

SANMOTION
CLOSED LOOP STEPPING SYSTEMS
Model No.PB
TYPE R 4Axis
RS-485+PIO Type
DC24/36V
Instruction Manual

SANYO DENKI

PREFACE

This manual provides the standard installation procedure, functions, operations, specifications, and terminologies of the PB2D003R1U* new servo systems.

To use your PB2D003R1U* with its maximum performance, read throughout this manual before turning it on.

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0. SAFETY PRECAUTIONS

This chapter provides cautions for ensuring safe use of the PB amplifier. Read before use.

0.1 Introduction

This servo motor, servo driver is designed for use in general industrial equipment. It is not designed for use in home electric appliances or medical equipment. Do not use in medical that could possibly endanger human life or result in serious consequences. Example of general industrial equipment for which the servo system is designed for include robots, transporters, and chip mounters.

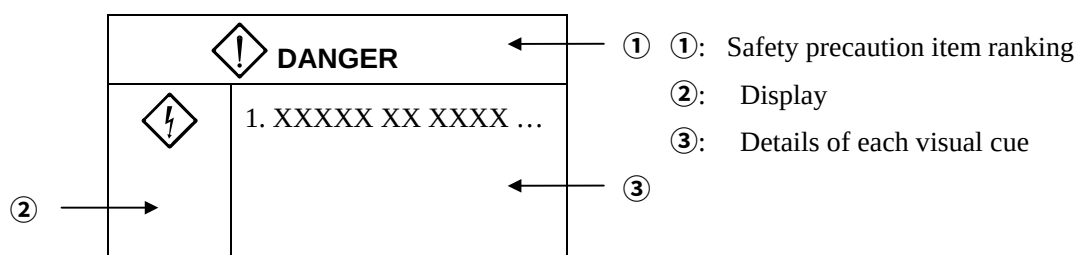
Before using the servo system (installation, operation, maintenance, inspection, etc.), be sure to read this User's Manual thoroughly in order to familiarize yourself with proper operation. Obtain a full understanding of the equipment, safety information, and precautions.

0.2 Explanation about Indications

Familiarize yourself with the contents of each indication.

0.2.1 Conventions of indications

In the following description, each indication is completed as shown in the figure below.



0.2.2 Safety Precaution Item Ranking

There are four ranks:



This indicates the existence of imminent hazard which, if the system is incorrectly operated, is very likely to result in death or a serious injury.



This indicates the existence of potential hazard which, if the system is incorrectly operated, is very likely to result in a moderate injury or slight injury or only physical damage.

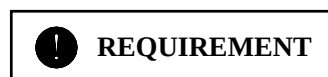
Items described in



may lead to a very serious result depending on the situation. Each indication contains important information that you should observe.



This indicates restrictions or limitations.



This indicates what must be done without fail.

0. SAFETY PRECAUTIONS

0.2.3 Visual cues

The following eight visual cues are used in this manual:

Kind of symbol	Example of symbol
Visual cue of danger	  Danger, injury Electric shock
Visual cue for caution	   Caution Fire Burn
Visual cue for restriction	  Restriction Disassembly not allowed
Visual cue for requirement	 Requirement

0. SAFETY PRECAUTIONS

0.3 Caution when Using

 DANGER	
	(General)
	1. Do not use the system in an explosive atmosphere. Doing otherwise may result in injury or fire.
	2. Do not touch the working amplifier under any circumstances. Touching inside the amplifier may result in electric shock.
	3. Do not conduct work while power is being supplied. Be sure to wait at least one minute after turning off the power supply before doing an electrical wiring or inspection work. Touching inside the amplifier may result in electric shock.
	4. Only properly trained staff should take charge of transportation, installation, piping, wiring, operation, manipulation, maintenance, and inspection work. Doing otherwise may result in electric shock, injury, or fire.
	(Wiring)
	5. To avoid getting an electric shock, be sure to ground the earth terminal of the driver or motor.
	6. Avoid damaging cables, applying excessive stress to them, putting a heavy objects on them, or nipping them. Doing otherwise may result in electric shock.
	7. Make a connections with the power cable according to the connection diagram or the Operation's Manual. Failure to do so may result in electric shock or fire.
	(Operation)
	8. Before starting the motor, take necessary safety measures such as covering the rotary parts. Never touch a rotating part of the motor. Doing so may result in injury.
	9. Never approach or touch terminals when the power is on. Removing the terminal base cover may result in electric shock.

0. SAFETY PRECAUTIONS

 CAUTION	
	(General)
	1. Before starting installation, operation, maintenance, or inspection, be sure to read the Operator's Manual carefully and observe the instructions in it. Failure to observe the instructions may result in electric shock, injury, or fire.
	2. Do not use the system out of the specifications of the amplifier. Doing so may result in electric shock, injury, or damage.
	3. Do not use a damaged amplifier. Doing so may result in injury or fire.
	4. Do not remove the nameplate.
	5. Use an amplifier and a driver in the specified combination. Doing so may result in a fire or failure.
	6. Note that the amplifier/motor and peripheral units will become hot enough to cause a burn.
	7. This amplifier is an open-flame type. Do not touch the printed circuit boards. Doing so may result in damage.
	(Unpacking)
	8. Check if the product is the ordered one. Installing an incorrect wrong product may result in injury or damage.
	9. Avoid applying static electricity to the encoder terminals on the motor. Doing so may result in functional failures.

0. SAFETY PRECAUTIONS

 CAUTION	
	(Wiring)
	10. Do not measure the insulation resistance and dielectric strength. Doing so may result in damage. Call us if you need such testing.
	11. Perform wiring in accordance with the Technical Standards for Electric Equipment and instructions in 4. Wiring. Failure to do so may result in a burn or fire.
	12. The amplifier is not equipped with an overcurrent protection function. Consequently, make wirings properly and accurately paying attention not to cause shorting of power circuits. Failure to do so may result in breakage of the amplifier and the motor.
	13. Be careful not to apply static electricity, high voltage to the sensor terminals of the motor or printed circuit boards of the amplifier. Doing so may result in functional failures.
	(Installation)
	14. Do not let foreign matter fall onto the printed circuit boards of the amplifier. Doing so may result in damage or a fire.
	15. Give a clearance as specified in the Instruction Manual between the amplifier and inside of the control panel or other devices. Doing so may result in damage.
	16. Never apply a strong shock to the system. Doing so may result in damage.
	17. At installation, take extreme care so as to prevent the unit from dropping or turning over.
	18. Never install the unit in a place where water may splash, in an inflammable gas atmosphere, or near combustible materials. Doing so may result in a fire or failure.
	19. Always install to a noncombustible structure like a metal structure. Otherwise, fire accident may occur.

0. SAFETY PRECAUTIONS

 CAUTION	
	(Operation)
	20. The motor is not equipped with protection means. Install an earth leakage breaker, an excessive temperature rise prevention means and an emergency stop unit as necessary protection measures. Failure to do so may result in an injury or a fire accident.
	21. Never touch the heat sink of the amplifier, regenerative resistor, motor, or other part while the power is on or for awhile after the power has been turned off. These parts may become very hot, causing a burn on contact.
	22. In the event of any abnormality, stop operating the system at once. Failure to do so may result in electric shock, injury, or fire.
	23. Never make an extreme adjustment change that will cause the system operation to become unstable. Doing so may result in injury.
	24. At trial operation, fix the motor and check the operation separate from the mechanical system, then install the system on the machine. Failure to do so may result in an injury.
	25. The holding brake is not a stop unit to secure the safety of the machine. Install a stop unit to secure the safety on the machine side. Failure to do so may result in an injury.
	26. When an alarm occurs, remove the cause of the alarm and secure safety. After that, reset the alarm, then result the system operation. Failure to follow this procedure may result in an injury.
	27. After a recovery from an instantaneous power interruption, the operation may be restarted suddenly. Do not approach the machine. (Design the machine so that safety for personnel may be secured even if the system operation is restarted.) Approaching the machine when it restarts may result in an injury.
	28. Make sure the supply voltage is within the specified range. If the supply voltage is out of specification, functional failures may occur

0. SAFETY PRECAUTIONS

 CAUTION	
	(Maintenance)
	29. The amplifier frame becomes very hot. Take care to avoid burns when doing maintenance and inspection.
	30. The electrolytic capacitors of the amplifier will deteriorate with age. As preventive measures, we recommend you to replace them in about 5 years (when ambient temperature is 40°C). Also, replacement of the fuses in about 10 years is recommended. When replacing them, contact us.
	31. Do not let dust accumulate on the printed circuit boards in the amplifier. Doing so may result in damage.
	32. When repair is required, please contact us. Disassembly of the system by the user may render it inoperable.
	(Transportation)
	33. Take extreme care not to drop or turn over turn system, because it is very dangerous.
	34. Do not hold the unit by the cables or the motor shaft. Doing so may result in injury or equipment failure.
	35. Do not touch the connector pins of the amplifier when conveying the equipment. Doing so may result in damage.
	(Scrapping)
	36. When discarding the amplifier and the motor, dispose of it as a general industrial waste.

0. SAFETY PRECAUTIONS

 RESTRICTION	
	(Storage) 1. Do not store the system in a place exposed to rain or moisture or in a place where noxious gas or liquid exists. Doing so may result in functional failures.
	(Operation) 2. The brake built in the motor is used for holding. Do not use it for ordinary braking. Using this brake for braking will damage it.
	(Maintenance) 3. Do not disassembly or repair the system. Doing so may result in fire or electric shock.

0. SAFETY PRECAUTIONS

 REQUIREMENT	
 	(Storage) 1. Store the system in a place which is not exposed to direct sunlight and in the determined temperature/humidity range (–20°C to +65°C, 90% RH or less without condensation). 2. When the system is to be stored for a long time (more than 3 years as a reference period), consult us. Long-time storage will lower the capacity of the electrolytic capacitor. 3. Use the power supply that primary side (AC input) and secondary side (DC output) are reinforced isolated.
	 (Operation) 4. Install an emergency stop circuit out side so that the system operation may be stopped immediately to shut off the power supply.  5. Be sure to use in places free from direct sunlight under the specified temperature and humidity conditions (amplifier: 0°C to 55°C and 20% to 90% RH without condensation; and motors; 0°C to +40°C and 20% to 90% RH without condensation).
	 (Transportation) 6. Loadage exceeding the specified loading capacity will cause a load collapse. Observe the indication.

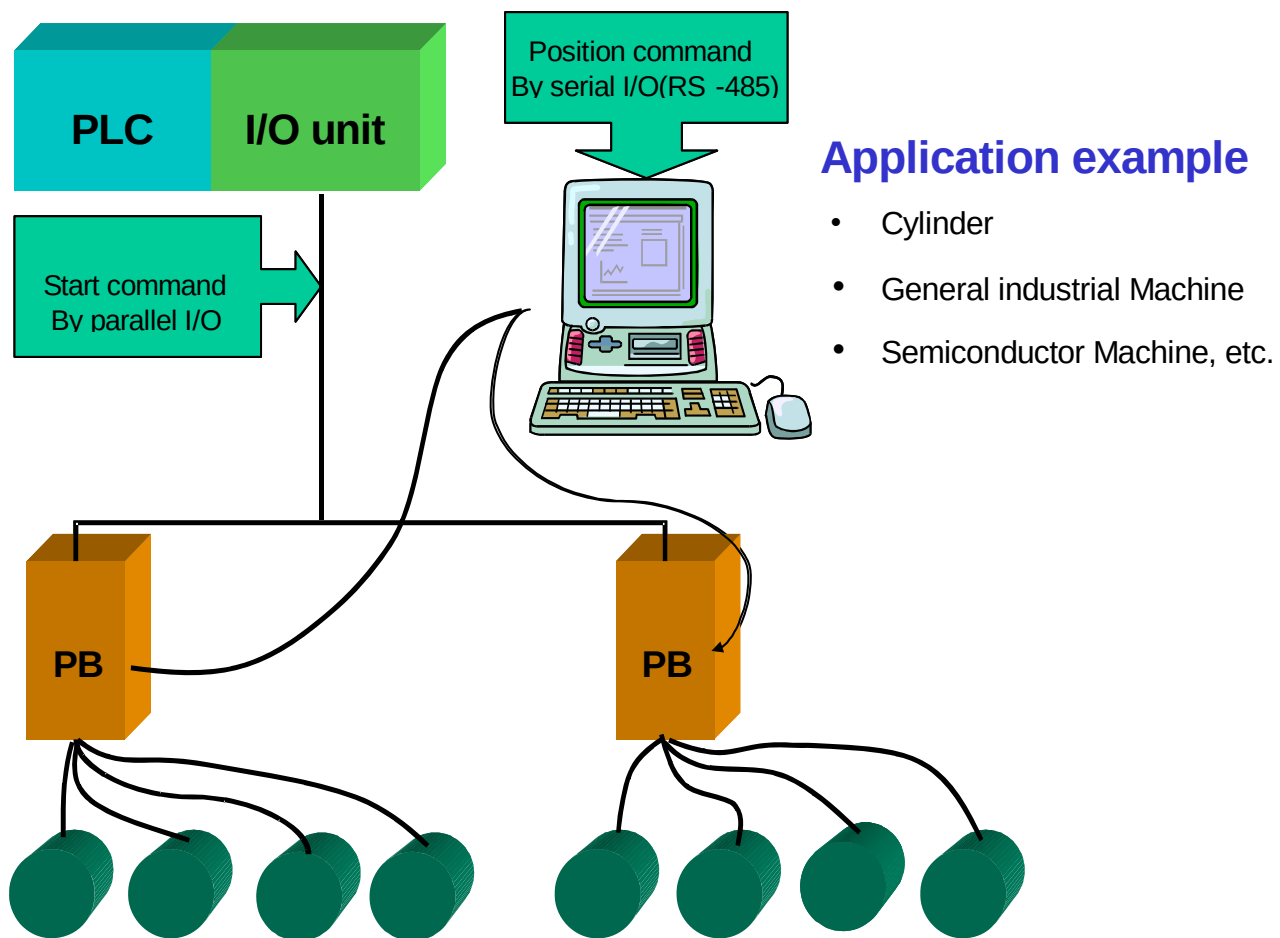
1. OVERVIEW AND CHARACTERISTICS

1.1 Overview

“PB” was born as a new, intelligent, and easy to handle Servo Motor System combining the best attribute of the design and production technology of high performance precise compact motor with the latest control technology.

This is a Software Servo System which controls according to the upper controller commands.

1.2 Features



- * Position command stored beforehand through SIO or program can be started by Point or program number designation and startup trigger signal. As this can be controlled by general PIO, hardware cost can be cut down.
- * The simultaneous starting function for more than one Amplifier is available.
- * Various functions such as push operation and Return-to-origin are also available.
- * Especially in minor stroke and high hit-rate operation, this system is designed to have higher response of acceleration/deceleration than the other servo system in the same size.
- * The motor current is regulated based on the load, and it results in less heat and high efficiency. Larger torque can be continuously used especially in low velocity comparing to other conventional motors, which is favorable to downsizing of the system.

1. OVERVIEW AND CHARACTERISTICS

- * Since this system has its unique stop holding torque, slight vibration is not caused unlike conventional servos.
- * The various functions such as Holding Brake Control, Limit and Automatic Origin Detection are built in the amplifier.
- * The integrated four axes contribute to the wiring-saved, down sizing and reducing the weight of system.

1.3 Point / Program Function

1. Point function

Any direct command can be allotted to 256 points in maximum.

Allotted command is stored in non-volatile memory inside the amplifier and can be executed by I/O signal of CN1. Owing to this, motion control by sequencer, etc. can be realized easily. As the special controller is not required, the cost stem can be reduced.

When use two or more amplifiers, they can be started together because of having an execution signal to be connected to daisy chain in all axes.

2. Program Function

A series of any sequence can be stored beforehand in non-volatile memory inside the amplifier and executed by I/O signal of CN1. For program count, either 8 programs or 256 programs can be selected.

Program count	Program line count
256	16 lines (0 to 15)
8	512 lines (0 to 511)

Complicated sequence can be also executed by direct command or support of command exclusive for program such as Timer Wait, Branching Condition, Subroutine, Loop Counter. Owing to this, it can be used also in the stand-alone.

3. Communication

The command can be directly transmitted and controlled through serial communication in conformity with RS-485. Also when apply two or more amplifiers, they can be started together by the support of wholesale command for all axes.

Decentralizing and wiring saving can be recognized.

2. UNPACKING AND INSTALLATION

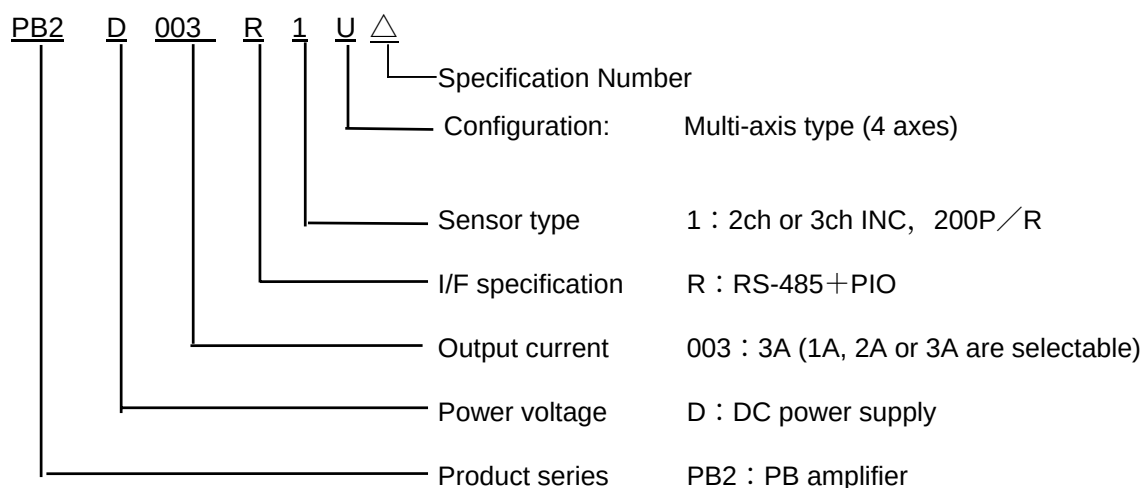
2.1 Confirmation of the Product

Check the following after receiving the product. Contact us if any abnormality is detected.

- Check if the model names of the motor and the Amplifier match those of the ordered ones. (The names are described after “MODEL” on the main nameplate.)
- Check the appearance of the motor and the Amplifier to confirm they are free from breakage or damage of its parts.

2.2 Product Numbering System

2.2.1 Amplifier model number



Specification Number

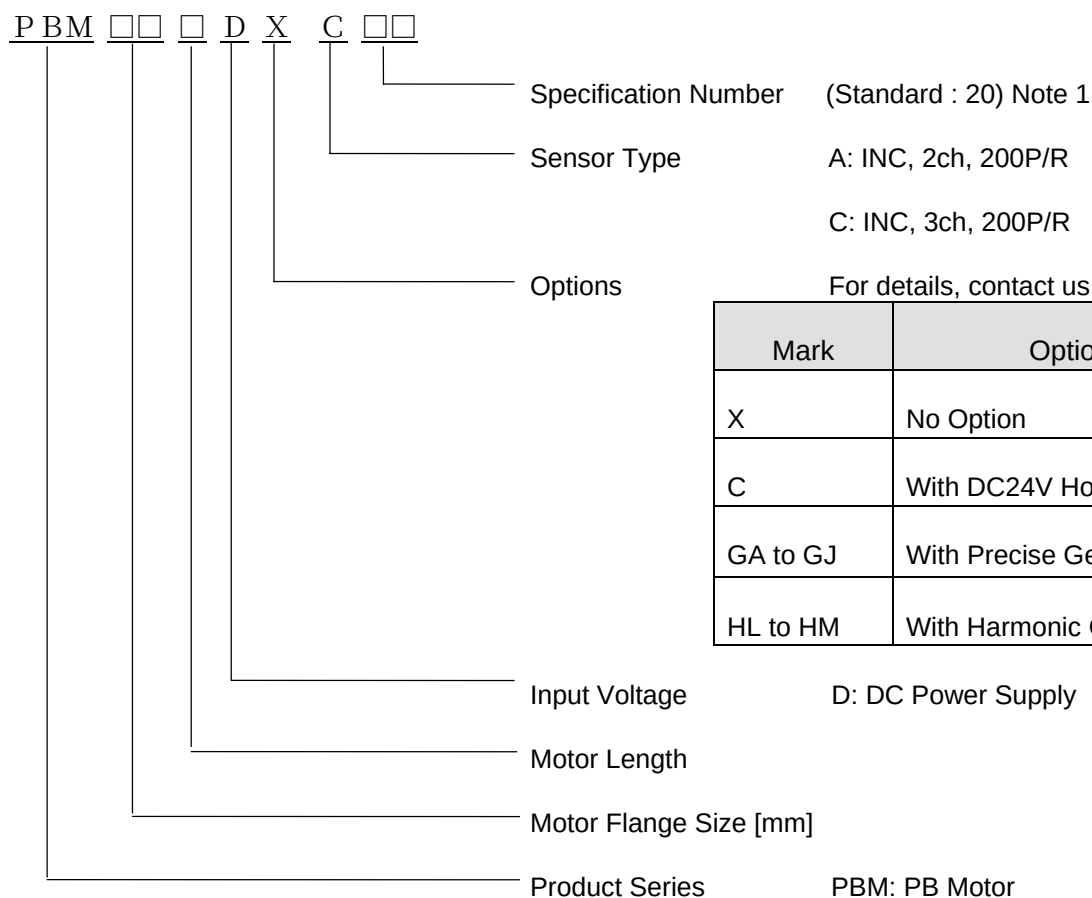
Spec. No △	Communication Spec.	Power Supply	Main Circuit Power Voltage	Control Circuit Power Voltage
0	2-wire half duplex	Single input	24/36V $\pm$ 10%	-
1	2-wire half duplex	Separate	24/36V $\pm$ 10%	24V $\pm$ 10%
2	4-wire full duplex	Single input	24/36V $\pm$ 10%	-
3	4-wire full duplex	Separate	24/36V $\pm$ 10%	24V $\pm$ 10%

Note 1) Consult us when using holding brake at main circuit power voltage of 36V. The holding brake release voltage of standard product should be at 24V.

Note 2) When using separate power supply, use the control circuit power for the built-in holding brake control circuit. The power voltage for control circuit, unless using holding brake, is from 12V to 36V.

2. UNPACKING AND INSTALLATION

2.2.2 Motor Model Number



Note 1) Consult us for the products whose model names are other than standard.

2.2.3 Motor/ Amplifier Combination

The combination of the amplifier and the motor is shown below. Check the combination carefully since the motor may be damaged if they are combined other than specified.

Excitation Current	1A/ phase	2A/ phase	3A/ phase
Applicable Motor	PBM282D**2* PBM284D**2*	PBM423D**2* PBM503D**2* PBM565D**2*	PBM503D**2* PBM565D**2* PBM603D**2* PBM604D**2*

The excitation current shall be selected by Soft Switch. Refer to “the Chapter 7: Soft Switch” for the setting details.

2. UNPACKING AND INSTALLATION

2.3 Amplifier Installation

2.3.1 Precautions on Installation

In case of using in incorrect conditions, troubles or accidents by malfunction may be caused. Refer to the following.



Case	Precautions
When installing the Amplifier in a box	The temperature in the box may be higher than the outside temperature due to the power loss of built-in equipment and the box size. Be sure to keep the temperature around the Amplifier at 131 ° F (55°C) or lower by considering box size, installation place and installing cooling system. It would be recommended to keep the ambient temperature of Amplifier at 104 ° F (40°C) or lower to secure the long life time of the Amplifier.
When there is a vibration source nearby	Insert shock absorber between the Amplifier base and the mounting place so that vibration may not be transmitted directly to the Amplifier.
When there is heat source nearby	Even if there is a possibility that a temperature rise may be caused by convection or radiation, keep the ambient temperature of the Amplifier lower than 131 ° F (55°C) .
When there is corrosive gas	If the Amplifier is operated for a long time, contact failure will come to occur at contact parts (e.g., connectors). So, never install the Amplifier in corrosive gas atmosphere.
When there is explosive gas or combustible gas	Never install the Amplifier in the atmosphere where explosive gas or combustible gas exists. That may cause fires or explosion.
When there is dust or oil mist	Never install the Amplifier in such atmosphere containing dusts or oil mists. Dusts or oil mists adhered to or accumulated on the Amplifier may lower insulation or cause leak between conductors of applicable parts, damaging the Amplifier.
When there is a large noise source	Induction noise will enter input signals and the power supply circuit, causing Amplifier's malfunction. When there is a possibility of noise entering, take proper measures such as inserting a noise filter, revising line wiring and preventing noise generation.

2. UNPACKING AND INSTALLATION

2.3.2 How to Install Servo Amplifier

1. Direction

The following mounting direction is possible for the specified model below:

Configuration of Amplifier	Mounting Direction	Amplifier Model
Open Frame	Bottom Mount (M3×2 screws)	PB2D003R1U△
	Rear Mount (M3×2 screws)	

As the cooling method is natural convection type, determine the installation method considering cooling effect. For installation dimensions, see “10. Amplifier’s External View”.

2. Board arrangement conditions

Provide a space of 50 mm at minimum on both upper and lower sides of the Servo Amplifier and more than 10mm for both sides of Amplifier, so as not to prevent air from flowing out of the radiator. If heat remains on the upper part of the amplifier, install a fan to force air to flow.

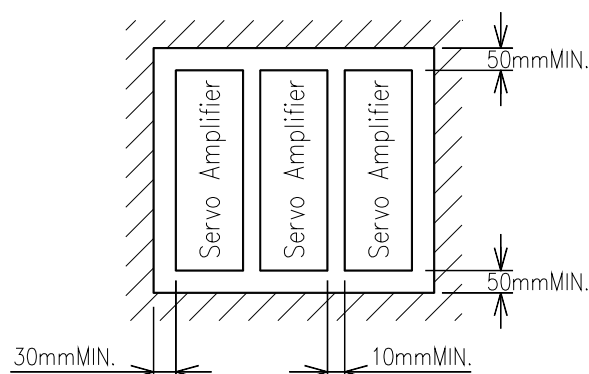


Fig. 2-1

2. UNPACKING AND INSTALLATION

2.4 Motor Installation

2.4.1 Precautions on Motor Installation

Note the following precautions on the installation and place.



Case	Precautions
When installing the motor in a box	Be sure to keep the internal temperature of atmosphere within 32 to 104 ° F (0 to 40°C) by considering the box size and cooling wheel.
Radiation condition	Be sure to keep the surface temperature at 185 ° F (85 °C) or lower by properly determining the radiation condition. See Fig. 2-2 for the temperature measuring points of motor surface.
Connection to the opposite machine	When installing gear, pulley, etc., fix the cut area of output shaft with screws. Do not adopt the procedure which the thrust load is applied such as push-in. Perform centering accurately between the motor shaft and the opposite machine and connect them. A slight offset causes breakage of the shaft or damage of bearing.
When there is electrical conductive particles	Keep the motor away from water, cut liquid, rain drops, or electrical conductive particles such as dust and iron powder.
When there is flammable or explosive gas	Keep the motor away from corrosive (acid or alkali), flammable, or explosive liquid/gas by all means.
When install motor to movable area	Do not use motor in movable area. Since the used wire or the cable is for wiring, it may be broken. When use it in movable area, contact us.
When extracting a connector	Do not apply the stress to lead wire when extracting a connector from amplifier or junction cable. It may be broken.
When performing belt driving	Check that the shaft-converted value of the belt tension does not exceed the allowable thrust load. (See Chapter 9 Motor Basic Specification.)

2. UNPACKING AND INSTALLATION

2.4.2 How to Install Motor

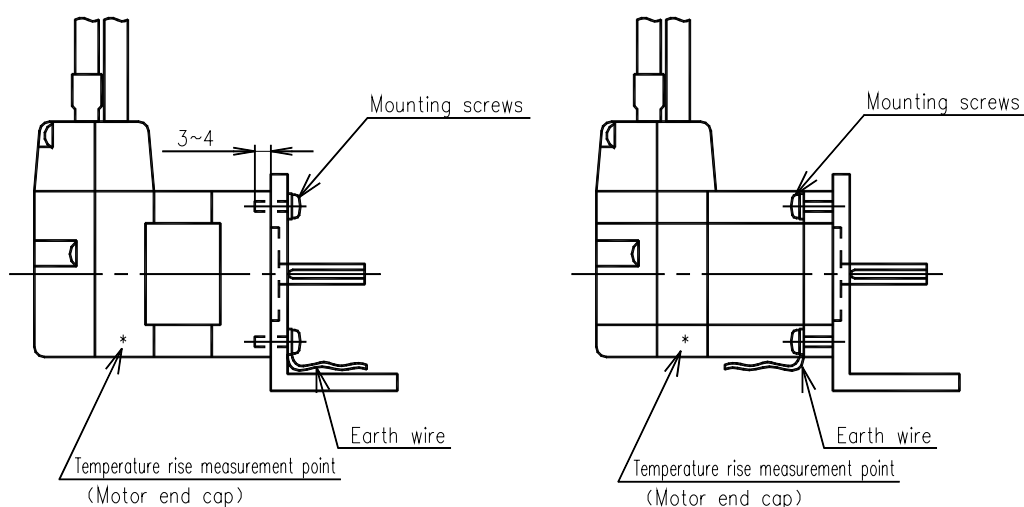


Fig. 2-2 Example of Motor Installation

Install the motor by using tap hole on installation side or installation hole, and mounting faucet joint. For pitch dimensions of tap hole and diameter of counter lock, see “10. Motor External View”.

Motor model name	Screw	Precautions
PBM28*	M2.6 pitch × 2 screws	Select screw length so as to keep the motor tap holes length of 3 to 4 mm. Recommended tightening torque is 0.4 N · m.
PBM42* PBM50*	M3 pitch × 4 screws	Select screw length so as to keep the motor tap holes length of 3 to 4 mm. Recommended tightening torque is 0.6 N · m.
PBM56* PBM60*	M4 pitch × 4 screws	Use 4 installation holes (diameter 4.5) on motor flange. Recommended tightening torque is 1.4 N · m.

3. WIRING

3.1 External Wiring Diagram

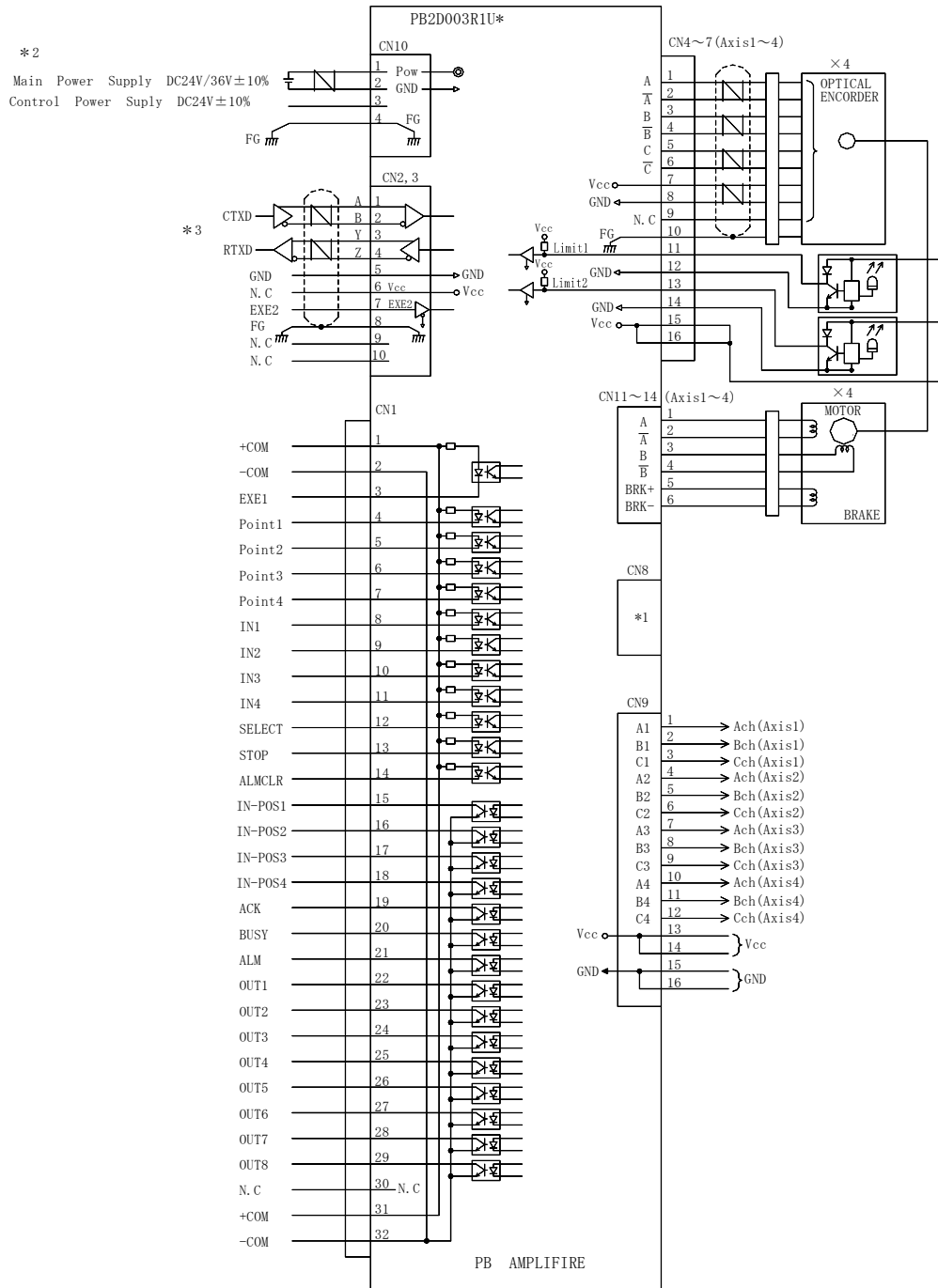
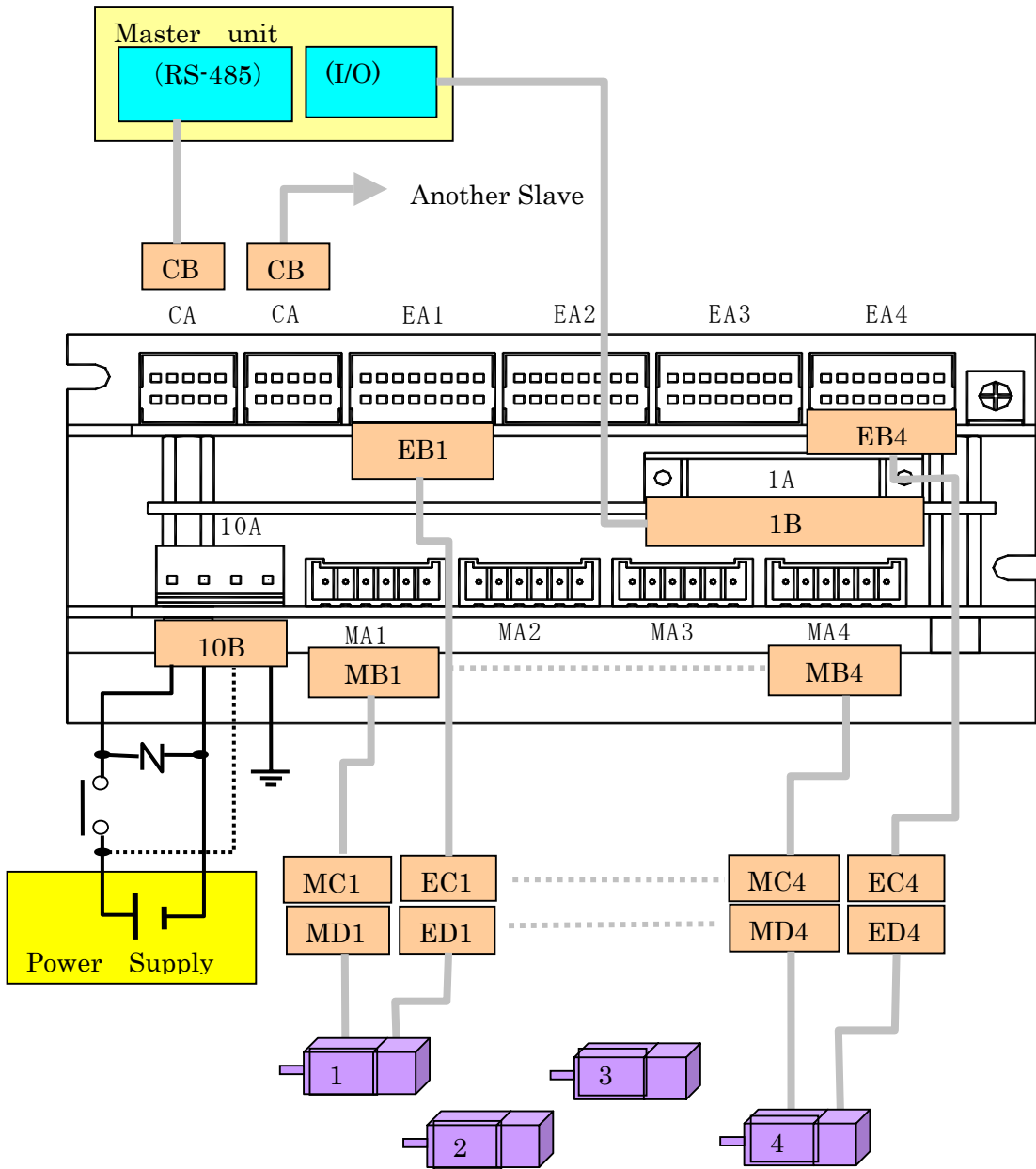


Fig. 3-1 External Wiring Diagram (as an example for full duplex)

- * 1 CN8 is designed for test purpose. This connector is not necessary to connect.
- * 2 Connecting procedure for power supply differs depending upon Amplifier models. See the section of 3.6.3 for the power connecting details.
- * 3 Communicating specification differs depending upon Amplifier models. See the section of 3.6.5 for the communication connecting details.
- * 4 The functions of IN1 to IN4 and OUT1 to OUT8 are allocated by command 11h, 16h. Refer to Section 7 for more information.

3. WIRING

3.2 External Mounting Wiring Diagram



* A sign of a mention during a figure stands for the connector that showed in a connector model / a sign of the next page.

3. WIRING

*

3.3 Connector Model

	Application	CN No	Mark	Description	Model Number	Maker
Amplifier side	Power Supply	CN10	10B	Contact	SVH-41T-P1.1	JST
				Housing	VHR-4N	
			10A	Post	B 4PS-VH	
	Power	CN11 to 14	MB	Terminal	50351-8100	Molex
				Housing	51103-0600	
			MA	Housing	53426-0610	
	Encoder	CN4 to 7	EB	Terminal	SPH-002T-P0.5L	JST
				Housing	PADP-16V-1-S	
			EA	Header	S16B-PADSS-1GW	
	Communication	CN2,3	CB	Terminal	SPH-002T-P0.5L	JST
				Housing	PADP-10V-1-S	
			CA	Header	S10B-PADSS-1GW	
	I/O	CN1	1B	Receptacle	8822E-032-171D	KEL
			1A	Plug	8830E-032-170LD	
	Flash	CN8	8A	Pin Header	DF11-14DP-2DS	Hirose Electric
			8B	Socket	DF11-14DS-2C	
				Crimp-style terminal	DF11-2428SCA (#24 to #28, separately)	
	Sensor Output	CN9	9A	Pin Header	DF11-16DP-2DS	Hirose Electric
			9B	Socket	DF11-16DS-2C	
				Crimp-style terminal	DF11-2428SCA (#24 to #28, separately)	
Motor side	Motor		MD 1to4	Housing	51111-0610	Molex
				Contact	50397-8100 (#22 to #28, separately)	
			MC 1to4	Housing	51112-0610	
				Contact	50398-8100 (#22 to #28, separately)	
	Encoder		ED 1to4	Housing	51030-0930	
				Contact	50083-8060 (#24 to #30, in chain) 50084-8060 (#22 to #24, in chain)	
			EC 1to4	Housing	51029-0910	
				Contact	50087-8060 (#24 to #30, in chain) 50088-8060 (#22 to #24, in chain)	

* Refer to "the Appendix 2: Option" for the cable options.

3. WIRING

3.4 Extension Cable Size

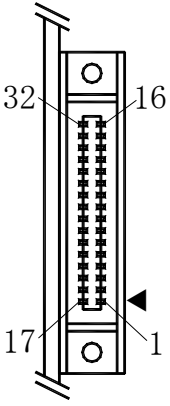
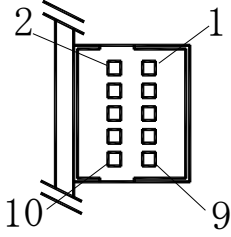
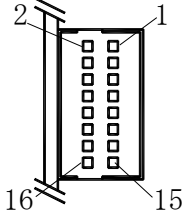
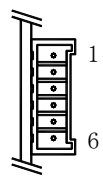
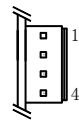
Wire according to the extension cable type and size below.

Description	Type	Size	Maximum Extension (recommended)
Signal Cable	Flat Cable (1.27mm pitch)	AWG28 (7/0.127)	3 m
Encoder Cable	Twisted Pair, Shield Cable	AWG24 AWG26	1 2 m 8 m
Motor Cable	Discrete Cable	AWG22	2 0 m
Power Supply Cable	Discrete Cable	AWG16 to 20	2 m
Earth Cable	Discrete Cable	AWG20 min.	—
Communication Cable	Twisted Pair, Shield Cable	AWG24 to 28	1 0 0 m

- (*1) The maximum extension length is meaning whole length of cable. The Motor and Encoder cable length include the whole length from amplifier to motor.
- (*2) When extending cables over the recommended maximum extension length as above, wire carefully so as not to be affected by radio noise. Note that our guarantee will not cover the troubles due to the cable extensions.

3. WIRING

3.5 Connector Pin Arrangement (Amplifier Side)

CN No/ Description	Terminal		Signals		Pin Arrangement (Amplifier side)
CN 1 I/O Signal	1	17	+COM	In-Position3	
	2	18	-COM	In-Position4	
	3	19	EXE1	Ack	
	4	20	Point1	Busy	
	5	21	Point2	ALM	
	6	22	Point3	Out1	
	7	23	Point4	Out2	
	8	24	IN1	Out3	
	9	25	IN2	Out4	
	10	26	IN3	Out5	
	11	27	IN4	Out6	
	12	28	SELECT	Out7	
	13	29	STOP	Out8	
	14	30	ALMCLR	N.C	
	15	31	In-Position1	+COM	
	16	32	In-Position2	-COM	
CN 2, 3 Communication	1		Half duplex A	Full Duplex A	
	2		B	B	
	3		N.C	Y	
	4		N.C	Z	
	5		GND	GND	
	6		VCC	VCC	
	7		EXE2	EXE2	
	8		FG	FG	
	9		N.C	N.C	
	10		N.C	N.C	
CN 4 to 7 Sensor	1	9	A	FG	
	2	10	A/	FG	
	3	11	B	Limit1	
	4	12	B/	GND	
	5	13	C	Limit2	
	6	14	C/	GND	
	7	15	VCC(5V)	VCC(5V)	
	8	16	GND	VCC(5V)	
CN 11 to 14 Motor	1		A		
	2		A/		
	3		B		
	4		B/		
	5		BRK+		
	6		BRK-		
CN 10 Power Supply Note 1) , 2)	1		Single 24/36VDC	Separate 24/36VDC	
	2		GND	GND	
	3		N.C	24VDC	
	4		FG	FG	

Note 1) Consult us when using holding brake at main circuit power voltage of 36V. The holding brake release voltage of standard product should be at 24V.

Note 2) When using separate power supply, use the control circuit power for the built-in holding brake control circuit. The power voltage for control circuit, unless using holding brake, is from 12V to 36V.

3. WIRING

3.6 Wiring

3.6.1 Wiring Notice

1) To prevent malfunction due to noise

Note the followings to prevent malfunction due to noise:

- Arrange the noise filter, the Servo Amplifier and the upper controller near by.
- Be sure to install surge absorbers for relay coils, magnetic contacts, induction motors and brake solenoid.
- Do not put the power supply line, motor line and signal line in the same duct or bundle them.
- When a large noise source such as an electric welding machine or an electric discharge machine exist nearby, insert noise filters to the power supply and input circuit.
- Do not bundle the primary and secondary side wires of noise filter.
- Do not make the earth cable longer.

2) Wiring

Wrong wiring of the amplifier and the motor may damage the products, be sure to check that wiring has been performed properly. Wiring should be performed in the power off status.

3) Fuse

A fuse is installed in the amplifier. It will prevent the extension of damage caused by the power supply's problem or the motor earth fault, but it cannot protect the amplifier itself.

4) Cable Size

Make sure to use the specified wire gauge cable.

5) Emergency Stop Circuit

Make sure to arrange the emergency stop circuit so as to stop operation immediately and cutoff power.

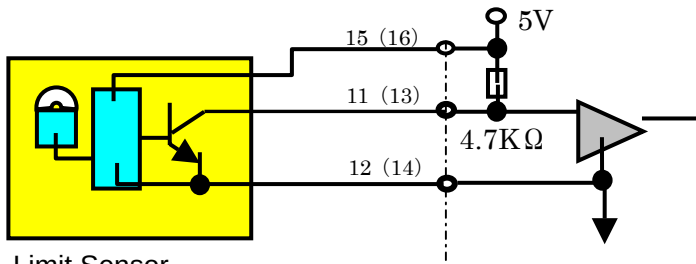
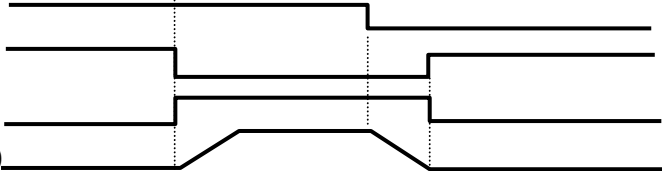
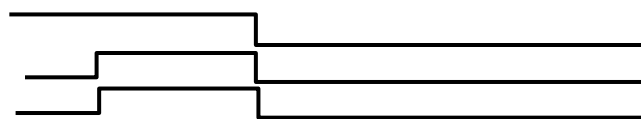
3. WIRING

3.6.2 Motor/ Sensor Connection

Connect the connector for motor power cable (CN11 to 14) and encoder connector (CN4 to 7). Relay cable is required for the motor and encoder connection. See the Appendix 2 for the Optional Relay Cables. If there are axes not connected, turn OFF the dip switch (No. 3 to 6 are corresponding Axis 1 to 4) corresponding to the each axis. Refer to the Chapter 5.1 for the dip switch setting details.

In case of External Limit Sensor and Original Sensor connection:

Number 11 to 14 pins of encoder connector (CN4 to 7) will be the input pins for Limit Sensor (number 11 is for SDN signal common use).

Function	Description
Input Circuit	 Limit Sensor * In case of the sensor not be able to use by VCC, supply the power externally. * In case of connecting VCC, current consumption should be 0.4A or lower.
CN4 to 7 No. 11 pin (SDN/ Hard Limit)	With command code 11h setting, forward/ backward direction hard limit input or Limit input function invalid will be selected. When back-to-origin is actuated (Type1. 2), origin signal input will be automatically valid regardless of the selected functions. • Limit Function  • Back to Origin (Type1=SDN Detection/ Grid shift=0 Case) 
CN4 to 7 No. 13 pin (Hard Limit)	With command code 11h setting, forward/ backward direction hard limit input or Limit input function invalid will be selected.

Note 1) Perform dip switch setting before turning ON the power supply.

Note 2) Be sure to wire in the status of power OFF, or amplifier may be broken.

Note 3) Number 5, 6 pins of the connector for power line is for the holding brake connection. Unless having holding brake, it is not necessary to connect.

Note 4) In case of installing the motor on the moving place, be sure to use movable cable. Consult us when optional cable is required.

Note 5) In case that motor wire is in metal conduit or metal box, be sure to earth the metal.

3. WIRING

3.6.3 Power Supply Connection

- Use the power supply that primary side (AC input) and secondary side (DC output) are reinforced isolated.
- The power supply of the instantaneous output corresponding type is recommended to correspond to the instantaneous current in acceleration/ deceleration.
- Note that the power supply voltage may increase unless using regenerative unit.
- Select the power supply capacity including all axes to be used for motors by referring to the table below. The current consumption, however, changes depending upon load condition, operational timing of each axis and so on. Select the capacity considering those operational conditions.

The Maximum Power Consumption per Axis (Load ration = 100%)

Motor	Power Supply Capacity (24V Input)	Power Supply Capacity (36V Input)
PBM282 (1A)	3 4 V A	4 8 V A
PBM284 (1A)	3 8 V A	5 4 V A
PBM423 (2A)	4 0 V A	5 8 V A
PBM503 (2A)	3 6 V A	5 2 V A
PBM565 (2A)	4 2 V A	6 8 V A
PBM503 (3A)	4 2 V A	5 6 V A
PBM565 (3A)	9 2 V A	1 4 4 V A
PBM603 (3A)	7 2 V A	1 2 0 V A
PBM604 (3A)	9 0 V A	1 4 0 V A

- **Regenerative Unit**

Regenerative control circuit is not built in the amplifier. When generating regenerative voltage of 45V or higher due to load and operational conditions, regenerative unit must be connected. If using motor size of 50, 56 or 60 square, make sure to validate the operation in the status of connecting regenerative unit when turning ON the system.

Note 1) When regenerative voltage comes to 45V or higher, amplifier may be broken.

Note 2) See the Appendix 3 for the regenerative unit connection and the unit specs.

- **Power Supply Wiring**

Amplifier Model	Power Supply Spec.	Main Circuit Power Voltage	Control Circuit Power Voltage	CN10 Pin No.			
				1	2	3	4
PB2D003R1U0/2	Single	24/36V±10%	No need to connect	24V	GND	NC	FG
PB2D003R1U1/3	Separate	24/36V±10%	24V±10%	24/36V	GND	24V	FG

Note 1) Consult us when using holding brake at 36V of road power supply. The holding brake release voltage of the standard product is at 24V.

Note 2) When using separate power supply, the control circuit power supply for the built-in holding brake should be used. Unless using holding brake, the power supply voltage for control circuit shall be from 12V to 36V.

- **Earth**

Perform better than Class-3 earth (Earth resistance: Maximum 100 Ω) without fail.

3. WIRING

3.6.4 PIO Interface

• CN1 Pin Assignment Input Signal

Pin NO	Signal Name	Description	Logic	
			Select	Logic
1	5 to 24VDC	Input Port Common Power Supply 5 to 24VDC	No	-
2	-COM	Dedicated GND for Output Port Common	No	-
3	EXE1	Executing signal for Point or Program	No	Off→On
4	POINT1	Point/ Program No. Select bit1	No	On=1 Off=0
5	POINT2	Point/ Program No. Select bit2	No	
6	POINT3	Point/ Program No. Select bit3	No	
7	POINT4	Point/ Program No. Select bit4	No	
8	IN1	The following functions are selectable by command code 16h for IN1 to IN4. • Point command input 5 to 8 (Corresponding to IN1 to IN4) • General purpose use input 1 to 4 (Used for branch condition in the program and so on) • Pause1 to 4, full axes pause (Temporary stop input) • Interlock1 to 4, full axes interlock (Stop signal keeping SON status) The equivalent functions to Pause and Interlock shall be valid through communication by command code of 48h/ 49h and 4Eh/ 4Fh.	No	-
9	IN2		No	
10	IN3		No	
11	IN4		No	
12	SELECT	Select that the objective to be executed, specified by POINT input, is Point or Program.	YES	-
13	STOP	Emergency Stop Input (All axes stop and become SOFF status). The equivalent function will be valid through communication by command code of 4C and 4D.	YES	-
14	ALMCLR	Alarm Clear Signal The equivalent function will be valid through communication by command code of 4A.	YES	-

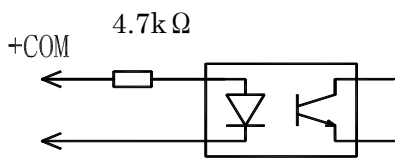
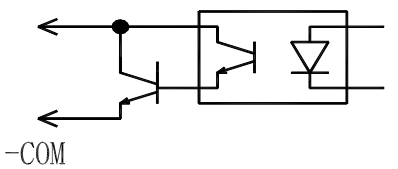
3. WIRING

Output Signal

Pin NO	Signal Name	Description	Logic	
			Select	Logic
15	In-Position1	Axis 1 In-Position signal output	No	On = In-POS OFF = Out-POS
16	In-Position2	Axis 2 In-Position signal output	No	
17	In-Position3	Axis 3 In-Position signal output	No	
18	In-Position4	Axis 4 In-Position signal output	No	
19	ACK	Response signal against EXE	No	On=Active
20	BUSY	Executing program, Output when SOFF	No	On=Active
21	ALM	Alarm output	Yes	-
22	OUT1	The following functions are selectable for OUT 1 to 8: • General purpose use output 1 to 8 • Motor stop signal output 1 to 4, Full axes (AND condition) • H. Limit monitor 1 to 4, Full axes (or condition) • ZONE signal 1 to 4, Full axes (AND condition) • Return-to-origin complete 1 to 4, Full axes (AND condition) • END signal 1 to 4, Full axes (AND condition) • STOP input monitor	No	-
23	OUT2		No	
24	OUT3		No	
25	OUT4		No	
26	OUT5		No	
27	OUT6		No	
28	OUT7		No	
29	OUT8		No	
30	N C	Reserved Port	No	-
31	5 to 24VDC	Input Port Common power supply 5 to 24VDC	No	-
32	-COM	Dedicated GND for Output Port Common	No	-

- * As to OUT1 to OUT8 and IN1 to IN4 of CN1, select the function beforehand by I/O function (command code 16h) before use.
- * See the Chapter 4 for the I/O signal details.

CN1 DC Characteristics

Circuit	Specification
	Input Signal • 5 to 24VDC ±10%
	Output Signal • Less than 30VDC/ 30mA

3. WIRING

3.6.5 Communication Connection

Communication connecting procedures are as follows according to amplifier models:

Amplifier Model	Communication	Connecting Procedure
PB2D003R1U0 PB2D003R1U1	Half duplex	
PB2D003R1U2 PB2D003R1U3	Full duplex	

- Note 1) When connecting more than one amplifier, keep the number 6 pin (VCC) for communication connecting cable between amplifiers unconnected.
- Note 2) In case of connecting more than one amplifier by daisy chain, confirm that amplifier address by address setting switch on the amplifier front is not overlapped.
- Note 3) When using VCC from 6 pin of communication connector for external device, current consumption should be at 0.4Arms or less.
- Note 4) The terminating resistance of amplifier as end node should be ON (Perform terminate setting by dip switch. See Chapter 5.1 for the setting procedure).

RS-232/RS-485 Conversion

When using PB amplifier by RS-232C communication, use communication conversion unit. Optional conversion unit is available. See the Appendix 4 for details.

PC I/F

Supporting software for PC is available for Operational check when starting up devices, Edit and execution of program data and Point, Teaching function and so on. Consult us if required.

EXE2 signal (command code 11h and execution signal that is connectable by daisy chain which allocated in the communication connector CN2, 3) enables to activate the designated Point or Program per amplifier simultaneously or Stop.

0 (Default) : STOP Input (Input Logic Selected by 16h.)

1 : EXE2 signal

Circuit	Specification
	Input Signal • DC 5 V ~ 2.4 V ± 10 %

4. I/O SIGNAL

4.1 I/O Signal Function

4.1.1 Point Execution/ Program Execution

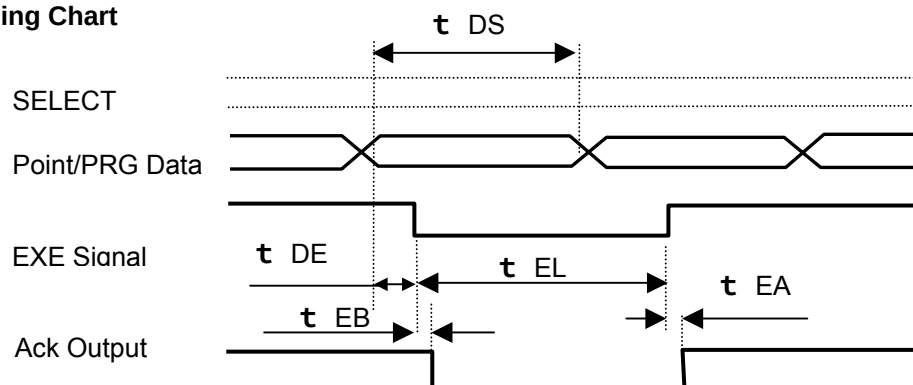
This function is to store the Point (allocating optional direct command by one-to-one) or Program (optional sequence by program command or optional direct command) in the non-volatile memory in amplifier beforehand, and execute by I/O signal operation. The following I/O signals shall be used for this function. (See the Chapter 5.2 for Point/ Program edit and activation examples):

Signal	CN No.	Pin No.	Function
EXE1	1	3	The object to be executed, designated by SELECT and Point No., will be started by turning EXE signal from OFF to ON.
EXE2	2,3	7	In case of connecting more than one amplifier, this becomes execution signal against all amplifiers. By setting command code 11h, it becomes function select to STOP signal. To validate EXE2 signal, set DAT3-bit6=1
Ack	1	19	This is a response signal for EXE. No response when impracticable command is issued. * No Ack response when without Point store * Recognizing NOP operation in the Program as normal command
Point n	1	4 to 7	Selecting Point number or Program number. Recognizing as ON=1 and OFF=0
IN n	1	8 to 11	When setting general purpose input function to Point input function by command code 16h, Point/ Program numbers can be extended to 255 at max
SELECT	1	12	The object to be started by EXE (Point/ Program) is selected. This will be logically selected by command code 16h.
Busy	1	20	This becomes ON during Program execution, SOFF and saving operation to non-volatile memory.

Point/ Program Select Example

Pin Number	Setting				
4 (Point1)	Off	On	Off	————	On
5 (Point2)	Off	Off	On		On
6 (Point3)	Off	Off	Off		On
7 (Point4)	Off	Off	Off		On
8 (Point5)	Off	Off	Off		On
9 (Point6)	Off	Off	Off		On
10 (Point7)	Off	Off	Off		On
11 (Point8)	Off	Off	Off		On
Point/ Program Number	0	1	2		255

Timing Chart



Point Data Holding Time: t_{DS}	2ms min	EXE Signal setting up Time: t_{DE}	1ms min
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4. I/O SIGNAL

EXE Signal Holding Time : t_{EL}

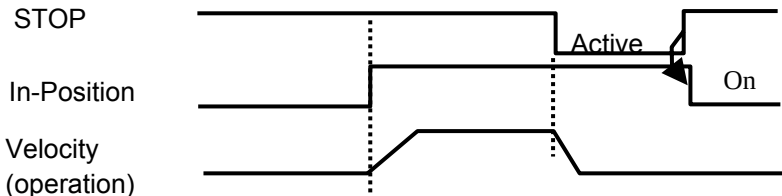
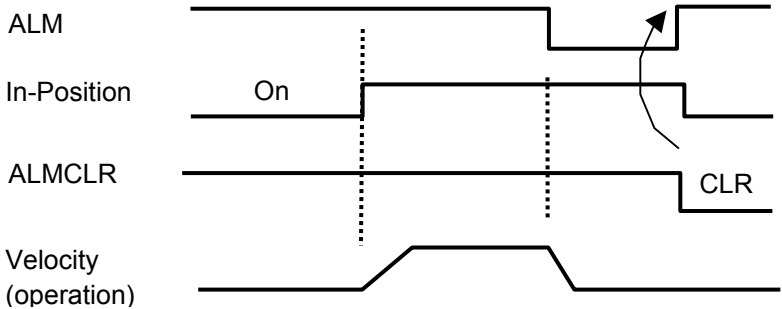
1ms min

Ack Signal Response Delay Time: $t_{EA}=t_{EB}$

1ms max

4.1.2 Input Signal

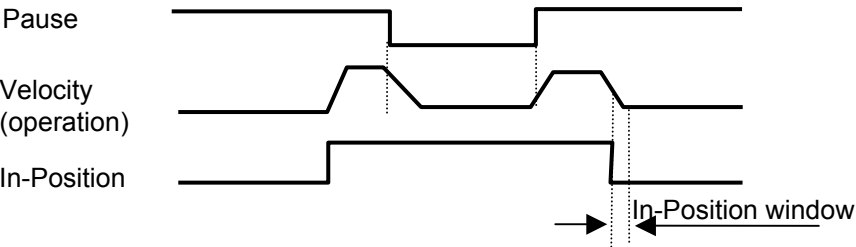
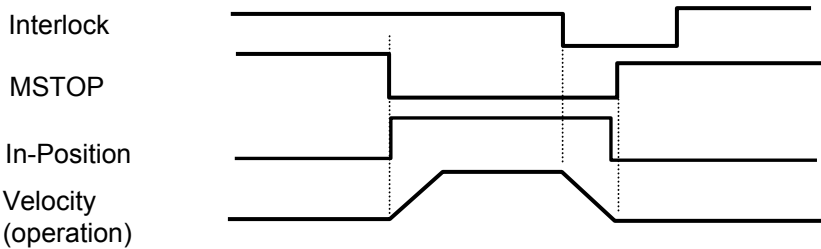
1) Input Signal to Fix the Function allocation

Signal	CN No.	Pin No.	Function
STOP	1	13	This signal works as an emergency stop for all axes. Amplifiers turn to servo OFF status. - Input during travel  * STOP release will be valid after inputting STOP, motor stops completely and passing 300ms. * When interlock turns OFF without alarm by STOP releasing, it moves to servo ON status automatically. * STOP command set by communication will be released by STOP signal release (Edge recognition of Active → Non Active) * Inputting OR condition of "Communication/ STOP input Port" will switch to stop status. * STOP input logic will be selected by command code 16h.
ALMCLR	1	14	This is an alarm clear signal for releasable alarm. - Alarm occurs during operation.  * Alarm becomes releasable after alarm occurs, motor stops completely and passing 300ms. * ALM input logic will be selected by command code 16h. * Non-releasable alarm shall be cleared by turning the power ON again or initialization command. * An ALMCLR signal becomes edge recognition.

4. I/O SIGNAL

2) General Purpose Input Signal

For the general purpose input (IN1 to 4) of CN1 Pin No. 8 to 11, functions will be selected per pin number by command code 16h. See the description of Command code 16h and DAT 3 to 6 for the details.

Signal	CN No.	Pin No.	Function
IN n	1	8 to 11	The following functions shall be selected. • Point input function Select input between Point or Program number. • General purpose input function Used for blanching condition in program and so on. • Pause input function Pause input for all axes or specified axis. Pause status by ON, pause will be released by OFF. When inputting the signal during operation, down the speed and stop according to the deceleration rate set in advance. The target position remains and the operation to the target position resumes by releasing signal.  * Enabled for operation command during executing program. * In case that pause input is valid through communication, the pause command through communication will be released by pause input release. • Interlock Function This signal stops operation of all axes or specified axis with servo enable status. The stopped position becomes the target position. Interlock status by ON, and interlock will be released by OFF.  * Motion command is not accepted during Interlock. Command error occurs by communication, and no Ack response for EXE. * Initializing is not accepted during Interlock status. * Interlock status is released by deceleration/ stop complete and signal OFF. * Interlock command set through communication will be released by Interlock release (edge recognition of On→Off). * Enabled for operation command during executing program.

4. I/O SIGNAL

4.1.3 Output Signal Function

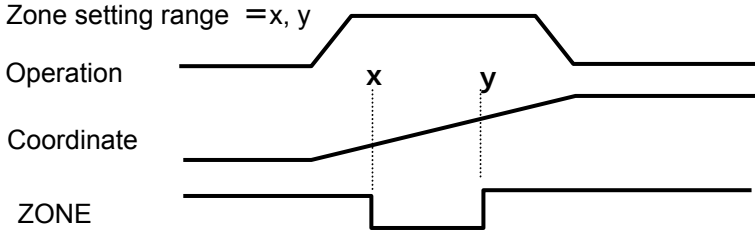
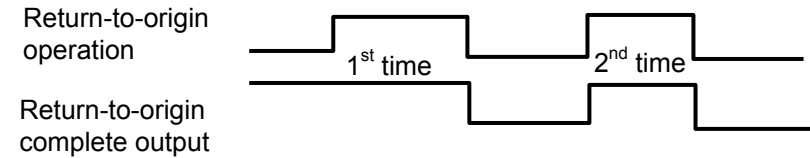
1) Output Signal to Fix the Function allocation

Signal	CN No.	Pin No.	Function
In-Position	1	15 to 18	Outputs In-position status (No.15 to 18 pins corresponds to Axis 1 to 4) per axis. - Logic: On=in-Position, Off=Out-Position - Setting: In-Position window is set by command code 30h. Power supply input Initializing operation Operation In-Position In-Position window * Out-position status when SOFF * Out-position when Pause status * In-position status when return-to-origin with normal completion * Out-position status during Limit deceleration, and turns to In-position status when stop. * The In-position window is judged from the target position during the Soft Servo operation. * In-position status during recognizing power voltage establishment in the amplifier after turning on the main circuit power. * Out-position during initializing operation.
ALM	1	21	This signal turns on when alarm occurs. Output by “or” condition of all axes. - Logic: Selected by command code 16h - Operation when ALM: Selected by command code 15h 0= Stopping all axes by ALM occurs at any axis. 1= Continue operation except for the axis ALM occurred.

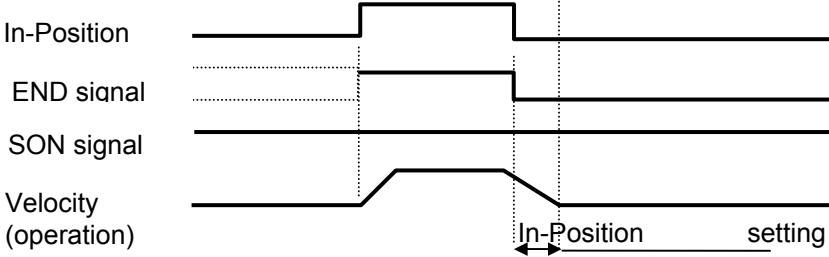
4. I/O SIGNAL

2) General Purpose Output Signal

For the general purpose output (Out1 to 8) of CN1 Pin No. 22 to 29, functions will be selected per pin number by command code 16h. See the description of Command code 16h and DAT 7 to 14 for the details.

Signal	CN No.	Pin No.	Function
Out n	1	22 to 29	The following functions shall be selected. General purpose output function Command code 4Bh: The status of signals can be set by "Bit Out Command". When the pins are not allocated as General Purpose Output, the bit operation by "Bit Out Command" is ignored. Motor STOP signal output Choice in an AND condition of one specific axis or all axes is possible. Output the movement completion state for an arbitrary movement order. Logic: On=In drive Off=Movement completion *It is not reply to a movement order equal to or less than 1.8 degrees in a motor. H Limit monitor H. Limit Monitor function for all effective axes or specified axis. The signal turns on when H. Limit function by command code 11h is effective. In case of designating all axes, it outputs by OR condition of all axes. Logic: On=H. Limit status ZONE Outputs ZONE status by AND condition of all effective axes or specified axis. The signal turns on in the coordinate position range set by command code 31h in advance. Should be used for the work positioning judge, activating trigger for other axes and so on. Logic: On=in the ZONE range Zone setting range =x, y  * The signal is irrespective of amplifier status, however, the signal is unstable when wire malfunction or error alarm is detected. Return-to-origin complete The signal turns on at return-to-origin complete status by AND condition of all effective axes or specified axis. Logic: On= Return-to-origin complete  * When resume return-to-origin operation after its completion the signal turns OFF, and turns ON when normal completion again.

4. I/O SIGNAL

Signal	CN No.	Pin No.	Function
Out n	1	22 to 29	~Continued from preceding page~ • END signal The signal indicates motor operational status by AND condition of all effective axes or specified axis. The END signal responses only to the operation by EXE signal. Stop by Pause, Limit, Interlock, ALM, STOP or Soft Servo error shall be considered as abnormal termination, remaining OFF. Take this signal for judging whether motion command by EXE signal completed normally. Logic: .OFF = During operation Setting: Operational complete is judged from In-position setting window by command code 30h.  * Turns ON at normal completion of initializing operation. * Turns ON when In-position is on and Ack is low status to secure END signal window in case such as short motion command is executed. * Turns ON at normal completion of Soft Servo operation * Dribble in Soft Servo (when the work is pushed to the pushing direction after normal completion) is not monitored. Once completing pushing, remains ON. • STOP monitor Monitoring amplifier STOP status. Logic: On= STOP status * STOP input port status is reflected to monitor irrespective of amplifier status. • SDN Signal monitor Monitoring input state of a SDN signal. Logic: On = input signal Lo

5. ACTIVATION

This Chapter explains procedure, adjustment and operational functions for activation verification. Make sure to refer this Chapter in the first use.

5.1 Preparation

1) Dip Switch Setting

Setting dip switch allocated on the amplifier board in the power OFF status.

- Communication speed: Set for the communication speed. In case of using Sanyo PC I/F as master, set at 9600 or 38400bps.
- Axis setting: Set the axis effective switch OFF for the axis not connected.
- Termination resistance: In case of daisy chain connection of more than one address, set only the termination resistance of end node address to ON. Termination resistance setting differs depending upon communication specification.

For half duplex communication: only SW7, 8 are ON

For full duplex communication: SW 7 to 10 are ON

DIP SW Setting

No	Function	Setting at ex-factory	O F F		ON	Remarks
1	Communication speed	9600bps	SW1	SW2	bps	
2	Communication speed		On	On	9600	
			Off	On	38400	
			On	Off	115200	
			Off	Off	128000	
3	Effective Axis 1	Valid	Invalid		Valid	Set valid/ invalid of Axis 1
4	Effective Axis 2	Valid	Invalid		Valid	Set valid/ invalid of Axis 2
5	Effective Axis 3	Valid	Invalid		Valid	Set valid/ invalid of Axis 3
6	Effective Axis 4	Valid	Invalid		Valid	Set valid/ invalid of Axis 4
7	Terminator Resistance	Connected	Not Connected		Connected	When connecting more than one amplifier, set only the last axis to ON.
8	Terminator Resistance	Connected	Not Connected		Connected	
9	Terminator Resistance	Connected	Not Connected		Connected	
10	Terminator Resistance	Connected	Not Connected		Connected	

2) Rotary Switch Setting

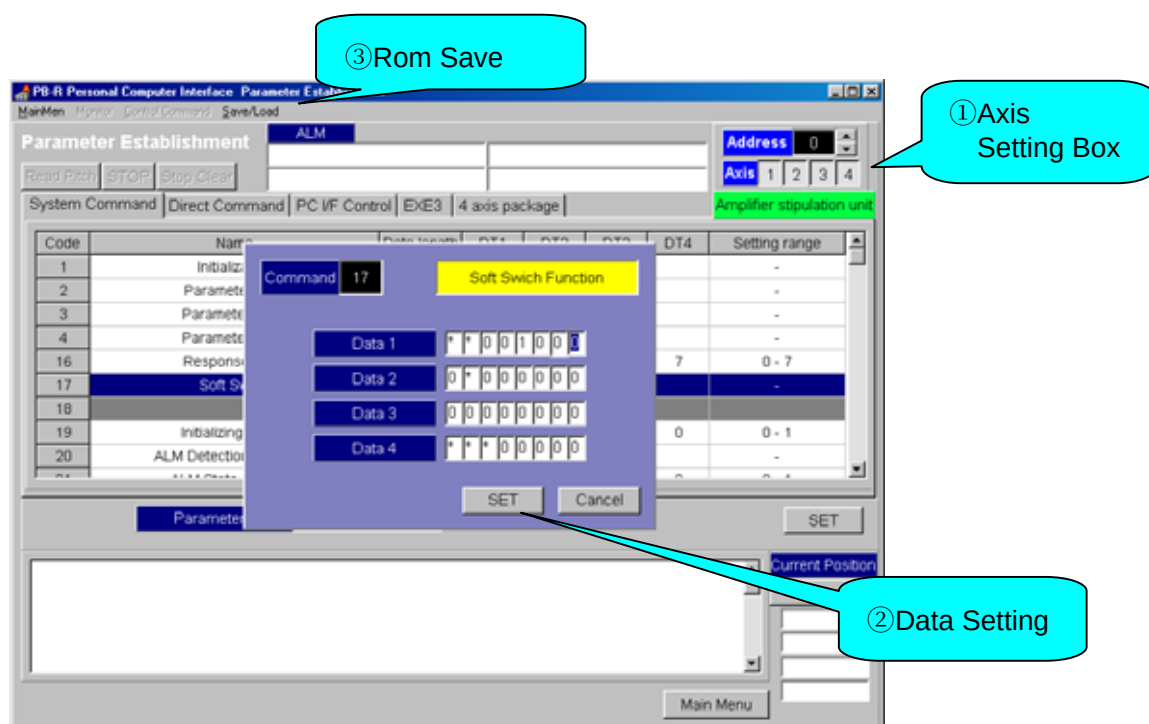
Set address by rotary switch on amplifier front. Setting range should be from 0 to Eh. Note that the addresses should not overlap if more than one amplifier would be connected.

5. ACTIVATION

3) Soft Switch Setting

Connect master device (e.g. Sanyo PC I/F) and power supply without connecting motor. Turn On the power (only control power when separate power supply) and set Soft Switch. Soft Switch sets command for excitation current, motor code, resolution and so on. Make sure to set the excitation current and motor code that match to the connected motor from the first. Setting procedure in case of using Sanyo PC I/F is as follows. See the Chapter 7 for command details.

- Activate PC I/F software and select Direct command of Main Menu.
- Validate only the designated axis in the ① Axis Setting Box. If setting data is identical for axes, those axes are selectable simultaneously.
- Click data display of System Command - Soft Switch, and Data setting box appears.
- After completing data setting, click ②SET button below in the Data setting box.
- At the time of transmitting, the set value is not stored in EEPROM. Executing "Rom Save" in the Menu Bar ③Save/ Load, the set value will be saved in the EEPROM. Thus, the stored value in the EEPROM is effective when turning ON the power again, as far as not overwritten.



- * Refer to the PC I/F Specifications for activation procedure and connection of PC I/F.
- * The optional communication converting board is required in case of using PC I/F. See the Appendix 4 for the details.

4) Wiring

Plug OFF the power supply (shat off after transmitting command code 03h and passing over 5s), and then connect motor and I/O.

- * Unless using I/O, the connection is not necessary.

5. ACTIVATION

5) Turn OFF the Power and ON

Turn ON the power supply (control/ main circuit power when separate power supply) PB motor, STOP or Interlock is released after turning ON the power supply, executes initializing operation automatically without alarm status according to the initializing operation type set by command code 13h. It moves to servo ON status after initializing operation completed. Thus through this process, activation will be enabled. Fig. 5-1 is the timing chart when turning ON the power supply as follows

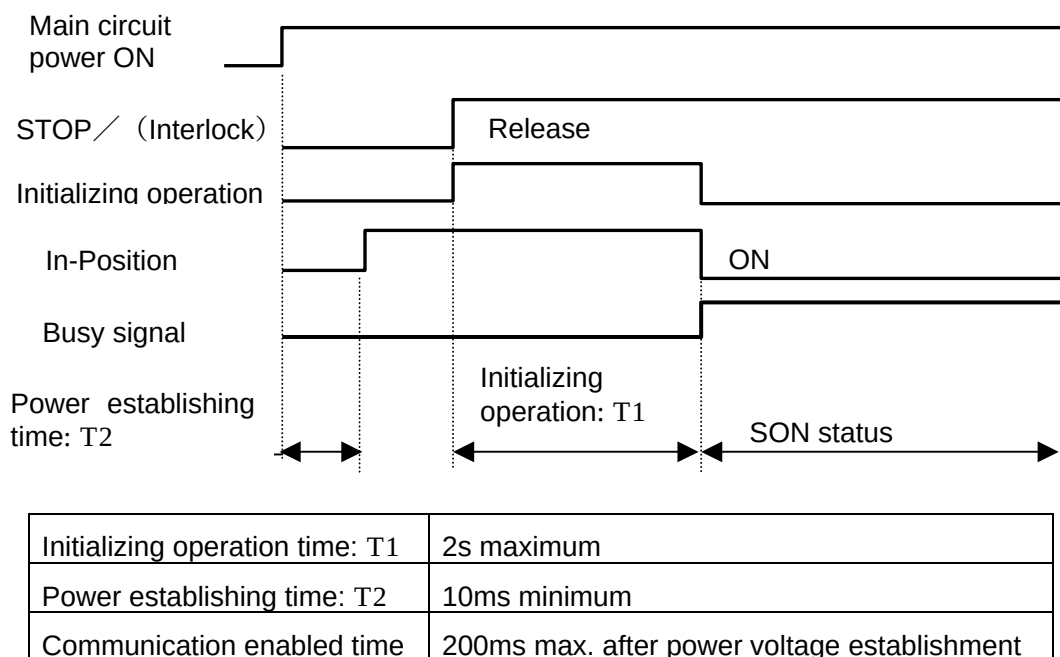


Fig. 5-1 Timing Chart When turning ON Power Supply

- In-position signal turns OFF after turning ON the main circuit power and when recognizing power voltage establishment automatically in amplifier.
- In case that STOP is released, In-position signal turns ON after completing initialization.
- In case that initializing operation type is 0 (initial value), moves 8 degree max. at motor axis and 3.6 degree max. when Type 1. Initializing operation starts from fixation excitation position after turning ON the power, and return to the original position.
- Initializing operation time may differ depending upon load condition per axis.
- When ALM is not occurred at operational completion, motor becomes servo ON status.
- Busy signal can be used instead of servo ON signal when turning on the power supply.

5. ACTIVATION

5.2 Activation

Completing Section 5.1, and motor activation in the servo ON status will be enabled. There are two activation procedures, one is through communication and the other is by PIO.

5.2.1 Controlling by PIO

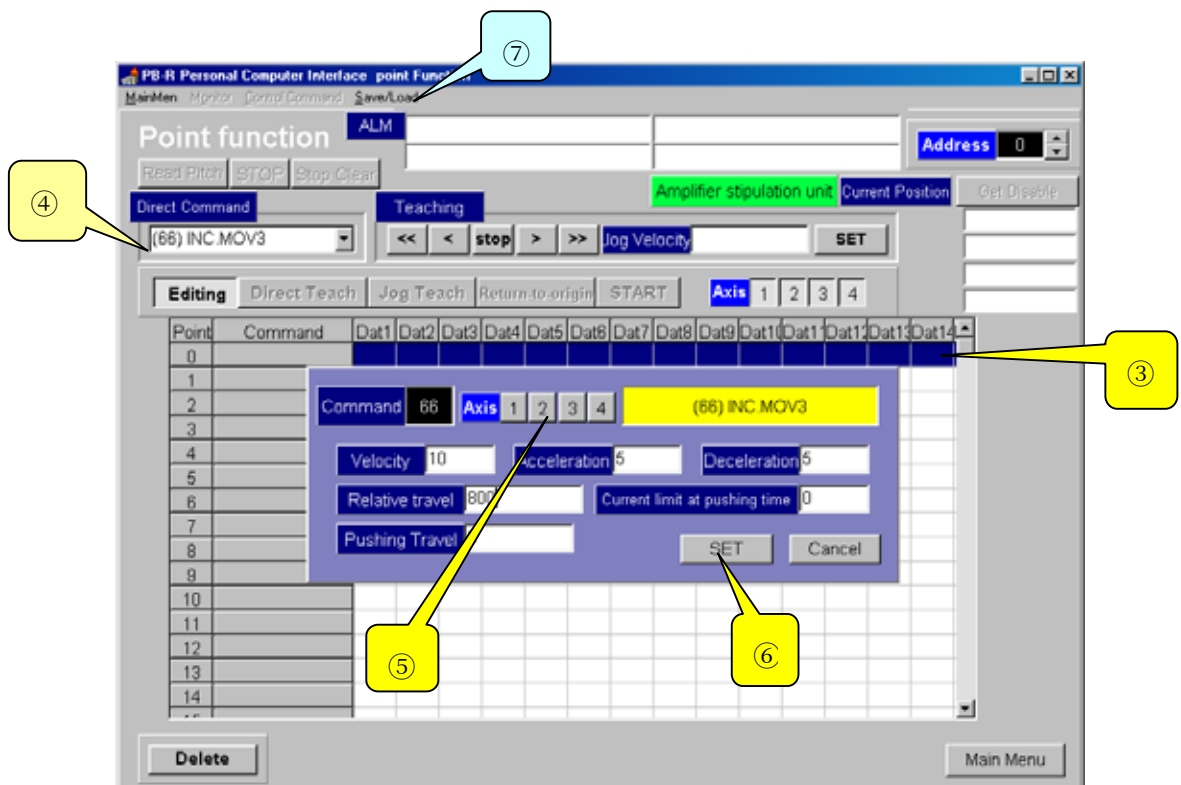
To control by PIO, the command should be saved in designated Point number or Program number in advance. Activation will be executed by EXE signal.

1) Execution example of Point command

Procedure example in case using Sanyo PC I/F

a) Storing move command (example of storing relative move command by command code 42)

- ① Start up the PC I/F online.
- ② Select Point function from Main Menu.
- ③ Point No. select: After clicking edit button, click the data domain of designated allocation Point number.
- ④ Select INC MOV3 of direct command, and Data setting box appears.
- ⑤ Select designated axis number to drive (from axis to axes are selectable).
- ⑥ After inputting each data, click "SET" button in the data setting box. The box will disappear and data will be indicated in the display.
- ⑦ Click "Save/ Load" in the Menu Bar to execute "Rom Save".

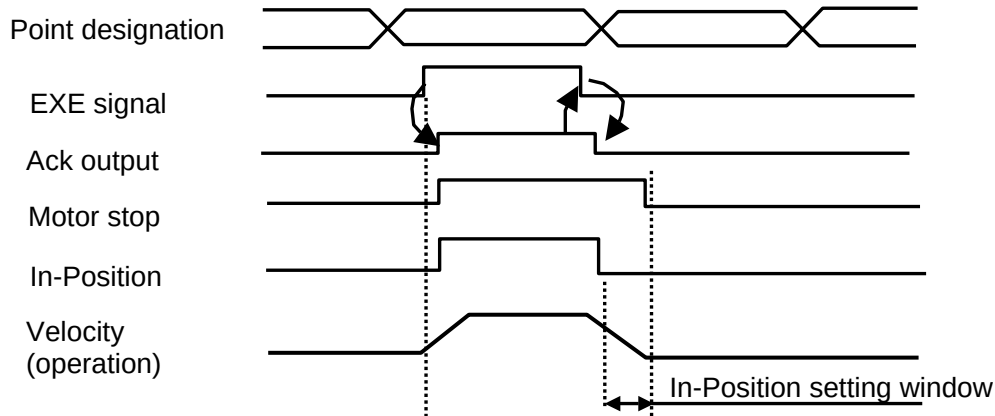


- Make sure to input the all data by decimal.

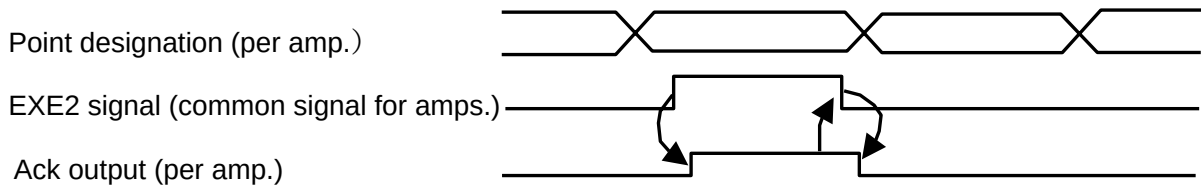
That is all to complete the drive command storing to Point. Since the Point data is stored in the non-volatile memory, the data remains even after turning OFF the power supply.

5. ACTIVATION

- b) Activate the Point or Program that stored in the process of a), by EXE1 (CN1, No.3 pin) signal. Refer to the Section 4.1 for the Timing chart details of EXE signal.



- c) Use EXE2 signal for the Point of more than one amplifier or when activating all Programs at once. EXE2 signal (when designating EXE2 by Soft Switch, command code 11h and execution signal that is connectable by daisy chain which allocated in the communication connector CN2, 3) enables to activate the designated Point or Program per amplifier simultaneously. The timing chart is identical to that of EXE1 signal.



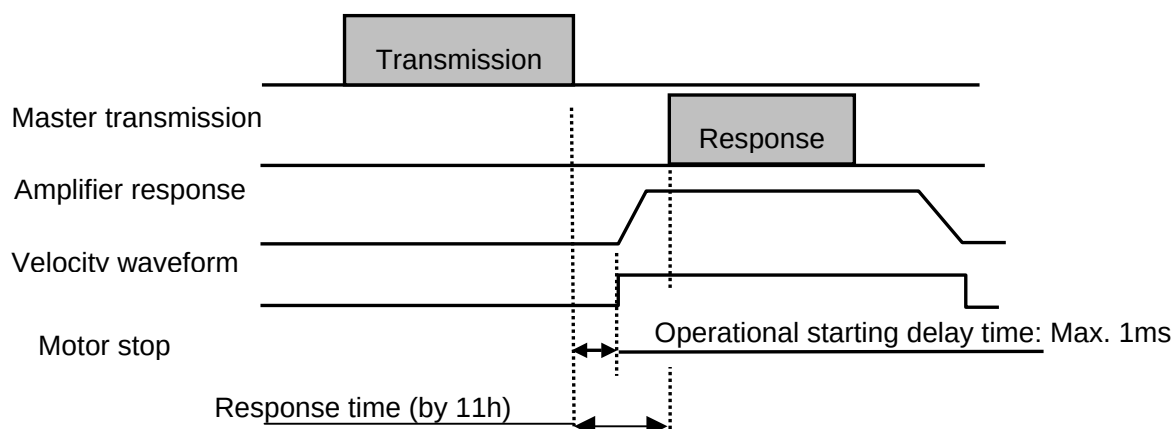
- * When designated Point or Program is not stored to execute, judges as NOP.
- * Allocating to Point or Program of move commands that differ in axes connecting to one amplifier, is not acceptable.
- * Allocating to Point or Program of the identical move command from axes for the simultaneous activation is acceptable.

5. ACTIVATION

5.2.2 Activation Through Communication

Below is procedure example for activation in case by command issue through communication. The procedure differs depending upon the activating designation. See the Chapter 6 for the communication specifications.

- a) When activating Point data stored in the 5.2.1 section by PC I/F software communication.
 - After completing “Rom Save”, click the designated data display domain of Point number to execute, and select Point.
 - Activating by clicking “START” button
- b) Executing System command/ Direct command/ RD command
 System command, Direct command and RD command other than stored data of Point/ PRG execute immediately at the point of acceptance through communication as shown in the timing chart below:



- Drive data example by command code 42h
 (e. g., Activate address 0/ Axis 1, 3: forward direction, 800PLS without Hard Stop)

Transmitting Data

Transmitting Data													
Packet length	ADR	CMD Code	Velocity	Acceleration	Deceleration	Travel (LSB First)				Push I	Push travel		Check sum
0Eh	50h	42h	Optional	Optional	Optional	20h	03h	00	00	00	00	00	*

Response Data (success response)

Packet length	ADR	Response status	Check Sum
04h	50h (echo back)	*	*

5. ACTIVATION

c) Point / Program execution in other than PC I/F

Below is a procedure example of activating Point or Program stored in the non-volatile memory in advance through communication in optional master device by communication.
e.g.) Storing relative motion command to Point 1 and activate through communication.

① Storing relative motion command to Point 1 (drive data example by command code 42h):

Packet Length	ADR	CMD Code	Point No	Store CMD	Velocity	Acceleration	Deceleration	Travel (LSB First)				Push I	Push travel		Check sum
10h	50h	56h	01h	42h	*	*	*	20h	03h	0	0	0	0	0	*

Note) Make sure to designate the effective axis, or command error occurs. No operation when no axis is designated. Axis must be specified.

② Specifying the activating designation (Point No.) by command code 55h.

Packet Length	ADR* Note 1	CMD Code	Point/PRG select	Point/PRG No	Check Sum
06h	*0h	55h	00	01h	*

Note) The specified axis is acceptable even if it differs that stored in Point as far as designating effective axis.

③ Activating by 50h.

Packet Length	ADR*Note 1)	CMD Code	Check Sum
04h	*0h	50h	*

Note) The designated axis when stored in Point is valid as far as specifying effective axis.

d) Activating all axes through communication (Address = *F setting)

If only specifying *Fh to address, all the connected amplifiers execute the received signal as command to the self-station. Only the amplifier set to address "0" will respond.

* The dispersion of command executing start time per axis is at 0.5ms at maximum.

5. ACTIVATION

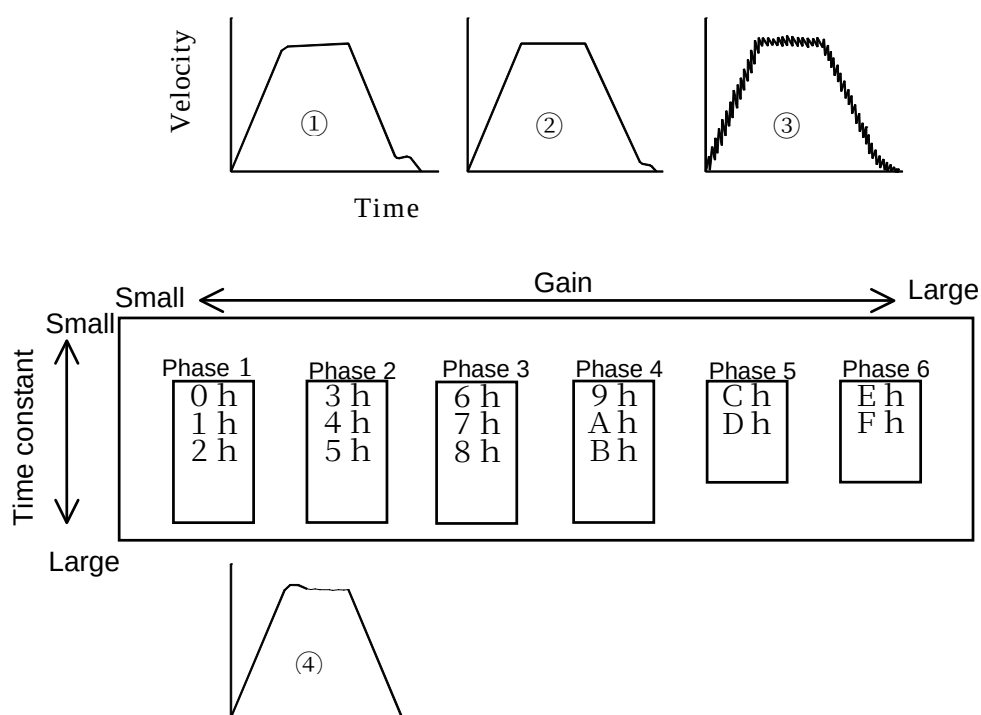
5.3 Adjustment

5.3.1 Servo Parameter

To optimize PB system capability, adjusting servo parameter (command code 21h) is required. The outline of adjusting procedure is as follows:

Select the normalized servo parameter from the set value of 16 phases.

- Servo parameters are divided to the 6-phase proportional gain. Below shows the relation between servo parameter and velocity waveform.
- Stepping up the phase gradually until motor or load will not oscillate (0h→3h→6h→...), then select the one phase. Since the gain increases as stepping up phases, velocity waveform transforms as①→②→③.
- Next, select time constant from the same phase with checking load response and positioning status. The number is larger, overshoot becomes bigger as ④.



The relation between servo parameter and velocity waveform

- * Optional velocity monitoring tool to check velocity waveform is available. See the Appendix 3 for details.
- * When shortening drive time, the maximum torque can be gained when acceleration by setting the acceleration at maximum.
- * Unless under shooting when stop can be avoided by adjusting servo parameter, deceleration slop needs to be set easier.

5. ACTIVATION

5.3.2 Other Adjusting Parameters

Adjusting functions are describes as follows. See the Chapter 7 for the command code details.

- **Power Limit (command code 20h)**

PB system has a function setting excitation current according to amplifier status. Use this function to reduce motor/ amplifier heat and current consumption. Note that the required current is controlled in the amplifier during operation, usually controlling Power Limit value is not necessary.

- **Low Pass Filter (command code 22h)**

This function is to set the low pass filter of velocity feedback. It is effective in case such as mechanism resonance. Note that enlarging set value, however, results in response delay.

- **Correction Factor (command code 24h)**

This functions is effective in case of setting loosen the slope of deceleration. It should be used for such as soft landing by adjustment meeting with the deceleration degree.

5. ACTIVATION

5.4 Operational Description

Additional move command and acceleration velocity change is possible in PB system during operation. Also, PB system has Hard Stop function and Automatic Return-to-origin function. Operational examples are as follows:

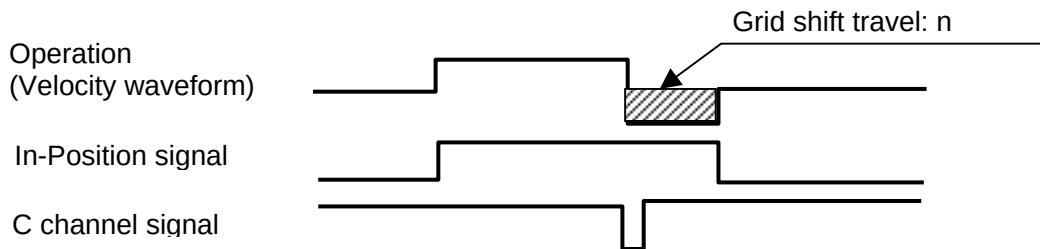
5.4.1 Return-to-origin Command (Command Code 45h)

Executing origin detection according to the origin detection type set at Return-to-origin activation.

✱ In-position signal when Return-to-origin turns ON after completing origin detection.

1) C Channel Detection Mode: Type 0

Continuously rotates in the specified direction at Return-to-origin low speed, and detect the first C channel signal. After detection, travels for grid shift at Return-to-origin low speed and preset absolute position counter.

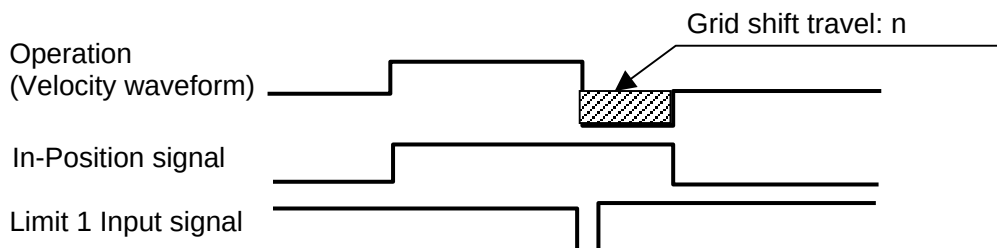


✱ When setting impractical velocity, travel over the C channel detecting position and return to the home. Setting the velocity at 4 or less is recommended.

✱ Selecting the motor with C channel is required.

2) External Sensor Signal=Origin: Type 1

Sensor position is detected by inputting output signal of external proximity sensor and so on into No.11 pin of CN 4 to 7, and it becomes origin. Continuously rotates in the specified direction and stop with deceleration when external sensor signal becomes active. Travel for grid shift against external sensor signal detecting position and preset absolute position counter. When the external sensor signal is already active, starts from the operation in reverse direction against command.



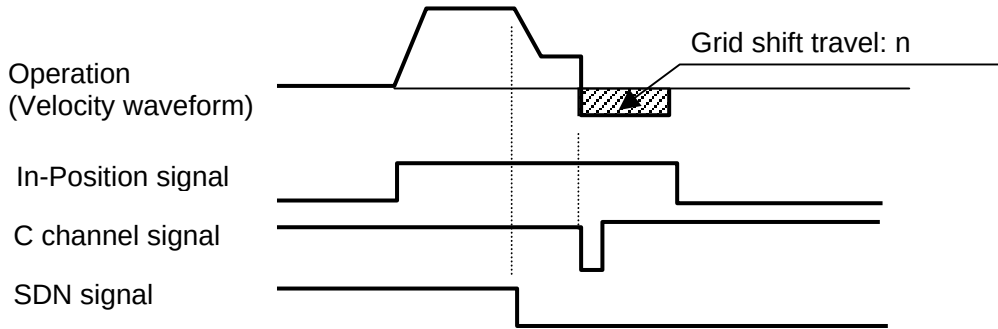
✱ Grid shift travel is coded relative position. When the grid shift travel code is reverse to Return-to-origin direction, operation will be in opposite direction.

✱ See the Section 3.6.2 for the External Sensor details.

5. ACTIVATION

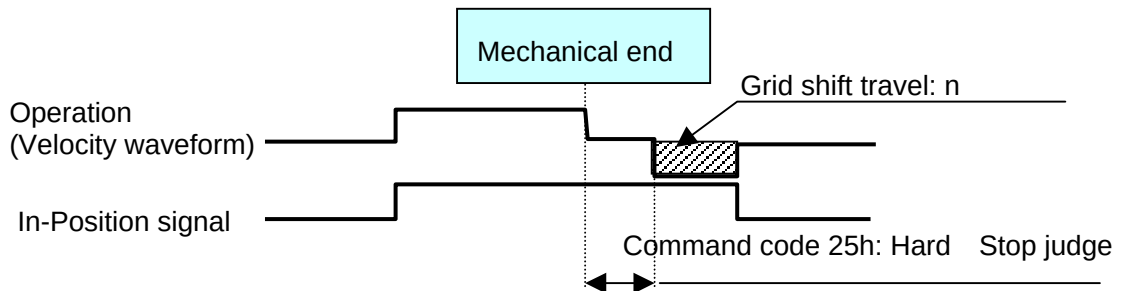
3) External Sensor+C Channel Detection Mode: Type 2

Continuously rotates in the specified direction and decelerate when external sensor signal (SDN) becomes active. Detect the first C channel at Return-to-origin low speed and travel for grid shift, and then preset absolute position counter.



4) Hard Stop Origin Detection: Type 3

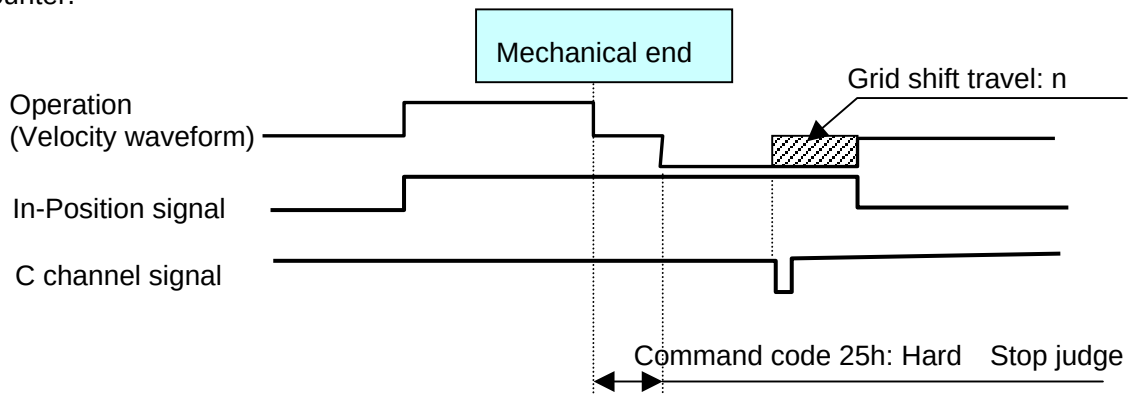
Continuously rotates in the specified direction at specified Return-to-origin speed and current control, and detect Hard Stop. Then travel for grid shift in the specified grid shift direction with coded at Return-to-origin low speed, and preset absolute position counter.



* Make sure to set grid shift travel code so as to operate in the reverse direction to Hard Stop direction.

5) Hard Stop + C Channel Origin Detection: Type 4

Continuously rotate in the specified direction at the specified Return-to-origin speed and current control. After detecting Hard Stop, travel in the reverse direction at Return-to-origin low speed and detect the first C channel. After detection, travel for grid shift and preset absolute position counter.



5. ACTIVATION

5.4.2 Hard Stop Operation

PB system has Hard Stop function continuously operating from usual driving, that can be used for forced work.

Setting Conditions for Hard Stop

- **Hard Stop Judge Time (Command Code 25h):**

Set the judge time for Soft Serve completion before activation. Hard Stop completion is judged at the point of passing Hard Stop judge time after current command reaches to the current when Hard Stop, and then output motor stop signal.

- ◆ In case that the current when Hard Stop does not reach to the current limit, stop at Hard Stop travel completion and output motor stop signal.
- ◆ After completing Hard Stop operation normally and if Work moves to the Hard Stop direction, motor moves to the target position set at Hard Stop travel. Motor stop signal output remains.

- **Velocity When Hard Stop (Command Code 26h):**

Set Hard Stop velocity before activation. Take the shock when Hard Stop into consideration and use at low speed is recommended.

- **Current Limit When Hard Stop:**

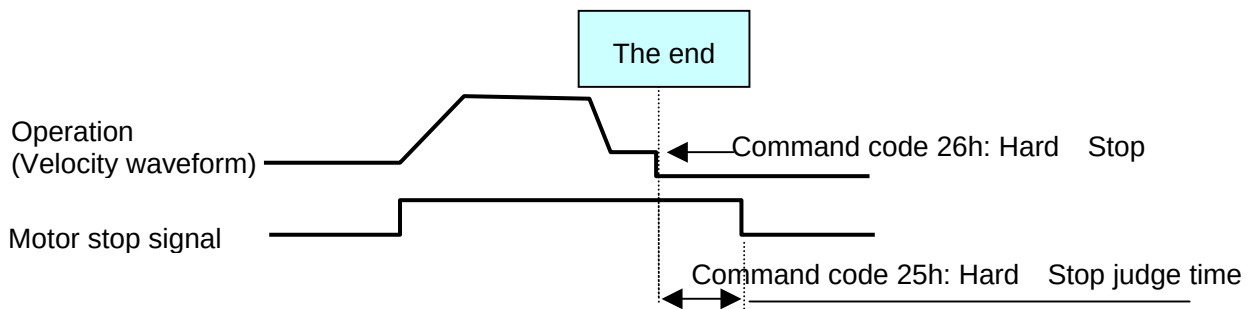
Set per command issue. The torque when Hard Stop is calculated as follows:

$$\text{Torque when Hard Stop} = \text{Maximum stall torque} \times \text{setting value} / 255 (\pm 20\%)$$

- **Hard stop Travel:**

Hard Stop travel is added to the target position of usual driving. Set the target position that fully pushes against the Hard Stop position.

- * In case that current limit when Hard Stop is 0, be sure to set Hard Stop travel to 0.



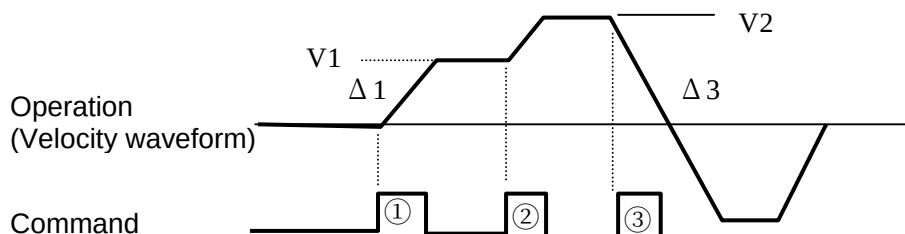
- * When alarm detecting condition (command code 14h: DAT4: Push) is 0 (enabling), alarm will be detected by error.
- * When Hard Stop occurred before starting Hard Stop travel, OL error will be detected. OL alarm shall not be detected during Hard Stop travel.
- * When Work is pushed back in reverse direction during Hard Stop operation, servo error will be detected according to the setting of alarm detecting condition (command code 14h: DAT2, 3).
- * As to the target position when executing relative travel command after Hard Stop completion, relative travel will be effective against the target position set by Hard Stop travel.
- * In case of Hard Stop operation is enabled, the position set at usual drive becomes target position during usual driving, and Hard Stop travel will be added internally at starting deceleration point. Then changing to the Hard Stop velocity and turns into Hard Stop operation. Thus, the target position changes during Hard Stop drive, and take care on handling In-position signal.

5. ACTIVATION

5.4.3 Additional Command

Velocity, acceleration/ deceleration and target position can be changed in PB system.

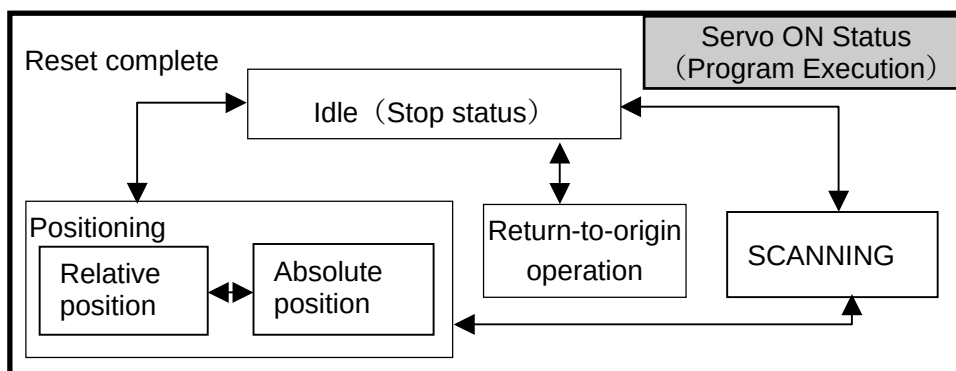
Example of additional travel command;



- ① Travel command issue: Velocity V1, Acceleration $\Delta 1$
- ② Velocity change (Command code: 36h, Velocity V2)
- ③ Additional travel command: Deceleration $\Delta 3$, Setting weight position to reverse rotation.

The following chart shows status transition when Servo ON. These transitional operation indicated by allows are executed with additional commands.

* Additional command of Return-to-origin is not acceptable during optional travel.



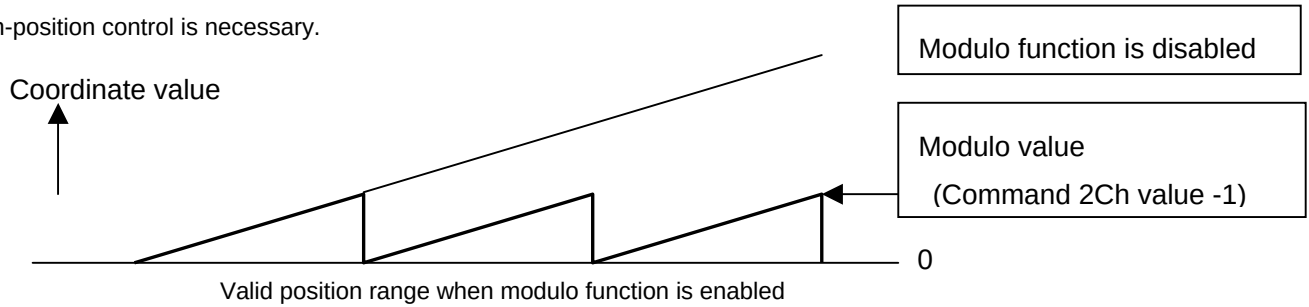
5. ACTIVATION

5.4.4 Modulo function

The following describes the modulo function (coordinate range adjustment function).

This function presets the amplifier internal coordinates to the range specified by command 2Ch. The operation is performed in the direction selected by command 2Dh. The modulo function is enabled if command 2Bh=1.

This function is effective for applications where shortcut-control of rotating loads or switching from velocity control to in-position control is necessary.



- * When using incremental move commands or SCAN operation, the coordinates (absolute position monitor) follow the modulo settings.

6. COMMUNICATION SPECIFICATIONS

6.1 Communication Specifications

Communication specifications of PB system are as follows:

6.1.1 Communication Format

Contents	Specifications
Communication Speed *Note 1	9600, 38400, 115200, 128000 (Select by DIP Switch) Setting: See the page 5-1.
Synchronization	Start-stop synchronization
Data Bit	8 Bits
Parity Bit	Even
Stop Bit	1 Bit
Slave Station No. *Note 2	1 to 15 stations (Select by Rotary Switch)
Data Length	255 Bites Maximum
Data	Hexadecimal
Data Transmission	LSB First
Transfer Method	Two Wire Half-Duplex, Four Wire Full-Duplex or Polling (Amplifier Model Specification: See the page 2-1.)

Note 1) Consult us for communication speed of other than standard.

Note 2) Amplifier address F is for batch command for all axes and it should no be used.

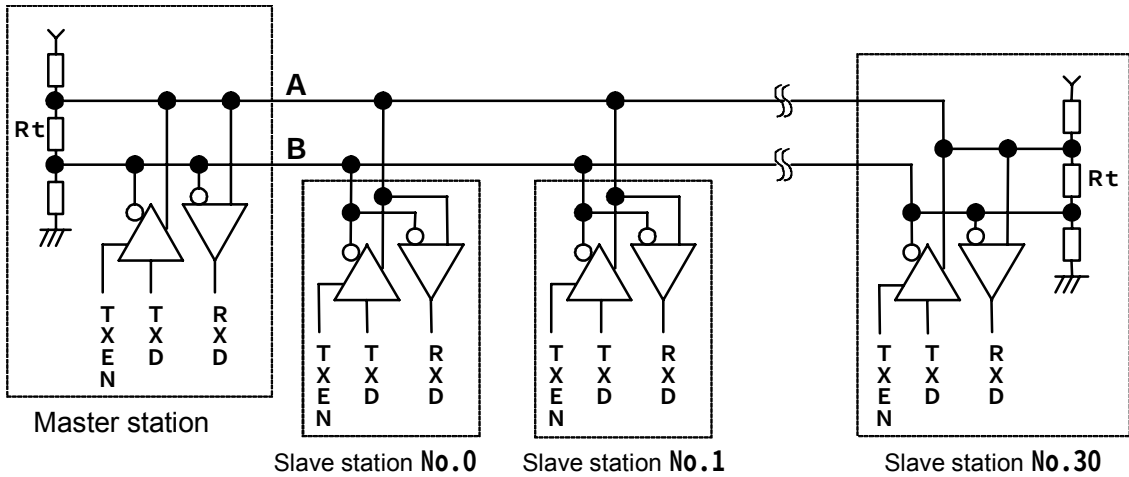
6.1.2 Hardware

Contents	Specifications
Line Driver/ Receiver IC	Half-Duplex: SN75176B (TI) equivalent Full-Duplex: SN751178 (TI) equivalent
Cable	3 or 4 Twisted Pair Shielded Cable
Terminator Resistor	Connecting terminator resistor (Rt: 150Ω) to both ends of signal wires. Built-in for Amplifier (Setting: See 5.1 page)
Extended Length	100m Maximum
Isolation	Not available
Connector (Amplifier Side)	S10B-PADSS-1GW (JST)

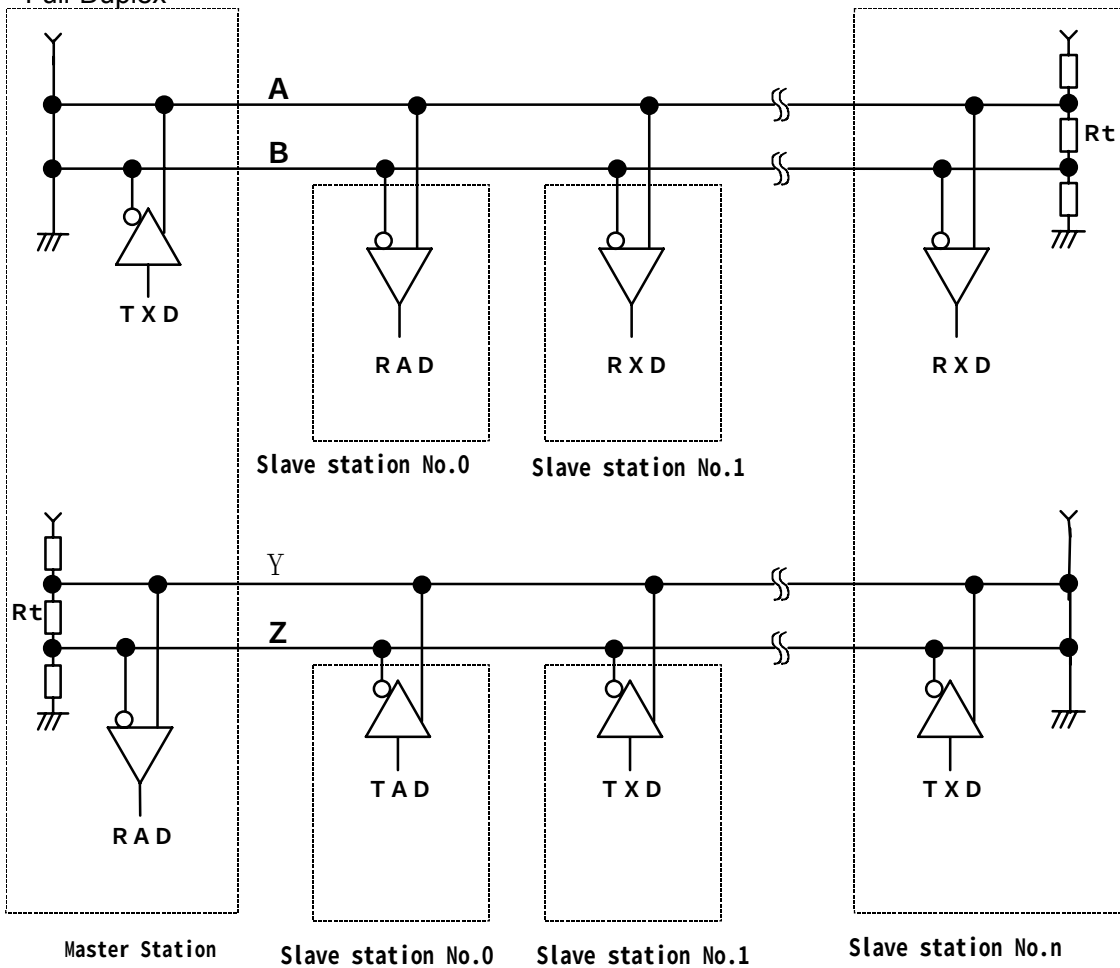
6. COMMUNICATION SPECIFICATIONS

6.1.3 Daisy Chain

Half-Duplex



Full-Duplex



6. COMMUNICATION SPECIFICATIONS

6.2 Data Format

6.2.1 Command Issue (Master Station → Slave Station)

Packet Length	Address	Command Code	Data	Check Sum
1byte	1byte	1byte	n byte	1byte

① Packet Length

Indicate bites for one Packet by hexadecimal number. Set the total bites of the command from Packet Length to Check Sum.

$$\text{Packet Length} = \text{Data Bytes (N)} + 4$$

② Address

Set the target address and axis number.

Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
Axis4	Axis3	Axis2	Axis1	Address (All address are designated for F)			

(Axis designation) 1=Valid 0=Invalid

The axes of the amplifier with 4 axes are designated by upper 4 bits of address setting data.

Valid/Invalid of axis designation is defined per command. Valid/Invalid of command per axis are listed in the Command List in the Chapter 7.2.

- * Axis designation of axis designation invalid command is ignored.
- * Command error is issued when designating invalid axis by Dip switch.

(Address)

The maximum connecting number of amplifiers is 15. Designating address set by rotary switch.

When setting address = F, it becomes batch command for all amplifiers connected to communication line. Only the amplifier of address 0, will response in this case.

③ Command Code

Designate command code defined in the Chapter 7.

- * No response in case of setting the most significant bit of command code = 1 when issuing command, except for system command of 0 to 1F and RD command after 80.

④ Data

Data bytes differ depending on the command. Set the data defined per command. 2 bytes or more than 2 bytes data commands in the order of lower then upper.

⑤ Check Sum

Set the lowest byte of the total bytes of the packet data excluded check sum data.

6. COMMUNICATION SPECIFICATIONS

6.2.2 Status Response (Slave station → Master Station)

Packet Length	Address	Communication Status	Response Data	Check Sum
1 byte	1 byte	1 byte	n byte	1 byte

① Packet Length

Indicate bites for one Packet by hexadecimal number.

$$\text{Packet Length} = \text{Response data Bytes (N)} + 4$$

② Address

Lower 4 bits indicates slave station address responding status data by hexadecimal. Upper 4 bits is for echo back of axis select.

③ Communication Status

Each slave station allocates the communication status of the latest command and device status into one byte as communication status. The response data is for all valid axes status.

Bit No.	Contents	Data		considered for criteria * 1
		0	1	
0	Operation End	Not complete	Complete	AND
1	In-position Status	Out of position	In-position	AND
2	Amplifier Alarm Status	No Alarm	Alarm	OR
3	Servo ON Status	SOFF	SON	AND
4	Limit (Both Soft and Hard)	No Limit	Limit	OR
5	Command Error * 2	No Error	Error	-
6	STOP Control Status	Operation	STOP	-
7	No Function Allocation	—	—	

* 1 Only valid axes are considered for criteria. The invalid axis set by Dip switch does not count.

* 2 Command error is issued under the following conditions:

- When the amplifier receives undefined command.
- When the amplifier receives unacceptable command (See the Appendix 4 for the details of unacceptable command to amplifier)

④ Response Data

The response data bytes will differ depending on the latest command and data. There will be no response data attached to the reply for the command other than RD. 2 bytes or more than 2 bytes data commands in the order of lower then upper.

When executing optional RD command of more than one axis, responding from the axis with lower axis number.

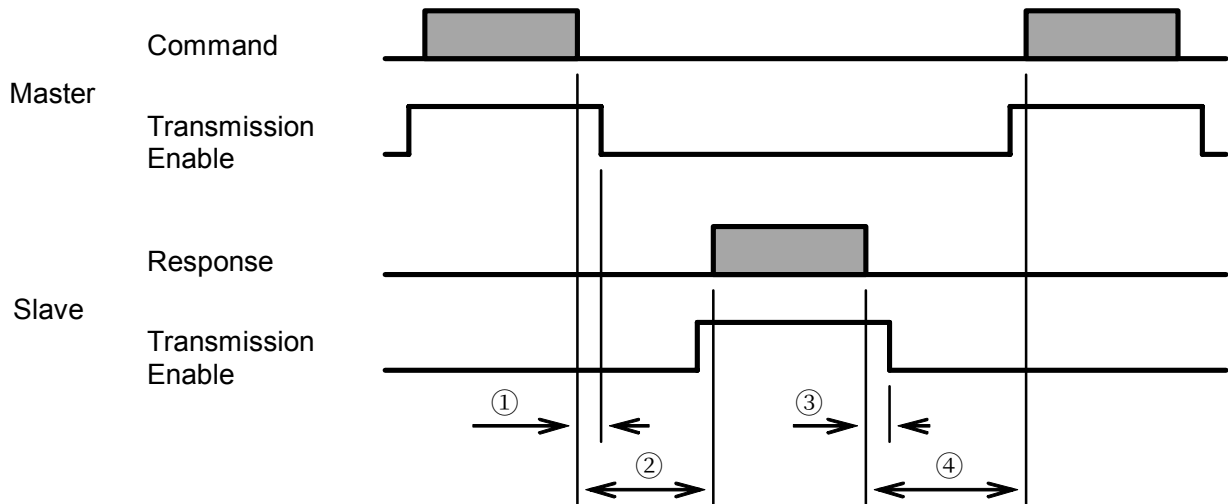
⑤ Check Sum

The lowest byte of the total bytes of the packet data excluded check sum data.

6. COMMUNICATION SPECIFICATIONS

6.3 Communication Procedure, Timing Chart (Half-Duplex Communication)

6.3.1 Communication Procedure (Normal Status: Half-Duplex Communication)



- ① Master, Complete transmission → Transmission enable Turn OFF Less than $[T1]$
- ② Master, Complete transmission → Slave Respond . . . more than $[T1]$ less than $[T2]$
- ③ Slave, Complete Response → Transmission Enable Turn OFF Less than $[T1]$
- ④ Slave, Complete Response → Master, Transmit Next Command More than $[T1]$

- 1) The master station sends commands with an address attached to their header (packet length).
- 2) The master station must turn off transmission enable within $[T1]$ of command issuance to enter the receiving mode.
- 3) All the slave stations must turn off transmission enable to enter the receiving mode.
- 4) Each slave station can transfer a signal immediately after it receives a command sent to its address.
- 5) Slave stations send a status response with their own address added to the header.
- 6) When a slave station receives a command, it must start sending a reply (response) between $[T1]$ and $[T2]$.
- 7) Slave stations must turn off transmission enable with in $[T1]$ after the completion of response.
- 8) The master station can issue another command $[T1]$ later after it receives a response from a slave station.
- 9) When the master station fails to receive a response from a slave station until $[T3]$, it judges the failure as a timeout error and is able to issue another command. (It can issue the command again.)
- 10) When communication is not completed and there is no communication in $[T3]$, slave stations discard the data they have received and recognize the next data as a header (packet length).
- 11) When a communication error occurs, the master station suspends command issuance for at least $[T3]$ and clears the buffer of the slave stations.
- 12) When a communication error occurs, slave stations discard the data they have received. They do not respond. A communication error is indicated by opening the line for at least $[T3]$.
- 13) When slave stations receive an undefined command, they report an error as a status reply.

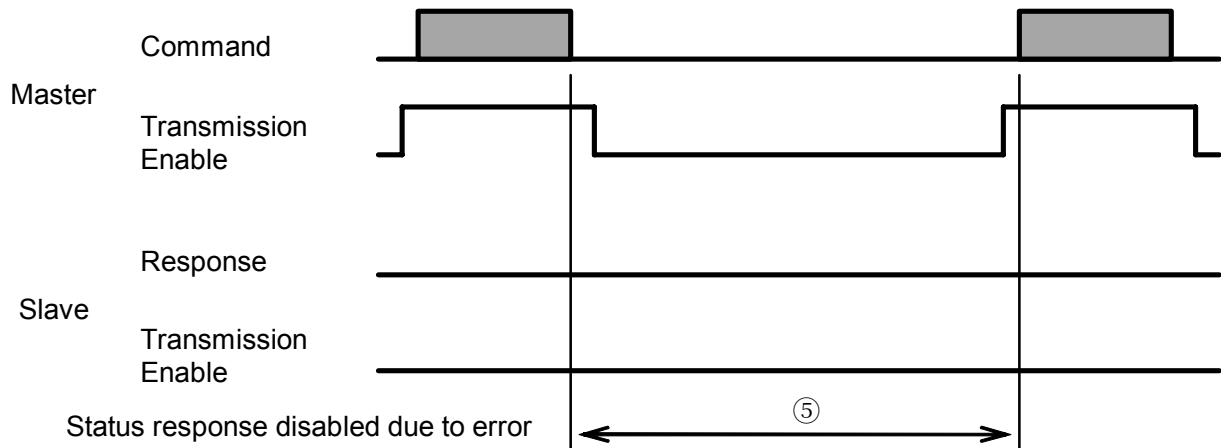
6. COMMUNICATION SPECIFICATIONS

Note 1) When the control power supply is turned on or off, the amplifier may output indefinite data while the CPU does not operate due to an indefinite power supply status.
Customers are advised to ignore such indefinite data.

Note 2) ② response time is selected by command code 11h.

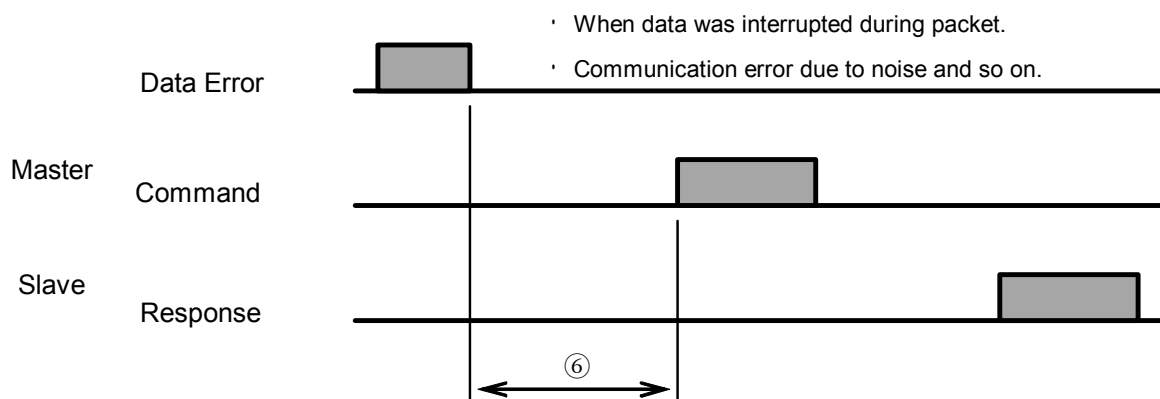
6.3.2 Communication Timing Chart (Data Error: Half-Duplex Communication)

1) When the Slave station replay , but no status response (With replay)



i) ⑤ Time until the master station can issue next command when having issued command and not receiving status response. . . . more than [T 3]

2) Data Error is issued



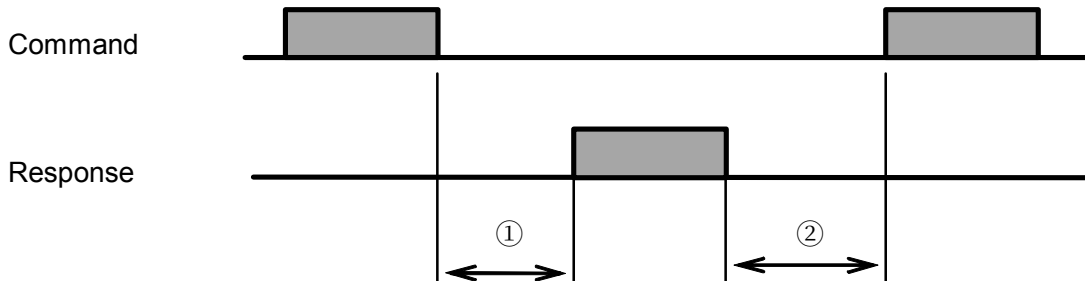
i) When data error occurs (when master station fails to recognize a packet), master station suspends command issuance for at least ⑥ [T 3] .

ii) Slaves discard the received data if transmission stops more than [T 3] then recognizing the next data as a header (Packet Length). As they succeed to recognize a packet, return to the normal process.

6. COMMUNICATION SPECIFICATIONS

6.4 Communication Procedure, Timing Chart (Full-Duplex Communication)

6.4.1 Communication Procedure (Normal Status: Full-Duplex Communication)



- ① Master, Complete Transmission → Slave Respond . . . More than [T 1] Less than [T 2]
② Slave, Complete Response → Master, Transmit Next Command More than 1ms

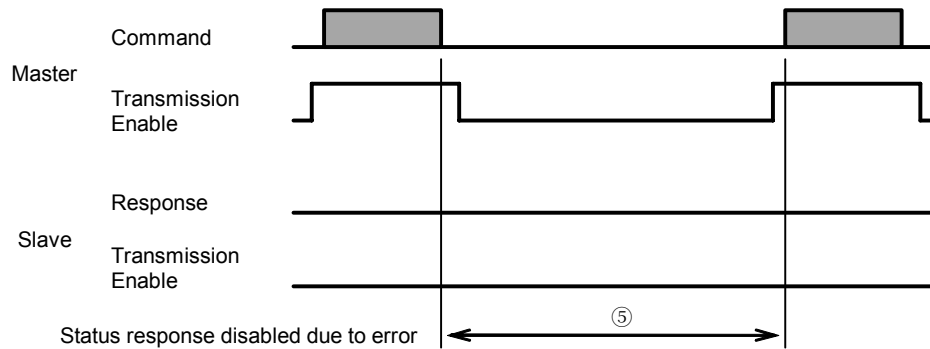
- 1) The master station sends commands with an address attached to their header (packet length).
- 2) Each slave station can transfer a signal immediately after it receives a command sent to its address.
- 3) Slave stations send a status response with their own address added to the header.
- 4) When a slave station receives a command, it must start sending a reply (response) between [T1] and [T2].
- 5) The master station can issue another command [T1] later after it receives a response from a slave station.
- 6) When the master station fails to receive a response from a slave station until [T3], it judges the failure as a timeout error and is able to issue another command. (It can issue the command again.)
- 7) When communication is not completed and there is no communication in [T3], slave stations discard the data they have received and recognize the next data as a header (packet length).
- 8) When a communication error occurs, the master station suspends command issuance for at least [T3] and clears the buffer of the slave stations.
- 9) When a communication error occurs, slave stations discard the data they have received. They do not respond. A communication error is indicated by opening the line for at least [T3].
- 10) When slave stations receive an undefined command, they report an error as a status reply.

Note 1) When the control power supply is turned on or off, the amplifier may output indefinite data while the CPU does not operate due to an indefinite power supply status.
Customers are advised to ignore such indefinite data.

6. COMMUNICATION SPECIFICATIONS

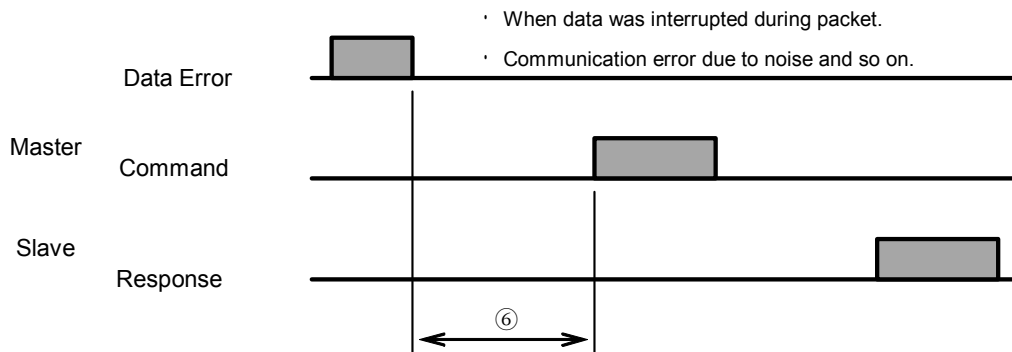
6.4.2 Communication Procedure (Data Error: Full-Duplex Communication)

- 1) When the Slave station replay , but no status response (With replay)



- i) ⑤ Time until the master station can issue next command when having issued command and not receiving status response. . . . more than $[T_3]$

- 2) Data Error is issued



- iii) When data error occurs (when master station fails to recognize a packet), master station suspends command issuance for at least ⑥ $[T_3]$.
- iv) Slaves discard the received data if transmission stops more than $[T_3]$ then recognizing the next data as a header (Packet Length). As they succeed to recognize a packet, return to the normal process.

6.5 Standard response time

$[T_1]$ can be set to $500 \mu\text{sec} \times 2^n$ ($n = 0 \sim 7$:Command=11h)

According to the T_1 setting, $[T_2] = [T_1] \times 2$ and $[T_3] = [T_1] \times 4$.

Table 6.1 shows the standard $[T_1]$, $[T_2]$, and $[T_3]$ values.

Table 6.1 Standard response time

Unit: ms

Response time setting n	T1	T2	T3	Response time setting n	T1	T2	T3
0	0.5	1	2	4	8	16	32
1	1	2	4	5	16	32	64
2	2	4	8	6	32	64	128
3	4	8	16	7	64	128	256

6. COMMUNICATION SPECIFICATIONS

6.6 Memory Access, Communication Examples

6.6.1 Memory Access

The following is the Access Conditions to ROM (EEPROM).

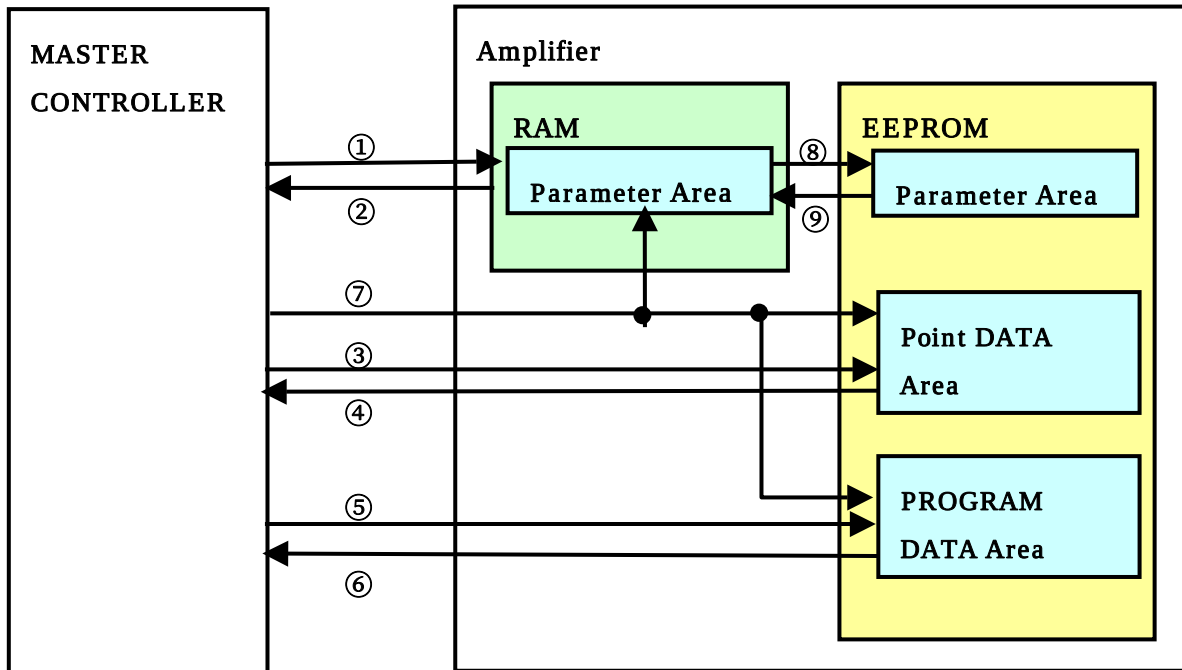


Fig. 6-1 Memory Access

No.	Function	Command Code
①	Parameter WR	Transmit parameters per optional system command/ direct command (having initial value). Transmitted data changes the value in RAM. ⑧ : The data will be saved in the non-volatile memory by executed parameter saving.
②	Parameter RD	Read optional command data (RD) by 80h. RD value is the value read from RAM.
③	Point Data Save	Optional Point data will be saved in non-volatile memory by 56h. Saving is executed per 1 Point.
④	Point Data RD	Read the data (RD) per Point by 81h.
⑤	Program Data Save	Save optional Program data in non-volatile memory by 57h. Saving is executed per line.
⑥	Program Data RD	Read the data (RD) per line by 82h.
⑦	Parameter CLR	Parameter initialization and Point/Program data will be cleared by 02h. To save the initialized parameter in non-volatile memory, execute ⑧.
⑧	Parameter Save	Butch save RAM parameters to non-volatile memory by 03h.
⑨	Parameter Load	Butch load EEPROM parameters to RAM by 04h. When turning ON the power or executing 01h, the parameter will be loaded to RAM.

6. COMMUNICATION SPECIFICATIONS

6.6.2 Communication Examples

Below is communication example according to the memory access showed in the figure 6-1.

① Parameter WR

Transmit Ex.) Setting command code 21h (servo parameter = 5) to address = 0, Axes 1, 3.

Packet Length	Address	Command Code	Data	Check sum
5	50h	21h	5	7Bh

② Parameter RD

Ex.) RD servo parameter of Axis 1 and 3 by parameter RD command.

Reply Data)

Packet Length	Address	Command Code	Data	Check sum
5	50h	80h	21h	F6h

Reply Data)

Packet Length	Address	Response	Data 1	Data 2	Data 3	Check sum
7	50h	*	21h (command code)	x (Axis1Gain)	y (Axis 2Gain)	*

* When designating more than one axis, replay data comes from all the designated axes starting from the axis with lower number in order.

③ Point Data Save

Transmit Data Format

Packet Length	Address	Command Code (56h)	Point No.	Direct Command Code	Data	Check sum
---------------	---------	--------------------	-----------	---------------------	------	-----------

<Point store of 4 Axes Batch Command (70h to 73h)>

The data can be allocated to the different Point number per axis by 4 Axes Batch command.

Axis No.	Axis 1	Axis 2	Axis 3	Axis 4
Point No.	n	n+1	n+2	n+3

* The axis data of "Axis designation = 0" (invalid axis set by Dip switch and designated valid/invalid by upper 4 bytes of address designating byte, in advance) will be invalid, and data to Point will be not updated.

6. COMMUNICATION SPECIFICATIONS

④ Point Data RD

Transmit Data Form

Packet Length	Address	81h	Point No.	Check sum
---------------	---------	-----	-----------	-----------

Reply Data Form

Packet Length	Address	Return Status	Valid Axis No.	Designating Command Code	Data	Check sum
---------------	---------	---------------	----------------	--------------------------	------	-----------

- * Upper 4 bits of address in axis designation will be echo back the value when storing.
- * Command code of 4 axes batch travel command (command code 70h to 73h) will be converted and saved as follows. Please be reminded when reading stored data (RD).

[Conversion Code]

Command Code	Converted Command Code
70 (Relative move command only for travel)	38h
71 (Absolute move command only for travel)	3Ah
72 (Relative move command including acceleration/deceleration and velocity commands)	42h (Stored as No Soft Servo)
73 (Absolute move command including acceleration/deceleration and velocity commands)	44h (Stored as No Soft Servo)

⑤ Program Data Save

Transmit Data Form

Packet Length	Address	57h	Program No.	Line No. (2Byte)	Optional Command Code	Data	Check sum
---------------	---------	-----	-------------	------------------	-----------------------	------	-----------

- * 4 axes batch command can not be used to Program.

⑥ Program Data RD

Transmit Data Form

Packet Length	Address	82h	Program No.	Line No. (2Byte)	Check sum
---------------	---------	-----	-------------	------------------	-----------

Reply Data Form

Packet Length	Address	Return Status	Command Code	Data (n Byte)	Check sum
---------------	---------	---------------	--------------	----------------	-----------

- * Program No. and Line No. are not attached to the returned data.

⑦ Parameter CLR

Transmit Data Form

Packet Length	Address	02h	Check sum
---------------	---------	-----	-----------

⑧ Parameter Save

Transmit Data Form

Packet Length	Address	03h	Check sum
---------------	---------	-----	-----------

⑨ Parameter Load

Transmit Data Form

Packet Length	Address	04h	Check sum
---------------	---------	-----	-----------

6. COMMUNICATION SPECIFICATIONS

6.6.3 EEPROM Access Time

After the amplifier receives the following commands, EEPROM access process time starts. After issuing these commands, command issue or power OFF in the regulated process time should not be performed. Otherwise, data may be lost or EEPROM error may occur.

Command Code	Max. Process Time
02h : Clear Parameter	6 s
03h : Save Parameter	20 m s
56h : Point Data Load	20 m s
57h : Program Data Load	20 m s

7. COMMAND

7. Command

7.1 Command List

1) System Command

The system commands are used for Save/Load of data and the setting conditions for using the amplifier.

This parameter group is not available to designate points or to use in program.

2) Direct Command

The direct commands are used for setting the motor operation and adjustment function related to operation. The direct commands can be used for point designation.

This command group is available to designate program except the followings.

Function	Command codes that cannot be designated.
Command Code	3Bh, 3Dh, 4Ah, 4Ch

3) Four Axis Batch Command

The four axis batch commands are used for issuing different move command for each axis.

Data is saved in different Point No. in each axis.

This command group is not available to designate program.

4) Point Store, Program Command

This parameter group commands the functions related to point and program.

5) RD Command

This command group reads or monitors direct command set value, point, program data and amplifier status.

* Whether the commands can be received or not depends on the amplifier status. Refer to Appendix 5 (Amplifier Status Transition Drawings, List of Commands Receivable/Not Receivable.)

7. COMMAND

1) System Command

Code (hex)	Code (Decimal)	Command	Abbreviation	Data Length (byte)	Page	Axis Designation	Initial Value (hex)
01	1	Initialization	INI	0	7-6	NO	—
02	2	Parameter Clear	P.CLR	0	7-6	NO	—
03	3	Parameter Save	P.Save	0	7-6	NO	—
04	4	Parameter Load	P.Load	0	7-6	NO	—
10	16	Response Time	R.Time	1	7-6	NO	7
11	17	Soft Switch	S.SW	4	7-7	OK	8,0,4,0
13	19	Initializing Motion	RST.MOV	1	7-8	OK	0
14	20	Alarm Detection Condition	ALM	4	7-9	OK	8,215,1E
15	21	Status Transition at Alarm	ALM.Act	1	7-9	NO	0
16	22	Input/Output Port Function	I/O	14 (d)	7-10	NO	0
1B	27	Program Length	PRG	1	7-13	NO	0
1F	31	User Memory	MEM	8	7-13	NO	0

2) Direct Command

Code (hex)	Code (Decimal)	Command	Abbreviation	Data Length (byte)	Page	Axis Designation	Initial Value (hex)
20	32	Power Limit	P.L	3	7-14	OK	B2,FF,B2
21	33	Gain Parameter	Gain	1	7-14	OK	0
22	34	Low Pass Filter	LPF	1	7-14	OK	0
24	36	Deceleration Timing	Hosei	2	7-15	OK	0,1
25	37	Hard Stop, Time	MS.Time	1	7-15	OK	0F
26	38	Hard Stop, Velocity	MS.Vel	1	7-15	OK	2
2B	43	Modulo enabled	Modulo	1		OK	Disable
2C	44	Modulo value	Modulo value	4		OK	320h
2D	45	Modulo rotational direction	Modulo DIR	1		OK	2
30	48	In-Position	IN-POS	4	7-15	OK	4
31	49	ZONE Output	ZONE	8	7-16	OK	0,0
32	50	+ Software Limit	+S.LIM	4	7-16	OK	Maximum
33	51	- Software Limit	-S.LIM	4	7-16	OK	Maximum
34	52	Preset Absolute Position	CNT.RST	4	7-17	OK	-
35	53	Holding Brake Control	Br.Ena	1	7-17	OK	1
36	54	Move, Velocity Setting	Vel	1	7-17	OK	2
37	55	Move, Acceleration/Deceleration Setting	ACC	2	7-17	OK	1,1

7. COMMAND

Code (hex)	Code (Decimal)	Command	Abbreviation	Data Length (byte)	Page	Axis Designation	Initial Value (hex)
38	56	Relative Position Move Command 1(Move only)	INC.MOV1	4	7-18	OK	-
3A	58	Absolute Position Move Command 1(Move only)	ABS.MOV1	4	7-19	OK	-
3B	59	Relative Position Move Command (Velocity, Acceleration/Deceleration, Hard Stop, In-Position)	INC.MOV2	14 (d)	7-20	OK	-
3D	61	Absolute Position Move Command 2 (Velocity, Acceleration/Deceleration, Hard Stop, In-Position)	ABS.MOV2	14 (d)	7-21	OK	-
40	64	SCAN Move Command	SCAN	5	7-22	OK	-
41	65	SCAN Stop Command	SCAN.ST	0	7-22	OK	-
42	66	Relative Position Move Command (Velocity, Acceleration/Deceleration, Hard Stop Option)	INC.MOV3	10 (d)	7-23	OK	-
44	68	Absolute Position Move Command (Velocity, Acceleration/Deceleration, Hard Stop Option)	ABS.MOV3	10 (d)	7-4	OK	-
45	69	Return-to-Origin Command	ORG.MOV	10 (d)	7-25	OK	-
47	71	Deviation Clear	Dev.CLR	0	7-27	OK	-
48	72	Pause Command	Pause	0	7-27	OK	-
49	73	Pause Clear	PauseCLR	0	7-27	OK	-
4A	74	Alarm Clear	ALM.CLR	0	7-27	OK	-
4B	75	Bit OUT	Bit.OUT	1	7-27	NO	-
4C	76	STOP Command	STOP	0	7-28	NO	-
4D	77	STOP Clear	STOP.CLR	0	7-28	NO	-
4E	78	Interlock Command	Interlock	0	7-28	OK	-
4F	79	Interlock Clear	Int.CLR	0	7-28	OK	-

7. COMMAND

3) Four Axis Batch Command

Code (hex)	Code (Decimal)	Command	Abbreviation	Data Length (byte)	Page	Program Designation
70	112	Relative Move Command (Move only)	INC4Mov1	16 (d)	7-30	NO
71	113	Absolute Move Command (Move only)	ABS4Mov1	16 (d)	7-31	NO
72	114	Relative Move Command (Velocity, Acceleration/Deceleration option)	INC4Mov2	28 (d)	7-32	NO
73	115	Absolute Move Command (Velocity, Acceleration/Deceleration option)	ABS4Mov2	28 (d)	7-33	NO

4) Point/Program Command

Code (hex)	Code (Decimal)	Command	Abbreviation	Data Length (byte)	Page	Axis Designation	Program Designation
50	80	Point/PRG START	START	0	7-34	NO	NO
51	81	STEP Operation	STEP	3	7-34	NO	NO
52	82	Program Stop	PRG.STOP	0	7-34	NO	NO
55	85	Start Object Designation	TARGET	2	7-35	NO	NO
56	86	POINT Store	POINT.STR	n	7-35	NO	NO
57	87	Program Store	PRG.STR	n	7-36	NO	NO
60	96	Program End	P.END	0	7-37	NO	OK
61	97	Timer Wait	TIMER	2	7-37	NO	OK
62	98	In-Position JUMP	IN-POSJ	3	7-37	OK	OK
63	99	In-Port JMP	In-PortJ	4	7-38	NO	OK
64	100	ZONE JMP	ZONE-J	3	7-38	OK	OK
65	101	Actual Position JMP	A-PosJ	7	7-39	OK	OK
66	102	Unconditional Jump	JMP	2	7-39	NO	OK
67	103	Motor Stop Jump	Mstop J	3	7-40	OK	OK
6A	106	Loop Counter (FOR)	FOR	2	7-40	NO	OK
6B	107	Loop Counter (NEXT)	NEXT	1	7-40	NO	OK
6C	108	Sub-routine Call	GOSUB	2	7-41	NO	OK
6D	109	Return	Return	0	7-41	NO	OK

7. COMMAND

5) RD Command

Code (hex)	Code (Decimal)	Command	Abbreviation	Data Length (Byte)	Page	Axis Designation
80	128	Parameter Read	P.RD	1	7-42	OK
81	129	Point Data Read	Point.RD	1	7-42	NO
82	130	Program Data Read	PRG.RD	3	7-42	NO
83	131	Amplifier Status Read	STATUS	0	7-43	OK
84	132	Absolute Position Read	ABS.RD	0	7-44	OK
85	133	Velocity Monitor	Vel.MON	0	7-44	OK
86	134	ALMCode	ALMCode	0	7-44	OK
87	135	Communication Error 1	Com.ERR1	0	7-45	NO
88	136	Communication Error 2	Com.ERR2	0	7-45	NO
89	137	Software Revision	Soft.REV	0	7-45	NO
8A	138	Program Stop Line	PRG.LINE	0	7-45	NO
8B	139	Power Supply Voltage Read	E.MON	0	7-46	NO
8C	140	Loop Counter Read	CNT.RD	0	7-46	NO
8D	141	Input/Output Status Read	I/O.MON	0	7-46	NO
8E	142	Axis Designation Read	AXIS	0	7-47	NO

7. COMMAND

7.2 System Command

Refer to 6.5 for of memory access details of command codes 01 to 04.

Command Code : 01h

Data Length : 0 byte

Initialization	INI
Initializes the amplifier status same as when the power supply is turned on. Parameters that were saved in non-volatile memory are loaded in RAM. * Communication is unstable in 2s after initialization. * Note that, if Parameter Save (03h) is not executed after changing parameter, the power supply will be shut off or the parameter is not saved due to the execution of this command.	

Command Code : 02h

Data Length : 0 byte

Parameter Clear	P.CLR
Initializes the parameters to the values at shipment. Point data and program data are all cleared. * Parameters on RAM are initialized. In case of initializing parameters on ROM, command the Parameter Save Command (03h).	

Command Code : 03h

Data Length : 0 byte

Parameter Save	P.Save
Parameters on RAM are saved in non-volatile memory. * When changing optional parameters, their values on RAM are changed. Note that the values are not saved without execution of Parameter Save.	

Command Code : 04h

Data Length : 0 byte

Parameter Load	P.Load
Parameters saved in non-volatile memory are loaded in RAM. *Same as when the power supply is turned on and commanding initialization.	

Command Code : 10h

Data Length : 1 byte

Response Time				R.Time				
Set Range	n=0 to 7		Default Value	0				
Set Data	T1=500μsec×2 ⁿ T2=2×T1 T3=2×T2							
Refer to:	Chapter 6							
Sets the response time of amplifier status. The set value becomes effective beginning from the return to this command.								
DAT NO	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
DAT1	*	*	*	*	*	Response Time		
*If 0 is designated, the status right after receive will be returned. Note that the amplifier status may not be reflected on the return data.								
*In case of other data than 0, amplifier status is reflected on the return data.								

7. COMMAND

Command Code : 11h

Data Length : 4 byte

Command: 0000

Soft Switch:DAT1 Default Value : 08h

① Motor Type (DAT1 bit0~2)

Motor type varies depending on the set value of excitation current.

Bit			Excitation Current (DAT4)		
Bit2	Bit1	Bit0	3A	2A	1A
0	0	0	565	423	282
0	0	1	503	503	422
0	1	0	603	565	284
0	1	1	604	(421)	—

() : Custom Motor

② Resolution (DAT1 bit3~5)

Bit5	Bit4	Bit3	Resolution (P/R)
0	0	0	200
0	0	1	800
0	1	0	1600
0	1	1	3200
1	0	0	6400
1	0	1	12800
1	1	0	12800
1	1	1	12800

Soft Switch:DAT3 Default Value : 0

Selects the input function allocated to CN4 to 7, 11 and 13 pins. The pin 11 automatically functions as return-to-origin sensor in case of return-to-origin operation (Type 1 and 2).

Set Value	Function of pin 11	Function of pin 13
0	Positive direction H.Limit	Positive direction H.Limit
1	Negative direction H.Limit	Negative direction H.Limit
2	Limit disabled	Limit disabled
3	Setting inhibited	Setting inhibited

- * If the same direction Limit is designated for pins 11 and 13, command error occurs.
- * After return-to-origin is complete, the origin sensor (pin 11) functions as Limit sensor if hardware limit function is selected. Make sure to turn the sensor signal off by setting a grid shift at return-to-origin execution.

7. COMMAND

Selects the input port function allocated to CN2,3 pin 7. Since connected by daisy chain, this functions as input function common to all axes.

Bit6 Set Value	EXE2 Function
0	STOP input
1	EXE input

Soft Switch:DAT4 Default Value : 0

④ Sets the excitation current.

Bit1	Bit0	Excitation Current
0	0	1 A
0	1	2 A
1	0	3 A
1	1	Setting inhibited.

Command Code : 13h

Data Length : 1 byte

Initialization <i>RST.MOV</i>			
Setting Range	0 to 1	Default Value	0
Setting Data	0=With weight load (Motion angle : 8 degrees max.) 1=Without weight load (Motion angle : 3.2 degrees max.)		
Refer to:	5.1		

Defines the method of initializing motion.

When the power supply is turned on, the PB system operates the motor within the specified range, which varies depending on the initialization type. If the motor hits the machine ends or if the weight load is applied, set 0. If not, set 1. See the allowable load as follows. Make sure to use the machine within the range.

Allowable Load

Motor Model	Inertia ($\times 10^{-4} \text{kg} \cdot \text{m}^2$)	Friction Load (N · m)	Unbalance Load (N · m)
PBM282D□ * 20	0.08	0.013	0.009
PBM284D□ * 20	0.16	0.036	0.024
PBM423D□ * 20	0.56	0.12	0.08
PBM503D□ * 20	1.2	0.17	0.11
PBM565D□ * 2 *	3.6	0.32	0.21
PBM603D□ * 20	4	0.39	0.26
PBM604D□ * 20	8.4	0.57	0.38

* If the status is not in STOP or ALM after the power supply is turned on, initialization is automatically executed. When initialization is normally complete, the amplifier switches to Servo ON. Initialization takes maximum of 2 seconds.

7. COMMAND

Command Code : 14h

Data Length : 4 byte

ALM Detection Condition								ALM
Sets the permission, inhibition and conditions of Alarm Detection.								
DAT1 : Sets the detection time for Load Stop (Stop continuing with target position not reached)								
DAT2、DAT3 : Sets the conditions for Servo error detection.								
DAT4 : Sets the permission and inhibition of optional alarm and Soft Limit detection.								
DATA NO	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
DAT1	*				Overload stop time			
DAT2	Maximum value of excessive deviation (Lower Byte)							
DAT3	Maximum value of excessive deviation (Higher Byte)							
DAT4	*	*	*	SL-	SL+	SE	Push	Wrap

ALM Detection Condition: DAT1 Default Value:8

Setting Unit:1s/LSB

Setting Range:1 to Ch

* Does not detect at Hard Stop motion and when Power Limit set value (20h, DAT2) is B2h or under at operation.

ALM Detection Condition: DAT2, DAT3 Default Value:215h)

Detection Condition: Detects when the revolution direction command and actual motion are reverse, which is equivalent to position deviation.

Setting Unit: 1PLS/LSB (equivalent to 800P/R)

Setting Range: 1 to FFFFh

* Detection is permitted when DAT4, Bit2=0.

ALM Detection Condition: DAT4 Default Value:1Eh

Setting Value: 0=Detection permitted. 1=Detection inhibited.

WRAP: Sets the ALM detection permit/inhibit when Wrap Around (coordinate codes reversed) occurs.

* Set 1 when continuous movement in one direction is needed.

Push: Sets the ALM detection permit/inhibit when the target position set by the Hard Stop move is reached at Hard Stop.

SE: Sets the permit/inhibit of servo error detection due to excessive deviation. If permitted, monitoring is performed by the detection conditions set at DAT2,3.

SL+: Sets +Soft Limit function permit (effective)/inhibit (ineffective) which is set by command 32h.

SL-: Sets - Soft Limit function permit (effective)/inhibit (ineffective) which is set by command 33h.

Command Code : 15h

Data Length : 1 byte

ALM Status Transition				ALM.Act
Setting Range	0 to 1	Default Value	0	
Setting Data	0=All axes stop when alarm occurs in one axis. 1=No transition to alarm status except for the axis where alarm occurs.			
Defines the status transition of the other axes than the one where alarm occurs.				

7. COMMAND

Command Code : 16h

Data Length : 14 (d) byte

Input/Output Port Function								I/O
Sets Input/Output logic of CN1 and Function. DAT1 : Input Signal Logic DAT2 : Output Signal Logic DAT3~DAT6 : Input Port Function DAT7~DAT14(D) : Output Port Function								
DATA NO	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
DAT1	*	*	Limit	CN2,3 STOP	*	ALMCLR	STOP	SELECT
DAT2	*	*	*	*	*	*	*	ALM
DAT3~6	Input Port Function Axis Selection				Input Port Function Selection			
DAT7~14	Output Port Function Axis Selection				Output Port Function Selection			

Input Signal Logic: DAT1 Default Value:0

Bit No	Signal	Function	Setting	
			0	1
Bit0	SELECT	CN1 EXE (Point/PRG)selection signal logic setting	ON=PRG OFF=Point	ON=Point OFF=PRG
Bit1	CN1 STOP	CN1 STOP input logic setting	A contact (ON=STOP)	B contact (OFF=STOP)
Bit2	ALMCLR	CN1 ALMCLR input logic setting	A contact (ON=ALMCLR)	B contact (OFF=ALMCLR)
Bit4	CN2,3 STOP	When EXE2 Function Selected STOP(Command=11)	A contact (Hi Active)	B contact (Lo Active)
Bit5	Limit	CN4~7 Limit input logic setting	A contact (Hi Active)	B contact (Lo Active)

Output Signal Logic : DAT2 Default Value : 0

Bit No	Signal	Function	Setting	
			0	1
Bit0	ALM	CN1 ALM output logic setting	A contact (ON=ALM)	B contact (OFF=ALM)

7. COMMAND

Command Code : 16h

Data Length : 14 (d) byte

Input/Output Port Function –Continued-

I/O

Input Port Function:DAT3 to DAT6 Default Value : 0

Sets the function for each input port of CN1. The following input Port is allocated to DAT No.

- DAT3=IN1 (pin 8) 、 DAT4=IN2 (pin 9) 、 DAT5=IN3 (pin 10) 、 DAT6=IN4 (pin 11)

Data Type

Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
Axis Selection : Selects axis for each function. 0=All axes、 1=Axis 1、 2=Axis 2、 3=Axis 3、 4=Axis 4				Function selection : Refer to the table below. * Axis selection is ignored depending on the function.			

Function Selection

Set Value	Function	Axis Setting	Notes
0	Point Input Function	Disabled	Point 5 to 8 are fixed allocation to CN1, pins 8 to 11. * In case of other functions than Point, its input Port is treated as Point Recognition "0".
1	General Purpose Input Function	Disabled	General purpose input 1 to 4 are fixed allocation to CN1, pins 8 to 11.
2	Pause Input Function	Enabled	This functions as Pause Input for all axes or a specific axis.
3	Interlock Input Function	Enabled	This functions as interlock input for all axes or a specific axis.

7. COMMAND

Command Code : 16h

Data Length : 14 (d) byte

Input/Output Port Function –Continued-

I/O

Output Port Function : DAT7 to 14 (d) Default Value : 0

Sets the function for each output Port. The following output Port are allocated to DAT No.

- DAT7 to DAT14(D) is allocated to OUT1 to OUT8.

Data Type

Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
Axis selection : Selects axis for each function. 0=All axes、1=Axis 1、2=Axis 2、3=Axis 3、 4 =Axis 4				Function Selection : Refer to the table below. * Axis selection is ignored depending on the function.			

Function

Set Value	Function	Axis Setting	Notes
0	General Purpose Input	Disabled	Out 1 to 8 are allocated to CN1、 pins 22 to 28. * General purpose output operation by Bit Out Command is disabled for other function setting Port than general purpose output.
1	In-Position	Enabled	In-position signal output function for all axes or for a specific axis. When all axes are designated, it outputs under AND condition of effective axis.
2	H.Limit Monitor	Enabled	H. Limit monitoring function for all axes or for a specific axis. Outputs when H.Limit function is enabled. When a specific axis is designated, it outputs under OR condition of the two H.Limit, and when all axes are designated, it outputs under OR condition of all axes.
3	ZONE Output	Enabled	Zone signal output function for all axes or for a specific axis. When all axes are designated, it outputs under And condition of all axes.
4	Return-to-origin Complete	Enabled	Return-to-origin complete signal output function for all axes or for a specific axis. When all axes are designated, it outputs under And condition of all axes.
5	END Signal	Enabled	END signal output function for all axes or for a specific axis. When all axes are designated, it outputs under And condition of all axes.
6	STOP Monitor	Disabled	Monitors the STOP signal input status.
7	SDN Monitor	Enabled	Monitors the SDN signal input status. (A Limit1 input signal: CN4 to 7, the 11th pin)

7. COMMAND

Command Code : 1Bh

Data Length : 1 byte

Program Length				PRG
Setting Range	0 to 1	Default Value	0 (256PRG×16Line)	
Setting Data	0=256PRG×16Line 1=8PRG×512LINE			
Selects the number of programs.				

Command Code : 1Fh

Data Length : 8 byte

User Memory		MEM	
Setting Range	0 to FFh	Default Value	0
An open 8Byte memory area is provided for users to use for data management or else. Command data is storable in non-volatile memory by executing Command Code03:Parameter Save. The data is readable by commanding 1F at command code of 80h.			

7. COMMAND

7.3 Direct Command

Command Code : 20h

Data Length : 3 byte

Power Limit								P.Limit
Setting Range	0 to FFh			Default Value	P.Limit1,2,3=B2h,FFh,B2h			
The power limit value (motor excitation current limit value) of each amplifier status can be set by this parameter.								
DATA NO	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
DAT1	P.Limit 1 : Idle current when positioning is completed at servo ON status.							
DAT2	P.Limit 2 : Current upper limit value while the motor is running.							
DAT3	P.Limit 3 : Current limit at ALM or STOP status.							
Expression								
* P.Limit2 : Setting Current(A)= (Setting Value(d)/255) ×Rated Current								
* P.Limit1,3 : Setting Current(A)= (Setting Value(d)/255) ×Rated Current×0.7								

Command Code : 21h

Data Length : 1 byte

Gain Parameter							Gain
Setting Range	0 to Fh			Default Value	0		
Refer to:	5.3						
Selects the gain parameter from the following preset value.							
	Low	←	Gain	→	High		
	Short	00h	03h	06h	09h	0Ch	0Eh
Time Constant	Medium	01h	04h	07h	0Ah	0Dh	0Fh
	Long	02h	05h	08h	0Bh		

Command Code : 22h

Data Length : 1 byte

Low Pass Filter				LPF
Setting Range	0 to 3	Default Value	0	
Refer to:	5.3			
This is a low pass filter for velocity loop. When the rigidity of the machine is low, this is effective to prevent resonance. If cut-off frequency is too low, the response gets worse.				
Setting Value		Cut-off Frequency		
0		220Hz		
1		80		
2		40		
3		20		

7. COMMAND

Command Code : 24h

Data Length : 2 byte

Deceleration Timing								HOSEI
Refer to:	5.3							
This parameter revises the starting point of deceleration that is calculated in the amplifier. When the setting is larger, the deceleration starts slower. This command is useful when the application needs soft stop.								
DATA NO	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
DAT1	*							Valid/Invalid
DAT2	Coefficient of Deceleration							
DAT1 : 0 = Predefined deceleration 1 = DAT2 set value is valid.								
DAT2 : 1PLS/LSB (Equivalent to 800P/R) Setting Range : 1 to FFh								

Command Code : 25h

Data Length : 1 byte

Hard Stop, Time				MS.Tim
Setting Range	0 to FFh	Default Value	Fh (150ms)	
Setting Unit	10msec／LSB			
Refer to:	5.4.2			
Set the Hard Stop completion time for Hard Stop return-to-origin and Hard Stop operation. The time is counted from the current reached to the Hard Stop current limit value.				

Command Code : 26h

Data Length : 1 byte

Hard Stop, Velocity				MS.Vel
Setting Range	0 to F0h	Default Value	2 (37.5min ⁻¹)	
Setting Unit	18.75min ⁻¹ ／LSB			
Refer to:	5.4.2			
Set the Hard Stop velocity. Please set the velocity considering the impact when the load hits the work point.				

7. COMMAND

Command Code : 2Bh

Data Length : 1 byte

Modulo Enable										MODJURO ENA
Refer to:		5.4.4								
Enables or disables the modulo function. When enabled, absolute move commands perform modulo operation.										
* When modulo is enabled, the target position should be set in the following range:										
0 ≤ Target position ≤ Modulo value -1										
DATA NO	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0		
DAT1	*								有効/無効	
DAT1 : 0=Modulo function disabled; 1=Modulo function enabled										

Command Code : 2Ch

Data Length : 4 byte

Modulo Value				MJ.CNT
Setting range	50 ~ 134217727 (800 p/r)	Initial Value	Equivalent of 1 rotation	
Setting unit	800P/R			
Sets the modulo pulse number per rotation.				
* Coordinate setting is not possible for the negative direction.				

Command Code : 2Dh

Data Length : 1 byte

Modulo Direction				MJ.DIR
Setting range	0 ~ 2	Initial Value	2 (Shortcut)	
Sets the direction of the modulo operation.				
0=Negative direction				
1=Positive direction				
2=Shortcut				

7. COMMAND

Command Code : 30h

Data Length : 4 byte

In-Position				In-Pos
Setting Range	0 to 7FFFFFFh	Default Value	4	
Setting Unit	0.45degree/LSB (Motor shaft rotation angle)			
Set the in-position width. When the motor reaches this range, in-position output turns on. • This function is allocated by command 16h output Port function setting in CN1 general purpose output. ＊This setting is valid for move commands that do not have their own in-position setting.				

Command Code : 31h

Data Length : 8 byte

ZONE			Zone
Setting Range	Depends on the set resolution. : ①	Default Value	0,0 (No output)
Setting Unit	360degrees/Resolution Set Value (The value which is set by command code 11h, DAT1.)		

Sets the absolute position range where Zone signal outputs. Outputs when the motor position is within the set coordinate. This function is useful for monitoring work position.

- Input the commands in order from X to Y. (x < y)

-Negative End

Coordi

ZONE

X

Y

+Positive End

Resolution	Positive End (Max.)	Negative End (Min.)
200	1FFFFFF	FE000001
800	7FFFFFF	F8000001
1600	FFFFFFF	F0000001
3200	1FFFFFFF	E0000001
6400	3FFFFFFF	C0000001
12800	7FFFFFFF	80000001

* Zone output is not a short-cut control output.

* The range includes the set value.

* This function is allocated by command 16h output Port function setting in CN1 general purpose output.

7. COMMAND

Command Code : 32/33h

Data Length : 4 byte

+ Software Limit / — Software Limit			±S.Lim
Setting Range	Depends on the set resolution : ①	Default Value	Maximum Value
Setting Unit	360degrees / Resolution Set Value (The value which is set by command code 11h, DAT1.)		
Sets the software limit absolute position. This function is valid when permitted by command code 14h.			
(Detection Condition)		①Setting Range	
• When optional move command is received.			
If the target position exceeds the Limit, the Amplifier issues a command error and the command is not executed.			
• SCAN Move			
When actual position exceeds the Limit, the motor decelerates to stop. Command to the Limit direction becomes an error. Command to the opposite direction of Limit is normally received.			
• Return-to-origin Move			
Does not monitor Limit when return-to-origin is incomplete and during return-to-origin move.			

7. COMMAND

Command Code : 25h

Data Length : 4 byte

Preset Absolute Position			CNT.RST
Absolute position counter in the amplifier is preset. The setting range varies depending on the resolution set value.			
Setting Range			
Resolution	Positive End	Negative End	
200	1FFFFFF	FE000001	
800	7FFFFFF	F8000001	
1600	FFFFFFF	F0000001	
3200	1FFFFFFF	E0000001	
6400	3FFFFFFF	C0000001	
12800	7FFFFFFF	80000001	

Command Code : 35h

Data Length : 1 byte

Command Code		Data Length	Unit
Holding Brake Control			Br.Ena
Setting Range	0,1	Default Value	1
Set Value	0=Release 1=Brake		
This command controls the holding brake at servo off (including alarm, stop) status.			
*When executing this command during servo on, command error occurs and the holding brake remains released.			

Command Code : 36h

Data Length : 1 byte

Command		Data		Length	Byte
Velocity					Vel
Setting Range	0 to F0h	Default Value	2 (37.5min ⁻¹)		
Setting Unit	18.75min ⁻¹ / LSB				
This command is used for driving velocity of command codes 38, 3A, E0 and E1, or for velocity change during optional drive.					

Command Code : 37h

Data Length : 2 byte

Acceleration/Deceleration Setting					Acc			
Setting Range	1 to FFh		Default Value		1,1			
Setting Unit	61.23rad/s ² (0.585min ⁻¹ /ms/LSB)							
This command is used for acceleration/deceleration speed of command codes 38, 3A, E0, E1 and return-to-origin, or for acceleration/deceleration speed change during drive.								
DATA NO	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
DAT1	Acceleration							
DAT2	Deceleration							

7. COMMAND

Code : 38h

Data Length : 4 byte

Relative Move Command(Without Option)				INC.MOV1
Setting Range	Depends on the resolution.	Default Setting	-	
Setting Unit	360degrees/Resolution Set Value (The value which is set by command code 11h, DAT1.)			

Set the relative move distance. The rotation direction is decided by + or – of the move command.

(+=Positive Direction, -=Negative Direction)

Velocity and acceleration/deceleration are set by the set values of command codes 36, 37h.

DATA NO	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
DAT1	Relative Move Distance (Lowest Byte)							
DAT2	Relative Move Distance (Lower Byte)							
DAT3	Relative Move Distance (Higher Byte)							
DAT4	Relative Move Distance (Highest Byte)							

Setting Range (Depends on the resolution.)

Resolution	Positive END	Negative End
200	1FFFFFFF	FE000001
800	7FFFFFFF	F8000001
1600	FFFFFFF	F0000001
3200	1FFFFFFF	E0000001
6400	3FFFFFFF	C0000001
12800	7FFFFFFF	80000001

- * When a relative position move command is input while the motor is running by absolute position move command, the relative move distance is reflected on the target position which was set by absolute position command.
- * This is a command that sets only a relative move distance without option to command codes 3B, 42h. When commands are added while the motor is running by velocity or acceleration/deceleration move commands, the velocity and acceleration/deceleration set value of command code 36h, 37h are valid.

7. COMMAND

Command Code : 3Ah

Data Length : 4 byte

Absolute Position Move Command (Without Option)

ABS.MOV1

Setting Range	Depends on resolution	Default Value	-
Setting Unit	360degrees/Set Resolution Value (The value which is set by command code 11h, DAT1.)		

Sets the absolute move distance. Rotation direction is decided by the present position and the command position.

Command Position > Present Position : + Positive Direction

Command Position < Present Position :- Negative Direction

Velocity and acceleration/deceleration are set by the set values of command codes 36, 37h.

DATA NO	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
DAT1	Absolute Move Distance (Lowest Byte)							
DAT2	Absolute Move Distance (Lower Byte)							
DAT3	Absolute Move Distance (Higher Byte)							
DAT4	Absolute Move Distance (Highest Byte)							

Setting Range (Depends on the resolution.)

Resolution	Positive End	Negative End
200	1FFFFFFF	FE000001
800	7FFFFFFF	F8000001
1600	FFFFFFF	F0000001
3200	1FFFFFFF	E0000001
6400	3FFFFFFF	C0000001
12800	7FFFFFFF	80000001

* This is a command that sets only an absolute move distance without option to command codes 3d, 44h. When commands are issued while the motor is running by velocity or acceleration/deceleration move commands, the velocity and acceleration/deceleration set value of command code 36h, 37h are valid.

* Does not perform short-cut control.

7. COMMAND

Command Code : 3Bh

Data Length : 14(d) byte

Relative Position Move Command (Velocity, Acceleration/Deceleration, Hard Stop, In-Position) NC.MOV2

This command includes optional functions of velocity, acceleration/deceleration, Hard Stop and In-Position settings. The rotation direction is decided by +/- of the move command.

(+ = Positive Direction, - = Negative Direction.)

DATA NO	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
DAT1	Velocity (Setting Range : 0 to F0h Setting Unit : $18.75\text{min}^{-1}/\text{LSB}$)							
DAT2	Acceleration (Setting Range : 1to FFh Setting Unit : $61.23\text{rad}/\text{s}^2$ ($0.585\text{min}^{-1}/\text{ms}/\text{LSB}$))							
DAT3	Deceleration (Setting Range : 1to FFh Setting Unit : $61.23\text{rad}/\text{s}^2$ ($0.585\text{min}^{-1}/\text{ms}/\text{LSB}$))							
DAT4	Relative Move Distance (Lowest Byte)							
DAT5	Relative Move Distance (Lower Byte)							
DAT6	Relative Move Distance (Higher Byte)							
DAT7	Relative Move Distance (Highest Byte)							
DAT8	Hard Stop Current Limit (Setting Range : 0to FFh Set Value : 0=Without Hard Stop/ 1 to FF : Current Limit at Hard Stop)							
DAT9	Hard Stop Move Distance (Lower Byte)							
DAT10	Hard Stop Move Distance (Higher Byte)							
DAT11	In-Position Width (Lowest Byte)							
DAT12	In-Position Width (Lower Byte)							
DAT13	In-Position Width (Higher Byte)							
DAT14	In-Position Width (Highest Byte)							

Data Setting Range

Resolution	Relative Move Distance		Hard Stop	In-Position Width
	Positive Direction	Negative Direction	* Same direction same as Relative Move Command.	Setting Unit is fixed to 0.45 degree base.
200	1FFFFFFF	FE000001	3FF	0 to 7FFFFFFh
800	7FFFFFFF	F8000001	FFF	
1600	FFFFFFF	F0000001	1FFF	
3200	1FFFFFFF	E0000001	3FFF	
6400	3FFFFFFF	C0000001	7FFF	
12800	7FFFFFFF	80000001	FFFF	

* This cannot be used in program.

* When a relative position move command is input while the motor is running by absolute position move command, the relative move distance is reflected on the target position which was set by absolute position command.

7. COMMAND

Command Code : 3Dh

Data Length : 14(d) byte

Absolute Move Command (Velocity, Acceleration/Deceleration, Hard Stop, In-Position)

ABS.MOV2

This command includes optional functions of velocity, acceleration/deceleration, Hard Stop, In-Position settings.

The rotation direction is decided by the present position and command position.

Command position > Present position : Positive Direction

Command position < Present position : Negative Direction

DATA NO	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
DAT1	Velocity (Setting Range : 0 to F0h Setting Unit : $18.75\text{min}^{-1}/\text{LSB}$)							
DAT2	Acceleration (Setting Range : 1 to FFh Setting Unit : $61.23\text{rad}/\text{s}^2$ ($0.585\text{min}^{-1}/\text{ms}/\text{LSB}$))							
DAT3	Deceleration (Setting Range : 1 to FFh Setting Unit : $61.23\text{rad}/\text{s}^2$ ($0.585\text{min}^{-1}/\text{ms}/\text{LSB}$))							
DAT4	Absolute Move Distance (Lowest Byte)							
DAT5	Absolute Move Distance (Lower Byte)							
DAT6	Absolute Move Distance (Higher Byte)							
DAT7	Absolute Move Distance (Highest Byte)							
DAT8	Hard Stop Current Limit (Setting Range : 0 to FFh Set Value : 0=Without Hard Stop 1 to FF : Current Limit at Hard Stop)							
DAT9	Hard Stop Move Distance (Lower Byte)							
DAT10	Hard Stop Move Distance (Higher Byte)							
DAT11	In-Position Width (Lowest Byte)							
DAT12	In-Position Width (Lower Byte)							
DAT13	In-Position Width (Higher Byte)							
DAT14	In-Position Width (Highest Byte)							

Data Setting Range

Resolution	Absolute Move Distance		Hard Stop Move Distance	In-Position Width
	Positive End	Negative End	* Same direction as the move command.	Setting Unit is fixed to 0.45 degree base.
200	1FFFFFFF	FE000001	3FF	0 to 7FFFFFFh
800	7FFFFFFF	F8000001	FFF	
1600	FFFFFFF	F0000001	1FFF	
3200	1FFFFFFF	E0000001	3FFF	
6400	3FFFFFFF	C0000001	7FFF	
12800	7FFFFFFF	80000001	FFFF	

* This cannot be used in program.

7. COMMAND

Command Code : 40h

Data Length : 5(d) byte

SCAN Move Command

SCAN

This is a jog command to run the motor continuously.

DATA NO	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
DAT1	*							Direction
DAT2	Velocity (Setting Range : 0 to F0h Setting Unit : $18.75\text{min}^{-1}/\text{LSB}$)							
DAT3	Acceleration (Setting Range : 1 to FFh Setting Unit : $61.23\text{rad}/\text{s}^2$ ($0.585\text{min}^{-1}/\text{ms}/\text{LSB}$))							
DAT4	Deceleration (Setting Range : 1 to FFh Setting Unit : $61.23\text{rad}/\text{s}^2$ ($0.585\text{min}^{-1}/\text{ms}/\text{LSB}$))							
DAT5	Hard Stop Current Limit (Setting Range : 0 to FFh Set Value : 0=Without Hard Stop / 1 to FF : Current Limit at Hard Stop)							

DAT1:0=Positive Direction 1=Negative Direction

- * When Hard Stop current limit is set as other than 0, overload detection error is not detected during SCAN move.
- * When the application needs a continuous rotation or one direction rotation, set the command code as 14h, DAT4, bit0=0, and wrap around as permission.
- * When the actual position reaches the Soft Limit range during SCAN move, the motor decelerates and stops.
- * Hard Stop complete can be recognized by the motor stop signal output or END signal. In-position signal remains in move.
- * When Hard Stop is moving by SCAN operation, Hard Stop move error is not detected.

Command Code : 41h

Data Length : 0 byte

SCAN Move Stop

SCAN.ST

This is a stop command of SCAN Move.

When this command is issued during SCAN Move, the motor decelerates and stops, and the stopped position is set as target position.

7. COMMAND

Command Code : 42h

Data Length : 10(d) byte

Relative Position Move Command(With Velocity, Acceleration/Deceleration Hard Stop Settings)

INC.MOV3

This relative position move command includes additional functions of velocity, acceleration/deceleration, Hard Stop function settings. Rotation direction is decided by +/- of the move command. (+=Positive Direction, -=Negative Direction)

DATA NO	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
DAT1	Velocity (Setting Range : 0~F0h Setting Unit : $18.75\text{min}^{-1}/\text{LSB}$)							
DAT2	Acceleration (Setting Range : 1~FFh Setting Unit : $61.23\text{rad}/\text{s}^2$ ($0.585\text{min}^{-1}/\text{ms}/\text{LSB}$))							
DAT3	Deceleration (Setting Range : 1~FFh Setting Unit : $61.23\text{rad}/\text{s}^2$ ($0.585\text{min}^{-1}/\text{ms}/\text{LSB}$))							
DAT4	Relative Move Distance (Lowest Byte)							
DAT5	Relative Move Distance (Lower Byte)							
DAT6	Relative Move Distance (Higher Byte)							
DAT7	Relative Move Distance (Highest Byte)							
DAT8	Hard Stop Current Limit (Setting Range : 0~FFh Set Value : 0=Without Hard Stop/ 1~FF : Current Limit at Hard Stop,)							
DAT9	Hard Stop Move Distance (Lower Byte)							
DAT10	Hard Stop Move Distance (Higher yte)							

Data Range

Resolution	Relative Move Distance		Hard Stop Move Distance
	Positive End	Negative End	*Same direction as relative move command.
200	1FFFFFFF	FE000001	3FF
800	7FFFFFFF	F8000001	FFF
1600	FFFFFFF	F0000001	1FFF
3200	1FFFFFFF	E0000001	3FFF
6400	3FFFFFFF	C0000001	7FFF
12800	7FFFFFFF	80000001	FFFF

* When a relative position move command is input while motor is running by absolute position move command, the relative move distance is reflected on the target position which was set by absolute position command.

7. COMMAND

Command Code : 44h

Data Length : 10(d) byte

Absolute Position Move Command (Velocity, Acceleration/Deceleration, Hard Stop Settings.)

ABS.MOV3

This command includes optional functions of velocity, acceleration/deceleration, Hard Stop settings.

The rotation direction is decided by the present position and command position.

Command position > Present position : Positive Direction

Command position < Present position : Negative Direction

DATA NO	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
DAT1	Velocity (Setting Range : 0~F0h Setting Unit : $18.75\text{min}^{-1}/\text{LSB}$)							
DAT2	Acceleration (Setting Range : 1~FFh Setting Unit : $61.23\text{rad}/\text{s}^2$ ($0.585\text{min}^{-1}/\text{ms}/\text{LSB}$))							
DAT3	Deceleration (Setting Range : 1~FFh Setting Unit : $61.23\text{rad}/\text{s}^2$ ($0.585\text{min}^{-1}/\text{ms}/\text{LSB}$))							
DAT4	Absolute Move Distance (Lowest Byte)							
DAT5	Absolute Move Distance (Lower Byte)							
DAT6	Absolute Move Distance (Higher Byte)							
DAT7	Absolute Move Distance (Highest Byte)							
DAT8	Hard Stop Current Limit (Setting Range : 0~FFh Set Value : 0=Without Hard Stop/ 1~FF : Current Limit at Hard Stop)							
DAT9	Hard Stop Move Distance (Lower Byte)							
DAT10	Hard Stop Move Distance (Higher Byte)							

Data Setting Range

Resolution	Absolute Move Distance		Hard Stop Move Distance
	Positive End	Negative End	* Same direction as the move command
200	1FFFFFFF	FE000001	3FF
800	7FFFFFFF	F8000001	FFF
1600	FFFFFFF	F0000001	1FFF
3200	1FFFFFFF	E0000001	3FFF
6400	3FFFFFFF	C0000001	7FFF
12800	7FFFFFFF	80000001	FFFF

*

7. COMMAND

Command Code : 45h

Data Length : 10(d) byte

Return-to-Origin Command

ORG.MOV3

Refer to: 5.4.1

This as a Return-to-Origin command. The acceleration/deceleration follows the setting of Command Code 37h.

DATA NO	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
DAT1	*	*	*	Rotation Direction	*	Return-to-Origin Type		
DAT2	Return-to-Origin High Velocity (Setting Range : 1~F0h Setting Unit : 18.75min ⁻¹ ／LSB)							
DAT3	Return-to-Origin Low Velocity (Setting Range : 1~F0h Setting Unit : 18.75min ⁻¹ ／LSB)							
DAT4	Grid Shift Value (Lower Byte)							
DAT5	Grid Shift Value (Higher Byte)							
DAT6	Return-to-Origin Hard Stop Current Limit (Setting valid for Type3,4) (Setting Range : 1~FFh)							
DAT7	Counter Preset Value (Lowest Byte)							
DAT8	Counter Preset Value (Lower Byte)							
DAT9	Counter Preset Value (Higher Byte)							
DAT10	Counter Preset Value (Highest Byte)							

DAT1 : Return-to-Origin Type

Bit2	Bit1	Bit0	Return-to-Origin Type
0	0	0	Detect C-channel
0	0	1	Detect S D N
0	1	0	Detect S D N & C-channel
0	1	1	Hard Stop, Return-to-Origin
1	0	0	Hard Stop, Detect C-channel
Others			Setting Inhibited

DAT1 : Rotation Direction

0=Positive Direction 1=Negative Direction

Data Setting Range

Resolution	Grid Shift		Counter Preset	
	Positive End	Negative End	Positive End	Negative End
200	1FF	FE01	1FFFFFFF	FE000001
800	7FF	F801	7FFFFFFF	F8000001
1600	FFF	F001	FFFFFFF	F0000001
3200	1FFF	E001	1FFFFFFF	E0000001
6400	3FFF	C001	3FFFFFFF	C0000001
12800	7FFF	8001	7FFFFFFF	80000001

*Grid Shift value is with direction mark which decides the rotation direction.

7. COMMAND

Basic Operations of Return-to-Origin

Return-to-Origin	Operation
Detect C-channel	Detects C phase for the motor sensor (1PLS/rotation) as Origin.
Detect SDN	Recognizes the SDN signal edge connected to CN4 to CN7 pin 11 of each axis as Origin.
Detect SDN & C-channel	After recognizing the SDN signal edge connected to CN4 to CN7 pin 11 of each axis, detects the first C phase signal as Origin.
Hard Stop Return-to-Origin	Detects Hard Stop stop by machine end as Origin. * Make sure to set the direction mark of grid shift value opposite to that of Hard Stop.
Hard Stop & Detect C-channel	After detecting Hard Stop stop by machine end, moves to opposite direction and detects the first C phase signal as Origin.

Set Value Valid/Invalid Depending on the Return-to-Origin Type.

Return-to-Origin Type	Velocity	Low Velocity	Grid Shift Value	Current Limit	Preset Value
Detect C-channel	Invalid	Valid	Valid	Invalid	Valid
Detect SDN	Valid	Valid	Valid	Invalid	Valid
Detect SDN & C-channel	Valid	Valid	Valid	Invalid	Valid
Hard Stop Return-to-Origin	Valid	Valid	Valid	Valid	Valid
Hard Stop & Detect C-channel	Valid	Valid	Valid	Valid	Valid

7. COMMAND

Command Code : 47h

Data Length : 0 byte

Deviation Clear

Dev.CLR

Clears the deviation counter. The position at the time of command receipt is set as the target position.

When amplifier receives this command during motor is running, motor decelerates and returns to the position where command is issued.

- * At the time of status transition to Servo Off, the stop position becomes the target position. When an external force turns the motor, the stop position becomes the target position. (With follow-up motion when returning to Servo On)

Command Code : 48h

Data Length : 0 byte

Pause Command

Pause

Pause the motor rotation. The motor decelerates and stops with the target position kept remaining. Release the Pause Command, and motion to the target position resumes.

- * This command is effective for motion commands during program operation.
- * When Pause function is allocated in input Port, this command functions under OR condition with the command.
- * Pause input function is allocated by setting input Port function CN1 general purpose input as command 16h.

Command Code : 49h

Data Length : 0 byte

Pause Clear

Pause.CLR

Cancels Pause Command. Motion to the target position resumes at the same time as cancel.

- * When pause function of input port is active, it is unable to cancel the pause status.
- * Pause by command is canceled by edge recognition of the Pause function input status becoming Non-Active from Active.

Command Code : 4Ah

Data Length : 0 byte

Alarm Clear

ALM.CLR

Clears the alarm when an alarm occurred. This is valid to all axes. Cannot clear irrecoverable alarms. To clear irrecoverable alarms, turn on the power supply again or command initialization.

7. COMMAND

Command Code : 4Bh

Data Length : 0 byte

Bit Out				Bit Out			
Commands the output status of general purpose output port.							
Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
Out8	Out7	Out6	Out5	Out4	Out3	Out2	Out1

0 : Photo Coupler OFF 1 : Photo Coupler ON

※ General purpose output port function differs depending on the amplifier model and the settings of soft switch (DAT4:bit 0 to 4). When general purpose output function is not selected, the output status commanded here is ignored.

Command Code : 4Ch

Data Length : 0 byte

STOP Command	STOP
Commands Stop to all axes. While in optional operation, stops the motor at maximum deceleration ratio and switches amplifier status as servo off.	
* Operates under OR condition with Stop Input Port.	
* When executing program operation, the program stops.	

Command Code : 4Dh

Data Length : 0 byte

STOP Clear	STOP.Clr
When this command is issued, the stop status is canceled then amplifier status automatically switches to servo off.	
* Stop command is canceled by edge recognition of the Stop function input status becoming Non-Active from Active.	
* Input port Stop cannot be canceled by this command.	

Command Code : 4Eh

Data Length : 0 byte

Interlock Command	INT
This command interrupts the motion command. When this command is issued, motor decelerates at the set deceleration velocity and stops. The stop position is set as target position. Motor decelerates and stops with SON status remaining. During interlock motion, move command is not received.	
* Move command during interlock causes command error.	
* Initialization motion is not executed during interlock.	

Command Code : 4Fh

Data Length : 0 byte

Interlock Clear	INT.CLR
This command cancels interlock status.	
* Interlock command is canceled by edge recognition of the interlock input status becoming Non-Active from Active.	
* Input port Interlock cannot be canceled by this command.	

7. COMMAND

7.5 Four Axes Batch Command

This command issues move data for 4 axes regardless of valid/invalid of the axis. In case of point store, this is allocated to consecutive point numbers for each axis. Therefore, note that simultaneous start is unable in case of point start.

- * This command is ignored when commanded to the axis which was set invalid by dip switch.
- * Make sure to set axis designation Bit as 0 for invalid axis (higher 4 bit of address allocation Byte).
- * Axis designation by axis designation Bit is valid.

<Point Store>

In case of store, Point No. allocation is fixed as follows.

Axis No	Axis 1	Axis 2	Axis 3	Axis 4
Point No	n	n+1	n+2	n+3

- * Regardless of the axis which was set invalid by Dip Switch, or of valid/invalid setting made by higher 4 Bit of address designation Byte, the above point No. allocation is fixed. However, point data of invalid axis is not updated.

<Data Transformation at Point Store>

Command codes are transformed as follows for saving data in each point.

Be careful when reading data.

Code Transformation

Command Code	Transformed Command Code
70 (Relative Move Command, Move only)	38h
71 (Absolute Move Command, Move only)	3Ah
72 (Relative Move Command , Acceleration/Deceleration, Velocity)	42h (To be stored as without Hard Stop.)
73 (Absolute Move Command, Acceleration/Deceleration, Velocity)	44h (To be stored as without Hard Stop.)

7. COMMAND

Command Code : 70h

Data Length : 16(d) byte

4 Axes Batch Relative Move Command (Without Option) *INC.4MOV1*

Setting Range	Depends on Resolution	Default Value	-
Setting Unit	360 Degree / Set Resolution (Value set by Command Code 11h, DAT1.)		

Commands relative position move to 4 axes separately. Rotation direction is decided by +/- of the move command.

(+=Positive Direction, -=Negative Direction)

- Velocity and acceleration/deceleration follow the setting of Command Code 36, 37h.

DATA NO				Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
Axis1	Axis 2	Axis 3	Axis 4								
1	5	9	13	Relative Move Distance (Lowest Byte)							
2	6	10	14	Relative Move Distance (Lower Byte)							
3	7	11	15	Relative Move Distance (Higher Byte)							
4	8	12	16	Relative Move Distance (Highest Byte)							

Setting Range of Relative Move Distance (Depends on Resolution.)

Resolution	Positive End	Negative End
200	1FFFFFFF	FE000001
800	7FFFFFFF	F8000001
1600	FFFFFFF	F0000001
3200	1FFFFFFF	E0000001
6400	3FFFFFFF	C0000001
12800	7FFFFFFF	80000001

- * When a relative position move command is input while motor is running by absolute position move command, the relative move distance is reflected on the target position which was set by absolute position command.

7. COMMAND

Command Code : 71h

Data Length : 16(d) byte

4 Axes Batch Absolute Move Command (Without Option) **ABS.4MOV1**

Setting Range	Depends on Resolution	Default Value	-
Setting Unit	360 Degree/Set Resolution (Value set by Command Code 11h, DAT1.)		

Commands absolute position move to 4 axes separately. Rotation direction is decided by present position and command position.

Command Position > Present Position : Positive Direction

Command Position < Present Position : Negative Direction

- Velocity and acceleration/deceleration follow the setting of Command Code 36, 37h.

DATA NO				Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
Axis1	Axis2	Axis3	Axis4								
1	5	9	13	Absolute Move Distance (Lowest Byte)							
2	6	10	14	Absolute Move Distance (Lower Byte)							
3	7	11	15	Absolute Move Distance (Higher Byte)							
4	8	12	16	Absolute Move Distance (Highest Byte)							

Setting Range of Absolute Move Distance (Depends on resolution.)

Resolution	Positive End	Negative End
200	1FFFFFFF	FE000001
800	7FFFFFFF	F8000001
1600	FFFFFFF	F0000001
3200	1FFFFFFF	E0000001
6400	3FFFFFFF	C0000001
12800	7FFFFFFF	80000001

* Does not perform short-cut control.

7. COMMAND

Command Code : 72h

Data Length : 28(d) byte

4 Axes Batch Relative Move Command(Velocity, Acceleration/Deceleration Settings)

INC.4MOV2

Commands relative position move for 4 axes separately with options of velocity and acceleration/deceleration settings. Rotation Direction is decided by +/- of the Command Code. (+ = Positive Direction, - = Negative Direction)

DATA NO				Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
Axis 1	Axis 2	Axis 3	Axis 4								
1	8	15	22	Velocity (Setting Range : 0~F0h Setting Unit : $18.75\text{min}^{-1}/\text{LSB}$)							
2	9	16	23	Acceleration (Setting Range : 1~FFh Setting Unit : $61.23\text{rad}/\text{s}^2$ ($0.585\text{min}^{-1}/\text{ms}/\text{LSB}$))							
3	10	17	24	Deceleration (Setting Range : 1~FFh Setting Unit : $61.23\text{rad}/\text{s}^2$ ($0.585\text{min}^{-1}/\text{ms}/\text{LSB}$))							
4	11	18	25	Relative Move Distance (Lowest Byte)							
5	12	19	26	Relative Move Distance (Lower Byte)							
6	13	20	27	Relative Move Distance (Higher Byte)							
7	14	21	28	Relative Move Distance (Highest Byte)							

Setting Range of Relative Move Distance (Depends on resolution.)

Resolution	Positive END	Negative End
200	1FFFFFFF	FE000001
800	7FFFFFFF	F8000001
1600	FFFFFFF	F0000001
3200	1FFFFFFF	E0000001
6400	3FFFFFFF	C0000001
12800	7FFFFFFF	80000001

* When a relative position move command is input while motor is running by absolute position move command, the relative move distance is reflected on the target position which was set by absolute position command.

7. COMMAND

Command Code : 73h

Data Length : 28(d) byte

4 Axes Batch Absolute Move Command (Velocity, Acceleration/Deceleration Settings)

ABS.4MOV2

Commands absolute position move to 4 axes separately with options of velocity and acceleration/deceleration settings. Rotation Direction is decided by command position and present position.

Command Position > Present Position : Positive Direction

Command Position < Present Position : Negative Direction

DATA NO				Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
Axis 1	Axis 2	Axis 3	Axis 4								
1	8	15	22	Velocity (Setting Range : 0~F0h Setting Unit : 18.75min ⁻¹ /LSB)							
2	9	16	23	Acceleration (Setting Range : 1~FFh Setting Unit : 61.23rad/s ² (0.585min ⁻¹ /ms /LSB))							
3	10	17	24	Deceleration (Setting Range : 1~FFh Setting Unit : 61.23rad/s ² (0.585min ⁻¹ /ms /LSB))							
4	11	18	25	Absolute Move Distance (Lowest Byte)							
5	12	19	26	Absolute Move Distance (Lower Byte)							
6	13	20	27	Absolute Move Distance (Higher Byte)							
7	14	21	28	Absolute Move Distance (Highest Byte)							

Setting Range of Absolute Move Distance (Depends on resolution.)

Resolution	Positive End	Negative End
200	1FFFFFFF	FE000001
800	7FFFFFFF	F8000001
1600	FFFFFFFF	F0000001
3200	1FFFFFFFFF	E0000001
6400	3FFFFFFFFF	C0000001
12800	7FFFFFFFFF	80000001

* Does not execute short-cut control.

7. COMMAND

7.6 Point, Program Command

7.6.1 Point 、PRG

Command Code : 50h

Data Length : 0 byte

START Command	START
Starts the operation of Point Move or Program that is designated by 55h. Make sure to set the object to be executed by Command 55h beforehand.	

Command Code : 51h

Data Length : 3 byte

STEP Operation								STEP
Executes Step Operation for program (for the designated program line).								
Note that the program No. and line designation range differ depending on the setting of Command 1Bh.								
DATA NO	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
DAT1	Program Number							
DAT2	Line Number (Lower))							
DAT3	*	*	*	*	*	*	*	Line No. (Higher)

Setting Range

Number of Programs	256 (Command 1Bh =0)	8 (Command 1Bh =1)
Program Number	0~FFh	0~7
Line Number	0~0Fh	0~1FFh

Response :

The response to STEP Operation Command is the next line number (2Byte). Response format is as follows:

Packet Length	Address	Response Status	Line Number (Lower)	Line Number (Higher)	Check Sum
---------------	---------	-----------------	---------------------	----------------------	-----------

- * If the next execution line is uncertain when Step Operation is executed from the middle of Gosub/Return Command, the amplifier responds FFFF.
- * During Step Operation of Timer Wait, the time set by Timer is invalid.

7. COMMAND

Command Code : 52h

Data Length : 0 byte

Program Stop

P.STOP

Stops the program operation. The amplifier stays in Servo On status.

- * Unable to stop the program line which is already processing. Use STOP Command to stop all operation.
- * If the command is issued when program is not running, command error occurs.
- * Refer to Command Code 8Ah to read stopped program line.

Command Code : 55h

Data Length : 2 byte

Start Object Designation

TARGET

Designates an execution operation when Start Command is issued by Command 50h. Designates Point Move or Program Operation.

DATA NO	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
DAT1								Start Object(Point/PRG Select) 0=Point/1=PRG
DAT2	Point/PRG No							

Setting Range

Start Object	Setting Range
When Point is selected.	0~FFh
When PRG is selected (256PRG) (8PRG)	0~FFh 0~7

*When Program Operation is selected, the setting range differs depending on the program number selected by Command 1Bh.

Command Code : 56h

Data Length : Optional byte

Point Store Command

Point_oSave

Direct Command or 4 Axes Batch Command is allocated to the designated Point Number. Data length differs depending on the Direct Command to be stored. Refer to 6.5.2 for details of communication method.

DATA NO	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
DAT1	Point No (Setting Range 0~FFh)							
DAT2	Command Code to be saved (Direct Command or 4 Axis Batch Command)							
DAT3 以降	Differs depending on command of DAT2.							

- * When 4 Axis Batch Command is saved, the data for 4 Axes are allocated to 4 Point and saved.
- * When executing Point which is not saved, command error occurs. In case of execution by EXE, there is no Ack Response.

7. COMMAND

Command Code : 57h

Data Length : Optional byte

Program Store Command

PRG_oSave

Direct Command is allocated to designated Program Number. Data length varies depending on the Direct Command to be stored. Refer to 6.5.2 for details of communication method.

DATA NO	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
DAT1	PRG No (Setting Range : 256PRG=0~FFh/8PRG=0~7)							
DAT2	Line Number (Lower Byte)							
DAT3	Line Number Higher Byte)							
DAT4	Command Code to be saved (Direct Command)							
DAT5 以降	Differs depending on the command of DAT4							

※ The command line without description is judged as NOP and program execution continues.

7. COMMAND

7.6.2 Program Only Command

Setting Range for Jump address number of branch condition depends on the number of programs selected by 1Bh.

Number of Programs	256 (Command 1Bh = 0)	8 (Command 1Bh = 1)
Line Number	0~0Fh	0~1FFh

Command Code : 60h

Data Length : 0 byte

Program END	END
Defines the end of the program. Program execution is complete at the time of END Command recognition. ※ The program line without description is recognized as NOP and program execution continues. Make sure to describe END Command. ※ Sub-routine programs are available to write after program end.	

Command Code : 61h

Data Length : 2 byte

Timer Wait		T.Wait						
Setting Range	0 ~ FFFFh (65535ms)	Default Value	-					
Setting Unit	1ms/LSB							
Delay Timer can be set by this command.								
DATA NO	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
DAT1	Delay Timer (Lower Byte)							
DAT2	Delay Timer (Higher Byte)							
* This command is ignored during STEP operation.								

7. COMMAND

Command Code : 62h

Data Length : 3 byte

In-Position JMP									In-Pos JMP
Jumps to the designated address by In-Position condition which is set by Command Code 30h. Jumps to the designated address, when the condition matches. When it does not, the next line is executed. Multiple axes can be designated simultaneously by axis designation. Jumps by AND condition of the designated axis.									
DATA NO	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0	
DAT1	*							Branch Condition Jumps to the designated line when 0 = In-Position Jumps to the designated line When 1 = Out-Position	
DAT2	Jump Address Number (Lower Byte)								
DAT3	Jump Address Number (Higher Byte)								
e.g.) In case of waiting In-Position after motor start. (The next line is executed In-Position.)									
DAT No	DAT1	DAT2			DAT3				
Data	1	Designates own line (line number to describe this branch condition).							

Command Code : 63h

Data Length : 4 byte

In-Port JMP									In-Port JMP
This is a conditional jump command monitoring General Purpose Input signals. Jumps to the designated jump address when the condition matches. When it does not, the next line is executed.									
DATA NO	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0	
DAT1	*							Branch Condition Jumps to the designated line when 0 = Condition matches Jumps to the designated line when 1 = Condition does not match.	
DAT2	*	*	*	*	IN4	IN3	IN2	IN1	
	Set Value : 0 = OFF, 1 = ON								
DAT3	Jump Address Number (Lower Byte)								
DAT4	Jump Address Number (Higher Byte)								

* Regardless of the input port function by soft switch setting, this command is compared and judged with the set condition.

* Operation for each input bit is unable. Judgment is for the input status of all 4 bit.

7. COMMAND

Command Code : 64h

Data Length : 3 byte

Zone JMP

Zone JMP

Jumps to the designated address by Zone output condition set by Command Code 31. Jumps to the designated jump address when the condition matches. When it does not, the next line is executed. Multiple axes can be designated simultaneously by axis designation. Jumps by AND condition of the designated axis.

DATA NO	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
DAT1	*							Branch Condition Jumps to the designated line when 0 = Inside the Zone range 1 = Outside the Zone range
DAT2	Jump Address Number (Lower Byte)							
DAT3	Jump Address Number (Higher Byte)							

7. COMMAND

Command Code : 65h

Data Length : 7 byte

Actual Position JMP

POS_oJMP

This is a conditional jump command monitoring the actual position (absolute position).

Jumps to the designated jump address when the condition matches. When it does not, the next line is executed. When multiple axes are designated simultaneously, command error occurs.

DATA NO	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
DAT1	*							Branch Condition Jumps when 0=Greater Than (Set Value□Actual position) Jumps when 1=Less Than (Set Value> Actual Position)
DAT2	Absolute Position (Lowest Byte)							
DAT3	Absolute Position (Lower Byte)							
DAT4	Absolute Position (Higher Byte)							
DAT5	Absolute Position (Highest Byte)							
DAT6	Jump Address Number (Lower Byte)							
DAT7	Jump Address Number (Higher Byte)							

Absolute Position Setting Range

Resolution	Positive End	Negative End
200	1FFFFFFF	FE000001
800	7FFFFFFF	F8000001
1600	FFFFFFF	F0000001
3200	1FFFFFFF	E0000001
6400	3FFFFFFF	C0000001

Command Code : 66h

Data Length : 2 byte

JMP

JMP

Jumps to the designated address without condition.

DATA NO	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
DAT6	Jump Address Number (Lower Byte)							
DAT7	Jump Address Number (Higher Byte)							

7. COMMAND

Command Code : 67h

Data Length : 3 byte

Motor Stop Jump

MSTOP_oJMP

This is a conditional jump command monitoring motor stop status. Jumps to the designated address when condition matches. When it does not, the next line is executed.

Multiple axes can be designated simultaneously by axis designation. Jumps by AND condition of the designated axis.

DATA NO	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
DAT1	*							Branch Condition Jumps to the designated line when 0=Motor runs. Jumps to the designated line when 1 =Motor stops.
DAT2	Jump Address Number (Lower Byte)							
DAT3	Jump Address Number (Higher Byte)							

e.g.) In case of waiting In-Position after motor start. (The next line is executed In-Position.)

DAT No	DAT1	DAT2	DAT3
Data	1	Designates own line (line number to describe this branch condition).	

Command Code : 6Ah

Data Length : 2 byte

FOR (Loop Counter)

For

Repeats the program lines between For and Next Commands (Command 6Bh) for designated turns. Used with Next Command.

DATA NO	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
DAT1	*				Loop Number : Setting Range=0~A			
DAT2	Loop Counter (Number of Repetition) : Setting Range=1~FFh							

- * Loop counter increments by 1 which is starting from 1. Executed repeatedly for designated turns.
- * Multiple loop can be set by using Loop Number
- * The value of the loop counter is cleared as 0 when the count is complete.

Command Code : 6Bh

Data Length : 1 byte

NEXT (Loop Counter)

NEXT

Repeats the program lines between For and Next Commands (Command 6Bh) for designated turns. Used with For Command.

DATA NO	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
DAT1	*				Loop Number : Setting Range=0~A			

- * The same loop number as in For Command is designated.

7. COMMAND

Command Code : 6Ch

Data Length : 2 byte

Subroutine Call

Gosub

Calls a subroutine. Designated by line number.

Used with Return Command (Command 6Dh).

DATA NO	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
DAT1	Subroutine First Line Number (Lower Byte)							
DAT2	Subroutine First Line Number (Higher Byte)							

* Up to 16 subroutine programs can be used in one program.

Command Code : 6Dh

Data Length : 0 byte

Return

Return

Finish the subroutine program then return to the main program.

Used with Gosub Command.

* Up to 16 subroutine programs can be used in one program.

7. COMMAND

7.7 Read Command

Command Code : 80h

Data Length : 1 byte

Parameter Rd

PAR.RD

The set value of any Direct Command and System Command can be read by this command.

When multiple axes are designated, the data contents of smaller numbered axis are returned first.

Refer to 6.5.2 for details.

DATA NO	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
DAT1	Command Code that wants to read.							

* The return data is the set value on RAM.

* Parameters that have no initial values cannot be read.

Command Code : 81h

Data Length : 1 byte

Point RD

Point.RD

The point data stored in designated point number can be read by this command.

Refer to 6.5.2. for details.

DATA NO	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
DAT1	Point Number that wants to read.							

Form of Return Data

Packet Length	Address	Return Status	Effective Axis No.	Command Code	Data	Check sum
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Command Code : 82h

Data Length : 3 byte

Program RD

PRG.RD

One line of designated program can be read. Refer to 6.5.2 for details.

DATA NO	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
DAT1	Program No. that wants to read.							
DAT2	Program Line Number (Lower Byte)							
DAT3	Program Line Number (Higher Byte)							

Form of Return Data

Packet Length	Address	Return status	Command Code	Data (n Byte)	Check sum
---------------	---------	---------------	--------------	---------------	-----------

7. COMMAND

Command Code : 83h

Data Length : 0 byte

Amplifier Status RD

STATUS

Amplifier status for each axis is returned. When multiple axes are designated, the data contents of smaller numbered axis are returned first.

Return Data

DAT1 : Amplifier Status 1 (For each Axis)

b i t	Contents	Data		Explanation
		0	1	
0	Motion Complete	Incomplete	Complete	Motor Stop Status
1	In-Position Status	Inside the Range	Outside the Range	In-Position Signal Status
2	Amplifier Alarm Status	Normal	Alarm	Amplifier Alarm Status
3	Initialization Executed	Complete	Incomplete	Initialization Complete Status
4	Servo ON / OFF Status	ON	OFF	Servo ON/OFF Status
5	*	-	-	Always returns 0.
6	Return-to-Origin Complete	Incomplete	Complete	Return-to-Origin Complete Status
7	Pause Control Status	Not PAUSE	PAUSE	PAUSE Control Status

DAT2 : Amplifier Status 2 (For each axis)

b i t	Contents	Data		Explanation
		0	1	
0	+Soft Limit	Without Limit	Limit	Positive Direction Soft Limit Status
1	-Soft Limit	Without Limit	Limit	Negative Direction Soft Limit Status
2	Brake	Release	Excitation	Holding Brake Control Status
3	Interlock Control Status	No Interlock	Interlock	Interlock Control Status
4	H.Limit1	Without Limit	Limit	H.Limit1 Status
5	H.Limit2	Without Limit	Limit	H.Limit1 Status
6	*	-	-	Always returns 0.
7	*	-	-	Always returns 0.

- * As for Soft Limit and H. Limit, amplifier responds the status when their functions are valid.
- * Pause, Interlock and STOP returns only in the amplifier status where their functions are valid. When the functions that want monitoring are invalid in the amplifier status, 0 is returned regardless of the I/O status.

7. COMMAND

Command Code : 84h

Data Length : 0 byte

Absolute Position RD	Pos.RD
Reads the absolute position data inside the amplifier. When multiple axes are designated, the data contents of smaller numbered axis are returned first. The response data is a signed 4Byte data.	

Command Code : 85h

Data Length : 0 byte

Velocity Monitor	Vel.MON
Reads the actual velocity. When multiple axes are designated, the data contents of smaller numbered axis are returned first.	
The response data is 1Byte and the unit is $18.75\text{min}^{-1}/\text{LS}$.	

Command Code : 86h

Data Length : 0 byte

ALM Monitor	ALM.MON
Reads alarm code. The response data is 1Byte and returns alarm code.	
In case of Alarm Status Transition (Command Code 15h)=0, alarm occurrence in other axis makes own axis transit to alarm status and motor stops.	

Alarm Code

Abbreviation	Alarm Code(hex)	Description	Alarm Clear
No Alarm	0 0	—	—
C P U E	—	CPU Error	Impossible
E E P E R	1 0	ROM Error	Impossible
D E	0 1	Sensor Disconnection	Impossible
O V	0 2	Main Power Over Voltage	Possible
M P E	0 3	Main Power Error (Main Power is Low.)	Possible
R S T E	0 4	Initialization Error	Impossible
O V F	0 5	Servo Error	Possible
O L	0 6	Servo Error (Motor stops for n second.)	Possible
O S	0 7	Over Speed	Possible
R G O L	0 8	Regeneration Voltage Over Load	Possible
ORG	0 9	Return-to-Origin Error	Possible
CNTOVF	0 A	Deviation Counter Over Flow	Possible
Wrap around	0 B	Exceeds the Coordinates Range	Possible
Hard Stop Error	0 C	Not to reach the pushing position	Possible
Over Heat	0 D	Over Heat(Amp.)	Possible
Alarms for other axes	1 0	Transit to Alarm Status due to other axis alarm	-

7. COMMAND

Command Code : 87h

Data Length : 0 byte

Communication Error 1

COMER1.MON

Displays all communication error codes that have been occurred since power turn on.

The data can be cleared by shutting off the power.

Command Code : 88h

Data Length : 0 byte

Communication Error 2

COMER2.MON

Displays the latest communication error code. The data can be cleared by shutting of the power.

Alarm Contents

Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
*	*	Overrun	Flaming	Parity	*	Time Out	Sum

0 : No Error History / 1 : Error Occurred

Command Code : 89h

Data Length : 0 byte

Software Revision

Soft.Rev

Displays the software type and revision.

Response Data

DATA NO	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
DAT1	Power Supply Input Type (0=Simple Power Supply/1=Separate)				Number of Effective Axes (Currently fixed to 4.)			
DAT2	Software Revision							

Command Code : 8Ah

Data Length : 0 byte

Program Stop Line

P.STLINE

When the program is canceled or suspended by STOP, Program Stop or Alarm, the program stop line can be read by this command.

Response Data

DATA NO	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
DAT1	Program Stop Line Number (Lower Byte)							
DAT2	Program Stop Line Number (Higher Byte)							

7. COMMAND

Command Code : 8Bh

Data Length : 0 byte

Power Supply Voltage Monitor								VIN.MON
RD Unit	703 (D) /V							
The main circuit power supply voltage inside the amplifier can be monitored by this command. In this amplifier, Regenerative voltage=Input power supply voltage.								
Response Data								
DATA NO	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
DAT1	Regenerative voltage (Lower Byte)							
DAT2	Regenerative voltage (Higher Byte)							
DAT3	Input power supply voltage (Lower Byte)							
DAT4	Input power supply voltage (Higher Byte)							

Command Code : 8Ch

Data Length : 0 byte

Loop Counter RD	CNT.RD
Responds the present value of loop counter designated by program only command, For/Next Command. The response returns all loop counter's data in the order of loop number 0 to A. Use this command when reading the loop counter during STEP operation.	

Command Code : 8Dh

Data Length : 0 byte

I/O Status RD

IO.Mon

Input/Output signal status of CN1 can be monitored by this command. Signal status can be monitored regardless of the function valid/invalid.

Signal Logic

Data	0	1
Input Port	Photo Coupler OFF	Photo Coupler ON
Output Port	Photo Coupler ON	Photo Coupler OFF

Response Data

bit	Input Port (DAT1)	Input Port (DAT2)	Input Port (DAT3)	Output Port (DAT4)	Output Port (DAT5)
0	Point 1	EXE	Axis1H.Limit1	MSTOP 1	OUT1
1	Point 2	SELECT	Axis1H.Limit2	MSTOP 2	OUT2
2	Point 3	STOP	Axis2H.Limit1	MSTOP 3	OUT3
3	Point 4	ACLR	Axis2H.Limit2	MSTOP 4	OUT4
4	I N 1	*	Axis3H.Limit1	ACK	OUT5
5	I N 2	*	Axis3H.Limit2	BUSY	OUT6
6	I N 3	*	Axis4H.Limit1	ALM	OUT7
7	I N 4	EXE2	Axis4H.Limit2	*	OUT8

7. COMMAND

Command Code : 8Eh

Data Length : 0 byte

Axis Designation RD								AXIS
Valid/Invalid status of axes set by Dip Switch can be read by this command.								
Response Data 0=Invalid 1=Valid								
DATA NO	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
DAT1	*				Axis 4	Axis 3	Axis 2	Axis 1

8. PROTECTIVE FUNCTION AND MAINTENANCE

8.1 Protective Function

The Alarm Status can be monitored by watching flushing interval of LED2 or using Alarm Code Read Command through communication in order to identify alarm cause. Refer to the table below for alarm cause and how to treat them. When alarms cannot be cleared normally, consult with us.

8.1.1 Alarm Display and Alarm Code

LED2 Flushing Interval	Abbreviation	Alarm Code (hex)	Alarm Description	Clear
OFF	No Alarm	0 0	—	—
ON	C P U E	—	CPU Error	Impossible
	EEPER	1 0	Non-Volatile Memory Error	Impossible
1	D E	0 1	Sensor Disconnection	Impossible
2	O V	0 2	Main Power High (Over Voltage)	Possible
	M P E	0 3	Main Power Low	Possible
3	R S T E	0 4	Initialization Error (Overload) Power Line Disconnection	Impossible
4	O V F	0 5	Servo Error	Possible
	O L	0 6	Servo Error (Stop)	Possible
	O S	0 7	Over Speed	Possible
5	R G O L	0 8	Regenerative Overload	Possible
6	ORG	0 9	Return-to-Origin Error	Possible
7	CNTOVF	0 A	Deviation Counter Overflow	Possible
	Wrap around	0 B	Absolute Position Coordinates Error	Possible
8	HSTOP	0 C	Soft Servo Incomplete Motion (Hit Stop)	Possible
9	OH	0 D	Amplifier Overheat Detection	Possible
--	AXIS	2 0	Alarm of other axes	-

- * For some alarms that cannot be cleared, turn off to on the power supply after the cause of the alarm is removed. Then they can be cleared.
- * Alarm status transition follows the setting of Command Code 15h, when alarm occurs to other axis.

8. PROTECTIVE FUNCTION AND MAINTENANCE

8.2 Restoring Measures

Alarm (Code)	Cause of the Alarm	Countermeasures
CPUE	- Power supply voltage VCC (5V) drops. - Excessive noise is applied and CPU problem. - Amplifier breaks.	- Check that power supply voltage is within the specification. - Take measures against noise source. - Replace amplifier.
DE (Sensor Disconnection)	Sensor disconnection or connection error. In case of sensor disconnection, this is detected right after power turns on. *Detects only A or B.	- Review sensor wiring. - If there is noise source near the system. Take countermeasures against noise.
OV (Over-voltage)	Amplifier main circuit power supply voltage is higher than the specification. *This is not detected during Servo ON.	Improve amplifier power supply voltage within specification.
MPE(Power Supply Voltage Drops)	Amplifier main circuit power supply voltage is lower than the specification. *This is not detected in STOP or ALM status.	Improve amplifier power supply voltage within specification.
RSTE (Initialization Error)	- Disconnection of power line - Amplifier is used out of allowable range of load condition. (Refer to 9.3) - Soft Servo to machine end. *This is detected only after power supply turns on.	- Review wiring of power line. - Review load condition. - Select initialization Type 1 in the status striking machine end.
OVF (Servo Error)	- Excessive acceleration/deceleration designation - Overload - Holding brake control circuit breaks. - Inappropriate setting value of detect condition *This is detected in case of ALM detect permit by Command Code 14h.	- Review the set value of acceleration/deceleration and Gain. - Review load condition. - Check that the brake is open. - Review detection condition (Command 14h).
OL (Servo Error)	- Soft Servo to machine end - Overload - Power line disconnection after initialization * This is detected when PowerLimit1=B2hor greater. * This is detected when motor stops longer than the set time (set by Command 23h). * This is not detected during Soft Servo motion.	- Existence of obstacles. - Review load condition. - Check the disconnection of power line.
OS (Over Speed)	- Overload - Inappropriate acceleration/deceleration *Detecting velocity: : 5 4 0 0 min⁻¹ fixed	- Review load condition. - Review settings of acceleration/deceleration and Gain.
RGOL (Regenerative Error)	- Regenerative unit is not used. - Regenerative unit breaks. *Alarm is detected when regenerative voltage exceeds allowable value.	- Connect regenerative unit. - Replace regenerative unit. - Review operation condition.
ORG (Return-to-Origin Error)	- C-phase return-to-origin is executed without C-channel - Sensor C disconnection	- Change the motor to the one with C phase. - Confirm sensor cable wiring.

8. PROTECTIVE FUNCTION AND MAINTENANCE

Alarm (Code)	Cause of the Alarm	Countermeasures
EEPER (Memory Error)	• Non-volatile memory data error. (Supply power shut off while writing memory. • Non-volatile memory breaks. * This is detected right after supply power turns on. * All parameters are initialized when memory error is detected. It will take about 1s for initialization.	Wait more than 1 second then turn off and turn on power supply. If problem is not cleared, replace amplifier If problem is cleared, re-set all data.
CNTOVF	• Overflow of amplifier internal counter by additional move command.	• Check distance of move command.
Wrap around	• Continuous rotation in one direction. • Motion is near the range where marks are about to reverse in the coordinates. * In case of Wrap Around detection permit by Command Code 14h.	• Set Wrap Around Detection as inhibit (Command 14h). • Review the coordinates range.
Hard Stop Error	• If the motion is complete without reaching current limit set value during Hard Stop operation. * This is detected in case of detection permit by Command Code 14h.	• Review the current limit value of Hard Stop operation.
Amplifier Overheat Detection	• Heat radiation shortage • Ambient temperature is high.	• Review radiation condition. • Lower the ambient temperature. • Improve the Power Limit set value.

8. PROTECTIVE FUNCTION AND MAINTENANCE

8.3 Maintenance

Check the surroundings, clean dust, and tighten screws periodically. Please note the followings.

- (1) In case of repair, please contact us.
- (2) Since amplifier frame is heated to high temperature, beware of it at the time of maintenance and inspection.
- (3) We recommend that the electrolytic capacitor inside the amplifier be replaced every five years (atmosphere : 104 ° F (40°C)) before it deteriorates by age.

8.4 Guarantee Terms

If designing or productive fault is found on the products, we will repair or replace the products for free of charge for 1 year since delivery.

However, we cannot guarantee for any damage or accident caused by incorrect operation or handling.

8.5 Disposal

Dispose of the amplifier and the motor as industrial wastes.

9. SANDARD SPECIFICATIONS

9.1 Amplifier Standard Specification

Amplifier Model			PB2D003R1U※		
Control Systems			PWM Control		
Power	Excitation current setting		1 A/ phase	2 A/ phase	3 A/ phase
Supply	Single power supply		DC24V/36V±10%	DC24V/36V±10%	DC24V/36V±10%
	Max. current consumption		1.5A/Axis	2A/Axis	4A/Axis
Condition	Ambient	Operating	0 to 5 5℃		
	temperature	Storage	－2 0 to 7 0℃		
	Operating/ Storage humidity		90%RH or less (without condensing)		
	Vibration resistance		0.5 G (tested at frequency range of 10 to 55 Hz, 2 hours each in X, Y and Z-axis direction)		
Appearance			Open Frame structure		
Weight (Open Frame)			Approx. 0.5Kg		
Outer Dimension (Toray)			W 120×H 55×D80		
Function	Rotational Speed		0 to 4500 min ^{－1}		
	Resolution (P／R)		200, 800, 1600, 3200, 6400, 12800		
	Regenerative processing		Not available (External regenerative unit is optional)		
	Safety interlock function		Over-voltage, Regenerated voltage overload, Over-speed, Over Heat,Encoder disconnection, Reset error, CPU error, Overload stop, Soft Servo Error		
	LED Display		Power status, Alarm		
	Operational Function		Normal drive, Homing operation, Soft Servo		
	Rotary Switch		Slave station address setting (0 to E Hex)		
	Dip switch		Terminating resistor, Communication speed, Axis valid/invalid		
I/O Signal	Input Signal		EXE, Point input (4 points), General purpose input (4 points), STOP、ALMCLR、Select		
	Output Signal		Ack, Motor stop 1 to 4, ALM, Busy, General purpose output (8 points)		
	Serial communication synchronization		RS-485 equivalent, Start-stop Synchronization		
	Communication Speed		Communication Speed: 9600bps, 38400bps, 115200bps, 128000bps		
	Communication Method		Half duplex/ Full duplex (Depending upon Amplifier models)		

1. Be sure to use the power supply which is Insulated between input and output.
2. Insulation resistance and withstand voltage tests should not be conducted by customer. Condensers for anti-noise are used between the power supply and earth.
3. In case that regenerative error occurred, amplifier may be broken. Be sure to confirm if regenerative unit is required before use.

9. SANDARD SPECIFICATIONS

9.2 Specification of Standard Motor Combination

Excitation Current	Motor Model	Maximum stall torque (N·m)	Rotor inertia ($\times 10^{-4}\text{kg}\cdot\text{m}^2$)	Mass [kg]	Allowable thrust load [N]	Allowable radial load [N]
1 A	PBM282D□*2*	0.055	0.008	0.16	9.8	33
	PBM284D□*2*	0.12	0.016	0.25	9.8	33
2 A	PBM423D□*2*	0.39	0.056	0.35	9.8	49
	PBM503D□*2*	0.57	0.12	0.59	14.7	96
	PBM565D□*2*	1.05	0.36	1.05	14.7	167
3 A	PBM503D□*2*	0.47	0.12	0.59	14.7	96
	PBM565D□*2*	0.98	0.36	1.05	14.7	167
	PBM603D□*2*	1.3	0.4	0.85	14.7	167
	PBM604D□*2*	1.9	0.84	1.42	14.7	167

* Consult us for the specification of optional parts such as gear and holding brake.

* The maximum holding torque when stop is 70% of the maximum stall torque.

Allowable torque when initialization

Initialization is executed in PB system when turning ON the power supply, and allowable torque in the initialization is shown in the table below. Note that initialization error may occur if load beyond the values in the table is applied.

Motor Model	Allowable Maximum Inertia ($\times 10^{-4}\text{kg}\cdot\text{m}^2$)	Allowable Maximum Friction Torque (N · m)	Allowable Maximum Load (N · m)
PBM282D□*2*	0.08	0.013	0.009
PBM284D□*2*	0.16	0.036	0.024
PBM423D□*2*	0.56	0.12	0.08
PBM503D□*2*	1.2	0.17	0.11
PBM565D□*2*	3.6	0.3	0.2
PBM603D□*2*	4	0.4	0.3
PBM604D□*2*	8.4	0.57	0.38

* Allowable maximum inertia is 10 times of rotor inertia as guideline, however, use in case of inertia ratio over this guideline is possible. Consult us for details.

9. SANDARD SPECIFICATIONS

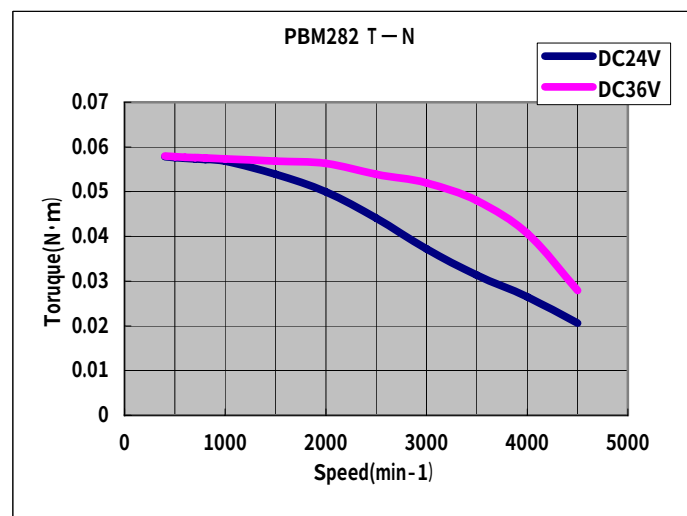
9.3 Common Motor Specification

Encoder Spec.	Basic Dividing Count		P / R	200 × 4
	Channel Number		—	2 or 3
	Maximum Response Frequency		K H z	100
	Output system		—	Line Driver
Common Specification	Condition	Ambient temp.	°C	0 to + 40
		Storage temp.	°C	-20 to +40
		Ambient humidity	% R H	20 to 90
	Vibration resistance		G	10 (Tested at frequency of 10 to 500 Hz, 2 hours each in X, Y and Z-axis direction)
	Impact resistance		G	30 (Impact waveform; Half sine waves, Impact time; 11 ms, 3 times each in X, Y and Z-axis directions)
	Withstanding voltage		V	500 VAC for 1 minute
	Insulation resistance		MΩ	10 at min. 500 VDC
	Insulation Class		—	Class B
	Protection method		—	Totally enclosed, Self cooling down
	Allowable Motor Surface Temperature		°C	85 at max. (Consider radiation conditions to keep the temperature within the specification.)

9. SANDARD SPECIFICATIONS

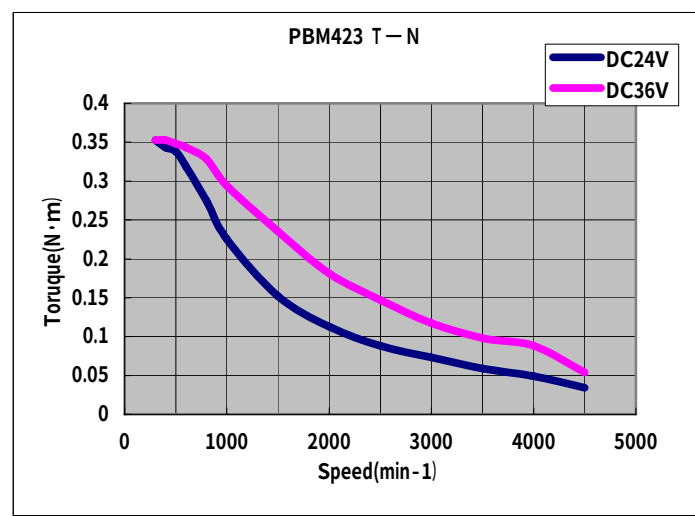
9.4 Characteristics of Velocity - Torque

Excitation Current: 1A/ phase

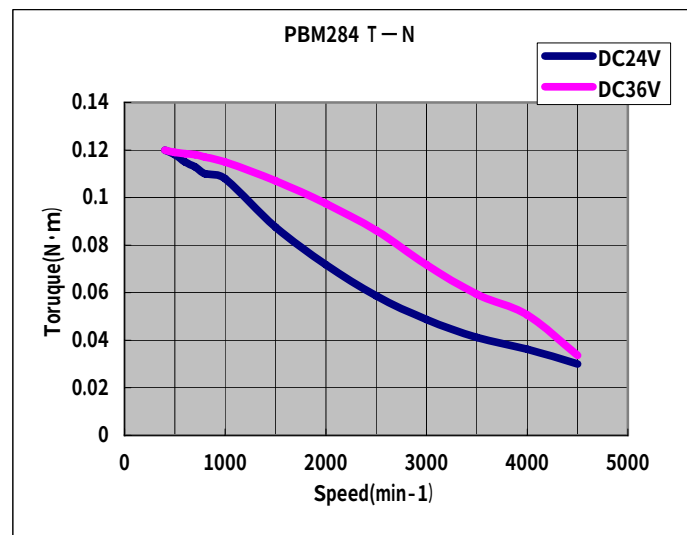


PBM282

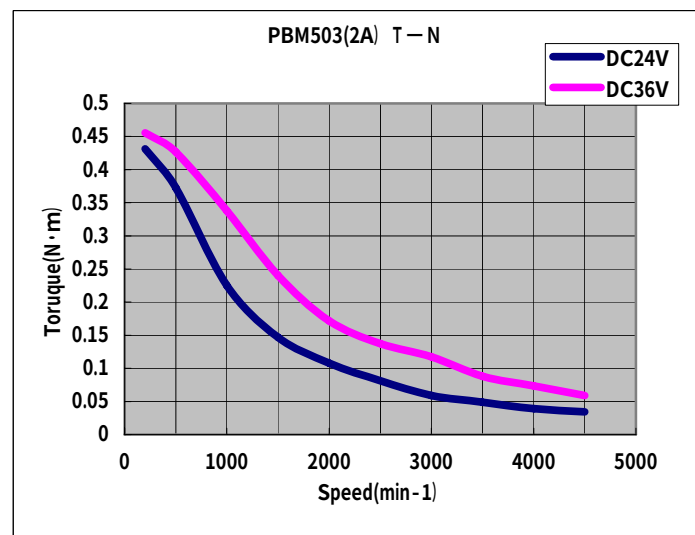
Excitation Current: 2A/ phase



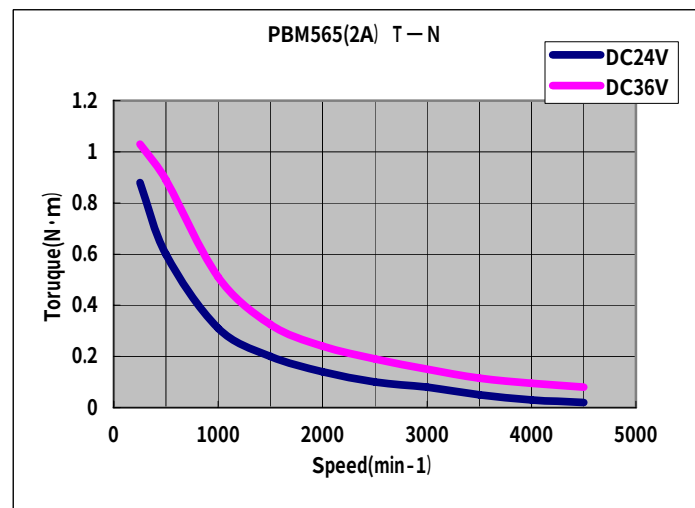
PBM423



PBM284



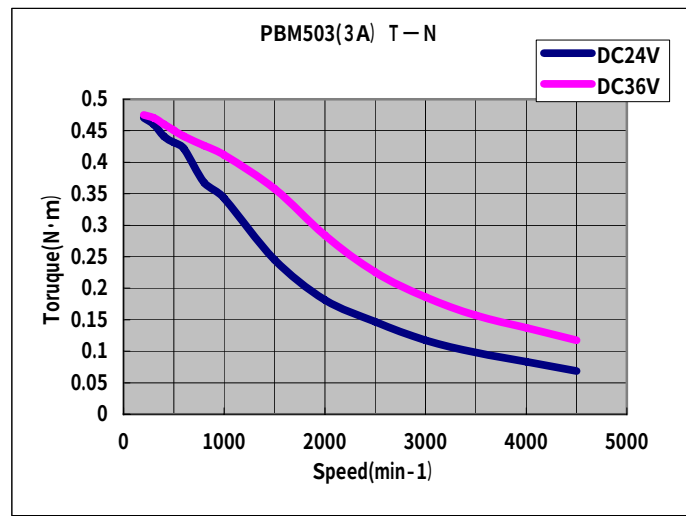
PBM503



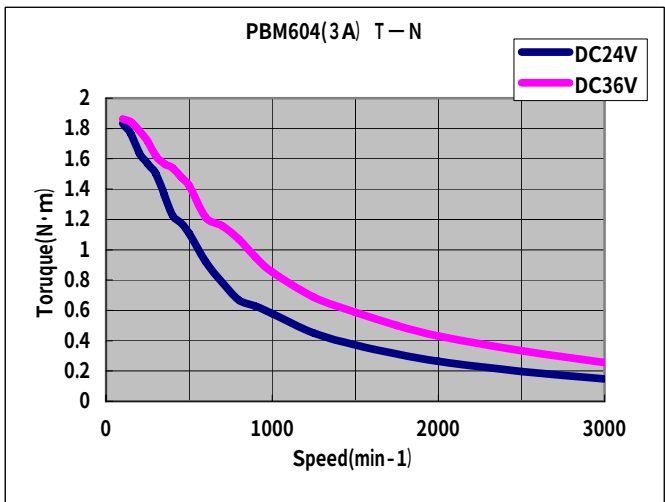
PBM565

9. SANDARD SPECIFICATIONS

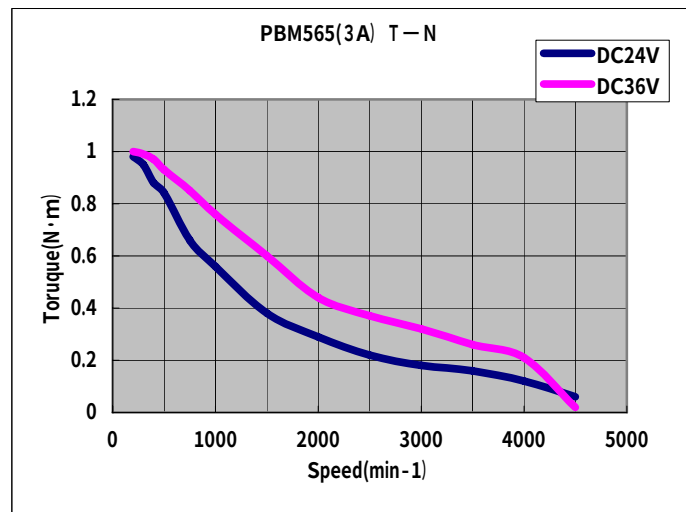
Excitation Current: 3A/ phase



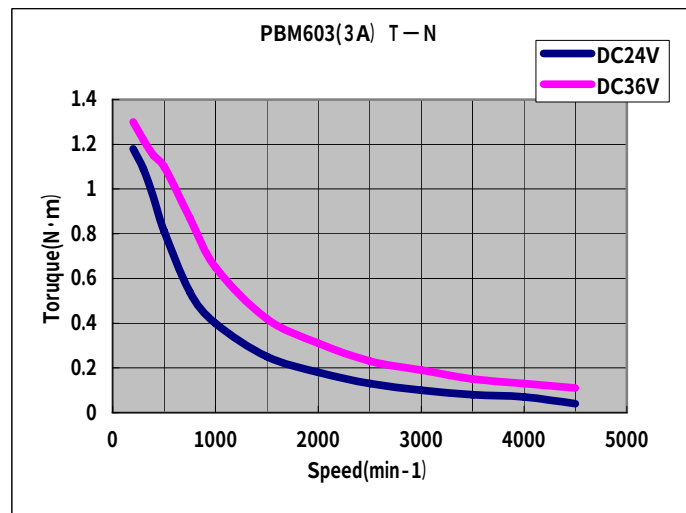
PBM503



PBM604



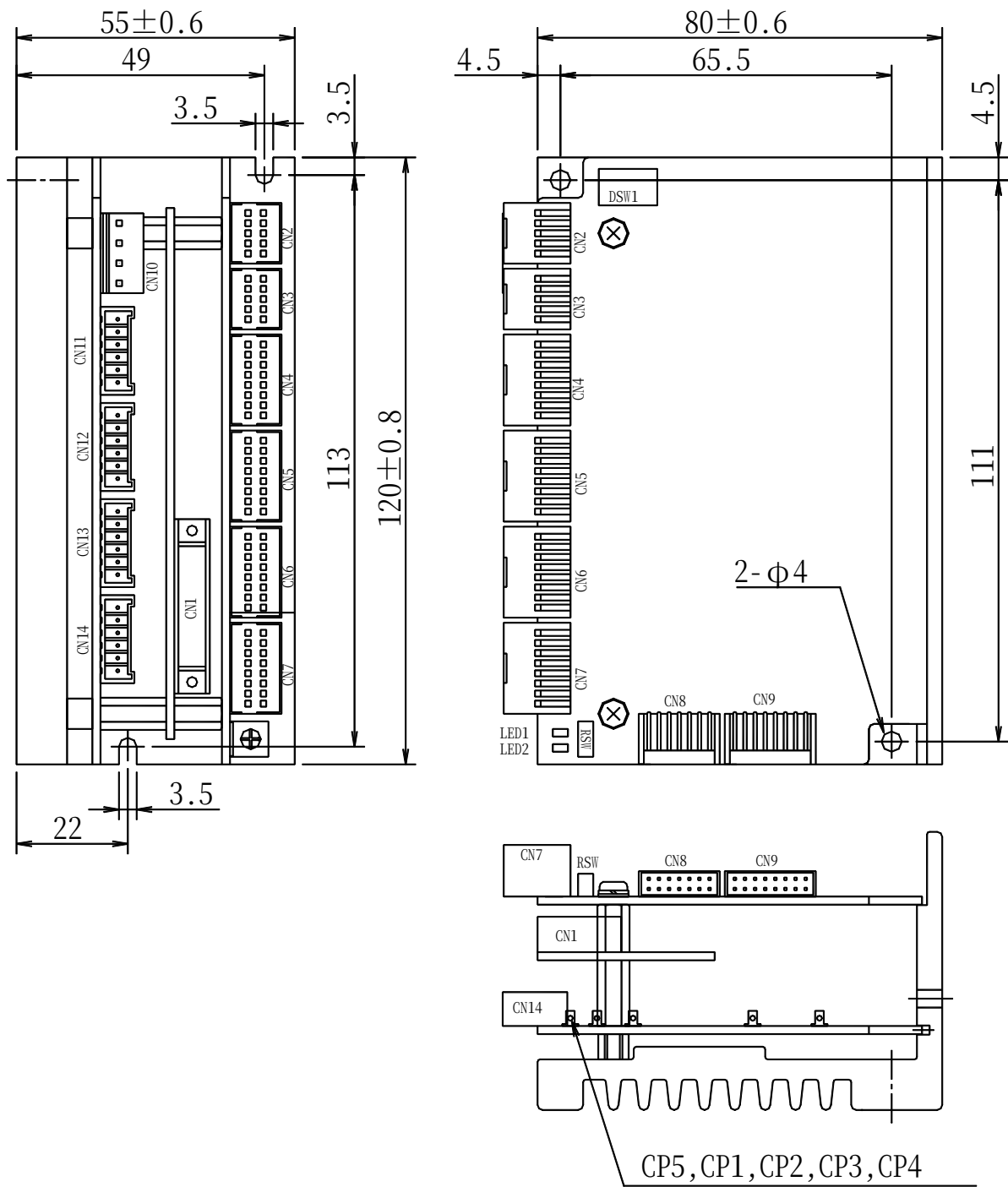
PBM565



PBM603

10. DIMENSIONS

10.1 Amplifier Outline Dimensions



CP1~4 : Icmd Monitor (Axis1~4) Output=1.2V/A±10%
 CP5 : GND

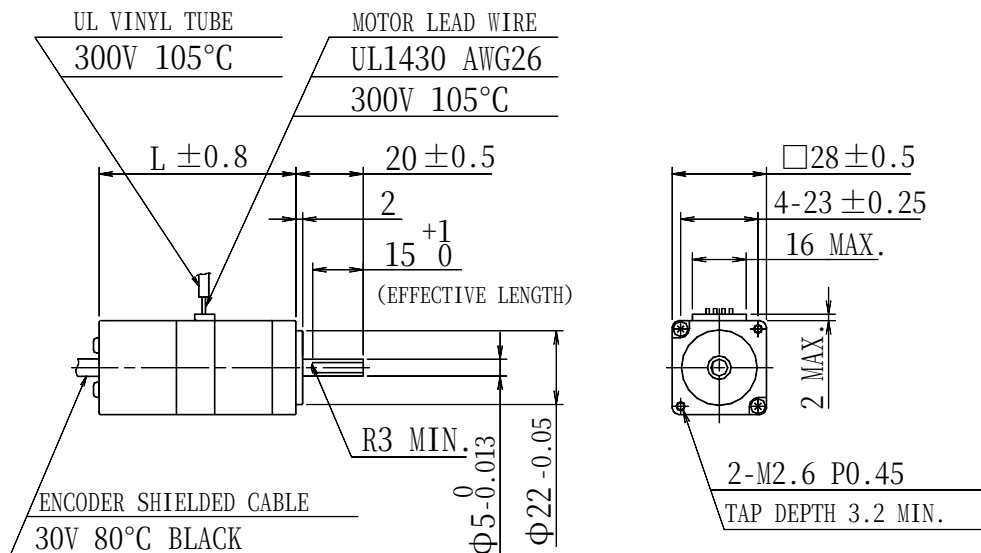
10. DIMENSIONS

10.2 Motor Outline Dimensions

Note) For motors with optional brake or gears, contact us.

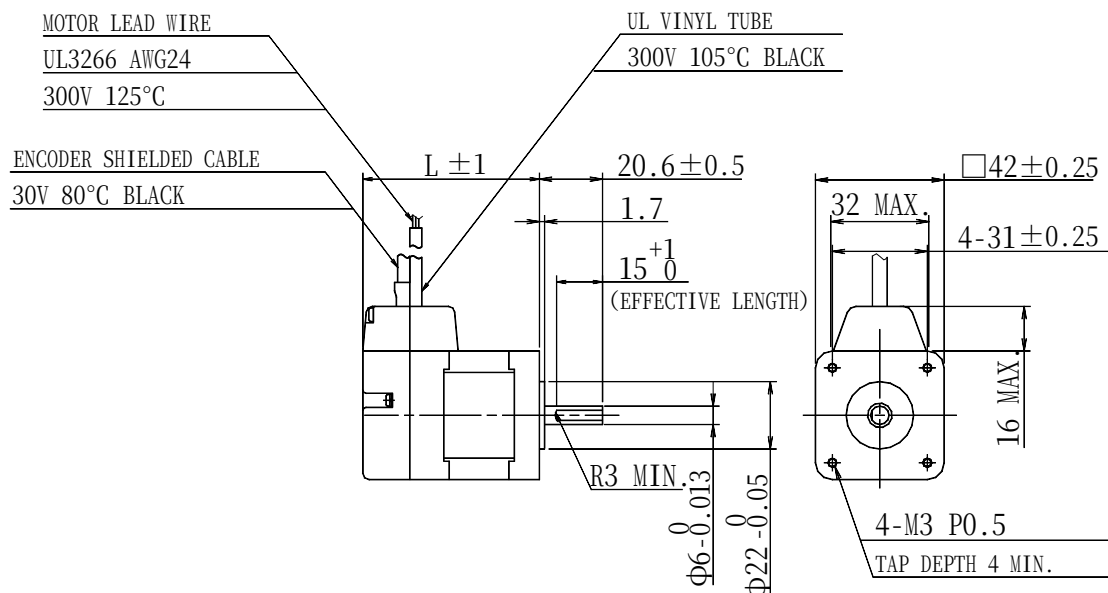
Note) Lines running from motor and sensor are 300mm long (standard).

Note) Refer to Chapter 2, for details of connector types.



Model No.	L
2 8 2	5 8. 5
2 8 4	7 7. 8

Fig.9.2 Motor Outline Dimension (P BM 2 8 *Type)



Model No.	L
4 2 2	5 1. 3
4 2 3	5 7. 6

Fig.9.3 Motor Outline Dimension (P BM 4 2 *Type)

10. DIMENSIONS

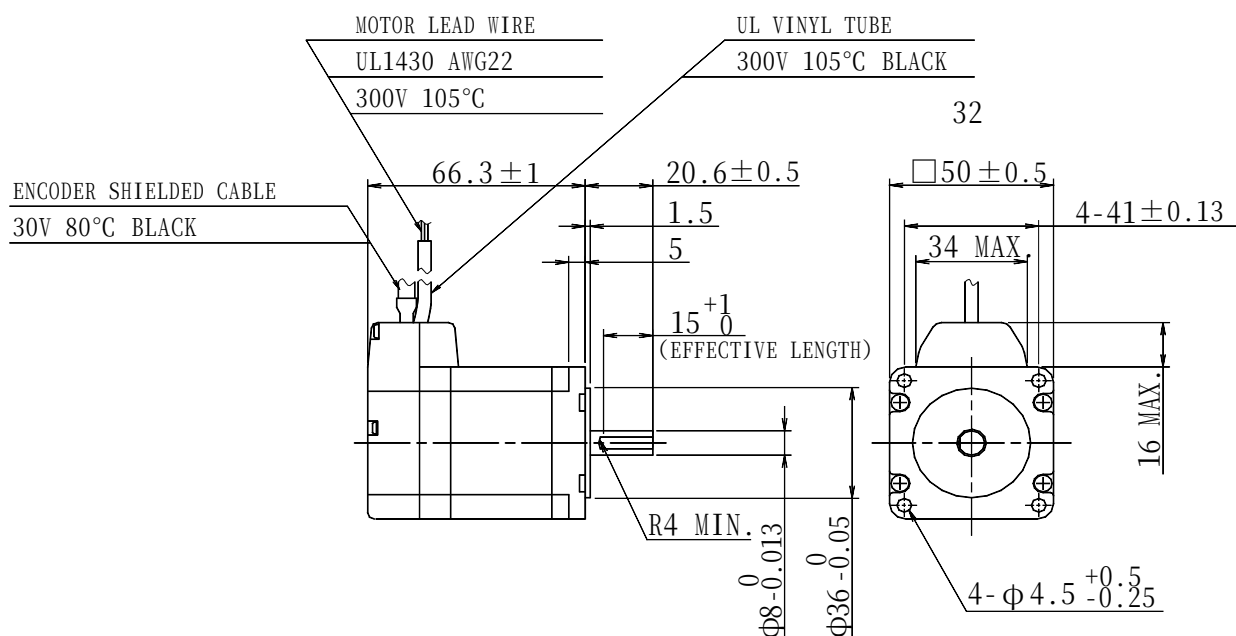


Fig.9.4 Motor Outline Dimension (P BM 5 0 3 Type)

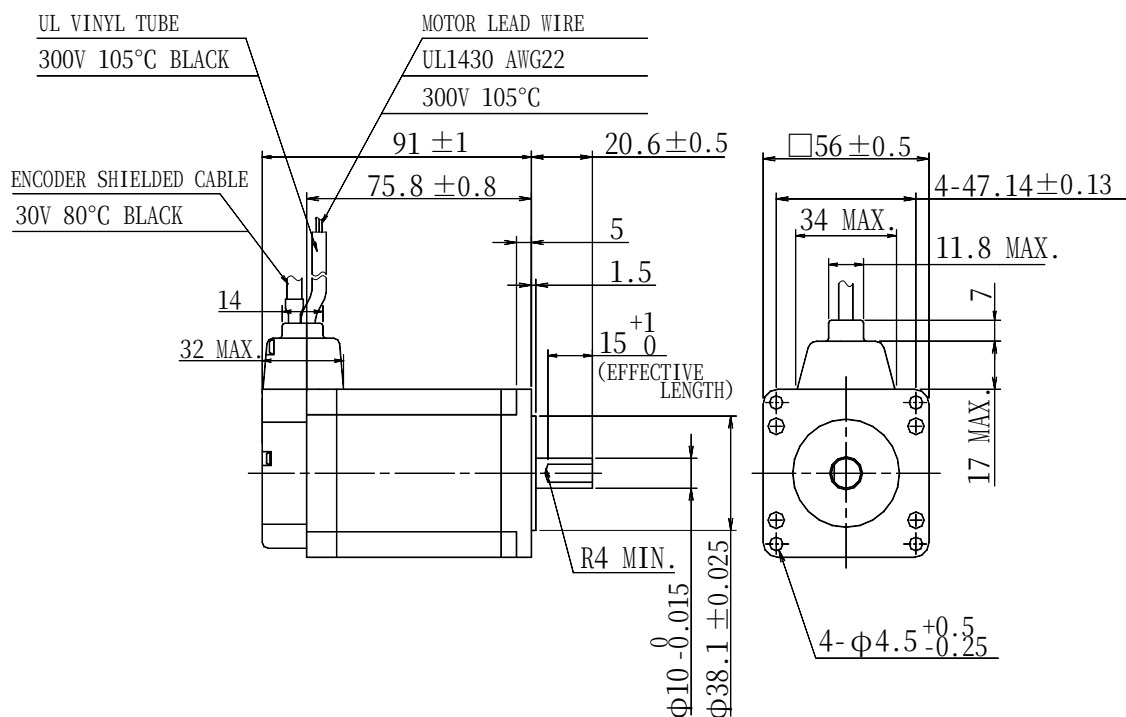


Fig.9.5 Motor Outline Dimension (P BM 5 6 5 Type)

10. DIMENSIONS

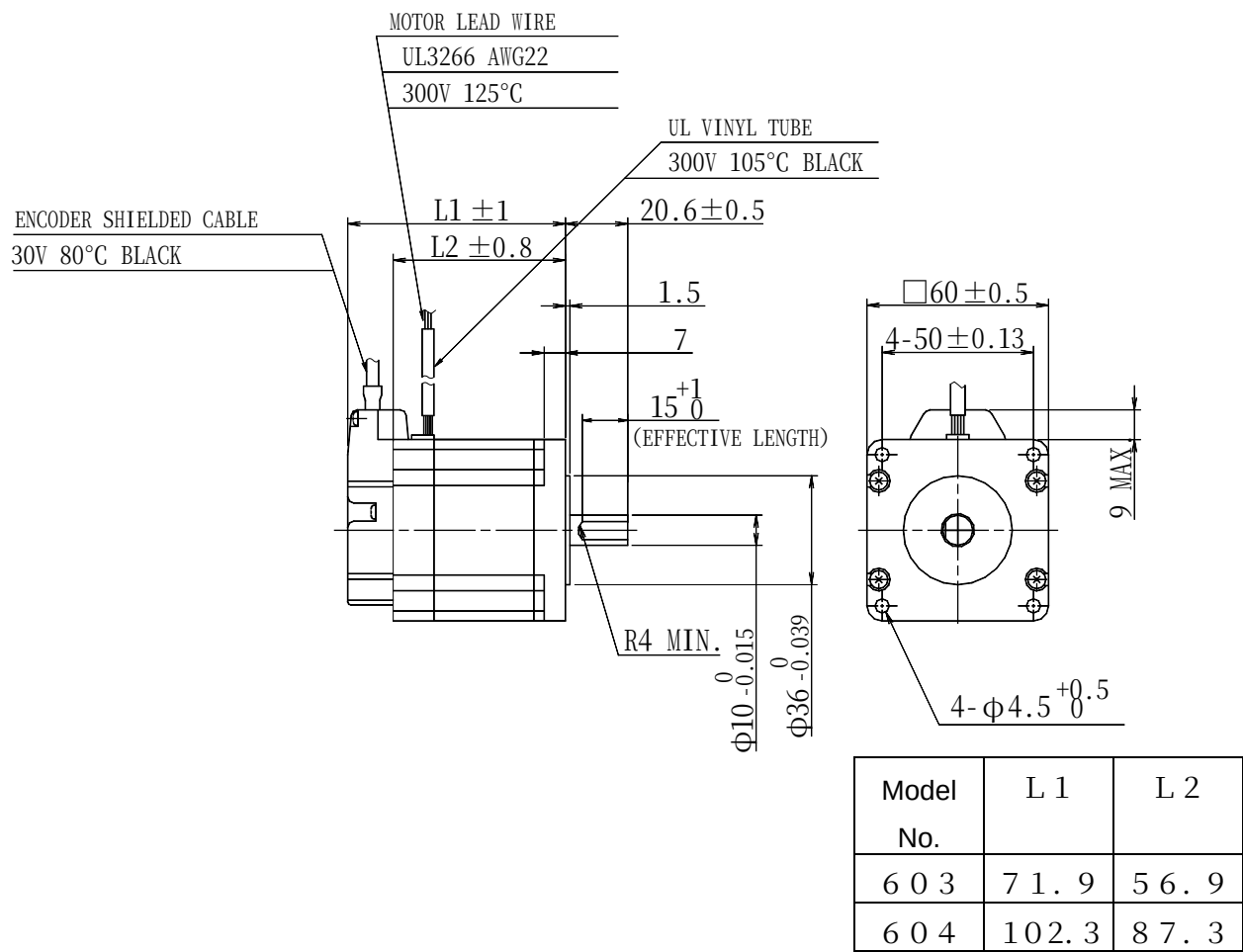
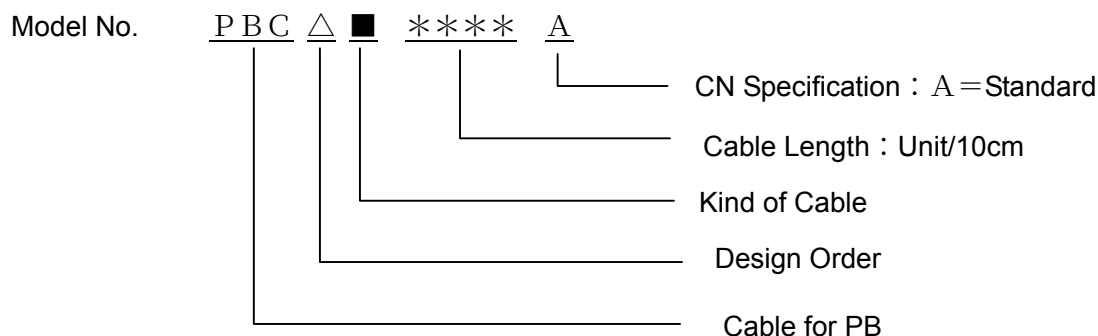


Fig. 9.6 Motor Outline Dimension (P BM 6 0 *Type)

APPENDIX. OPTION

Appendix 1 List of Optional Model Numbers

1) Cable



No	Kind of Cable	Model No.	Standard Length	Standard Model No.	Maximum Extension (Recommended)
1	I O Cable	PBC4S****A	1m	PBC4S0010A	2m
2	Sensor Cable (Without Lead Wire for External Sensor)	PBC5E****A	3m	PBC5E0030A	20m
3	Sensor Cable (With Lead Wire for External Sensor)	PBC5E****C	3m	PBC5E0030C	20m
4	Motor Cable	PBC4M****A	3m	PBC4M0030A	20m
5	Communication Cable (Amplifier - Amplifier)	PBC4C****A	0.5m	PBC4C0005A	100m
6	Communication Cable (Converter - Amplifier CN2,3)	PBC3T****A	0.5m	PBC3T0005A	2m
7	Power Supply Cable	PBC6P****A	2m	PBC6P0020A	2m

* If a longer or shorter cable than the standard one is necessary, contact us.

2) Regenerative Unit

Kind	Model No.	Note
Regenerative Unit (With Regenerative Resistor)	PBFE-01	With Regenerative Resistor 10Ω. Without Overheat Detection

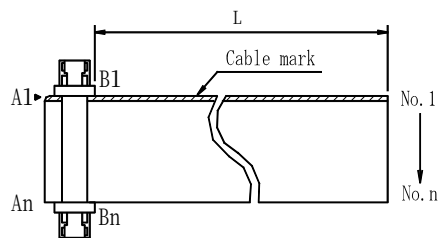
3) PCIF Unit

Kind	Model No.	Note
PC Software Applicable to Windows TM	SPBR1W-01	Applicable to Windows TM 95,98,2000,NT Software environment is for both Japanese and English.
RS-232C / RS-485 Communication Converting Unit	Half Duplicate PBFM-U4 (Set Model No.)	Unit Structure • Main Body : PBFM-P1 • Cable : PBC3T0005A (50cm)
	Whole Duplicate PBFM-U3 (Set Model No.)	Unit Structure • Main Body : PBFM-R1 • Cable : PBC3T0005A (50cm)
F/V Monitor Unit (Velocity Monitor)	PBFV-U1 (Set Model No.)	Unit Structure • Main Body : PBFV-01 • Cable : PBC2F0005A(50cm)

APPENDIX. OPTION

Appendix2 Cables

I/O Cable



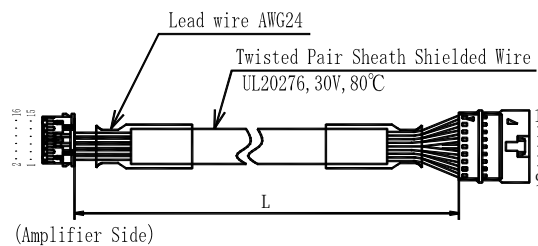
Cable Model No.	Length
PBC4S0010A	98cm

(メーカー型番: 8822E-032-171D-098S-A0)

Cable connection

Cable 1	Cable 2
A1 — No. 1	B1 — No. 17
A2 — No. 2	B2 — No. 18
⋮	⋮
An — No. 16	Bn — No. 32

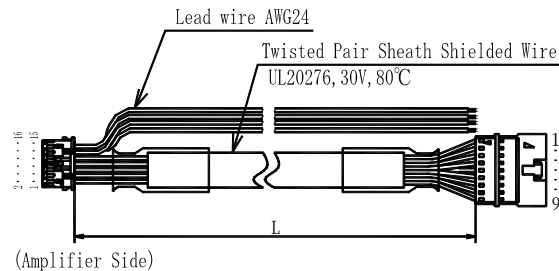
Encoder ext. cable (Without Lead Wire for External Sensor)



Cable Model No.	Length
PBC5E0030A	3m

Pin No.	Lead color	Signal name
1	Blue	A
2	Brown	$\bar{A}$
3	Green	B
4	Purple	$\bar{B}$
5	White	C
6	Yellow	$\bar{C}$
7	Red	+5V
8	Black	5G
9	Black	FG
10	—	N.C
11	—	Limit1
12	—	GND
13	—	Limit2
14	—	GND
15	—	Vcc
16	—	Vcc

Encoder ext. cable (With Lead Wire for External Sensor)



Cable Model No.	Length
PBC5E0030C	3m

Pin No.	Lead color	Signal name
1	Blue	A
2	Brown	$\bar{A}$
3	Green	B
4	Purple	$\bar{B}$
5	White	C
6	Yellow	$\bar{C}$
7	Red	+5V
8	Black	5G
9	Black	FG
10	—	N.C
11	Blue	Limit1
12	Black	GND
13	Yellow	Limit2
14	Black	GND
15	Red	Vcc
16	Red	Vcc

APPENDIX. OPTION

Motor cable

Lead wire AWG22
300V, 105°C

UL vinyl tube
300V, 105°C, 黒

(Amplifier Side)

L

Cable Model No.	Length
PBC4M0030A	3m

Pin No.	Lead color	Signal name
1	Blue	A
2	Orange	A
3	Red	B
4	Yellow	B
5	White	BRK+
6	Black	BRK-

Power cable

Lead wire AWG20
300V, 105°C

L

Cable Model No.	Length
PBC6P0020A	2m

Pin No.	Lead color	Signal name
1	Red	Pow
2	Blue	GND
3	Yellow	CONV
4	Green	FG

Comm. cable (Amplifier - Amplifier)

Twisted Pair Sheath Shielded Wire

L

Cable Model No.	Length
PBC4C0005A	0.5m

Pin No.	Lead color	Signal name
1	Yellow	A
2	White	B
3	Brown	Y
4	Blue	Z
5	Black	GND
6	—	Vcc
7	Purple	EXE2
8	Black	FG
9	—	N.C
10	—	N.C

*For pin arrangement details of each connector, refer to 3.5.

APPENDIX. OPTION

Appendix 3 Regenerative Unit

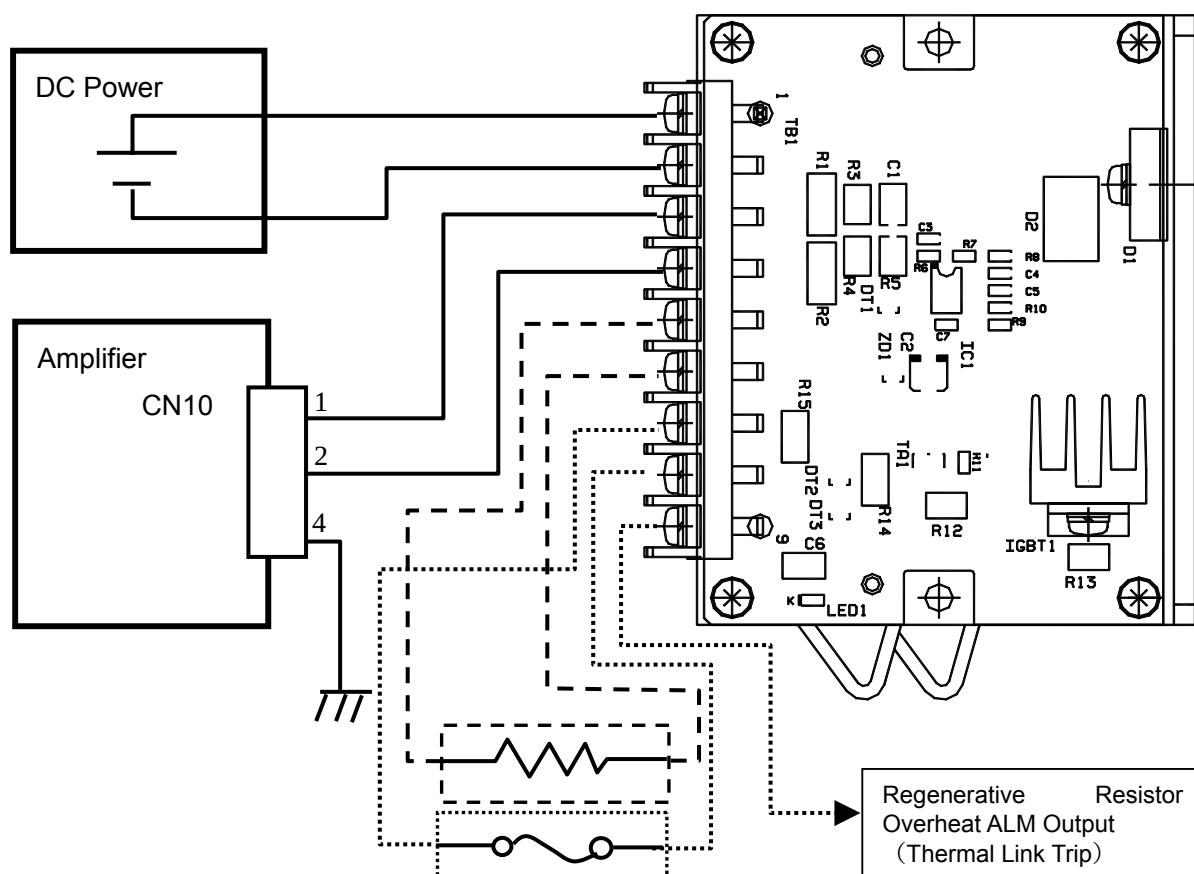
Regenerative control circuit is not built in the amplifier. When 45V or more of regenerative voltage is generated due to load or operation conditions, make sure to connect a regenerative unit. In case of 50, 56 or 60 angle of the motor size, make sure to connect a regenerative unit when setting up the system and check the operation in advance.

Note) When regenerative voltage becomes 45 V or more, the amplifier may break.

Note) For standard type, regenerative resistor of 10Ω, 60W is built in the amplifier. If overheat or error of the regenerative resistor occurs, the regenerative resistor needs to be changed. In this case, contact us.

Regenerative Unit External Wiring

Regenerative resistor (without thermal link) has been built in the Regenerative unit. When an external regenerative resistor or thermal link is necessary, contact us.



Terminal Board Pin Arrangement

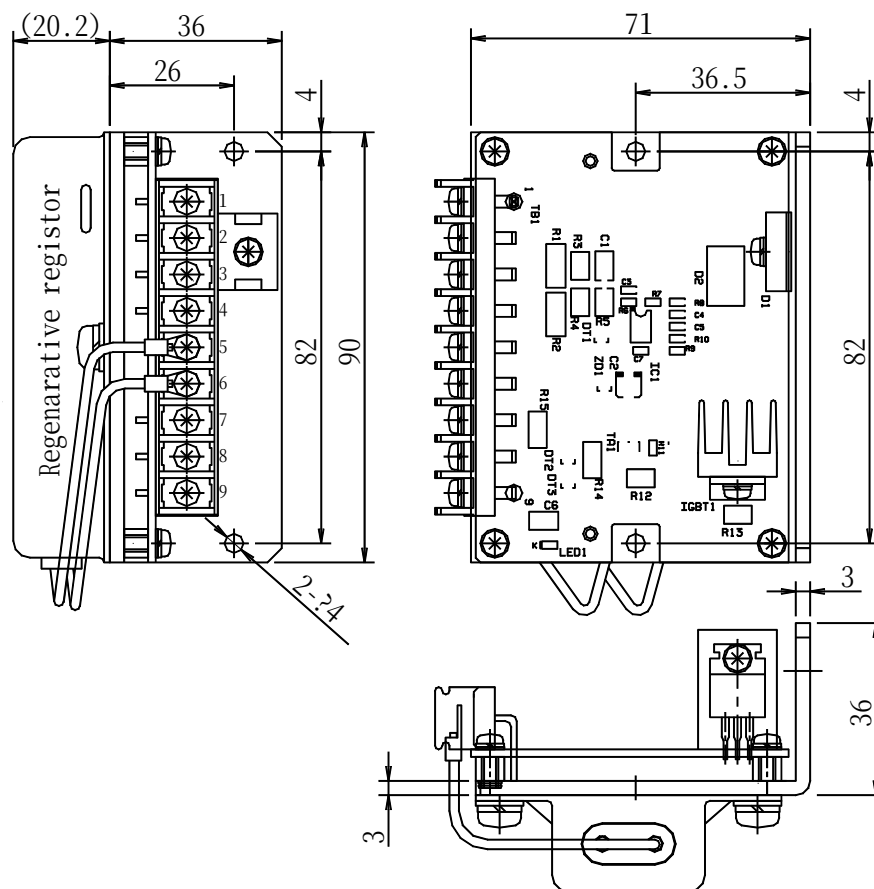
Pin No.	Function	Pin No.	Function	Pin No.	Function
1	Power Supply Input	4	Amplifier GND	7	Thermal Link
2	Power Supply GND	5	Regenerative Resistor	8	Thermal Link
3	Amplifier VIN	6	Regenerative Resistor	9	Overheat output ALM output

APPENDIX. OPTION

Regenerative Unit Standard Specification

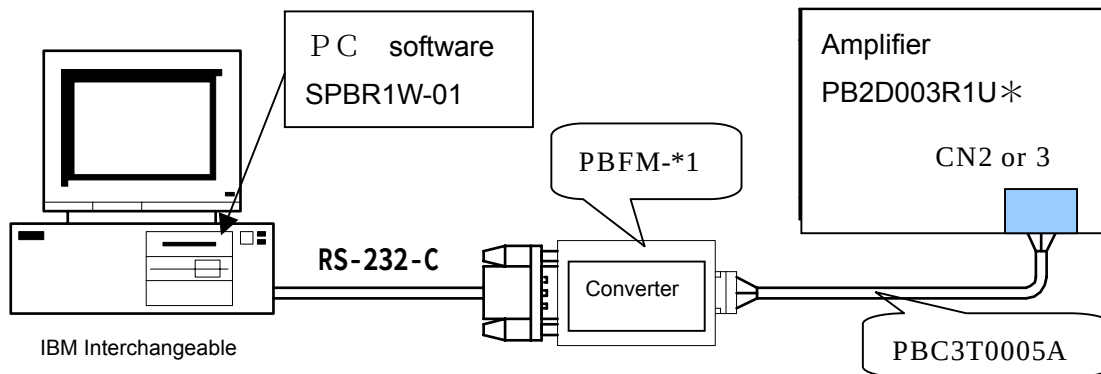
Model No.			PBFE-01		
Built-in Regenerative Resistor			10Ω、 60W（Without Thermal Link）		
Power Supply	Single Power Supply Maximum Consumed Current		DC24V/36V±10%		
Environment	Ambient Temperature	Operation	0 ～ 55℃ (32℉ ～ 131℉)		
		Storage	-20 ～ 70℃ (-4℉ ～ 158℉)		
	Humidity (Operation/Storage)		90%RH or less（No Condensation）		
	Vibration Resistance		0.5 G（When tested in the X、Y and Z directions for 2 hours at the frequency range between 10 to 55 Hz.）		
Structure			Open Frame Structure		
Mass（Open Frame）			Approx. Kg		
Outside Dimension（Tray）			W120×H55×D80		
Terminal Board			OTB-755B-9P-C-4L-WS（Osada） Wire Connecting Screw：M3×6L		

External Views of Regenerative Unit



APPENDIX. OPTION

Appendix 4 PC Interface

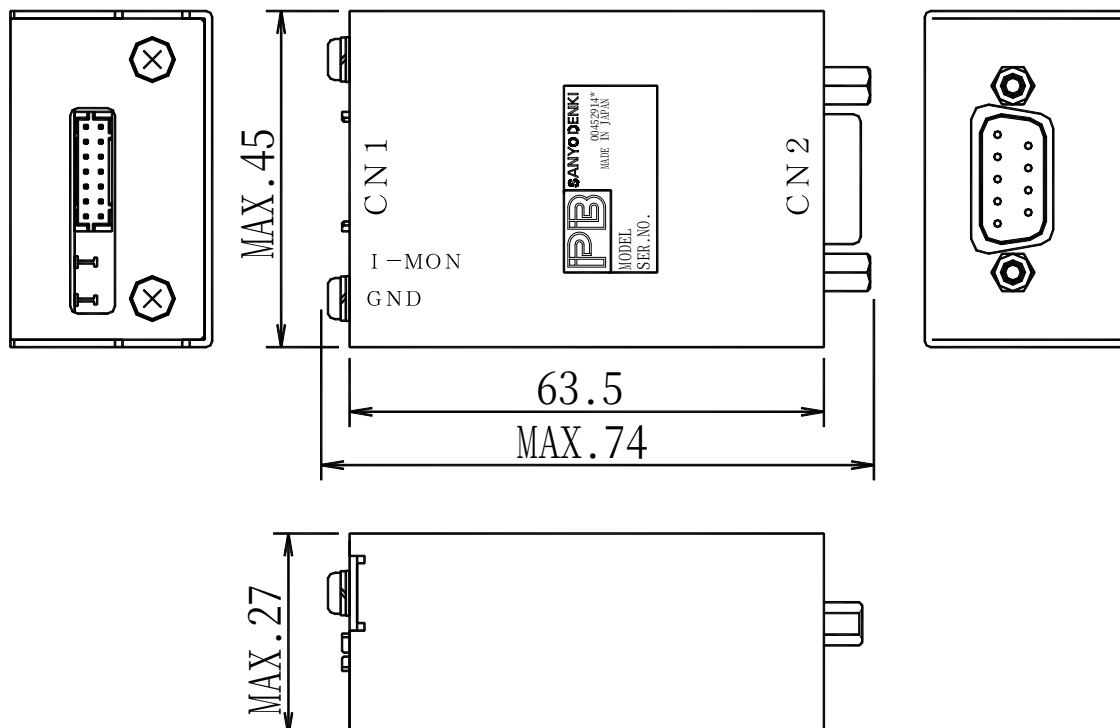


- * Customers are requested to prepare a straight cable for RS-232C between PC and the converter.
- * Refer to M0005273 for specifications of PC I/F.

External views of converter

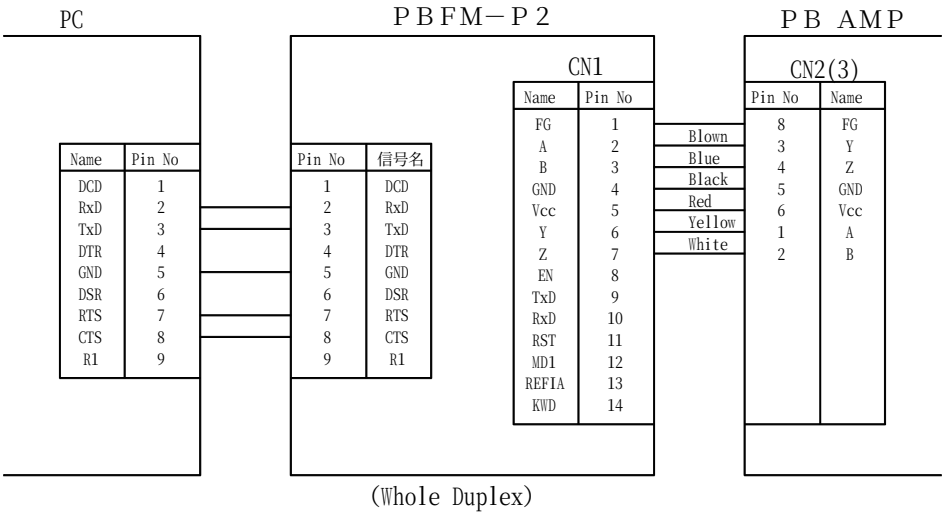
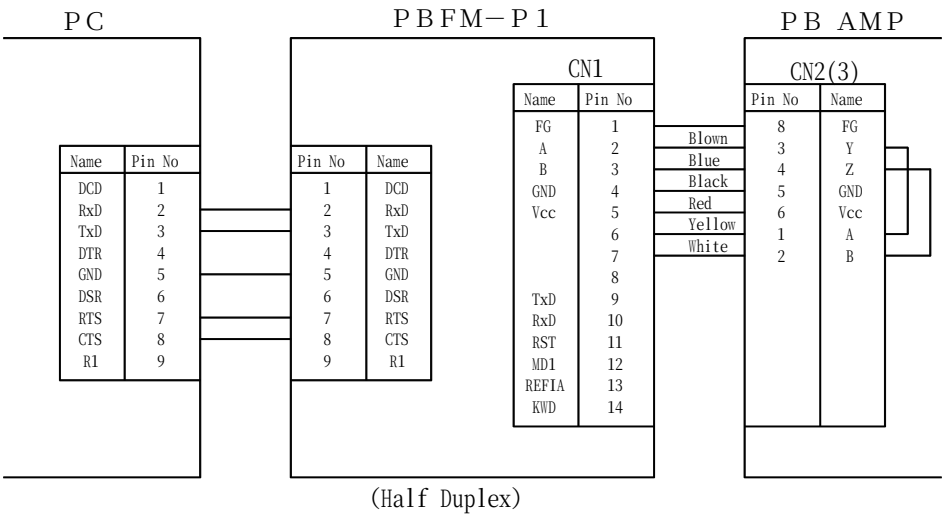
Half Duplicate : PBFM-P1

Whole Duplicate : PBFM-R1



APPENDIX. OPTION

Example of Cable Arrangement (In case of using D — S u b 9 pin.)



APPENDIX. OPTION

Appendix 5 Velocity Monitor

The PB amplifier is not equipped with the velocity monitoring function (analog output). In order to monitor the motor velocity wave form, use an optional F/V monitor. Choose an axis to be monitored by a dip switch on the F/V board for monitoring one axis each. Connect CN9 on the amplifier and F/V board to monitor the velocity.

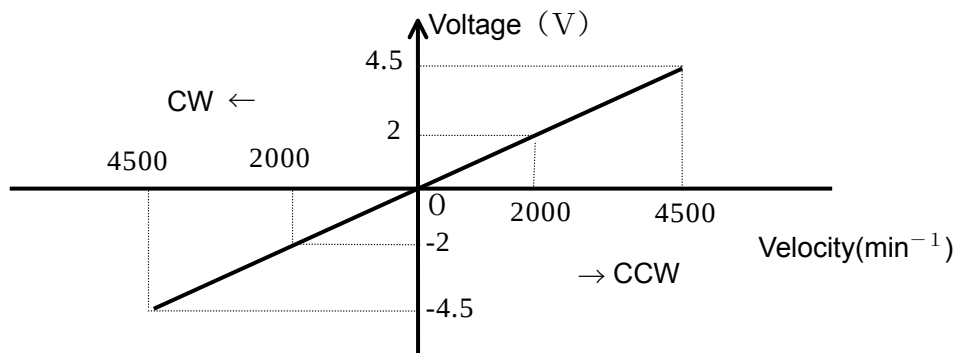
- * Cable for F/V monitor has the same connectors on both ends. Be careful for its connecting direction.

1) Output

Output is by analog voltage from CN3, 3 pin on the F/V monitor board.

With 0V in the middle, output is – at CW direction and + at CCW direction (when viewed from motor mounting surface).

Output Voltage : $1\text{ V} / 1000\text{ min}^{-1} \pm 20\%$



Velocity Monitor Output

2) SW1 (Dip Switch) Setting

Choose an axis by setting SW1. Multiple axes cannot be monitored at a time.

Axis No	SW1 Setting			
	1	2	3	4
1	ON	OFF	OFF	OFF
2	OFF	ON	OFF	OFF
3	OFF	OFF	ON	OFF
4	OFF	OFF	OFF	ON

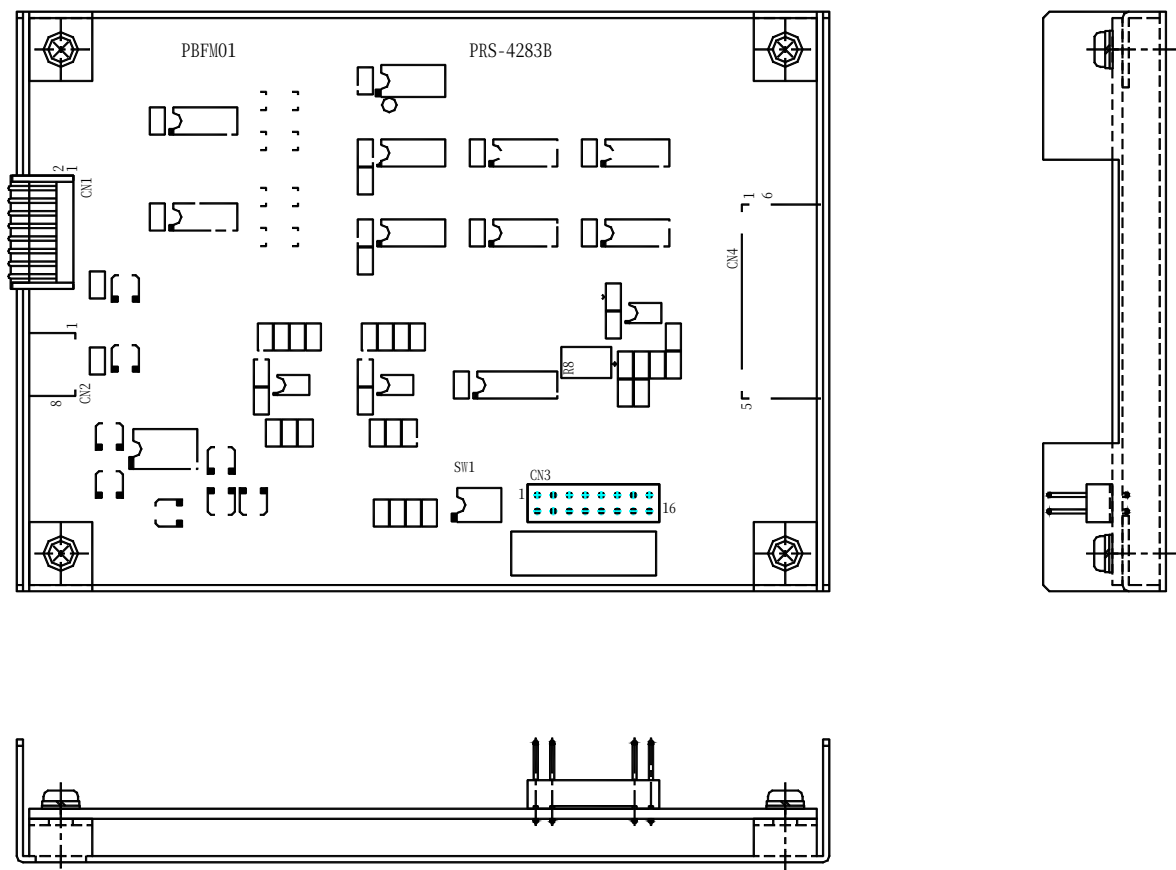
3) Pin Arrangement on F/V Board Side

Pin No.	Signal	Pin No.	Signal	Pin No.	Signal	Pin No.	Signal
1	VCC	5	-	9	Axis1 Sensor A	13	Axis3 Sensor A
2	GND	6	-	10	Axis1 Sensor B	14	Axis3 Sensor B
3	Velocity Monitor	7	-	11	Axis2 Sensor A	15	Axis4 Sensor A
4	-	8	-	12	Axis2 Sensor B	16	Axis4 Sensor B

- * Sensor output signal is CMOS output.

APPENDIX. OPTION

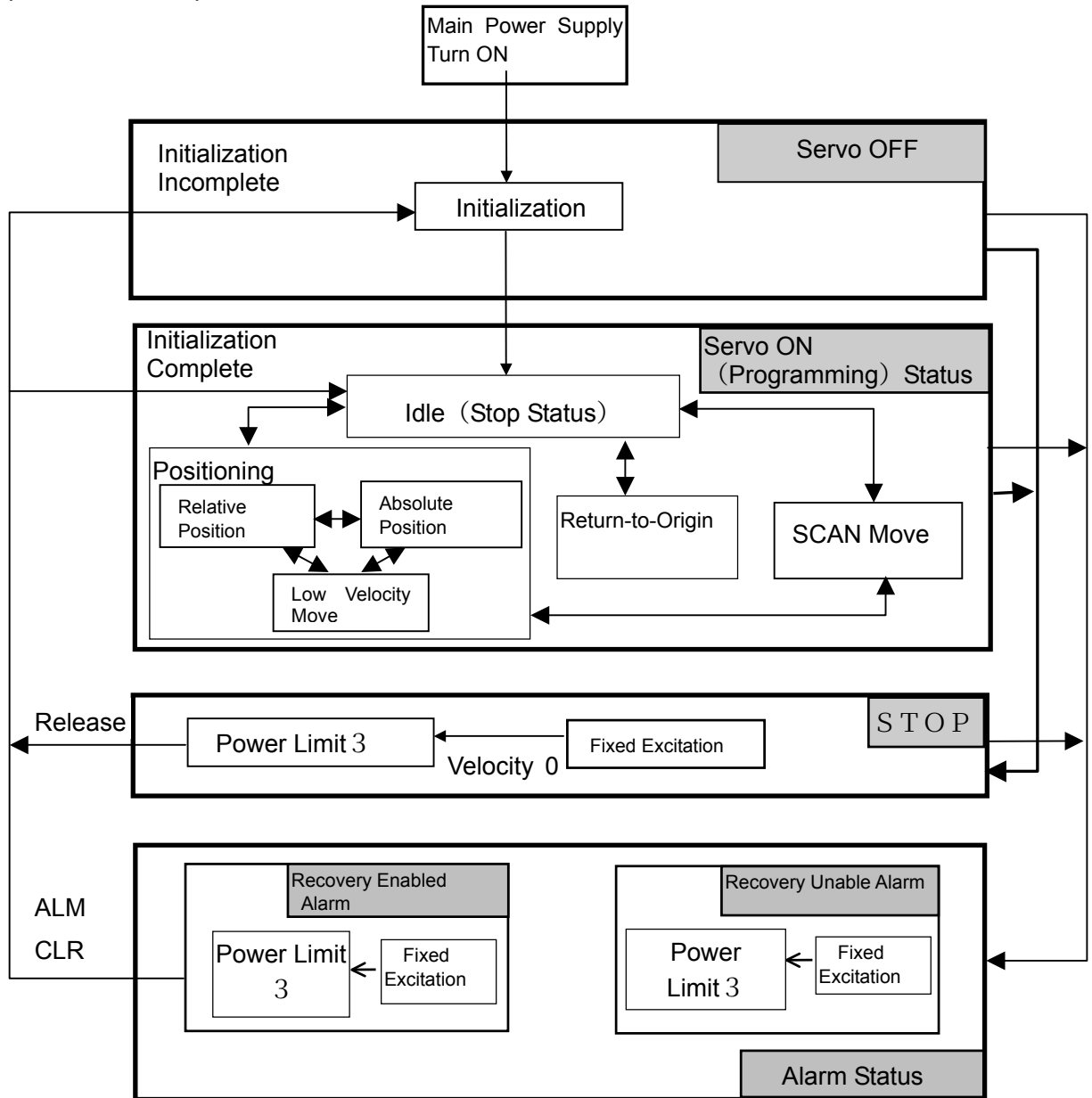
4) External Views/ External Mounting Wire Arrangement of F/V Monitor



APPENDIX. OPTION

Appendix 6 Status Transition

The following shows the transitions of the amplifier status. Whether command execution is enabled or disabled depends on the amplifier status. Refer to the list of code receive.



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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*Remarks : Specifications Are Subject To Change Without Notice.