M0007688

SANMOTION

AC SERVO SYSTEMS

R

TYPE S

Analog / Pulse Input Type

For Linear Motor

Instruction Manual

SANYO DENKI

Preface

This product corresponds with the shipping regulations given in the Export Trade Control Ordinance (Table 1, item 16) and the Foreign Exchange Ordinance (Table 1, item 16). When these products are exported by customers, and when exported including the other freight or together with other freight, it is recommended to fulfill the requirements related to Security Export Control with the relevant authorities, including “Information Requirements” and “Objective Requirements”.

This manual outlines the functions, wiring, installation, operations, maintenance, specifications, etc. of the AC servo amplifier “R” Series Type S. The “R” Series Type S AC servo amplifier system is compatible with a wide variety of various applications requiring low, medium or high capacity, high efficiency, reduced footprint, and excellent cost performance.
This product was developed to offer a series of servo motors that are easy to use and offer excellent functionality in an AC servo motor. It fulfills various needs, such as the downsizing of the control panel, and offers compatability for a wide range of applications requiring a servo motor.

★Precautions related to this Instruction Manual

- In order to fully understand the functions of AC servo amplifier “R” Series Type S, please read this instruction manual thoroughly before using it.
- After reading this manual thoroughly, please keep it handy for reference.
- Please contact the dealre or sales representative if there are defects such as nonconsecutive pages, missing pages or if the manual is lost or damaged.
- Carefully and completely follow the safety instructions outlined in this manual. Please note that safety is not guaranteed for usage methods other than those specified in this manual or usage methods intended for the original product.
- The contents of this manual may be modified without prior notice, as revisions or additions are made in the usage method of this product. Modifications are performed per the revisions of this manual.
- Permission is granted to reproduce or omit part of the attached figures (as abstracts) for use.
- Although the manufacturer has taken all possible measures to ensure the veracity of the contents of this manual, if you should notice any error or ommission, please notify the dealer or sales office of the finding.

【Safety Precautions】

This chapter is a summary of the safety precautions regarding the use of the R-series type-S amplifier.
Please read this entire manual carefully prior to installing, operating, performing maintenance or inspecting this device to ensure proper use.
Use this device only after learning about its operation, safety information, and the precautions related to its use. After reading the User Manual, keep it in a location where it is always available to the user for easy reference.

The R-series servo amplifiers and servo motors were designed for use with general industrial equipment. The following instructions should be followed:

- Read the User Manual carefully before any installation or assembly work to ensure proper use.
- Do not perform any retrofitting or modification of the product.
- Consult with your sale representatives or a trained professional technician regarding the installation and maintenance of these devices.
- Special consideration, such as redundant services or an emergency generator, is required when operating, maintaining and controlling devices in certain applications related to human safety or public functions. Contact your distributor or sales office if you intend to use these devices in applications such as;
  - ※ In medical instruments or systems used for life support;
  - ※ With control systems for trains or elevators, the failure of which could cause bodily injury;
  - ※ In computer systems of social or public importance;
  - ※ In other equipment or systems related to human safety or public infrastructure.

- Additionally, please contact your distributor or sales office if the device is to be used in an environment where vibration is present, such as in-vehicle or transport applications.

Safety Precautions [Make sure to follow.]

This documentation uses the following annotation. Make sure to strictly follow these safety precautions.

■ There are four precaution levels.

Danger	Denotes immediate hazards which WILL probably cause severe bodily injury or death as a result of incorrect operation.
Caution	Denotes hazards which COULD cause bodily injury and product or property damage as a result of incorrect operation.
	Even those hazards denoted by this symbol could lead to a serious accident.
Prohibited	Indicates actions that must not be allowed to occur prohibited actions.
Mandatory	Indicates actions that must be carried out (mandatory actions).

■ There are eight graphic symbols.

Type	Sample symbols
Danger symbols	Danger /Injury, Electric shock
Caution symbols	Caution, Fire, Burn
Prohibition symbols	Prohibited, Disassembly prohibited
Mandatory symbol	Mandatory

Danger

Do not use this device in explosive environment. Injury or fire could otherwise result.	Do not touch the inside of the amplifier. Electric shock could otherwise result.
Do not perform any wiring, maintenance or inspection when the device is hot-wired. After switching the power off, wait at least 5 minutes before performing these tasks. Electric shock could otherwise result.	Only technically qualified personnel should transport, install, wire, operate, or perform maintenance and inspection on this device. Electric shock, injury or fire could otherwise result.

Safety Precautions [Make sure to follow.]

Danger

The protective ground terminal (⏚) should always be grounded. The ground terminal of the linear motor should always be connected to the protective ground terminal (⏚) of the servo amplifier. Electric shock could otherwise result.	Do not damage the cable, do not apply unreasonable stress to it, do not place heavy items on it, and do not insert it in between objects. Electric shock could otherwise result.
Wiring should be done based on the wiring diagram or the user manual. Electric shock or fire could otherwise result.	Do not touch the rotating part of the linear motor during operation. Bodily injury could otherwise result.
Do not touch or get close to the terminal while the device is powered up. Electric shock could otherwise result.	Do not unplug the connector while the device is powered up. Electric shock could otherwise result.
Magnetic rails have been magnetized. Keep away from the magnets anyone who has electronic medical device such as a pace maker. Otherwise, the medical device will not work appropriately, leading to a serious danger to the person who has the medical device. Serious danger may be caused.	Magnetic rails have been magnetized. A strong magnetic attraction (or repulsion between magnets) arises between the magnets themselves or the magnets and any other objects made of iron such as jigs. Treat them carefully. Bodily injury could otherwise result.
Magnetic rails and coil have metal edges. Handle them with care. Bodily injury could otherwise result.	Voltage is generated at the motor power line when the coil is moved after having been installed. Electric shock could otherwise result.
Install a good protection cover at the mover. Bodily injury could otherwise result.	

Safety Precautions [Make sure to follow.]

Caution

Please read the User Manual carefully before installation, operation, maintenance or inspection, and perform these tasks according to the instructions. Electric shock, injury or fire could otherwise result.	Do not use the amplifier or the linear motor outside their specifications. Electric shock, injury or damage to the device could otherwise result.
Do not use a defective amplifier or linear motor. Injury or fire could otherwise result.	Use the amplifier and linear motor together in the specified combination. Fire or damage to the device could otherwise result.
Keep away dust, water or others from the coil moving area and the magnetic rails. Electric shock, injury or damage to the device could otherwise result.	The linear motor and the stage may be very heavy. Take care not to drop them. Injury could otherwise result.
Be careful of the high temperatures generated by the amplifier / linear motor and the peripherals. Burn could otherwise result.	Open the box only after checking its top and bottom location. Bodily injury could otherwise result.
Check that the product is as per your order. If a wrong product is installed, an injury or breakage may result. Injury or damage to the device could otherwise result.	Keep static electricity away from the motor's sensor terminals. Damage to the device could otherwise result.
Do not measure the insulation resistance and the pressure resistance. Damage to the device could otherwise result.	Wiring should follow electric equipment technical standards and indoor wiring regulations. An electrical short or fire could otherwise result.
Wiring connections must be secure. Otherwise, the linear motor may run away. Bodily injury could otherwise result.	Keep static electricity and high voltage away from the sensor terminals of the motor. Damage to the device could otherwise result.
Do not stand on the device or place heavy objects on top of it. Bodily injury could otherwise result.	Do not obstruct the air intake and exhaust vents, and keep them free of debris and foreign matter. Fire could otherwise result.

Safety Precautions [Make sure to follow.]

Caution

Make sure the mounting orientation is correct.  Fire or damage to the device could otherwise result.	Consult the User Manual regarding the required distance between the amplifier, the control panel interior, and other devices.  Fire or damage to the device could otherwise result.
Do not expose the device to water, corrosive or flammable gases, or any flammable material.  Fire or damage to the device could otherwise result.	Secure the device against falling, overturning, or shifting inadvertently during installation. For the linear motors with eyebolts, make sure to use them.  Bodily injury could otherwise result.
Do not subject the device to excessive shock or vibration.  Damage to the device could otherwise result.	Install the device on a metal or other non-flammable support.  Fire could otherwise result.
During working, do not hold any magnetic recorders such as magnetic cards, electronic clocks, kips or floppy disks.  Those recorders will be magnetized and cannot be used.	There will be more than 5 times as strong a magnetic attraction force as the maximum force between the coil and the magnetic rail. Fix this device (core type) firmly enough to resist it.  Bodily injury could otherwise result.
There is no safeguard on the linear motor. Use an over-voltage safeguard, short-circuit breaker, overheating safeguard, and emergency stop to ensure safe operation.  Injury or fire could otherwise result.	Do not touch the radiation fin of the amplifier, the regenerative resistor, or the linear motor while the device is powered up, or immediately after switching the power off, as these parts generate excessive heat.  Burn could otherwise result.
In the case of any irregular operation, stop the device immediately.  Electric shock, injury or fire could otherwise result.	Do not perform extensive adjustments to the device as they may result in unstable operation.  Bodily injury could otherwise result.
Trial runs should be performed with the linear motor in a fixed position, separated from the mechanism. After verifying successful operation, install the motor on the mechanism.  Bodily injury could otherwise result.	The securing brake is not to be used as a safety stop for the mechanism. Install a safety stop device on the mechanism.  Bodily injury could otherwise result.
Make sure to install a limit switch and collision safety device at the stroke end.  Bodily injury could otherwise result.	Make the collision safety device strong enough to resist the maximum output of the system.  Bodily injury could otherwise result.

Safety Precautions [Make sure to follow.]

Caution

Please contact your distributor or sales office if repairs are necessary. Disassembly could render the device inoperative. Damage to the device could otherwise result.	Make sure the device does not fall, overturn, or move inadvertently during transportation. Bodily injury could otherwise result.
When carrying the device, do not hold it with the cables. Damage to the device or bodily injury could otherwise result.	If the amplifier or the linear motor is no longer in use, it should be discarded as general industrial waste.
In the case of an alarm, first remove the cause of the alarm, and then verify safety. Next, reset the alarm and restart the device. Bodily injury could otherwise result.	Verify that the power specifications are normal. Damage to the device could otherwise result
Avoid getting close to the device, as a momentary power outage could cause it to suddenly restart (It should be designed to be safe even in the case of a sudden restart). Bodily injury could otherwise result.	Standard specification servo amplifiers have a dynamic brake resistor. Do not rotate the linear motor continuously from the outside when the amplifier is not powered on, because the dynamic brake resistor will heat up, and can be dangerous. Fire or burn could otherwise result.
Be careful during maintenance and inspection, as the body of the amplifier becomes hot. Burn could otherwise result.	It is recommended to replace the electrolytic capacitors in the amplifier after 5 years, if used at an average temperature of 40°C year round. The expected life of the cooling fan linear motor is 10 years, if used at an average temperature of 40°C year round. Regular replacement is recommended. Damage to the device could otherwise result.
Make sure to refer to the installation procedure at the times of maintenance inspection or loosening the system surrounding bolts. Bodily injury could otherwise result.	Do not put any conductive materials near the coil and the amplifier. Accidents by short-circuiting or electric shock could otherwise result.
When a work must be done with the protective cover removed, start working carefully and safely paying attention to an electric shock or runaway. Electric shock or injury could otherwise result.	

Safety Precautions [Make sure to follow.]

Prohibited

Do not store the device where it could be exposed to rain, water, toxic gases or other liquids. Damage to the device could otherwise result.	The built-in brake is intended to secure the linear motor; do not use it for regular control. Damage to the brake could otherwise result. Damage to the device could otherwise result.
Do not overhaul the device. Fire or electric shock could otherwise result.	Do not remove the nameplate attached to the device.
Do not apply additional treatment to the magnet area. Rust or fire could otherwise result.	

Mandatory

Store the device where it is not exposed to direct sunlight, and within the specified temperature and humidity ranges {−20°C to+ 65°C, below 90% RH (non-condensing)}.	Please contact our office if the amplifier is to be stored for a period of 3 years or longer. The capacity of the electrolytic capacitors decreases during long-term storage, and could cause damage to the device. Damage to the device could otherwise result.
Install an external emergency stop circuit that can stop the device and cut off the power instantaneously. Install an external protective circuit to the amplifier to cut off the power from the main circuit in the case of an alarm. Motor interruption, bodily injury, burnout, fire and secondary damages could otherwise result.	Operate within the specified temperature and humidity range {Amplifier: Temperature 0°C to 55°C, Humidity below 90% RH (non-condensing); Linear motor: Temperature 0°C to 40°C, Humidity below 90% RH (non-condensing)}. Burnout or damage to the device could otherwise result.
Follow the directions written on the outside box. Excess stacking could result in collapse. Bodily injury could otherwise result.	The linear motor angling bolts are used for transporting the motor itself; do not use them for transporting the machinery, etc. Damage to the device or bodily injury could otherwise result.
When transporting the magnetic rail, it must packed as it was. Transporting it without package could result in injury, since it has been magnetized.	Items heavier than 18kg shall be moved by a crane or a lift. Bodily injury could otherwise result.

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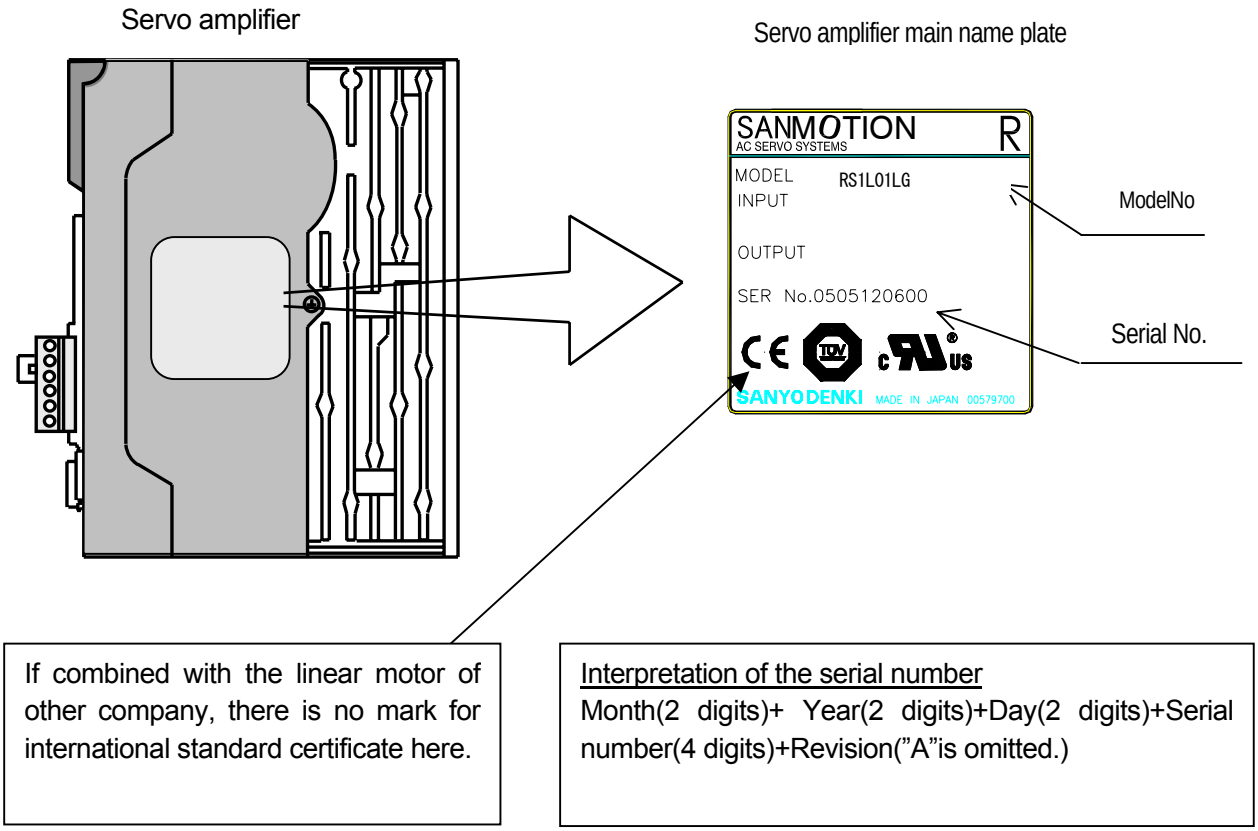
1

[Prior to Use]

1. Prior to Use [Product verification]

■ Verify the followings when the product arrives. If you find any discrepancy, contact your distributor or sales office.

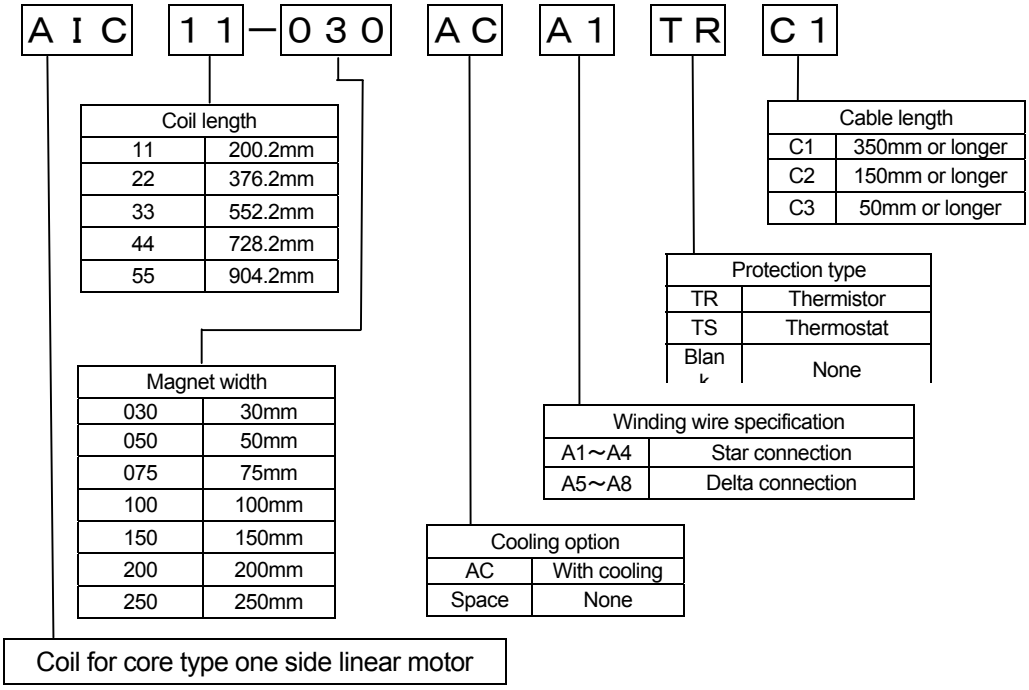
- Verify that the model number of the linear motor or servo amplifier is the same as ordered.
  (The model number is located on the main name plate, following the word “MODEL”.)（
- Verify that there are no abnormalities, such as damages to the exterior of the linear motor and the servo amplifier, or missing accessories.
- Verify that there are no loose screws on the linear motor and the servo amplifier.



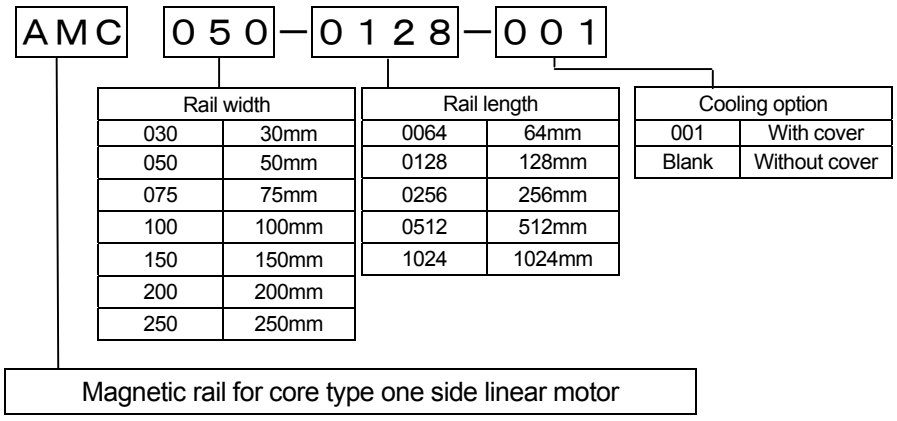
If combined with the linear motor of other company, there is no mark for international standard certificate here.

Interpretation of the serial number
Month(2 digits)+ Year(2 digits)+Day(2 digits)+Serial number(4 digits)+Revision(”A”is omitted.)

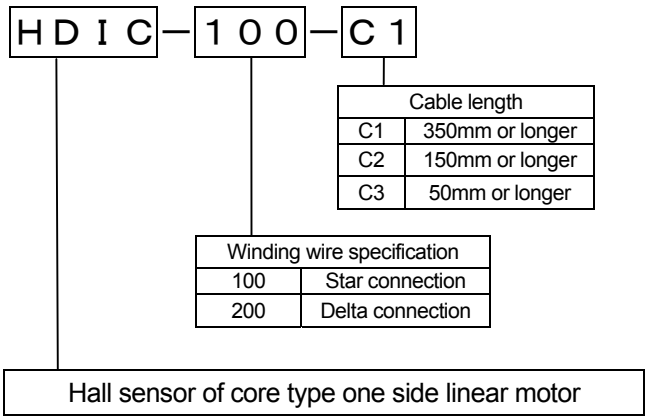
■ Core type one side linear motor【**Coil model number**】



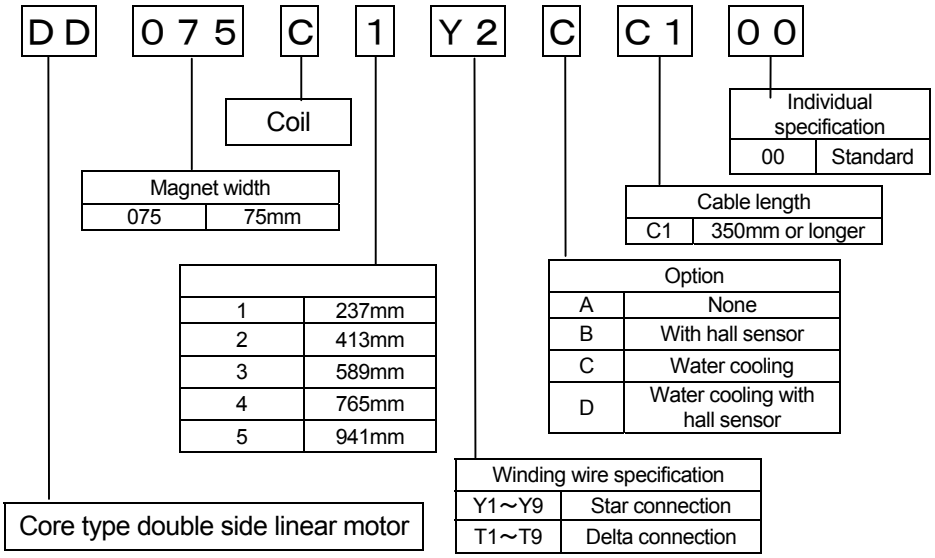
■ Core type one side linear motor【**Magnetic rail model number**】



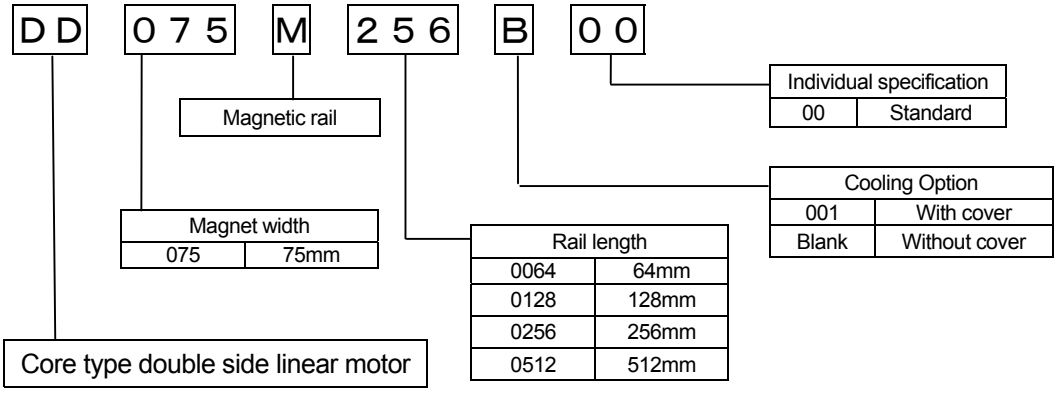
■ Core type one side linear motor【**Hall sensor model number**】



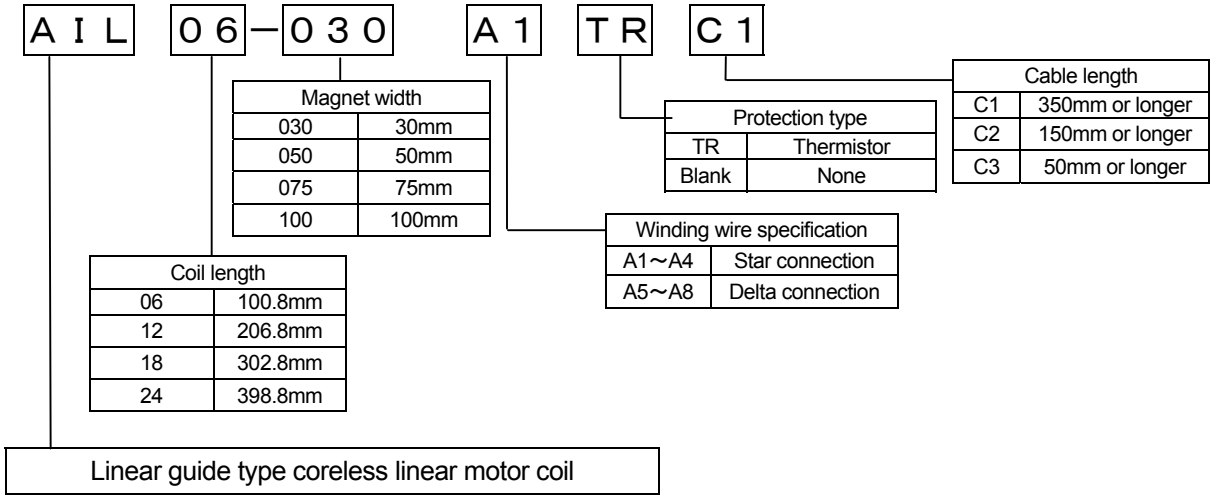
■ Core type double side linear motor【Coil model number】



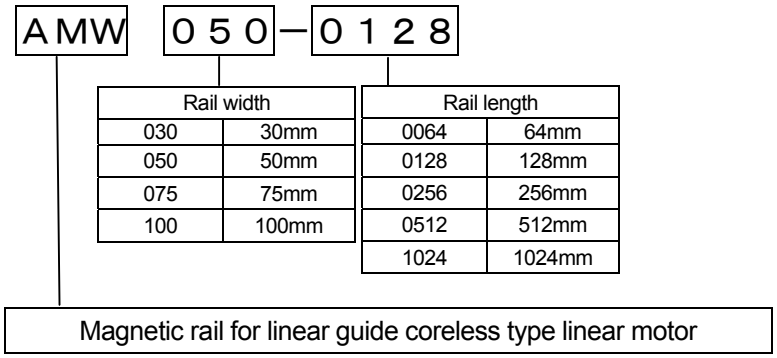
■ Core type double side linear motor【Magnetic rail model number】



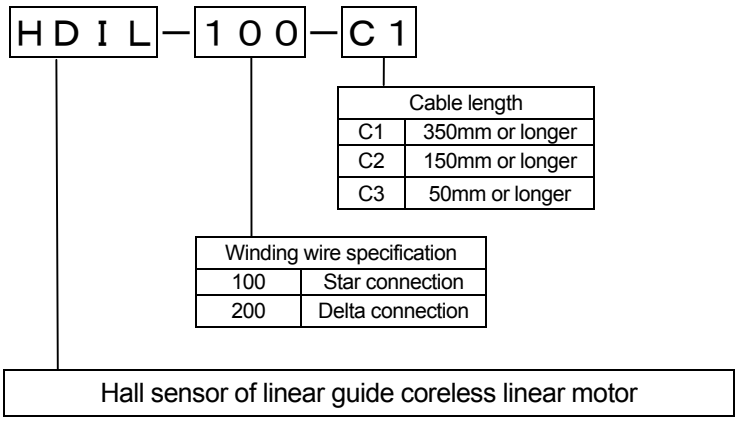
■ Coreless type linear motor【Coil model number】



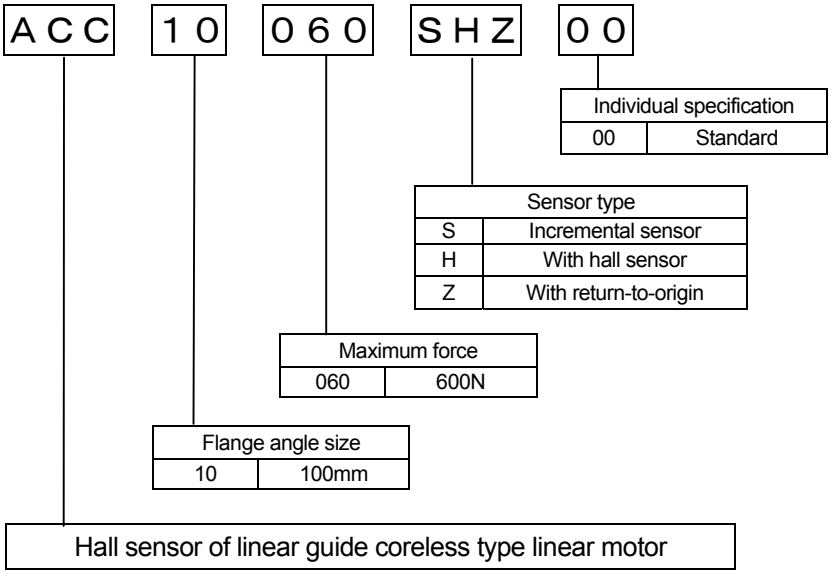
■ Coreless type linear motor【Magnetic rail model number】



■ Core type one side linear motor【Hall sensor model number】

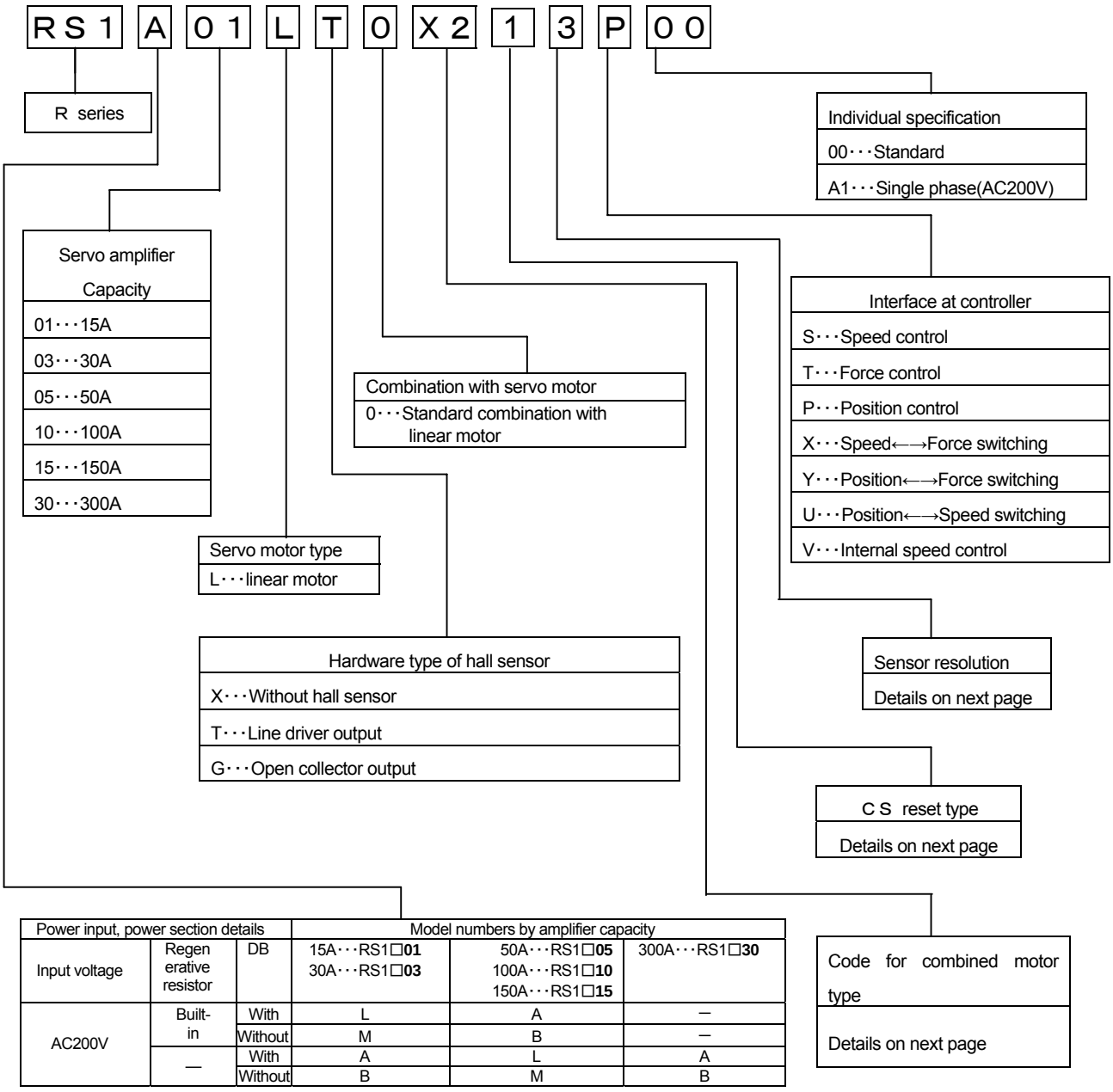


■ Cylinder type linear motor model number



1. Prior to Use [Servo amplifier model number]

■ Servo amplifier model number; combined with SANYO DENKI's 3 phase synchronous type linear motor



Power input, power section details			Model numbers by amplifier capacity		
Input voltage	Regenerative resistor	DB	15A···RS1□**01** 30A···RS1□**03**	50A···RS1□**05** 100A···RS1□**10** 150A···RS1□**15**	300A···RS1□**30**
AC200V	Built-in	With	L	A	—
		Without	M	B	—
	—	With	A	L	A
		Without	B	M	B

The design order is noted by alphabetical characters at the end of the Lot Number on the name plate.

■ Code for combined motor type

200VAC input specification

Combined servo amplifier	linear motor model number	Motor code	Combined servo amplifier	linear motor model number	Motor code	Combined servo amplifier	linear motor model number	Motor code
RS1L01L RS1A01L RS1M01L RS1B01L	AIL06-030A1	Y1	RS1L05L RS1A05L RS1M05L RS1B05L	AIC11-100A5	Z4	RS1L15L RS1A15L RS1M15L RS1B15L	DD075C2Y2C	X2
	AIL06-050A1	Y2		AIC11-150A5	Z5		AIC44-100A7	ZH
	AIL06-075A1	Y3		AIC11-200A5	Z6		AIC44-150A7	ZJ
	AIL06-100A1	Y4		AIC22-050A2	Z7		AIC44-200A7	ZK
	AIL12-030A1	Y5		AIC22-075A2	Z8		AIC44-250A7	ZL
	ACC10060	YP		AIL18-050A3	Y9			
				AIL18-075A3	YA			
				AIL18-100A3	YB			
				AIL24-050A3	YC			
				AIL24-075A3	YD			
				AIL24-100A3	YE			
RS1L03L RS1A03L RS1M03L RS1B03L	AIC11-030A1	Z1	RS1L10L RS1A10L RS1M10L RS1B10L	DD075C1Y2C	X1	RS1L30L RS1M30L	DD075C3Y2C	X3
	AIC11-050A1	Z2		AIC22-100A6	Z9		DD075C4Y2C	X4
	AIC11-075A1	Z3		AIC22-150A6	ZA		DD075C5Y2C	X5
	AIL12-050A2	Y6		AIC22-200A6	ZB		AIC55-250A7	ZM
	AIL12-075A2	Y7		AIC33-050A7	ZC			
	AIL12-100A2	Y8		AIC33-075A7	ZD			
				AIC33-100A7	ZE			
				AIC33-150A7	ZF			

■ CS reset type

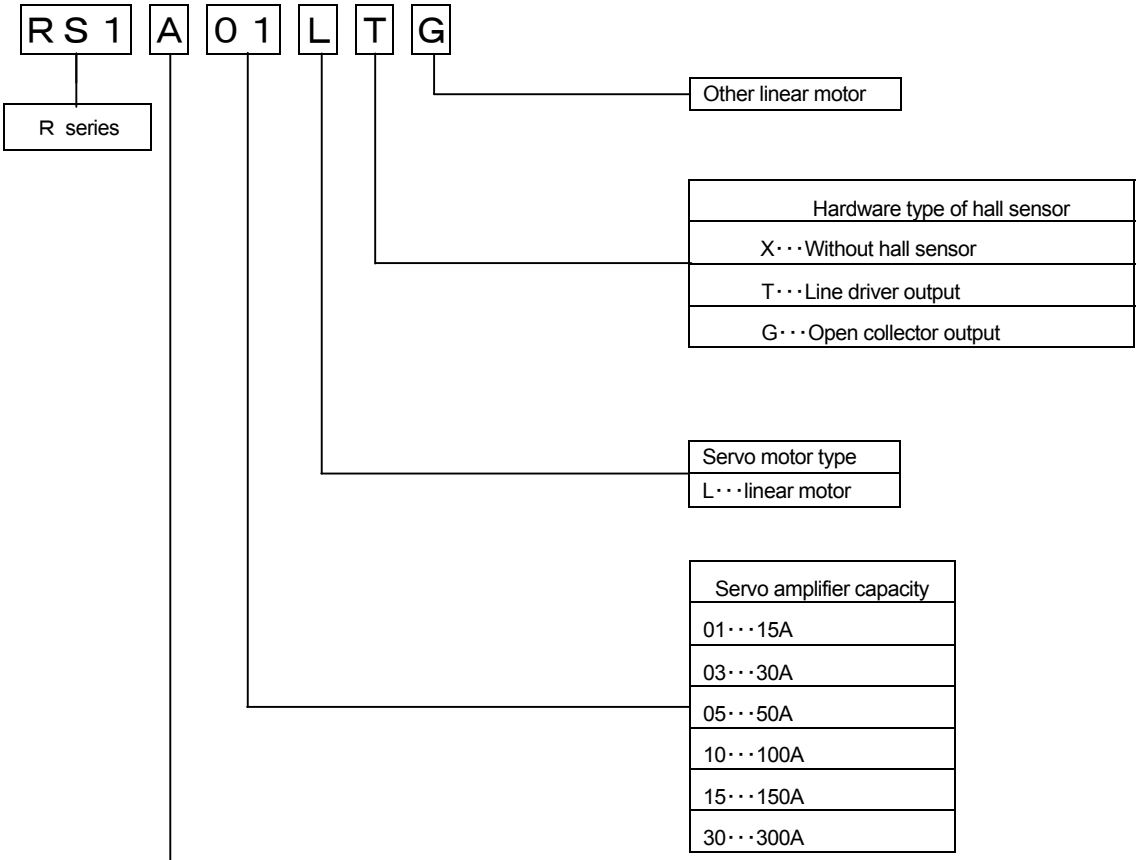
Sensor code	Linear sensor type	With/without hall sensor	CS resetting method	Remarks
1	Incremental	With	Hall sensor U phase	Standard for linear guide type
2	Incremental	With	Incremental Z phase	Standard for cylinder type
3	Incremental	With	———	
6	Incremental	Without	Fixed excitation	

■ Sensor resolution

Sensor code	Resolution	Sensor code	Resolution
1	1μm [1000P/mm]	6	0.5μm [2000P/mm]
2	2μm [500P/mm]	7	1.25μm [800P/mm]
3	5μm [200P/mm]	8	2.5μm [400P/mm]
4	0.1 μm [10000P/mm]	9	0.05μm [20000P/mm]
5	0.25μm [4000P/mm]	0	Others

1. Prior to Use [Servo amplifier model number]

■ Servo amplifier model number; combined with other linear motors

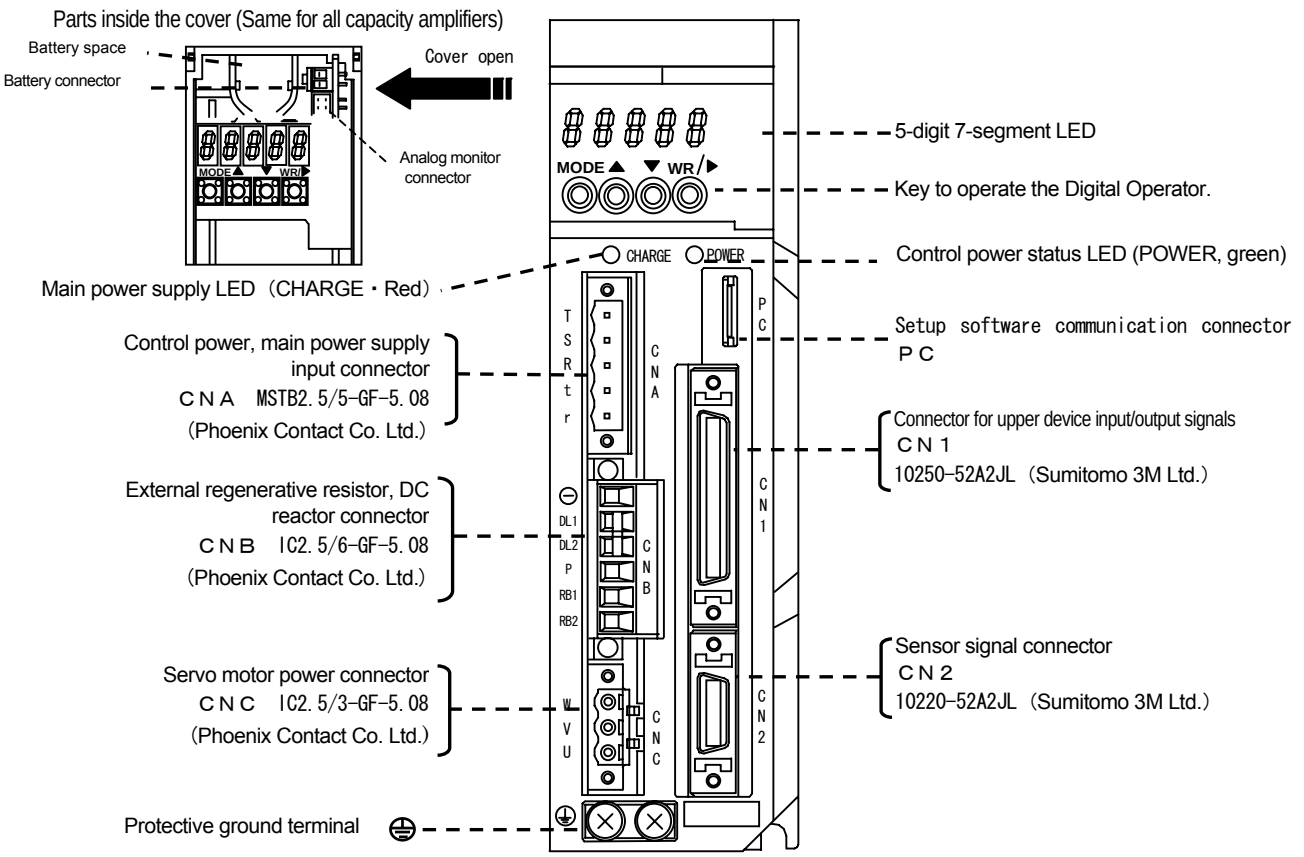


Power input, power section details			Model numbers by amplifier capacity		
Input voltage	Regenerative resistor	DB	15A···RS1□**01** 30A···RS1□**03**	50A···RS1□**05** 100A···RS1□**10** 150A···RS1□**15**	300A···RS1□**30**
AC200 V	Built-in	W	L	A	—
		W/O	M	B	—
	—	W	A	L	A
		W/O	B	M	B

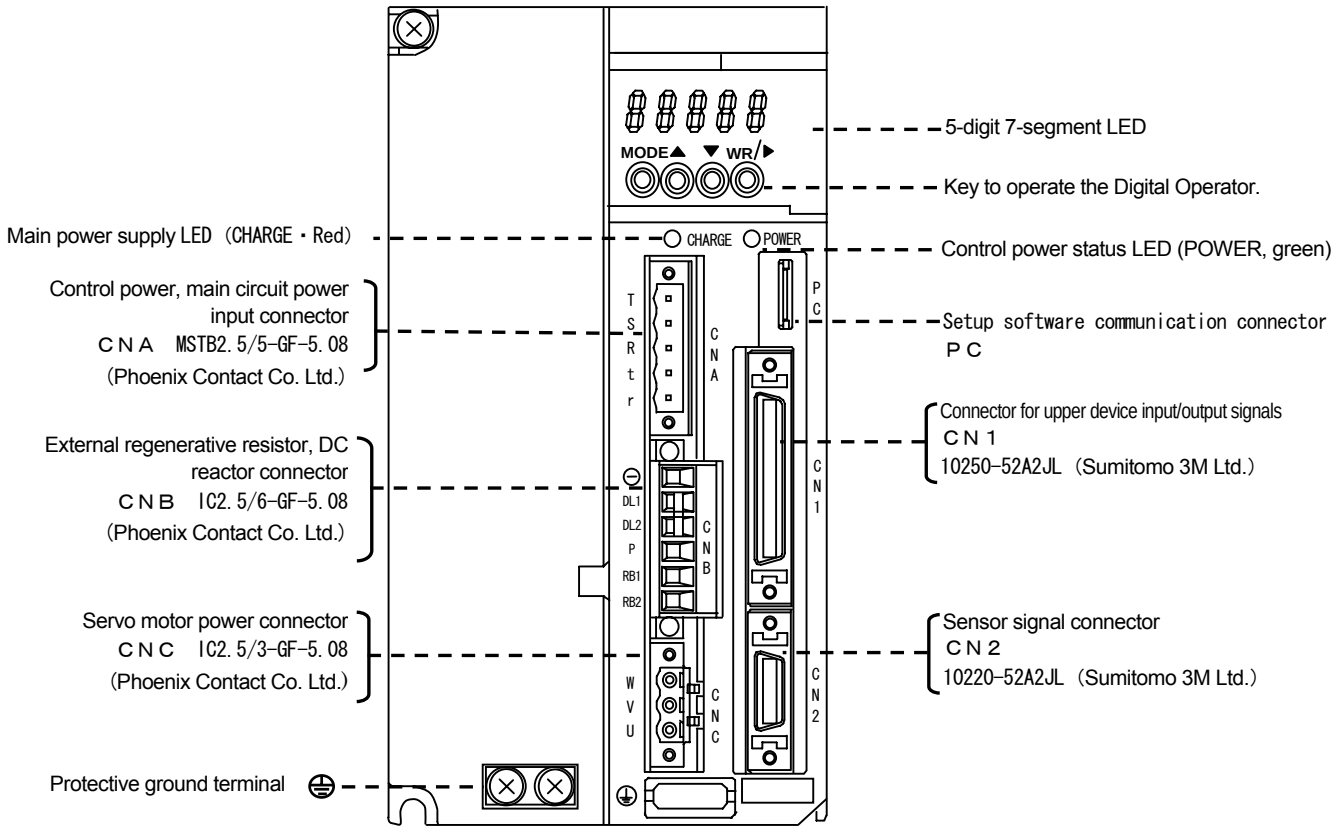
The design order is noted by alphabetical characters at the end of the Lot Number on the name plate.

Certification mark does not come with the product, since it is other than that certified by international standards.

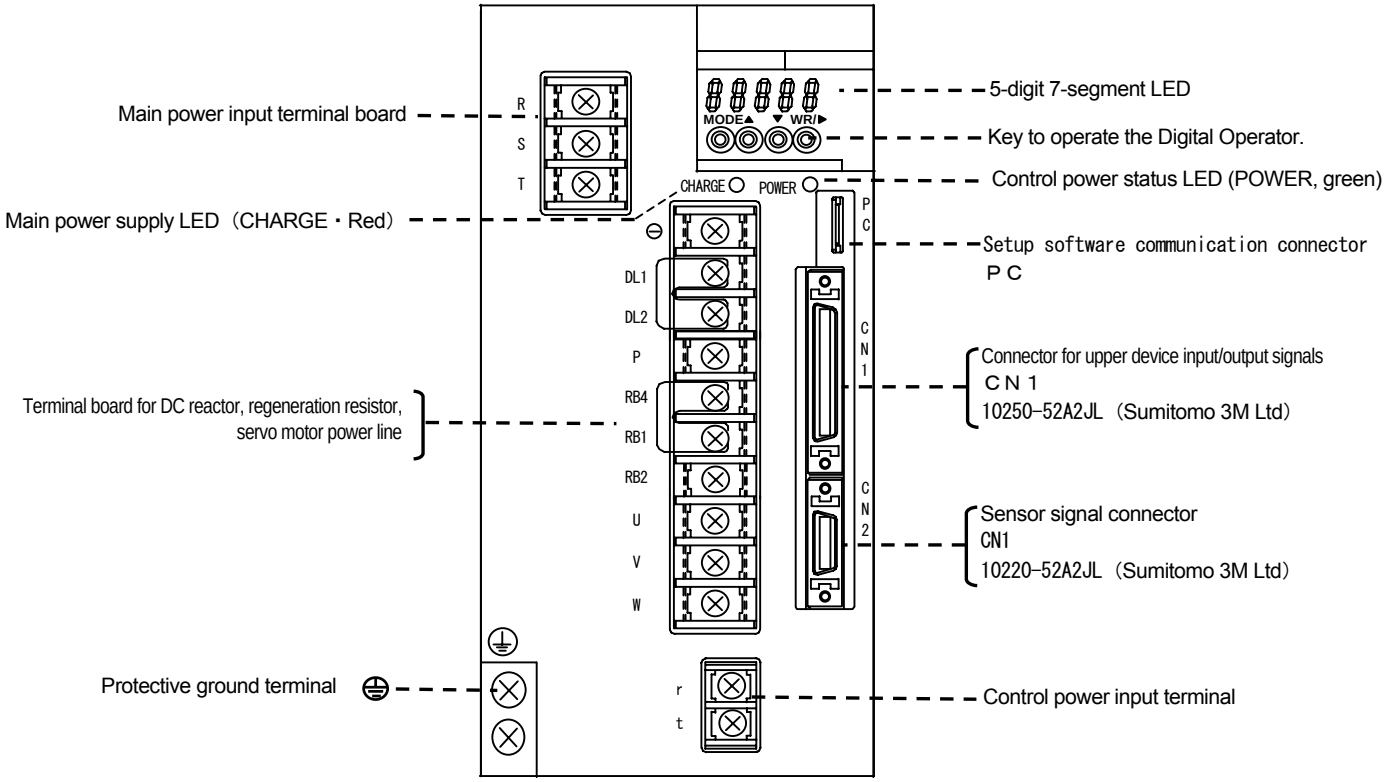
■ RS1□01L□ / RS1□03L□



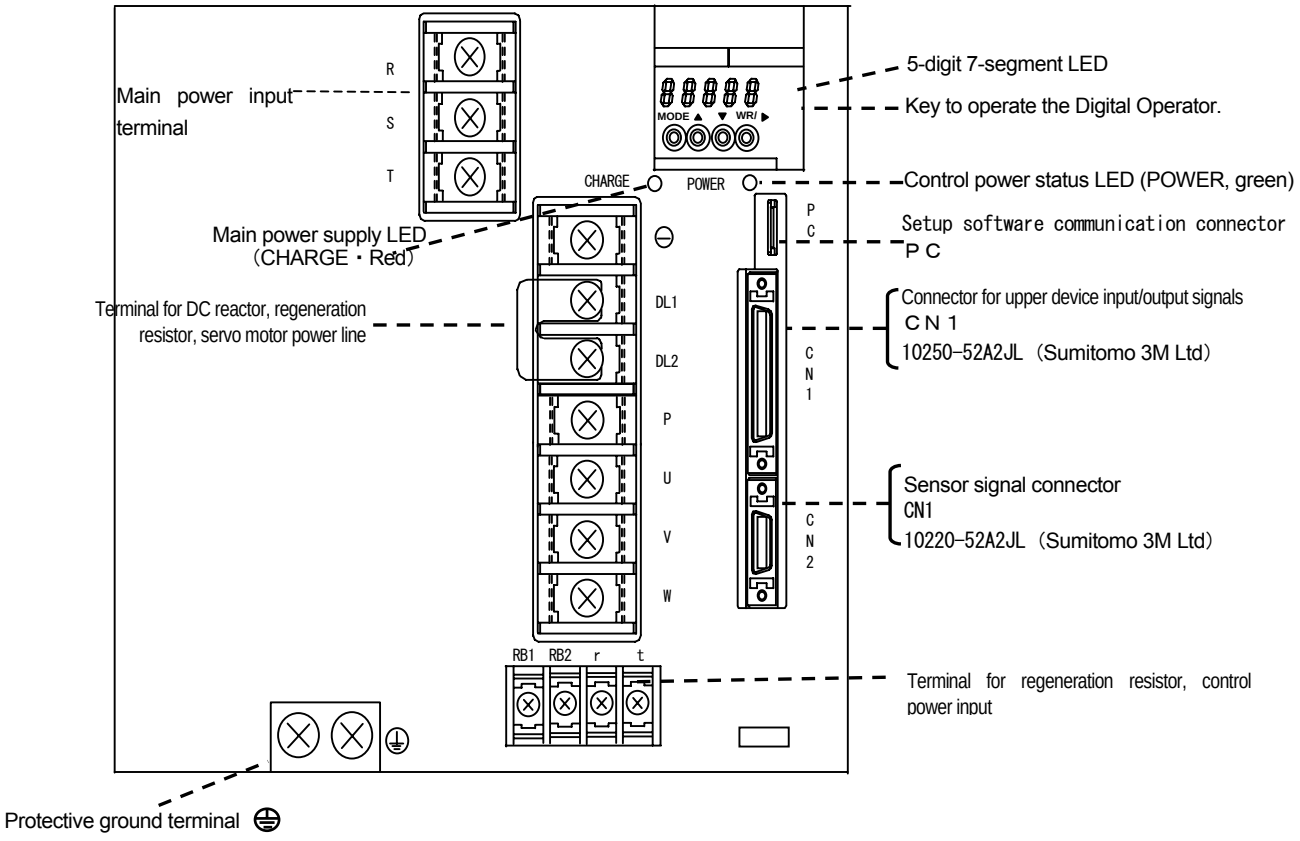
■ RS1□05L□



■ RS1□10L□ / RS1□15L□



■ RS1□30L□



2

[Installation]

2. Installation [Servo amplifier]

■ Please note the following points regarding the servo amplifier installation location and mounting method.

Various precautions

The device should be installed on non-flammable surfaces only. Installation on or near flammable materials can cause fire.	Do not stand, put or drop heavy items on the servo amplifier.
Operate the device within the specified environmental conditions.	Do not drop the device or subject it to excessive shock.
Do not install or operate a damaged device, or one with damaged parts; return it for repair.	Make sure no screws or other conductive or flammable materials get inside the servo amplifier.
Contact your distributor or sales office if the servo amplifier was stored or out of use for an extended period of time.	

If enclosed in a cabinet

The temperature inside the cabinet can exceed the external temperature depending on the power consumption of the device and the size of the cabinet. Consider the cabinet size, cooling, and placement, and make sure the temperature around the servo amplifier does not exceed 55°C. For longevity and reliability purposes it is recommended to keep the temperature below 40°C.

If there is a vibration source nearby

Protect the servo amplifier from vibration by installing it on a base with a shock absorber.

If there is a heat generator nearby

If the ambient temperature may increase due to convection or radiation, make sure the temperature near the servo amplifier does not exceed 55°C.

If corrosive gas is present

Long-term use may cause contact failure on the connectors and connecting parts.
Never use the device where it may be exposed to corrosive gas.

If explosive or combustible gas is present

Never use the device where explosive or combustible gas is present. The device's relays and contacts, regenerative resistors and other parts can arc (spark) and can cause fire or explosion.

If dust or oil mist is present

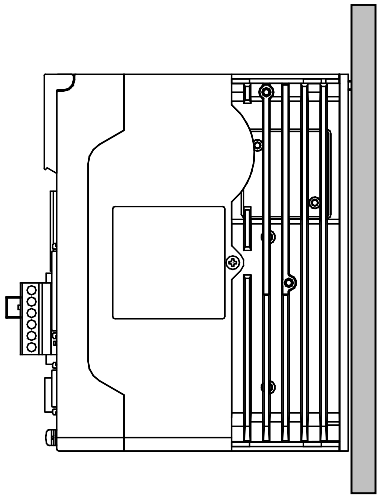
The device cannot be used where dust or oil mist is present. If dust or oil mist accumulates on the device, it can cause insulation deterioration or leakage between the conductive parts, and damage the servo amplifier.

If a large noise source is present

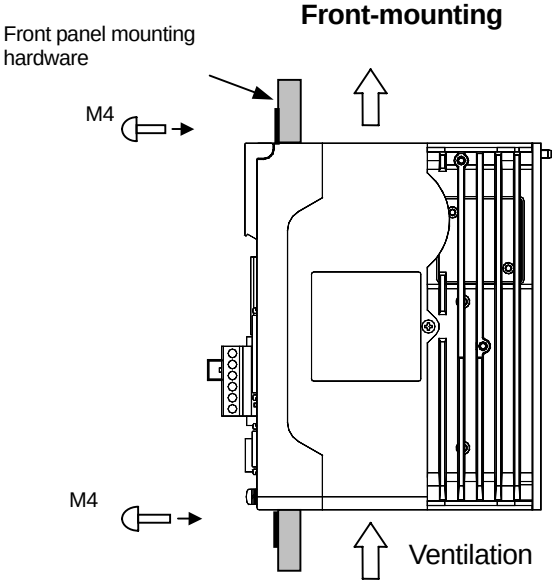
If inductive noise enters the input signals or the power circuit, it can cause a malfunction. If there is a possibility of noise, inspect the line wiring and take appropriate noise prevention measures. A noise filter should be installed to protect the servo amplifier.

■ Mounting direction and location

Rear-mounting



Front-mounting

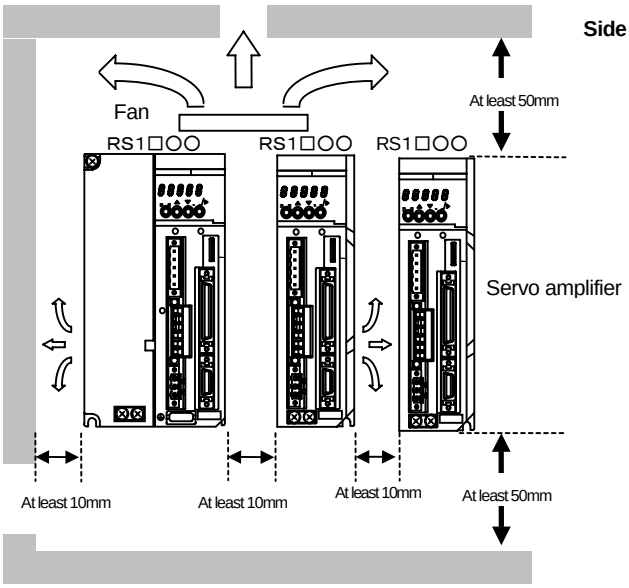


For metal fittings for front/rear mounting, refer to options (compatible with PY2 mounting).

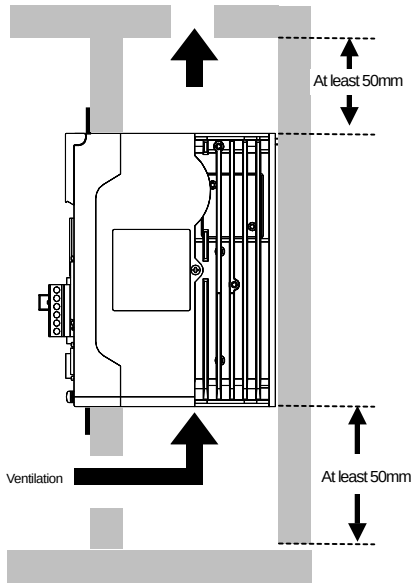
■ Arrangement within the machine

- Leave at least 10 mm space above and below the servo amplifier to ensure unobstructed airflow from the inside of the servo amplifier and the radiator. If heat gets trapped above the servo amplifier, use a fan to create airflow.
- Leave at least 10 mm space on both sides of the servo amplifier to ensure unobstructed airflow from the heat-sinks on the side and from the inside of the servo amplifier.
- If the R-series servo amplifier is installed on its side, make sure that the ambient temperature does not exceed 50°C, and mount the back panel to a metal plate at least 2mm thick.
- For RS1□03・RS1□05, a fan is attached at the side. Therefore, it is recommended that the servo amplifier be mounted in an arrangement as shown below.

Front view



Side view



2. Installation [Linear motor]

■ Precautions for Linear Motor Installation

In handling the Linear Motor, note the following precautions, or any accident or breakage may occur. Ask experts in respective fields for transportation, installation, wiring, operation, maintenance and inspection.

- Wear designated clothes and safety shoes. Wear non-slip gloves when the power is turned off, but do not while operation.

- Since the unit is heavily packed as exports, use a crane or forklift for unloading it. Only qualified persons are allowed to operate cranes and forklifts.

- The magnetic rails have been magnetized. So do not wear or hold any magnetic materials when opening the wooden frame, because there is high magnetic attraction force. While the product is covered in a wooden frame, there is no danger of attraction, but take care not to carry or hold anything magnetic such as magnetic cards. If any of the magnetic recording device such as floppy disk or precision electric equipment such as a personal computer is placed near the magnetic rails, its data may be damaged and troubles may occur.

- Products of 18kg or heavier must be handled by 2 persons.

- When the product is temporarily stored before installing on the test component, make sure to keep it on a wooden rest.

- Anyone who has a pace maker, other electric medical equipment or magnetic materials transplanted in his/her body must not be within 50cm from the Linear Motor.

- Use a carriage and a crane for moving the products of 18kg or heavier. Even if the product is lighter than 18kg, transport it using e a carriage.

- Install a limit switch and collision safety equipment (e.g. a shock absorber) at the stroke end. Beware to make the equipment resist the maximum output of the system. Take care not to make the collision safety equipment directly stress the coil or magnetic rails.

- When the power is turned ON, do not let anyone enter the moving area of the equipment by putting a cover or blocking board. The power must be turned OFF whenever someone enters within the movable area.

- At the time of power failure, alarm and emergency stop, the dynamic brake will start. However, there is a controlling delay time (0.01 to 0.05s), during which the system is under free running. In case when the movable part is heavy or the operation speed is fast, running distance is long and some collision safety equipment is needed.

- The motor itself does not have a mechanical brake, so when the position is to be maintained at the time of power turn off, a mechanical brake is specially needed.

2. Installation [Core type one side linear motor]

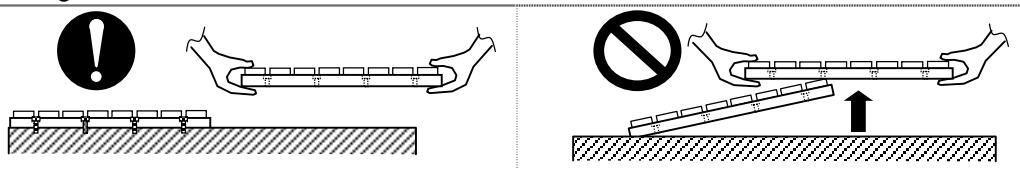
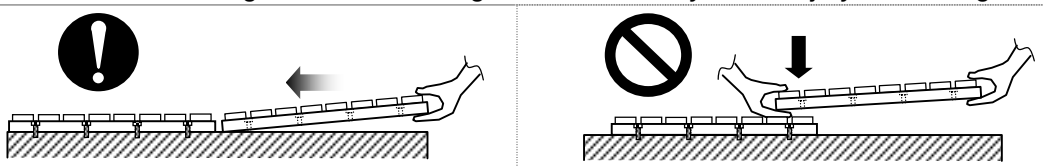
■ Installation place

Install the Linear Motor indoors under the following environment.

- Ambient temperature: 0 to 40°C
- Storage temperature: -20 to 65°C
- Ambient humidity: 20 to 90% Without dew condensation.
- Good ventilation, no corrosive or explosive gases present.
- No dust or dirt accumulation in the environment.
  Easy access for inspection and cleaning.

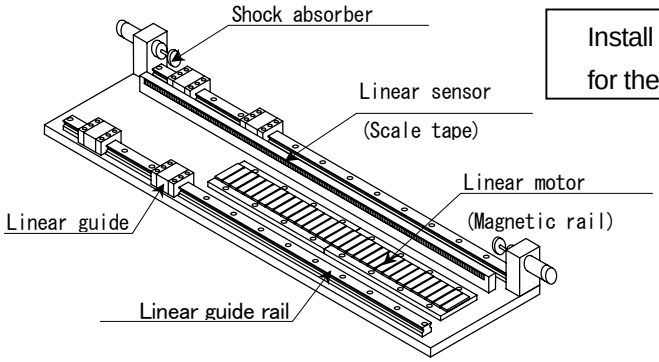
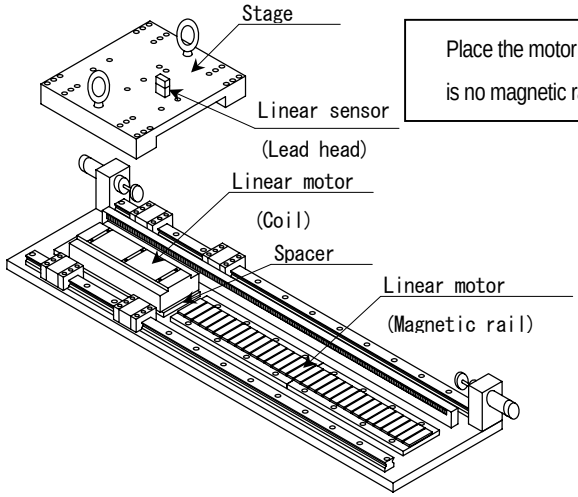
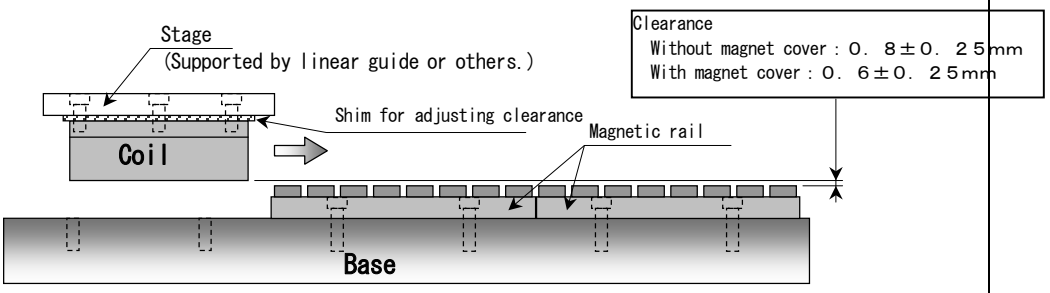
■ Installation of core type one side linear motor

- **Installation of magnetic rails**

Step	Description
1	Strong magnet is set in the surface of the magnetic rail. High magnetic attraction force exists between themselves and between the rails and the motor coil or tools made of iron. Take care not to have your hands caught
2	Attraction force between the motor coil and the magnetic rail is more than 5 times as strong as the maximum force, which is constant even when the motor power is off. Therefore, the system structure must be rigid enough to support the magnetic attraction and maintain precision.
3	Do not start operation having any magnetic dust or metal, or dirt on the surface of the magnetic rails, otherwise, those foreign materials may be caught in the mover and cause troubles. Depending on the operation condition, bellows or sliding cover is needed to prevent foreign materials from attaching. Take care to keep the surface of the magnetic rails clean.
4	All the pinholes of the magnetic rails must be facing the same direction.
5	When installing, the bottom of the magnetic rails (flat surface) must be the contact point. If the top surface (uneven surface) comes near the base, high magnetic force is generated and may cause injury or breakage.
6	Position pinholes of the magnetic rails (ϕ5.11) must be all on the same side. If not, polarity order of the magnetic rails is inappropriate and there is a danger of runaway.
7	Install the magnetic rails one by one using all the installing screws. Tightening torque of the installing screws M6 is 13.6N・m or more (recommended: screw strength class 10.9, and non-magnetic screws), their engagement length is 9mm or longer and apply fixatives. If some magnetic rails are not fixed by appropriate screws, magnetic attraction will be generated when other magnetic rails or magnetized metal come near, resulting in injury or breakage. 
8	Install the magnetic rails in order from end. When installing one magnetic rail next to the one already fixed, do not place the former above the latter but place it from the side of the latter. Otherwise, magnetic force will be generated and may cause injury or breakage. 

2. Installation [Core type one side linear motor]

● Installation of coil ＜where there is no magnetic rail.＞

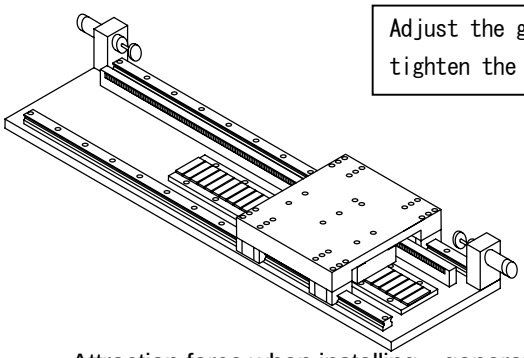
Step	Description
1	Install the magnetic rail at only the half of the whole stroke, and confirm that each area with and without magnetic rail is longer than the coil length by 50mm minimum.  Install the magnetic rail except for the motor coil length.
2	Place the coil on the base where there is no magnetic rail using a spacer. Use a spacer of appropriate material which does not damage the base and the coil. Take care not to have your fingers caught in between the coil and the base. Use a spacer which is a little thinner than the magnetic rails.  Place the motor coil and the stage where there is no magnetic rail installed, and tighten the installing bolts
3	All the M5 taps for installing the coil must be used. Tightening torque is 8.0N･m or more (screw strength class 10.9 or more), engagement length is longer than 6mm and shorter than 8mm. Apply fixatives. Insert a shim between the coil and the stage to adjust the gap between the magnetic rail and the coil. Its appropriate length is or the one without magnet cover, for the one with magnet cover. ・Without magnet cover：0.8±0.25mm ・With magnet cover　：0.6±0.25mm 

2. Installation [Core type one side linear motor]

4

Slide the movable stage which has the coil installed onto the magnetic rails which have been fixed by screws. Magnetic force by which the coil is drawn toward the magnet surface is shown in the table below. When the whole coil is on the magnetic rail, attraction force no longer exists.

Adjust the gap between the motor coil and magnetic rail, tighten the installing bolts.

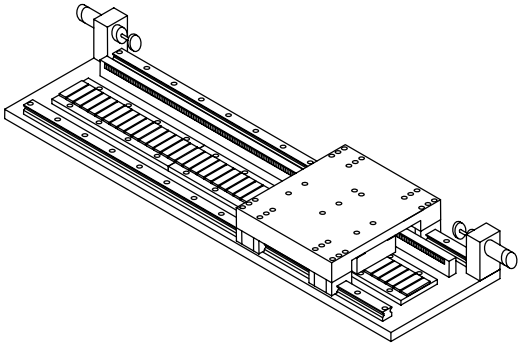


Attraction force when installing : generates both ± every 16mm approximately.

Series	Force
AIC□□-050	Approx. ±100N
AIC□□-075	Approx. ±150N
AIC□□-100	Approx. ±200N
AIC□□-150	Approx. ±300N
AIC□□-200	Approx. ±400N
AIC□□-250	Approx. ±500N

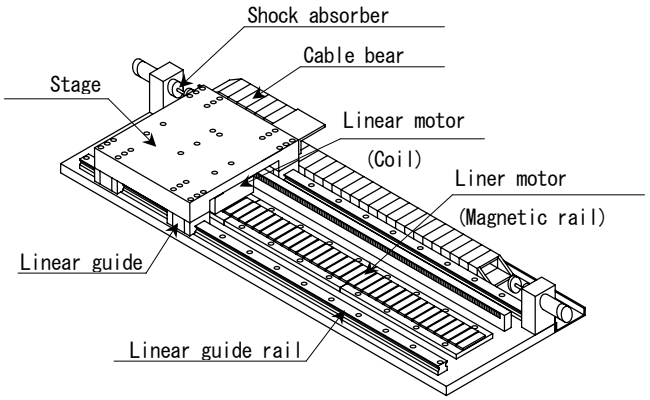
5

Install the remaining magnetic rails.



6

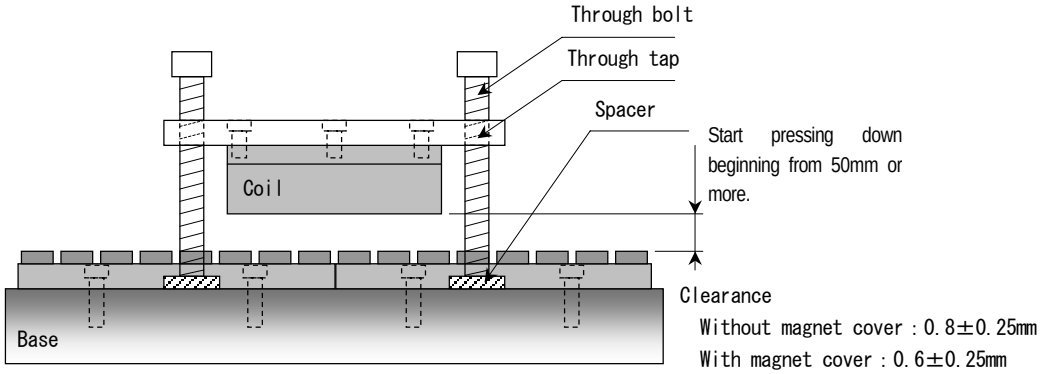
Installation is complete when the motor has been installed. Then conduct wiring.

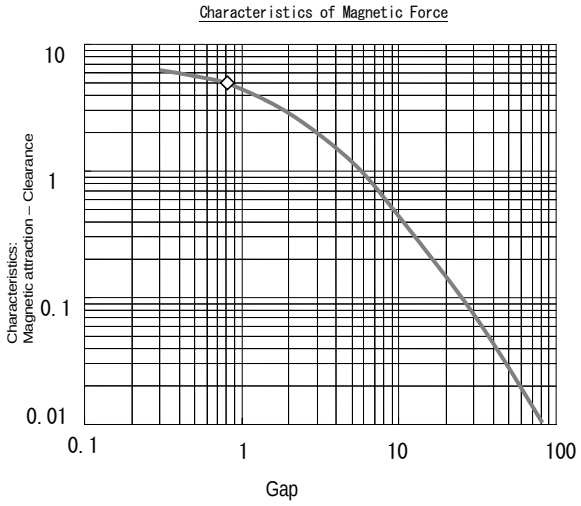


2. Installation [Core type one side linear motor]

- Installation of coil (where there are magnetic rails.)

Step	Description
1	After having installed all the magnetic rails, place the coil above the magnetic rails using non-magnetic spacer of 50mm or thicker. Non magnetic spacer must be of the material which would not be compressed by the coil self weight.
2	Prepare through taps to horizontally raise or lower the stage by bolts. Tips of the through bolts must contact the base so that the stage can be lifted. To avoid any damage between the through bolts and the base, use spacers made of resin. Take the magnetic attraction force into account when choosing the shape and number of the taps and spacers.
3	Install the stage on top of the coil and connect them together. Insert through bolts into through taps and lift the stage and the coil together, then separate the coil and non-magnetic spacers and remove the spacers.
4	Press more than two through screws down in order to lower the stage horizontally until the guide block can support it. Then remove the through bolts. Adjust the stage where the space between the coil and the magnet is wide and attraction force is small.



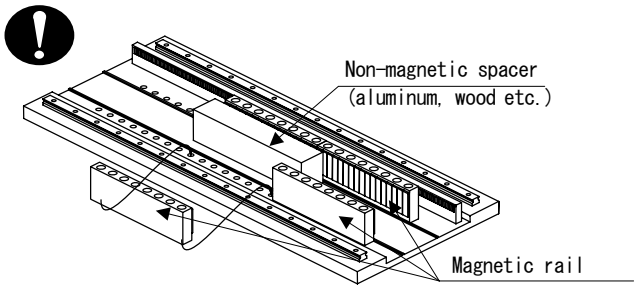
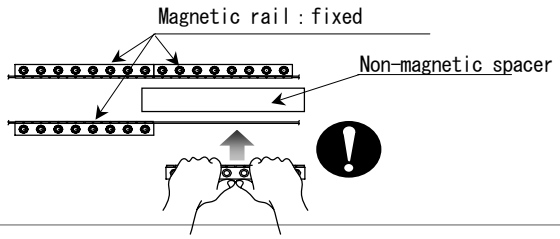
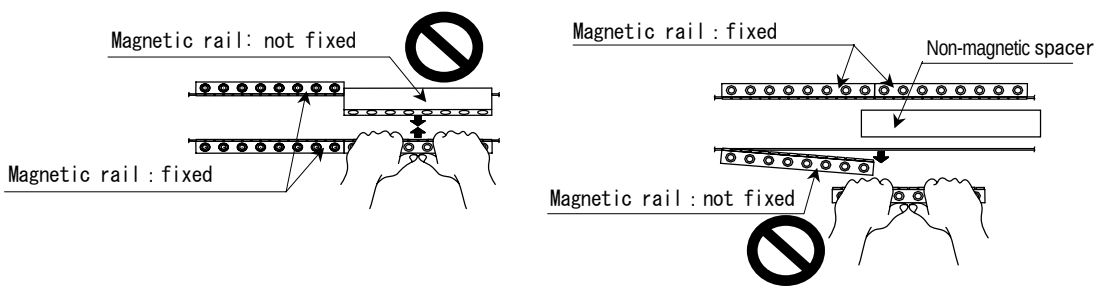


Keep 50mm or more for security reasons.

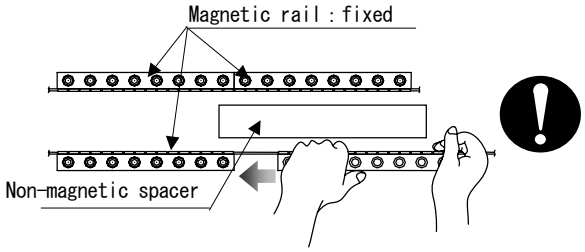
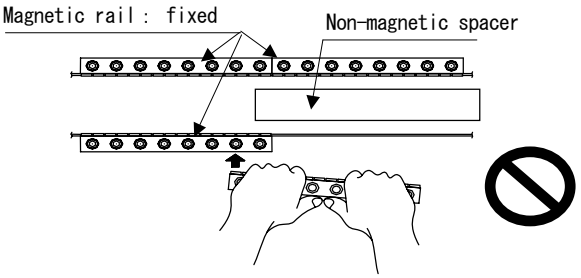
2. Installation [Core type double side linear motor]

■ Installation of core type both side linear motor

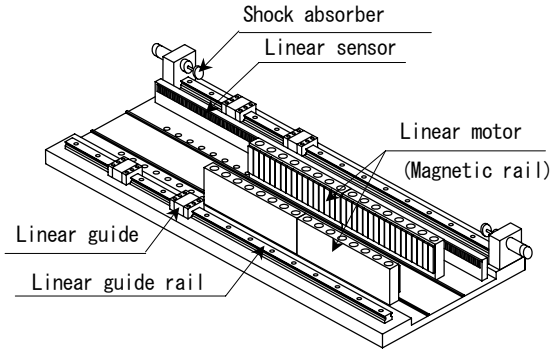
● **Installation and precautions of magnetic rails**

Step	Description
1	Strong magnet is set on the surface of the magnetic rails. High magnetic attraction force is generated between the magnets themselves and between the motor coil, tools or jigs made of iron when they are placed near the magnetic rails. Take care not to have your hands caught.
2	Magnetic attraction force exists between the magnetic rails and the motor coil, which is constant even when the motor power is turned off. Therefore, the system structure must be rigid enough to support the magnetic attraction and maintain precision.
3	Do not start operation having any magnetic dust or metal, or dirt on the surface of the magnetic rails, otherwise, those foreign materials may be caught in the mover and cause troubles. Depending on the operation condition, bellows or sliding cover is needed to prevent foreign materials form attaching. Take care to keep the surface of the magnetic rails clean.
4	When installing the magnetic rails, make sure to set the magnet surface (uneven surface) of the magnetic rail on each side facing each other. For security reasons, place a non-magnetic spacer of 30 to 80mm in width and 100mm or higher between the facing magnetic rails to avoid magnetic attraction between the magnetic rails on both sides. 
5	When installing the magnetic rails, make sure that the counter sinking on the installation holes should be facing up. If installed in wrong direction, the installing bolt head will interfere the motor coil and cause breakage.
6	Install the magnetic rails one by one using all the installing bolts. Tightening torque of the installing bolts M10 is 66 N･m or more (recommended: bolt strength class 12.9), their engagement length is 15mm or longer and apply anti-loosening agent. If any magnetic rails are not fixed by appropriate bolts, magnetic attraction will be generated when other magnetic rails or magnetized metal come near, resulting in injury or breakage.  

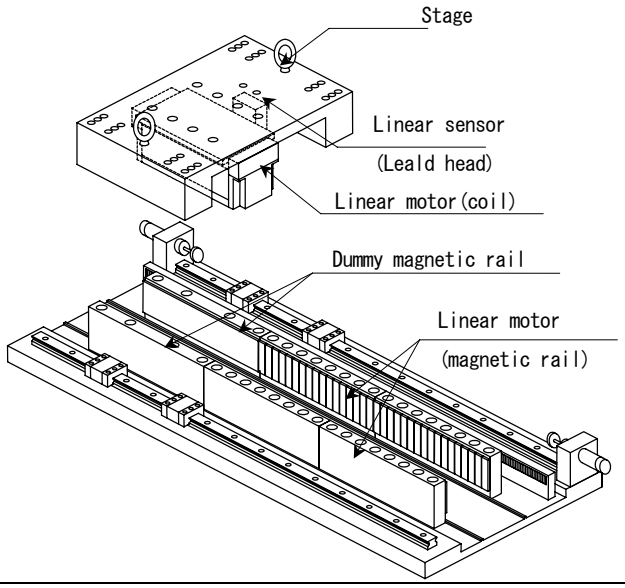
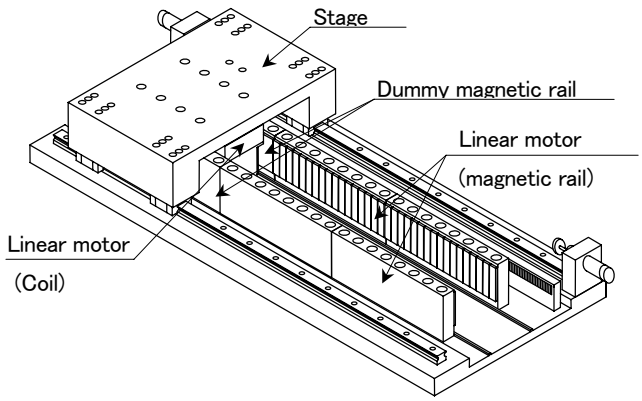
2. Installation [Core type double side linear motor]

7	Install the magnetic rails in order from end. When installing one magnetic rail next to the one already fixed, do not place the former from the side of the latter but place it from front or back of the latter. Otherwise, magnetic force will be generated and may cause injury or breakage.
	
	

● Installation of coil

Step	Description
1	Install the magnetic rail at only the half of the whole stroke, and confirm that each area with and without magnetic rail is longer than the coil length by 50mm minimum.
	 Install the magnetic rail except for the motor coil length.

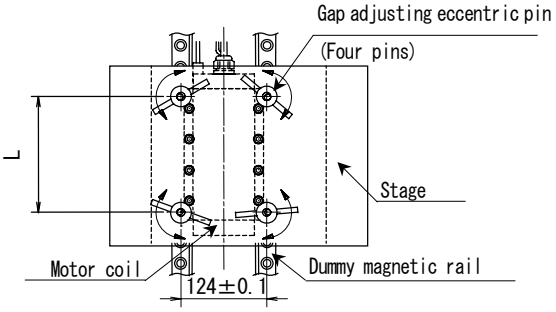
2. Installation [Core type double side linear motor]

2	Install a dummy magnetic rail on the stroke without magnetic rails and insert the motor coil onto the dummy magnetic rail. Take care not to have your fingers caught in between the motor coil and the base. (See “External View for the shape of dummy magnetic rail”.)
	
3	Temporarily fix the motor coil and the stage using installing bolts and adjust the gap between the dummy magnetic rail and the coil. Appropriate length of the gap is 1.3±0.2mm for the one without magnet cover, 1.1±0.2mm for the one with magnet cover. It is recommended that the difference of gaps at two points be 0.2mm maximum. After adjusting the gap, tighten the installing bolts for the motor coil and the stage. All the M8 taps for installing the motor coil must be used. Tightening torque is 38N・m (bolt strength class 12.9), engagement length is 8mm to 12mm. Apply fixatives.
	
	How to adjust the gap
	Make sure to perform gap adjustment on the area where the motor coil is facing dummy magnetic rail. If adjustment is performed on the area with magnetic rails, injury or breakage may occur, because high magnetic attraction force exists on the motor coil. Never adjust the gap on the area with the magnetic rails.

2. Installation [Core type double side linear motor]

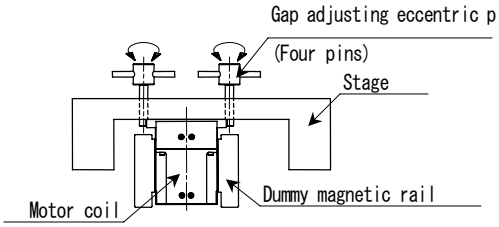
When eccentric pins are used.

・When eccentric pins are used, adjust the gap from top of the stage.
・Make four or more holes for eccentric pins on top of the stage. The hole location must be determined so that the eccentric pins touch the upper plate of the motor coil. If the eccentric pins stress other point than the upper plate, the motor coil may break. See the recommended values in the figure below for the location of the pin holes. Refer to the external diagram for recommended shape of the eccentric pins.
・Insert the eccentric pins into the eccentric pin holes on the stage and turn them left and right to adjust the gap. It is recommended that the difference of gaps at two points between the dummy magnetic rail and the motor coil be 0.2mm maximum.



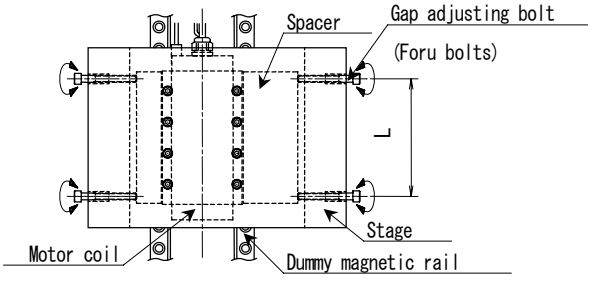
Coil model number	L(mm)
DD075C1	170 ±5
DD075C2	345 ±5
DD075C3	520 ±5
DD075C4	670 ±5
DD075C5	870 ±5

(Recommended location value of gap adjusting eccentric pin)

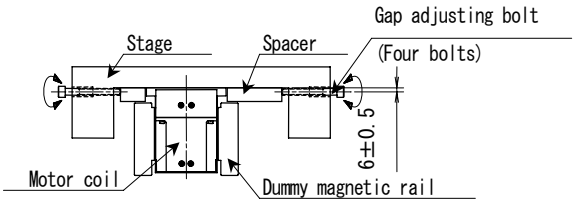


When bolts are used.

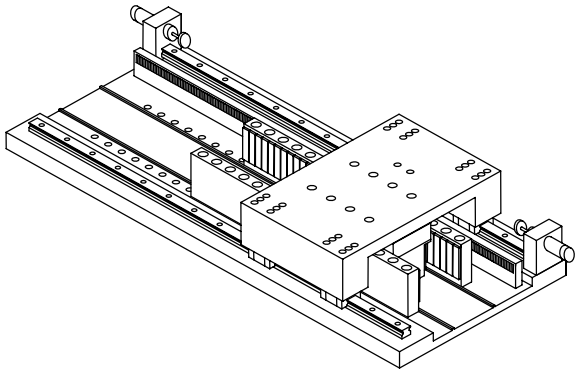
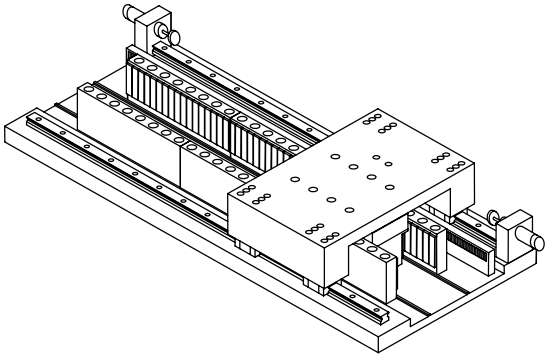
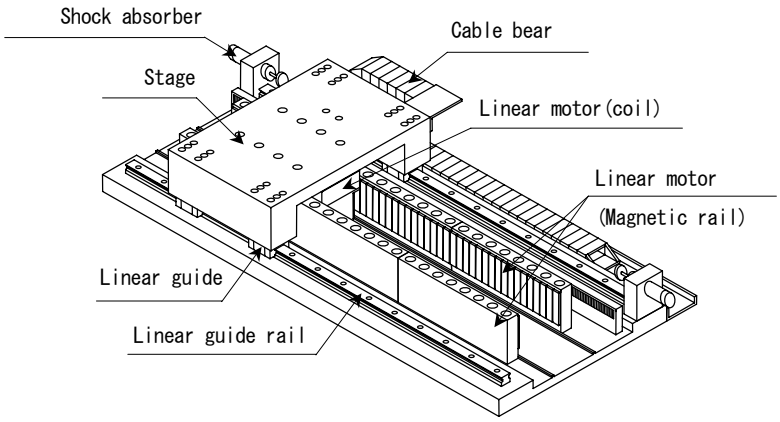
3 ・When bolts are used, adjust the gap from side of the stage.
Prepare four or more taps for gap adjusting bolts on the side of the stage. The hole position must be determined so that the tip of the gap adjusting bolt touches the upper plate of the motor coil. If the bolts stress other point than the upper plate, the motor coil may break. See the recommended values in the figure below for the location of taps of bolts. As tap diameter, M8 or M10 is recommended.
・Insert the gap adjusting bolts into the taps on the side of the stage and turn them left and right to adjust the gap. If the bolt is too short for its tip to reach the upper plate of the motor coil, put a spacer between the tip of the bolt and upper plate. It is recommended that the difference of gaps at two points between the dummy magnetic rail and the motor coil be 0.2mm maximum.



Coil model number	L(mm)
DD075C1	170 ±5
DD075C2	345 ±5
DD075C3	520 ±5
DD075C4	670 ±5
DD075C5	870 ±5

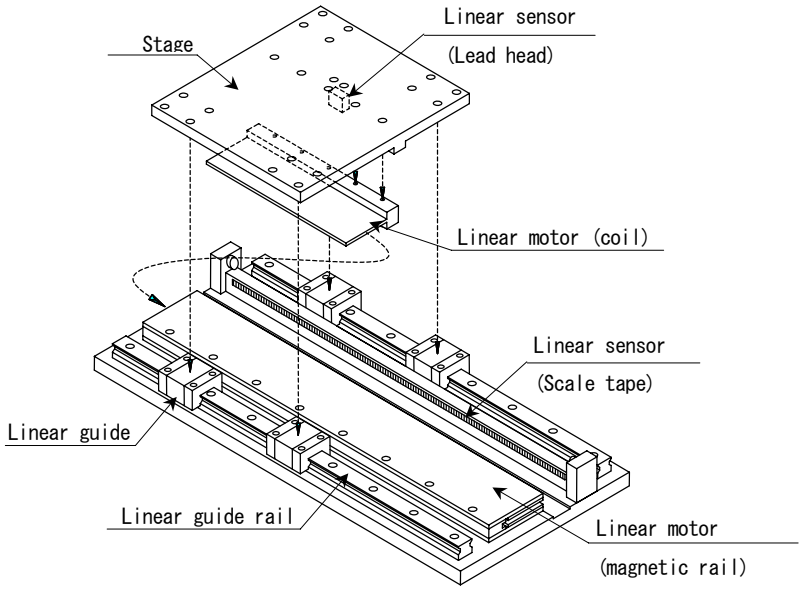
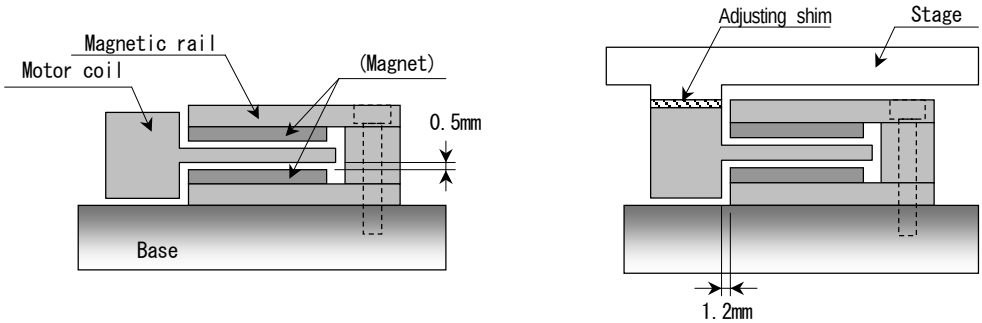


2. Installation [Core type double side linear motor]

4	Slide the movable stage with the motor coil installed towards the magnetic rail side which was fixed with screws. At this time, the motor coil is drawn towards the magnetic rail side by the force of approx. ±300N. When the motor coil is completely inside the magnetic rail, the force no longer exists.
	
5	Remove the dummy magnetic rail and install the remaining magnetic rail.
	
6	When the motor has been installed, conduct wiring.
	

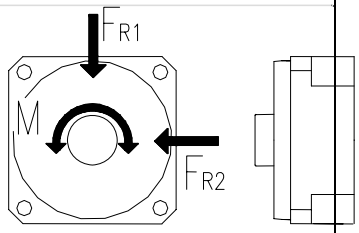
2. Installation [Coreless linear motor]

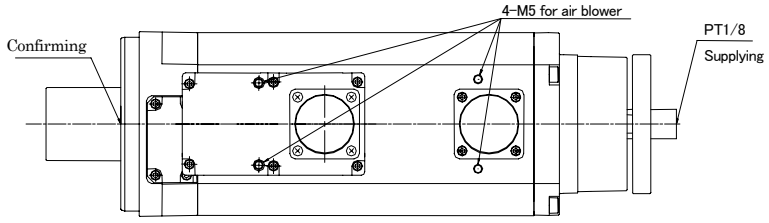
■ Installation of coreless linear motor

Step	Description
1	Strong magnet is set in the magnetic rail. High magnetic force is generated between themselves and between the rails and the motor coil or tools made of iron. Take care not to have your hands caught. Do not start operation having any magnetic dust or metal, or dirt on the surface of the magnetic rails, otherwise, those foreign materials may be caught in the mover and cause troubles. Depending on the operation condition, bellows or sliding cover is needed to prevent foreign materials from attaching. Take care to keep the surface of the magnetic rails clean. 
2	When installing the magnetic rail, use position pin holes (ϕ5.11) to determine the position. Use all the taps on the side or the bottom of the magnetic rail and tighten the bolts. For the coil, use all the taps on the installing surface.
3	Determine the coil position by putting shim between the coil and the stage so that the coil and the magnetic rail do not contact all through the stroke. To make the positioning easier, put non-magnetic shim between the coil and the magnetic rail and determine appropriate position of the coil. 
4	When the motor has been installed, conduct wiring.

2. Installation [Cylinder type linear motor]

■ Cylinder type linear motor

<table>
<tr><th>Step</th><th>Description</th></tr>
<tr><td>1</td><td>Rotation moment loaded on the load installation board mounted on the output shaft side is all received at the rotation stop at the opposite side of the output shaft. Therefore, if the rotation moment is too large, breakage or shorter service life of the motor may result. When the load is installed, fix the mover and make the rotation moment not load on the output shaft. While operation, observe the allowable load shown in the table below.
<table>
<tr><td>Maximum allowable moment load</td><td>M direction</td><td>8</td><td>(N·m)</td></tr>
<tr><td rowspan="2">Maximum allowable radial load</td><td>F_{R1} direction</td><td>70</td><td>(N·m)</td></tr>
<tr><td>F_{R2} direction</td><td>70</td><td>(N·m)</td></tr>
</table>


</td></tr>
<tr><td>2</td><td>To prevent dust from entering, four M5 air blower taps are provided on the top. The product has clearance going through inside on the flange surface, so air blowing is required to give pressure inside to prevent dust from entering when used in dusty environment. When air blowing is necessary, pipe the air blower taps and stop up other unused taps by M5 screws. Their engagement length is 8mm or less.</td></tr>
<tr><td>3</td><td>Supply grease periodically onto the bearing to make the place constantly oily. Interval for supplying grease is either a total operation distance of 1500 to 1700km or 8 to 10 months, which come earlier. Pour grease into PT1/8 grease supplying hole which is on the opposite side of the output shaft until the grease spills from the other hole on the output shaft side. Wipe up the spilled grease. We recommend that grease amount for 1 time be less than 2 shots by a grease gun of 0.7cc/1 supply. The location of the motor mover when grease is supplied shall be the center of the whole movable range plus output shaft. At the time of shipment, the motor has already AFC grease (maker: THK Ltd.) filled, therefore, the THK Ltd. made AFC grease is recommended for supplying later on. Because of the back and forth movement in a short stroke, lack of oil is easy to occur and fretting may result. F the grease other than the recommended one is used, consider their affinity and choose a good one for resisting fretting.


</td></tr>
<tr><td>4</td><td>As return to zero operation after the control power is turned on, drive the motor cross the Z phase signal at least once. If operating without crossing the Z phase signal, there is a danger that the generated force will reduce up to half the specified value.</td></tr>
</table>

2. Installation [Cable installation]

■ Cable installation and considerations

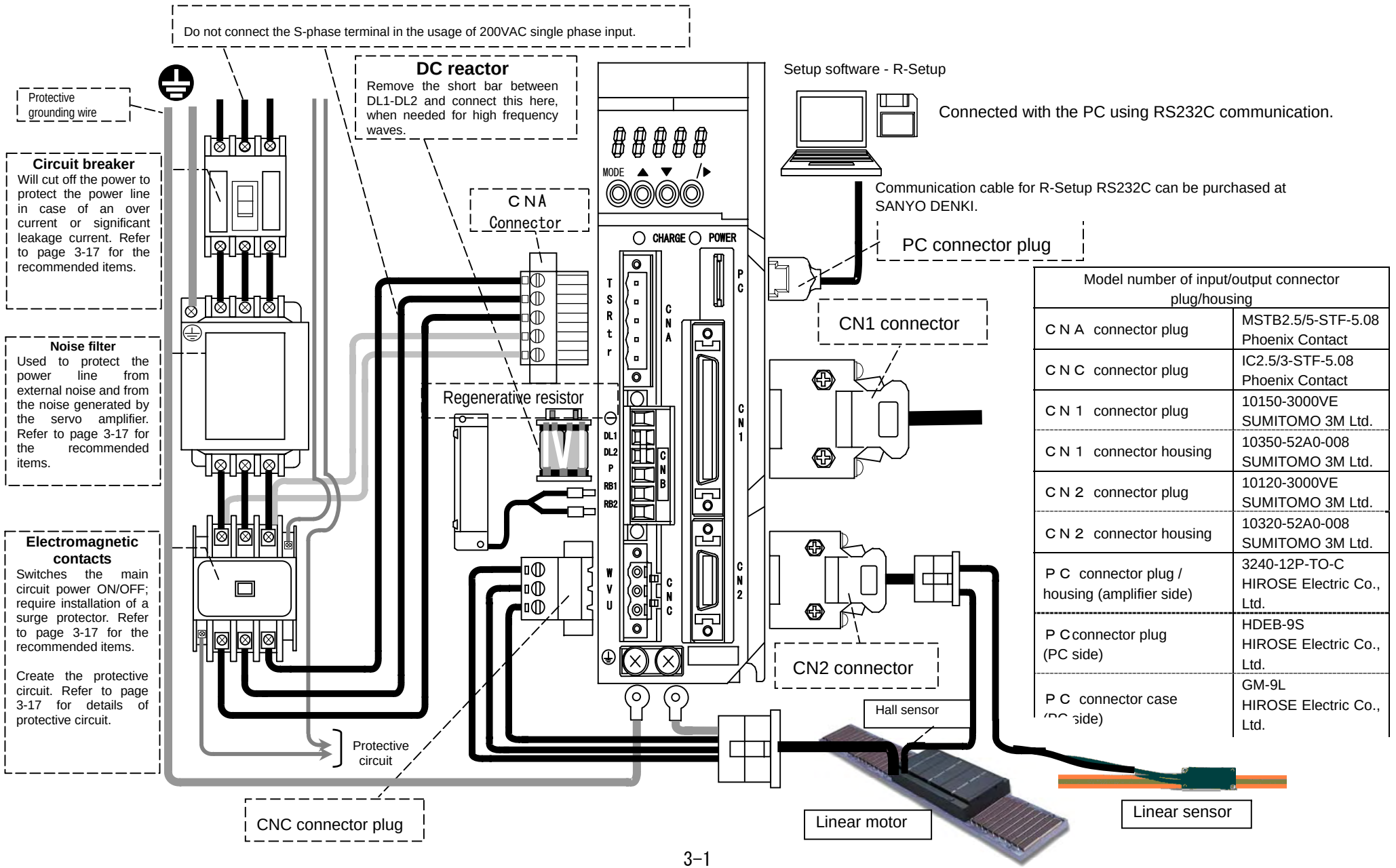
- Be careful not to give stress or damage to the cables.
- When it is anticipated to move the servomotor, allow enough flexion radius of the cable to avoid stress.
- Install the cables where there is no danger of their sheaths being damaged by cutting flakes or other sharp materials. Avoid contact with any corner of machines.
  Take care not to step on the cables or not to have any machine mounted on them.
- Clamp the cables to the machine to avoid stress and self-gravity at the connection point.
- Cables connected from the coil are not robot cables, so fix them firmly and do not make them bend repeatedly. When cables are moved by cable bearer or others, prepare a robot cable as an extension cable. In that case, determine a flexion radius of each cable by the necessary flexion lifetime and type of wire.
- It is recommended that the cables of a mover should have a structure that enables periodic replacement.

3

[Wiring]

3. Wiring [Packaged wiring diagram RS1□01/RS1□03/RS1□05]

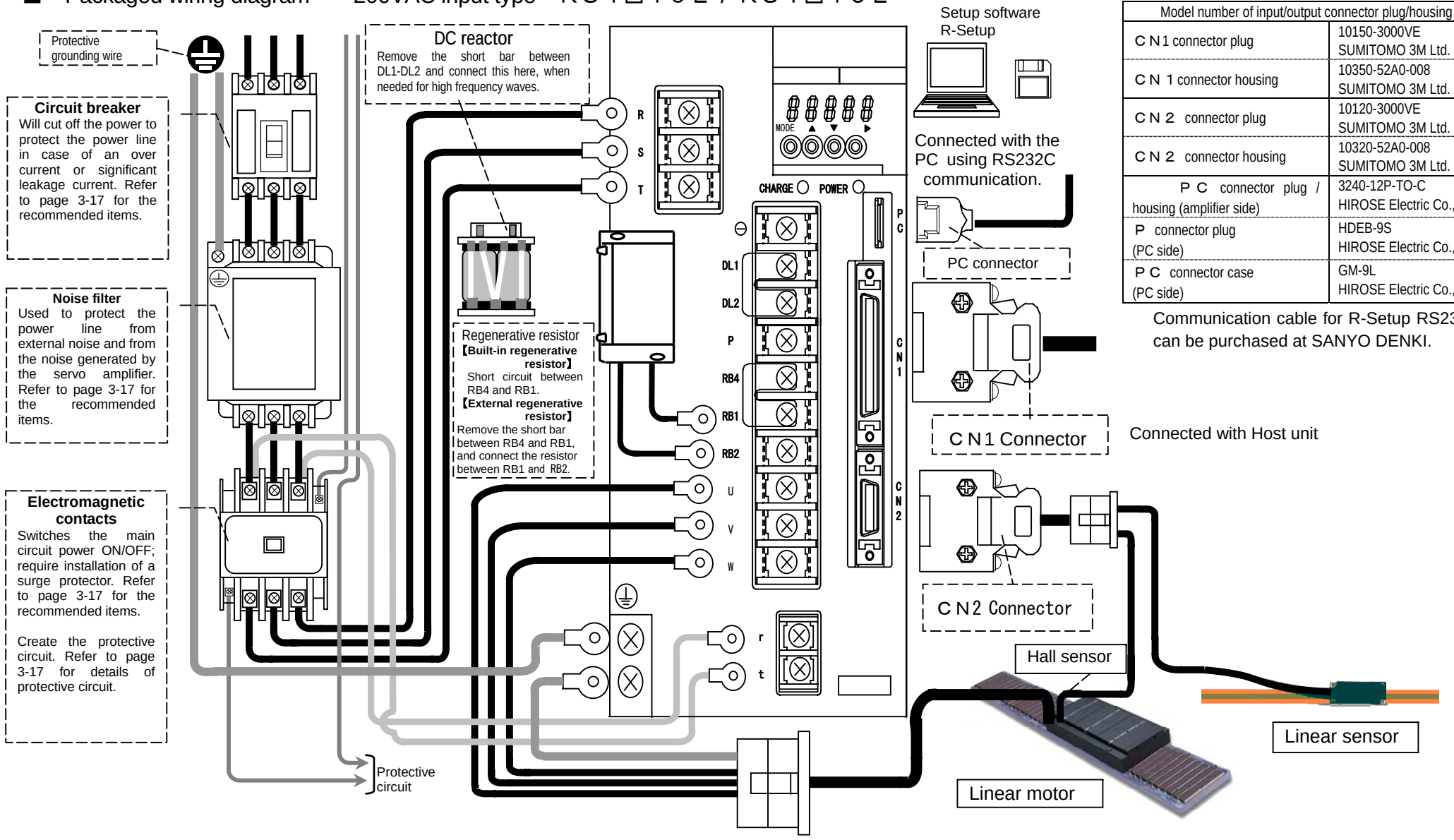
■ Packaged wiring diagram 200VAC input type RS1□01L / RS1□03L/ RS1□05L



Model number of input/output connector plug/housing	
CNA connector plug	MSTB2.5/5-STF-5.08 Phoenix Contact
CNC connector plug	IC2.5/3-STF-5.08 Phoenix Contact
CN1 connector plug	10150-3000VE SUMITOMO 3M Ltd.
CN1 connector housing	10350-52A0-008 SUMITOMO 3M Ltd.
CN2 connector plug	10120-3000VE SUMITOMO 3M Ltd.
CN2 connector housing	10320-52A0-008 SUMITOMO 3M Ltd.
PC connector plug / housing (amplifier side)	3240-12P-TO-C HIROSE Electric Co., Ltd.
PC connector plug (PC side)	HDEB-9S HIROSE Electric Co., Ltd.
PC connector case (PC side)	GM-9L HIROSE Electric Co., Ltd.

3. Wiring [Packaged wiring diagram RS1□10/RS1□15]

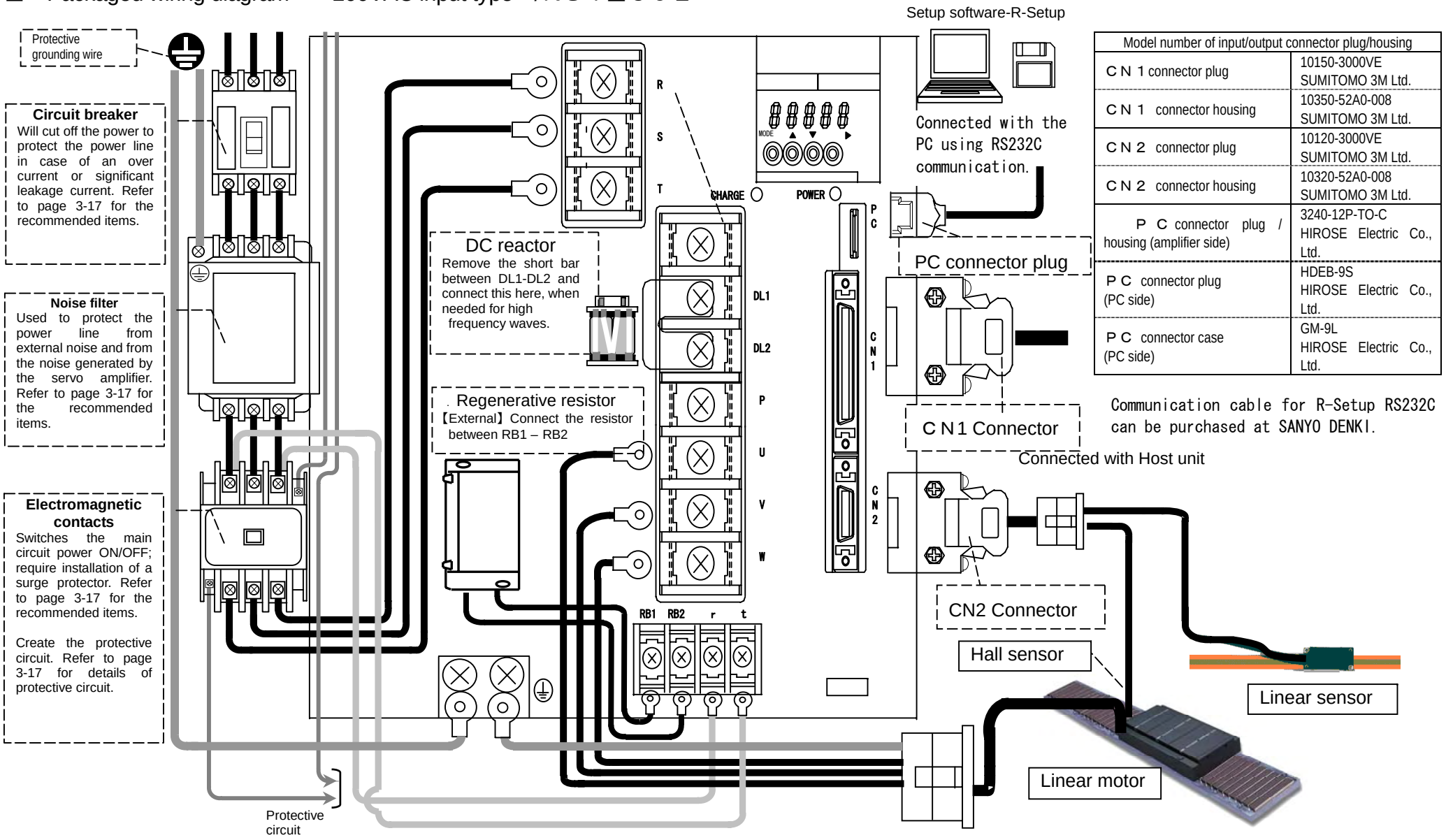
■ Packaged wiring diagram 200VAC input type RS1□10L / RS1□15L



Model number of input/output connector plug/housing	
CN1 connector plug	10150-3000VE SUMITOMO 3M Ltd.
CN1 connector housing	10350-52A0-008 SUMITOMO 3M Ltd.
CN2 connector plug	10120-3000VE SUMITOMO 3M Ltd.
CN2 connector housing	10320-52A0-008 SUMITOMO 3M Ltd.
PC connector plug / housing (amplifier side)	3240-12P-TO-C HIROSE Electric Co., Ltd.
P connector plug (PC side)	HDEB-9S HIROSE Electric Co., Ltd.
PC connector case (PC side)	GM-9L HIROSE Electric Co., Ltd.

Communication cable for R-Setup RS232C can be purchased at SANYO DENKI.

■ Packaged wiring diagram 200VAC input type /ＲＳ１□３０Ｌ



Model number of input/output connector plug/housing	
ＣＮ１connector plug	10150-3000VE SUMITOMO 3M Ltd.
ＣＮ１ connector housing	10350-52A0-008 SUMITOMO 3M Ltd.
ＣＮ２ connector plug	10120-3000VE SUMITOMO 3M Ltd.
ＣＮ２ connector housing	10320-52A0-008 SUMITOMO 3M Ltd.
ＰＣ connector plug / housing (amplifier side)	3240-12P-TO-C HIROSE Electric Co., Ltd.
ＰＣ connector plug (PC side)	HDEB-9S HIROSE Electric Co., Ltd.
ＰＣ connector case (PC side)	GM-9L HIROSE Electric Co., Ltd.

Communication cable for R-Setup RS232C can be purchased at SANYO DENKI.

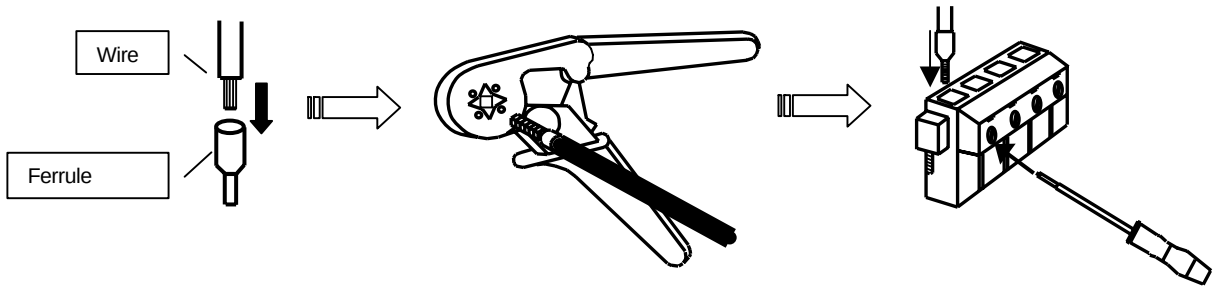
3. Wiring [High Voltage Circuit; Terminal Name and Functions]

■ High voltage circuit; terminal name and functions

Terminal name	Connector marking	Remarks	
Main power source	R・T or R・S・T	Single phase AC200～230V +10%,-15% 50/60Hz±3%	
		Three phase AC200～230V +10%,-15% 50/60Hz±3%	
Control power source	r・t	Single phase AC200～230V +10%,-15% 50/60Hz±3%	
Linear motor connector	U・V・W	Connected with linear motor.	
Protective grounding connector	⏚	Connected with grounding wire of power source band of linear motor.	
Regenerative resistor connector	RB1・RB2 RB4	RS1□01L□ RS1□03L□ RS1□05L□ RS1□30L□	Regenerative resistor will be connected to RB1・RB2. If it is built-in, the regenerative resistor has been connected at the time of shipment. In case of regeneration power shortage, an external regenerative resistor is connected to RB1・RB2. There is no terminal RB4.
		RS1□10L□ RS1□15L□	In case of a built-in regenerative resistor, RB1・RB4 are short-circuited by a short bar at the time of shipment. IF regenerative power is short, remove the short bar between RB1・RB4 (open) and connect an external regenerative resistor at RB1・RB2.
DC reactor connector	DL1・DL2	Short circuited at the time of shipment. If high frequency waves need to be controlled, remove the short bar between DL1 and DL2 and connect a DC reactor between DL1 and DL2.	
Maker maintenance	P・⊖	For maker maintenance. Do not connect anything.	

■ How to insert high voltage circuit connector

- Insert the wire into ferrule, and use an special tool to crimp it in.
- Insert the ferrule deep into the connector, and tighten it with a special minus screw driver etc.
  The recommended torque is 0.5 to 0.6 N・m.



3. Wiring [High Voltage Circuit; Terminal Name and Functions]

- Model number of recommended ferrules and crimping tools for various wire sizes （Manufactured by Phoenix Contact.）

mm^2	AWG	Model number		
		1Pcs/Pkt	1000Pcs/Pkt	Taped components
0.75 mm^2	18	AI0.75-8GY	AI0.75-8GY-1000	AI0.75-8GY-B (1000Pcs/Pkt)
1.0 mm^2	18	AI1-8RD	AI1-8RD-1000	AI1-8RD-B (1000Pcs/Pkt)
1.5 mm^2	16	AI1.5-8BK	AI1.5-8BK-1000	AI1.5-8BK-B (1000Pcs/Pkt)
2.5 mm^2	14	AI2.5-8BU	AI2.5-8BU-1000	AI2.5-8BU-B (500Pcs/Pkt)

Note） GY : Gray, RD : Red, BK : Black, BU : Blue
Crimping tool model number：0.25mm^2～6mm^2：CRIMPFOX UD 6-4、
0.75mm^2～10mm^2: CRIMPFOX UD 10-4

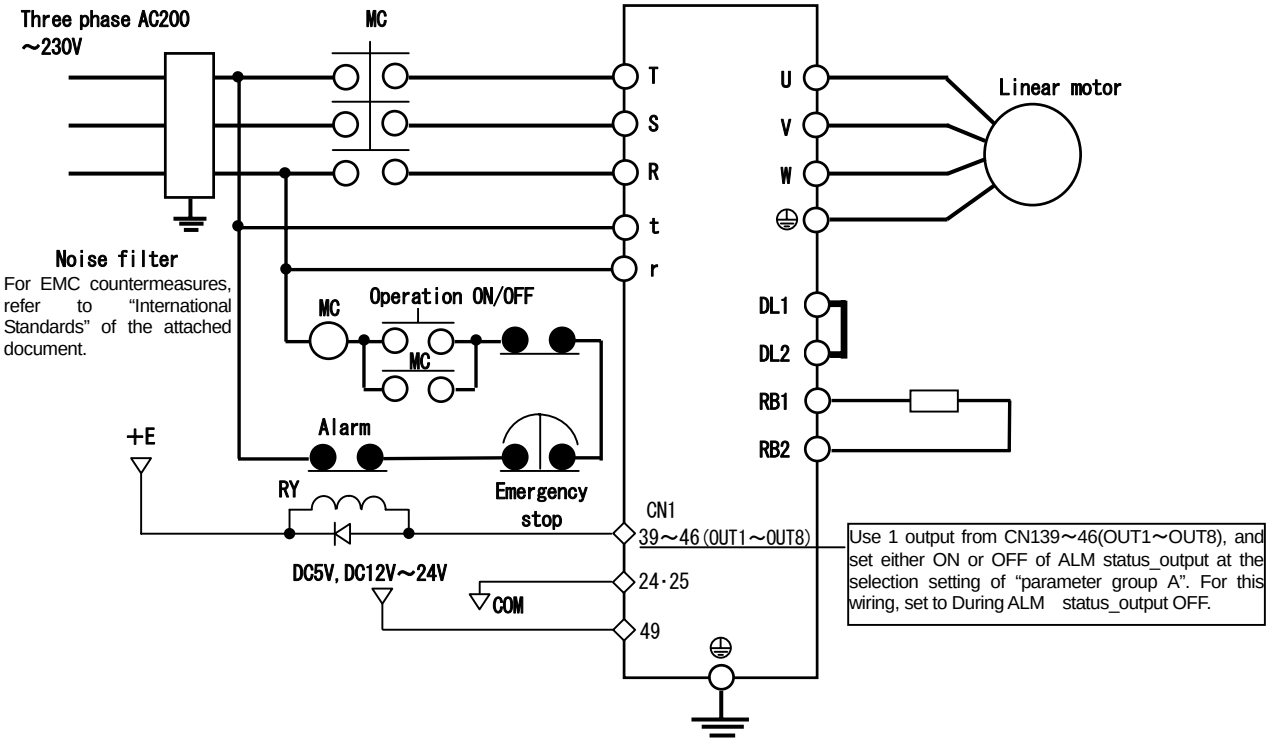
■ High voltage circuit terminal; tightening torque

	Terminal marking			
Amplifier type	CNA	CNB	CNC	⏚
RS1□01 RS1□03 RS1□05	[0.5～0.6 N･m]			[1.18 N･m] M4（screw size）

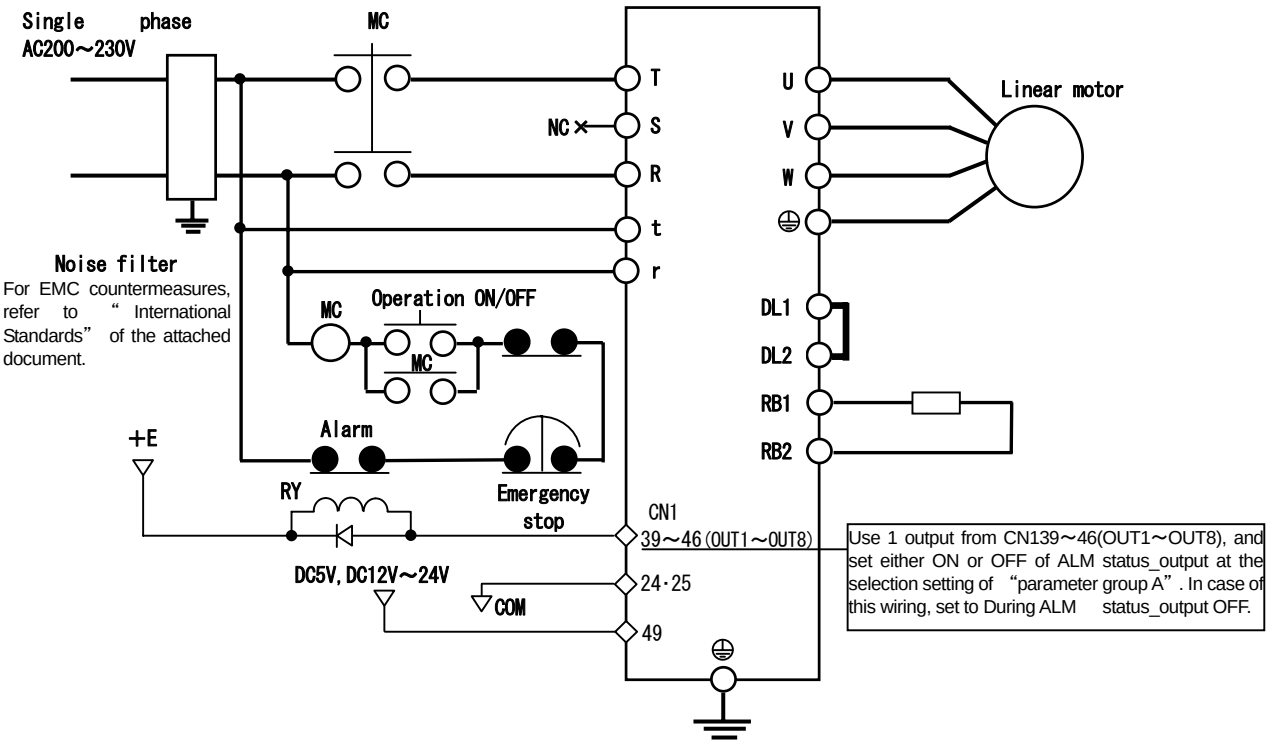
	Terminal marking															
Amplifier type	R	S	T	⊖	DL1	DL2	P	RB4	RB1	RB2	U	V	W	r	t	⏚
RS1□10 RS1□15	[1.18 N･m] M4（screw size）															

	Terminal marking														
Amplifier type	R	S	T	⊖	DL1	DL2	P	U	V	W	⏚	RB1	RB2	r	t
RS1□30	[3.73 N･m] M6（screw size）											[1.18 N･m] M4（screw size）			

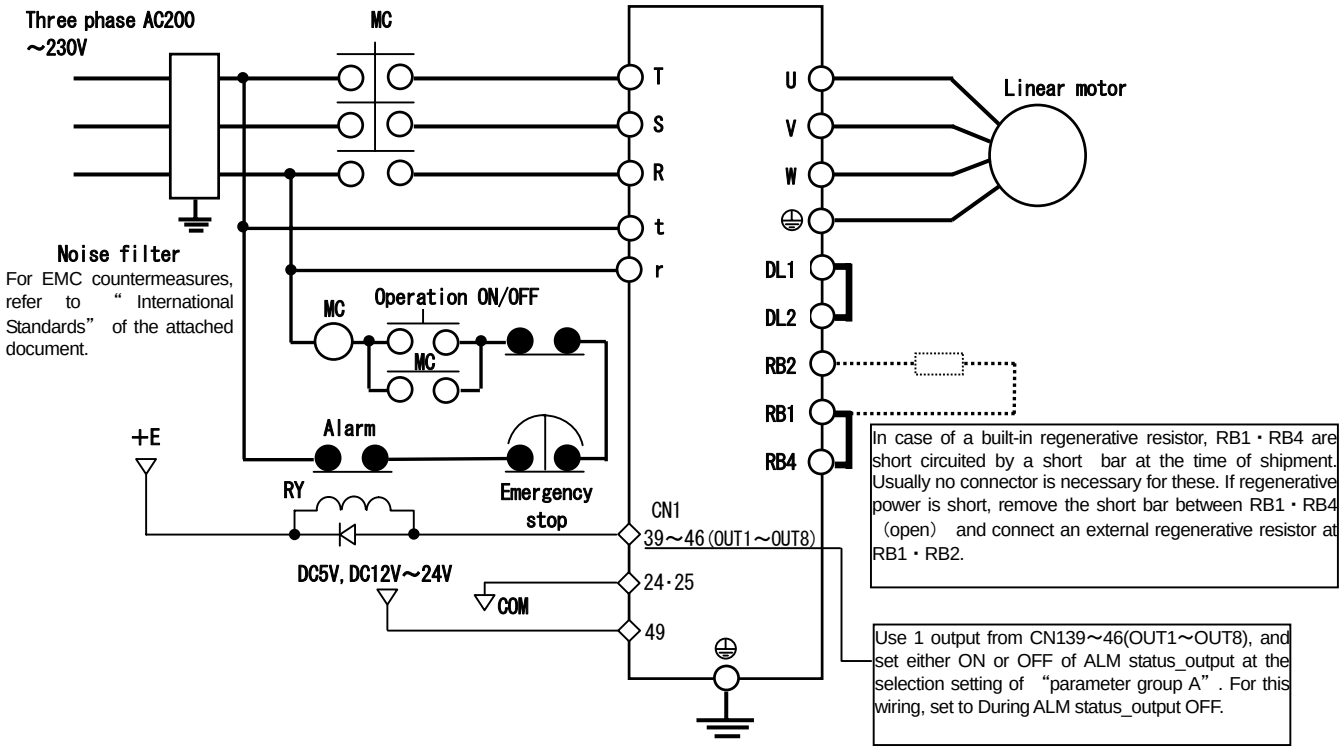
■ Three phase 200V RS1□01L・RS1□03L・RS1□05L・RS1□30L



■ Single phase 200V RS1□01L・RS1□03L・RS1□05L



■ Three phase 200V RS1□10L・RS1□15L

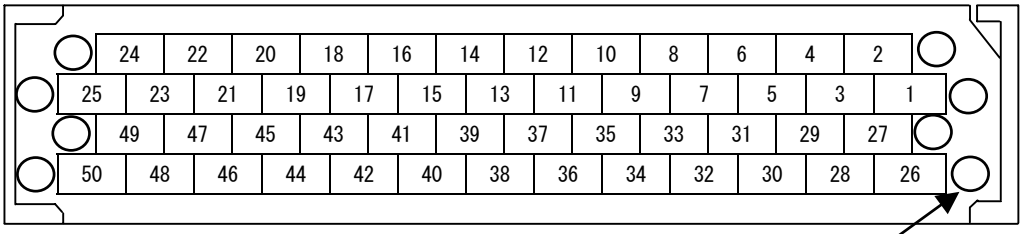


■ Low voltage circuit; terminal name and functions

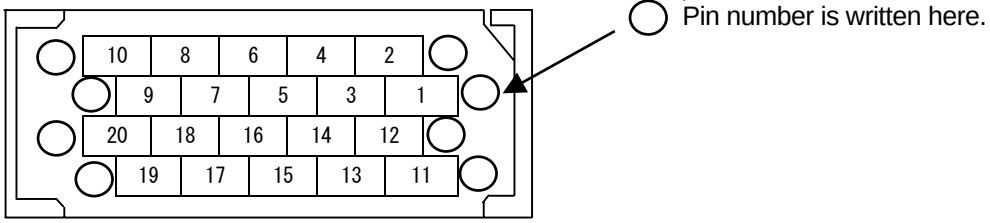
Terminal name	Terminal symbol	Description
Upper device input/output signal connector	CN1	Connects the input/output circuit between upper device (upper controller) and the Servo amplifier.
Sensor/encoder connector	CN2	Connects the sensor/encoder circuit of the servo motor.

■ Connector terminal number

● CN1 10150-3000VE （Soldered side）



● CN2 10120-3000VE（Soldered side）



■ CN1 connector terminal layout

24	22	20	18	16	14	12	10	8	6	4	2
OUT-COM	T-COMP	SG	F-TLA	$\overline{\text{CONT8}}$	$\overline{\text{CONT7}}$	SG	$\overline{\text{PS}}$	$\overline{\text{ZO}}$	$\overline{\text{BO}}$	$\overline{\text{AO}}$	BTN-1

25	23	21	19	17	15	13	11	9	7	5	3	1
OUT-COM	SG	V/T-REF	R-TLA	SG	CONT8	CONT7	ZOP	PS	ZO	BO	AO	BTP-1

49	47	45	43	41	39	37	35	33	31	29	27
OUT-PWR	SG	OUT7	OUT5	OUT3	OUT1	CONT1	CONT3	CONT5	SG	$\overline{\text{R-PC}}$	$\overline{\text{F-PC}}$

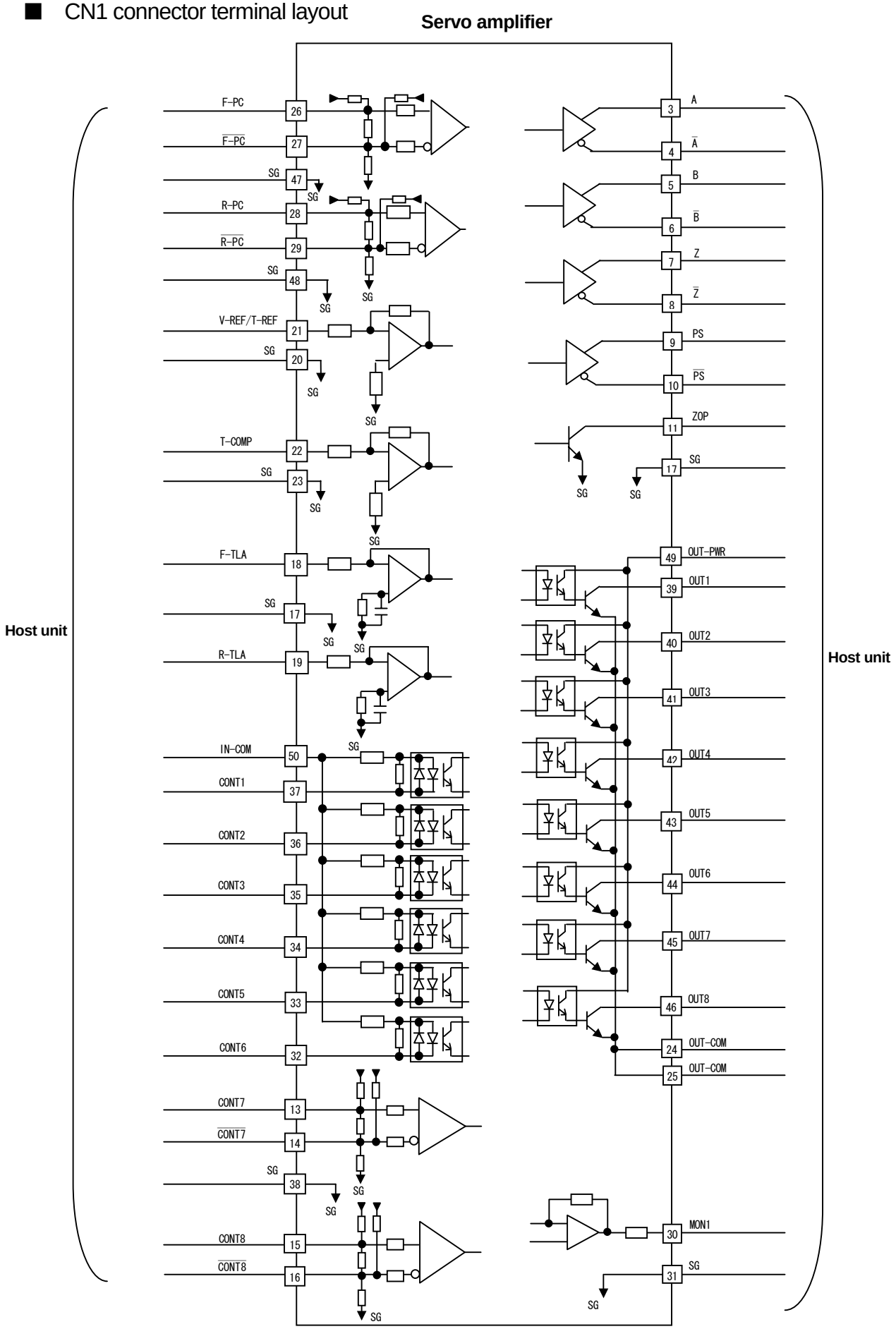
50	48	46	44	42	40	38	36	34	32	30	28	26
IN-COM	SG	OUT8	OUT6	OUT4	OUT2	SG	CONT2	CONT4	CONT6	MON1	R-PC	F-PC

■ CN1 terminal name

Terminal number	Signal name	
1	BTP-1	Battery minus
2	BTN-1	Battery plus
3	A0	A phase position signal output
4	$\overline{\text{A0}}$	/A phase position signal output
5	BO	B phase position signal output
6	$\overline{\text{BO}}$	/B phase position signal output
7	ZO	Z phase position signal output
8	$\overline{\text{ZO}}$	/Z phase position signal output
9	PS	Position data output
10	$\overline{\text{PS}}$	Position data output
11	ZOP	Z phase Position data output
12	SG	Common for pins 3～11
17	SG	Common for pins 18･19
18	F-TLA	Analog current limit input
19	R-TLA	Analog current limit input
20	SG	Common for pin 21
21	V-REF	Speed command input
	T-REF	Torque command input
22	T-COMP	Torque compensation input
23	SG	2Common for pin 22
26	F-PC	Command pulse input
27	$\overline{\text{F-PC}}$	Command pulse input
28	R-PC	Command pulse input
29	$\overline{\text{R-PC}}$	Command pulse input
47	SG	Common for pins 26･27
48	SG	Common for pins 28･29

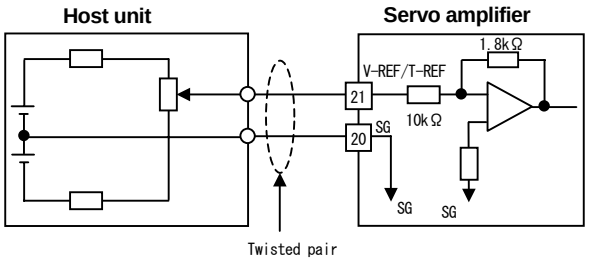
Terminal number	Signal name	
30	MON1	Analog monitor output
31	SG	Common for pin 30
13	CONT7	Generic input
14	$\overline{\text{CONT7}}$	Generic input
15	CONT8	Generic input
16	$\overline{\text{CONT8}}$	Generic input
38	SG	Common for pins 13～16
32	CONT6	Generic input
33	CONT5	Generic input
34	CONT4	Generic input
35	CONT3	Generic input
36	CONT2	Generic input
37	CONT1	Generic input
50	CONT-COM	Generic input power source
39	OUT1	Generic output
40	OUT2	Generic output
41	OUT3	Generic output
42	OUT4	Generic output
43	OUT5	Generic output
44	OUT6	Generic output
45	OUT7	Generic output
46	OUT8	Generic output
49	OUT-PWR	Generic output power source
24	OUT-COM	Generic output Common
25	OUT-COM	Generic output Common

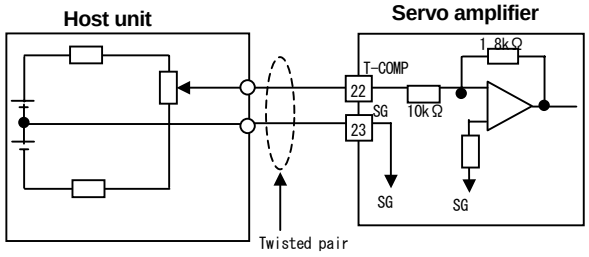
■ CN1 connector terminal layout

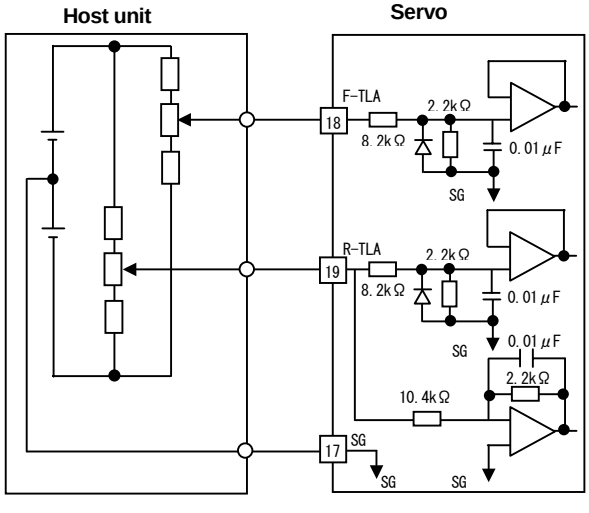


■ Connection example with analog input circuit

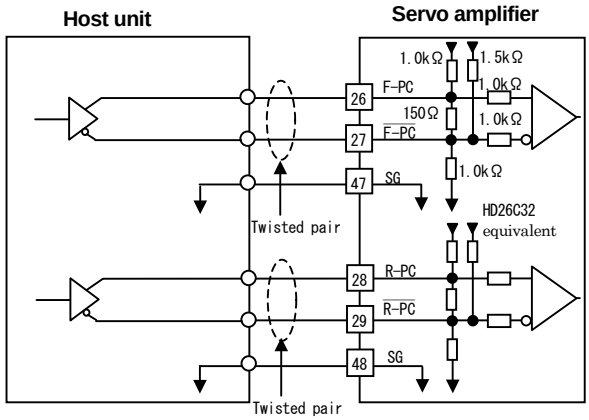
● Analog input circuit

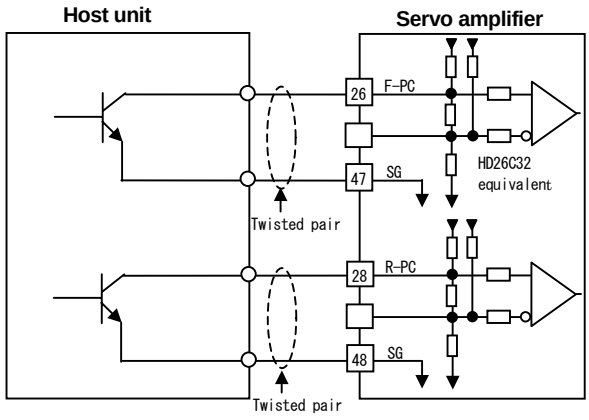
Speed command input / Torque command input	
・Analog command input is either speed command input or torque command input. ・Speed command input → Speed control type ・Torque command input → Torque control type ・Input impedance is 10kΩ.	

Force compensation input circuit	
・DC±2.0V – Rated torque	

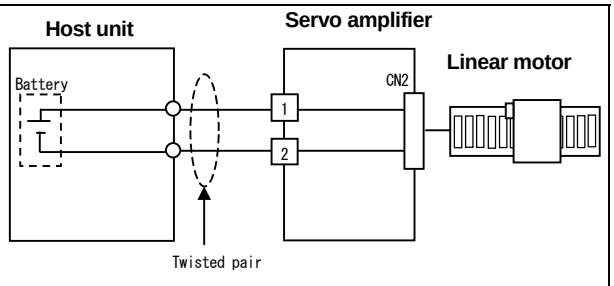
Positive side external torque limit input / Reverse side external torque limit input	
・DC±2.0V – Rated torque	

● Position command input circuit [Input circuit : Line receiver]

Command pulse input – Host unit line driver output	
・Connected with line driver. ・Applicable line driver : HD26C31 or equivalent manufactured by HITACHI. ・Position command input is command pulse input. ・Command pulse input → Position control type ・Three types of command input pulse: [Positive pulse + Reverser pulse] Maximum 5M pulse/second [Code + Pulse train] Maximum 5M pulse/second [90° phase difference two phase pulse train] Maximum 2.5M pulse/second ・Make sure to connect SG. If not, malfunction due to noise or damage may be caused.	

Command pulse input – Host unit open collector output	
・Connected with open collector transistor circuit. ・Position command input is command pulse input. ・command pulse input → Position control type ・Three types of command input pulse [Positive pulse+ Reverse pulse] [Code + Pulse train [90° phase difference two phase pulse train] ・Maximum pulse frequency : 150kHz	

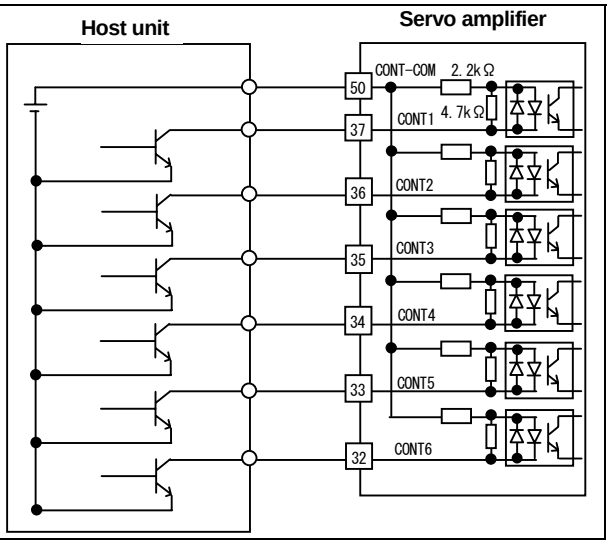
● Battery input circuit

・Connected with back up battery when absolute encoder and absolute sensor are in use. ・If a battery is built-in the servo amplifier, no connection is necessary here.	

■ Connection example with generic input circuit

● Generic input circuit CONT1～CONT6 [Input circuit : Bi-directional photo coupler]

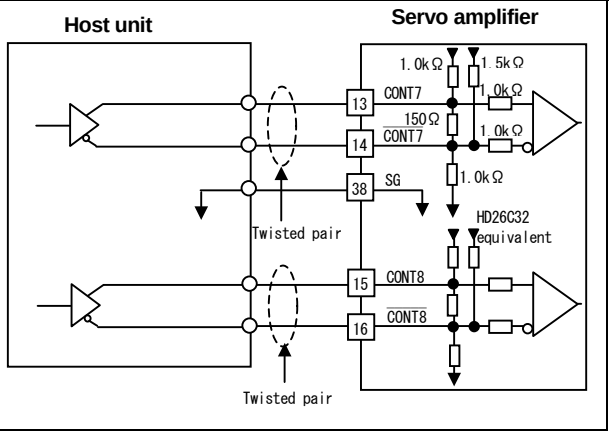
- Connected with transistor circuit of relay or open collector.
- Voltage range of power source : DC5V～24V
- Minimum current : 100mA



● Generic input circuit CONT7・CONT8 [Input circuit : Line receiver]

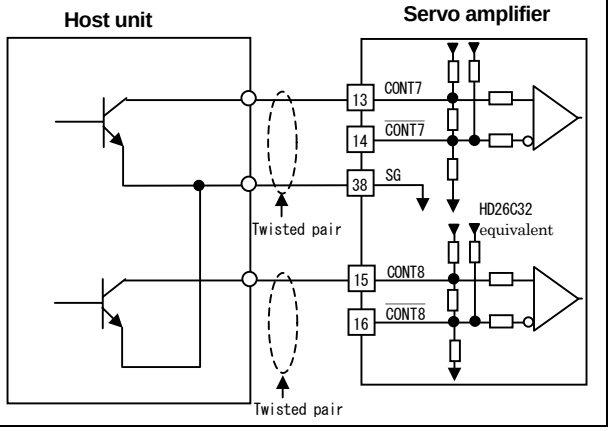
Host unit line driver output

- Connected with line driver
- Applicable line driver : HD26C31 equivalent manufactured by HITACHI.
- Make sure to connect SG. If not, malfunction due to noise or damage may be caused.



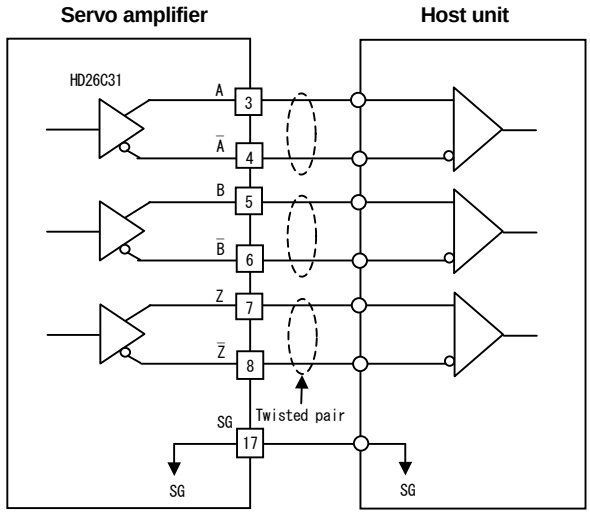
Host unit open collector output

- Connected with open collector transistor circuit.

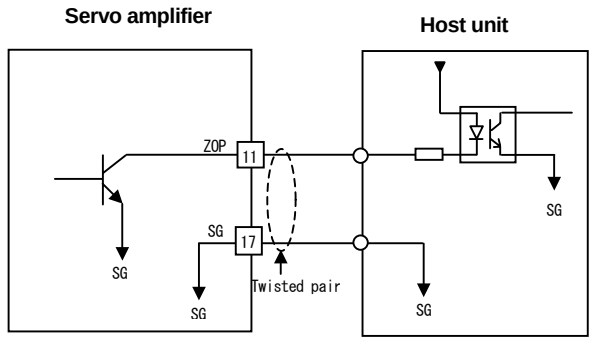


■ Connection example with position signal output circuit

● Incremental pulse signal output circuit [Output circuit : Line driver]

・Connected with line receiver. ・Applicable line receiver : HD26C32 equivalent manufactured by HITACHI. ・Make sure to connect SG. If not malfunction due to noise or damage may be caused. ・Outputs the signals of incremental encoder A phase – B phase pulse and origin z phase pulse.	

● Origin Z phase output circuit [Output circuit : Open collector]

・Outputs the signals of incremental encoder origin Z phase pulse.（open collector） ・Maximum voltage ：DC30V ・Maximum current：10mA	

■ Connection example with generic output circuit

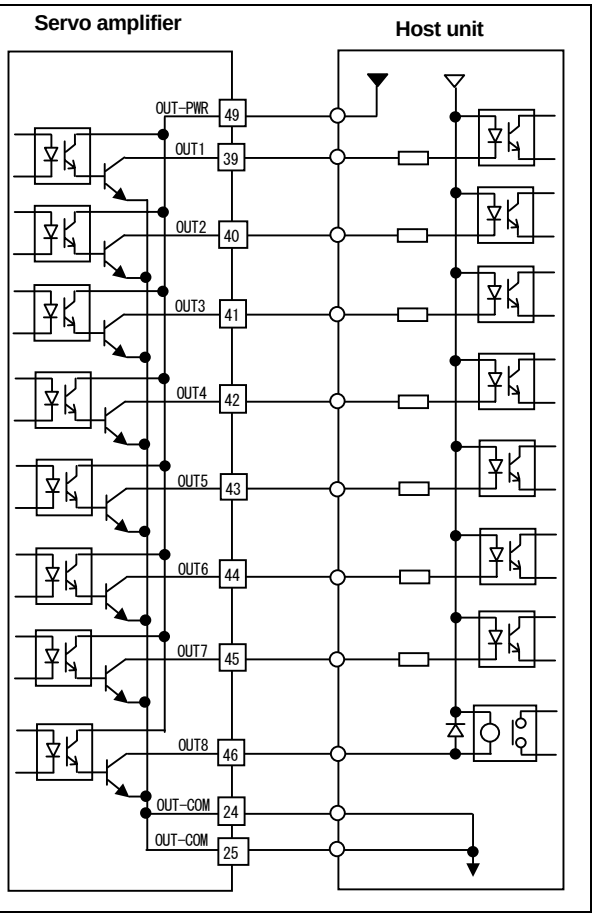
● Generic output circuit OUT1～OUT8 [Output circuit : Open collector]

・Connected with photo coupler or relay circuit.

・OUT-PWR (outer power source) specification
Power source voltage range : DC5V ±5% 、DC12V～24V ±10%
minimum current : 20mA

・Specification of input circuit power source
Power source voltage range : DC5V ±5%
Power source voltage range : DC12V～15V ±10%
Power source voltage range : DC24V ±10%

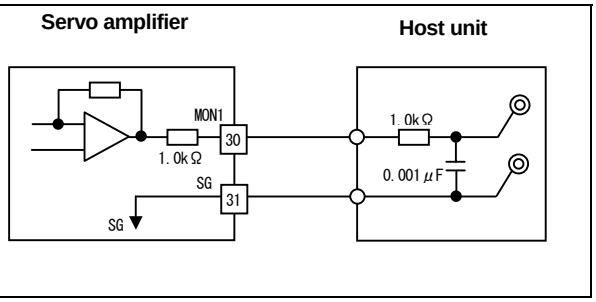
Maximum current : DC5V‥‥‥‥‥10mA
Maximum current : DC12V～15V‥‥30mA
Maximum current : DC24V‥‥‥‥‥50mA



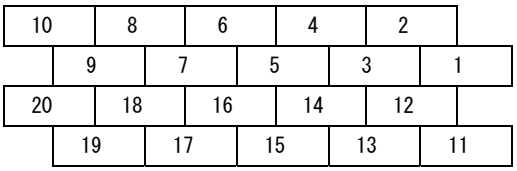
■ Connection example with analog output circuit

● Analog monitor output circuit

・Outputs the selection of analog monitor output 1.
・Load shall be less than 2mA.
・Output resistance shall be １ｋΩ.



■ CN2 terminal layout



■ Sensor wiring

● Linear motor with a hall sensor (Length of sensor cable : shorter than 20m)

Linear sensor (Incremental output)		
Terminal No.	Signal name	Description
3	A	A phase position signal output
4	$\bar{A}$	
5	B	B phase position signal output
6	$\bar{B}$	
7	Z	Z phase position signal output
8	$\bar{Z}$	
Hall sensor (Differential output)		
Terminal No.	Signal name	Description
9	S1	U phase signal output
10	$\bar{S1}$	
13	S2	V phase signal output
14	$\bar{S2}$	
15	S3	W phase signal output
16	$\bar{S3}$	
power source		
12	5V	5Vpower source
17	5V	5Vpower source
19	5V	5Vpower source
11	SG	5Vpower source common
18	SG	5Vpower source common
20	SG	5Vpower source common

1,2 ……Not connected.

Linear sensor (Incremental output)		
Terminal No.	Signal name	Description
3	A	A phase position signal output
4	$\bar{A}$	
5	B	B phase position signal output
6	$\bar{B}$	
7	Z	Z phase position signal output
8	$\bar{Z}$	
Hall sensor (Open collector output)		
Terminal No.	Signal name	Description
9	S1	U phase signal output
10	—	—
13	S2	V phase signal output
14	—	—
15	S3	W phase signal output
16	—	—
power source		
12	5V	5Vpower source
17	5V	5Vpower source
19	5V	5Vpower source
11	SG	5Vpower source common
18	SG	5Vpower source common
20	SG	5Vpower source common

1,2 ……Not connected.

● Linear motor without a hall sensor (Length of sensor cable : shorter than 30m.)

Incremental encoder		
Terminal No.	Signal name	Description
3	A0	A phase position signal output
4	$\bar{A0}$	
5	BO	B phase position signal output
6	$\bar{BO}$	
7	ZO	Z phase position signal output
8	$\bar{ZO}$	
power source		
9	5V	5Vpower source
12	5V	5Vpower source
17	5V	5Vpower source
19	5V	5Vpower source
10	SG	5Vpower source common
11	SG	5Vpower source common
16	SG	5Vpower source common
18	SG	5Vpower source common
20	SG	5Vpower source common

1,2,13,14,15 ……Not connected.

■ Examples of power capacity・peripherals・wire diameter

Input voltage	Servo amplifier capacity RS1＊□□L	Control power source (VA)	Circuit breaker	Noise filter (EMC corresponding)	Electro-magnetic contactor	Main power wire diameter R・S・T	Control power wire diameter r・t	Linear motor power line diameter U・V・W	Protective grounding wire diameter ⏚	Regenerative resistor wire diameter RB□
AC 200V	01	40	**NF30 shape 10A** Manufactured by Mitsubishi Ltd.	**RF3010-DLC** Manufactured by RASMI	**S-N10** manufactured by Mitsubishi Ltd.	AWG16 equivalent	AWG16 equivalent	AWG16 equivalent	AWG16 equivalent	AW16 equivalent
	03		**NF30 shape 10A** Manufactured by Mitsubishi Ltd.			AWG14 equivalent		AWG14 equivalent	AWG14 equivalent	AW16 equivalent
	05		**NF30 shape 15A** Manufactured by Mitsubishi Ltd.			AWG12 equivalent		AWG12 equivalent	AWG12 equivalent	AW14 equivalent
	10		**NF50 shape 30A** Manufactured by Mitsubishi Ltd.	**RF3020-DLC** Manufactured by RASMI	**S-N18** manufactured by Mitsubishi Ltd.	AWG10 equivalent		AWG10 equivalent	AWG10 equivalent	AW12 equivalent
	15		**NF50 shape 50A** Manufactured by Mitsubishi Ltd.	**RF3030-DLC** Manufactured by MANUFACTURED BY RASMI **3SUP-HK30-ER-6B** Manufactured by Okaya.	**S-N35** manufactured by Mitsubishi Ltd.	AWG8 equivalent		AWG8 equivalent	AWG8 equivalent	AWG10 equivalent
			NF100 shape 75A Manufactured by Mitsubishi Ltd.	**3SUP-HK50-ER-6B** Manufactured by Okaya. **FS5559-35-33** Manufactured by SCHAFFNER	**S-N50** manufactured by Mitsubishi Ltd.					
	30		**NF100 shape 100A** Manufactured by Mitsubishi Ltd.	**RF3070-DLC** Manufactured by RASMI	**S-N65** manufactured by Mitsubishi Ltd.	AWG6 equivalent		AWG6 equivalent	AWG6 equivalent	AWG8 equivalent

- AWG 24 or equivalent for ＣＮ１・ＣＮ２.
- Recommended surge protector :R・A・V-781BXZ-2A　Okaya Electric Industries Co., Ltd.

- The information in this table is based on the rated current flowing at three bundled lead wires in ambient temperature of 40℃.
- When wires are bundled or put into a wire-duct, take the allowable current reduction ratio into account.
- If ambient temperature is high, service life of the wires becomes shorter due to heat-related deterioration. In this case, use heat-resistant vinyl wires.
- Depending on the capacity of the linear motor, thinner electric wires than indicated in the table can be used for the main circuit power input connector and for the motor connector.（Choose appropriate size of wires in accordance with the power capacity.）

■ Connector

	Name	SANYO DENKI model No.	Model No. of applicable amplifier	Name	Manufacturer's model No.	Manufacturer
①	CN1	AL-00385594	All	Plug	10150-3000VE	SUMITOMO 3M Ltd.
				Shell kit	10350-52A0-008	
②	CN2	AL-00385596	All	Plug	10120-3000VE	
				Shell kit	10320-52A0-008	
③	CNA	AL-00329461-01	RS1□01～RS1□05（200Vinput ）	Plug	MSTB2.5/5-STF-5.08	Phoenix Contact Ltd.
④	CNB	AL-Y0000988-01	RS1□01～RS1□05（200Vinput ）	Plug	IC2.5/6-STF-5.08	
⑤	CNC	AL-00329458-01	RS1□01～RS1□05（200Vinput ）	Plug	IC2.5/3-STF-5.08	
⑥	PC	AL-00490833-01	All	Communication cable for Setup software "R-Setup"		

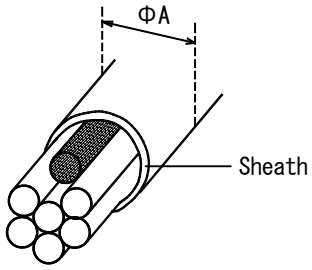
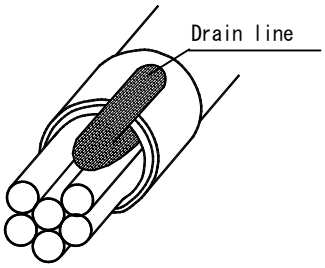
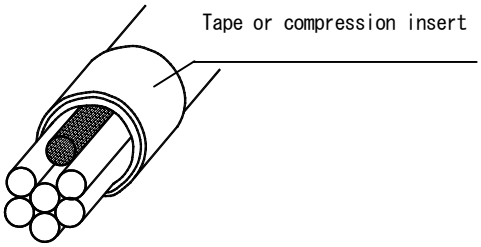
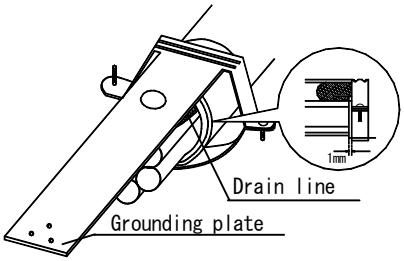
Combination	SANYO DENKI model No.	Model No. of applicable amplifier
Set of ①+②	AL-00292309	All
Set of ③+⑤	AL-00416792	RS1□01～RS1□05（200Vinput ）
Set of ①+②+③+⑤	AL-00393603	RS1□01～RS1□05（200Vinput ）

- The recommended tightening torque of CNA～C is 0.5～0.6N・m.
- If it is necessary to have an insulation distance between the main circuit wires and between the main circuit－signal circuit wires, pole terminals with insulation sleeves should be used. (If the wire in use is thicker than AWG12, these cannot be used.)
- The recommended tightening torque for the jack-screws of the CN1, CN2 shell kit is 0.196±0.049N・m.

■ CN1, CN2 Shielding method

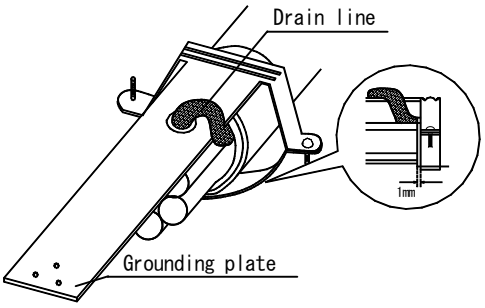
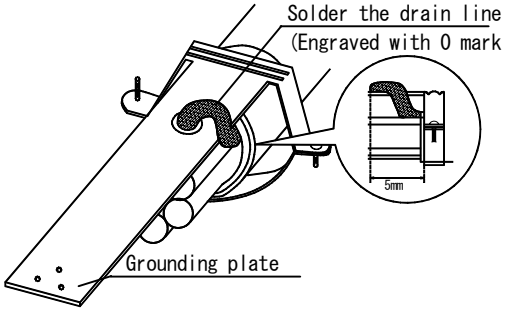
The following diagram shows the shielding on the CN1 and CN2 connectors.
There are 2 shielding methods; by using a clamp or by soldering.

● **Using a clamp**

1	 Remove the sheath of the cable.	3	 Fold back the drain line.
2	 Attach a tape or a compression insert. The tape or compression insert must be on top of the sheath of the cable.	4	 Tighten the cable clamp from the top of the drain line. Attach it about 1 mm away from the tape or the compression insert.

＊Attach the compression insert before soldering the cable to the connector.

● **Soldering**（Take the same steps 1 and 2 as for clamping.）

1	 Rotate the cable to place the drain line near the grounding plate.	2	

● **Appropriate φA size of CN1 and CN2.**

The following table shows the appropriate φA sizes for CN1 and CN2. If within the appropriate φA sizes, no compression insert is needed.

Connector No.	Appropriate φA	Connector model	Manufacturer
CN1	15.0~16.5mm	10150－3000VE 10350－52A0－008	SUMITOMO 3M Ltd.
CN2	10.5~12.0mm	10120－3000VE 10320－52A0－008	SUMITOMO 3M Ltd.

4

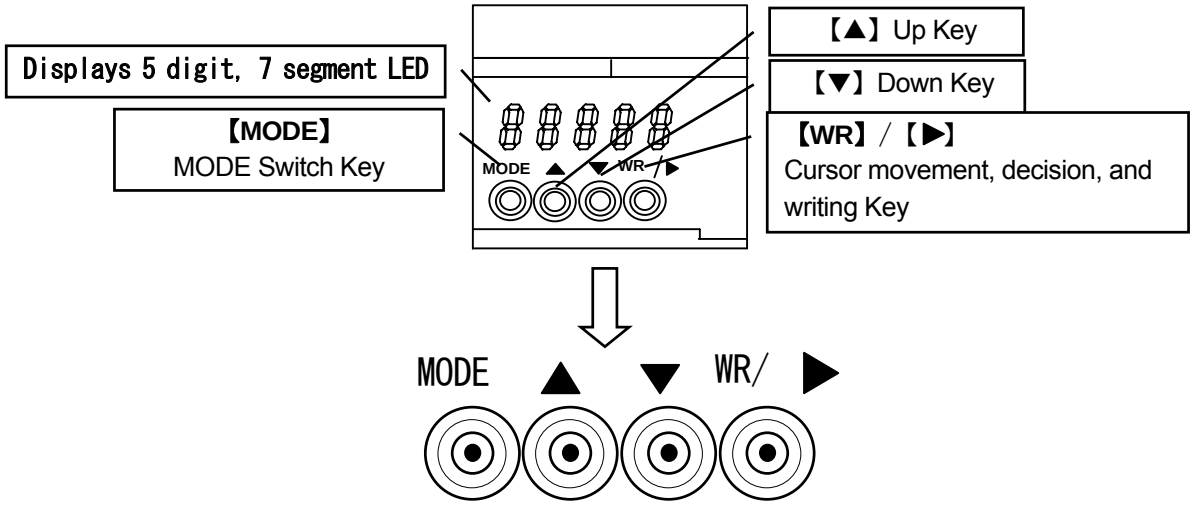
[Digital operator]

4. Digital Operator [Names and Functions]

■ Digital Operator

- It is possible to change or set the parameters and to confirm the status display, monitor display, test operation and alarm history with the built-in digital operator.

■ Digital operator name and functions



Display	Function	Input time
Digital display	Displays monitor value or parameter setting value in five digits.	———
WR	**To input selections and write edited data**.	More than 1second
MODE	Changes the Mode.	Less than 1 second
▶	Cursor Key. Changes the cursor position when editing.	Less than 1 second
▲ ▼	Up/Down key. Changes the numeric value.	Less than 1 second

■ Displays by Cursor key and Up/Down key

- Up and Down from “1 to 9”

  Press the Up key, and the blinking numeric value of LED display will increase. Press the Down key, and the numeric value decreases.

- Up from “9”

  Press the Up key, and the numeric value at cursor position increases and shifts to the left digit.

- Down from “0”

  Press the Down key, and the numeric value at cursor position decreases and the numeric values in the left of cursor position shift to the right.

  If there is no numeric value in the left of cursor position, all the left digits from cursor position show 9 with a right shift.

- Up/Down of “Symbol”

  When the display is “0”, “+ data” will be displayed by pressing the Up key and “- data” by the Down key, regardless of the cursor position. When the display is other than “0”, there will be a left shift or right shift as usual.

  (Display of “0” =” 0000”,” 000”,” 00”)

  The [+data] has no light on the furthest left digit, and the [−data] has a symbol of [−] on the furthest left digit.

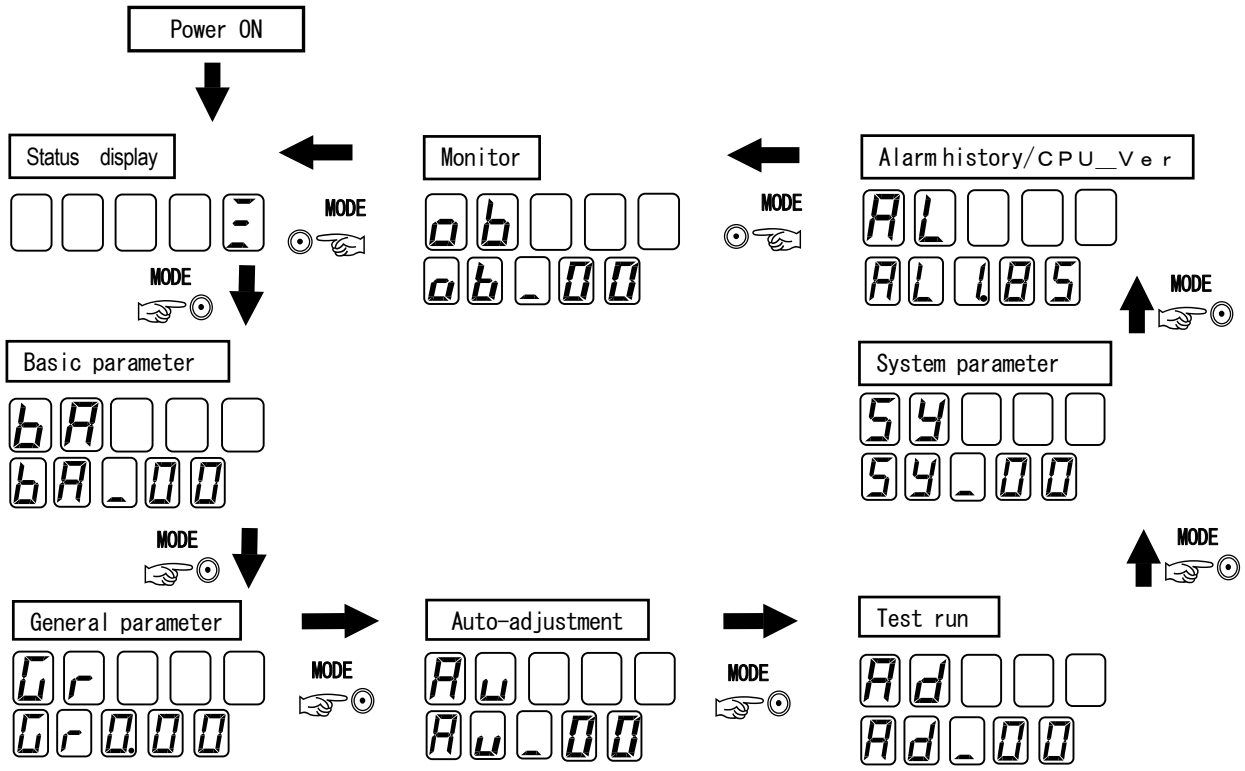
■ Various modes

- It is possible to display the status, to change or set the parameters, to automatically set the notch filter, and to confirm test operation, alarm history and monitor display with the built-in digital operator.

<table>
<tr><th>Mode</th><th>Contents</th></tr>
<tr><td>Status Display</td><td>Displays the establishment of control or main power supply, Servo ON, over-travel, warning and alarm status. [Page 4-3]</td></tr>
<tr><td>[bA]
Basic parameter</td><td>Parameters necessary for test operations by JOG and auto-tuning. Can be set at generic parameter mode. [Page 4-7]</td></tr>
<tr><td>[Gr]
General parameter</td><td>Settings can be made suitable for machines and equipment. Parameters for adjusting servo gain can be changed. Classified into 10 groups according to the functions. [Page 4-9]
<table>
<tr><th>Group</th><th>Description of Group</th></tr>
<tr><td>Group0</td><td>Settings of tuning mode.</td></tr>
<tr><td>Group1</td><td>Settings of basic control parameters.</td></tr>
<tr><td>Group2</td><td>Settings of vibration suppressing control/notch filter/disturbance observer</td></tr>
<tr><td>Group3</td><td>Settings of gain switching control/vibration suppressing frequency switching</td></tr>
<tr><td>Group4</td><td>To set high setting control.</td></tr>
<tr><td>Group8</td><td>Settings related to system control</td></tr>
<tr><td>Group9</td><td>Settings related to general purpose input signals/function condition setting</td></tr>
<tr><td>GroupA</td><td>Settings related to generic output signals/monitor output signals/set-up software</td></tr>
<tr><td>GroupB</td><td>Settings related to system sequence/warnings or alarms.</td></tr>
<tr><td>GroupC</td><td>Settings related to linear sensor and hall sensor.</td></tr>
</table></td></tr>
<tr><td>[Au]
Automatic adjustment</td><td>Enables Automatic Adjustment for Torque Command; Notch Filter A, Vibration Suppressor frequency and Offset of Analog Velocity/Torque/Torque Addition Command. [Page 4-11]</td></tr>
<tr><td>[Ad]
Test operation</td><td>Enables JOG operation, Alarm Reset, Automatic Tuning Result writing, ~~Encoder Clear~~ and Alarm History Clear.
[Page 4-12]</td></tr>
<tr><td>[Sy]
System Parameter</td><td>Sets the parameters related to servo amplifier – linear motor combination and specifications. [Page 4-15]</td></tr>
<tr><td>[AL]
Alarm history, software version</td><td>Displays the latest 7 alarm events, as well as the servo amplifier CPU software version. [Page 4-16]</td></tr>
<tr><td>[ob]
Monitor</td><td>Displays the servo amplifier status such as Velocity, Velocity Command, Torque, Torque command, Position Deviation and Servo Adjustment Gain when using auto-tuning. [Page 4-5]</td></tr>
</table>

■ How to change the modes

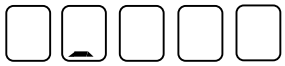
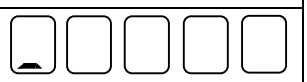
- Change the modes in the order as shown below by pressing the MODE key for changing the settings or for test operation.



■ Status display mode

- In the status display mode, various conditions are displayed according to the status of the servo amplifier as shown below.

Servo amplifier status	Marking
Control power supply established Control power supply (r、t) has been established and amplifier ready (RDY) is ON.	-
Main power supply being established. Main power supply (R, S, T) has been established, but operation preparation completion signal is OFF.	_
Main power supply established. Main power supply (R, S, T) has been established, and operation preparation completion signal is ON.	=
Fixed excitation being required. (blinking) Main power supply (R, S, T) has been established, but fixed excitation is not completed.	■
Fixed excitation being executed. "Upper round arch" rotates.	∩
Fixed excitation completed. "Lower round arch" rotates, and the display changes to main power supply established.	∪
Servo ON status Rotates drawing a character "8".	8
Over-travel status at forward rotation. Forward rotation is in "Over-travel" status in position and speed control type.	7
Over-travel status at reverse rotation. Reverse rotation is in "Over-Travel" status in position and speed control type.	⊦

Overload warning status If operation is kept on, alarm may be issued.	
Regenerative overload warning status If operation is kept on, alarm may be issued.	
Battery warning status Replace the battery.	
Alarm display When an alarm rings, take corrective actions as instructed in “Chapter 8, Maintenance”.	

- In addition to the above, warning functions include “excessive deviation warning” and “amplifier temperature warning”, which can be confirmed at monitor mode.
- There is a possibility that an overload warning will be detected when the control power is supplied, if the overload warning level is set below 75% (generic parameter GroupB Page22), because a rated load of 75% (hot start) has been assumed for the overload detection process when control power is supplied.

■ Description of monitor mode

- Various contents can be monitored as shown below at each page of monitor mode.

Page	Name	Contents	Unit	Display form
00	Servo Amplifier Status	Main circuit power supply status. Operation preparation status. Servo ON status: Servo ON Displays the status of servo amplifier, as mentioned above.	---	Code
01	Warning Status 1	Displays warning status.	---	Bit
02	Warning Status 2	Displays warning status.	---	
03	General purpose input CONT8~1 monitor	Displays the status of the general input terminal.	---	
04	General purpose output OUT8~1 monitor	Displays status of general output terminal.	---	
05	Velocity Monitor	Displays motor moving speed.	min^{-1}	Decimal
06	Velocity Command Monitor	Displays velocity command value.	min^{-1}	
07	Force Monitor	Displays output force of the motor.	%	
08	Force Command Monitor	Displays force command value.	%	
09	Position Deviation Monitor	Displays position deviation value.	Pulse	32 bit data Hexadecimal
0A	Actual Position Monitor (Linear sensor)	Displays the current position assumed that the position at the time of control power turn-ON is origin. This is a free run counter, therefore, if the current position exceeds the displayed range, the maximum value of reverse polarity will be displayed.	Pulse	
0B	~~External Actual Position Monitor (External Encoder)~~			
0C	Command Position Monitor			
0D	Analog Velocity Command / Analog Torque Command Input Voltage	Displays entered command voltage.	mV	Decimal
0E	Position Command Pulse Input Frequency Monitor	Displays entered command pulse frequency.	k Pulse /s	
0F	U-Phase Electric Angle Monitor	Always displays U-phase electric angle, excluding encoder(sensor) errors.	deg	
10	~~Absolute Encoder PS Data (High)~~	~~Displays position data PS of absolute encoder.~~	~~x2^32 P~~	~~32 bit data Hexadecimal~~
11	~~Absolute Encoder PS Data (Low)~~	~~Displays position data PS of absolute encoder.~~	~~Pulse~~	
12	Regenerative Resistor Operation Percentage	Displays run rate of regenerative resistance.	%	Decimal
13	Motor Operating Rate Monitor	Displays the accurate value, however, it may sometimes take several hours for the value to become stable depending on the operation pattern..	%	
14	Predicted Motor Operating Rate Monitor	Displays estimated value of the linear motor usage ratio. Estimated from brief operation. In an application where the same operation pattern repeats in a short time, the usage ratio can be confirmed soon.	%	

15	Load Inertia Ratio Monitor	Values can be confirmed when gain switching and auto-tuning functions are used.	%	Decimal
16	Position Loop Proportional Gain Monitor		1/s	
17	Position Loop Integral Time Constant Monitor	Values can be confirmed when gain switching function is used.	ms	
18	Velocity Loop Proprotional Gain Monitor	Values can be confirmed when gain switching and auto-tuning functions are used.	Hz	
19	Velocity Loop Integral Time Constant Monitor		ms	
1A	Force command filter monitor		Hz	
1B	Incremental Encoder Signal Monitor	Displays CN2 incremental signals.	-----	Bit
1C	Load Force Monitor (Estimate Value)	Displays load force.	%	Decimal
1D	Power Monitor	Displays the main circuit DC voltage.	V	
1E	Servo Amplifier Operation Time	Counted during control power is being turned ON. The time is displayed value×2 (hours).	×2 hour	

■ How to operate the monitor mode

● See the followings for how to operate the monitor mode and how to interpret the displayed data.

Step	Key	Description	Display status
1	MODE	Press the MODE key to display monitor mode.	ob
2	——	Displays the page automatically. After the power supply is turned ON, “Page 00” is displayed. Then, the previously displayed page is displayed.	ob 00
3	▶	Pressing the cursor key makes the blinking LED move. Move the blinking LED to the desired page to be changed.	ob 00
4	▲▼	Pressing the UP key increases the blinking numeric value and the Down key decreases.	ob 01
5	WR	On the page to be monitored, press the WR key to display the data.	Refer to display form.
6	MODE	Pressing the MODE key returns to step 2.	ob 00
7	MODE	Pressing the MODE key again returns to status display.	
✍	When the pages not allocated are set, the display is as shown in the right.		no.dAt

Page	Name	Display form: Code			
			Display		Display
00	Servo Amplifier Status	Control power established	00	Main power established	04
		Main power being established	02	Servo ON status	08

Page	Name	Display form: Bit	
			Display
01	Warning Status 1	Warning status 1 Warning status 2	LED 1 beginning from right 4 3 2 1 ←[LED] 7 6 5 4 3 2 1 0 Bit ↑With warning
02	Warning Status 2		
03	General Purpose Input CONT8 to CONT1 Monitor		
04	General Purpose Output CONT8 to CONT1 Monitor		
1B	Incremental Encoder Signal Monitor	General purpose input General purpose output Incremental signal	LED 1 beginning from right ↓Without warning 4 3 2 1←[LED]↑ 7 6 5 4 3 2 1 0 Bit ↓ Input photo coupler ON Output transistor ON Signal level H Input photo coupler OFF Output transistor OFF Signal level L

4. Digital Operator

[Monitor mode operations and display]

Name	Corresponding bits							
	7	6	5	4	3	2	1	0
Warning Status 1	Excessive deviation warning	—	Speed limit operation running	Force limit operation running	Regeneration overload warning	Overload warning	—	Amplifier temperature warning
Warning Status 2	—	~~Low battery warning~~	—	—	Reverse over -travel	Forward over -travel	—	Main circuit power being charged
General Purpose Input CONT8 to CONT1 Monitor	CONT8	CONT7	CONT6	CONT5	CONT4	CONT3	CONT2	CONT1
General Purpose Output OUT8 to OUT1 Monitor	OUT8	OUT7	OUT6	OUT5	OUT4	OUT3	OUT2	OUT1
Incremental signal	—	Hall sensor S 3 phase signal	Hall sensor S 2 phase signal	Hall sensor S 1 phase signal	—	Linear sensor incremental Z phase signal	Linear sensor incremental B phase signal	Linear sensor incremental A phase signal

Page	Name
05	Velocity Monitor
06	Velocity Command Monitor
07	Force Monitor
08	Force Command Monitor
0E	Position Command Pulse Input Frequency Monitor
0F	U-Phase Electric Angle Monitor
13	Motor Operating Rate Monitor
14	Predicted Motor Operating Rate Monitor
15	Load Inertia Ratio Monitor
16	Position Loop Proportional Gain Monitor
18	Velocity Loop Proportional Gain Monitor
1A	Force Command Filter Monitor
1C	Load Force Monitor (Estimate Value)
1D	Power Monitor
1E	Servo Amplifier Operation Time

Displayed form: Decimal

Display of "−" data	Display of "+" data
−5000	5000
− 100	100

The "+" data is displayed without the mark "+" on LED.

Display range			
Name	Maximum	Minimum	Unit
Velocity Monitor / Velocity Command Monitor	±9999	0	min^{-1}
Force Monitor / Force Command Monitor	±499	0	%
Position Command Pulse Input Frequency Monitor	±6000	0	k Pulse/s
U-Phase Electric Angle Monitor	359	0	deg
Motor Operating Rate Monitor / Predicted Motor Operating Rate Monitor	499	0	%
Load Inertia Ratio Monitor	15000	0	%
Position Loop Proportional Gain Monitor	3000	1	1/s
Velocity Loop Proportional Gain Monitor	2000	1	Hz
Force Command Filter Monitor	2000	1	Hz
Load Force Monitor (Estimate Value)	±499	0	%
Power Monitor	1000	0	V
Servo Amplifier Operation Time	—	—	×2 hour

Page	Name
09	Position Deviation Monitor
0A	Actual Position Monitor (Linear sensor)
0B	External Actual Position Monitor (External Encoder)
0C	Command Position Monitor
10	~~Absolute Encoder PS Data (High)~~
11	~~Absolute Encoder PS Data (Low)~~

Display form: 32 bit data displayed in hexadecimal

Bit data display "31"-"16"	Bit data display "15"-"0"
H. 0000	L. 0000

Display range			
Name	Maximum	Minimum	Unit
Position Deviation Monitor / Actual Position Monitor / Command Position Monitor	7FFF-FFFF	8000-0000	Pulse
~~Absolute Encoder PS Data High/Low~~	~~FFFF-FFFF~~	~~0000-0000~~	~~Pulse~~

Pressing the ▲ key displays "H" data, and ▼ key displays "L" data.

Page	Name
0D	Analog Velocity Command/ Force Command Input Voltage
12	Regenerative Resistor Operation Percentage
17	Position Loop Integral Time Constant Monitor
19	Velocity Loop Integral Time Constant Monitor

Display form : Decimal point

Decimal point "−" data display	Decimal point "+" data display
−12. 00	12. 00

The "+" data is displayed without the mark "+" on LED.

Display range			
Name	Maximum	Minimum	Unit
Analog Velocity Command/ Force Command Input Voltage	±12.00	0.00	V

Data display of "1 decimal place"	Data display of "2 decimal places"
0.1	0.01

Display range			
Name	Maximum	Minimum	Unit
Regenerative Resistor Operation Percentage	99.99	0.00	%
Position Loop Integral Time Constant Monitor	1000.0	0.5	msec
Velocity Loop Integral Time Constant Monitor	1000.0	0.5	msec

4. Digital Operator [Basic Parameter Mode Operations and Display]

■ Description of basic parameter mode

● The following parameters can be set and changed at each page of the basic parameter mode.
These parameters are necessary when test run by JOG operation and real time auto-tuning are used.

MODE	Page	Name	Contents	Group and Page
Ba	00	Setup Software, Communication Axis Number	Selects the axis number when communicating with PC.	GroupA 20
	01	Setup Software, Communication Baud Rate	Selection of Baud rate when communicating with PC.	GroupA 21
	02	Tuning Mode	Tuning mode selection	Group0 00
	03	Automatic Tuning Response	Response when auto-tuning is used.	Group0 02
	04	Position Command Filter	Sets the low pass filter of position command pulse	Group1 01
	05	Electric Gear Ratio 1	Sets the electric gear for position command pulse	Group8 15
	06	In-Position Window	Range setting for positioning complete signal output	Group8 41
	07	Forward over -travel	Condition selection to enable forward over-travel function	Group9 00
	08	Reverse Over-Travel	Condition selection to enable reverse over-travel function	Group9 01
	09	Alarm Reset Function	Condition selection to enable alarm resetting function	Group9 02
	~~0A~~	~~Absolute Encoder Clear Function~~	~~Condition selection to enable encoder clearing function~~	~~Group9 03~~
	0B	Deviation Clear Function	Condition selection to enable deviation clearing function	Group9 04
	0C	SERVO-ON Function	Condition selection to enable servo ON function	Group9 05
	0D	Force Limit, Input Selection	Condition selection to enable force limiting function	Group9 32
	0E	JOG Velocity Command	Sets the speed command at JOG operation.	GroupB 00
	0F	Encoder Output Pulse, Divide Ratio	Setting of encoder pulse dividing output	GroupC 05
	10	Analog Velocity Command Offset	Manual offset adjustment of analog speed command	----

✍ See “Chapter 5, Parameter” for details of parameters.

■ How to set the basic parameter mode

● See the followings for how to operate and set the basic parameter mode.

Step	Key	Description	Display status
1	MODE	Press the MODE key to display basic mode.	bA
2	——	Displays the page automatically. After the power supply is turned ON, “Page 00” is displayed. Then, the previously displayed page is displayed.	bA 00
3	▶	Pressing the cursor key makes the blinking LED move. Move the blinking LED to the page to be changed.	bA 00
4	▲ ▼	Pressing the UP key increases the blinking value and the Down key decreases.	bA 03
5	WR	On the page to be changed, press the WR key to display the data.	Refer to display form
6	▶	Pressing the cursor key makes the blinking LED move. Move the blinking LED to the desired value to be changed.	0d
7	▲ ▼	Pressing the UP key increases the blinking value and the Down key decreases.	00
8	WR	Press the WR key, and the display will blink 3 times to write. If writing is impossible, the numeric value is out of setting range. Check the setting value again.	00
9	MODE	Pressing the MODE key returns to step 2.	bA 00
10	MODE	Pressing the MODE key again returns to status display.	
✍	When the pages not allocated are set, the display is as shown in the right.		no.dAt

✍ For setting the dividing ratio of dividing output, different procedure is taken at step 5.
Refer to page 4-8 for how to set fractions.

4. Digital Operator [Basic Parameter Mode Operations and Display]

Page	Name	Display form: decimal
00	Setup Software, Communication Axis Number	Data display: 00
01	Setup Software, Communication Baud Rate	
02	Tuning Mode	
03	Automatic Tuning Response	
06	In-Position Window	
07	Forward Over-Travel Function	
08	Reverse Over-Travel Function	
09	Alarm Reset Function	
0A	~~Absolute Encoder Clear Function~~	
0B	Deviation Clear Function	
0C	SERVO-ON Function	
0D	Force Limit, Input Selection	
0E	JOG Velocity Command	

Name	Standard setting	Unit	Setting range
Communication axis number of Setup software	01	—	01～0F
communication baud rate of Setup software	05	—	00～05
Tuning mode	00	—	00～02
Auto-tuning response	5	—	1～30
Positioning complete range	100	Pulse	1～65535
Forward over-travel function	0D	—	00～27
Reverse over-travel function	0B	—	
Alarm resetting function	10	—	
~~Absolute encoder clearing function~~	06	—	
Deviation clearing function	08	—	
Servo ON function	02	—	
Force limiting function	0E	—	
ＪＯＧ speed command	50	min^{-1}	0～32767
Dividing ratio of encoder pulse dividing output	1/1	—	1/8192～1/1

Page	Name	Display form: decimal point
04	Position Command Filter Data display of "decimal point 1": 0.1	

Name	Standard setting	Unit	Setting range
position command filter	0.0	ms	0.0～2000.0

Page	Name	Display form: fraction
10	Analog Velocity Command Offset Display of "－"data: －1000 Display of "＋"data: 1000	

Standard setting value	Unit	Setting range
0	—	-9999～+9999

Page	Name	Display form : fraction
05 0F	Electric Gear Ratio Encoder Output Pulse, Divide Ratio Data display of numerator: 1 Data display of denominator: 1. ✍ Denominator is displayed with a dot at its right.	

Name	Standard setting value	Unit	Setting range
Electric Gear Ratio	1/1		1/32767～32767/1
Encoder Output Pulse, Divide Ratio	1/1	----	1/8192～1/1

How to set fractional data. [different from step 5 of the basic mode setting procedure]

The following example is when the data needs to be changed to 2/64 from the set value of 1/1.

5	WR	Press the WR key on the page to be changed, and the numerator data will be displayed.	1
	▶	Pressing the cursor key makes the blinking LED move. Move the blinking LED to the page to be changed.	1
	▲▼	Pressing the UP key increases the blinking numeric value and the Down key decreases.	2
	WR	Press the WR key, and the display will blink 3 times to write. If writing is impossible, the numeric value is out of setting range. Check the setting value again.	2
	▼	Press the Down key, and denominator data will be displayed. ✍ Denominator is displayed with a dot at its right.	1.
	▶	Pressing the cursor key makes the blinking LED move. Move the blinking to the numeric value to be changed.	1.
	▲▼	Pressing the UP key increases the blinking numeric value and the Down key decreases.	64.
	WR	Press the WR key, and the display will blink 3 times to write. If writing is impossible, the numeric value is out of setting range. Check the setting value again.	64.
9	Return to step 9 of the basic mode setting procedure.		

4. Digital Operator [General Parameter Mode Operations and Display]

■ Description of general parameter mode

● The following parameters can be set and changed at each page of general parameter mode. Settings can be made suitable for machines and equipment. Parameters for adjusting servo gain can be changed. Classified into 10 groups according to their functions.

Group	Description Group
Group0	Tuning mode setting
Group1	Settings of basic control parameters
Group2	Settings of damping control/notch filter/disturbance observer
Group3	Settings of gain switching control/damping frequency switching
Group4	To set high setting control
Group8	Settings related to system control
Group9	Settings related to general purpose input signals/function condition setting
GroupA	Settings related to general purpose output signals/monitor output signals/Setup software
GroupB	Settings related to system sequence/warning and alarms
GroupC	Settings related to linear sensor and hall sensor

✍ Refer to “Chapter5, Parameter” for details of parameters.

■ How to set the general parameter mode

● See the followings for operations and setting method of general parameters.

Step	Input key	Description	Display status
1	MODE	Press the MODE key to display basic mode.	Gr
2	——	Page is automatically displayed. Once power is turned ON,”group 0” “Page 00” is displayed and then the previously displayed group and page are displayed. Group No. Parameter Page No.	Gr0.00
3	▶	Pressing the cursor key makes the blinking LED move. Move the blinking LED to the group or page to be changed.	Gr0.00
4	▲ ▼	Pressing the UP key increases the blinking numeric value and the Down key decreases.	Gr0.00
5	WR	On the desired group or page, press the WR key to display the data.	Refer to Display form
6	▶	Pressing the cursor key makes the blinking LED move. Move the blinking LED to the numeric value to be changed.	Od
7	▲ ▼	Pressing the UP key increases the blinking numeric value and the Down key decreases.	OO
8	WR	Press the WR key, and the display will blink 3 times to write the data. If writing is impossible, the numeric value is out of setting range. Check the setting value again.	OO
9	MODE	Pressing the MODE key returns to step 2.	Gr0.00
10	MODE	Pressing the MODE key again, returns to status display.	
✍	When the pages not allocated are set, the display is as shown in the right.		no.dAt

✍ For setting the dividing ratio of encoder pulse dividing output and electronic gear 1, 2, different procedure is taken at step 5. Refer to page 4-10 for how to set fractions.

Display form : integer

Display of "-"data	Display of "+"data
− 1000	1000
	15000

"The +"data is displayed without the mark "+" on LED.
The setting ranges of the table below are displayed as shown in the left.

Name	Setting range	Unit
Position Loop Proportional Gain	1～3000	1/s
Load Inertia Ratio (Load Mass Ratio)	0～15000	%
Acceleration Feedback Gain	-1000～+1000	0.1%
Force Command Filter	1～2000	Hz
Force Command Filter Order	1～3	
Acceleration Compensation	-9999～+9999	Pulse

The above parameters are examples. Refer to "Chapter 5, Parameter" for parameter list.

Display form: decimal point

Display of "decimal point " data
12. 00

The setting ranges of the table below are displayed as shown in the left.

Name	Setting range	Unit
Position Command Filter	0.0～2000.0	ms
Velocity Loop Integral Time Constant	0.5～1000.0	ms

The above parameters are examples. Refer to "Chapter 5, Parameter" for the parameter list.

Display form: fraction

Data display of numerator	Data display of denominator
1	1.

Denominator is displayed with a dot at its right.
The setting ranges of the table below are displayed as shown in the left.

Name	Setting range
Encoder Output Pulse, Divide Ratio	1/8192～1/1
Electric Gear Ratio 1	1/32767～32767/1
Electric Gear Ratio 2	1/32767～32767/1

How to set fractional data. [different from step 5 of general parameter mode setting procedure.

The following example is when the data needs to be changed to 2/64 from the set value of 1/1

5	WR	On the page to be changed, press the WR key to display the numerator data.	1
	▶	Pressing the cursor key makes the blinking LED move. Move the blinking LED to the page to be changed.	1
	▲▼	Pressing the UP key increases the blinking numeric value and the Down key decreases.	2
	WR	Press the WR key, and the display will blink 3 times to write the data. If writing is impossible, the numeric value is out of setting range. Check the setting value again.	2
	▼	Press the Down key to display denominator data. Denominator is displayed with a dot at its right.	1.
	▶	Pressing the cursor key makes the blinking LED move. Move the blinking LED to the numeric value to be changed.	1.
	▲▼	Pressing the UP key increases the blinking numeric value and the Down key decreases.	64.
	WR	Press the WR key, and the display will blink 3 times to write the data. If writing is impossible, the numeric value is out of setting range. Check the setting value again.	64.
9	Return to step 9 of the general parameter mode setting procedure.		

4．Digital Operator [Auto-adjustment mode operations and display]

■ Description of auto-adjustment mode

● Automatic Notch Frequency Tuning, automatic Vibration Suppressor Frequency Tuning, automatic offset of Analog Velocity and Force Command, and Analog Force Addition Command Auto-Offset can be executed.

MODE	Page	Name
Au	00	Execution of Automatic Notch Frequency Tuning. Note 2)
	01	Execution of Automatic Vibration Suppressor Frequency Tuning Note 2)
	02	Automatic Offset Adjustment of Velocity /Force Command
	03	Automatic Offset Adjustment of Analog Force Addition Command

■ How to set the auto-adjustment mode

● See the followings for how to operate and set the auto-adjustment mode.

Step	Input key	Description	Display status
1	MODE	Press the MODE key to display test run mode.	Au
2	——	Page is displayed automatically. Once the power is turned ON, ”Page 00” is displayed then the previously displayed page is displayed.	Au 00
3	▶	Pressing the cursor key makes the blinking LED move. Move the blinking LED to the page to be changed.	Au 00
4	▲▼	Pressing the UP key increases the blinking numeric value and the Down key decreases.	Au 01
5	WR	On the page to be changed, press the WR key to display execution confirmation.	-y_n-
6	▲	Press the ▲ key for execution.	Proceed to step 7
	▼	Press the ▼ key for cancellation and to return to step 3.	Au 01
7	___	“ rdy ” is displayed when execution is possible. Move to step 8. Note1)	rdy
	___	“ no.rdy ” is displayed when execution is impossible. Press the MODE key to return to step 3.	no.rdy
8	MODE	Press the MODE key for cancellation, and move to step 11 for Auto-Notch and auto-Vibration Suppressor. For Automatic Offset Adjustment of Analog Velocity /Force Command, Automatic Offset Adjustment of Analog Force Addition Command, return to step 3.	
	WR	Press the WR key for execution. Display is as shown in the right while Auto-Notch and Auto-Vibration Suppressor are being executed.	r.u.n. .8
9		When completed normally, “ -END- ” is displayed. “ -Err- ” is displayed in case of an error.	-End-
10	MODE	Pressing the MODE key returns to step 7 for Auto-Notch and Auto- Vibration Suppressor. For Automatic Offset Adjustment of Analog Velocity /Force Command, Automatic Offset Adjustment of Analog Force Addition Command, returns to step 3.	
11		Completes with the display of “ AL_dF ”.	AL dF
✍	For Auto- Vibration Suppressor, pressing the MODE key during execution of step 8 cancels the execution and moves to step 11.		

Note 1） At the time of Automatic Notch Frequency and Automatic Vibration Suppressor Frequency Tuning, if the main circuit power is shut off in this status, make sure to turn On the main power source again or turn OFF and ON the control power.

Note 2） If the control mode switching type is in use, it may not be possible to use this. Switch the control mode at the base side [03 : _Velo－Torq] to Velo (Velocity control) to use this.

4. Digital Operator [Test run mode operations and display]

■ Description of test run mode

- JOG operation, alarm reset, encoder clear, alarm history clear, and Save Result of Automatic Tuning can be executed.

MODE	Page	Name
Ad	00	Execution of JOG operation Note 2)
	01	Execution of Alarm Reset
	02	Save Result of Automatic Tuning
	03	Execution of Encoder Clear
	04	Execution of Alarm History Clear
	05	Fixed excitation

■ How to set the test run mode

- See the followings for how to operate and set the test run mode.

Step	Input key	Description	Display status
1	MODE	Press the MODE key to display test run mode.	Ad
2	––	Page is automatically displayed. Once the power source is turned ON, "Page 00" is displayed then the previously displayed page is displayed.	Ad 00
3	▶	Pressing the cursor key makes the blinking LED move. Move the blinking LED to the page to be changed.	Ad 00
4	▲▼	Pressing the UP key increases the blinking numeric value and the Down key decreases.	Ad 01
5	WR	On the page to be changed, press the WR key to display confirmation.	–y_n–
6	▲	Press the ▲ key for execution.	Proceed to step 7
	▼	Press the ▼ key for cancellation and to return to step 3.	Ad 01
7	–––	" rdy " is displayed when execution is possible. Move to step 8. Note 1)	rdy
	–––	" no.rdy " is displayed when execution is impossible. Press the MODE key to return to step 3.	no.rdy
✍	On and after step 8, the display and operations differ depending on the function in use. See the following pages for display and operations described separately for each function.		

Note1)At the time of JOG operation, if the main circuit power is shut off in this status, press the MODE key or turn ON the main power source again or turn OFF and ON the control power.
Note2) If the control mode switching type is in use, it may not be possible to use this. Switch the control mode at the base side [03 : _Velo－Torq] to Velo (Velocity control) to use this.

● See the followings for how to operate and set JOG operation.

Step	Input key	Description	Display status
8	MODE	Press the MODE key for cancellation and to proceed to step 10.	AL dF
	WR	Pressing the WR key displays a number of '8' in servo ON status. Note 1)	8
9	▲	Press the ▲ key, and the motor shaft moves forward. (Dot moves.) Note 1)	r.u.n. .8
	▼	Press the ▼ key, and the motor shaft moves reversely. (Dot moves.) Note 1)	r.u.n. .8
	✍ Command speed at the time of JOG operation shall be set at "general parameter, GroupB_00". If not changed, it moves at "50mm/s" as was set at the time of shipment.		
10	MODE	Press the MODE key, and JOG operation will end. The display shows " AL_dF ", which is not an error.	AL dF

✍ Digital operator cannot perform JOG operation from servo ON status. Servo ON signal from upper device shall be turned OFF. When general parameter "group 9 05" is set to "01:_Always_ON", set this to "00:_Always_OFF" to execute JOG operation.

Note1) At the time of JOG operation, if the main circuit power is shut off, press the MODE key.

● See the followings for how to operate Alarm Reset.

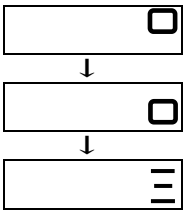
Step	Input key	Description	Display status
8	MODE	Press the MODE key for cancellation and to return to step 3.	Ad 01
	WR	Press the WR key to reset the alarm and "-End-" will be displayed. While "-Err-" is displayed, alarm cause is not yet eliminated. Take the corrective actions as instructed in "Chapter 8, Maintenance".	-End- -Err-
9	MODE	Press the MODE key to return to step 3.	Ad 01

● See the followings for how to operate Automatic Tuning Result writing / Alarm History Clear.

Step	Input key	Description	Display status
8	MODE	Press the MODE key for cancellation and to return to step 3.	Ad_02
	WR	Press the WR key, and the operation is executed.	
9		When completed normally, "-End-" is displayed. If not"-Err-" is displayed.	-End- -Err-
10	MODE	Pressing the MODE key returns to step 7.	Ad_02

✍ When "Automatic Tuning Result writing" is used at digital operator, it is impossible to write after monitoring the tuning result.

● See the followings for how to operate the fixed excitation.

Step	Input key	Description	Status display
8	MODE	Press the MODE key for cancellation and to return to step 3.	Ad 05
	WR	Press the WR key and the fixed excitation is executed. During fixed excitation, the linear motor moves right and left, so do not stand near the linear motor. While being executed, the display changes as shown in the right, and when the last display appears, the fixed excitation is completed.	
		When an alarm rings, take corrective actions as instructed in "Chapter 8, Maintenance".	AL 44
9	MODE	Pressing the MODE key returns to step 3.	Ad 05

4. Digital Operator [System parameter mode operations and display]

■ Description of system parameter mode

- On each page of the system parameter mode, parameters are set related to combinations and specifications of servo amplifier and servo motor as shown below.

MODE	Page	Name	Setting range
Sy	00	Main Power, Input Type	2 ways (1way)
	01	Motor Encoder Type	1way
	02	Incremental Encoder, Function Setting	10 ways
	03	Incremental Encoder, Resolution Setting	10P/mm ～ 65535P/mm
	04	~~Absolute Encoder, Function Setting~~	---
	05	~~Absolute Encoder, Resolution Setting~~	---
	06	Servo amplifier information [editing disabled]	---
	07	Motor Type [editing disabled]	---
	08	Control Mode	6ways
	09	Position Loop Control and Position Loop Encoder Selection	2ways
	0A	External Encoder, Resolution Setting	10P/mm ～ 65535P/mm
	0B	Regenerative Resistor Selection	3ways

✍ Refer to “Chapter 5, Parameter” for details of parameters

■ How to set the system parameter mode

- See the followings for how to operate and set the system parameter mode.

Step	Input key	Description	Display status
1	MODE	Press the MODE key to display system parameter mode.	Sy
2	——	Page is automatically displayed. Once the power source is turned ON, “Page 00” is displayed then the previously displayed page is displayed.	Sy 00
3	▶	Pressing the cursor key makes the blinking LED move. Move the blinking LED to the page to be changed.	Sy 00
4	▲▼	Pressing the UP key increases the blinking numeric value and the Down key decreases.	Sy 0b
5	WR	On the page to be changed, press the WR key to display the data.	01
6	▶	Pressing the cursor key makes the blinking LED move. Move the blinking LED to the numeric value to be changed.	01
7	▲▼	Pressing the UP key increases the blinking numeric value and the Down key decreases.	02
8	WR	Press the WR key, and the display will blink 3 times to write the data. If writing is impossible, the numeric value is out of setting range. Check the setting value again.	02
9	MODE	Pressing the MODE key returns to step 2.	Sy 0b
10	MODE	Pressing the MODE key again returns to status display.	
✍	When the pages not allocated are set, the display is as shown in the right.		no.dAt

4. Digital Operator [Alarm trace／CPU Ver mode operations and display]

■ Description of Alarm trace/CPU_Ver mode

- It is possible to confirm the latest 7 alarms and the software version of servo amplifier CPU.

MODE	Page	Name
AL	1	1st latest alarm
	2	2nd latest alarm
	3	3rd latest alarm
	4	4th latest alarm
	5	5th latest alarm
	6	6th latest alarm
	7	7th latest alarm
	CPU software version	

✍ Refer to “Chapter 8, Maintenance” for details of alarms.

■ How to display the alarm trace mode

- See the followings for how to operate and display the alarm trace.

Step	Input key	Description	Display status
1	MODE	Press the MODE key to display system parameter mode.	AL
2	——	Page is automatically displayed. Once the power source is turned ON, [1st latest alarm] is displayed then the previously displayed page is displayed.	AL1.85
3	▲▼	Pressing the UP key increases the blinking numeric value and the Down key decreases. The blinking number shows the alarm history.	

■ How to display CPU software version.

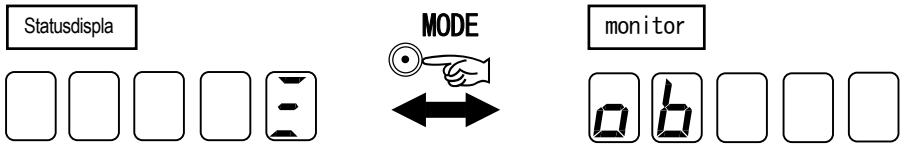
- See the followings for how to display the CPU software version.

Step	Input key	Description	Display status
1	MODE	Press the MODEkey to display system parameter mode.	AL
2	——	Page is automatically displayed. Once the power source is turned ON, “1st latest alarm” is displayed then the previously displayed page is displayed.	AL1.85
3	▲▼	Press the Up/Down key, and the display as shown in the right appears.	CPu.no
4	WR	Press the WR key to display the version.	**.**.*
5	MODE	Press the MODE key to return to step 3.	CPu.no

4. Digital Operator [Password setting]

■ Description of password function

● The password function allows selection of a password and protection against unauthorized parameter changes. Once a password has been set, “status mode” and “monitor mode” can only be used. Utilize this function to avoid operational mistakes.



■ How to set and release password

Step	Input key	Description	Status display
1	MODE	Turn ON the power source or press the MODE key to display the status display mode.	
2	▲	Press the Up key, and the display shown in the right appears.	−PAS−
		Display starts blinking : password not yet set → password setting	−PAS−
		Display turns ON : Password has been set.→ Password release	−PAS−
4	WR	Press the WR key to display “ 0000 ”.	0000
5	▲▼	Pressing the UP key increases the blinking numeric value and the Down key decreases.	
		For password setting, use a combination of 4 digit numeric values and alphabets in hexadecimal.	1000
		To release the password, input the previously set 4 digit password.	
6	WR	Press the WR key, and the display blinks 3 times to write or release the password.	1000
		When writing is disabled, “ -Err- “ shows that this is out of setting range. “ 0000 ” and “ FFFF ” are invalid.	−Err−
		When release is disabled, “ -Err- “ shows that this is a wrong password.	
7	MODE	Press the MODE key to return to step 1.	

✍ ・For password setting, it is important to make a note of the password and remember it for future reference. Without the password, it is impossible to release the lock function.

・The password function is enabled or disabled by turning OFF the control power and then once again switching it ON. The possible values for a password is a combination of 4 digits from 0 to 9 and A to F. “ 0000 ” and “ FFFF ” are invalid. Setting and release of a password cannot be performed by “Setup software –R- Setup”. Once a password has been set, parameters cannot be changed via “Setup software –R- Setup”. If parameters are changed via “Setup software –R- Setup”, “communication establishment” will be disconnected.

5

[Parameter]

5. Parameter [Parameter List]

■ General Parameter Group 0 [Auto-tuning setting]

Page	Name	Standard Value	Unit	Display Range	Reference page	level
00	Tuning mode	00:_AutoTun	—	00～02	5-7	Ba
01	Automatic Tuning Characteristic	00:_Positioning1	—	00～04	5-7	Ad
02	Automatic Tuning Response	5	—	1～30	5-7	Ba
03	Automatic Tuning, Automatic Parameter Saving	00:_Auto_Saving	—	00～01	5-7	Ad
10	Automatic Notch Filter Tuning, Force Command	50	%	10～100	5-7	Ad
20	Automatic Vibration Suppressor Frequency Tuning, Force Command	25	%	10～100	5-7	Ad
21	Automatic Vibration Suppressor Frequency Tuning, Friction Compensation Value	5	%	0～50	5-7	Ad

■ General Parameter Group 1 [Basic controlling parameter setting]

Page	Name	Standard Value	Unit	Display Range	Reference page	level
01	Position command filter	0.0	ms	0.0～2000.0	5-7	Ba
02	Position Loop Proportional Gain 1	30	1/s	1～3000	5-7	Ad
03	Position Loop Integral Time Constant 1	1000.0	ms	0.5～1000.0	5-7	Ad
04	Higher Tracking Control, Position Compensation Gain	0	%	0～100	5-8	Ad
05	Feed Forward Gain	0	%	0～100	5-8	Ad
08	Feed Forward Filter	2000	Hz	1～2000	5-8	Ad
10	Velocity Command Filter	2000	Hz	1～2000	5-8	Ad
12	Velocity Feedback Filter	1500	Hz	1～2000	5-8	Ad
13	Velocity Loop Proportional Gain 1	50	Hz	1～2000	5-8	Ad
14	Velocity Loop Integral Time Constant 1	20.0	ms	0.5～1000.0	5-8	Ad
15	Load Inertia Ratio (Load Mass Ratio) 1	100	%	0～15000	5-8	Ad
16	Higher Tracking Control, Velocity Compensation Gain	0	%	0～100	5-8	Ad
17	Acceleration Feedback Gain	0.0	%	-100.0～100.0	5-8	Ad
18	Acceleration Feedback Filter	500	Hz	1～2000	5-8	Ad
20	Force Command Filter 1	600	Hz	1～2000	5-8	Ad
21	Force Command Filter Order	2	Order	1～3	5-8	Ad

■ General Parameter Group 2 [Vibration suppressing control／Notch filter／Disturbance observer setting]

Page	Name	Standard Value	Unit	Display Range	Reference page	Level
00	Vibration Suppressor Frequency 1	500	Hz	5～500	5-9	Ad
01	Vibration Suppressor Level Selection	00	—	00～03	5-9	Ad
10	Velocity Command,Notch Filter	500	Hz	50～500	5-9	Ad
20	Force Command,Notch Filter A	2000	Hz	100～2000	5-9	Ad
21	TCNFILA, Low Frequency Phase Delay Improvement	00	—	00～02	5-9	Ad
22	Force Command,Notch Filter B	2000	Hz	100～2000	5-9	Ad
23	TCNFILB, Depth Selection	00	—	00～03	5-9	Ad
24	Force Command, Notch Filter C	2000	Hz	100～2000	5-9	Ad
25	TCNFILC, Depth Selection	00	—	00～03	5-9	Ad
26	Force Command,Notch Filter D	2000	Hz	100～2000	5-9	Ad
27	TCNFILD, Depth Selection	00	—	00～03	5-10	Ad
30	Observer characteristic	00:_Low	—	00～01	5-10	Ad
31	Observer Compensation Gain	0	%	0～100	5-10	Ad
32	Observer Output, Low Pass Filter	50	Hz	1～2000	5-10	Ad
33	Observer Output, Notch Filter	2000	Hz	100～2000	5-10	Ad

■ General Parameter Group 3［Setting for gain switching control／vibration suppressing frequency switching］

Page	Name	Standard Value	Unit	Display Range	Reference page	level
00	Position Loop Proportional Gain 2	30	1/s	1～3000	5-10	Ad
01	Position Loop Integral Time Constant 2	1000.0	ms	0.5～1000.0	5-10	Ad
02	Velocity Loop Proportional Gain 2	50	Hz	1～2000	5-10	Ad
03	Velocity Loop Integral Time Constant 2	20.0	ms	0.5～1000.0	5-10	Ad
04	Load Inertia Ratio (Load Mass Ratio) 2	100	%	0～15000	5-10	Ad
05	Force Command Filter 2	600	Hz	1～2000	5-10	Ad
10	Position Loop Proportional Gain 3	30	1/s	1～3000	5-11	Ad
11	Position Loop Integral Time Constant 3	1000.0	ms	0.5～1000.0	5-11	Ad
12	Velocity Loop Proportional Gain 3	50	Hz	1～2000	5-11	Ad
13	Velocity Loop Integral Time Constant 3	20.0	ms	0.5～1000.0	5-11	Ad
14	Load Inertia Ratio (Load Mass Ratio) 3	100	%	0～15000	5-11	Ad
15	Force Command Filter 3	600	Hz	1～2000	5-11	Ad
20	Position Loop Proportional Gain 4	30	1/s	1～3000	5-11	Ad
21	Position Loop Integral Time Constant 4	1000.0	ms	0.5～1000.0	5-11	Ad
22	Velocity Loop Proportional Gain 4	50	Hz	1～2000	5-11	Ad
23	Velocity Loop Integral Time Constant 4	20.0	ms	0.5～1000.0	5-11	Ad
24	Load Inertia Ratio (Load Mass Ratio) 4	100	%	0～15000	5-11	Ad
25	Force Command Filter 4	600	Hz	1～2000	5-11	Ad
30	Low Pass Filter of Gain Switching	0	ms	0～100	5-11	Ad
40	Vibration Suppressor Frequency 2	500	Hz	5～500	5-12	Ad
41	Vibration Suppressor Frequency 3	500	Hz	5～500	5-12	Ad
42	Vibration Suppressor Frequency 4	500	Hz	5～500	5-12	Ad

■ General Parameter Group 4［To set high setting control］

Page	Name	Standard Value	Unit	Display Range	Reference page	level
00	Command Velocity, Low Pass Filter	1000	Hz	1～2000	5-12	Ad
01	Command Velocity Threshold	20	min^{-1}	0～65535	5-12	Ad
02	Acceleration Compensation	0	×50 Pulse	-9999～+9999	5-12	Ad
03	Deceleration Compensation	0	×50 Pulse	-9999～+9999	5-12	Ad

■ General Parameter Group 8［Control system setting］

Page	Name	Standard Value	Unit	Display Range	Reference page	level
00	Command Input Polarity	00:_PC+_VC+_TC+	—	00～07	5-13	Ad
01	Analog Input Dead Band	00:_Disabled	—	00～01	5-13	Ad
11	Position Command Pulse, Form Selection	00:_F-PC_R-PC	—	00～02	5-13	Ad
12	Position Command Pulse, Count Polarity	00:_Type1	—	00～03	5-13	Ad
13	Position Command Pulse, Digital Filter	00:_834nsec	—	00～07	5-14	Ad
14	Position Command, Pulse Multiplier	1	—	1～63	5-14	Ad
15	Electric Gear Ratio 1	1/1	—	1/32767～32767/1	5-14	Ba
16	Electric Gear Ratio 2	1/1	—	1/32767～32767/1	5-14	Ad
17	Positioning method	00:_Pulse_Interval	—	00～01	5-14	Ad
18	Inposition / Position Deviation Monitor	00:_After_Filter	—	00～01	5-14	Ad
19	Deviation Clear Selection	00_Type1	—	00～03	5-14	Ad
20	Preset Velocity Command 1	100	mm/s	0～32767	5-15	Ad
21	Preset Velocity Command 2	200	mm/s	0～32767	5-15	Ad
22	Preset Velocity Command 3	300	mm/s	0～32767	5-15	Ad
23	Velocity Compensation Command, Input Selection	02:_VCOMP	—	01～02	5-15	Ad
24	Preset Velocity Compensation Command	0	mm/s	-9999～+9999	5-15	Ad
25	Analog Velocity Command, Reference (Analog Velocity Compensation Command, Ref.)	500	mm/s /V	0～4000	5-15	Ad
26	Velocity Command, Acceleration Time Constant	0	ms	0～16000	5-15	Ad
27	Velocity Command, Deceleation Time Constant	0	ms	0～16000	5-15	Ad
28	Velocity Limit	65535	mm/s	1～65535	5-15	Ad
30	Force Compensation Command, Input Selection	02:_TCOMP	—	01～02	5-15	Ad
31	Preset Force Compensation Command 1	0	%	-500～500	5-16	Ad
32	Preset Force Compensation Command 2	0	%	-500～500	5-16	Ad
33	Analog Force Command, Reference	50	%/V	0～500	5-16	Ad
34	Analog Force Compensation Command, Reference	50	%/V	0～500	5-16	Ad
35	Force Limit, Input Selection	00:_TCLM	—	00～03	5-16	Ad
36	Internal Force Limit	100	%	10～500	5-16	Ad
37	Force Limit at Sequence Operation	120	%	10～500	5-16	Ad
38	Fixed Excitation Current Command	25	%	1～100	5-16	Ad
40	In-Position Near Range	500	Pulse	1～65535	5-17	Ad
41	In-Position Window	100	Pulse	1～65535	5-17	Ba
42	Speed Zero Range	50	mm/s	50～500	5-17	Ad
43	Low Speed Range	50	mm/s	0～65535	5-17	Ad
44	Speed Matching Width	50	mm/s	0～65535	5-17	Ad
45	High Speed Range	1000	mm/s	0～65535	5-17	Ad

■ General Parameter Group 9［Function enabling condition setting］

Page	Name	Standard Value	Display Range	Reference page	level
00	Positive Over-Travel Function	0D:_CONT6_OFF	00～27	5-18,19	Ba
01	Negative Over-Travel Function	0B:_CONT5_OFF	00～27	5-18,19	Ba
02	Alarm Reset Function	10:_CONT8_ON	00～27	5-18,19	Ba
03	~~Absolute Encoder Clear Function~~	~~06:_CONT3_ON~~	~~00～27~~	~~5-18,19~~	~~Ba~~
04	Deviation Clear Function	08:_CONT4_ON	00～27	5-18,19	Ba
05	SERVO-ON Function	02:_CONT1_ON	00～27	5-18,19	Ba
10	Control Mode Switching Function	00:_Always_ Disable	00～27	5-18,19	Ad
11	Position Command Pulse Inhibit Function and Velocity Command Zero Clamp Function	00:_Always_ Disable	00～27	5-18,19	Ad
12	Electric Gear Switching Function	00:_Always_ Disable	00～27	5-18,19	Ad
13	Gain Switching Function, Select Input 1	00:_Always_ Disable	00～27	5-18,19	Ad
14	Gain Switching Function, Select Input 2	00:_Always_ Disable	00～27	5-18,19	Ad
15	Vibration Suppressor Frequency, Select Input 1	00:_Always_ Disable	00～27	5-18,19	Ad
16	Vibration Suppressor Frequency, Select Input 2	00:_Always_ Disable	00～27	5-18,19	Ad
17	Position Loop Proportional Control, Switching Function	01:_Always_ Enable	00～27	5-18,19	Ad
18	Fixed Excitation Function	01:_Always_ Enable	00～27	5-18,19	Ad
20	Preset Velocity Command, Select Input 1	00:_Always_ Disable	00～27	5-18,19	Ad
21	Preset Velocity Command, Select Input 2	00:_Always_ Disable	00～27	5-18,19	Ad
22	Preset Velocity Command, Direction of Move	00:_Always_ Disable	00～27	5-18,19	Ad
23	Preset Velocity Command, Operation Start Signal Input	00:_Always_ Disable	00～27	5-18,19	Ad
24	Preset Velocity Command, Positive Move Signal Input	00:_Always_ Disable	00～27	5-18,19	Ad
25	Preset Velocity Command, Negative Move Signal Input	00:_Always_ Disable	00～27	5-18,19	Ad
26	Velocity Loop Proportional Control, Switching Function	04:_CONT2_ON	00～27	5-18,19	Ba
27	Velocity Compensation Function, Select Input	00:_Always_ Disable	00～27	5-18,19	Ad
30	Force Compensation Function, Select Input 1	00:_Always_ Disable	00～27	5-18,19	Ad
31	Force Compensation Function,Select Input 2	00:_Always_ Disable	00～27	5-18,19	Ad
32	Force Limit, Input Selection	0E:_CONT7_ON	00～27	5-18,19	Ba
33	Disturbance Observer	00: Always_ Disable	00～27	5-18,19	Ad
40	External Error Input	00:_Always_ Disable	00～27	5-18,19	Ad
41	Main Power Discharge Function	01:_Always_ Enable	00～27	5-18,19	Ad
42	Emergency Stop Function	00:_Always_ Disable	00～27	5-18,19	Ad

■ General Parameter Group A［Setting for output condition of general output terminal/monitor output selection/setup software］

Page	Name	Standard Value	Display Range	Reference page	level
00	General Purpose Output 1	18:_INP_ON	00～5B	5-20,21	Ad
01	General Purpose Output 2	0C:_TLC_ON	00～5B	5-20,21	Ad
02	General Purpose Output 3	02:_S-RDY_ON	00～5B	5-20,21	Ad
03	General Purpose Output 4	0A:_MBR_ON	00～5B	5-20,21	Ad
04	General Purpose Output 5	33:_ALM5_OFF	00～5B	5-20,21	Ad
05	General Purpose Output 6	35:_ALM6_OFF	00～5B	5-20,21	Ad
06	General Purpose Output 7	37:_ALM7_OFF	00～5B	5-20,21	Ad
07	General Purpose Output 8	39:_ALM_OFF	00～5B	5-20,21	Ad
10	Digital Monitor, Output Signal Selection	00:Always_OFF	00～5B	5-20,21	Ad
11	Analog Monitor 1, Output Signal Selection	05:VMON_2mV/ min^{-1}	00～15	5-20	Ad
12	Analog Monitor 2, Output Signal Selection	02:TCMON_2V/TR	00～15	5-20	Ad
13	Analog monitor output polarity	00:_MON1+_MON2+	00～08	5-22	Ad
20	Setup Software, Communication Axis Number	01:_#1	01～0F	5-22	Ba
21	Setup Software, Communication Baud Rate	05:_38400bps	00～05	5-22	Ba

■ General Parameter Group B［Setting related to sequence/alarms］

Page	Name	Standard Value	Unit	Display Range	Reference page	Level
00	JOG Velocity Command	50	min^{-1}	0～32767	5-23	Ba
10	Dynamic Brake Action Selection	04:_SB__Free	—	00～05	5-23	Ad
11	Over-Travel Action Selection	00:_CMDINH_SB_SON	—	00～06	5-23	Ad
12	Emergency Stop Operation	00:_SERVO-BRAKE	—	00～01	5-23	Ad
13	Delay Time of Engaging Holding Brake (holding brake holding delay time)	300	ms	0～1000	5-24	Ad
14	Delay Time of Releasing Holding Brake (holding brake release delay time)	300	ms	0～1000	5-24	Ad
15	Brake Operation Beginning Time	0	ms	0～65535	5-24	Ad
16	Power Failure Detection Delay Time	32	ms	20～1000	5-24	Ad
17	Wait time for Initialization Completion	00:_Disabled	—	00～ 03	5-24	Ad
20	Following Error Warning Level	65535	X1024 pulse	1～65535	5-24	Ad
21	Following Error Limit	500	X1024 pulse	1～65535	5-24	Ad
22	Overload Warning Level	90	%	20～100	5-25	Ad
23	Speed Feedback Error (ALM_C3) Detection	01:_Enabled	—	00～01	5-25	Ad
24	Speed Control Error (ALM_C2) Detection	00:_Disabled	—	00～01	5-25	Ad

■ General Parameter Group C［Encoder related setting］

Page	Name	Standard Value	Unit	Display Range	Reference page	Level
00	~~Position detection system choice~~	~~00:_Absolute~~	~~—~~	~~00～01~~	~~5-26~~	~~Ad~~
01	Motor Incremental Encoder, Digital Filter	01:_220nsec	—	00～07	5-26	Ad
02	Hall sensor, Digital Filter	01:_220nsec	—	00～07	5-26	Ad
03	Hall sensor Polarity Invert	00:_Type1	—	00～07	5-26	Ad
04	Encoder Pulse Divided Output, Selection	00:_Motor_Enc.	—	00～01	5-27	Ad
05	Encoder Output Pulse, Divide Ratio	1/1	—	1/8192～1/1	5-27	Ba
06	Encoder Pulse Divided output, Polarity	00:_Type1	—	00～03	5-27	Ad
07	~~Encoder Signal Output (PS), Format~~	~~00:_Binary~~	~~—~~	~~00～02~~	~~5-27~~	~~Ad~~
08	~~Abusolute Encoder Clear Function Selection~~	~~00:_Status_MultiTurn~~	~~—~~	~~00～01~~	~~5-27~~	~~Ad~~
09	CS Offset	0	deg	0～359	5-27	Ad
0A	Z Phase CS Normalization Offset	0	deg	0～359	5-27	Ad
0B	Linear Sensor Direction Selection	00:_Standard	—	00～01	5-28	Ad

■ General Parameter [Digital operator basic mode]

Page	Name	Group and Page	Standard Value	Display Range	Reference page
00	Setup Software, Communication Axis Number	GroupA 20	01:_#1	01～0F	5-22
01	Setup Software, Communication Baud Rate	GroupA 21	05:_38400bps	00～05	5-22
02	Tuning Mode	Group0 00	00:_AutoTun	00～02	5-7
03	Automatic Tuning Response	Gropu0 02	5	1～30	5-7
04	Position Command Filter [ms]	Group1 01	0.0	0.0～2000.0	5-7
05	Electric Gear Ratio 1	Group8 15	1/1	1/32767～32767/1	5-14
06	In-Position Window [pulse]	Group8 41	100	1～65535	5-17
07	Positive Over-Travel Function	Group9 00	0D:_CONT6_OFF	00～27	5-18,19
08	Negative Over-Travel Function	Group9 01	0B:_CONT5_OFF		5-18,19
09	Alarm Reset Function	Group9 02	10:_CONT8_ON		5-18,19
0A	~~Absolute Encoder Clear Function~~	~~Group9 03~~	~~06:_CONT3_ON~~		5-18,19
0B	Deviation Clear Function	Group9 04	08:_CONT4_ON		5-18,19
0C	SERVO-ON Function	Group9 05	02:_CONT1_ON		5-18,19
0D	Force Limit, Input Selection	Group9 32	0E:_CONT7_ON		5-18,19
0E	JOG Velocity Command	GroupB 00	50	0～32767	5-23
0F	Encoder Output Pulse, Divide Ratio	GroupC 05	1/1	1/8192～1/1	5-27
10	Analog Velocity Command Offset	----	0	-9999～9999	---

■ System parameter [for Setup software - R-Setup]

Page	Name	Display Range	Reference page
00	Main Power, Input Type	2 ways(depending on the hardware type)	5-28
01	Motor Encoder Type	1 way	5-28
02	Incremental Encoder, Function Setting	10 ways(depending on the hardware type)	5-28
03	Incremental Encoder, Resolution Setting	10P/mm ～ 65535P/mm	5-28
04	~~Absolute Encoder, Function Setting~~	—	5-28
05	~~Absolute Encoder, Resolution Setting~~	—	5-28
06	Motor Type	—	5-29
08	Control Mode	6 ways	5-29
09	Position Loop Control and Position Loop Encoder Selection	1 way (depending on the hardware type)	5-29
0A	~~External Encoder, Resolution Setting~~	~~10P/mm ～ 65535P/mm~~	5-29
0B	Regenerative Resistor Selection	3ways	5-29

■ System parameter [for digital operator]

Page	Name	Display Range	Reference page
00	Main Power, Input Type	2 ways (depending on the hardware type)	5-28
01	Motor Encoder Type	1 way	5-28
02	Incremental Encoder, Function Setting	10 ways (depending on the hardware type)	5-28
03	Incremental Encoder, Resolution Setting	10P/mm ～ 65535P/mm	5-28
04	~~Absolute Encoder, Function Setting~~	—	5-28
05	~~Absolute Encoder, Resolution Setting~~	—	5-28
06	Information of Servo Amplifier	[for maker maintenance]	5-29
07	Linear Motor Code	—	5-29
08	Control Mode	6ways	5-29
09	Position Loop Control and Position Loop Encoder Selection	1 way (depending on the hardware type)	5-29
0A	~~External Encoder, Resolution Seting~~	~~10P/mm ～ 65535P/mm~~	5-29
0B	Regenerative Resistor Selection	3ways	5-29

5.Parameter [Parameter setting value【Group0】【Group1】]

■ General parameter Group 0 [Auto-tuning settings]

<table>
<tr><th>Page</th><th>Contents</th></tr>
<tr><td>00</td><td>
Tuning mode [TUNMODE]
<table>
<tr><th>Setting range</th><th>Unit</th><th>Standard value</th></tr>
<tr><td>00～02</td><td>—</td><td>00:_AutoTun</td></tr>
</table>
<table>
<tr><th>Selection</th><th>Contents</th></tr>
<tr><td>00:_AutoTun</td><td>Automatic Tuning</td></tr>
<tr><td>01:_AutoTun_JRAT-Fix</td><td>Autiomatic Tuning (JRAT Fixed)</td></tr>
<tr><td>02:_ManualTun</td><td>Manual Tuning</td></tr>
</table>
</td></tr>
<tr><td>01</td><td>
Automatic Tuning Characteristic [ATCHA]
<table>
<tr><th>Setting range</th><th>Unit</th><th>Standard value</th></tr>
<tr><td>00～04</td><td>—</td><td>00:_Positioning1</td></tr>
</table>
<table>
<tr><th>Selection</th><th>Contents</th></tr>
<tr><td>00:_Positioning1</td><td>Positioning Control 1</td></tr>
<tr><td>01:_Positioning2</td><td>Positioning Control 2</td></tr>
<tr><td>02:_Positioning3</td><td>Positioning Control 3</td></tr>
<tr><td>03:_Trajectory1</td><td>Trajectory Control</td></tr>
<tr><td>04:_Trajectory2</td><td>Trajectory Control (KP Fixed)</td></tr>
</table>
</td></tr>
<tr><td>02</td><td>
Automatic Tuning Response [ATRES]
<table>
<tr><th>Setting range</th><th>Unit</th><th>Standard value</th></tr>
<tr><td>1～30</td><td>—</td><td>5</td></tr>
</table>
Sets the auto-tuning response. The larger the set value, the higher the response. Make the setting suitable for rigidity of the device.
</td></tr>
<tr><td>03</td><td>
Automatic Tuning, Automatic Parameter Saving [ATSAVE]
<table>
<tr><th>Setting range</th><th>Unit</th><th>Standard value</th></tr>
<tr><td>00～01</td><td>—</td><td>00:_Auto_Saving</td></tr>
</table>
The parameter (JRAT) obtained from auto-tuning result is automatically saved.
<table>
<tr><th>Selection</th><th>Contents</th></tr>
<tr><td>00:_Auto_Saving</td><td>Saves Parameter Automatically in JRAT1.</td></tr>
<tr><td>01:_No_Saving</td><td>Automatic Saving is Invalidity</td></tr>
</table>
</td></tr>
<tr><td>10</td><td>
Automatic Notch Filter Tuning, Force Command [ANFILTC]
<table>
<tr><th>Setting range</th><th>Unit</th><th>Standard value</th></tr>
<tr><td>10～100</td><td>%</td><td>50</td></tr>
</table>
Sets the force command value applied to the motor at the time of auto-notch filter tuning.
Larger value makes the tuning more accurate; however, note that it also makes the move of the machine larger.
</td></tr>
<tr><td>20</td><td>
Automatic Vibration Suppressor Frequency Tuning, Force Command [ASUPTC]
<table>
<tr><th>Setting range</th><th>Unit</th><th>Standard value</th></tr>
<tr><td>10～100</td><td>%</td><td>25</td></tr>
</table>
Sets the force command value applied to the motor at the time of auto-vibration suppressing frequency tuning.
Larger value makes the tuning more accurate, however, note that it also makes the move of the machine larger.
</td></tr>
<tr><td>21</td><td>
Automatic Vibration Suppressor Frequency Tuning, Friction Compensation Value [ASUPFC]
<table>
<tr><th>Setting range</th><th>Unit</th><th>Standard value</th></tr>
<tr><td>0～50</td><td>%</td><td>5</td></tr>
</table>
Sets the friction force compensation added to the motor force at the time of auto-vibration suppressing frequency tuning. Set this value close to actual friction force, and vibration suppressing frequency tuning will be more accurate.
</td></tr>
</table>

■ General parameter Group 1 [Basic control parameter setting]

<table>
<tr><th>Page</th><th>Contents</th></tr>
<tr><td>01</td><td>
Position command filter [PCFIL]
<table>
<tr><th>Setting range</th><th>Unit</th><th>Standard value</th></tr>
<tr><td>0.0～2000.0</td><td>ms</td><td>0.0</td></tr>
</table>
Parameter to put primary low pass filter to the position command. Time constant of the filter is set. Filter is disabled with the set value of 0.0ms.
</td></tr>
<tr><td>02</td><td>
Position Loop Proportional Gain 1 [KP1]
<table>
<tr><th>Setting range</th><th>Unit</th><th>Standard value</th></tr>
<tr><td>1～3000</td><td>1/s</td><td>30</td></tr>
</table>
Proportional gain for position controller.
When auto-tuning result saving is executed, the tuning result is automatically saved in this parameter.
</td></tr>
<tr><td>03</td><td>
Position Loop Integral Time Constant 1 [TPI1]
<table>
<tr><th>Setting range</th><th>Unit</th><th>Standard value</th></tr>
<tr><td>0.5～1000.0</td><td>ms</td><td>1000.0</td></tr>
</table>
Integral time constant for position controller. When position loop proportional control switching function is disabled, this setting becomes enabled.
Integral term is disabled (proportional control) with the set value of 1000.0ms.
</td></tr>
</table>

Page	Contents			
04	Higher Tracking Control, Position Compensation Gain [TRCPGN]			
	Setting range	Unit	Standard value	Parameter to enhance following-up performance. The larger value can make the following-up performance higher. When the value other than 0% is set, position command filter and feed forward gain are automatically set.
	0～100	%	0	
05	Feed Forward Gain [FFGN]			
	Setting range	Unit	Standard value	Feed forward compensation gain at the time of position control.
	0～100	%	0	
08	Feed Forward Filter [FFFIL]			
	Setting range	Unit	Standard value	Parameter to put primary low pass filter to feed forward command. Sets the cut-off frequency. Filter is disabled with the set value of 2000Hz.
	1～2000	Hz	2000	
10	Velocity Command Filter [VCFIL]			
	Setting range	Unit	Standard value	Parameter to put primary low pass filter to velocity command. Sets the cut-off frequency. Filter is disabled with the set value of 2000Hz.
	1～2000	Hz	2000	
12	Velocity Feedback Filter [VDFIL]			
	Setting range	Unit	Standard value	Parameter to put primary low pass filter to velocity feedback. Sets the cut-off frequency. Filter is disabled with the set value of 2000Hz.
	1～2000	Hz	1500	
13	Velocity Loop Proportional Gain 1 [KVP1]			
	Setting range	Unit	Standard value	Proportional gain of velocity controller. When auto-tuning result saving is executed, the tuning result is automatically saved in this parameter.
	1～2000	Hz	50	
14	Velocity Loop Integral Time Constant 1 [TVI1]			
	Setting range	Unit	Standard value	Integral time constant of velocity controller. When velocity loop proportional control switching function is disabled, this set value is enabled. Integral term (proportional control) is disabled with the set value of 1000.0ms. When auto-tuning result saving is executed, the tuning result is automatically saved in this parameter.
	0.5～1000.0	ms	20.0	
15	Load Inertia Ratio (Load Mass Ratio) 1 [JRAT1]			
	Setting range	Unit	Standard value	Sets inertia moment of the loading device to the motor inertia moment. Set value＝JL/JM×100% JL：Load inertia moment JM：Motor inertia moment When auto-tuning result saving is executed, the tuning result is automatically saved in this parameter.
	0～15000	%	100	
16	Higher Tracking Control, Velocity Compensation Gain [TRCVGN]			
	Setting range	Unit	Standard value	Parameter to enhance following-up performance. The larger value can make the following-up performance higher. When velocity loop proportional control switching function is used, set this to 0%.
	0～100	%	0	
17	Acceleration Feedback Gain [AFBK]			
	Setting range	Unit	Standard value	Compensation function to make the velocity loop stable. Multiply this gain with the detected acceleration to compensate force command. Setting unit is 0.1%.
	-100.0～100.0	%	0.0	
18	Acceleration Feedback Filter [AFBFIL]			
	Setting range	Unit	Standard value	Parameter to put primary low pass filter to acceleration feedback compensation. Sets the cut-off frequency. Filter is disabled with the set value of 2000Hz.
	1～2000	Hz	500	
20	Force Command Filter 1 [TCFIL1]			
	Setting range	Unit	Standard value	Parameter to put low pass filter to force command. Sets the cut-off frequency. When auto-tuning result saving is executed, the tuning result is automatically saved in this parameter.
	1～2000	Hz	600	
21	Force Command Filter Order [TCFILOR]			
	Setting range	Unit	Standard value	Parameter to set ordinal number of force command filter.
	1～3	Order	2	

■ General parameter Group 2 [vibration suppressing control / notch filter / disturbance observer settings]

<table>
<tr><th>Page</th><th colspan="2">Contents</th></tr>
<tr><td rowspan="2">00</td><td colspan="2">Vibration Suppressor Frequency 1 [SUPFRQ1]</td></tr>
<tr><td><table><tr><th>Setting range</th><th>Unit</th><th>Standard value</th></tr><tr><td>5～500</td><td>Hz</td><td>500</td></tr></table></td><td>Parameter to set the frequency of restricting vibration.
Inside the servo amplifier, vibration suppressing frequency from 5～99Hz is treated by 1HzUnit, and that from 100～500Hz is by 10HzUnit. Even when set by lower unit than these, operations do not change.
Vibration suppressing control is disabled with the set value of 500Hz.
When auto-frequency tuning is executed, the tuning result is automatically saved in this parameter.
Change this while the motor stops.</td></tr>
<tr><td rowspan="2">01</td><td colspan="2">Vibration Suppressor Level Selection [SUPLV]</td></tr>
<tr><td><table><tr><th>Setting range</th><th>Unit</th><th>Standard value</th></tr><tr><td>00～03</td><td>—</td><td>00</td></tr></table></td><td>Parameter to set the size of vibration suppressing control effect. The smaller the value is, the greater the effect will be.
Change this while the motor stops.</td></tr>
<tr><td rowspan="2">10</td><td colspan="2">Velocity Command,Notch Filter [VCNFIL]</td></tr>
<tr><td><table><tr><th>Setting range</th><th>Unit</th><th>Standard value</th></tr><tr><td>50～500</td><td>Hz</td><td>500</td></tr></table></td><td>Parameter to set notch filter to velocity command. Sets the center frequency.
Inside the servo amplifier, the center frequency from 50～99Hz is treated by 1HzUnit and that from 100～500Hz is by 10HzUnit. Even when set by lower unit than these, operations do not change.
Filter is disabled with the set value of 500Hz.</td></tr>
<tr><td rowspan="2">20</td><td colspan="2">Force Command,Notch Filter A [TCNFILA]</td></tr>
<tr><td><table><tr><th>Setting range</th><th>Unit</th><th>Standard value</th></tr><tr><td>100～2000</td><td>Hz</td><td>2000</td></tr></table></td><td>Parameter to set notch filter to force command. Sets the center frequency.
Inside the servo amplifier, the center frequency is treated by 10HzUnit. Even when set by lower unit than 1HzUnit, operations do not change.
Filter is disabled with the set value of 2000Hz.
When auto-notch filter tuning is executed, the tuning result is automatically saved in this parameter.</td></tr>
<tr><td rowspan="2">21</td><td colspan="2">TCNFILA, Low Frequency Phase Delay Improvement [TCNFPA]</td></tr>
<tr><td><table><tr><th>Setting range</th><th>Unit</th><th>Standard value</th></tr><tr><td>00～02</td><td>—</td><td>00</td></tr></table></td><td>Parameter to improve phase delay at lower frequency than center frequency of force command notch filter A.
The larger the value is, the greater the effect is.
Same characteristics as the standard notch filter with the set value of 0.</td></tr>
<tr><td rowspan="2">22</td><td colspan="2">Force Command,Notch Filter B [TCNFILB]</td></tr>
<tr><td><table><tr><th>Setting range</th><th>Unit</th><th>Standard value</th></tr><tr><td>100～2000</td><td>Hz</td><td>2000</td></tr></table></td><td>Parameter to set notch filter to force command. Sets the center frequency.
Inside the servo amplifier, the center frequency is treated by 10HzUnit. Even when set by 1HzUnit, operations do not change.
Filter is disabled with the set value of 2000Hz.</td></tr>
<tr><td rowspan="2">23</td><td colspan="2">TCNFILB, Depth Selection [TCNFDB]</td></tr>
<tr><td><table><tr><th>Setting range</th><th>Unit</th><th>Standard value</th></tr><tr><td>00～03</td><td>—</td><td>00</td></tr></table></td><td>Parameter to set the depth of force command notch filter B. The larger the value is, the shallower.</td></tr>
<tr><td rowspan="2">24</td><td colspan="2">Force Command, Notch Filter C [TCNFILC]</td></tr>
<tr><td><table><tr><th>Setting range</th><th>Unit</th><th>Standard value</th></tr><tr><td>100～2000</td><td>Hz</td><td>2000</td></tr></table></td><td>Parameter to set notch filter to force command. Sets the center frequency.
Inside the servo amplifier, the center frequency is treated by 10HzUnit. Even when set by 1HzUnit, operations do not change.
Filter is disabled with the set value of 2000Hz.</td></tr>
<tr><td rowspan="2">25</td><td colspan="2">TCNFILC, Depth Selection [TCNFDC]</td></tr>
<tr><td><table><tr><th>Setting range</th><th>Unit</th><th>Standard value</th></tr><tr><td>00～03</td><td>—</td><td>00</td></tr></table></td><td>Parameter to set the depth of force command notch filter C. The larger the value is, the shallower.</td></tr>
<tr><td rowspan="2">26</td><td colspan="2">Force Command,Notch Filter D [TCNFILD]</td></tr>
<tr><td><table><tr><th>Setting range</th><th>Unit</th><th>Standard value</th></tr><tr><td>100～2000</td><td>Hz</td><td>2000</td></tr></table></td><td>Parameter to set notch filter to force command. Sets the center frequency.
Inside the servo amplifier, the center frequency is treated by 10HzUnit. Even when set by 1HzUnit, operations do not change.
Filter is disabled with the set value of 2000Hz.</td></tr>
</table>

<table>
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<tr><td>27</td><td>TCNFILD, Depth Selection [TCNFDD]
<table><tr><th>Setting range</th><th>Unit</th><th>Standard value</th></tr><tr><td>00～03</td><td>—</td><td>00</td></tr></table>
Parameter to set the depth of force command notch filter D. The greater the value is, the shallower the depth will be.</td></tr>
<tr><td>30</td><td>Observer characteristic [OBCHA]
<table><tr><th>Setting range</th><th>Unit</th><th>Standard value</th></tr><tr><td>00～01</td><td>—</td><td>00:_Low</td></tr></table>
Selects the observer characteristics.<table><tr><th>Selection</th><th>Contents</th></tr><tr><td>00:_Low</td><td>For Low Cycle</td></tr><tr><td>01:_Middle</td><td>For Middle Cycle</td></tr></table></td></tr>
<tr><td>31</td><td>Observer Compensation Gain [OBG]
<table><tr><th>Setting range</th><th>Unit</th><th>Standard value</th></tr><tr><td>0～100</td><td>%</td><td>0</td></tr></table>
Observer compensation gain. The larger the value is, the higher the suppression characteristics will be. However, if this is too large, oscillation may sometimes occur.</td></tr>
<tr><td>32</td><td>Observer Output, Low Pass Filter [OBLPF]
<table><tr><th>Setting range</th><th>Unit</th><th>Standard value</th></tr><tr><td>1～2000</td><td>Hz</td><td>50</td></tr></table>
Sets the cut off frequency of observer output low pass filter. Filter is disabled with the set value of 2000Hz.
When the observer characteristics are “01: Middle (For Middle Cycle) ”, the function is disabled.</td></tr>
<tr><td>33</td><td>Observer Output, Notch Filter [OBNFIL]
<table><tr><th>Setting range</th><th>Unit</th><th>Standard value</th></tr><tr><td>100～2000</td><td>Hz</td><td>2000</td></tr></table>
Sets the center frequency of observer output notch filter. Inside the servo amplifier, the center frequency is treated by 10HzUnit. Even when set by 1HzUnit, operations do not change.
Filter is disabled with the set value of 2000Hz.</td></tr>
</table>

■ General parameter Group 3 [Gain switching control / vibration suppressing frequency switching settings]

<table>
<tr><th>Page</th><th>Contents</th></tr>
<tr><td>00</td><td>Position Loop Proportional Gain 2 [KP2]
<table><tr><th>Setting range</th><th>Unit</th><th>Standard value</th></tr><tr><td>1～3000</td><td>1/s</td><td>30</td></tr></table>
Proportional gain for position controller.</td></tr>
<tr><td>01</td><td>Position Loop Integral Time Constant 2 [TPI2]
<table><tr><th>Setting range</th><th>Unit</th><th>Standard value</th></tr><tr><td>0.5～1000.0</td><td>ms</td><td>1000.0</td></tr></table>
Integral time constant for position controller.
Integral term is disabled (proportional control) with the set value of 1000.0ms.
✍ Cannot be used when the position loop proportional control switching function is enabled.</td></tr>
<tr><td>02</td><td>Velocity Loop Proportional Gain 2 [KVP2]
<table><tr><th>Setting range</th><th>Unit</th><th>Standard value</th></tr><tr><td>1～2000</td><td>Hz</td><td>50</td></tr></table>
Proportional gain for velocity controller.
When load inertia is the one set by load inertia moment ratio (load mass ratio) 2, the response is this set value.</td></tr>
<tr><td>03</td><td>Velocity Loop Integral Time Constant 2 [TVI2]
<table><tr><th>Setting range</th><th>Unit</th><th>Standard value</th></tr><tr><td>0.5～1000.0</td><td>ms</td><td>20.0</td></tr></table>
Integral time constant for velocity controller.
Enabled when velocity loop proportional control switching function is disabled.
Integral term is disabled (proportional control) with the set value of 1000.0ms.</td></tr>
<tr><td>04</td><td>Load Inertia Ratio (Load Mass Ratio) 2 [JRAT2]
<table><tr><th>Setting range</th><th>Unit</th><th>Standard value</th></tr><tr><td>0～15000</td><td>%</td><td>100</td></tr></table>
Sets the inertia moment of load device to the motor inertia moment. Set value＝JL/JM×100%
JL：Load inertia moment
JM：Motor inertia moment</td></tr>
<tr><td>05</td><td>Force Command Filter 2 [TCFIL2]
<table><tr><th>Setting range</th><th>Unit</th><th>Standard value</th></tr><tr><td>1～2000</td><td>Hz</td><td>600</td></tr></table>
Parameter to set low pass filter to force command. Sets the cut off frequency.</td></tr>
</table>

<table>
<tr><th>Page</th><th>Contents</th></tr>
<tr><td>10</td><td>Position Loop Proportional Gain 3 [KP3]
<table><tr><th>Setting range</th><th>Unit</th><th>Standard value</th></tr><tr><td>1～3000</td><td>1/s</td><td>30</td></tr></table></td><td>Proportional gain for position controller.</td></tr>
<tr><td>11</td><td>Position Loop Integral Time Constant 3 [TPI3]
<table><tr><th>Setting range</th><th>Unit</th><th>Standard value</th></tr><tr><td>0.5～1000.0</td><td>ms</td><td>1000.0</td></tr></table></td><td>Integral time constant for position controller.
Integral term is disabled (proportional control) with the set value of 1000.0ms.
✍ Cannot be used when position loop proportional control switching function is enabled.</td></tr>
<tr><td>12</td><td>Velocity Loop Proportional Gain 3 [KVP3]
<table><tr><th>Setting range</th><th>Unit</th><th>Standard value</th></tr><tr><td>1～2000</td><td>Hz</td><td>50</td></tr></table></td><td>Proportional gain for velocity controller.
When load inertia is the one set by load inertia moment ratio (load mass ratio) 2, the response is this set value.</td></tr>
<tr><td>13</td><td>Velocity Loop Integral Time Constant 3 [TVI3]
<table><tr><th>Setting range</th><th>Unit</th><th>Standard value</th></tr><tr><td>0.5～1000.0</td><td>ms</td><td>20.0</td></tr></table></td><td>Integral time constant for velocity controller. This setting is enabled when velocity loop proportional control switching function is disabled.
Integral term is disabled (proportional control) with the set value of 1000.0ms.</td></tr>
<tr><td>14</td><td>Load Inertia Ratio (Load Mass Ratio) 3 [JRAT3]
<table><tr><th>Setting range</th><th>Unit</th><th>Standard value</th></tr><tr><td>0～15000</td><td>%</td><td>100</td></tr></table></td><td>Sets the inertia moment of load device to the motor inertia moment. Set value＝JL/JM×100%
JL：Load inertia moment
JM：Motor inertia moment</td></tr>
<tr><td>15</td><td>Force Command Filter 3 [TCFIL3]
<table><tr><th>Setting range</th><th>Unit</th><th>Standard value</th></tr><tr><td>1～2000</td><td>%</td><td>600</td></tr></table></td><td>Parameter to set low pass filter to force command. Sets the cut off frequency.</td></tr>
<tr><td>20</td><td>Position Loop Proportional Gain 4 [KP4]
<table><tr><th>Setting range</th><th>Unit</th><th>Standard value</th></tr><tr><td>1～3000</td><td>1/s</td><td>30</td></tr></table></td><td>Proportional gain for position controller.</td></tr>
<tr><td>21</td><td>Position Loop Integral Time Constant 4 [TPI4]
<table><tr><th>Setting range</th><th>Unit</th><th>Standard value</th></tr><tr><td>0.5～1000.0</td><td>ms</td><td>1000.0</td></tr></table></td><td>Integral time constant for position controller. Integral term is disabled (proportional control) with the set value of 1000.0ms.
✍ Cannot be used when position loop proportional control switching function is enabled.</td></tr>
<tr><td>22</td><td>Velocity Loop Proportional Gain 4 [KVP4]
<table><tr><th>Setting range</th><th>Unit</th><th>Standard value</th></tr><tr><td>1～2000</td><td>Hz</td><td>50</td></tr></table></td><td>Proportional gain for velocity controller.
When load inertia is the one set by load inertia moment ratio (load mass ratio) 2, the response is this set value.</td></tr>
<tr><td>23</td><td>Velocity Loop Integral Time Constant 4 [TVI4]
<table><tr><th>Setting range</th><th>Unit</th><th>Standard value</th></tr><tr><td>0.5～1000.0</td><td>ms</td><td>20.0</td></tr></table></td><td>Integral time constant for velocity controller. This setting is enabled when velocity loop proportional control switching function is disabled.
Integral term is disabled (proportional control) with the set value of 1000.0ms.</td></tr>
<tr><td>24</td><td>Load Inertia Ratio (Load Mass Ratio) 4 [JRAT4]
<table><tr><th>Setting range</th><th>Unit</th><th>Standard value</th></tr><tr><td>0～15000</td><td>%</td><td>100</td></tr></table></td><td>Sets the inertia moment of load device to the motor inertia moment. Set value＝JL/JM×100%
JL：Load inertia moment
JM：Motor inertia moment</td></tr>
<tr><td>25</td><td>Force Command Filter 4 [TCFIL4]
<table><tr><th>Setting range</th><th>Unit</th><th>Standard value</th></tr><tr><td>1～2000</td><td>%</td><td>600</td></tr></table></td><td>Parameter to set low pass filter to force command. Sets the cut off frequency.</td></tr>
<tr><td>30</td><td>Low Pass Filter of Gain Switching [GCFIL]
<table><tr><th>Setting range</th><th>Unit</th><th>Standard value</th></tr><tr><td>0～100</td><td>ms</td><td>0</td></tr></table></td><td>Parameter to set time constant for gain switching.
The larger the value is, the gentler the switching is.</td></tr>
</table>

<table>
<tr><th>Page</th><th>Contents</th></tr>
<tr><td rowspan="2">40</td><td colspan="2">Vibration Suppressor Frequency 2 [SUPFRQ2]</td></tr>
<tr><td>
<table>
<tr><th>Setting range</th><th>Unit</th><th>Standard value</th></tr>
<tr><td>5～500</td><td>Hz</td><td>500</td></tr>
</table>
</td><td>Parameter to set the frequency of vibration suppressing vibration.
In the servo amplifier, the vibration suppressing frequency from 5 to 99Hz is treated by 1Hz unit, and from 100 to 500Hz is by 10Hz unit. Operations do not change if set by lower unit than these.
Vibration suppressing control is disabled when the set value is 500Hz.

✍ Change this while the motor stops.</td></tr>
<tr><td rowspan="2">41</td><td colspan="2">Vibration Suppressor Frequency 3 [SUPFRQ3]</td></tr>
<tr><td>
<table>
<tr><th>Setting range</th><th>Unit</th><th>Standard value</th></tr>
<tr><td>5～500</td><td>Hz</td><td>500</td></tr>
</table>
</td><td>Parameter to set the frequency of vibration suppressing vibration.
In the servo amplifier, the vibration suppressing frequency from 5 to 99Hz is treated by 1H unit, and from 100 to 500Hz is by 10Hz unit. Operations do not change if set by lower unit than these.
Vibration suppressing control is disabled when the set value is 500Hz.

✍ Change this while the motor stops.</td></tr>
<tr><td rowspan="2">42</td><td colspan="2">Vibration Suppressor Frequency 4 [SUPFRQ4]</td></tr>
<tr><td>
<table>
<tr><th>Setting range</th><th>Unit</th><th>Standard value</th></tr>
<tr><td>5～500</td><td>Hz</td><td>500</td></tr>
</table>
</td><td>Parameter to set the frequency of vibration suppressing vibration.
In the servo amplifier, the vibration suppressing frequency from 5 to 99Hz is treated by 1H unit, and from 100 to 500Hz is by 10Hz unit. Operations do not change if set by lower unit than these.
Vibration suppressing control is disabled when the set value is 500Hz.

✍ Change this while the motor stops.</td></tr>
</table>

■ General parameter Group 4 [High setting control settings]

<table>
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<tr><td rowspan="2">00</td><td colspan="2">Command Velocity, Low Pass Filter [CVFIL]</td></tr>
<tr><td>
<table>
<tr><th>Setting range</th><th>Unit</th><th>Standard value</th></tr>
<tr><td>1～2000</td><td>Hz</td><td>1000</td></tr>
</table>
</td><td>Sets the cut off frequency of low pass filter, when command velocity is calculated. When the position command resolution is low, lower the cut off frequency. Filter is disabled when the set value is 2000Hz.</td></tr>
<tr><td rowspan="2">01</td><td colspan="2">Command Velocity Threshold [CVTH]</td></tr>
<tr><td>
<table>
<tr><th>Setting range</th><th>Unit</th><th>Standard value</th></tr>
<tr><td>0～65535</td><td>min^{-1}</td><td>20</td></tr>
</table>
</td><td>When the command velocity calculated from position command is larger than this threshold, acceleration or deceleration compensation will be performed.</td></tr>
<tr><td rowspan="2">02</td><td colspan="2">Acceleration Compensation [ACCCO]</td></tr>
<tr><td>
<table>
<tr><th>Setting range</th><th>Unit</th><th>Standard value</th></tr>
<tr><td>-9999～+9999</td><td>×50 Pulse</td><td>0</td></tr>
</table>
</td><td>Compensation at acceleration.</td></tr>
<tr><td rowspan="2">03</td><td colspan="2">Deceleration Compensation [DECCO]</td></tr>
<tr><td>
<table>
<tr><th>Setting range</th><th>Unit</th><th>Standard value</th></tr>
<tr><td>-9999～+9999</td><td>×50 Pulse</td><td>0</td></tr>
</table>
</td><td>Compensation at deceleration.</td></tr>
</table>

■ General parameter Group 8［Settings for control system］

<table>
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Command Input Polarity [CMDPOL]
<table>
<tr><th>Setting range</th><th>Unit</th><th>Standard value</th></tr>
<tr><td>00～07</td><td>—</td><td>00:_PC+_VC+_TC+</td></tr>
</table>
Select the command polarity from the contents blow.
<table>
<tr><th>Input command</th><th>Command polarity</th><th>Rotation direction</th><th>Selection</th></tr>
<tr><td>position command</td><td>＋</td><td>Forward</td><td rowspan="3">00:_PC+_VC+_TC+</td></tr>
<tr><td>Velocity command</td><td>＋</td><td>Forward</td></tr>
<tr><td>Force command</td><td>＋</td><td>Forward</td></tr>
</table>
<table>
<tr><th>Input command</th><th>Command polarity</th><th>Rotation direction</th><th>Selection</th></tr>
<tr><td>Position command</td><td>＋</td><td>Reverse</td><td rowspan="3">04:_PC-_VC+_TC+</td></tr>
<tr><td>Velocity command</td><td>＋</td><td>Forward</td></tr>
<tr><td>Force command</td><td>＋</td><td>Forward</td></tr>
</table>
<table>
<tr><th>Input command</th><th>Command polarity</th><th>Rotation direction</th><th>Selection</th></tr>
<tr><td>position command</td><td>＋</td><td>Forward</td><td rowspan="3">01:_PC+_VC+_TC-</td></tr>
<tr><td>Velocity command</td><td>＋</td><td>Forward</td></tr>
<tr><td>force command</td><td>＋</td><td>Reverse</td></tr>
</table>
<table>
<tr><th>Input command</th><th>Command polarity</th><th>Rotation direction</th><th>Selection</th></tr>
<tr><td>position command</td><td>＋</td><td>Reverse</td><td rowspan="3">05:_PC-_VC+_TC-</td></tr>
<tr><td>V velocity command</td><td>＋</td><td>Forward</td></tr>
<tr><td>Force command</td><td>＋</td><td>Reverse</td></tr>
</table>
<table>
<tr><th>Input command</th><th>Command polarity</th><th>Rotation direction</th><th>Selection</th></tr>
<tr><td>position command</td><td>＋</td><td>Forward</td><td rowspan="3">02:_PC+_VC-_TC+</td></tr>
<tr><td>Velocity command</td><td>＋</td><td>Reverse</td></tr>
<tr><td>Force command</td><td>＋</td><td>Forward</td></tr>
</table>
<table>
<tr><th>Input command</th><th>Command polarity</th><th>Rotation direction</th><th>Selection</th></tr>
<tr><td>position command</td><td>＋</td><td>Reverse</td><td rowspan="3">06:_PC-_VC-_TC+</td></tr>
<tr><td>Velocity command</td><td>＋</td><td>Reverse</td></tr>
<tr><td>force command</td><td>＋</td><td>Forward</td></tr>
</table>
<table>
<tr><th>Input command</th><th>Command polarity</th><th>Rotation direction</th><th>Selection</th></tr>
<tr><td>Position command</td><td>＋</td><td>Forward</td><td rowspan="3">03:_PC+_VC-_TC-</td></tr>
<tr><td>Velocity command</td><td>＋</td><td>Reverse</td></tr>
<tr><td>Force command</td><td>＋</td><td>Reverse</td></tr>
</table>
<table>
<tr><th>Input command</th><th>Command polarity</th><th>Rotation direction</th><th>Selection</th></tr>
<tr><td>position command</td><td>＋</td><td>Reverse</td><td rowspan="3">07:_PC-_VC-_TC-</td></tr>
<tr><td>Velocity command</td><td>＋</td><td>Reverse</td></tr>
<tr><td>force command</td><td>＋</td><td>Reverse</td></tr>
</table>
</td></tr>
<tr><td>01</td><td>
Analog Input Dead Band [VC/TC-DB]
<table>
<tr><th>Setting range</th><th>Unit</th><th>Standard value</th></tr>
<tr><td>00～01</td><td>—</td><td>00:_Disabled</td></tr>
</table>
Select enabled/disabled of analog input dead zone.
<table>
<tr><th>Selection</th><th>Contents</th></tr>
<tr><td>00:_Disabled</td><td>Disabled</td></tr>
<tr><td>01:_Enabled</td><td>Enabled</td></tr>
</table>
</td></tr>
<tr><td>11</td><td>
Position Command Pulse, Form Selection [PCPTYP]
<table>
<tr><th>Setting range</th><th>Unit</th><th>Standard value</th></tr>
<tr><td>00～02</td><td>—</td><td>00:_F-PC_R-PC</td></tr>
</table>
Select the position command pulse type from the contents below.
<table>
<tr><th>Selection</th><th>Contents</th></tr>
<tr><td>00:_F-PC_R-PC</td><td>Positive Move Pulse + Negative Move Pulse</td></tr>
<tr><td>01:_2PhasePulse</td><td>Two-Phase Pulse Train of 90 Degrees Phase Difference</td></tr>
<tr><td>02:_CODE_PC</td><td>Code + Pulse Train</td></tr>
</table>
✍ The set value is enabled after control power is turned ON again.
</td></tr>
<tr><td>12</td><td>
Position Command Pulse, Count Polarity [PCPPOL]
<table>
<tr><th>Setting range</th><th>Unit</th><th>Standard value</th></tr>
<tr><td>00～03</td><td>—</td><td>00:_Type1</td></tr>
</table>
Select the position command pulse count polarity from the contents below.
<table>
<tr><th>Selection</th><th>Contents</th></tr>
<tr><td>00:_Type1</td><td>F-PC/ Count at the Rising Edge : R-PC/ Count at the Rising Edge</td></tr>
<tr><td>01:_Type2</td><td>F-PC/ Count at the Falling Edge : R-PC/ Count at the Rising Edge</td></tr>
<tr><td>02:_Type3</td><td>F-PC/ Count at the Rising Edge : R-PC/ Count at the Falling Edge</td></tr>
<tr><td>03:_Type4</td><td>F-PC/ Count at the Falling Edge : R-PC/ Count at the Falling Edge</td></tr>
</table>
✍ The set value is enabled after control power is turned ON again.
</td></tr>
</table>

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Position Command Pulse, Digital Filter [PCPFIL]

Setting range	Unit	Standard value
00～07	—	00:_834nsec

Select the setting of position command pulse digital filter from the contents below.
As timing for command direction, observe the specifications of position command. When the pulse command form is “Two-Phase Pulse Train of 90 Degrees Phase Difference ”, observe the specification s of position command.

Selection	Contents
00:_834nsec	Minimum Pulse Width = 834nsec
01:_250nsec	Minimum Pulse Width = 250nsec
02:_500nsec	Minimum Pulse Width = 500nsec
03:_1.8usec	Minimum Pulse Width = 1.8μsec
04:_3.6usec	Minimum Pulse Width = 3.6μsec
05:_7.2usec	Minimum Pulse Width = 7.2μsec
06:_125nsec	Minimum Pulse Width = 125nsec
07:_83.4nsec	Minimum Pulse Width = 83.4nsec

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Position Command, Pulse Multiplier [PCPMUL]

Setting range	Unit	Standard value
1～63	—	1

Parameter to multiply the command pulse by x1～x63. Values from 1 to 63 are set, which are always enabled.

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Electric Gear Ratio 1 [GER1]

Setting range	Unit	Standard value
1/32767～32767/1	—	1/1

Page 16

Electric Gear Ratio 2 [GER2]

Setting range	Unit	Standard value
1/32767～32767/1	—	1/1

Setting of electronic gear to position command pulse.

$$f1 \longrightarrow \frac{N\ (1 \sim 32767)}{D\ (1 \sim 32767)} \longrightarrow f2 \quad (f2 = f1 \times N/D)$$

$1/32767 \leqq N/D \leqq 32767$

Page 17

Positioning method [EDGEPOS]

Setting range	Unit	Standard value
00～01	—	00:_Pulse _Interval

Select the encoder pulse positioning from the contents below.

Selection	Contents
00:_Pulse_Interval	Specify Pulse Interval
01:_Pulse_Edge	Specify Pulse Edge

✍ The set value is enabled after control power is turned ON again.

Page 18

Inposition / Position Deviation Monitor [PDEVMON]

Setting range	Unit	Standard value
00～01	—	00:_After_Filter

Select the positioning complete signal (ＩＮＰ) and position deviation monitor from the contents below.

Selection	Contents
00:_After_Filter	Compare "Position Command Value After Filter Passes by" with "Feedback Value"
01:_Before_Filter	Compare "Position Command Value Before Filter Passes by" with "Feedback Value"

Page 19

Deviation Clear Selection [CLR]

Setting range	Unit	Standard value
00～03	—	00:_Type1

Select the position deviation clearing method from the contents below.

Selection		Contents
00:_Type1	When SERVO-OFF/ Clear Deviation : Deviation Clear Input/ Level Detection	During servo OFF, deviation clear is always executed. While deviation clear input is ON, deviation clear is always executed.
01:_Type2	When SERVO-OFF/ Clear Deviation : Deviation Clear Input/ Edge Detection	At the edge of OFF→ON of deviation clear input, deviation clear is executed.
02:_Type3	When SERVO-OFF/ Not Clear Deviation : Deviation Clear Input/ Level Detection	During servo OFF, deviation clear is not executed. (After servo ON, the motor may operate suddenly.)
03:_Type4	When SERVO-OFF/ Not Clear Deviation : Deviation Clear Input/ Edge Detection	During servo OFF, deviation clear is not executed. (After servo ON, the motor may operate suddenly.)

<table>
<tr><th>Page</th><th>Contents</th></tr>
<tr><td>20</td><td>
Preset Velocity Command 1 [VC1] Refer to “Chapter 7. Adjustment ・ Functions Internal velocity command”.
<table>
<tr><th>Setting range</th><th>Unit</th><th>Standard value</th></tr>
<tr><td>0～32767</td><td>mm/s</td><td>100</td></tr>
</table>
Parameter for setting velocity command of internal velocity operation.
When internal velocity selection input 1 is valid and internal velocity selection input 2 is invalid, this parameter is enabled.
</td></tr>
<tr><td>21</td><td>
Preset Velocity Command 2 [VC2] Refer to “Chapter 7, Adjustment ・ Functions Internal velocity command “.
<table>
<tr><th>Setting range</th><th>Unit</th><th>Standard value</th></tr>
<tr><td>0～32767</td><td>mm/s</td><td>200</td></tr>
</table>
Parameter for setting velocity command of internal velocity operation.
When internal velocity selection input 1 is invalid and internal velocity selection input 2 is valid, this parameter is enabled.
</td></tr>
<tr><td>22</td><td>
Preset Velocity Command 3 [VC3] Refer to “Chapter 7, Adjustment ・ Functions Internal velocity command”.
<table>
<tr><th>Setting range</th><th>Unit</th><th>Standard value</th></tr>
<tr><td>0～32767</td><td>mm/s</td><td>300</td></tr>
</table>
Parameter for setting velocity command of internal velocity operation.
When internal velocity selection input 1 is valid and internal velocity selection input 2 is valid, this parameter is enabled.
</td></tr>
<tr><td>23</td><td>
Velocity Compensation Command, Input Selection [VCOMSEL]
<table>
<tr><th>Setting range</th><th>Unit</th><th>Standard value</th></tr>
<tr><td>01～02</td><td>—</td><td>02:_VCOMP</td></tr>
</table>
Select velocity addition command input from the contents below.
<table>
<tr><th>Selection</th><th></th><th>Contents</th></tr>
<tr><td>01:_Analog_Input</td><td>Apply Analog Velocity Compensation Command</td><td>When velocity addition function is valid, analog velocity addition command value is used.</td></tr>
<tr><td>02:_VCOMP</td><td>Apply Preset Velocity Compensation Command</td><td>When velocity addition function is valid, internal velocity addition command value id used.</td></tr>
</table>
</td></tr>
<tr><td>24</td><td>
Preset Velocity Compensation Command [VCOMP]
<table>
<tr><th>Setting range</th><th>Unit</th><th>Standard value</th></tr>
<tr><td>-9999～+9999</td><td>mm/s</td><td>0</td></tr>
</table>
Parameter for using velocity addition command in a fixed value when velocity addition function is used.
</td></tr>
<tr><td>25</td><td>
Analog Velocity Command, Reference (Analog Velocity Compensation Command, Ref.) [VCGN]
<table>
<tr><th>Setting range</th><th>Unit</th><th>Standard value</th></tr>
<tr><td>0～4000</td><td>mm/s/V</td><td>500</td></tr>
</table>
Parameter for setting analog velocity (addition) command scaling.
</td></tr>
<tr><td>26</td><td>
Velocity Command, Acceleration Time Constant [TVCACC]
<table>
<tr><th>Setting range</th><th>Unit</th><th>Standard value</th></tr>
<tr><td>0～16000</td><td>ms</td><td>0</td></tr>
</table>
Parameter for restricting acceleration of command, to analog velocity command input, analog velocity addition input, and internal velocity command.
Acceleration : 0 min^{-1} → forward ・reverse rotation
Sets the acceleration time for 1000 min^{-1}.
</td></tr>
<tr><td>27</td><td>
Velocity Command, Deceleation Time Constant [TVCDEC]
<table>
<tr><th>Setting range</th><th>Unit</th><th>Standard value</th></tr>
<tr><td>0～16000</td><td>ms</td><td>0</td></tr>
</table>
Parameter for restricting deceleration of command, to analog velocity command input, analog velocity addition input, and internal velocity command.
Deceleration : forward ・reverse rotation → 0 min^{-1}
Sets the deceleration time for 1000 min^{-1}.
</td></tr>
<tr><td>28</td><td>
Velocity Limit [VCLM]
<table>
<tr><th>Setting range</th><th>Unit</th><th>Standard value</th></tr>
<tr><td>1～65535</td><td>mm/s</td><td>65535</td></tr>
</table>
Parameter for restricting the velocity command.
Sets the maximum value of velocity command. Velocity command is restricted by this value at operations of position control and velocity control.
When the set value is larger than 50000, velocity command is restricted at (maximum speed×1.1). Set this parameter when it is to be restricted at lower than (motor rotation speed ×1.1).
（Use the standard value usually.）
</td></tr>
<tr><td>30</td><td>
Force Compensation Command, Input Selection [TCOMSEL]
<table>
<tr><th>Setting range</th><th>Unit</th><th>Standard value</th></tr>
<tr><td>01～02</td><td>—</td><td>02:_TCOMP</td></tr>
</table>
Selects the force addition command input from the contents below.
<table>
<tr><th>Selection</th><th>Contents</th></tr>
<tr><td>01:_Analog_Input</td><td>When force addition function is valid, analog force addition command value is used.</td></tr>
<tr><td>02:_TCOMP</td><td>When force addition function is valid, internal force addition command value is used.</td></tr>
</table>
</td></tr>
</table>

<table>
<tr><th>Page</th><th>Contents</th></tr>
<tr><td>31</td><td>Preset Force Compensation Command 1 [TCOMP1]
<table><tr><th>Setting range</th><th>Unit</th><th>Standard value</th></tr><tr><td>-500～+500</td><td>%</td><td>0</td></tr></table>
Parameter for using force addition command in a fixed value, when force addition function is used.</td></tr>
<tr><td>32</td><td>Preset Force Compensation Command 2 [TCOMP2]
<table><tr><th>Setting range</th><th>Unit</th><th>Standard value</th></tr><tr><td>-500～+500</td><td>%</td><td>0</td></tr></table>
Parameter for using force addition command in a fixed value, when force addition function is used.</td></tr>
<tr><td>33</td><td>Analog Force Command, Reference [TCGN]
<table><tr><th>Setting range</th><th>Unit</th><th>Standard value</th></tr><tr><td>0～500</td><td>%/V</td><td>50</td></tr></table>
Parameter for setting analog force command scaling.</td></tr>
<tr><td>34</td><td>Analog Force Compensation Command, Reference [TCOMPGN]
<table><tr><th>Setting range</th><th>Unit</th><th>Standard value</th></tr><tr><td>0～500</td><td>%/V</td><td>50</td></tr></table>
Parameter for adjusting force addition command input scaling.</td></tr>
<tr><td>35</td><td>Force Limit, Input Selection [TLSEL]
<table><tr><th>Setting range</th><th>Unit</th><th>Standard value</th></tr><tr><td>00～03</td><td>—</td><td>00:_TCLM</td></tr></table>
Select the force command limiting method from the contents below.
The selection of limit is when force command limit function is valid.
<table><tr><th>Selection</th><th></th><th>Contents</th></tr><tr><td>00:_TCLM</td><td>Internal force limit value (TCLM) is used.</td><td>Forward side(forward direction)：limited at internal set value.
Reverse side (reverse direction)：limited at internal set value.</td></tr><tr><td>01:_Analog_1</td><td>External force limit input is used.
Forward side／F-TLA、
Reverse side／R-TLA(－voltage input)</td><td>Forward side(forward direction)：limited at + voltage input at F-TLA.
Reverse side (reverse direction)：limited at – voltage input at R-TLA.</td></tr><tr><td>02:_Analog_2</td><td>External force limit input is used.
Forward side／F-TLA、
Reverse side／R-TLA(＋ voltage input)</td><td>Forward side (forward direction)：limited at + voltage input at F-TLA.
Reverse side (reverse direction)：limited at + voltage input at R-TLA.</td></tr><tr><td>03:_Analog_3</td><td>External force limit input is used.
Forward side／F-TLA
Reverse side／F-TLA</td><td>Forward (forward direction)side：limited at + voltage input at F-TLA.
Reverse (reverse direction)side：limited at + voltage input at F-TLA.</td></tr></table></td></tr>
<tr><td>36</td><td>Internal Force Limit [TCLM]
<table><tr><th>Setting range</th><th>Unit</th><th>Standard value</th></tr><tr><td>10～500</td><td>%</td><td>100</td></tr></table>
Parameter for limiting output force. Force limit value is determined by comparing it with the rated output force.(100%= rated force)
Output force is limited at the internal force limit set value when the force limit input signal is functioning.
Output force is restricted by TP if a value exceeding the peak output force TP is selected.</td></tr>
<tr><td>37</td><td>Force Limit at Sequence Operation [SQTCLM]
<table><tr><th>Setting range</th><th>Unit</th><th>Standard value</th></tr><tr><td>10～500</td><td>%</td><td>120</td></tr></table>
Parameter for setting sequence operation force limit value (JOG operation, holding brake operation waiting, and OT status, etc.) Force limit value is determined by comparing it with the rated output force. (100%=rated force)
During sequence operation, output force is restricted by this set value.
Output force is restricted by TP if a value exceeding the peak output force TP is selected.</td></tr>
<tr><td>38</td><td>Fixed Excitation Current Command [CTCLM]
<table><tr><th>Setting range</th><th>Unit</th><th>Standard value</th></tr><tr><td>1～100</td><td>%</td><td>25</td></tr></table>
Fixed excitation current command value
Sets the current command when fixed excitation is operated. This is a ratio against the motor rated current. (100% = rated current)</td></tr>
</table>

<table>
<tr><th>Page</th><th colspan="2">Contents</th></tr>
<tr><td rowspan="2">40</td><td colspan="2">In-Position Near Range [NEAR]</td></tr>
<tr><td><table><tr><th>Setting range</th><th>Unit</th><th>Standard value</th></tr><tr><td>1～65535</td><td>Pulse</td><td>500</td></tr></table></td><td>Parameter for setting the output range of near range signal (near in-position complete).
Near range signal is output when the deviation counter is lower than this set value.
Encoder pulse is standard irrespective of electronic gear and command multiplication functions.</td></tr>
<tr><td rowspan="2">41</td><td colspan="2">In-Position Window [INP]</td></tr>
<tr><td><table><tr><th>Setting range</th><th>Unit</th><th>Standard value</th></tr><tr><td>1～65535</td><td>Pulse</td><td>100</td></tr></table></td><td>Parameter for setting output range of positioning complete signal.
Positioning complete signal is output when the deviation counter is lower than this set value.
Encoder pulse is standard irrespective of the electronic gear function or command multiplication function.
Incremental encoder
→ Encoder pulse multiplied by 4 is standard.
Absolute encoder
（except for the ones with incremental signal）
→absolute value is standard.</td></tr>
<tr><td rowspan="2">42</td><td colspan="2">Speed Zero Range [ZV]</td></tr>
<tr><td><table><tr><th>Setting range</th><th>Unit</th><th>Standard value</th></tr><tr><td>50～500</td><td>mm/s</td><td>50</td></tr></table></td><td>Set value for detecting zero-speed status (motor stop). When the motor speed becomes lower than this value, zero-speed status is detected.</td></tr>
<tr><td rowspan="2">43</td><td colspan="2">Low Speed Range [LOWV]</td></tr>
<tr><td><table><tr><th>Setting range</th><th>Unit</th><th>Standard value</th></tr><tr><td>0～65535</td><td>mm/s</td><td>50</td></tr></table></td><td>Parameter for setting low-speed output range.
When the speed is lower than this value, low-speed range is output.</td></tr>
<tr><td rowspan="2">44</td><td colspan="2">Speed Matching Width [VCMP]</td></tr>
<tr><td><table><tr><th>Setting range</th><th>Unit</th><th>Standard value</th></tr><tr><td>0～65535</td><td>mm/s</td><td>50</td></tr></table></td><td>Parameter for setting the range of velocity matching output. Velocity matching is output when the speed deviation (difference between speed command and actual speed) is within the setting range.</td></tr>
<tr><td rowspan="2">45</td><td colspan="2">High Speed Range [VA]</td></tr>
<tr><td><table><tr><th>Setting range</th><th>Unit</th><th>Standard value</th></tr><tr><td>0～65535</td><td>mm/s</td><td>1000</td></tr></table></td><td>Parameter for setting the value for speed attainment output. When the speed exceeds this set value, velocity attainment is output.
If the motor speed exceeds the selected value during force control operations, and when the control switching function is enabled, the force command is always set to 0. Fixed speed cannot be controlled. Avoid continuous usage in this manner.</td></tr>
</table>

■ General parameter Group 9 [Condition settings for enabling functions]

Input signals and conditions to enable the functions of each page are set.

✍ Selection contents to be set are on the next page.

Page	Contents	Setting range	Standard value
00	Positive Over-Travel Function [F-OT]	00～27	OD:_CONT6_OFF
01	Negative Over-Travel Function [R-OT]	00～27	OB:_CONT5_OFF
02	Alarm Reset Function [AL-RST]	00～27	10:_CONT8_ON
03	~~Absolute Encoder Clear Function [ECLR]~~	00～27	O6:_CONT3_ON
04	Deviation Clear Function [CLR]	00～27	O8:_CONT4_ON
05	SERVO-ON Function [S-ON]	00～27	O2:_CONT1_ON
10	Control Mode Switching Function [MS]	00～27	00:_Always_Disable
11	Position Command Pulse Inhibit Function and Velocity Command Zero Clamp Function [INH/Z-STP]	00～27	00:_Always_Disable
12	Electric Gear Switching Function [GERS]	00～27	00:_Always_Disable
13	Gain Switching Function, Select Input 1 [GC1]	00～27	00:_Always_Disable
14	Gain Switching Function, Select Input 2 [GC2]	00～27	00:_Always_Disable
15	Vibration Suppressor Frequency, Select Input 1 [SUPFSEL1]	00～27	00:_Always_Disable
16	Vibration Suppressor Frequency, Select Input 2 [SUPFSEL2]	00～27	00:_Always_Disable
17	Position Loop Proportional Control, Switching Function [PLPCON]	00～27	01:_Always_Enable
18	Fixed Excitation Function [CSET]	00～27	00:_Always_Disable

Page	Contents	Setting range	Standard value
20	Preset Velocity Command, Select Input 1 [SP1]	00～27	00:_Always_Disable
21	Preset Velocity Command, Select Input 2 [SP2]	00～27	00:_Always_Disable
22	Preset Velocity Command, Direction of Move [DIR]	00～27	00:_Always_Disable
23	Preset Velocity Command, Operation Start Signal Input [RUN]	00～27	00:_Always_Disable
24	Preset Velocity Command, Positive Move Signal Input [RUN-F]	00～27	00:_Always_Disable
25	Preset Velocity Command, Negative Move Signal Input [RUN-R]	00～27	00:_Always_Disable
26	Velocity Loop Proportional Control, Switching Function [VLPCON]	00～27	O4:_CONT2_ON
27	Velocity Compensation Function, Select Input [VCOMPS]	00～27	00:_Always_Disable
30	Force Compensation Function, Select Input 1 [TCOMPS1]	00～27	00:_Always_Disable
31	Force Compensation Function,Select Input 2 [TCOMPS2]	00～27	00:_Always_Disable
32	Force Limit, Input Selection [TL]	00～27	OE:_CONT7_ON
33	Disturbance Observer [OBS]	00～27	00:_Always_Disable
40	External Error Input [EXT-E]	00～27	00:_Always_Disable
41	Main Power Discharge Function [DISCHARG]	00～27	01:_Always_Enable
42	Emergency Stop Function [EMR]	00～27	00:_Always_Disable

● General parameter Group 9 List of selection contents

When functions are to be always enabled or disabled.

Selection	Contents
00:_Always_ Disable	Always disable the function.
01:_Always_ Enable	Always enable the function.

When functions are to be used with the generic input signals.

Selection	Contents
02:_CONT1_ON	Enable the function when general purpose input CONT1 is ON.
03:_CONT1_OFF	Enable the function when general purpose input CONT1 is OFF.
04:_CONT2_ON	Enable the function when general purpose input CONT2 is ON.
05:_CONT2_OFF	Enable the function when general purpose input CONT2 is OFF.
06:_CONT3_ON	Enable the function when general purpose input CONT3 is ON.
07:_CONT3_OFF	Enable the function when general purpose input CONT3 is OFF.
08:_CONT4_ON	Enable the function when general purpose input CONT4 is ON.
09:_CONT4_OFF	Enable the function when general purpose input CONT4 is OFF.
0A:_CONT5_ON	Enable the function when general purpose input CONT5 is ON.
0B:_CONT5_OFF	Enable the function when general purpose input CONT5 is OFF.
0C:_CONT6_ON	Enable the function when general purpose input CONT6 is ON.
0D:_CONT6_OFF	Enable the function when general purpose input CONT6 is OFF.
0E:_CONT7_ON	Enable the function when general purpose input CONT7 is ON.
0F:_CONT7_OFF	Enable the function when general purpose input CONT7 is OFF.
10:_CONT8_ON	Enable the function when general purpose input CONT8 is ON.
11:_CONT8_OFF	Enable the function when general purpose input CONT8 is OFF.

When functions are to be set with the conditions of linear motor speed.

Selection	Contents
12:_LOWV_IN	Enable the function during low speed status (speed is less than LOWV).
13:_LOWV_OUT	Enable the function while low speed status is not kept.
14:_VA_IN	Enable the function during high speed status (speed is more than VA).
15:_VA_OUT	Enable the function while high speed status is not kept.
16:_VCMP_IN	Enable the function during speed matching status (velocity deviation < VCMP).
17:_VCMP_OUT	Enable the function while speed matching status is not kept.
18:_ZV_IN	Enable the function during zero speed status (speed is less than ZV).
19:_ZV_OUT	Enable the function while zero speed status is not kept.

When functions are to be set with the conditions of positioning signals.

Selection	Contents
20:_NEAR_IN	Enable the function during NEAR status (position deviation < NEAR).
21:_NEAR_OUT	Enable the function while NEAR status is not kept.
1A:_INP_IN	Enable the function during In-Position status (position deviation < INP).
1B:_INP_OUT	Enable the function while In-Position status is not kept.
26:_INPZ_IN	Enable the function during PCMD=0 and In-position Status.
27:_INPZ_OUT	Disable the function during PCMD=0 or In-position Status.

When functions are to be set with the conditions of force / speed limit

Selection	Contents
1C:_TLC_IN	Enable the function during force limiting.
1D:_TLC_OUT	Enable the function while force limiting is not performed.
1E:_VLC_IN	Enable the function during velocity limiting.
1F:_VLC_OUT	Enable the function while velocity limiting is not performed.

When functions are to be set with the linear motor moving direction and stop status.

Selection	Contents
22:_VMON_>_+LV	Enable the function when Moving Direction is Positive (VMON > LOWV).
23:_VMON_<=_+LV	Enable the function when Moving Direction is not Positive (VMON <= LOWV).
24:_VMON_<_-LV	Enable the function when Moving Direction is Negative (VMON < LOWV).
25:_VMON_>=_-LV	Enable the function when Moving Direction is not Negative (VMON >= LOWV).

■ General parameter Group A [generic output terminal outputting condition/monitor output selection/setup software settings]

<table>
<tr><th>Page</th><th>Name and Contents</th></tr>
<tr><td>00</td><td>General Purpose Output 1 [OUT1]
<table><tr><th>Setting range</th><th>Standard value</th></tr><tr><td>00～5B</td><td>18:_INP_ON</td></tr></table></td></tr>
<tr><td>01</td><td>General Purpose Output 2 [OUT2]
<table><tr><th>Setting range</th><th>Standard value</th></tr><tr><td>00～5B</td><td>OC:_TLC_ON</td></tr></table></td></tr>
<tr><td>02</td><td>General Purpose Output 3 [OUT3]
<table><tr><th>Setting range</th><th>Standard value</th></tr><tr><td>00～5B</td><td>02:_S-RDY_ON</td></tr></table></td></tr>
<tr><td>03</td><td>General Purpose Output 4 [OUT4]
<table><tr><th>Setting range</th><th>Standard value</th></tr><tr><td>00～5B</td><td>0A:_MBR_ON</td></tr></table></td></tr>
<tr><td>04</td><td>General Purpose Output 5 [OUT5]
<table><tr><th>Setting range</th><th>Standard value</th></tr><tr><td>00～5B</td><td>33:_ALM5_OFF</td></tr></table></td></tr>
<tr><td>05</td><td>General Purpose Output 6 [OUT6]
<table><tr><th>Setting range</th><th>Standard value</th></tr><tr><td>00～5B</td><td>35:_ALM6_OFF</td></tr></table></td></tr>
<tr><td>06</td><td>General Purpose Output 7 [OUT7]
<table><tr><th>Setting range</th><th>Standard value</th></tr><tr><td>00～5B</td><td>37:_ALM7_OFF</td></tr></table></td></tr>
<tr><td>07</td><td>General Purpose Output 8 [OUT8]
<table><tr><th>Setting range</th><th>Standard value</th></tr><tr><td>00～5B</td><td>39:_ALM_OFF</td></tr></table></td></tr>
<tr><td></td><td>Output signals for Generic output OUT1～Generic output OUT8 are selected.
✍ Selection values to be set are on the next page.</td></tr>
<tr><td>10</td><td>Digital Monitor, Output Signal Selection [DMON]
<table><tr><th>Setting range</th><th>Standard value</th></tr><tr><td>00～5B</td><td>00:_Always_OFF</td></tr></table></td></tr>
<tr><td></td><td>Output signals for digital monitor output are selected.
✍ Selection values to be set are on the next page.</td></tr>
<tr><td>11</td><td>Analog Monitor 1, Output Signal Selection [MON1]
<table><tr><th>Setting range</th><th>Standard value</th></tr><tr><td>00～15</td><td>05:_VMON_2mV/min^{-1}</td></tr></table></td></tr>
<tr><td>12</td><td>Analog Monitor 2, Output Signal Selection [MON2]
<table><tr><th>Setting range</th><th>Standard value</th></tr><tr><td>00～15</td><td>02:_TCMON_2V/TR</td></tr></table></td></tr>
<tr><td></td><td>Output signals for analog monitor output 1, 2 are selected from the followings.</td></tr>
<tr><td></td><td>
<table>
<tr><td>00</td><td>Reserved</td></tr>
<tr><td>01:_TMON_2V/TR</td><td>Force monitor 2V/ rated force</td></tr>
<tr><td>02:_TCMON_2V/TR</td><td>Force command monitor 2V/ rated force</td></tr>
<tr><td>03:_VMON_0.2mV/ min^{-1}</td><td>Velocity monitor 0.2mV/ mm/s</td></tr>
<tr><td>04:_VMON_1mV/ min^{-1}</td><td>Velocity monitor 1mV/ mm/s</td></tr>
<tr><td>05:_VMON_2mV/ min^{-1}</td><td>Velocity monitor 2mV/ mm/s</td></tr>
<tr><td>06:_VMON_3mV/ min^{-1}</td><td>Velocity monitor 3mV/ mm/s</td></tr>
<tr><td>07:_VCMON_0.2mV/ min^{-1}</td><td>Velocity command monitor 0.2mV/ mm/s</td></tr>
<tr><td>08:_VCMON_1mV/ min^{-1}</td><td>Velocity command monitor 1mV/ mm/s</td></tr>
<tr><td>09:_VCMON_2mV/ min^{-1}</td><td>Velocity command monitor 2mV/ mm/s</td></tr>
<tr><td>0A:_VCMON_3mV/ min^{-1}</td><td>Velocity command monitor 3mV/ mm/s</td></tr>
<tr><td>0B:_PMON_0.1mV/P</td><td>Position deviation counter monitor 0.1mV/ Pulse</td></tr>
<tr><td>0C:_PMON_1mV/P</td><td>Position deviation counter monitor 1mV/ Pulse</td></tr>
<tr><td>0D:_PMON_10mV/P</td><td>Position deviation counter monitor 10mV/ Pulse</td></tr>
<tr><td>0E:_PMON_20mV/P</td><td>Position deviation counter monitor 20mV/ Pulse</td></tr>
<tr><td>0F:_PMON_50mV/P</td><td>Position deviation counter monitor 50mV/Pulse</td></tr>
<tr><td>10:_FMON_2mV/kP/s</td><td>Position command pulse monitor (position command pulse input frequency)2mV/kPulse/s</td></tr>
<tr><td>11:_FMON_10mV/kP/s</td><td>Position command pulse monitor (position command pulse input frequency)10mV/kPulse/s</td></tr>
<tr><td>12:_TLMON_EST_2V/TR</td><td>Load force monitor (estimated value) 2V/ rated force</td></tr>
<tr><td>13:_Sine-U</td><td>U phase electric angle Sin 8 V peak</td></tr>
<tr><td>14:_VBUS_1V/DC100V</td><td>Main circuit DC voltage 1V/DC100V</td></tr>
<tr><td>15:_VBUS_1V/DC10V</td><td>Main circuit DC voltage 1V/DC10V</td></tr>
</table>
</td></tr>
</table>

● Generic output OUT1～Generic output OUT8, List of selection contents for digital monitor output

When functions are to be always enabled or disabled.

Selection	Contents
00: _Always_OFF	The output is always OFF.
01: _Always_ON	The output is always ON.

When Generic input signal status is to be output.

Selection	Contents
3A: _CONT1_ON	The output is ON while general purpose input CONT 1 is ON.
3B: _CONT1_OFF	The output is OFF while general purpose input CONT 1 is ON.
3C: _CONT2_ON	The output is ON while general purpose input CONT 2 is ON.
3D: _CONT2_OFF	The output is OFF while general purpose input CONT 2 is ON.
3E: _CONT3_ON	The output is ON while general purpose input CONT 3 is ON.
3F: _CONT3_OFF	The output is OFF while general purpose input CONT 3 is ON.
40: _CONT4_ON	The output is ON while general purpose input CONT 4 is ON.
41: _CONT4_OFF	The output is OFF while general purpose input CONT 4 is ON.

Selection	Contents
42: _CONT5_ON	The output is ON while general purpose input CONT 5 is ON.
43: _CONT5_OFF	The output is OFF while general purpose input CONT 5 is ON.
44: _CONT6_ON	The output is ON while general purpose input CONT 6 is ON.
45: _CONT6_OFF	The output is OFF while general purpose input CONT6 is ON.
46: _CONT7_ON	The output is ON while general purpose input CONT 7 is ON.
47: _CONT7_OFF	The output is OFF while general purpose input CONT 7 is ON.
48: _CONT8_ON	The output is ON while general purpose input CONT 8 is ON.
49: _CONT8_OFF	The output is OFF while general purpose input CONT 8 is ON.

When servo amplifier inner status is to be output.

Selection	Contents
02: _S-RDY_ON	The output is ON during Servo Ready complete.
03: _S-RDY_OFF	The output is OFF during Servo Ready complete.
58: _S-RDY2_ON	The output is ON during Servo Ready complete.
59: _S-RDY2_OFF	The output is OFF during Servo Ready complete.
04: _P-ON_ON	The output is ON while the main power supply is turned on.
05: _P-ON_OFF	The output is OFF while the main power supply is turned on.
06: _A-RDY_ON	The output is ON during the main power supply ON permission.
07: _A-RDY_OFF	The output is OFF during the main power supply ON permission.
08: _S-ON_ON	The output is ON during motor excitation.
09: _S-ON_OFF	The output is OFF during motor excitation.
0A: _MBR-ON_ON	The output is ON while holding brake excitation signal outputs.
0B: _MBR-ON_OFF	The output is OFF while holding brake excitation signal outputs.
0C: _TLC_ON	The output is ON during force limiting.
0D: _TLC_OFF	The output is OFF during force limiting.
0E: _VLC_ON	The output is ON during velocity limiting.
0F: _VLC_OFF	The output is OFF during velocity limiting.
10: _LOWV_ON	The output is ON during low speed status (speed is less than LOWV).
11: _LOWV_OFF	The output is OFF during low speed status (speed is less than LOWV).
12: _VA_ON	The output is ON during high speed status (speed is more than VA).
13: _VA_OFF	The output is OFF during high speed status (speed is more than VA).
14: _VCMP_ON	The output is ON during speed matching status (velocity deviation < VCMP).
15: _VCMP_OFF	The output is OFF during speed matching status (velocity deviation < VCMP).

Selection	Contents
16: _ZV_ON	The output is ON during zero speed status (speed is less than ZV).
17: _ZV_OFF	The output is OFF during zero speed status (speed is less than ZV).
1C: _CMD-ACK_ON	The output is ON while command can be accepted.
1D: _CMD-ACK_OFF	The output is OFF while command can be accepted.
1E: _GC-ACK_ON	The output is ON during gain switching.
1F: _GC-ACK_OFF	The output is OFF during gain switching.
20: _PCON-ACK_ON	The output is ON during velocity loop proportional control switching.
21: _PCON-ACK_OFF	The output is OFF during velocity loop proportional control switching.
22: _GERS-ACK_ON	The output is ON during electric gear switching.
23: _GERS-ACK_OFF	The output is OFF during electric gear switching.
24: _MS-ACK_ON	The output is ON during control mode switching.
25: _MS-ACK_OFF	The output is OFF during control mode switching.
26: _F-OT_ON	The output is ON during positive over-travel status.
27: _F-OT_OFF	The output is OFF during positive over-travel status.
28: _R-OT_ON	The output is ON during negative over-travel status.
29: _R-OT_OFF	The output is OFF during negative over-travel status.
4A: _CHARGE_ON	The output is ON while main power supply (capacitor) is charging.
4B: _CHARGE_OFF	The output is OFF while main power supply (capacitor) is charging.
4C: _DB_OFF	The output is OFF during dynamic braking.
4D: _DB_ON	The output is ON during dynamic braking.

When positioning signal is to be output.

Selection	Contents
18: _INP_ON	The output is ON during In-Position status (position deviation < INP).
19: _INP_OFF	The output is OFF during In-Position status (position deviation < INP).
1A: _NEAR_ON	The output is ON during In-Position Near status (position deviation < NEAR).
1B: _NEAR_OFF	The output is OFF during In-Position Near status (position deviation < NEAR).
5A: _INPZ_ON	The output is ON during PCMD=0 and In-position Status.
5B: _INPZ_OFF	The output is OFF during PCMD=0 and In-position Status.

When warning signal is to be output.

Selection	Contents
2A: _WNG-OFW_ON	The output is ON during following warning status (position deviation > OFWLV).
2B: _WNG-OFW_OFF	The output is OFF during following warning status (position deviation > OFWLV).
2C: _WNG-OLW_ON	The output is ON during over-load warning status.
2D: _WNG-OLW_OFF	The output is OFF during over-load warning status.
2E: _WNG-ROLW_ON	The output is ON during regenerative over-load warning status.
2F: _WNG-ROLW_OFF	The output is OFF during regenerative over-load warning status.
30: _WNG-BAT_ON	The output is ON during battery warning.
31: _WNG-BAT_OFF	The output is OFF during battery warning.

When alarm signals are to be output.

Selection	Contents
32: _ALM5_ON	Output alarm code, bit 5. (Positive logic).
33: _ALM5_OFF	Output alarm code, bit 5. (Negative logic).
34: _ALM6_ON	Output alarm code, bit 6. (Positive logic).
35: _ALM6_OFF	Output alarm code, bit 6. (Negative logic).
36: _ALM7_ON	Output alarm code, bit 7. (Positive logic).
37: _ALM7_OFF	Output alarm code, bit 7. (Negative logic).
38: _ALM_ON	The output is ON during alarm status.
39: _ALM_OFF	The output is OFF during alarm status.

When alarm signals are to be made compatible with PY.

Selection	Contents
50: _PYALM1_ON	Output PY compatible alarm code 1. (Positive logic).
51: _PYALM1_OFF	Output PY compatible alarm code 1. (Negative logic).
52: _PYALM2_ON	Output PY compatible alarm code 2. (Positive logic).
53: _PYALM2_OFF	Output PY compatible alarm code 1. (Negative logic).
54: _PYALM4_ON	Output PY compatible alarm code 4. (Positive logic).
55: _PYALM4_OFF	Output PY compatible alarm code 4. (Negative logic).
56: _PYALM8_ON	Output PY compatible alarm code 8. (Positive logic).
57: _PYALM8_OFF	Output PY compatible alarm code 8. (Negative logic).

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Analog monitor output polarity [MONPOL]

Setting range	Standard value
00～08	00:_MON1+_MON2+

The output polarity of analog monitor output MON1 and MON2 is selected from the contents below.

Selection	Contents
00:_MON1+_MON2+	MON1 : Output the positive voltage at forward rotation (positive direction). Output the positive/negative voltage. MON2 : Output the positive voltage at forward rotation (positive direction). Output the positive/negative voltage.
01:_MON1-_MON2+	MON1 : Output the negative voltage at forward rotation (positive direction). Output the positive/negative voltage. MON2 : Output the positive voltage at forward rotation (positive direction). Output the positive/negative voltage.
02:_MON1+_MON2-	MON1 : Output the positive voltage at forward rotation (positive direction). Output the positive/negative voltage. MON2 : Output the negative voltage at forward rotation (positive direction). Output the positive/negative voltage.
03:_MON1-_MON2-	MON1 : Output the negative voltage at forward rotation (positive direction). Output the positive/negative voltage. MON2 : Output the negative voltage at forward rotation (positive direction). Output the positive/negative voltage.
04:_MON1ABS_MON2+	MON1 : Output the positive voltage at both forward rotation (positive direction) and reverse rotation (reverse direction). MON2 : Output the positive voltage at forward rotation (positive direction). Output the positive/negative voltage.
05:_MON1ABS_MON2-	MON1 : Output the positive voltage at both forward rotation (positive direction) and reverse rotation (reverse direction). MON2 : Output the negative voltage at forward rotation (positive direction). Output the positive/negative voltage.
06:_MON1+_MON2ABS	MON1 : Output the positive voltage at forward rotation (positive direction). Output the positive/negative voltage. MON2 : Output the positive voltage at both forward rotation (positive direction) and reverse rotation (reverse direction).
07:_MON1-_MON2ABS	MON1 : Output the negative voltage at forward rotation (positive direction). Output the positive/negative voltage. MON2 : Output the positive voltage at both forward rotation (positive direction) and reverser rotation (reverse direction).
08:_MON1ABS_MON2ABS	MON1 : Output the positive voltage at both forward rotation (positive direction) and reverse rotation (reverse direction). MON2 : Output the positive voltage at both forward rotation (positive direction) and reverse rotation(reverse direction).

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Setup Software, Communication Axis Number [COMAXIS]

Setting range	Standard value
01～0F	01:_#1

The axis number for communication with PC is selected from the contents below.

✍ The selected value is enabled after turning ON the control power again.

Selection	Selection
01:_#1	09:_#9
02:_#2	0A:_#A
03:_#3	0B:_#B
04:_#4	0C:_#C
05:_#5	0D:_#D
06:_#6	0E:_#E
07:_#7	0F:_#F
08:_#8	

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Setup Software, Communication Baud Rate [COMBAUD]

Setting range	Standard value
00～05	05:_38400bps

The baud rate for communication with PC is selected from the contents below.

✍ The selected value is enabled after turning ON the control power again.

Selection
00:_1200bps
01:_2400bps
02:_4800bps
03:_9600bps
04:_19200bps
05:_38400bps

■ General parameter Group B［sequence/alarm related settings］

<table>
<tr><th>Page</th><th>Contents</th></tr>
<tr><td>00</td><td>
JOG Velocity Command [JOGVC]
<table>
<tr><th>Setting range</th><th>Unit</th><th>Standard value</th></tr>
<tr><td>0～32767</td><td>mm/s</td><td>50</td></tr>
</table>
Velocity command for test run and adjustment JOG operation is set.
</td></tr>
<tr><td>10</td><td>
Dynamic Brake Action Selection [DBOPE]
<table>
<tr><th>Setting range</th><th>Unit</th><th>Standard value</th></tr>
<tr><td>00～05</td><td>—</td><td>04:_SB__Free</td></tr>
</table>
Dynamic brake operation when shifted from servo ON → servo OFF, and during servo OFF is selected from the contents below.
✍ When the main circuit power is shut OFF, the dynamic brake will operate irrespective of this setting.
<table>
<tr><th colspan="2">Selection</th></tr>
<tr><td>00:_Free_Free</td><td>When Servo-OFF, Free-Run is operated. After stops, Motor-Free is operated.</td></tr>
<tr><td>01:_Free_DB</td><td>When Servo-OFF, Free-Run is operated. After stops, Dynamic-Braking is performed.</td></tr>
<tr><td>02:_DB__Free</td><td>When S-OFF, Dynamic-Braking is performed. After stops, Motor-Free is operated.</td></tr>
<tr><td>03:_DB__DB</td><td>When S-OFF, Dynamic-Braking is performed. After stops, Dynamic-Braking.</td></tr>
<tr><td>04:_SB__Free</td><td>When Servo-OFF, Servo-Braking is performed. After stops, Motor-Free is operated.</td></tr>
<tr><td>05:_SB__DB</td><td>When Servo-OFF, Servo-Braking is performed. After stops, Dynamic-Braking.</td></tr>
</table>
</td></tr>
<tr><td>11</td><td>
Over-Travel Action Selection [ACTOT]
<table>
<tr><th>Setting range</th><th>Unit</th><th>Standard value</th></tr>
<tr><td>00～06</td><td>—</td><td>00:_CMDINH_SB_SON</td></tr>
</table>
Operations at over travel are selected from the contents below.
<table>
<tr><th>Selection</th><th>Contents</th></tr>
<tr><td>00:_CMDINH_SB_SON</td><td>PC is inhibited and Servo-Braking is performed. After stops, S-ON is operated.</td></tr>
<tr><td>01:_CMDINH_DB_SON</td><td>PC is inhibited and Dynamic-Braking is performed. After stops, S-ON is operated.</td></tr>
<tr><td>02:_CMDINH_Free_SON</td><td>PC is inhibited and Free-Run is performed. After stops, Servo-ON is operated.</td></tr>
<tr><td>03:_CMDINH_SB_SOFF</td><td>PC is inhibited and Servo-Braking is performed. After stops, S-OFF is operated.</td></tr>
<tr><td>04:_CMDINH_DB_SOFF</td><td>PC is inhibited and Dynamic-Braking is performed. After stops, S-OFF is operated</td></tr>
<tr><td>05:_CMDINH_Free_SOFF</td><td>PC is inhibited and Free-Run is performed. After stops, Servo-OFF is operated.</td></tr>
<tr><td>06:_CMDACK_VCLM=0</td><td>****</td></tr>
</table>
</td></tr>
<tr><td>12</td><td>
Emergency Stop Operation [ACTEMR]
<table>
<tr><th>Setting range</th><th>Unit</th><th>Standard value</th></tr>
<tr><td>00～01</td><td>—</td><td>00:_SERVO-BRAKE</td></tr>
</table>
Forced stop operations (EMR) are selected from the contents below.
<table>
<tr><th>Selection</th><th>Contents</th></tr>
<tr><td>00:_SERVO-BRAKE</td><td>When EMR is input, motor is stopped by servo brake operations.</td></tr>
<tr><td>01:_DINAMIC-BRAKE</td><td>When EMR is input, motor is stopped by dynamic brake operations.</td></tr>
</table>
</td></tr>
</table>

<table>
<tr><th>Page</th><th>Contents</th></tr>
<tr><td>13</td><td>Delay Time of Engaging Holding Brake (holding brake holding delay time) [BONDLY]
<table><tr><th>Setting range</th><th>Unit</th><th>Standard value</th></tr><tr><td>0～1000</td><td>ms</td><td>300</td></tr></table>
Holding brake operation delay time when shifted from servo ON to servo OFF is set.
When shifted from servo ON to servo OFF, motor excitation is maintained during this time.
(Velocity command is Zero.)</td></tr>
<tr><td>14</td><td>Delay Time of Releasing Holding Brake (holding brake release delay time) [BOFFDLY]
<table><tr><th>Setting range</th><th>Unit</th><th>Standard value</th></tr><tr><td>0～1000</td><td>ms</td><td>300</td></tr></table>
Holding brake operation release delay time when shifted from servo OFF to servo ON is set.
When shifted from servo OFF to servo ON, motor is excited during this time.
(Velocity Command is Zero.)</td></tr>
<tr><td>15</td><td>Brake Operation Beginning Time [BONBGN]
<table><tr><th>Setting range</th><th>Unit</th><th>Standard value</th></tr><tr><td>0～65535</td><td>ms</td><td>0</td></tr></table>
Parameter for setting motor free operation time, dynamic brake operation time and servo brake operation time.
When shifted from servo ON to Servo OFF, holding brake and dynamic brake start to operate after this set time.
When motor does not stop even after servo OFF at gravity axis or else, motor is stopped by holding brake and dynamic brake. In the system where motor speed becomes lower than Speed Zero Range (ZV) within the set time, this setting does not function.
If set to 0msec, brake operation start time is disabled (＝infinite).</td></tr>
<tr><td>16</td><td>Power Failure Detection Delay Time [PFDDLY]
<table><tr><th>Setting range</th><th>Unit</th><th>Standard value</th></tr><tr><td>20～1000</td><td>ms</td><td>32</td></tr></table>
The delay time from control power OFF to control power error detection is set. The larger value makes the detection of instantaneous stop slower.
(Larger set value will only result in slower detection of error. In case of power failure of internal logic circuit, operation is the same as when control power is turned ON again. In case of energy shortage of main circuit power, other errors, such as main circuit power loss, may be detected.)
In this setting, actual detection delay time varies by 12ms and +6ms.
✍ The selected value is enabled after control power is turned ON again.</td></tr>
<tr><td>17</td><td>Wait Time for Initialization Completion
<table><tr><th>Setting range</th><th>Unit</th><th>Standard value</th></tr><tr><td>00～03</td><td>-</td><td>00:_Disable</td></tr></table>
<table><tr><th>Selection</th><th>Contents</th></tr><tr><td>00:_Disabled</td><td>Disabled</td></tr><tr><td>01:_1000ms</td><td>1000 [ms]</td></tr><tr><td>02:_1400ms</td><td>1400 [ms]</td></tr><tr><td>03:_1800ms</td><td>1800 [ms]</td></tr></table>
Wait time for the initialization completion is selected from the contents below:
✍ The set value is enabled after control power is turned ON again.</td></tr>
<tr><td>20</td><td>Following Error Warning Level [OFWLV]
<table><tr><th>Setting range</th><th>Unit</th><th>Standard value</th></tr><tr><td>1～65535</td><td>×1024 Pulse</td><td>65535</td></tr></table>
Parameter to output warning before excessive position deviation alarm (following error) is output.</td></tr>
<tr><td>21</td><td>Following Error Limit [OFLV]
<table><tr><th>Setting range</th><th>Unit</th><th>Standard value</th></tr><tr><td>1～65535</td><td>×1024 Pulse</td><td>500</td></tr></table>
Parameter for setting the value to output position excessive deviation alarm (following error). Encoder pulse is the standard irrespective of electronic gear and command multiplication function.</td></tr>
</table>

<table>
<tr><th>Page</th><th colspan="2">Contents</th></tr>
<tr><td rowspan="2">22</td><td colspan="2">Overload Warning Level [OLWLV]</td></tr>
<tr><td>
<table>
<tr><th>Setting range</th><th>Unit</th><th>Standard value</th></tr>
<tr><td>20～100</td><td>%</td><td>90</td></tr>
</table>
</td><td>Parameter for outputting warnings before overload alarm is output. The possible level to be set is ranged from 20%～99%, assuming that the overload alarm level is 100%.
When set to 100%, overload warning and overload alarm are output at one time.
Overload detection is assumed and set as 75% of a rated load when control power is turned ON (hot start).
Therefore, if this is set to below 75%, overload warning may be output when control power is turned ON.
✍ The set value is enabled after control power is turned ON again.</td></tr>
<tr><td rowspan="2">23</td><td colspan="2">Speed Feedback Error (ALM_C3) Detection [VFBALM]</td></tr>
<tr><td>
<table>
<tr><th>Setting range</th><th>Unit</th><th>Standard value</th></tr>
<tr><td>00～01</td><td>—</td><td>01:_Enabled</td></tr>
</table>
<table>
<tr><th>Selection</th><th>Contents</th></tr>
<tr><td>00:_Disabled</td><td>Disabled</td></tr>
<tr><td>01:_Enabled</td><td>Enabled</td></tr>
</table>
</td><td>Select either one from enabled or disabled of velocity feedback error alarm detection.</td></tr>
<tr><td rowspan="2">24</td><td colspan="2">Speed Control Error (ALM_C2) Detection [VCALM]</td></tr>
<tr><td>
<table>
<tr><th>Setting range</th><th>Unit</th><th>Standard value</th></tr>
<tr><td>00～01</td><td>—</td><td>00:_Disabled</td></tr>
</table>
<table>
<tr><th>Selection</th><th>Contents</th></tr>
<tr><td>00:_Disabled</td><td>Disabled</td></tr>
<tr><td>01:_Enabled</td><td>Enabled</td></tr>
</table>
</td><td>Select either one from enabled or disabled of velocity control error alarm detection.
In such an operation pattern as causing a motor overshoot to the command, velocity control error may be detected by mistake. For this, set this parameter to “disabled”.</td></tr>
</table>

■ General parameter Group C [Encoder related settings]

<table>
<tr><th>Page</th><th>Contents</th></tr>
<tr><td rowspan="3">00</td><td colspan="2">~~Position detection system choice [ABS/INCSYS]~~</td></tr>
<tr><td>
<table>
<tr><th>Setting range</th><th>Unit</th><th>Standard value</th></tr>
<tr><td>00～01</td><td>—</td><td>00:_Absolute</td></tr>
</table>
</td><td>Position detection system is selected from the contents below.</td></tr>
<tr><td>
<table>
<tr><th>Selection</th><th>Contents</th></tr>
<tr><td>00:_Absolute</td><td>Absolute System</td></tr>
<tr><td>01:_Incremental</td><td>Incremental System</td></tr>
</table>
</td><td>Selecting “incremental system” enables the use similar to incremental encoder without installing a backup battery in the absolute encoder.</td></tr>
<tr><td rowspan="3">01</td><td colspan="2">Motor Incremental Encoder, Digital Filter [ENFIL]</td></tr>
<tr><td>
<table>
<tr><th>Setting range</th><th>Unit</th><th>Standard value</th></tr>
<tr><td>00～07</td><td>—</td><td>01_220nsec</td></tr>
</table>
</td><td>Settings for motor incremental encoder digital filter are selected from the contents below.</td></tr>
<tr><td colspan="2">
<table>
<tr><th>Selection</th><th>Contents</th></tr>
<tr><td>00:_110nsec</td><td>Minimum Pulse Width = 110nsec (Minimum Pulse Phase Difference = 37.5nsec)</td></tr>
<tr><td>01:_220nsec</td><td>Minimum Pulse Width = 220nsec</td></tr>
<tr><td>02:_440nsec</td><td>Minimum Pulse Width = 440nsec</td></tr>
<tr><td>03:_880nsec</td><td>Minimum Pulse Width = 880nsec</td></tr>
<tr><td>04:_75nsec</td><td>Minimum Pulse Width = 75nsec (Minimum Pulse Phase Difference = 37.5nsec)</td></tr>
<tr><td>05:_150nsec</td><td>Minimum Pulse Width = 150nsec</td></tr>
<tr><td>06:_300nsec</td><td>Minimum Pulse Width = 300nsec</td></tr>
<tr><td>07:_600nsec</td><td>Minimum Pulse Width = 600nsec</td></tr>
</table>
</td></tr>
<tr><td rowspan="3">02</td><td colspan="2">Hall sensor, Digital Filter [EX-ENFIL]</td></tr>
<tr><td>
<table>
<tr><th>Setting range</th><th>Unit</th><th>Standard value</th></tr>
<tr><td>00～07</td><td>—</td><td>01_220nsec</td></tr>
</table>
</td><td>Settings for hall sensor digital filter are selected from the contents below.
✍ The minimum pulse width that can be set at maximum is the one that can be set at [ENFIL], motor incremental encoder digital filter. The setting value shall be the same as [ENFIL], motor incremental encoder digital filter.</td></tr>
<tr><td colspan="2">
<table>
<tr><th>Selection</th><th>Contents</th></tr>
<tr><td>00:_110nsec</td><td>Minimum pulse width ＝110nsec(Minimum phase difference＝37.5nsec)</td></tr>
<tr><td>01:_220nsec</td><td>Minimum pulse width ＝220nsec</td></tr>
<tr><td>02:_440nsec</td><td>Minimum pulse width ＝440nsec</td></tr>
<tr><td>03:_880nsec</td><td>Minimum pulse width ＝880nsec</td></tr>
<tr><td>04:_75nsec</td><td>Minimum pulse width ＝75nsec(Minimum phase difference＝37.5nsec)</td></tr>
<tr><td>05:_150nsec</td><td>Minimum pulse width ＝150nsec</td></tr>
<tr><td>06:_300nsec</td><td>Minimum pulse width ＝300nsec</td></tr>
<tr><td>07:_600nsec</td><td>Minimum pulse width ＝600nsec</td></tr>
</table>
</td></tr>
<tr><td rowspan="3">03</td><td colspan="2">Hall sensor Polarity Invert [EX-ENPOL]</td></tr>
<tr><td>
<table>
<tr><th>Setting range</th><th>Unit</th><th>Standard value</th></tr>
<tr><td>00～07</td><td>—</td><td>00:_Type1</td></tr>
</table>
</td><td>Hall sensor signal polarity is selected from the contents below.
✍ The set value is enabled after control power is turned ON again.</td></tr>
<tr><td colspan="2">
<table>
<tr><th>Selection</th><th colspan="3">Contents</th></tr>
<tr><td>00:_Type1</td><td>S3/ Not Reversed</td><td>S2/ Not Reversed</td><td>S1/ Not Reversed</td></tr>
<tr><td>01:_Type2</td><td>S3/ Not Reversed</td><td>S2/ Not Reversed</td><td>S1/ Reversed</td></tr>
<tr><td>02:_Type3</td><td>S3/ Not Reversed</td><td>S2/ Reversed</td><td>S1/ Not Reversed</td></tr>
<tr><td>03:_Type4</td><td>S3) Not Reversed</td><td>S2/ Reversed</td><td>S1/ Reversed</td></tr>
<tr><td>04:_Type5</td><td>S3/ Reversed</td><td>S2/ Not Reversed</td><td>S1/ Not Reversed</td></tr>
<tr><td>05:_Type6</td><td>S3/ Reversed</td><td>S2/ Not Reversed</td><td>S1/ Reversed</td></tr>
<tr><td>06:_Type7</td><td>S3/ Reversed</td><td>S2/ Reversed</td><td>S1/ Not Reversed</td></tr>
<tr><td>07:_Type8</td><td>S3/ Reversed</td><td>S2/ Reversed</td><td>S1/ Reversed</td></tr>
</table>
</td></tr>
</table>

<table>
<tr><th>Page</th><th>Contents</th></tr>
<tr><td>04</td><td>
Encoder Pulse Divided Output, Selection [PULOUTSEL]
<table>
<tr><th>Setting range</th><th>Unit</th><th>Standard value</th></tr>
<tr><td>00～01</td><td>—</td><td>00:_Motor_Enc.</td></tr>
</table>
Encoder pulse division output signal is selected from the contents below.
<table>
<tr><th colspan="2">Selection</th></tr>
<tr><td>00:_Motor_Enc.</td><td>Motor Encoder</td></tr>
<tr><td>01:_External_Enc.</td><td>External Encoder</td></tr>
</table>
</td></tr>
<tr><td>05</td><td>
Encoder Output Pulse, Divide Ratio [ENRAT]
<table>
<tr><th>Setting range</th><th>Unit</th><th>Standard value</th></tr>
<tr><td>1/1～1/64
2/3～2/64
1/8192～8191/8192</td><td>—</td><td>1/1</td></tr>
</table>
Parameter for setting division ratio of encoder pulse dividing output. Division ratio is set.
</td></tr>
<tr><td>06</td><td>
Encoder Pulse Divided output, Polarity [PULOUTPOL]
<table>
<tr><th>Setting range</th><th>Unit</th><th>Standard value</th></tr>
<tr><td>00～03</td><td>—</td><td>00:_Type1</td></tr>
</table>
Encoder pulse dividing output polarity is selected from the followings.
<table>
<tr><th>Selection</th><th>Contents</th></tr>
<tr><td>00:_Type1</td><td>A-Phase Signal / Not Reversed : Z-Phase Signal Logic / High Active</td></tr>
<tr><td>01:_Type2</td><td>A-Phase Signal / Reversed : Z-Phase Signal Logic / High Active</td></tr>
<tr><td>02:_Type3</td><td>A-Phase Signal / Not Reversed : Z-Phase Signal Logic / Low Active</td></tr>
<tr><td>03:_Type4</td><td>A-Phase Signal / Reversed : Z-Phase Signal Logic / Low Active</td></tr>
</table>
</td></tr>
<tr><td>07</td><td>
~~Encoder Signal Output (PS), Format [PSOFORM]~~
<table>
<tr><th>Setting range</th><th>Unit</th><th>Standard value</th></tr>
<tr><td>00～02</td><td>—</td><td>00:_Binary</td></tr>
</table>
Signal format of encoder signal output(ＰＳ) is selected from the followings.
✍ The set value is enabled after control power is turned ON again.
<table>
<tr><th>Selection</th><th>Contents</th></tr>
<tr><td>00:_Binary</td><td>Binary Code Output</td></tr>
<tr><td>01:_Decimal</td><td>Decimal ASCII Code Output</td></tr>
<tr><td>02:_Encoder_Signal</td><td>Encoder Signal Direct Output</td></tr>
</table>
</td></tr>
<tr><td>08</td><td>
~~Abusolute Encoder Clear Function Selection [ECLRFUNC]~~
<table>
<tr><th>Setting range</th><th>Unit</th><th>Standard value</th></tr>
<tr><td>00～01</td><td>—</td><td>00:_Status_MultiTurn</td></tr>
</table>
Used for clearing some absolute encoder warnings which are not automatically restored.
✍ Valid when wire-saving absolute encoder is used.
<table>
<tr><th>Selection</th><th>Contents</th></tr>
<tr><td>00:_Status_MultiTurn</td><td>Clear Encoder Status (Alarm and Warning) and Multi Turn Data</td></tr>
<tr><td>01:_Status</td><td>Clear Only Encoder Status</td></tr>
</table>
</td></tr>
<tr><td>09</td><td>
CS Offset [CSOF]
<table>
<tr><th>Setting range</th><th>Unit</th><th>Standard value</th></tr>
<tr><td>0～359</td><td>deg</td><td>330</td></tr>
</table>
Sets the motor electric angle.
If the motor has a hall sensor, the amount of offset from U phase electric angle of 0 deg to U phase hall sensor output edge will be set with electric angle conversion.
</td></tr>
</table>

0A — Z phase CS Normalization Offset

Setting range	Unit	Standard value
0～359	deg	330

Z phase signal offset aginst the motor electric angle is set.
Enabled when CS normalization is executed by Z phase signal. The offset from U phase electric angle of 0 deg to Z phase signal output position will be set with electric angle conversion.

0B — Linear Sensor Direction Selection [ENCDIR]

Setting range	Unit	Standard value
00～01	-	00:_Standard

Select the signal polarity of the linear encoder (connected to CN2). Polarity for A phase and B phase can be selected. (In case of a wire-saving incremental encoder, U phase and V phase signal polarities will not change.)

✍ The set value is enabled when the control power is turned ON again.

Slection	Description
00：_Standard	B phase signal rises first at forward movement.
01：_Reversed	A phase signal rises first at forward movement.

■ System parameter

00 — Main Power, Input Type

Selects the input mode for power supplied to the main circuit power supply.
Setting range varies depending on the hardware type.

Selection	Description
00：_AC_3-phase	3 phase A C power is supplied to the main circuit.
01：_AC_Single-phase	Single phase A C power is supplied to the main circuit.

01 — Motor Encoder Type

Selection	Description
00：_Inclemental_ENC	Incremental Encoder

02 — Incremental Encoder, Function Setting

Incremental encoder type is selected when an incremental encoder is used for the motor encoder.
Setting range varies depending on the hardware type.

Selection	Description
80:_INC-E_type1	Signal ／A, B, Z+ S１・S2・S3 (Open collector output) : CS Normalization／EU
81:_INC-E_type2	Signal ／A, B, Z+ S１・S2・S3 (Differencial output) : CS Normalization／EU
82:_INC-E_type3	Signal ／A, B, Z+ S１・S2・S3 (Open collector output) : CS Normalization／Ｚ phase
83:_INC-E_type4	Signal ／A, B, Z+ S１・S2・S3 (Differencial output) : CS Normalization／Ｚ phase
84:_INC-E_type5	Signal ／A, B, Z+ S１・S2・S3 (Open collector output) : CS Normalization／None
85:_INC-E_type6	Signal ／A, B, Z+ S１・S2・S3 (Differencial output) : CS Normalization／None
86:_INC-E_type7	Signal ／Wire-saving incremental encoder : CS Normalization／Ｚ phase
87:_INC-E_type8	Signal ／Wire-saving incremental encoder : CS Normalization／None
88:_INC-E_type9	Signal ／A, B, Z only : CS Normalization／Software setting (Fixed excitation)
89:_INC-E_type10	Signal ／A, B, Z only : CS Normalization／Software setting (Forced setting)

03 — Incremental Encoder, Resolution Setting

Linear sensor resolution is set.
Set the pulse (multiplied by 4) per 1mm of the linear sensor.

Setting range	Unit	Standard value
10～65535	P/mm	—

04 — ~~Absolute Encoder, Function Setting~~

05 — ~~Absolute Encoder, Resolution Setting~~

<table>
<tr><td>Page</td><td colspan="2">Description</td></tr>
<tr><td>06</td><td>Combined motor model number</td><td>In “The set up software”, model numbers of combined motor and their codes are shown.
When combined motor is to be changed, change the motor parameter setting of “The set up software”.
✍Combined motor cannot be changed.
✍ Page contents are different for digital operator. Refer to Note 1).</td></tr>
<tr><td rowspan="2">08</td><td>Control Mode</td><td>Selects control mode.</td></tr>
<tr><td colspan="2">
<table>
<tr><th>Selection</th><th>Description</th></tr>
<tr><td>00：_Force</td><td>Force Control Mode</td></tr>
<tr><td>01：_Velocity</td><td>Velocity Control Mode</td></tr>
<tr><td>02：_Position</td><td>Position Control Mode</td></tr>
</table>
<table>
<tr><th>Setting</th><th>Description</th></tr>
<tr><td>03：_Velo－Torq</td><td>Velocity - Force Switch Mode</td></tr>
<tr><td>04：_Posi－Torq</td><td>Position - Force Switch Mode</td></tr>
<tr><td>05：_Posi－Velo</td><td>Position - Velocity Switch Mode</td></tr>
</table>
✍ when the switching type between [03:Velo-Torq] [04：_Posi－Torq] and [05：_Posi－Velo] is used, there is a possibility that “auto-notch frequency tuning”, “auto-vibration suppressing frequency tuning” and “JOG operation” cannot be used.
To use these, switch the control mode to the base side (Velo(velocity control) in case of [03：_Velo－Torq]).
</td></tr>
<tr><td rowspan="2">09</td><td>Position Loop Control and Position Loop Encoder Selection</td><td>Position loop encoder is selected used for position loop control method and position loop control.
Setting range varies depending on the hardware type.</td></tr>
<tr><td colspan="2">
<table>
<tr><th>Setting</th><th>Description</th></tr>
<tr><td>00：_Motor_encoder</td><td>Semi-Closed Control / Motor Encoder</td></tr>
<tr><td>~~01：_Ext－ENC~~</td><td>~~Fully Closed Control / Extenal Encoder~~</td></tr>
</table>
</td></tr>
<tr><td rowspan="2">0A</td><td>~~External Encoder, Resolution Setting~~</td><td></td></tr>
<tr><td colspan="2">
<table>
<tr><th>Setting range</th><th>Unit</th><th>Standard value</th></tr>
<tr><td>10～65535</td><td>P/R</td><td>—</td></tr>
</table>
</td></tr>
<tr><td rowspan="2">0B</td><td>Regenerative Resistor Selection</td><td>Selects the type of regenerative resistance to be connected.</td></tr>
<tr><td colspan="2">
<table>
<tr><th>Setting</th><th>Description</th></tr>
<tr><td>00：_Not_connect</td><td>Regenerative Resistor is not Connected</td></tr>
<tr><td>01：_Built-in_R</td><td>Use Built-In Regenerative Resistor</td></tr>
<tr><td>02：_External_R</td><td>Use External Regenerative Resistor</td></tr>
</table>
</td></tr>
</table>

Note ） In case of digital operator

Page	Description	
06	Servo amplifier information	This is for maker maintenance.
07	Combined motor code	In the digital operator, motor codes of the selected servo motor are displayed. To change the combined motor, change the motor parameter setting at “The set up software”. ✍ Combined motor cannot be changed by the digital operator.

6

[Operations]

6. Operations ［Procedure prior to operation］

■ After wiring, test run will begin. Please do not connect the shaft of the linear motor with the machine.

● Confirm installation and wiring of the servo amplifier and linear motor.

[Confirmation of installation and wiring]

Procedure	Item	Contents
1	Installation	Referring to [Chapter 2. Installation], install the servo amplifier and the linear motor. Do not connect the shaft of the linear motor into the machine to keep the status of no load.
2	Wiring and connection	Referring to [Chapter 3. Wiring], perform wirings for the power supply, the linear motor, and the upper device. However, please do not connect CN1 with the servo amplifier after wiring has been done.
3	Power supply turning on	Please turn on the power supply. Please confirm the alarm code is not being displayed at a digital operator of the servo amplifier. When it is displayed, follow the instructions in [Chapter 8 Maintenance].

● Confirm the specifications and the combination of the servo amplifier and linear sensor.

[Confirmation and Change of specification]

Procedure	Item	Contents
4	Confirmation of servo amplifier specification	Use the AC servo system supporting tool R-Setup to confirm and set the specifications of the servo amplifier. ・Amplifier Capacity ・Control power supply input voltage ・Control power supply input type ・Main circuit power supply input voltage ・Main Power, Input Type ・Control mode ・~~Encoder selection for full-close control~~ ・Regenerative Resistor Selection
5	Confirmation of linear sensor specification	Use the AC servo system supporting tool R-Setup to confirm and set the specifications of the linear motor encoder. ・Motor Encoder Type ・Incremental encoder function selection ・Incremental Encoder, Resolution Setting ・~~Absolute encoder function selection~~ ~~・Absolute Encoder, Resolution Setting~~ ~~・Confirmation of external encoder specification~~
6	Confirmation of combined linear motor	At the time of shipment, the smallest linear motor is combined with the servo amplifier of each capacity. Confirm the linear motor model number and change the parameter for the one in use.
7	Power supply re-turning on	Turn off the power once and turn it on again. Parameter will have been changed by turning off the power supply. Without turning off the power, even if a parameter is changed here, the parameter change will not complete.
8	Reconfirmation	Please check again the specification changes of servo amplifier and servo encoder, and combination with linear motor. Many of the troubles at test run, such as linear motor not operating, are caused by mistakes in parameter setting.

6. Operations ［Procedure prior to operation］

● The movement of the servo amplifier and linear motor is confirmed by driving JOG. [JOG driving]

Procedure	Item	Contents
9	JOG driving	Do not connect the shaft of the linear motor into the machine to keep the status of no load, and perform JOG operation. Confirm that the linear motor moves forwards and backwards.

● Connect the upper device with CN1, and set the parameter of the I/O signal.[I/O signal confirmation]

Procedure	Item	Contents
10	Setting of generic I/O signal	The generic I/O signal (CN1) has been set to standard at the time of shipment. Set I/O signals necessary to the servo amplifier.
11	Confirmation of input signal	Confirm the I/O signal status using the monitoring function inside the servo amplifier. Please confirm that there are protecting functions such as emergency stop, over travel, and alarm reset.
12	The servo on signal is input.	The servo on signal is input, and the linear motor is excited. Please confirm the digital operator on the servo amplifier front is displaying a shape of “8".
13	Command input	Input the command matched with the control mode in use. Confirm the command input at the servo amplifier monitoring function. Confirm that command input and the rotation direction are correct.
14	Power supply shut off	After the servo on signal is turned off, turn the power supply off.

● Connect the linear motor shaft with the machine and confirm the operation.

[Confirmation of machine’s operation function]

Procedure	Item	Contents
15	Command input （low-speed）	Input the command (low-speed) matched with the control mode in use. Confirm the normal operation of moving direction, moving distance, emergency stop, over travel (F-OT・R-OT), etc.

● Input the operation pattern in use and start to operate the machine. [Operation]

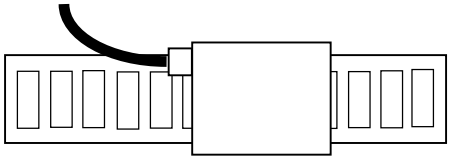
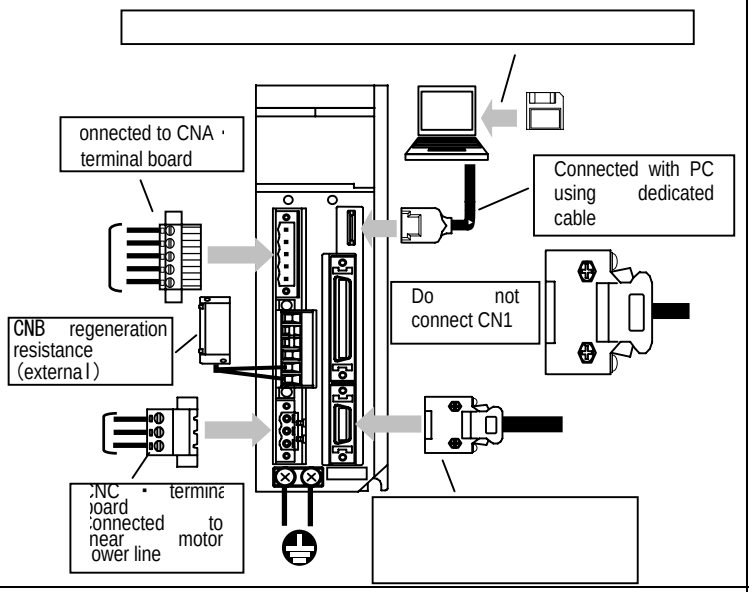
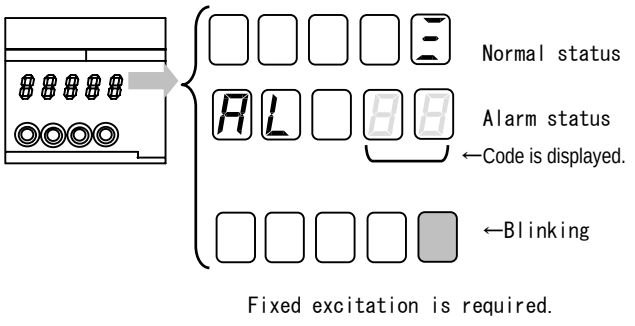
Procedure	Item	Contents
16	Operation	At the time of shipment, real time auto-tuning (automatic adjustment for servo gain and filter) has been set. There is no need for manual tuning if operations and characteristics are appropriate.

So far, overall procedure is shown.

More detailed procedure is described in the following pages.

6. Operations [Confirmation of installation and wiring]

■ [Step 1～Step 3] Confirmation of installation and wiring

Step	Item	Contents
1	Installation Install the servo amplifier and linear motor referring to [Chapter 2, Installation]. Do not connect the linear motor shaft to the machine to keep the status of no load.	
2	Wiring ・Connecting Wire the power supply, linear motor and upper device referring to [Chapter 3, Wiring]. Confirm the correct wiring. If the linear motor does not rotate or is in a state of runaway / overload in test run, wrong wiring may be the cause of it. Do not connect CN1 to servo amplifier after wiring.	
3	Turning on the power supply Turn on the power supply. Confirm that there is no alarm code displayed on the digital operator of servo amplifier. If there is one, follow the instructions in [[Chapter 8, Maintenance]. When a hall sensor is not used for detection of magnetic pole, the display is blinking, which requires fixed excitation.	

6. Operations [Confirmation and change of servo amplifier specifications]

■ [Step 4 ～Step 8] Confirming specifications and combination of servo amplifier ・linear sensor

<table>
<tr><th>Step</th><th>Item and Contents</th></tr>
<tr><td rowspan="6">4</td><td colspan="2">Confirming servo amplifier specifications　　System parameter settings
Use the AC servo system supporting tool R-Setup to confirm and set the specifications of the servo amplifier.
For how to use [the setup software R-Setup], refer to [R-SETUP　Instruction　Manual].</td></tr>
<tr><td>Item</td><td></td></tr>
<tr><td>Amplifier Capacity
Capacity of the servo amplifier.
Motor Motion
Structure of the motor that can be combined.
Control power input voltage
Voltage to be supplied to the control power.
Input type of control power supply
Input type of the control power supply.
Main Power, Input Voltage
Power voltage to be supplied to main circuit.</td><td>Setting cannot be changed.

Make sure that the contents being displayed are suitable for the machine specifications.</td></tr>
<tr><td>Main Power, Input Type
Selects the input type supplied to main circuit power. Change the set value to 01：_AC_Single-phase for single phase use.</td><td><table><tr><th>Set value</th><th>Contents</th></tr><tr><td>00：_AC_3-phase</td><td>Provide 3-phase AC Power Supply to the Main Power Supply</td></tr><tr><td>01：_AC_Single-phase</td><td>Provide Single-Phase AC Power Supply to the Main Power Supply</td></tr></table></td></tr>
<tr><td>Control Mode
Selects the control mode. Change the control mode suitable for upper device.</td><td><table><tr><th>Setting</th><th>Contents</th></tr><tr><td>00：_Torque</td><td>Torque Control Mode</td></tr><tr><td>01：_Velocity</td><td>Velocity Control Mode</td></tr><tr><td>02：_Position</td><td>Position Control Mode</td></tr><tr><td>03：_Velo－Torq</td><td>Velocity - Torque Switch Mode</td></tr><tr><td>04：_Posi－Torq</td><td>Position - Torque Switch Mode</td></tr><tr><td>05：_Posi－Velo</td><td>Position - Velocity Switch Mode</td></tr></table></td></tr>
<tr><td>Full flossed control encoder selection
No change is necessary for other than full closed system. Confirm that this is set to standard value, at the time of shipment, of 00：_Motor_encoder.</td><td>This is to be set when the system is full closed control.<table><tr><th>Setting</th><th>Contents</th></tr><tr><td>00：_Motor_encoder</td><td>Semi-Closed Control / Motor Encoder</td></tr><tr><td>~~01：_Ext－ENC~~</td><td>~~Fully Closed Control / Extenal Encoder~~</td></tr></table></td></tr>
<tr><td>Regenerative Resistor Selection
Selects the regeneration resistance to be connected.</td><td><table><tr><th>Setting</th><th>Contents</th></tr><tr><td>00：_Not_connect</td><td>Regenerative Resistor is not Connected</td></tr><tr><td>01：_Built-in_R</td><td>Use Built-In Regenerative Resistor</td></tr><tr><td>02：_External_R</td><td>Use External Regenerative Resistor</td></tr></table></td></tr>
</table>

6. Operations [Confirmation and change of servo motor encoder specifications]

Step	Item and Contents
5	**Confirming linear sensor specifications** **System parameter setting** Use the AC servo system supporting tool R-Setup to confirm and set the specifications of the linear sensor. For how to use [the setup software R-Setup], refer to [R-SETUP Instruction Manual].

Item

Motor Encoder Type

Selects the linear sensor type.

Setting value	Contents
00：_Incremental_ENC	Incremental Encoder
~~01：_Absolute_ENC~~	~~Absolute Encoder~~

Incremental Encoder, Function Setting

Selects detailed function of incremental encoder.

This is set when motor encoder type is “incremental encoder”.

Setting value	Contents
00：_Standard	Wiring-Save Incremental Encoder [Standard (4-Pairs)]
~~01：_7pairs_INC-E~~	~~Incremental Encoder with CS Signal. [7-Pairs]~~

Incremental Encoder, Resolution Setting

Sets the incremental encoder resolution.

Sets the pulse number of motor shaft one rotation.
500P/R ～ 65535P/R Setting unit＝Pulse/Rev.

~~Absolute Encoder, Function Setting~~

~~Selects detailed function of absolute encoder.~~

~~This is set when the motor encoder type is “absolute encoder”.~~

~~setting~~	~~Contents~~
~~04:PA035C-2.5MH_Manu~~	~~PA035, Asynchronous, 2.5Mbps, Half Duplex (Manual Setting)~~
~~05:PA035C-4MH_Manu~~	~~PA035, Asynchronous, 4Mbps, Half Duplex (Manual Setting)~~
~~06:RA062C-2.5MH_Manu~~	~~RA062, Asynchronous, 2.5Mbps, Half Duplex (Manual Setting)~~
~~07:RA062C-4MH_Manu~~	~~RA062, Asynchronous, 4Mbps, Half Duplex (Manual Setting)~~
~~80:RA062M-1MF~~	~~RA062, Manchester, 1Mbps, Full Duplex~~
~~81:RA062M-2MF~~	~~RA062, Manchester, 2Mbps, Full Duplex~~
~~84:ABS-E~~	~~ABS-E, 1Mbps (Absolute Encoder with Incremental Signal)~~

~~Absolute Encoder, Resolution Setting~~

~~Sets the absolute encoder resolution.~~

~~Sets the pulse number of motor shaft one rotation.~~

~~This is set when the motor encoder type is “absolute encoder”.~~

~~Setting~~	~~Contents~~	~~Setting~~	~~Contents~~
~~00:_2048-division~~	~~2048-division~~	~~06:_131072-division~~	~~131072-division~~
~~01:_4096-division~~	~~4096-division~~	~~07:_262144-division~~	~~262144-division~~
~~02:_8192-division~~	~~8192-division~~	~~08:_524288-division~~	~~524288-division~~
~~03:_16384-division~~	~~16384-division~~	~~09:_1048576-division~~	~~1048576-division~~
~~04:_32768-division~~	~~32768-division~~	~~0A:_2097152-division~~	~~2097152-division~~
~~05:_65536-division~~	~~65536-division~~		

~~External encoder resolution~~

~~Sets the resolution of external encoder in use.~~

~~This is set when the system is full-closed control or something.~~

~~Sets the pulse number converted to motor shaft one rotation.~~

~~500P/R ～ 65535P/R Setting unit＝Pulse/Rev.~~

6. Operations [Confirmation and change of servo motor encoder specifications]

Step	Item and Contents	
6	Confirming the combined linear motor　　System parameter setting Use the AC servo system supporting tool R-Setup to confirm and set the model type of combined linear motor. For how to use [the setup software R-Setup], refer to [R-SETUP　Instruction　Manual].	
	Item	
	Model number of combined motor Shows the combined motor model number.	Ex: DD075C2Y2C(0000-0064) ↑ Model number of combined motor is displayed. Combined motor can be changed at Motor parameter setting.

Step	Item and Contents
7	Turning ON the power again　　Power shut off→turn ON again Turn OFF the power of servo amplifier and turn it ON again. Turning OFF the power makes the parameter re-written. Without turning OFF the power, the parameter cannot be changed. Make sure to turn OFF→turn ON again.

Step	Item and Contents
8	Reconfirming the specifications　　Reconfirmation Reconfirm the specifications and combination of the changed servo amplifier, linear motor encoder and linear motor. Many of the troubles at test run, such as linear motor not operating, are caused by mistakes in parameter setting.

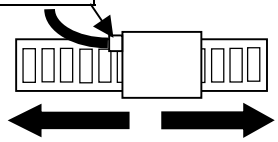
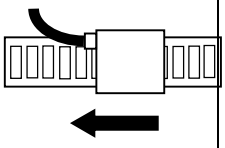
■ Fixed excitation

When a hall sensor is not used for detection of magnetic pole, CS position setting operation of the linear motor (fixed excitation operation) is necessary. There are 3 operation methods for fixed excitation.

1. Input signals from generic input signals CONT1 ～8.
2. Input signals from digital operator. (Refer to 4-12 Description of Test Run Mode, “Fixed excitation”.)
3. Input signals from the setup software, R-Setup.

Here, please use 2. Input signals from digital operator. Details of fixed excitation are shown in 6-13 “Fixed excitation sequence”. Make sure to refer to it and pay attention to some notes as well.

■ [Step 9] JOG operation

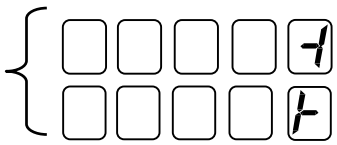
Step	Item	Contents		
9	JOG operation Do not connect the linear motor shaft to the machine to keep the status of no load for JOG operation. Confirm that the linear motor moves forward and backward.	Power line outlet is forward movement.  Forward Backward		
	How to use digital operator			
	Setting of [forward over travel] is to be changed. Standard setting at the time of shipment 0d → 00 Can also be changed from general parameter group 9 page 00.	**MODE**	Press the MODE key to display basic mode.	bA 00
		▲▼▶	Press the cursor/up/down key to display bA 07.	bA 07
		WR/▶	Press the WR/▶ key for more than 1 sec, and the set value is displayed.	0d
		▲▼▶	Press the cursor/up/down key to change 0d to 00. [Forward rotation over travel disabled.	00
		WR/▶	Press the WR/▶ key for more than 1 sec, and the values is written.	00
		MODE	Press the MODE key to display bA 07 again.	bA 07
	Setting of [reverse over travel] is to be changed. Standard setting at the time of shipment 0b → 00 Can also be changed from general parameter group 9 page 01.	▲▼▶	Press the cursor/up/down key to display bA 08.	bA 08
		WR/▶	Press the WR/▶ key for more than 1 sec, and the set value is displayed.	0b
		▲▼▶	Press the cursor/up/down key to change 0b to 00. [Reverse over travel disabled]	00
		WR/▶	Press the WR/▶ key for more than 1 sec, and the set value is written.	00
		MODE	Press the MODE key to terminate.	
	Forward / Reverse	Input key	Description	Display status
	 Motor positive direction / Motor reverse direction	**MODE**	Press the MODE key to display test run/adjustment mode.	Ad 0
		▲	Press the ▲ key to display "Ad 5" of speed JOG.	Ad 5
		WR/▶	Press the WR/▶ key for more than 1 sec, and confirmation display "−y__n−" will appear.	-y__n-
		▲	Press the ▲ key to display "rdy". Press the ▼ key to return to "Ad 5".	Rdy
		WR/▶	Press the WR/▶ key for more than 1 sec, and servo ON status.	8
		▲	Press the ▲ key, and the linear motor rotates forward (CCW) at 50min^{-1}.	r.u.n. .8
		▼	Press the ▼ key, and the linear motor rotates backward (CW) at 50min^{-1}.	r.u.n. .8
		MODE	Press the MODE key to terminate. Alarm "AL dF" is displayed.	AL dF
		Alarm "AL dF"is displayed, which is not an error.		

✍ The speed at JOG operation can be changed at general parameter group B page 00.

■[Step １０～１４] Connection of upper device with CN1, parameter setting for I/O signals

<table>
<tr><th>Step</th><th>Item</th><th>Contents</th></tr>
<tr><td rowspan="3">10</td><td>I/O signal setting</td><td>Settings for generic I/O signals (CN1) are standard ones set at the time of shipment.
Necessary I/O signals are set at the servo amplifier.</td></tr>
<tr><td>Generic input signal
Standard setting at the time of shipment</td><td>General parameter Group 9
<table>
<tr><th>Input signal</th><th>Name</th><th>Set value</th></tr>
<tr><td>CONT1</td><td>SERVO-ON Function</td><td>02:_CONT1_ON</td></tr>
<tr><td>CONT2</td><td>Velocity Loop Proportional Control, Switching Function</td><td>04:_CONT2_ON</td></tr>
<tr><td>CONT3</td><td>External trip input function</td><td>06:_CONT3_ON</td></tr>
<tr><td>CONT4</td><td>Deviation Clear Function</td><td>08:_CONT4_ON</td></tr>
<tr><td>CONT5</td><td>Negative Over-Travel Function</td><td>0B:_CONT5_OFF</td></tr>
<tr><td>CONT6</td><td>Positive Over-Travel Function</td><td>0D:_CONT6_OFF</td></tr>
<tr><td>CONT7</td><td>Torque Limit, Input Selection</td><td>0E:_CONT7_ON</td></tr>
<tr><td>CONT8</td><td>Alarm Reset Function</td><td>10:_CONT8_ON</td></tr>
</table>
✍ Generic input signals (CONT1 TO CONT8) shall be allocated to functions necessary to the device, referring to [Chapter 5, Parameter][Parameter setting value Ｇｒｏｕｐ９].</td></tr>
<tr><td>Generic output signal
Standard setting at the time of shipment</td><td>General parameter Group A
<table>
<tr><th>Page</th><th>Name</th><th>Standard set value</th></tr>
<tr><td>00</td><td>General Purpose Output 1</td><td>18:_INP_ON</td></tr>
<tr><td>01</td><td>General Purpose Output 2</td><td>0C:_TLC_ON</td></tr>
<tr><td>02</td><td>General Purpose Output 3</td><td>02:_S-RDY_ON</td></tr>
<tr><td>03</td><td>General Purpose Output 4</td><td>0A:_MBR_ON</td></tr>
<tr><td>04</td><td>General Purpose Output 5</td><td>33:_ALM5_OFF</td></tr>
<tr><td>05</td><td>General Purpose Output 6</td><td>35:_ALM6_OFF</td></tr>
<tr><td>06</td><td>General Purpose Output 7</td><td>37:_ALM7_OFF</td></tr>
<tr><td>07</td><td>General Purpose Output 8</td><td>39:_ALM_OFF</td></tr>
</table>
✍ Generic output signals (OUT1 TO OUT8) shall be allocated to functions necessary to the device, referring to [Chapter 5, Parameter][Parameter setting value Group A].</td></tr>
</table>

Step	Item	Contents
11	Confirmation of input signals	Input signal status is monitored by the monitoring function inside the servo amplifier. Confirm that there are protective functions such as emergency stop, over travel and alarm reset. ✍ Confirm that every I/O signal is properly functioning using generic input (CONT8 TO CONT1) monitor and generic output (OUT8 TO OUT1) monitor, referring to [Chapter 4, Digital operator][How to operate monitor mode].

Step	Item	Contents
12	Servo ON signal is input.	Servo ON signal is input and the linear motor is excited. Confirm that the digital operator on the servo amplifier front is drawing the character “8”. ✍ The display shown below indicates over travel status. When there is nothing wrong with the device, check again the above procedure 10 TO 11 and [Chapter 3, Wiring] [Generic input wiring example]. Over travel 

6. Operations [Confirmation of I/O signals／Confirmation of device operation]

<table>
<tr><th>Step</th><th>Item</th><th>Contents</th></tr>
<tr><td>13</td><td>Command input</td><td>
Input the command suitable for the control mode in use. Check that the rotation direction matches the command input. Confirm the command input using monitoring function inside the servo amplifier.

● When velocity controlled, torque controlled.
Monitor mode 0D
<table>
<tr><td>Analog velocity command ／
Analog torque command input voltage</td><td>Command voltage being input is displayed.</td></tr>
</table>
● When position controlled.
Monitor mode 0E
<table>
<tr><td>Position pulse monitor (Position command pulse input frequency)</td><td>Command pulse frequency being input is displayed.</td></tr>
</table>
✍ Many of the cases when monitor values do not change with command input are resulted from wrong wiring. Check the wiring again, referring to [Chapter3, Wiring] [Terminal layout] [Wiring example of input circuit].
</td></tr>
</table>

Step	Item	Contents
14	Power shut off	Turns OFF the servo ON signal, then turns OFF the power supply.

■ [Step 15] Connect the linear motor shaft with the machine and check the operation.

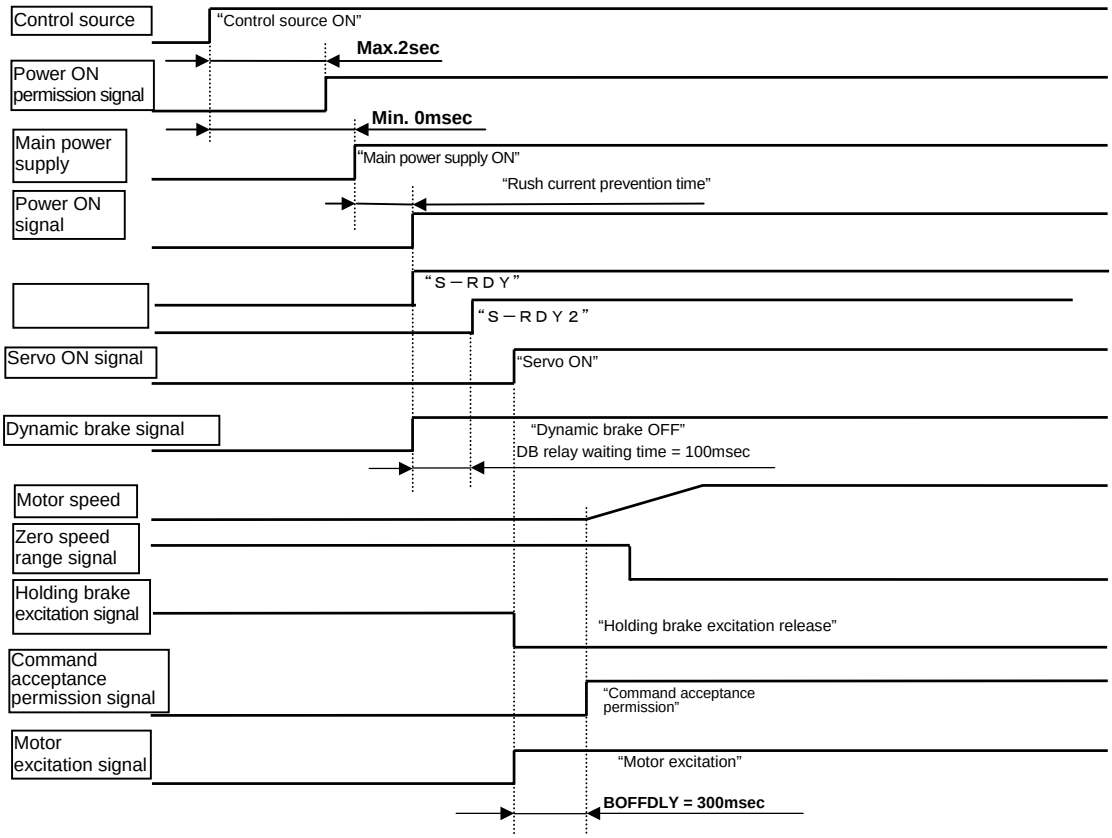
Step	Item	Contents
15	Command input （low speed）	Input the command (low speed) suitable for the control mode in use. Check the operation direction, distance, emergency stop and over travel (F-OT・R-OT) so that they are properly operating.

■ [Step 16] Input the command of the operation pattern in use and start the machine.

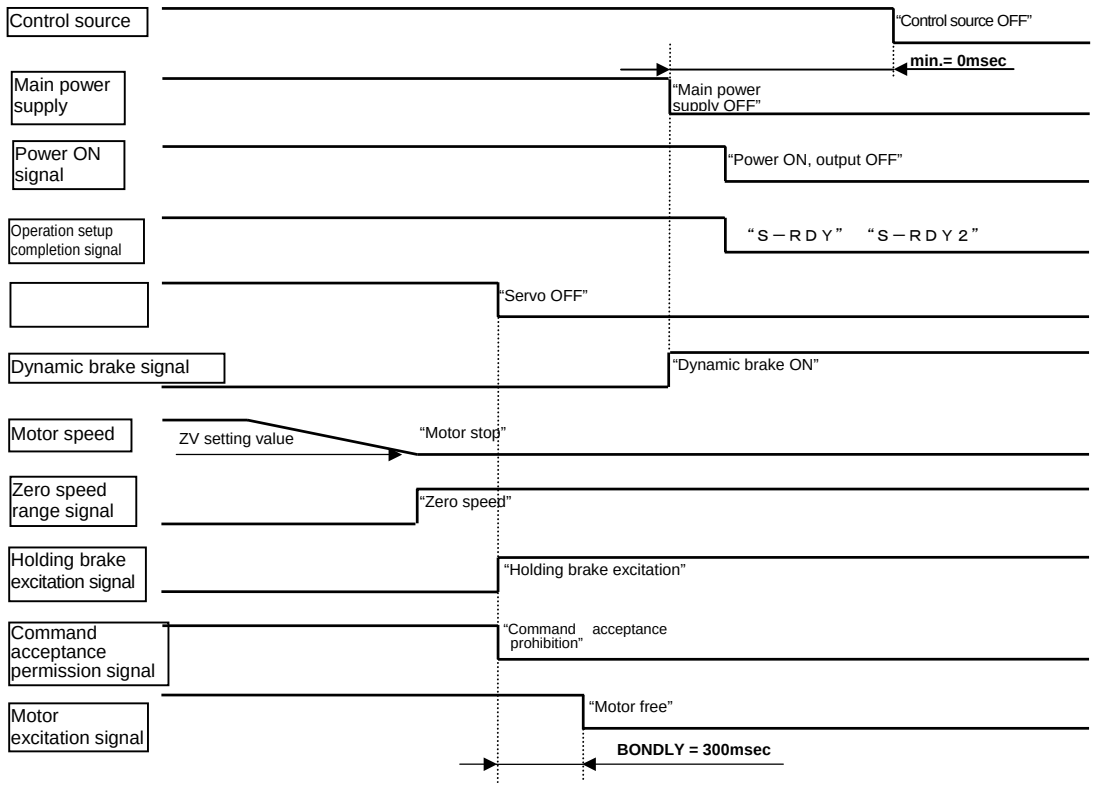
Step	Item	Contents
16	Operation	At the time of shipment, auto-tuning (auto-adjustment for servo gain and filter, etc.) has been set. If there is nothing wrong with operation, manual tuning is not necessary.

■ Operation sequence from power turn ON to power shut OFF at the standard shipment setting

● [Power ON → Servo ON]



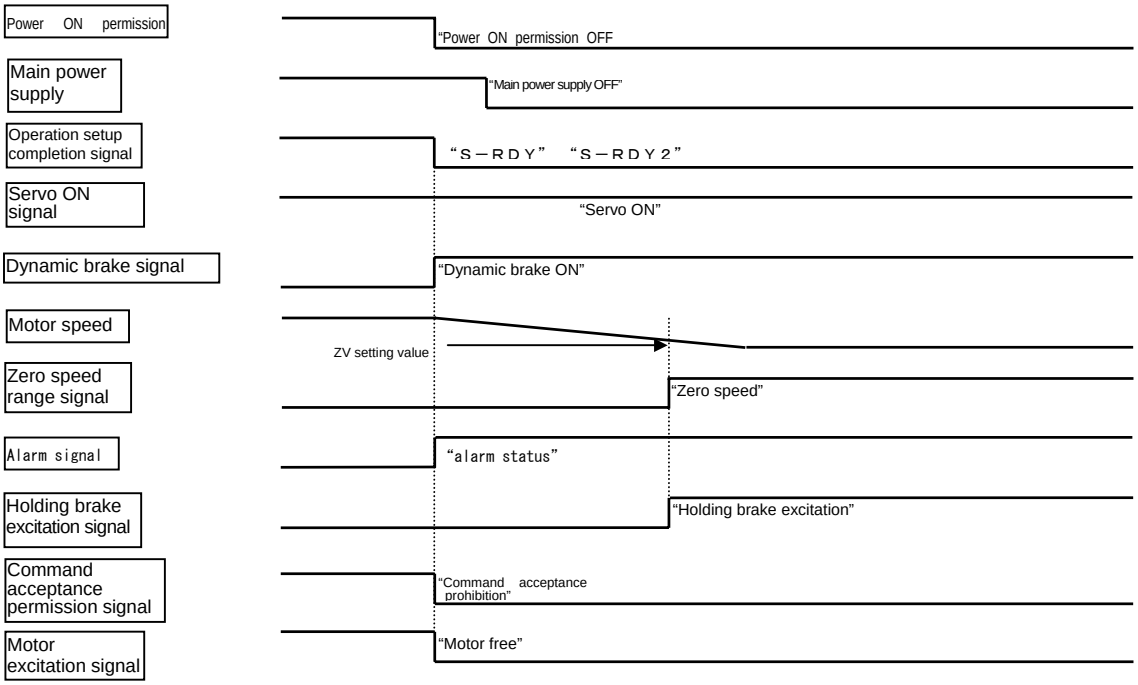
● [Servo OFF → Power OFF]



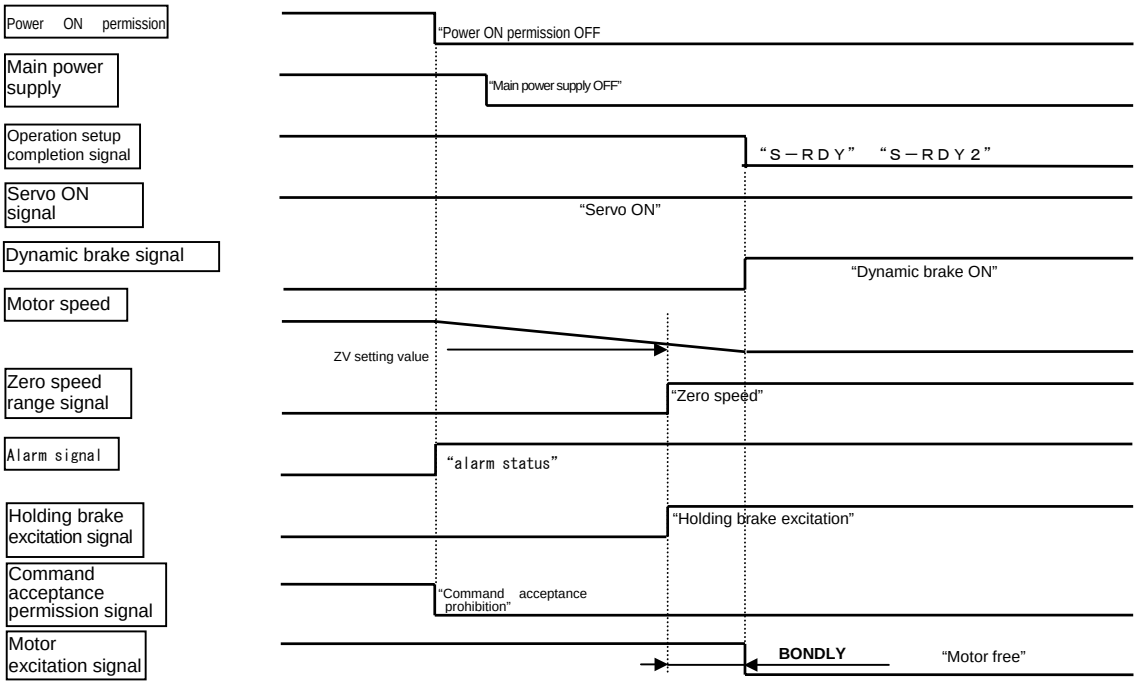
■ Alarm sequence

When an alarm rings, the linear motor is stopped by dynamic brake or servo brake. Which brake is used depends on the alarm. Refer to [Chapter 8, Maintenance] [Alarm list].

● Stop by dynamic brake at alarm



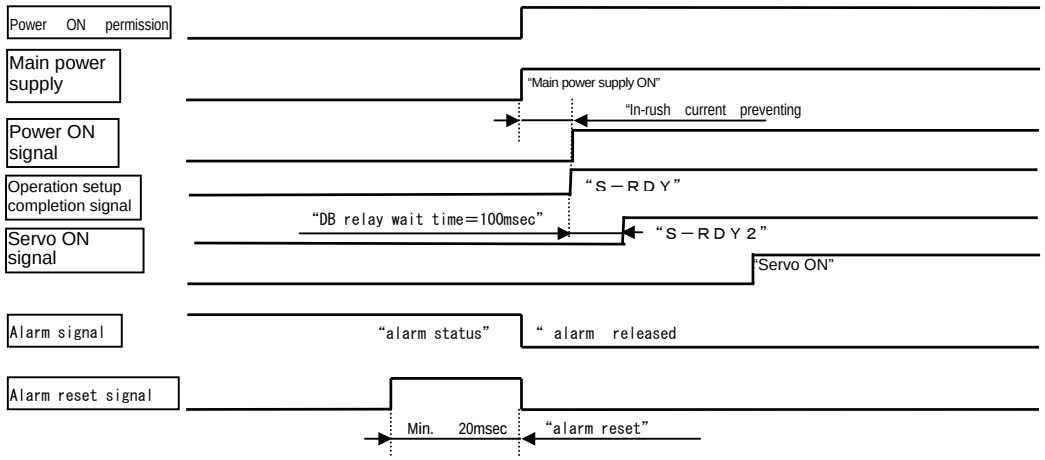
● Stop by servo brake at alarm



Install a protective circuit referring to [Chapter 3, Wiring] [Wiring example of high voltage circuit, protective circuit]. The above sequence is the one when protective circuit is installed.

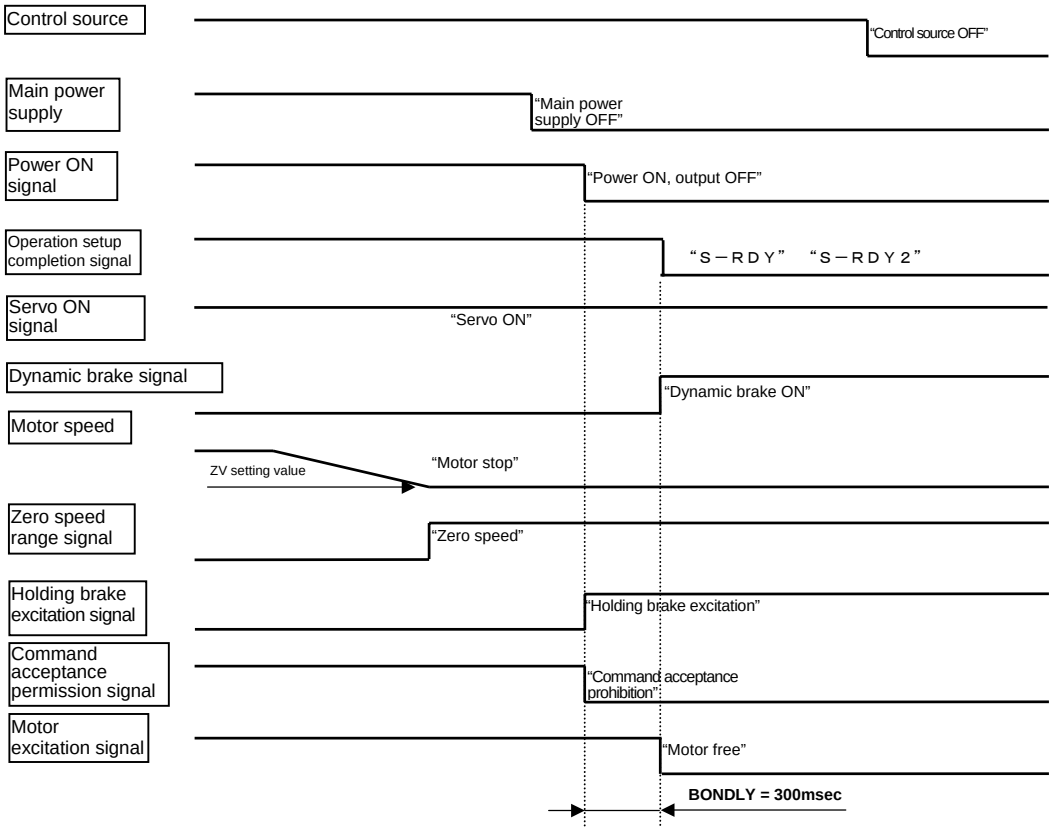
■ Sequence at alarm reset

Alarms can be reset by inputting alarm reset signal from generic input signal.

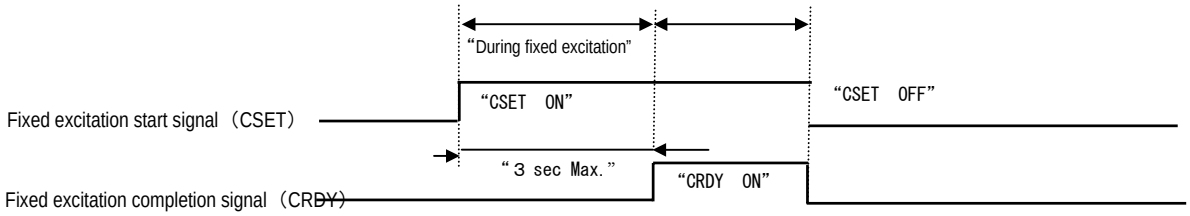


✍ Some alarms cannot be reset unless the power is reset (control power is turned OFF and ON again) or encoder is cleared. Refer to [Chapter 8, Maintenance] [Alarm list].

■ Sequence when power is turned OFF during operation (During servo ON)



■ Sequence for fixed excitation



- When the fixed excitation start signal (CSET) is input after the main power is turned on, a certain amount of current flows to each phase by turns and the linear motor moves to the CS 0 degree point. (Moves by a maximum of approx. ±1/4 pitch between the same magnetic pole.)
- After completion of fixed excitation, the fixed excitation completion signal (CRDY) is output.

✍ Fixed excitation can always be operated during servo ready status. Therefore, take care not to input fixed excitation start signal (CSET) again by mistake, otherwise, fixed excitation operation will start again.

■ How to operate fixed excitation

- There are 3 operation methods for fixed excitation.
  - ・Input signal from generic input signal.
  - ・Input signal from digital operator.
  - ・Input signal form the setup software R-Setup.
- Operation by signal input from generic input signal.
  1) Turn ON the main power source. 3 horizontal lines on the 7 segment LED (on the furthest right) of the servo amplifier starts blinking.
  2) Input fixed excitation start signal (ＣＳＥＴ).
     - Parameter group 9・Page １８：Fixed excitation function (ＣＳＥＴ)
  3) During fixed excitation, upper square of the 7 segment LED (furthest right) rotates and then lower one rotates, and 3 horizontal lines will appear (no blinking). When fixed excitation completes, ＣＲＤＹ output signal is output from generic output signal. Generic output signals can be selected by parameters. If motor stop has been confirmed after completion of fixed excitation, turn OFF the fixed excitation start signal (ＣＳＥＴ). At this position, set CS.

- Fixed excitation current command value of fixed excitation.
  - ・The set value of fixed excitation current command shall the one that will generate at least 5 times as much thrust as the static friction.
    Parameter group ８・Page ３８：Fixed excitation current command (ＣＴＣＬＭ)：２５% As standard.

✍ Note that the motor moves by fixed excitation operation. Take care not to come near the motor since the operation repeats 3 times.

✍ If the friction exceeds the thrust generated by current, the motor cannot move to the correct position. If the motor turns to Servo ON in this status, it may run away.

✍ In fixed excitation operation, the motor moves by a maximum of approx. ±1/4 pitch between the same magnetic pole. Note that fixed excitation cannot be operated from the stroke end.

7

[Adjustment · Functions]

■ Structure of tuning ≪General parameter Group 0≫

At “parameter Group 0 ”, tuning structure of the R series servo amplifier is as follows.

≪General parameter Group 0 ≫

Page	Name
00	Tuning Mode
01	Automatic Tuning Characteristic
02	Automatic Tuning Response
03	Automatic Tuning, Automatic Parameter Saving

00:_AutoTun	Automatic Tuning
01:_AutoTun_JRAT-Fix	Automatic Tuning (JRAT Fixed)
02:_ManualTun	Manual Tuning

00:_Positioning1	Positioning Control 1
01:_Positioning2	Positioning Control 2
02:_Positioning3	Positioning Control 3
03:_Trajectory1	Trajectory Control 1
04:_Trajectory2	Trajectory Control 2 (KP Fixed)

1～30	Automatic Tuning Response

00:_Auto_Saving	Saves Parameter Automatically in JRAT1.
01:_No_Saving	Automatic Saving is Invalidity

● Tuning Mode [page 00]

00:_AutoTun auto- tuning

The servo amplifier estimates the load inertia moment ratio of the machine and equipment at real time and automatically tunes the servo gain so that it will become the best one. The parameters for the servo amplifier to automatically tune vary depending on the selected auto-tuning characteristics.

※The servo amplifier estimates the load inertia moment ratio at the time of acceleration/deceleration. Therefore, for operations with only excessively low acceleration/deceleration time constant or with only low force with low velocity, this mode cannot be used. Also, operations with large disturbance force or with large mechanical clearance, this mode cannot be used, either.

01:_AutoTun_JRAT-Fix Usage at Auto-tuning [JRAT manual setting].

01:_AutoTun_JRAT-Fix Automatic Tuning (JRAT Fixed)

Based on the load inertia moment ratio（JRAT1） which was set, the servo amplifier automatically tunes and makes the servo gain the best one. The parameters for the servo amplifier to automatically tune vary depending on the selected auto-tuning characteristics.

02:_ManualTun Manual Tuning

This is used in order for adjusting the servo gain to the machine and equipment to ensure the maximum response, and when characteristics in auto-tuning are insufficient.

● Automatic Tuning Characteristic [page 01]

Characteristics adjusted to machines and equipment are selected when Automatic Tuning and Automatic Tuning (JRAT Fixed) are used.

When Manual Tuning is used, this does not function.

● Automatic Tuning Response [page 02]

Set this when Automatic Tuning and Automatic Tuning (JRAT Fixed) are used. The larger set value makes the response higher. Set this suitable for the equipment rigidity.

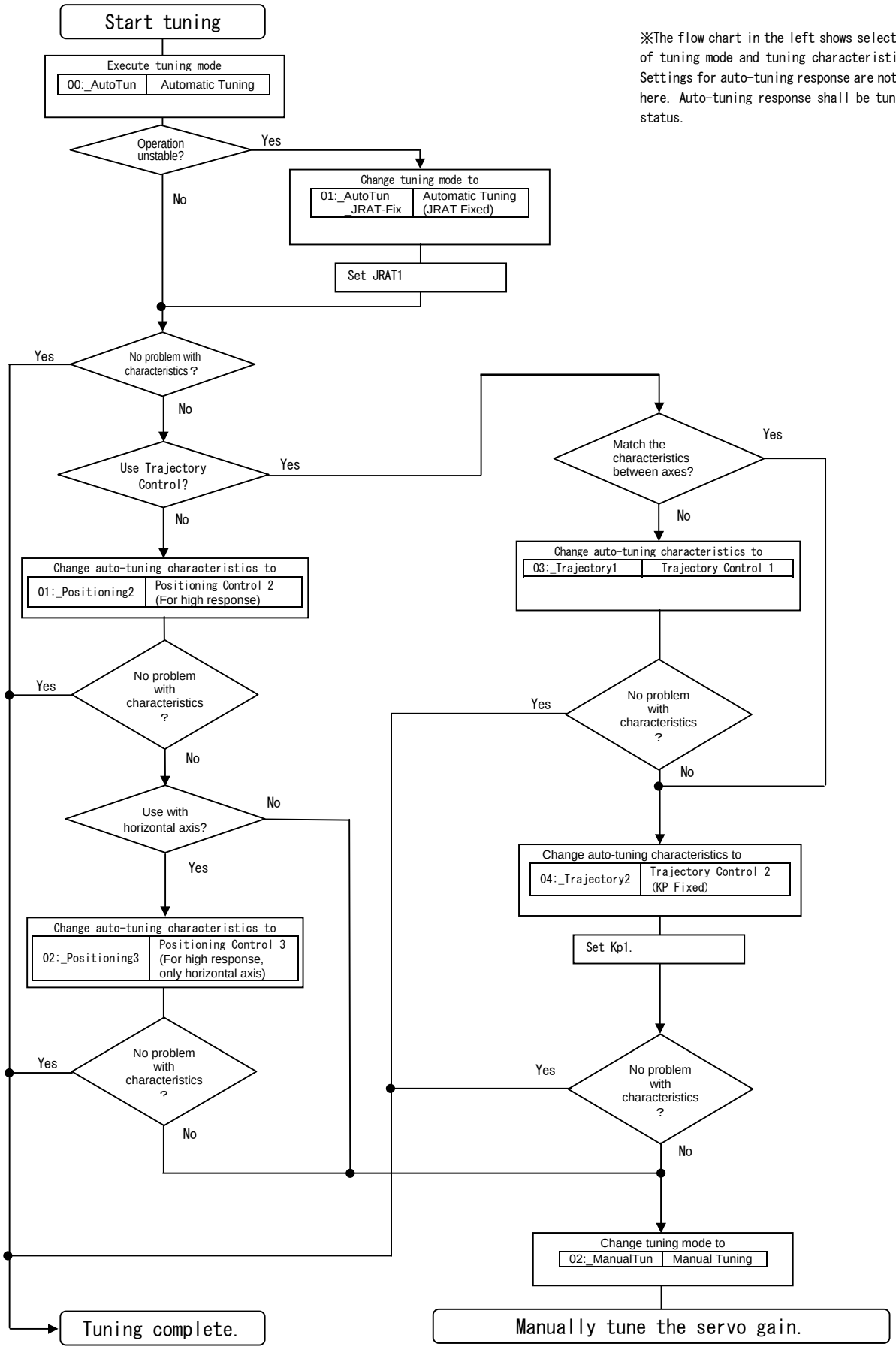
When Manual Tuning is used, this does not function.

● Automatic Tuning, Automatic Parameter Saving [load inertia moment ratio] [page ０３]

The “load inertia moment ratio” obtained from auto-tuning is automatically saved in parameter ＪＲＡＴ１ at every 2 hours. The set value is enabled when Automatic Tuning is used.

When Automatic Tuning (JRAT Fixed) and Manual Tuning are used, this does not function.

■ Tuning method selecting procedure



※The flow chart in the left shows selecting method of tuning mode and tuning characteristics.
Settings for auto-tuning response are not indicated here. Auto-tuning response shall be tuned at each status.

■ Monitoring servo gain adjustment parameter

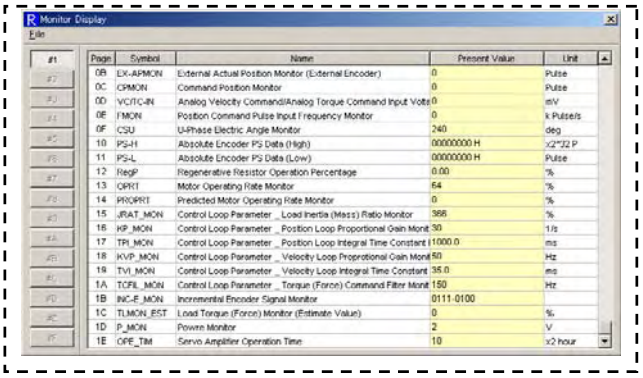
The following parameters can be monitored when auto-tuning is used.

● Digital operator

Monitor mode	Name
Page 15	Load Inertia Ratio Monitor
Page 16	Position Loop Proportional Gain Monitor
Page 18	Velocity Loop Proprotional Gain Monitor
Page 19	Velocity Loop Integral Time Constant Monitor
Page 1A	Force Command Filter Monitor

For how to operate these,
refer to “Chapter 4, Digital operator”.

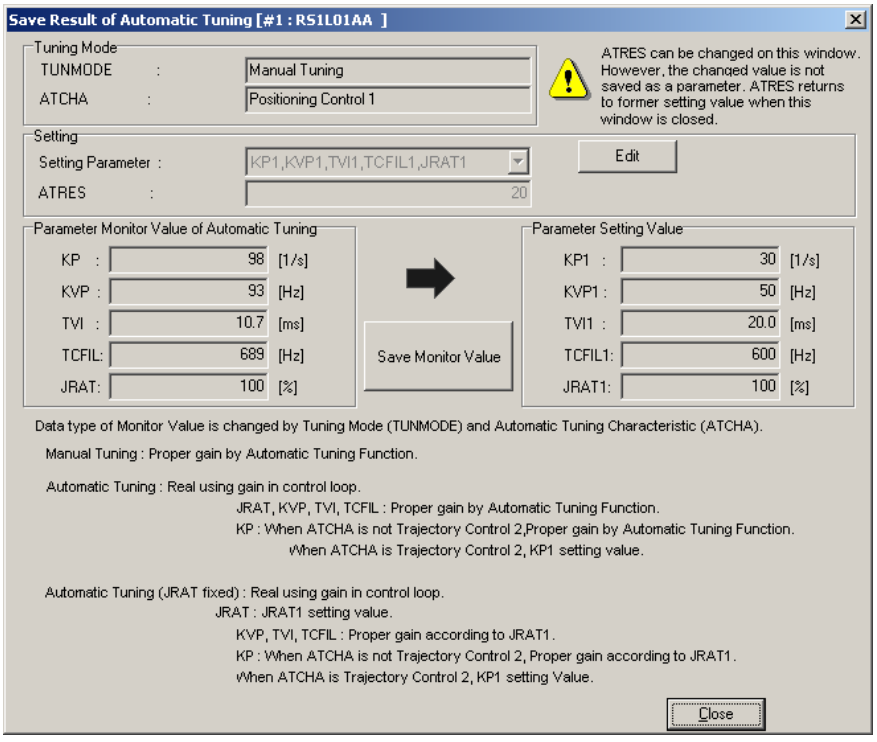
● R－S E T U P



For how to operate these, refer to “R-SETUP Instruction Manual”.

■ Using auto-tuning result at manual tuning.

At manual tuning, auto-tuning result is saved as a batch or by selection using R－S E T U P, and can be used as controlling parameter.

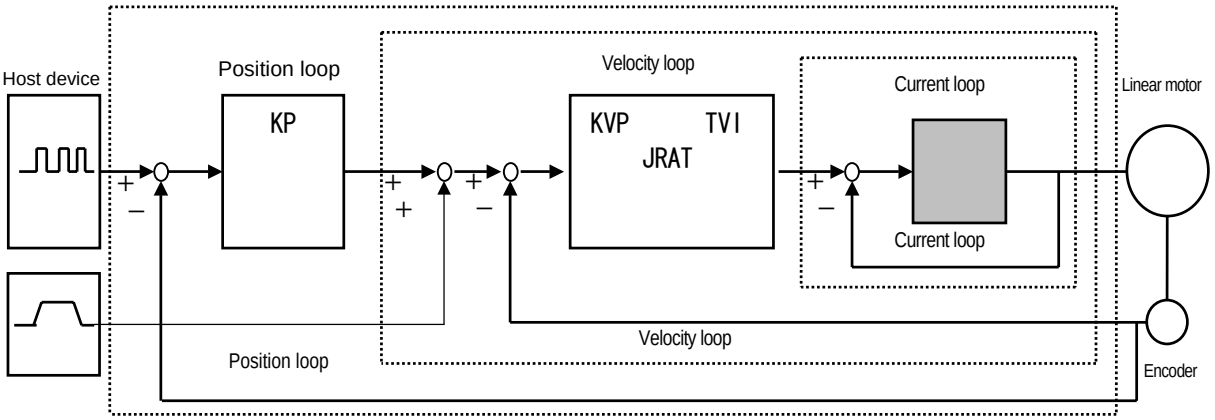


For how to operate these, refer to “ R-SETUP Instruction Manual”.

Note） In the setting of TUNMODE=02:_ManualTun, parameter setting value is used in the control loop. When auto-tuning result saving is executed, the gain parameter being used will change (except during gain switch over). Therefore, the motor operation may change suddenly. Execute auto-tuning result saving while servo OFF or motor stoppage.

■ Servo system structure

Servo system consists of 3 subsystems; the position loop, the velocity loop and the current loop. High response is required for the internal loops. If this structure is compromised, it could result in instability, low response, vibration or oscillation.



The response of the current loop is ensured internally in the servo amplifier, there is no need for the user to make additional adjustments.

■ Servo adjustment parameters

Position Command Filter [PCFIL]

When the position command resolution is low, set this parameter to suppress the ripples contained in the position command. The larger value of this will make the ripple suppressing effect greater, however, delay will be greater.

※ When higher tracking control position compensation gain is set to other than 0%, this parameter is automatically set.

Position Loop Proportional Gain [KP]

Set this equivalent to $KP_{[1/S]}=KVP_{[Hz]}/4・2\pi$.

Higher Tracking Control, Position Compensation Gain [TRCPGN]

When tracking effect needs to be improved under high resolution of position command, increase this parameter after adjustment of higher tracking control velocity compensation gain.

Feed Forward Gain [FFGN]

Tracking effect of position command can be improved by increasing this gain.

Under positioning control, set this to approximately ３０～４０%.

※When higher tracking control position compensation gain is set to other than 0%, this parameter is automatically set.

Feed Forward Filter [FFFIL]

When position command resolution is low, set this parameter to suppress ripples.

Velocity Command Filter [VCFIL]

Under velocity control, when there is a big noise component contained in velocity command, set this parameter to suppress the noise.

Velocity Loop Proportional Gain [KVP]

Set this as high as possible within such a stable operation range as not to cause vibration or oscillation of the machine. If JRAT is accurately set, the set value of KVP becomes the velocity loop response zone.

Velocity Loop Integral Time Constant [TVI]

Set this equivalent to $TVI_{[ms]}=1000/(KVP_{[Hz]})$.

Load Inertia Ratio [JRAT]

Set the value calculated as shown below.

$$JRAT = \frac{\text{Motor axis converted load inertia moment 【JL】}}{\text{Motor inertia moment 【JM】}} \times 100\%$$

Higher Tracking Control, Velocity Compensation Gain [TRCVGN]

Tracking effect can be improved by increasing compensation gain.
Adjust this so as to shorten the positioning setting time.
※Set the value of JRAT properly to use this function.

Force Command Filter 1 [TCFIL]

When rigidity of the mechanical device is high, set this value high and the velocity loop proportional gain can be set to high. When rigidity of the mechanical device is low, set this value low and resonance in high frequency zone and abnormal sound can be suppressed. For normal usage, set this below １２００Hz.

■ Adjustment method of vibration suppressing control

Set vibration suppressing frequency to suppress the low frequency vibration at the tip or the body of the machine. Vibration suppressing frequency is obtained by executing auto-tuning of vibration suppressing frequency or by calculating vibration frequency of vibrating point at positioning and its reciprocal. When vibration does not stop with the vibration suppressing control, there is a possibility that the gain for control system may be too high. In this case, lower the control system gain. Also, when used together with high tracking control velocity compensation gain, vibration suppressing effect may be greater.

※Vibration suppressing control function can be used together with auto-tuning.

■ Adjustment method of notch filter

Set the force command notch filter to suppress high frequency resonance resulted from coupling and rigidity of the device mechanism. Notch filter center frequency can be obtained by executing auto-notch filter tuning or by system analysis.

※Force command notch filter function can be used together with auto-tuning.

※When resonance of the device mechanism does not stop even after this parameter is set, there may be two or more resonance points. In this case, insert notch filters B, C and D to suppress each of them. If not yet suppressed, there is a possibility that auto-tuning response or control gain is too high. If so, lower the auto-tuning response or control gain.

■ Adjustment method of disturbance observer

Set the disturbance observer to suppress the disturbance applied to the motor.
At first, use the low frequency observer characteristics. If not suppressed by that, use that for medium frequency. Gradually increase the observer compensation gain.
The higher the observer compensation gain becomes, the more the disturbance suppressing characteristics will be improved.

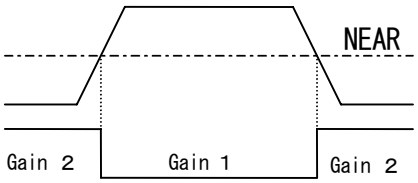
However, if it is excessively high, oscillation may result. Use this within the range not causing oscillation.

※Disturbance observer cannot be used with auto-tuning.

■ Adjustment method of gain switch over

When tracking effect is insufficient even if basic parameters of high tracking control position compensation gain and high tracking control velocity compensation gain are set, set the gain switch over so that tracking effect can be improved.

(Example)Gain is increased near positioning compete.



The value of gain 2 shall be set to 1.2 times the value of gain 1.

※Gain switch over function cannot be used with auto-tuning.

■ Adjustment method of high setting control

When tracking effect is insufficient even after gain switch over, set the high setting control parameter and in-position setting characteristics can be improved. When position command resolution is low, set the value of command velocity calculation low pass filter low. Set the acceleration compensation so that the position deviation near acceleration conclusion becomes small. Set the deceleration compensation so that the position deviation near deceleration conclusion (positioning complete) becomes small.

※This function cannot be used together with auto-tuning.

■ How to make R series control characteristics equal to Q series standard characteristics

Parameter change as follows can make the status equal to Q series standard characteristics.

Group	Page		Before change	After change
0	00	Tuning Mode	00:_AutoTun	02:ManualTun
1	16	Higher Tracking Control, Velocity Compensation Gain	0%	100%

■ Functions of Group 8

[Group 8] 00

Command Input Polarity [CMDPOL] Velocity control mode Position control mode Force control mode

The rotation direction of the linear motor can be reversed without modifying the input command wiring or the linear motor wiring.

Input command	Command polarity	Rotation direction	Selected value
Position command	+	Forward	00:_PC+_VC+_TC+
Velocity command	+	Forward	
Force command	+	Forward	

Input command	Command polarity	Rotation direction	Selected value
Position command	+	Reverse	04:_PC-_VC+_TC+
Velocity command	+	Forward	
Force command	+	Forward	

Input command	Command polarity	Rotation direction	Selected value
Position command	+	Forward	01:_PC+_VC+_TC-
Velocity command	+	Forward	
Force command	+	Reverse	

Input command	Command polarity	Rotation direction	Selected value
Position command	+	Reverse	05:_PC-_VC+_TC-
Velocity command	+	Forward	
Force command	+	Reverse	

Input command	Command polarity	Rotation direction	Selected value
Position command	+	Forward	02:_PC+_VC-_TC+
Velocity command	+	Reverse	
Force command	+	Forward	

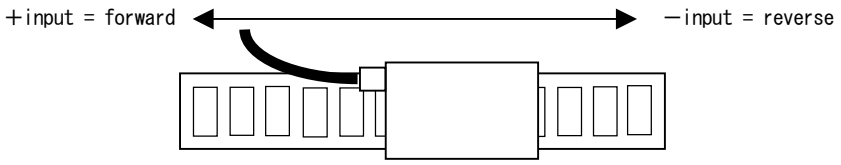
Input command	Command polarity	Rotation direction	Selected value
Position command	+	Reverse	06:_PC-_VC-_TC+
Velocity command	+	Reverse	
Force command	+	Forward	

Input command	Command polarity	Rotation direction	Selected value
Position command	+	Forward	03:_PC+_VC-_TC-
Velocity command	+	Reverse	
Force command	+	Reverse	

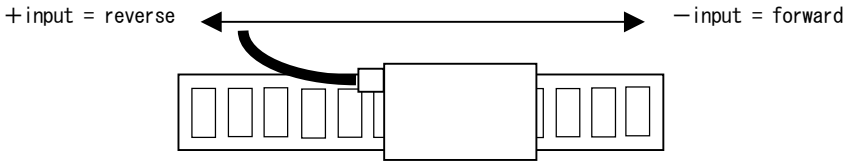
Input command	Command polarity	Rotation direction	Selected value
Position command	+	Reverse	07:_PC-_VC-_TC-
Velocity command	+	Reverse	
Force command	+	Reverse	

∗Using the initial factory settings, the linear motor moves forward with a positive (+) input, and reversely with a negative (-) input.

Standard command input polarity setting



Modified command input polarity setting



[Group 8] 11

Position Command Pulse, Form Selection [PCPTYP] Position control mode

3 types of location command pulse can be selected; make this selection per the specifications of the host unit.

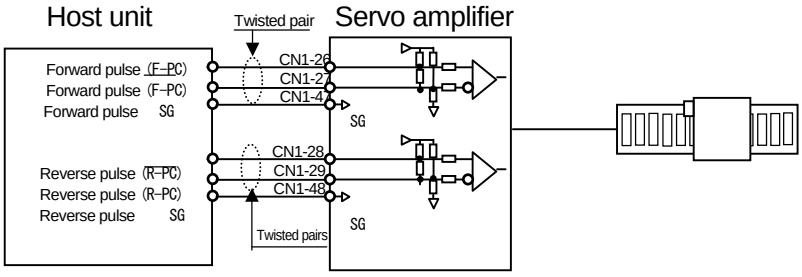
Selected value	Contents
00:_F-PC_R-PC	Positive Move Pulse + Negative Move Pulse
01:_2PhasePulse	Two-Phase Pulse Train of 90 Degrees Phase Difference
02:_CODE_PC	Code + Pulse Train

The location command pulse input command is the input command used for location control. Connect to CN1 location command pulse input.

Forward	Reverse
Positive Move Pulse (F-PC) : CN1-26	Negative Move Pulse (R-PC) : CN1-28
Positive Move Pulse ($\overline{\text{F-PC}}$) : CN1-27	Negative Move Pulse ($\overline{\text{R-PC}}$) : CN1-29
Positive Move Pulse SG : CN1-47	Negative Move Pulse SG : CN1-48

There are 2 output types for the host unit, the “Line driver output” and the “Open collector output”.

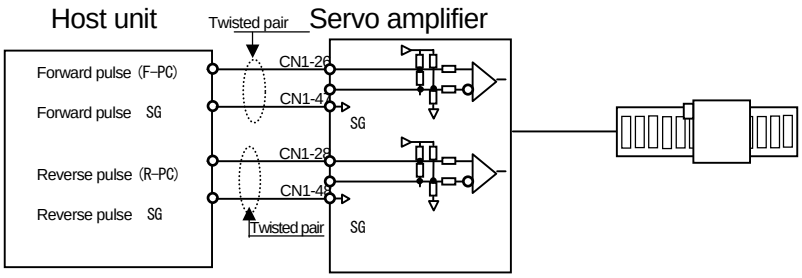
Using line driver output



* Always connect SG.

* Line Receiver : HD26C32 or equivalent

Using open collector output



* Always connect SG.
* Line Receiver : HD26C32 or equivalent

[Group 8] 12

Position Command Pulse, Count Polarity [PCPPOL] Position control mode

Position command pulse count polarity can be selected form the following 4 types. Select the one suitable for the host unit.

Selected value	Contents
00:_Type1	F-PC/ Count at the Rising Edge: R-PC/ Count at the Rising Edge
01:_Type2	F-PC/ Count at the Falling Edge: R-PC/ Count at the Rising Edge
02:_Type3	F-PC/ Count at the Rising Edge: R-PC/ Count at the Falling Edge
03:_Type4	F-PC/ Count at the Falling Edge: R-PC/ Count at the Falling Edge

[Group 8] 13

Position Command Pulse, Digital Filter [PCPFIL] Position control mode

When the time for minimum pulse width at position command input maximum frequency is less than the digital filter set value, alarm “AL D2” will be issued. Set the smaller value for digital filter than the time of minimum pulse width at the time of position command input maximum frequency. Select the position command pulse digital filter setting from the followings according to the command pulse type of the unit in use.

Forward pulse string ＋ Reverse pulse string

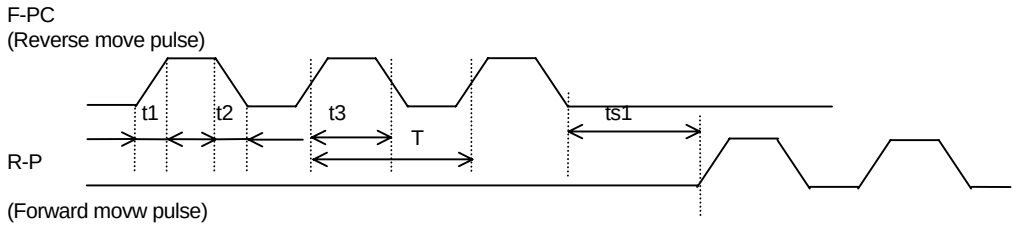
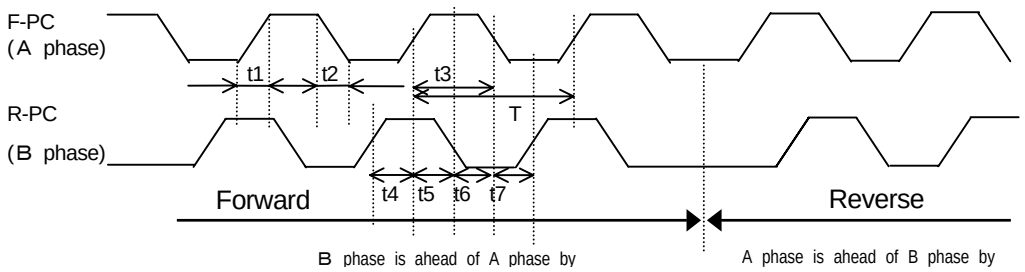
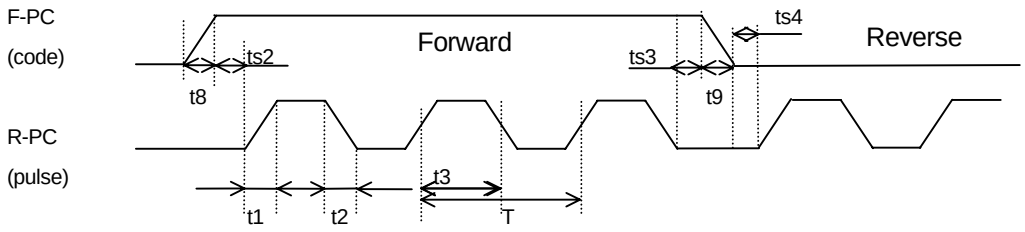
Selected value	Minimum pulse width [t]	Position command input maximum frequency[f]
00	t ＞ 834 nsec	f ＜ 599 Kpps
01	t ＞ 250 nsec	f ＜ 2.0 Mpps
02	t ＞ 500 nsec	f ＜ 1.0 Mpps
03	t ＞ 1.8 μsec	f ＜ 277 Kpps
04	t ＞ 3.6 μsec	f ＜ 138 Kpps
05	t ＞ 7.2 μsec	f ＜ 69 Kpps
06	t ＞ 125 nsec	f ＜ 4 Mpps
07	t ＞ 83.4 nsec	f ＜ 5.9 Mpps

90° phase difference 2 phase pulse

Selected value	A phase・B phase Minimum edge interval [t]	Position command input maximum frequency[f]
00	t ＞ 834 nsec	f ＜ 599 Kpps
01	t ＞ 250 nsec	f ＜ 2.0 Mpps
02	t ＞ 500 nsec	f ＜ 1.0 Mpps
03	t ＞ 1.8 μsec	f ＜ 277 Kpps
04	t ＞ 3.6 μsec	f ＜ 138 Kpps
05	t ＞ 7.2 μsec	f ＜ 69 Kpps
06	t ＞ 164 nsec	f ＜ 1.5 Mpps
07	t ＞ 164 nsec	f ＜ 1.5 Mpps

Code ＋ pulse string

Selected value	Minimum pulse width [t]	Position command input maximum frequency[f]
00	t ＞ 834 nsec	f ＜ 599 Kpps
01	t ＞ 250 nsec	f ＜ 2.0 Mpps
02	t ＞ 500 nsec	f ＜ 1.0 Mpps
03	t ＞ 1.8 μsec	f ＜ 277 Kpps
04	t ＞ 3.6 μsec	f ＜ 138 Kpps
05	t ＞ 7.2 μsec	f ＜ 69 Kpps
06	t ＞ 125 nsec	f ＜ 4 Mpps
07	t ＞ 83.4 nsec	f ＜ 5.9 Mpps

Command pulse	Command pulse timing
Positive Move Pulse + Negative Move Pulse	
Two-Phase Pulse Train of 90 Degrees Phase Difference	
Code + Pulse Train	

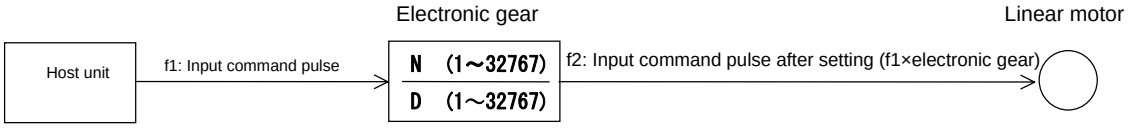
	Positive Move Pulse + Negative Move Pulse	Two-Phase Pulse Train of 90 Degrees Phase Difference	Code + Pulse Train
t1・t8	≦0.1 μs	≦0.1 μs	≦0.1 μs
t2・t9	≦0.1 μs	≦0.1 μs	≦0.1 μs
ts1・ts2 ts3・ts4	＞T	＞T	＞T
t4・t5・t6・t7	——	＞250ns	——
(t3/T)x100	50%	50%	50%

[Group 8]15,16

Electric Gear Ratio * [GER*] — Position control mode

This function allows a distance setting on the linear motor in reference to the location command pulse from the unit.

Setting range	Unit	Standard set value
1/32767～32767/1	—	1/1



Electronic gear setting range: $\frac{1}{32767} \leqq \frac{N}{D} \leqq \frac{32767}{1}$

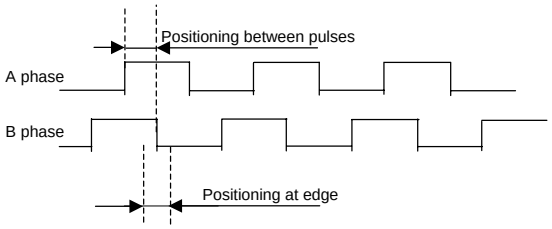
Refer to “Materials; Electronic Gear”.

[Group 8] 17

Positioning Method [EDGEPOS] — Position control mode

The location of positioning stop is selected; between encoder pulses or at edge.

Selected value	Contents
00:_Pulse_Interval	Specify Pulse Interval
01:_Pulse_Edge	Specify Pulse Edge

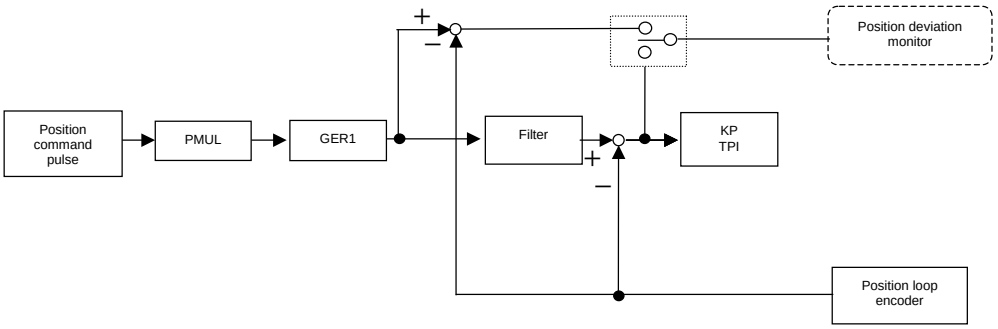


[Group 8] 18

Inposition / Position Deviation Monitor [PDEVMON] — Position control mode

Positioning complete signal when the position control mode is used, and position command used for outputting position deviation monitor can be selected from before or after the position command filter passes.

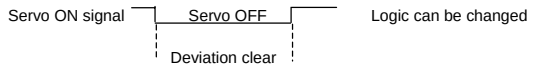
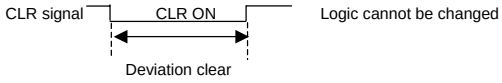
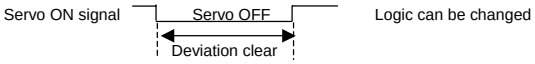
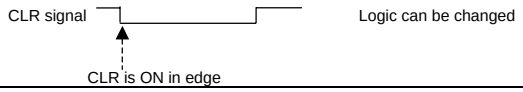
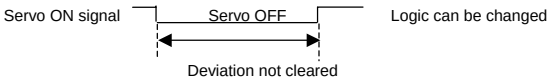
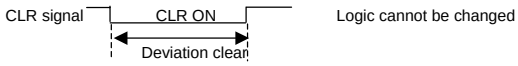
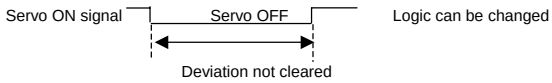
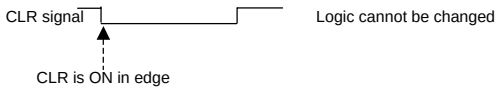
Selected value	Contents
00:_After_Filter	Compare "Position Command Value After Filter Passes by" with "Feedback Value"
01:_Before_Filter	Compare "Position Command Value Before Filter Passes by" with "Feedback Value"



[Group 8] 19

Deviation Clear Selection [CLR] Position control mode

This function is used for changing the location deviation counter in the servo amplifier from the host unit to zero.

Selection		Description
0H	When SERVO-OFF/ Clear Deviation : Deviation Clear Input/ Level Detection	・Deviation is always cleared when servo is off.  ・Deviation is always cleared when deviation clear input is ON. 
1H	When SERVO-OFF/ Clear Deviation : Deviation Clear Input/ Edge Detection	・Deviation is always cleared when servo is off.  ・Deviation is cleared in the edge when deviation clear input becomes OFF/ON. 
2H	When SERVO-OFF/ Not Clear Deviation : Deviation Clear Input/ Level Detection	・Deviation is not cleared when servo is OFF. ・The motor may start suddenly after servo is turned ON with location deviation detected.  ・Deviation is cleared in the edge when deviation clear input becomes OFF/ON. 
3H	When SERVO-OFF/ Not Clear Deviation : Deviation Clear Input/ Edge Detection	・Deviation is not cleared when servo is OFF. ・The motor may start suddenly after servo is turned ON with location deviation detected.  ・Deviation is cleared in the edge when deviation clear input becomes OFF/ON. 

Select the conditions for enabling deviation clear.

Parameter Group9 page04	CLR ：Deviation Clear Function

[Group 8] 20 to 22

Preset Velocity Command1 to 3 [VC*] Velocity control mode

The linear motor can be controlled using Preset Velocity Command. Preset Velocity Command settings have 3 ways. Preset Velocity Command and rotation direction can be selected via conditions of generic input CONT1 to CONT8.

1. Set the Preset Velocity Command value.

Parameter Group8Page20	VC1: Preset Velocity Command 1	0 to 32767mm/s
Parameter Group8Page21	VC2: Preset Velocity Command 2	0 to 32767 mm/s
Parameter Group8Page22	VC3: Preset Velocity Command 3	0 to 32767 mm/s

2. Select the conditions for enabling the Preset Velocity Command. The Preset Velocity Command requires the selection of valid conditions.

Parameter Group9Page20	SP1: Preset Velocity Command, Select Input 1
Parameter Group9Page21	SP2: Preset Velocity Command, Select Input 2

SP1：Preset Velocity Command, Select Input 1 SP2：Preset Velocity Command, Select Input 2	Valid Invalid	→	VC1: internal velocity command 1
SP1：Preset Velocity Command, Select Input 1 SP2：Preset Velocity Command, Select Input 2	Invalid Valid	→	VC2: internal velocity command 2
SP1：Preset Velocity Command, Select Input 1 SP2：Preset Velocity Command, Select Input 2	Valid Valid	→	VC3: internal velocity command 3
SP1：Preset Velocity Command, Select Input 1 SP2：Preset Velocity Command, Select Input 2	Invalid Invalid	→	Analog velocity command

3. Begin operation with the Preset Velocity Command and select the conditions for rotation direction.

Parameter Group9Page22	DIR: Preset Velocity Command, Direction of Move
Parameter Group9Page23	RUN: Preset Velocity Command, Operation Start Signal Input
Parameter Group9Page24	RUN-F: Preset Velocity Command, Positive Move Signal Input
Parameter Group9Page25	RUN-R: Preset Velocity Command, Negative Move Signal Input

4 If the above conditions are valid, run the linear motor with the selection combinations listed below.

RUN: Preset Velocity Command, Operation Start Signal Input	Valid	Linear motor moves forward
DIR: Preset Velocity Command, Direction of Move	Invalid	
RUN: Preset Velocity Command, Operation Start Signal Input	Valid	Linear motor in reverse
DIR: Preset Velocity Command, Direction of Move	Valid	

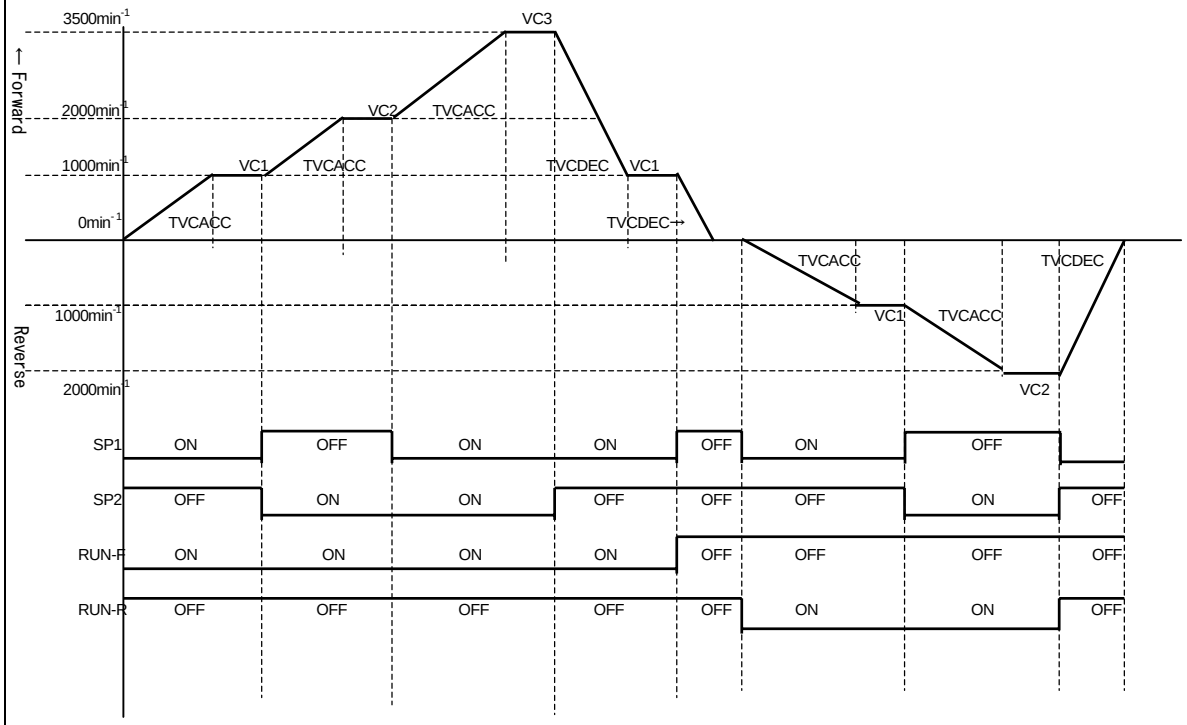
RUN-F: Preset Velocity Command, Positive Move Signal Input	Valid	Linear motor moves forward
RUN-R: Preset Velocity Command, Negative Move Signal Input	Valid	Linear motor in reverse

Examples of setting and operation pattern at the Preset Velocity Command operation.

VC1: Preset Velocity Command 1	1000 mm/s
VC2: Preset Velocity Command 2	2000 mm/s
VC3: Preset Velocity Command 3	3500 mm/s

SP1: Preset Velocity Command, Select Input 1	Enable the function when general purpose input CONT3 is ON.
SP2: Preset Velocity Command, Select Input 2	Enable the function when general purpose input CONT4 is ON.

RUN-F: Preset Velocity Command, Positive Move Signal Input	Enable the function when general purpose input CONT5 is ON.
RUN-R: Preset Velocity Command, Negative Move Signal Input	Enable the function when general purpose input CONT5 is OFF.



[Group 8] 23 to 25

Velocity Compensation Command, Input Selection [VCOMSEL] /
Preset Velocity Compensation Command [VCOMP] Position control mode
Analog Velocity (Compensation) Command, Reference [VCGN]

The velocity compensation addition function is the fast-forward function in the velocity control system. The Velocity Compensation Command, Input Selection has 2 settings: the Preset Velocity Compensation Command and the Analog Velocity Compensation Command. The Preset Velocity Compensation Command is used when the velocity compensation command value is a fixed value. The Analog Velocity Compensation Command is used when setting the velocity compensation command input value from the host unit.

1. Set the Preset Velocity Compensation Command value.

Parameter Group8 Page24	VCOMP：Preset Velocity Compensation Command	-9999 to +9999 mm/s

2. Select the Velocity Compensation Command input method.

Parameter Group8 Page23	VCOMSEL：Velocity Compensation Command, Input Selection

Selection		Description
01:_Analog_Input	Apply Analog Velocity Compensation Command	Use analog velocity addition command value when velocity addition function is valid.
02:_VCOMP	Apply Preset Velocity Compensation Command	Use internal velocity addition command value when velocity addition function is valid.

3. Select the condition for enabling the Velocity Compensation Function and then input the setting.

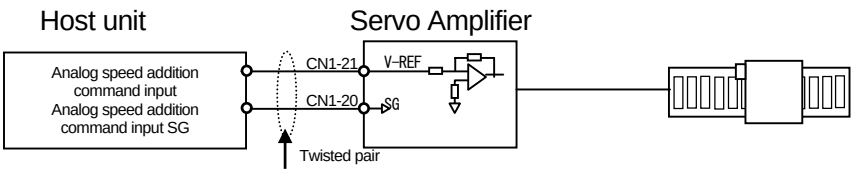
Parameter Group9 Page27	VCOMPS：Velocity Compensation Function, Select Input

1. Set the Analog Velocity Compensation Command, Reference.（This is shared with Analog Velocity Command, Reference.）

Parameter group 8 page 25	VCGN : Analog Velocity Command, Reference	0 to 4000 mm/s/V

The input used in the Analog Velocity Compensation Command is the same as the Analog Velocity Command / Analog Force Command input.

Analog Velocity Compensation Command input：CN1-21 【Input voltage range -10V to +10V】
Analog Velocity Compensation Command input SG ：CN1-20



2. Select the Velocity Compensation Command input method.

Parameter Group8 Page23	VCOMSEL：Velocity Compensation Command Input Selection

Selection		Description
01:_Analog_Input	Apply Analog Velocity Compensation Command	Use Analog Velocity Compensation Command value when Velocity Compensation Function is valid.
02:_VCOMP	Apply Preset Velocity Compensation Command	Use Preset Velocity Compensation Command value when Velocity Compensation Function is valid.

3. Select the conditions for enabling the velocity addition function.

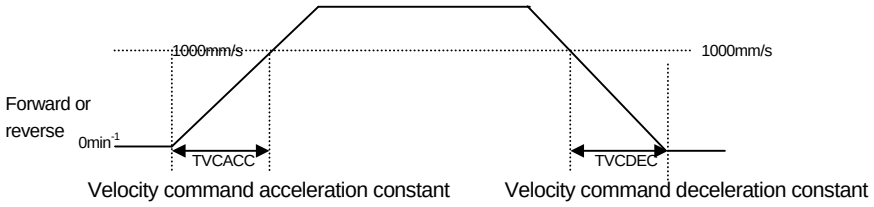
Parameter Group9 Page27	VCOMPS：Velocity Compensation Function

[Group 8] 26 to 27

Velocity Command, Acceleration Time Constant. [TVCACC]
Velocity Command, Deceleation Time Constant. [TVCDEC] Velocity control mode

The step input velocity command can be changed to a constant acceleration/deceleation velocity command using the Velocity Command, Acceleration/Deceleation Time Constant.
Acceleration/deceleration time per ±1000mm/s is set.

Parameter Group8Page26	TVCACC：Velocity Command, Acceleration Time Constant.	0～16000 ms
Parameter Group8Page27	TVCDEC：Velocity Command, Acceleration Time Constant.	0～16000 ms



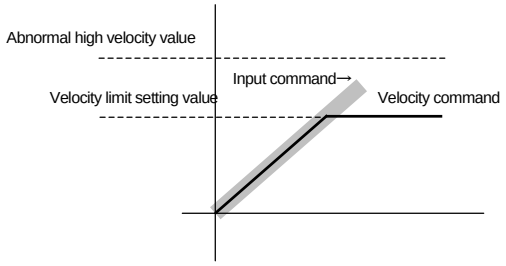
The Analog Velocity Command and Preset Velocity Command can be used together.

[Group 8] 28

Velocity Limit [VCLM] Velocity control mode Position control mode

An host limit value can be locked in with the velocity limit command.
This value cannot be set to exceed the velocity capabilities of the adjoining motor.

Parameter Group8Page28	VCLM：Velocity Limit	1～65535 mm/s



[Group 8] 30 to 34

Force Compensation Command, Input Selection [TCOMSEL] Analog Force Compensation Command, Reference [TCOMPGN]

Preset Force Compensation Command 1 [TCOMP1] Preset Force Compensation Command 2 [TCOMP2]

Force Compensation Function, Select Input 1 [TCOMPS1] Force Compensation Function, Select Input 2 [TCOMPS2]

Velocity control mode Position control mode

The force addition function is the fast-forward function of the force control system. There are 2 types of settings for the force addition command input function: the internal force addition command and the analog force addition command. The internal force addition command can be used when using the force addition command value as a fixed value. The internal force addition command can be used when setting the force addition command input value from the host unit.

1. Sets the internal force addition command value.

Parameter Group8Page31	TCOMP : Preset Force Compensation Command 1	-500 to +500 %
Parameter Group8Page32	TCOMP : Preset Force Compensation Command 2	-500 to +500 %

2. Select the force addition command input method.

Parameter Group8Page30	TCOMSEL : Force Compensation Command, Input Selection

Selection		Description
0 H	Force addition function disabled	
1 H	Apply Analog Force Compensation Command	Use analog force addition command value when force addition function is valid.
2 H	Apply Preset Force Compensation Command	Use internal force addition command value when force addition function is valid.

3. Select the condition for enabling the force addition function and then input the setting.

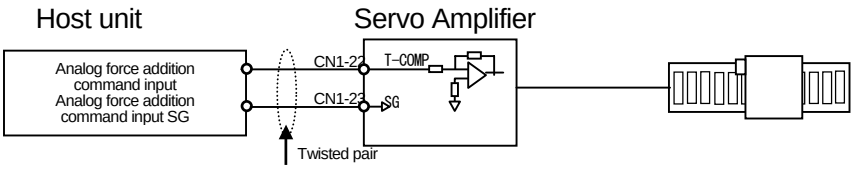
Parameter Group9Page30	TCOMPS1 : Force Compensation Function, Select Input 1
Parameter Group9Page31	TCOMPS2 : Force Compensation Function, Select Input 2

1. Sets the analog force addition command scaling.

Parameter Group8Page34	TCOMPGN : Analog Force Compensation Command, Reference	0～500 %

2. The input used in the analog force addition command provides the signal analog force addition command input of CN1.

Analog force addition command input : CN1-22 【Input voltage range -10V～+10V】
Analog force addition command input SG : CN1-23



3. Select the force addition command input method.

Parameter Group8Page30	TCOMSEL : Force Compensation Command, Input Selection

Selection		Description
0 H	Force addition function disabled	
1 H	Apply Analog Force Compensation Command	Use analog force addition command value when force addition function is valid.
2 H	Apply Preset Force Compensation Command	Use internal force addition command value when force addition function is valid.

4. Select the conditions for enabling the force addition function.

Parameter Group9Page30	TCOMPS1 : Force Compensation Function, Select Input 1
Parameter Group9Page31	TCOMPS2 : Force Compensation Function, Select Input 2

[Group 8]35 to 36

Force Limit, Input Selection [TLSEL]　Internal Force　Limit　[TCLM]

Velocity control mode Position control mode Force control mode

There are two areas where selections for the force limit function can be made: the internal force limit and the external force limit. The two selections have different settings, and affect the operation of the unit in different ways.

Internal force limit

The internal force limit (constant) can be used to limit the maximum force and protect the unit mechanism. Set these parameters according to the following table.

Parameter Group8 Page35	TLSEL: Force Limit, Input Selection

Selection value		Description
00:_TCLM	Apply Internal Force Limit Value. (TCLM)	Forward (positive direction)：limited by internal constant. Reverse (reverse direction)：limited by internal constant.

2. Internal force limit value setting

Parameter Group8 Page36	TCLM：Internal Force　Limit	10～500%

3. Force limit function enable

Parameter Group9 Page32	TL: Force limit function

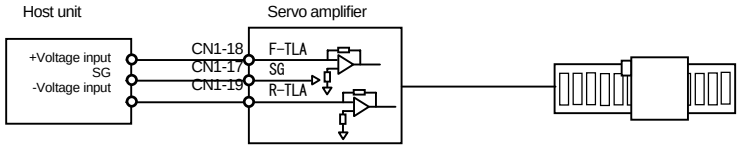
Conditions for enabling force limit permission function are selected. When conditions are valid, force limit is permitted and operation starts.

* If the value is set higher than the maximum output force (T_P) of the linear motor, it will be limited by (T_P).
* Set this value after considering the acceleration time. Too low of a setting can result in insufficient acceleration force and poor control.
* The internal force limit should be set higher than the acceleration force.
* The internal force limit is identical for forward and reverse rotation. Separate force limits cannot be set.

External force limit

With the external force limit function, separate force limits can be set for forward and reverse rotation. There is a designated input for external force limit on the CN1 input signal.

Forward force limit input (F-TLA)：CN1-18 【Input voltage range　0V～+10V】
Reverse force limit input (R-TLA)：CN1-19 【Input voltage range -10V～+10V】
SG　：CN1-17

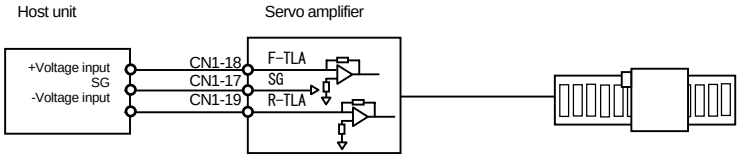


The input voltage specification and the input signal specification can be used in three ways.

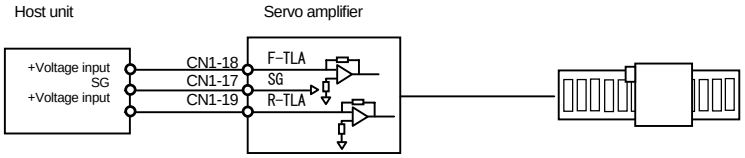
Parameter Group8Page35	TLSEL: Force Limit, Input Selection

Selection value		Description
01:_Analog_1	Apply External Input: Positive Move/ F-TLA. Negative Move/ R-TLA (- Volt Input).	・Forward: The limit will be the positive voltage input to F-TLA. ・Reverse: The limit will be the negative voltage input to R-TLA.
02:_Analog_2	Apply External Input: Positive Move/ F-TLA. Negative Move/ R-TLA (+ Volt Input).	・Forward: The limit will be the positive voltage input to F-TLA. ・Reverse: The limit will be the positive voltage input to R-TLA.
03:_Analog_3	Apply External Input: Positive Move/ F-TLA. Negative Move/ F-TLA.	・Forward: The limit will be the positive voltage input to F-TLA. ・Reverse: The limit will be the positive voltage input to F-TLA.

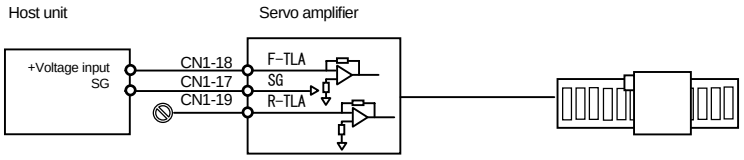
01:_Analog_1



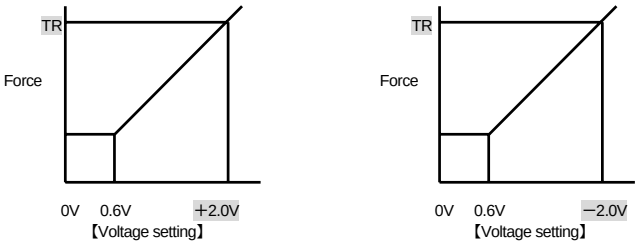
02:_Analog_2



03:_Analog_3



Connect the voltage corresponding to the force limit to the external force input pin. The relationship between the input voltage and the limitable force is the rated force (TR) = 2V for the type of linear motor used.



Force limit function enable

Parameter Group9Page32	TL: Force Limit, Input Selection

Conditions for enabling force limit permission function are selected. When conditions are valid, force limit is permitted and operation starts.

[Group 8] 37

Force Limit at Sequence Operation [SQTCLM] Velocity control mode Position control mode Force control mode

During the sequence operation the output force is limited. Limiting the output force protects the unit mechanism.

The force limits during sequence operation support the following sequence operations:

- ・JOG operation
- ・Over travel operation
- ・Securing brake standby time
- ・Servo brake operation

Sequence operation force limit value setting

Parameter Group 8 Page37	SQTCLM：Force Limit at Sequence Operation	10～500%

If this value is set higher than the maximum output force (TP) of the linear motor, it will be limited by (TP).

[Group 8] 40

In-Position Near Range [NEAR] Position control mode

Outputs signal indicating proximity to position completion.

This is used together with positioning complete signal (INP) and near range of positioning complete is output.

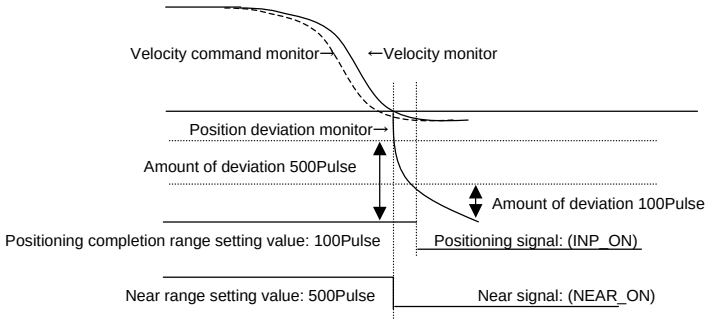
Parameter Group8Page40	NEAR：In-Position Near Range	1～65535 Pulse

Parameter GroupAPage0＊	OUT*：General Purpose Output＊

Selection		Description
1A	NEAR_ON	The output is ON during In-Position Near status (position deviation < NEAR).
1B	NEAR_OFF	The output is OFF during In-Position Near status (position deviation < NEAR).

Determine the logical status of the NEAR signal output, and to which output terminal to assign the positioning completion signal output. The assignment of the output terminal is the same location as the positioning completion signals (above).

If set to a value greater than the positioning completion range settings, the host unit receives the NEAR signal before receiving the positioning completion signal (INP), and transition to the positioning completion operations is enabled.



[Group 8] 41

In-Position Window [INP] Position control mode

The positioning completion signal is output from the selected output terminal when linear motor movement is completed (reaches the set deviation counter value) during location control mode.

Setting the positioning completion range

Parameter Group8Page41	INP：In-Position Window	1～65535 Pulse

Set the deviation counter value with positioning completion signals. The encoder pulse is standard, irrespective of the command pulse multiplication and electronic gear settings.

Incremental encoder: 4 times (4x) encoder pulses is standard.

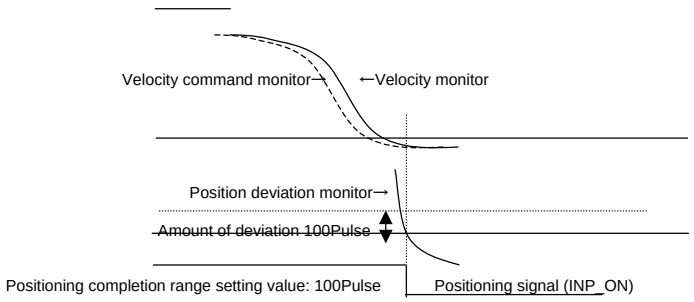
~~Absolute encoder: absolute value is standard.~~

Setting the positioning completion signal

Parameter GroupA Page0＊	OUT*：General Purpose Output＊

Selection		Description
18	INP_ON	The output is ON during In-Position status (position deviation < INP).
19	INP_OFF	The output is OFF during In-Position status (position deviation < INP).

Determine the logical status of the positioning completion signal output, and to which output terminal to assign the positioning completion signal output.



[Gruoup 8] 43 to 45

Low Speed Range [LOWV] Speed Matching Width [VCMP] High Speed Range [VA]

Position control mode Velocity control mode Force control mode

This parameter affects settings for the speed output range. The signal can be output from general output (OUT1～OUT8) and used as a valid condition for all functions. However, the speed coincidence range is invalid in force control mode.

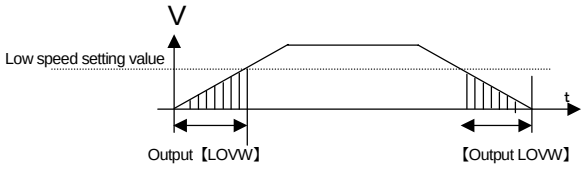
To direct signals to the host unit, make assignments to the signals in parameter Group 9. Use the general output terminal (OUT1～OUT8) of the connected CN1.

Parameter GroupA Page0＊	OUT*：General Purpose Output＊

Selection		Description
10	LOWV_ON	The output is ON during low speed status (speed is less than LOWV).
11	LOWV_OFF	The output is OFF during low speed status (speed is less than LOWV).
12	VA_ON	The output is ON during high speed status (speed is more than VA).
13	VA_OFF	The output is OFF during high speed status (speed is more than VA).
14	VCMP_ON	The output is ON during speed matching status (speed deviation < VCMP).
15	VCMP_OFF	The output is OFF during speed matching status (speed deviation < VCMP).

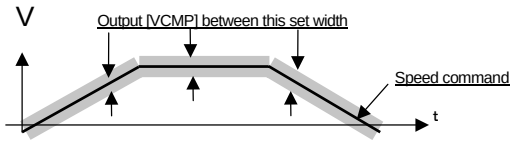
Low speed range: Low speed signal is sent if speed goes below the set value.

Parameter Group8 Page43	LOWV：Low speed range	0～65535mm/s



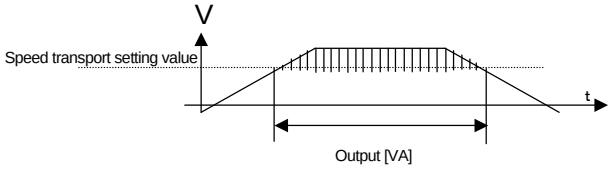
Speed Matching Width: Speed coincidence range signal is given if speed deviation reaches the set range.

Parameter Group8 Page44	VCMP：Speed Matching Width	0～65535mm/s



Speed transport settings: Speed transport signal is given if speed exceeds the set value.

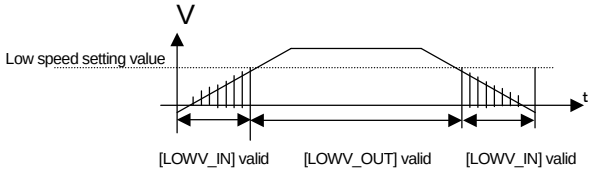
Parameter Group1 Page08	VA：High Speed Range	0～65535mm/s



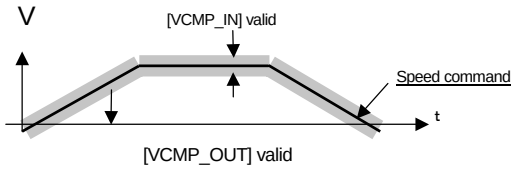
Various functions can be made valid without output signals taken into the host unit when this is used together with Group9 function enabling conditions (input signals).

Selection		Description
12	LOWV_IN	Enable the function during low speed status (speed is less than LOWV).
13	LOWV_OUT	Enable the function while low speed status is not kept.
14	VA_IN	Enable the function during high speed status (speed is more than VA).
15	VA_OUT	Enable the function while high speed status is not kept.
16	VCMP_IN	Enable the function during speed matching status (speed deviation < VCMP).
17	VCMP_OUT	Enable the function while speed matching status is not kept.

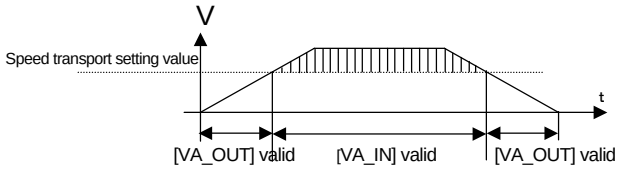
Low speed status [LOWV_IN]: Function is enabled during low speed status (speed below LOWV set value).
Low speed status [LOWV_OUT]: Function is enabled outside of low speed status (speed below LOWV set value).



Speed coincidence status [VCMP_IN]: Function is enabled during speed coincidence status
(speed deviation below VCMP set value).
Speed coincidence status [VCMP_OUT]: Function is enabled outside of speed coincidence status
(speed deviation below VCMP set value).



Speed transport status [VA_IN]: Function is enabled during speed transport status (speed above VA set value).
Speed transport status [VA_OUT]: Function is enabled outside of speed transport status (speed above VA set value).



7. Adjustment • Functions[Functions of Group 9] [Over travel]

■ Functions of Group 9

[Group 9] 00 to 01

Positive Over-Travel Function [F-OT]

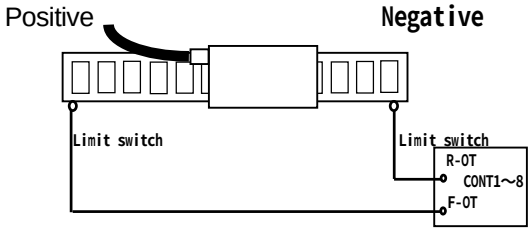
Position control mode Velocity control mode Force control mode

Negative Over-Travel Function [R-OT]

The over travel function uses a limit switch to prevent damage to the unit. It stops the unit when the movement range of the moving part is exceeded.

1. Allocate the over travel input signal to CONT1~CONT8.

Parameter Group9 Page00	F-OT : Positive Over-Travel Function
Parameter Group9 Page02	R-OT : Negative Over-Travel Function



2. If the over travel function is used, select the operating conditions of "Position command input, Linear motor stop operation and Servo ON signal" in the case of over travel.

Parameter GroupB Page11	ACTOT : Over-Travel Action Selection

Selected value	Contents
00:_CMDINH_SB_SON	• PC is inhibited and Servo-Braking is performed. After stops, S-ON is operated. (At OT, command disabled = velocity limit command = 0)
01:_CMDINH_DB_SON	• PC is inhibited and Dynamic-Braking is performed. After stops, S-ON is operated. (At OT, command disabled = velocity limit command = 0)
02:_CMDINH_Free_SON	• PC is inhibited and Free-Run is performed. After stops, Servo-ON is operated. (At OT, command disabled = velocity limit command = 0)
03:_CMDINH_SB_SOFF	• PC is inhibited and Servo-Braking is performed. After stops, S-OFF is operated.
04:_CMDINH_DB_SOFF	• PC is inhibited and Dynamic-Braking is performed. After stops, S-OFF is operated
05:_CMDINH_Free_SOFF	• PC is inhibited and Free-Run is performed. After stops, Servo-OFF is operated.
06:_CMDACK_VCLM=0	• Position Command is accepted and Velocity Limit is zero.

If "the motor is stopped by servo brake operation" [00:_CMDINH_SB_SON][03:_CMDINH_SB_SOFF] is selected when over travel occurs, force at the time of servo brake operation can be set at the sequence force operation limit value.

Parameter Group8 Page37	SQTCLM: Force Limit at Sequence Operation	10~500%

If the value is set higher than the maximum output force (TP) of the linear motor, it will be limited by (TP).

[Group 9] 02

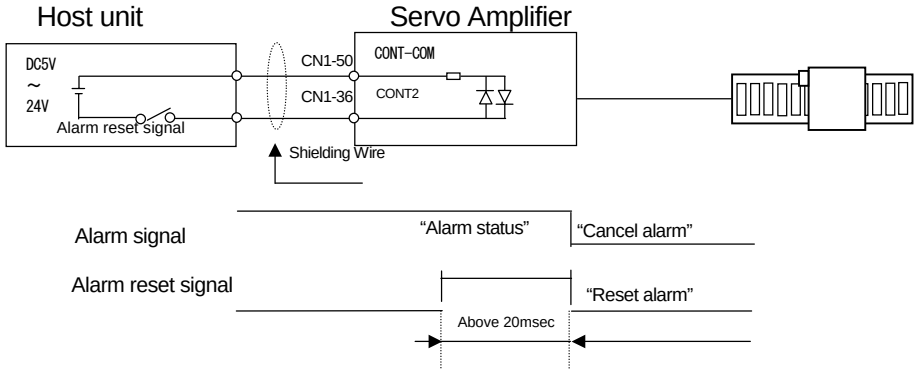
Alarm Reset Function [AL-RST] Position control mode Velocity control mode Force control mode

This function enables the sending of an alarm reset signal from the host unit. An alarm is cleared by enabling alarm reset function (AL-RST).

The conditions for enabling alarm reset function are assigned. The alarm is cleared if the AL-RST signal is valid.

Parameter Group9 Page02	AL-RST : Alarm Reset Function

The following circuit is created when valid conditions are assigned to CONT2. The logic can also be modified by the allocation of valid conditions.



＊Note that any alarm not cleared by simply turning OFF the control power supply cannot be cleared with the alarm reset signal.

[Group 9] 05

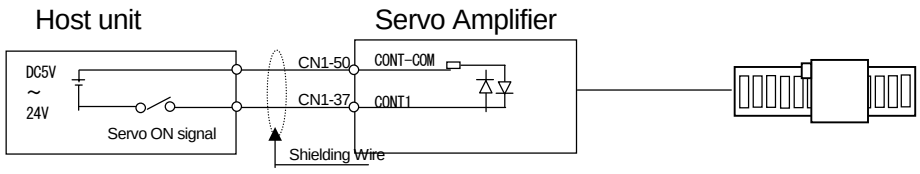
SERVO-ON Function [S-ON] Position control mode Velocity control mode Force control mode

This function enables the sending of a servo ON signal from the host unit. The linear motor can be set to "ready" status by enabling the servo ON function (SON).

The conditions for enabling the Servo ON function are assigned. The linear motor is set to "ready" status when the SON signal is enabled.

Parameter Group9 Page05	S-ON : SERVO-ON Function

The following circuit is created when valid conditions are assigned to CONT1.The logic can also be modified by the allocation of valid conditions.



[Group 9] 10

Control Mode Switching Function [MS] Position control mode Velocity control mode Force control mode

2 types of control mode can be switched and used. The control mode to be combined is selected by system parameter and can be switched with control mode switch over function.

Control mode is selected from system parameter Page 08.

Page	Name	Setting range
08	Control Mode	6 ways

Setting	Contents
03：_Velo－Torq	Velocity Control Mode — force control switching type
04：_Posi－Torq	Position Control Mode — force control switching type
05：_Posi－Velo	Position control — velocity control switching type

After setting has been changed →The value becomes valid when control power is turned ON again.

Conditions enabling control mode switch over function are allocated. When MS signal is valid, control mode is switched.

Parameter Group9 Page10	MS：Control Mode Switching Function

✍ When control mode switch over type is in use, there is a possibility that “auto-notch frequency tuning”, “auto-vibration suppressing frequency tuning”, and “JOG operation” cannot be used. Switch the control mode to the base side (disable MS) prior to using “auto-notch frequency tuning”, “auto-vibration suppressing frequency tuning”, and “JOG operation”.

[Group 9] 11

Position Command Pulse Inhibit Function and Velocity Command Zero Clamp Function [INH/Z-STP]

Velocity control mode Position control mode

This can be used as position command pulse inhibit function (INHIBIT function) in the position control type, and as zero velocity stop function in the velocity control type.
When the function is enabled while linear motor is operating, input command is inhibited and the linear motor stops at linear motor excitation status. In the position control type, even if position command pulse is input, the input pulse is not counted in the servo amplifier.

Conditions enabling position command pulse inhibit/zero velocity stop function are allocated. When signals of INH/Z-STP are valid, this will function.

Parameter Group9 Page11	INH/Z-STP：Position Command Pulse Inhibit Function ／ Velocity Command Zero Clamp Function

7. Adjustment・Functions [Functions of Group 9] [Gain switch over]

[Ｇｒｏｕｐ９]１３～１４

Gain Switching Function, Select Input 1 [GC1]　Gain Switching Function, Select Input 2 [GC2]

Position control mode　Velocity control mode　Force control mode

4 types of gains can be switched and used.

Conditions enabling gain switch over are allocated. When the signal of GC1 and GC2 combination is valid, the set value of corresponding GAIN becomes enabled.

Parameter Group9 Page13	GC1：Gain Switching Function, Select Input 1
Parameter Group9 Page14	GC2：Gain Switching Function, Select Input 2

GC1：Gain Switching Function, Select Input 1	Disabled	Enabled	Disabled	Enabled
GC2：Gain Switching Function, Select Input 2	Disabled	Disabled	Enabled	Enabled
	↓	↓	↓	↓
Gain to be enabled	GAIN 1	GAIN 2	GAIN 3	GAIN4

[Group 9]15 to 16

Position control mode　Velocity control mode　Force control mode

Vibration Suppressor Frequency, Select Input 1 [SUPFSEL1]

Vibration Suppressor Frequency, Select Input 2　[SUPFSEL2]

4 types of vibration suppressing frequency can be switched and used.

Conditions for enabling vibration suppressing frequency selection input are allocated. When the signal of SUPFSEL1 and SUPFSEL2 combination is valid, the set value of corresponding vibration frequency becomes enabled.

Parameter Group9 Page15	SUPFSEL1：Vibration Suppressor Frequency, Select Input 1
Parameter Group9 Page16	SUPFSEL2：Vibration Suppressor Frequency, Select Input 2

SUPFSEL1：Vibration Suppressor Frequency, Select Input 1	Disabled	Enabled	Disabled	Enabled
SUPFSEL2：Vibration Suppressor Frequency, Select Input 2	Disabled	Disabled	Enabled	Enabled
	↓	↓	↓	↓
Vibration suppressing frequency to be enabled	Vibration Suppressor Frequency 1 Group 2 Page 0 0	Vibration Suppressor Frequency 2 Group 3 Page 4 0	Vibration Suppressor Frequency 3 Group 3 Page 4 1	Vibration Suppressor Frequency 4 Group 3 Page 4 2

[Group 9] 17

Position Loop Proportional Control, Switching Function [PLPCON]

Position control mode

Switching between position loop PI control←→ P control is possible. Switching is possible when position loop proportional control switchover function (PPCON) is enabled.

Conditions for enabling position loop proportional control switchover function are allocated. Switches to proportional control when the signal of PPCON is valid.

Parameter Group9 Page17	PLPCON：Position Loop Proportional Control, Switching Function

ＰＩ control（proportional・integral control）・・・・Position loop proportional gain（KP）・Integral time constant（TPI）
Ｐ control （Proportional control） ・・・・Position loop proportional gain（KP）

＊ Position loop integral time constant (TPI)is 1000.0ms at standard setting, therefore, integral function is invalid.

[Group 9] 26

Velocity Loop Proportional Control, Switching Function [VLPCON]

Velocity control mode Position control mode

Velocity loop PI control / P control can be used alternatively. Activate switching by enabling the velocity loop comparison control switching function (PCON)

The conditions for enabling the velocity loop comparison control switching function are assigned. Change the comparison control when the PCON signal is valid.

Parameter Group9 Page26	VLPCON：Velocity Loop Proportional Control, Switching Function

PI control (comparison / integral control): Velocity loop comparison gain (KVP) / Velocity loop reset time constant (TVI)
P control (Comparison control): Velocity loop comparison gain (KVP)

＊ When set to comparison control, servo gain is reduced and the servo system is made stable.
＊ When the velocity loop reset time constant (TVI) is set to 1000.0ms, it is not necessary to use this function, since the reset time constant in use is invalid (Comparison control)

7. Adjustment · Functions [Functions of Group 9] [External trip · Forced discharge · Emergency stop]

[Group 9] 40

External Error Input [EXT-E] Position control mode Velocity control mode Force control mode

This function can output a contact input (such as external thermal) as an alarm (AL55H) in the servo amplifier.

The conditions for enabling the external trip function are assigned. An alarm (AL55H) is given if the EXT-E signal is valid.

Parameter Group9 Page40	EXT-E : External Error Input

[Group 9] 41

Main Power Discharge Function [DISCHARG] Position control mode Velocity control mode Force control mode

This function forcefully discharges voltage charged in the condenser for the main circuit power supply in the servo amplifier when power supply to the main circuit is cut. However, discharge is not possible when the main circuit power supply is ON.

The conditions for enabling forced discharge function are assigned. Forced discharge is possible when the DISCHARGE signal is valid.

Parameter Group9 Page41	DISCHARGE : Main Power Discharge Function

[Group 9] 42

Emergency Stop Function [EMR] Position control mode Velocity control mode Force control mode

This function enables an emergency stop of the linear motor after receiving an emergency stop signal in the servo amplifier.

The conditions for enabling the unit emergency stop signal are assigned. The unit emergency stop function is executed when the EMR signal is valid.

Parameter Group9 Page42	EMR : Emergency Stop Function

7. Adjustment・Functions [Functions of Group B] [Dynamic brake・Forced stop]

■ Functions of Group B

[ＧｒｏｕｐB]１０

Dynamic Brake Action Selection [DBOPE] Position control mode Velocity control mode Force control mode

Conditions for stop at servo OFF can be selected from Servo brake/dynamic brake/free run.
Conditions after linear motor stop can be selected from dynamic brake/free run.

Parameter GroupB Page10	DBOPE: Dynamic Brake Action Selection

Selected value	
00:_Free_Free	When Servo-OFF, Free-Run is operated. After stops, Motor-Free is operated.
01:_Free_DB	When Servo-OFF, Free-Run is operated. After stops, Dynamic-Braking is performed.
02:_DB__Free	When S-OFF, Dynamic-Braking is performed. After stops, Motor-Free is operated.
03:_DB__DB	When S-OFF, Dynamic-Braking is performed. After stops, Dynamic-Braking.
04:_SB__Free	When Servo-OFF, Servo-Braking is performed. After stops, Motor-Free is operated.
05:_SB__DB	When Servo-OFF, Servo-Braking is performed. After stops, Dynamic-Braking.

[ＧｒｏｕｐB]１２

Forced stop operation [ACTEMR] Position control mode Velocity control mode Force control mode

When forced stop is executed by power shut off while linear motor is operating (linear motor is not stopped), conditions for linear motor stop can be selected from servo brake/dynamic brake.

Parameter GroupB Page12	ACTEMR : Emergency Stop Operation

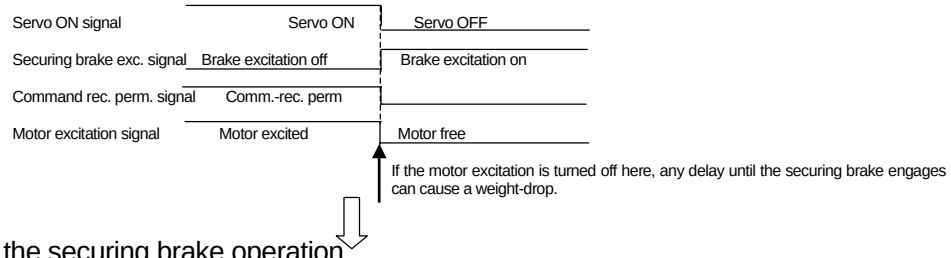
Selected value	Contents
00:_SERVO-BRAKE	When EMR is input, motor is stopped by servo brake operation.
01:_DINAMIC-BRAKE	When EMR is input, motor is stopped by dynamic brake operation.

[ＧｒｏｕｐB]１３

Position control mode Velocity control mode Force control mode

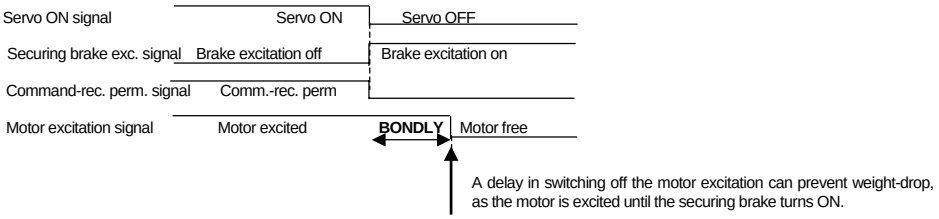
Delay Time of Engaging Holding Brake [BONDLY]

This function is enabled during servo brake operation at servo OFF. It is disabled for dynamic brake and free-run.



Set the delay time for the securing brake operation

Parameter GroupB Page13	BONDLY：Delay Time of Engaging Holding Brake	0～1000ms



・The setting increment is 4 msec. If the setting is 0 msec, the command is disabled (forced zero) for 4 msec after SON.

・The securing brake excitation signal can be output through the generic outputs (OUT1～OUT8).

Parameter GroupA Page0＊	OUT*：General Purpose Output*

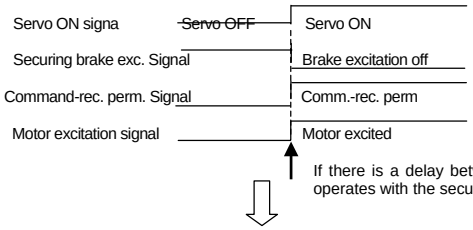
0A:_MBR-ON_ ON	The output is ON while holding brake excitation signal outputs.
0B:_MBR-ON_ OFF	The output is OFF while holding brake excitation signal outputs.

[Securing brake release delay time]

[ＧｒｏｕｐB]１４

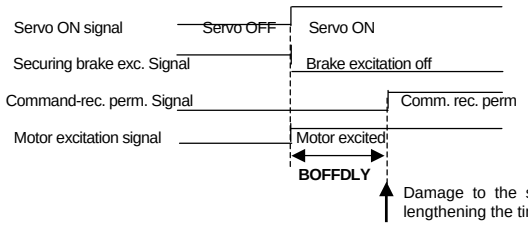
Position control mode Velocity control mode Force control mode

Delay Time of Releasing Holding Brake [BOFFDLY]



・Set the delay time for the securing brake release

Parameter GroupB Page14	BOFFDLY：Delay Time of Releasing Holding Brake	0～1000ms



・The setting increment is 4 msec. If the setting is 0 msec, the command is disabled (forced zero) for 4 msec after SON.

・The securing brake excitation signal can be output through the generic outputs (OUT1～OUT8).

Parameter Group9 Page0＊	OUT*：General Purpose Output *

0A:_MBR-ON_ ON	The output is ON while holding brake excitation signal outputs.
0B:_MBR-ON_ OFF	The output is OFF while holding brake excitation signal outputs.

[ＧｒｏｕｐB]１５

Brake Operation Beginning Time [BONBGN] Position control mode Velocity control mode Force control mode

If the motor does not stop within the time frame set for the brake operation start (BONBGN) when the servo is turned OFF, the securing brake and the dynamic brake force the motor to stop. The function can be disabled by setting the value to "０"ms. The setting increment is ４ｍｓｅｃ; therefore, set the value to 4 msec or higher.

Parameter GroupB Page15	BONBGN：Brake Operation Beginning Time	0 ～ 65535ms

＊ The term "motor does not stop" (above) means that the motor velocity does not fall below the zero velocity (ZV) range.

＊ The stop sequence is different depending on the condition settings of the emergency stop operation.

＊ When the brake operation start time (BONBGN) passes, the linear motor will be forced to stop by both the dynamic brake and the securing brake, which can cause damage to the securing brake. Therefore, use this function only after considering the specifications and the sequence of the unit.

[ＧｒｏｕｐＢ]１６

Power Failure Detection Delay Time [PFDDLY] Position control mode Velocity control mode Force control mode

This function can set a delay period, after power off of the control power supply, for detecting problems in the control power supply. Detection of unexpected power failure is diminished when this value is increased. However, even if this value is increased and problem detection is delayed, when the power supply to the internal logic circuit is exhausted, routine operations at the time of control power supply cut off / restart will continue.

Parameter GroupB Page16	PFDDLY：Power Failure Detection Delay Time	20 ～ 1000 ms

＊When energy to the main circuit power supply is insufficient, problems like a reduction in main circuit power supply are also detected.

＊The actual anomaly detection delay time compared to the selected value can vary between -12ms and +6ms.

[ＧｒｏｕｐB]２０

Following Error Warning Level [OFWLV]

Position control mode Velocity control mode Force control mode

This function gives a warning before reaching excessive deviation alarm status.

Set the deviation excessive warning value.

Parameter GroupB Page20	OFWLV：Following Error Warning Level	1～65535 × 1024 pulse

For sending the signals to the host unit, assign the signals in parameter Group 9. Output from general output number (OUT1～OUT8) of the connected CNss1.

Parameter GroupA Page0＊	OUT*：General Purpose Output＊

2A:_WNG-OFW_ON	The output is ON during following warning status (position deviation > OFWLV).
2B:_WNG-OFW_OFF	The output is OFF during following warning status (position deviation > OFWLV).

[ＧｒｏｕｐB]２１

Following Error Limit [OFLV] Position control mode Velocity control mode Force control mode

Parameter to set the value for outputting excessive position deviation alarm. Encoder pulse is the standard irrespective of electronic gear or command multiplication functions.

Deviation counter overflow value is set.

Parameter GroupB Page21	OFLV：Following Error Limit	1 ～ 65535 × 1024 pulse

[ＧｒｏｕｐB]２２

Overload Warning Level [OLWLV] Position control mode Velocity control mode Force control mode

This function will send a warning before reaching overload alarm status. Set the ratio corresponding to the overload alarm value to 100%. When set to 100%, the overload warning and overload alarm are given simultaneously.

Set the overload warning level.

Parameter GroupB Page22	OLWLV：Overload Warning Level	20～100 %

For sending the signals to the host unit, assign the signals in parameter Group 9. Output from general output terminal (OUT1～OUT8) of the connected CN1.

Parameter GroupA Page0＊	OUT*：General Purpose Output＊

2C:_WNG-OLW_ON	The output is ON during over-load warning status.
2D:_WNG-OLW_OFF	The output is OFF during over-load warning status.

＊The overload detection process is assumed to be 75% of the rated load at the time of starting the control power supply (hot start). At this time, if the overload warning level is set below 75%, an overload warning is given after starting the control power supply.

■ Functions of Group C

[ＧｒｏｕｐC]０１～０２

Position control mode Velocity control mode Force control mode

Motor Incremental Encoder, Digital Filter [ENFIL]

External Incremental Encoder, (Sensor) Digital Filter [EX-ENFIL]

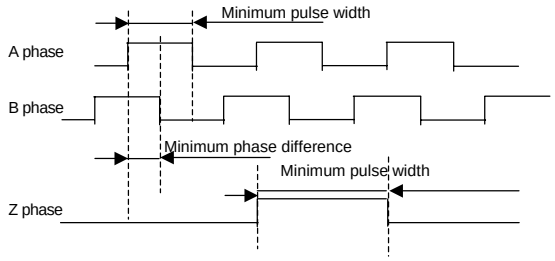
You can set the digital filer value of the incremental pulse for the selected incremental encoder. When noise is superimposed on the incremental encoder, the pulse below the set value is removed as noise. Set this value by considering the frequency of pulses from the selected encoder and the maximum number of rotations of the linear motor. If the input value is greater than the encoder frequency during the peak rotation of the linear motor, the encoder pulse is removed and the linear motor will stop.

The motor encoder and external encoder can be set separately.

Selection for motor incremental encoder digital filter

Parameter GroupC Page01	ENFIL：Motor Incremental Encoder, Digital Filter
Parameter GroupC Page02	EX-ENFIL：External Incremental Encoder, (Sensor) Digital Filter

Selected value	Contents
00:_110nsec	Minimum Pulse Width＝110nsec (Minimum Pulse Phase Difference = 37.5nsec)
01:_220nsec	Minimum Pulse Width＝220nsec
02:_440nsec	Minimum Pulse Width＝440nsec
03:_880nsec	Minimum Pulse Width＝880nsec
04:_75nsec	Minimum Pulse Width＝75nsec (Minimum Pulse Phase Difference = 37.5nsec)
05:_150nsec	Minimum Pulse Width＝150nsec
06:_300nsec	Minimum Pulse Width＝300nsec
07:_600nsec	Minimum Pulse Width＝600nsec



[ＧｒｏｕｐC]０３

Hall Sensor Polarity Invert [EX-ENPOL]

Position control mode Velocity control mode Force control mode

You can select external encoder pulse polarity.

Parameter GroupC Page03	EX-ENPOL：Hall Sensor Polarity Invert

Selected value	Contents		
00:_Type1	EX-Z / Not Reversed	EX-B / Not Reversed	EX-A／Not Reversed
01:_Type2	EX-Z / Not Reversed	EX-B / Not Reversed	EX-A／Reversed
02:_Type3	EX-Z / Not Reversed	EX-B／Reversed	EX-A／Not Reversed
03:_Type4	EX-Z / Not Reversed	EX-B／Reversed	EX-A／Reversed
04:_Type5	EX-Z / Reversed	EX-B / Not Reversed	EX-A／Not Reversed
05:_Type6	EX-Z / Reversed	EX-B / Not Reversed	EX-A／Reversed
06:_Type7	EX-Z / Reversed	EX-B／Reversed	EX-A／Not Reversed
07:_Type8	EX-Z / Reversed	EX-B／Reversed	EX-A／Reversed

[ＧｒｏｕｐC]０４

Encoder Pulse Divided Output, Selection [PULOUTSEL]

Position control mode Velocity control mode Force control mode

Encoder pulse divider output can be selected from 2 types; motor encoder or external encoder.

Parameter GroupCPage04	PULOUTSEL : Encoder Pulse Divided Output

・For semi-closed control, select 0:Motor encoder.
・~~In case of absolute sensor except for incremental absolute encoder, incremental pulse of 8192P/R is input in the divider circuit.~~

[ＧｒｏｕｐC]０５

Encoder Output Pulse, Divide Ratio [ENRAT] Position control mode Velocity control mode Force control mode

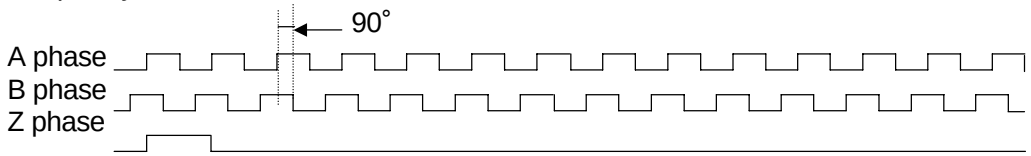
The encoder signals (Phase A/ Phase B) used in the host unit can be output according to a ratio formula. When using in the host unit's position loop control, input the result (obtained after dividing the number of encoder pulses) as an integer. However, when using this function to monitor the host unit, input a ratio that is as close to the setup value as possible.
The output of Z phase is not divided. Output can be sin O/C（CN1-11）.
Division ratio for the encoder pulse divider output is set.

Parameter GroupC Page05	ENRAT：Encoder Output Pulse, Divide Ratio	1/1～1/8192

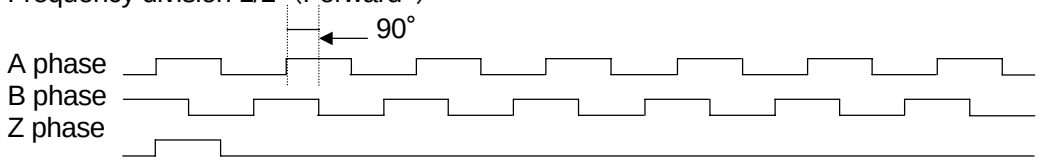
The following settings are possible.

When numerator is “1” : 1/1～1/64、1/8192 can be set.
When numerator is “2” : 2/3～2/64、2/8192 can be set.
When denominator is “8192” : 1/8192 ～ 8191/8192 can be set.

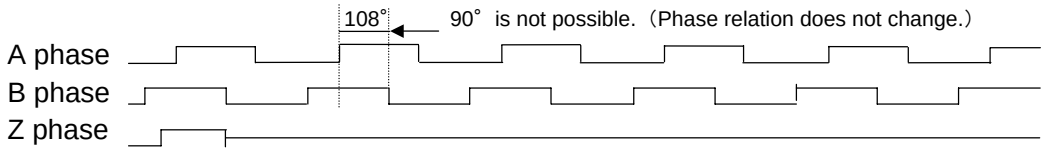
Frequency division 1/1（Forward ）



Frequency division 1/2（Forward ）



Frequency division 2/5（Forward ）



＊ Destabilizes for 1 sec after control power is supplied.

[ＧｒｏｕｐC]０６

Encoder Pulse Divided output, Polarity [PULOUTPOL]

Position control mode Velocity control mode Force control mode

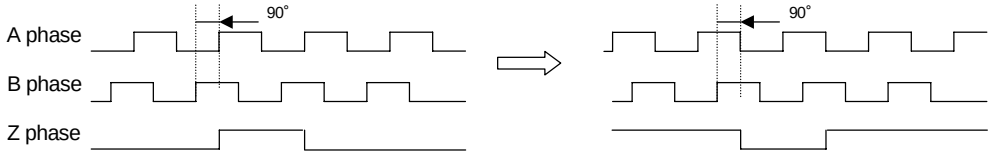
The polarity of the encoder pulse frequency output can be selected.

Parameter GroupC Page06	PULOUTPOL : Encoder Pulse Divided output, Polarity

Selected value	Contents
00:_Type1	A-Phase Signal / Not Reversed : Z-Phase Signal Logic / High Active
01:_Type2	A-Phase Signal / Reversed : Z-Phase Signal Logic / High Active
02:_Type3	A-Phase Signal / Not Reversed : Z-Phase Signal Logic / Low Active
03:_Type4	A-Phase Signal / Reversed : Z-Phase Signal Logic / Low Active

Setting 0H (Frequency division ratio 1/1: with forward move) Using the incremental encoder

Setting 3H (Frequency division ratio 1/1: with forward move) Using the incremental encoder



~~[Ｇｒｏｕｐ C]０８~~

~~Abusolute Encoder Clear Function Selection~~ [~~ECLRFUNC~~]

~~Position control mode Velocity control mode Force control mode~~

~~Select the conditions for enabling absolute encoder clear.~~

~~Parameter Group9 Page03~~	~~ECLR : Abusolute Encoder Clear Function~~

~~When using a wire-saving absolute sensor, you can select the contents to be cleared. Wire-saving absolute sensor~~

~~Clear "Warning + multiple rotation data"~~

~~Clear only "Warning"~~

~~Parameter GroupC Page08~~	~~ECLRFUNC : Abusolute Encoder Clear Function Selection~~

~~Selected value~~	~~Contents~~
~~00:_Status_MultiTurn~~	~~Clear Encoder Status (Alarm and Warning) and Multi Turn Data~~
~~01:_Status~~	~~Clear Only Encoder Status~~

~~* These conditions are applicable only to the wire-saving absolute encoder.~~

~~* Do not input this while the linear motor is rotating. Confirm that the linear motor stops before inputting this.~~

■ Description of monitor

All signals and internal status of the servo amplifier can be monitored. There are 3 kinds of monitors.

1. Analog monitor / Digital monitor
   Monitor box and dedicated monitor cable are needed. Refer to “Materials; Option, Monitor box”.
   Refer to “Chapter 1, Prior to Use, Servo Amplifier Part Names 1-5” for locations for connectors to be connected.
2. Monitor in display （Setup software－Ｒ－ＳＥＴＵＰ, Digital Operator）

● **Analog monitor**（２ channels）

[Group A]11 to 13

Analog Monitor 1, Output Signal Selection [MON1]

Analog Monitor 2, Output Signal Selection [MON2]

Analog Monitor, Output Polarity [MONPOL]

Position control mode Velocity control mode Force control mode

Analog monitor for use is selected.

Parameter GroupA Page11	MON1：Analog Monitor 1, Output Signal Selection
Parameter GroupA Page12	MON2：Analog Monitor 2, Output Signal Selection

Selected value	Contents
00	Reserved
01:_TMON_2V/TR	Force Monitor 2V/ rated force
02:_TCMON_2V/TR	Force Command Monitor 2V/ rated force
03:_VMON_0.2mV/ min^{-1}	Velocity Monitor 0.2mV/ mm/s
04:_VMON_1mV/ min^{-1}	Velocity Monitor 1mV/ mm/s
05:_VMON_2mV/ min^{-1}	Velocity Monitor 2mV/ mm/s
06:_VMON_3mV/ min^{-1}	Velocity Monitor 3mV/ mm/s
07:_VCMON_0.2mV/ min^{-1}	Velocity Command Monitor 0.2mV/ mm/s
08:_VCMON_1mV/ min^{-1}	Velocity Command Monitor 1mV/ mm/s
09:_VCMON_2mV/ min^{-1}	Velocity Command Monitor 2mV/ mm/s
0A:_VCMON_3mV/ min^{-1}	Velocity Command Monitor 3mV/ mm/s
0B:_PMON_0.1mV/P	Position Deviation Monitor 0.1mV/ Pulse
0C:_PMON_1mV/P	Position Deviation Monitor 1mV/ Pulse
0D:_PMON_10mV/P	Position Deviation Monitor 10mV/ Pulse
0E:_PMON_20mV/P	Position Deviation Monitor 20mV/ Pulse
0F:_PMON_50mV/P	Position Deviation Monitor 50mV/Pulse
10:_FMON_2mV/kP/s	Position Command Pulse Input Frequency Monitor 2mV/kPulse/s
11:_FMON_10mV/kP/s	Position Command Pulse Input Frequency Monitor 10mV/kPulse/s
12:_TLMON_EST_2V/TR	Load Force Monitor (Estimete Value) 2V/ rated force (thrust)
13:_Sine-U	Sine-U
14:_VBUS_1V/DC100V	Main Power Circuit D.C. Voltage 1V/DC100V
15:_VBUS_1V/DC10V	Main Power Circuit D.C. Voltage 1V/DC10V

Select this when polarity is to be changed.

Parameter GroupA Page12	MONPOL: Analog Monitor, Output Polarity

Selected value	Contents
00:_MON1+_MON2+	MON1： Positive voltage output in forward rotation; output pos and neg voltage. MON2：Positive voltage output in forward rotation; output pos and neg voltage.
01:_MON1-_MON2+	MON1：Negative voltage output in forward rotation; output pos and neg voltage. MON2：Positive voltage output in forward rotation; output pos and neg voltage.
02:_MON1+_MON2-	MON1：Positive voltage output in forward rotation; output pos and neg voltage. MON2：Negative voltage output in forward rotation; output pos and neg voltage.
03:_MON1-_MON2-	MON1：Negative voltage output in forward rotation; output pos and neg voltage. MON2：Negative voltage output in forward rotation; output pos and neg voltage.
04:_MON1ABS_MON2+	MON1：Positive voltage output together in forward and reverse rotation MON2：Positive voltage output in forward rotation; output pos and neg voltage.
05:_MON1ABS_MON2-	MON1：Positive voltage output together in forward and reverse rotation MON2：Negative voltage output in forward rotation; output pos and neg voltage.
06:_MON1+_MON2ABS	MON1：Positive voltage output in forward rotation; output pos and neg voltage. MON2：Positive voltage output together in forward and reverse rotation
07:_MON1-_MON2ABS	MON1：Negative voltage output in forward rotation; output pos and neg voltage. MON2：Positive voltage output together in forward and reverse rotation
08:_MON1ABS_MON2ABS	MON1：Positive voltage output together in forward and reverse rotation MON2：Positive voltage output together in forward and reverse rotation

7. Adjustment・Functions [Monitor] [Digital monitor]

[Displayed monitor list]

● Digital monitor（1 channel）

[Group A] 12

Digital Monitor 1, Output Signal Selection [DMON]

Position control mode Velocity control mode Force control mode

Digital monitor for use is selected.

Parameter GroupA Page12	DMON：Digital Monitor 1, Output Signal Selection

For selected values, refer to “Chapter 5, Parameter [Parameter setting value【GroupA】] generic output OUT1～ generic output OUT8, and setting selection list of digital monitor output.

● List of monitors in display

[monitor] 00 to 1E

Page	Name	Contents	Unit
00	Servo Amplifier Status	Displays the statuses of main circuit power being supplied, operation ready and servo ON.	---
01	Warning status 1	Displays warning status.	---
02	Warning status 2	Displays warning status.	---
03	General Purpose Input CONT8 to CONT1 Monitor	Displays generic input terminal status.	---
04	General Purpose Output OUT8 to OUT1 Monitor	Displays generic output terminal status.	---
05	Velocity Monitor	Displays motor rotation velocity.	mm/s
06	Velocity Command Monitor	Displays velocity command value.	mm/s
07	Force Monitor	Displays motor output force.	%
08	Force Command Monitor	Displays force command value.	%
09	Position Deviation Monitor	Displays position deviation values.	Pulse
0A	Actual Position Monitor	Displays current position compared with original position when the control power is turned ON. This is a free run counter. Therefore, when current position exceeds the displayed range, the display is maximum value of reversed polarity.	Pulse
0B	External Actual Position Monitor		
0C	Command Position Monitor		
0D	Analog Velocity Command/Analog Force Command Input Voltage	Displays command voltage being input.	mV
0E	Position Command Pulse Input Frequency Monitor	Displays command pulse frequency being input.	k Pulse/s
0F	U-Phase Electric Angle Monitor	Displays electric angle of U phase. Except for encoder (sensor) error, this is always displayed.	deg
10	~~Absolute Encoder PS Data (High)~~	~~Displays absolute encoder position data PS.~~	~~x2^32 P~~
11	~~Absolute Encoder PS Data (Low)~~	~~Displays absolute encoder position data PS.~~	~~Pulse~~
12	Regenerative Resistor Operation Percentage	Displays regeneration resistance operation status.	%
13	Motor Operating Rate Monitor	Displays exact values, however, it may take several hours for the value to become stable depending on the operation pattern.	%
14	Predicted Motor Operating Rate Monitor	Displays estimated value of linear motor usage ratio, which is estimated from a short period of operation. In an application where the same operation pattern repeats in a short period of time, the usage ratio can be confirmed fast.	%
15	Load Inertia (Mass) Ratio Monitor	Values can be confirmed when gain switch over and auto-tuning functions are used.	%
16	Position Loop Proportional Gain Monitor		s^{-1}
17	Position Loop Integral Time Constant Monitor	Values can be confirmed when gain switch over function is used.	ms
18	Velocity Loop Proprotional Gain Monitor	Values can be confirmed when gain switch over and auto-tuning function are used.	Hz
19	Velocity Loop Integral Time Constant Monitor		ms
1A	Force Command Filter Monitor		Hz
1B	Incremental Encoder Signal Monitor	Incremental signal of CN2 is displayed.	-----
1C	Load Force Monitor (Estimate Value)	Load force is displayed.	%
1D	Powre Monitor	Main circuit DC voltage is displayed.	V
1E	Servo Amplifier Operation Time	Counted while control power supply is ON. The time is displayed value × 2 hours.	× 2 hour

For displays of monitor by digital operator, refer to “Chapter 4, Digital operator”.

For displays of monitor by Setup Software, refer to “Setup Software R-SETUP”.

8

[Maintenance]

8. Maintenance [Trouble Shooting]

■ Corrective Actions for Problems During Operation

●When troubles occur without any alarm displayed, check and take corrective actions for them referring to the description below. When alarm rings, take corrective measures referring to “Trouble Shooting When Alarm Rings” .

⚠ Conducting investigations or corrective actions without turning the power OFF is dangerous, and could lead to injury.

No	Problems	Investigation	Assumed causes and corrective actions
1	“≡” does not blink in 7-segment LED even if main power is ON.	Check the voltage at the power input terminal.	• If voltage is low, check the power supply. • If there is no voltage, check that wires and screws are fastened properly.
		Check if red “CHARGE” LED is blinking.	• Internal power circuit of servo amplifier is defective. → Replace the servo amplifier.
2	7-segment LED displays a rotating character “8” (Servo ON status), but motor does not rotate.	Check if command is entered.	• Reenter the previous command.
		Check if servo is locked.	• Fasten the connecting screws, as power line of motor is not connected.
		Check if torque limit is input.	• Because torque limit has been input, motor cannot rotate more than load torque.
		Enter deviation clear to check if process is continued.	• Stop the input of deviation clear.
3	Rotations of linear motor are unstable and less than the specified command.	Check if proportional control is entered.	• Stop the input of proportional control.
		Check if torque limit is input.	Quit inputting torque limit.
4	Linear motor rotates only once, and stops.	Check motor power line.	• The motor power line is not connected.
		Check if the encoder resolution settings are correct.	• Change the settings and turn ON the power again.

No	Problems	Investigation	Assumed causes and corrective actions
5	Linear motor is accelerated.	Check the motor power line.	• Phase order of motor power line does not match.
		Check the wiring of encoder cable.	• Wiring of A phase and B phase of the encoder is incorrect.
		Check the wiring of hall sensor.	• Wiring of hall sensor is incorrect.
6	Motor is vibrating with frequency above 200 Hz.	—	• Reduce the loop gain speed. Set the force command low-pass filter and torque command notch filter.
7	Excessive over shoot/ under shoot during starting / stopping.	—	• Adjust the servo tuning “response”. • Reduce the loop gain speed. • Increase the integral time constant. • Simplify the acceleration and declaration command. Use position command low-pass filter. •
8	Abnormal sound occurs	Check that there is no defect in mechanical installation.	• Observe by operating one motor. • Pay attention while coupling and confirm that there is no unbalance.
		Check whether abnormal sound is random or periodic while operating at low speed.	• Confirm that the twisted pair and shield processing of encoder signal line are correct. • Confirm that the wiring for encoder line and power line are installed in the same port. • Confirm that the power supply voltage is sufficient.

■ Alarm List

	Alarm code								Alarm title	Alarm contents	Detection Operations	Alarm Clear
	Display	3 bits output			PY compatible code							
		Bit7	Bit6	Bit5	ALM8	ALM4	ALM2	ALM1				
Abnormality related to drive	21H	0	0	1	0	0	0	1	Power Module Error (Overcurrent)	・Over current of drive module ・Abnormality in drive power source ・Overheating of drive module	D B	V
	22H				0	0	0	1	Current Detection Error 0	・Abnormality of electric current detection value	D B	V
	23H				0	0	0	1	Current Detection Error 1	・Abnormality of Electric current detection circuit	D B	V
	24H				0	0	0	1	Current Detection Error 2	・Abnormality in communication with Electric current detection circuit	D B	V
Abnormality related to load	41H	0	1	0	0	0	1	0	Overload 1	・Excessive effective torque	S B	V
	42H				0	0	1	0	Overload 2	・Stall over load	D B	V
	43H				0	1	0	1	Regenerative Error	・Regeneration load ratio exorbitance	D B	V
	44H				1	0	0	0	Fixed Excitation Error	・CS detection error	—	V
	51H				0	0	1	1	Amplifier Overheat	・Overheating detection of amplifier ambient temperature	S B	V
	52H				0	0	1	1	RS Overheat	・Detection of in-rush prevention resistance overheating	S B	V
	53H				0	0	1	1	Dynamic Brake Resistor Overheat	・ Overheating detection of DB resistor	S B	V
	54H				0	1	0	1	Internal Overheat	・Overheating detection of Internal regeneration resistor	D B	V
	55H				0	0	1	1	External Error	・Overheating detection of External regeneration resistor	D B	V

	Alarm code								Alarm name	Alarm contents	Operations while detecting	Alarm clear
	Display	3 bits output			PY compatible code							
		Bit7	Bit6	Bit5	ALM8	ALM4	ALM2	ALM1				
Abnormality in power source	61H	0	1	1	0	1	0	1	Overvoltage	・DC Excess voltage of main circuit	D B	V
	62H				1	0	0	1	Main Circuit Undervoltage	・DC Main circuit low voltage	D B	V
	63H				1	0	1	0	Main Power Supply Fail Phase	・1 phase of the 3 phase main circuit power supply disconnected	S B	V
	71H				0	1	1	1	Control Power Supply Undervoltage	・Control power supply low voltage	D B	V Note 2)
	72H				0	1	1	1	Control Power Error	・Under voltage of + 12 V	S B	V
Abnormality related to encoder wiring	81H	1	0	0	1	0	0	0	Encoder Pulse Error 1 (A-phase, B-phase, Z-phase)	・Incremental encoder (A, B, Z) signal line break ・Power supply break	D B	" "
	~~82H~~				~~1~~	~~0~~	~~0~~	~~0~~	~~Absolute Encoder Signal Disconnect~~	~~・Absolute Encoder (PS) signal line break~~	~~D B~~	~~V~~
	83H				1	0	0	0	External Encoder Pulse Error (CN-EXT: A-Phase, B-Phase, Z-Phase)	・Breaking of full close Encoder (A, B) signal line	D B	V
	84H				1	0	0	0	Communication Error Between Encoder and Amplifier	・Encoder serial signal time out	D B	V Note 5)
	85H				1	0	0	0	Encoder Initial Process Error	・Failed to read CS data of incremental encoder ・Abnormality in initial process of absolute encoder ・Cable break	—	" "
	86H				1	0	0	0	CS Error	・CS data leaping position	DB	" "
	87H				1	0	0	0	CS Signal Disconnection	・CS signal line break	D B	" "
	~~91H~~				~~1~~	~~0~~	~~0~~	~~0~~	~~Encoder Command Error~~	~~・Mismatch of transmission command and reception command~~	~~D B~~	~~V~~
	~~92H~~				~~1~~	~~0~~	~~0~~	~~0~~	~~Encoder FORM Error~~	~~・Start, Stop bit Abnormality ・Insufficient data length~~	~~D B~~	~~V~~
	~~93H~~				~~1~~	~~0~~	~~0~~	~~0~~	~~Encoder SYNC Error~~	~~・Data cannot be received during the prescribed time after the command is sent.~~	~~D B~~	~~V~~
	~~94H~~				~~1~~	~~0~~	~~0~~	~~0~~	~~Encoder CRC Error~~	~~・CRC generated from the received data and sent CRC does not match~~	~~D B~~	~~V~~

Note 1:Control power error or servo ready OFF is detected during instantaneous break of 1.5 to 2 cycles. Detection of control power error and servo ready OFF can be delayed by setting larger value of PFDDLY（Group B Page 16）.

Note 2:When the main power voltage increases or decreases gradually or is suspended, main circuit low voltage or main power failed phase may be detected.

Note 3:When the control panel voltage drops below ＋5 V due to suspension of control power, the alarm cannot be cleared without turning OFF the control power, even if having been restored with only a little drop from ＋5 V resulting in detection of control power supply error. Turn OFF the control power to reset the alarm.

Note 4:Prolonged instantaneous stop of the control power is regarded as a power shut OFF / turning ON again, and is not recorded in the alarm history. (Stop for 1 second or longer is surely judged as power shut OFF / turning ON again.)

Note 6:"V" means it is possible to reset. " " means it is not possible to reset.

8. Maintenance [Alarm List]

	Alarm code								Alarm name	Alarm contents	Operations while detecting	Alarm clear
	Display	3 bits output			PY compatible code							
		Bit7	Bit6	Bit5	ALM8	ALM4	ALM2	ALM1				
Abnormality in encoder main body	~~A 1 H~~	~~1~~	~~0~~	~~1~~	~~1~~	~~0~~	~~0~~	~~0~~	~~Encoder Error 1~~	~~· Breakdown of Encoder internal device~~	~~D B~~	~~Note 3)~~
	~~A 2 H~~				~~1~~	~~0~~	~~0~~	~~0~~	~~Absolute Encoder Battery Error~~	~~· Battery low voltage~~	~~D B~~	~~Note 3)~~
	~~A 3 H~~				~~1~~	~~0~~	~~0~~	~~0~~	~~Encoder Overheat~~	~~· Motor built-in Encoder Overheating~~	~~D B~~	~~Note 3)~~
	~~A 5 H~~				~~1~~	~~0~~	~~0~~	~~0~~	~~Encoder Error 3~~	~~· Error generation of multi-rotation data~~ ~~· Abnormality in operations of temperature sensor~~	~~D B~~	~~Note 3)~~
	~~A 6 H~~				~~1~~	~~0~~	~~0~~	~~0~~	~~Encoder Error 4~~	~~· Encoder internal EEPROM data is not set~~ ~~· Overflow of multi-rotation data~~	~~D B~~	~~Note 3)~~
	~~A 7 H~~				~~1~~	~~0~~	~~0~~	~~0~~	~~Encoder Error 5~~	~~· Resolver Abnormality~~ ~~· Light receiving abnormality in encoder~~	~~D B~~	~~Note 3)~~
	~~A 8 H~~	~~1~~	~~0~~	~~1~~	~~1~~	~~0~~	~~0~~	~~0~~	~~Encoder Error 6~~	~~· Resolver disconnection~~ ~~· Light receiving abnormality in encoder~~	~~D B~~	~~Note 3)~~
	~~A 9 H~~				~~1~~	~~0~~	~~0~~	~~0~~	~~Failure of Encoder~~	~~· Encoder failure~~	~~D B~~	~~Note 3)~~
	~~B 2 H~~				~~1~~	~~0~~	~~0~~	~~0~~	~~Encoder Error 2~~	~~· Position data incorrect~~	~~D B~~	~~Note 3)~~
	~~B 3 H~~				~~1~~	~~0~~	~~0~~	~~0~~	~~Absolute Encoder Multi-Turn Counter Error~~	~~· Detection of incorrect multiple rotations coefficient~~	~~D B~~	~~Note 3)~~
	~~B 4 H~~				~~1~~	~~0~~	~~0~~	~~0~~	~~Absolute Encoder Single-Turn Counter Error~~	~~· Detection of incorrect 1 rotation coefficient~~	~~D B~~	~~Note 3)~~
	~~B 5 H~~				~~1~~	~~0~~	~~0~~	~~0~~	~~Over-allowable Speed of Absolute Encoder at Turning ON~~	~~· Exceeds the permitted speed of motor rotation speed when the power is turned ON~~	~~D B~~	~~Note 3)~~
	~~B 6 H~~				~~1~~	~~0~~	~~0~~	~~0~~	~~Encoder Memory Error~~	~~· Access error of Encoder internal EEPROM~~	~~D B~~	~~Note 3)~~
	~~B 7 H~~				~~1~~	~~0~~	~~0~~	~~0~~	~~Acceleration Error~~	~~· Exceeds the permitted speed for motor rotation~~	~~D B~~	~~Note 3)~~
Control system abnormality	C 1 H	1	1	0	0	1	1	0	Overspeed	· Motor rotation speed is 120 % more than the highest speed limit	D B	V
	C 2 H				1	1	0	0	Speed Control Error	· Torque command and acceleration direction are not matching.	D B	V
	C 3 H				1	1	0	0	Speed Feedback Error	· Motor power disconnection (Note 2)	D B	V
	D 1 H				1	1	0	1	Following Error (Excessive Position Deviation)	· Position error exceeds setup value	D B	V
	D 2 H				1	1	0	1	Faulty Position Command Pulse Frequency 1	· Frequency of entered position command pulse is excessive	S B	V
	D 3 H				1	1	0	1	Faulty Position Command Pulse Frequency 2	· Position command frequency after electronic gear is high.	S B	V
	D F H				1	1	0	1	Test Run Close	· Detection in 'Test mode end' status	D B	V
Control system/Memory system abnormality	E 1 H	1	1	1	1	1	1	1	EEPROM Error	· Abnormality of amplifier with built-in EEPROM	D B	" "
	E 2 H				1	1	1	1	EEPROM Check Sum Error	· Error in check sum of EEPROM (entire area)	—	" "
	E 3 H				1	1	1	1	Internal RAM Error	· Access error in CPU built in RAM	—	" "
	E 4 H				1	1	1	1	Process Error between CPU and ASIC	·Access abnormality in CPU ~ ASIC	—	" "
	E 5 H				1	1	1	1	Parameter Error 1	·Detection when non-corresponding or undefined amplifier, motor, encoder code are specified.	—	" "
	E 6 H				1	1	1	1	Parameter Error 2	· Error in combining motor, encoder, and/or amplifier code set from system parameter	—	" "
	F 1 H				1	1	1	1	Task Process Error	· Error in interruption process of CPU	D B	" "
	F 2 H				1	1	1	1	Initial Process Time-Out	·Detection when initial process does not end within initial process time	—	" "

Note 1: Alarm that rings in 'Test mode end' status is not recorded in the alarm history.

Note 2: When there is a rapid motor slow down simultaneous with servo ON, there is a possibility that a break in the motor's power line cannot be detected.

~~Note 3: Due to abnormality in encoder main body, encoder clear may sometimes be needed.~~

Note 4:"V" means it is possible to reset. " "means it is not possible to reset.

■ Warning List

	Warning Title	Warning Contents
Load system	Overload Warning	· When the effective torque exceeds the set torque
	Regenerated Overload Warning	· In case of overload of regenerative resistance
	Amplifier Overheating Warning	· Ambient temperature of the amplifier is out of range of the set temperature
Power supply system	Main circuit is charging	· Voltage of main circuit is above DC 105 V
External input system	Forward over travel	· While entering forward over travel
	Reverse over travel	· While entering reverse over travel
Encoder system	~~Absolute encoder battery warning~~	~~· Battery voltage is below 3.0 V~~
Control system	Restricting force command	· While restricting the torque command by torque restriction value
	Restricting speed command	· While restricting the speed command by speed value.
	Excessive position deviation	· When position deviation warning setup value is outside the prescribed limits

8. Maintenance [Trouble Shooting When Alarm Occurs]

Alarm code 21H (Power Module Error / Overcurrent)

Status at the time of alarm	Cause			
	1	2	3	4
Issued when control power is turned ON.	(V)		V	(V)
Issued at servo input.	V	V	V	
Issued while starting and stopping the motor.	(V)	(V)	(V)	
Issued after extended operating time.	(V)	(V)	(V)	V

Corrective actions

Cause		Investigation and corrective actions
1	・U/V/W-phase of amplifier is short circuited due to the wiring in amplifier and motor. Also, U/V/W-phases are grounded in the earth.	・Check the wiring between the amplifier and motor, and confirm that there is no error. If some error is detected, modify or change the wiring.
2	・Short circuit or fault in U/V/W phases on linear motor side.	・Replace the linear motor.
3	・Defect in control print panel ・Defect in power device	・Replace the servo amplifier.
4	・Overheat is detected in Power device (IPM).	・Confirm that the cooling fan motor for the servo amplifier is working. If it is not working, replace the servo amplifier. ・Confirm that the temperature of the control panel (ambient temperature of the servo amplifier) does not exceed 55℃. If in excess of 55(C, check the installation method of the servo amplifier, and confirm that the cooling temperature of the control panel is set to below 55℃

Alarm code 22H (Current Detection Error 0)

Status during alarm	Cause	
	1	2
Issued when the control power is turned ON.	V	(V)
Issued after the power is turned ON.	(V)	V

Corrective actions

Cause		Investigation and corrective actions
1	・Defect in control print panel ・ Defect in power device	・ Replace the servo amp.
2	・ Servo amplifier and motor are not combined properly	・ Confirm that the proper codes (per the specified Motor Codes) have been used for the linear motor; if not, replace the linear motor.

Note) V means the cause number with high possibility.

(V) means the cause number with middle possibility.

8. Maintenance [Trouble Shooting When Alarm Occurs]

Alarm code 23H (Current Detection Error 1)
Alarm code 24H (Current Detection Error 2)

Status during alarm	Cause	
	1	2
Issued when the control power is turned ON.	V	
Issued during operation.	(V)	V

Corrective actions

Cause		Investigation and corrective actions
1	・Defect in internal circuit of servo amplifier.	・Replace the servo amplifier.
2	・Malfunction due to noise	・Confirm proper grounding of the amplifier. ・ Add ferrite core or similar countermeasures against noise.

Alarm code 41H (Overload 1)

Status during alarm	Cause								
	1	2	3	4	5	6	7	8	9
Issued when power supply control is turned ON.	V								
Issued at input of servo ON.	V	V							V
After command input, issued without moving the motor.		V			V	V	V		V
After command input, brief motor movement			V	V	V		(V)	V	

Corrective actions

Cause		Investigation and corrective actions
1	・Defect in servo amplifier control panel or power element peripheral	・Replace the servo amplifier.
2	・Defect in encoder circuit of linear sensor	・Replace the linear sensor.
3	・Effective torque exceeds the rated torque.	・Monitor the load status using motor usage ratio monitor (OPRT), and check if effective force exceeds the rated value. ▪ Or, calculate the motor effective force from load conditions and operation conditions. →If the effective force is excessive, check the operating or loading, or replace the capacity of the large motor.
4	・Defect in motor-amplifier combination	・Check if the motor in use matches with the recommended type, and replace if it is improper.
5	・Holding brake of linear motor does not release.	・Check that the wiring and voltage of the holding brake are acceptable; if not, repair. → If the above are OK, replace the linear motor.
6	・Wiring of U/V/W –phase between servo amplifier and motor do not match.	・ Check the wiring conditions and restore if improper.
7	・One or all connections of U/V/W -phase wiring of servo amplifier / motor is disconnected	・ Check the wiring conditions and restore if improper.
8	・Machines collided.	・Check the operating conditions and limit switch.
9	・Linear sensor resolution does not match.	・Match the incremental resolution of the system parameter with the linear sensor resolution.

During the alarm caused by conditions in #3 (above), if OFF→ON of power supply control is repeated, there is a risk of burning out the linear motor.
Wait for longer than 30 min. for cooling purposes after power shut OFF, and resume operations.

Note) V means the cause number with high possibility.
(V) means the cause number with middle possibility.

Alarm code 42H (Overload 2)

Status during alarm	Cause								
	1	2	3	4	5	6	7	8	9
Issued when power supply control is turned ON.	V								
Issued at input of servo ON.	V	V							V
After command input, issued without rotating the motor.		V			V	V	V		V
After command input, brief motor rotation			V	V	V		(V)	V	

Corrective actions

Cause		Investigation and corrective actions
1	·Defect in servo amplifier control panel or power element peripheral	·Replace the servo amplifier.
2	·Defect in encoder circuit of linear motor	·Replace the linear motor.
3	▪ Rotation is less than 50 min^{-1} and torque command exceeds approx. 2 times of rated torque.	▪ Check if torque command exceeds approx. 2 times of the rated torque by torque command monitor (TCMON). ▪ Or, calculate the motor effective torque from load conditions and operation conditions. →If the effective torque is excessive, check the operating or loading, or replace the capacity of the large motor.
4	·Defect in motor-amplifier combination	▪ Check the motor type setting and the motor in use are matching. If not, correct them.
5	·Holding brake of linear motor does not release.	▪ Check that wirings and voltage for holding brake are correct. If not, repair them. →If they are appropriate, replace the linear motor.
6	·Wiring of U/V/W –phase between servo amplifier and motor do not match.	· Check the wiring conditions and restore if improper.
7	·One or all connections of U/V/W -phase wiring of servo amplifier / motor is disconnected	· Check the wiring conditions and restore if improper.
8	·Machines collided.	·Check the operating conditions and limit switch.
9	·Encoder pulse number setting does not match with the motor.	·Match the encoder pulse number with the motor.

Alarm code 43H (Regenerative Error)

Status during alarm	Cause							
	1	2	3	4	5	6	7	8
Issued when power supply control is turned ON.							V	
Issued when power supply of main circuit is turned ON.						V	V	V
Issued during operation.	V	V	V	V	V		(V)	

Corrective actions

Cause		Investigation and corrective actions
1	· Exceeded permitted value of regenerating power in built-in regenerative resistance specifications. · Excessive load inertia, or tact time is short.	· Check the load inertia and operating pattern. · Use an external regeneration resistor. · Set the load inertia within the specified range. · Increase the deceleration time. · Increase the tact time.
2	· Regenerative resistance wiring conflicts with built-in regenerative resistance specifications.	· Check wiring and replace if incorrect.
3	· Regenerative resistance wiring conflicts with external regeneration resistor specifications.	· Check wiring and replace if incorrect.
4	· Regeneration resistor is disconnected.	· For built-in regeneration resistor specifications, replace the servo amplifier. · For external regeneration resistor specifications, replace the regeneration resistor.
5	· Resistance value of external regeneration resistor is excessive.	· Replace the current resistance value with a value matching the specifications.
6	· Input power supply voltage exceeds the specified range.	· Check the input power supply voltage level.
7	· Defect in control circuit of servo amplifier.	· Replace the servo amplifier.
8	· When external regenerative resistance is selected for system parameter Page OB and external regenerative resistance is not installed.	· Install the external regenerative resistance. · Set to “Do not connect regenerative resistance“.

If the setting of system parameter page OB regeneration resistance is incorrect, regeneration error is not detected properly, and the amplifier and surrounding circuit may be damaged or burnt.

Note) V means the cause number with high possibility.
(V) means the cause number with middle possibility.

8. Maintenance [Trouble Shooting When Alarm Occurs]

Alarm code 44H (Fixed Excitation Error)

Status during alarm	Cause	
	1	2
Issued when power supply control is turned ON.		V
Issued during fixed excitation	V	

Corrective actions

Cause		Investigation and corrective actions
1	・Fixed excitation current limit is excessively low. ・Motor hit the stroke end.	・Set the higher value for fixed excitation current limit. ・Secure distance to the stroke end.
2	・Defective control circuit of the servo amplifier	・Replace the servo amplifier

Alarm code 51H (Amplifier Overheat)

Status during alarm	Cause				
	1	2	3	4	5
Issued when power supply control is turned ON.	(V)		V	(V)	
Issued during operation.	(V)	V	V	V	
Issued after emergency stop.					V

Corrective actions

Cause		Investigation and corrective actions
1	・Defect in internal circuit of servo amplifier.	・Replace the servo amplifier.
2	・Regenerating power exceeded.	・Check the operating conditions. ・Use external regeneration resistor.
3	・Regenerating power is within the specified range but ambient temperature of servo amplifier is out of specified range.	・Confirm that the cooling method maintains the temperature of control panel between 0 ~ 55℃.
4	・Regenerating power is within the specified range but built-in cooling fan of servo amplifier is stopped.	・For an amplifier equipped with a fan motor, check that the fan motor is running; if not, replace the servo amplifier.
5	・Regeneration energy during emergency stop exceeded.	・Change the servo amp. ・Check the loading condition.

Abnormalities are detected in the internal temperature of the amplifier regardless of its ambient temperature. When an amplifier ambient temperature warning is issued, please be sure to check the cooling method of the control panel.

Alarm code 52H (RS Overheat) [only for RS1□30]

Status during alarm	Cause		
	1	2	3
Issued when power supply is turned ON.	V		
Issued when main circuit power supply is turned ON.		V	
Issued during operation.			V

Corrective actions

Cause		Investigation and corrective actions
1	Defect in internal circuit of servo amplifier.	Replace the servo amplifier
2	・Power turning ON is repeated too frequently.	・Turn ON/OFF the power less frequently.

3	▪ Ambient temperature is high.	▪ For a servo amplifier equipped with a cooling fan motor, check that the fan motor is running properly. If not, replace the servo amplifier. ▪ Check if the temperature inside the control panel (servo amplifier ambient temperature) exceeds ５５℃. If it does, review the servo amplifier installing method and cooling method of control panel to make it below ５５℃.

Note) V means the cause number with high possibility.
(V) means the cause number with middle possibility.

Alarm code 53H (Dynamic Brake Resistor Overheat)

Status during alarm	Cause	
	1	2
Issued when power supply is turned ON.	V	
Issued during operation.	(V)	V

Corrective actions

Cause		Investigation and corrective actions
1	▪ Defect in internal circuit of servo amplifier.	▪ Replace the servo amplifier.
2	▪ DB operation frequency exceeded.	▪ Use the dynamic brake so as not to exceed the permissive frequency.

Alarm code 54H (Internal Overheat)

Status during alarm	Cause		
	1	2	3
Issued when power supply control is turned ON.	(V)		V
Issued during operation.	(V)	V	V

Corrective actions

Cause		Investigation and corrective actions
1	▪ Defect in internal circuit of servo amplifier.	▪ Replace the servo amplifier.
2	▪ Regenerating power excessive.	▪ Check the built-in regenerative resistance absorption power. ▪ Check the operating conditions, so that regenerating power is within permitted absorption power. ▪ Use an external regeneration resistor.
3	▪ Improper wiring of built-in regeneration resistor.	▪ Confirm improper condition and repair if necessary.

When using a regeneration resistance built in the servo amplifier, make sure to set “built-in regeneration resistance” at system parameter Page ０Ｂ [Regeneration resistance type]. This setting makes the judgment between enabled/disabled of the overheating protection detection treatment of the built-in regeneration resistance. When “No connected regenerative resistance or external regenerative resistance” is selected, overheating of built-in regenerative resistance is not detected. Therefore, there is a danger that built-in regenerative resistance will burn out or be damaged.

Note) V means the cause number with high possibility.
(V) means the cause number with middle possibility.

Alarm code 55H (External Error)

●When external regenerative resistor and output terminal of the host unit are not connected.

Status during alarm	Cause	
	1	2
Issued when power supply control is turned ON.	V	(V)

Corrective actions

Cause		Investigation and corrective actions
1	• Validity condition for external trip function is set to 'Valid'.	When not used, set 00 : _Always_Disable at Group9 40.
2	• Defect in control panel of servo amplifier.	• Replace the servo amplifier.

●When external regenerative resistor is not connected

Status during alarm	Cause		
	1	2	3
Issued when power supply control is turned ON.	V		(V)
Issued after operation.		V	(V)

Corrective actions

Cause		Investigation and corrective actions
1	• Improper wiring of external regenerative resistance.	• Check wiring and replace if necessary.
2	• External regeneration resistor is operating.	• Check the operating conditions. • Increase the capacity of the external regeneration resistor.
3	• Defect in control panel of servo amplifier.	• Replace the servo amplifier.

● When output terminal of the host unit is connected:
Eliminate the alarm trigger of the host unit.

Note) V means the cause number with high possibility.
(V) means the cause number with middle possibility.

8. Maintenance [Trouble Shooting When Alarm Occurs]

Alarm code 61H (Overvoltage)

Status during alarm	Cause			
	1	2	3	4
Issued when power supply control is turned ON.	V			
Issued when power supply of main circuit is turned ON.	V	V		
Issued at the time of motor start/stop.		(V)	V	V

Corrective actions

Cause		Investigation and corrective actions
1	• Defect in control panel of servo amplifier.	• Replace the servo amplifier.
2	• The power supply voltage of main circuit exceeds the rated value.	• Reduce the power supply voltage to within the specified range.
3	• Excessive load inertia.	• Reduce the load inertia to within the specified range.
4	▪ Incorrect wiring for regeneration resistance ▪ Built-in regeneration circuit is not functioning.	▪ Wire the regeneration resistance correctly. • While using the external regenerative resistance, check the wiring and resistance value. • Replace the servo amplifier if any abnormality occurs.

Alarm code 62H (Main Circuit Under Voltage)

Status during alarm	Cause				
	1	2	3	4	5
Issued when power supply control is turned ON.				V	(V)
Issued after power supply of main circuit is turned ON.	V	V			
Issued during operation, alarm resetting is possible.		(V)	V		
Issued during operation, alarm resetting is not possible.		V			

Corrective actions

Cause		Investigation and corrective actions
1	• Power supply voltage is below the specified range.	• Check the power supply and set it within the specified range.
2	• Rectifier of main circuit is broken.	• Replace the servo amplifier.
3	• Input voltage is reduced and/or blinking.	• Check the power supply and confirm that there is no blinking or low voltage.
4	• Low voltage outside of the specified range is supplied to the main circuit (R/S/T).	• Check the main circuit voltage. Confirm that there is no external power supply to R/S/T when the main circuit is OFF.
5	• Defect in internal circuit of the servo amplifier.	• Replace the servo amplifier.

Note) V means the cause number with high possibility.
(V) means the cause number with middle possibility.

Alarm code 63H (Main Power Supply Fail Phase)

Status during alarm	Cause		
	1	2	3
Issued when power supply control is turned ON.		V	
Issued when power supply of main circuit is turned ON.	V		V
Issued during motor operations.	(V)		
Alarm issued during single-phase power input selection.			V

Corrective actions

Cause		Investigation and corrective actions
1	· One out of 3 phases (R/S/T) is not inserted.	· Check the wiring and repair if necessary.
2	· Defect in internal circuit of Servo amplifier.	· Replace the servo amplifier.
3	· Servo amplifier is not specified for single phase.	· Check the model number and delivery specifications of the servo amplifier and replace it with a servo amplifier for single-phase power supply. · Edit the parameters and use a single-phase specification amplifier.

Alarm code 71H (Control Power Supply Under Voltage)

Status during alarm	Cause		
	1	2	3
Issued at the time of power on.	(V)	V	
Issued during operation.	(V)		V

Corrective actions

Cause		Investigation and corrective actions
1	·Defect in internal circuit of the servo amplifier.	·Replace the servo amplifier.
2	·Power supply voltage is within the specified range.	·Confirm that the power supply is set within the specified range.
3	·Input voltage is fluctuating or stopped.	·Confirm that the power supply is neither stopped nor reduced.

Alarm code 72H (±12V Control Power Error)

Status during alarm	Cause	
	1	2
Issued when power supply control is turned ON.	(V)	V

Corrective actions

Cause		Investigation and corrective actions
1	·Defect in internal circuit of the servo amplifier.	·Replace the servo amplifier.
2	·Defect in external circuit	· Restart the power supply after removing the connector; if alarm is not issued, check the external circuit. · Restart the power supply after replacing the motor; if alarm is not issued, there is defect in the encoder's internal circuit.

Note) V means the cause number with high possibility.

(V) means the cause number with middle possibility.

8. Maintenance [Trouble Shooting When Alarm Occurs]

Alarm code 81H (Encoder Pulse Error 1 /A-phase, B-phase, Z-phase)

~~Alarm code 82H (Absolute Encoder Signal Disconnect)~~

Alarm code 83H (External Encoder A-phase, B-phase error)

Alarm code 84H (Communication Error Between Encoder and Amplifier)

Alarm code 87H (CS Signal Disconnection)

Status during alarm	Cause					
	1	2	3	4	5	6
Issued when power supply control is turned ON.	V	V	V	V	V	V
Issued after servo is turned ON.				V	V	
Issued during operation.	(V)			V	V	

Corrective actions

Cause		Investigation and corrective actions
1	For encoder wiring: ·Improper wiring ·Connector is removed ·Loose connection ·Linear sensor cable is too long ·Linear sensor cable is too thin	· Check wiring and repair any abnormality. · Confirm that the linear sensor power supply voltage is above 4.75 V; increase it if below 4.75 V.
2	· Wrong amplifier encoder type is selected.	·Select the correct encoder type.
3	·Linear sensor that does not match with amplifier encoder type is attached.	·Replace with linear motor equipped with proper linear sensor.
4	·Defect in servo amplifier control circuit	·Replace the servo amplifier.
5	·Defect in linear sensor	· Replace the linear motor.
6	·Parameter set to 'Full-close/Servo system'.	· Edit the parameter and set to 'Semi-close/System setup'.

Alarm code 85H (Encoder Initial Process Error)

Status during alarm	Cause			
	1	2	3	4
Issued when power supply control is turned ON.	V	V	V	V

Corrective actions

Cause		Investigation and corrective actions
1	For linear sensor wiring: ·Improper wiring ·Connector is removed ·Loose connection ·Linear sensor cable is too long ·Linear sensor cable is too thin	· Check wiring and repair any abnormality. · Confirm that the linear sensor power supply voltage is above 4.75 V; increase it if below 4.75 V.
2	· Wrong amplifier encoder type is selected.	·Select the correct encoder type.
3	· Defect in servo amplifier control circuit	·Replace the servo amplifier.
4	·Defect in linear sensor	·Replace the linear sensor.

Alarm code 86H (CS Error)

Status during alarm	Cause
	1
Issued while motor is operated.	V

Corrective actions

Cause	Investigation and corrective actions

1	・For wirings of linear sensor / hall sensor; Malfunction due to noise.	・ Check that the amplifier grounding wire is correctly installed. ・Confirm the shielding of the sensor cable. ・ Add ferrite core or others and take countermeasures against noise.

Note) V means the cause number with high possibility.
(V) means the cause number with middle possibility.

~~Alarm code 91H (Encoder Command Error)~~

~~Alarm code 92H (Encoder FORM Error)~~

~~Alarm code 93H (Encoder SYNC Error)~~

~~Alarm code 94H (Encoder CRC Error)~~

These abnormalities are detected in the internal part of the absolute position detector for the start-stop synchronization system.

Status during alarm	Cause		
	1	2	3
Issued when control power supply is turned ON.	(V)	V	V

Corrective actions

Cause		Investigation and corrective actions
1	• Defect in encoder	• Replace the linear motor.
2	• Malfunction due to noise	• Confirm proper grounding of the amplifier. • Check the shielding of the encoder cable. • Add ferrite core or similar countermeasures against noise.
3	• Abnormality in encoder wiring.	• Check wiring between the encoder and amplifier.

~~Alarm code A1H (Encoder Error 1)~~

~~This is detected in the internal part of the absolute position detector (RA062M) for the Manchester encoding system.~~

~~Status during alarm~~	~~Cause~~
	~~1~~
~~Issued when power supply is turned ON.~~	~~V~~
~~Issued during operation.~~	~~V~~

~~Corrective actions~~

~~Cause~~		~~Investigation and corrective actions~~
~~1~~	~~Defect in internal circuit of encoder~~	~~• Turn ON the power supply again; if not restored, replace the motor.~~

~~"Encoder clearing and alarm resetting methods" vary depending on the sensor/encoder in use.~~
~~Refer to page 49 "Materials; Encoder Clear".~~

~~Alarm code A2H (Absolute Encoder Battery Error)~~

~~Status during alarm~~	~~Cause~~	
	~~1~~	~~2~~
~~Issued when control power is turned ON.~~	~~V~~	~~V~~
~~Issued during operation.~~		~~V~~

~~Corrective actions~~

~~Cause~~		~~Investigation and corrective actions~~
~~1~~	~~Loose connection of battery cable.~~	~~• Confirm the battery connection in the front ON/OFF switch of the amplifier.~~
~~2~~	~~Low battery voltage~~	~~• Check the battery voltage.~~

"Encoder clearing and alarm resetting methods" vary depending on the sensor/encoder in use.
Refer to page 49 "Materials; Encoder Clear".

Note) V means the cause number with high possibility.
(V) means the cause number with middle possibility.

Alarm code A3H (Encoder Overheat)

This is detected in the internal part of the absolute position detector for the start stop synchronization system.

Status during alarm	Cause		
	1	2	3
Issued when control power supply is turned ON.	(V)	V	
Issued while stopping the motor.	(V)	V	
Issued during motor operations.		V	V

Corrective actions

Cause		Investigation and corrective actions
1	・Defect in internal circuit of encoder	・Turn ON the power supply again; if not restored, replace the motor.
2	・Motor is not generating heat, but encoder ambient temperature is high.	・Confirm that the cooling method keeps the encoder ambient temperature below 80°C.
3	・Motor is overheated.	・Confirm the cooling procedure of the linear motor.

✍ "Encoder clearing and alarm resetting methods" vary depending on the sensor/encoder in use.
Refer to page 49 "Materials; Encoder Clear".

Alarm code A5H (Encoder Error 3)

This is detected in the internal part of the absolute position detector for the start stop synchronization system.

Status during alarm	Cause		
	1	2	3
Issued when power supply is turned ON.	(V)	V	V
Issued during motor operations.	(V)	V	

Corrective actions

Cause		Investigation and corrective actions
1	・Defect in internal circuit of encoder	・Turn ON the power supply again; if not restored, replace the motor.
2	・Malfunction due to noise	・Confirm proper grounding of the amplifier. ・Check the shielding of the encoder cable. ・Add ferrite core or similar countermeasures against noise.
3	・Number of rotations exceeds the permitted number of rotations.	・Turn ON the power supply again, when motor is stopped.

✍ "Encoder clearing and alarm resetting methods" vary depending on the sensor/encoder in use.
Refer to page 49 "Materials; Encoder Clear".

Note) V means the cause number with high possibility.
(V) means the cause number with middle possibility.

Alarm code A6H (Encoder Error 4)

When abnormalities are detected in the internal part of the absolute position detector for the start stop synchronization system.

Status when alarm rings.	Cause		
	1	2	3
Issued when power supply is turned ON.	V	V	
Issued during motor operations.		V	V

Corrective actions

Cause		Investigation and corrective actions
1	Defect in internal circuit of encoder	- Turn ON the power supply again; if not restored, replace the motor.
2	Malfunction due to noise	- Confirm proper grounding of the amplifier. - Check the shielding of the encoder cable. - Add ferrite core or similar countermeasures against noise.
3	Multi-rotation counter overflows.	- Correct the operation pattern, and avoid the continuous operation in a fixed direction.

✍ "Encoder clearing and alarm resetting methods" vary depending on the sensor/encoder in use.
Refer to page 49 "Materials; Encoder Clear".

Alarm code A7H (Encoder Error 5)
Alarm code A8H (Encoder Error 6)
Alarm code A9H (Failure of Encoder)

When abnormalities are detected in the internal part of the absolute position detector for the start stop synchronization system.

Status during alarm	Cause	
	1	2
Issued when power supply is turned ON.	V	V
Issued during motor operations.	(V)	V

Corrective actions

Cause		Investigation and corrective actions
1	Defect in internal circuit of encoder	- Turn ON the power supply again; if not restored, replace the motor.
2	Malfunction due to noise	- Confirm proper grounding of the amplifier. - Check the shielding of the encoder cable. - Add ferrite core or similar countermeasures against noise.

✍ "Encoder clearing and alarm resetting methods" vary depending on the sensor/encoder in use.
Refer to page 49 "Materials; Encoder Clear".

Note) V means the cause number with high possibility.
(V) means the cause number with middle possibility.

Alarm Code B2H (Encoder Error 2)

When abnormality is detected in the internal part of the absolute position detector (RAO62M) of the Manchester system.

Status during alarm	Cause	
	1	2
Issued during operation.	(V)	V

Corrective actions

Cause		Investigation and corrective actions
1	Defect in internal circuit of encoder	Turn ON the power supply again; if not restored, replace the motor.
2	Malfunction due to noise	Confirm proper grounding of the amplifier. Check the shielding of the encoder cable. Add ferrite core or similar countermeasures against noise.

✍ "Encoder clearing and alarm resetting methods" vary depending on the sensor/encoder in use.
Refer to page 49 "Materials; Encoder Clear".

Alarm code B3H (Absolute Encoder Multi-Turn Counter Error)
Alarm code B4H (Absolute Encoder Single-Turn Counter Error)
Alarm code B6H (Encoder Memory Error)

When abnormalities are detected in the internal part of the absolute position detector for the start-stop synchronization system.

Status during alarm	Cause	
	1	2
Issued when control power supply is turned ON.	V	
Issued while operation.	(V)	V

Corrective actions

Cause		Investigation and corrective actions
1	Defect in internal circuit of encoder	Turn ON the power supply again; if not restored, replace the motor.
2	Malfunction due to noise	Confirm proper grounding of the amplifier. Check the shielding of the encoder cable. Add ferrite core or similar countermeasures against noise.

✍ "Encoder clearing and alarm resetting methods" vary depending on the sensor/encoder in use.
Refer to page 49 "Materials; Encoder Clear".

Note) V means the cause number with high possibility.
(V) means the cause number with middle possibility.

Alarm code B5H (Over-allowable Speed of Absolute Encoder at Turning ON)

When abnormalities are detected in the internal part of the absolute position detector for the start-stop synchronization system.

Status during alarm	Cause		
	1	2	3
Issued when power supply is turned ON.	V		(V)
Issued while stopping the motor.	V	V	
Issued while rotating the motor.	(V)	V	V

Corrective actions

Cause		Investigation and corrective actions
1	・Defect in internal circuit of encoder	・Turn ON the power supply again; if not restored, replace the motor.
2	・Malfunction due to noise	・Confirm proper grounding of the amplifier. ・Check the shielding of the encoder cable. ・Add ferrite core or similar countermeasures against noise.
3	・Number of motor rotations exceeds the permitted speed.	・Check the operation pattern and reduce the maximum number of rotations.

✍ "Encoder clearing and alarm resetting methods" vary depending on the sensor/encoder in use.
Refer to page 49 "Materials; Encoder Clear".

Alarm code B7H (Acceleration Error)

When abnormalities are detected in the internal part of the absolute position detector for the start-stop synchronization system.

Status during alarm	Cause		
	1	2	3
Issued while stopping the motor.	V	V	
Issued while rotating the motor.	(V)	V	V

Corrective actions

Cause		Investigation and corrective actions
1	・Defect in internal circuit of encoder	・Turn ON the power supply again; if not restored, replace the motor.
2	・Malfunction due to noise	・Confirm proper grounding of the amplifier. ・Check the shielding of the encoder cable. ・Add ferrite core or similar countermeasures against noise.
3	・The acceleration of motor rotation exceeds the permitted acceleration	・Check the operation pattern, and extend the acceleration and declaration time.

✍ "Encoder clearing and alarm resetting methods" vary depending on the sensor/encoder in use.
Refer to page 49 "Materials; Encoder Clear".

Note) V means the cause number with high possibility.
(V) means the cause number with middle possibility.

Alarm code C1H (Overspeed)

Status during alarm	Cause			
	1	2	3	4
Issued when control power supply is turned ON.	V	(V)		
Issued if command is entered after Servo ON	(V)	V		
Issued when the motor is started.			V	V
Issued other than operating and starting the motor		V	V	

Corrective actions

Cause		Investigation and corrective actions
1	• Defect in control panel of servo amplifier.	• Replace the servo amplifier.
2	• Defect in the encoder of linear motor	• Replace the linear motor.
3	• Excessive overshoot while starting.	• Monitor speed with the analog monitor. →Adjust the servo parameters if overshoot is excessive. → Simplify the acceleration and declaration command pattern. → Reduce the load inertia.
4	• Wiring of U/V/W -phase between servo amplifier and motor do not match.	• Check the wiring and repair any irregularities.

Note) V means the cause number with high possibility.
(V) means the cause number with middle possibility.

Alarm code C2H (Speed Control Error)

Status during alarm	Cause				
	1	2	3	4	5
Issued when control power supply is turned ON.					V
Issued while due to input of Servo ON	V		V		
Issued if command is entered.	V	V	V		
Issued while starting and stopping the motor.				V	

Corrective actions

Cause		Investigation and corrective actions
1	• Wiring of U/V/W -phase between servo amplifier and motor do not match.	• Check the wiring and repair any irregularities.
2	• The wiring of A, B phase of INC-E and ABS-EI encoder connection is incorrect.	• Check the wiring and repair any irregularities.
3	• The motor is vibrating (oscillating).	• Adjust the servo parameters so that linear motor will not vibrate (oscillate).
4	• Excessive overshoot and undershoot.	• Monitor speed with the analog monitor. • Adjust the servo parameters to reduce overshoot and undershoot. • Increase acceleration and declaration command time. Mask the alarm.
5	• Abnormality in servo amplifier control circuit	• Replace the servo amplifier.

For the speed control error alarm, an alarm may occur while starting and stopping when load inertia is excessive. For this reason, in the gravitational axis applications, "Do not detect" is selected as the standard setting. If its detection is needed, consult our representatives.

Alarm code C3H (Speed Feedback Error)

Status during alarm	Cause		
	1	2	3
Issued when command is entered.	V	(V)	V

Corrective actions

Cause		Investigation and corrective actions
1	• Motor is not moving.	• Confirm that the power line is properly connected. • Replace the linear motor.
2	• Defect in internal circuit of servo amplifier.	• Replace the servo amplifier.
3	• The motor is vibrating (oscillating).	• Adjust the servo parameter so that linear motor will not vibrate (oscillate).

Note) V means the cause number with high possibility.
(V) means the cause number with middle possibility.

8. Maintenance [Trouble Shooting When Alarm Occurs]

Alarm code D1H (Following Error / Excessive Position Deviation)

Status during alarm	Cause											
	1	2	3	4	5	6	7	8	9	10	11	12
Issued when control power supply is turned ON.										V		
Issued when servo ON is stopped.						V					V	
Issued immediately after entering the command.	V	(V)	V	V	V		V	(V)	V		(V)	
Issued during starting or stopping at high speed.	V	V					V	V	V		(V)	V
Issued during the operations by lengthy command.		V					V	(V)			(V)	

Corrective actions

Cause		Investigation and corrective actions
1	• Position command frequency is high or acceleration and declaration time is short.	• Correct the position command of the controller
2	• Excessive initial load or low motor capacity.	• Correct the load condition or increase the motor capacity
3	• Holding brake is not released.	• Check the wiring and repair any abnormalities. If specified voltage is applied, replace the linear motor.
4	• Motor is mechanically locked or machine is colliding.	• Check the machinery system.
5	• One or all phases of U/V/W -phase of the servo amplifier and motor has disconnected.	• Check and repair the wiring connections.
6	• Motor is being rotated by an external force (Gravity, etc.) during stopping (positioning completion).	• Check the load, and/or increase the motor capacity.
7	• Valid current limit command is entered by the controller, and the current limit setting is reduced. • Number of sensor resolution does not match with the linear sensor.	• Increase the current limit value or disable the current limit. • Match the number of linear sensor resolution.
8	• Settings of servo parameters (Position loop gain, etc.) are not appropriate.	• Check the servo parameter settings (Raise the position loop gain, etc.)
9	• Excessive deviation setting value is reduced.	• Set a greater value for excessive deviation.
10	• Defect in control panel of servo amplifier.	• Replace the servo amplifier.
11	• Linear motor encoder is defective.	• Replace the linear motor.
12	• Power supply voltage is low.	• Check the power supply voltage.

Alarm code D2H (Faulty Position Command Pulse Frequency 1)

Status during alarm	Cause
	1
Issued after entering position command pulse.	V

Corrective actions

Cause		Investigation and corrective actions
1	• Command for the digital filter setting of the command pulse input is entered	• Decrease the frequency of the command pulse. • Increase the frequency of the digital filter.

Note) V means the cause number with high possibility.
(V) means the cause number with middle possibility.

Alarm code D3H (Faulty Position Command Pulse Frequency 2)

Status during alarm	Cause	
	1	2
Issued after entering position command pulse.	V	V

Corrective actions

Cause		Investigation and corrective actions
1	• Frequency of command pulse input is excessive.	• Reduce the frequency of command pulse input.
2	• Setting value of electronic gear is excessive.	• Decrease the electronic gear setting value.

Alarm code DFH (Test Run Close)

Status during alarm	Cause
	1
Occurred after execution of test mode.	V

Corrective actions

Cause		Investigation and corrective actions
1	• Normal operation.	• Clear the alarm and restore operation. (After completion of test mode, to confirm any deviation in the controller).

Alarm code E1H (EEPROM Error)

Status during alarm	Cause	
	1	2
Issued when control power supply is turned ON.	V	(V)
Issued during display key operation or computer interface operation.		V

Corrective actions

Cause		Investigation and corrective actions
1	• Correct value not read by CPU by nonvolatile memory of built-in servo amplifier.	• Replace the servo amplifier.
2	• Defect in the servo amplifier control panel	• Replace the servo amplifier.

Note) V means the cause number with high possibility.
(V) means the cause number with middle possibility.

Alarm code E2H (EEPROM Check Sum Error)

Status during alarm	Cause	
	1	2
Issued when control power supply is turned ON.	(V)	V

Corrective actions

Cause		Investigation and corrective actions
1	• Correct value not read by CPU by nonvolatile memory of built-in servo amplifier	• Replace the servo amplifier.
2	• Failed to write into the nonvolatile memory during last power supply cutoff.	• Change the optional parameters, turn ON the power supply again, and confirm that alarm has cleared. → If alarm is not cleared, replace the servo amplifier.

Alarm code E3H (Internal RAM Error)
Alarm code E4H (Process Error between CPU and ASIC)

Status during alarm	Cause
	1
Issued when control power supply is turned ON.	V

Corrective actions

Cause		Investigation and corrective actions
1	• Defect in the servo amplifier control panel	• Replace the servo amplifier.

Alarm code E5H (Parameter Error 1)

Status during alarm	Cause	
	1	2
Issued when control power supply is turned ON.	V	V
Issued after changing any of system parameters.	V	

Corrective actions

Cause		Investigation and corrective actions
1	• Selected value is outside the specified range for a system parameter.	• Confirm the model number of the servo amplifier. • Confirm selected values of system parameters and modify if necessary. →Turn ON the power again and confirm that alarm is cleared.
2	• Defect in servo amplifier	• Replace the servo amplifier.

Note) V means the cause number with high possibility.
(V) means the cause number with middle possibility.

Alarm code E6H (Parameter Error 2)

Status during alarm	Cause	
	1	2
Issued when control power supply is turned ON.	V	V
Issued after changing any of system parameters.	V	

Corrective actions

Cause		Investigation and corrective actions
1	• Selected values of system parameters and actual hardware do not match • Improper assembly of system parameter settings.	• Confirm the model number of servo amplifier. • Confirm selected values of system parameters and correct if necessary. →Turn ON the power again and confirm that alarm is cleared.
2	• Defect in servo amplifier	• Replace the servo amplifier.

Alarm code F1H (Task Process Error)

Status during alarm	Cause
	1
Issued while operating.	V

Corrective actions

Cause		Investigation and corrective actions
1	• Abnormality in control circuit of servo amplifier	• Replace the servo amplifier

Alarm code F2H (Initial Process Time-Out)

Status during alarm	Cause	
	1	2
Issued when control power supply is turned ON.	V	V

Corrective actions

Cause		Investigation and corrective actions
1	• Defect in internal circuit of servo amplifier	• Replace the servo amplifier.
2	• Malfunction due to noise	• Confirm proper grounding of the amplifier. • Add ferrite core or similar countermeasures against noise.

Note) V means the cause number with high possibility.
(V) means the cause number with middle possibility.

■ Corrective Actions for Problems During Operation

● For maintenance purposes, a daily inspection is typically sufficient.
Upon inspection, refer to the following description.

Inspection location	Testing conditions			Inspection Items	Inspection Methods	Solution if abnormal
	Time	During operation	While stopping			
Linear motor	Daily	V		Vibration	Check for excessive vibration.	Contact dealer/sales office.
	Daily	V		Sound	Check if there is no abnormal sound as compared to normal sound.	
	Periodic		V	Cleaning	Check for dirt and dust.	Clean with cloth or air. → ⚠1
	Yearly		V	Measure the insulation resistance value	Contact the dealer or sales office.	
Servo amplifier	Periodic		V	Cleaning	Check for dust accumulated in the accessories.	Clean with air. → ⚠1
	Yearly		V	Loose screws	Check for loose connections	Fasten the screws properly.
Temperature	On demand	V		Measure ambient temperature / motor frame temperature	Ambient temperature Motor frame temperature	Set the ambient temperature within the limit. Check the load condition pattern.

⚠ 1. While cleaning with air, confirm that there is no oil content and/or moisture in the air.
2. This inspection and replacement period is when water- or oil-proof functions are required.

■ Parts Overhaul

Parts indicated in Table 9-5 may deteriorate over time. Perform periodic inspection for preventive maintenance.

No.	Part name	Number of average replacement years	Corrective measures / usage conditions
1	Condenser for smoothing main circuit	5 Years	Replacement with new part is necessary. Load ratio : Less than 50% of rated output current of amplifier Usage condition: Average temp. 40℃ year-round
2	Cooling Fan motor	5 Years	Replacement with new part is necessary. Usage condition: Average temp. 40℃ year-round
3	Electrolysis condenser (other than condenser for smoothing main circuit)	5 Years	Replacement with new part is necessary. Usage condition: Average temp. 40℃ year-round Annual usage period is 4800 hours
4	Fuse	10 Years	Replacement with new part is necessary.

1. Condenser for smoothing the main circuit

・If the servo amplifier is in use for more than 3 years, contact the dealer or sales office.
The capacity of the condenser for smoothing the main circuit is reduces due to the frequency of motor output current and power ON/ OFF during usage, and it may cause damage.

・When the condenser is used with an average 40℃ through out the year, and exceeds more than 50% of the rated output current of servo amplifier, it is necessary to replace the condenser with a new part every 5 years.

・When used in an application where the power turn ON/OFF is repeated more than 30 times a day, consult our representatives.

2. Cooling Fan motor

・The R-Series Amplifier is set corresponding to the degree of pollution specified in EN50178 or IEC 664-1.As it is not dust proof or oil proof, use it in an environment above Pollution Degree 2 (i.e., Pollution Degree 1,2).

・R-Series servo amplifiers models RS1□03, RS1□05 RS1□10 RS1□15 and RS1□30 have a built-in cooling fan; therefore be sure to maintain a space of 50mm on the upper and lower side of the amplifier for airflow. Installation in a narrow space may cause damage due to a reduction in the static pressure of the cooling fan and/or degradation of electronic parts. Replacement is necessary if abnormal noise occurs, or oil or dust is observed on the parts. Also, at an average temperature of 40°C year-round, the life expectancy is 5 years.

✍ At SANYO DENKI, the overhauled servo amplifier is shipped with the same parameters as the ones before overhauling. Be sure to confirm the parameters before use.

9

[Specifications]

9.Specifications [Servo amplifier]

■ General specifications

Basic specifications	Model number			RS1□01□	RS1□03□	RS1□05□	RS1□10□	RS1□15□	RS1□30□
	Control function			Speed control, force control, or position control (Parameter change)					
	Control system			IGBT PWM control Sinusoidal drive					
	*1Input power		Main circuit	Three-phase AC200~230V+10, -15%, 50/60Hz±3Hz Single phase AC200~230V+10, -15%, 50/60Hz±3Hz*2					
			Controlling circuit	Single phase AC200~230V+10, -15%, 50/60Hz±3Hz					
	Environment	Ambient temperature*4		0～55℃					
		Storage temperature		-20～+65℃					
		Operating / storage humidity		Below 90%RH (no condensation)					
		Elevation		Below 200 m from the sea level					
		Vibration		0.5G Frequency range 10～55HZ Tested for 2H in each direction X.Y.Z					
		Shock		5G					
	Structure			Built-in tray type power supply					
	Mass Kg			0.9	1.0	2.2	5.5	6.8	10.0
Performance	In case of speed control specification	Speed control range*5		1:5000					
		Frequency characteristics*7		600Hz(JL=JM)					
Built-in functions	Protection functions			Over current, Current detection error, Overload, Regeneration error, Amplifier overheating, External overheating, Over voltage, Main circuit low voltage, Main circuit open-phase, Control power supply error, Sensor error, Over speed, Speed control error, Speed feedback error, Excessive position error, Position command pulse error, CPU error, Built-in memory error, Battery error, Parameter error					
	LED display			Status display, Monitor display, Alarm display, Parameter settings, Adjustment mode					
	Dynamic brake			Built-in					
	Regeneration process			Built-in					
	Applied load inertia			Within the applied load inertia of combined servo motor					
	Monitor output	Speed monitor (VMO)		2.0Ⅴ±10% (at 1000min^{-1})					
		Current monitor (IMO)		2.0Ⅴ±10% (at 100%)					
Input / Output signal	For speed/torque control specification	Speed command	Command voltage	DC±2.0V (at 1000min^{-1} command, Forward motor rotation with positive command, maximum input voltage ±10V)					
			Input impedance	Approx. 10k Ω					
		Torque command	Command voltage	DC±2.0V (at 100% force, Forward motor rotation with positive command)					
			Input impedance	Approx. 10k Ω					
		Current input limit		DC±2.0V ±15% (at rated armature current)					
		Sequence input signal		Servo on, Alarm reset, Torque limit, Encoder clear, Forward rotation inhibition, Reverse rotation inhibition, Command inhibition, External trip, Forced discharge, Emergency stop, Change of control mode, Proportional control, Gain switch, Internal speed setting					
		Sequence output signal		Servo ready, Power ON, Servo ON, Holding brake timing, Within torque limit, Within speed limit, Low speed, velocity attainment, Matching speed, Zero speed, Command acceptable, Status of gain switch, Speed loop proportional control status, Control mode switchover status, Forward OT, Reverse OT, Warning, Alarm code (3Bit)					
		Position output signal (Pulse division)		N/8192 (N=1～8191), 1/N (N=1～64) or 2/N (N=3~64)					
	For position control specification	Position command	Maximum input pulse frequency	5M pulse/second (Reverse rotation Forward rotation pulse, symbol + Pulse), 1.25M pulse/second (90° phase difference Two phase pulse)					
			Input pulse type	Forward rotaion+Reverse rotation command pulse or symbol+Pulse string command or 90°phase difference Two phase sequence command					
			Electronic gear	N/D (N=1～32767, D=1～32767) however, 1/32767 ≦N/D≦ 32767					
		Current input limit		DC±2.0V ±15% (at Rated armature current)					
		Sequence input signal		Servo ON, Warning reset, Torque limit, Clear encoder, Forward rotation inhibition, Reverse rotation inhibition, Command inhibition, External trip, Forced discharge, Emergency stop, Deviation Clear, Change of control mode, Proportional control, Gain switch, Change of electronic gear, Position loop proportional control					
		Sequence output signal		Servo ready, Power ON, Servo ON, Holding brake timing, Within torque limit, Within speed limit, Low speed, velocity attainment, Matching speed, Zero speed, Position fixed, Near range, Command acceptable, Status of gain switch, Speed loop proportional control status, Changed status of electronic gear, Changed control mode status, Forward OT, Reverse OT, Warning, Alarm code (3 bit)					
		Position output signal (Pulse division)		N/8192 (N=1～8191), 1/N (N=1～64) or 2/N (N=3～64)					

9.Specifications [Servo amplifier]

＊ 1 Source Voltage should be within the specified range.

AC200V Power input type Specified power supply range AC170V～AC253V

Install a step-down transformer if power supply exceeds the specified power supply.

＊2 AC200V single-phase input type corresponds only to ＲＳ１□０１／ＲＳ１□０３／ＲＳ１□０５.

＊3 When stored in a box, be sure that the internal temperature does not exceed this range.

＊4 Minimum rotational speed is determined as equivalent to the amplifier not stopping for a load with maximum continuous torque.

9. Specifications [Servo Amplifier]

● Incoming current

Input voltage	Amplifier model name	Control circuit (Maximum value between 1ms after input)*2	Main circuit (Maximum value between 1.2 seconds after input)
AC200V	RS1□01□	40A(O-P)	18A(O-P)*1
	RS1□03□		
	RS1□05□		
	RS1□10□		
	RS1□15□		
	RS1□30□		

＊1 The incoming current value is at its maximum when AC230V is supplied.

＊2 Use a thermistor as the incoming current prevention circuit for the power supply control.

When the power is turned ON again immediately after disconnection, or power supply ON/disconnection is repeated over a short time, or the ambient temperature and thermistor temperature is high, an incoming current exceeding the above values may occur.

● Current leakage

Since the “R series” Servo amplifier drives the motor by PWM control of the IPM, a high-frequency electric current leakage can flow through the floating capacity of the motor winding, power cable or amplifier. This may cause a malfunction in the short circuit breaker and the protective relay installed in the power supply electric circuit. Therefore, use the inverter as an electricity leakage breaker, as it provides a countermeasure against improper operation.

Motor model number	Electric current leakage per motor
RS1□01□	0.5 mA
RS1□03□	0.5 mA
RS1□05□	1.5 mA
RS1□10□	3.0 mA
RS1□15□	3.0 mA
RS1□30□	5.0 mA

・When using 2 or more motors, the electric current leakage each motor is compounded.

・The above values are based on using the recommended tough**, rubber-sheathed 2mm cable** as a power line.

・The system must be grounded (Type D, 3rd type) so that a dangerous voltage condition (on the main part of the machine, i.e., operation panel, etc.) does not occur during an emergency leakage.

・The value of leaked current is measured by an ordinary leak checker (700Hz Filter).

● Calorific value

Input voltage	Amplifier capacity	Maximum calorific value of servo amplifier (W)
AC200V	RS1□01A	32
	RS1□03A	66
	RS1□05A	63
	RS1□10A	137
	RS1□15A	222
	RS1□30A	566

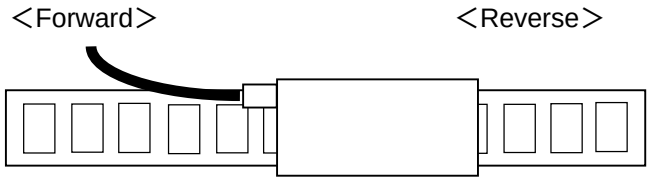
・Because heat generation of the built-in regeneration resistance is not included in the values given in this table, it may be necessary to add it (if needed).

・Be sure to carefully follow the installation method outlined in “Section 2, Installation”.

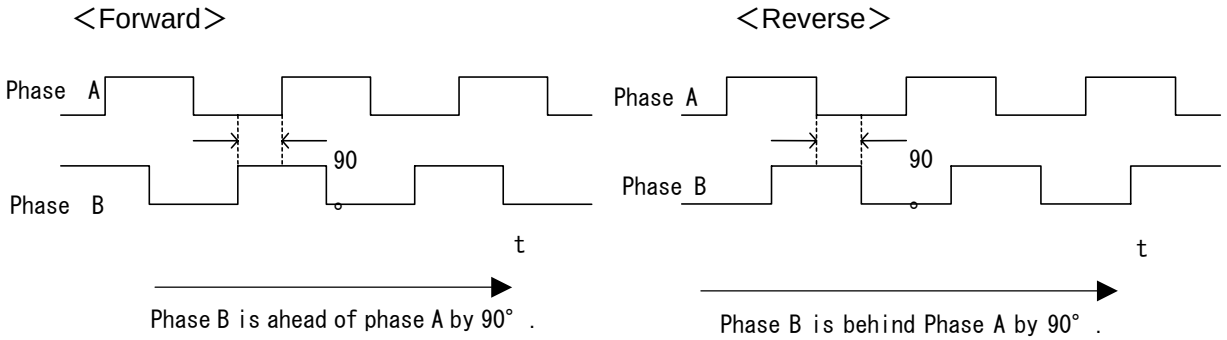
9. Specifications [Move Direction]

■ Specifications of move direction

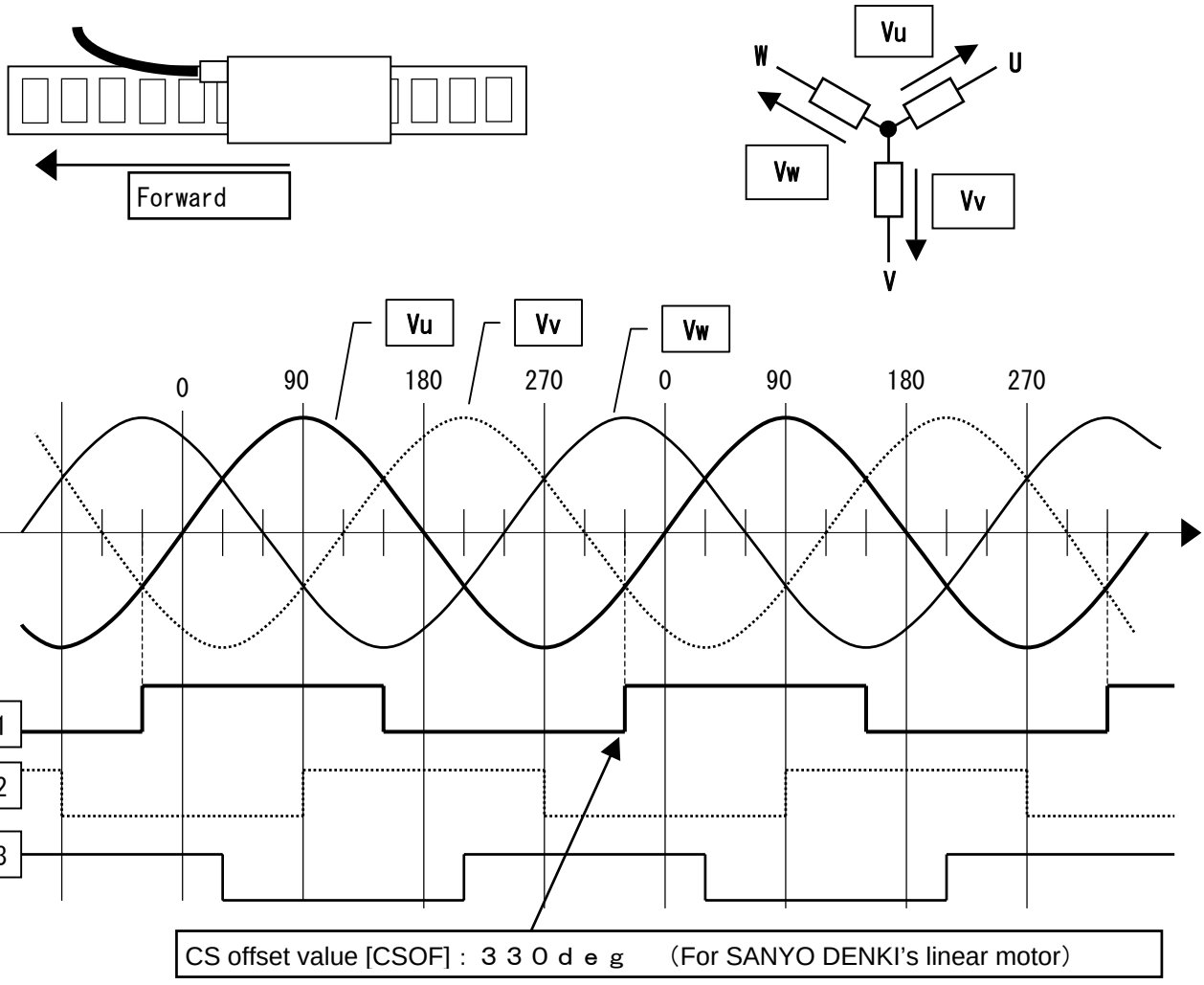
● Forward move of the linear motor means that of the power line leading when a command for position increasing is input.



● Linear sensor signal phase



■ Linear motor voltage phase order and hall sensor phase order at forward move.



Materials

[Selection Details]

[International Standards]

[Dimension]

[Linear motor data sheet]

[Option]

Materials: Selection Details [Motor Selection Procedure]

■ Precautions for loading condition

- Negative load

  The servo amplifier cannot perform such operations with negative load as the motor is continuously operated from loading for more than several seconds.

  [Example]

  ・Downward motor drive (when there is no counter weight.)

  ・When using like a generator, such as the wind-out spindle of a winder.

  If the amplifier is used with a negative load, contact your dealer or sales representatives.

- Load mass (ML)

  When the servo amplifier is used with an excessively large load mass compared with the coil mass (movable element), main circuit power overvoltage may be detected and regeneration error may be issued.

  In this cases, take the following measures. For more details, consult with your dealer or sales representatives.

  ① Decrease the current limit.

  ② Extend the acceleration and deceleration time (slow down).

  ③ Decrease the maximum speed in use.

  ④ Install an external regenerative resistor (optional).

■ Motor selection procedure

Select the motor following the procedure shown below:

- Temporary selection of the motor

  Temporarily select the coil whose maximum force fulfills the necessary force for using.

  (This shall be at least "load mass × maximum acceleration + α".)

- Necessary maximum force

  Calculate the necessary maximum force with the motor mass, friction and gravity taken into account. Confirm that the maximum force of the temporarily selected motor be larger than the necessary maximum force. It is recommended to have a margin of 10% or more, considering the load variation.

- Necessary effective force

  Confirm that the continuous rated force of the temporarily selected motor is greater than the necessary effective force. It is recommended to have a margin of 10% or more, considering the load variation.

- Selection of magnetic rails

  Select the magnetic rails so as to fulfill the necessary stroke of the temporarily selected motor.

- Slowing-down distance at the time of dynamic brake operation

  Calculate the slowing-down distance when dynamic brake is used in the temporarily selected motor, and check That there is no problem.

- Instantaneous tolerance of dynamic brake

  Obtain the energy which will be consumed by dynamic brake resistance in 1 dynamic brake operation of the selected motor, and confirm that it is below what the amplifier allows.

- Regeneration process

  Obtain the regeneration power of the selected motor, and confirm that it is below allowable power of the regenerative resistor.

Materials: Selection Details [Maximum Force/Effective Force]

■ Necessary maximum force, necessary effective force

Obtain the friction force Ff.

$Ff = (M \cdot g \cdot \cos\theta + Fatt) \cdot \mu + Fadd$ [N]

Mc	: Coil mass	[kg]
ML	: Load mass	[kg]
M	: Mover mass =MC + ML	[kg]
g	: Gravity acceleration =9.8	[m/s^2]
$\cos\theta$	: Driving surface angle against horizon [rad]	(If it is horizontal, $\cos\theta = 1$)
Fatt	: Magnetic attraction force [N]	
μ	: Friction coefficient	
Fadd	: Seal resistance [N]	(Moving friction, cover friction and cable pulling-around resistance are included.)

Obtain the gravity applied to the mover.

$Fw = M \cdot g \cdot \sin\theta$ [N]

M	:	Mover mass	= MC + ML	[kg]
G	:	Gravity acceleration	= 9.8	[m/s^2]
θ	:	Driving surface angle against horizon [rad]		(If it is horizontal, $\sin\theta = 0$)

Obtain the necessary maximum force Fmax, and confirm that Motor maximum force Fp ＞ Maximum necessary force Fmax.

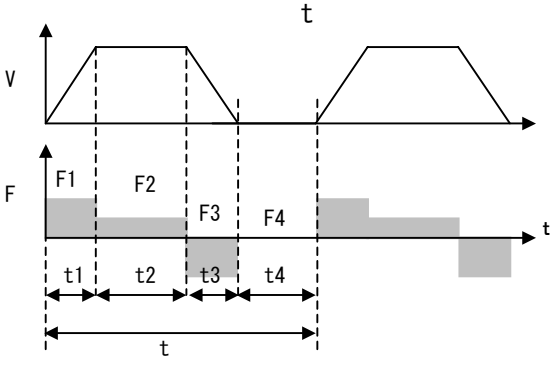
$Fmax = M \cdot amax + Ff + Fw + Fwork$ [N]

M	:	Mover mass	=MC + ML	[kg]
amax	:	Maximum acceleration		[m/s2]
Ff	:	Friction force		[N]
Fw	:	Gravity	[N]	
Fwork	:	Working reaction force		[N]

✍It is recommended to have a margin of 0.9・Fp ≧ Fmax or more, considering load variation.

Confirm that Motor continuous rated force Fr ＞ Squared average necessary force Frms.

$$Frms = \frac{\sqrt{(F1^2 \cdot t1 + F2^2 \cdot t2 + F3^2 \cdot t3 + \cdots)}}{t} \quad [N]$$



✍It is recommended to have a margin of 0.9・Fr ≧ Frms or more, considering load variation.

Materials: Selection Details [Maximum Force/Effective Force]

■ Selection of magnetic rails

The following 5 selection lengths are available for the magnetic rails with/without core:

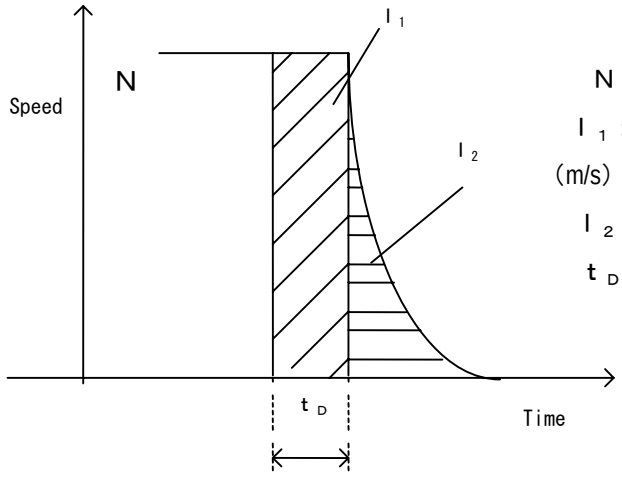
64, 128, 256, 512, 1024 [mm]

Decide the length so as to fulfill “Magnetic rails Coil length + Stroke + Margin”.

It is recommended to fix the magnetic rails to about half the whole stroke from the end, and to fix the coil on the movable stage where there is no magnetic rail. Thus, it will become easier to fix the coil on the movable stage.

■ Slowing-down distance by dynamic brake

Since the SANYO Linear Servo Motor is a permanent magnet type, dynamic brake can be in operation by short-circuiting the motor power line. Dynamic brake starts to operate at an emergency stop due to alarms or others. Along the horizontal axis with frictions excluded, slowing-down distance on the movable stage at the time of dynamic brake operation can be obtained by the expression below:



N : Motor driving speed (m/s)

l_1 : Slowing-down distance due to amplifier inner processing time t_D (m/s)

l_2 : Slowing-down distance due to dynamic brake operation (m/s)

t_D : Delay time from signal output to operation start (s)

(Depends on the amplifier capacity : See below.)

Servo amplifier model	Delay time t_D (S)
RS1□01 □=L/A/N/E	10×10^{-3}
RS1□03 □=L/A/N/E	10×10^{-3}
RS1□05 □=A/L	10×10^{-3}
RS1□10 □=A/L	24×10^{-3}
RS1□15 □=A/L	24×10^{-3}
RS1A30	42×10^{-3}

Braking delay time

[Standard formula] Friction (Ff) is considered as 0.

Slowing-down distance = V ·tD + M·(α·v + βv3) [m]

V : Motor speed [m/s]

tD : Braking delay time [s]

M : Mover mass =Mc+ML [kg]

α, β : Constant related to dynamic brake (Materials-5)

■ Instantaneous tolerance of dynamic brake

● If the load mass (M_L) substantially exceeds the applicable load inertia, abnormal heat can be generated due to dynamic brake resistance. Take precautions against situations such as an overheat alarm or the failure of dynamic break resistance, and consult your dealer or sales representative if such a situation is anticipated.

The energy (E_{RD}) consumed by dynamic brake resistance in 1 dynamic brake operation is as follows:

$$ERD = \frac{2.5}{R\phi + 2.5} \times \frac{1}{2} M \cdot v^2 \quad [J]$$

Rφ	: Resistance per motor 1 phase	[Ω]	
M	: Mover mass		[kg]
V	: Speed just before deceleration		[m/s]

Dynamic brake resistance may fail if the energy E_{RD} consumed by dynamic brake resistance during dynamic brake operation exceeds the energy shown in the following table. Consult with the dealer or sales representative if such a situation is anticipated.

Amplifier Model Name	E_{RD} （J）
RS1□01 □=L／A／N／E	360
RS1□03 □=L／A／N／E	360
RS1□05 □=A／L	1800
RS1□10 □=A／L	2450
RS1□15 □=A／L	2450
RS1A30	9384

■Allowable frequency of dynamic brake

●The allowable frequency (main circuit power ON/OFF) of the dynamic brake is less than 10 rotations per hour and 50 rotations per day under the conditions of maximum speed within the applicalbe load inertia. In basic terms, operation of the dynamic brake in six-minute intervals between two operations is permissable at maximum speed, but if the brake is to be operated with greater frequency, the motor speed must be reduced.

Standard formula:

$$\frac{6 \text{ min}}{(\text{Number of rated rotations} / \text{maximum number of rotations for usage})^2}$$

Materials: Selection Details [Dynamic Brake]

■ Dynamic brake constant table

Amplifier capacity	Motor model number	α	β	M(kg)
RS1A01 RS1L01	AIL06-030A1	5.90E-02	1.58E-05	0.27
	AIL06-050A1	2.51E-02	1.57E-05	0.32
	AIL06-075A1	1.37E-02	7.72E-06	0.38
	AIL06-100A1	9.10E-03	7.23E-06	0.45
	AIL12-030A1	2.27E-02	1.28E-05	0.42
RS1A03 RS1L03	AIL12-050A2	1.72E-02	5.74E-06	0.52
	AIL12-075A2	8.88E-03	2.98E-06	0.65
	AIL12-100A2	5.70E-03	2.88E-06	0.77
	AIC11-030A1	7.24E-03	5.45E-04	2.5
	AIC11-050A1	2.88E-03	4.57E-04	3.6
	AIC11-075A1	1.43E-03	3.95E-04	5.0
	ACC10060SHZ02	2.12E-03	8.29E-05	2
RS1A05 RS1L05	AIL18-050A3	1.45E-02	3.02E-06	0.72
	AIL18-075A3	7.29E-03	1.61E-06	0.91
	AIL18-100A3	4.57E-03	1.60E-06	1.10
	AIL24-050A3	1.32E-02	1.87E-06	0.92
	AIL24-075A3	6.49E-03	1.02E-06	1.17
	AIL24-100A3	4.00E-03	1.02E-06	1.42
	AIC11-100A5	1.84E-03	1.70E-04	6.5
	AIC11-150A5	8.92E-04	1.52E-04	9.4
	AIC11-200A5	5.44E-04	1.39E-04	12.3
	AIC22-050A2	2.39E-03	1.37E-04	6.9
	AIC22-075A2	1.14E-03	1.24E-04	9.6
RS1A10 RS1L10	AIC22-100A6	1.63E-03	4.79E-05	12.5
	AIC22-150A6	7.61E-04	4.46E-05	18.1
	AIC22-200A6	4.49E-04	4.21E-05	23.7
	AIC33-050A7	6.01E-03	2.43E-05	10.4
	AIC33-075A7	2.72E-03	2.31E-05	14.4
	AIC33-100A7	1.56E-03	2.22E-05	18.9
	AIC33-150A7	7.17E-04	2.11E-05	27.3
	AIC33-200A7	4.17E-04	2.01E-05	35.7
	DD075C1Y2C	1.63E-03	9.96E-05	14.7
RS1A15 RS1L15	AIC44-100A7	1.52E-03	1.28E-05	25.0
	AIC44-150A7	6.96E-04	1.22E-05	36.2
	AIC44-200A7	4.02E-04	1.18E-05	47.4
	AIC44-250A7	2.85E-04	1.24E-05	58.5
	DD075C2Y2C	1.43E-03	2.83E-05	26.5
RS1A30	AIC55-250A7	2.78E-04	8.14E-06	73
	DD075C3Y2C	1.37E-03	1.32E-05	38.1
	DD075C4Y2C	1.33E-03	7.60E-06	49.5
	DD075C5Y2C	1.31E-03	4.94E-06	61.7

The values for α and β are based on an assumed resistance value of the power line of 0Ω. If the combination with an amplifier is different than those shown above, consult our dealer or sales office.

■ Regeneration Process

●The regeneration capacity of the servo amplifier depends on the allowable power of the regenerative resistor. When using the servo amplifier with built-in regeneration resistor, be sure to calculate regeneration resistance **PM** and confirm that **PM<PRI** (the allowable power for the built-in regeneration resistor) is fulfilled.

When regeneration power **PM** exceeds the permitted power (**PRI**) of the built-in regeneration resistor, you can operate by conducting regeneration restance (PM) caluculation, confirming that PM<PRO (the maximum allowable power of the exterior regeneration resistor) is fulfilled, and connecting the opional external regeneration resistor

	Built-in regeneration resistor is available [PM]	Regeneration resistor connecting number	External regeneration resistor is available [PM]	Regeneration resistor connecting number	Contact us in case below
RS1□01	PM= 2W and below	Ⅰ	PM=220Wand below	Refer to "Materials" page 9	PM=220W and up
RS1□03	PM= 5W and below	Ⅰ	PM=220Wand below		PM=220W and up
RS1□05	PM= 20W and below	Ⅰ	PM=500Wand below		PM=500Wand up
RS1□10	PM= 90W and below	Ⅱ	PM=500Wand below		PM=500Wand up
RS1□15	PM=120W and below	Ⅱ	PM=500Wand below		PM=500Wand up
RS1□30	———	———	PM=500Wand below		PM=500Wand up

✍ If using a built-in regeneration resistor, please specify the model number of the servo amplifier with built-in regeneration resistor referring to "Section 1: Prior to Use – Servo Amplifier Model Number"

If using an exterior regeneration resistor, please specify the model number of the servo amplifier without built-in regeneration resistor.

✍ When regeneration power **PM** exceeds the maximum permitted power (**PRO**) of the external regeneration resistor, reconsider the acceleration constant, load inertia, etc.

● Resistance Value of Servo Amplifier Built-in Regeneration Resistor

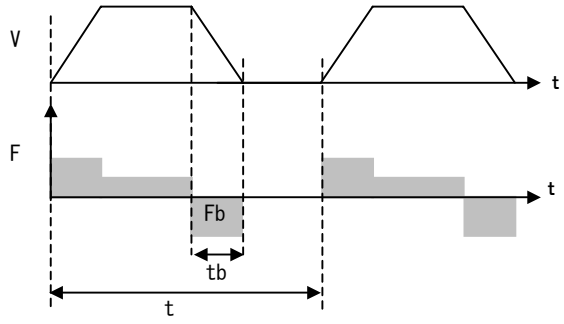
Model Number of Servo Amplifier with Built-in Regeneration Resistor	Resistance Value of Built-in Regeneration Resistor
RS1□01 □=L／M／N／P	100Ω
RS1□03 □=L／M／N／P	50Ω
RS1□05 □=A／B	17Ω
RS1A10 □=A／B	10Ω
RS1A15 □=A／B	6Ω

■ How to calculate regeneration power (PM) by operation along horizontal axis

● Regeneration energy is calculated.

$$PM = \left[\left[\frac{1}{2 \cdot t} \cdot M \cdot v^2 \right] - \left[\frac{v}{2 \cdot t} \cdot Ff \cdot tb \right] \right] - \left[\left[\frac{3 \cdot R\phi \cdot tb}{t} \right] \times \left[\frac{M \cdot v - Ff \cdot tb}{Kf \cdot tb} \right]^2 \right] \quad [J/s] = [W]$$

PM	:	Regeneration power	[W]
M	:	Mover mass	[kg]
V	:	Speed just before deceleration	[m/s]
t	:	Frequency	[s]
tb	:	Deceleration time	[s]
Ff	:	Friction force	[N]
Rϕ	:	Resistance per motor 1 phase	[Ω]
Kf	:	Force constant	[N/A]



Fb=M·v/tb−Ff

■ Confirmation method of regeneration power PM in actual operation

● Regeneration power **PM** can be easily confirmed in the digital operator or by Q-SETUP setup software.

Digital operator ･･･	Monitor mode	Page 12・	Regeneration circuit operating rate
Setup software ･･･	Monitor display	Page 12・ＲｅｇＰ・	Regeneration circuit operating rate

✍ The monitor value of the regeneration circuit operating rate shows the operating rate of regeneration circuit. The display range is 0.01%~99.99%.

● The actual regeneration power **PM** can be calculated from this monitor value by following equation.

Input Supply Voltage：In case of ＡＣ２００Ｖ specification

$$\text{Regeneration power PM（W）} = \frac{400(\text{V}) \times 400(\text{V})}{\text{Regeneration resistance（Ω）}} \times \frac{\text{regeneration circuit operating rate（\%）}}{100(\%)}$$

Input Supply Voltage：In case of ＡＣ１００Ｖ specification

$$\text{Regeneration power PM（W）} = \frac{200(\text{V}) \times 200(\text{V})}{\text{Regeneration resistance（Ω）}} \times \frac{\text{regeneration circuit operating rate（\%）}}{100(\%)}$$

● Calculation Example

Servo Amplifier Model Number： ＲＳ１Ｌ０１＊＊

[With built-in regeneration resistance/Input Supply Voltage：ＡＣ２００Ｖ Specification]

Regeneration resistance value： １００Ω [Built-in Regeneration Resistance]

Monitor Value： 0.12% [ＲｅｇＰ]

$$\text{Regeneration power PM（W）} = \frac{400(\text{V}) \times 400(\text{V})}{100(\Omega)} \times \frac{0.12(\%)}{100(\%)} = 1.92\ (\text{W})$$

✍ The regeneration power calculated from this monitor value continues to be the target until the end of operations. Regeneration power varys with the voltage fluctuation of the input power supply and changes across the ages of the servo amplifier and the loading device.

✍ Select regeneration resistance by calculating regeneration power **PM** from the operation pattern, as per the calculation method of regeneration power **PM.**

Materials: Selection Details [External Regenerative Resistor]

■ Selection of Optional External Regenerative Resistor

- You can select the combination of external regenerative resistors based on effective regenerative power [PM] sought by the regeneration calculation.

Amplifier Model Number	[PM]	Up to 10W	Up to 30W	Up to 55W	Up to 60W	Up to 110W	Below 220W	220W and over
RS1□01	Resistor Sign	A×1	C×1	E×1	D×2	F×2	E×4	Contact
	Connection Number	Ⅲ	Ⅲ	Ⅲ	Ⅳ	Ⅳ	Ⅵ	
RS1□03	Resistor Sign	B×1	D×1	F×1	C×2	E×2	F×4	Contact
	Connection Number	Ⅲ	Ⅲ	Ⅲ	Ⅴ	Ⅴ	Ⅵ	

Amplifier Model Number	[PM]	Up to 55W	Up to 125W	Up to 250W	Below 500W	500W and over
RS1□05	Resistor Sign	G×1	H×1	Ⅰ×2	H×4	Contact
	Connection Number	Ⅲ	Ⅲ	Ⅳ	Ⅵ	

Amplifier Model Number	[PM]	Up to 125W	Up to 250W	Below 500W	500W and over
RS1□10	Resistor Sign	Ⅰ×1	H×2	Ⅰ×4	Contact
	Connection Number	Ⅲ	Ⅴ	Ⅵ	

Amplifier Model Number	[PM]	Up to 125W	Up to 250W	Below 500W	500W and over
RS1□15	Resistor Sign	J×1	K×2	J×4	Contact
	Connection Number	Ⅲ	Ⅴ	Ⅵ	

Amplifier Model Number	[PM]	Up to 250W	Below 500W	500W and over
RS1□30	Resistor Sign	L×1	L×2	Contact
	Connection Number	Ⅲ	Ⅴ	

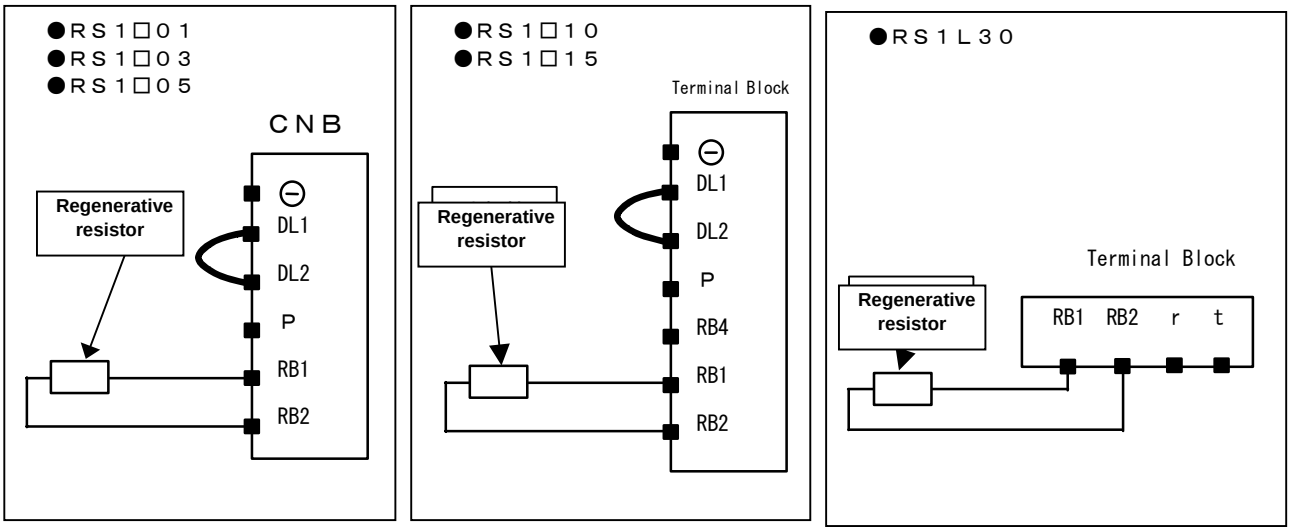
✍ The above resistor sign of a combination of an external regenerative resistor correspond to the following table.
Please select a resistor model name corresponding to a resistor sign.

✍ The above connection number of a combination of an external regenerative resistor is on the next page.
Please make a connection based on the connection number.

Resistor Sign	Resistor Model Number	Resistance Value	Thermostat	Permissible Effective Power	Outline Drawing
A	REGIST-080W100	100Ω	Normal close Contact	10W	Refer to 'Materials 13-14'
B	REGIST-080W50B	50Ω		10W	
C	REGIST-120W100	100Ω		30W	
D	REGIST-120W50B	50Ω		30W	
E	REGIST-220W100	100Ω		55W	
F	REGIST-220W50B	50Ω		55W	
G	REGIST-220W20B	20Ω		55W	
H	REGIST-500W20B	20Ω		125W	
Ⅰ	REGIST-500W10B	10Ω		125W	
J	REGIST-500W7B	7Ω		125W	
K	REGIST-500W14B	14Ω		125W	
L	REGIST-1000W6R	6.7Ω		250W	Refer to 'Materials15'

Materials: Selection Details [External Regenerative Resistor]

■ Connection of External Regenerative Resistor



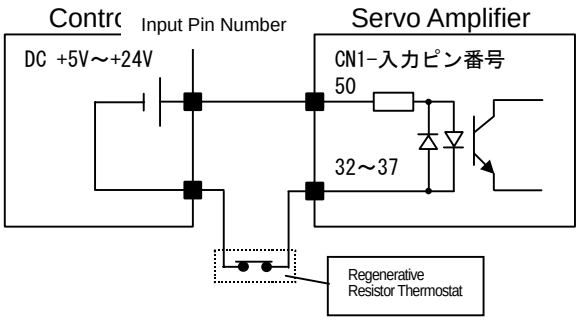
✍ Please make sure to install the external regenerative resistor with twisted wires and use as a short wire which is up to 5 meters long as possible.

✍ Use nonflammable electric wire or perform non-combustible processing (silicon tube, etc.) for connecting cable and wires, and install wiring so as to not come in contact with the built-in unit .

✍ Please make sure to change the set-up of “System Parameter” and “Regenerative Resistance Selection” in line with the kind of regenerative resistor you connect.

■ Connection of the Thermostat of a Regenerative Resistor

● Please use any of these general-purpose input [ＣＯＮＴ１～ＣＯＮＴ６].



✍ Please allocate the connected general-purpose input (any of [ＣＯＮＴ１～ＣＯＮＴ６]) to [Group9 40 External Trip Input Function of General Parameter].

Parameter Set-up Example：When connecting the thermostat to ＣＯＮＴ６

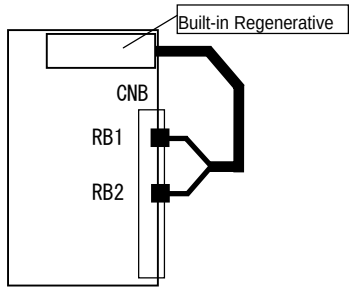
The external trip function will be valid when【０ＤＨ：ＣＯＮＴ６＿ＯＦＦ】CONT6 is turned off in [Grop6 40 External Trip Input Function]

Alarm (ALM-55) will be output from the servo amplifier when the thermostat of a regenerative resistor trips (the contact point comes off) because of heating.

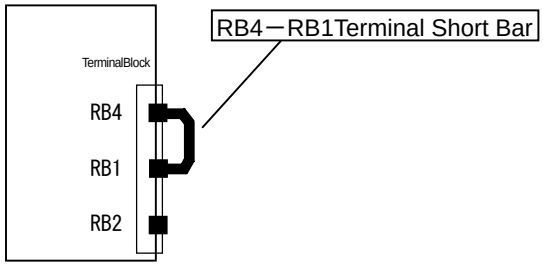
Materials: Selection Details [External Regenerative Resistor]

■ Connection Number of External Regenerative Resistor Combination

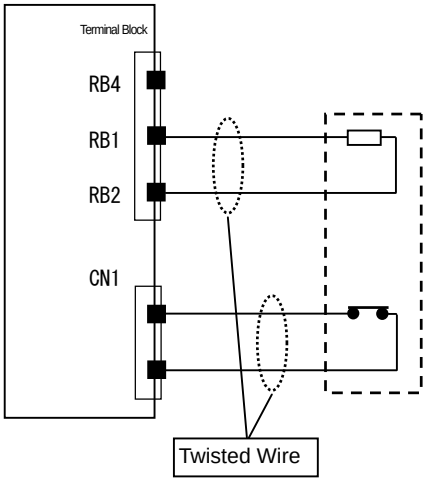
Connection Ⅰ



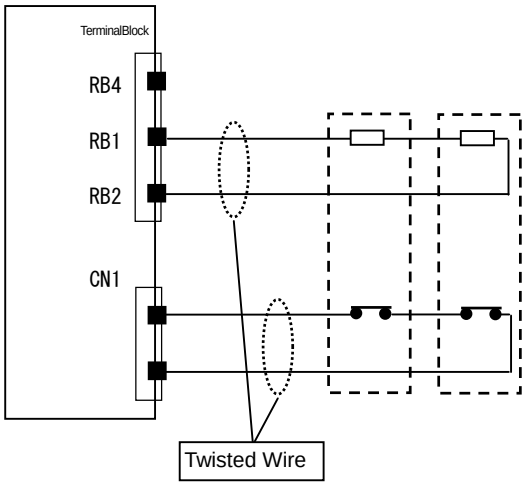
Connection Ⅱ



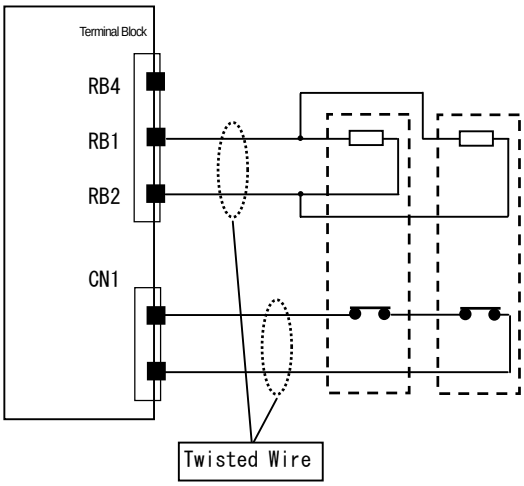
Connection Ⅲ



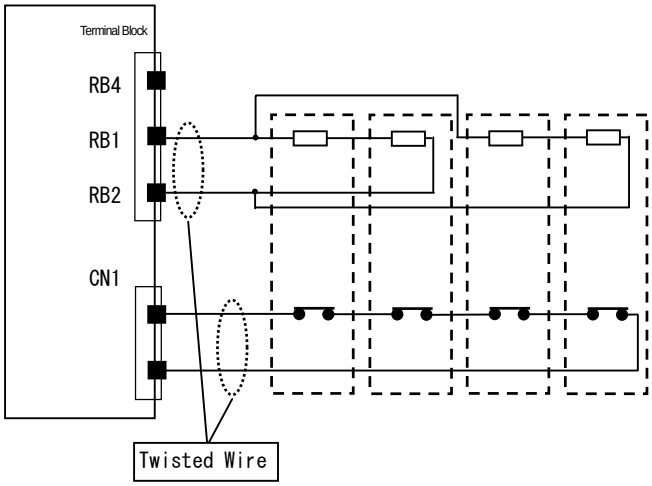
Connection Ⅳ ［× 2］ Series Connection



Connection Ⅴ ［× 2］ Parallel Connection



Connection Ⅵ ［× 4］ Series/Parallel Connection



Materials: Selection Details [External Regenerative Resistor]

■ Protection Function of Regenerative Resistor

With the R series servo amplifier, the regenerative resistance protection function is specified by parameter selections. Appropriate protection for regenerative resistance is applied by setting parameters according to the type of regenerative resistance to be connected. Set the appropriate parameters following the instructions below.

● The protection functions are divided into three main types:

① Protection for a short-time, high load factor (using built-in or external regenerative resistance): An error is detected when the power absorption of regenerative resistance is extremely high over a short time period (100msec to 10 seconds). A 'Regenerative Error' alarm ("ALM_43") is issued when this error is detected.

② Protection when allowable power absorption is exceeded for long time (using built-in regenerative resistance): An error is detected when the power absorption of the built-in regenerative resistance exceeds the allowable power absorption over a long time period (from a few seconds to a few minutes). An 'Internal Overheat' alarm ("ALM_54") is issued when this error is detected.

③ Protection during thermostat operation of the external regenerative resistor: An error is detected when the external trip function is started. An 'External error / external trip' alarm ("ALM_55") is issued when this error is detected.

● The two parameters requiring settings are given below.

①	Regenerative resistance selection	System parameter	[0B]
②	External trip input function	General parameter	[Group9 40]

● Relationship between parameter settings and protection functions

Regenerative resistance in use		Parameter setting		Protection function operation		
Resistor	Thermostat	Regenerative resistance selection	External trip input function	Regenerative error [ALM_43]	Internal overheat [ALM_54]	External Alarm External Trip [ALM_55]
Not Connecting	–	00:_Not_Connect	–	Invalid	Invalid	–
Built-in Regenerative Resistance	–	01:_Built-in_R	–	Valid	Valid	–
External Regenerative Resistance	–	02:_External_R	–	Valid	Invalid	–
External Regenerative Resistance	Connect to servo amplifier	02:_External_R	Setting	Valid	Invalid	Valid

Make appropriate settings to regenerative resistance [System parameter/Page0B] when using a built-in regenerative resistance.
If these parameter settings are incorrect, normally detected errors related to built-in regenerative resistance may not be detected, possibly causing burning/fuming of regenerative resistance.

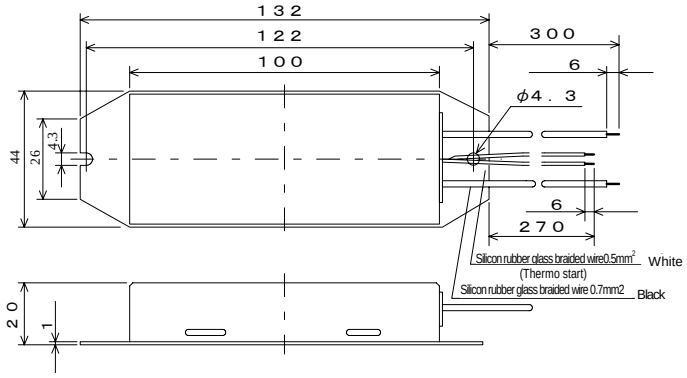
The built-in regenerative resistance may generate heat even if the overheat alarm is not issued. Do not touch the servo amplifier for 30 minutes after power is disconnected in the case of a power failure, as there is a risk of burn.

Incorrect parameter settings may cause irregular operation of the protection functions. Upon an alarm, confirm its cause and adjust the settings appropriately.

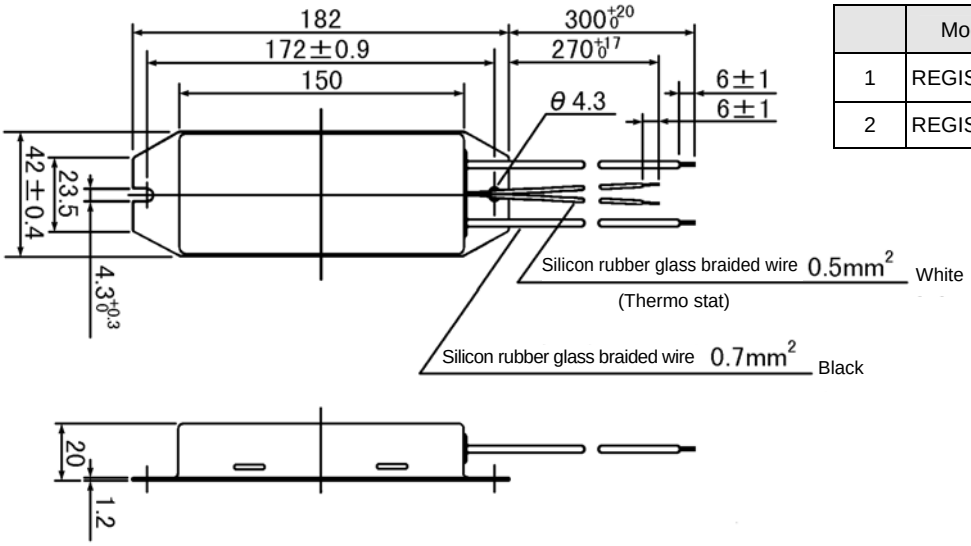
Materials: Selection Details [External Regenerative Resistor Dimension]

■ External Dimension of Regenerative Resistor

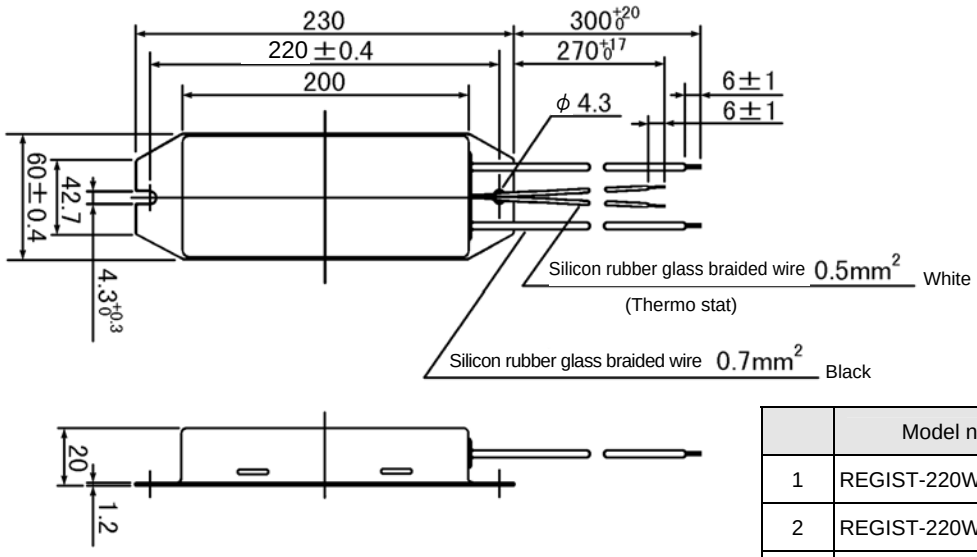
Unit : mm



	Model number	Thermostat
1	REGIST-080W100B	Normal close contact
2	REGIST-080W50B	Normal close contact

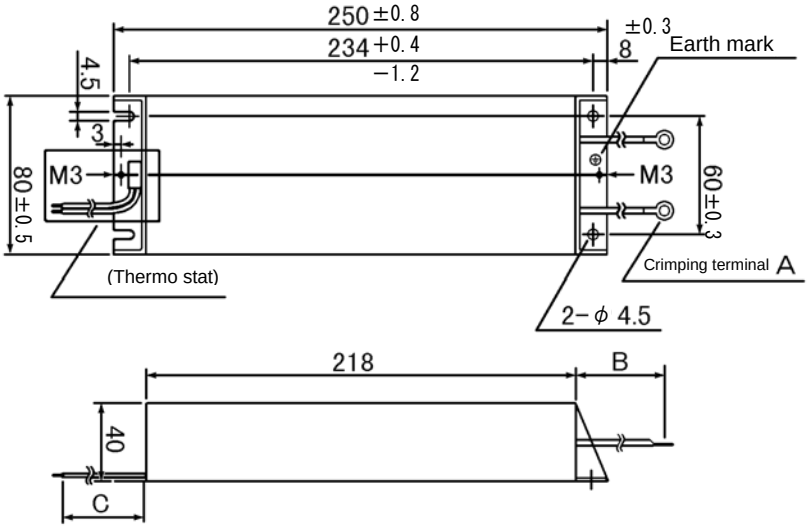


	Model number	Thermostat
1	REGIST-120W100B	Normal close contact
2	REGIST-120W50B	Normal close contact



	Model number	Thermostat
1	REGIST-220W50B	Normal close contact
2	REGIST-220W20B	Normal close contact
3	REGIST-220W100B	Normal close contact

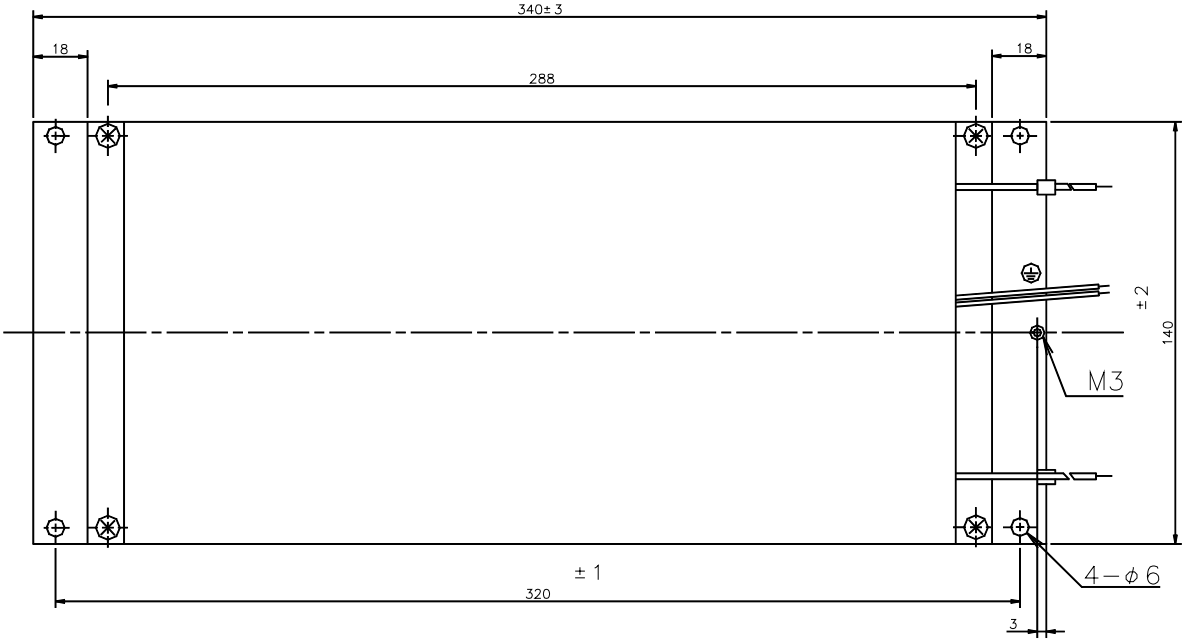
Materials: Selection Details [External Regenerative Resistor Dimension]

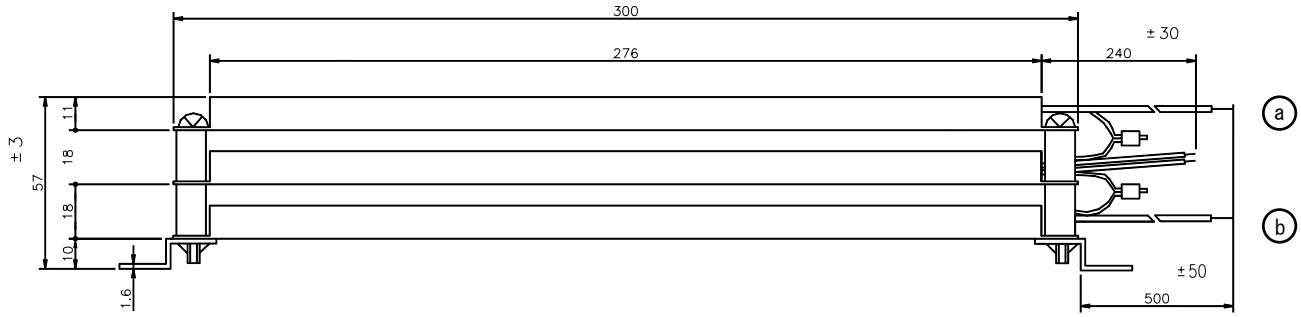


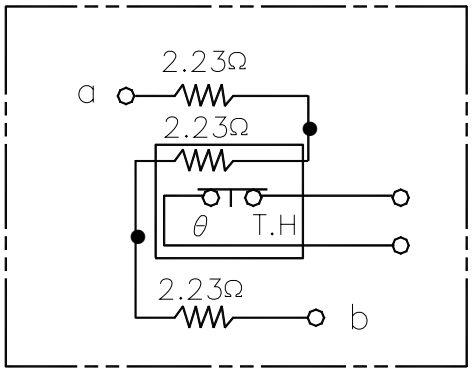
	Model number	Thermostat
1	REGIST-500W20B	Normal close contact
2	REGIST-500W20	None
3	REGIST-500W10B	Normal close contact
4	REGIST-500W10	None
5	REGIST-500W7B	Normal close contact
6	REGIST-500W7	None
7	REGIST-500W14B	Normal close contact
8	REGIST-500W14	None

Crimping terminal A=M5
B=700mm±15
C=350mm±15

Materials: Selection Details [External Regenerative Resistor Dimension]







結 線 図

	Model number	Thermostat
1	REGIST-1000W6R7B	Normal close contact

Materials: International Standards [International Standards Conformity]

■ Outline of International Standards Conformity

● R S 1 servo amplifier conforms to the international standards below.

Mark	International standards	Standard number	Certification Organization
c UL us	UL standard	UL508C	UL （Underwriters Laboratories inc.）
	CSA standard	UL508C	
TÜV	EN standard	EN50178 EN61000-6-2 EN61800-3	TÜV （TÜV Product Service Japan, Ltd.）

● Precautions for conformity standards

① Make sure to use the servo amplifier and the servo motor in a proper combination. Check “Section 1 : Prior to use --- Servo amplifier type number.

② Make sure to install the servo amplifier in your control panel in an environment where the pollution level specified in EN50178 and IEC664 is no less than 2 (polution level 1, 2). The control panel installation configuration (under IP54) must exclude exposure to water, oil, carbon, dust, etc.

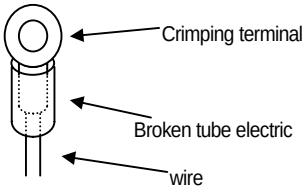
③ The servo amplifiers must be used under the conditions specified in overvoltage categoryⅢ, EN50178. For the interface, use a DC power supply with reinforced and insulated input and outputs.

④ Always ground the protective earth terminals of the servo amplifier to the power supply earth. (⏚)

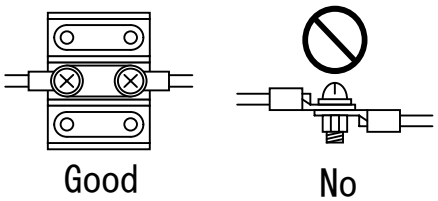
⑤ When connecting grounding wire to the protective earth terminal, always connect one wire in one terminal; never connect jointly with multiple wires or terminals.

⑥ When connecting the leakage stopper, make sure to connect the protective earth terminal to the power supply earth. (⏚

⑦ Connect earthing wire by using a crimping terminal with insulated tube, so that the connected wire will not touch the neighboring terminals.



⑧ For wire relays, use a fixed terminal block to connect wires; never connect wires directly.



⑨ Connect an EMC filter to the input power supply of the unit.

⑩ Use an EN/ IEC-standard compatible no-fuse circuit breaker and electromagnetic contactor.

Materials: International Standards [International Standards Conformity]

■ International standard certificate number

Classification	Category	File No.
UL / cUL：Servo amplifier	Power Conversion Equipment	E179775

Command classification	Type	File No.
Low voltage command ：Servo amplifier	Attested certificate	B 05 05 30982 044

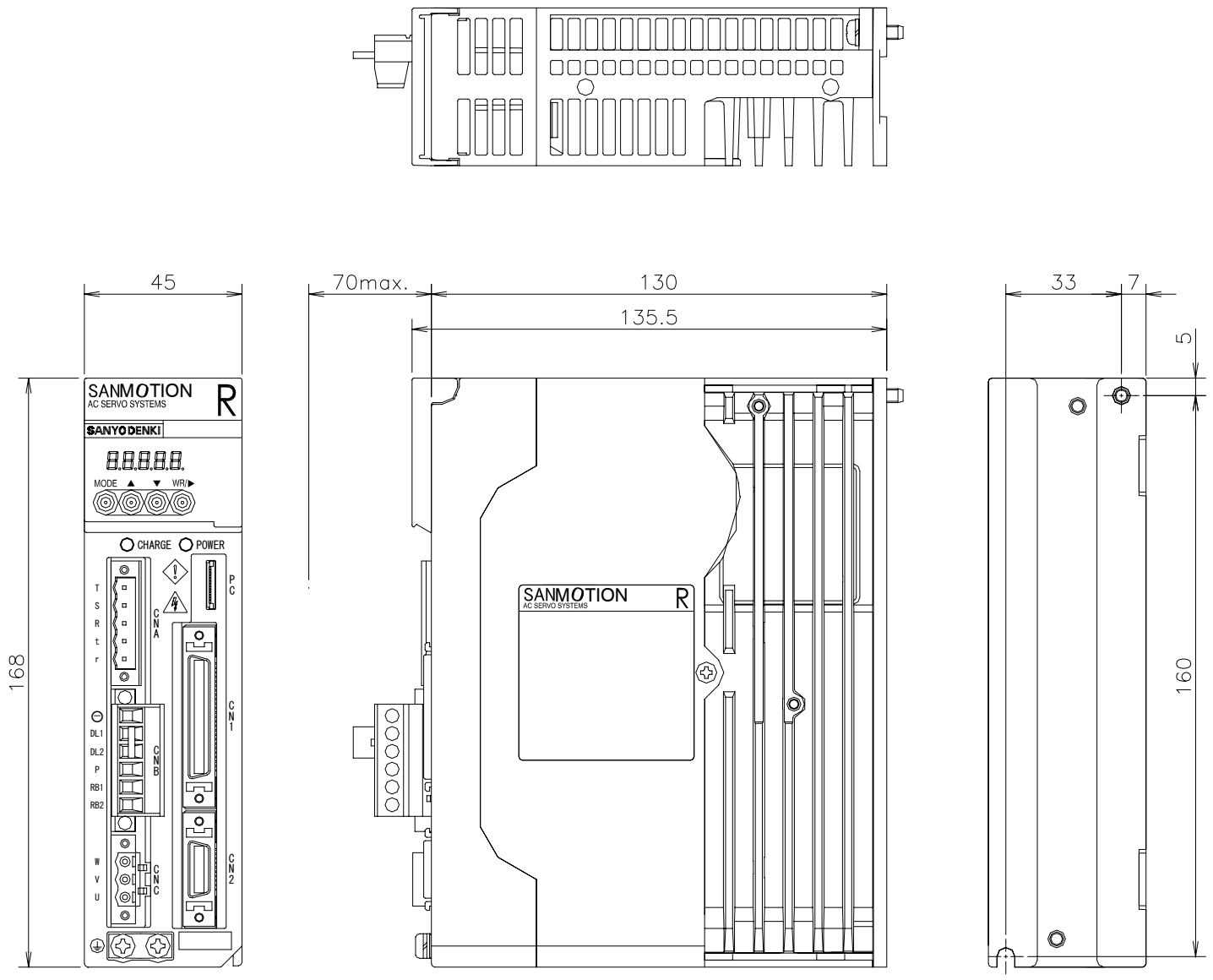
✍ The file number of UL is available at the UL homepage: http://www.ul.com/database/.

✍ Please contact your dealer or sales representative if you need the above certiification.

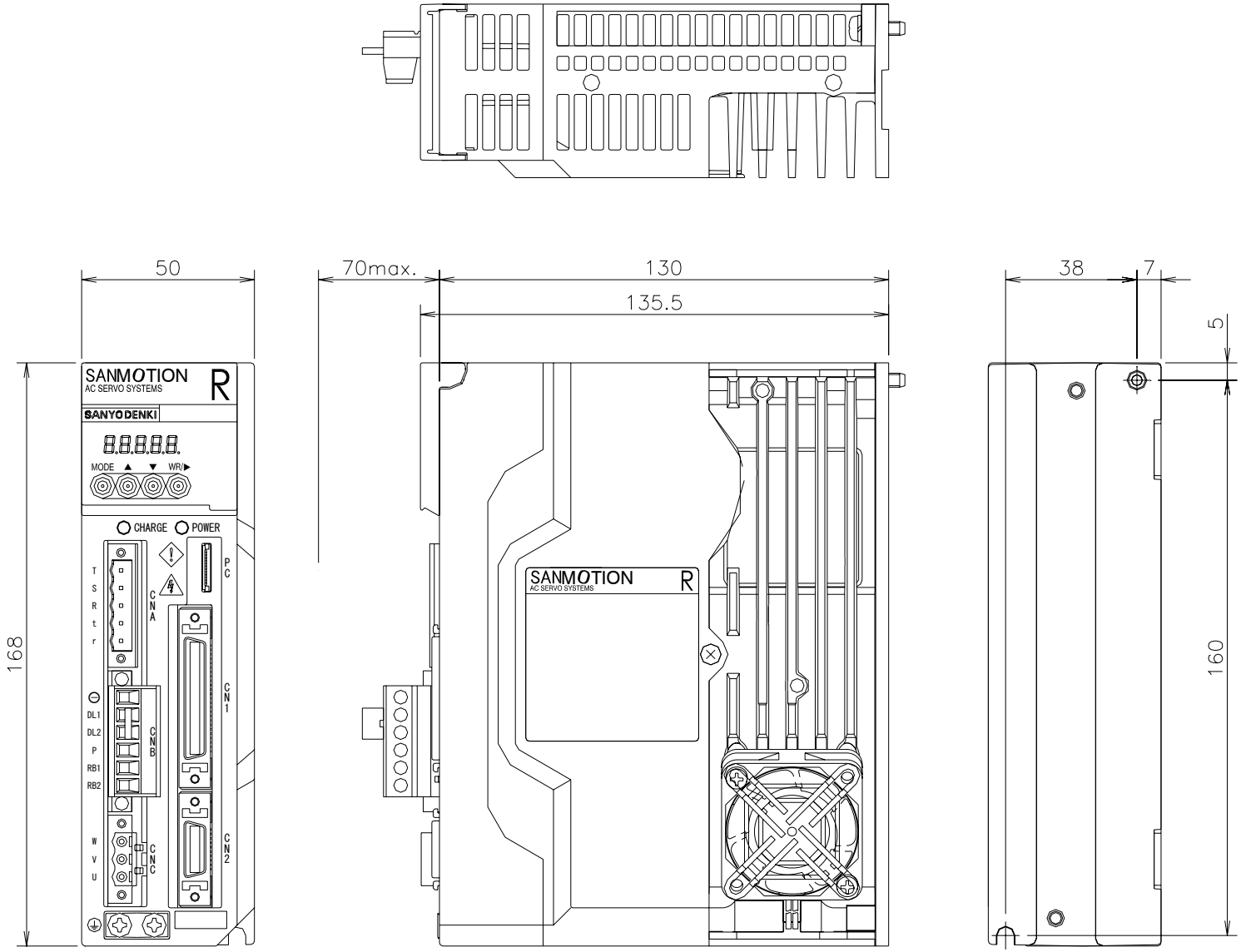
■ Inplementation of check test

EMC testing of equipment and devices in which the RS1 servo system is incorporated should meet the Emission and immunity (electromagnetic compatibility) standards for the usage environment / and operating conditions. It is necessary to follow the instructions mentioned above and conduct a final conformity check test after review.

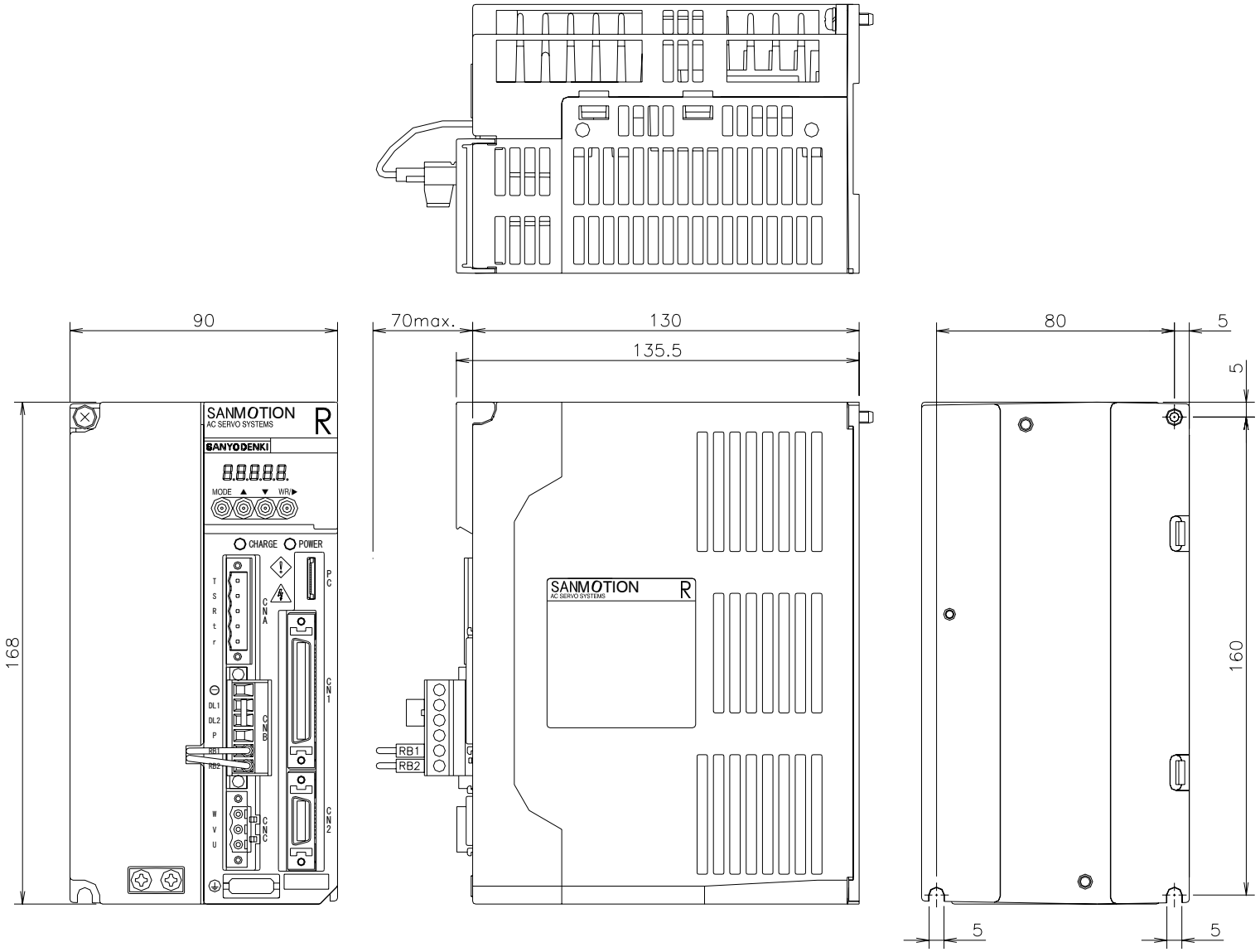
Materials: Dimension [RS1□01]



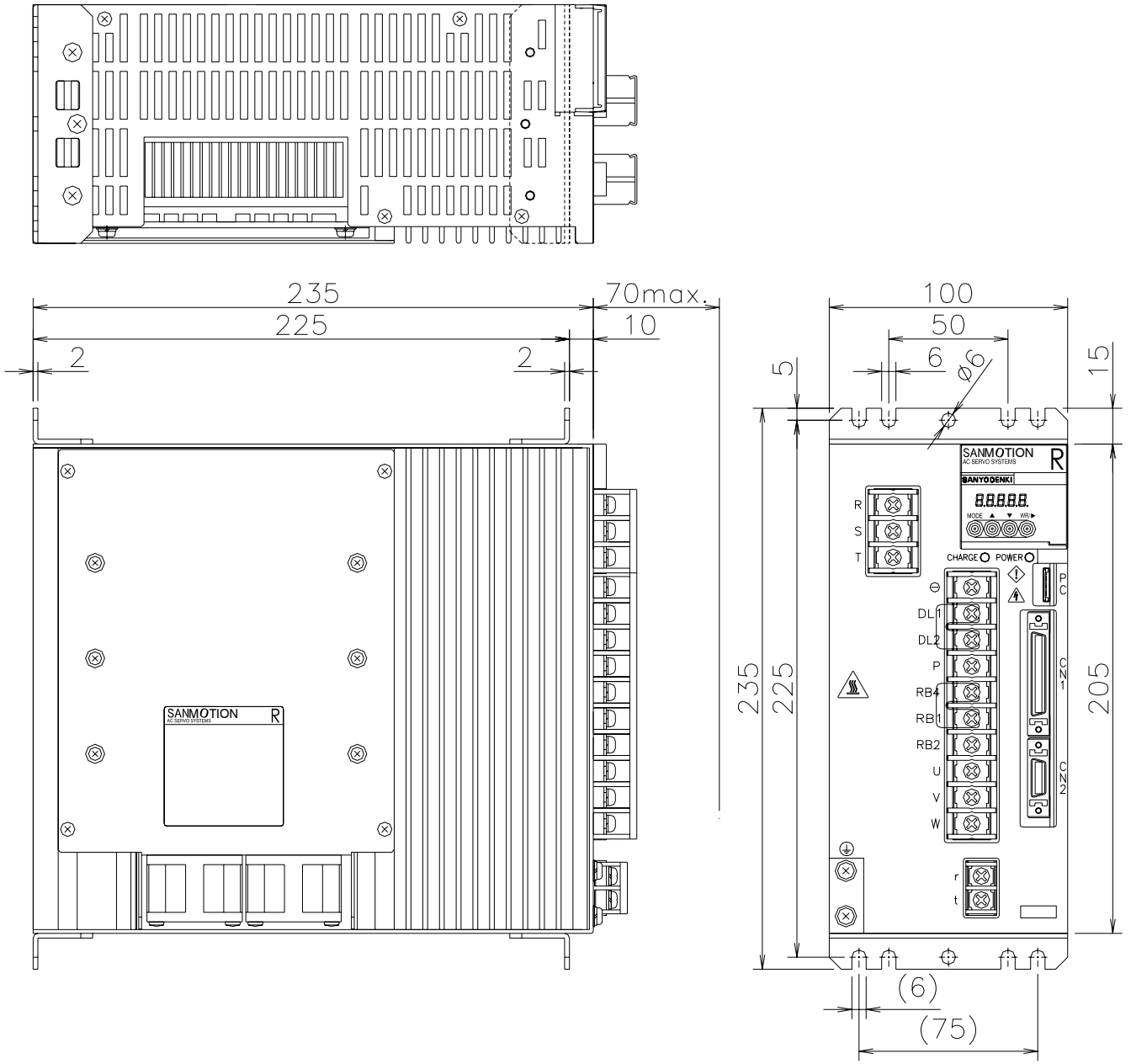
Materials: Dimension [RS1□03]



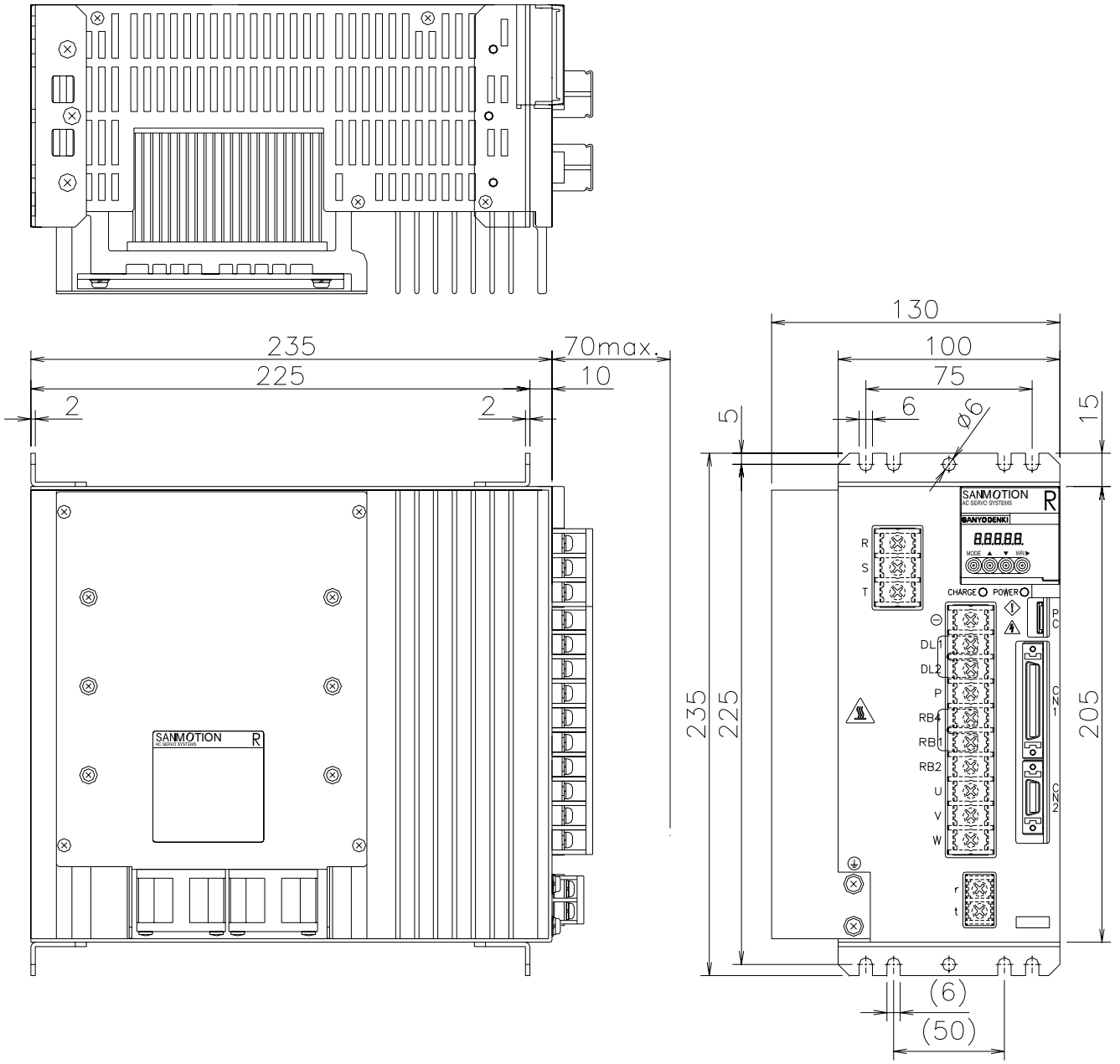
Materials: Dimension [RS1□05]



Materials: Dimension [RS1□10]

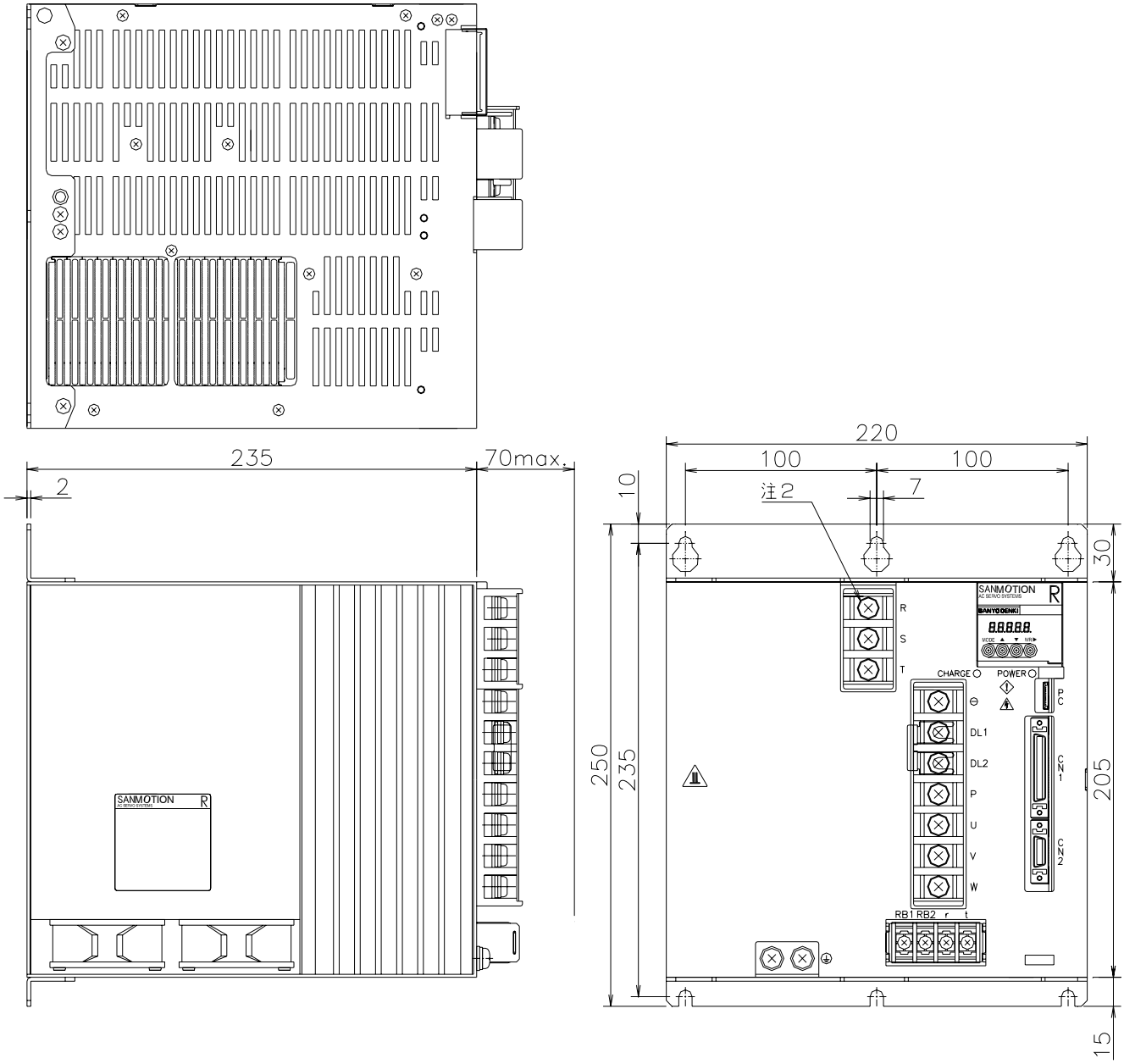


Materials: Dimension [RS1□15]



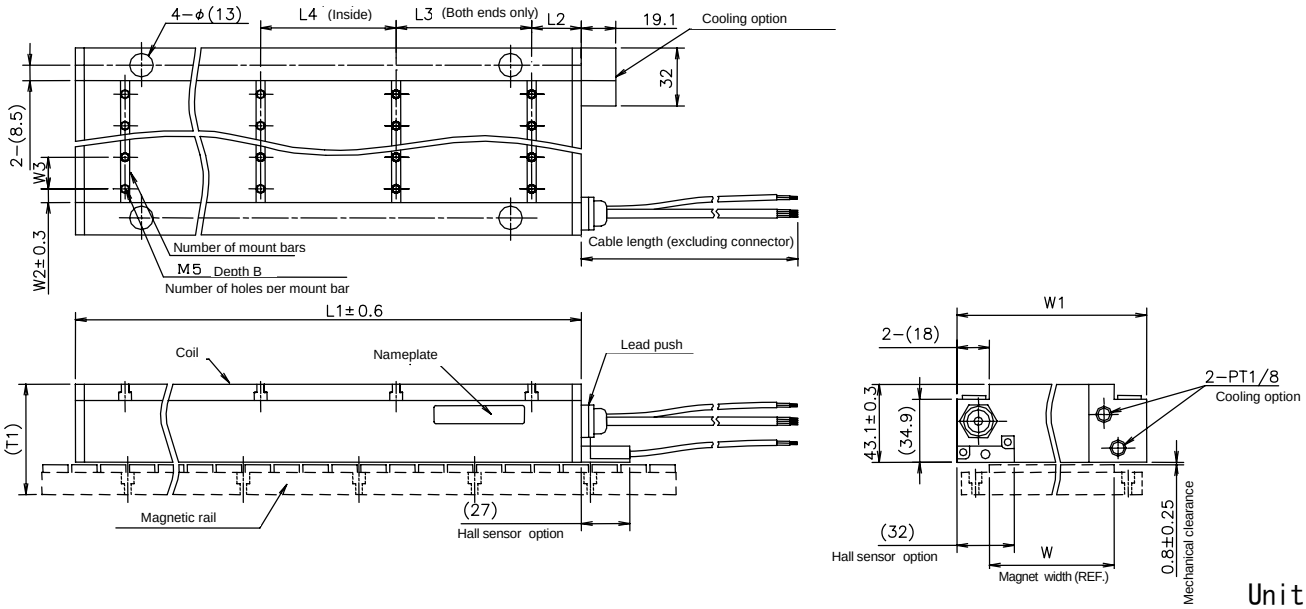
Materials: Dimension

[RS1□30]



Materials: Dimension

- Coil dimension; Core type one-side linear motor



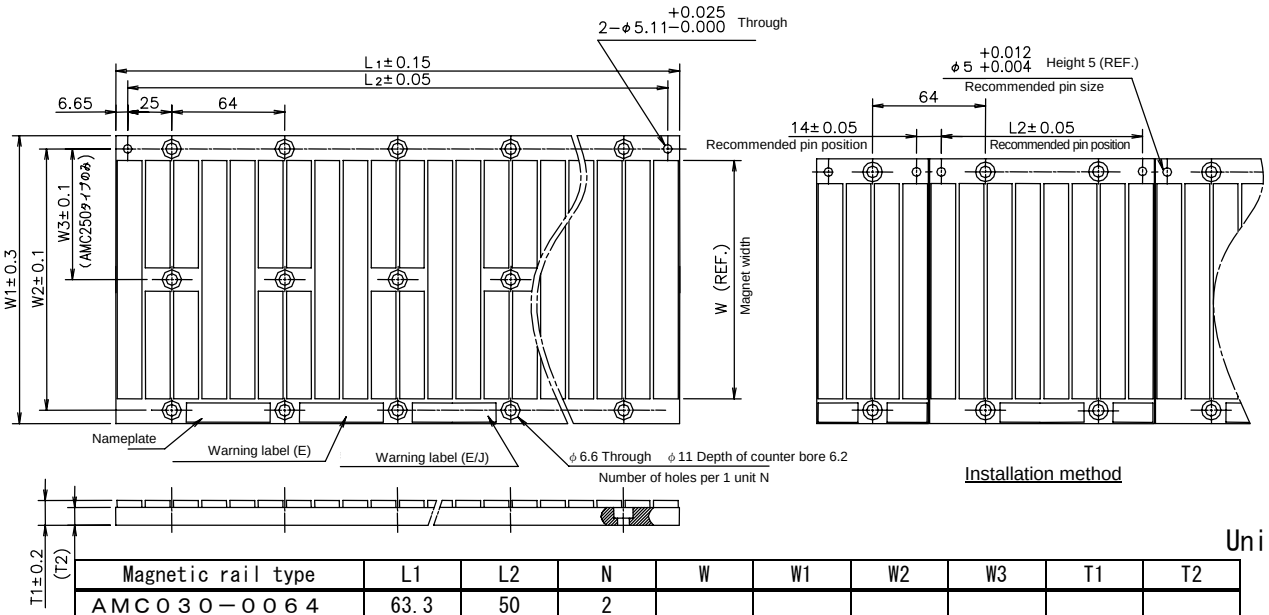
Unit：mm

Coil type	L1	L2	L3	L4	N1	N2	W	W1	W2	W3	T1
ＡＩＣ１１－０３０	200.2	25.1	75	－	3	2	30	65 ±1	7.0	16.0	58
ＡＩＣ２２－０３０	376.2	38.1	75	75	5						
ＡＩＣ３３－０３０	552.2	51.1	75	75	7						
ＡＩＣ４４－０３０	728.2	26.6	75	75	10						
ＡＩＣ５５－０３０	904.2	38.1	76.5	－	12						
ＡＩＣ１１－０５０	200.2	25.1	75	－	3	2	50	85 ±1	7.0	36.0	58
ＡＩＣ２２－０５０	376.2	38.1	75	75	5						
ＡＩＣ３３－０５０	552.2	51.1	75	75	7						
ＡＩＣ４４－０５０	728.2	26.6	75	75	10						
ＡＩＣ５５－０５０	904.2	38.1	76.5	－	12						
ＡＩＣ１１－０７５	200.2	25.1	75	－	3	3	75	110 ±1	5.5	32.0	58
ＡＩＣ２２－０７５	376.2	38.1	75	75	5						
ＡＩＣ３３－０７５	552.2	51.1	75	75	7						
ＡＩＣ４４－０７５	728.2	26.6	75	75	10						
ＡＩＣ５５－０７５	904.2	38.1	76.5	－	12						
ＡＩＣ１１－１００	200.2	25.1	75	－	3	3	100	135 ±1	14.0	36.0	58
ＡＩＣ２２－１００	376.2	38.1	75	75	5						
ＡＩＣ３３－１００	552.2	51.1	75	75	7						
ＡＩＣ４４－１００	728.2	26.6	75	75	10						
ＡＩＣ５５－１００	904.2	38.1	76.5	－	12						
ＡＩＣ１１－１５０	200.2	25.1	75	－	3	5	150	185 ±1.5	11.0	32.0	60
ＡＩＣ２２－１５０	376.2	38.1	75	75	5						
ＡＩＣ３３－１５０	552.2	51.1	75	75	7						
ＡＩＣ４４－１５０	728.2	26.6	75	75	10						
ＡＩＣ５５－１５０	904.2	38.1	76.5	－	12						
ＡＩＣ１１－２００	200.2	25.1	75	－	3	6	200	235 ±1.5	10.0	36.0	60
ＡＩＣ２２－２００	376.2	38.1	75	75	5						
ＡＩＣ３３－２００	552.2	51.1	75	75	7						
ＡＩＣ４４－２００	728.2	26.6	75	75	10						
ＡＩＣ５５－２００	904.2	38.1	76.5	－	12						
ＡＩＣ１１－２５０	200.2	25.1	75	－	3	7	250	285 ±1.5	11.0	38.0	60
ＡＩＣ２２－２５０	376.2	38.1	75	75	5						
ＡＩＣ３３－２５０	552.2	51.1	75	75	7						
ＡＩＣ４４－２５０	728.2	26.6	75	75	10						
ＡＩＣ５５－２５０	904.2	38.1	76.5	－	12						

Note1) Use all the M5 taps for mounting the coil. Tightening torque shall be 8.0N･m or higher（screw strength class 10.9 or higher） and engaging must be 6mm to 8mm. Apply fixatives.

Materials: Dimension

- Magnetic rail dimension; Core type one-side linear motor (without magnet cover)



Unit：mm

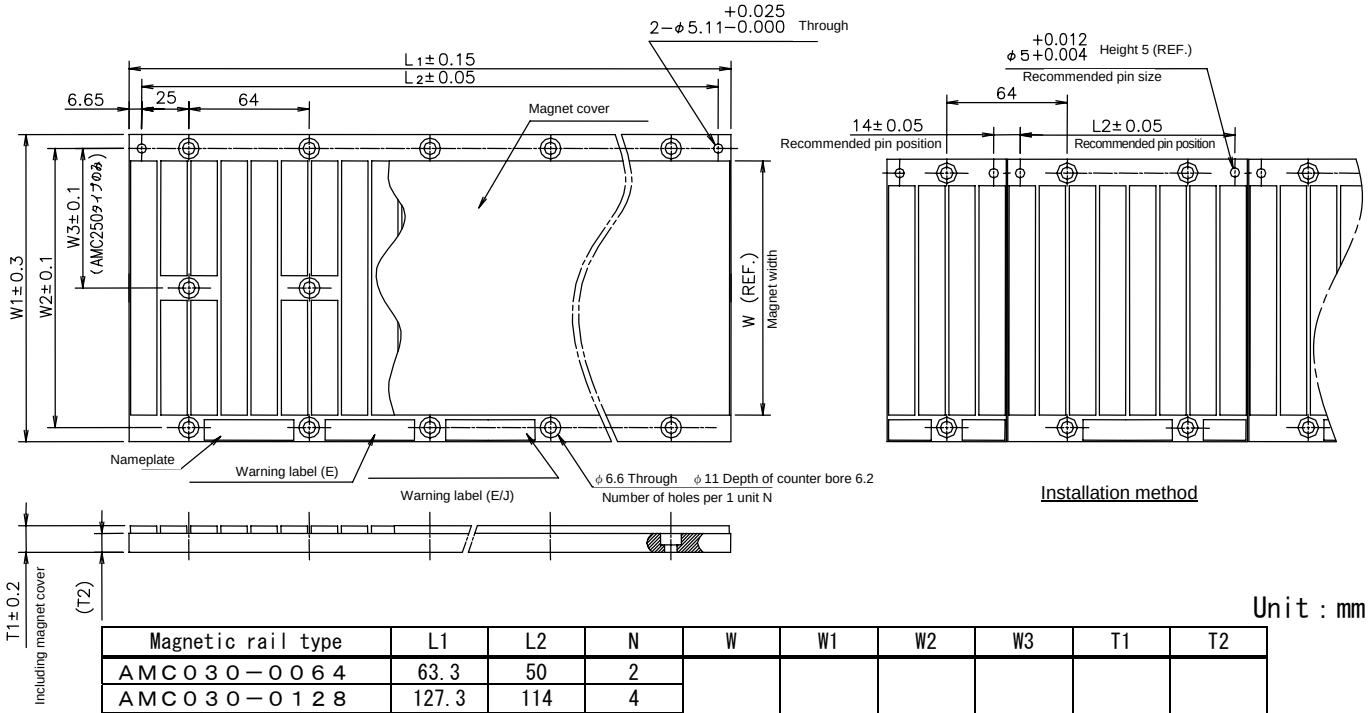
Magnetic rail type	L1	L2	N	W	W1	W2	W3	T1	T2
ＡＭＣ０３０－００６４	63.3	50	2	30	60	45	－	14.1	10
ＡＭＣ０３０－０１２８	127.3	114	4						
ＡＭＣ０３０－０２５６	255.3	242	8						
ＡＭＣ０３０－０５１２	511.3	498	16						
ＡＭＣ０３０－１０２４	1023.3	1010	32						
ＡＭＣ０５０－００６４	63.3	50	2	50	80	65	－	14.1	10
ＡＭＣ０５０－０１２８	127.3	114	4						
ＡＭＣ０５０－０２５６	255.3	242	8						
ＡＭＣ０５０－０５１２	511.3	498	16						
ＡＭＣ０５０－１０２４	1023.3	1010	32						
ＡＭＣ０７５－００６４	63.3	50	2	75	105	90	－	14.1	10
ＡＭＣ０７５－０１２８	127.3	114	4						
ＡＭＣ０７５－０２５６	255.3	242	8						
ＡＭＣ０７５－０５１２	511.3	498	16						
ＡＭＣ０７５－１０２４	1023.3	1010	32						
ＡＭＣ１００－００６４	63.3	50	2	100	130	115	－	14.1	10
ＡＭＣ１００－０１２８	127.3	114	4						
ＡＭＣ１００－０２５６	255.3	242	8						
ＡＭＣ１００－０５１２	511.3	498	16						
ＡＭＣ１００－１０２４	1023.3	1010	32						
ＡＭＣ１５０－００６４	63.3	50	2	150	180	165	－	16.1	12
ＡＭＣ１５０－０１２８	127.3	114	4						
ＡＭＣ１５０－０２５６	255.3	242	8						
ＡＭＣ１５０－０５１２	511.3	498	16						
ＡＭＣ１５０－１０２４	1023.3	1010	32						
ＡＭＣ２００－００６４	63.3	50	2	200	230	215	－	16.1	12
ＡＭＣ２００－０１２８	127.3	114	4						
ＡＭＣ２００－０２５６	255.3	242	8						
ＡＭＣ２００－０５１２	511.3	498	16						
ＡＭＣ２００－１０２４	1023.3	1010	32						
ＡＭＣ２５０－００６４	63.3	50	3	250	285	270	135	16.1	12
ＡＭＣ２５０－０１２８	127.3	114	6						
ＡＭＣ２５０－０２５６	255.3	242	12						
ＡＭＣ２５０－０５１２	511.3	498	24						
ＡＭＣ２５０－１０２４	1023.3	1010	48						

Note1) Check that all the pin holes on the magnetic rail are facing the same direction.

Note 2) Tightening torque for the mouning M6 screws shall be 13.6N･m or higher（screw strength class 10. 9 or higher and non-magnetic ones are recommended.）Engaing shall be 9mm or longer. Apply fixatives.

Materials: Dimension

- Magnetic rail dimension: Core type one-side linear motor (with magnet cover)



Installation method

Unit：mm

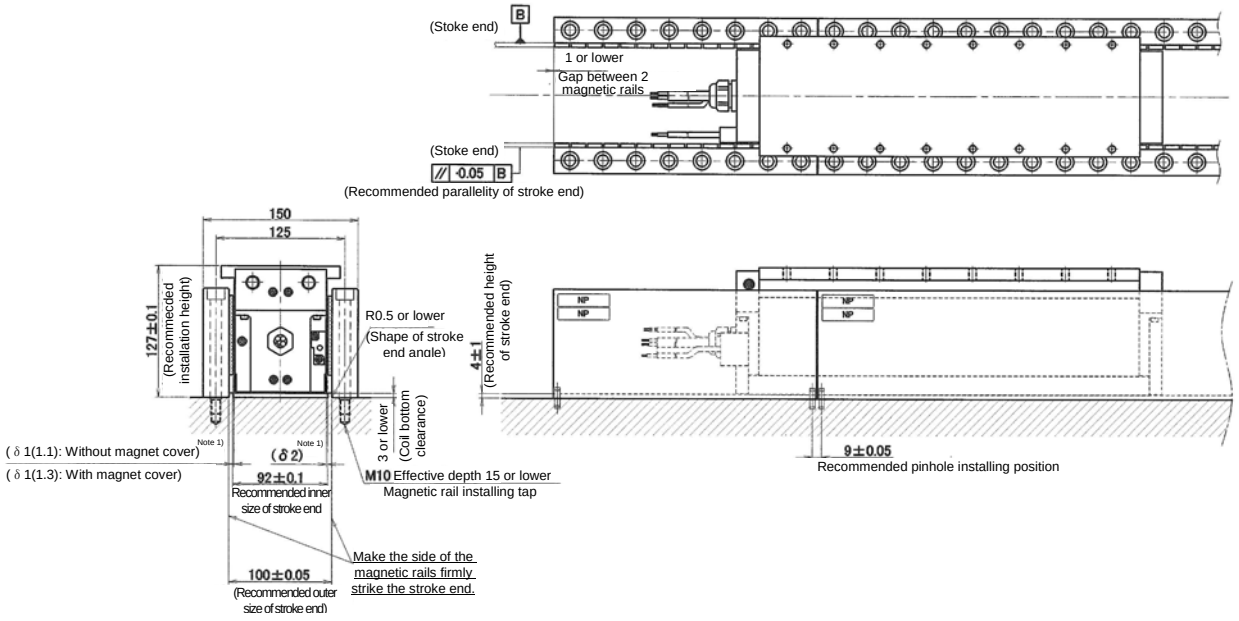
Magnetic rail type	L1	L2	N	W	W1	W2	W3	T1	T2
ＡＭＣ０３０－００６４	63.3	50	2	30	60	45	-	14.4	10
ＡＭＣ０３０－０１２８	127.3	114	4						
ＡＭＣ０３０－０２５６	255.3	242	8						
ＡＭＣ０３０－０５１２	511.3	498	16						
ＡＭＣ０３０－１０２４	1023.3	1010	32						
ＡＭＣ０５０－００６４	63.3	50	2	50	80	65	-	14.4	10
ＡＭＣ０５０－０１２８	127.3	114	4						
ＡＭＣ０５０－０２５６	255.3	242	8						
ＡＭＣ０５０－０５１２	511.3	498	16						
ＡＭＣ０５０－１０２４	1023.3	1010	32						
ＡＭＣ０７５－００６４	63.3	50	2	75	105	90	-	14.4	10
ＡＭＣ０７５－０１２８	127.3	114	4						
ＡＭＣ０７５－０２５６	255.3	242	8						
ＡＭＣ０７５－０５１２	511.3	498	16						
ＡＭＣ０７５－１０２４	1023.3	1010	32						
ＡＭＣ１００－００６４	63.3	50	2	100	130	115	-	14.4	10
ＡＭＣ１００－０１２８	127.3	114	4						
ＡＭＣ１００－０２５６	255.3	242	8						
ＡＭＣ１００－０５１２	511.3	498	16						
ＡＭＣ１００－１０２４	1023.3	1010	32						
ＡＭＣ１５０－００６４	63.3	50	2	150	180	165	-	16.4	12
ＡＭＣ１５０－０１２８	127.3	114	4						
ＡＭＣ１５０－０２５６	255.3	242	8						
ＡＭＣ１５０－０５１２	511.3	498	16						
ＡＭＣ１５０－１０２４	1023.3	1010	32						
ＡＭＣ２００－００６４	63.3	50	2	200	230	215	-	16.4	12
ＡＭＣ２００－０１２８	127.3	114	4						
ＡＭＣ２００－０２５６	255.3	242	8						
ＡＭＣ２００－０５１２	511.3	498	16						
ＡＭＣ２００－１０２４	1023.3	1010	32						
ＡＭＣ２５０－００６４	63.3	50	3	250	285	270	135	16.4	12
ＡＭＣ２５０－０１２８	127.3	114	6						
ＡＭＣ２５０－０２５６	255.3	242	12						
ＡＭＣ２５０－０５１２	511.3	498	24						
ＡＭＣ２５０－１０２４	1023.3	1010	48						

Note1) Check that all the pin holes on the magnetic rail are facing the same direction.

Note 2) Tightening torque for the mouning M6 screws shall be 13.6N･m or higher（screw strength class 10. 9 or higher and non-magnetic ones are recommended.）Engaing shall be 9mm or longer. Apply fixatives.

Materials: Dimension

- Mounting diagram: Core type couble side linear motor

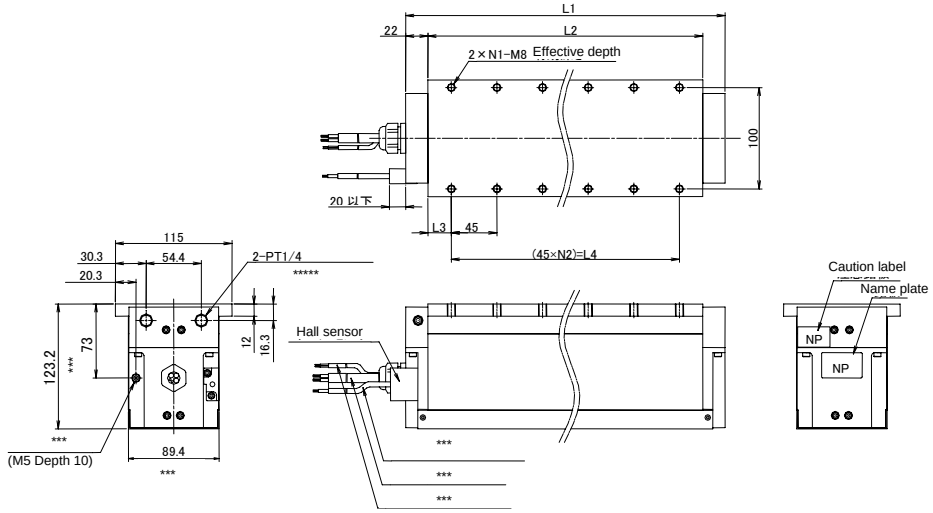


Unit：mm

Note1) For the mounting error between coil and magnetic rail, it is recommended that the mechanical gap between δ1 and δ2 shall be less than 0.2.

Note2) Make sure to apply some collision safety device (such as a shock absorber) at the stroke end. And avoid direct stress of the collision safety device on the coil itself.

- Coil dimension: Core type double side linear motor



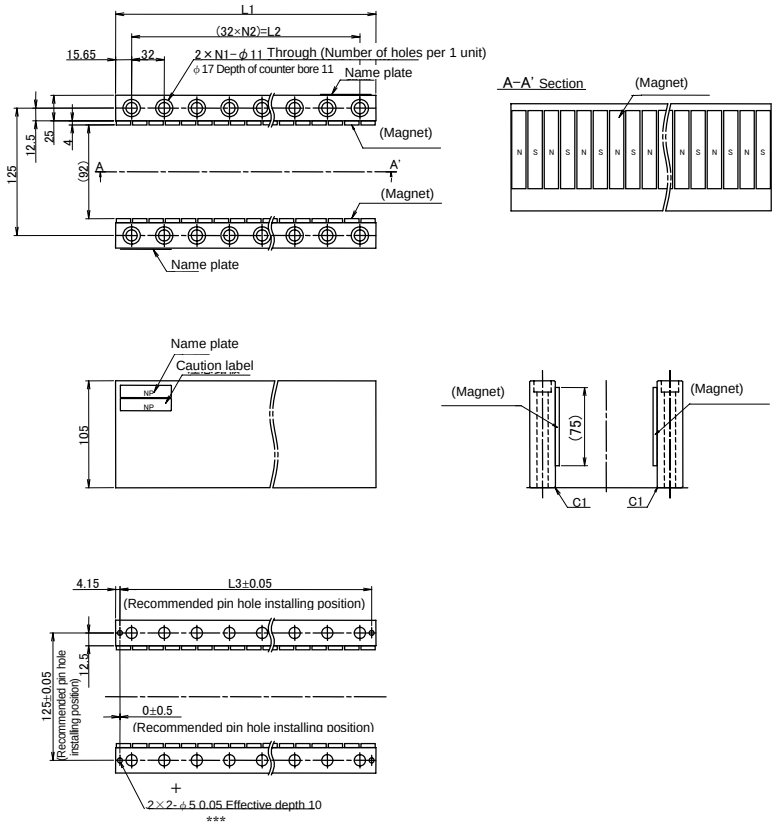
Unit：mm

Coil type	L1	L2	L3	L4	N1	N2
ＤＤ０７５Ｃ１	237	193	29	135	4	3
ＤＤ０７５Ｃ２	413	369	27	315	8	7
ＤＤ０７５Ｃ３	589	545	25	495	12	11
ＤＤ０７５Ｃ４	765	721	23	675	16	15
ＤＤ０７５Ｃ５	941	897	21	855	20	19

Note) Use all the coil mounting M8 taps. Tightening torque for them shall be 39N･m or higher（screw strength class 12. 9 or higher.） Engaing shall be 8mm to 12mm. Apply fixatives.

Materials: Dimension

- Magnetic rail dimension: Core type double side linear motor（Without magnet cover）



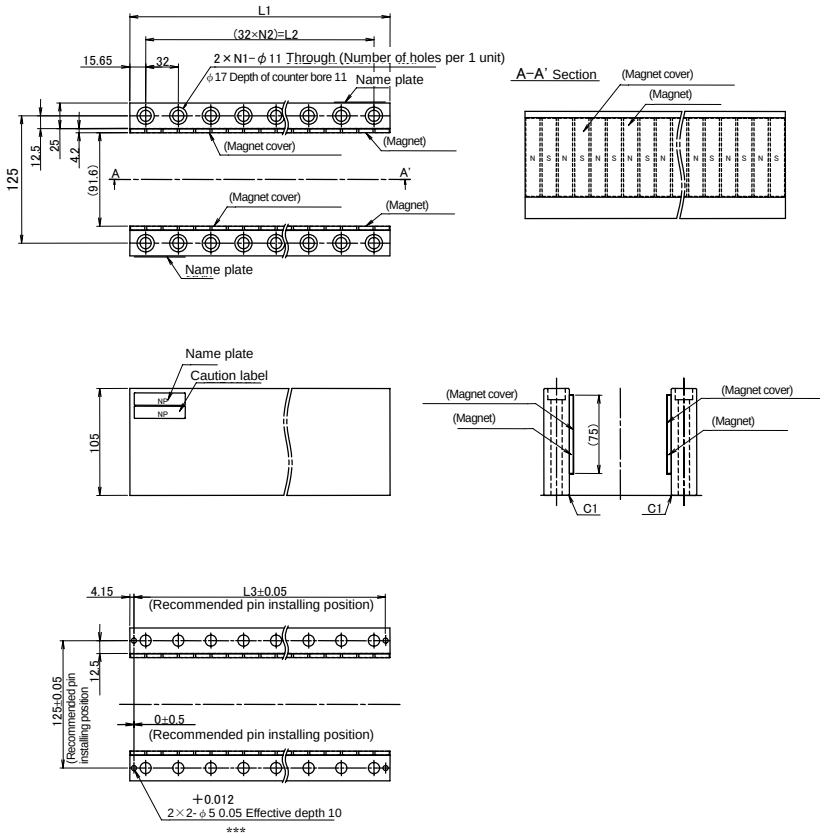
Unit：mm

Magnetic rail type	L1	L2	L3	N1	N2
ＤＤ０７５Ｍ０６４Ａ	63.3	32	55	2	1
ＤＤ０７５Ｍ１２８Ａ	127.3	96	119	4	3
ＤＤ０７５Ｍ２５６Ａ	255.3	224	247	8	7
ＤＤ０７５Ｍ５１２Ａ	511.3	480	503	16	15

Note) Tightening torque for the magnetic rail mouning M10 bolts shall be 66N･m or higher（screw strength class 12. 9 or higher). Engaing shall be15mm or longer. Apply fixatives.

Materials: Dimension

- Magnetic rail dimension: Core type double side linear motor (with magneticover)



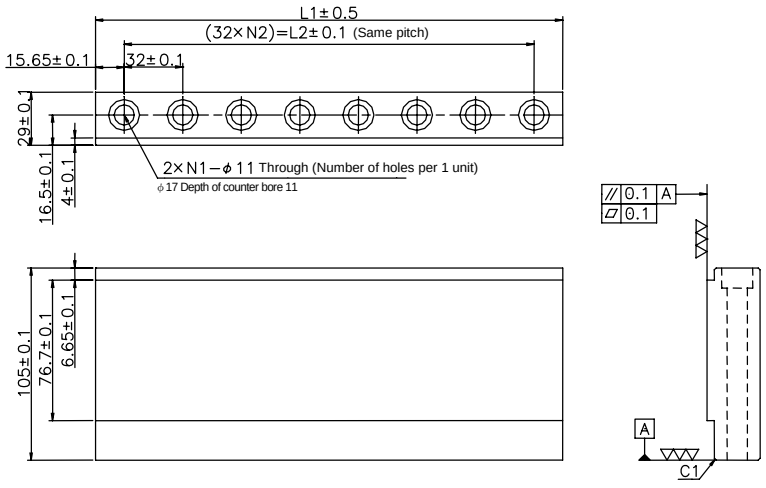
Unit：mm

Magnetic rail type	L1	L2	L3	N1	N2
ＤＤ０７５Ｍ０６４Ｂ	63.3	32	55	2	1
ＤＤ０７５Ｍ１２８Ｂ	127.3	96	119	4	3
ＤＤ０７５Ｍ２５６Ｂ	255.3	224	247	8	7
ＤＤ０７５Ｍ５１２Ｂ	511.3	480	503	16	15

Note) Tightening torque for the magnetic rail mouning M10 bolts shall be 66N･m or higher（screw strength class 12. 9 or higher). Engaing shall be 15mm or longer. Apply fixatives.

Materials: Dimension

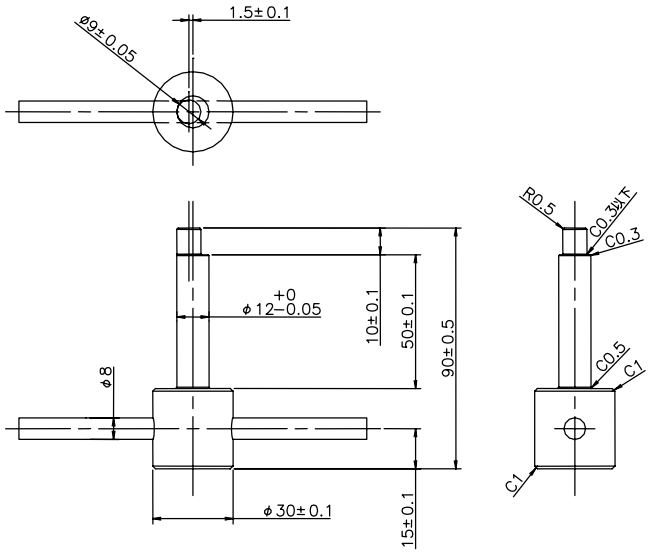
- Dummy magnetic rail dimension: Core type double side linear motor



Unit：mm

Dummy magnetic rail type	L1	L2	N1	N2
ＤＤ０７５ＤＭ２５６Ａ	255.3	224	8	7
ＤＤ０７５ＤＭ５１２Ａ	511.3	480	16	15

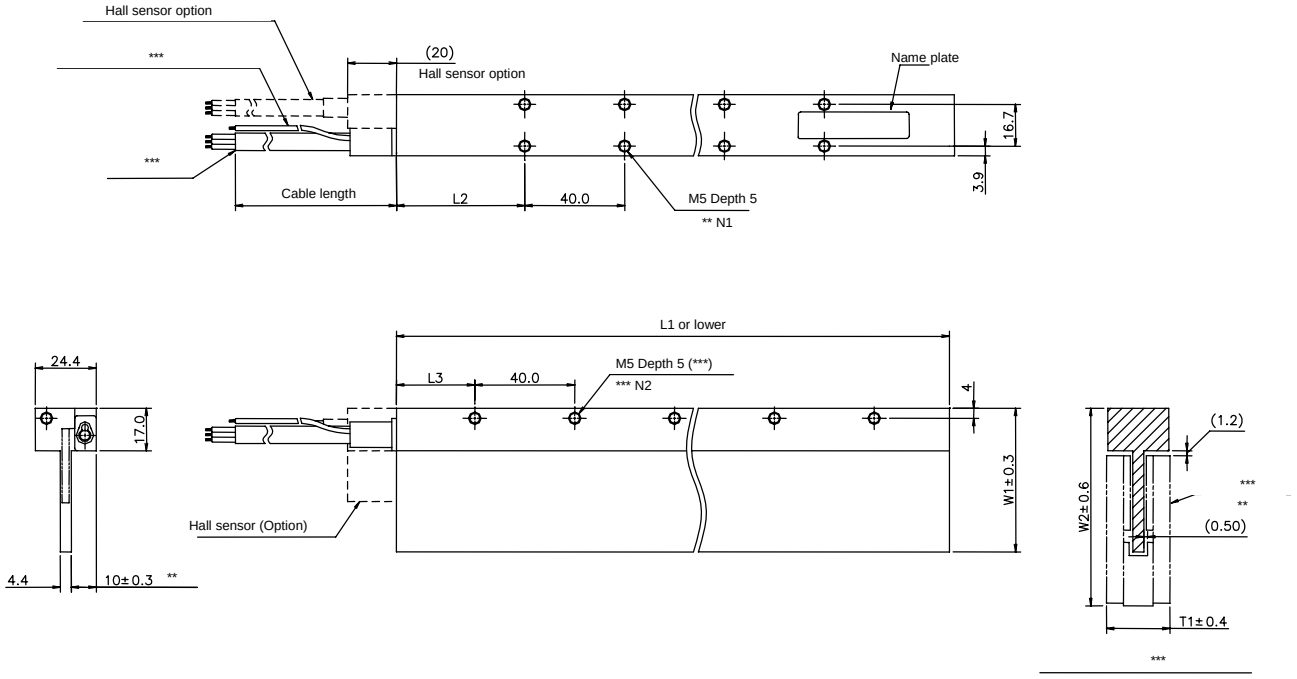
- Gap adjusting jig dimension: Core type double side linear servo motor



Unit：mm

Materials: Dimension

● Coil dimention: Coreless linear motor



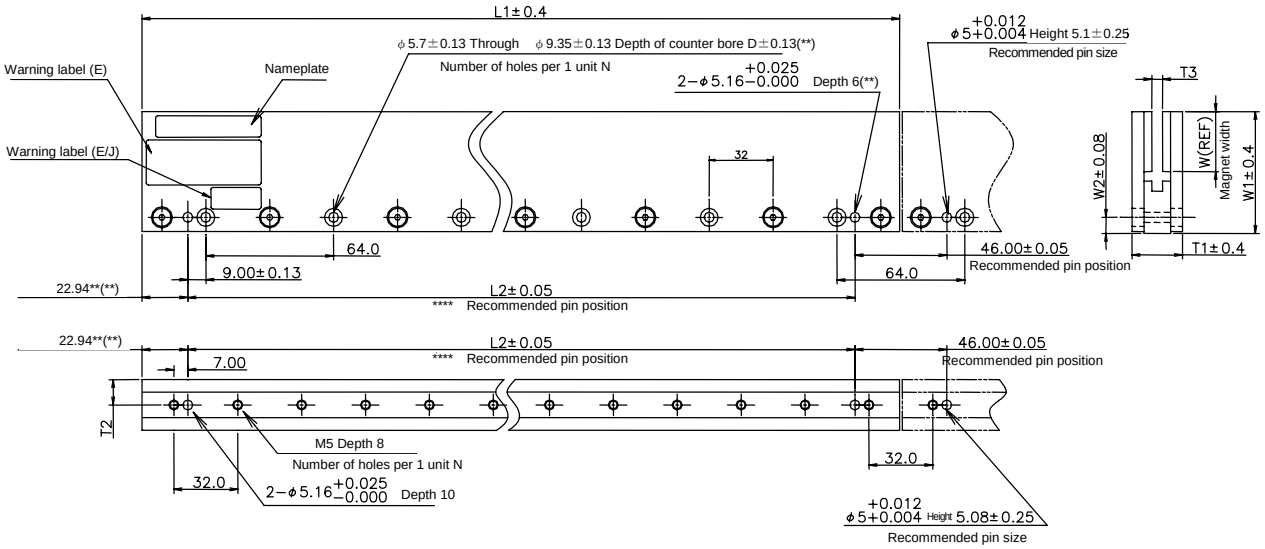
Unit：mm

コイルタイプ	L1	L2	L3	N1	N2	W1	W2	TI
ＡＩＬ０６－０３０	110.8	35.3	15.4	4	3	57.3	78.5	25.4
ＡＩＬ１２－０３０	206.8	43.4	23.4	8	5			
ＡＩＬ１８－０３０	302.8	51.4	31.4	12	7			
ＡＩＬ２４－０３０	398.8	19.4	39.4	20	9			
ＡＩＬ０６－０５０	110.8	35.3	15.4	4	3	77.3	98.5	25.4
ＡＩＬ１２－０５０	206.8	43.4	23.4	8	5			
ＡＩＬ１８－０５０	302.8	51.4	31.4	12	7			
ＡＩＬ２４－０５０	398.8	19.4	39.4	20	9			
ＡＩＬ０６－０７５	110.8	35.3	15.4	4	3	102.3	123.5	30.0
ＡＩＬ１２－０７５	206.8	43.4	23.4	8	5			
ＡＩＬ１８－０７５	302.8	51.4	31.4	12	7			
ＡＩＬ２４－０７５	398.8	19.4	39.4	20	9			
ＡＩＬ０６－１００	110.8	35.3	15.4	4	3	127.3	148.5	34.0
ＡＩＬ１２－１００	206.8	43.4	23.4	8	5			
ＡＩＬ１８－１００	302.8	51.4	31.4	12	7			
ＡＩＬ２４－１００	398.8	19.4	39.4	20	9			

Note 1) Use all the M5 coil mounting taps on one surface. Tightening torque for them shall be 8.06N･m or higher（screw strength class 10. 9 or higher）. Engaing shall be 5mm. Apply fixatives.

Materials: Dimension

- Magnetic rail dimension: Coreless linear motor



Unit：mm

Magnetic rail type	L1	L2	N1	N2	W	W1	W2	T1	T2	T3	D
ＡＭＷ０３０－００６４	63	18	1	2	30	60.2	7.11	25.4	12.7	5.79 ±0.43	5.79
ＡＭＷ０３０－０１２８	127.3	82	2	4							
ＡＭＷ０３０－０２５６	255	210	4	8							
ＡＭＷ０３０－０５１２	511	466	8	16							
ＡＭＷ０３０－１０２４	1023.3	978	16	32							
ＡＭＷ０５０－００６４	63	18	1	2	50	80.2	7.11	25.4	12.7	5.79 ±0.43	5.79
ＡＭＷ０５０－０１２８	127.3	82	2	4							
ＡＭＷ０５０－０２５６	255	210	4	8							
ＡＭＷ０５０－０５１２	511	466	8	16							
ＡＭＷ０５０－１０２４	1023.3	978	16	32							
ＡＭＷ０７５－００６４	63	18	1	2	75	105.2	8.23	30	15	6.55 ±0.53	7.95
ＡＭＷ０７５－０１２８	127.3	82	2	4							
ＡＭＷ０７５－０２５６	255	210	4	8							
ＡＭＷ０７５－０５１２	511	466	8	16							
ＡＭＷ０７５－１０２４	1023.3	978	16	32							
ＡＭＷ１００－００６４	63	18	1	2	100	130.2	8.23	34	17	6.55 ±0.53	9.96
ＡＭＷ１００－０１２８	127.3	82	2	4							
ＡＭＷ１００－０２５６	255	210	4	8							
ＡＭＷ１００－０５１２	511	466	8	16							
ＡＭＷ１００－１０２４	1023.3	978	16	32							

Note 1) Tightening torque for the mouning M6 screws shall be 13.6N･m or higher（screw strength class 10. 9 or higher). Engaing shall be 9mm or longer. Apply fixatives.

Materials: Servo Motor Data Sheet [Characteristics Table]

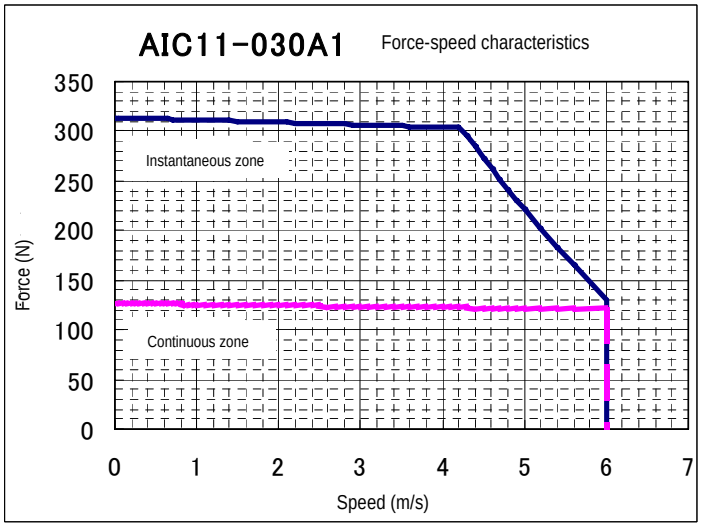
(1) Core Type One Side Linear Motor

Item	Code	Unit	**AIC11-030A1**
*Continuous rated force	Fr	N	120
*Maximum force	Fp	N	300
Rated speed	vr	m/s	4.0
Maximum speed	vp	m/s	6.0
Continuous current	Ir	Arms	4.0
Maximum current	Ip	Arms	11.3
Magnetic agraction	Fatt	N	1440
Electric time constant	τ	ms	8.8
Force constant	Kf	N/Arms	37.8
Phase induction voltage constant (Y connection conversion)	Keϕ	Vrms/m/s	12.6
*Motor constant	Km	N/√W	15.0
Coil mass	Mc	kg	2.5
Magneticrail mass	Mw	kg/m	5.5
Coil length (with hall sensor included)	Lc	mm	227
Pole core pitch	2τp	mm	32
Magnetic rail model number			AMC030-0064, -0128, -0256, -0512, -1024

・The values marked with "*" are the ones after the temperature rise and others are at 25℃ . All are the typical values.

・ All values and characteristics are the ones when an iron stage of t10×" coil length" × 150mm or equivalent is installed.

・ Force－ speed characteristics show the value when the amplifier power voltage is AC200V、3ϕ. If the power voltage is lower than AC200V, instantaneous zone will reduce.



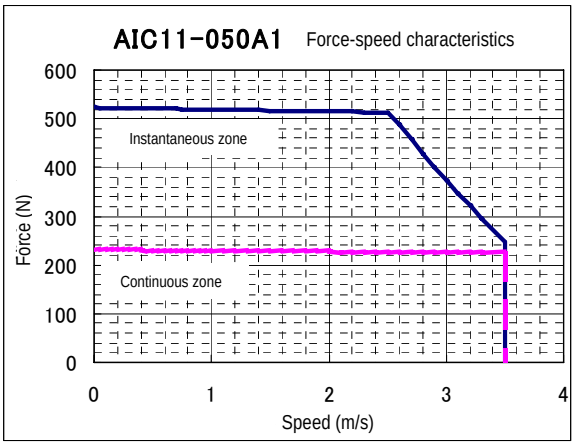
Materials: Servo Motor Data Sheet [Characteristics Table]

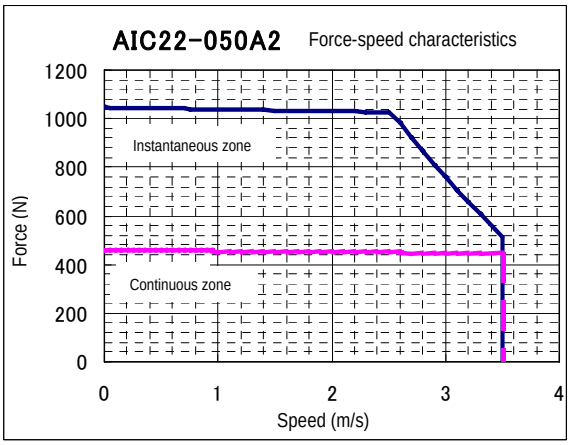
Item	Code	Unit	AIC11-050A1	AIC22-050A2	AIC33-050A7
*Continuous ratedforce	Fr	N	230	450	650
* Maximumforce	Fp	N	500	1000	1500
Rated speed	vr	m/s	2.5	2.4	4.5
Maximum speed	vp	m/s	3.5	3.4	6.0
Continuous current	Ir	Arms	4.4	8.7	22.7
Maximum current	Ip	Arms	11.3	22.0	55.0
Magnetic attraction force	Fatt	N	2430	4850	7350
Electric time constant	τ	ms	10.3	10.1	10.2
Force constant	Kf	N/Arms	62.9	63.0	36.3
Phase induction voltage constant (Y connection conversion)	Keϕ	Vrms/m/s	21.0	21.0	12.1
* Motor constant	Km	N/√W	22.4	31.0	36.6
Coil mass	Mc	kg	3.6	6.9	10.4
Magnetic rail mass	Mw	kg/m	7.6	7.6	7.6
Coil length (with hall sensor included)	Lc	mm	227	403	579
Pole core pitch	2τp	mm	32	32	32
Magnetic rail model number			AMC050-0064, -0128, -0256, -0512, -1024		

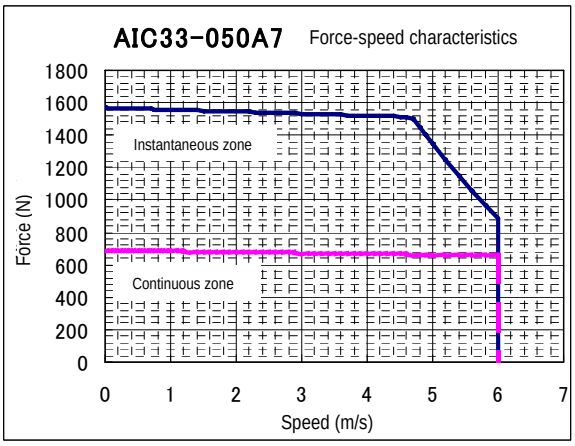
・The values marked with "*" are the ones after the temperature rise and others are at 25℃ . All are the typical values.

・All values and characteristics are the ones when an iron stage of t12×" coil length"×180mm or equivalent is installed.

・Force－ speed characteristics show the value when the amplifier power voltage is AC200V、3ϕ.
If the power voltage is lower than AC200V, instantaneous zone will reduce.







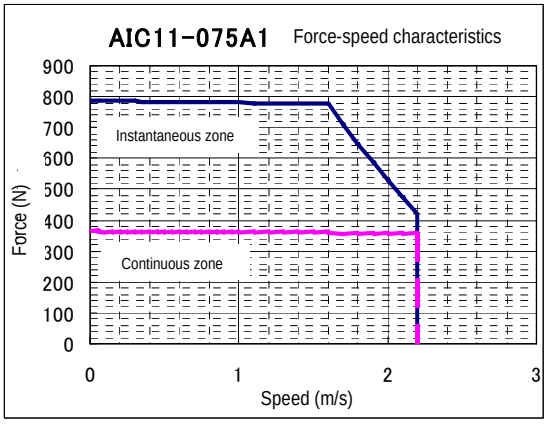
Materials: Servo Motor Data Sheet [Characteristics Table]

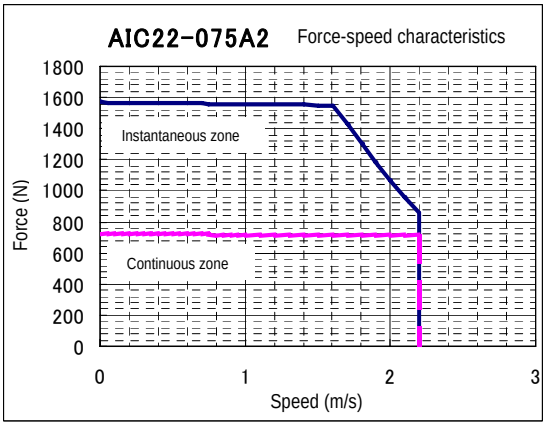
Item	Code	Unit	AIC11-075A1	AIC22-075A2	AIC33-075A7
*Continuous ratedforce	Fr	N	360	720	1000
* Maximumforce	Fp	N	750	1500	2250
Rated speed	vr	m/s	1.6	1.6	3.0
Maximum speed	vp	m/s	2.2	2.2	4.0
Continuous current	Ir	A	4.6	9.2	23.9
Maximum current	Ip	A	11.3	22.0	55.0
Magnetic attraction force	Fatt	N	3650	7280	11030
Electric time constant	τ	ms	11.3	11.1	11.2
Force constant	Kf	N/Arms	94.4	94.4	54.5
Phaswe induction voltage constant (Y connection conversion)	Keϕ	Vrms/m/s	31.5	31.5	18.2
* Motor constant	Km	N/√W	28.8	40.5	46.1
Coil mass	Mc	kg	5.0	9.6	14.4
Magnetic rail mass	Mw	kg/m	10.2	10.2	10.2
Coil length (with hall sensor included)	Lc	mm	227	403	579
Pole core pitch	2τp	mm	32	32	32
Magnetic railmodel number			AMC075-0064, -0128, -0256, -0512, -1024		

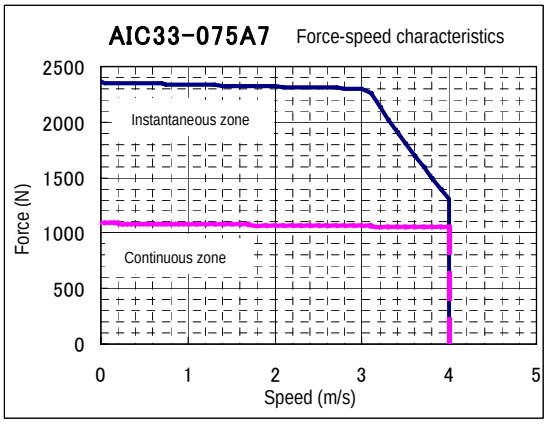
・The values marked with "*" are the ones after the temperature rise and others are at 25℃ . All are the typical values.

・ All values and characteristics are the ones when an iron stage of t15×" coil length"×200mm or equivalent is installed.

・Force－ speed characteristics show the value when the amplifier power voltage is AC200V、3ϕ. If the power voltage is lower than AC200V, instantaneous zone will reduce.



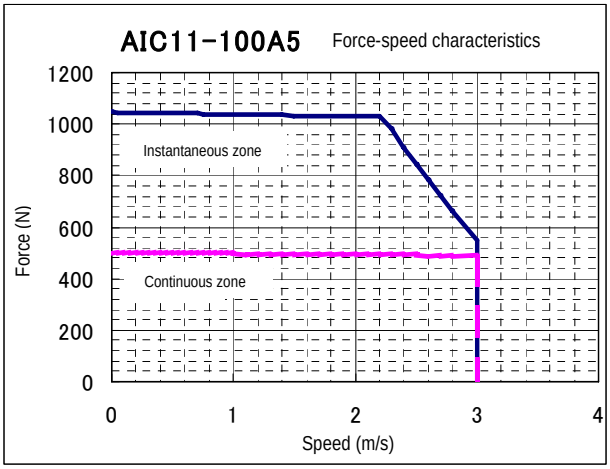


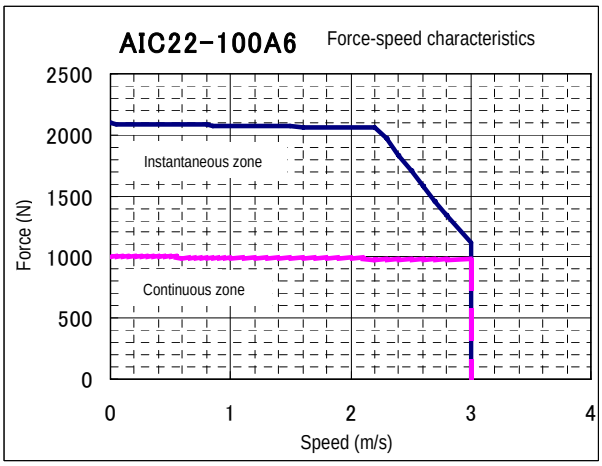


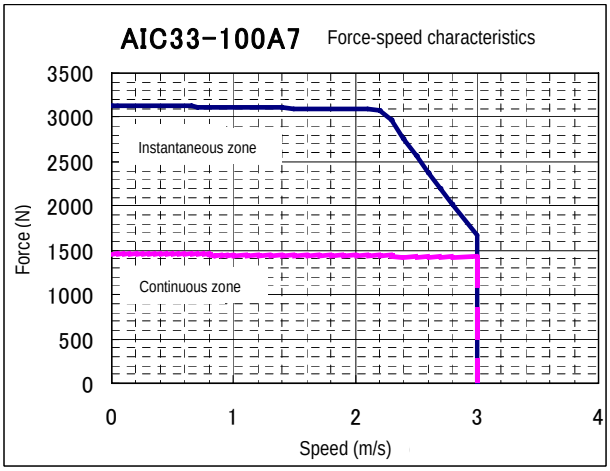
Materials: Servo Motor Data Sheet [Characteristics Table]

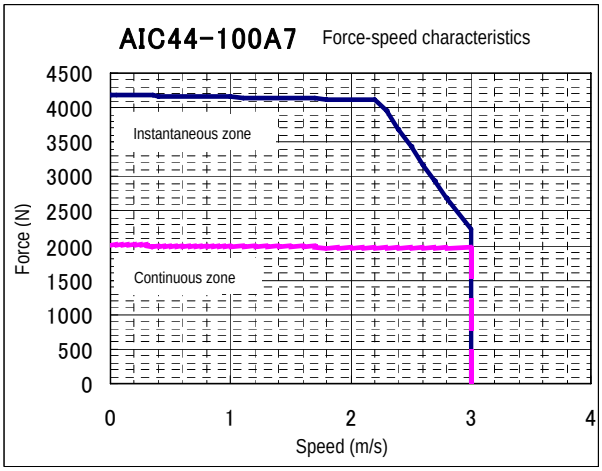
Item	Code	Unit	AIC11-100A5	AIC22-100A6	AIC33-100A7	AIC44-100A7
*Continuous rated force	Fr	N	480	1000	1400	2000
* Maximum force	Fp	N	1000	2000	3000	4000
Rated speed	vr	m/s	2.2	2.2	2.2	2.2
Maximum speed	vp	m/s	3.0	3.0	3.0	3.0
Continuous current	Ir	A	8.2	16.5	24.0	33.0
Maximum current	Ip	A	19.1	38.1	55.0	76.4
Magnetic attraction force	Fatt	N	4900	9810	14700	19600
Electric time constant	τ	ms	11.9	11.8	11.8	11.9
Force constant	Kf	N/Arms	72.7	72.7	72.7	72.7
Phase induction voltage constant (Yonnection conversion)	Keϕ	Vrms/m/s	24.2	24.2	24.2	24.2
* Motor constant	Km	N/$\sqrt{W}$	33.4	48.9	57.6	69.1
Coil mass	Mc	kg	6.5	12.5	18.9	25.0
Magnetic rail mass	Mw	kg/m	12.8	12.8	12.8	12.8
Coil length (with hall sensor included)	Lc	mm	227	403	579	755
Pole core pitch	2τp	mm	32	32	32	32
Magnetic rail model number			AMC100-0064, -0128, -0256, -0512, -1024			

- The values marked with "*" are the ones after the temperature rise and others are at 25℃ . All are the typical values.
- All values and characteristics are the ones when an iron stage of t15×" coil length"×250mm or equivalent is installed.
- Force— speed characteristics show the value when the amplifier power voltage is AC200V、3ϕ.
  If the power voltage is lower than AC200V, instantaneous zone will reduce.









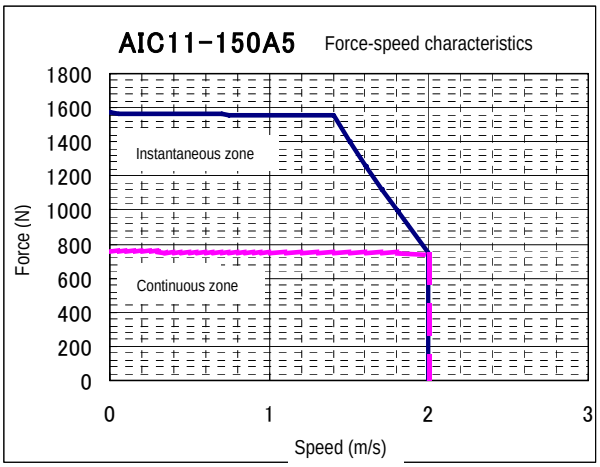
Materials: Servo Motor Data Sheet [Characteristics Table]

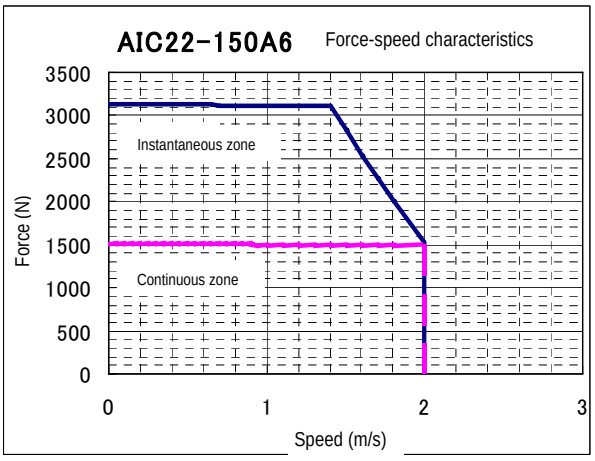
Item	Code	Unit	AIC11-150A5	AIC22-150A6	AIC33-150A7	AIC44-150A7
*Continuous rated force	Fr	N	720	1500	2150	3000
* Maximumforce	Fp	N	1500	3000	4500	6000
Rated speed	vr	m/s	1.4	1.4	1.4	1.4
Maximum speed	vp	m/s	2.0	2.0	2.0	1.8
Continuous current	Ir	A	8.3	16.6	24.0	33.2
Maximum current	Ip	A	19.1	38.1	55.0	76.4
Magnetic attraction force	Fatt	N	7290	14550	22050	29400
Eelectric time constant	τ	ms	12.5	12.5	12.5	12.5
Force constant	Kf	N/Arms	109.0	109.0	109.0	109.0
Phase induction voltage constant (Y connection conversion)	Keϕ	Vrms/m/s	36.3	36.3	36.3	36.3
* Motor constant	Km	N/√W	41.7	61.3	74.7	87.0
Coil mass	Mc	kg	9.4	18.1	27.3	36.2
Magnetic rail mass	Mw	kg/m	20.9	20.9	20.9	20.9
Coil length(with hall sensor included)	Lc	mm	227	403	579	755
Pole core pitch	2τp	mm	32	32	32	32
Magnetic railmodel number			AMC150-0064, -0128, -0256, -0512, -1024			

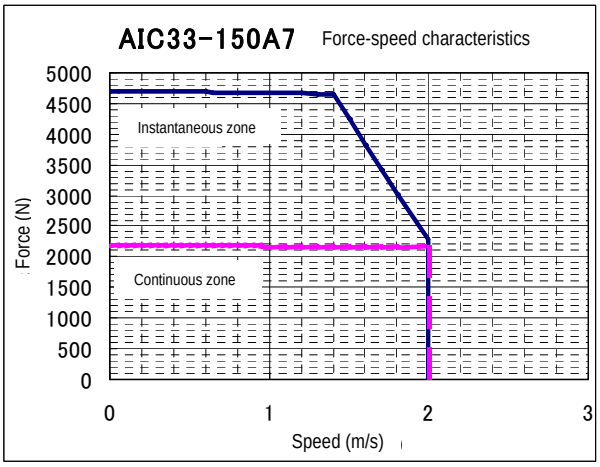
・The values marked with "*" are the ones after the temperature rise and others are at 25℃ . All are the typical values.

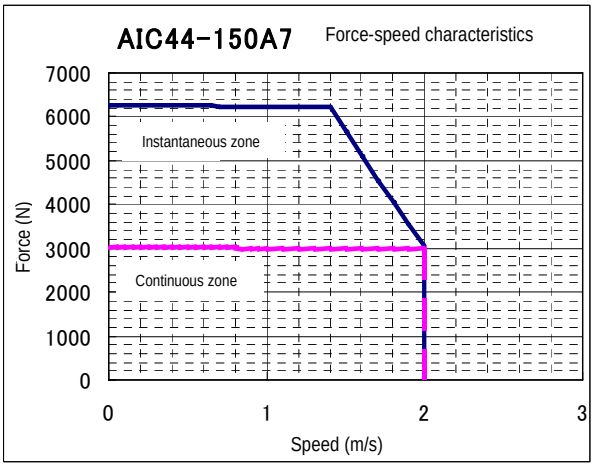
・ All values and characteristics are the ones when an iron stage of t20×" coil length"×300mm or equivalent is installed

・Force— speed characteristics show the value when the amplifier power voltage is AC200V、3ϕ.
If the power voltage is lower than AC200V, instantaneous zone will reduce.





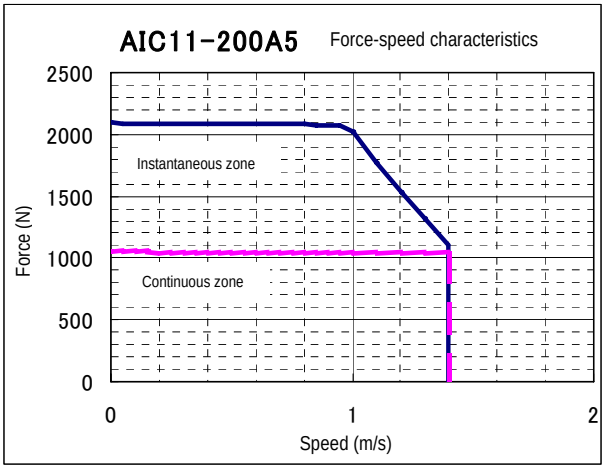


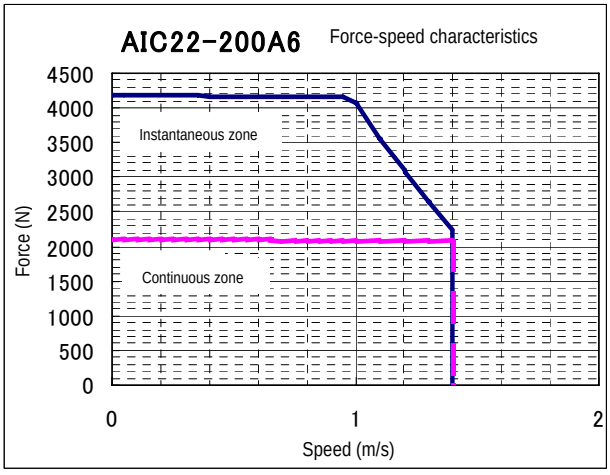


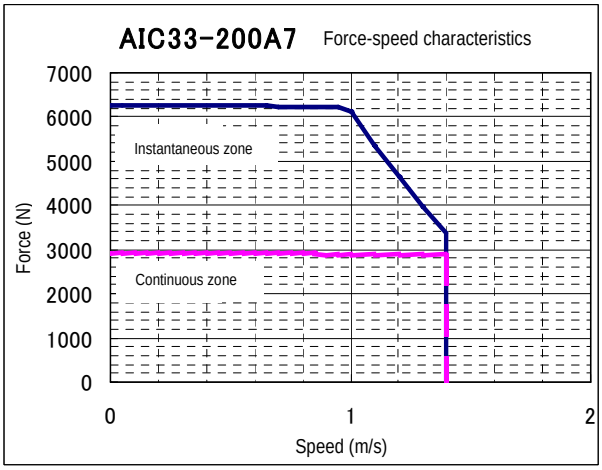
Materials: Servo Motor Data Sheet [Characteristics Table]

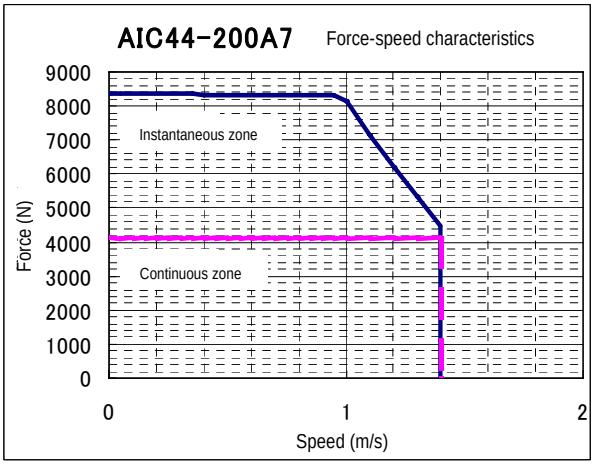
Item	Code	Unit	AIC11-200A5	AIC22-200A6	AIC33-200A7	AIC44-200A7
*Continuous rated force	Fr	N	1100	2100	2900	4000
* Maximum force	Fp	N	2000	4000	6000	8000
Rated speed	vr	m/s	1.0	1.0	1.0	1.0
Maximum speed	vp	m/s	1.4	1.4	1.4	1.4
Continuous current	Ir	A	8.6	17.3	24.0	34.0
Maximum current	Ip	A	19.1	38.1	55.0	76.4
Magnetic attraction force	Fatt	N	9850	19720	29400	39400
Electric time constant	τ	ms	12.8	12.9	12.9	12.9
Force constant	Kf	N/Arms	145.4	145.4	145.4	145.4
Phase induction voltage constant (Y connection conversion)	Keϕ	Vrms/m/s	48.5	48.5	48.5	48.5
* Motor constant	Km	N/$\sqrt{W}$	53.9	72.9	88.6	99.8
Coil mass	Mc	kg	12.3	23.7	35.7	47.4
Magnetic rail mass	Mw	kg/m	26.9	26.9	26.9	26.9
Coil length(wih hall sensor included)	Lc	mm	227	403	579	755
Pole core pitch	2τp	mm	32	32	32	32
Magnetic rail model number			AMC200-0064, -0128, -0256, -0512, -1024			

- The values marked with "*" are the ones after the temperature rise and others are at 25℃ . All are the typical values.
- All values and characteristics are the ones when an iron stage of t25×" coil length"×350mm or equivalent is installed.
- Force－ speed characteristics show the value when the amplifier power voltage is AC200V、3ϕ. If the power voltage is lower than AC200V, instantaneous zone will reduce.









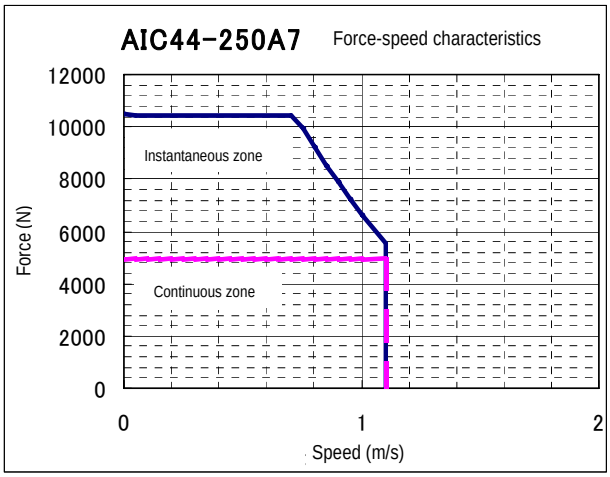
Materials: Servo Motor Data Sheet [Characteristics Table]

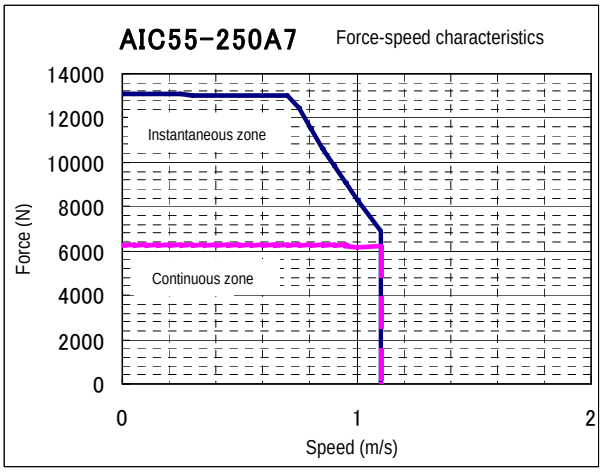
Item	Code	Unit	AIC44-250A7	AIC55-250A7
*Continuous rated force	Fr	N	4900	6200
* Maximum force	Fp	N	10000	12500
Rated speed	vr	m/s	0.6	0.6
Maximum speed	vp	m/s	1.0	1.0
Continuous current	Ir	A	34.0	42.9
Maximum current	Ip	A	76.4	96.1
Magnetic attraction force	Fatt	N	49200	61500
Electric time constant	τ	ms	13.3	13.2
Force constant	Kf	N/Arms	174.6	174.6
Phase induction voltage constant (Y connection conversion)	Keϕ	Vrms/m/s	58.2	58.2
* Motor constant	Km	N/$\sqrt{}$W	111	124
Coil mass	Mc	kg	58.5	73
Magnetic rail mass	Mw	kg/m	32.9	32.9
Coil length(with hall sensor included)	Lc	mm	755	931
Pole core pitch	2 τ p	mm	32	32
Magnetic rail model number			AMC250-0064, -0128, -0256, -0512, -1024	

・The values marked with "*" are the ones after the temperature rise and others are at 25℃ . All are the typical values.

・All values and characteristics are the ones when an iron stage of t30 × " coil length" × 400mm or equivalent is installed.

・Force－ speed characteristics show the value when the amplifier power voltage is AC200V、3ϕ.
If the power voltage is lower than AC200V, instantaneous zone will reduce.





Materials: Servo Motor Data Sheet [Characteristics Table]

(2) Core type double side linear motor

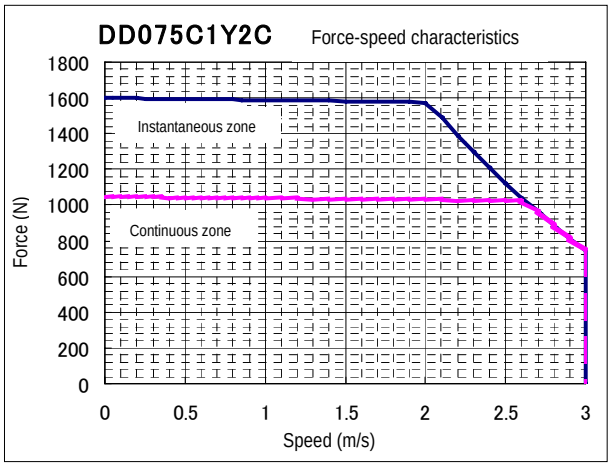
Item	Code	Unit	DD075C1Y2C	DD075C2Y2C
*Continuous ratedforce	Fr	N	1050	2100
* Maximumforce	Fp	N	1600	3200
Rated speed	vr	m/s	2.0	2.0
Maximum speed	vp	m/s	2.5	2.5
Continuous current	Ir	A	15.7	31.5
Maximum current	Ip	A	27.4	54.8
Magnetic attraction force	Fatt	N	380	750
Electric time constant	τ	ms	9.0	9.0
Force constant	Kf	N/Arms	78.0	78.0
Phase induction voltage constant (Yconnection conversion)	Keϕ	Vrms/m/s	26.0	26.0
Cooling fluid (water)		L/min.	1.5	2.0
Cooling fluid (oil)		L/min.	3.0	4.0
Cooling fluid temperature		℃	20	20
* Motor constant	Km	N/√W	36.5	51.5
Coil mass	Mc	kg	14.7	26.5
Magnetic rail mass	Mw	kg/m	40.5	40.5
Coil length (with hall sensor included)	Lc	mm	257	433
Pole core pitch	2τp	mm	32	32
Magnetic rail model number			DD075M064, 128, 256, 512	

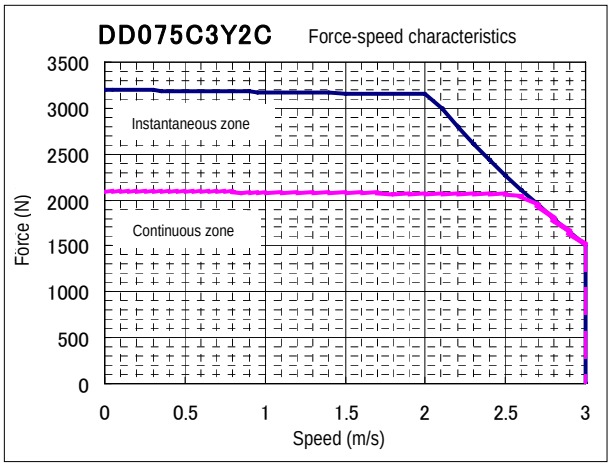
・The values marked with "*" are the ones after the temperature rise and others are at 25℃ . All are the typical values.

・ The magnetic attraction force is a reference value when installing the coil and the magnetic rail with an accuracy of ±0.1mm.

・All values and characteristics are the ones when an iron stage of t30×" coil length"×400mm or equivalent is installed.

・Force－ speed characteristics show the value when the amplifier power voltage is AC200V、3ϕ. If the power voltage is lower than AC200V, instantaneous zone will reduce.





Materials: Servo Motor Data Sheet [Characteristics Table]

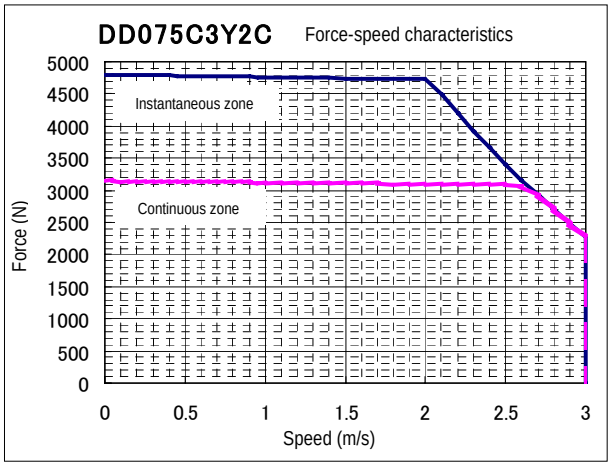
Item	Code	Unit	DD075C3Y2C	DD075C4Y2C	DD075C5Y2C
*Continuous ratedforce	Fr	N	3100	4150	4500
* Maximumforce	Fp	N	4800	6400	8000
Rated speed	vr	m/s	2.0	2.0	2.0
Maximum speed	vp	m/s	2.5	2.5	2.5
Continuous current	Ir	A	47.2	62.9	68.0
Maximum current	Ip	A	82.2	110	137
Magnetic attraction force	Fatt	N	1150	1500	1900
Electric time constant	τ	ms	9.0	9.0	9.0
Force constant	Kf	N/Arms	78.0	78.0	78.0
Phase induction voltage constant (Yconnection conversion)	Keϕ	Vrms/m/s	26.0	26.0	26.0
Cooling fluid (water)		L/min.	2.5	3.0	3.5
Cooling fluid (oil)		L/min.	5.0	6.0	7.0
Cooling fluid temperature		℃	20	20	20
* Motor constant	Km	N/√W	62.1	72.1	80.8
Coil mass	Mc	kg	38.1	49.5	61.7
Magnetic rail mass	Mw	kg/m	40.5	40.5	40.5
Coil length(with hall sensor included)	Lc	mm	609	785	961
Pole core pitch	2τp	mm	32	32	32
Magnetic rail model number			DD075M064, 128, 256, 512		

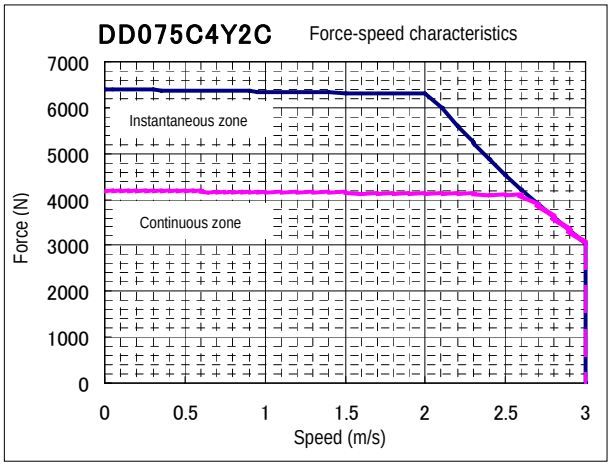
・ The values marked with "*" are the ones after the temperature rise and others are at 25℃ . All are the typical values.

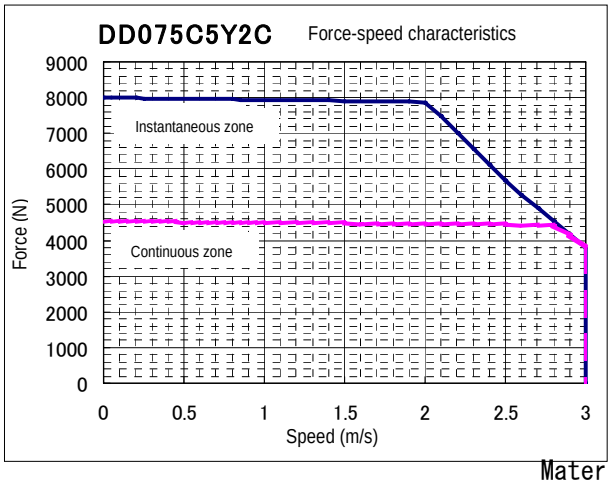
・ The magnetic attraction force is a reference value when installing the coil and the magnetic rail with an accuracy of ±0.1mm.

・ All values and characteristics are the ones when an iron stage of t30×" coil length"×400mm or equivalent is installed.

・Force－ speed characteristics show the value when the amplifier power voltage is AC200V、3ϕ.
If the power voltage is lower than AC200V, instantaneous zone will decrease.







Materials: Servo Motor Data Sheet [Characteristics Table]

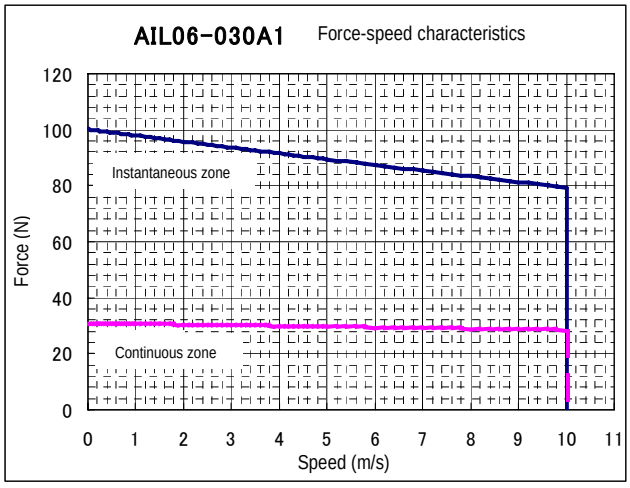
(3)Coreless type linear motor

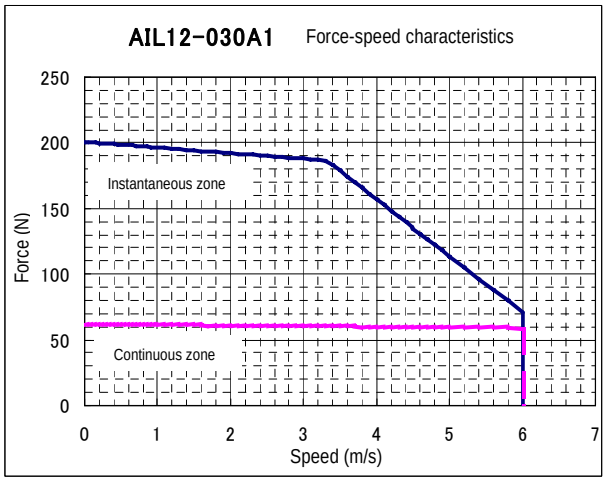
Item	Code	Unit	**AIL06-030A1**	**AIL12-030A1**
*Continuous ratedforce	Fr	N	30	60
* Maximumforce	Fp	N	80	180
Rated speed	vr	m/s	8.0	3.2
Maximum speed	vp	m/s	10.0	6.0
Continuous current	Ir	Arms	2.2	2.2
Maximum current	Ip	Arms	7.1	7.1
Magnetic attraction force	Fatt	N	0	0
Electric time constant	τ	ms	0.26	0.30
Force constant	Kf	N/Arms	16.8	33.7
Phase induction voltage constant	Keϕ	Vrms/m/s	5.6	11.2
* Motor constant	Km	N/√W	3.8	5.4
Coil mass	Mc	kg	0.27	0.42
Magnetic rail mass	Mw	kg/m	9.6	9.6
Coil length(with hall sensor included)	Lc	mm	132	228
Pole core pitch	2τp	mm	32	32
Magnetic rail model number			AMW030-0064, -0128, -0256, -0512, -1024	

・The values marked with "*" are the ones after the temperature rise and others are at 25℃ . All are the typical values.

・ All values and characteristics are the ones when an iron stage of t10×" coil length"×180mm or equivalent is installed.

・ Force— speed characteristics show the value when the amplifier power voltage is AC200V、3ϕ.
If the power voltage is lower than AC200V, instantaneous zone will reduce.

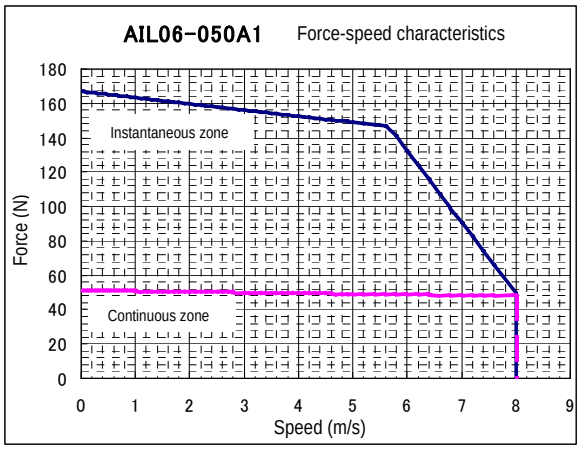


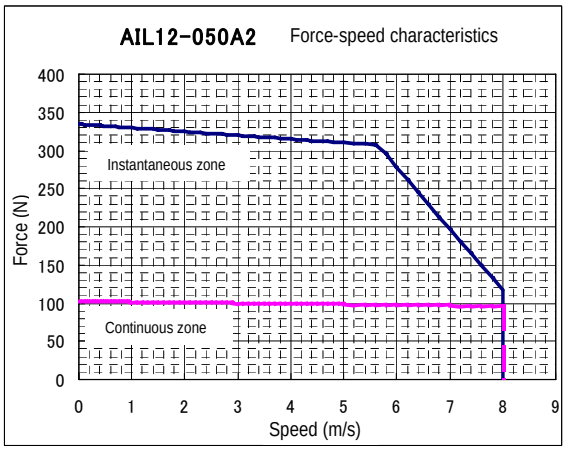


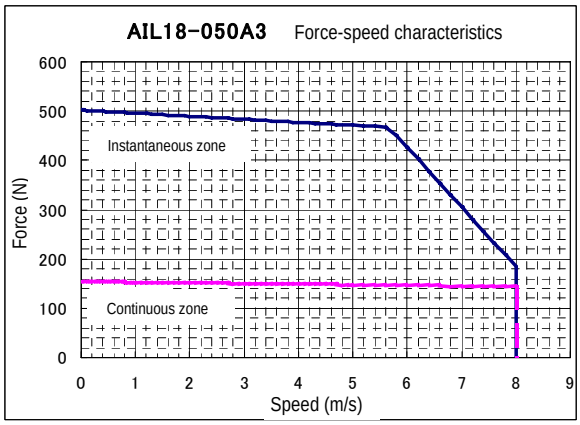
Materials: Servo Motor Data Sheet [Characteristics Table]

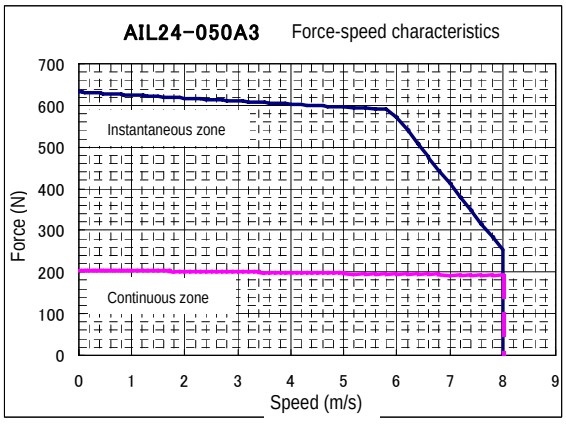
Item	Code	Unit	AIL06-050A1	AIL12-050A2	AIL18-050A3	AIL24-050A3
*Continuous ratedforce	Fr	N	50	100	150	190
* Maximumforce	Fp	N	140	300	460	590
Rated speed	vr	m/s	5.5	5.5	5.5	5.5
Maximum speed	vp	m/s	8.0	8.0	8.0	8.0
Continuous current	Ir	Arms	2.1	4.3	6.5	8.6
Maximum current	Ip	Arms	7.0	14.0	21.0	26.5
Magnetic attraction force	Fatt	N	0	0	0	0
Electric time constant	τ	ms	0.35	0.35	0.35	0.35
Force constant	Kf	N/Arms	28.5	28.5	28.5	28.5
Phase induction voltage constant	Keϕ	Vrms/m/s	9.5	9.5	9.5	9.5
* Motor constant	Km	N/$\sqrt{W}$	5.5	7.8	9.5	10.4
Coil mass	Mc	kg	0.32	0.52	0.72	0.92
Magnetic rail mass	Mw	kg/m	12.5	12.5	12.5	12.5
Coil length(with hall ssensor included)	Lc	mm	132	228	324	420
Pole core pitch	2τp	mm	32	32	32	32
Magnetic rail model number			AMW050-0064, -0128, -0256, -0512, -1024			

- The values marked with "*" are the ones after the temperature rise and others are at 25℃ . All are the typical values.
- All values and characteristics are the ones when an iron stage of t10×" coil length"×200mm or equivalent is installed.
- Force－ speed characteristics show the value when the amplifier power voltage is AC200V、3ϕ. If the power voltage is lower than AC200V, instantaneous zone will reduce.





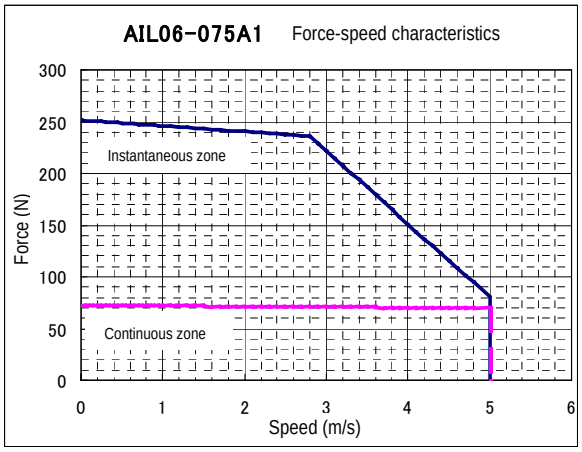


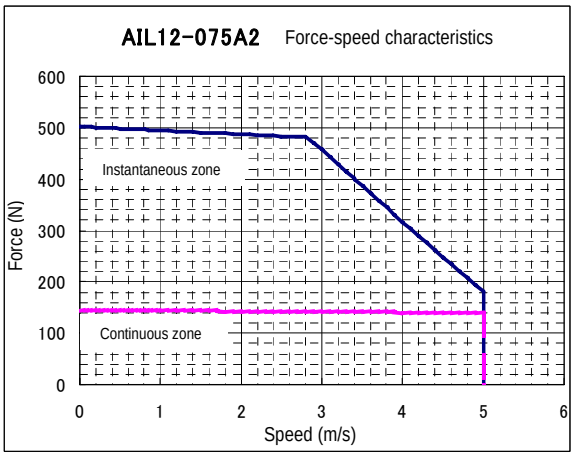


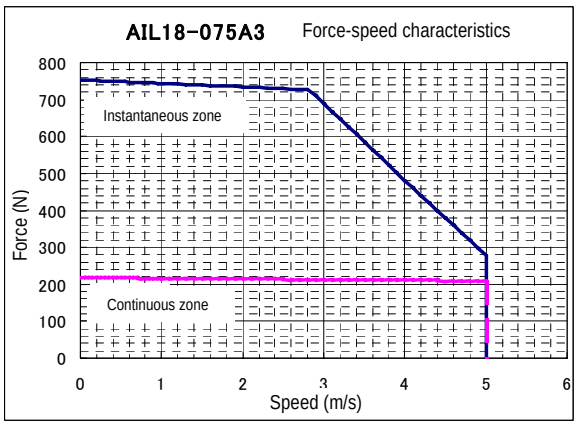
Materials: Servo Motor Data Sheet [Characteristics Table]

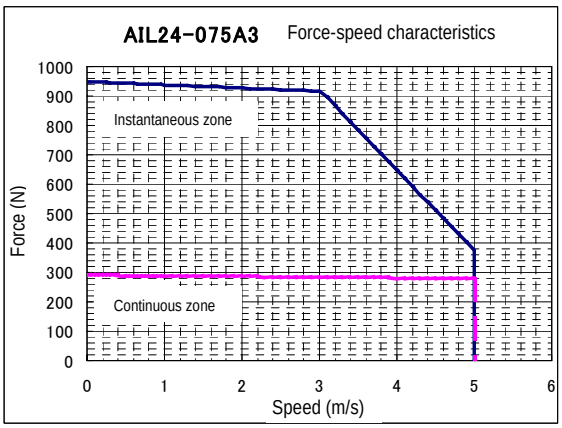
Item	Code	Unit	AIL06-075A1	AIL12-075A2	AIL18-075A3	AIL24-075A3
*Continuous ratedforce	Fr	N	70	140	210	280
* Maximumforce	Fp	N	230	470	720	900
Rated speed	vr	m/s	2.8	2.8	2.8	3.0
Maximum speed	vp	m/s	5.0	5.0	5.0	5.0
Continuous current	Ir	A	2.0	4.1	6.1	8.1
Maximum current	Ip	A	7.0	14.0	21.0	26.5
Magnetic attraction force	Fatt	N	0	0	0	0
Electric time constant	τ	ms	0.30	0.30	0.30	0.30
Force constant	Kf	N/Arms	42.8	42.8	42.8	42.8
Phase induction voltage constant	Keϕ	Vrms/m/s	14.3	14.3	14.3	14.3
* Motor constant	Km	N/√W	7.0	9.9	12.1	13.9
Coil mass	Mc	kg	0.38	0.65	0.91	1.17
Magnetic rail mass	Mw	kg/m	19.4	19.4	19.4	19.4
Coil length(with hall sensor included)	Lc	mm	132	228	324	420
Pole core pitch	2τp	mm	32	32	32	32
Magnetic rail model number			AMW075-0064, -0128, -0256, -0512, -1024			

- The values marked with "*" are the ones after the temperature rise and others are at 25℃ . All are the typical values.
- All values and characteristics are the ones when an iron stage of t10×" coil length"×230mm or equivalent is installed.
- Force－ speed characteristics show the value when the amplifier power voltage is AC200V、3ϕ. If the power voltage is lower than AC200V, instantaneous zone will reduce.









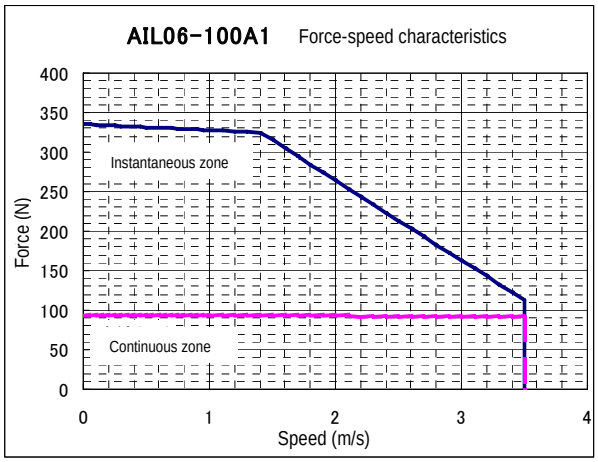
Materials: Servo Motor Data Sheet [Characteristics Table]

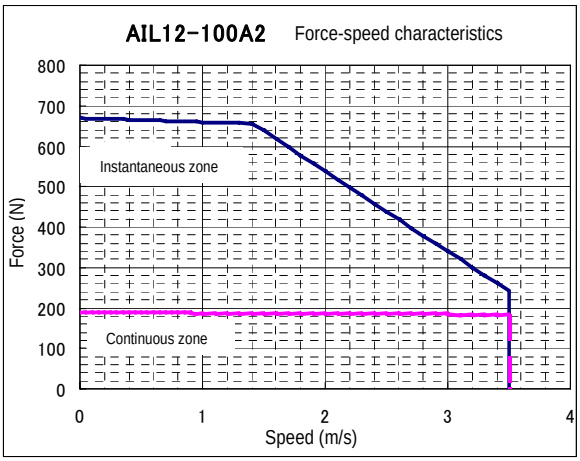
Item	Code	Unit	AIL06-100A1	AIL12-100A2	AIL18-100A3	AIL24-100A3
*ontinuous ratedforce	Fr	N	90	190	280	370
* Maximumforce	Fp	N	320	650	980	1240
Rated speed	vr	m/s	1.4	1.4	1.4	1.5
Maximum speed	vp	m/s	3.5	3.5	3.5	3.5
Continuous current	Ir	A	2.0	4.0	5.9	7.9
Maximum current	Ip	A	7.0	14.0	21.0	26.5
Magnetic attraction force	Fatt	N	0	0	0	0
Electric time constant	τ	ms	0.33	0.33	0.33	0.33
Force constant	Kf	N/Arms	57.0	57.0	57.0	57.0
Phase induction voltage constant	Keϕ	Vrms/m/s	19.0	19.0	19.0	19.0
* Motor constant	Km	N/√W	8.2	12.2	14.7	16.8
Coil mass	Mc	kg	0.45	0.77	1.10	1.42
Magnetic rail mass	Mw	kg/m	28	28	28	28
Coil length(with hall sensor included)	Lc	mm	132	228	324	420
Pole core pitch	2τp	mm	32	32	32	32
Magnetic rail model number			AMW100-0064, -0128, -0256, -0512, -1024			

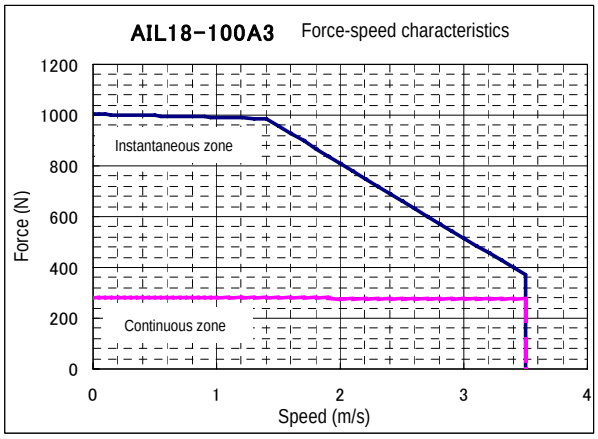
・The values marked with "*" are the ones after the temperature rise and others are at 25℃ . All are the typical values.

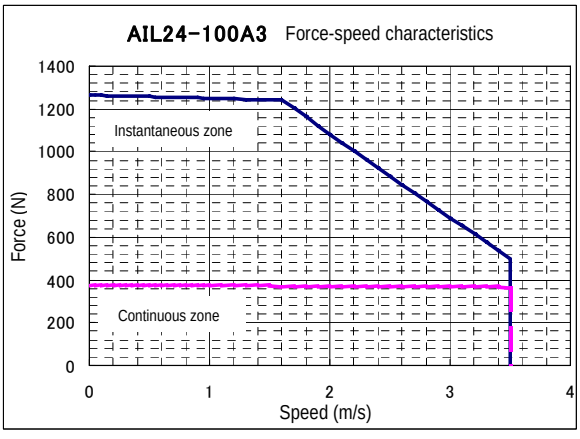
・ All values and characteristics are the ones when an iron stage of t10×" coil length"×230mm or equivalent is installed.

・Force－ speed characteristics show the value when the amplifier power voltage is AC200V、3ϕ.
If the power voltage is lower than AC200V, instantaneous zone will reduce.





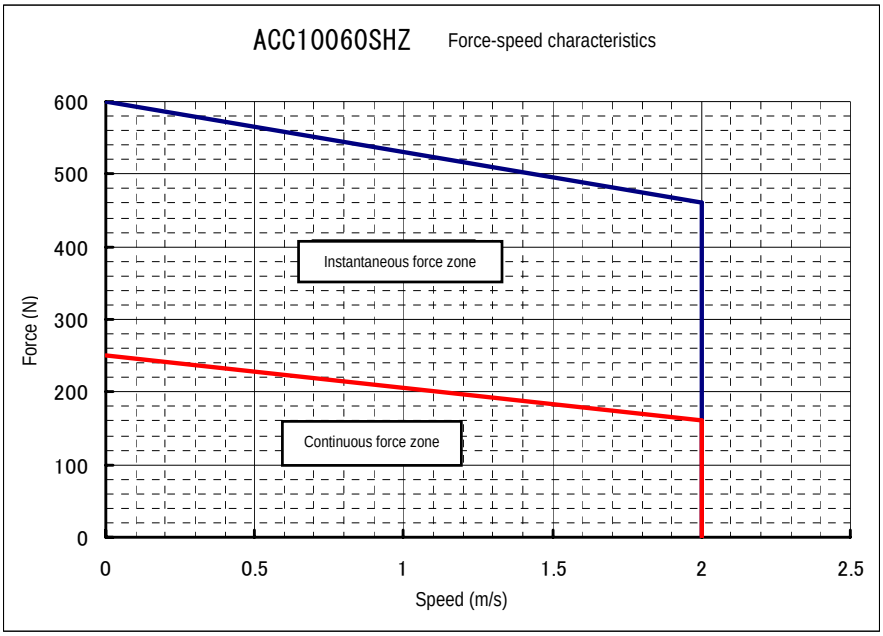




(4) Cylinder type linear motor

Item	Code	Unit	**ACC10060SHZ**
*Continuous ratedforce	Fr	N	250
* Maximumforce	Fp	N	600
Rated speed	vr	m/s	1.0
Maximum speed	vp	m/s	2.0
Continuous current	I r	Arms	3.8
Maximum current	Ip	Arms	10.0
Magnetic attraction force	Fatt	N	—
Mover mass	Mc	kg	2.0
Motor mass	Mm	kg/m	8.0
Sensor signal frequency	P	μm	4.0
Sensor resolution (4 multiplied)	S	μm	1.0

- The values marked with "*" are the ones after the temperature rise and others are at 20℃ . All are the typical values.
- All values and characteristics are the ones when an aluminum radiator plate of t10× 300mm or equivalent is installed.
- Force— speed characteristics show the value when the amplifier power voltage is AC200V、3φIf the power voltage is lower than AC200V, instantaneous zone will reduce.



Materials: Option [Metal Mounting Fittings]

■ Input-output connector

Connector table for AC200V input type

Application	Model number	Contents	Manufacturer	Manufacturer's model number
Single connector	AL-00385594	CN1 Plug and housing	Sumitomo 3M Ltd.	10150-3000VE 10350-52A0-008
	AL-00385596	CN2 Plug and housing	Sumitomo 3M Ltd.	10120-3000VE 10320-52A0-008
	AL-00329461-01	CAN Plug	Phoenix Contact Co., Ltd.	MSTB2.5/5-STF-5.08
	AL-Y0000988-01	CNB Plug	Phoenix Contact Co., Ltd.	IC2.5/6-STF-5.08
	AL-00329458-01	CNCのPlug	Phoenix Contact Co., Ltd.	IC2.5/3-STF-5.08
Low voltage circuit connector set	AL-00292309	CN1,CN のPlug and housing	Sumitomo 3M Ltd.	10150-3000VE 10350-52A0-008 10120-3000VE 10320-52A0-008
High voltage circuit connector set＊	AL-00416792	CNA,CNC Plug	Phoenix Contact Co., Ltd.フ	MSTB2.5/5-STF-5.08 IC2.5/3-STF-5.08
Amplifier capacity RS1□01～RS1□05 Standard set	AL-00393603	CN1,CN2 Plug and housing CNA,CNC Plug	Sumitomo 3M Ltd. Phoenix Contact Co., Ltd.	10150-3000VE 10350-52A0-008 10120-3000VE 10320-52A0-008 MSTB2.5/5-STF-5.08 IC2.5/3-STF-5.08
Amplifier capacity RS1□10,RS1□15 RS1□30 Standard set	AL-00292309	CN1,CN2 Plug and housing	Sumitomo 3M Ltd.	10150-3000VE 10350-52A0-008 10120-3000VE 10320-52A0-008

＊ CNB is installed in the servo amplifier. It is not included in the high-voltage circuit connector set.

AC100V input type

Application	Model number	Contents	Manufacturer	Manufacturer's model number
Single connector	AL-00329461-02	CAN plug	Phoenix Contact Co., Ltd.	MSTB2.5/4-STF-5.08
Amplifier capacity RS1□01～RS1□03 Standard set	AL-00492384	CN1,CN2 Plug and housing CNA,CNC Plug	Sumitomo 3M Ltd. Phoenix Contact Co., Ltd.	10150-3000VE 10350-52A0-008 10120-3000VE 10320-52A0-008 MSTB2.5/4-STF-5.08 IC2.5/3-STF-5.08

Setup software communication cable

Model number	Remarks
AL-00490833-01	Dedicated cable

Materials: Option [Metal Mounting Fittings]

■ Metal mounting fittings

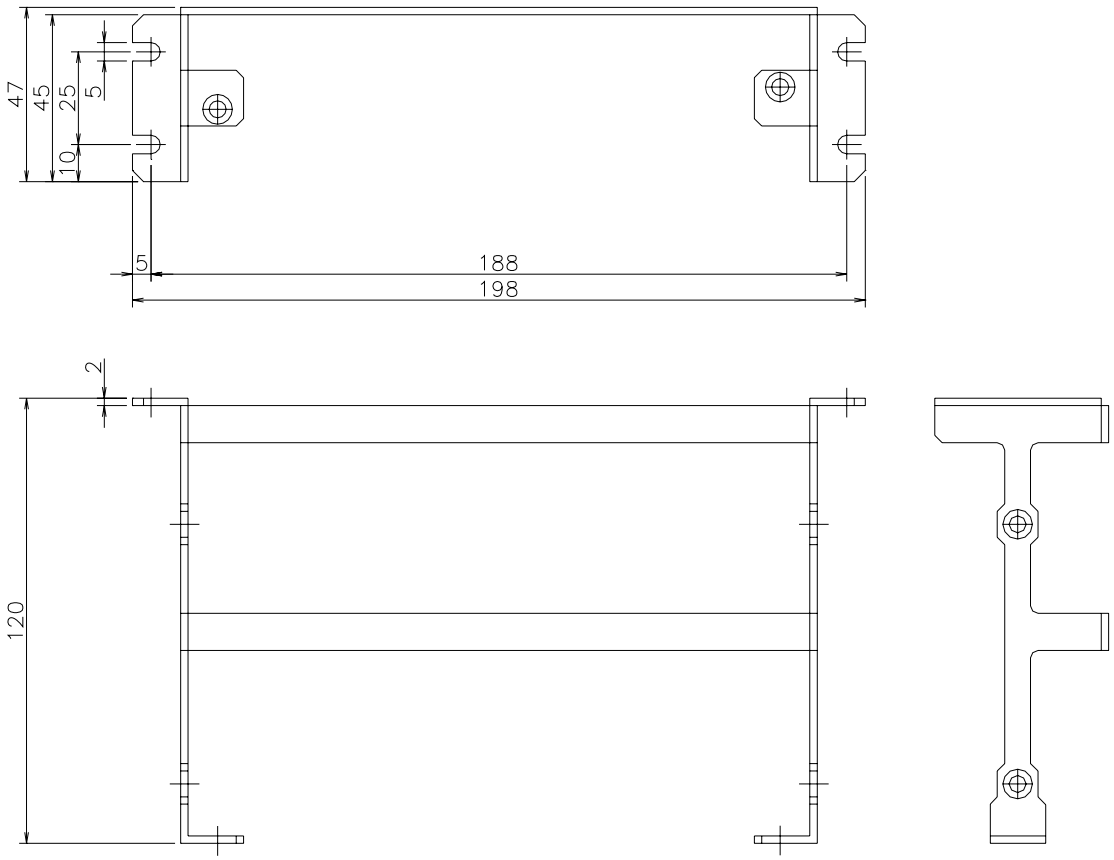
The mounting fittings which are compatible with the conventional ones (PY2 series) are available for the servo amplifiers of ＲＳ１□０１、ＲＳ１□０３、ＲＳ１□０５.

● Table of metal mounting fittings for ＲＳ１□０１～０５

Servo amplifier model number	Mounting position	Model	Contents
RS1□01	Front	AL-00582788-01	Fitting metals : 1 Tightening screws : 6
RS1□03	Front	AL-00582789-01	Fitting metals : 1 Tightening screws : 6
RS1□01, RS1□03	Back	AL-00582791-01	Fitting metals : 1 Tightening screws : 2
RS1□05	Front	AL-00582790-01	Fitting metals : 1 Tightening screws : 6
	Back	AL-00582792-01	Fitting metals : 1 Tightening screws : 2

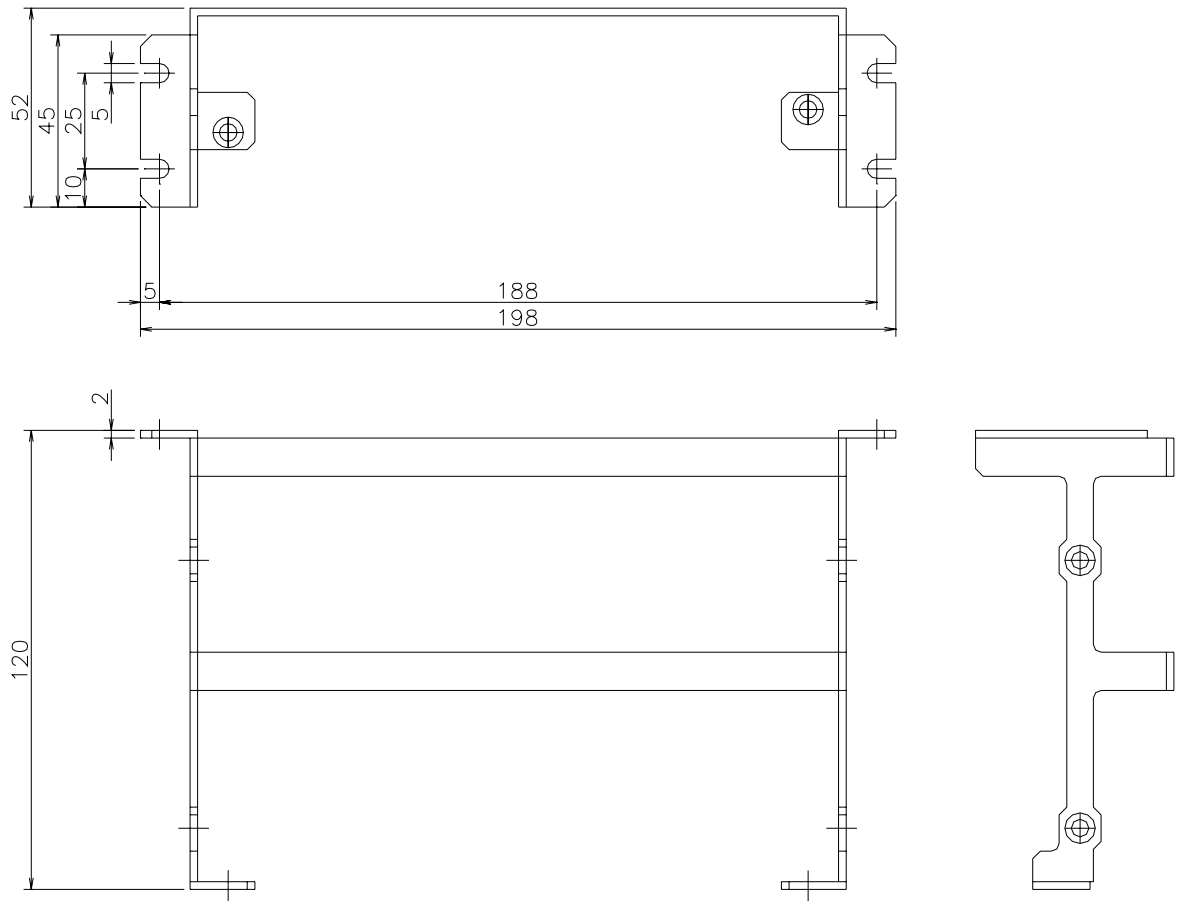
Metal mounting fittings of this option employ trivalent chromate plating treatment.
（Surface color：Blue-silver / different from the body color.）

● AL-00582788-01

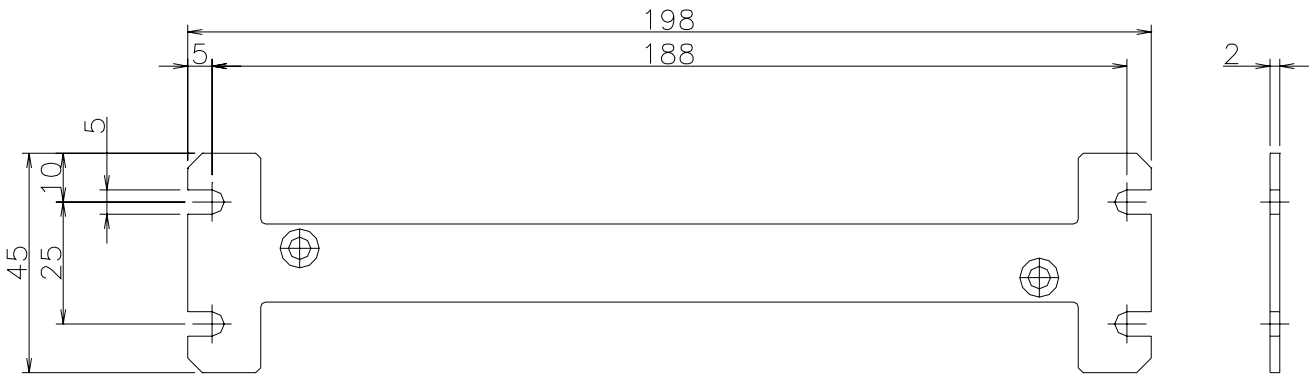


Materials: Option [Metal Mounting Fittings]

- AL-00582789-01

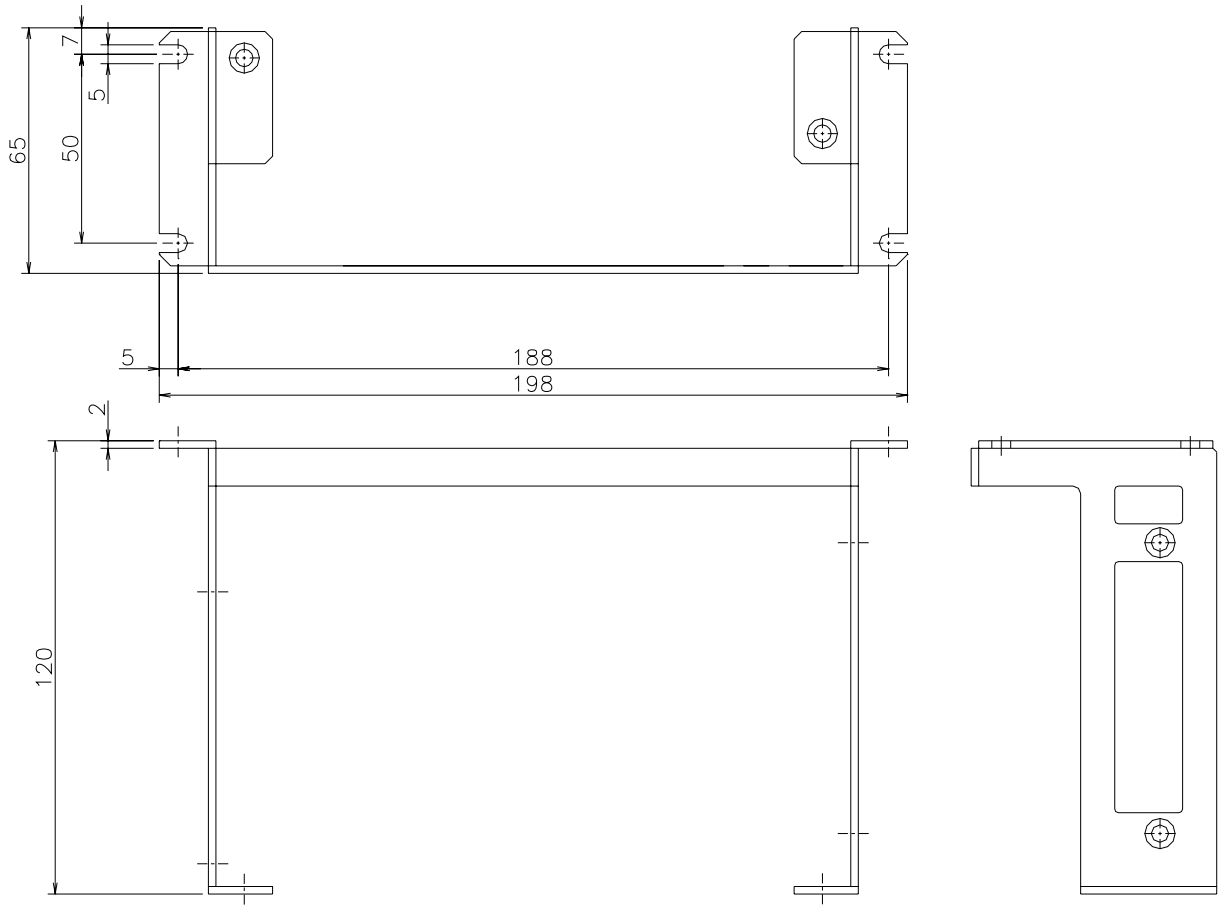


- AL-00582791-01

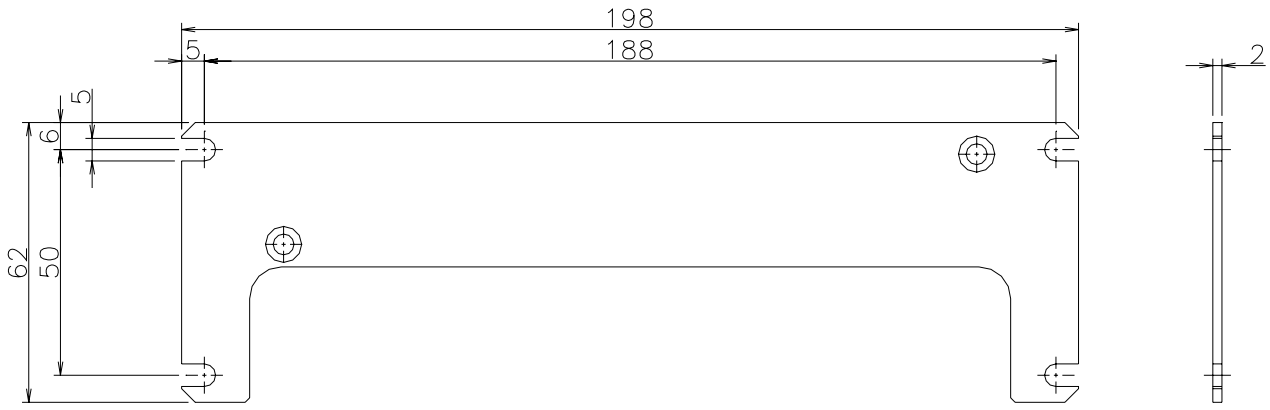


Materials: Option [Metal Mounting Fittings]

- AL-00582790-01



- AL-00582792-01

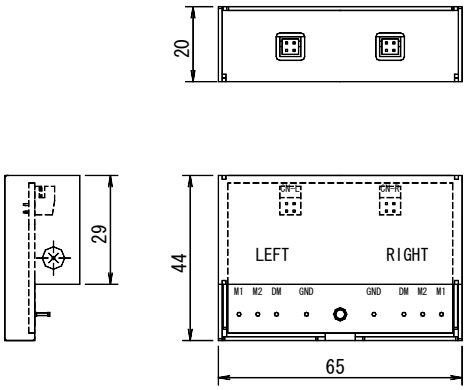


■ Monitor box

● Monitor box and dedicated cable

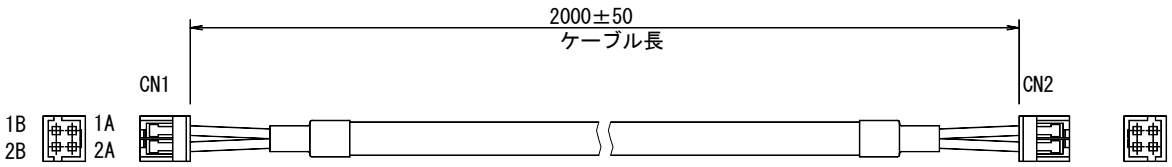
Model number	Remarks
Q-MON-1	Monitor box ＋ Dedicated cables（2 cables）

Two dedicated cables shown below come with this monitor box.



● Dedicated cable

Model number	Remarks
AL-00496726-01	Dedicated cables （2 cables）



Terminal name	Function
１Ａ	Analog monitor 1
１Ｂ	Analog monitor 2
２Ａ	ＧＮＤ
２Ｂ	Digital monitor

	Manufacturer model number	Manufacturer
Connector	LY10-DC4	Japan Aviation Electronics Industry Ltd.
Contact	LY10-C1-1-10000	Japan Aviation Electronics Industry Ltd.

MEMO

Release
Revision A Nov.2006

Precautions For Adoption

⚠ Cautions

The possibility of moderate or minor injury
and the occurrence of physical damage are assumed
when the precautions at right column are not observed.
Depending on the situation,
this may cause serious consequences.
Be sure to follow all listed precautions.

⚠ Cautions

- Be sure to read the instruction manual before using this product.
- Take sufficient safety measures and contact us before applying this product to medical equipment that may involve human lives.
- Contact us before adapting this product for use with equipment that could cause serious social or public effects.
- The use of this product in high motion environments where vibration is present, such as in vehicles or shipping vessels, is prohibited.
- Do not convert or modify any equipment components.

* Please contact our Business Division for questions and consultations regarding the above.

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