.
<table>
<tr><th rowspan="2">Station No.</th><th colspan="8">(Note 1) Remote output</th></tr>
<tr><th>RX (n+2)9</th><th>RX (n+2)8</th><th>RX (n+2)7</th><th>RX (n+2)6</th><th>RX (n+2)5</th><th>RX (n+2)4</th><th>RX (n+2)3</th><th>RX (n+2)2</th></tr>
<tr><td>(Note 2)</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td></tr>
<tr><td>0</td><td>1</td><td>1</td><td>1</td><td>1</td><td>1</td><td>1</td><td>1</td><td>1</td></tr>
<tr><td>1</td><td>1</td><td>1</td><td>1</td><td>1</td><td>1</td><td>1</td><td>1</td><td>0</td></tr>
<tr><td>2</td><td>1</td><td>1</td><td>1</td><td>1</td><td>1</td><td>1</td><td>0</td><td>1</td></tr>
<tr><td>⋮</td><td>⋮</td><td>⋮</td><td>⋮</td><td>⋮</td><td>⋮</td><td>⋮</td><td>⋮</td><td>⋮</td></tr>
<tr><td>253</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>1</td><td>0</td></tr>
<tr><td>254</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>1</td></tr>
</table>
Note 1. 0: OFF
1: ON
2. All station outputs turn to “0” (OFF) when the current position is out of the in-position range.

At power-on, emergency stop or alarm occurrence, if the current position is within the in-position range of each station, corresponding station number is output.
While operating in the automatic operation mode, if the current position is within the in-position range of the target next station, corresponding station number is output.
While operating in the indexer JOG operation of manual operation mode, if the current position is within the in-position range of the station where the servo motor stops by turning off the start (RYn1), corresponding station number is output.
When home position return is incomplete, station number is not output.</td><td rowspan="8"></td><td>RX(n+2)2</td></tr>
<tr><td>Station output 2</td><td>RX(n+2)3</td></tr>
<tr><td>Station output 3</td><td>RX(n+2)4</td></tr>
<tr><td>Station output 4</td><td>RX(n+2)5</td></tr>
<tr><td>Station output 5</td><td>RX(n+2)6</td></tr>
<tr><td>Station output 6</td><td>RX(n+2)7</td></tr>
<tr><td>Station output 7</td><td>RX(n+2)8</td></tr>
<tr><td>Station output 8</td><td>RX(n+2)9</td></tr>
</table>

Signal name (Device name)	Description	Device No.	
		1 station occupied	2 stations occupied
Trouble	A trouble is assigned to the CN6-15 pin as an external output signal. RX(n＋1)A or RX(n+3)A turns ON when the protective circuit is activated to shut off the base circuit. When no alarm has occurred, RX(n＋1)A or RX(n＋3)A turns OFF within about 1.5s after power is switched ON.	RX(n＋1)A	RX(n＋3)A
Remote station communication ready	This signal turns ON at power-on and turns off at a trouble occurrence or in the reset (RY(n＋1)A or RY(n＋3)A) ON status.	RX(n＋1)B	RX(n＋3)B

(3) Remote registers

The signal whose Remote Register field has an oblique line cannot be used.

(a) Input (PC or PLC...etc → driver)

Remote register		Signal name	Description	Setting range
1 station occupied	2 stations occupied			
RWwn	RWwn	Monitor 1	Demands the status indication data of the driver. 1) When 1 station is occupied Setting the monitor code of the status indication item to be monitored to RWwn and turning RYn8 to ON sets data to RWrn. RXn8 turns on at the same time. 2) When 2 stations are occupied Setting the monitor code of the status indication item to be monitored to RWwn and turning RYn8 to ON sets data to RWrn. RXn8 turns on at the same time. When demanding 32-bit data, specifying the lower 16-bit code No. and turning RYn8 to ON sets the lower 16-bit data to RWwn and the upper 16-bit data to RWrn. data is stored in the RXn8. RXn8 turns on at the same time. Refer to section 15.2.3 for the item of the monitor code of the status indication.	Refer to section 15.2.3.
RWwn+1	RWwn+1	Monitor 2	Demands the status indication data of the driver. 1) When 1 station is occupied Setting the monitor code of the status indication item to be monitored to RWwn+1 and turning RYn8 to ON sets data to RWrn+1. RXn8 turns on at the same time. 2) When 2 stations are occupied Setting the monitor code of the status indication item to be monitored to RWwn+1 and turning RYn8 to ON sets data to RWrn+5. RXn8 turns on at the same time. When demanding 32-bit data, specifying the lower 16-bit code No. and turning RYn8 to ON sets the lower 16-bit data to RWwn＋5 and the upper 16-bit data to RWrn+6. Data is stored in the RXn8. RXn8 turns on at the same time. Refer to section 16.2.3 for the item of the monitor code of the status indication.	Refer to section 15.2.3.
RWwn＋2	RWwn＋2	Instruction code	Sets the instruction code used to perform parameter or point table data read and write, alarm reference or the like. Setting the instruction code No. to RWwn＋2 and turning RYn9 to ON executes the instruction. RXn9 turns to ON on completion of instruction execution. Refer to section 15.2.4 (1) for instruction code No. definitions.	Refer to section 15.2.4 (1).

Remote register		Signal name	Description	Setting range
1 station occupied	2 stations occupied			
RWwn+3	RWwn+3	Writing data	Sets the written data used to perform parameter or point table data write, alarm history clear or the like. Setting the written data to RWwn+3 and turning RYn9 to ON writes the data to the driver. RXn9 turns to ON on completion of write. Refer to section 15.2.4 (2) for written data definitions.	Refer to section 15.2.4 (2).

(b) Output (Driver → PC or PLC...etc)

Note that the data set to RWrn and RWrn+1 depends on whether 1 station or 2 stations are occupied.

If you set inappropriate code No. or data to the remote register input, the error code is set to respond code (RWrn+2). Refer to section 3.5.5 for the error code.

When 1 station is occupied

Remote register	Signal name	Description
RWrn	Monitor 1 data	The data of the monitor code set to RWwn is set.
RWrn+1	Monitor 2 data	The data of the monitor code set to RWwn+1 is set.
RWrn+2	Respond code	"0000" is set when the codes set to RWwn to RWwn+3 are executed normally.
RWrn+3	Reading data	Data corresponding to the read code set to RWwn+2 is set.

When 2 stations are occupied

Remote register	Signal name	Description
RWrn	Monitor 1 data lower 16bit	The lower 16 bits of the data of the monitor code set to RWwn are set.
RWrn+1	Monitor 1 data upper 16bit	The upper 16 bits of the data of the monitor code set to RWwn are set. A sign is set if there are no data in the upper 16 bits.
RWrn+2	Respond code	"0000" is set when the codes set to RWwn to RWwn+6 are executed normally.
RWrn+3	Reading data	Data corresponding to the read code set to RWwn+2 is set.
RWrn+4		
RWrn+5	Monitor 2 data lower 16bit	The lower 16 bits of the data of the monitor code set to RWwn+1 are set.
RWrn+6	Monitor 2 data upper 16bit	The upper 16 bits of the data of the monitor code set to RWwn+1 are set. A sign is set if there are no data in the upper 16 bits.
RWrn+7		

15.2.3 Monitor codes

To demand 32-bit data when 2 stations are occupied, specify the lower 16-bit code No. Use any of the instruction codes 0101 to 011C to read the decimal point position (multiplying factor) of the status indication.
Setting any code No. that is not given in this section will set the error code (□□1□) to respond code (RWrn＋2). At this time, "0000" is set to RWrn, RWrn＋1, RWrn＋5 and RWrn＋6.

Code No.		Monitored item	Answer data (Driver → PC or PLC...etc)	
1 station occupied	2 stations occupied		Data length	Unit
0000h	0000h			
0001h	0001h	Not used in indexer positioning operation.		
0002h				
0003h	0003h			
0004h				
0005h	0005h			
0006h				
0007h	0007h			
0008h	0008h	Point table No.	16bit	[No.]
0009h				
000Ah	000Ah	Feedback pulse value lower 16bit	16bit	[pulse]
000Bh		Feedback pulse value upper 16bit	16bit	[pulse]
000Ch				
000Dh				
000Eh	000Eh	Droop pulse value lower 16bit	16bit	[pulse]
000Fh		Droop pulse value upper 16bit	16bit	[pulse]
0010h	0010h			
0011h	0011h	Regenerative load factor	16bit	[%]
0012h	0012h	Effective load factor	16bit	[%]
0013h	0013h	Peak load factor	16bit	[%]
0014h	0014h	Instantaneously occurring torque	16bit	[%]
0015h	0015h	ABS counter	16bit	[rev]
0016h	0016h	Motor speed lower 16bit	16bit	×0.1[rev/min]
0017h		Motor speed upper 16bit	16bit	×0.1[rev/min]
0018h	0018h	Bus voltage	16bit	[V]
0019h	0019h	Not used in indexer positioning operation.		
001Ah				
001Bh	001Bh			
001Ch	001Ch	Within one-revolution position lower 16bit	16bit	[pulse]
001Dh		Within one-revolution position upper 16bit	16bit	[pulse]
001Eh	001Eh	Station No.	16bit	[No.]

15.2.4 Instruction codes (RWwn＋2・RWwn＋3)

Refer to section 3.6.2 for the instruction code timing charts.

(1) Read instruction codes

The word data requested to be read with the instruction code 0000h to 0AFFh is read by Read code (RWrn＋3).

Set the command code No. corresponding to the item to RWrn＋2. The codes and answer data are all 4-digit hexadecimal numbers.

Setting any command code No. that is not given in this section will set the error code (□□1□) to respond code (RWrn＋2). At this time, "0000" is set to Reading data (RWrn＋3).

Code No.	Item/Function	Reading data (RWrn+3) contents (Driver → PC or PLC...etc)
0000h	Operation mode Reads the current operation mode.	0000: CC-Link operation mode 0001: Test operation mode
0002h	Travel multiplying factor Reads the multiplying factor of the position data in the point table set in parameter No.PA05.	□□□□ Travel multiplying factor 0300: ×1000 0200: ×100 0100: ×10 0000: ×1
0010h	Current alarm (warning) reading Reads the alarm No. or warning No. occurring currently.	0 0 □□ Occurring alarm No./warning No.
0020h	Alarm number in alarm history (most recent alarm)	0 0 □□ Alarm No. that occurred in past
0021h	Alarm number in alarm history (first recent alarm)	
0022h	Alarm number in alarm history (second recent alarm)	
0023h	Alarm number in alarm history (third recent alarm)	
0024h	Alarm number in alarm history (fourth recent alarm)	
0025h	Alarm number in alarm history (fifth recent alarm)	
0030h	Alarm occurrence time in alarm history (most recent alarm)	□□□□ Occurrence time of alarm that occurred in past
0031h	Alarm occurrence time in alarm history (first recent alarm)	
0032h	Alarm occurrence time in alarm history (second recent alarm)	
0033h	Alarm occurrence time in alarm history (third recent alarm)	
0034h	Alarm occurrence time in alarm history (fourth recent alarm)	
0035h	Alarm occurrence time in alarm history (fifth recent alarm)	

<table>
<tr><th>Code No.</th><th>Item/Function</th><th>Reading data (RWrn+3) contents
(Driver → PC or PLC...etc)</th></tr>
<tr><td>0040h</td><td>Input device status 0
Reads the statuses (OFF/ON) of the input devices.</td><td>bit 0 to bit F indicate the OFF/ON statuses of the corresponding input devices.
bitF bit0
<table>
<tr><th>bit</th><th>Device</th><th>bit</th><th>Device</th></tr>
<tr><td>0</td><td>Servo-on</td><td>8</td><td>Monitor output execution demand</td></tr>
<tr><td>1</td><td>Start</td><td>9</td><td>Instruction code execution demand</td></tr>
<tr><td>2</td><td>Rotation direction specifying</td><td>A</td><td>Next station selection 1</td></tr>
<tr><td>3</td><td>Proximity dog</td><td>B</td><td>Next station selection 2</td></tr>
<tr><td>4</td><td>Forward rotation stroke end</td><td>C</td><td>Next station selection 3</td></tr>
<tr><td>5</td><td>Reverse rotation stroke end</td><td>D</td><td>Next station selection 4</td></tr>
<tr><td>6</td><td>Operation mode selection 1</td><td>E</td><td>Next station selection 5</td></tr>
<tr><td>7</td><td>Operation mode selection 2</td><td>F</td><td></td></tr>
</table></td></tr>
<tr><td>0041h</td><td>Input device status 1
Reads the statuses (OFF/ON) of the input devices.</td><td>bit 0 to bit F indicate the OFF/ON statuses of the corresponding input devices.
bitF bit0
<table>
<tr><th>bit</th><th>Device</th><th>bit</th><th>Device</th></tr>
<tr><td>0</td><td>Position instruction execution demand</td><td>7</td><td>Proportion control</td></tr>
<tr><td>1</td><td>Speed instruction execution demand</td><td>8</td><td>Gain changing</td></tr>
<tr><td>2</td><td></td><td>9</td><td></td></tr>
<tr><td>3</td><td>Next station selection 6</td><td>A</td><td>Position/speed specifying system selection</td></tr>
<tr><td>4</td><td>Next station selection 7</td><td>B</td><td></td></tr>
<tr><td>5</td><td>Next station selection 8</td><td>C</td><td>Speed selection 1</td></tr>
<tr><td>6</td><td>Internal torque limit selection</td><td>D</td><td>Speed selection 2</td></tr>
<tr><td></td><td></td><td>E</td><td>Speed selection 3</td></tr>
<tr><td></td><td></td><td>F</td><td>For manufacturer setting</td></tr>
</table></td></tr>
<tr><td>0042h</td><td>Input device status 2
Reads the statuses (OFF/ON) of the input devices.</td><td>bit 0 to bit F indicate the OFF/ON statuses of the corresponding input devices.
bitF bit0
<table>
<tr><th>bit</th><th>Device</th><th>bit</th><th>Device</th></tr>
<tr><td>0</td><td></td><td>8</td><td></td></tr>
<tr><td>1</td><td></td><td>9</td><td></td></tr>
<tr><td>2</td><td></td><td>A</td><td>Reset</td></tr>
<tr><td>3</td><td></td><td>B</td><td></td></tr>
<tr><td>4</td><td></td><td>C</td><td></td></tr>
<tr><td>5</td><td></td><td>D</td><td></td></tr>
<tr><td>6</td><td></td><td>E</td><td></td></tr>
<tr><td>7</td><td></td><td>F</td><td></td></tr>
</table></td></tr>
</table>

<table>
<tr><th>Code No.</th><th>Item/Function</th><th>Reading data (RWrn+3) contents
(Driver → PC or PLC...etc)</th></tr>
<tr><td>0050h</td><td>Output device status 0
Reads the statuses (OFF/ON) of the Output devices.</td><td>bit 0 to bit F indicate the OFF/ON statuses of the corresponding output devices.
bitF bit0
<table>
<tr><th>bit</th><th>Device</th><th>bit</th><th>Device</th></tr>
<tr><td>0</td><td>Ready</td><td>8</td><td>Monitoring</td></tr>
<tr><td>1</td><td>In position</td><td>9</td><td>Instruction code execution completion</td></tr>
<tr><td>2</td><td>Rough match</td><td>A</td><td>Warning</td></tr>
<tr><td>3</td><td>Home position return completion</td><td>B</td><td>Battery warning</td></tr>
<tr><td>4</td><td>Limiting torque</td><td>C</td><td>Movement completion</td></tr>
<tr><td>5</td><td></td><td>D</td><td>Dynamic brake</td></tr>
<tr><td>6</td><td>Electromagnetic brake interlock</td><td>E</td><td></td></tr>
<tr><td>7</td><td></td><td>F</td><td></td></tr>
</table></td></tr>
<tr><td>0051h</td><td>Output device status 1
Reads the statuses (OFF/ON) of the Output devices.</td><td>bit 0 to bit F indicate the OFF/ON statuses of the corresponding output devices.
bitF bit0
<table>
<tr><th>bit</th><th>Device</th><th>bit</th><th>Device</th></tr>
<tr><td>0</td><td>Position instruction execution completion</td><td>7</td><td>Station output 6</td></tr>
<tr><td>1</td><td>Speed instruction execution completion</td><td>8</td><td>Station output 7</td></tr>
<tr><td>2</td><td>Station output 1</td><td>9</td><td>Station output 8</td></tr>
<tr><td>3</td><td>Station output 2</td><td>A</td><td>Station output 9</td></tr>
<tr><td>4</td><td>Station output 3</td><td>B</td><td></td></tr>
<tr><td>5</td><td>Station output 4</td><td>C</td><td></td></tr>
<tr><td>6</td><td>Station output 5</td><td>D</td><td></td></tr>
<tr><td></td><td></td><td>E</td><td></td></tr>
<tr><td></td><td></td><td>F</td><td>For manufacturer setting</td></tr>
</table></td></tr>
<tr><td>0052h</td><td>Output device status 2
Reads the statuses (OFF/ON) of the Output devices.</td><td>bit 0 to bit F indicate the OFF/ON statuses of the corresponding output devices.
bitF bit0
<table>
<tr><th>bit</th><th>Device</th><th>bit</th><th>Device</th></tr>
<tr><td>0</td><td></td><td>9</td><td></td></tr>
<tr><td>1</td><td></td><td>A</td><td>Trouble</td></tr>
<tr><td>2</td><td></td><td>B</td><td>Remote station communication ready</td></tr>
<tr><td>3</td><td></td><td>C</td><td></td></tr>
<tr><td>4</td><td></td><td>D</td><td></td></tr>
<tr><td>5</td><td></td><td>E</td><td></td></tr>
<tr><td>6</td><td></td><td>F</td><td></td></tr>
<tr><td>7</td><td></td><td></td><td></td></tr>
<tr><td>8</td><td></td><td></td><td></td></tr>
</table></td></tr>
</table>

Code No.	Item/Function	Reading data (RWrn+3) contents (Driver → PC or PLC...etc)
0081h	Energization time Reads the energization time from shipment.	Returns the energization time [h]. Energization time
0082h	Power ON frequency Reads the number of power-on times from shipment.	Returns the number of power-on times. Power ON frequency
00A0h	Ratio of load inertia moment Reads the estimated ratio of load inertia moment to servo motor shaft inertia moment.	Return unit [times]. Ratio of load inertia moment
00B0h	Home position within-1-revolution position lower 16bit (CYC0) Reads the lower 16 bits of the cycle counter value of the absolute home position.	Return unit [pulses]. Cycle counter value
00B1h	Home position within-1-revolution position upper 16bit Reads the upper 16 bits of the cycle counter value of the absolute home position.	Return unit [pulses]. Cycle counter value
00B2h	Home position Multi-revolution data (ABS0) Multi-revolution counter value of absolute home position reading.	Return unit [rev]. Multi-revolution counter value
00C0h	Error parameter No./Point data No. reading Reads the parameter No./point table No. in error.	Parameter No. or point table No. Parameter group 0: Basic setting parameters (No.PA□□) 1: Gain/filter parameters (No.PB□□) 2: Extension setting parameters (No.PC□□) 3: I/O setting parameters (No.PD□□) Type 1: Parameter No. 2: Point table No.
0100h to 011Dh	Monitor multiplying factor Reads the multiplying factor of the data to be read with the monitor code. The instruction codes 0100 to 011D correspond to the monitor codes 0000 to 001D. 0000 applies to the instruction code that does not correspond to the monitor code.	Monitor multiplying factor 0003: ×1000 0002: ×100 0001: ×10 0000: ×1

Code No.	Item/Function	Reading data (RWrn+3) contents (Driver → PC or PLC...etc)
0200h	Parameter group reading Reads the parameter group to be read with code No.8200h to be written.	0 0 0 □ Parameter group 0: Basic setting parameters (No.PA□□) 1: Gain/filter parameters (No.PB□□) 2: Extension setting parameters (No.PC□□) 3: I/O setting parameters (No.PD□□)
0201h to 02FFh	Parameter data reading Reads the set value of each No. of the parameter group read with code No.0200h. The decimal value converted from the 2 lower digits of the code No. corresponds to the parameter No. If the instruction code is set outside the range set in parameter No.PA19, an error code is returned and the data cannot be read.	The value set in the parameter No. corresponding to the requested group name is stored.
0301h to 03FFh	Data form of parameter Reads the data format of each No. of the parameter group read with code No.0200h. The decimal value converted from the 2 lower digits of the code No. corresponds to the parameter No. If the instruction code is set outside the range set in parameter No.PA19, an error code is returned and the data cannot be read.	The value set in the parameter No. corresponding to the requested group name is stored. 0 □ □ □ Decimal point position 0: Without decimal point 1: First least significant digit (without decimal point) 2: Second least significant digit 3: Third least significant digit 4: Fourth least significant digit Data format 0: Used unchanged as hexadecimal 1: Must be converted into decimal Parameter write type 0: Valid after write 1: Valid when power is switched on again after write
0601h to 06FFh	Servo motor speed of point table No.1 to 255 The decimal value converted from the 2 lower digits of the code No. corresponds to the point table No.	The servo motor speed set to the requested point table No. is returned. □ □ □ □ Servo motor speed
0701h to 07FFh	Acceleration time constant of point table No.1 to 255 The decimal value converted from the 2 lower digits of the code No. corresponds to the point table No.	The acceleration time constant set to the requested point table No. is returned.
0801h to 08FFh	Deceleration time constant of point table No.1 to 255 The decimal value converted from the 2 lower digits of the code No. corresponds to the point table No.	The deceleration time constant set to the requested point table No. is returned.

(2) Write instruction codes

Set the data, which was requested to be written with the instruction code 8010h to 91FFh.

Set the instruction code No. corresponding to the item to Instruction code (RWwn＋2) and the written data to Writing data (RWwn＋3). The codes and answer data are all 4-digit hexadecimal numbers.

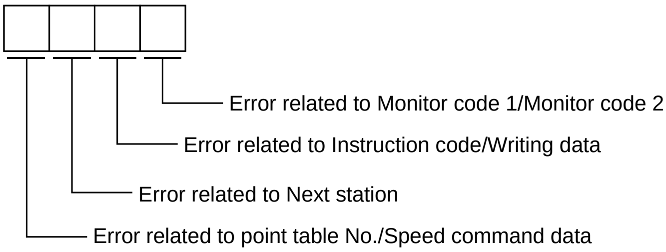
When the instruction code which has not been described in this section is set, the error code (□□1□) is stored in respond code (RWrn＋2).

Code No.	Item	Writing data (RWwn+3) contents (PC or PLC...etc→ Driver)
8010h	Alarm reset command Deactivates the alarm that occurred.	1EA5
8101h	Feedback pulse value display data is clear Resets the display data of the status indication "feedback pulse value" to 0.	1EA5
8200h	Parameter group write command Writes the group of parameters that are written to with codes No.8201h to 82FFh and 8301h to 83FFh. Writes the group of parameters that are read with codes No.0201h to 02FFh and 0301h to 03FFh.	0 0 0 □ Parameter group 0: Basic setting parameters (No.PA□□) 1: Gain/filter parameters (No.PB□□) 2: Extension setting parameters (No.PC□□) 3: I/O setting parameters (No.PD□□)
8201h to 82FFh	Data RAM instruction of parameter Writes the set value of each No. of the parameter group written by code No.8200h to RAM. These values are cleared when power is switched off. The decimal value converted from the 2 lower digits of the code No. corresponds to the parameter No. An error code is returned if an instruction code outside the range set in parameter No. PA19 or a value outside the setting range of the corresponding parameter is written.	Convert the decimal values into hexadecimal before setting.
8301h to 83FFh	Data EEP-ROM instruction of parameter Writes the set value of each No. of the parameter group written with code No.8200h to EEP-ROM. Written to EEP-ROM, these values are held if power is switched off. The decimal value converted from the 2 lower digits of the code No. corresponds to the parameter No. An error code is returned if an instruction code outside the range set in parameter No.PA19 or a value outside the setting range of the corresponding parameter is written.	Convert the decimal values into hexadecimal before setting.
8601h to 86FFh	Motor speed of point table Writes the motor speeds of point table No.1 to 255 to RAM. These values are cleared when power is switched off. The decimal value converted from the 2 lower digits of the code No. corresponds to the point table No.	Convert the values into hexadecimal before setting.

Code No.	Item	Writing data (RWwn+3) contents (PC or PLC...etc → Driver)
8701h to 87FFh	Acceleration time constant data RAM command of point table Writes the acceleration time constants of point table No.1 to 255 to RAM. These values are cleared when power is switched off. The decimal value converted from the 2 lower digits of the code No. corresponds to the point table No.	Convert the values into hexadecimal before setting.
8801h to 88FFh	Deceleration time constant data RAM command of point table Writes the deceleration time constants of point table No.1 to 255 to RAM. These values are cleared when power is switched off. The decimal value converted from the 2 lower digits of the code No. corresponds to the point table No.	Convert the values into hexadecimal before setting.
8D01h to 8DFFh	Servo motor speed data EEP-ROM command of point table Writes the servo motor speeds of point table No.1 to 255 to EEP-ROM. Written to EEP-ROM, these values are held if power is switched off. The decimal value converted from the 2 lower digits of the code No. corresponds to the point table No.	Convert the values into hexadecimal before setting.
8E01h to 8EFFh	Acceleration time constant data EEP-ROM command of point table Writes the acceleration time constants of point table No.1 to 255 to EEP-ROM. Written to EEP-ROM, these values are held if power is switched off. The decimal value converted from the 2 lower digits of the code No. corresponds to the point table No.	Convert the values into hexadecimal before setting.
8F01h to 8FFFh	Deceleration time constant data EEP-ROM command of point table Writes the deceleration time constants of point table No.1 to 255 to EEP-ROM. Written to EEP-ROM, these values are held if power is switched off. The decimal value converted from the 2 lower digits of the code No. corresponds to the point table No.	Convert the values into hexadecimal before setting.

15.2.5 Respond codes (RWrn＋2)

If any of the monitor codes, instruction codes, Next station, Point table Nos./Speed command data set to the remote register is outside the setting range, the corresponding error code is set to respond code (RWwn＋2). "0000" is set if they are normal.



Code No.	Error	Details
0	Normal answer	Instruction was completed normally.
1	Code error	▪ The monitor code not in the specifications was set. ▪ Read/write of the point table of No.255 or later was set.
2	Parameter ▪ point table selection error	▪ The parameter No. disabled for reference was set.
3	Write range error	▪ An attempt was made to write the parameter or point table data outside the setting range.

15.3 Signal

15.3.1 Signal (device) explanation

POINT
・In the indexer positioning operation, devices assigned to the CN6 connector cannot be changed.

(1) I/O device

(a) Input device

<table>
<tr><th>Device</th><th>Symbol</th><th>Connector pin No.</th><th>Functions/Applications</th></tr>
<tr><td>Forced stop</td><td>EMG</td><td>CN6-1</td><td>Turn EMG off (open between commons) to bring the motor to an emergency stop state, in which the base circuit is shut off and the dynamic brake is operated. Turn EMG on (short between commons) in the emergency stop state to reset that state.</td></tr>
<tr><td>Proximity dog</td><td>DOG</td><td>CN6-2</td><td>When DOG is turned OFF, the proximity dog is detected. The polarity of dog detection can be changed using parameter No.PD16.
<table>
<tr><th>Parameter No.PD16</th><th>Proximity dog (DOG) detection polarity</th></tr>
<tr><td>□0□□ (initial value)</td><td>OFF</td></tr>
<tr><td>□1□□</td><td>ON</td></tr>
</table></td></tr>
<tr><td>Forward rotation stroke end</td><td>LSP</td><td>CN6-3</td><td rowspan="2">When starting operation, turn LSP/LSN to ON. Turning it to OFF causes a sudden stop, resulting in servo lock. A stopping method can be changed in parameter No.PD20.
When not using the forward/reverse rotation stroke end, set "Automatic ON" in parameter No.PD01.
<table>
<tr><th colspan="2">(Note) Input signal</th><th colspan="2">Operation</th></tr>
<tr><th>LSP</th><th>LSN</th><th>CCW direction</th><th>CW direction</th></tr>
<tr><td>1</td><td>1</td><td>○</td><td>○</td></tr>
<tr><td>0</td><td>1</td><td></td><td>○</td></tr>
<tr><td>1</td><td>0</td><td>○</td><td></td></tr>
<tr><td>0</td><td>0</td><td></td><td></td></tr>
</table>
Note. 0: OFF
1: ON</td></tr>
<tr><td>Reverse rotation stroke end</td><td>LSN</td><td>CN6-4</td></tr>
</table>

(b) Output device

POINT

- Output devices assigned to the CN6 connector pins can be used with the remote output of the CC-Link communication function.

Device	Symbol	Connector pin No.	Functions/Applications
Ready	RD	CN6-14	RD turns ON when the driver is ready to operate after servo-on.
Trouble	ALM	CN6-15	ALM turns off when power is switched off or the protective circuit is activated to shut off the base circuit. Without alarm occurring, ALM turns on within 1.5s after power-on. The significance of this device is opposite of that of remote output (RX (n+1)A or RX (n+3)A).
Home position return completion	ZP	CN6-16	ZP turns ON when a home position return is completed. ZP turns ON at completion of a home position return. In an absolute position detection system, RXn3 turns ON when operation is ready to start, but turns OFF in any of the following cases. 1) Servo-on (RYn0) is turned OFF. 2) Forced stop (EMG) is turned OFF. 3) Reset (RY(n+1)A or RY(n+3)A) is turned ON. 4) Alarm occurs. 5) Forward rotation stroke end (LSP) or Reverse rotation stroke end (LSN) is turned OFF. 6) Home position return has not been made after product purchase. 7) Home position return has not been made after occurrence of Absolute position erase (A25) or Absolute position counter warning (AE3). 8) Home position return has not been made after electronic gear change. 9) Home position return has not been made after the absolute position detection system was changed from invalid to valid. 10) Parameter No.PA14 (Station No. direction selection) has been changed. 11) While a home position return is being made. When any of 1) to 11) has not occurred and a home position return is already completed at least once, Home position return completion (ZP) turns to the same output status as Ready (RD).

(2) Input signals

Device	Symbol	Connector pin No.	Functions/Applications
Manual pulse generator	PP	CN6-6	Not used in indexer positioning operation.
	NP	CN6-19	

(3) Output signals

Refer to section 4.8.2 for the output interfaces (symbols in the I/O Division field in the table) of the corresponding connector pins.

Device	Symbol	Connector pin No.	Functions/Applications	I/O division
Encoder A-phase pulse (differential line driver)	LA LAR	CN6-11 CN6-24	Outputs pulses per servo motor revolution set in parameter No.PA15 in the differential line driver system. In CCW rotation of the servo motor, the encoder B-phase pulse lags the encoder A-phase pulse by a phase angle of $\pi/2$. The relationships between rotation direction and phase difference of the A- and B-phase pulses can be changed using parameter No.PC19	DO-2
Encoder B-phase pulse (differential line driver)	LB LBR	CN6-12 CN6-25		
Encoder Z-phase pulse (differential line driver)	LZ LZR	CN6-13 CN6-26	Outputs the zero-point signal of the encoder in the differential line driver system. One pulse is output per servo motor revolution. This signal turns on when the zero-point position is reached. (Negative logic) The minimum pulse width is about 400μs. For home position return using this pulse, set the creep speed to 100r/min. or less.	DO-2

(4) Power supply

Signal	Symbol	Connector pin No.	Functions/Applications	I/O division
Digital I/F power supply input	DICOM	CN6-5	Used to input 24VDC (24VDC±10% 150mA) for I/O interface. The power supply capacity changes depending on the number of I/O interface points to be used. Connect the plus of 24VDC terminal external power supply for the sink interface.	
Digital I/F common	DOCOM	CN6-17	Common terminal for input signals such as DOG and EMG. Pins are connected internally. Separated from LG. Connect the plus of 24VDC terminal external power supply for the source interface.	
Control common	LG	CN6-23	Common terminal for the differential line driver of the encoder pulses (LA・LAR・LB・LBR・LZ・LZR).	
Shield	SD	Plate	Connect the external conductor of the shield cable.	

15.3.2 Detailed description of signals (devices)

(1) Forward rotation start・reverse rotation start・temporary stop/restart

(a) A start (RYn1) should make the sequence which can be used after the main circuit has been established. These signals are invalid if it is switched on before the main circuit is established. Normally, it is interlocked with the ready signal (RD).

(b) A start in the driver is made when a start (RYn1) changes from OFF to ON. The delay time of the driver's internal processing is max. 3ms. The delay time of other devices is max. 10ms.

(c) The ON time of a start (RYn1), should be 6ms or longer to prevent a malfunction.

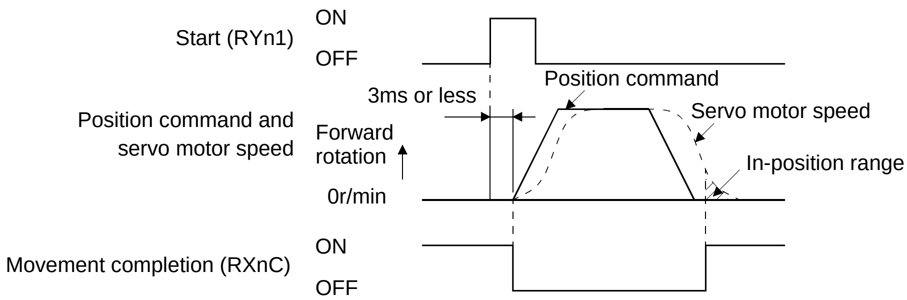
(d) During operation, the start (RYn1) is not accepted. The next operation should always be started after the rough match (RXn2) is output with the rough match output range set to “0” or after the movement completion (RXnC) is output.

(2) Movement completion・rough match・in position

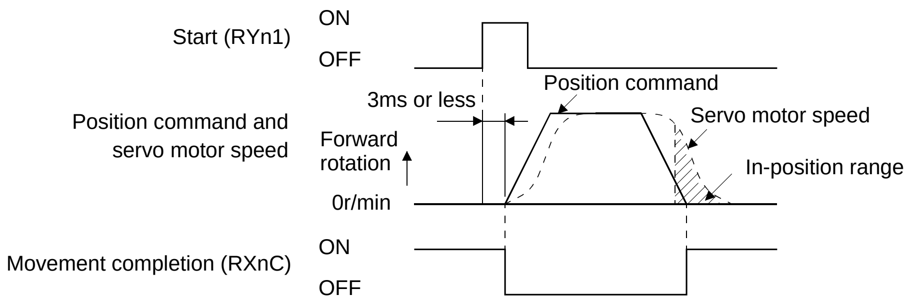
POINT
・If an alarm cause, etc. are removed and servo-on occurs after a stop is made by servo-off, alarm occurrence or Forced stop (EMG) ON during automatic operation, Movement completion (MEND), Rough-match, (CPO) and In position (INP) are turned on. To resume operation, confirm the current position and the selected point table No. for preventing unexpected operation.

(a) Movement completion

The following timing charts show the output timing relationships between the position command generated in the driver and the movement completion (RYnC). This timing can be changed using parameter No.PA10 (in-position range). RYnC turns ON in the servo-on status.



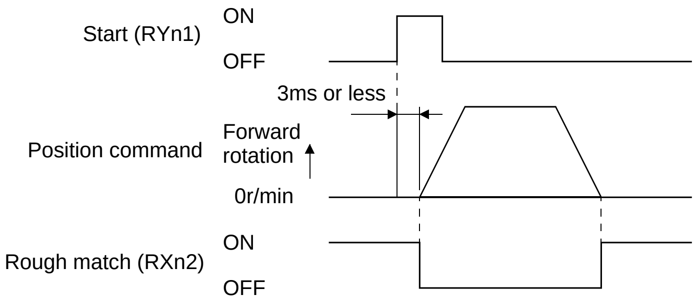
When parameter No.PA10 is small



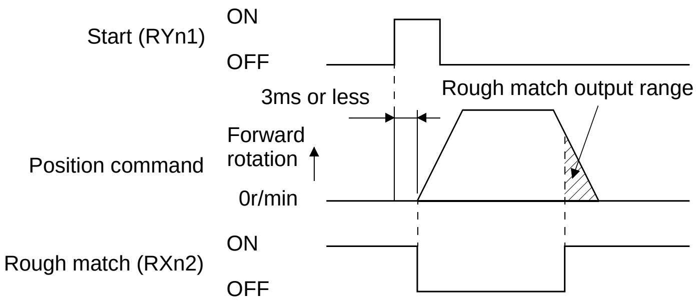
When parameter No.PA10 is large

(b) Rough match

The following timing charts show the relationships between the signal and the position command generated in the driver. This timing can be changed using parameter No.PC11 (rough match output range). RXn2 turns ON in the servo-on status.



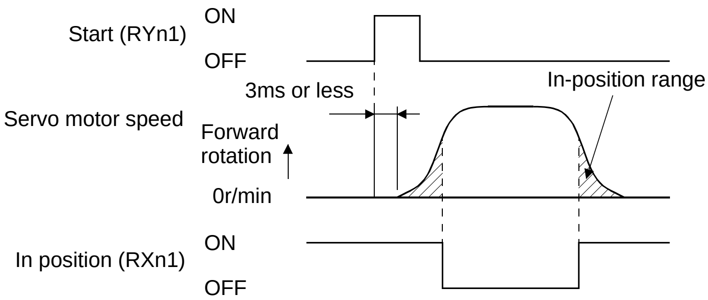
When "0" is set in parameter No.PC11



When more than "0" is set in parameter No.PC11

(c) In position

The following timing chart shows the relationship between the signal and the feedback pulse of the servo motor. This timing can be changed using parameter No.PA10 (in-position range). turns on RYn1 in the servo-on status.



When positioning operation is performed once

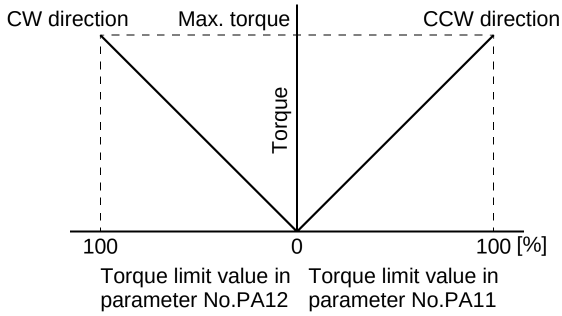
(3) Torque limit

CAUTION	・If the torque limit is canceled during servo lock, the servo motor may suddenly rotate according to position deviation in respect to the command position.

POINT
・In the indexer positioning operation, the torque limit 2 becomes automatically effective depending on the operation status.

(a) Torque limit and torque

By setting parameter No.PA11 (forward rotation torque limit) or parameter No.PA12 (reverse rotation torque limit), torque is always limited to the maximum value during operation. A relationship between the limit value and servo motor torque is shown below.



(b) Torque limit value selection

As shown below, the forward rotation torque limit (parameter No.PA11), reverse rotation torque limit (parameter No.PA12) or internal torque limit 2 (parameter No.PC35) can be chosen using the external torque limit selection (RY(n＋2)6).

(Note) RY(n＋2) 6	Limit value status			Torque limit to be enabled	
				CCW driving/CW regeneration	CW driving/CCW regeneration
0				Parameter No.PA11	Parameter No.PA12
1	Parameter No.PC35	>	Parameter No.PA11 Parameter No.PA12	Parameter No.PA11	Parameter No.PA12
	Parameter No.PC35	<	Parameter No.PA11 Parameter No.PA12	Parameter No.PC35	Parameter No.PC35

Note. 0: OFF
1: ON

(c) Limiting torque (RXn4)

RXn4 turns on when the servo motor torque reaches the torque limited.

15.4 Switching power on for the first time

⚠ WARNING	• Do not operate the switches with wet hands. You may get an electric shock.

⚠ CAUTION	• Before starting operation, check the parameters. Some machines may perform unexpected operation. • Take safety measures, e.g. provide covers, to prevent accidental contact of hands and parts (cables, etc.) with the driver heat sink, regenerative resistor, servo motor, etc. since they may be hot while power is on or for some time after power-off. Their temperatures may be high and you may get burnt or a parts may damaged. • During operation, never touch the rotating parts of the servo motor. Doing so can cause injury.

When switching power on for the first time, follow this section to make a startup.

15.4.1 Startup procedure

Wiring check	Check whether the driver and servo motor are wired correctly using visual inspection, DO forced output function (Section 7.7.4,), etc. (Refer to section 15.4.3.)
↓	
Surrounding environment check	Check the surrounding environment of the driver and servo motor. (Refer to section 15.4.3.)
↓	
Parameter setting	Set the parameters as necessary, such as the used control mode and regenerative option selection with the parameter unit or set up software(MR Configurator). (Refer to chapter 6.)
↓	
Test operation of servo motor alone in test operation mode	For the test operation, with the servo motor disconnected from the machine and operated at the speed as low as possible, and check whether the servo motor rotates correctly. (Refer to sections 7.7)
↓	
Test operation of servo motor alone by commands	For the test operation with the servo motor disconnected from the machine and operated at the speed as low as possible, and check whether the servo motor rotates correctly.
↓	
Test operation with servo motor and machine connected	Connect the servo motor with the machine, give operation commands from the host command device, and check machine motions.
↓	
Gain adjustment	Make gain adjustment to optimize the machine motions. (Refer to chapter 8.)
↓	
Actual operation	
↓	
Stop	Stop giving commands and stop operation.

15.4.2 Wiring check

(1) Power supply system wiring

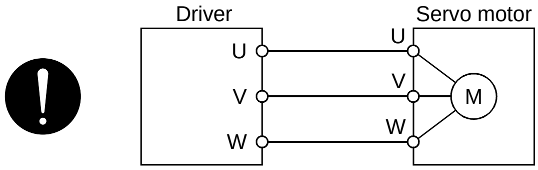
Before switching on the main circuit and control circuit power supplies, check the following items.

(a) Power supply system wiring

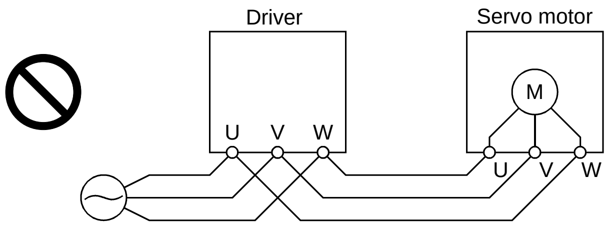
The power supplied to the power input terminals (L_1, L_2, L_3, L_{11}, L_{21}) of the driver should satisfy the defined specifications. (Refer to section 1.2.)

(b) Connection of driver and servo motor

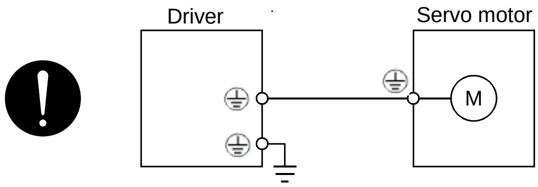
1) The servo motor power supply terminals (U, V, W) of the driver match in phase with the power input terminals (U, V, W) of the servo motor.



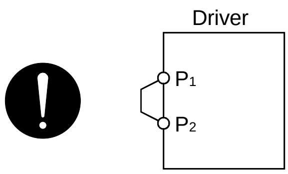
2) The power supplied to the driver should not be connected to the servo motor power supply terminals (U, V, W). To do so will fail the connected driver and servo motor.



3) The earth terminal of the servo motor is connected to the PE terminal of the driver.



4) P_1-P_2 (For 11kW or more, P_1-P) should be connected.



(c) When option and auxiliary equipment are used

1) When regenerative option is used under 3.5kW for 200V class

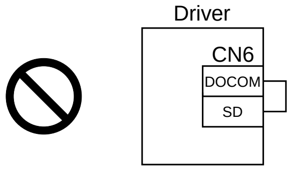
- The lead between P terminal and D terminal of CNP2 connector should not be connected.
- The generative brake option should be connected to P terminal and C terminal.
- A twisted cable should be used. (Refer to section 13.2.)

(2) I/O signal wiring

(a) The I/O signals should be connected correctly.
Use DO forced output to forcibly turn on/off the pins of the CN6 connector. This function can be used to perform a wiring check. (Refer to section 7.7.4.) In this case, switch on the control circuit power supply only.

(b) 24VDC or higher voltage is not applied to the pins of connectors CN6.

(c) SD and DOCOM of connector CN6 is not shorted.



15.4.3 Surrounding environment

(1) Cable routing

(a) The wiring cables are free from excessive force.

(b) The encoder cable should not be used in excess of its flex life. (Refer to section 12.4.)

(c) The connector part of the servo motor should not be strained.

(2) Environment

Signal cables and power cables are not shorted by wire offcuts, metallic dust or the like.

15.5 Startup

15.5.1 Power on and off procedures

(1) Power-on

Switch power on in the following procedure. Always follow this procedure at power-on.

1) Switch off the servo-on (RYn0).

2) Make sure that the start (RYn1) is off.

3) Switch on the main circuit power supply and control circuit power supply.
When main circuit power/control circuit power is switched on, the driver display shows "b01" (if the driver has the station number of 1).

b01

In the absolute position detection system, first power-on results in the absolute position lost (A25) alarm and the servo system cannot be switched on.
The alarm can be deactivated then switching power off once and on again.
Also in the absolute position detection system, if power is switched on at the servo motor speed of 3000r/min or higher, position mismatch may occur due to external force or the like. Power must therefore be switched on when the servo motor is at a stop.

(2) Power-off

1) Make sure that the start (RYn1) is off.

2) Switch off the Servo-on (RYn0).

3) Switch off the main circuit power supply and control circuit power supply.

15.5.2 Stop

In any of the following statuses, the driver interrupts and stops the operation of the servo motor.
Refer to section 4.11 for the servo motor equipped with a lock.

(a) Servo-on (RYn0) OFF
The base circuit is shut off and the servo motor coasts.

(b) Alarm occurrence
When an alarm occurs, the base circuit is shut off and the dynamic brake is operated to bring the servo motor to a sudden stop.

(c) Forced stop (EMG) OFF
The base circuit is shut off and the dynamic brake is operated to bring the servo motor to a sudden stop. The servo forced stop warning (AE6) occurs.

(d) Forward rotation stroke end (LSP), reverse rotation stroke end (LSN) OFF
The droop pulse value is erased and the servo motor is stopped and servo-locked. It can be run in the opposite direction.

15.5.3 Test operation

Before starting actual operation, perform test operation to make sure that the machine operates normally.
Refer to section 15.5.1 for the power on and off methods of the driver.

Step	Description
Test operation of servo motor alone in JOG operation of test operation mode	In this step, confirm that the driver and servo motor operate normally. With the servo motor disconnected from the machine, use the test operation mode and check whether the servo motor correctly rotates at the slowest speed. Refer to section 7.7 or the test operation mode.
↓	
Test operation of servo motor alone by commands	In this step, confirm that the servo motor correctly rotates at the slowest speed under the commands from the command device. Make sure that the servo motor rotates in the following procedure. 1) Switch on the Forced stop (EMG) and Servo-on (RYn0). When the driver is put in a servo-on status, the Ready (RD) switches on. 2) Switch on the Forward rotation stroke end (LSP) or Reverse rotation stroke end (LSN). 3) When the point table is designated to switch on the start (RYn1) the servo motor starts rotating. Give a low speed command at first and check the rotation direction, etc. of the servo motor. If the servo motor does not operate in the intended direction, check the input signal.
↓	
Test operation with servo motor and machine connected	In this step, connect the servo motor with the machine and confirm that the machine operates normally under the commands from the command device. Make sure that the servo motor rotates in the following procedure. 1) Switch on the Forced stop (EMG) and Servo-on (RYn0). When the driver is put in a servo-on status, the Ready (RD) switches on. 2) Switch on the Forward rotation stroke end (LSP) or Reverse rotation stroke end (LSN). 3) When the point table is specified from the command device and the start (RYn1) is turned ON, the servo motor starts rotating. Give a low speed command at first and check the operation direction, etc. of the machine. If the machine does not operate in the intended direction, check the input signal. In the status display, check for any problems of the servo motor speed, load ratio, etc. 4) Then, check automatic operation with the program of the command device.

15.5.4 Parameter setting

The driver can be used by merely changing the basic setting parameters (No.PA□□) mainly.
As necessary, set the gain filter parameters (No.PB□□), extension setting parameters (No.PC□□) and I/O setting parameters (No.PD□□).

Parameter group	Main description
Basic setting parameter (No.PA□□)	Set the basic setting parameters first. Generally, operation can be performed by merely setting this parameter group. In this parameter group, set the following items. Control mode selection (select the position control mode) Regenerative option selection Absolute position detection system selection Setting of command input pulses per revolution Electronic gear setting Auto tuning selection and adjustment In-position range setting Torque limit setting Command pulse input form selection Servo motor rotation direction selection Encoder output pulse setting
Gain filter parameter (No.PB□□)	If satisfactory operation cannot be achieved by the gain adjustment made by auto tuning, execute in-depth gain adjustment using this parameter group. This parameter group must also be set when the gain changing function is used.
Extension setting parameter (No.PC□□)	This parameter group is unique to LECSC□-□ driver.
I/O setting parameter (No.PD□□)	Set the stopping method of the stroke end (LSP and LSN), torque limit delay time and others.

15.5.5 Point table setting

Set necessary items to the point table before starting operation. The following table indicates the items that must be set.

Name	Description
Position data	Not used in indexer positioning operation. Do not change this value by any means.
Servo motor speed	Set the command speed of the servo motor for execution of positioning.
Acceleration time constant	Set the acceleration time constant.
Deceleration time constant	Set the deceleration time constant.
Dwell	Not used in indexer positioning operation. Do not change this value by any means.
Auxiliary function	Not used in indexer positioning operation. Do not change this value by any means.

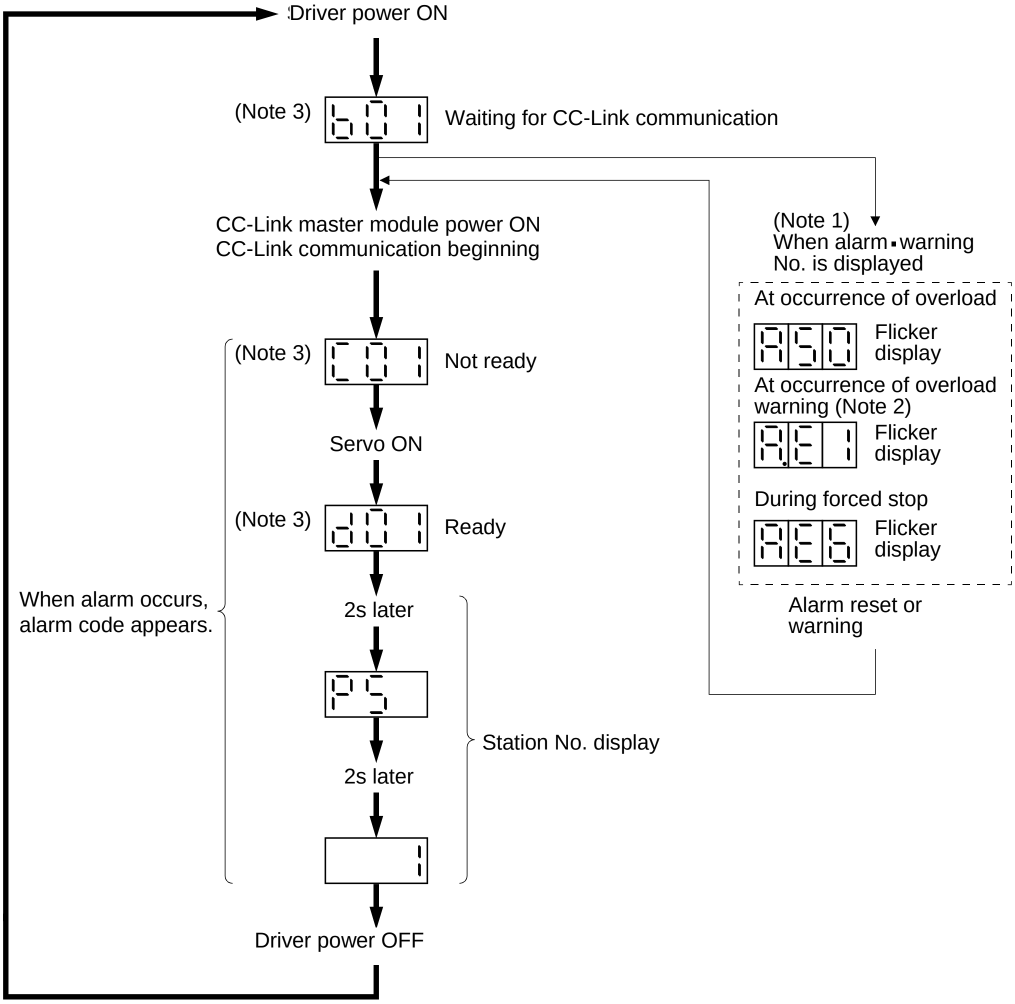
15.5.6 Actual operation

Start actual operation after confirmation of normal operation by test operation and completion of the corresponding parameter settings. Perform a home position return as necessary.

15.6 Driver display

On the driver display (three-digit, seven-segment display), check the status of communication with the CC-Link driver at power-on, check the station number, and diagnose a fault at occurrence of an alarm.

(1) Display sequence



Note 1. Only alarm and warning No. are displayed, but no station No. is displayed.

2. If warning other than AE6 occurs during the servo on, flickering the second place of decimal point indicates that it is during the servo on.
3. The right-hand segments of b01, c02 and d16 indicate the axis number.
(Below example indicates Station No.1)

Station No.1 Station No.2 Station No.64

(2) Indication list

Indication	Status	Description
b##	Waiting for CC-Link communication	・Power of the CC-Link master module was switched on at the condition that the power of CC-Link master module is OFF. ・The CC-Link master module is faulty.
(Note 1) d##	Ready	The servo was switched on after completion of initialization and the driver is ready to operate. (This is indicated for 2 seconds.)
(Note 1) C##	Not ready	The driver is being initialized or an alarm has occurred.
(Note 2) $$$	Ready for operation	Two seconds have passed after the driver is ready to operate by turning ON the servo-on (RYn1).
(Note 3) A**	Alarm・Warning	The alarm No./warning No. that occurred is displayed. (Refer to section 15.12.4.)
888	CPU error	CPU watchdog error has occurred.
(Note 4) b00.	(Note 4) Test operation mode	JOG operation・positioning operation・programmed operation・DO forced output
(Note 1) d##. C##.		Motor-less operation

Note 1. ## denotes any of numerals 00 to 16 and what it means is listed below.

##	Description
00	Set to the test operation mode.
01	Station number 1
02	Station number 2
03	Station number 3
: :	: :
62	Station number 62
63	Station number 63
64	Station number 64

Note 2. $$$ indicates numbers from 0 to 254, and the number indicates the executing station number.

3. ＊＊ indicates the warning/alarm No.

4. Requires set up software(MR Configurator).

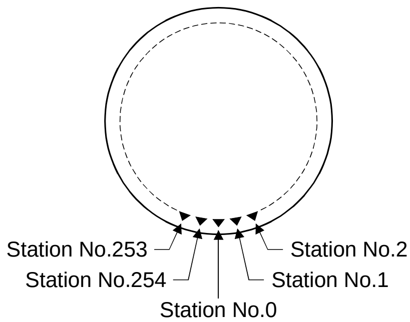
15.7 Automatic operation mode

POINT
・In the absolute position detection system, the following restriction condition applies for the number of gears on machine-side (parameter No.PA06 CMX) and servo motor speed (N). ・When CMX ≦ 2000, N ＜ 3076.7 r/min ・When CMX ＞ 2000, N ＜ 3276.7–CMX r/min ・When the servo motor is operated at servo motor speed higher than the limit value, the absolute position counter warning (AE3) occurs.

15.7.1 What is automatic operation mode?

(1) Concept of indexer

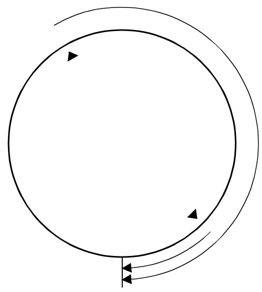
Select the station, which is dividing the circumference (360 degrees) of the machine side into up to 255, using 8-bit device of the next station selection 1 to 8 (RYnA to RYnE, and RY(n＋2)3 to RY(n＋2)5), and execute positioning.



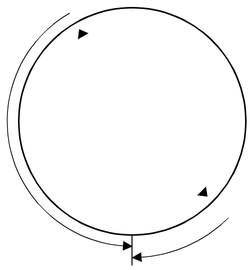
Set the number of stations in the parameter No.PC46.

(2) Rotation direction

There are two types of operation methods: Rotation direction specifying indexer, which is to always rotate in the fixed direction and execute positioning to a station, and Shortest rotating indexer, which is to automatically change the rotation direction for the shortest distance and execute positioning to a station.



Rotation direction specifying indexer



Shortest rotating indexer

15.7.2 Automatic operation mode 1 (Rotation direction specifying indexer)

In this operation mode, the servo motor rotates in the fixed direction and executes positioning to a station.

(1) When not using the remote register

Select the station number using 8-bit device of the next station selection 1 to 8 (RYnA to RYnE, and RY(n＋2)3 to RY(n＋2)5), and execute positioning. For the servo motor speed and acceleration/ deceleration time constant during operation, the value set in the point table is used.

(a) Device/Parameter

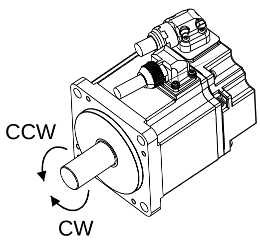
Set the input devices and parameters as indicated below.

Item	Device/Parameter	Setting description
Indexer positioning operation selection	Parameter No.PA01	1□□□: Select the indexer positioning operation.
Automatic operation mode 1 (Rotation direction specifying indexer) selection	Operation mode selection 1 (RYn6)	Turn off RYn6.
	Operation mode selection 2 (RYn7)	Turn on RYn7.

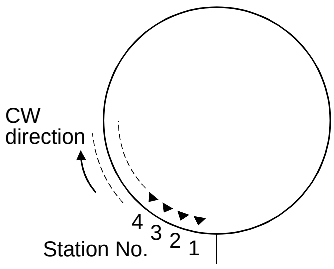
(b) Other parameter settings

1) Setting the allocation direction of station numbers

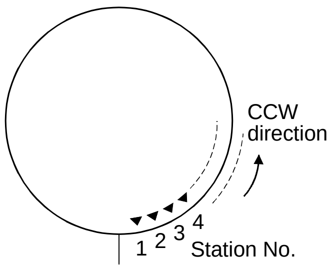
Select the allocation direction of station numbers using the parameter No.PA14 (Station No. direction selection).



Parameter No.PA14 setting	Station No. allocation direction Start (RYn1) ON
0 (Initial value)	Station No. is allocated in CW direction in order of 1, 2, 3…
1	Station No. is allocated in CCW direction in order of 1, 2, 3…



Parameter No.PA14: 0 (Initial value)



Parameter No.PA14: 1

2) Setting the number of stations

Set the number of stations in the parameter No.PC46.

	Parameter No.PC46 setting value				
	0000 to 0002	0003	0004	・・・	00FF
Number of stations	2	3	4	・・・	255
Station No.	No.1 No.0	No.2 No.1 No.0	No.2 No.3 No.1 No.0	・・・	No.254 No.0 No.1

(c) Setting the speed data

Set the servo motor speed, acceleration time constant, and deceleration time constant in the point table number 1 to 8.

Name	Setting range	Unit	Description
Servo motor speed	0 to permissible speed	r/min	Set the command speed of the servo motor for execution of positioning. The setting should be equal to or less than the instantaneous permissible speed of the servo motor.
Acceleration time constant	0 to 20000	ms	Set the time until the rated speed of the servo motor is reached.
Deceleration time constant	0 to 20000	ms	Set the time until the servo motor running at rated speed comes to a stop.

(d) Operation

Select the station number for positioning, using 8-bit device of the next station selection 1 to 8 (RYnA to RYnE, and RY(n＋2)3 to RY(n＋2)5).

(Note) Device								Station No.
2 stations occupied								
			1 stations occupied					
RY(n＋2)5	RY(n＋2)4	RY(n＋2)3	RYnE	RYnD	RYnC	RYnB	RYnA	
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	1	1
0	0	0	0	0	0	1	0	2
0	0	0	0	0	1	0	1	3
⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮
1	1	1	1	1	1	0	1	253
1	1	1	1	1	1	1	0	254

Note. 0: OFF
1: ON

Select the point table using the speed selection 1 (RY(n＋2)C) to speed selection 3 (RY(n＋2)E). Turn on the start (RYn1) to execute positioning with the speed data set in the point table. Rotation direction of the servo motor is the direction set in the rotation direction specifying (RYn2). When one station is occupied, RY(n＋2)C, RY(n＋2)D, and RY(n＋2)E are not available so that the point table number cannot be selected. Use point table No.1 when one station is occupied.

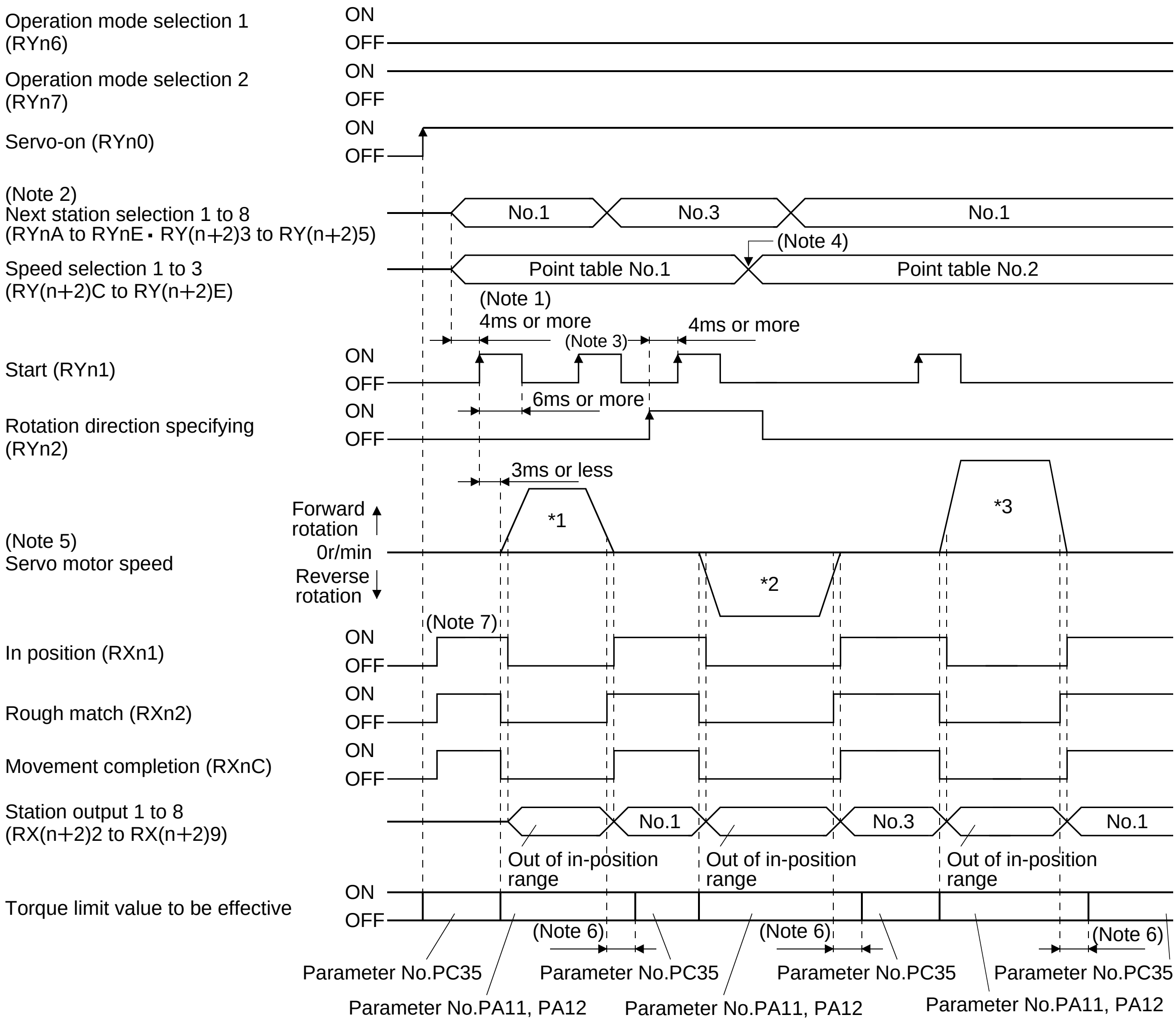
(Note) Device			Point table No.
RY(n＋2)E	RY(n＋2)D	RY(n＋2)C	
0	0	0	1
0	0	1	2
0	1	0	3
0	1	1	4
1	0	0	5
1	0	1	6
1	1	0	7
1	1	1	8

Note. 0: OFF
1: ON

(e) Timing chart

POINT
・Always execute a home position return. The home positioning incomplete (A90) occurs when turning on the start (RYn1) without executing a home position return.

The timing chart is shown below.



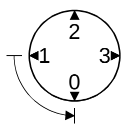
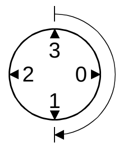
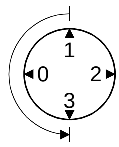
Note 1. Configure a sequence that changes the next station selection (RYnA to RYnE and RY(n＋2)3 to RY(n＋2)5) and speed selection (RY(n＋2)C to RY(n＋2)E) earlier, considering the delay time of CC-Link communication.

2. When the selected station number exceeds the value that is dividing number set in the parameter No.PC46 minus one, the next station warning (A97) occurs.

3. The start (RYn1) is invalid even if it is turned on during operation. When executing another operation, turn on RYn1 after the movement completion (RXnC) turns on.

4. Change of the servo motor speed and acceleration/deceleration time constant by the speed selection 1 (RY(n＋2)C) to speed selection 3 (RY(n＋2)E) becomes effective when the start (RYn1) turns on. Even if the speed selection 1 to 3 are changed during servo motor rotation, they do not become effective.

5. The following shows the operation to be executed.

Operation	*1	*2	*3
Station	No.1	No.3	No.1
Servo motor speed Acceleration/deceleration time constant	Point table No.1	Point table No.1	Point table No.2
Positioning			

6. Delay time from when RXn1 turns on until the torque limit value changes to the parameter No.PC35 value can be set in the parameter No.PD26.

7. After power-on, if the current position is within the in-position range of each station, the in position (RXn1) turns on.

(2) When using the remote register

Select the station number using the next station (RWwn＋4) remote register and execute positioning. For the speed data during operation, select the point table number using the point table No./Speed command data (RWwn＋6) remote register, or directly set the servo motor speed.

(a) Device/Parameter

Set the input devices and parameters as indicated below.

Item	Device/Parameter	Setting description
Indexer positioning operation selection	Parameter No.PA01	1□□□: Select the indexer positioning operation.
Speed data setting method selection	Parameter No.PC30	Select the setting method for speed data. □□0□: Uses the point table setting value. □□1□: Uses the servo motor speed setting value for the point table No./Speed command data (RWwn+6) remote register. In the case, always set the acceleration/deceleration time constant in the point table No.1. (Refer to (2) (c) in this section.)
Automatic operation mode 1 (Rotation direction specifying indexer) selection	Operation mode selection 1 (RYn6)	Turn off RYn6.
	Operation mode selection 2 (RYn7)	Turn on RYn7.
Position/speed specifying system selection	Position/speed specifying system selection (RY(n＋2)A)	Turn on RY(n＋2)A.

(b) Other parameter settings

1) Setting the servo motor rotation direction and allocation direction of station numbers
Select the allocation direction of station numbers using the parameter No.PA14 (Station No. direction selection). Setting is the same as that for when not using the remote register. Refer to (1) (b) 1) in this section.

2) Setting the number of stations
Set the number of stations in the parameter No.PC46. Setting is the same as that for when not using the remote register. Refer to (1) (b) 2) in this section.

(c) Setting the speed data

1) When using the speed data of point table
Set the servo motor speed, acceleration time constant, and deceleration time constant in the point table number 1 to 8.

Name	Setting range	Unit	Description
Servo motor speed	0 to permissible speed	r/min	Set the command speed of the servo motor for execution of positioning. The setting should be equal to or less than the instantaneous permissible speed of the servo motor.
Acceleration time constant	0 to 20000	ms	Set the time until the rated speed of the servo motor is reached.
Deceleration time constant	0 to 20000	ms	Set the time until the servo motor running at rated speed comes to a stop.

(2) When directly setting the servo motor speed (only when two stations are occupied)
Set the followings because the acceleration time constant and deceleration time constant of the point table No.1 are used.

Name	Setting range	Unit	Description
Servo motor speed	0 to permissible speed	r/min	Setting is not required.
Acceleration time constant	0 to 20000	ms	Set the time until the rated speed of the servo motor is reached.
Deceleration time constant	0 to 20000	ms	Set the time until the servo motor running at rated speed comes to a stop.

(d) Operation

1) When using the speed data of point table
Set the station number for positioning by using the next station (RWwn+4) remote register. Set the point table number in the point table No./Speed command data (RWwn+6) remote register. Turn on the start (RYn1) to execute positioning with the speed data set in the point table.

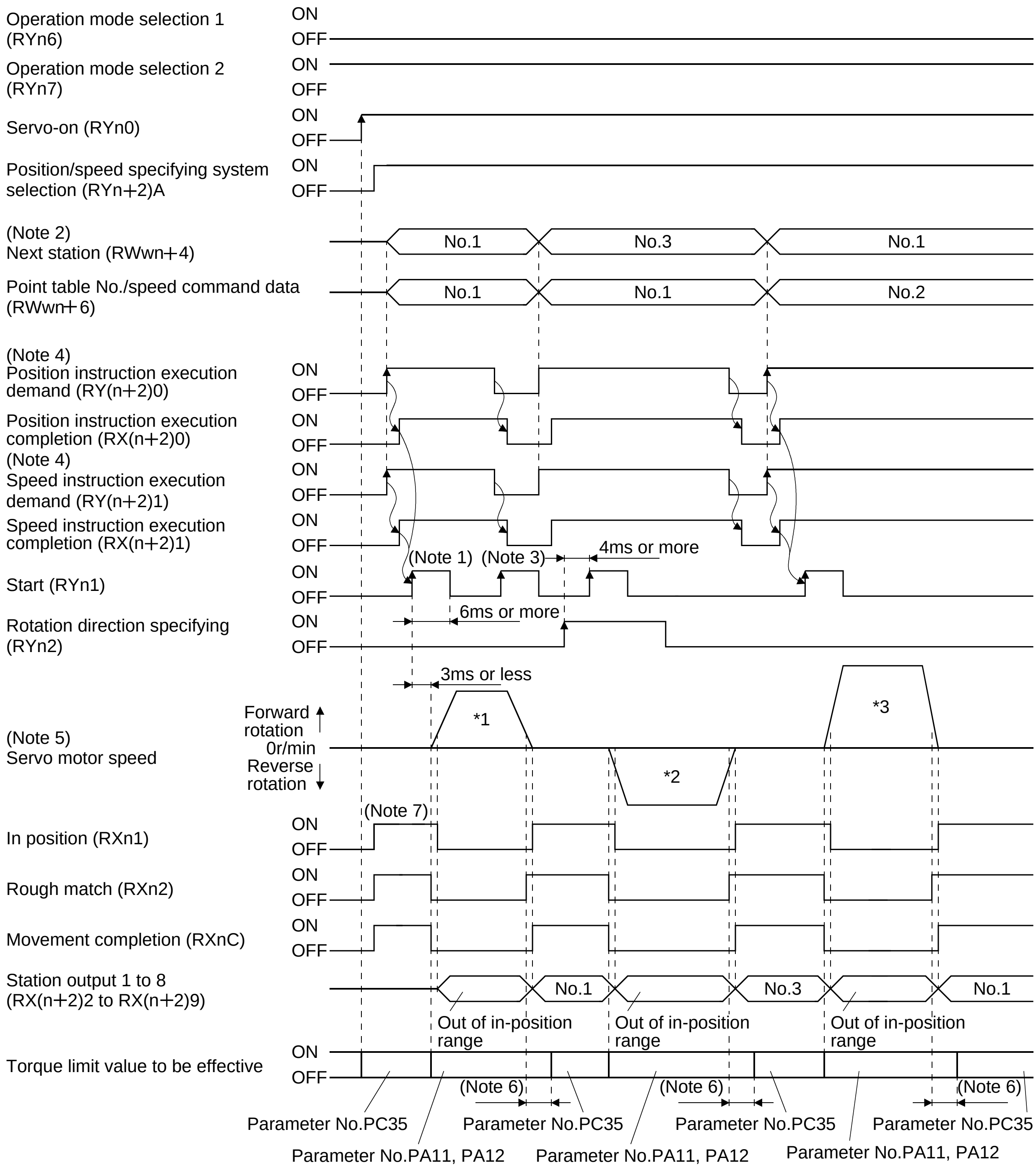
2) When directly setting the servo motor speed (only when two stations are occupied)
Set the station number for positioning by using the next station (RWwn+4) remote register. Set the servo motor speed in the point table No./Speed command data (RWwn+6) remote register. Turn on the start (RYn1) to execute positioning with the servo motor speed set in RWwn+6 and the acceleration time constant and deceleration time constant set in the point table No.1.

(e) Timing chart

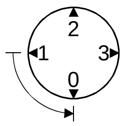
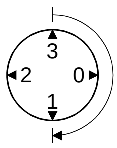
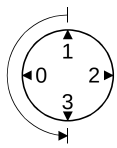
POINT
· Always execute a home position return. The home positioning incomplete (A90) occurs when turning on the start (RYn1) without executing a home position return.

The timing chart is shown below.

1) When using the speed data of point table

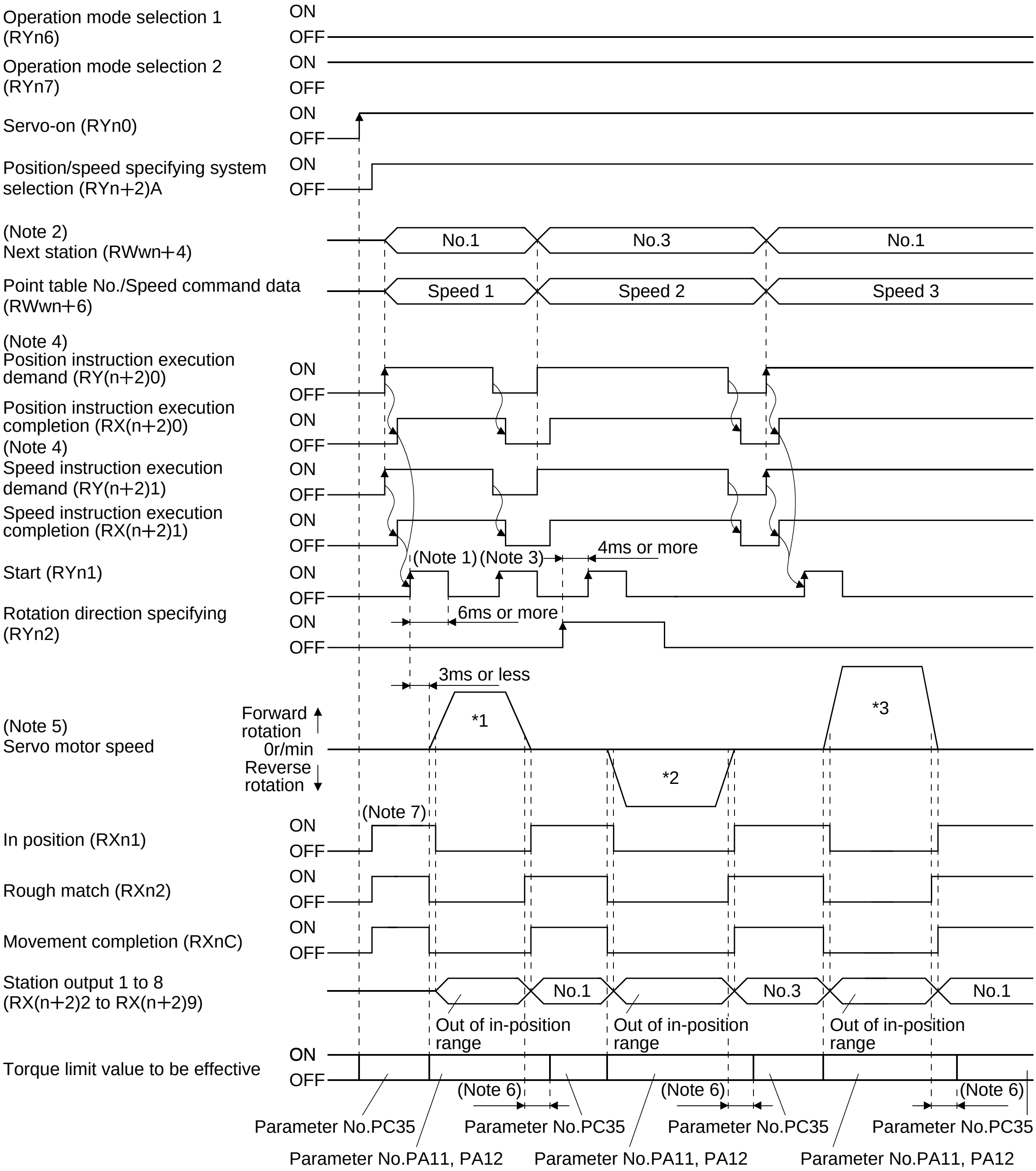


Note 1. Configure a sequence that changes RWwn＋4 and RWwn＋6 earlier, considering the delay time of CC-Link communication.
2. When the selected station number exceeds the value that is dividing number set in the parameter No.PC46 minus one, the next station warning (A97) occurs
3. The start (RYn1) is invalid even if it is turned on during operation. When executing another operation, turn on RYn1 after the movement completion (RXnC) turns on.
4. For details of the operation timing of RY(n＋2)0 and RY(N＋2)1, refer to the section 3.6.2 (3).
5. The following shows the operation to be executed.

Operation	*1	*2	*3
Station	No.1	No.2	No.3
Servo motor speed Acceleration/deceleration time constant	Point table No.1	Point table No.1	Point table No.2
Positioning			

6. Delay time from when RXn1 turns on until the torque limit value changes to the parameter No.PC35 value can be set in the parameter No.PD26.
7. After power-on, if the current position is with the in-position range of each station, the in position (RXn1) turns on.

2) When directly setting the servo motor speed



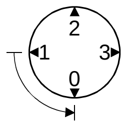
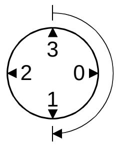
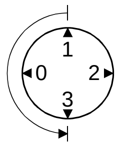
Note 1. Configure a sequence that changes RWwn＋4 and RWwn＋6 earlier, considering the delay time of CC-Link communication.

2. When the selected station number exceeds the value that is dividing number set in the parameter No.PC46 minus one, the next station warning (A97) occurs.

3. The start (RYn1) is invalid even if it is turned on during operation. When executing another operation, turn on RYn1 after the movement completion (RXnC) turns on.

4. For details of the operation timing of RY(n＋2)0 and RY(N＋2)1, refer to the section 3.6.2 (3).

5. The following shows the operation to be executed.

Operation	*1	*2	*3
Station	No.1	No.3	No.1
Servo motor speed	Speed 1	Speed 2	Speed 3
Acceleration/deceleration time constant	Point table No.1	Point table No.1	Point table No.1
Positioning			

6. Delay time from when RXn1 turns on until the torque limit value changes to the parameter No.PC35 value can be set in the parameter No.PD26.

7. After power-on, if the current position is with the in-position range of each station, the in position (RXn1) turns on.

15.7.3 Automatic operation mode 2 (Shortest rotating indexer)

In this operation mode, the servo motor automatically changes the direction for the shortest distance and executes positioning.

(1) When not using the remote register

Select the station number using 8-bit device of the next station selection 1 to 8 (RYnA to RYnE, and RY(n＋2)3 to RY(n＋2)5), and execute positioning. For the servo motor speed and acceleration/ deceleration time constant during operation, the value set in the point table is used.

(a) Device/Parameter

Set the input devices and parameters as indicated below.

Item	Device/Parameter	Setting description
Indexer positioning operation selection	Parameter No.PA01	1□□□: Select the indexer positioning operation.
Automatic operation mode 2 (Rotation direction specifying indexer) selection	Operation mode selection 1 (RYn6)	Turn on MD0.
	Operation mode selection 2 (RYn7)	Turn on MD1.

(b) Other parameter settings (Setting the number of stations)

Set the number of stations in the parameter No.PC46. Setting is the same as that for the automatic operation mode 1. Refer to (1) (b) 2) in section 15.7.2.

In the automatic operation mode 2, the station No. direction selection (parameter No.PA14) is not used.

(c) Setting the speed data

Set the servo motor speed, acceleration time constant, and deceleration time constant in the point table number 1 to 8. Setting is the same as that for the automatic operation mode 1. Refer to (1) (c) in section 15.7.2.

(d) Operation

Select the station number for positioning, using 8-bit device of the next station selection 1 to 8 (RYnA to RYnE, and RY(n+2)3 to RY(n+2)5).

(Note) Device								Station No.
2 stations occupied			1 stations occupied					
RY(n＋2)5	RY(n＋2)4	RY(n＋2)3	RYnE	RYnD	RYnC	RYnB	RYnA	
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	1	1
0	0	0	0	0	0	1	0	2
0	0	0	0	0	1	0	1	3
⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮
1	1	1	1	1	1	1	0	253
1	1	1	1	1	1	1	1	254

Note. 0: OFF
1: ON

Select the point table using the speed selection 1 (RY(n＋2)C) to speed selection 3 (RY(n＋2)E). Turn on the start (RYn1) to execute positioning with the speed data set in the point table. When one station is occupied, RY(n＋2)C, RY(n＋2)D, and RY(n＋2)E are not available so that the point table number cannot be selected. Use the point table No.1 when one station is occupied.

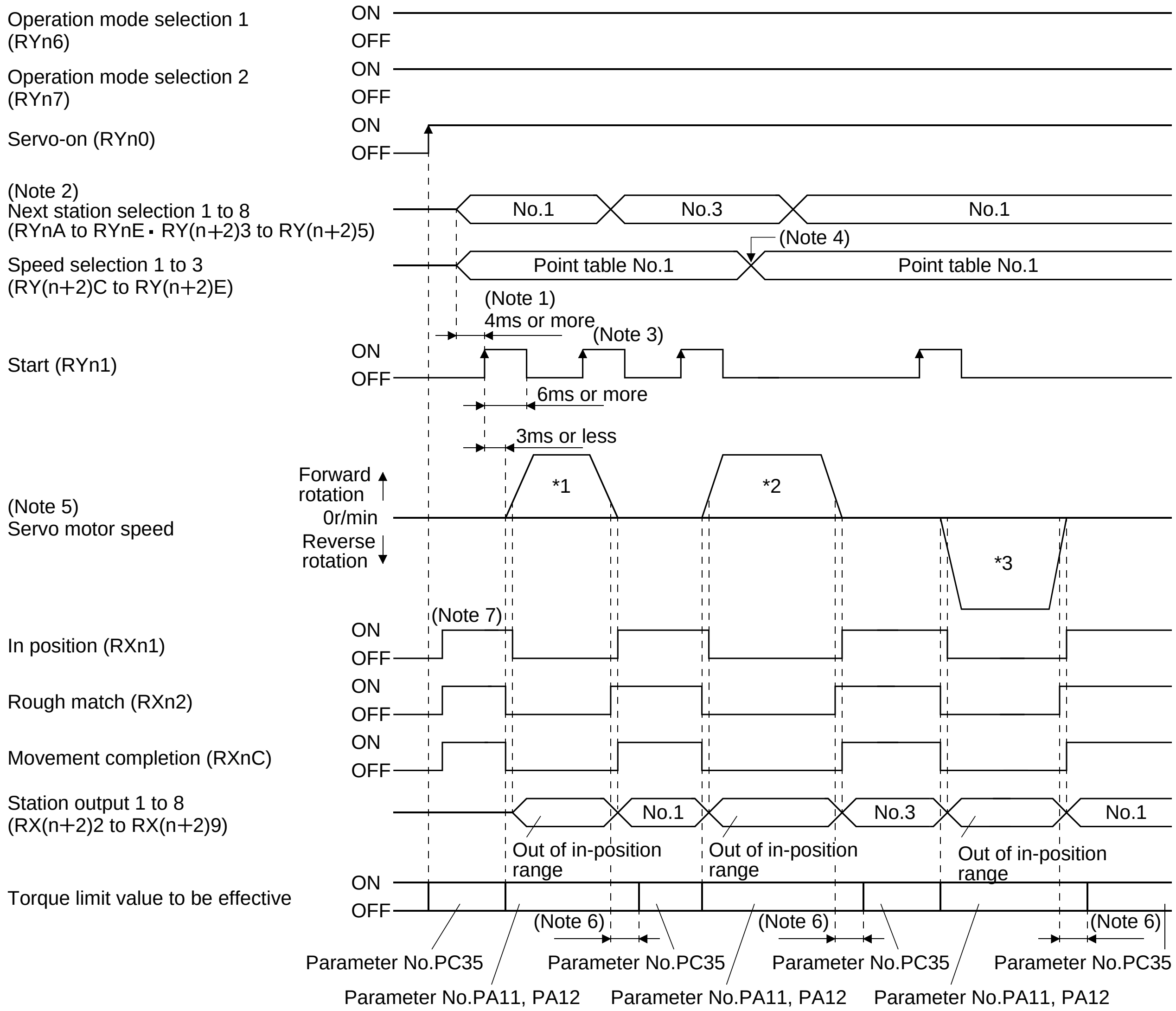
(Note) Device			Pint table No.
RY(n＋2)E	RY(n＋2)D	RY(n＋2)C	
0	0	0	1
0	0	1	2
0	1	0	3
0	1	1	4
1	0	0	5
1	0	1	6
1	1	0	7
1	1	1	8

Note. 0: OFF
1: ON

(e) Timing chart

POINT
▪ Always execute a home position return. The home positioning incomplete (A90) occurs when turning on the start (RYn1) without executing a home position return.

The timing chart is shown below.



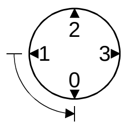
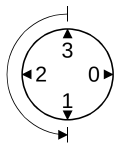
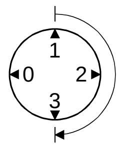
Note 1. Configure a sequence that changes the next station selection (RYnA to RYnE and RY(n＋2)3 to RY(n＋2)5) and speed selection (RY(n＋2)C to RY(n＋2)E) earlier, considering the delay time of CC-Link communication.

2. When the selected station number exceeds the value that is dividing number set in the parameter No.PC46 minus one, the next station warning (A97) occurs.

3. The start (RYn1) is invalid even if it is turned on during operation. When executing another operation, turn on RYn1 after the movement completion (RXnC) turns on.

4. Change of the servo motor speed and acceleration/deceleration time constant by the speed selection 1 (RY(n＋2)C) to speed selection 3 (RY(n＋2)E) becomes effective when the start (RYn1) turns on. Even if the speed selection 1 to 3 are changed during servo motor rotation, they do not become effective.

5. The following shows the operation to be executed.

Operation	*1	*2	*3
Station	No.1	No.3	No.1
Servo motor speed Acceleration/deceleration time constant	Point table No.1	Point table No.1	Point table No.2
Positioning			

6. Delay time from when RXn1 turns on until the torque limit value changes to the parameter No.PC35 value can be set in the parameter No.PD26.

7. After power-on, if the current position is with the in-position range of each station, the in position (RXn1) turns on.

(2) When using the remote register

Select the station number using the next station (RWwn＋4) remote register and execute positioning. For the speed data during operation, select the point table number using the point table No./Speed command data (RWwn＋6) remote register, or directly set the servo motor speed.

(a) Device/Parameter

Set the input devices and parameters as indicated below.

Item	Device/Parameter	Setting description
Indexer positioning operation selection	Parameter No.PA01	1□□□: Select the indexer positioning operation.
Speed data setting method selection	Parameter No.PC30	Select the setting method for speed data. □□0□: Uses the point table setting value. □□1□: Uses the servo motor speed setting value for the point table No./Speed command data (RWwn＋6) remote register. In the case, always set the acceleration/deceleration time constant in the point table No.1. (Refer to (2) (c) in this section.)
Automatic operation mode 2 (Rotation direction specifying indexer) selection	Operation mode selection 1 (RYn6)	Turn on RYn6.
	Operation mode selection 2 (RYn7)	Turn on RYn7.
Position/speed specifying system selection	Position/speed specifying system selection (RY(n＋2)A)	Turn on RY(n＋2)A.

(b) Other parameter settings (Setting the number of stations)
Set the number of stations in the parameter No.PC46. Setting is the same as that for the automatic operation mode 1. Refer to (1) (b) 2) in section 15.7.2.
In the automatic operation mode 2, the station No. direction selection (parameter No.PA14) is not used.

(c) Setting the speed data
1) When using the speed data of point table
Set the servo motor speed, acceleration time constant, and deceleration time constant in the point table number 1 to 7. Setting is the same as that for the automatic operation mode 1. Refer to (2) (c) 1) in section 15.7.2.

2) When directly setting the servo motor speed (only when two stations are occupied)
Set the followings because the acceleration time constant and deceleration time constant of the point table No.1 are used. Setting is the same as that for the automatic operation mode 1. Refer to (2) (c) 2) in section 15.7.2.

(d) Operation
1) When using the speed data of point table
Set the station number for positioning by using the next station (RWwn＋4) remote register. Set the point table number in the point table No./Speed command data (RWwn＋6) remote register. Turn on the start (RYn1) to execute positioning with the speed data set in the point table.

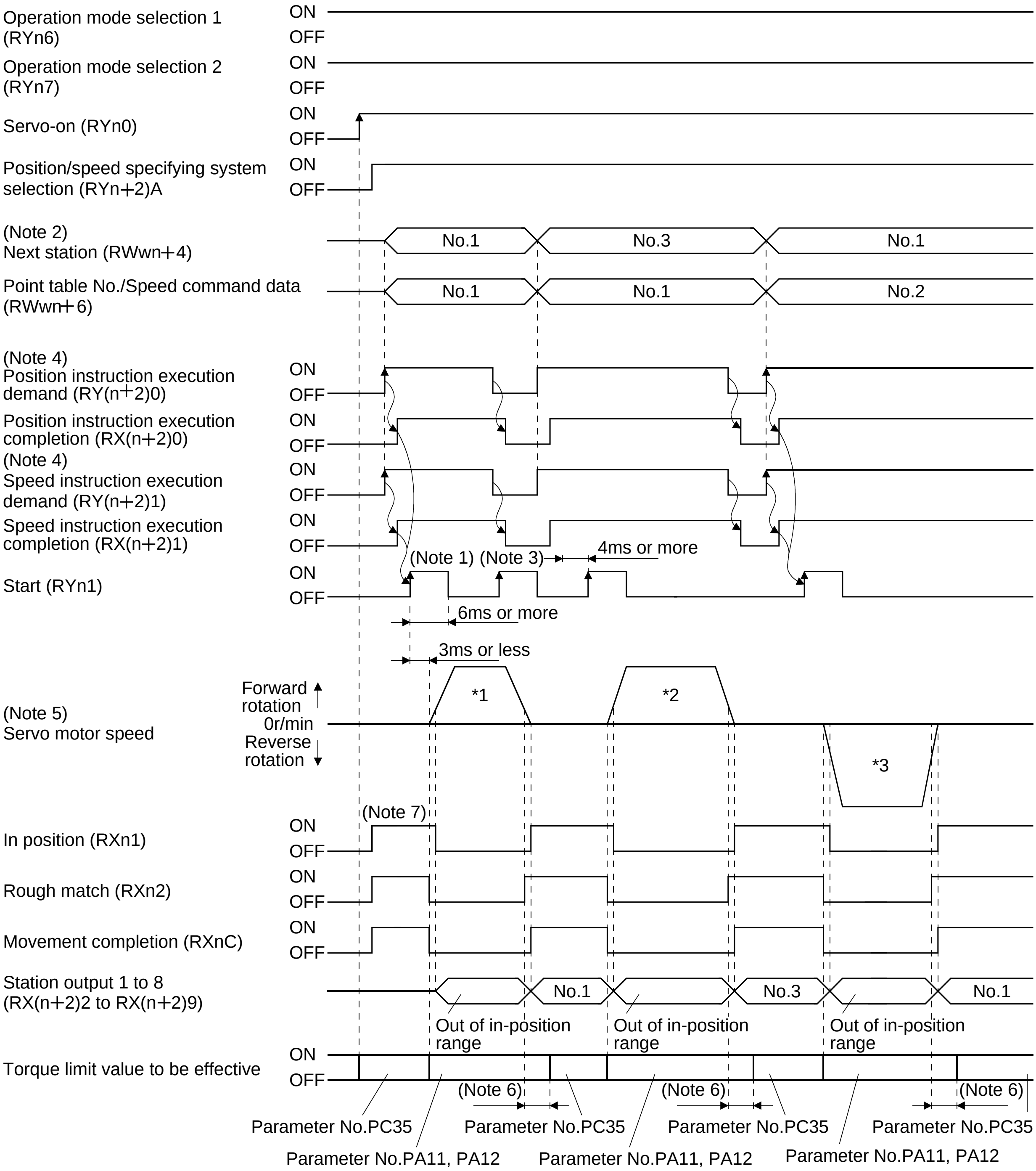
2) When directly setting the servo motor speed (only when two stations are occupied)
Set the station number for positioning by using the next station (RWwn＋4) remote register. Set the servo motor speed in the point table No./Speed command data (RWwn＋6) remote register. Turn on the start (RYn1) to execute positioning with the servo motor speed set in RWwn＋6 and the acceleration time constant and deceleration time constant set in the point table No.1.

(e) Timing chart

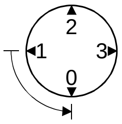
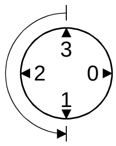
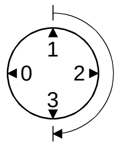
POINT
・Always execute a home position return. The home positioning incomplete (A90) occurs when turning on the start (RYn1) without executing a home position return.

The timing chart is shown below.

1) When using the speed data of point table

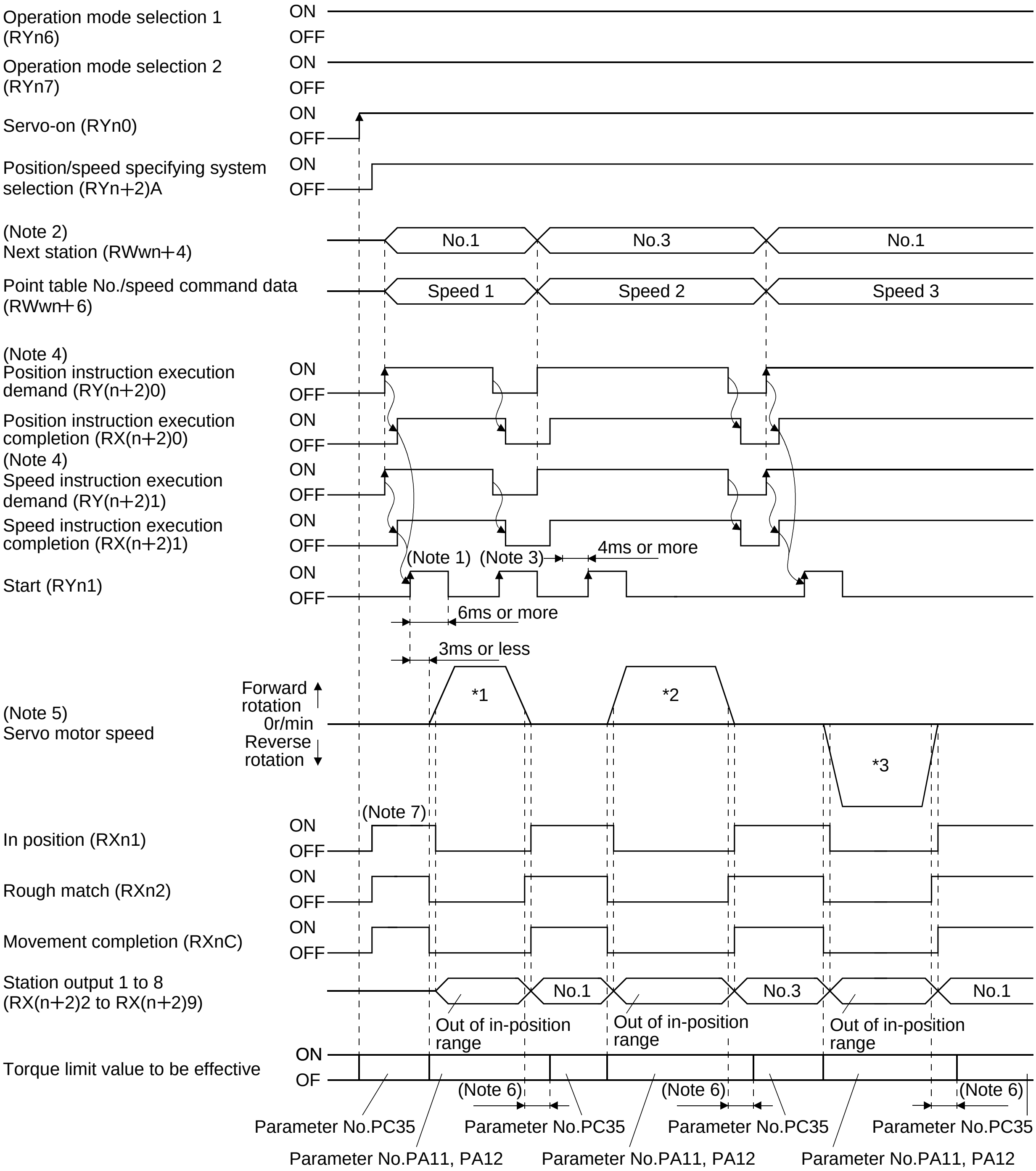


Note 1. Configure a sequence that changes RWwn＋4 and RWwn＋6 earlier, considering the delay time of CC-Link communication.
2. When the selected station number exceeds the value that is dividing number set in the parameter No.PC46 minus one, the next station warning (A97) occurs.
3. The start (RYn1) is invalid even if it is turned on during operation. When executing another operation, turn on RYn1 after the movement completion (RXnC) turns on.
4. For details of the operation timing of RY(n＋2)0 and RY(N＋2)1, refer to the section 3.6.2 (3).
5. The following shows the operation to be executed.

Operation	*1	*2	*3
Station	No.1	No.3	No.1
Servo motor speed Acceleration/deceleration time constant	Point table No.1	Point table No.1	Point table No.2
Positioning			

6. Delay time from when RXn1 turns on until the torque limit value changes to the parameter No.PC35 value can be set in the parameter No.PD26.
7. After power-on, if the current position is with the in-position range of each station, the in position (RXn1) turns on.

2) When directly setting the servo motor speed (only when 2 stations are occupied)



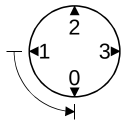
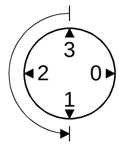
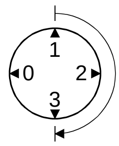
Note 1. Configure a sequence that changes RWwn＋4 and RWwn＋6 earlier, considering the delay time of CC-Link communication.

2. When the selected station number exceeds the value that is dividing number set in the parameter No.PC46 minus one, the next station warning (A97) occurs.

3. The start (RYn1) is invalid even if it is turned on during operation. When executing another operation, turn on RYn1 after the movement completion (RXnC) turns on.

4. For details of the operation timing of RY(n＋2)0 and RY(N＋2)1, refer to the section 3.6.2 (3).

5. The following shows the operation to be executed.

Operation	*1	*2	*3
Station	No.1	No.3	No.1
Servo motor speed	Speed 1	Speed 2	Speed 3
Acceleration/deceleration time constant	Point table No.1	Point table No.1	Point table No.1
Positioning			

6. Delay time from when RXn1 turns on until the torque limit value changes to the parameter No.PC35 value can be set in the parameter No.PD26.

7. After power-on, if the current position is with the in-position range of each station, the in position (RXn1) turns on.

15.8 Manual operation mode

For adjusting the machine or home position, JOG operation or indexer JOG operation can be used to move the position to any position.

15.8.1 Indexer JOG operation

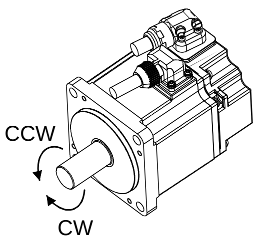
(1) Setting

Set the devices and parameters as indicated below according to the purpose of use. In this case, the next station selection 1 to 8 (RYnA to RYnE and RY(n＋2)3 to RY(n＋2)5) and the speed selection 1 to 3 (RY(n＋2)C to RY(n＋2)E) are invalid.

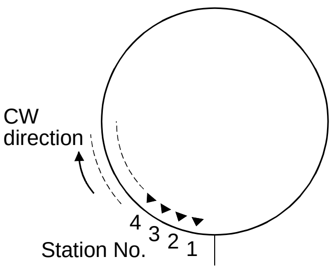
Item	Device/Parameter	Setting description
Indexer positioning operation selection	Parameter No.PA01	1□□□: Select the indexer positioning operation.
Manual operation mode selection	Operation mode selection 1 (RYn6)	Turn on RYn6.
	Operation mode selection 2 (RYn7)	Turn off RYn7.
Indexer JOG operation selection	Parameter No.PC45	Set it to "□□□0 (Initial value)"
Station No. direction	Parameter No.PA14	Refer to (2) in this section.
JOG speed	Point table No.1	Use the servo motor speed in the point table No.1.
Acceleration/deceleration time constant	Point table No.1	Use the acceleration/deceleration time constant in the point table No.1.

(2) Setting the allocation direction of station numbers

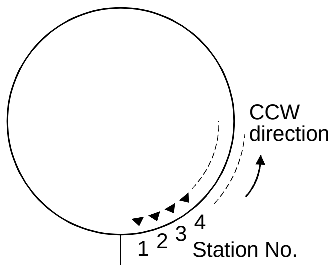
Select the allocation direction of station numbers using the parameter No.PA14 (Station No. direction selection).



Parameter No.PA14 setting	Station No. allocation direction Start (RYn1) ON
0 (Initial value)	Station No. is allocated in CW direction in order of 1, 2, 3…
1	Station No. is allocated in CCW direction in order of 1, 2, 3…



Parameter No.PA14: 0 (Initial value)



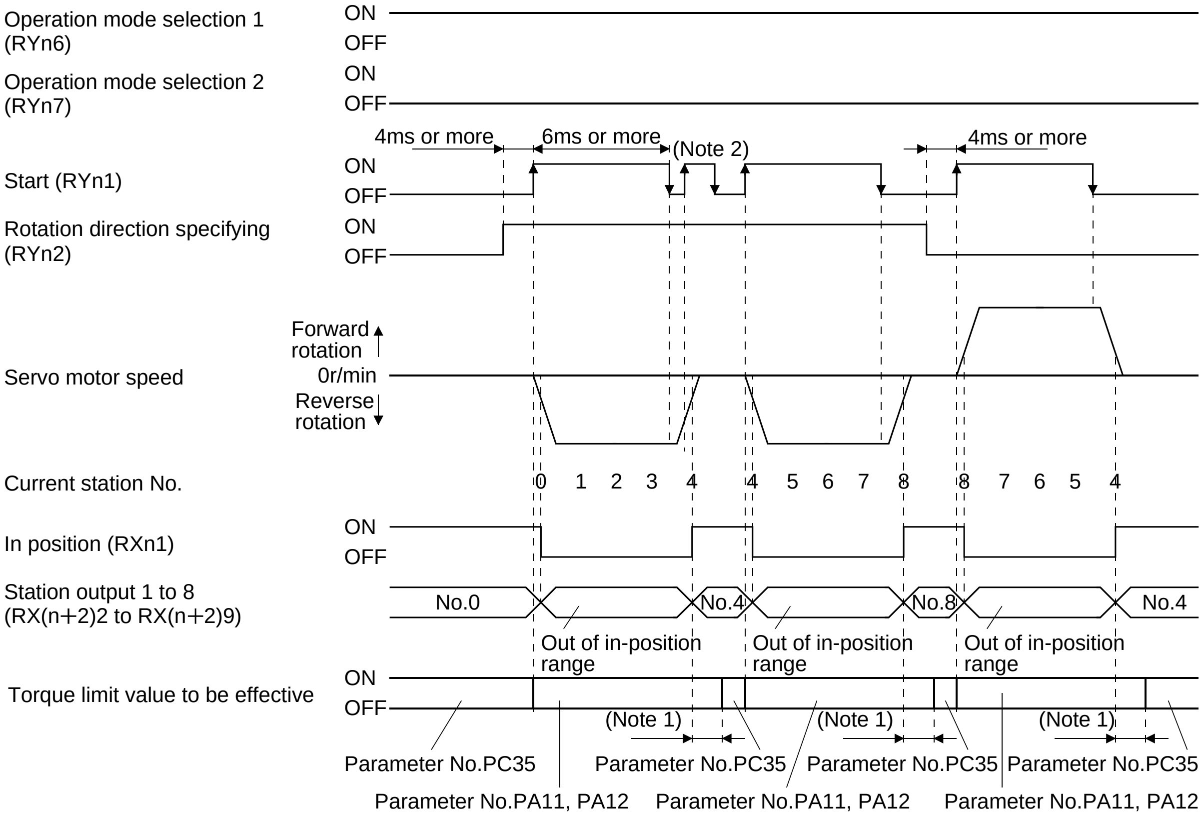
Parameter No.PA14: 1

(3) Operation

Turn on the start (RYn1) to operate the servo motor with the servo motor speed, acceleration time constant, and deceleration time constant set in the point table No.1. Turning off RYn1 makes the servo motor execute positioning to the station where the servo motor can decelerate to stop. For the rotation direction, refer to (2) in this section.

(4) Timing chart

The following timing chart shows an example when executing the indexer JOG operation from the status where the servo motor is at a stop on the station No.0 when the servo-on is turned on.



Note 1. Torque limit delay time can be set in the parameter No.PD26.

2. The start (RYn1) is invalid even if it is turned on during operation. When executing another operation, turn on RYn1 after the movement completion (RXnC) turns on.

15.8.2 JOG operation

(1) Setting

Set the devices and parameters as indicated below for the purpose of use. In this case, the next station selection 1 to 8 (RYnA to RYnE and RY(n＋2)3 to RY(n＋2)5) and the speed selection 1 to 3 (RY(n＋2)C to RY(n＋2)E) are invalid.

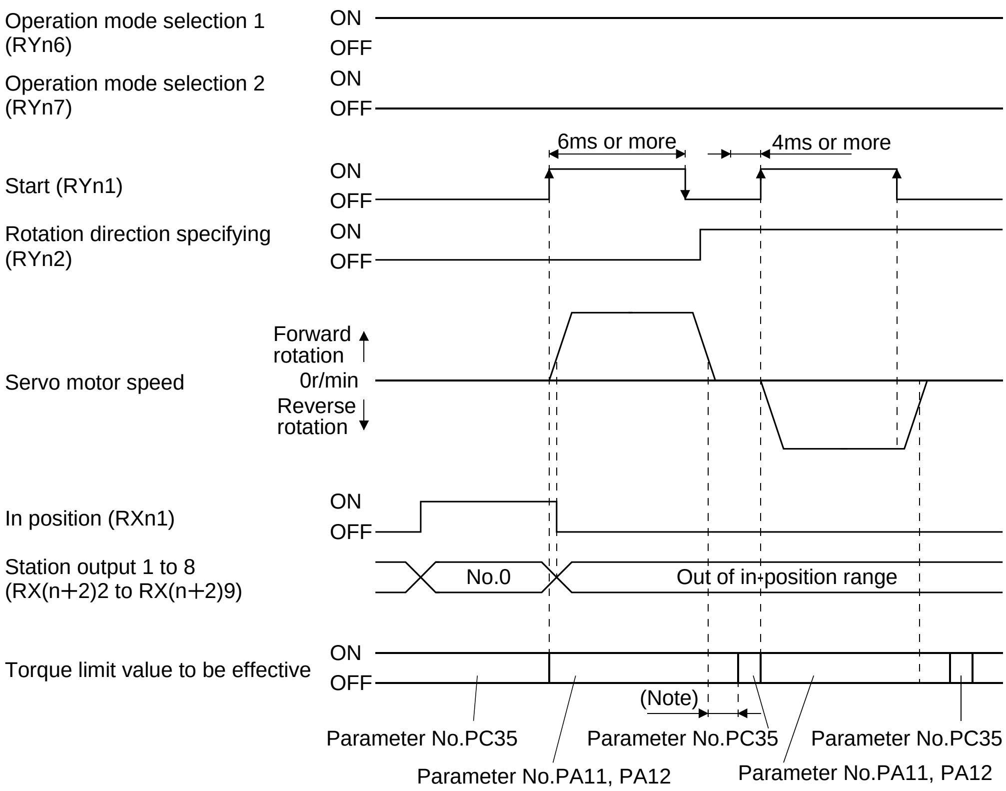
Item	Device/Parameter	Setting description
Indexer positioning operation selection	Parameter No.PA01	1□□□: Select the indexer positioning operation.
Manual operation mode selection	Operation mode selection 1 (RYn6)	Turn on RYn6
	Operation mode selection 2 (RYn7)	Turn off RYn7
JOG operation selection	Parameter No.PC45	Set it to "□□□1".
Station No. direction	Parameter No.PA14	Refer to (2) in this section.
JOG speed	Point table No.1	The setting is the same as for the indexer JOG operation. Refer to (2) in section 15.8.1.
Acceleration/deceleration time constant	Point table No.1	Use the acceleration/deceleration time constant in the point table No.1.

(2) Operation

Turn on the start (RYn1) to operate the servo motor with the servo motor speed, acceleration time constant, and deceleration time constant set in the point table No.1. Turning off RYn1 makes the servo motor decelerate to stop regardless of stations. For the rotation direction, refer to (2) in section 15.8.1.

(3) Timing chart

The following timing chart shows an example when executing the indexer JOG operation from the status where the servo motor is at a stop on the station No.0 when the servo-on is turned on.



Note. Torque limit delay time can be set in the parameter No.PD26.

15.9 Home position return mode

15.9.1 Outline of home position return

Home position return is performed to match the command coordinates with the machine coordinates. In the incremental system, home position return is required every time input power is switched on. In the absolute position detection system, once home position return is done at the time of installation, the current position is retained if power is switched off. Hence, home position return is not required when power is switched on again.

This driver has the home position return methods given in this section. Choose the most appropriate method for your machine structure and application.

This driver has the home position return automatic return function which executes home position return by making an automatic return to a proper position if the machine has stopped beyond or at the proximity dog. Manual motion by jog operation or the like is not required.

(1) Home position return types

Choose the optimum home position return according to the machine type, etc.

Type	Home position return method	Features
Torque limit changing dog type home position return	With deceleration started at the front end of a proximity dog, the position where the first Z-phase signal is given past the rear end of the dog or a motion has been made over the home position shift distance starting from the Z-phase signal is defined as a home position.	･General home position return method using a proximity dog. ･Repeatability of home position return is excellent. ･The machine is less burdened. ･Used when the width of the proximity dog can be set greater than the deceleration distance of the servo motor. ･Torque limit value by the parameter No.PC35 (Internal torque limit 2) becomes effective while the servo motor at stop.
Torque limit changing data setting type home position return	An arbitrary position is defined as a home position.	･No proximity dog required. ･Torque limit value turns to “0” in the home position return mode.

(2) Home position return parameter

When performing home position return, set each parameter as follows.

(a) Choose the home position return method with parameter No.PC02 (Home position return type).

Parameter No.PC02

0	0	0	

Home position return method
0:
1:
2:
3:
4:
5: Not used in indexer postioning operation.
6:
7:
8:
9:
A:
C: Torque limit changing dog type
D: Torque limit changing data setting type

(b) Choose the starting direction of home position return with parameter No.PC03 (Home position return direction). Set "0" to start home position return in the direction in which the station No. is incremented from the current position, or "1" to start home position return in the direction in which the address is decremented.

Parameter No.PC03

0	0	0	

Home position return direction
0: Station No. increment direction
1: Station No. decrement direction

(c) Choose the polarity at which the proximity dog is detected with parameter No.PD16 (Input polarity setting). Set "0" to detect the dog when the proximity dog device (DOG) is OFF, or "1" to detect the dog when the device is ON.

Parameter No.PD16

0	0	0	

Proximity dog input polarity
0: OFF indicates detection of the dog
1: ON indicates detection of the dog

(3) Instructions

1) Before starting home position return, always make sure that the limit switch operates.

2) Confirm the home position return direction. Incorrect setting will cause the machine to run reversely.

3) Confirm the proximity dog input polarity. Not doing so may cause unexpected operation.

15.9.2 Torque limit changing dog type home position return

A home position return method using a proximity dog. With deceleration started at the front end of the proximity dog, the position where the first Z-phase signal is given past the rear end of the dog or a motion has been made over the home position shift distance starting from the Z-phase signal is defined as a home position. A limit can be put on the servo motor torque at home position return execution and at stop separately.

(1) Devices, parameters

Set the input devices and parameters as follows.

Item	Device/Parameter used	Description
Home position return mode selection	Operation mode selection 1 (RYn6)	Turn off RYn6.
	Operation mode selection 2 (RYn7)	Turn off RYn7.
Torque limit changing dog type home position return	Parameter No.PC02	□□□C: Torque limit changing dog type home position return is selected.
Home position return direction	Parameter No.PC03	Refer to section 15.9.1 (2) and choose home position return direction.
Dog input polarity	Parameter No.PD16	Refer to section 15.9.1 (2) and choose dog input polarity.
Home position return speed	Parameter No.PC04	Set speed until detection of dog.
Creep speed	Parameter No.PC05	Set speed after detection of dog.
Home position shift distance	Parameter No.PC06	Set when shifting the home position starting at the first Z-phase signal after passage of proximity dog rear end.
Home position return acceleration/deceleration time constants	Point table No.1	Use the acceleration/deceleration time constants of point table No.1.
Torque limit value at home position return execution	Point table No.PA11	Set the torque limit value for the forward rotation direction at home position return execution.
	Point table No.PA12	Set the torque limit value for the reverse rotation direction at home position return execution.
Torque limit value at stop	Point table No.PC35	Set the torque limit value at stop.

(2) Length of proximity dog

Adjust the length of proximity dog or home position return speed so that the servo motor speed reaches to the creep speed while detecting the proximity dog (DOG).

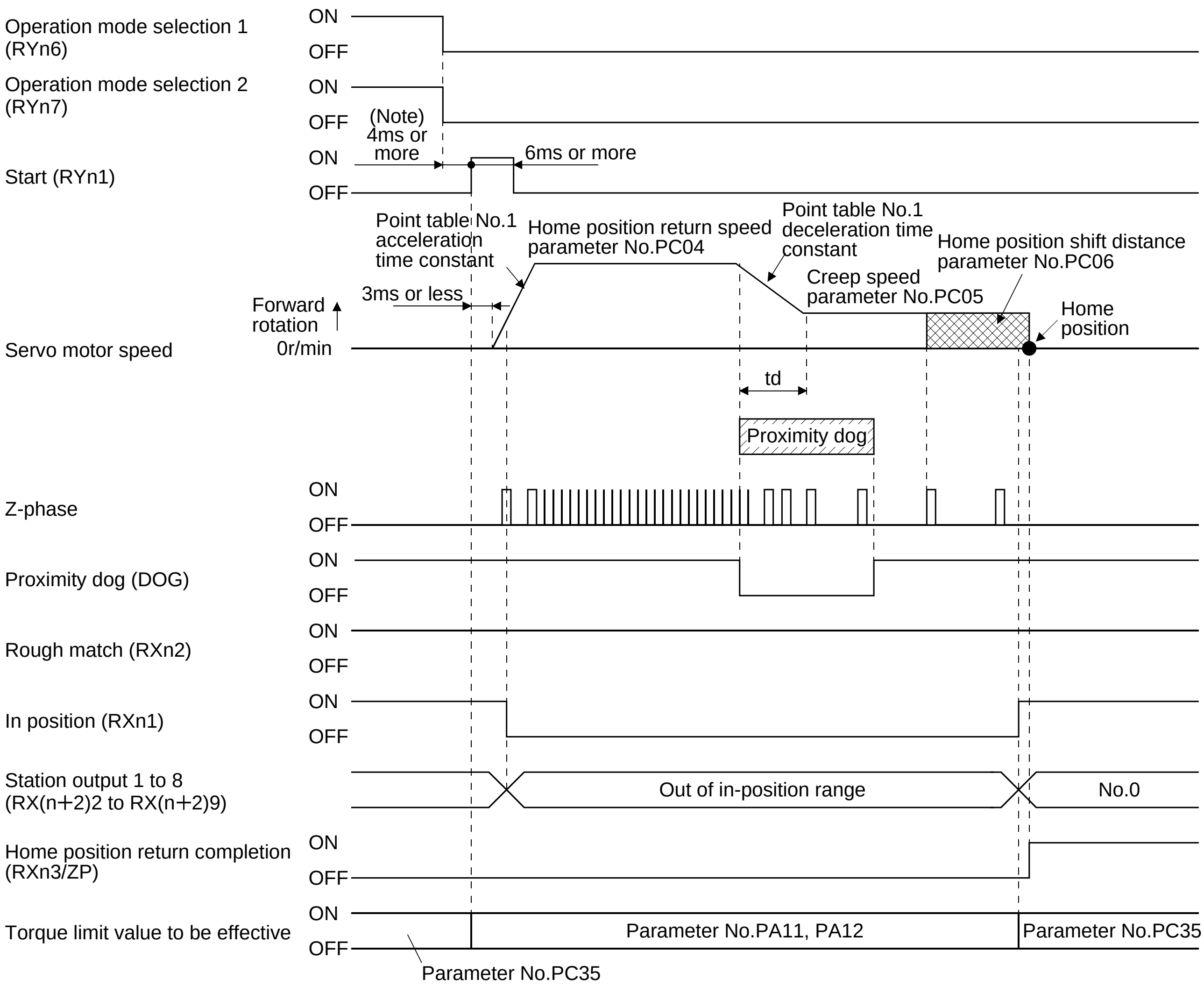
$$L_1 \geq \frac{V}{60} \cdot \frac{td}{2} \times \frac{CDV}{CMX} \times 360$$

L_1 : Angle that proximity dog holds on the circumference of machine side [degree]

V : Home position return speed of motor side [r/min]

td : Deceleration time of motor side [s]

(3) Timing chart



Note. Configure a sequence that changes the operation mode earlier, considering the delay time of CC-Link communication.

15.9.3 Torque limit changing data setting type home position return

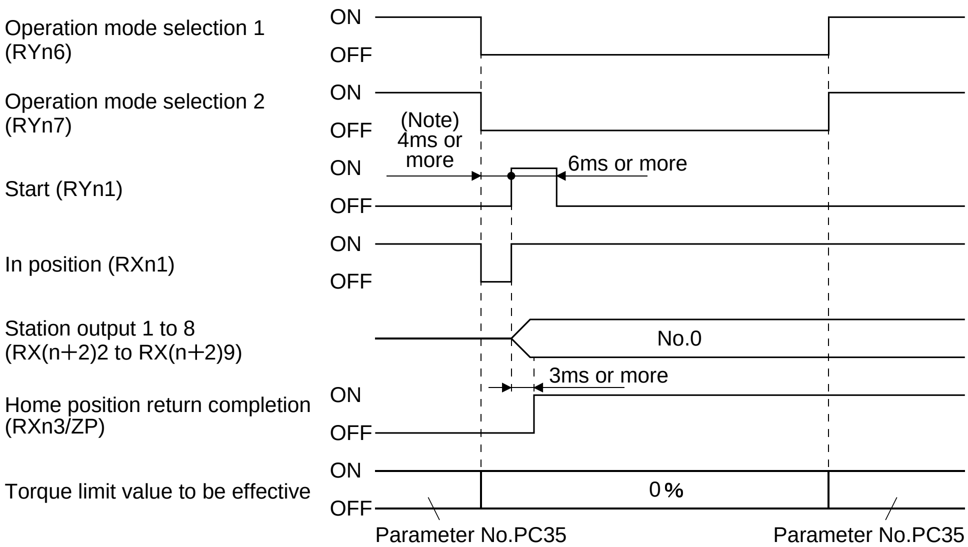
POINT

- Torque limit becomes effective after completing the torque limit changing data setting type home position return, so that when the servo motor is rotated by the external force, a difference occurs in between the command position and the current position. In the home position return mode, even if a difference occurs in between the command position and the current position, the error excessive alarm (A52) does not occur. Therefore, when the mode is changed from home position return to automatic operation, depending on the size of difference between the command position and the current position, the error excessive alarm (A52) occurs. Note that if the error excessive alarm (A52) does not occur, the servo motor rotates to eliminate the difference.

Use the torque limit changing data setting type home position return to set the home position in any place. JOG operation can be used for moving a position. For this home position return, torque generation is stopped at the same time when the mode is changed to the home position return mode. Home position can be set for any position by rotating the axis with external force.
The proximity dog (DOG) cannot be used. The proximity dog (DOG) is disabled even if it is turned off.

(1) Device/Parameter
Set the input devices and parameters as indicated below.

Item	Device/Parameter	Setting description
Home position return mode selection	Operation mode selection 1 (RYn6)	Turn off RYn6.
	Operation mode selection 2 (RYn7)	Turn off RYn7.
Position/speed specifying system by remote register (only when 2 stations are occupied)	Position/speed specifying system selection (RY(n+2)A)	Turn off RY(n+2)A.
Torque limit changing data setting type home position return	Parameter No.PC02	□□□D: Select the torque limit changing data setting type.



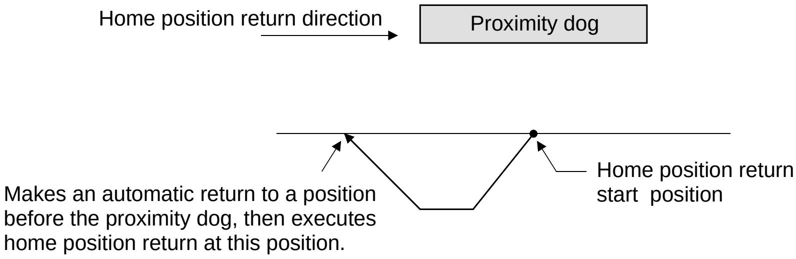
Note. Configure a sequence that changes the operation mode earlier, considering the delay time of CC-Link communication.

15.9.4 Home position return automatic return function

If the current position is at or beyond the proximity dog in the home position return using the proximity dog, this function starts home position return after making a return to the position where the home position return can be made.

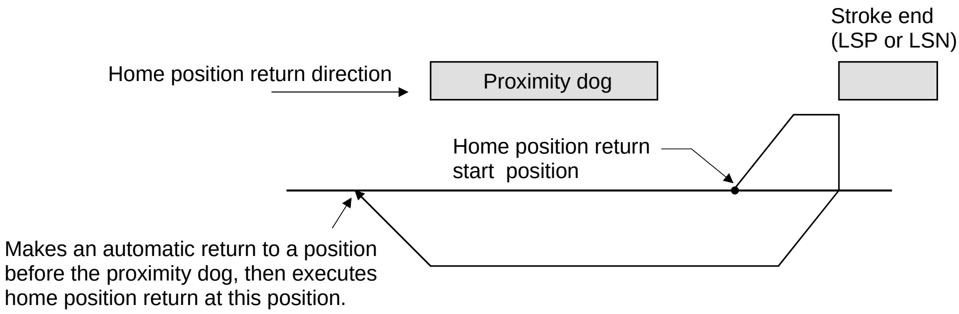
(1) When the current position is at the proximity dog

When the current position is at the proximity dog, an automatic return is made before home position return.



(2) When the current position is beyond the proximity dog

At a start, a motion is made in the home position return direction and an automatic return is made on detection of the stroke end (LSP or LSN). The motion stops past the front end of the proximity dog, and home position return is resumed at that position. If the proximity dog cannot be detected, the motion stops on detection of the LSP or LSN switch and A90 occurs.



Software limit cannot be used with these functions.

15.10 Absolute position detection system

CAUTION	• If an absolute position erase alarm (A25) or an absolute position counter warning (AE3) has occurred, always perform home position setting again. Not doing so may cause unexpected operation.

POINT

- If the encoder cable is disconnected, absolute position data will be lost in the following servo motor series. LE-□-□. After disconnecting the encoder cable, always execute home position setting and then positioning operation.
- When the following parameters are changed, the home position is lost when turning on the power after the change. Execute the home position return again when turning on the power.
  - Parameter No.PA06 (Number of gears on machine-side)
  - Parameter No.PA07 (Number of gears on servo motor-side)
  - Parameter No.PA14 (Station No. direction selection)
  - Parameter No.PC07 (Home position return position data)

This driver contains a single-axis driver. Also, all servo motor encoders are compatible with an absolute position detection system. Hence, an absolute position detection system can be configured up by merely loading an absolute position data back-up battery and setting parameter values.

(1) Restrictions

In the absolute position detection system, the following restriction condition applies for the number of gears on machine-side (parameter No.PA06 CMX) and servo motor speed (N).

- When CMX ≦ 2000, N ＜ 3076.7 r/min
- When CMX ＞ 2000, N ＜ 3276.7 - CMX r/min

When the servo motor is operated at servo motor speed higher than the limited value, the absolute position counter warning (AE3) occurs.

(2) Specifications

Item	Description
System	Electronic battery backup system.
Battery	1 piece of lithium battery (primary battery, nominal＋3.6V) Type: LEC-MR-J3BAT.
Maximum revolution range	Home position＋32767 rev.
(Note 1) Maximum speed at power failure	3000r/min
(Note 2) Battery backup time	Approx. 10,000 hours (battery life with power off)
Battery storage period	5 years from date of manufacture.

Note 1. Maximum speed available when the shaft is rotated by external force at the time of power failure or the like.

2. Time to hold data by a battery with power off. It is recommended to replace the battery in three years independently of whether power is kept on or off.

(3) Structure

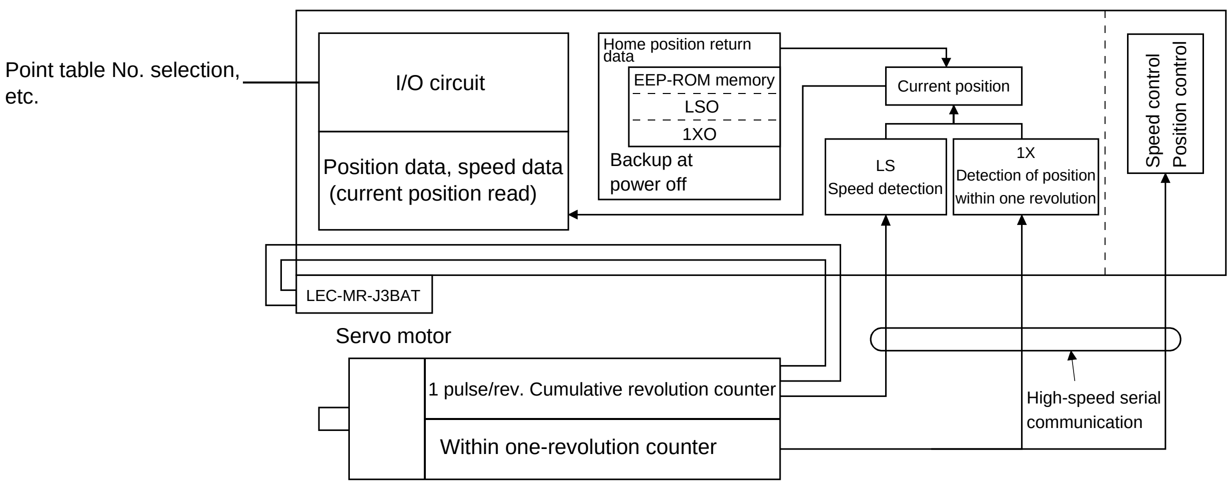
Component	Description
Driver	Use standard models.
Servo motor	
Battery	LEC-MR-J3BAT
Encoder cable	Use a standard model. (Refer to section 13.1.)

(4) Outline of absolute position detection data communication

For normal operation, as shown below, the encoder consists of a detector designed to detect a position within one revolution and a cumulative revolution counter designed to detect the number of revolutions.

The absolute position detection system always detects the absolute position of the machine and keeps it battery-backed, independently of whether the general-purpose PC or PLC...etc power is on or off. Therefore, once the home position is defined at the time of machine installation, home position return is not needed when power is switched on thereafter.

If a power failure or a fault occurs, restoration is easy.



(5) Battery installation procedure

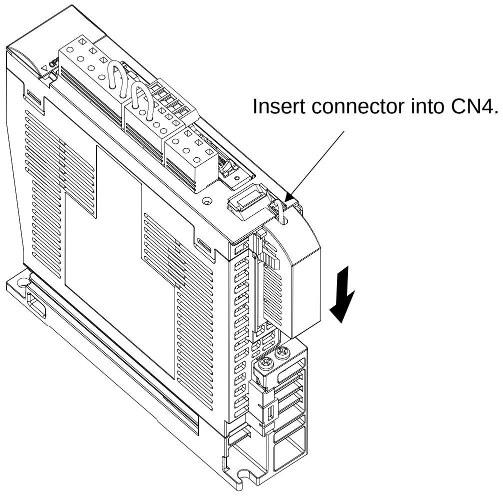
⚠ WARNING	・Before installing a battery, turn off the main circuit power while keeping the control circuit power on. Wait for 15 minutes or more until the charge lamp turns off. Then, confirm that the voltage between P(+) and N(−) is safe with a voltage tester and others. Otherwise, an electric shock may occur. In addition, always confirm from the front of the driver whether the charge lamp is off or not.

POINT

- The internal circuits of the driver may be damaged by static electricity. Always take the following precautions.
  - Ground human body and work bench.
  - Do not touch the conductive areas, such as connector pins and electrical parts, directly by hand.
- Before starting battery changing procedure, make sure that the main circuit power is switched OFF with the control circuit power ON. When battery is changed with the control power OFF, the absolute position data is lost.

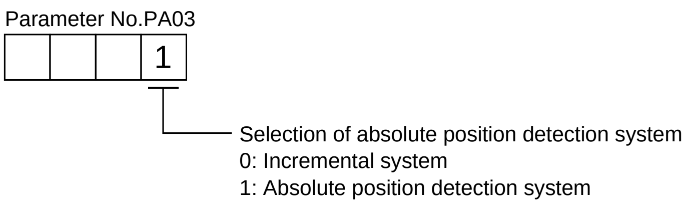
(a) For LECSC□-□

POINT
・For the driver with a battery holder on the bottom, it is not possible to wire for the earth with the battery installed. Insert the battery after executing the earth wiring of the driver.



(b) Parameter setting

Set parameter No.PA03 (Absolute position detection system) as indicated below to make the absolute position detection system valid.



15.11 Parameters

⚠ CAUTION	・Never adjust or change the parameter values extremely as it will make operation instable.

POINT
・For any parameter whose symbol is preceded by *, set the parameter value and switch power off once, then switch it on again to make that parameter setting valid.

In this driver, the parameters are classified into the following groups on a function basis.

Parameter group	Main description
Basic setting parameters (No.PA□□)	Make basic setting with these parameters. Generally, the operation is possible only with these parameter settings.
Gain/filter parameters (No.PB□□)	Use these parameters when making gain adjustment manually.
Extension setting parameters (No.PC□□)	These parameters are inherent to the LECSC□-□ driver.
I/O setting parameters (No.PD□□)	Use these parameters when changing the I/O devices of the driver.

Mainly setting the basic setting parameters (No.PA□□) allows the setting of the basic parameters at the time of introduction.

15.11.1 Basic setting parameters (No.PA□□)

(1) Parameter list

No.	Symbol	Name	Initial value	Unit
PA01	*STY	Control mode	0000h	
PA02	*REG	Regenerative option	0000h	
PA03	*ABS	Absolute position detection system	0000h	
PA04		Not used in indexer positioning operation.	0000h	
PA05		Do not change the parameter.	0000h	
PA06	*CMX	Number of gears on machine-side	1	
PA07	*CDV	Number of gears on servo motor-side	1	
PA08	ATU	Auto tuning mode	0001h	
PA09	RSP	Auto tuning response	12	
PA10	INP	In-position range	100	pulse
PA11	TLP	Forward rotation torque limit	100.0	%
PA12	TLN	Reverse rotation torque limit	100.0	%
PA13		For manufacturer setting	0002h	
PA14	*POL	Rotation direction selection	0	
PA15	*ENR	Encoder output pulses	4000	pulse/rev
PA16		For manufacturer setting	0000h	
PA17		Do not change this valve by any means.	0000h	
PA18			0000h	
PA19	*BLK	Parameter write inhibit	000Ch	

(2) Parameter write inhibit

Parameter			Initial value	Unit	Setting range
No.	Symbol	Name			
PA19	*BLK	Parameter write inhibit	000Ch		Refer to the text.

POINT

- This parameter is made valid when power is switched off, then on after setting.

In the factory setting, this driver allows changes to the basic setting parameter, gain/filter parameter and extension setting parameter settings. With the setting of parameter No.PA19, write can be disabled to prevent accidental changes.

The following table indicates the parameters which are enabled for reference and write by the setting of parameter No.PA19. Operation can be performed for the parameters marked ○ .

Parameter No.PA19 setting	Setting operation	Basic setting parameters No.PA□□	Gain/Filter parameters No.PB□□	Extension setting parameters No.PC□□	I/O setting parameters No.PD□□
0000h	Reference	○			
	Write	○			
000Bh	Reference	○	○	○	
	Write	○	○	○	
000Ch (initial value)	Reference	○	○	○	○
	Write	○	○	○	○
100Bh	Reference	○			
	Write	Parameter No. PA19 only			
100Ch	Reference	○	○	○	○
	Write	Parameter No. PA19 only			

(3) Selection of command system

Parameter			Initial value	Unit	Setting range
No.	Symbol	Name			
PA01	*STY	Control mode	0000h		Refer to the text.

POINT

- This parameter is made valid when power is switched off, then on after setting.

Select the command system.

Parameter No.PA01

	0	0	0

Operation method
0: Point table positioning operation
1: Indexer positioning operation

(4) Selection of regenerative option

Parameter			Initial value	Unit	Setting range
No.	Symbol	Name			
PA02	*REG	Regenerative option	0000h		Refer to the text.

POINT
- This parameter is made valid when power is switched off, then on after setting.
- Wrong setting may cause the regenerative option to burn.
- If the regenerative option selected is not for use with the driver, parameter error (A37) occurs.

Set this parameter when using the regenerative option, brake unit, power regeneration converter, or power regeneration common converter.

Parameter No.PA02

0	0		

Selection of regenerative option
00: Regenerative option is not used
・For 100W driver regenerative resistor is not used
・For 200W driver regenerative resistor is used
02: LEC-MR-RB-032
03: LEC-MR-RB-12

(5) Using absolute position detection system

Parameter			Initial value	Unit	Setting range
No.	Symbol	Name			
PA03	*ABS	Absolute position detection system	0000h		Refer to the text.

POINT
- This parameter is made valid when power is switched off, then on after setting.

Set this parameter when using the absolute position detection system.

Parameter No.PA03

0	0	0	

Selection of absolute position detection system (refer to section 16.10)
0: Used in incremental system
1: Used in absolute position detection system

(6) Electronic gear

Parameter			Initial value	Unit	Setting range
No.	Symbol	Name			
PA06	*CMX	Number of gears on machine-side	1		1 to 16384
PA07	*CDV	Number of gears on servo motor-side	1		1 to 16384

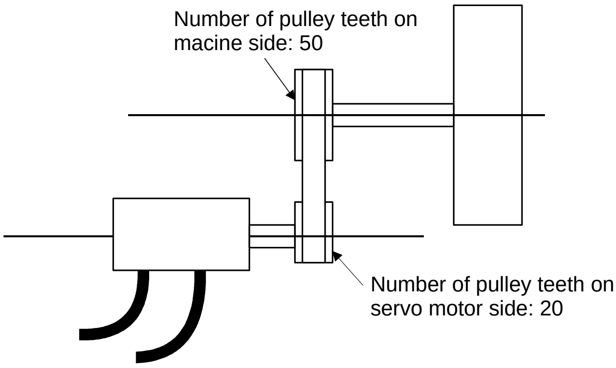
CAUTION
- False setting will result in unexpected fast rotation, causing injury.

POINT
- This parameter is made valid when power is switched off, then on after setting.
- Set the electronic gear within the following condition range.
  (1) 1/9999≦CMX/CDV≦9999
  (2) CDV×STN≦32767
  (3) CMX×CDV≦100000
  When a value out of the condition range is set, the parameter error (A37) occurs. If the setting of electronic gear ratio is small, the servo motor may not operate with the set servo motor speed.
- Setting range of the parameters No.PA06 and PA07 for the indexer positioning operation is 1 to 16384. It is different from the setting range for the point table positioning operation.

Use the parameters No. PA06 and PA07 to adjust the rotation amount “m” on the servo motor shaft that is necessary to rotate the machine side “n” times. A setting example for electronic gear is shown next.

(a) Example 1

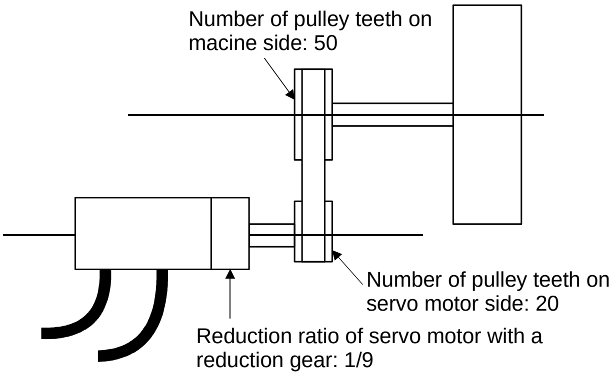
When the number of pulley teeth on the machine-side is 50, and the number of pulley teeth on the servo motor side is 20.



Parameter No.PA06: 50
Parameter No.PA07: 20

(b) Example 2

When the number of pulley teeth on the machine-side is 50, the number of pulley teeth on the servo motor side is 20, and using the servo motor with 1/9 reduction gear.



$$\frac{50}{20} \times \frac{9}{1} = \frac{450}{20}$$

Parameter No.PA06: 450
Parameter No.PA07: 20

(7) Auto tuning

Parameter			Initial value	Unit	Setting range
No.	Symbol	Name			
PA08	ATU	Auto tuning mode	0001h		Refer to the text.
PA09	RSP	Auto tuning response	12		1 to 32

Make gain adjustment using auto tuning. Refer to section 8.2 for details.

(a) Auto tuning mode (parameter No.PA08)

Select the gain adjustment mode.

Parameter No.PA08

0	0	0	

Gain adjustment mode setting

Setting	Gain adjustment mode	Automatically set parameter No. (Note)
0	Interpolation mode	PB06・PB08・PB09・PB10
1	Auto tuning mode 1	PB06・PB07・PB08・PB09・PB10
2	Auto tuning mode 2	PB07・PB08・PB09・PB10
3	Manual mode	

Note. The parameters have the following names.

Parameter No.	Name
PB06	Ratio of load inertia moment to servo motor inertia moment
PB07	Model loop gain
PB08	Position loop gain
PB09	Speed loop gain
PB10	Speed integral compensation

(b) Auto tuning response (parameter No.PA09)

If the machine hunts or generates large gear sound, decrease the set value. To improve performance, e.g. shorten the settling time, increase the set value.

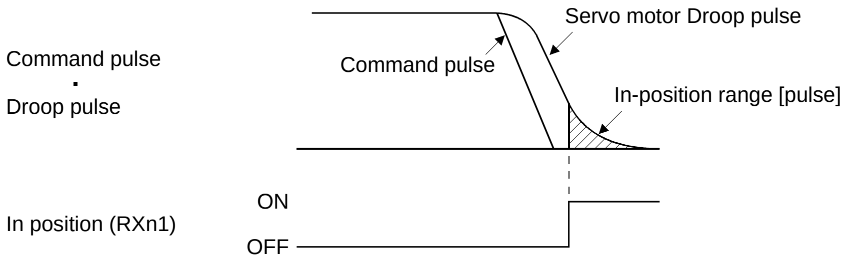
Setting	Response	Guideline for machine resonance frequency [Hz]
1	Low response	10.0
2		11.3
3		12.7
4		14.3
5		16.1
6		18.1
7		20.4
8		23.0
9		25.9
10		29.2
11		32.9
12		37.0
13		41.7
14		47.0
15		52.9
16	Middle response	59.6

Setting	Response	Guideline for machine resonance frequency [Hz]
17	Low response	67.1
18		75.6
19		85.2
20		95.9
21		108.0
22		121.7
23		137.1
24		154.4
25		173.9
26		195.9
27		220.6
28		248.5
29		279.9
30		315.3
31		355.1
32	Middle response	400.0

(8) In-position range

Parameter			Initial value	Unit	Setting range
No.	Symbol	Name			
PA10	INP	In-position range	100	pulse	0 to 10000

Set the range for outputting the movement completion (RXnC) and the in position (RXn1) in command pulse unit.



(9) Torque limit

Parameter			Initial value	Unit	Setting range
No.	Symbol	Name			
PA11	TLP	Forward rotation torque limit	100.0	%	0 to 100.0
PA12	TLN	Reverse rotation torque limit	100.0	%	0 to 100.0

The torque generated by the servo motor can be limited.

(a) Forward rotation torque limit (parameter No.PA11)
Set this parameter on the assumption that the maximum torque is 100[%]. Set this parameter when limiting the torque of the servo motor in the CCW driving mode or CW regeneration mode. Set this parameter to "0.0" to generate no torque.

(b) Reverse rotation torque limit (parameter No.PA12)
Set this parameter on the assumption that the maximum torque is 100[%]. Set this parameter when limiting the torque of the servo motor in the CW driving mode or CCW regeneration mode. Set this parameter to "0.0" to generate no torque.

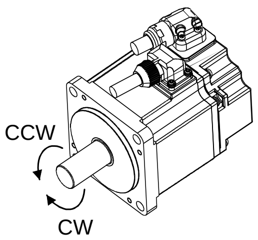
(10)Station No. direction selection

Parameter			Initial value	Unit	Setting range
No.	Symbol	Name			
PA14	*POL	Station No. direction selection	0		0・1

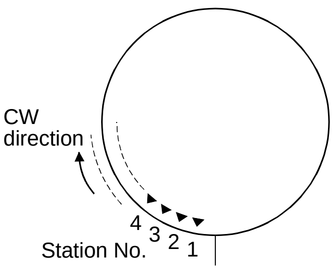
POINT

- This parameter is made valid when power is switched off, then on after setting.

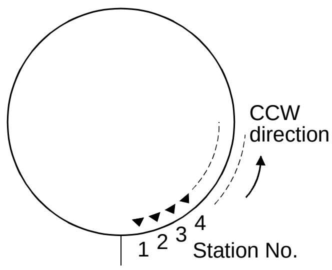
Select the allocation direction of station numbers using the parameter No.PA14 (Station No. direction selection).



Parameter No.PA14 setting	Station No. allocation direction Start (RYn1) ON
0 (Initial value)	Station No. is allocated in CW direction in order of 1, 2, 3...
1	Station No. is allocated in CCW direction in order of 1, 2, 3...



Parameter No.PA14: 0 (Initial value)



Parameter No.PA14: 1

(11)Encoder output pulse

Parameter			Initial value	Unit	Setting range
No.	Symbol	Name			
PA15	*ENR	Encoder output pulse	4000	pulse/rev	1 to 65535

POINT
・This parameter is made valid when power is switched off, then on after setting.

Used to set the encoder pulses (A-phase, B-phase) output by the driver.
Set the value 4 times greater than the A-phase or B-phase pulses.
You can use parameter No.PC19 to choose the output pulse setting or output division ratio setting.
The number of A/B-phase pulses actually output is 1/4 times greater than the preset number of pulses.
The maximum output frequency is 4.6Mpps (after multiplication by 4). Use this parameter within this range.

(a) For output pulse designation
Set "□□0□" (initial value) in parameter No.PC19.
Set the number of pulses per servo motor revolution.
Output pulse = set value [pulses/rev]
For instance, set "5600" to Parameter No.PA15, the actually output A/B-phase pulses are as indicated below.

$$\text{A・B-phase output pulses} = \frac{5600}{4} = 1400\text{[pulse]}$$

(b) For output division ratio setting
Set "□□1□" in parameter No.PC19.
The number of pulses per servo motor revolution is divided by the set value.

$$\text{Output pulse} = \frac{\text{Resolution per servo motor revolution}}{\text{Set value}} \text{ [pulses/rev]}$$

For instance, set "8" to Parameter No.PA15, the actually output A/B-phase pulses are as indicated below.

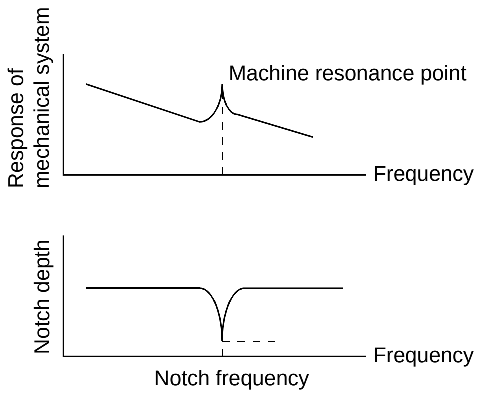
$$\text{A・B-phase output pulses} = \frac{262144}{8} \cdot \frac{1}{4} = 8192\text{[pulse]}$$

15.11.2 Gain/filter parameters (No.PB□□)

(1) Parameter list

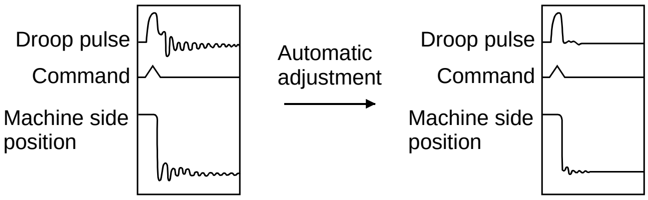
No.	Symbol	Name	Initial value	Unit
PB01	FILT	Adaptive tuning mode (Adaptive filter Ⅱ)	0000h	
PB02	VRFT	Vibration suppression control tuning mode (Advanced vibration suppression control)	0000h	
PB03		For manufacturer setting	0000h	
PB04	FFC	Feed forward gain	0	%
PB05		For manufacturer setting	500	
PB06	GD2	Ratio of load inertia moment to servo motor inertia moment	7.0	Multiplier (×1)
PB07	PG1	Model loop gain	24	rad/s
PB08	PG2	Position loop gain	37	rad/s
PB09	VG2	Speed loop gain	823	rad/s
PB10	VIC	Speed integral compensation	33.7	ms
PB11	VDC	Speed differential compensation	980	
PB12		For manufacturer setting	0	
PB13	NH1	Machine resonance suppression filter 1	4500	Hz
PB14	NHQ1	Notch shape selection 1	0000h	
PB15	NH2	Machine resonance suppression filter 2	4500	Hz
PB16	NHQ2	Notch shape selection 2	0000h	
PB17		Automatic setting parameter		
PB18	LPF	Low-pass filter	3141	rad/s
PB19	VRF1	Vibration suppression control vibration frequency setting	100.0	Hz
PB20	VRF2	Vibration suppression control resonance frequency setting	100.0	Hz
PB21		For manufacturer setting	0.00	
PB22			0.00	
PB23	VFBF	Low-pass filter selection	0000h	
PB24	*MVS	Slight vibration suppression control selection	0000h	
PB25		For manufacturer setting	0000h	
PB26	*CDP	Gain changing selection	0000h	
PB27	CDL	Gain changing condition	10	
PB28	CDT	Gain changing time constant	1	ms
PB29	GD2B	Gain changing ratio of load inertia moment to servo motor inertia moment	7.0	Multiplier (×1)
PB30	PG2B	Gain changing position loop gain	37	rad/s
PB31	VG2B	Gain changing speed loop gain	823	rad/s
PB32	VICB	Gain changing speed integral compensation	33.7	ms
PB33	VRF1B	Gain changing vibration suppression control vibration frequency setting	100.0	Hz
PB34	VRF2B	Gain changing vibration suppression control resonance frequency setting	100.0	Hz
PB35		For manufacturer setting	0.00	
PB36			0.00	
PB37			100	
PB38			0	
PB39			0	
PB40			0	
PB41			1125	
PB42			1125	
PB43			0004h	
PB44			0000h	
PB45			0000h	

(2) Detail list

<table>
<tr><th>No.</th><th>Symbol</th><th>Name and function</th><th>Initial value</th><th>Unit</th><th>Setting range</th></tr>
<tr><td>PB01</td><td>FILT</td><td>Adaptive tuning mode (Adaptive filter Ⅱ)
Select the setting method for filter tuning. Setting this parameter to "□□□1" (filter tuning mode 1) automatically changes the machine resonance suppression filter 1 (parameter No.PB13) and notch shape selection (parameter No.PB14).


0 0 0 □
Filter tuning mode selection
<table>
<tr><th>Setting</th><th>Filter adjustment mode</th><th>Automatically set parameter</th></tr>
<tr><td>0</td><td>Filter OFF</td><td>(Note)</td></tr>
<tr><td>1</td><td>Filter tuning mode</td><td>Parameter No.PB13
Parameter No.PB14</td></tr>
<tr><td>2</td><td>Manual mode</td><td></td></tr>
</table>
Note. Parameter No.PB13 and PB14 are fixed to the initial values.

When this parameter is set to "□□□1", the tuning is completed after positioning is done the predetermined number or times for the predetermined period of time, and the setting changes to "□□□2". When the filter tuning is not necessary, the setting changes to "□□□0". When this parameter is set to "□□□0", the initial values are set to the machine resonance suppression filter 1 and notch shape selection. However, this does not occur when the servo off.</td><td>0000h</td><td></td><td></td></tr>
</table>

<table>
<tr><th>No.</th><th>Symbol</th><th>Name and function</th><th>Initial value</th><th>Unit</th><th>Setting range</th></tr>
<tr><td>PB02</td><td>VRFT</td><td>Vibration suppression control tuning mode (Advanced vibration suppression control)
The vibration suppression is valid when the parameter No.PA08 (auto tuning) setting is "□□□2" or "□□□3". When PA08 is "□□□1", vibration suppression is always invalid.
Select the setting method for vibration suppression control tuning. Setting this parameter to "□□□1" (vibration suppression control tuning mode) automatically changes the vibration suppression control vibration frequency (parameter No.PB19) and vibration suppression control resonance frequency (parameter No.PB20) after positioning is done the predetermined number of times.


0 0 0 □
Vibration suppression control tuning mode
<table>
<tr><th>Setting</th><th>Vibration suppression control tuning mode</th><th>Automatically set parameter</th></tr>
<tr><td>0</td><td>Vibration suppression control OFF</td><td>(Note)</td></tr>
<tr><td>1</td><td>Vibration suppression control tuning mode (Advanced vibration suppression control)</td><td>Parameter No.PB19
Parameter No.PB20</td></tr>
<tr><td>2</td><td>Manual mode</td><td></td></tr>
</table>
Note. Parameter No.PB19 and PB20 are fixed to the initial values.

When this parameter is set to "□□□1", the tuning is completed after positioning is done the predetermined number or times for the predetermined period of time, and the setting changes to "□□□2". When the vibration suppression control tuning is not necessary, the setting changes to "□□□0".
When this parameter is set to "□□□0", the initial values are set to the vibration suppression control - vibration frequency and vibration suppression control - resonance frequency. However, this does not occur when the servo off.</td><td>0000h</td><td></td><td></td></tr>
<tr><td>PB03</td><td></td><td>For manufacturer setting
Do not change this value by any means.</td><td>0000h</td><td></td><td></td></tr>
<tr><td>PB04</td><td>FFC</td><td>Feed forward gain
Set the feed forward gain. When the setting is 100%, the droop pulses during operation at constant speed are nearly zero. However, sudden acceleration/deceleration will increase the overshoot. As a guideline, when the feed forward gain setting is 100%, set 1s or more as the acceleration/deceleration time constant up to the rated speed.</td><td>0</td><td>%</td><td>0
to
100</td></tr>
</table>

No.	Symbol	Name and function	Initial value	Unit	Setting range
PB05		For manufacturer setting Do not change this value by any means.	500		
PB06	GD2	Ratio of load inertia moment to servo motor inertia moment Used to set the ratio of the load inertia moment to the servo motor shaft inertia moment. When auto tuning mode 1 and interpolation mode is selected, the result of auto tuning is automatically used. (Refer to section 8.1.1) In this case, it varies between 0 and 100.0.	7.0	Multiplier (×1)	0 to 300.0
PB07	PG1	Model loop gain Set the response gain up to the target position. Increase the gain to improve track ability in response to the command. When auto turning mode 1,2 is selected, the result of auto turning is automatically used.	24	rad/s	1 to 2000
PB08	PG2	Position loop gain Used to set the gain of the position loop. Set this parameter to increase the position response to level load disturbance. Higher setting increases the response level but is liable to generate vibration and/or noise. When auto tuning mode 1,2 and interpolation mode is selected, the result of auto tuning is automatically used.	37	rad/s	1 to 1000
PB09	VG2	Speed loop gain Set this parameter when vibration occurs on machines of low rigidity or large backlash. Higher setting increases the response level but is liable to generate vibration and/or noise. When auto tuning mode 1,2 manual mode and interpolation mode is selected, the result of auto tuning is automatically used.	823	rad/s	20 to 50000
PB10	VIC	Speed integral compensation Used to set the integral time constant of the speed loop. Lower setting increases the response level but is liable to generate vibration and/or noise. When auto tuning mode 1,2 and interpolation mode is selected, the result of auto tuning is automatically used.	33.7	ms	0.1 to 1000.0
PB11	VDC	Speed differential compensation Used to set the differential compensation. Made valid when the proportion control (RY(n＋2)7) is switched on.	980		0 to 1000
PB12		For manufacturer setting Do not change this value by any means.	0		
PB13	NH1	Machine resonance suppression filter 1 Set the notch frequency of the machine resonance suppression filter 1. Setting parameter No.PB01 (filter tuning mode 1) to "□□□1" automatically changes this parameter. When the parameter No.PB01 setting is "□□□0", the setting of this parameter is ignored.	4500	Hz	100 to 4500

<table>
<tr><th>No.</th><th>Symbol</th><th>Name and function</th><th>Initial value</th><th>Unit</th><th>Setting range</th></tr>
<tr><td>PB14</td><td>NHQ1</td><td>Notch shape selection 1
Used to selection the machine resonance suppression filter 1.

0 □ □ 0

Notch depth selection
<table>
<tr><th>Setting value</th><th>Depth</th><th>Gain</th></tr>
<tr><td>0</td><td>Deep</td><td>-40dB</td></tr>
<tr><td>1</td><td rowspan="2">to</td><td>-14dB</td></tr>
<tr><td>2</td><td>-8dB</td></tr>
<tr><td>3</td><td>Shallow</td><td>-4dB</td></tr>
</table>
Notch width
<table>
<tr><th>Setting value</th><th>Width</th><th>α</th></tr>
<tr><td>0</td><td>Standard</td><td>2</td></tr>
<tr><td>1</td><td rowspan="2">to</td><td>3</td></tr>
<tr><td>2</td><td>4</td></tr>
<tr><td>3</td><td>Wide</td><td>5</td></tr>
</table>
Setting parameter No.PB01 (filter tuning mode 1) to "□□□1" automatically changes this parameter.
When the parameter No.PB01 setting is "□□□0", the setting of this parameter is ignored.</td><td>0000h</td><td></td><td>Refer to name and function column.</td></tr>
<tr><td>PB15</td><td>NH2</td><td>Machine resonance suppression filter 2
Set the notch frequency of the machine resonance suppression filter 2.
Set parameter No.PB16 (notch shape selection 2) to "□□□1" to make this parameter valid.</td><td>4500</td><td>Hz</td><td>100
to
4500</td></tr>
<tr><td>PB16</td><td>NHQ2</td><td>Notch shape selection 2
Select the shape of the machine resonance suppression filter 2.

0 □ □ □

Machine resonance suppression filter 2 selection
0: Invalid
1: Valid

Notch depth selection
<table>
<tr><th>Setting value</th><th>Depth</th><th>Gain</th></tr>
<tr><td>0</td><td>Deep</td><td>-40dB</td></tr>
<tr><td>1</td><td rowspan="2">to</td><td>-14dB</td></tr>
<tr><td>2</td><td>-8dB</td></tr>
<tr><td>3</td><td>Shallow</td><td>-4dB</td></tr>
</table>
Notch width
<table>
<tr><th>Setting value</th><th>Width</th><th>α</th></tr>
<tr><td>0</td><td>Standard</td><td>2</td></tr>
<tr><td>1</td><td rowspan="2">to</td><td>3</td></tr>
<tr><td>2</td><td>4</td></tr>
<tr><td>3</td><td>Wide</td><td>5</td></tr>
</table></td><td>0000h</td><td></td><td>Refer to name and function column.</td></tr>
<tr><td>PB17</td><td></td><td>Automatic setting parameter
The value of this parameter is set according to a set value of parameter No.PB06 (Ratio of load inertia moment to servo motor inertia moment).</td><td></td><td></td><td></td></tr>
</table>

No.	Symbol	Name and function	Initial value	Unit	Setting range
PB18	LPF	Low-pass filter Set the low-pass filter. Setting parameter No.PB23 (low-pass filter selection) to "□□0□" automatically changes this parameter. When parameter No.PB23 is set to "□□1□", this parameter can be set manually.	3141	rad/s	100 to 18000
PB19	VRF1	Vibration suppression control vibration frequency setting Set the vibration frequency for vibration suppression control to suppress low-frequency machine vibration, such as enclosure vibration. Setting parameter No.PB02 (vibration suppression control tuning mode) to "□□□1" automatically changes this parameter. When parameter No.PB02 is set to "□□□2", this parameter can be set manually.	100.0	Hz	0.1 to 100.0
PB20	VRF2	Vibration suppression control resonance frequency setting Set the resonance frequency for vibration suppression control to suppress low-frequency machine vibration, such as enclosure vibration. Setting parameter No.PB02 (vibration suppression control tuning mode) to "□□□1" automatically changes this parameter. When parameter No.PB02 is set to "□□□2", this parameter can be set manually.	100.0	Hz	0.1 to 100.0
PB21		For manufacturer setting	0.00		
PB22		Do not change this value by any means.	0.00		
PB23	VFBF	Low-pass filter selection Select the low-pass filter. 0 0 □ 0 Low-pass filter selection 0: Automatic setting 1: Manual setting (parameter No.PB18 setting) When automatic setting has been selected, select the filter that has the band width close to the one calculated with $\frac{VG2 \cdot 10}{1 + GD2}$ [rad/s]	0000h		Refer to name and function column.
PB24	*MVS	Slight vibration suppression control selection Select the slight vibration suppression control. When parameter No.PA08 (auto tuning mode) is set to "□□□3", this parameter is made valid. 0 0 0 □ Slight vibration suppression control selection 0: Invalid 1: Valid	0000h		Refer to name and function column.

No.	Symbol	Name and function	Initial value	Unit	Setting range
PB25		For manufacturer setting Do not change this value by any means.	0000h		
PB26	*CDP	Gain changing selection Select the gain changing condition. (Refer to section 9.6.) 0 0 □ □ Gain changing selection Under any of the following conditions, the gains change on the basis of the parameter No.PB29 to PB32 settings. 0: Invalid 1: Gain changing (RX(n+2)8) is ON 2: Command frequency (Parameter No.PB27 setting) 3: Droop pulse value (Parameter No.PB27 setting) 4: Servo motor speed (Parameter No.PB27 setting) Gain changing condition 0: Valid at more than condition (Valid when gain changing (RX(n+2)8) is ON) 1: Valid at less than condition (Valid when gain changing (RX(n+2)8) is OFF)	0000h		Refer to name and function column.
PB27	CDL	Gain changing condition Used to set the value of gain changing condition (command frequency, droop pulses, servo motor speed) selected in parameter No.PB26. The set value unit changes with the changing condition item. (Refer to section 9.6.)	10	kpps pulse r/min	0 to 9999
PB28	CDT	Gain changing time constant Used to set the time constant at which the gains will change in response to the conditions set in parameters No.PB26 and PB27. (Refer to section 9.6.)	1	ms	0 to 100
PB29	GD2B	Gain changing ratio of load inertia moment to servo motor inertia moment Used to set the ratio of load inertia moment to servo motor inertia moment when gain changing is valid. This parameter is made valid when the auto tuning is invalid (parameter No. PA08: □□□3).	7.0	Multiplier (×1)	0 to 300.0
PB30	PG2B	Gain changing position loop gain Set the position loop gain when the gain changing is valid. This parameter is made valid when the auto tuning is invalid (parameter No. PA08: □□□3).	37	rad/s	1 to 2000
PB31	VG2B	Gain changing speed loop gain Set the speed loop gain when the gain changing is valid. This parameter is made valid when the auto tuning is invalid (parameter No. PA08: □□□3). Note. The setting range of 50000 applies to the driver whose software version is A3 or later. The setting range of the driver whose software version is older than A3 is 20 to 20000. When the software version of set up software(MR Configurator) is A3 or earlier, 20001 or more cannot be set. Use the display/operation section of the driver to set 20001 or more.	823	rad/s	20 to 20000
PB32	VICB	Gain changing speed integral compensation Set the speed integral compensation when the gain changing is valid. This parameter is made valid when the auto tuning is invalid (parameter No. PA08: □□□3).	33.7	ms	0.1 to 5000.0

No.	Symbol	Name and function	Initial value	Unit	Setting range
PB33	VRF1B	Gain changing vibration suppression control vibration frequency setting Set the vibration frequency for vibration suppression control when the gain changing is valid. This parameter is made valid when the parameter No.PB02 setting is "□□□2" and the parameter No.PB26 setting is "□□□1". When using the vibration suppression control gain changing, always execute the changing after the servo motor has stopped.	100.0	Hz	0.1 to 100.0
PB34	VRF2B	Gain changing vibration suppression control resonance frequency setting Set the resonance frequency for vibration suppression control when the gain changing is valid. This parameter is made valid when the parameter No.PB02 setting is "□□□2" and the parameter No.PB26 setting is "□□□1". When using the vibration suppression control gain changing, always execute the changing after the servo motor has stopped.	100.0	Hz	0.1 to 100.0
PB35		For manufacturer setting Do not change this value by any means.	0.00		
PB36			0.00		
PB37			100		
PB38			0		
PB39			0		
PB40			0		
PB41			1125		
PB42			1125		
PB43			0004h		
PB44			0000h		
PB45			0000h		

15.11.3 Extension setting parameters (No.PC□□)

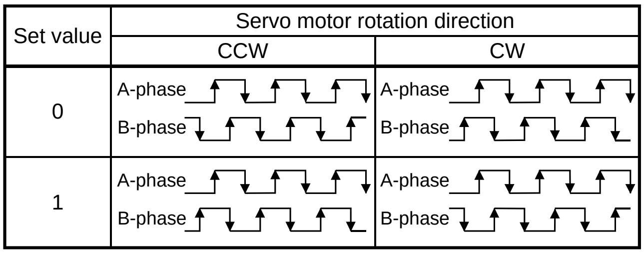
(1) Parameter list

No.	Symbol	Name	Initial value	Unit
PC01		For manufacturer setting	0000h	
PC02	*ZTY	Home position return type	0000h	
PC03	*ZDIR	Home position return direction	0001h	
PC04	ZRF	Home position return speed	500	r/min
PC05	CRF	Creep speed	10	r/min
PC06	ZST	Home position shift distance	0	μm
PC07		Not used in indexer positioning operation.	0	
PC08			1000	
PC09			100	
PC10			15.0	
PC11	CRP	Rough match output range	0	pulse
PC12	JOG	Jog speed	100	r/min
PC13		Not used in indexer positioning operation.	0	
PC14	*BKC	Backlash compensation	0	pulse
PC15		For manufacturer setting	0000h	
PC16	MBR	Electromagnetic brake sequence output	100	ms
PC17		Not used in indexer positioning operation.	50	
PC18	*BPS	Alarm history clear	0000h	
PC19	*ENRS	Encoder output pulse selection	0000h	
PC20	*SNO	Station number setting	0	station
PC21	*SOP	RS-422 communication function selection	0000h	
PC22	*COP1	Function selection C-1	0000h	
PC23		For manufacturer setting	0000h	
PC24		Not used in indexer positioning operation.	0000h	
PC25		For manufacturer setting	0000h	
PC26	*COP5	Function selection C-5	0000h	
PC27		For manufacturer setting	0000h	
PC28		Not used in indexer positioning operation.	0000h	
PC29		For manufacturer setting	0000h	
PC30	*DSS	Remote register-based position/speed specifying system selection	0000h	
PC31		Not used in indexer positioning operation.	0	
PC32				
PC33			0	
PC34				
PC35	TL2	Internal torque limit 2	100.0	%
PC36		For manufacturer setting	0000h	
PC37		Not used in indexer positioning operation.	0	
PC38				
PC39			0	
PC40				
PC41		For manufacturer setting	0000h	
PC42			0000h	
PC43			0000h	
PC44			0000h	
PC45	*COP9	Function selection C-9	0000h	
PC46	*STN	Indexer positioning operation number of stations/rotation	0000h	
PC47	PSST	Indexer positioning operation station home position shift distance	0000h	pulse
PC48		For manufacturer setting	0000h	

No.	Symbol	Name and function	Initial value	Unit
PC49		For manufacturer setting	0000h	
PC50			0000h	

(2) Detail list

No.	Symbol	Name and function	Initial value	Unit	Setting range
PC01		For manufacturer setting Do not change this value by any means.	0000h		
PC02	*ZTY	Home position return type Used to set the home position return system. (Refer to section 5.6.) Parameter No.PC02 0 0 0 □ Home position return method 0: 1: 2: 3: 4: 5: Not used in indexer postioning operation. 6: 7: 8: 9: A: C: Torque limit changing dog type D: Torque limit changing data setting type	0000h		Refer to name and function column.
PC03	*ZDIR	Home position return direction Used to set the home position return direction. Parameter No.PC03 0 0 0 □ Home position return direction 0: Station No. increment direction 1: Station No. decrement direction	0001h		Refer to name and function column.
PC04	ZRF	Home position return speed Used to set the servo motor speed for home position return. (Refer to section 15.9.)	500	r/min	0 to permissible speed
PC05	CRF	Creep speed Used to set the creep speed after proximity dog detection. (Refer to section 15.9.)	10	r/min	0 to permissible speed
PC06	ZST	Home position shift distance Used to set the shift distance starting at the Z-phase pulse detection position inside the encoder. (Refer to section 15.9.)	0	μm	0 to 65535
PC07		Not used in indexer positioning operation. Do not change the parameter.	0		
PC08			1000		
PC09			100		
PC10			15.0		
PC11	CRP	Rough match output range Used to set the command remaining distance range where the rough match (RXn2) is output.	0	$\times 10^{STM}$μm	0 to 65535
PC12	JOG	Jog speed Used to set the jog speed command.	100	r/min	0 to permissible speed

No.	Symbol	Name and function	Initial value	Unit	Setting range
PC13		Not used in indexer positioning operation. Do not change the parameter.	0		
PC14	*BKC	Backlash compensation Used to set the backlash compensation made when the command direction is reversed. This function compensates for the number of backlash pulses in the opposite direction to the home position return direction. For the home position ignorance (servo-on position as home position), this function compensates for the number of backlash pulses in the opposite direction to the first rotating direction after establishing the home position by switching ON the servo-on (RYn0). In the absolute position detection system, this function compensates for the backlash pulse count in the direction opposite to the operating direction at power-on.	0	pulse	0 to 32000
PC15		For manufacturer setting Do not change this value by any means.	0000h		
PC16	MBR	Electromagnetic brake sequence output Used to set the delay time (Tb) between when the electromagnetic brake interlock (MBR) switches off and when the base circuit is shut off.	100	ms	0 to 1000
PC17		Not used in indexer positioning operation. Do not change the parameter.	50		
PC18	*BPS	Alarm history clear Used to clear the alarm history. 0 0 0 □ Alarm history clear 0: Invalid 1: Valid When alarm history clear is made valid, the alarm history is cleared at next power-on. After the alarm history is cleared, the setting is automatically made invalid (reset to 0).	0000h		Refer to name and function column.
PC19	*ENRS	Encoder output pulse selection Use to select the, encoder output pulse direction and encoder output pulse setting. 0 0 □ □ Encoder output pulse phase changing Changes the phases of A, B-phase encoder pulses output .  Encoder output pulse setting selection (refer to parameter No.PA15). 0: Output pulse designation 1: Division ratio setting 2: Outputs the encoder pulse without processing it.	0000h		Refer to name and function column.

No.	Symbol	Name and function	Initial value	Unit	Setting range
PC20	*SNO	Station number setting Used to specify the station number for RS-422 serial communication and USB communication. Always set one station to one axis of driver. If one station number is set to two or more stations, normal communication cannot be made.	0	station	0 to 31
PC21	*SOP	RS-422 communication function selection Select the communication I/F and select the RS-422 communication conditions. 0 □ □ 0 RS-422 communication baud rate selection 0: 9600 [bps] 1: 19200 [bps] 2: 38400 [bps] 3: 57600 [bps] 4: 115200[bps] RS-422 communication response delay time 0: Invalid 1: Valid, reply sent after delay time of 800 μs or more	0000h		Refer to name and function column.
PC22	*COP1	Function selection C-1 Select the encoder cable communication system selection. □ 0 0 0 Encoder cable communication system selection 0: Two-wire type 1: Four-wire type The following cables are of 2-wire type. LE-CSE-□2□ LE-CSE-□5□ LE-CSE-□A□ Incorrect settinf will result in an encoder alarm1(A16) or encoder alarm2(A20)	0000h		Refer to the name and function field.
PC23		For manufacturer setting Do not change this value by any means.	0000h		
PC24		Not used in indexer positioning operation. Do not change the parameter.	0000h		
PC25		For manufacturer setting Do not change this value by any means.	0000h		
PC26	*COP5	Function selection C-5 Select the stroke limit warning (A99). 0 0 0 □ Stroke limit warning (A99) selection 0: Valid 1: Invalid When this parameter is set to "1", A99 will not occur if the forward rotation stroke end (LSP) or reverse rotation stroke end (LSN) turns OFF.	0000h		Refer to name and function column.
PC27		For manufacturer setting Do not change this value by any means.	0000h		
PC28		Not used in indexer positioning operation. Do not change the parameter.	0000h		

No.	Symbol	Name and function	Initial value	Unit	Setting range
PC29		For manufacturer setting Do not change this value by any means.	0000h		
PC30	*DSS	Remote register-based position/speed specifying system selection This parameter is made valid when Position/speed specification selection (RY(n+2)A) is turned ON with 2 stations occupied. Select how to receive the position command and speed command. When 1 station is occupied, selection of "0001" or "0002" will result in a parameter error. 0 0 0 □ Set value 0: Position command: Set the station No.; Speed command: Specify the servo point table No. Set value 1: Position command: Set the station No.; Speed command: Specify the servo motor speed. (Note) Note. In the case, always set the acceleration/deceleration time constant in the point table No.1.	0000h		Refer to name and function column.
PC31		Not used in indexer positioning operation. Do not change the parameter.	0		
PC32					
PC33			0		
PC34					
PC35	TL2	Internal torque limit 2 Set this parameter to limit servo motor torque on the assumption that the maximum torque is 100[%]. When 0 is set, torque is not produced.	100.0	%	0 to 100.0
PC36		For manufacturer setting Do not change this value by any means.	0000h		
PC37		Not used in indexer positioning operation. Do not change the parameter.	0		
PC38					
PC39			0		
PC40					
PC41		For manufacturer setting Do not change this value by any means.	0000h		
PC42			0000h		
PC43			0000h		
PC44			0000h		
PC45	*COP9	Function selection C-9 Select the manual operation mode. 0 0 0 □ Manual operation for indexer positioning operation selection (Refer to section 16.7.3) 0: Indexer JOG operation 1: JOG operation	0000h		0000h to 0001h

Sub-table for PC30:

Set value	Position command	Speed command
0	Set the station No.	Specify the servo point table No.
1		Specify the servo motor speed. (Note)

<table>
<tr><th>No.</th><th>Symbol</th><th>Name and function</th><th>Initial value</th><th>Unit</th><th>Setting range</th></tr>
<tr><td>PC46</td><td>*STN</td><td>Indexer positioning operation number of stations/rotation
Set the number of stations (dividing number) per machine rotation. When the setting value is 2 or lower, the number of stations is set to 2.
<table>
<tr><th>Setting value</th><th>Number of stations</th></tr>
<tr><td>0000</td><td>2</td></tr>
<tr><td>0001</td><td>2</td></tr>
<tr><td>0002</td><td>2</td></tr>
<tr><td>0003</td><td>3</td></tr>
<tr><td>0004</td><td>4</td></tr>
<tr><td>.
.
.</td><td>.
.
.</td></tr>
<tr><td>00FF</td><td>255</td></tr>
</table></td><td>0000h</td><td>Number of stations</td><td>0000h
to
00FFh</td></tr>
<tr><td>PC47</td><td>PSST</td><td>Indexer positioning operation station home position shift distance
This parameter is available only in the absolute position detection system.
Set the distance for shifting the home position toward the set home position in number of pulses.
This shift distance does not become valid immediately after the home position setting. It becomes valid after turning off and then on the power.
When the sift distance is larger than the in-position range, the in position (RXn1) does not turn on at power-on.
Set the number of pulses to be shifted after converting it into hexadecimal.
The setting range is from −2000 to 2000 pulse.</td><td>0000h</td><td>pulse</td><td>Refer to name and function column</td></tr>
<tr><td>PC48</td><td rowspan="3"></td><td rowspan="3">For manufacturer setting
Do not change this value by any means.</td><td>0000h</td><td rowspan="3"></td><td rowspan="3"></td></tr>
<tr><td>PC49</td><td>0000h</td></tr>
<tr><td>PC50</td><td>0000h</td></tr>
</table>

(3) Alarm history clear

The alarm history can be confirmed by using the set up software(MR Configurator). The driver stores one current alarm and five past alarms from when its power is switched on first. To control alarms which will occur during operation, clear the alarm history using parameter No.PC18 (alarm history clear) before starting operation. Clearing the alarm history automatically returns to "□□□0".

This parameter is made valid by switching power off, then on after setting.

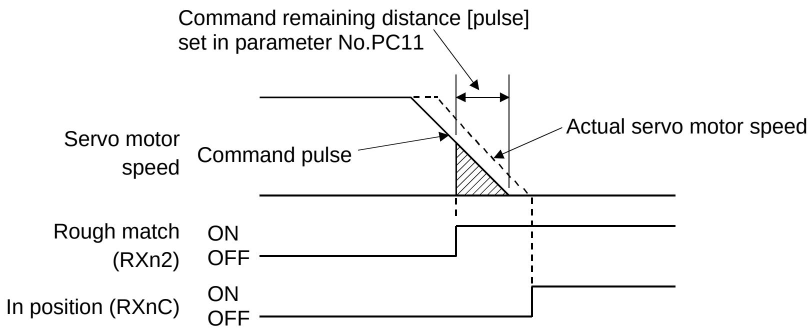
Parameter No.16

0	0	0	

Alarm history clear
0: Invalid (not cleared)
1: Valid (cleared)

(4) Rough match output

Rough match (RXn2) is output when the command remaining distance reaches the value set in parameter No.PC11 (rough match output range). The setting range is 0 to 65535 [pulse].



15.11.4 I/O setting parameters (No.PD□□)

(1) Parameter list

No.	Symbol	Name	Initial value	Unit
PD01	*DIA1	Input signal automatic ON selection 1	0000h	
PD02		For manufacturer setting	0000h	
PD03		Not used in indexer positioning operation.	0000h	
PD04			0000h	
PD05		For manufacturer setting	0000h	
PD06		Not used in indexer positioning operation.	002Bh	
PD07			000Ah	
PD08			000Bh	
PD09			0002h	
PD10			0003h	
PD11			0024h	
PD12			0C00h	
PD13		For manufacturer setting	0000h	
PD14		Not used in indexer positioning operation.	0800h	
PD15		For manufacturer setting	0000h	
PD16	*DIAB	Input polarity selection	0000h	
PD17		For manufacturer setting	0000h	
PD18			0000h	
PD19	*DIF	Response level setting	0002h	
PD20	*DOP1	Function selection D-1	0010h	
PD21		For manufacturer setting	0000h	
PD22		Not used in indexer positioning operation.	0000h	
PD23		For manufacturer setting	0000h	
PD24	*DOP5	Function selection D-5	0000h	
PD25		For manufacturer setting	0000h	
PD26	TLT	Indexer positioning operation torque limit delay time	0064h	
PD27		For manufacturer setting	0000h	
PD28			0000h	
PD29			0000h	
PD30			0000h	

(2) Detail list

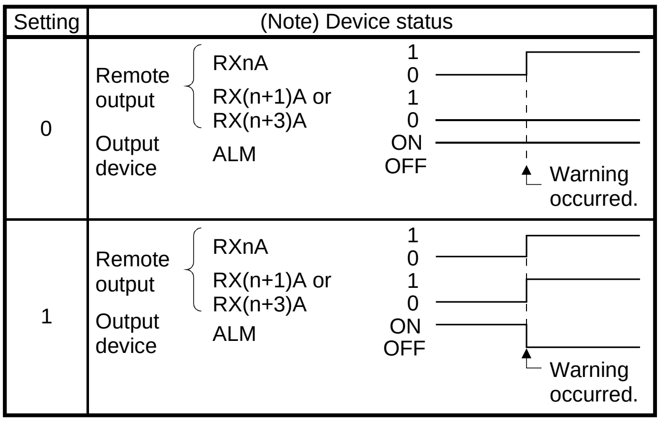
<table>
<tr><th>No.</th><th>Symbol</th><th>Name and function</th><th>Initial value</th><th>Unit</th><th>Setting range</th></tr>
<tr><td>PD01</td><td>*DIA1</td><td>Input signal automatic ON selection 1
Select the input devices to be automatically turned ON.
part is for manufacturer setting. Do not set the value by any means.

□ □ 0 0
<table>
<tr><th rowspan="2">Device name</th><th colspan="2">Initial value</th></tr>
<tr><th>BIN</th><th>HEX</th></tr>
<tr><td></td><td>0</td><td rowspan="4">0</td></tr>
<tr><td></td><td>0</td></tr>
<tr><td>Forward rotation stroke end (LSP)</td><td>0</td></tr>
<tr><td>Reverse rotation stroke end (LSN)</td><td>0</td></tr>
</table>
<table>
<tr><th rowspan="2">Device name</th><th colspan="2">Initial value</th></tr>
<tr><th>BIN</th><th>HEX</th></tr>
<tr><td>Forced stop (EMG)</td><td>0</td><td rowspan="4">0</td></tr>
<tr><td></td><td>0</td></tr>
<tr><td></td><td>0</td></tr>
<tr><td></td><td>0</td></tr>
</table>
BIN 0: Used as external input signal.
BIN 1: Automatic ON

For example, to turn ON SON, the setting is "□□□4".</td><td>0000h</td><td></td><td>Refer to name and function column.</td></tr>
<tr><td>PD02</td><td></td><td>For manufacturer setting
Do not change this value by any means.</td><td>0000h</td><td></td><td></td></tr>
<tr><td>PD03</td><td rowspan="2"></td><td rowspan="2">Not used in indexer positioning operation.
Do not change the parameter.</td><td>0000h</td><td rowspan="2"></td><td rowspan="2"></td></tr>
<tr><td>PD04</td><td>0000h</td></tr>
<tr><td>PD05</td><td></td><td>For manufacturer setting
Do not change this value by any means.</td><td>0000h</td><td></td><td></td></tr>
<tr><td>PD06</td><td rowspan="7"></td><td rowspan="7">Not used in indexer positioning operation.
Do not change the parameter.</td><td>002Bh</td><td rowspan="7"></td><td rowspan="7"></td></tr>
<tr><td>PD07</td><td>000Ah</td></tr>
<tr><td>PD08</td><td>000Bh</td></tr>
<tr><td>PD09</td><td>0002h</td></tr>
<tr><td>PD10</td><td>0003h</td></tr>
<tr><td>PD11</td><td>0024h</td></tr>
<tr><td>PD12</td><td>0C00h</td></tr>
<tr><td>PD13</td><td></td><td>For manufacturer setting
Do not change this value by any means.</td><td>0000h</td><td></td><td></td></tr>
<tr><td>PD14</td><td></td><td>Not used in indexer positioning operation.
Do not change the parameter.</td><td>0800h</td><td></td><td></td></tr>
<tr><td>PD15</td><td></td><td>For manufacturer setting
Do not change this value by any means.</td><td>0000h</td><td></td><td></td></tr>
<tr><td>PD16</td><td>*DIAB</td><td>Input polarity selection
Used to set the proximity dog input polarity. (Refer to section 5.6.)

0 0 0 □
Proximity dog input polarity
0: OFF indicates detection of the dog
1: ON indicates detection of the dog</td><td>0000h</td><td></td><td>Refer to name and function column.</td></tr>
</table>

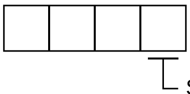
No.	Symbol	Name and function	Initial value	Unit	Setting range
PD17		For manufacturer setting Do not change this value by any means.	0000h		
PD18			0000h		
PD19	*DIF	Response level setting Used to select the input. 0 0 0 □ Input filter If external input signal causes chattering due to noise, etc., input filter is used to suppress it. 0: None 1: 0.88[ms] 2: 1.77[ms] 3: 2.66[ms] 4: 3.55[ms] 5: 4.44[ms]	0002h		Refer to name and function column.
PD20	*DOP1	Function selection D-1 Select the stop processing at forward rotation stroke end (LSN)/reverse rotation stroke end (LSN) OFF and the base circuit status at reset (RY(N+1)A or RY(n+3)A) ON. 0 0 □ □ Stopping method used when forward rotation stroke end (LSP), reverse rotation stroke end (LSN) device or software limit is valid 0: Sudden stop (home position erased) 1: Slow stop (home position erased) 2: Slow stop (Setting contents is the same as for “1”.) 3: Sudden stop (Setting contents is the same as for “0”.) Even in this case, when LSP or LSN is detected, home position return is required again before executing automatic operation. However, in the absolute position detection system (parameter No.PA03:□□□1), the home position return completion (ZP) can be turned on by turning on the servo-on. In the case, executing another home position. Selection of base circuit status at reset (RY(n+1)A or RY(n+3)A)ON 0: Base circuit not switched off 1: Base circuit switched off	0010h		Refer to name and function column.
PD21		For manufacturer setting Do not change this value by any means.	0000h		
PD22		Not used in indexer positioning operation. Do not change the parameter.	0000h		
PD23		For manufacturer setting Do not change this value by any means.	0000h		

<table>
<tr><th>No.</th><th>Symbol</th><th>Name and function</th><th>Initial value</th><th>Unit</th><th>Setting range</th></tr>
<tr><td>PD24</td><td>*DOP5</td><td>Function selection D-5
Select the output status of the warning (RXnA).
0 0 _ 0
Selection of output device at warning occurrence
Select the warning (RXnA) and trouble (RX(n+1)A or RX(n+3)A) output status at warning occurrence.

Note. 0: OFF
1: ON</td><td>0000h</td><td></td><td></td></tr>
<tr><td>PD25</td><td></td><td>For manufacturer setting
Do not change this value by any means.</td><td>0000h</td><td></td><td></td></tr>
<tr><td>PD26</td><td>TLT</td><td>Indexer positioning operation torque limit delay time
Set the delay time from when the in position (RXn1) turns on until the internal torque limit 2 (parameter No.PC35) becomes effective.
Set the delay time after converting it into hexadecimal. The setting range is from 0 to 1000 ms.</td><td>0064h</td><td>ms</td><td>Refer to name and function column.</td></tr>
<tr><td>PD27</td><td rowspan="4"></td><td rowspan="4">For manufacturer setting
Do not change this value by any means.</td><td>0000h</td><td rowspan="4"></td><td rowspan="4"></td></tr>
<tr><td>PD28</td><td>0000h</td></tr>
<tr><td>PD29</td><td>0000h</td></tr>
<tr><td>PD30</td><td>0000h</td></tr>
</table>

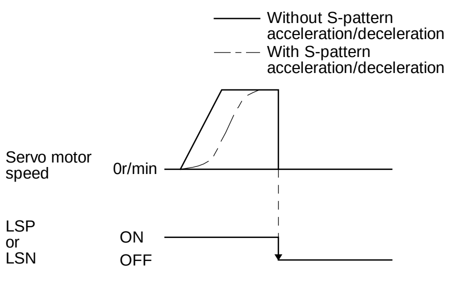
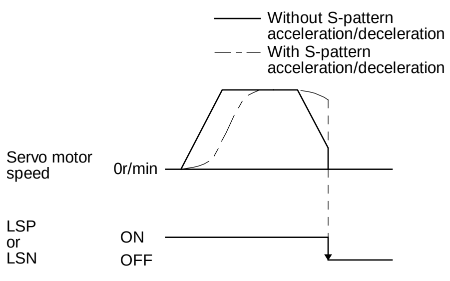
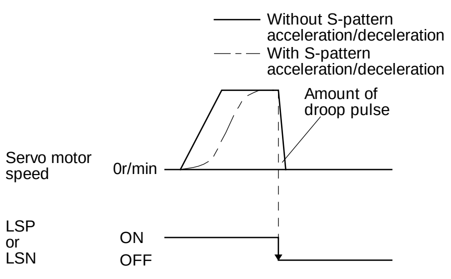
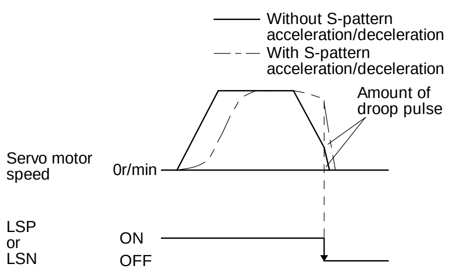
(3) Stopping method when the forward stroke end (LSP) or reverse stroke end (LSN) is valid

The setting of the first digit of parameter No.PD20 enables to select a stopping method of the servo motor when the forward rotation stroke end (LSP) or reverse rotation stroke end (LSN) turns off.

Parameter No.PD20



Stopping method when the forward rotation stroke end (LSP) or reverse rotation stroke end (LSN) is valid
0: Sudden stop (home position erased)
1: Slow stop (home position erased)
2: Slow stop (Setting contents is the same as for “1”.)
3: Sudden stop (Setting contents is the same as for “0”.)

<table>
<tr><th rowspan="2">Setting value of parameter No.PD20</th><th colspan="2">Operation status</th><th rowspan="2">Remarks</th></tr>
<tr><th>When rotating at constant speed</th><th>When decelerating to stop</th></tr>
<tr><td>□□□0
(Initial value)
·
□□□3</td><td>
</td><td>
</td><td>Clears droop pulses and stops.
Erases the home position.
A difference occurs between the command position and the current position.
Execute a home position return again.</td></tr>
<tr><td>□□□1
·
□□□2</td><td>
</td><td>
</td><td>Moves for the amount of droop pulse and stops.
Erases the home position.
A difference occurs between the command position and the current position.
Execute a home position return again.</td></tr>
</table>

15.12 TROUBLESHOOTING

15.12.1 Trouble at start-up

CAUTION	・Excessive adjustment or change of parameter setting must not be made as it will make operation instable.

POINT

・Using the set up software(MR Configurator), you can refer to unrotated servo motor reasons, etc.

The following faults may occur at start-up. If any of such faults occurs, take the corresponding action.

No.	Start-up sequence	Fault	Investigation	Possible cause	Reference
1	Power on	・LED is not lit. ・LED flickers.	Not improved if connectors CN2, CN3 and CN6 are disconnected.	1. Power supply voltage fault 2. Driver is faulty.	
			Improved when connectors CN6 is disconnected.	Power supply of CN6 cabling is shorted.	
			Improved when connector CN2 is disconnected.	1. Power supply of encoder cabling is shorted. 2. Encoder is faulty.	
			Improved when connector CN3 is disconnected.	Power supply of CN3 cabling is shorted.	
		Alarm occurs.	Refer to section 15.12.4 and remove cause.		Section 15.12.4
2	Switch on servo-on (RYn0) signal.	Alarm occurs.	Refer to section 15.12.4 and remove cause.		Section 15.12.4
		Servo motor shaft is not servo-locked (is free).	1. Check the external I/O signal indication to see if the servo-on (RYn0) signal is ON.	1. Servo-on (RYn0) is not input. (Wiring mistake) 2. 24VDC power is not supplied to DICOM.	
3	Gain adjustment	Rotation ripples (speed fluctuations) are large at low speed.	Make gain adjustment in the following procedure. 1. Increase the auto tuning response level. 2. Repeat acceleration and deceleration several times to complete auto tuning.	Gain adjustment fault	Chapter 8
		Large load inertia moment causes the servo motor shaft to oscillate side to side.	If the servo motor may be run with safety, repeat acceleration and deceleration several times to complete auto tuning.	Gain adjustment fault	Chapter 8
4	Cyclic operation	Position shift occurs	Confirm the cumulative command pulses, cumulative feedback pulses and actual servo motor position.	Pulse counting error, etc. due to noise.	

15.12.2 Operation at error occurrence

An error occurring during operation will result in any of the statuses indicated in the following table.

Error location	Description	Operation mode	
		Test operation	CC-Link operation
Servo side alarm occurrence	Servo operation	Stop	Stop
	CC-Link data communication	Continued	Continued
Option unit communication error	Servo operation	Stop	Stop
	CC-Link data communication	Stop	Stop
CC-Link communication error	Servo operation	Stop	Stop
	CC-Link data communication	Stop	Stop
PC or PLC...etc error/STOP	Servo operation	Continued	Stop
	CC-Link data communication	Stop	Stop
Servo side warning occurrence	Servo operation	Stop	Continued
	CC-Link data communication	Continued	Continued

15.12.3 CC-Link communication error

This section gives the definitions of the indications given in the communication alarm display section.
The driver has four LED indications.

L.RUN : Lit at normal receive of refresh data. Extinguished when data is not received for a given period of time.
SD : Lit when send data is "0".
RD : Lit when the carrier of receive data is detected.
L.ERR : Lit when the data addressed to the host is in CRC or abort error.

(Note) Communication alarm display LED				Operation
L.RUN	SD	RD	L.ERR	
○	◎	◎	◎	Normal communication is made, but a CRC error sometimes occurs due to noise.
○	◎	◎	●	Normal communication
○	◎	●	◎	Hardware fault
○	◎	●	●	Hardware fault
○	●	◎	◎	Receive data results in CRC error, disabling a response.
○	●	◎	●	Data does not reach the host.
○	●	●	◎	Hardware fault
○	●	●	●	Hardware fault
●	◎	◎	◎	Polling response is made, but refresh receive is in CRC error.
●	◎	◎	●	Hardware fault
●	◎	●	◎	Hardware fault
●	◎	●	●	Hardware fault
●	●	◎	◎	Data addressed to the host resulted in CRC error.
●	●	◎	●	Data does not reach the host, or the data addressed to the host cannot be received due to noise.
●	●	●	◎	Hardware fault
●	●	●	○	Baud rate setting illegal
●	●	○	○	Station number setting illegal
●	○	○	◎	Baud rate or station number setting changed midway (ERROR flickers for about 4s)
●	●	●	●	Data cannot be received due to power-off, power supply failure, open cable, etc. WDT error occurrence (hardware fault)

Note. ○ : Lit ● : Extinguished ◎ : Flicker

15.12.4 When alarm or warning has occurred

POINT
· Configure up a circuit which will detect the trouble (ALM) signal and turn off the servo-on (RYn0) at occurrence of an alarm.

(1) Alarms and warning list

When a fault occurs during operation, the corresponding alarm or warning is displayed. If any alarm or warning has occurred, refer to (2), (3) in this section and take the appropriate action. When an alarm occurs, ALM turns off.

After its cause has been removed, the alarm can be deactivated in any of the methods marked ○ in the alarm deactivation column.

	Display	Name	Alarm deactivation		
			Power OFF→ON	(Note 3) MR Configurator parameter unit	(Note 2) Alarm reset (RES)
Alarms	A10	Undervoltage	○	○	○
	A12	Memory error 1 (RAM)	○		
	A13	Clock error	○		
	A15	Memory error 2 (EEP-ROM)	○		
	A16	Encoder error 1 (At power on)	○		
	A17	Board error	○		
	A19	Memory error 3 (Flash-ROM)	○		
	A1A	Motor combination error	○		
	A20	Encoder error 2	○		
	A24	Main circuit error	○	○	○
	A25	Absolute position erase	○		
	A30	Regenerative error	(Note 1) ○	(Note 1) ○	(Note 1) ○
	A31	Overspeed	○	○	○
	A32	Overcurrent	○		
	A33	Overvoltage	○	○	○
	A37	Parameter error	○		
	A45	Main circuit device overheat	(Note 1) ○	(Note 1) ○	(Note 1) ○
	A46	Servo motor overheat	(Note 1) ○	(Note 1) ○	(Note 1) ○
	A47	Cooling fan alarm	○		
	A50	Overload 1	(Note 1) ○	(Note 1) ○	(Note 1) ○
	A51	Overload 2	(Note 1) ○	(Note 1) ○	(Note 1) ○
	A52	Error excessive	○	○	○
	A61	Operation alarm	○	○	○
	A8A	Serial communication time-out error	○	○	○
	A8D	CC-Link alarm	○	○	○
	A8E	Serial communication error	○	○	○
	888	Watchdog	○		

	Display	Name
Warnings	A90	Home positioning incomplete warning
	A92	Open battery cable warning
	A96	Home position setting error
	A97	Next station warning
	A99	Stroke limit warning
	A9D	CC-Link warning 1
	A9E	CC-Link warning 2
	A9F	Battery warning
	AE0	Excessive regeneration warning
	AE1	Overload warning 1
	AE3	Absolute position counter warning
	AE6	Servo forced stop warning
	AE8	Cooling fan speed reduction warning
	AE9	Main circuit off warning
	AEC	Overload warning 2
	AED	Output watt excess warning

Note 1. Deactivate the alarm about 30 minutes of cooling time after removing the cause of occurrence.
2. Turns on RY(n+1)A or RY(n+3)A.
3. Clicking the "Alarm reset" button on the "Alarm display" screen of set up software(MR Configurator) allows an alarm to be deactivated.
Pressing the "STOP RESET" key of the parameter unit allows an alarm to be deactivated.

(2) Remedies for alarms

CAUTION	
⚠ CAUTION	・When any alarm has occurred, eliminate its cause, ensure safety, then reset the alarm, and restart operation. Otherwise, injury may occur. ・If an absolute position erase (A25) occurred, always make home position setting again. Not doing so may cause unexpected operation. ・As soon as an alarm occurs, turn off Servo-on (RYn0) and power off.

POINT

- When any of the following alarms has occurred, do not deactivate the alarm and resume operation repeatedly. To do so will cause the driver/servo motor to fail. Remove the cause of occurrence, and leave a cooling time of more than 30 minutes before resuming operation.
  - Regenerative error (A30)
  - Overload 1 (A50)
  - Overload 2 (A51)
- For the alarm deactivation method, refer to (1) in this section.

When an alarm occurs, the trouble (ALM) switches off and the dynamic brake is operated to stop the servo motor. At this time, the display indicates the alarm No.
The servo motor comes to a stop. Remove the cause of the alarm in accordance with this section. Use the set up software(MR Configurator) to refer to a factor of alarm occurrence.

Display	Name	Definition	Cause	Action
A10	Undervoltage	Power supply voltage dropped. LECSC2-□: 160VAC or less LECSC1-□: 83VAC or less	1. Power supply voltage is low.	Check the power supply.
			2. There was an instantaneous control power failure of 60ms or longer.	
			3. Shortage of power supply capacity caused the power supply voltage to drop at start, etc.	
			4. The bus voltage dropped to the following value or less. LECSC2-□: 200VDC LECSC1-□: 158VDC	
			5. Faulty parts in the driver. Checking method Alarm (A10) occurs if power is switched on after disconnection of all cables but the control circuit power supply cables.	Change the driver.
A12	Memory error 1 (RAM)	RAM, memory fault	Faulty parts in the driver. Checking method Alarm (any of A12 and A13) occurs if power is switched on after disconnection of all cables but the control circuit power supply cables.	Change the driver.
A13	Clock error	Printed board fault		

Display	Name	Definition	Cause	Action
A15	Memory error 2 (EEP-ROM)	EEP-ROM fault	1. Faulty parts in the driver Checking method Alarm (A15) occurs if power is switched on after disconnection of all cables but the control circuit power supply cables.	Change the driver.
			2. The number of write times to EEP-ROM exceeded 100,000.	
			3. The multi-revolution data, which is saved as a home position, read from EEP-ROM is abnormal.	Execute a home position setting.
A16	Encoder error 1 (At power on)	Communication error occurred between encoder and driver.	1. Encoder connector (CN2) disconnected.	Connect correctly.
			2. Encoder fault	Change the servo motor.
			3. Encoder cable faulty (Wire breakage or shorted)	Repair or change the cable.
			4. Encoder cable type (2-wire, 4-wire) selection was wrong in parameter setting.	Correct the setting in the fourth digit of parameter No.PC22.
A17	Board error	CPU/parts fault	Faulty parts in the driver Checking method Alarm (A17 or A19) occurs if power is switched on after disconnection of all cables but the control circuit power supply cable.	Change the driver.
A19	Memory error 3 (Flash ROM)	ROM memory fault		
A1A	Motor combination error	Wrong combination of driver and servo motor.	Wrong combination of driver and servo motor connected.	Use correct combination.
A20	Encoder error 2	Communication error occurred between encoder and driver.	1. Encoder connector (CN2) disconnected.	Connect correctly.
			2. Encoder cable faulty (Wire breakage or shorted)	Repair or change the cable.
			3. Encoder fault	Change the servo motor.
A24	Main circuit error	Ground fault occurred at the servo motor power (U,V and W phases) of the driver.	1. Power input wires and servo motor power wires are in contact.	Connect correctly.
			2. Sheathes of servo motor power cables deteriorated, resulting in ground fault.	Change the cable.
			3. Main circuit of driver failed. Checking method Alarm (A24) occurs if the servo is switched on after disconnecting the U, V, W power cables from the driver.	Change the driver.

Display	Name	Definition	Cause	Action
A25	Absolute position erase	Absolute position data in error	1. Voltage drop in encoder (Battery disconnected.)	After leaving the alarm occurring for a few minutes, switch power off, then on again. Always make home position setting again.
			2. Battery voltage low	Change the battery. Always make home position setting again.
			3. Battery cable or battery is faulty.	
		Power was switched on for the first time in the absolute position detection system.	4. Home position not set.	After leaving the alarm occurring for a few minutes, switch power off, then on again. Always make home position setting again.
A30	Regenerative error	Permissible regenerative power of the built-in regenerative resistor or regenerative option is exceeded.	1. Wrong setting of parameter No. PA02	Set correctly.
			2. Built-in regenerative resistor or regenerative option is not connected.	Connect correctly
			3. High-duty operation or continuous regenerative operation caused the permissible regenerative power of the regenerative option to be exceeded. Checking method Call the status display and check the regenerative load ratio.	1. Reduce the frequency of positioning. 2. Use the regenerative option of larger capacity. 3. Reduce the load.
			4. Power supply voltage is abnormal. LECSC2-□□:260VAC or more LECSC1-□□:More than 135VAC	Check the power supply
			5. Built-in regenerative resistor or regenerative option faulty.	Change the driver or regenerative option.
		Regenerative transistor fault	6. Regenerative transistor faulty. Checking method 1) The regenerative option has overheated abnormally. 2) The alarm occurs even after removal of the built-in regenerative resistor or regenerative option.	Change the driver.
A31	Overspeed	Speed has exceeded the instantaneous permissible speed.	1. Input command pulse frequency exceeded the permissible instantaneous speed frequency.	Set command pulses correctly.
			2. Small acceleration/deceleration time constant caused overshoot to be large.	Increase acceleration/deceleration time constant.
			3. Servo system is instable to cause overshoot.	1. Re-set servo gain to proper value. 2. If servo gain cannot be set to proper value. 1) Reduce load inertia moment ratio; or 2) Reexamine acceleration/ deceleration time constant.
			4. Electronic gear ratio is large (parameters No.PA06, PA07)	Set correctly.
			5. Encoder faulty.	Change the servo motor.

Display	Name	Definition	Cause	Action
A32	Overcurrent	Current that flew is higher than the permissible current of the driver. (If the alarm (A32) occurs again when turning ON the servo after resetting the alarm by turning OFF/ON the power when the alarm (A32) first occurred, the transistor (IPM, IGBT) of the driver may be at fault. In the case, do not repeat to turn OFF/ON the power. Check the transistor with the checking method of "Cause 2".)	1. Short occurred in servo motor power (U, V, W).	Correct the wiring.
			2. Transistor (IPM, IGBT) of the driver faulty. Checking method Alarm (A32) occurs if power is switched on after U,V and W are disconnected.	Change the driver.
			3. Ground fault occurred in servo motor power (U, V, W).	Correct the wiring.
			4. External noise caused the overcurrent detection circuit to misoperate.	Take noise suppression measures.
A33	Overvoltage	The following shows the input value of converter bus voltage. LECSC□-□: 400VDC or more	1. Regenerative option is not used.	Use the regenerative option.
			2. Though the regenerative option is used, the parameter No.PA02 setting is "□□00 (not used)".	Set correctly.
			3. Lead of built-in regenerative resistor or regenerative option is open or disconnected.	1. Change the lead. 2. Connect correctly.
			4. Regenerative transistor faulty.	Change the driver
			5. Wire breakage of built-in regenerative resistor or regenerative option.	1. For wire breakage of built-in regenerative resistor, change the driver. 2. For wire breakage of regenerative option, change the regenerative option.
			6. Capacity of built-in regenerative resistor or regenerative option is insufficient.	Add regenerative option or increase capacity.
			7. Power supply voltage high.	Check the power supply.
			8. Ground fault occurred in servo motor power (U, V, W).	Correct the wiring.

Display	Name	Definition	Cause	Action
A37	Parameter error	Parameter setting is wrong.	1. Driver fault caused the parameter setting to be rewritten.	Change the driver.
			2. Regenerative option not used with driver was selected in parameter No.PA02.	Set parameter No.PA02 correctly.
			3. Value outside setting range has been set in electronic gear.	Set parameters No.PA06, PA07 correctly.
			4. The number of write times to EEP-ROM exceeded 100,000 due to parameter write, etc.	Change the driver.
			5. The MR-J3-D01 (Mitsubishi Electric Corporation) is connected to the driver for the indexer positioning operation.	The MR-J3-D01 (Mitsubishi Electric Corporation) cannot be used for the indexer positioning operation.
		Point table setting is wrong.	6. Setting value is out of the setting range.	Set it correctly.
A45	Main circuit device overheat	Main circuit device overheat.	1. Driver faulty.	Change the driver.
			2. The power supply was turned on and off continuously by overloaded status.	The drive method is reviewed.
			3. Ambient temperature of servo motor is over 55℃ (131°F).	Check environment so that ambient temperature is 0 to 55℃ (32 to 131°F).
			4. Used beyond the specifications of close mounting.	Use within the range of specifications.
A46	Servo motor overheat	Servo motor temperature rise actuated the thermal sensor.	1. Ambient temperature of servo motor is over 40℃ (104°F).	Check environment so that ambient temperature is 0 to 40℃ (32 to 104°F).
			2. Servo motor is overloaded.	1. Reduce load. 2. Check operation pattern. 3. Use servo motor that provides larger output.
			3. Thermal sensor in encoder is faulty.	Change the servo motor.
A47	Cooling fan alarm	The cooling fan of the driver stopped, or its speed decreased to or below the alarm level.	Cooling fan life expiration (Refer to section 2.5.)	Change the cooling fan of the driver.
			Foreign matter caught in the cooling fan stopped rotation.	Remove the foreign matter.
			The power supply of the cooling fan failed.	Change the driver.

Display	Name	Definition	Cause	Action
A50	Overload 1	Load exceeded overload protection characteristic of driver.	1. Driver is used in excess of its continuous output current.	1. Reduce load. 2. Check operation pattern. 3. Use servo motor that provides larger output.
			2. Servo system is instable and hunting.	1. Repeat acceleration/deceleration to execute auto tuning. 2. Change auto tuning response setting. 3. Set auto tuning to OFF and make gain adjustment manually.
			3. Machine struck something.	1. Check operation pattern. 2. Install limit switches.
			4. Wrong connection of servo motor. Driver's output terminals U, V, W do not match servo motor's input terminals U, V, W.	Connect correctly.
			5. Encoder faulty. Checking method When the servo motor shaft is rotated with the servo off, the cumulative feedback pulses do not vary in proportion to the rotary angle of the shaft but the indication skips or returns midway.	Change the servo motor.
			6. After Overload 2 (A51) occurred, turn OFF/ON the power supply to clear the alarm. Then the overload operation is repeated.	1. Reduce load. 2. Check operation pattern. 3. Use servo motor that provides larger output.
A51	Overload 2	Machine collision or the like caused max. For the time of the alarm occurrence, refer to the section 12.1.	1. Machine struck something.	1. Check operation pattern. 2. Install limit switches.
			2. Wrong connection of servo motor. Driver's output terminals U, V, W do not match servo motor's input terminals U, V, W.	Connect correctly.
			3. Servo system is instable and hunting.	1. Repeat acceleration/deceleration to execute auto tuning. 2. Change auto tuning response setting. 3. Set auto tuning to OFF and make gain adjustment manually.
			4. Encoder faulty. Checking method When the servo motor shaft is rotated with the servo off, the cumulative feedback pulses do not vary in proportion to the rotary angle of the shaft but the indication skips or returns midway.	Change the servo motor.

Display	Name	Definition	Cause	Action
A52	Error excessive	The difference between the model position and the actual servo motor position exceeds three rotations. (Refer to the function block diagram in section 1.1.2.)	1. Acceleration/deceleration time constant is too small.	Increase the acceleration/deceleration time constant.
			2. Forward rotation torque limit (parameter No.PA11) or reverse rotation torque limit (parameter No.PA12) are too small.	Increase the torque limit value.
			3. Motor cannot be started due to torque shortage caused by power supply voltage drop.	1. Check the power supply capacity. 2. Use servo motor which provides larger output.
			4. Position loop gain (parameter No.PB08) value is small.	Increase set value and adjust to ensure proper operation.
			5. Servo motor shaft was rotated by external force.	1. When torque is limited, increase the limit value. 2. Reduce load. 3. Use servo motor that provides larger output.
			6. Machine struck something.	1. Check operation pattern. 2. Install limit switches.
			7. Encoder faulty.	Change the servo motor.
			8. Wrong connection of servo motor. Driver's output terminals U, V, W do not match servo motor's input terminals U, V, W.	Connect correctly.
A61	Operation alarm	Setting mistake of auxiliary function.	"1" or "3" is set for the auxiliary function of point table No.255.	Set "0" or "2" for the value of auxiliary function.
A8A	Serial communication time-out error	Communication stopped for longer than the specified time.	1. Communication cable breakage.	Repair or change the communication cable.
			2. Communication cycle longer than regulated time.	Shorten the communication cycle.
			3. Wrong protocol.	Correct protocol.
A8D	CC-Link alarm	Normal communication with the master station cannot be made.	1. The station number switch (STATION NO.) setting is 0 or not less than 65.	Set the station number to within the range 1 to 64, and switch power on.
			2. The baud rate switch (MODE) setting is outside the range 0 to 4.	Set the baud rate switch (MODE) to within the range 0 to 4.
			3. The transmission status is abnormal.	Reexamine the wiring.
			4. CC-Link twisted cable wiring incorrect.	1. Repair or change the CC-Link twisted cable. 2. Connect the cable or connector correctly.
			5. CC-Link twisted cable faulty.	
			6. The CC-Link connector has come off.	
			7. The terminating resistor is not connected.	Connect the terminating resistor correctly.
			8. Noise entered the CC-Link twisted cable.	
			9. The CC-Link master unit was reset.	
A8E	Serial communication error	Serial communication error occurred between driver and communication device (e.g. personal computer).	1. Communication cable fault (Open cable or short circuit).	Repair or change the cable.
			2. Communication device (e.g. personal computer) faulty.	Change the communication device (e.g. personal computer).

Display	Name	Definition	Cause	Action
(Note) 888	Watchdog	CPU, parts faulty.	Fault of parts in driver. Checking method Alarm (888) occurs if power is switched on after disconnection of all cables but the control circuit power supply cable.	Change the driver.

Note. At power-on, "888" appears instantaneously, but it is not an error.

(3) Remedies for warnings

CAUTION	・If an absolute position counter warning (AE3) occurred, always make home position setting again. Not doing so may cause unexpected operation.

POINT

- When any of the following alarms has occurred, do not resume operation by switching power of the driver OFF/ON repeatedly. The driver and servo motor may become faulty. If the power of the driver is switched OFF/ON during the alarms, allow more than 30 minutes for cooling before resuming operation.
  - Excessive regenerative warning (AE0)
  - Overload warning 1 (AE1)
- Always execute a home position return when the forward rotation stroke end (LSP) or the reverse rotation stroke end (LSN) turns off.

If AE6 occur, the servo off status is established. If any other warning occurs, operation can be continued but an alarm may take place or proper operation may not be performed.
Remove the cause of warning according to this section. Use the set up software(MR Configurator) to refer to a factor of warning occurrence.

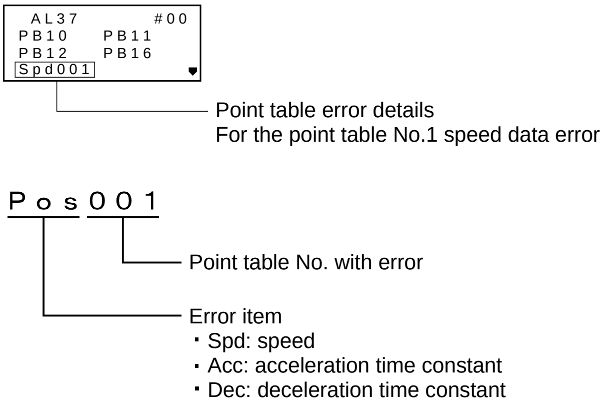
Display	Name	Definition		Cause	Action
A90	Home position return incomplete	In incremental system	Positioning operation was performed without home position return.	1. Positioning operation was performed without home position return.	Perform home position return.
			Home position return ended abnormally.	2. Home position return speed could not be decreased to creep speed.	Check home position return speed/creep speed/moving distance after proximity dog.
				3. Limit switch was actuated during home position return starting at other than position beyond dog.	
			Home position return is incomplete.	4. Indexer JOG operation (in automatic/ manual operation) was executed without home position return.	Perform home position return. This warning is automatically cleared after executing a home position return.
				5. The operation method (parameter No.PA01), electronic gear (parameter No.PA06 and PA07), station No. direction selection (parameter No.PA14), or number of stations/rotation (parameter No.PC46) is changed.	
		In absolute position detection system	Positioning operation was performed without home position setting.	1. Positioning operation was performed without home position setting.	Perform home position setting.
			Home position setting ended abnormally.	2. Home position setting speed could not be decreased to creep speed. 3. Limit switch was actuated during home position setting starting at other than position beyond dog.	Check home position setting speed/creep speed/moving distance after proximity dog.
			Operation was performed without making home position setting while an absolute position erase (A25) is being occurred.	4. Voltage drop in encoder (Battery disconnected.)	After leaving the alarm occurring for a few minutes, switch power off, then on again. Always make home position setting again.
				5. Battery voltage low	Change the battery. Always make home position setting again.
				6. Battery cable or battery is faulty.	
			Home position setting is incomplete.	7. Indexer JOG operation (in automatic/ manual operation) was executed without home position setting.	Perform home position setting. This warning is automatically cleared after executing a home position setting.
				8. The operation method (parameter No.PA01), electronic gear (parameter No.PA06 and PA07), station No. direction selection (parameter No.PA14), or number of stations/rotation (parameter No.PC46) is changed.	

Display	Name	Definition	Cause	Action
A92	Open battery cable warning	Absolute position detection system battery voltage is low.	1. Battery cable is open.	Repair cable or changed.
			2. Battery voltage supplied from the driver to the encoder fell to about 3V or less. (Detected with the encoder)	Change the battery.
A96	Home position setting error	Home position setting could not be made.	1. Droop pulses remaining are greater than the in-position range setting.	Remove the cause of droop pulse occurrence
			2. Command pulse entered after clearing of droop pulses.	Do not enter command pulse after clearing of droop pulses.
			3. Creep speed high.	Reduce creep speed.
A97	Next station warning	Automatic operation is executed with invalid next station setting.	1. Automatic operation has been started when station number that exceeded the setting value of parameter No.PC46 (number of stations/rotation) is specified.	Specify the station number up to the maximum number of stations set in the parameter No.PC46 (indexer positioning operation number of stations/rotation).
			2. Automatic operation has been started when the next station selection 1 to 8 (RYnA to RYnE, and RY(n+2)3 to RY(n+2)5) are all set to on.	
A99	Stroke limit warning	The limit switch become valid.	The stroke end (LSP or LSN) of the direction which gave instructions was turned off.	Reexamine the operation pattern to turn LSP/LSN ON.
A9D	CC-Link warning 1	The station number switch or baud rate switch position was changed from the setting at power-on.	1. The station number switch position was changed from the setting at power-on.	Return to the setting at power-on.
			2. The baud rate switch position was changed from the setting at power-on.	
			3. The occupied station count switch position was changed from the setting at power-on.	
A9E	CC-Link warning 2	Communication error of cable.	1. The transmission status is abnormal.	Take measures against noise.
			2. CC-Link twisted cable wiring incorrect.	1. Change the CC-Link twisted cable. 2. Connect the cable or connector correctly.
			3. CC-Link twisted cable faulty.	
			4. The CC-Link connector has come off.	
			5. The terminating resistor is not connected.	Connect the terminating resistor correctly.
			6. Noise entered the CC-Link twisted cable.	
A9F	Battery warning	Voltage of battery for absolute position detection system reduced.	Battery voltage fell to 3.2V or less. (Detected with the driver)	Change the battery.
AE0	Excessive regenerative warning	There is a possibility that regenerative power may exceed permissible regenerative power of built-in regenerative resistor or regenerative option.	Regenerative power increased to 85% or more of permissible regenerative power of built-in regenerative resistor or regenerative option. Checking method Call the status display and check regenerative load ratio.	1. Reduce frequency of positioning. 2. Change the regenerative option for the one with larger capacity. 3. Reduce load.
AE1	Overload warning 1	There is a possibility that overload alarm 1 or 2 may occur.	Load increased to 85% or more of overload alarm 1 or 2 occurrence level. Cause, checking method Refer to A50, A51.	Refer to A50, A51.

Display	Name	Definition	Cause	Action
AE3	Absolute position counter warning	Absolute position encoder pulses faulty.	1. Noise entered the encoder.	Take noise suppression measures.
			2. Encoder faulty.	Change the servo motor.
		The multi-revolution counter value of the absolute position encoder exceeded the maximum revolution range.	3. The movement amount from the home position exceeded a 32767 rotation or 37268 rotation in succession.	Make home position setting again.
		The update cycle for writing the multi-revolution counter value of the absolute position encoder to EEPROM is short.	Refer to POINT in section 15.7.	Refer to POINT in section 15.7.
AE6	Servo forced stop warning	EMG is off.	External forced stop was made valid. (EMG was turned off.)	Ensure safety and deactivate forced stop.
AE8	Cooling fan speed reduction warning	The speed of the driver decreased to or below the warning level.	Cooling fan life expiration (Refer to section 2.5.)	Change the cooling fan of the driver.
			The power supply of the cooling fan is broken.	Change the driver.
AE9	Main circuit off warning	Servo-on (SON) was switched on with main circuit power off.		Switch on main circuit power.
AEC	Overload warning 2	Operation, in which a current exceeding the rating flew intensively in any of the U, V and W phases of the servo motor, was repeated.	During a stop, the status in which a current flew intensively in any of the U, V and W phases of the servo motor occurred repeatedly, exceeding the warning level.	1. Reduce the positioning frequency at the specific positioning address. 2. Reduce the load. 3. Replace the driver/ servo motor with the one of larger capacity.
AED	Output watt excess warning	The status, in which the output wattage (speed × torque) of the servo motor exceeded the rated output, continued steadily.	Continuous operation was performed with the output wattage (speed × torque) of the servo motor exceeding 150% of the rated output.	1. Reduce the servo motor speed. 2. Reduce the load.

15.12.5 Point table error

When a point table error occurs, the parameter error (A37) occurs. After the parameter No. of parameter error (A37), the point table error details are displayed.



16. SERVO MOTOR

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16. SERVO MOTOR

16.1 Servo motor with a lock

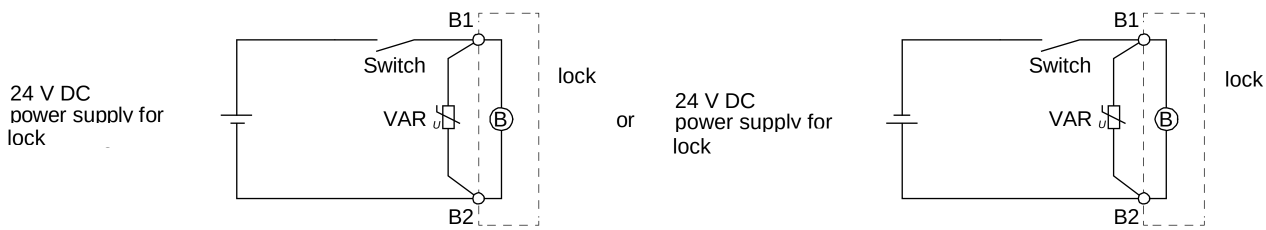
16.1.1 Features

⚠CAUTION	●The lock is provided to prevent a drop at a power failure or servo alarm occurrence during vertical drive or to hold a shaft at a stop. Do not use it for normal braking (including braking at servo-lock). ●The lock has a time lag. Use the lock so that servo motor control starts after the lock has completely opened. Be sure to check the time lag of the locking with a real machine. ●Configure a lock circuit so that it is activated also by an external EMG stop switch. ●While the lock is opened, the motor may be raised to high temperature regardless of driving. ●The life will be shorten under sudden acceleration/deceleration conditions.

The servo motor with a lock can be used to prevent a drop in vertical lift applications or to ensure double safety at an emergency stop, for example. When operating the servo motor, supply power to the lock to release the lock. Switching power off enables the lock.

(1) Lock power supply

Prepare the following power supply for use with the lock only. The lock terminals (B1 and B2) have no polarity.



The surge absorber (VAR) must be installed between B1 and B2. When you use a diode for a surge absorber, the locking time will be longer.

(2) Sound generation

Though the brake lining may rattle during operation, it poses no functional problem.
If braking sounds, it may be improved by setting the machine resonance suppression filter in the driver parameters.

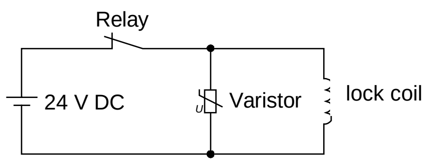
(3) Selection of surge absorbers for lock circuit

The following shows an example how to select a varistor with a surge absorber.

(a) Selection conditions

Item	Condition
Lock specification	R [Ω]: Resistance (Note) L [H]: Inductance (Note) Vb [V]: Power supply voltage
Desired suppression voltage	Vs [V] or less
Durable surge application time	N times

Note. Refer to section 16.1.2



(b) Tentative selection and verification of surge absorber

1) Maximum allowable circuit voltage of varistor

Tentatively select a varistor whose maximum allowable voltage is larger than Vb [V].

2) Lock current (Ib)

$$Ib = \frac{Vb}{R} \text{ [A]}$$

3) Energy (E) generated by lock coil

$$E = \frac{L \times Ib^2}{2} \text{ [J]}$$

4) Varistor limit voltage (Vi)

From the energy (E) generated in the lock coil and the varister characteristic diagram, calculate the varistor limit voltage (Vi) when the lock current (Ib) flows into the tentatively selected varistor during opening of the circuit.

Vi is favorable when the varistor limit voltage (Vi) [V] is smaller than the desired suppressed voltage (Vs) [V].

If Vi is not smaller than Vs, reselect a varistor or improve the withstand voltage of devices.

5) Surge current width (τ)

Given that the varistor absorbs all energies, the surge current width (τ) will be as follows.

$$\tau = \frac{E}{Vi \times Ib} \text{ [S]}$$

6) Examining surge life of varister

From the varistor characteristic diagram, the guaranteed current value (Ip) in which the number of the surge application life is N at the surge current width (τ). Calculate the guaranteed current value (Ip) ratio to lock current (Ib).

If an enough margin is ensured for Ip/Ib, the number of the surge application life N [time] can be considered as favorable.

(4) Others

A leakage magnetic flux will occur at the shaft end of the servo motor equipped with a lock. Note that chips, screws, etc. are attracted.

16.1.2 Characteristics of servo motor with a lock

⚠CAUTION	
	●The lock is provided to prevent a drop at a power failure or servo alarm occurrence during vertical drive or to hold a shaft at a stop. Do not use it for normal braking (including braking at servo-lock). ●Before performing the operation, be sure to confirm that the lock operates properly. ●The operation time of the lock differs depending on the power supply circuit you use. Be sure to check the operation delay time with a real machine.

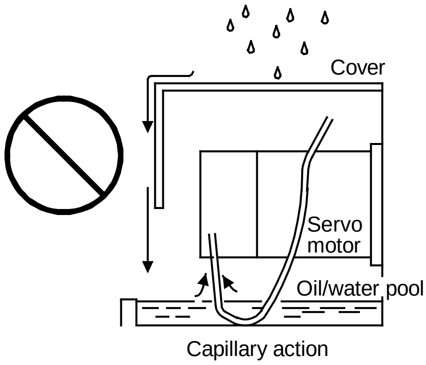
The characteristics (reference value) of the lock provided for the servo motor with a lock are indicated below.

Item	Servo motor	LE-□-B S5 (50W)	LE-□-B S6 (100W)	LE-□-B S7 (200W)	LE-□-B S8 (400W)
Type (Note 1)		Spring actuated type safety lock			
Rated voltage (Note 4)		24 V DC $^{0}_{-10\%}$			
Power consumption	[W] at 20 °C	6.3		7.9	
Coil resistance (Note 6)	[Ω]	91.0		73.0	
Inductance (Note 6)	[H]	0.15		0.18	
Lock static friction torque	[N•m]	0.32		1.3	
Release delay time (Note 2)	[s]	0.03		0.03	
Locking delay time (Note 2) [s]	DC off	0.01		0.02	
Permissible locking work	Per locking [J]	5.6		22	
	Per hour [J]	56		220	
Lock looseness at servo motor shaft (Note 5)	[degrees]	2.5		1.2	
Lock life (Note 3)	Number of lockings [times]	20000			
	Work per locking [J]	5.6		22	
Selection example of surge absorbers to be used (Note 7, 8)	For the suppressed voltage 145 V	TND20V-680KB (135[V])			
	For the suppressed voltage 370 V	TND10V-221KB (360[V])			

Note
1. There is no manual release mechanism. When it is necessary to hand-turn the servo motor shaft for machine centering, etc., use a separate 24 V DC power supply to release the lock electrically.
2. The value for initial on gap at 20 °C.
3. The lock gap will increase as the brake lining wears, but the gap is not adjustable.
   The lock life indicated is the number of locking cycles after which adjustment will be required.
4. Always prepare a power supply exclusively used for the lock.
5. These are design values. These are not guaranteed values.
6. These are measured values. These are not guaranteed values.
7. Select the lock control relay properly, considering the characteristics of the lock and surge absorber. When you use a diode for a surge absorber, the locking time will be longer.
8. Manufactured by Nippon Chemi-Con Corporation.

16.2 Protection from oil and water

(1) Do not use the servo motor with its cable soaked in oil or water.



(2) If oil such as cutting oil drops on the servo motor, the sealant, packing, cable and others may be affected depending on the oil type.

16.3 Cable

The standard motor and encoder cables routed from the servo motor should be fixed to the servo motor to keep them unmovable. Otherwise, the cable may disconnect. In addition, do not modify the connectors, terminals and others at the ends of the cables.

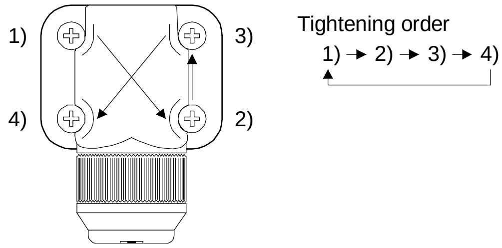
16.4 Rated speed of servo motor

The rated speed of servo motor (LE-S5-□, LE-S6-□, LE-S7-□, LE-S8-□) is 3000[r/min].

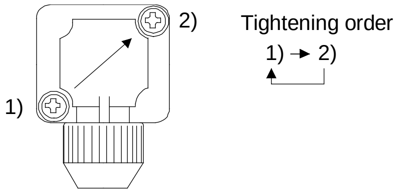
16.5 Mounting connectors

If the connector is not fixed securely, it may come off or may not produce a splash-proof effect during operation.
To achieve the IP rating IP65, pay attention to the following points and install the connectors.

(1) When screwing the connector, hold the connector still and gradually tighten the screws in a crisscross pattern.

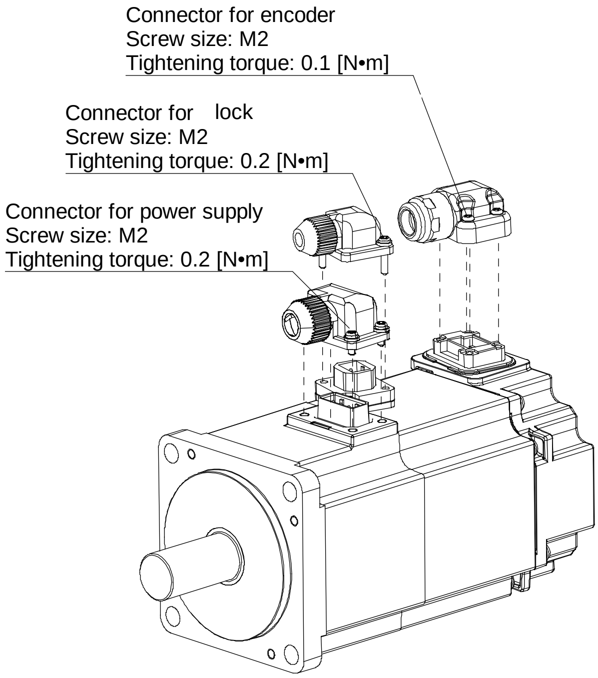


Connector for power supply, connector for encoder



Connector for lock

(2) Tighten the screws evenly. Tightening torques are as indicated below.



(3) The servo motor fitting part of each connector is provided with a splash-proof seal (O ring). When mounting a connector, use care to prevent the seal (O ring) from dropping and being pinched. If the seal (O ring) has dropped or is pinched, a splash-proof effect is not produced.

APPENDIX

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App. 1 Parameter list

POINT

- For any parameter whose symbol is preceded by *, set the parameter value and switch power off once, then switch it on again to make that parameter setting valid.

Basic setting parameters (PA □□)		
No.	Symbol	Name
PA01	*STY	Control mode
PA02	*REG	Regenerative option
PA03	*ABS	Absolute position detection system
PA04	*AOP1	Function selection A-1
PA05	*FTY	Feeding function selection
PA06	*CMX	Electronic gear numerator
PA07	*CDV	Electronic gear denominator
PA08	ATU	Auto tuning
PA09	RSP	Auto tuning response
PA10	INP	In-position range
PA11	TLP	Forward rotation torque limit
PA12	TLN	Reverse rotation torque limit
PA13		For manufacturer setting
PA14	*POL	Rotation direction selection
PA15	*ENR	Encoder output pulses
PA16 to PA18		For manufacturer setting
PA19	*BLK	Parameter write inhibit

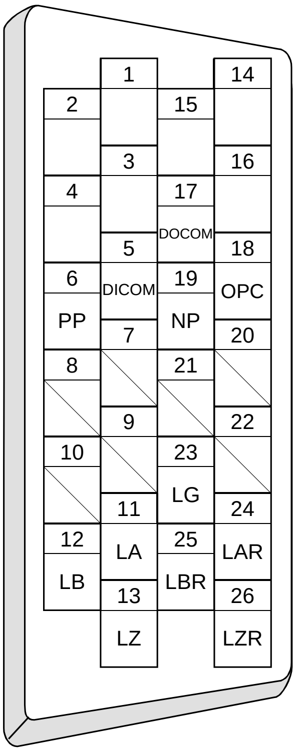
Gain/filter parameters (PB □□)		
No.	Symbol	Name
PB01	FILT	Adaptive tuning mode (Adaptive filter Ⅱ)
PB02	VRFT	Vibration suppression control tuning mode (Advanced vibration suppression control)
PB03		For manufacturer setting
PB04	FFC	Feed forward gain
PB05		For manufacturer setting
PB06	GD2	Ratio of load inertia moment to servo motor inertia moment
PB07	PG1	Model loop gain
PB08	PG2	Position loop gain
PB09	VG2	Speed loop gain
PB10	VIC	Speed integral compensation
PB11	VDC	Speed differential compensation
PB12		For manufacturer setting
PB13	NH1	Machine resonance suppression filter 1
PB14	NHQ1	Notch form selection 1
PB15	NH2	Machine resonance suppression filter 2
PB16	NHQ2	Notch form selection 2
PB17		Automatic setting parameter
PB18	LPF	Low-pass filter
PB19	VRF1	Vibration suppression control vibration frequency setting
PB20	VRF2	Vibration suppression control resonance frequency setting
PB21		For manufacturer setting
PB22		
PB23	VFBF	Low-pass filter selection
PB24	*MVS	Slight vibration suppression control selection
PB25		For manufacturer setting
PB26	*CDP	Gain changing selection
PB27	CDL	Gain changing condition
PB28	CDT	Gain changing time constant
PB29	GD2B	Gain changing ratio of load inertia moment to servo motor inertia moment
PB30	PG2B	Gain changing position loop gain
PB31	VG2B	Gain changing speed loop gain
PB32	VICB	Gain changing speed integral compensation
PB33	VRF1B	Gain changing vibration suppression control vibration frequency setting
PB34	VRF2B	Gain changing vibration suppression control resonance frequency setting
PB35 to PB45		For manufacturer setting

Extension setting parameters (PC □□)		
No.	Symbol	Name
PC01		For manufacturer setting
PC02	*ZTY	Home position return type
PC03	*ZDIR	Home position return direction
PC04	ZRF	Home position return speed
PC05	CRF	Creep speed
PC06	ZST	Home position shift distance
PC07	*ZPS	Home position return position data
PC08	DCT	Moving distance after proximity dog
PC09	ZTM	Stopper type home position return stopper time
PC10	ZTT	Stopper type home position return torque limit value
PC11	CRP	Rough match output range
PC12	JOG	Jog speed
PC13	*STC	S-pattern acceleration/deceleration time constant
PC14	*BKC	Backlash compensation
PC15		For manufacturer setting
PC16	MBR	Electromagnetic brake sequence output
PC17	ZSP	Zero speed
PC18	*BPS	Alarm history clear
PC19	*ENRS	Encoder output pulse selection
PC20	*SNO	Station number setting
PC21	*SOP	RS-422 communication function selection
PC22	*COP1	Function selection C-1
PC23		For manufacturer setting
PC24	*COP3	Function selection C-3
PC25		For manufacturer setting
PC26	*COP5	Function selection C-5
PC27		For manufacturer setting
PC28	*COP7	Function selection C-7
PC29		For manufacturer setting
PC30	*DSS	Remote register-based position/speed specifying system selection
PC31	LMPL	Software limit +
PC32	LMPH	
PC33	LMNL	Software limit −
PC34	LMNH	
PC35	TL2	Internal torque limit 2
PC36		For manufacturer setting
PC37	*LPPL	Position range output address +
PC38	*LPPH	
PC39	*LNPL	Position range output address −
PC40	*LNPH	
PC41 to PC50		For manufacturer setting

I/O setting parameters (PD □□)		
No.	Symbol	Name
PD01	*DIA1	Input signal automatic ON selection 1
PD02		For manufacturer setting
PD03	*DIA3	Input signal automatic ON selection 3
PD04	*DIA4	Input signal automatic ON selection 4
PD05		For manufacturer setting
PD06	*DI2	Input signal device selection 2 (CN6-2)
PD07	*DI3	Input signal device selection 3 (CN6-3)
PD08	*DI4	Input signal device selection 4 (CN6-4)
PD09	*DO1	Input signal device selection 1 (CN6-14)
PD10	*DO2	Input signal device selection 2 (CN6-15)
PD11	*DO3	Input signal device selection 3 (CN6-16)
PD12	DIN1	External DI function selection 1
PD13		For manufacturer setting
PD14	DIN3	External DI function selection 3
PD15		For manufacturer setting
PD16	*DIAB	Input polarity selection
PD17		For manufacturer setting
PD18		
PD19	*DIF	Response level setting
PD20	*DOP1	Function selection D-1
PD21		For manufacturer setting
PD22	*DOP3	Function selection D-2
PD23		For manufacturer setting
PD24	*DOP5	Function selection D-5
PD25 to PD30		For manufacturer setting

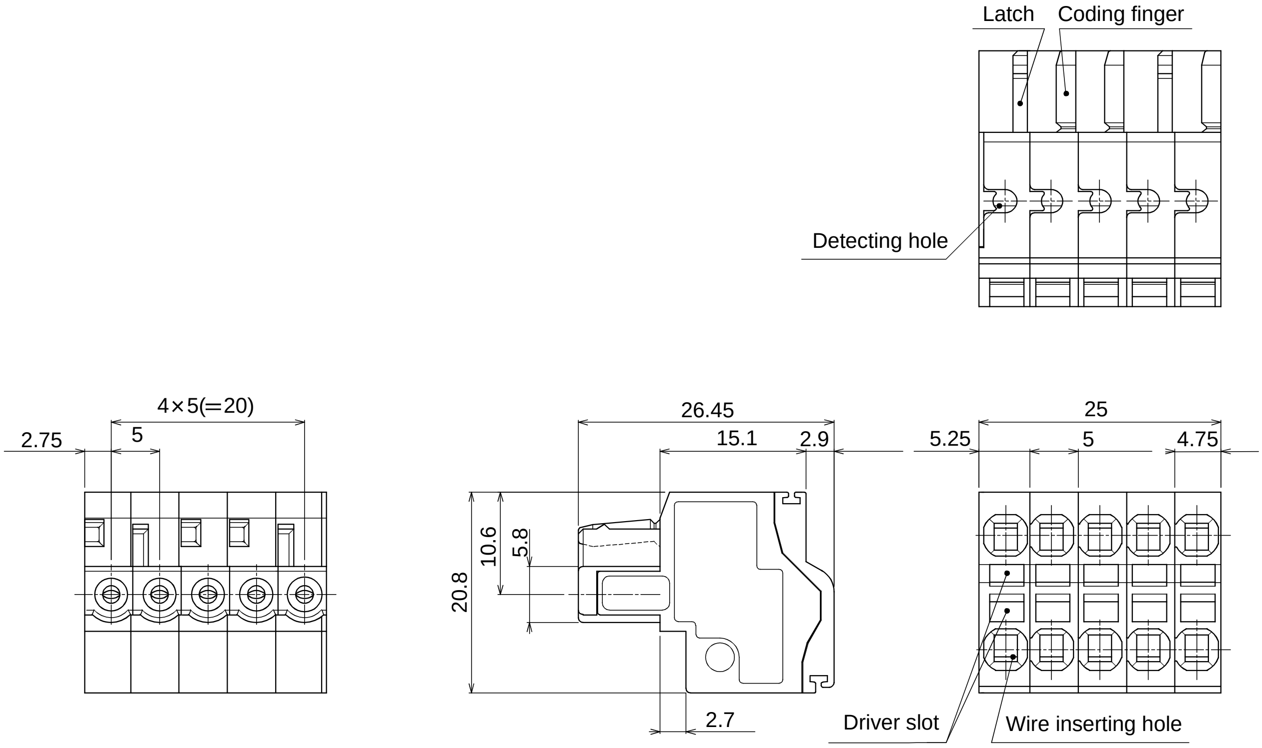
App. 2 Signal layout recording paper

CN6



App. 3 Twin type connector: outline drawing for 721-2105/026-000(WAGO)

[Unit: mm]



App. 4 Parameter list

POINT

- For any parameter whose symbol is preceded by *, set the parameter value and switch power off once, then switch it on again to make that parameter setting valid.

Basic setting parameters (PA □□)		
No.	Symbol	Name
PA01	*STY	Control mode
PA02	*REG	Regenerative option
PA03	*ABS	Absolute position detection system
PA04		Not used in indexer positioning operation.
PA05		
PA06	*CMX	Number of gears on machine-side
PA07	*CDV	Number of gears on servo motor-side
PA08	ATU	Auto tuning
PA09	RSP	Auto tuning response
PA10	INP	In-position range
PA11	TLP	Forward rotation torque limit
PA12	TLN	Reverse rotation torque limit
PA13		For manufacturer setting
PA14	*POL	Rotation direction selection
PA15	*ENR	Encoder output pulses
PA16 to PA18		For manufacturer setting
PA19	*BLK	Parameter write inhibit

Gain/filter parameters (PB □□)		
No.	Symbol	Name
PB01	FILT	Adaptive tuning mode (Adaptive filter II)
PB02	VRFT	Vibration suppression control tuning mode (Advanced vibration suppression control)
PB03		For manufacturer setting
PB04	FFC	Feed forward gain
PB05		For manufacturer setting
PB06	GD2	Ratio of load inertia moment to servo motor inertia moment
PB07	PG1	Model loop gain
PB08	PG2	Position loop gain
PB09	VG2	Speed loop gain
PB10	VIC	Speed integral compensation
PB11	VDC	Speed differential compensation
PB12		For manufacturer setting
PB13	NH1	Machine resonance suppression filter 1
PB14	NHQ1	Notch form selection 1
PB15	NH2	Machine resonance suppression filter 2
PB16	NHQ2	Notch form selection 2
PB17		Automatic setting parameter
PB18	LPF	Low-pass filter
PB19	VRF1	Vibration suppression control vibration frequency setting
PB20	VRF2	Vibration suppression control resonance frequency setting
PB21		For manufacturer setting
PB22		
PB23	VFBF	Low-pass filter selection
PB24	*MVS	Slight vibration suppression control selection
PB25		For manufacturer setting
PB26	*CDP	Gain changing selection
PB27	CDL	Gain changing condition
PB28	CDT	Gain changing time constant
PB29	GD2B	Gain changing ratio of load inertia moment to servo motor inertia moment
PB30	PG2B	Gain changing position loop gain
PB31	VG2B	Gain changing speed loop gain
PB32	VICB	Gain changing speed integral compensation
PB33	VRF1B	Gain changing vibration suppression control vibration frequency setting
PB34	VRF2B	Gain changing vibration suppression control resonance frequency setting
PB35 to PB45		For manufacturer setting

Extension setting parameters (PC□□)		
No.	Symbol	Name
PC01		For manufacturer setting
PC02	*ZTY	Home position return type
PC03	*ZDIR	Home position return direction
PC04	ZRF	Home position return speed
PC05	CRF	Creep speed
PC06	ZST	Home position shift distance
PC07		Not used in indexer positioning operation.
PC08		
PC09		
PC10		
PC11	CRP	Rough match output range
PC12	JOG	Jog speed
PC13		Not used in indexer positioning operation.
PC14	*BKC	Backlash compensation
PC15		For manufacturer setting
PC16	MBR	Electromagnetic brake sequence output
PC17		Not used in indexer positioning operation.
PC18	*BPS	Alarm history clear
PC19	*ENRS	Encoder output pulse selection
PC20	*SNO	Station number setting
PC21	*SOP	RS-422 communication function selection
PC22	*COP1	Function selection C-1
PC23		For manufacturer setting
PC24		Not used in indexer positioning operation.
PC25		For manufacturer setting
PC26	*COP5	Function selection C-5
PC27		For manufacturer setting
PC28	*COP7	Function selection C-7
PC29		For manufacturer setting
PC30	*DSS	Remote register-based position/speed specifying system selection
PC31		Not used in indexer positioning operation.
PC32		
PC33		
PC34		
PC35	TL2	Internal torque limit 2
PC36		For manufacturer setting
PC37		Not used in indexer positioning operation.
PC38		
PC39		
PC40		
PC41 to PC44		For manufacturer setting
PC45	*COP9	Function selection C-9
PC46	*STN	Indexer positioning operation number of stations/rotation
PC47	PSST	Indexer positioning operation station home position shift distance
PC48 to PC50		For manufacturer setting

I/O setting parameters (PD□□)		
No.	Symbol	Name
PD01	*DIA1	Input signal automatic ON selection 1
PD02		For manufacturer setting
PD03		Not used in indexer positioning operation.
PD04		
PD05		For manufacturer setting
PD06		Not used in indexer positioning operation.
PD07		
PD08		
PD09		
PD10		
PD11		
PD12		
PD13		For manufacturer setting
PD14		Not used in indexer positioning operation.
PD15		For manufacturer setting
PD16	*DIAB	Input polarity selection
PD17		For manufacturer setting
PD18		
PD19	*DIF	Response level setting
PD20	*DOP1	Function selection D-1
PD21		For manufacturer setting
PD22		Not used in indexer positioning operation.
PD23		For manufacturer setting
PD24	*DOP5	Function selection D-5
PD25		For manufacturer setting
PD26	TLT	Indexer positioning operation torque limit delay time
PD27 to PD30		For manufacturer setting

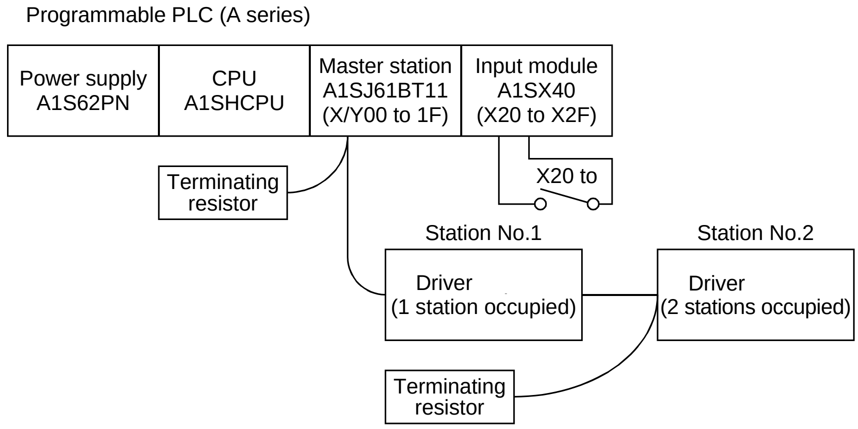
App. 5 Program example with programmable PLC (A series) (point table positioning operation)

App. 5.1 Function-by-function programming examples

This section explains specific programming examples for servo operation, monitor, parameter read and write, and others on the basis of the equipment makeup shown in appendix 8.1.1.

App. 5.1.1 System configuration example

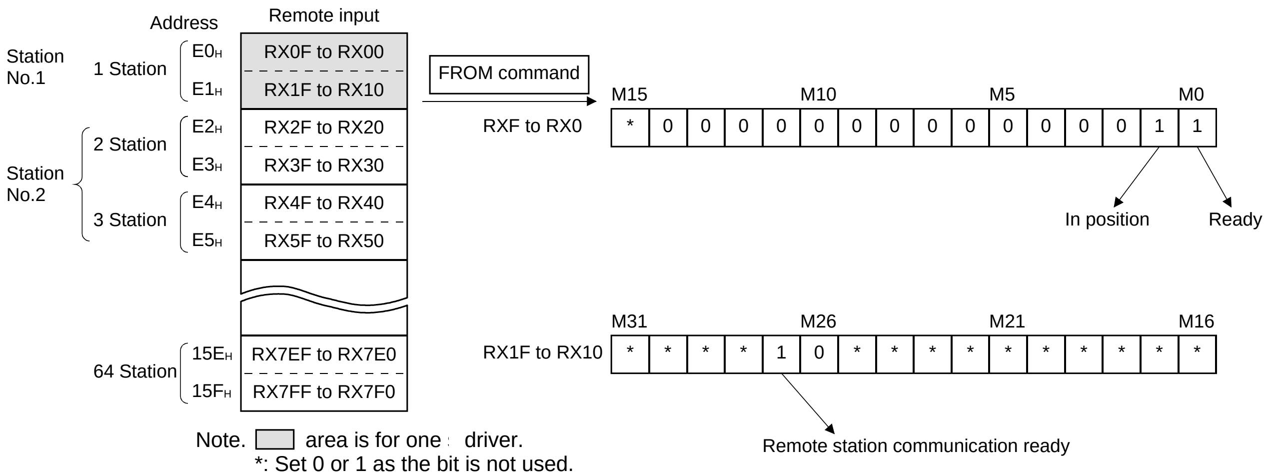
As shown below, the CC-Link system master・local unit is loaded to run two drivers (1 station occupied / 2 stations occupied).



App. 5.1.2 Reading the driver status

Read the driver status from the master station buffer memory. The driver status is always stored in the remote input RX (addresses E0H to 15FH) Read the driver status of station 1 to M0 to M31.

Reads remote input (RX00 to RX1F) of buffer memory to M0 to M31.



Note. [ ] area is for one driver.
*: Set 0 or 1 as the bit is not used.

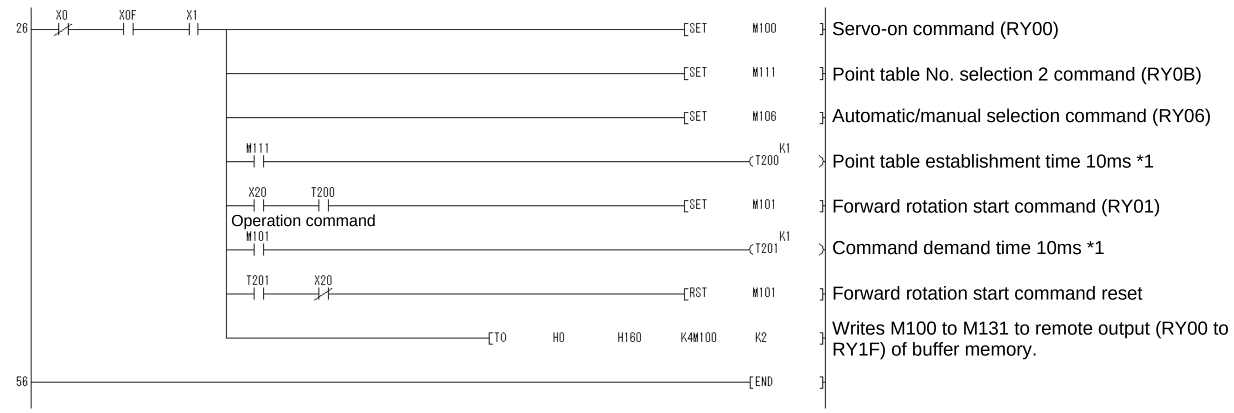
Driver status (1 station occupied)

M0: Ready (RD)	M8: Monitoring (MOF)	M16: ―――	M24: ―――
M1: In position (INP)	M9: Instruction code execution completion (COF)	M17: ―――	M25: ―――
M2: Rough match (CPO)	M10: Warning (WNG)	M18: ―――	M26: Trouble (ALM)
M3: Home position return completion (ZP)	M11: Battery warning (BWNG)	M19: ―――	M27: Remote station communication ready (CRD)
M4: Limiting torque (TLC)	M12: Movement completion (MEND)	M20: ―――	M28: ―――
M5: ―――	M13: Dynamic brake interlock (DB)	M21: ―――	M29: ―――
M6: Electromagnetic brake interlock (MBR)	M14: Position range (POT)	M22: ―――	M30: ―――
M7: Temporary stop (PUS)	M15: ―――	M23: ―――	M31: ―――

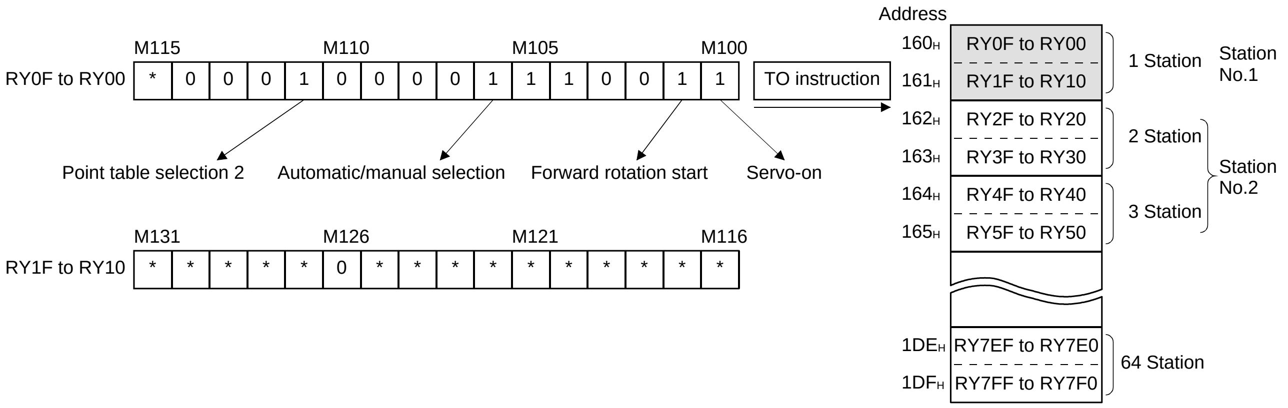
App. 5.1.3 Writing the operation commands

To operate the driver, write the operation commands to the remote output RY (addresses 160H to 1DFH). Perform positioning operation of point table No.2 for the driver of station 2.

Start the operation by turning on X20.



*1: Setting time for the timer should be larger than the command processing time or twice the link scan time whichever larger. When the setting time is short, the command cannot be received properly.



Note. area is for one driver.
*: Set 0 as the bit is not used.

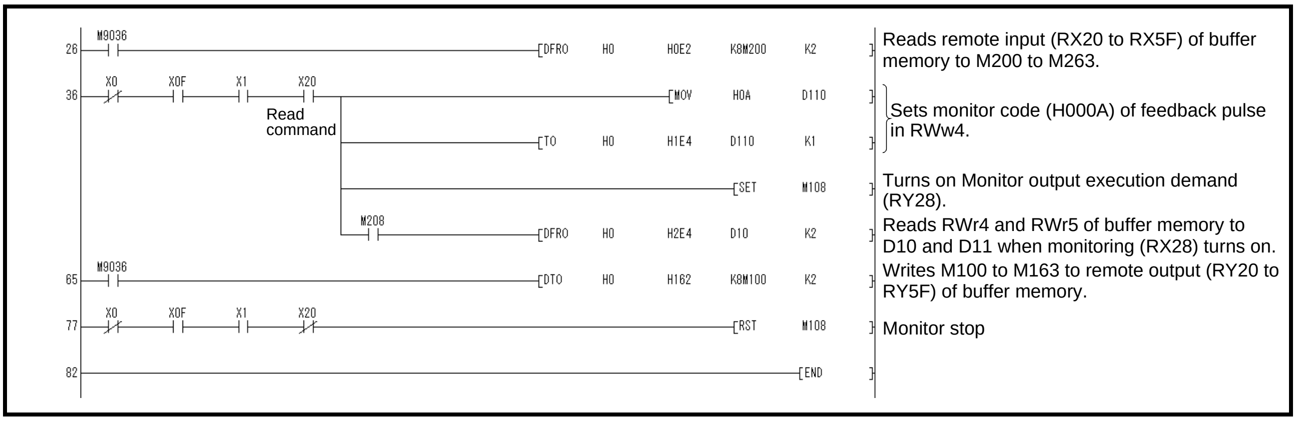
Operation commands (1 station occupied)			
M100: Servo-on (SON)	M108: Monitor output execution demand (MOR)	M116: ―――	M124: ―――
M101: Forward rotation start (ST1)		M117: ―――	M125: ―――
M102: Reverse rotation start (ST2)	M109: Instruction code execution demand (COR)	M118: ―――	M126: Reset (RES)
M103: Proximity dog (DOG)		M119: ―――	M127: ―――
M104: Forward rotation stroke end (LSP)	M110: Point table No. selection 1 (DI0)	M120: ―――	M128: ―――
M105: Reverse rotation stroke end (LSN)	M111: Point table No. selection 2 (DI1)	M121: ―――	M129: ―――
M106: Automatic/manual selection (MDO)	M112: Point table No. selection 3 (DI2)	M122: ―――	M130: ―――
M107: Temporary stop/Restart (TSTP)	M113: Point table No. selection 4 (DI3)	M123: ―――	M131: ―――
	M114: Point table No. selection 5 (DI4)		
	M115: Clear (CR)		

App. 5.1.4 Reading the data
Read various data of the driver.

(1) Reading the monitor value
Read the (feedback pulse value) of the driver of station 2 to D1.

Data No.	Description
H000A	Cumulative feedback pulse data (hexadecimal)

Read the cumulative feedback pulse monitor by turning on X20.



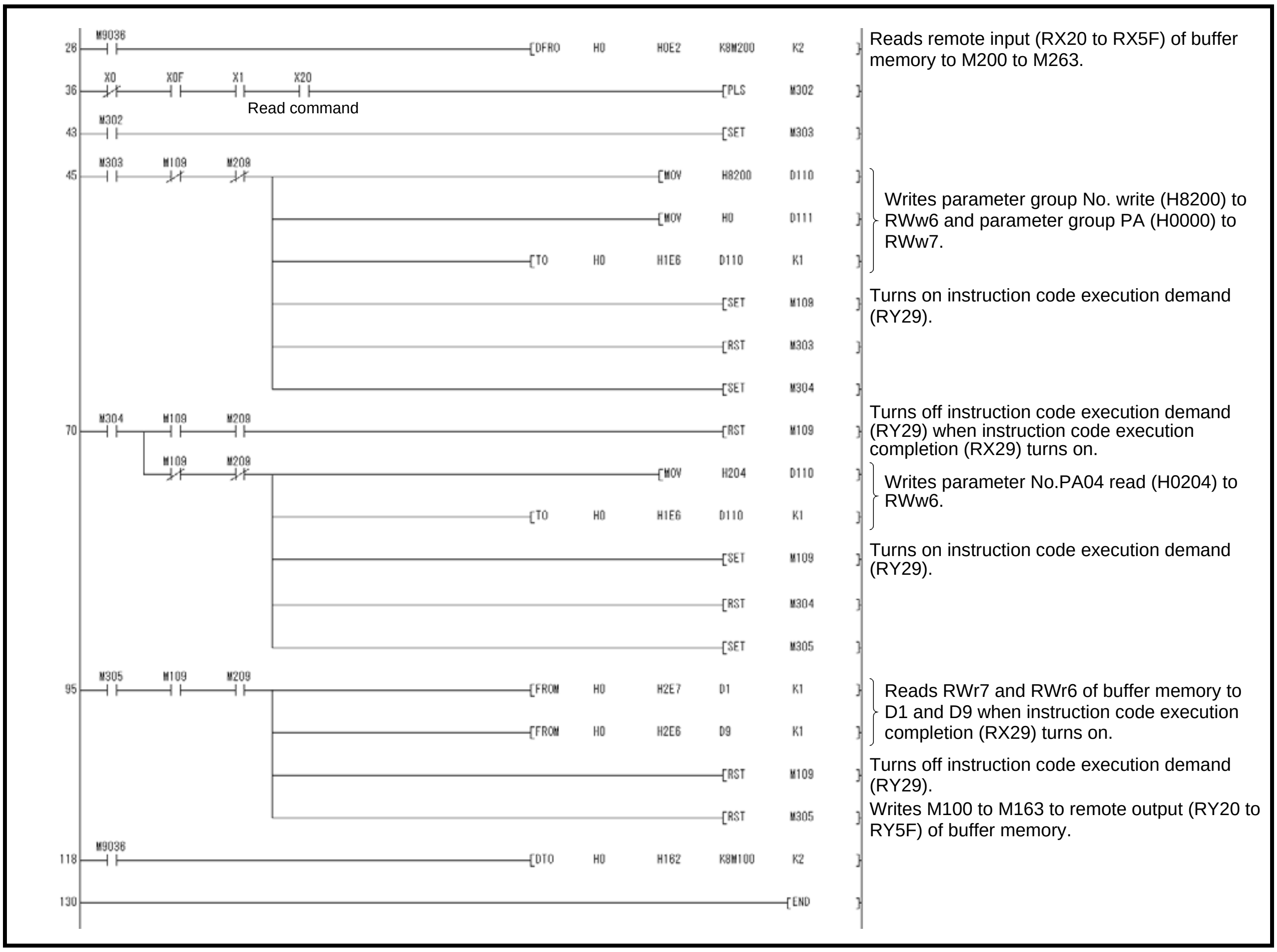
(2) Reading the parameter

Read parameter No.PA04 "Function selection A-1" of the driver of station 2 to D1.

Data No.	Description
H8200	Parameter group selection
H2024	Parameter No.PA04 setting (hexadecimal)

Read the parameter No.PA04 by turning on X20.

The respond code at instruction code execution is set to D9.



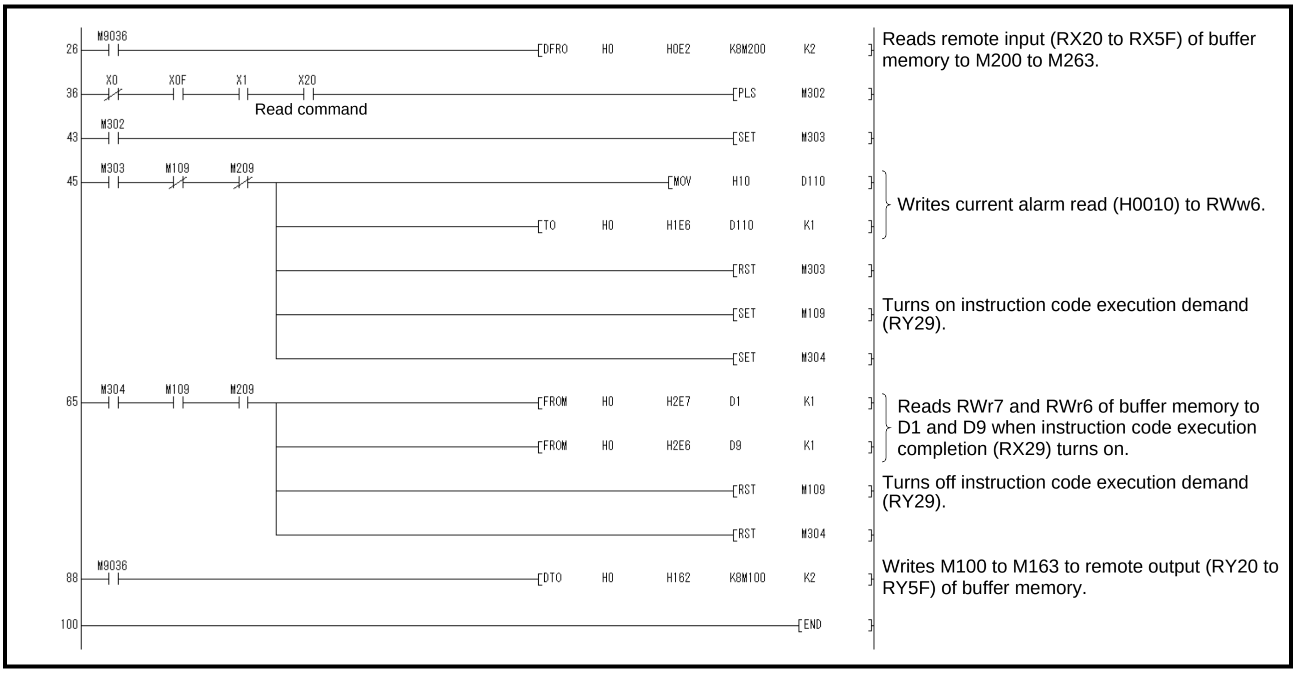
(3) Reading the alarm definition

Read the alarm definition of the driver of station 2 to D1.

Data No.	Description
H0010	Occurring alarm/warning No. (hexadecimal)

Read current alarms by turning on X20.

The respond code at instruction code execution is set to D9.



App. 5.1.5 Writing the data

This section explains the programs for writing various data to the driver.

(1) Writing the servo motor speed data of point table

Change the servo motor speed data in the point table No.1 of the driver of station 2 to "100".

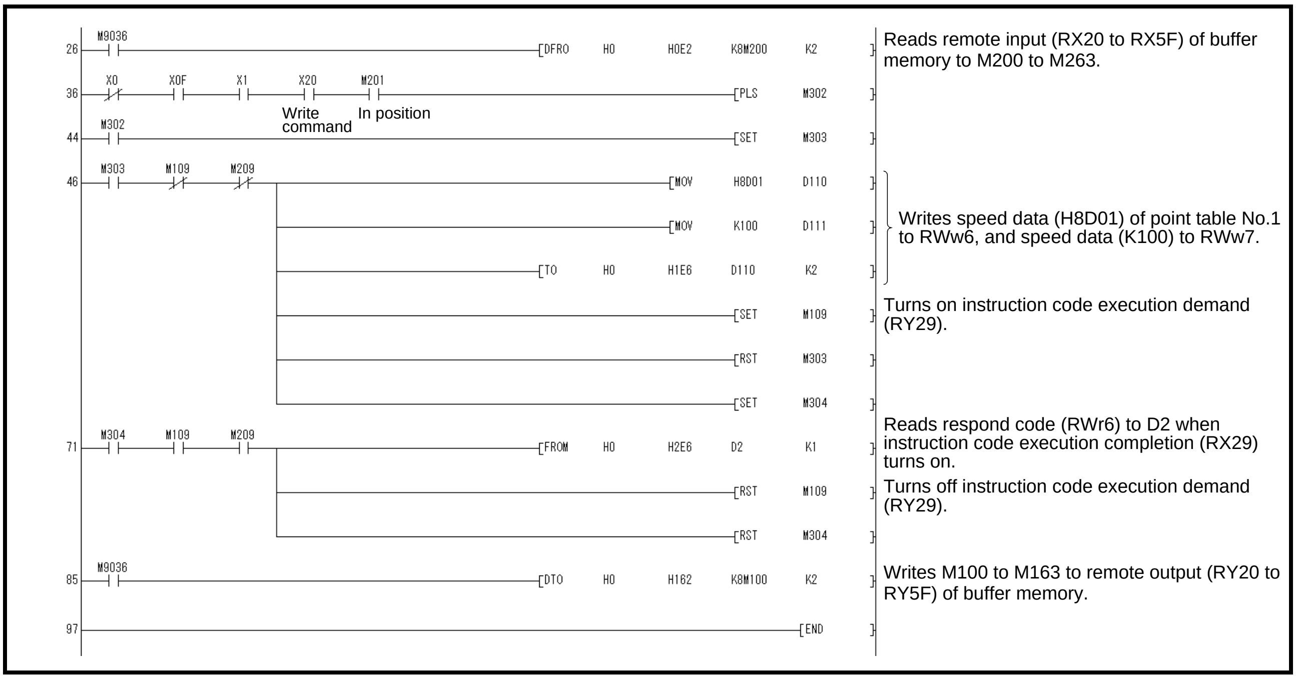
The following shows a program example for writing data to the driver when two stations are occupied. Writing is disabled for the driver when one station is occupied.

Code No.	Description
H8D01	Write of servo motor speed data of point table No.1 (hexadecimal)

Set data	Description
K100	Servo motor speed data of point table No.1 (decimal)

Write the data to the servo motor speed data of point table No.1 by turning on X20.

The respond code at instruction code execution is set to D2.



(2) Writing the parameter

The following shows a program example when two stations are occupied.

Change parameter No.PC12 (JOG speed) of the driver of station 2 to "100".

The parameter group PC is specified as follows.

Code No.	Description
8200h	Parameter group selection

Set data	Description
H0002	Set data (hexadecimal)

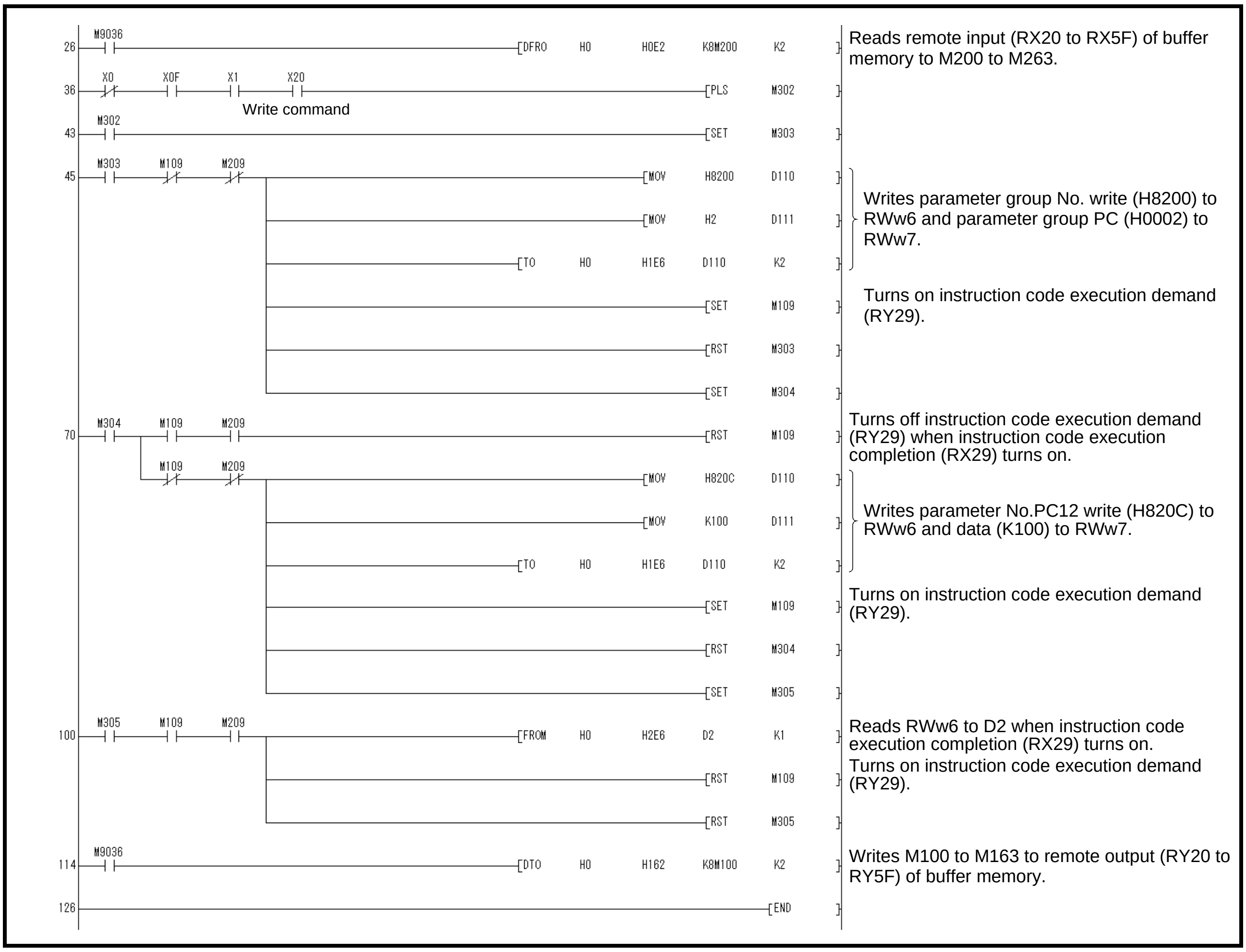
The parameter No.12 is changed to "100" as follows.

Code No.	Description
H820C	Parameter No.PC12 write (hexadecimal)

Set data	Description
K100	Set data (decimal)

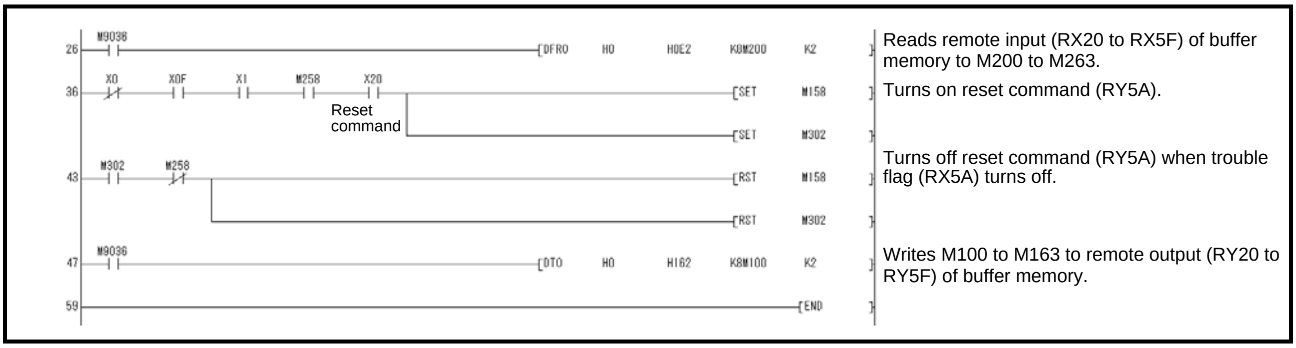
Write the data to the parameter No.PC12 by turning on X20.

The respond code at instruction code execution is set to D2.



(3) Driver alarm resetting program examples

(a) Deactivate the alarm of the driver of station 2 by issuing a command from the programmable PLC.
Reset the driver on the occurrence of a servo alarm by turning on X20.

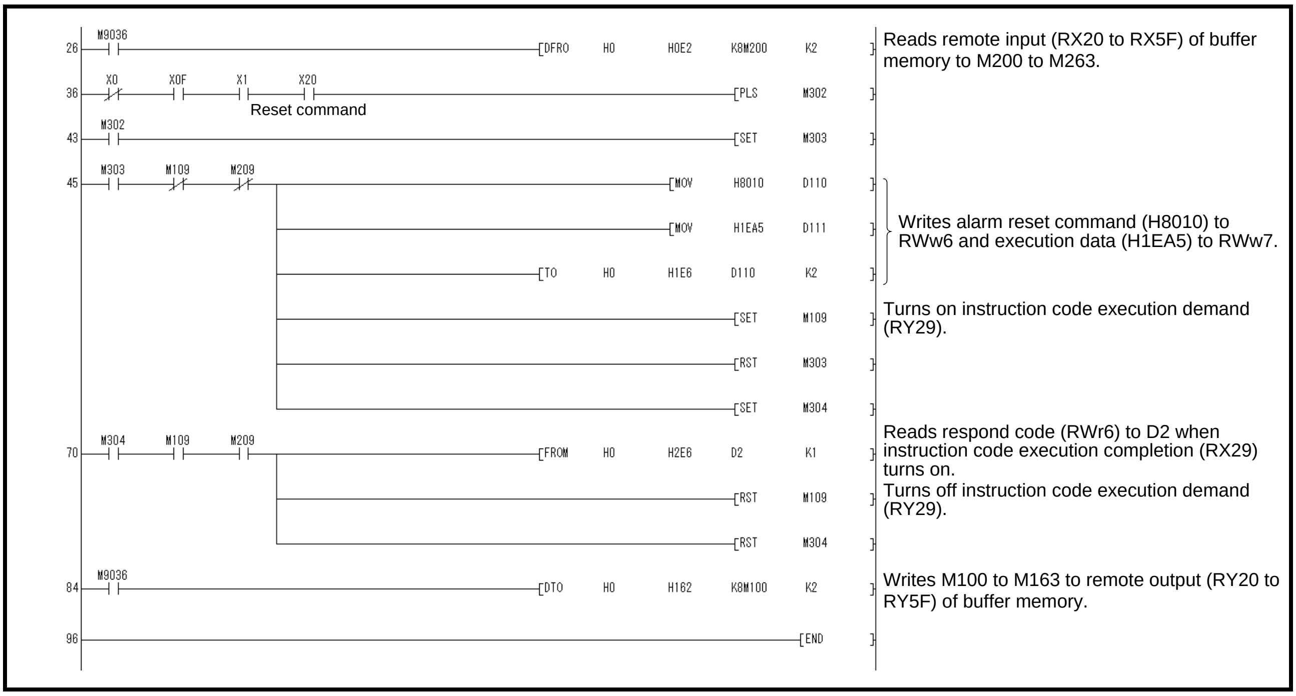


(b) Deactivate the alarm of the driver of station 2 using the instruction code.

Code No.	Description
H8010	Alarm reset command (hexadecimal)

Set data	Description
H1EA5	Execution data (hexadecimal)

Reset the driver by turning on X20.
The respond code at instruction code execution is set to D2.



App. 5.1.6 Operation

This section explains the operation programs of the driver.

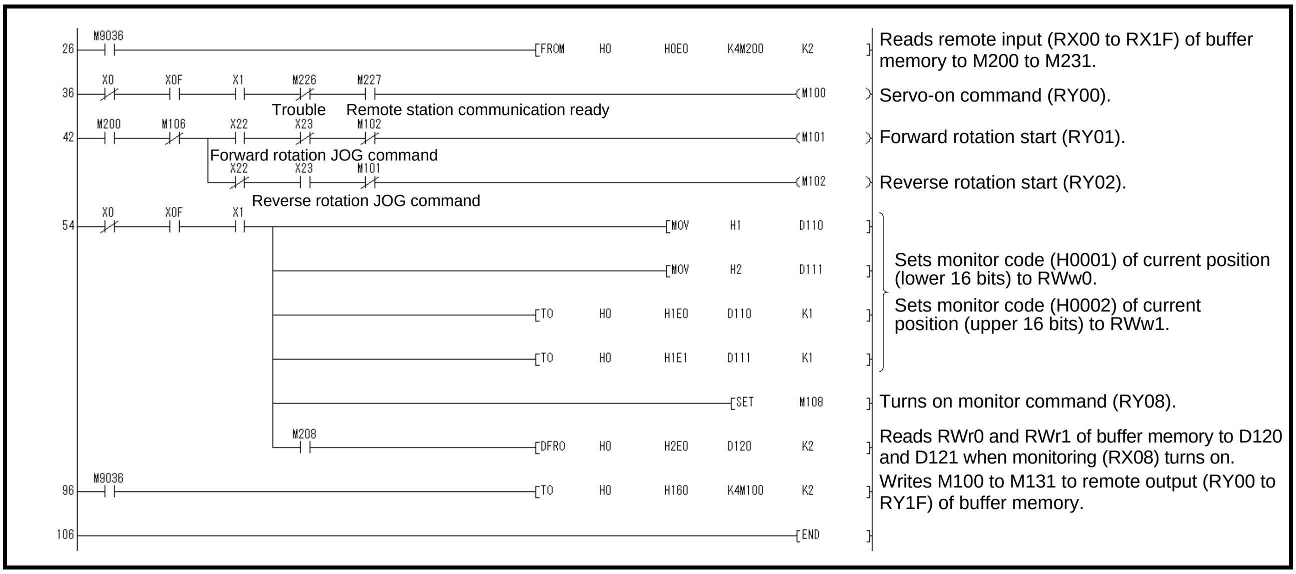
(1) JOG operation

Perform JOG operation of the driver of station 1 and read the "current position" data.

Code No.	Description
H0001	Lower 16-bit data of current position (hexadecimal)
H0002	Upper 16-bit data of current position (hexadecimal)

Start the forward rotation JOG operation by turning on X22.

Start the reverse rotation JOG operation by turning on X23.



(2) Remote register-based position data/speed data setting

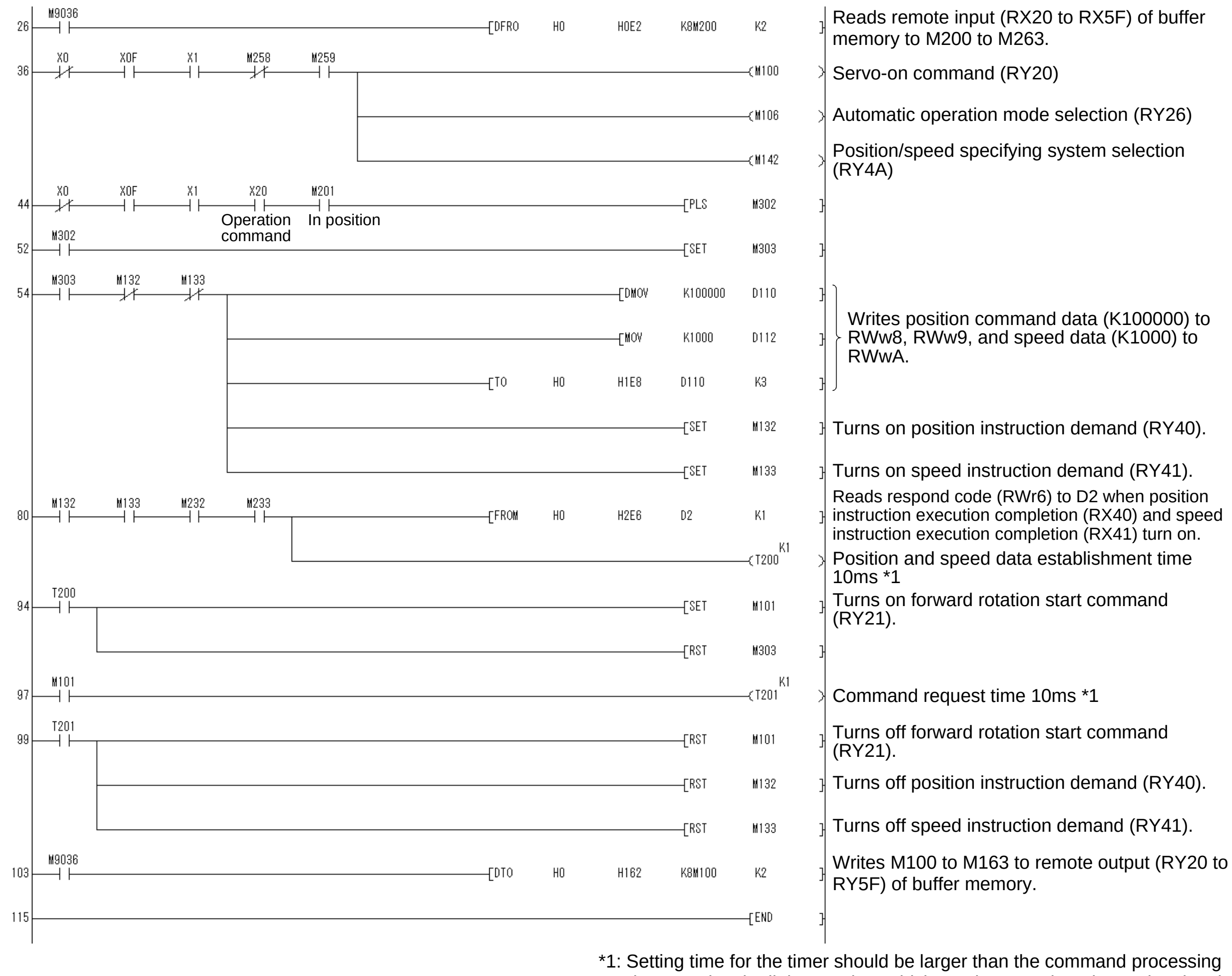
The following program example is only applicable when two stations are occupied.

Operate the driver of station 2 after specifying the position data as "100000" and the speed data as "1000" in the direct specification mode.

Preset "□□□2" in parameter No.PC30.

Set data	Description
K100000	Position command data (decimal)
K1000	Speed command data (decimal)

Execute positioning operation with position and speed settings specified in the remote register by turning on X20.



*1: Setting time for the timer should be larger than the command processing time or twice the link scan time whichever larger. When the setting time is short, the command cannot be received properly.

(3) Remote register-based point table No. setting (incremental value command system)

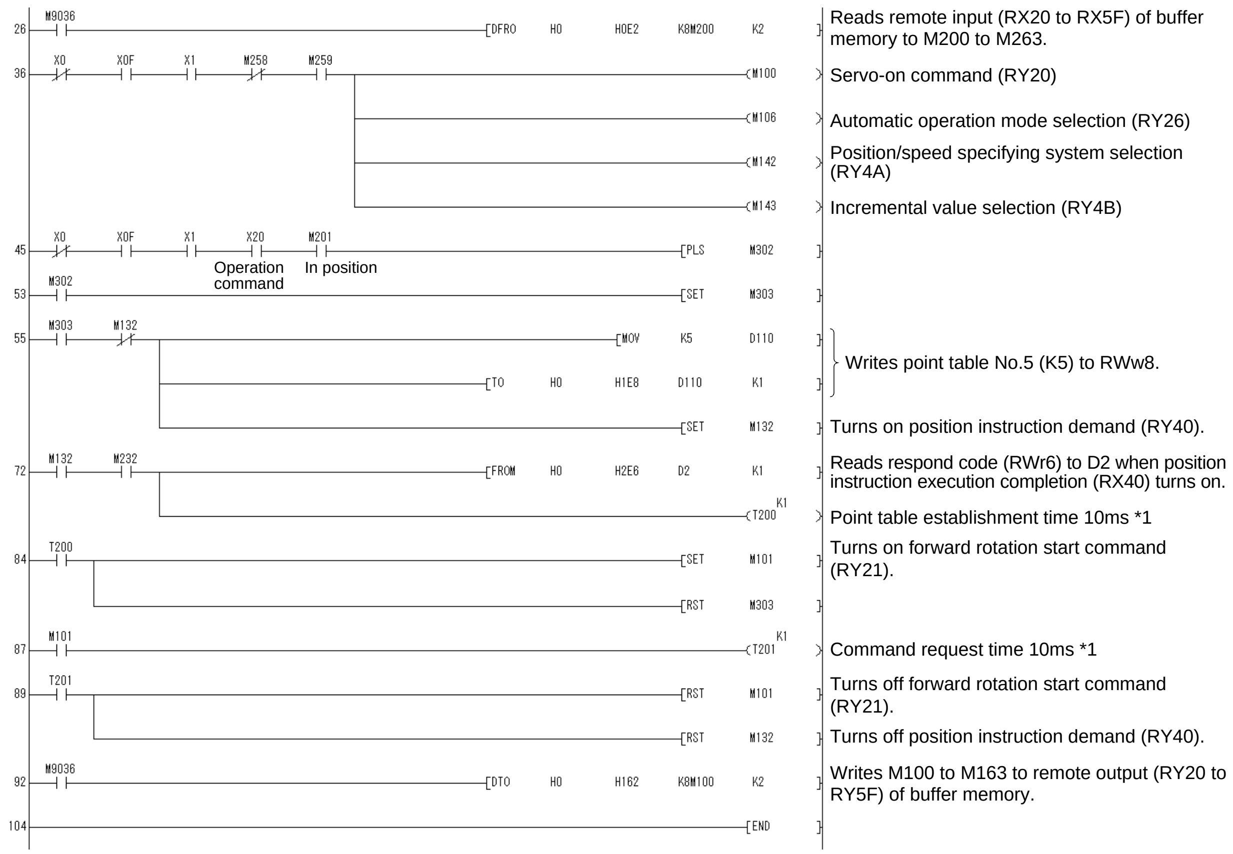
The following program example is only applicable when two stations are occupied.

Operate the driver of station 2 with incremental values after specifying the point table No.5 in the direct specification mode.

Preset "□□□0" in parameter No.PA01 and "□□□0" in parameter No.PC30.

Set data	Description
K5	Point table No. (decimal)

Execute positioning operation to the point table No.5 by turning on X20.



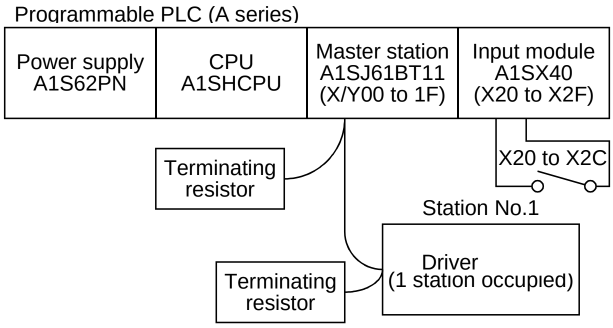
*1: Setting time for the timer should be larger than the command processing time or twice the link scan time whichever larger. When the setting time is short, the command cannot be received properly.

App. 5.2 Continuous operation program example

This section shows a program example which includes a series of communication operations from a servo start. The program will be described on the basis of the equipment makeup shown in appendix 8.2.1, appendix 8.2.3.

App. 5.2.1 System configuration example when 1 station is occupied

As shown below, the CC-Link system master ▪ local unit is loaded to run one driver (1 station occupied).



Input signal assignment

Input signal	Signal name	General operation when the input is on
X20	Reset command	Resets the driver on an occurrence of a servo alarm.
X21	Servo-on command	Turns on the servo motor. (Servo-on status)
X22	Forward rotation JOG command	Executes a forward JOG operation in the manual operation mode.
X23	Reverse rotation JOG command	Executes a reverse JOG operation in the manual operation mode.
X24	Automatic/manual selection	OFF: Manual operation mode ON: Automatic operation mode
X25	Home position return command	Executes a dog type home position return when home position return is incomplete in the automatic operation mode.
X26	Proximity dog command	OFF: Proximity dog is on. (Note) ON: Proximity dog is off.
X27	Positioning start command	Executes a positioning operation to the point table number specified by X28 to X2C when home position return is incomplete in the automatic operation mode.
X28	No. selection 1	Specifies the position for the point table No. selection 1
X29	No. selection 2	Specifies the position for the point table No. selection 2
X2A	No. selection 3	Specifies the position for the point table No. selection 3
X2B	No. selection 4	Specifies the position for the point table No. selection 4
X2C	No. selection 5	Specifies the position for the point table No. selection 5

Note. This is when the parameter No.PD16 is set to "□□□0 (initial value)" (detects the dog at off).

App. 5.2.2 Program example when 1 station is occupied

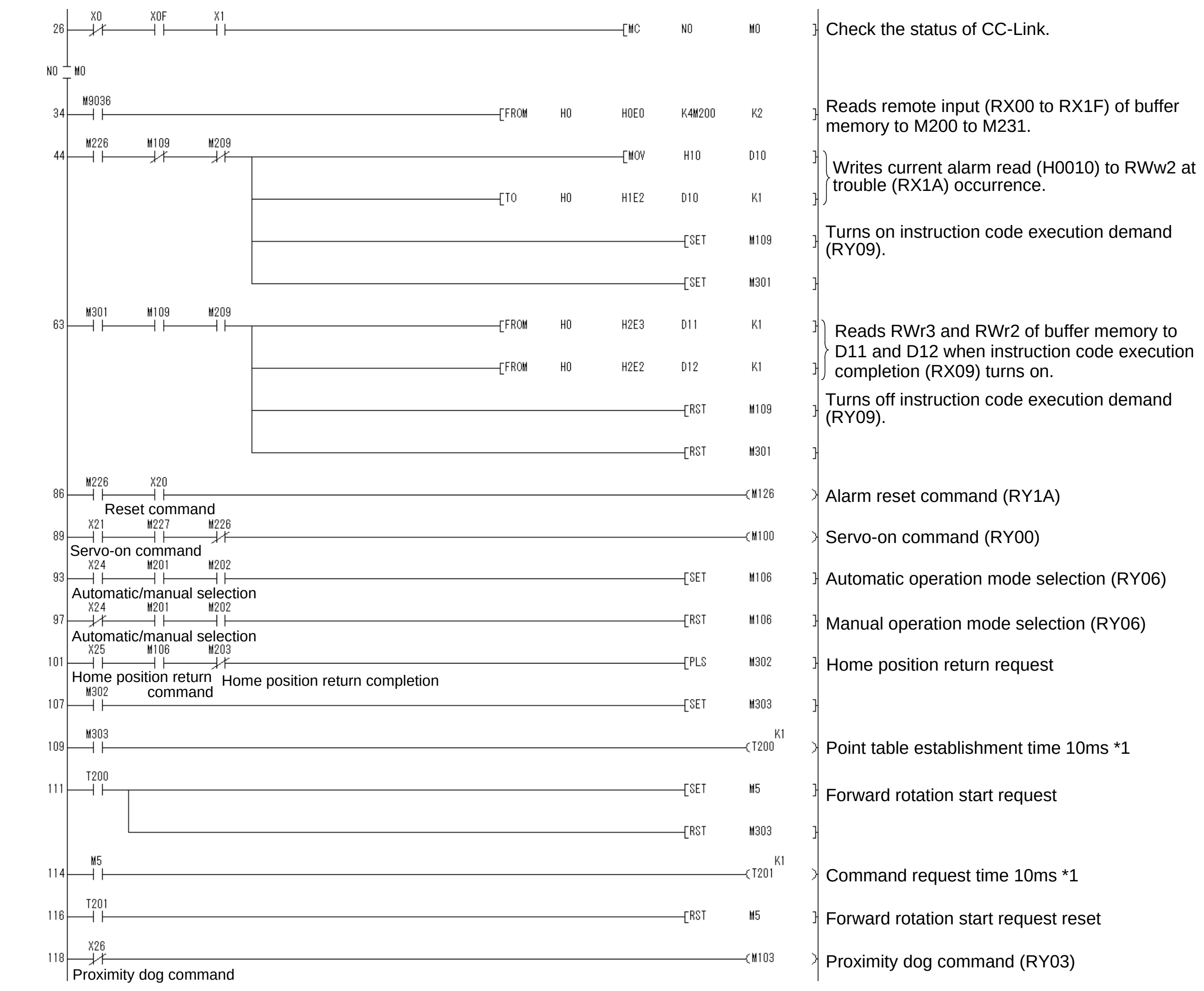
POINT

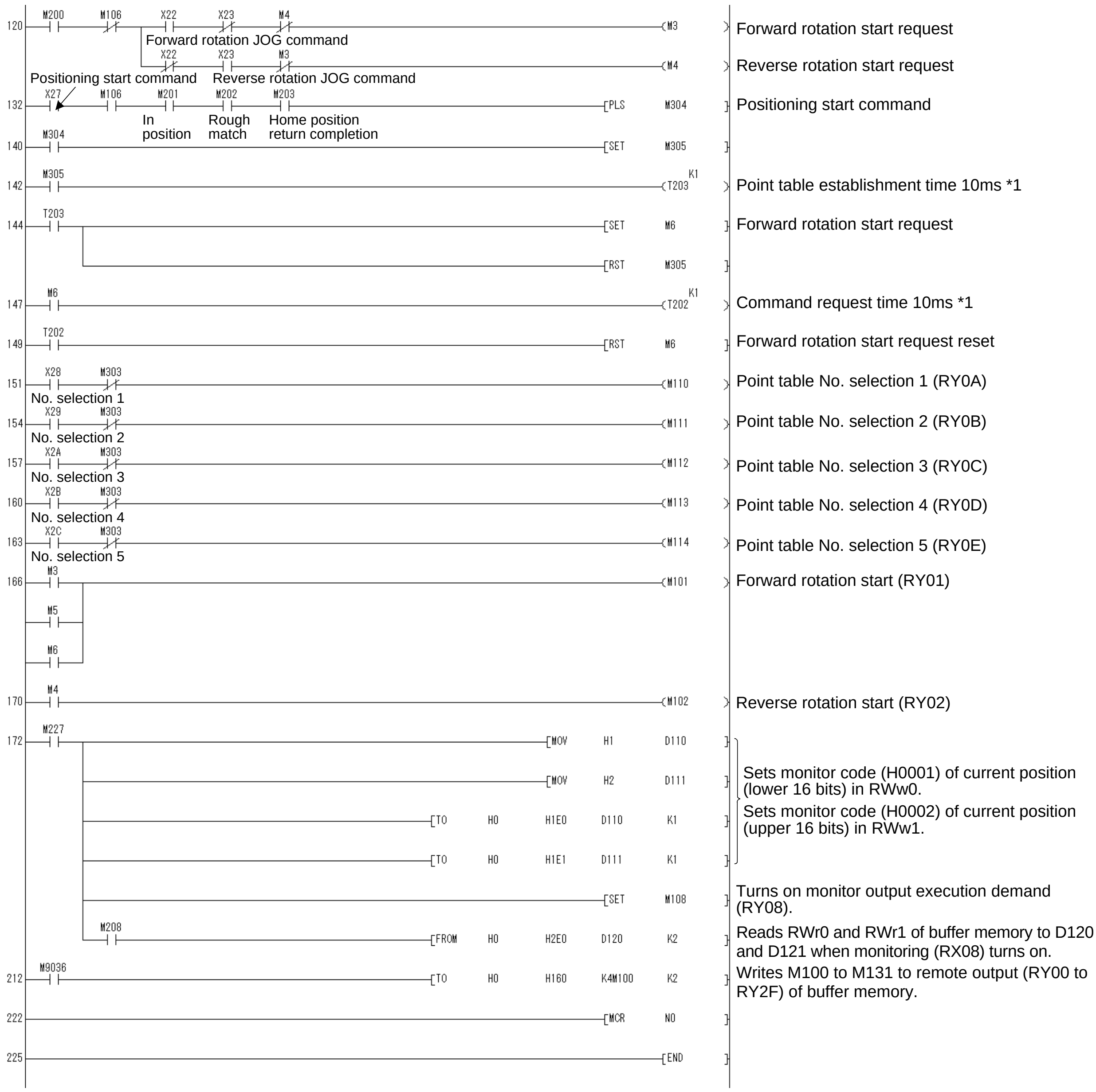
- To execute a dog type home position return with the CC-Link communication functions, set "□0□□" in parameter No.PD14 and use Proximity dog (DOG) with the remote input (RY03) in this example.

Operate the driver of station 1 in the positioning mode and read the "current position" data.

Operation: Alarm reset, dog type home position return, JOG operation, automatic operation under point table command

Code No.	Description
H0001	Lower 16-bit data of current position (hexadecimal)
H0002	Upper 16-bit data of current position (hexadecimal)

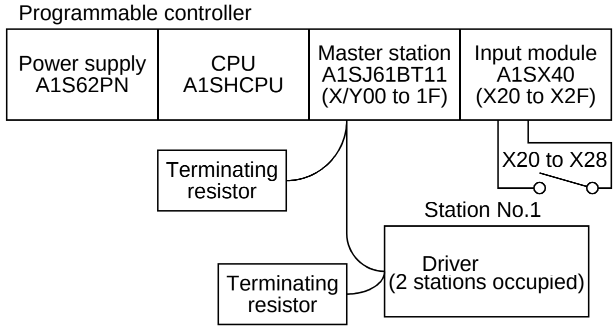




*1: Setting time for the timer should be larger than the command processing time or twice the link scan time whichever larger. When the setting time is short, the command cannot be received properly.

App. 5.2.3 System configuration example when 2 stations are occupied

As shown below, the CC-Link system master・local unit is loaded to run one drivers (2 station occupied).



Input signal assignment

Input signal	Signal name	General operation when the input is on
X20	Reset command	Resets the driver on an occurrence of a servo alarm.
X21	Servo-on command	Turns on the servo motor. (Servo-on status)
X22	Forward rotation JOG command	Executes a forward JOG operation in the manual operation mode.
X23	Reverse rotation JOG command	Executes a reverse JOG operation in the manual operation mode.
X24	Automatic/manual selection	OFF: Manual operation mode ON: Automatic operation mode
X25	Home position return command	Executes a dog type home position return when home position return is incomplete in the automatic operation mode.
X26	Proximity dog command	OFF: Proximity dog is on. (Note) ON: Proximity dog is off.
X27	Positioning start command	Executes a positioning operation with position and speed settings specified in the remote register when home position return is completed in the automatic operation mode.
X28	Position/speed setting system changing command	Changes to position/speed specification by the remote register.

Note. This is when the parameter No.PD16 is set to "□□□0 (initial value)" (detects the dog at off).

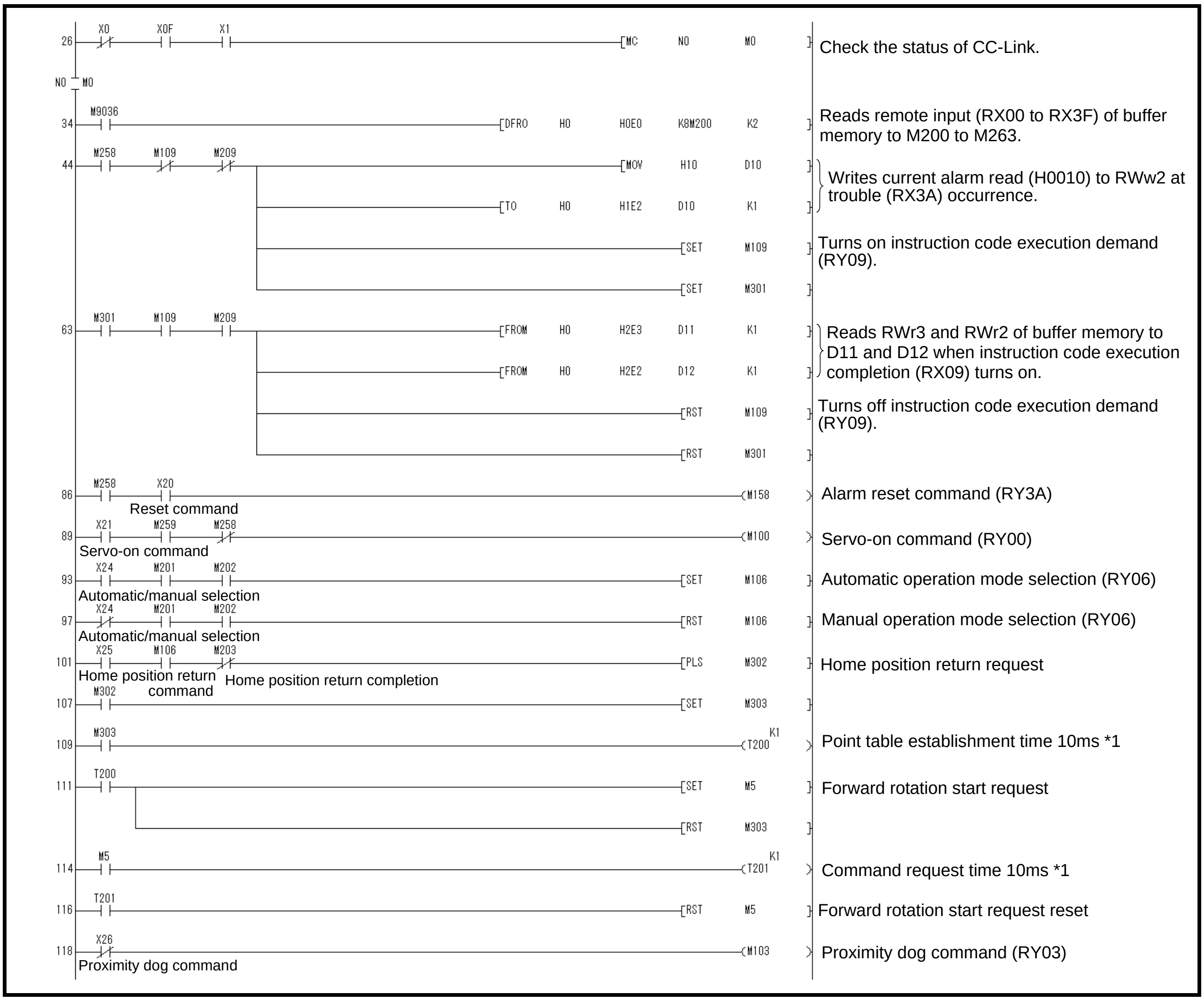
App. 5.2.4 Program example when 2 stations are occupied

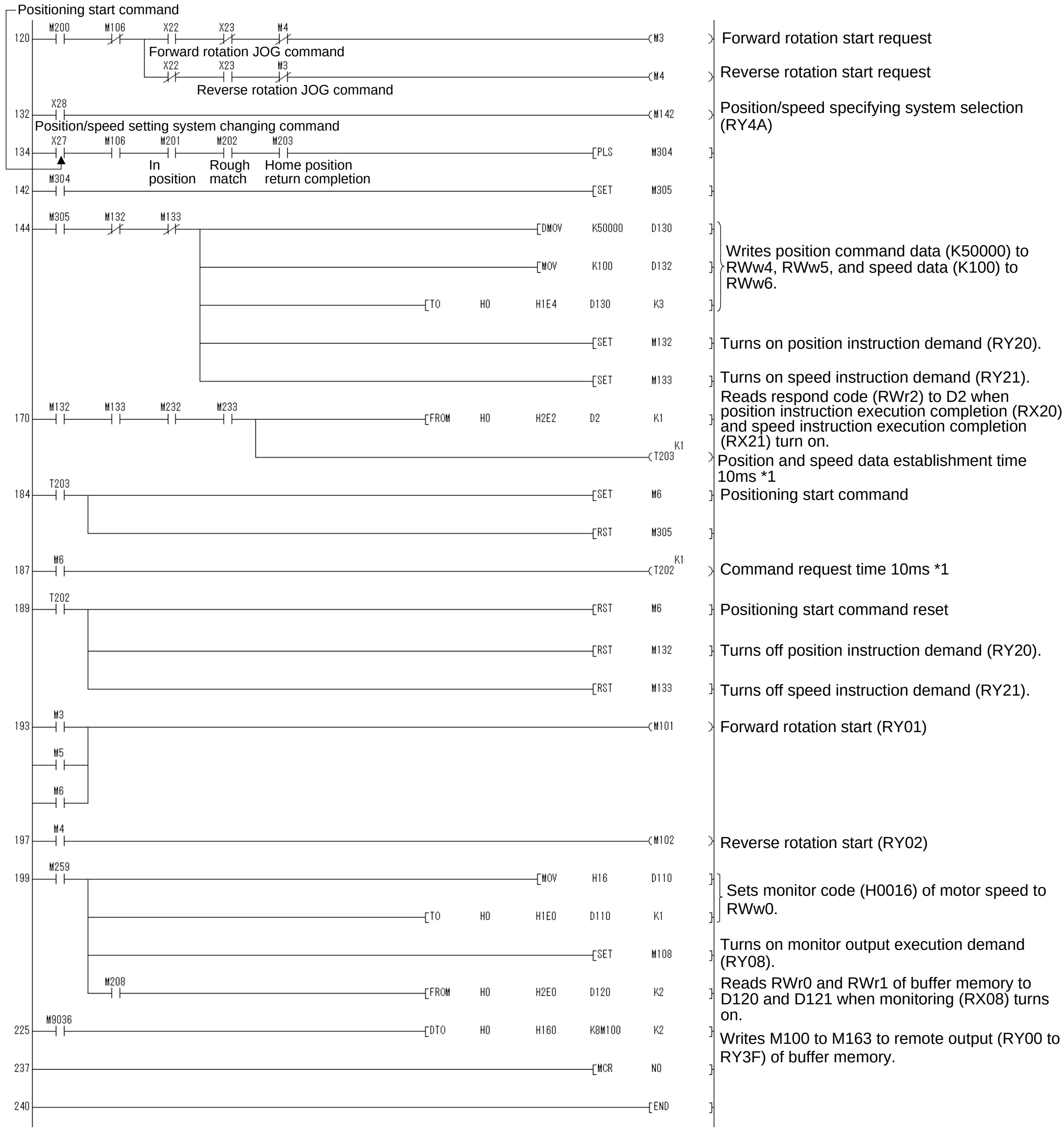
POINT
・To execute a dog type home position return with the CC-Link communication functions, set "□0□□" in parameter No.PD14 and use Proximity dog (DOG) with the remote input (RY03) in this example.

Operate the driver of station 1 in the positioning mode and read the "motor speed" data.
Preset the parameter No.PC30 to "□□□2".
Operation: Alarm reset, dog type home position return, JOG operation, automatic operation under point table command

Code No.	Description
H0016	32-bit data of motor speed (hexadecimal)

Code No.	Description
K50000	Position command data (decimal)
K100	Speed command data (decimal)





*1: Setting time for the timer should be larger than the command processing time or twice the link scan time whichever larger. When the setting time is short, the command cannot be received properly.

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