M0012315B

SANMOTION

AC SERVO SYSTEMS

R

3E Model

TYPE S

Built-in Positioning Function Model

For Rotary Motor, Linear Motor

Instruction Manual for functions

SANYO DENKI

Safety Precautions

Please read this User Manual and its appendix carefully prior to installation, operation, maintenance or inspection and perform all tasks according to the instructions provided here. A good understanding of this equipment, its safety information as well as all Warnings / Cautions is also necessary before using.
Matters that require attention are ranked as “Danger” “Warning” and “Caution” in this document.

■ Warning Symbol

	Denotes immediate hazards that will probably cause severe bodily injury or death as a result of incorrect operation.
	Denotes immediate hazards which will probably cause severe bodily injury or death as a result of incorrect operation.
	Denotes hazards which could cause bodily injury and product or property damage as a result of incorrect operation.

⚠ Caution Even those hazards denoted by this symbol could lead to a serious accident. Make sure to strictly follow these safety precautions.

■ Prohibited, Mandatory Symbols

	Indicates actions that must not be allowed to occur / prohibited actions.
	Indicates actions that must be carried out / mandatory actions.

Safety Precautions

■ Attention in use

⚠ Warning

- ◆ Do not use this device in explosive environment.
  Injury or fire could otherwise result.
- ◆ Do not perform any wiring, maintenance or inspection when the device is hot-wired. After switching the power off, wait at least 15 minutes before performing these tasks.
  Electric shock or damage could otherwise result.
- ◆ The protective ground terminal (⏚) should always be grounded to the unit or control board. The ground terminal of the motor should always be connected to the protective ground terminal (⏚) of the amplifier.
  Electric shock could otherwise result.
- ◆ Do not touch the inside of the amplifier.
  Electric shock could otherwise result.
- ◆ Do not damage the cable, do not apply unreasonable stress to it, do not place heavy items on it, and do not insert it in between objects.
  Electric shock could otherwise result.
- ◆ Do not touch the rotating part of the motor during operation.
  Bodily injury could otherwise result.

Caution

- Use the amplifier and motor together in the specified combination.
  Fire or damage to the device could otherwise result.
- Only technically qualified personnel should transport, install, wire, operate, or perform maintenance and inspection on this device.
  Electric shock, injury or fire could otherwise result.
- Do not expose the device to water, corrosive or flammable gases, or any flammable material.
  Fire or damage to the device could otherwise result.
- Be careful of the high temperatures generated by the amplifier/motor and the peripherals.
  Burn could otherwise result.
- Do not touch the radiation fin of the amplifier, the regenerative resistor, or the motor while the device is powered up, or immediately after switching the power off, as these parts generate excessive heat.
  Burn could otherwise result.
- In terms of designing safety systems using the Safe Torque Off function, personnel who have expertise of relevant safety standard are supposed to do that job with good understanding of this instruction manual.
  Injury or damage to the device could otherwise result.
- Please read the User Manual carefully before installation, operation, maintenance or inspection, and perform these tasks according to the instructions.
  Electric shock, injury or fire could otherwise result.
- Do not use the amplifier or the motor outside their specifications.
  Electric shock, injury or damage to the device could otherwise result.
- Regenerative resistor has instantaneous capacity. Contact our offices if the instantaneous regenerative power could be high as the result of high-inertia moment or high-velocity rotation.

■ Storage

Prohibited

- Do not store the device where it could be exposed to rain, water, toxic gases or other liquids.
  Damage to the device could otherwise result.

Safety Precautions

Mandatory

- Store the device where it is not exposed to direct sunlight, and within the specified temperature and humidity ranges {- 20°C to + 65°C, below 90% RH (non-condensing)}.
  Damage to the device could otherwise result.
- Please contact our office if the amplifier is to be stored for a period of 3 years or longer. The capacity of the electrolytic capacitors decreases during long-term storage, and could cause damage to the device.
  Damage to the device could otherwise result.
- Please contact our office if the amplifier is to be stored for a period of 3 years or longer.
  Confirmations such as bearings and the brakes are necessary.

■ Transportation

Caution

- When handling or moving this equipment, do not hold the device by the cables, the motor shaft or detector portion.
  Damage to the device or bodily injury could otherwise result.
- Keep in mind that it is dangerous at the time of conveyance if it falls and overturns.
  Bodily injury could otherwise result.

Mandatory

- Follow the directions written on the outside box. Excess stacking could result in collapse.
  Bodily injury could otherwise result.
- Use eyebolt of the motor only for transporting itself. Do not use for transportation of machinery combined with the motor.
  Damage to the device or bodily injury could otherwise result.

■ Installation

⚠ Caution

- ◆ Do not stand on the device or place heavy objects on top of it.
  Bodily injury could otherwise result.
- ◆ Make sure the mounting orientation is correct.
  Fire or damage to the device could otherwise result.
- ◆ Do not drop this device or subject it to excessive shock of any kind.
  Damage to the device could otherwise result.
- ◆ Do not obstruct the air intake and exhaust vents, and keep them free of debris and foreign matter.
  Fire could otherwise result.
- ◆ Consult the User Manual regarding the required distance inside the amplifier disposition.
  Fire or damage to the device could otherwise result.
- ◆ Open the box only after checking its top and bottom location.
  Bodily injury could otherwise result.
- ◆ Verify that the products correspond to the order sheet/packing list.
  Injury or damage could result.
- ◆ Take care of falling or overturning of the device during installation.
  Use eyebolts of the motor if supplied.
  Bodily injury could otherwise result.
- ◆ Install the device on a metal or other non-flammable support.
  Fire could otherwise result.
- ◆ Make the collision safety device strong enough to resist the maximum output of the system.
  Bodily injury could otherwise result.

Safety Precautions

■ Wiring

⚠ Caution

- ◆ Wiring connections must be secure.
  Bodily injury could otherwise result.
- ◆ Wiring should be completed based on the Wiring Diagram or the User Manual.
  Electric shock or fire could otherwise result.
- ◆ Wiring should follow electric equipment technical standards and indoor wiring regulations.
  An electrical short or fire could otherwise result.
- ◆ Do not connect a commercial power supply to the U, V or W terminals of the servo motor.
  Fire or damage to the device could otherwise result.
- ◆ Install a safety device such as a breaker to prevent external wiring short-circuits.
  Fire could otherwise result.
- ◆ Do not bind or band the power cable, input/output signal cable and/or encoder cable together or pass through the same duct or conduit.
  This action will cause faulty operation.
- ◆ Must add the surge absorbing diode if inductive load as relay connect to the control signal output of the amplifier. Please take care of polarity of the diode that will be cause of failure.
- ◆ Do not connect DC90V or AC power to the DC24V Brake of the servo motor. Also, do not connect AC400V to the AC200V Fan of the servo motor.
  An electrical short or fire could otherwise result.
- ◆ Please design a sequence that included braking delay time because the surge-absorbing component for the relay of holding brake of the servo motor gives braking delay time.
  Injury or load falling could otherwise result.

Mandatory

- ◆ Install an external emergency stop circuit that can stop the device and cut off the power instantaneously. Install an external protective circuit to the amplifier to cut off the power from the main circuit in the case of an alarm.
  Motor runaway, bodily injury, burnout, fire and secondary damages could otherwise result.

■ Operation

⚠ Caution

- ◆ Do not perform extensive adjustments to the device as they may result in unstable operation.
  Bodily injury could otherwise result.
- ◆ Trial runs should be performed with the motor in a fixed position, separated from the mechanism. After verifying successful operation, install the motor on the mechanism.
  Bodily injury could otherwise result.
- ◆ The holding brake is not to be used as a safety stop for the mechanism. Install a safety stop device on the mechanism.
  Bodily injury could otherwise result.
- ◆ In the case of an alarm, first remove the cause of the alarm, and then verify safety. Next, reset the alarm and restart the device.
  Bodily injury could otherwise result.
- ◆ Check that input power supply voltage is keeping a specification range.
  Damage to the device could otherwise result.
- ◆ Avoid getting close to the device, as a momentary power outage could cause it to suddenly restart (although it is designed to be safe even in the case of a sudden restart).
  Bodily injury could otherwise result.
- ◆ Do not use motor or amplifier which is defective or failed and damaged by fire.
  Injury or fire could otherwise result.
- ◆ In the case of any irregular operation, stop the device immediately.
  Electric shock, injury or fire could otherwise result.
- ◆ When using the servo motor in vertical axis, provide safety devices to prevent falls during the work that will cause an alarm condition.
  Injury or damage could result.

Safety Precautions

Prohibited

- The built-in brake is intended to secure the motor; do not use it for regular control.
  Damage to the brake could otherwise result.
  Damage to the device could otherwise result.
- Keep the motor's encoder cables away from static electricity and high voltage.
  Damage to the device could otherwise result.
- Standard specification servo amplifiers have a dynamic brake resistor. Do not rotate the motor continuously from the outside when the amplifier is not powered on, because the dynamic brake resistor will heat up, and can be dangerous.
  Fire or burn could otherwise result.
- Absolutely do not apply voltage more than the spec to the amplifier because overvoltage will be cause of part failure.
  Damage to the device or bodily injury could otherwise result.
- Avoid frequent on and off power supply.
  Inner parts might get premature failure in case of repeating ON/OFF of power supply 30 times or more per day, otherwise 5 times or more per hour.

Mandatory

- Install an external emergency stop circuit that can stop the device and cut off the power instantaneously. Install an external protective circuit to the amplifier to cut off the power from the main circuit in the case of an alarm.
  Motor runaway, bodily injury, burnout, fire and secondary damages could otherwise result.
- There is no safeguard on the motor. Use an over-voltage safeguard, short-circuit breaker, overheating safeguard, and emergency stop to ensure safe operation.
  Injury or fire could otherwise result.
- Operate within the specified temperature and humidity range.
  Servo Amplifier
  Temperature 0°C to 55°C
  Humidity below 90% RH (non-condensing).
  Servo Motor
  Temperature 0°C to 40°C
  Humidity below 90% RH (non-condensing).}
  Burnout or damage to the device could otherwise result.

■ Maintenance・Inspection

Caution

- Some parts of the servo amplifier (electrolytic capacitor, cooling fan, lithium battery for encoder, fuse and relay kinds) can deteriorate with long-term use. Please contact our offices for replacements.
  Damage to the device could otherwise result.
- Do not touch or get close to the terminal while the device is powered up.
  Electric shock could otherwise result.
- Be careful during maintenance and inspection, as the body of the amplifier becomes hot.
  Burn could otherwise result.
- Please contact your distributor or sales office if repairs are necessary. Disassembly could render the device inoperative.
  Damage to the device could otherwise result.

Prohibited

- Do not overhaul the device.
  Fire or electric shock could otherwise result.
- Do not measure the insulation resistance and the pressure resistance.
  Damage to the device could otherwise result.
- Absolutely do not unplug the connector while the device is powered up because hot plug will give damaged by surge to component.
  Electric shock or damage could otherwise result.
- Do not remove the nameplate cover attached to the device.

■ Disposal

Mandatory

- If the amplifier or the motor is no longer in use, it should be discarded as industrial waste.

Table of contents

1. Preface

1.1 Introduction ····· 1-1
1.1.1 Product overview ····· 1-1
1.2 Instruction manual ····· 1-2
1.2.1 Contents ····· 1-2
1.2.2 Precautions related to these instructions ····· 1-2

2. Interface

2.1 Parallel interface [C: I/O] ····· 2-1
2.1.1 CN1 I/O specification ····· 2-1
2.1.2 General outputs OUT (1) to (8) specification ····· 2-10
2.2 Serial interface [F: MODBUS communication] ····· 2-13
2.2.1 Description ····· 2-13
2.2.2 Communication time diagram ····· 2-19
2.2.3 Frame composition ····· 2-23
2.2.4 Function code ····· 2-25
2.2.5 Parameter ····· 2-46
2.2.6 Monitor data ····· 2-53
2.2.7 Point data ····· 2-56
2.2.8 Communication example ····· 2-60
2.2.9 Alarm clear ····· 2-66
2.2.10 Encoder clear procedure ····· 2-67

3. Positioning function parameters

3.1 Parameter setting ····· 3-1
3.1.1 Positioning function parameter list (Common) ····· 3-1
3.1.2 Positioning function parameter list (shown at C: I/O use) ····· 3-3
3.1.3 Positioning function parameter list (shown at F: MODBUS use) ····· 3-4
3.2 Each parameter functions ····· 3-5

4. Positioning function

4.1 Point data description ····· 4-1
4.2 Operations by external input ····· 4-16
4.3 Basic parameters for positioning ····· 4-26
4.4 Infinite motor rotation specification ····· 4-33
4.5 Fixed position stop JOG function ····· 4-36
4.6 Error sequence and software limit sequence ····· 4-39

Table of contents

5. Operations

5.1 Basic setting of the system ····· 5-1
5.1.1 Specification check ····· 5-1
5.1.2 System parameters ····· 5-3
5.1.3 Servo motor setting ····· 5-6
5.1.4 Motor encoder setting ····· 5-9
5.1.5 Main circuit power setting ····· 5-13
5.1.6 Regenerative resistor setting ····· 5-13
5.1.7 Control method selection ····· 5-14
5.1.8 Positioning function parameter setting ····· 5-14
5.2 Test operation ····· 5-14
5.3 Servo amplifier status display ····· 5-15
5.3.1 Normal display ····· 5-15
5.3.2 Alarm display ····· 5-15
5.3.3 Error display ····· 5-15
5.4 Operation sequence ····· 5-16
5.4.1 The operation sequence with factory setting from "turn power on" to "turn power off" ····· 5-16
5.4.2 Stop sequence at alarm ····· 5-18
5.4.3 Sequence of alarm reset ····· 5-20
5.4.4 Sequence when power is turned OFF during operation (During servo ON) ····· 5-21
5.5 Monitor function ····· 5-22
5.5.1 Monitor list ····· 5-22
5.5.2 Descriptions of each monitor ····· 5-23
5.5.3 Positioning function monitor list ····· 5-33
5.5.4 Positioning function monitor description ····· 5-34
5.6 Analog monitor and digital monitor ····· 5-37
5.7 Setting parameters ····· 5-38
5.7.1 Parameters list ····· 5-38
5.8 Parameter functions ····· 5-47
5.9 Control block diagram ····· 5-115
5.10 SEMI F47 supporting function ····· 5-118
5.10.1 Parameter setting ····· 5-118
5.10.2 Operational sequence ····· 5-118
5.10.3 Notes ····· 5-119
5.11 Virtual motor operation function ····· 5-120
5.11.1 Setting ····· 5-120
5.11.2 Restrictions ····· 5-121
5.11.3 Digital operator display ····· 5-122
5.11.4 Operating precautions ····· 5-122

Table of contents

6. Supporting function and test operation

6.1 Point data setting (Supporting function) ····· 6-1
6.1.1 Point data ····· 6-2
6.1.2 Test operation ····· 6-2
6.1.3 Homing ····· 6-2
6.1.4 Point move ····· 6-2
6.1.5 Test operation/Homing/Point move ····· 6-2
6.2 Test operation ····· 6-3
6.2.1 Check of installation and wiring ····· 6-3
6.2.2 Check of operation ····· 6-3
6.2.3 I/O signal setting ····· 6-4
6.2.4 Check of device operation ····· 6-5

7. Digital Operator

7.1 Parallel interface ····· 7-1
7.1.1 Digital Operator names and functions ····· 7-1
7.1.2 Modes ····· 7-1
7.1.2.1 Changing modes ····· 7-1
7.1.2.2 Mode contents ····· 7-2
7.1.3 Setting and display range ····· 7-3
7.1.4 Status display mode ····· 7-6
7.1.4.1 Status display mode ····· 7-6
7.1.4.2 Linear motor magnetic pole position detection process display ····· 7-6
7.1.4.3 Status display of warning ····· 7-7
7.1.4.4 Alarm code and servo amplifier status code when alarm occurs ····· 7-8
7.1.4.5 Alarm reset when alarm activated ····· 7-8
7.1.4.6 How to check the servo amplifier information 1 to 3 ····· 7-9
7.1.4.7 How to set pass ward ····· 7-10
7.1.4.8 How to cancel password ····· 7-11
7.1.5 Editing parameters ····· 7-12
7.1.5.1 Basic parameters, editing system parameters ····· 7-12
7.1.5.2 Editing general parameters ····· 7-13
7.1.6 How to tune automatic notch frequency ····· 7-14
7.1.7 Auto FF vibration suppression frequency tuning ····· 7-15
7.1.8 Encoder Clear ····· 7-16
7.1.9 Automatic tuning result writing ····· 7-16
7.1.10 Alarm history display ····· 7-17
7.1.11 How to clear alarm history ····· 7-18
7.1.12 Monitor display ····· 7-19
7.1.13 Fixed monitor display ····· 7-20
7.1.14 Motor code-setting of servo motor used ····· 7-20
7.1.15 Holding brake control (disabled) ····· 7-20

Table of contents

7.2 Serial interface communication ····· 7-21
7.2.1 Serial interface communication indicator ····· 7-21
7.2.2 Servo amplifier indicator ····· 7-22
7.2.2.1 Main Circuit Power Supply Indicator Code: CHARGE ····· 7-22
7.2.2.2 Control Power Supply Establish Indicator Code: POW ····· 7-22
7.2.3 Digital Operator Indicator ····· 7-23
7.2.3.1 Digital Operator Names and Functions ····· 7-23
7.2.3.2 Mode changes ····· 7-23
7.2.4 Digital Operator Display Form ····· 7-24
7.2.5 Status Display Mode ····· 7-24
7.2.5.1 Alarm Display ····· 7-25
7.2.5.2 How to Reset Alarm When Alarm Occurring ····· 7-25
7.2.5.3 Encoder Clear ····· 7-26
7.2.5.4 Automatic Tuning Result Writing ····· 7-26
7.2.6 Holding brake control (disabled) ····· 7-26
7.2.7 Alarm History Mode ····· 7-27
7.2.7.1 Alarm History Display Mode ····· 7-27
7.2.7.2 Clear Alarm History ····· 7-27
7.2.8 Monitor Display Mode ····· 7-28
7.2.9 Fixed monitor display ····· 7-28

8. Maintenance

8.1 Troubleshooting ····· 8-1
8.2 List of warning and alarm ····· 8-4
8.2.1 Warning List ····· 8-4
8.2.2 Alarm list ····· 8-5
8.2.3 Alarm list (Additional for Positioning function built-in servo amplifier) ····· 8-9
8.3 Troubleshooting when alarm activated ····· 8-10
8.3.1 Alarm display ····· 8-10
8.3.2 Corrective action for alarm ····· 8-10
8.3.3 Corrective action for alarm (Additional for Positioning function built-in servo amplifier) ····· 8-41
8.3.4 Correspondence table for EnDat Error message and alarm code ····· 8-42
8.4 Troubleshooting when error code activated ····· 8-43
8.4.1 Error code display ····· 8-43
8.4.2 Corrective action for error code ····· 8-44
8.5 Troubleshooting of status history display ····· 8-46
8.5.1 Status history display example ····· 8-46
8.5.2 Status history display list ····· 8-47
8.6 Encoder clear and alarm reset ····· 8-48
8.7 Inspection ····· 8-49
8.8 Service parts ····· 8-50
8.8.1 The parts requiring Inspection ····· 8-50
8.8.2 Replacing battery for motor encoder ····· 8-52

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1 Preface

In this chapter, Summary, Positioning, and How to use of this instruction manual are explained.

1.1 Introduction 1-1
1.1.1 Product overview 1-1
1.2 Instruction manual 1-2
1.2.1 Contents 1-2
1.2.2 Precautions related to these instructions 1-2

1. Preface

1.1 Introduction

1.1.1 Product overview

Thank you for purchasing the AC servo system, “SANMOTION R” 3E Model. Please make sure to read this instruction manual before use to operate this AC servo system correctly. After reading, please keep it handy to refer as needed.

■ Summary
This document is function manual of R 3E Model positioning function built-in type servo amplifier issued by SANYO DENKI.
This manual describes technical specification of how to activate each function according to interface type, C: I/O type and F: MODBUS communication type.
For reading, pertinent knowledge about servo amplifier, positioning function and MODBUS communication etc is required.

■ Related document
Refer another document M0012314, for the information of servo amplifier and especially "Safety precautions".

1.2 Instruction manual

This manual outlines the specifications, installation, wiring, operations, functions, maintenance, etc. of the AC servo amplifier "SANMOTION R" 3E Model EtherCAT interface as follows:

1.2.1 Contents

- Chapter 1 Preface
  Describes this document.

- Chapter 2 Interface
  Describes interfaces.
  There are two types of interface for this product.
  Refer the interface type according to model number specification.

- Chapter 3 Positioning function parameter
  Describes parameters related to positioning function.

- Chapter 4 Positioning function
  Describes positioning function.

- Chapter 5 Operation
  Describes operation sequence, how to use test operation and parameters.

- Chapter 6 Supporting function and test operation
  Describes supporting function for point data setting, and test operation.

- Chapter 7 Digital operator
  Describes LED indication and how to use digital operator.

- Chapter 8 Maintenance
  Describes troubleshooting when alarms occur and inspection.

1.2.2 Precautions related to these instructions

In order to fully understand the functions of this product, please read this instruction manual thoroughly before using the product. After thoroughly reading the manual, keep it handy for reference.

Carefully and completely follow the safety instructions outlined in this manual.

Note that safety is not guaranteed for usage methods other than those specified in this manual or those methods intended for the original product.

Permission is granted to reproduce or omit a portion of the attached figures (as abstracts) for use.

The contents of this manual may be modified without prior notice as revisions or additions are created regarding the usage method of the product. Modifications are performed as per the revisions of this manual.

Although the manufacturer has taken all possible measures to ensure the veracity of the contents of this manual, should you notice any error or omission, please notify the nearest branch office or head office written in back cover.

Moreover, original text of this instruction manual is Japanese. Original text writing has priority if there is difference between original text and the other language writing.

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2 Interface

In this chapter, interfaces of parallel interface (I/O) and serial interface (MODBUS communication) is explained. Please refer to applicable interface due to interface type (C: I/O, F: MODBUS communication) in servo amplifier model number.

2.1 Parallel interface [C: I/O] 2-1

2.1.1 CN1 I/O specification 2-1

2.1.2 General outputs OUT (1) to (8) specification 2-10

2.2 Serial interface [F: MODBUS communication] 2-13

2.2.1 Description 2-13

2.2.2 Communication time diagram 2-19

2.2.3 Frame composition 2-23

2.2.4 Function code 2-25

2.2.5 Parameter 2-46

2.2.6 Monitor data 2-53

2.2.7 Point data 2-56

2.2.8 Communication example 2-60

2.2.9 Alarm clear 2-66

2.2.10 Encoder clear procedure 2-67

2. Inteface

2.1 Parallel interface [C: I/O]

2.1.1 CN1 I/O specification

CN1 input/output signals specification

Signal name	Code	Pin number	I/O	Conditions for input (Restrictions)	Description
Slowdown before Home	SDN	19	I	1) For incremental encoder use, it is effective during homing operation. 2) For absolute encoder use, it is effective during homing operation with condition of incremental system selection and homing function enabled.	Normally Closed contact input (Sw2_bit7: standard setting) 1) For homing operation with incremental encoder use, it becomes homing low speed by contact open (OFF). 2) Homing completes by changing contact open (OFF) to close (ON) during homing low speed. Homing method is selected by ID0E (Z_typ) in groupA. ■ Homing method (00: C-Signal) Homing completes by finding encoder C-phase signal after changing contact open (OFF) to close (ON). ■ Homing method (01: SDN-OFF) Homing completes at the same timing of changing contact open (OFF) to close (ON).
+ Over travel	+OT	20	I	Always acceptable.	Normally Closed contact input (Sw2_bit2: standard setting) Positive move is prohibited by inputting Open (OFF) and stops suddenly. After sudden stop, servo is OFF.
- Over travel	-OT	21	I	Always acceptable.	Normally Closed contact input (Sw2_bit2: standard setting) Negative move is prohibited by inputting Open (OFF) and stops suddenly. After sudden stop, servo is OFF.
External data setting	E_STR	22	I	-	Normally Opened contact input
				External data setting function	■ External data setting permission (Sw1_bit0=1) Performs external point teaching as external data setting.
				Home position setting function	■ E_STR input is used as replacement of home position setting input if in the condition of External data setting prohibition (Sw1_bit0=0) and Home position setting input selection (Sw2_bit3=1). ■ E_STR input is not used if in the condition of Home position setting input selection (Sw2_bit3=0). Performs home position setting by point move of point specification 254.
				Fixed excitation starting signal CSET function	■ E_STR input is used as replacement of CSET input if in the condition of External data setting prohibition (Sw1_bit0=0) and Home position setting input selection (Sw2_bit3=1).

CN1 input/output signals specification

Signal name	Code	Pin number	I/O	Conditions for input (Restrictions)	Description
External error	EXT-E	23	I	Always acceptable.	Normally Closed contact input (Sw2_bit5: standard setting) Alarm is issued by inputting Open (OFF).
External power source for input signals	+24V	26	(I)	-	Power source for input circuit. (24 VDC±10%) It shall be provided from external DC power.
Starting	RUN	27	I	1) Not acceptable when other input signals (ZRT, +JOG/ -JOG, +1STEP/ -1STEP, CACL) are ON. 2) Both MOVE and PFIN outputs must be OFF for performing new point move. (Not acceptable during movement) 3) Acceptable only at servo “ON” status (8-segment LED displays a rotating character of 8) with command reception permitted condition. 4) Acceptable when external operation (operated through CN1) is enabled.	Normally Opened contact input A signal to start point move operations. 1) Starts at the switching edge from Open (OFF) to Close (ON). 2) Moves to specified point by turning ON of point specification inptut at start reception. 3) When starting signal is turned OFF during operation, it decelerates and stops momentarily. When starting signal is turned ON again, continues point move. 4) Starting signal shall be kept ON state until positioning completion (PFIN turns ON). Note) "Point move" includes continuous point move.
Homing	ZRT	28	I	1) Not acceptable when other input signals (RUN, +JOG/ -JOG, +1STEP/ -1STEP, CACL) are ON. 2) Both MOVE and PFIN outputs must be OFF for performing new point move. (Not acceptable during movement) 3) Acceptable only at servo “ON” status (8-segment LED displays a rotating character of 8) with command reception permitted condition. 4) Acceptable when external operation (operated through CN1) is enabled.	Normally Opened contact input A signal to start homing operations. ■ For incremental encoder use 1) Starts homing at the switching edge from Open (OFF) to Close (ON). 2) Homing signal shall be kept ON state until homing completion (PFIN turns ON). 3) At homing operation, if homing start signal is turned OFF while high speed movement, it decelerates and stops into a temporary stop status (feed hold). And when homing start signal is turned ON again, resumes the homing operation. When in the low speed move mode, even if homing start signal is turned OFF, temporary stop status may not occur. ■ For absolute encoder use 1) Starts homing operation at the switching edge from Open (OFF) to Close (ON). 2) At homing operation, returns to origin-set coordinate.

2. Inteface

CN1 input/output signals specification

Signal name	Code	Pin number	I/O	Conditions for input (Restrictions)	Description
+ Manual feeding	+JOG	29	I	1) Not acceptable when other input signals (RUN, ZRT, +1STEP / -1STEP) are ON. 2) Do not turn ON both +JOG and -JOG signals at the same time. 3) Not acceptable when alarms or others are occuring. 4) Acceptable only at servo “ON” status (8-segment LED displays a rotating character of 8) with command reception permitted condition. 5) Acceptable when external operation (operated through CN1) is enabled.	Normally Opened contact input A signal for positive move with manual operation from external. 1) Starts moving at the switching edge from Open (OFF) to Close (ON), keeps move while ON and decelerates / stops at OFF. 2) When RAP signal is OFF, the speed set by the parameter, manual low speed (L_jog), is the feeding speed, and when ON, the speed set by the parameter, manual high speed (H_jog), is the feeding speed. 3) During manual feeding, MOVE and PFIN remain OFF.
- Manual feeding	-JOG	30	I		Normally Opened contact input A signal for negative move with manual operation from external. 1) Starts moving at the switching edge from Open (OFF) to Close (ON), keeps move while ON and decelerates / stops at OFF. 2) When RAP signal is OFF, the speed set by the parameter, manual low speed (L_jog), is the feeding speed, and when ON, the speed set by the parameter, manual high speed (H_jog), is the feeding speed. 3) During manual feeding, MOVE and PFIN remain OFF.
Manual high speed/ Override	RAP / OVRID	31	I	1) Manual high speed (RAP): Valids at manual feeding and 1-step feeding, by external operation (through CN1). 2) Override (OVRID): Acceptable at point move and homing.	Normally Opened contact input 1) Switches high / low speed of manual operation. Switches the amount and speed of 1-step feeding. 2) Performs each move with the velocity of multiplying factor set into the parameter (OVRID).

CN1 input/output signals specification

Signal name	Code	Pin number	I/O	Conditions for input (Restrictions)	Description
Alarm reset	ARST	32	I	1) Effective at the time alarm / error.	Normally Opened contact input A signal to release alarms/errors in alarm/error issuing status. 1) Reset the arlams/errors after eliminating their causes. 2) Some alarms may not be released by this signal depending on the contents.
Cancel	CACL	33	I	Effective only at move by RUN, ZRT, +1step / -1step.	Normally Opened contact input A signal to cancel the point move, home position return, 1 step feeding, and to make another move possible. 1) During point move/homing/1step feeding turns into CACL positioning status by CACL_ON. 2) When point move/homing/1 step feeding signal is turned OFF during CACL positioning status, and when CACL signal is turned OFF, operations are aborted (invalid) and other moves are possible.
Servo ON	S-ON	34	I	1) Acceptable when external operation (operated through CN1) is enabled. 2) Invalids while issuing alarm.	Normally Opened contact input A signal to turn ON the motor excitation. 1) When servo ON signal is turned OFF, servo motor excitation becomes OFF into free status. 2) When servo ON signal is turned OFF, holding brake excitation timing output (HBON) turns OFF.

2. Inteface

CN1 input/output signals specification

<table>
<tr><th>Signal name</th><th>Code</th><th>Pin number</th><th>I/O</th><th>Conditions for input (Restrictions)</th><th>Description</th></tr>
<tr><td>Output selection 1</td><td>SEL1</td><td>35</td><td>I</td><td rowspan="3">Acceptable when external operation (through CN1) is enabled.</td><td rowspan="3">Normally Opened contact input

Signals to select meanings (contents) of 8 bit signal of generic outputs OUT(1) to (8). See the combinations below.

<table><tr><th>SEL1</th><th>SEL2</th><th>SEL3</th><th>Description</th></tr><tr><td>OFF</td><td>OFF</td><td>OFF</td><td>Zone signal</td></tr><tr><td>ON</td><td>OFF</td><td>OFF</td><td>Error/alarm code</td></tr><tr><td>OFF</td><td>ON</td><td>OFF</td><td>Execution point number</td></tr><tr><td>ON</td><td>ON</td><td>OFF</td><td>M output</td></tr><tr><td>OFF</td><td>OFF</td><td>ON</td><td>Warning</td></tr><tr><td>ON</td><td>OFF</td><td>ON</td><td>Secondary control signal</td></tr><tr><td>OFF</td><td>ON</td><td>ON</td><td>Positioning-completed point number</td></tr><tr><td>ON</td><td>ON</td><td>ON</td><td>Reserved</td></tr></table></td></tr>
<tr><td>Output selection 2</td><td>SEL2</td><td>36</td><td>I</td></tr>
<tr><td>Output selection 3</td><td>SEL3</td><td>37</td><td>I</td></tr>
<tr><td>+1 step feeding</td><td>+1step</td><td>38</td><td>I</td><td rowspan="2">1) Not acceptable when other input signals (RUN, ZRT, +JOG/ -JOG, CACL) are ON.
2) Do not input both +1 step and -1 step signals at the same time.
3) Not acceptable when alarms or others are occuring.
4) Acceptable only at servo “ON” status (8-segment LED displays a rotating character of 8) with command reception permitted condition.

5) Acceptable when external operation (operated through CN1) is enabled.</td><td>Normally Opened contact input
A signal for positive move with manual operating constant feed from external.
1) Starts moving at the switching edge from Open (OFF) to Close (ON) and moves the distance set by the parameter.
2) When RAP signal is OFF, it moves the distance L_stp with manual low speed, and when ON, it moves the distance H_stp with manual high speed.</td></tr>
<tr><td>-1 step feeding</td><td>-1step</td><td>39</td><td>I</td><td>Normally Opened contact input
A signal for negative move with manual operating constant feed from external.
1) Starts moving at the switching edge from Open (OFF) to Close (ON) and moves the distance set by the parameter.
2) When RAP signal is OFF, it moves the distance L_stp with manual low speed, and when ON, it moves the distance H_stp with manual high speed.</td></tr>
</table>

CN1 input/output signals specification

Signal name	Code	Pin number	I/O	Conditions for input (Restrictions)	Description
Interruption start	IRUN	40	I	1) Acceptable when external operation is enabled. 2) It works just while point move.	Normally Opened contact input A signal to move to interruption point during point move. 1) During point move, moves to interruption point set in the point data which is being executed at the switching edge of interruption start from Open (OFF) to Close (ON). 2) Interruption move during interruption move is impossible
MFIN	MFIN	41	I	Acceptable when external operation is enabled.	Normally Opened contact input A signal to make a handshake against M output (MSTR). Turn the MFIN input from Open (OFF) to Close (ON) with the M output signal (MSTR) ON to make a handshake with M output. When M output type (M_typ) is “1”, use this MFIN input because handshake will be performed. Handshake will be not performed even if M output type is “1” when moved with speed change.
Point specification	IN(1)	42	I	Point number specification input must have been established at start time.	Normally Opened contact input A signal to specify the destination point number at starting signal input (RUN). 1) Specify the number with binary code. 2) Point specification is from 0 to 253.
	IN(2)	43	I		
	IN(4)	44	I		
	IN(8)	45	I		
	IN(16)	46	I		
	IN(32)	47	I		
	IN(64)	48	I		
	IN(128)	49	I		

2. Inteface

CN1 input/output signals specification

Signal name	Code	Pin number	I/O	Conditions for input (Restrictions)	Description
External power source for output signals	+24V	1 2	(I)	-	Power source for output circuit. (24 VDC±10%) It shall be provided from external DC power.
NC ready	NCRDY	3	O	1) Main circuit power input is allowed after 2 seconds around of control power turns on. It becomes NCRDY_ON by operation preparation completion after main circuit power turns on. 2) It becomes NCRDY_OFF at main circuit power OFF and alarm condition.	1) It becomes NCRDY_ON when control power and main power are established, with no alarms, and position loop is formed. 2) NCRDY_ON is the state of enabling a point positioning move, homeing, manual feeding and 1-step feeding are possible. In case that servo ON input signal is Open (OFF) also NCRDY_ON.
Holding brake excitation timing output	HBON	4	O	It becomes HBON_ON while motor is exciting.	Outputs the holding brake excitation (release) timing. At HBON_ON, holding brake is excited (released).
Error	Err	5	O	It becomes Err_ON at the time of the following errors. ■ + Software limit ■ − Software limit ■ Point data failure ■ Point loop count setting failure ■ Point loop nest setting failure ■ Homing operation failure	It becomes Err_ON in an error condition.
External operation mode output	EXT	6	O	1) It becomes EXT_ON when external operation is effective. 2) It becomes EXT_OFF when operated by PC.	1) It becomes EXT_ON when external operation input signal can be used. 2) It becomes EXT_OFF when operated by PC (in the PC mode). Do not perform external operation at this time.

CN1 input/output signals specification

Signal name	Code	Pin number	I/O	Conditions for input (Restrictions)	Description
While operation	MOVE	7	O	1) It is MOVE_OFF when power turns ON. 2) It is MOVE_OFF at alarms. 3) It is MOVE_ON during point move (until turning OFF the starting signal (RUN) after move completion). 4) It is MOVE_ON during homing (until turning OFF the homing signal (ZRT)). 5) It is MOVE_ON during 1 step feeding (until turning OFF ±1STEP signal after move completion). 6) It is MOVE_OFF during manual feeding.	1) It becomes MOVE_ON when receiving start input (RUN) at the time of point positioning move. MOVE_ON is maintained until start signal is turned OFF after move completion. The same for homing and 1-step feeding; MOVE_ON is maintained until homing signal or ±1STEP signal is turned OFF after move completion. 2) When signals of MOVE and PFIN are ON, input signal of each operation (starting, homing, manual feeding and 1-step feeding) is not acceptable.
Positioning completion	PFIN	8	O	1) It is PFIN_OFF when power turns ON. 2) It is PFIN_OFF at alarms. 3) It is PFIN_ON at point move (until turning OFF the starting signal (RUN) after move completion). 4) It is PFIN_ON at homing (until turning OFF the homing signal (ZRT) after move completion). 5) It is PFIN_ON during 1 step feeding (until turning OFF ±1STEP signal after move completion). 6) It is PFIN_OFF during manual feeding.	1) It becomes PFIN_ON when positioning completion at point positioning move. PFIN_ON is maintained until start signal is turned OFF after positioning completion. 2) It becomes PFIN_ON when homing completion at homing operation. PFIN_ON is maintained until homing signal is turned OFF after homing completion. 3) It becomes PFIN_ON when move completion at 1-step feeding. PFIN_ON is maintained until ±1STEP signal is turned OFF after move completion. 4) When signals of PFIN and MOVE are ON, input signal of each operation is not acceptable.
In-position	INPS	9	O	1) It is INPS_ON if within the in-position width, when power turns ON. 2) It is INPS_OFF generally during move. However, it is INPS_ON when moving at low speed within the in-position width. 3) It is INPS_OFF during alarms.	1) It becomes INPS_ON when current position is an ideal position within ± in-position width. 2) It becomes INPS_OFF once if moved outside the in-position width by an external force while stopping in the status of INPOS_ON. INPS_ON again when entering inside the in-position width by compensation. 3) In-position width is set by system in-position width of positioning function parameter.

2. Inteface

CN1 input/output signals specification

Signal name	Code	Pin number	I/O	Conditions for input (Restrictions)	Description
Homing completion (for use of incremental encoder)	ZFIN	10	O	When incremental encoder is used. 1) ZFIN_OFF is maintained when power turns ON and at alarms. 2) It becomes ZFIN_ON after homing completion.	When incremental encoder is used. 1) After power turned ON or alarms were released, it becomes ZFIN_ON when homing operation, which makes matching of the machine coordinate and unit coordinate, is completed. After that ZFIN_ON is maintained until another alarm or power shut off. 2) When power turns ON again or alarm is released, ZFIN_OFF is maintained unless homing operation is performed again.
Warning output (for use of absolute encoder)	WARN			When absolute encoder is used. 1) It becomes ZFIN_ON in the status of battery warning.	When absolute encoder is used. 1) It becomes WARN_ON when warning outputs from encoder due to absolute encoder battery voltage reduction. Note) Encoder may not detect voltage reduction due to characteristics of battery in use.
General output	OUT(1)	11	O	It depends on selection of input signal SEL1/SEL2/SEL3.	Outputs the item (alarm/zone signal etc) selected by input signal SEL1/SEL2/SEL3. This has meaning at OUT(1) to (8)_ON.
	OUT(2)	12	O		
	OUT(3)	13	O		
	OUT(4)	14	O		
	OUT(5)	15	O		
	OUT(6)	16	O		
	OUT(7)	17	O		
	OUT(8)	18	O		
Power ON ready	A-RDY	50	O	It becomes A-RDY_ON within 2 seconds after control power ON. However, it may require more than 2 seconds if external encoder is used. External encoder specification should be checked.	It becomes A-RDY_ON when amplifier becomes the state that can be turned on the main power supply, after control power established. (It becomes A-RDY_OFF at ALM etc.)
Common of external power for output signals	24G	24 25	(I)	-	Signal ground of 24VDC for driving output circuit and minus common of output circuit.

2.1.2 General outputs OUT (1) to (8) specification

Content of general outputs OUT (1) to (8) is selected by output selection signals SEL1/SEL2/SEL3.

Content of general outputs OUT (1) to (8)

	Content	Selection signals (input)			Remarks
		SEL1 (CN1-35)	SEL2 (CN1-36)	SEL3 (CN1-37)	
a	Zone signal	×	×	×	Switching is always effective. However, due to delay in contents switching, it shall be treated as indetermination during 50ms after switching.
b	Error/alarm codes	ON	×	×	
c	Execution point number	×	ON	×	
d	M output	ON	ON	×	
e	Warning	×	×	ON	
f	Secondary control signal	ON	×	ON	
g	Execution completion point number	×	ON	ON	
h	(Reserved)	ON	ON	ON	

* The mark (×) in the above table means OFF.

a) Zone signal
(SEL1 to 3: OFF)

■ Outputs zone signal to general outputs (1) to (8).
Zone (zon1L to zon8H) shall be set by positioning function parameters.

Current position	OUT(8)	OUT(7)	OUT(6)	OUT(5)	OUT(4)	OUT(3)	OUT(2)	OUT(1)
zon1L to zon1H	-	-	-	-	-	-	-	ON
zon2L to zon2H	-	-	-	-	-	-	ON	-
zon3L to zon3H	-	-	-	-	-	ON	-	-
zon4L to zon4H	-	-	-	-	ON	-	-	-
zon5L to zon5H	-	-	-	ON	-	-	-	-
zon6L to zon6H	-	-	ON	-	-	-	-	-
zon7L to zon7H	-	ON	-	-	-	-	-	-

* Note that the mark "-" can mean either ON or OFF.
For example, if the setting is the same for all zones, OUT (8) to (1) are all ON (inside the zones)or all OFF (outside the zones).

b) Error/alarm codes
(SEL1: ON)

■ Outputs a code to general outputs (1) to (8) when error/alarm code is issued.
Below shows an output example of error/alarm code.

Content	OUT (8)	OUT (7)	OUT (6)	OUT (5)	OUT (4)	OUT (3)	OUT (2)	OUT (1)	Code indication
(Nomal state)	×	×	×	×	×	×	×	×	00
+ software limit	×	×	×	ON	×	ON	ON	×	16
External overheat	×	ON	×	ON	×	ON	×	ON	55

* The mark (×) in the above table means OFF.
* Refer the section 8.4 for error code.
* Refer the section 8.3 for alarm code.

c) Execution point number
(SEL2: ON)

■ Outputs the point number currently being executed, by Binary code.
For example, when a single move by P001 is moved, “001” is output as a Binary code. When continuous moves by P002 to 006 are moved, currently executed points are output as Binary codes in “002” → “003” → “004” → “005” → “006”. These outputs are maintained until the next execution point is output or power shut off.

d) M output
(SEL1,2: ON)

■ Outputs general outputs (1) to (8), like as below, due to M code/M output type set by point data. Refer the description of M output in chapter 4 for detail.

	OUT(8)	OUT(7)	OUT(6)	OUT(5)	OUT(4)	OUT(3)	OUT(2)	OUT(1)
Contents	Mstr	Not used	Not used	Not used	Mout (M code output)			

e) Warning output
(SEL3: ON)

■ Outputs general outputs (1) to (8) like as below at warning output.

Condition	OUT(8)	OUT(7)	OUT(6)	OUT(5)	OUT(4)	OUT(3)	OUT(2)	OUT(1)	Remarks
No warning	×	×	×	×	×	×	×	×	
While amplifier internal temperature warning	×	×	×	×	×	×	×	ON	
While main circuit power charging	×	×	×	×	×	×	ON	×	
While overload warning	×	×	×	×	×	ON	×	×	
While regenerative overload warning	×	×	×	×	ON	×	×	×	
While torque limit operation	×	×	×	ON	×	×	×	×	
While velocity limit operation	×	×	ON	×	×	×	×	×	
While battery low voltage warning	×	ON	×	×	×	×	×	×	
While excessive deviation warning	ON	×	×	×	×	×	×	×	

* The mark (×) in the above table means OFF.
* Warning output shall be checked with the condition after establishing (ON status) of NC ready/in-position output/etc.

f) Secondary control signal
(SEL1,3: ON)

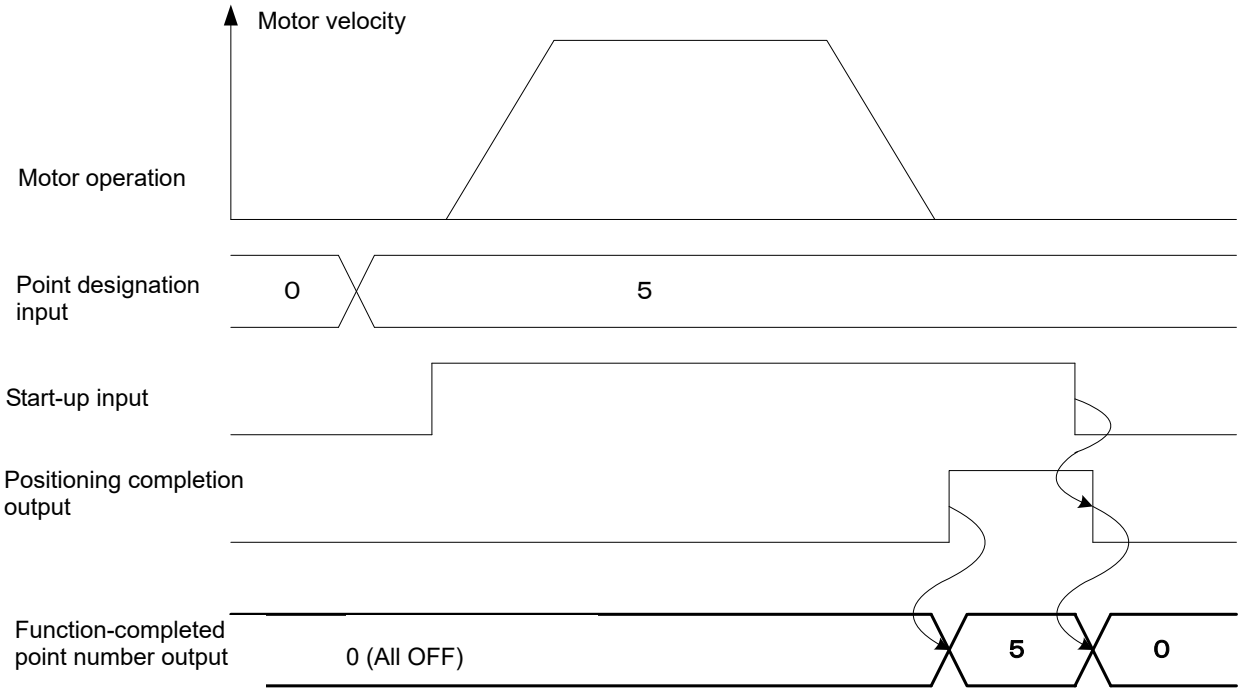
■ Outputs general outputs (1) to (8) like as below at secondary control signal output.

	OUT(8)	OUT(7)	OUT(6)	OUT(5)	OUT(4)	OUT(3)	OUT(2)	OUT(1)
Contents	Not used	Not used	Not used	Not used	SVACT output	SVRDY output	A_RDY output	ALM output

* ALM output: Turns ON at alarm.
* A_RDY output: Turns ON at power on permission. Turns OFF at alarm.
* SVRDY output: Turns ON at servo on permission. Turns OFF at alarm.
* SVACT output: Turns ON at command reception permission. Turns OFF at alarm.
  It becomes command reception inhibition state (turns OFF) at the condition of External operation mode output is OFF.

g) Execution completion point number
(SEL1: OFF, SEL2,3: ON)

■ Outputs a positioning-completed point number in binary code to general outputs (1) to (8) in conjunction with positioning completion signal (PFIN).
Codes to be output show valid values only when PFIN is on, if PFIN is off, the value is always 0 (All OFF). In line with this, completion of point number 0 cannot be recognized by using this signal.



h) Reserved
(SEL1,2,3: ON)

■ This function is reserved.

2. Inteface

2.2 Serial interface [F: MODBUS communication]

2.2.1 Description

CN0, CN1 serial interface (for MODBUS communication)

■ Basic specification

Item	Content	Default value	Remarks
Protocol	Modbus-RTU	-	Fixed to binary mode (ASCII mode is not applicable)
Interface	RS-485 (1:N)	-	N = 8 (Note 1)
Baud rate (bps)	4800, 9600, 19200, 38400, 57600 or 115200	115200	(Note 2)
Status bit	1	1	Fixed
Data length (bit)	8	8	Fixed
Parity	None, even or odd number	even	(Note 3)
Stop bit	1 or 2	1	(Note 3)
Electric specification	RS-485 compliant (half duplex communication)	RS-485 compliant (half duplex communication)	Fixed
Connector	RJ-45	-	

Note 1) Maximum number of multiaxis connection through this amplifier is 8. Set up a node address with the SANMOTION MOTOR Setup software or the rotary switch on amplifier front panel.
Note 2) Set up a communication setting (access speed) with the SANMOTION MOTOR Setup software or the rotary switch on amplifier front panel.
Note 3) Communication setting (parity, stop bit) is set up by the SANMOTION MOTOR Setup software.

■ Servo amplifier communication setting

◆ Servo amplifier communication setting can be changed by the rotary switches on amplifier front panel and the SANMOTION MOTOR Setup software (parameter Group 7).

ID	Name	Standard set value	Unit	Setting range
00	Host communication baud rate	05: 115200bps	-	00 to 05
01	Host communication format	00: Even_1Stop	-	00 to 02
02	Host communication slave address offset	00: +0	-	00 to F0
03	Host communication rotary switch 1 mode	00: Baudrate	-	00 to 01
04	Host communication wait time	0	N x 125 µs	0 to 8000
05	Host communication timeout	0	ms	0 to 10000
06	Host communication specification selection	00: MODBUS	-	00
07	Host communication function	00: Standard	-	00
08	Host communication output selection 1	00: FOUT	-	00 to 41
09	Host communication output selection 2	00: FOUT	-	00 to 41

◆ Rotary switch 1 function setting
When communication baud rate is selected, set the host communication slave address offset with ID02 of Group D.
When slave address offset is selected, set the host communication baud rate with ID00 of Group D.

ID	Description
03	Host communication rotary switch 1 mode [HCOMSWMODE]

Setting range	Standard set value
00, 01	00: Baudrate

Sets the rotary switch 1 (RSW1) function.

* Set value becomes valid after control power cycle.

Selection	Description
00: Baudrate	Sets a communication baud rate with the rotary switch 1.
01: Address	Sets a slave address offset with the rotary switch 1.

◆ Slave address host setting

ID	Description
02	Host communication slave address offset [HCOMADROFS]

Setting range	Standard set value
00 to F0	00: +0

Sets the offset value of the slave address of the servo amplifier that communicates with host.
Setting becomes valid when the rotary switch 1 mode is set as 00: Baudrate.
* Set value becomes valid after control power cycle.

Selection	Description
00: +0	0 is added to the rotary switch 2 value.
10: +16	16 is added to the rotary switch 2 value.
20: +32	32 is added to the rotary switch 2 value.
30: +48	48 is added to the rotary switch 2 value.
40: +64	64 is added to the rotary switch 2 value.
50: +80	80 is added to the rotary switch 2 value.
60: +96	96 is added to the rotary switch 2 value.
70: +112	112 is added to the rotary switch 2 value.
80: +128	128 is added to the rotary switch 2 value.
90: +144	144 is added to the rotary switch 2 value.
A0: +160	160 is added to the rotary switch 2 value.
B0: +176	176 is added to the rotary switch 2 value.
C0: +192	192 is added to the rotary switch 2 value.
D0: +208	208 is added to the rotary switch 2 value.
E0: +224	224 is added to the rotary switch 2 value.
F0: +240	240 is added to the rotary switch 2 value.

◆ Baud rate setting

ID	Description
00	Host communication baud rate [HCOMBAUD]

Setting range	Standard set value
00 to 05	05: 115200 bps

Sets the baud rate that communicates with host device.
Setting becomes valid when the rotary switch 1 mode is set as 01: Address.
* Set value becomes valid after control power cycle.

Selection
00: 4800 bps
01: 9600 bps
02: 19200 bps

Selection
03: 38400 bps
04: 57600 bps
05: 115200 bps

◆ Communication setting

ID	Description
01	Host communication format [HCOMFMT]

Setting range	Standard set value
00 to 02	00: Even_1Stop

Sets the format of communication with host device.
Start bit (1 bit) and data length (8 bits) are fixation.
All the data bits are 11-bit fixation.

* Set value becomes valid after control power cycle.

Selection	Description
00: Even_1Stop	Even parity, 1 stop bit
01: Odd_1Stop	Odd parity, 1 stop bit
02: None_2Stop	No parity, 2 stop bit

◆ Host communication wait time setting

ID	Description
04	Host communication wait time [HCOMWAIT]

Setting range	Unit	Standard set value
0 to 8000	N x 125 µs	0

Sets the response time from servo amplifier.
The response time from servo amplifier in case setting is 0 turns into silent interval time (3.5 character time) and totaled time of amplifier internal processing time.
Furthermore, when waiting time is required, it is possible to set up a value every 125µs unit.
Silent interval time becomes as below due to host communication specification selection. (In case set value zero)
For MODBUS = 3.5 character

* Set value becomes valid after control power cycle.

◆ Host communication timeout setting

ID	Description
05	Host communication timeout [HCOMTIMOUT]

Setting range	Unit	Standard set value
0 to 10000	ms	0

Sets the communication timeout time of servo amplifier.
Communication timeout is not detected when setting is 0.
When communication timeout time is set up, publish a communication message periodically so that communication timeout is not detected with servo amplifier.

* Set value becomes valid after control power cycle.

2. Inteface

◆ Communication specification setting

ID	Description
06	Host communication specification selection [HCOMSPEC]

Setting range	Standard set value
00	00: MODBUS

Sets a communication specification with host device.

* Set value becomes valid after control power cycle.

◆ Communication specification setting。

ID	Description
07	Host communication function [HCOMFUNC]

Setting range	Standard set value
00	00: Standard

Sets a communication specification with host device.

* Set value becomes valid after control power cycle.

◆ Host communication output selection 1, 2 setting

ID	Description
08 09	Host communication output selection 1 [HCOMOUT1] Host communication output selection 2 [HCOMOUT2]

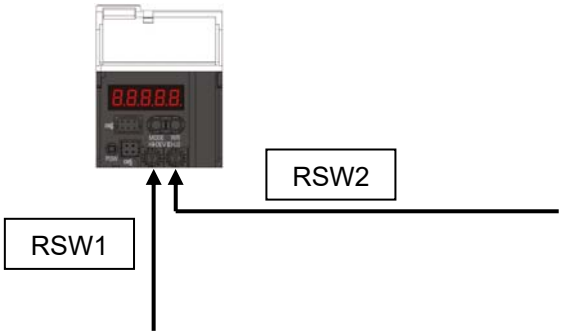
Setting range	Standard set value
00 to 41	00: FOUT

Sets a selection if coil I/O information selected to general output 1, 2 is desired to output.

* Selection will be output through general output 1 if 84/85/86/87 is selected to Group9 ID51 OUT1.
* Selection will be output through general output 1 if 84/85/86/87 is selected to Group9 ID51 OUT2.
* 00: FOUT has no selection.
* The signal, assigning a function to general output in CN2, is not subject to an output. The signal of coil input/output passing through MODBUS communication is subject to an output.

Selection	Selection	Selection	Selection	Selection
00:FOUT	10:M_FIN	20:IN(128)	30:CRDY	40:ZOUT_8
01:S-ON	11:BATCLR	21:NCRDY	31:MOUT_0	41:CSET
02:RUN	12:EXE-E	22:HBON	32:MOUT_1	
03:ZRT	13:BRK_FREE	23:ERR	33:MOUT_2	
04:+JOG	14:HOME	24:EXT	34:MOUT_3	
05:-JOG	15:SDN	25:MOVE		
06:RAP	16:+OT	26:PFIN		
07:ARST	17:-OT	27:INPS		
08:CACL	18:E_STR	28:WAR/ZFIN	38:MSTR	
09:OVRD_0	19:IN(1)	29:ALM	39:ZOUT_1	
0A:OVRD_1	1A:IN(2)	2A:A_RDY	3A:ZOUT_2	
0B:OVRD_2	1B:IN(4)	2B:SVRDY	3B:ZOUT_3	
0C:OVRD_3	1C:IN(8)	2C:SVACT	3C:ZOUT_4	
0D:+1STEP	1D:IN(16)	2D:IN_STOP	3D:ZOUT_5	
0E:-1STEP	1E:IN(32)	2E:IN_FEED	3E:ZOUT_6	
0F:IRUN	1F:IN(64)	2F:T_LIM_FLG	3F:ZOUT_7	

■ Slave address/Communication baud rate setting
Set lower address of slave with RSW2 rotary switch, after open amplifier front cover.
To assign over 16 of address, RSW1 function shall be changed to slave upper address from baud rate. Factory setting is baud rate.



RSW2	Slave lower address
0	0
1	1
2	2
・	・
・	・
・	・
D	D
E	E
F	F

RSW1	RSW1 Mode = 1 Slave upper address	RSW1 Mode = 0 Communication baud rate
0	0	115200bps
1	1	Unused
2	2	Unused
・	・	・
・	・	・
・	・	・
A	A	Unused
B	B	4800 bps
C	C	9600 bps
D	D	19200 bps
E	E	38400 bps
F	F	57600 bps

■ Termination resistor
Termination resistor shall be prepared additional.
Refer chapter 12 in the main instruction manual, for our optional parts.

■ Wiring
Refer chapter 4 in the main instruction manual, for wiring.

2.2.2 Communication time diagram

■ Master/Slave communication timing

◆ Normal message

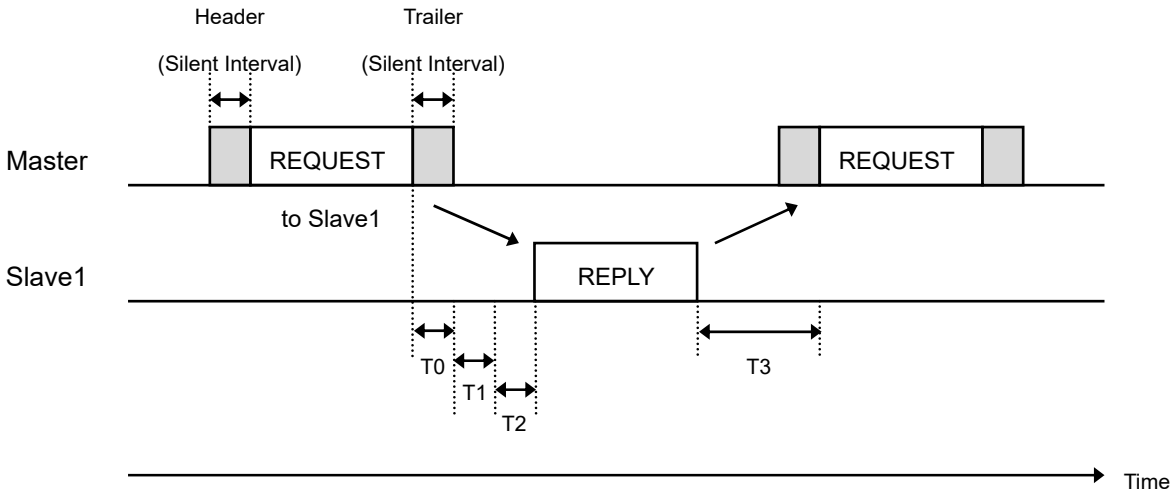
In the communication mode of MODBUS-RTU, the message frame judges the beginning of a message and the last by detection of the silent interval time of 3.5 or more characters.

Communication is started by the request from the master.

Communication is not started from the slave. Moreover, there is also no communication between slaves.

(1) Message is sent to the slave (servo amplifier) from the master. (Request)

(2) Message is returned to the master from the slave (servo amplifier). (Response)



T0･･･Silent interval time (for about 3.5 characters)

It shall be calculated for each communication baud rate.

e.g.) In case of 115200 bps communication baud rate [1/115200×3.5×11(bit) = about 334(μs)]

T1･･･Servo amplifier reception message processing time (about 500μs)

T2･･･Communication waiting time (from 0 to 1000 ms)

It is set to 0 ms at factory setting.

In the system that master cannot respond against amplifier response time (T0+T1), it can delay a response of amplifier with 125 μs unit by setting this value.

T3･･･The time after servo amplifier sends a response massage until it gives the next request to replying permission. It differs due to request messages from the master.

When the write-in request to a register is received, the preservation process to nonvolatile memory (EEPROM) is implemented. Therefore, in sending a write-in request, after passing the time of T3 or more, send the next request.

◆ The time after servo amplifier receives a request message until it sends to start of the response massage (Response time)
It is the sum total time of T0, T1, and T2.

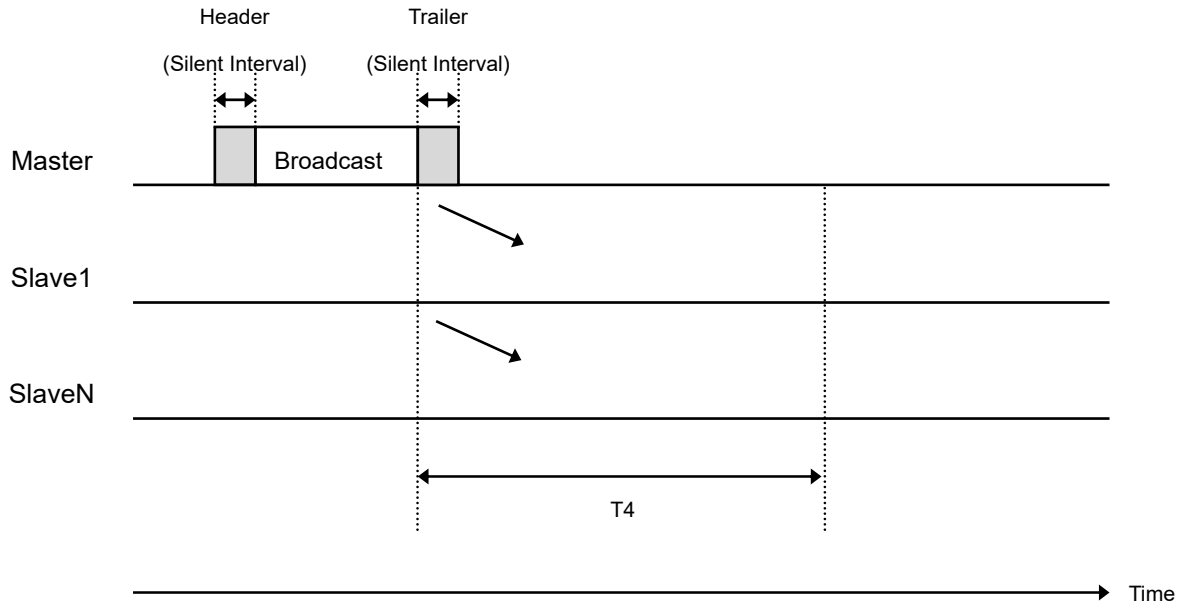
Communication baud rate (bps)	T0 (ms)	T1 (ms)	T2 (ms)	Response time (ms) [In case T2=0]
115200	0.334	0.5	0 to 1000	Approx. 0.834
57600	0.668			Approx. 1.168
38400	1			Approx. 1.5
19200	2			Approx. 2.5
9600	4			Approx. 4.5
4800	8			Approx. 8.5

◆ The time after servo amplifier sends a response massage until it gives the next request to replying permission

Function code	Function Name	Nonvolatile memory saving	T3 (ms)
0x01	Read Coils	None	T0 ms or more
0x03	Read Holding Registers		
0x05	Write Single Coil		
0x06	Write Single Register (Coil Input)		
0x08	Diagnostic		
0x10	Write Multiple Registers (Coil Input)		
	Write Multiple Registers (Point Data) [In case from the block 0 to 9]		
0x06	Write Single Register (Servo Gain)	Available	26 ms or more
0x10	Write Multiple Registers (Servo Gain)		26 ms x n word or more
	Write Multiple Registers (Point Data) [In case from the block 10 to 253]		

* In the write-in process to a coil input, the preservation process to nonvolatile memory (EEPROM) is not performed.
As for the data from block 0 to 9 of point data, the preservation process to nonvolatile memory (EEPROM) is not performed. In a write-in process of other servo gains, point data, etc., the preservation process to nonvolatile memory (EEPROM) is performed.
2-word data is contained in point data.
In writing in two or more word data (n- word), please take into consideration the time of T3.

◆ Broadcast message
Message can be simultaneously sent to two or more slaves.
There is no response from the slave to the broadcast message.



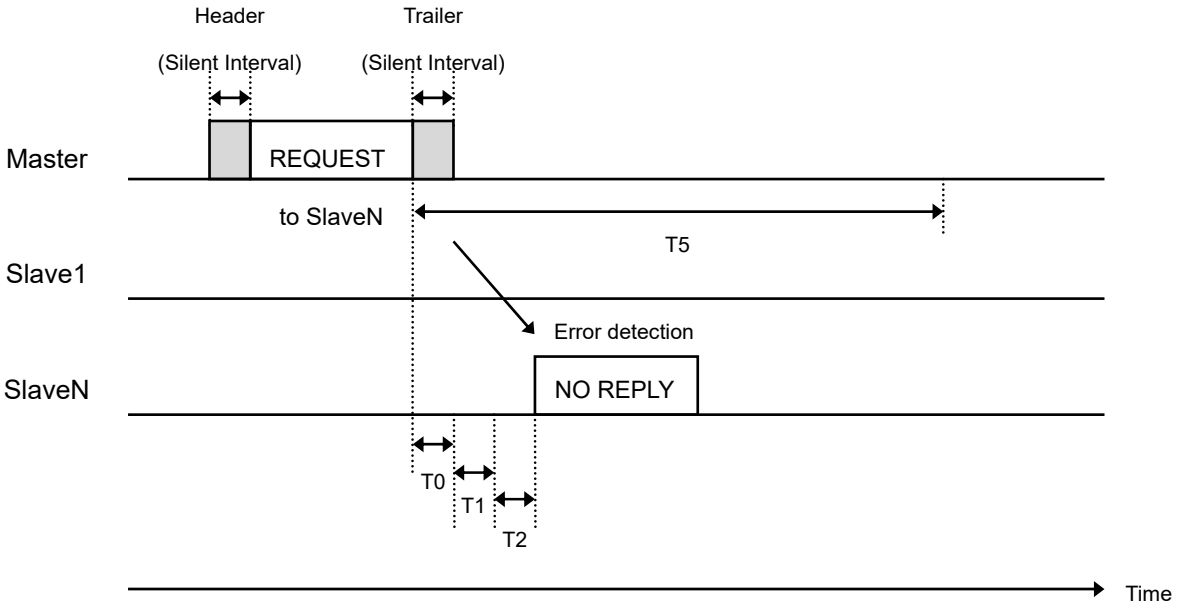
T4･･･Broadcast message response delay waiting time
Communication baud rate, send message and amplifier-inside processing time etc is included.
After this time progress, the master can send the following message.

◆ Broadcast message response delay waiting time
It differs due to communication baud rate and send message.
It shall be designed according to a word number (n) to be saved to nonvolatile memory, with referring the table below.
In the case of the outgoing message which is not saved to nonvolatile memory, calculate by n= 0.

Communication baud rate (bps)	T0 (ms)	T1 (ms)	Nonvolatile memory saving (ms)	T4 (ms)
115200	0.334	0.5	None: 0, Available: 26 x n-word	Approx. 0.834+26 x n or more
57600	0.668			Approx. 1.168+26 x n or more
38400	1			Approx. 1.5+26 x n or more
19200	2			Approx. 2.5+26 x n or more
9600	4			Approx. 4.5+26 x n or more
4800	8			Approx. 8.5+26 x n or more

◆ Error detection message
Slave (servo amplifier) will ignore a request and not return a response under the following conditions:
(1) When a slave detects a communication error during request message reception.
(2) When a slave address within request message and set within servo amplifier do not match.
(3) When the time interval between data within a request message is 3.5 characters or less.
(4) When the data length of a request message is wrong.

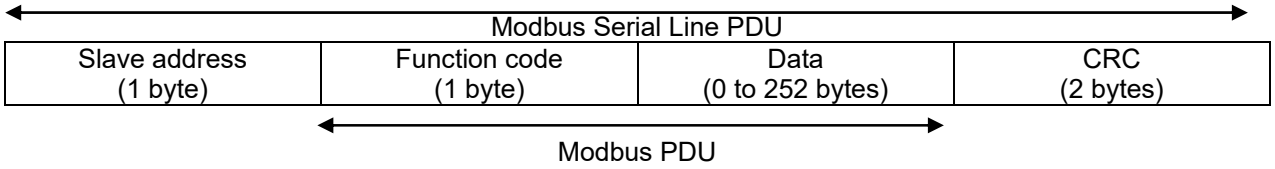
* Please prepare the timer which supervises a response in a master. And if the response does not come to within a timer time, send the same request message again. (Resending process)



T5･･･Response timeout time
Set up time to supervise timeout of the response from a slave by a master.

2.2.3 Frame composition

■ Modbus frame composition
The Modbus application protocol is defined by Protocol Data Unit (PDU), as below.



◆ Slave address

Slave address (1 byte)	Description
0x00	Broadcast address
0x01 to 0xF7	Slave address
0xF8 to 0xFF	Reserved

◆ Function code
Use Modbus-RTU communication and specify the function to be performed in servo amplifier.
The function code which corresponds with servo amplifier is shown below.

Function code (Hex)	Function	Description
0x01	Read Coils	Refers a status of I/O coils.
0x03	Read Holding Registers	Refers a holding register, such as parameter, monitor, and point data.
0x05	Write Single Coil	Writes in output coil.
0x06	Write Single Register	Writes in parameter etc. to holding register.
0x08	Diagnosis (Serial Line only)	Communication diagnosis (Loopback test).
0x10	Write Multiple Registers	Writes in parameter, point data, etc. to multiple holding register.

Note: Do not use function codes (FC) other than the above.
In writing to two or more coils, please set to the coil-assigning register address by using the function of "Write Single Coil" or "Write Multiple Registers".

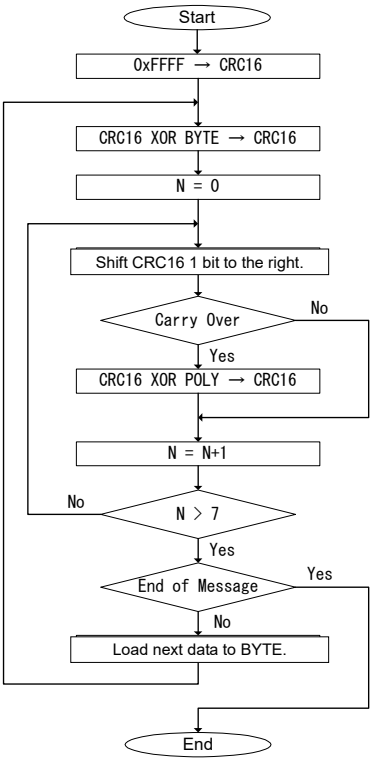
◆ Data
As for the data area, the allocation is different according to the function code.
For details, refer to explanation of each function code.

◆ CRC

CRC (Cyclic Redundancy Check) is used for error checking of Modbus-RTU.
The generation polynomial of CRC1-16 (X16+X15+X2+1) is used for generation of the CRC code.

1. CRC generation procedure
   (1) Load 0xFFFF to CRC16 (register).
   (2) Calculate the first byte of a message and Exclusive OR of CRC16 (register), and substitute the result for CRC16 (register).
   (3) Shift the CRC register 1 bit to the right, and put zero to the MSB.
   MSB is spilt over with 1 bit-shift so judge that next.
   (4) (If the LSB was 0):
   Returns to Step (3) without doing anything.
   (If the LSB was 1):
   Calculate Exclusive OR of fixed value (0xA001) and CRC16 (register), and substitute a result for CRC16 (register).
   Return to Step (3) and check the next bit.
   (5) Repeat Steps (3) and (4) until 8 shifts have been performed.
   (6) Repeat Steps (2) through (5) for the next 8-bit byte of the message.
   Continue doing this until all bytes of message have been processed.
   (7) The final content of the CRC register becomes the CRC value.
   (8) To add CRC into a message, CRC16 (register) lower byte added at first and then higher byte added.

Calculation algorithm of the CRC-16



XOR --- exclusive OR
N --- Shift number counter
POLY --- 1010 0000 0000 0001
BYTE --- Data(1byte)

2. CRC arrangement in a message
   For 16-bit CRC sent with the message, the low-order byte will be sent first, followed by the high-order byte.
   Below shows the example of if the CRC value is 0x1241 (0001 0010 0100 0001).

Slave address (1 byte)	Function code (1 byte)	Data (0 to 252 bytes)	CRC (2 bytes)	
			CRC Lo	CRC Hi
			0x41	0x12

3. CRC error judgment
   CRC value is calculated at sending side to add CRC to a message.
   Receiving side also calcurate CRC while receiving a message and compare calculated CRC and received CRC at last.
   As for servo amplifier, if these two values are not in agreement, a received message is canceled as a CRC error.
   Then waits for a message in preparation for the next reception. (Will not be in an alarm condition.)

2.2.4 Function code

■ 01 (0x01) Read Coils
Reads the coil status. (1=ON, 0=OFF)

Request

Slave address	1 byte	0x01 to 0xF7 Note 1)	
Function code	1 byte	**0x01**	
Coil starting address Hi	2 bytes	Area 1 = 0x0000 to 0x003F	Note 2)
Coil starting address Lo		Area 2 = 0x0040 to 0x004F	Note 2)
		Area 3 = 0x0060 to 0x006F	Note 2)
Coil number Hi	2 bytes	Area 1 = 0x0001 to 0x0040	Note 3)
Coil number Lo		Area 2 = 0x0001 to 0x0010	Note 3)
		Area 3 = 0x0001 to 0x0010	Note 3)
CRC-16 Lo	2 bytes		
CRC-16 Hi			

Note 1) Broadcasting cannot be performed.
Note 2) To a coil starting address, set the value of coil number minus 1.
Coil number is 1 to 64 as area 1, 65 to 80 as area 2 and 97 to 112 as area 3 are exist.
Note 3) The value 0 or exceeding **each area range** cannot be set as the number of read-out coils.
When that is set, an exception code (0x02) is sent back as an error response.

Normal Response

Slave address	1 byte	0x01 to 0xF7
Function code	1 byte	**0x01**
Byte number	1 byte	N Note 4)
Coil status	n bytes	n = N or N+1
CRC-16 Lo	2 bytes	
CRC-16 Hi		

Note 4) The quotient which divided the number of coils by 8 is a number of bytes (N).
When there is remainder, add 1 to a quotient and consider it as a number of bytes.
When there are the remaining bits in the coil status, the remaining bits are filled with zero.

Error Response

Slave address	1 byte	0x01 to 0xF7
Function code	1 byte	**0x81**
Exception code	1 byte	0x01 (Illegal Function) 0x02 (Illegal Data Address) 0x03 (Illegal Data Value) 0x04 (Slave Device Failure)
CRC-16 Lo	2 bytes	
CRC-16 Hi		

◆ Coil number (Bit data), Input assignment area 1
Refer to the coil input specification for explanation of each bit.

Coil number (Hex)	Bit data								Remarks
	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0	
0x0001	CACL	ARST	RAP	-JOG	+JOG	ZRT	RUN	S-ON	
0x0009	M_FIN	IRUN	-1step	+1step	OVRD_ 3	OVRD_ 2	OVRD_ 1	OVRD_ 0	
0x0011	E_STR	−OT	+OT	SDN	HOME	BRK_ FREE	EXT_E	BAT CLR	
0x0019	IN(128)	IN(64)	IN(32)	IN(16)	IN(8)	IN(4)	IN(2)	IN(1)	

Note) To a coil starting address, set the value of coil number minus 1.
Coil Number is 1 to 32.

◆ Coil number (Bit data), Output assignment area 1

Coil number (Hex)	Bit data								Remarks
	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0	
0x0021	WAR (ZFIN)	INPS	PFIN	MOVE	EXT	ERR	HBON	NCRDY	
0x0029	C_RDY	T_LIM _FLG	IN_ FEED	IN_ STOP	SVACT	SVRDY	A_RDY	ALM	
0x0031	MSTR	-	-	-	MOUT_3	MOUT_2	MOUT_1	MOUT_0	
0x0039	ZOUT_8	ZOUT_7	ZOUT_6	ZOUT_5	ZOUT_4	ZOUT_3	ZOUT_2	ZOUT_1	

Note) To a coil starting address, set the value of coil number minus 1.
Coil Number is 33 to 64. “-“ means reservation.

◆ Coil number (Bit data), Input assignment area 2

Coil number (Hex)	Bit data								Remarks
	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0	
0x0041	-	-	-	-	-	-	-	CSET	
0x0049	-	-	-	-	-	-	-	-	

Note) To a coil starting address, set the value of coil number minus 1.
Coil Number is 65 to 80. “-“ means reservation. Always set 0.

◆ Coil number (Bit data), Output assignment area 3

Coil number (Hex)	Bit data								Remarks
	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0	
0x0061	-	-	-	-	-	-	-	-	
0x0069	-	-	-	-	-	-	-	-	

Note) To a coil starting address, set the value of coil number minus 1.
Coil Number is 97 to 112. “-“ means reservation.

◆ The example of a coil readout
Alarm output/power on permission output/amplifier ready output of servo amplifier with slave address 1 are readout.
The status of each signals are as follows;

	SVACT	SVRDY	A_RDY	ALM
Coil number	0x002C	0x002B	0x002A	0x0029
Coil status	OFF	ON	OFF	ON

Request	Example (Hex)
Slave address	0x01
Function code	0x01
Coil starting address Hi	0x00
Coil starting address Lo	0x28
Coil number Hi	0x00
Coil number Lo	0x04
CRC-16 Lo	0xBD
CRC-16 Hi	0xC1

Normal Response	Example (Hex)
Slave address	0x01
Function code	0x01
Byte number	0x01
Coil status	0x05
CRC-16 Lo	0x91
CRC-16 Hi	0x8B

◆ Example: State when coil start address =0x0028 and coil number =4
It is as follows when INPUT_0 (coil number =0x0029) of a coil is set to LSB.
The bit besides the range of the number of coils (=4) is filled with zero (=OFF).

	Bit data							
	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
Coil number	0x0030	0x002F	0x002E	0x002D	0x002C	0x002B	0x002A	0x0029
Coil status	OFF	OFF	OFF	OFF	OFF	ON	OFF	ON

◆ Coil number list 1 (Input assignment area 1)

Coil number (Hex)	Abbreviation	Description	R/W	Remarks
0x0001	S-ON	Servo ON/OFF command bit	R/W	Note 1)
0x0002	RUN	Point startup command bit	R/W	
0x0003	ZRT	Home position move command bit	R/W	
0x0004	+JOG	Positive manual feed command bit	R/W	
0x0005	-JOG	Negative manual feed command bit	R/W	
0x0006	RAP	Fast/slow feed switching command bit	R/W	
0x0007	ARST	Alarm/error clearing command bit	R/W	Note 1)
0x0008	CACL	Point move cancellation bit	R/W	
0x0009	OVRD_0	Override command bit	R/W	
0x000A	OVRD_1	Override command bit	R/W	
0x000B	OVRD_2	Override command bit	R/W	
0x000C	OVRD_3	Override command bit	R/W	
0x000D	+1step	Positive 1 step feed command bit	R/W	
0x000E	-1step	Negative 1 step feed command bit	R/W	
0x000F	IRUN	Interrupt startup command bit	R/W	
0x0010	M_FIN	M output handshake input	R/W	
0x0011	BATCLR	Battery alarm clear command bit	R/W	Note 1)
0x0012	EXT_E	External error	R/W	Note 2)
0x0013	BRK_FREE	Brake release command bit	R/W	Note 2)
0x0014	HOME	Home position possible command bit	R/W	
0x0015	SDN	Homing slowdown command bit	R/W	Note 2)
0x0016	+OT	Positive over travel	R/W	Note 2)
0x0017	-OT	Negative over travel	R/W	Note 2)
0x0018	E_STR	Position instruction	R/W	Note 3)
0x0019	IN(1)	Point number command bit (Valid for point move.)	R/W	0 to 253
0x001A	IN(2)		R/W	
0x001B	IN(4)		R/W	
0x001C	IN(8)		R/W	
0x001D	IN(16)		R/W	
0x001E	IN(32)		R/W	
0x001F	IN(64)		R/W	
0x0020	IN(128)		R/W	

Note 1) It is also available that a function assigns to general input in CN2 by using the SANMOTION MOTOR Setup software.
If a function is assigned, it becomes valid with the condition of commanding via MODBUS communication or signal inputting to CN2 general input.

Note 2) A function shall be assigned to general input in CN2 by using the SANMOTION MOTOR Setup software.
In this product, commanding via MODBUS communication is not available because control timing cannot manage by harware signal via MODBUS communication.

Note 3) Position instruction is also available by using the SANMOTION MOTOR Setup software.

◆ Coil number list 2 (Output assignment area 1)

Coil number (Hex)	Abbreviation	Description	R/W	Remarks
0x0021	NCRDY	Controller ready output	R	
0x0022	HBON	Holding brake excitation timing output	R	
0x0023	ERR	Error output	R	
0x0024	EXT	External operation mode output	R	
0x0025	MOVE	Point moving output	R	
0x0026	PFIN	Point positioning completion output	R	
0x0027	INPS	In-position output	R	
0x0028	WAR (ZFIN)	Battery warning output (Homing completion signal only for incremental sensor)	R	
0x0029	ALM	Alarm output	R	
0x002A	A_RDY	Power on permission output	R	
0x002B	SVRDY	Servo ready output	R	
0x002C	SVACT	Command reception permission output	R	Note 4)
0x002D	IN_STOP	Pushing output	R	
0x002E	IN_FEED	Moving output	R	
0x002F	T_LIM_FLG	Current limiting output	R	
0x0030	C_RDY	Fixed excitation completion output	R	
0x0031	MOUT_0	M output 0	R	
0x0032	MOUT_1	M output 1	R	
0x0033	MOUT_2	M output 2	R	
0x0034	MOUT_3	M output 3	R	
0x0035	-	(Reserved)	R	
0x0036	-	(Reserved)	R	
0x0037	-	(Reserved)	R	
0x0038	MSTR	M output function handshake output	R	
0x0039	ZOUT_1	Zone output 1	R	
0x003A	ZOUT_2	Zone output 2	R	
0x003B	ZOUT_3	Zone output 3	R	
0x003C	ZOUT_4	Zone output 4	R	
0x003D	ZOUT_5	Zone output 5	R	
0x003E	ZOUT_6	Zone output 6	R	
0x003F	ZOUT_7	Zone output 7	R	
0x0040	ZOUT_8	Zone output 8	R	

Note 4) Confirm a command reception permission status (SVACT=1) via MODBUS communication, then operate each control signals of positioning function.

◆ Coil number list 3 (Input assignment area 2)

Coil number (Hex)	Abbreviation	Description	R/W	Remarks
0x0041	CSET	Fixed excitation starting command bit	R/W	
0x0042 to 0x0050	-	(Reserved)	R/W	

◆ Coil number list 4 (Output assignment area 3)

Coil number (Hex)	Abbreviation	Description	R/W	Remarks
0x0061 to 0x0070	-	(Reserved)	R	

2. Inteface

◆ Coil input/output specification
● Coil input specification

Coil number (Hex)	Signal name	Abbrev.	Input condition (Restriction)	Description
0x0001	Servo ON	S-ON	1) Allowable when external operation mode is effective. 2) Not allowable when alarm is issued.	A signal to turn ON motor excitation. 1) When servo ON signal is turned OFF, servo motor excitation becomes OFF into free status. 2) Motor axis cannot be driven during servo OFF. Servo OFF must be while motor shaft is fixed. 3) When servo ON signal is turned OFF, holding brake excitation timing output (HBON) turns OFF.
0x0002	Startup	RUN	1) Not acceptable when other input signals (ZRT, +/-JOG, +/-1STEP, CACL) are ON. 2) Both MOVE and PFIN outputs must be OFF for newly performing point move. (Not acceptable during movement) 3) Acceptable only at servo “ON” status (7-segment LED lights in order of "8" drawing) and at command reception permission state. 4) Acceptable at external operation mode enabled.	A signal to start a point move operations. 1) Starts by positive edge (0(OFF) to 1(ON)). 2) Moves to specified point by point input ON at start reception. 3) When start signal is turned OFF during operation, it decelerates and stops momentarily. When start signal is turned ON again, continues point move. 4) Start signal shall be kept ON status until positioning completion (PFIN turns ON). Note) Point move in this chapter includes continuous point move.
0x0003	Homing	ZRT	1) Not acceptable when other input signals (RUN, +/-JOG, +/-1STEP, CACL) are ON. 2) Both MOVE and PFIN outputs must be OFF for newly performing move. (Not acceptable during movement) 3) Acceptable only at servo “ON” status (7-segment LED lights in order of "8" drawing) and at command reception permission state. 4) Acceptable at external operation mode enabled.	A signal to start a homing operation. ■ When an incremental encoder is used. 1) Starts homing by positive edge (0(OFF) to 1(ON)). 2) Homing start signal shall be kept ON until homing completion (PFIN turns ON). 3) At homing operation, if homing start signal is turned OFF while high speed movement, it decelerates and stops into a temporary stop status (feed hold). And when homing start signal is turned ON again, resumes the homing operation. When in the low move mode, even if homing start signal is turned OFF, temporary stop status may not occur. ■ When an absolute encoder is used. 1) Starts homing by positive edge (0(OFF) to 1(ON)). 2) In homing operation, returns to the origin-set coordinate.

Coil number (Hex)	Signal name	Abbrev.	Input condition (Restriction)	Description
0x0004	Positive manual feeding	+JOG	1) Not acceptable when other input signals (RUN, +/-JOG, +/-1STEP, CACL) are ON. 2) Do not turn ON both +JOG and -JOG signals at the same time. 3) Not acceptable when alarms or others are occurring. 4) Acceptable only at servo “ON” status (7-segment LED lights in order of "8" drawing) and at command reception permission state. 5) Acceptable at external operation mode enabled.	A signal for positive move with manual operation via communication. 1) Starts move by positive edge (0(OFF) to 1(ON)), moves while ON and decelerates / stops at OFF. 2) When RAP signal is OFF, the speed set by parameter manual low speed(L_jog) is the feeding speed, and when ON, the speed set by parameter manual high speed (H_jog) is the feeding speed. 3) During JOG feeding, outputs of MOVE and PFIN remain OFF.
0x0005	Negative manual feeding	-JOG		A signal for negative move with manual operation via communication. 1) Starts move by positive edge (0(OFF) to 1(ON)), moves while ON and decelerates / stops at OFF. 2) When RAP signal is OFF, the speed set by parameter manual low speed(L_jog) is the feeding speed, and when ON, the speed set by parameter manual high speed (H_jog) is the feeding speed. 3) During JOG feeding, outputs of MOVE and PFIN remain OFF.
0x0006	Manual fast speed	RAP	1) Manual fast speed becomes effective at manual feeding and 1-step feeding. 2) Acceptable at external operation mode enabled.	1) Switches high/low velocity when manually operating. Switches amount of move and velocity at 1-step feed.
0x0007	Alarm reset	ARST	1) Effective at alarm/error. 2) Acceptable at external operation mode enabled.	A signal to release alarms/errors at alarm/error status. 1) Reset the alarms/errors after their causes have been eliminated. 2) Some alarms may not be released by this signal depending on the contents.
0x0008	Cancel	CACL	1) Effective only at move by RUN, ZRT, +/-1step.	A signal to cancel the point move, homing, 1 step feeding, so as to make another move possible. 1) During point move, homing and 1step feeding, turns into CACL positioning status by CACL_ON. 2) When point move, homing and 1 step feeding signals are turned OFF during CACL positioning status and then CACL signal is turned OFF, operations are aborted (invalid) and other moves are possible.

2. Inteface

Coil number (Hex)	Signal name	Abbrev.	Input condition (Restriction)	Description
0x0009	Override	OVRD_0	1) Not acceptable at move operation mode by PC and alarm issuing. 2) Acceptable at external operation mode enabled.	Setting of an override 0 to 15 is chosen by this 4-bit input. Selected override value is multiplied to move speed.
0x000A		OVRD_1		
0x000B		OVRD_2		
0x000C		OVRD_3		
0x000D	+1 step feeding	+1step	1) Not acceptable when other input signals (RUN, +/-JOG, CACL) are ON. 2) Do not turn ON both +1step and -1step signals at the same time. 3) Not acceptable when alarms or others are occurring. 4) Acceptable only at servo “ON” status (7-segment LED lights in order of "8" drawing) and at command reception permission state. 5) Acceptable at external operation mode enabled.	A signal for positive move with constant amount feeding operation via communication. 1) Starts move by positive edge (0(OFF) to 1(ON)) and moves by the amount set by parameter. 2) When RAP signal is OFF, moves by the amount of “L_stp” with manual low speed. When RAP signal is ON, moves by the amount of “H_stp” with manual high speed.
0x000E	-1 step feeding	-1step		A signal for negative move with constant pulse feeding operation via communication. 1) Starts move by positive edge (0(OFF) to 1(ON)) and moves by the amount set by parameter. 2) When RAP signal is OFF, moves by the amount of “L_stp” with manual low speed. When RAP signal is ON, moves by the amount of “H_stp” with manual high speed.
0x000F	Interruption start	IRUN	1) Acceptable at external operation mode enabled. 2) It can operate during point move only.	A signal to move to interruption point during point move. 1) During point move, moves to interruption point set in the point data which is being executed at the edge (0(OFF) to 1(ON)) of interruption startup. 2) Interruption move during interruption move is impossible.
0x0010	MFIN	M_FIN	1) Acceptable at external operation mode enabled.	A signal to make a handshake with M output (MSTR). Handshake with M output is performed by turning MFIN input 0 (OFF) → 1 (ON) with the M output signal (MSTR) ON. When M output type (M_typ) is “1”, use this MFIN input for handshake to be performed. If moved by changing speed, even when M output type is “1”, handshake is not performed.

Coil number (Hex)	Signal name	Abbrev.	Input condition (Restriction)	Description
0x0011	Battery Alarm Clear (Absolute encoder clear)	BAT CLR	1) Effective during the battery alarm. 2) Acceptable at external operation mode enabled.	A release signal during battery alarm output status. 1) Clear the battery alarm after removing occurrence causes. 2) It is necessary to reset the alarm separately for return. For details, please refer to Chapter 8 “Maintenance”.
0x0012	External error	EXT-E	It cannot use via communication.	To use external error, assign function of external trip input to one of CONT1 to CONT7 in CN2.
0x0013	Forced Brake Release	BRK_ FREE	It cannot use via communication.	Holding brake excitation signal output cannot release forcefully via communication because it is related to amplifier internal sequence. For a system requiring forced release, please solve it with external wiring.
0x0014	Home Position Set	HOME	1) Acceptable only at servo “ON” status (7-segment LED lights in order of "8" drawing) and at command reception permission state. 2) Acceptable at external operation mode enabled.	Origin point set is performed by input of a startup signal (RUN) with (ON) of this signal.
0x0015	Slowdown before Home	SDN	It cannot use via communication.	To use slowdown before home, assign signal of slowdown before home to one of CONT1 to CONT7 in CN2.
			1) When incremental encoder is used, this is effective during homing operation. 2) When absolute encoder is used, this is effective during homing operation, with selection of incremental system and homing valid.	1) During homing operation with an incremental encoder use, 0 (OFF) makes change to homing low speed. 2) During homing low speed, homing is completed by change of 0(OFF) to 1(ON). Homing method can be selected by a parameter for homing type (Z_typ), in GroupA ID0E. ■ Homing type (00: C-Signal) Homing completes by encoder C-phase signal detection after changing 0(OFF) to 1(ON) of SDN. ■Homing type (01: SDN-OFF) Homing completes by changing 0(OFF) to 1(ON) of SDN.

2. Inteface

Coil number (Hex)	Signal name	Abbrev.	Input condition (Restriction)	Description
0x0016	+Over travel	+OT	It cannot use via communication.	To use +over travel, assign function of positive over travel to one of CONT1 to CONT7 in CN2. Positive move is prohibited by changing input Open (OFF) and stops suddenly. After sudden stop, servo is OFF.
0x0017	-Over travel	-OT	It cannot use via communication.	To use -over travel, assign function of negative over travel to one of CONT1 to CONT7 in CN2. Negative move is prohibited by changing input Open (OFF) and stops suddenly. After sudden stop, servo is OFF.
0x0018	External data setting	E_STR	External data setting function	■ External data setting permission (Sw1_bit0=1) Performs external point teaching as external data setting.
0x0019	Point specification	IN(1)	Point number specification input must have been established at startup.	A signal to specify the target point number at startup (RUN) signal input. 1) Specify the number by binary code. 2) Numbers to be specified are from 0 to 253.
0x001A		IN(2)		
0x001B		IN(4)		
0x001C		IN(8)		
0x001D		IN(16)		
0x001E		IN(32)		
0x001F		IN(64)		
0x0020		IN(128)		

◆ Coil output specification

Coil number (Hex)	Signal name	Abbrev.	Output condition (Restriction)	Description
0x0021	NC ready	NC RDY	1) Main power becomes power ON enabled about 2 seconds after control power ON. This signal turns 1 (ON) with operation ready completion after main power turns ON. 2) This signal turns 0 (OFF) at main power OFF and alarms.	1) This signal turns 1 (ON) when control and main power is established, with no alarms, and position loop is formed. 2) During 1(ON), operations of point positioning move, homing, manual feeding and 1 step feeding are possible. NC ready is also 1(ON) when servo ON input signal is 0(OFF).
0x0022	Holding brake excitation timing output	HBON	This signal turns 1 (ON) while motor is exciting.	Outputs the holding brake excitation (release) timing. When this signal turns 1 (ON), holding brake is excited (released).
0x0023	Error	ERR	Turns 1 (ON) at error below. ■+Software limit ■-Software limit ■Point data failure ■Point loop number setting failure ■Point loop nest setting failure ■Homing error	This signal turns 1 (ON) at error state.
0x0024	External operation mode output	EXT	1) This signal turns 1(On) when operation via communication is effective. 2) Turns 0(OFF) at PC operation.	1) Turns 1(ON) when communication operation input signal can be used. 2) Turns 0(OFF) when operated by PC (in the PC mode). Do not operate via communication at this time.
0x0025	While operation	MOVE	1) 0(OFF) when power turns ON. 2) 0(OFF) at alarms. 3) 1(ON) during point move (from the time of move completed until turning OFF the startup signal (RUN)). 4) 1(ON) during homing (until turning OFF the homing signal (ZRT)). 5) 1(ON) during 1 step feeding (from the time of move completed until turning OFF ±1STEP signal). 6) 0(OFF) during manual feeding.	1) 1(ON) when receiving startup input (RUN) at the time of point positioning move. When move has been complete, 1(ON) is maintained until startup signal is turned OFF. The same for homing and 1 step feeding; When move has been complete, 1(ON) is maintained until homing signal or ±1STEP signal is turned OFF. 2) When signals of MOVE and PFIN are 1(ON), input signal of each operations (startup, homing, manual feeding and 1 step feeding) is not accepted.

2. Inteface

Coil number (Hex)	Signal name	Abbrev.	Output condition (Restriction)	Description
0x0026	Positioning completion	PFIN	1) 0(OFF) when power turns ON. 2) 0(OFF) at alarms. 3) 1(ON) during point move (from the time of move completed until turning OFF the startup signal (RUN)). 4) 1(ON) during homing (until turning OFF the homing signal (ZRT)). 5) 1(ON) during 1 step feeding (from the time of move completed until turning OFF ±1STEP signal). 6) 0(OFF) during manual feeding.	1) 1(ON) when positioning is complete at point positioning operation. 1(ON) is maintained until startup signal is turned OFF after positioning completion. 2) 1(ON) when homing is complete at homing operation. 1(ON) is maintained until homing signal is turned OFF after homing completion. 3) 1(ON) when move is complete at 1 step feeding. 1(ON) is maintained until ±1STEP signal is turned OFF after move completion. 4) When signals of PFIN and MOVE are 1(ON), input signals for other operations are not accepted.
0x0027	In-position	INPS	1) 1(ON) if within the in-position width when power turns ON. 2) Turns 0(OFF) during move generally. However, 1(ON) when moving at low speed within the in-position width. 3) 0(OFF) during alarms.	1) 1(ON) when current position is an ideal position within ± in-position width. 2) 0(OFF) once if moved outside the in-position width by an external means while stopping in the status of in-position output ON. 1(ON) again when entering inside the in-position width by corrective actions. 3) In-position width is set by system in-position width parameter.
0x0028	Warning output (When absolute encoder is used.)	WAR	When absolute encoder is used. 1(ON) in the status of battery warning.	When absolute encoder is used. This signal turns 1(ON) when the voltage of absolute encoder battery lowers, and warning is output from encoder. Note: There may be cases encoder cannot detect due to battery voltage drop characteristic.
	Homing completion (When incremental encoder is used.)	ZFIN	When incremental encoder is used. 1) 0(OFF) is maintained when power turns ON and at alarms. 2) 1(ON) after homing completion.	When incremental encoder is used. 1) After power turned ON or alarms were released, it becomes 1(ON) when homing operation, which makes matching of the machine coordinate and unit coordinate, is completed. After that 1(ON) is maintained until another alarm or power shut off. 2) When power turns ON again or alarm is released, 0(OFF) is maintained unless homing operation is performed again.

Coil number (Hex)	Signal name	Abbrev.	Output condition (Restriction)	Description
0x0029	Alarm	ALM	Outputs at alarm.	1(ON) at alarm state.
0x002A	Power on permission output	A_RDY	Turns 1(ON) within 2 seconds after control power ON. However, it may require more than 2 seconds if external encoder is used. External encoder specification should be checked.	It becomes 1(ON) when amplifier becomes the state that can be turned on the main power supply, after control power established. (It becomes 0(OFF) at ALM etc.)
0x002B	Servo ready output	SVRDY	Outputs at servo on enabled state.	It becomes 1(ON) at servo on enabled state. (It becomes 0(OFF) at ALM etc.)
0x002C	Command reception permission output	SVACT	Outputs at command reception permission.	It becomes 1(ON) at command reception permission. (It becomes 0(OFF) at ALM etc.) It becomes command reception inhibition state (turns OFF) at the condition of External operation mode output (EXT) is 0(OFF).
0x002D	Pushing output	IN_STOP	Outputs during pushing operation.	It becomes 1(ON) during pushing move with pushing move mode.
0x002E	Moving output	IN_FEED	Outputs during moving.	It becomes 1(ON) during move.
0x002F	Current limiting output	T_LIM_FLG	Outputs during current limit.	It becomes 1(ON) during current limit with torque limiting operation.
0x0030	Fixed excitation completion output	C_RDY	Outputs it at use of fixed excitation function with linear motor.	It becomes 1(ON) when fixed excitation is completed.

2. Inteface

Coil number (Hex)	Signal name	Abbrev.	Output condition (Restriction)	Description
0x0031	M output	MOUT_0	Function of M output is decided with three parameters of Code/Type/Delay.	4-bit outputs from “0000” to “1111”. For details, please refer to chapter 4.
0x0032		MOUT_1		
0x0033		MOUT_2		
0x0034		MOUT_3		
0x0035	(Reserved)	-	-	-
0x0036	(Reserved)	-	-	-
0x0037	(Reserved)	-	-	-
0x0038	M output function handshake output	MSTR	-	Outputs via M-output handshake mode. For details, please refer to chapter 4.
0x0039	Zone output	ZOUT_1	Outputs when there into a range between positive/negative directions set at zone setting.	It becomes 1(ON) when there into a range between positive/negative directions set at zone-1 setting.
0x003A		ZOUT_2		It becomes 1(ON) when there into a range between positive/negative directions set at zone-2 setting.
0x003B		ZOUT_3		It becomes 1(ON) when there into a range between positive/negative directions set at zone-3 setting.
0x003C		ZOUT_4		It becomes 1(ON) when there into a range between positive/negative directions set at zone-4 setting.
0x003D		ZOUT_5		It becomes 1(ON) when there into a range between positive/negative directions set at zone-5 setting.
0x003E		ZOUT_6		It becomes 1(ON) when there into a range between positive/negative directions set at zone-6 setting.
0x003F		ZOUT_7		It becomes 1(ON) when there into a range between positive/negative directions set at zone-7 setting.
0x0040		ZOUT_8		It becomes 1(ON) when there into a range between positive/negative directions set at zone-8 setting.

◆ 03 (0x03) Read Holding Registers
Reads a continuous holding register contents with specified amount from register starting address.

Request

Slave address	1 byte	0x01 to 0xF7 Note 1)
Function code	1 byte	**0x03**
Register starting address Hi	2 bytes	0x0000 to 0xFFFF Note 2)
Register starting address Lo		
Register number Hi	2 bytes	0x0001 to 0x007D
Register number Lo		
CRC-16 Lo	2 bytes	
CRC-16 Hi		

Note 1) Broadcasting cannot be performed.
Note 2) To a register starting address, set the readout register address of parameter, monitor or point data etc.

Normal Response

Slave address	1 byte	0x01 to 0xF7
Function code	1 byte	**0x03**
Byte number	1 byte	2 x N Note 3)
Register value	N x 2 bytes	
CRC-16 Lo	2 bytes	
CRC-16 Hi		

Note 3) Register number is input to N.

Error Response

Slave address	1 byte	0x01 to 0xF7
Function code	1 byte	**0x83**
Exception code	1 byte	0x01 (Illegal Function) 0x02 (Illegal Data Address) 0x03 (Illegal Data Value) 0x04 (Slave Device Failure)
CRC-16 Lo	2 bytes	
CRC-16 Hi		

- The example of readout of holding registers: Register starting address= 0x4012, quantity of registers= 2
  When current position of the driver with Slave Address 1 are read, the value of the current position is as follows;

Register starting address (Hex)	Name	Value
0x4012	Current position Hi (User coordinate Hi)	0x1234
0x4013	Current position Lo (User coordinate Lo)	0x5678

Request	Example (Hex)
Slave address	0x01
Function code	0x03
Register starting address Hi	0x40
Register starting address Lo	0x12
Register number Hi	0x00
Register number Lo	0x02
CRC-16 Lo	0x71
CRC-16 Hi	0xCE

Normal Response	Example (Hex)
Slave address	0x01
Function code	0x03
Byte number	0x04
Register value Highest	0x12
Register value Middle-Hi	0x34
Register value Middle-Lo	0x56
Register value Lowest	0x78
CRC-16 Lo	0x81
CRC-16 Hi	0x07

◆ 05 (0x05) Write Single Coil
Writes into single coil.

Request

Slave address	1 byte	0x01 to 0xF7 Note 1)
Function code	1 byte	**0x05**
Coil starting address Hi	2 bytes	Area 1 = 0x0000 to 0x001F Note 2) Area 2 = 0x0040 to 0x004F Note 2)
Coil starting address Lo		
Output value Hi	2 bytes	0x0000 (OFF) or 0xFF00 (ON)
Output value Lo		
CRC-16 Lo	2 bytes	
CRC-16 Hi		

Note 1) When broadcasting is performed, no response is returned.
Note 2) To a coil starting address, set the value of coil number minus 1.
Coil number is 1 to 32 as area 1 and 65 to 80 as area 2 are exist.

Normal Response

Slave address	1 byte	0x01 to 0xF7
Function code	1 byte	**0x05**
Coil starting address Hi	2 bytes	Area 1 = 0x0000 to 0x001F Area 2 = 0x0040 to 0x004F
Coil starting address Lo		
Output value Hi	2 bytes	0x0000 (OFF) または 0xFF00 (ON)
Output value Lo		
CRC-16 Lo	2 bytes	
CRC-16 Hi		

Error Response

Slave address	1 byte	0x01 to 0xF7
Function code	1 byte	**0x85**
Exception code	1 byte	0x01 (Illegal Function) 0x02 (Illegal Data Address) 0x03 (Illegal Data Value) 0x04 (Slave Device Failure)
CRC-16 Lo	2 bytes	
CRC-16 Hi		

◆ 06 (0x06) Write Single Register
Writes a data to the specified holding registers such as parameters (servo gain etc) and coil input.
Cannot write into holding registers, such as point data.

Request

Slave address	1 byte	0x01 to 0xF7 Note 1)	
Function code	1 byte	**0x06**	
Register starting address Hi	2 bytes	0x0008 to 0x0020 (Servo gain) 0x0080 to 0x0082 (Coil input)	Note 2)
Register starting address Lo			
Register number Hi	2 bytes	0x0000 to 0xFFFF	Note 3)
Register number Lo			
CRC-16 Lo	2 bytes		
CRC-16 Hi			

Note 1) When broadcasting is performed, no response is returned.
Note 2) To a register starting address, effective address shall be set.
When invalid address is set up, an exception code (0x02) is sent back as an abnormal response.
Note 3) To a register value, the value shall be set within the range which set to each parameter as maximam/minimum.
When the value out of range is set up, an exception code (0x03) is sent back as an abnormal response.

Normal Response

Slave address	1 byte	0x01 to 0xF7
Function code	1 byte	**0x06**
Register starting address Hi	2 bytes	0x0008 to 0x0020 (Servo gain) 0x0080 to 0x0082 (Coil input)
Register starting address Lo		
Register number Hi	2 bytes	0x0000 to 0xFFFF
Register number Lo		
CRC-16 Lo	2 bytes	
CRC-16 Hi		

Error Response

Slave address	1 byte	0x01 to 0xF7
Function code	1 byte	**0x86**
Exception code	1 byte	0x01 (Illegal Function) 0x02 (Illegal Data Address) 0x03 (Illegal Data Value) 0x04 (Slave Device Failure)
CRC-16 Lo	2 bytes	
CRC-16 Hi		

◆ 08 (0x08) Diagnosis (Serial Line only)
Uses for a communication check between master and slaves.

Request

Slave address	1 byte	0x01 to 0xF7	Note 1)
Function code	1 byte	**0x08**	
Sub-function Hi	2 bytes	0x0000	Note 2)
Sub-function Lo			
Data Hi	2 bytes	Any	Note 3)
Data Lo			
CRC-16 Lo	2 bytes		
CRC-16 Hi			

Note 1) Broadcasting cannot be performed.
Note 2) Set 0x0000 (Return Query Data) to the sub-function of diagnosis.
It does not support any other sub-function.
Note 3) Any value can be used as the test data.

Normal Response

Slave address	1 byte	0x01 to 0xF7
Function code	1 byte	**0x08**
Sub-function Hi	2 bytes	0x0000
Sub-function Lo		
Data Hi	2 bytes	Any (Echo back of request data)
Data Lo		
CRC-16 Lo	2 bytes	
CRC-16 Hi		

Error Response

Slave address	1 byte	0x01 to 0xF7
Function code	1 byte	**0x88**
Exception code	1 byte	0x01 (Illegal Function) 0x03 (Illegal Data Value) 0x04 (Slave Device Failure)
CRC-16 Lo	2 bytes	
CRC-16 Hi		

◆ 16 (0x10) Write Multiple Registers
Writes a data to the specified multiple holding registers such as parameters (servo gain etc), coil input, JOG, related data and point data etc.

Request

Slave address	1 byte	0x01 to 0xF7 Note 1)
Function code	1 byte	**0x10**
Register starting address Hi	2 bytes	0x0008 to 0x0020 (Servo gain) 0x0080 to 0x0082 (Coil input) 0x1000 to 0x1003 (JOG related data) 0x8000 to 0x9FBF (Point data) Note 2)
Register starting address Lo		
Register number Hi	2 bytes	0x0001 to 0x0018 (Servo gain) 0x0001 to 0x0003 (Coil input) 0x0001 to 0x0004 (JOG related data) 0x0001 to 0x0010 (Point data)
Register number Lo		
Byte number	1 byte	2 * N Note 3)
Register value	N x 2 bytes	Note 4)
CRC-16 Lo	2 bytes	
CRC-16 Hi		

Note 1) When broadcasting is performed, no response is returned.
Note 2) To a register starting address, effective address shall be set.
When invalid address is set up, an exception code (0x02) is sent back as an abnormal response.
Note 3) Register number is input to N.
Note 4) To a register value, the value shall be set within the range which set to each parameter as maximam/minimum.
When the value out of range is set up, an exception code (0x03) is sent back as an abnormal response.

Normal Response

Slave address	1 byte	0x01 to 0xF7
Function code	1 byte	**0x10**
Register starting address Hi	2 bytes	0x0008 to 0x0020 (Servo gain) 0x0080 to 0x0082 (Coil input) 0x1000 to 0x1003 (JOG related data) 0x8000 to 0x9FBF (Point data)
Register starting address Lo		
Register number Hi	2 bytes	0x0001 to 0x0018 (Servo gain) 0x0001 to 0x0003 (Coil input) 0x0001 to 0x0004 (JOG related data) 0x0001 to 0x0010 (Point data)
Register number Lo		
CRC-16 Lo	2 bytes	
CRC-16 Hi		

Error Response

Slave address	1 byte	0x01 to 0xF7
Function code	1 byte	**0x90**
Exception code	1 byte	0x01 (Illegal Function) 0x02 (Illegal Data Address) 0x03 (Illegal Data Value) 0x04 (Slave Device Failure)
CRC-16 Lo	2 bytes	
CRC-16 Hi		

2.2.5 Parameter

■ Parameter address range (0x0001 to 0x3FFF)
Parameter setting is performed with specifying a register address below.

Bit 15	**Bit 14**	Bit 13	Bit 12	Bit 11	Bit 10	Bit 9	Bit 8	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0	**0**	Parameter setting register address selection													

◆ Register Address List – Parameter 1

Register address (Hex)	Name	Standard set value	Unit	Setting range	R/W
0x0000 to 0x0007	(Reserved)	-	-	-	R
0x0008	Position Loop Proportional Gain 1	30	1/s	1 to 3000	R/W
0x0009	Position Loop Proportional Gain 2	30	1/s	1 to 3000	R/W
0x000A	Position Loop Proportional Gain 3	30	1/s	1 to 3000	R/W
0x000B	Position Loop Proportional Gain 4	30	1/s	1 to 3000	R/W
0x000C	Position Loop Integral Time Constant 1	10000	0.1ms	3 to 10000	R/W
0x000D	Position Loop Integral Time Constant 2	10000	0.1ms	3 to 10000	R/W
0x000E	Position Loop Integral Time Constant 3	10000	0.1ms	3 to 10000	R/W
0x000F	Position Loop Integral Time Constant 4	10000	0.1ms	3 to 10000	R/W
0x0010	Velocity Loop Proportional Gain 1	50	Hz	1 to 2000	R/W
0x0011	Velocity Loop Proportional Gain 2	50	Hz	1 to 2000	R/W
0x0012	Velocity Loop Proportional Gain 3	50	Hz	1 to 2000	R/W
0x0013	Velocity Loop Proportional Gain 4	50	Hz	1 to 2000	R/W

◆ Register Address List – Parameter 2

Register address (Hex)	Name	Standard set value	Unit	Setting range	R/W
0x0014	Velocity loop integral time constant 1	200	0.1 ms	3 to 10000	R/W
0x0015	Velocity loop integral time constant 2	200	0.1 ms	3 to 10000	R/W
0x0016	Velocity loop integral time constant 3	200	0.1 ms	3 to 10000	R/W
0x0017	Velocity loop integral time constant 4	200	0.1 ms	3 to 10000	R/W
0x0018	Load inertia moment ratio 1 (Load weight ratio)	100	%	0 to 15000	R/W
0x0019	Load inertia moment ratio 2 (Load weight ratio)	100	%	0 to 15000	R/W
0x001A	Load inertia moment ratio 3 (Load weight ratio)	100	%	0 to 15000	R/W
0x001B	Load inertia moment ratio 4 (Load weight ratio)	100	%	0 to 15000	R/W
0x001C	Torque command filter 1	600	Hz	1 to 4000	R/W
0x001D	Torque command filter 2	600	Hz	1 to 4000	R/W
0x001E	Torque command filter 3	600	Hz	1 to 4000	R/W
0x001F	Torque command filter 4	600	Hz	1 to 4000	R/W
0x0020	Position command smoothing time constant	0.0	0.1 ms	0.0 to 500.0	R/W

Note) Write in this area involves storing in non-volatile memory (EEPROM).
Do not use for frequent rewriting use, such as with every operation.

◆ Register Address List – Parameter 3 (Coil Input)

Register address (Hex)	Name	Standard set value	Unit	Setting range	R/W
0x0080	Coil Input Group 1	-	Bit	0 to 0xFFFF	R/W
0x0081	Coil Input Group 2	-	Bit	0 to 0xFFFF	R/W
0x0082	Coil Input Group 3	-	Bit	0 to 0xFFFF	R/W

Register Address = 0x0080 (Write/Read)

Bit15	Bit14	Bit13	Bit12	Bit11	Bit10	Bit9	Bit8
M_FIN	IRUN	-1step	+1step	OVRD_3	OVRD_2	OVRD_1	OVRD_0
Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
CACL	ARST	RAP	-JOG	+JOG	ZRT	RUN	S-ON

Register Address = 0x0081 (Write/Read)

Bit15	Bit14	Bit13	Bit12	Bit11	Bit10	Bit9	Bit8
IN (128)	IN (64)	IN (32)	IN (16)	IN (8)	IN (4)	IN (2)	IN (1)
Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
E_STR	−OT	+OT	SDN	HOME	BRK_ FREE	EXT_E	BAT CLR

Register Address = 0x0082 (Write/Read)

Bit15	Bit14	Bit13	Bit12	Bit11	Bit10	Bit9	Bit8
-	-	-	-	-	-	-	-
Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
-	-	-	-	-	-	-	CSET

◆ Register address list – Parameter 4 (Positioning function)

Register address (Hex)	Name	Unit	Setting range	R/W
0x0C00	System velocity limit (higher order byte) System velocity limit (lower order byte)	UV	1 to 2,147,483,647	R/W
0x0C02	PC operation velocity limit (higher order byte) PC operation velocity limit (lower order byte)	UV	1 to2,147,483,647	R/W
0x0C04	Positive direction software limit (higher order byte) Positive direction software limit (lower order byte)	UP	-2,147,483,648 to 2,147,483,647	R/W
0x0C06	Negative direction software limit (higher order byte) Negative direction software limit (lower order byte)	UP	-2,147,483,648 to 2,147,483,647	R/W
0x0C08	Pushing depth (higher order byte) Note 1) Pushing depth (lower order byte) Note 1)	Pulse	1 to2,147,483,647	R/W
0x0C0A	(Reserved)	-	0	R/W
0x0C0B	System in-position width Note 1)	Pulse	1 to 65,535	R/W
0x0C0C	System overflow (higher order byte) Note 1) System overflow (lower order byte) Note 1)	UP	1 to 2,147,483,647	R/W
0x0C0E	Overflow when current limited (higher order byte) Note 1) Overflow when current limited (lower order byte) Note 1)	UP	1 to 2,147,483,647	R/W
0x0C10	Backlash amount	UP	0 to 32,767	R/W
0x0C11	Software limit detection and operation direction Bit15 Bit8 | Bit7 Bit0 Operation direction Note 1) | Software limit detection	-	Bit7 to Bit0= 0, 1 Bit15 to Bit8= 0, 1	R/W
0x0C12	Acceleration/deceleration constant	UV/ms	1 to 65,535	R/W
0x0C13	S-shaped curve accel/decel time	ms	0 to 32,767	R/W
0x0C14	PC operation JOG-current limit	%	0 to 510	R/W
0x0C15	Homing type and direction Bit15 Bit8 | Bit7 Bit0 Homing direction | Homing type	-	Bit7 to Bit0= 0, 1 Bit15 to Bit8= 0, 1	R/W

◆ Register address list – Parameter 5 (Positioning function)

Register address (Hex)	Name	Unit	Setting range	R/W
0x0C16	Homing with high speed (higher order byte) Homing with high speed (lower order byte)	UV	1 to 2,147,483,647	R/W
0x0C18	Homing with low speed (higher order byte) Homing with low speed (lower order byte)	UV	1 to 2,147,483,647	R/W
0x0C1A	Origin position coordinate (higher order byte) Origin position coordinate (lower order byte)	UP	-2,147,483,648 to 2,147,483,647	R/W
0x0C1C	Origin-offset value (higher order byte) Origin-offset value (lower order byte)	UP	-2,147,483,648 to 2,147,483,647	R/W
0x0C1E	(Reserved)	-	0	R/W
0x0C1F	Origin in-position width Note 1)	Pulse	1 to 65,535	R/W
0x0C20	+STROKE (used only for infinite coordinate) (higher order byte) +STROKE (used only for infinite coordinate) (lower order byte)	UP	-2,147483,648 to 2,147,483,647	R/W
0x0C22	Effective stroke length of absolute encoder (higher order byte) Note 2) Effective stroke length of absolute encoder (lower order byte) Note 2)	UP	-2,147,483,648 to 2,147,483,647	R/W
0x0C24	Zone (1), negative end (higher order byte) Zone (1), negative end (lower order byte)	UP	-2147,483,648 to 2,147,483,647	R/W
0x0C26	Zone (1), positive end (higher order byte) Zone (1), positive end (lower order byte)	UP	-2147,483,648 to 2,147,483,647	R/W
0x0C28	Zone (2), negative end (higher order byte) Zone (2), negative end (lower order byte)	UP	-2147,483,648 to 2,147,483,647	R/W
0x0C2A	Zone (2), positive end (higher order byte) Zone (2), positive end (lower order byte)	UP	-2147,483,648 to 2,147,483,647	R/W
0x0C2C	Zone (3), negative end (higher order byte) Zone (3), negative end (lower order byte)	UP	-2147,483,648 to 2,147,483,647	R/W
0x0C2E	Zone (3), positive end (higher order byte) Zone (3), positive end (lower order byte)	UP	-2147,483,648 to 2,147,483,647	R/W
0x0C30	Zone (4), negative end (higher order byte) Zone (4), negative end (lower order byte)	UP	-2147,483,648 to 2,147,483,647	R/W
0x0C32	Zone (4), positive end (higher order byte) Zone (4), positive end (lower order byte)	UP	-2147,483,648 to 2,147,483,647	R/W
0x0C34	Zone (5), negative end (higher order byte) Zone (5), negative end (lower order byte)	UP	-2147,483,648 to 2,147,483,647	R/W

◆ Register address list – Parameter 6 (Positioning function)

Register address (Hex)	Name	Unit	Setting range	R/W
0x0C36	Zone (5), positive end (higher order byte) Zone (5), positive end (lower order byte)	UP	-2147,483,648 to 2,147,483,647	R/W
0x0C38	Zone (6), negative end (higher order byte) Zone (6), negative end (lower order byte)	UP	-2147,483,648 to 2,147,483,647	R/W
0x0C3A	Zone (6), positive end (higher order byte) Zone (6), positive end (lower order byte)	UP	-2147,483,648 to 2,147,483,647	R/W
0x0C3C	Zone (7), negative end (higher order byte) Zone (7), negative end (lower order byte)	UP	-2147,483,648 to 2,147,483,647	R/W
0x0C3E	Zone (7), positive end (higher order byte) Zone (7), positive end (lower order byte)	UP	-2147,483,648 to 2,147,483,647	R/W
0x0C40	Zone (8), negative end (higher order byte) Zone (8), negative end (lower order byte)	UP	-2147,483,648 to 2,147,483,647	R/W
0x0C42	Zone (8), positive end (higher order byte) Zone (8), positive end (lower order byte)	UP	-2147,483,648 to 2,147,483,647	R/W
0x0C44	High speed set for manual operation (higher order byte) High speed set for manual operation (lower order byte)	UV	1 to 2147483647	R/W
0x0C46	Low speed set for manual operation (higher order byte) Low speed set for manual operation (lower order byte)	UV	1 to 2147483647	R/W
0x0C48	1 step-displacement at high speed (higher order byte) 1 step-displacement at high speed (lower order byte)	UP	1 to 2147483647	R/W
0x0C4A	1 step-displacement at low speed (higher order byte) 1 step-displacement at low speed (lower order byte)	UP	1 to 2147483647	R/W
0x0C4C	Override 0 and override 1 Bit15 Bit8 | Bit7 Bit0 Override 1 | Override 0	%	Bit7 to Bit0 = 1 to 255, Bit15 to Bit8 = 1 to 255	R/W
0x0C4D	Override 2 and override 3 Bit15 Bit8 | Bit7 Bit0 Override 3 | Override 2	%	Bit7 to Bit0 = 1 to 255, Bit15 to Bit8 = 1 to 255	R/W

◆ Register address list – Parameter 7 (Positioning function)

Register address (Hex)	Name	Unit	Setting range	R/W
0x0C4E	Override 4 and override 5 Bit15 Bit8 | Bit7 Bit0 Override 5 | Override 4	%	Bit7 to Bit0 = 1 to 255, Bit15 to Bit8 = 1 to 255	R/W
0x0C4F	Override 6 and override 7 Bit15 Bit8 | Bit7 Bit0 Override 7 | Override 6	%	Bit7 to Bit0 = 1 to 255, Bit15 to Bit8 = 1 to 255	R/W
0x0C50	Override 8 and override 9 Bit15 Bit8 | Bit7 Bit0 Override 9 | Override 8	%	Bit7 to Bit0 = 1 to 255, Bit15 to Bit8 = 1 to 255	R/W
0x0C51	Override 10 and override 11 Bit15 Bit8 | Bit7 Bit0 Override 11 | Override 10	%	Bit7 to Bit0 = 1 to 255, Bit15 to Bit8 = 1 to 255	R/W
0x0C52	Override 12 and override 13 Bit15 Bit8 | Bit7 Bit0 Override 13 | Override 12	%	Bit7 to Bit0 = 1 to 255, Bit15 to Bit8 = 1 to 255	R/W
0x0C53	Override 14 and override 15 Bit15 Bit8 | Bit7 Bit0 Override 15 | Override 14	%	Bit7 to Bit0 = 1 to 255, Bit15 to Bit8 = 1 to 255	R/W
0x0C54	System division number (higher order byte) Note 1)	(Pulse)	1 to 131072	R/W
	System division number (lower order byte) Note 1)			
0x0C56	User division number (higher order byte) Note 1)	(mm)	1 to 131072	R/W
	User division number (lower order byte) Note 1)			

◆ Register address list – Parameter 8 (Positioning function)

Register address (Hex)	Name	Unit	Setting range	R/W
0x0C58	Decimal point of velocity/position data Bit15 Bit8 | Bit7 Bit0 Decimal point of velocity/position data | (Reserved)	-	Bit7 to Bit0= 0, Bit15 to Bit8= 0 to 5	R/W
0x0C59	Setting unit Bit15 Bit8 | Bit7 Bit0 (Reserved) | Setting unit	-	Bit7 to Bit0= 0 to 1, Bit15 to Bit8= 0	R/W
0x0C5A	Function switch 1 (function deleted)	-	0x0000 to 0xFFFF	R/W
0x0C5B	Function switch 2 (function deleted)	-	0x0000 to 0xFFFF	R/W
0x0C5C	Function switch 3	-	0x0000 to 0xFFFF	R/W
0x0C5D	Function switch 4	-	0x0000 to 0xFFFF	R/W

Note 1) When setting value is changed, control power cycle is required.
Note 2) When setting value has changed, make sure to perform home position setting.
If not performed, position displacement can occur.
Note 3) Unit of velocity system ”UV” and position system ”UP” are determined by setting parameters (S_pls, U_pls, D_dpo, Unit) by user.
Refer to section 4.3 in chapter 4 for unit determination.
Note 4) Refer to description of GroupA in chapter 3 for detail of positioning function parameters.
Note 5) "Functio switch 1 and 2" are deleted. For each function setting, please use a switch setting at GroupA in SANMOTION MOTOR Setup parameter.

◆ Anytime write dedicated area (From 0x1000)
The values re-written by using register in this area are effective anytime in each updating cycle.

Register address (Hex)	Name	Unit	Setting range	R/W	Note
0x1000	JOG-Velocity (higher order byte) JOG-Velocity (lower order byte)	UV	0 to 2,147,483,647	R/W	1), 2)
0x1002	JOG-acceleration	UV/ms	1 to 65,535	R/W	3), 4)
0x1003	Position command smoothing time constant	0.1 ms	0.0 to 500.0	R/W	5), 6)

Note 1) JOG-velocity when power supply turned on is preset to zero.
Note 2) When velocity is set to zero, JOG-moving is performed at the velocity set by parameters.
Note 3) When velocity is set to zero, the value set by parameter is also applied to the acceleration.
Note 4) Acceleration value shall be re-written prior to the setting for velocity, as once velocity is re-written, a command to immediately correspond the set velocity is generated.
Note 5) The values re-written by using this register are not stored in nonvolatile memory. Position command smoothing time constant when power supply turned on will be preset to the same value as the same name parameters which has been stored in nonvolatile memory (register address: 0x0020).
Note 6) If you have changed a value of position command smoothing time constant by using this register once, do not re-write the position command smoothing time constant via SANMOTION MOTOR Setup software or register address: 0x0020 without performing a control power cycle. Failure to do so results in “Memory error 1” or “Memory error 2” –state as parameters stored in nonvolatile memory becomes inconsistent.

2.2.6 Monitor data

■ Monitor

◆ Monitor Address Range (0x4000 to 0x7FFF)
Monitor data readout is performed with specifying a register address below.

Bit 15	**Bit 14**	Bit 13	Bit 12	Bit 11	Bit 10	Bit 9	Bit 8	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0	**1**	Monitor data register address selection													

◆ Register Address List – Monitor 1

Register address (Hex)	Name	Unit	R/W
0x4000	Servo Amplifier Status [Internal operation state: PF_CODE] Note 1)	-	R
0x4001	Warning Status Note 2)	-	R
0x4002	Velocity Monitor	min^{-1}	R
0x4003	Velocity Command Monitor	min^{-1}	R
0x4004	Torque Monitor	%	R
0x4005	Torque Command Monitor	%	R
0x4006	Regenerative Resistor Operating Rate	%	R
0x4007	Effective Torque Monitor	%	R
0x4008	Effective Torque Monitor (Estimated value)	%	R
0x4009	Control loop parameter_Load inertia moment ratio monitor	%	R
0x400A	Control loop parameter - Position loop proportional gain monitor	s^{-1}	R
0x400B	Control loop parameter - Position loop integral time constant monitor	ms	R
0x400C	Control loop parameter - Velocity loop proportional gain monitor	Hz	R
0x400D	Control loop parameter - Velocity loop integral time constant monitor	ms	R
0x400E	Control loop parameter - Torque command filter monitor	Hz	R
0x400F	Load torque monitor (Estimated value)	%	R
0x4010	Alarm code	-	R
0x4011	Execution point number	-	R
0x4012	Current position (User Coordinate Hi) Note 3)	-	R
0x4013	Current position (User Coordinate Lo)		
0x4014	Command position (User Coordinate Hi) Note 3)	-	R
0x4015	Command position (User Coordinate Lo)		
0x4016	Position deviation (User Coordinate Hi) Note 3)	-	R
0x4017	Position deviation (User Coordinate Lo)		

Note 1) Refer to section 5.5.4 in chapter 5 for the details. Servo amplifier status is readout with word unit, however, only low-order byte is effective, high-order byte will be cleared with zero.
Note 2) Refer to section 5.5.2 in chapter 5 for the details. The warning state readout with word unit becomes as follows: Low-order byte is warning state 1, high-order byte is warning state 2.
Note 3) Actual monitor value is indicated in user coordinate, but decimal point is not added.

◆ Register Address List – Monitor 2

Register address (Hex)	Name	Unit	R/W
0x4080	Coil Input Group1 Monitor Note4)	-	R
0x4081	Coil Input Group2 Monitor Note4)	-	R
0x4082	Coil Output Group1 Monitor	-	R
0x4083	Coil Output Group2 Monitor	-	R

Register Address = 0x4080 (Read)

Bit15	Bit14	Bit13	Bit12	Bit11	Bit10	Bit9	Bit8
M_FIN	IRUN	-1step	+1step	OVRD_3	OVRD_2	OVRD_1	OVRD_0
Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
CACL	ARST	RAP	-JOG	+JOG	ZRT	RUN	S-ON

Register Address = 0x4081 (Read)

Bit15	Bit14	Bit13	Bit12	Bit11	Bit10	Bit9	Bit8
IN (128)	IN (64)	IN (32)	IN (16)	IN (8)	IN (4)	IN (2)	IN (1)
Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
E_STR	−OT	+OT	SDN	HOME	BRK_ FREE	EXT_E	BAT CLR

Register Address = 0x4082 (Read)

Bit15	Bit14	Bit13	Bit12	Bit11	Bit10	Bit9	Bit8
C_RDY	T_LIM _FLG	IN_ FEED	IN_ STOP	SVACT	SVRDY	A_RDY	ALM
Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
WAR (ZFIN)	INPS	PFIN	MOVE	EXT	ERR	HBON	NCRDY

Register Address = 0x4083 (Read)

Bit15	Bit14	Bit13	Bit12	Bit11	Bit10	Bit9	Bit8
ZOUT_8	ZOUT_7	ZOUT_6	ZOUT_5	ZOUT_4	ZOUT_3	ZOUT_2	ZOUT_1
Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
MSTR	-	-	-	MOUT_3	MOUT_2	MOUT_1	MOUT_0

Note 4) This monitor is an echo back monitor of “Coil input group 1 and 2 (register address: 0x0080, 0x0081),” the values written into register address: 0x0080, 0x0081 can be readout as they are. To confirm CN2 input information, readout a register address: 0x4090.

◆ Register Address List – Monitor 3

Register address (Hex)	Name	Unit	R/W
0x4084	Alarm history (Present value)	-	R
0x4085	Alarm history (Last 1)	-	R
0x4086	Alarm history (Last 2)	-	R
0x4087	Alarm history (Last 3)	-	R
0x4088	Alarm history (Last 4)	-	R
0x4089	Alarm history (Last 5)	-	R
0x408A	Alarm history (Last 6)	-	R
0x408B	Alarm history (Last 7)	-	R

2. Inteface

◆ Register Address List – Monitor 4

Register address (Hex)	Name	Unit	R/W
0x408C	Coil Input Group3 Monitor	-	R
0x408D	(Reserved)	-	R
0x408E	Coil Output Group3 Monitor	-	R
0x408F	(Reserved)	-	R
0x4090	General input signal monitor	-	R

Register Address = 0x408C (Read)

Bit15	Bit14	Bit13	Bit12	Bit11	Bit10	Bit9	Bit8
-	-	-	-	-	-	-	-
Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
-	-	-	-	-	-	-	CSET

Register Address = 0x408D (Read)

Bit15	Bit14	Bit13	Bit12	Bit11	Bit10	Bit9	Bit8
-	-	-	-	-	-	-	-
Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
-	-	-	-	-	-	-	-

Register Address = 0x408E (Read)

Bit15	Bit14	Bit13	Bit12	Bit11	Bit10	Bit9	Bit8
-	-	-	-	-	-	-	-
Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
-	-	-	-	-	-	-	-

Register Address = 0x408F (Read)

Bit15	Bit14	Bit13	Bit12	Bit11	Bit10	Bit9	Bit8
-	-	-	-	-	-	-	-
Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
-	-	-	-	-	-	-	-

Register Address = 0x4090 (Read)

Bit15	Bit14	Bit13	Bit12	Bit11	Bit10	Bit9	Bit8
-	-	-	-	-	-	-	-
Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
-	CONT7	CONT6	CONT5	CONT4	CONT3	CONT2	CONT1

■ Alarm code

Alarm code is shown in low-order byte, high-order byte will be cleared with zero.
Refer to chapter 8 for the details of alarm code.

2.2.7 Point data

◆ Point Data Address Range (0x8001 to 0xBFFF)
Point data setting is performed with specifying a register address below.
Since there is some 4-byte data in point data, take consistency of the higher order of data, and a low order.

Bit 15	**Bit 14**	Bit 13	Bit 12	Bit 11	Bit 10	Bit 9	Bit 8	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
1	**0**	Point data block number selection									Point data selection				

◆ Register Address List 1 – Point Data Block 0

Register address (Hex)	Block number	Name	Unit	Setting range	R/W
0x8000	0	Velocity (Hi)	UV	1 to 2,147,483,647	R/W
		Velocity (Lo)			
0x8002		Position data (Hi)	UP	-2,147,483,647 to 2,147,483,647	R/W
		Position data (Lo)			
0x8004		Move mode	-	0 to 65,535	R/W
0x8005		Acceleration data	UV/ms	1 to 65,535	R/W
0x8006		S-shaped curve accel/decel time	ms	0 to 32,767	R/W
0x8007		Torque limit	%	0 to 799	R/W
0x8008		M output delay (Hi)	UP	-1 to 2,147,483,647	R/W
		M output delay (Lo)			
0x800A		M output type	-	0 to 65,535	R/W
0x800B		Startup point (Ip/Jp) at interruption startup	-	0 to 253	R/W
0x800C		Dwell time	ms	0 to 65,535	R/W
0x800D		Repeat count: count to be looped	-	0 to 65,535	R/W
0x800E		JP: point number of jump destination	-	0 to 253	R/W
0x800F		(Reserved)	-	0	R/W
0x8010 to 0x801F		(Reserved)	-	-	R

◆ Register Address List 2 – Point Data Block 1 to Block 253

Register address (Hex)	Block number	Name	Unit	Setting range	R/W
0x8020	1	Velocity (Hi)	UV	1 to 2,147,483,647	R/W
		Velocity (Lo)			
0x8022		Position data (Hi)	UP	-2,147,483,647 to 2,147,483,647	R/W
		Position data (Lo)			
0x8024		Move mode	-	0 to 65,535	R/W
0x8025		Acceleration data	UV/ms	1 to 65,535	R/W
0x8026		S-shaped curve accel/decel time	ms	0 to 32,767	R/W
0x8027		Torque limit	%	0 to 799	R/W
0x8028		M output delay (Hi)	UP	-1 to 2,147,483,647	R/W
		M output delay (Lo)			
0x802A		M output type	-	0 to 65,535	R/W
0x802B		Startup point (Ip/Jp) at interruption startup	-	0 to 253	R/W
0x802C		Dwell time	ms	0 to 65,535	R/W
0x802D		Repeat count: count to be looped	-	0 to 65,535	R/W
0x802E		JP: point number of jump destination	-	0 to 253	R/W
0x802F		(Reserved)	-	0	R/W
0x8030 ~ 0x803F		(Reserved)	-	-	R
0x8040 ~ 0x805F	2	(Structure is the same as block 0.)			
. **.** **.**	. . .	. . .			
0x9F80 ~ 0x9F9F	252	(Structure is the same as block 0.)			
0x9FA0 ~ 0x9FBF	253	(Structure is the same as block 0.)			

◆ Move mode

Bit assignment	Description
Bit15 to Bit14	01: Fixed
Bit13 to Bit12	Move mode 2 01: Continuous move 00: Last move
Bit11	0: Fixed
Bit10	Move mode ABS / INC 1: Position data is incremental (relative) command. 0: Position data is absolute command.
BIt9	Move mode Pushing: Exist/None 1: Move with "Pushing stop" 0: Normal Move (No pushing)
Bit8	Move mode Variable speed: Stop/ Continuous 1: Continuous speed change operation 0: Stop and change-speed operation
Bit7 to Bit4	Servo gain switching 1111 to 0101: default (Gain1) 0100: Gain 4 0011: Gain 3 0010: Gain 2 0001: Gain 1 0000: default (Gain1)
Bit3 to Bit0	Loop mode (Refer to chapter 4) 0000: Without loop mode function 0001: Jump without any condition 0010: 1-point jump 0011: Jump with condition 1111 to 0000: Reserved

* Refer to "Chapter 4 Positioning function, explanation of point data" for details of point data and move modes.

◆ M output type

Bit assignment	Description
Bit15 to Bit8	M output code Sets the data for M output. M output is 4 bits from 00000000 to 00001111. Set this to “00000000” for usual.
Bit7 to Bit0	11111111 to 00000011: Reserved 00000010: Only M output, without handshaking. 00000001: When the move is complete with handshaking mode, MSTR signal is output and wait until MFIN signal is input. After MFIN signal input, next move is performed. 00000000: Without M output operations. No change from the previous M output. Set this to “00000000” for usual.

◆ The write-in procedure of point data (Nonvolatile memory preservation procedure)

Block 0 to 9 of point data can be changed at any time.
Note) Difference between block 0 to 9 and 10 to 253 of point data

- Block 0 to 9 data is written in internal RAM.
- Block 10 to 253 data is written in nonvolatile memory.

* The number of times of writing in nonvolatile memory is limited to about 100,000 times while that of times of writing point data 0 to 9 is virtually unlimited, because the data is written in RAM. Thus, point data 0 to 9 is rewritable frequently.
However, RAM data disappears if the servo unit control power supply shuts down. To prevent this problem, a backup copy of RAM data must be created in a higher controller.

* How to set a default data of point 0 to 9
Rewrite the values via [SANMOTIOM MOTOR Setup] software after power supply turned on with point data not written by upper device.

A point data can be read/write on 32-byte block basis.
We recommend that readout a point data at first, changed, and then write, if it needs to be changed.
In principle, do not turn off the control power supply during writing operation.
Doing so causes writing is interrupted on the way. At that time, try write again.

2.2.8 Communication example

◆ Communication example is described on condition of the following.

Communication baud rate: 115,200 bps
Slave address: 1
Silent interval time (T0): about 334 µs
Servo amplifier processing time (T1) about 500 µs
Communication wait time (T2): 0 ms
Send message minimum transmitting time: 1/1,152,000 x 11 bit (per byte)
The conditions by the side of a master are considered as continuous transmission.
Please review according to the equipment to be used.
Response message minimum transmitting time: 125 µs (per byte)

* The example of communication timing is described by setting response time from servo amplifier to about 0.9 ms.

* In setting up a communication cycle (scanning cycle), set up a satisfactory value accodeing to composition, a system configuration (the number of axes), etc. of equipment and a communication message to be used.
In changing baud rate, please refer to the example and re-calculate it.

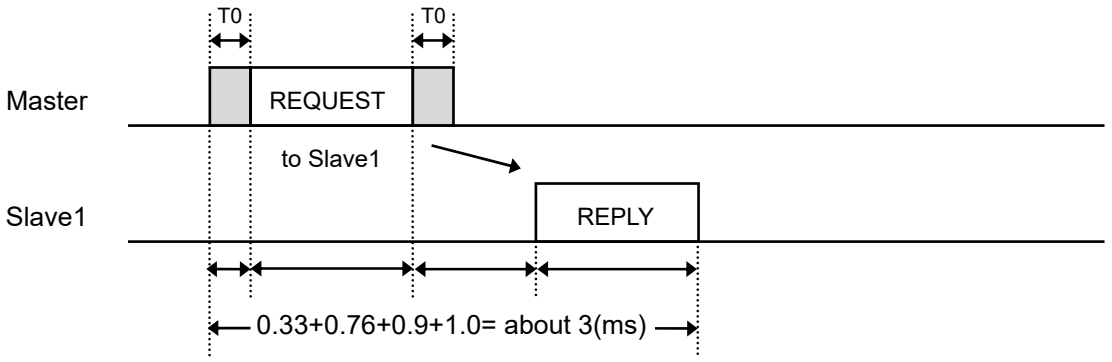
◆ Checks communication establishment by using a communication diagnostic message.

Request message: 8 bytes (message length=1/1,152,000×11 bit×8 bytes=about 0.76ms)

Slave Adr	FC	Sub-FuncHi	Sub-FuncLo	Data Hi	Data Lo	CRC16 Lo	CRC16 Hi
0x01	0x08	0x00	0x00	0x12	0x34	0xED	0x7C

Response massage: 8 bytes (message length=0.125×8=about 1ms)

Slave Adr	FC	Sub-FuncHi	Sub-FuncLo	Data Hi	Data Lo	CRC16 Lo	CRC16 Hi
0x01	0x08	0x00	0x00	0x12	0x34	0xED	0x7C



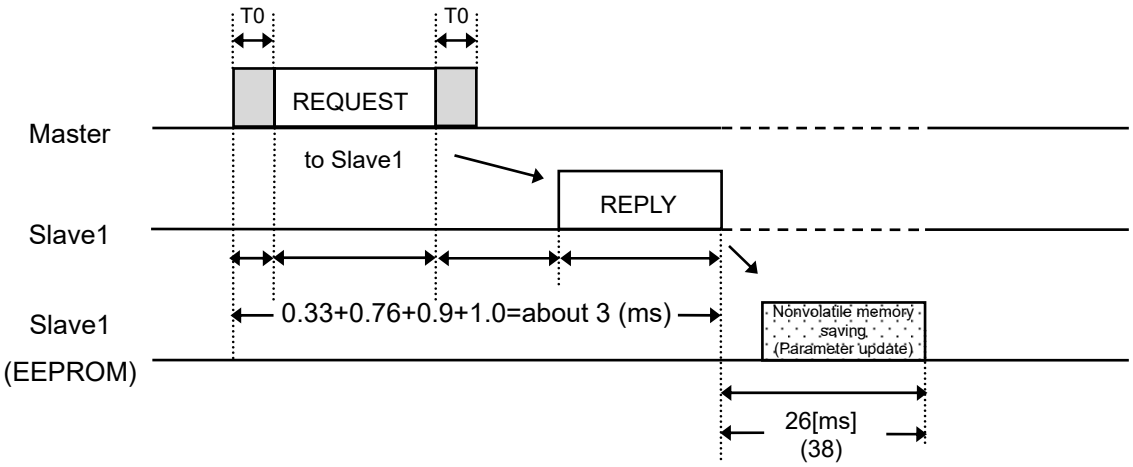
◆ Sets a servo gain.
Set the velocity loop proportional gain 1 as 100Hz.

Request message: 8 bytes (message length=1/1,152,000×11bit×8byte=about 0.76ms)

Slave Adr	FC	Reg Adr Hi	Reg Adr Lo	Reg Val Hi	Reg Val Lo	CRC16 Lo	CRC16 Hi
0x01	0x06	0x00	0x10	0x00	0x64	0x89	0xE4

Response massage: 8 bytes (message length=0.125×8=about 1ms)

Slave Adr	FC	Reg Adr Hi	Reg Adr Lo	Reg Val Hi	Reg Val Lo	CRC16 Lo	CRC16 Hi
0x01	0x06	0x00	0x10	0x00	0x64	0x89	0xE4



* In the write-in command (a single or multi) of a holding register, since a write- in value is saved at nonvolatile memory, the storing time of about 22 ms is spent inside amplifier.
Therefore, if the write-in command of a holding register is executed, please publish the next command after waiting for 29 ms or more.
It takes about 38 ms to reflect the parameter written to actual moving, so when moving work after setting parameter, make sure to issue command to operate after a lapse of 40 ms or more in consideration of margin.

◆ Readouts alarm history.
The eight-word continuation data in an alarm history zone is readout from monitor data.

Request message: 8 bytes (message length=1/1,152,000×11bit×8byte=about 0.76ms)

Slave Adr	FC	Reg Adr Hi	Reg Adr Lo	Quantity Hi	Quantity Lo	CRC16 Lo	CRC16 Hi
0x01	0x03	0x40	0x84	0x00	0x08	0x11	0xE5

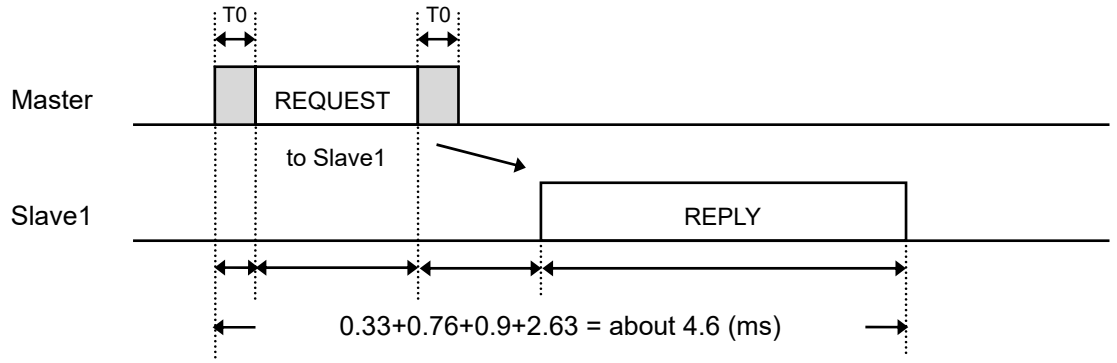
Response massage: 21 bytes (message length=0.125×21=about 2.63ms)

Slave Adr	FC	Byte Count
0x01	0x03	0x10

AlmNow Hi	AlmNow Lo	AlmLast1 Hi	AlmLast1 Lo	AlmLast2 Hi	AlmLast2 Lo	AlmLast3 Hi	AlmLast3 Lo

AlmLast4 Hi	AlmLast4 Lo	AlmLast5 Hi	AlmLast5 Lo	AlmLast6 Hi	AlmLast6 Lo	AlmLast7 Hi	AlmLast7 Lo

CRC16 Lo	CRC16 Hi



◆ Sets a point data. (Block 10 to 253)
Set the velocity data (32 bits) of block 10 as 0x12,345,678 out of point data.

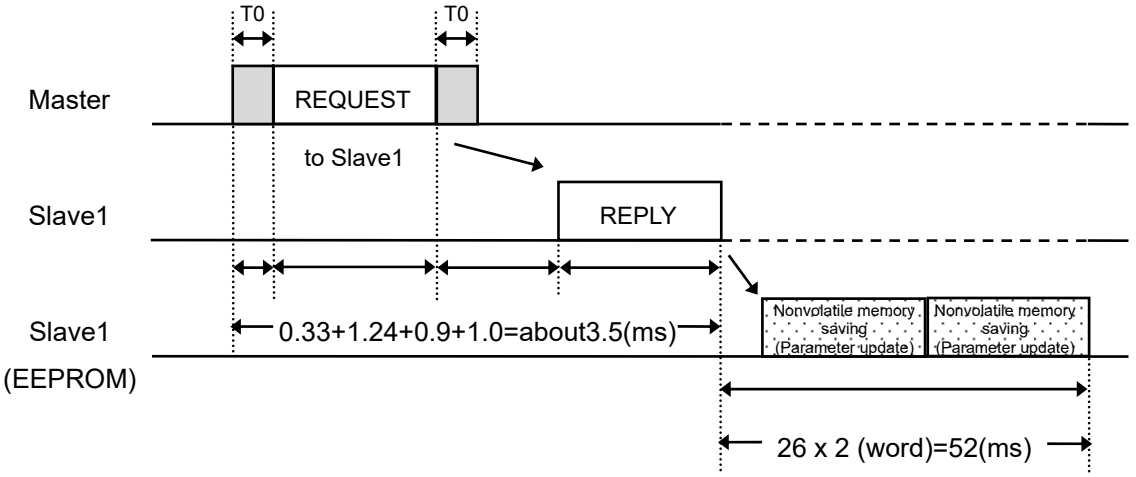
Request message: 13 bytes (message length=1/1,152,000×11bit×13byte=about 1.24ms)

Slave Adr	FC	Reg Adr Hi	Reg Adr Lo	Quantity Hi	Quantity Lo	Byte Count
0x01	0x10	0x81	0x40	0x00	0x02	0x04

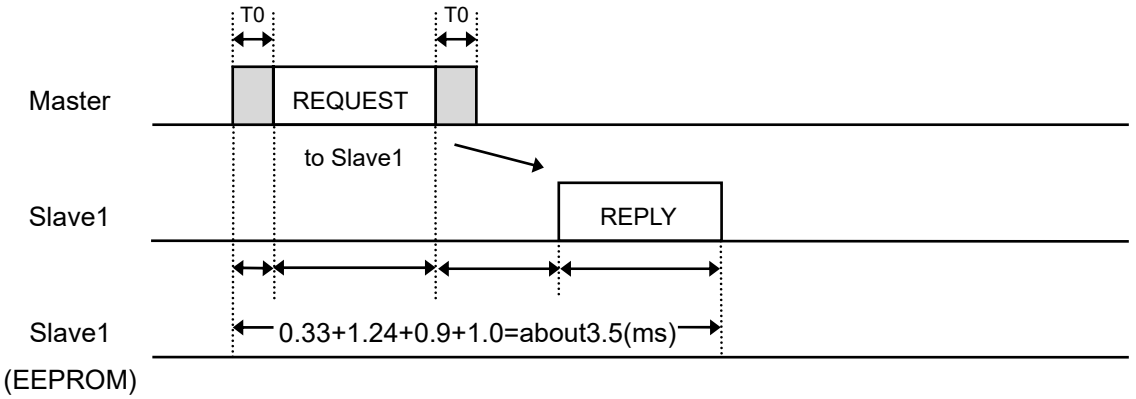
Speed HH	Speed HL	Speed LH	Speed LL	CRC16 Lo	CRC16 Hi
0x12	0x34	0x56	0x78	0xE0	0xFD

Response message: 8 bytes (message length=0.125×8= about 1ms)

Slave Adr	FC	Reg Adr Hi	Reg Adr Lo	Quantity Hi	Quantity Lo	CRC16 Lo	CRC16 Hi
0x01	0x10	0x81	0x40	0x00	0x02	0x68	0x20



◆ Sets a point data. (Block 0 to 9)
The point data of block 0 to 9 are not saved at nonvolatile memory.
Since it is renewal only of internal RAM, can change during turning on electricity at any time.



* In a point data, the time which can receive the next command differs due to operation of the block to set up.
Since time to respond with the number of data to set up differs, please design according to the example of usage.

◆ Sets a point data. (Block 10 to 253)
Set up all the data of block 10 out of point data.

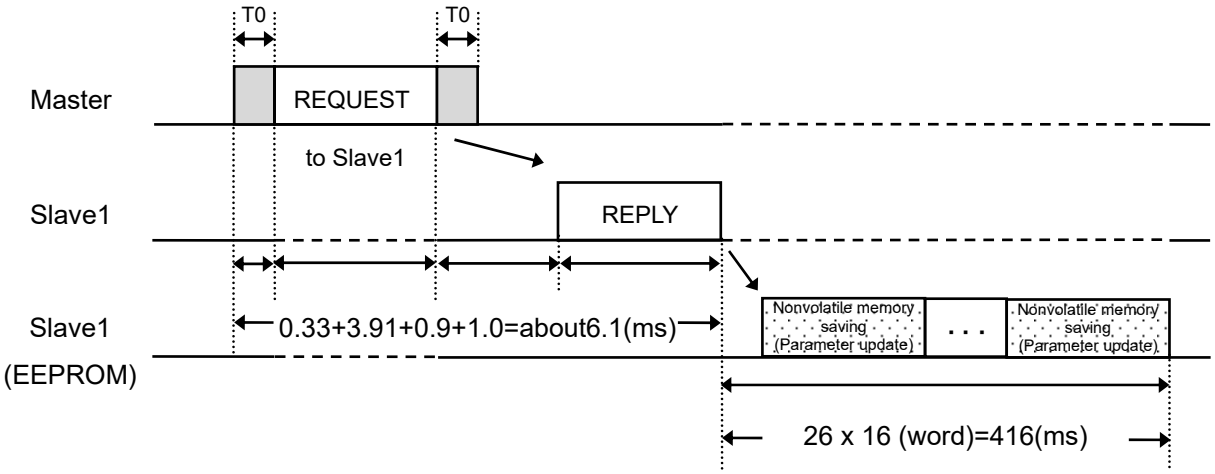
Request message: 41 bytes (message length=1/1,152,000×11bit×41byte=about 3.91ms)

Slave Adr	FC	Reg Adr Hi	Reg Adr Lo	Quantity Hi	Quantity Lo	Byte Count
0x01	0x10	0x81	0x40	0x00	0x10	0x20

Speed HH	Speed HL	Speed LH	Speed LL	.....	CRC16 Lo	CRC16 Hi

Response massage: 8 bytes (message length=0.125×8=about 1ms)

Slave Adr	FC	Reg Adr Hi	Reg Adr Lo	Quantity Hi	Quantity Lo	CRC16 Lo	CRC16 Hi
0x01	0x10	0x81	0x40	0x00	0x10	0xE8	0x2D



2. Inteface

◆ Sets a coil input. (32 bits all are set up with multi-register setup.)
When only a servo-on input is turned on and all other bits are set to OFF.

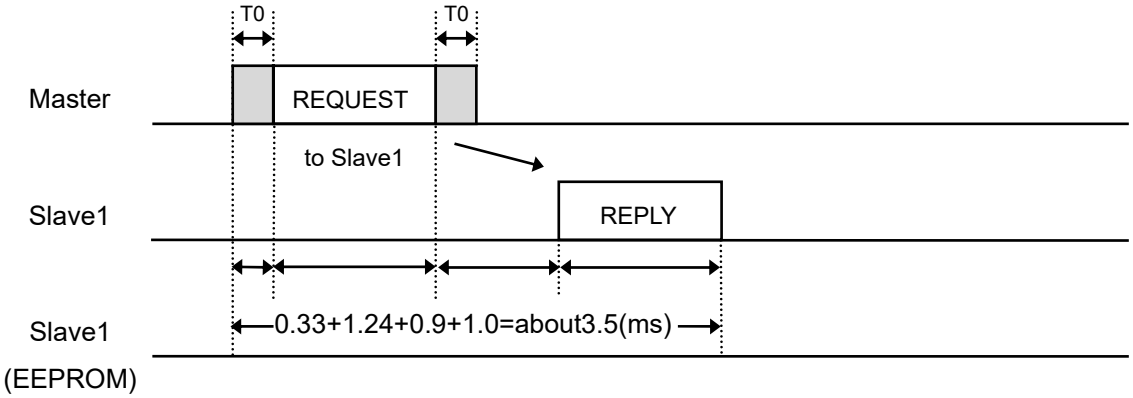
Request message: 13 bytes (message length=1/1,152,000×11bit×13byte=about 1.24ms)

Slave Adr	FC	Reg Adr Hi	Reg Adr Lo	Quantity Hi	Quantity Lo	Byte Count
0x01	0x10	0x00	0x80	0x00	0x02	0x04

CoilInG1 Hi	CoilInG1 Lo	CoilInG2 Hi	CoilInG2 Lo	CRC16 Lo	CRC16 Hi
0x00	0x01	0x00	0x00	0xAA	0x0F

Response massage: 8 bytes (message length=0.125×8=about 1ms)

Slave Adr	FC	Reg Adr Hi	Reg Adr Lo	Quantity Hi	Quantity Lo	CRC16 Lo	CRC16 Hi
0x01	0x10	0x00	0x80	0x00	0x02	0x40	0x20



◆ Radouts a coil output. (32 bits all are read with holding register readout.)

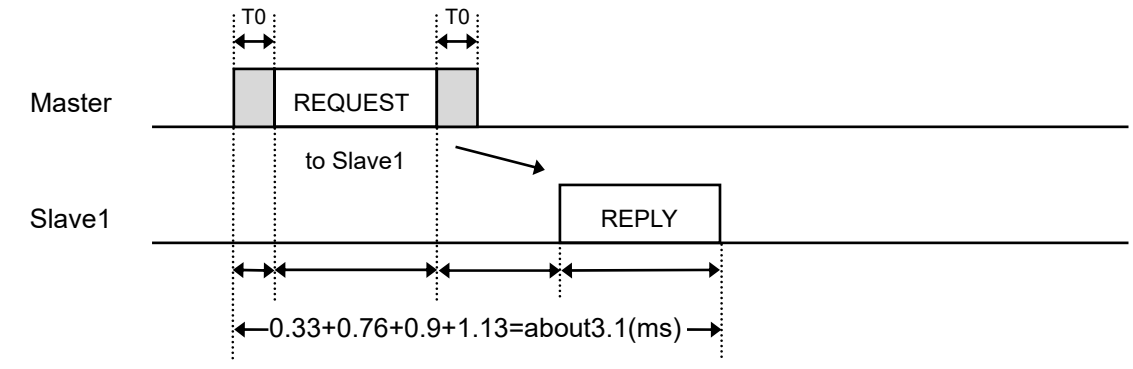
Request message: 8 bytes (message length=1/1,152,000×11bit×8byte=about 0.76ms)

Slave Adr	FC	Reg Adr Hi	Reg Adr Lo	Quantity Hi	Quantity Lo	CRC16 Lo	CRC16 Hi
0x01	0x03	0x40	0x82	0x00	0x02	0x71	0xE3

Response massage: 9 bytes (message length=0.125×9=about 1.13ms)

Slave Adr	FC	Byte Count
0x01	0x03	0x04

CoilOutG1Hi	CoilOutG1Lo	CoilOutG2Hi	CoilOutG2Lo	CRC16 Lo	CRC16 Hi



2.2.9 Alarm clear

◆ Alarm clear procedure (only 1 bit is set up by single coil setup.)

① Turn on an alarm clear input.

Request message: 8 bytes (message length=1/1,152,000×11bit×8byte=about 0.76ms)

Slave Adr	FC	Coil Adr Hi	Coil Adr Lo	Out Val Hi	Out Val Lo	CRC16 Lo	CRC16 Hi
0x01	0x05	0x00	0x06	0xFF	0x00	0x6C	0x3B

Response massage: 8 bytes (message length=0.125×8=about 1ms)

Slave Adr	FC	Coil Adr Hi	Coil Adr Lo	Out Val Hi	Out Val Lo	CRC16 Lo	CRC16 Hi
0x01	0x05	0x00	0x06	0xFF	0x00	0x6C	0x3B

② Wait for 20ms or more.

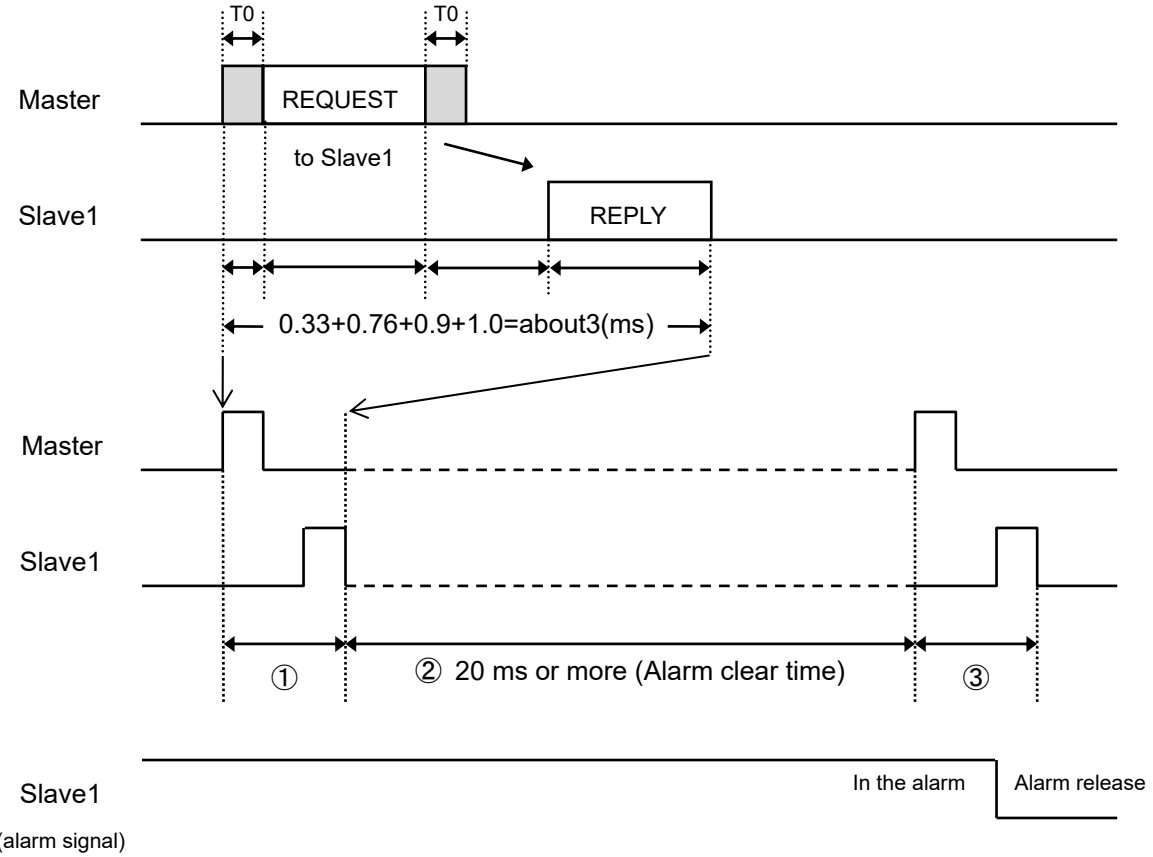
③ Turn off an alarm clear input.

Request message: 8 bytes (message length=1/1,152,000×11bit×8byte=about 0.76ms)

Slave Adr	FC	Coil Adr Hi	Coil Adr Lo	Out Val Hi	Out Val Lo	CRC16 Lo	CRC16 Hi
0x01	0x05	0x00	0x06	0x00	0x00	0x2D	0xCB

Response massage: 8 bytes (message length=0.125×8=about 1ms)

Slave Adr	FC	Coil Adr Hi	Coil Adr Lo	Out Val Hi	Out Val Lo	CRC16 Lo	CRC16 Hi
0x01	0x05	0x00	0x06	0x00	0x00	0x2D	0xCB



* By the single or multi-register setup, you may operate it together with other bits.
In order to clear an alarm condition inside amplifier, please continue ON for 20ms or more.
If an alarm clear input is turned off, an alarm condition will be canceled and it will return to a normal state.
However, reset may be impossible unless performing power cycle or clearing encoder depending on the kind of alarm. Please refer to alarm list in chapter 8.

2.2.10 Encoder clear procedure

◆ Encoder clear procedure (only 1 bit is set up by single coil setup.)

① Turn on an encoder clear input.

Request message: 8 bytes (message length=1/1,152,000×11bit×8byte=about 0.76ms)

Slave Adr	FC	Coil Adr Hi	Coil Adr Lo	Out Val Hi	Out Val Lo	CRC16 Lo	CRC16 Hi
0x01	0x05	0x00	0x10	0xFF	0x00	0x8D	0xFF

Response massage: 8 bytes (message length=0.125×8=about 1ms)

Slave Adr	FC	Coil Adr Hi	Coil Adr Lo	Out Val Hi	Out Val Lo	CRC16 Lo	CRC16 Hi
0x01	0x05	0x00	0x10	0xFF	0x00	0x8D	0xFF

② Wait for 4s or more.

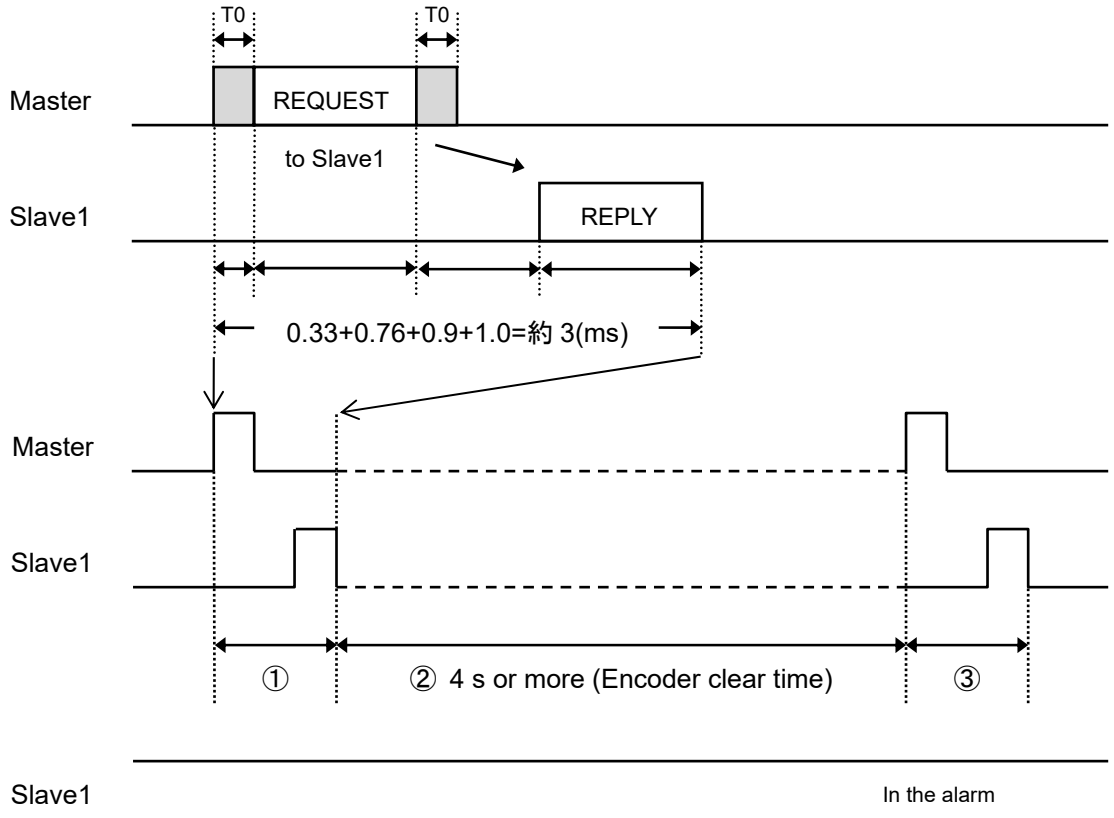
③ Turn off an encoder clear input.

Request message: 8 bytes (message length=1/1,152,000×11bit×8byte=about 0.76ms)

Slave Adr	FC	Coil Adr Hi	Coil Adr Lo	Out Val Hi	Out Val Lo	CRC16 Lo	CRC16 Hi
0x01	0x05	0x00	0x10	0x00	0x00	0xCC	0x0F

Response massage: 8 bytes (message length=0.125×8=about 1ms)

Slave Adr	FC	Coil Adr Hi	Coil Adr Lo	Out Val Hi	Out Val Lo	CRC16 Lo	CRC16 Hi
0x01	0x05	0x00	0x10	0x00	0x00	0xCC	0x0F



* By the single or multi-register setup, you may operate it together with other bits.
In order to clear an encoder clear condition inside amplifier, please continue ON for 4 s or more.
After turning off an encoder clear input, how to perform encoder clear/alarm reset differs due to an encoder in use.
Please refer to section 8.6 in chapter 8.

3

Positioning function parameters

In this chapter, parameters of positioning function are explained.
There are differences of parameter setting, due to interface type
(C: I/O, F: MODBUS communication) in servo amplifier model number.

3.1 Parameter setting 3-1
3.1.1 Positioning function parameter list (Common) 3-1
3.1.2 Positioning function parameter list (shown at C: I/O use) 3-3
3.1.3 Positioning function parameter list (shown at F: MODBUS use) 3-4
3.2 Each parameter functions 3-5

3. Positioning function parameters

3.1 Parameter setting

Below shows the positioning function parameter list in GroupA.
Some applicable parameters differ due to interface type shown in servo amplifier model number.

3.1.1 Positioning function parameter list (Common)

■ General parameter GroupA: Positioning function setting

ID	Symbol	Name	Standard set value	Unit	Setting range
00	S_vmx	System velocity limit	75000	UV	1 to 2147483647
01	T_vmx	PC operation velocity limit	10000	UV	1 to 2147483647
02	S_+OT	Positive direction software limit	99999999	UP	-2147483648 to 2147483647
03	S_-OT	Negative direction software limit	-99999999	UP	-2147483648 to 2147483647
04	Stp_P	Pushing depth	100	Pulse	1 to 2147483647
05	S_inp	System in-position width	100	Pulse	1 to 65535
06	S_ovf	System overflow	99999	UP	1 to 2147483647
07	T_ovf	Overflow when current limited	10000	UP	1 to 2147483647
08	Bakls	Backlash amount	0	UP	0 to 32767
09	SOTde	Software limit detection	01:Enabled	—	00 to 01
0A	M_dir	Operation direction	00:Positive_Dir	—	00 to 01
0B	Accel	Acceleration/deceleration constant	100	UP/sec^2	1 to 65535
0C	S_rat	S-shaped curve accel/decel time	0	ms	0 to 32767
0D	T_jog	PC operation JOG-current limit	100	%	0 to 799
0E	Z_typ	Homing type	00:C-Signal	—	00 to 02
0F	Z_dir	Homing direction	01:Negative	—	00 to 01
10	Z_hsp	Homing with high speed	1670	UV	1 to 2147483647
11	Z_lsp	Homing with low speed	80	UV	1 to 2147483647
12	Z_add	Origin position coordinate	0	UP	-2147483648 to 2147483647
13	Z_ofs	Origin-offset value	0	UP	-2147483648 to 2147483647
14	Z_inp	Origin in-position width	100	Pulse	1 to 65535
15	+STROKE	+STROKE	0	UP	-2147483648 to 2147483647
16	A_ofs	Effective stroke length of absolute encoder	-10000	UP	-2147483648 to 2147483647
17	Zon1L	Zone (1), negative end	0	UP	-2147483648 to 2147483647
18	Zon1H	Zone (1), positive end	0	UP	-2147483648 to 2147483647
19	Zon2L	Zone (2), negative end	0	UP	-2147483648 to 2147483647
1A	Zon2H	Zone (2), positive end	0	UP	-2147483648 to 2147483647
1B	Zon3L	Zone (3), negative end	0	UP	-2147483648 to 2147483647
1C	Zon3H	Zone (3), positive end	0	UP	-2147483648 to 2147483647
1D	Zon4L	Zone (4), negative end	0	UP	-2147483648 to 2147483647
1E	Zon4H	Zone (4), positive end	0	UP	-2147483648 to 2147483647
1F	Zon5L	Zone (5), negative end	0	UP	-2147483648 to 2147483647
20	Zon5H	Zone (5), positive end	0	UP	-2147483648 to 2147483647
21	Zon6L	Zone (6), negative end	0	UP	-2147483648 to 2147483647
22	Zon6H	Zone (6), positive end	0	UP	-2147483648 to 2147483647
23	Zon7L	Zone (7), negative end	0	UP	-2147483648 to 2147483647
24	Zon7H	Zone (7), positive end	0	UP	-2147483648 to 2147483647
25	Zon8L	Zone (8), negative end	0	UP	-2147483648 to 2147483647
26	Zon8H	Zone (8), positive end	0	UP	-2147483648 to 2147483647

* Unit: UV (User Velocity unit), UP (User Position unit)
Unit is determined by setting parameters (S_pls, U_pls, D_dpo, Unit) by user.

■ General parameter GroupA: Positioning function setting

ID	Symbol	Name	Standard set value	Unit	Setting range
27	H_jog	Manual high speed	1670	UV	1 to 2147483647
28	L_jog	Manual low speed	80	UV	1 to 2147483647
29	H_stp	High speed 1step travel distance	1000	UP	1 to 2147483647
2A	L_stp	Low speed 1step travel distance	100	UP	1 to 2147483647
2B	Ovride0	Override 0	100	%	1 to 255
2C	Ovride1	Override 1	150	%	1 to 255
2D	Ovride2	Override 2	100	%	1 to 255
2E	Ovride3	Override 3	100	%	1 to 255
2F	Ovride4	Override 4	100	%	1 to 255
30	Ovride5	Override 5	100	%	1 to 255
31	Ovride6	Override 6	100	%	1 to 255
32	Ovride7	Override 7	100	%	1 to 255
33	Ovride8	Override 8	100	%	1 to 255
34	Ovride9	Override 9	100	%	1 to 255
35	Ovride10	Override 10	100	%	1 to 255
36	Ovride11	Override 11	100	%	1 to 255
37	Ovride12	Override 12	100	%	1 to 255
38	Ovride13	Override 13	100	%	1 to 255
39	Ovride14	Override 14	100	%	1 to 255
3A	Ovride15	Override 15	100	%	1 to 255
3B	S_pls	System division number	8000	—	1 to 131072
3C	U_pls	User division number	1000	—	1 to 131072
3E	D_dpo	Decimal point of velocity/position data	2	—	0 to 5
3F	Unit	Setting unit	01:mm	—	00 to 02
50	Z_Stp	Pushing depth at homing	100	Pulse	1 to 2147483647
51	Z_Tlim	Pushing current limit value at homing	0	%	0 to 799
52	N_Tool	Index tool count	30	—	0 to 120

* Unit: UV (User Velocity unit), UP (User Position unit)
Unit is determined by setting parameters (S_pls, U_pls, D_dpo, Unit) by user.

3. Positioning function parameters

3.1.2 Positioning function parameter list (shown at C: I/O use)

■ General parameter GroupA: Positioning function setting

ID	Symbol	Name	Standard set value	Unit	Setting range
60	Sw1_bit0	External data setting	00:type1	—	00 to 01
61	Sw1_bit1	Coordinate at external data set teaching	00:type1	—	00 to 01
63	Sw1_bit3	Coordinate switching	00:type1	—	00 to 01
64	Sw1_bit4	Shortcut function switching	00:type1	—	00 to 01
65	Sw1_bit5	Zone signal function extension	00:type1	—	00 to 01
66	Sw1_bit6	Absolute encoder clear function External I/O mode	00:Disabled	—	00 to 01
67	Sw1_bit7	Deviation clear at pushing stop	00:type1	—	00 to 01
70	Sw2_bit0	Hardware overtravel (-OT)	01:type2	—	00 to 01
71	Sw2_bit1	Hardware overtravel (+OT)	01:type2	—	00 to 01
72	Sw2_bit2	Hardware overtravel logic	00:type1	—	00 to 01
73	Sw2_bit3	Home position set input switching	00:type1	—	00 to 01
74	Sw2_bit4	Homing function of absolute encoder	00:type1	—	00 to 01
75	Sw2_bit5	External error detection	01:type2	—	00 to 01
76	Sw2_bit6	Override selection	00:type1	—	00 to 01
77	Sw2_bit7	SDN signal switching	00:type1	—	00 to 01
79	Sw2_bit9	Fixed position stop JOG function	00:Disabled	—	00 to 01
80	Sw3	Function switch 3	0000	—	0000 to FFFF
81	Sw4	Function switch 4	0000	—	0000 to FFFF

3.1.3 Positioning function parameter list (shown at F: MODBUS use)

■ General parameter GroupA: Positioning function setting

ID	Symbol	Name	Standard set value	Unit	Setting range
60	Sw1_bit0	External data setting	00:type1	—	00 to 01
61	Sw1_bit1	Coordinate at external data set teaching	00:type1	—	00 to 01
63	Sw1_bit3	Coordinate switching	00:type1	—	00 to 01
64	Sw1_bit4	Shortcut function switching	00:type1	—	00 to 01
65	Sw1_bit5	Zone signal function extension	00:type1	—	00 to 01
67	Sw1_bit7	Deviation clear at pushing stop	00:type1	—	00 to 01
74	Sw2_bit4	Homing function of absolute encoder	00:type1	—	00 to 01
79	Sw2_bit9	Fixed position stop JOG function	00:Disabled	—	00 to 01
80	Sw3	Function switch 3	0000	—	0000 to FFFF
81	Sw4	Function switch 4	0000	—	0000 to FFFF

3. Positioning function parameters

3.2 Each parameter functions

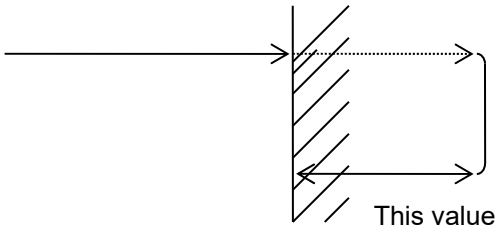
Each parameter functions are explained below.
For the parameter indicated UV (User Velocity unit) or UP (User Position unit) to unit, set a parameter value after deciding unit.
Unit is determined by setting parameters (S_pls, U_pls, D_dpo, Unit) of positioning basis. Refer to section 4.3 for details of unit decision.

■ GroupA: Positioning function setting

<table>
<tr><th>ID</th><th colspan="3">Description</th></tr>
<tr><td rowspan="4">00</td><td rowspan="3">System velocity limit
[S_vmx]</td><td>Standard value</td><td>75000</td></tr>
<tr><td>Setting range</td><td>1 to 2147483647</td></tr>
<tr><td>Unit</td><td>UV (User Velocity Unit)</td></tr>
<tr><td colspan="3">■ If the velocity exceeds this value through external operation, the velocity is limited at this setting.
* The parameter requiring unit decision.
* Set a velocity limit for external operation.</td></tr>
<tr><td rowspan="4">01</td><td rowspan="3">PC operation velocity limit
[T_vmx]</td><td>Standard value</td><td>10000</td></tr>
<tr><td>Setting range</td><td>1 to 2147483647</td></tr>
<tr><td>Unit</td><td>UV (User Velocity Unit)</td></tr>
<tr><td colspan="3">■ If the velocity exceeds this value through SANMOTION MOTOR Setup operation, the velocity is limited at this setting velocity.
In case of S_vmx < T_vmx, the velocity is limited at S_vmx.
* The parameter requiring unit decision.
* Set a velocity limit for SANMOTION MOTOR Setup operation.</td></tr>
<tr><td rowspan="4">02</td><td rowspan="3">Positive direction software limit
[S_+OT]</td><td>Standard value</td><td>99999999</td></tr>
<tr><td>Setting range</td><td>-2147483648 to 2147483647</td></tr>
<tr><td>Unit</td><td>UP (User Position Unit)</td></tr>
<tr><td colspan="3">■ If the current coordinate exceeds this value, the software limit gets errors.
◆ Software limit becomes valid after homing completion in case incremental encoder use, and valid anytime in case absolute encoder use.
◆ Performs deceleration stop if current position beyond this value and inhibits move to positive direction.
(Software limit error will be issued.)
◆ To escape, move by manual (JOG operation) to opposite (negative direction), and error is released when reached under limit (into operating area).
◆ Function becomes invalid if set SOTde (ID 09)=00:Disabled.
* The parameter requiring unit decision.</td></tr>
<tr><td rowspan="4">03</td><td rowspan="3">Negative direction software limit
[S_-OT]</td><td>Standard value</td><td>-99999999</td></tr>
<tr><td>Setting range</td><td>-2147483648 to 2147483647</td></tr>
<tr><td>Unit</td><td>UP (User Position Unit)</td></tr>
<tr><td colspan="3">■ If the current coordinate gets lower this value, the software limit gets errors.
◆ Software limit becomes valid after homing completion in case incremental encoder use, and valid anytime in case absolute encoder use.
◆ Performs deceleration stop if current position beyond this value and inhibits move to negative direction.
(Software limit error will be issued.)
◆ To escape, move by manual (JOG operation) to opposite (positive direction), and error is released when reached under limit (into operating area).
◆ Function becomes invalid if set SOTde (ID 09)=00:Disabled.
* The parameter requiring unit decision.</td></tr>
</table>

－GroupA－

<table>
<tr><th>ID</th><th colspan="3">Description</th></tr>
<tr><td rowspan="5">04</td><td rowspan="4">Pushing depth
[Stp_P]</td><td>Standard value</td><td>100</td></tr>
<tr><td>Setting range</td><td>1 to 2147483647</td></tr>
<tr><td>Unit</td><td>Pulse</td></tr>
<tr><td colspan="3">■ Sets pulses after contact at pushing operation.

◆ It means virtual intruding depth at pushing operation. For performing pushing operation with point move etc, positioning is completed when this value matches to difference between command/actual position (deviation), even if it does not reach target position.
 

* It becomes valid by control power cycle after setting change.</td></tr>
<tr><td rowspan="5">05</td><td rowspan="4">System in-position width
[S_inp]</td><td>Standard value</td><td>100</td></tr>
<tr><td>Setting range</td><td>1 to 65535</td></tr>
<tr><td>Unit</td><td>Pulse</td></tr>
<tr><td colspan="3">■ If the deviation value is within the set in-position, in-position output is performed.

◆ Outputs positioning completion/in-position when the difference between command position and actual position (deviation) is within +/-S_inp value.
◆ This value should usually be set with positioning error permissible value.

* It becomes valid by control power cycle after setting change.</td></tr>
<tr><td rowspan="5">06</td><td rowspan="4">System overflow
[S_ovf]</td><td>Standard value</td><td>99999</td></tr>
<tr><td>Setting range</td><td>1 to 2147483647</td></tr>
<tr><td>Unit</td><td>UP (User Position Unit)</td></tr>
<tr><td colspan="3">■ Sets an excessive deviation value, at overflow.

◆ Considers as defective position loop (defective tracking) including operation, and sets the value to be issued excessive position deviation (alarm).

* The parameter requiring unit decision.
* It becomes valid by control power cycle after setting change.</td></tr>
<tr><td rowspan="5">07</td><td rowspan="4">Overflow when current limited
[T_ovf]</td><td>Standard value</td><td>10000</td></tr>
<tr><td>Setting range</td><td>1 to 2147483647</td></tr>
<tr><td>Unit</td><td>UP (User Position Unit)</td></tr>
<tr><td colspan="3">■ Sets an excessive deviation value, at overflow during current limit.

* The parameter requiring unit decision.
* It becomes valid by control power cycle after setting change.</td></tr>
</table>

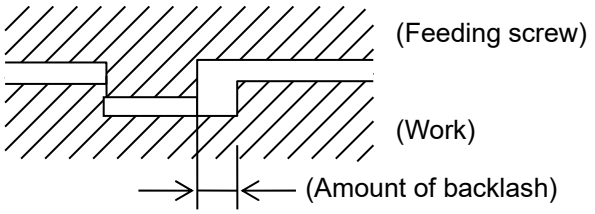
3. Positioning function parameters

－GroupA－

ID	Description		
08	Backlash amount [Bakls]	Standard value	0
		Setting range	0 to 32767
		Unit	UP (User Position Unit)

■ Sets the amount of backlash of the machine.

◆ Amount of backlash is carried out being added to travel data every time travel direction changes.
◆ Perform homing operation when you use backlash correction or after you alter setting.
◆ Correction starts when the direction reverses to the direction of homing completion.



* It becomes valid by control power cycle after setting change.

ID	Description		
09	Software limit detection [SOTde]	Standard value	01:Enabled
		Setting range	00 to 01
		Unit	—

■ Sets valid/invalid of software limit.

Selection		Contents
00	Disabled	Invalid
01	Enabled	Valid

ID	Description		
0A	Operation direction [M_dir]	Standard value	00:Positive_Dir
		Setting range	00 to 01
		Unit	—

■ Sets an operation direction of motor.

Selection		Contents
00	Positive_Dir	It is positive direction when coordinate value increased. (CCW)
01	Negative_Dir	It is negative direction when coordinate value increased. (CW)

* It becomes valid by control power cycle after setting change.

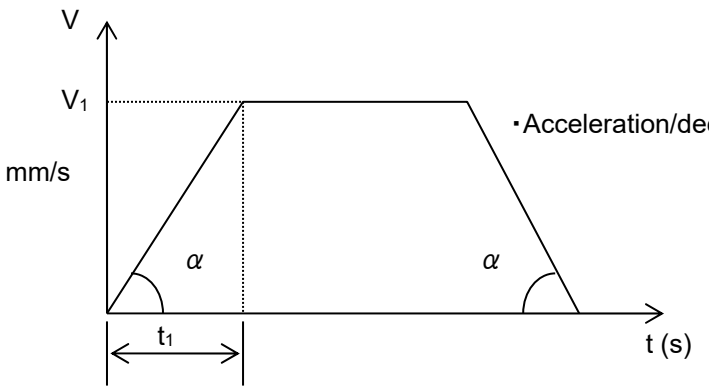
－GroupA－

ID	Description		
0B	Acceleration/deceleration constant [Accel]	Standard value	100
		Setting range	1 to 65535
		Unit	UP (User Position Unit)/sec^2

■ Sets an acceleration/deceleration at external operation/SANMOTION MOTOR Setup operation.

◆ This is used to move of manual (JOG), 1-step, homing.

Example



・Acceleration/deceleration is identical.

$$\text{Accel} = \frac{V_1 \times 10^{(D\_dpo)}}{t1 \times 10^3}$$ However V1=(mm/s)

When rising at 0.2 s until the velocity of 0 → 375(mm/s)

V1 = 375(mm/s)…(N = 4500min^{-1})

t1 = 0.2(s), D_dpo = 2, U_pls = 5.00 (mm)

$$\text{Accel} = \frac{375 \times 10^2}{0.2 \times 10^3} = 187.5 \rightarrow 188$$

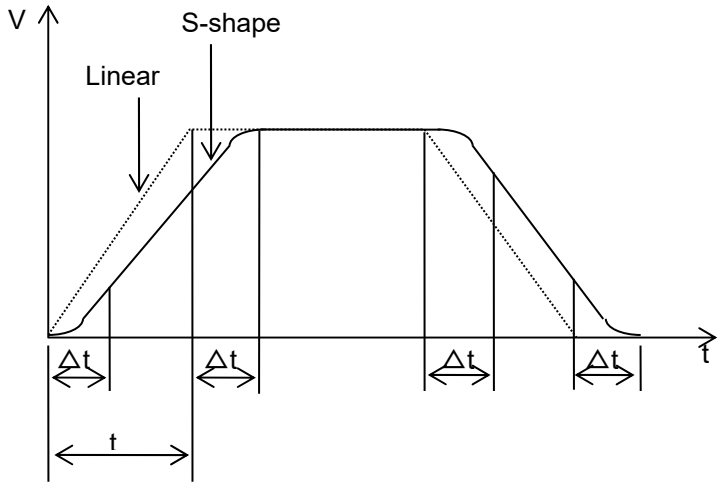
* When accel/decel constant is too high, overshoot or undershoot (vibration) is prone to happen.

3. Positioning function parameters

－GroupA－

<table>
<tr><th>ID</th><th colspan="3">Description</th></tr>
<tr><td rowspan="4">0C</td><td rowspan="3">S-shaped curve accel/decel time
[S_rat]</td><td>Standard value</td><td>0</td></tr>
<tr><td>Setting range</td><td>0 to 32767</td></tr>
<tr><td>Unit</td><td>ms</td></tr>
<tr><td colspan="3">■ Sets a S-shape time during S-shaped curve accel/decel.

◆ This parameter is not applied when “Fixed position stop JOG function” enabled. To smooth a velocity ramp, set the position command smoothing time constant.
◆ The curve section (△t) of s-shape in the acceleration and deceleration is set with time. It becomes linear acceleration/deceleration when set value is below 4 (ms). (Set “0” during the straight line.)
◆ If accel/decel time is short enough and the curve section of s-shape is too long, it may not reach acceleration constant (Accel).

* Rising (falling) time at S-shape is about △t longer (curve section of S-shape) than at straight line.
* The linear part at S-shape is acceleration constant (Accel).</td></tr>
</table>

－GroupA－

ID	Description		
0D	PC operation JOG-current limit [T_jog]	Standard value	100
		Setting range	0 to 799
		Unit	%
	■ Sets a current limit value when performing JOG operation from SANMOTION MOTOR Setup.		

3. Positioning function parameters

－GroupA－

ID	Description		
0E	Homing type [Z_typ]	Standard value	00:C-Signal
		Setting range	00 to 02
		Unit	—

■ Selects a homing method.

◆ When incremental encoder or incremental use absolute encoder are used, homing operation should be done at first for matching internal command coordinate and actual machine coordinate.

◆ Select a homing method and perform it at first.

Selection		Contents
00	C-Signal	C-phase signal search
01	SDN-OFF	SDN OFF search
02	STP-C-Cignal	Pushing stop and C-phase signal search

■ Homing type 0 (C-Signal selected)

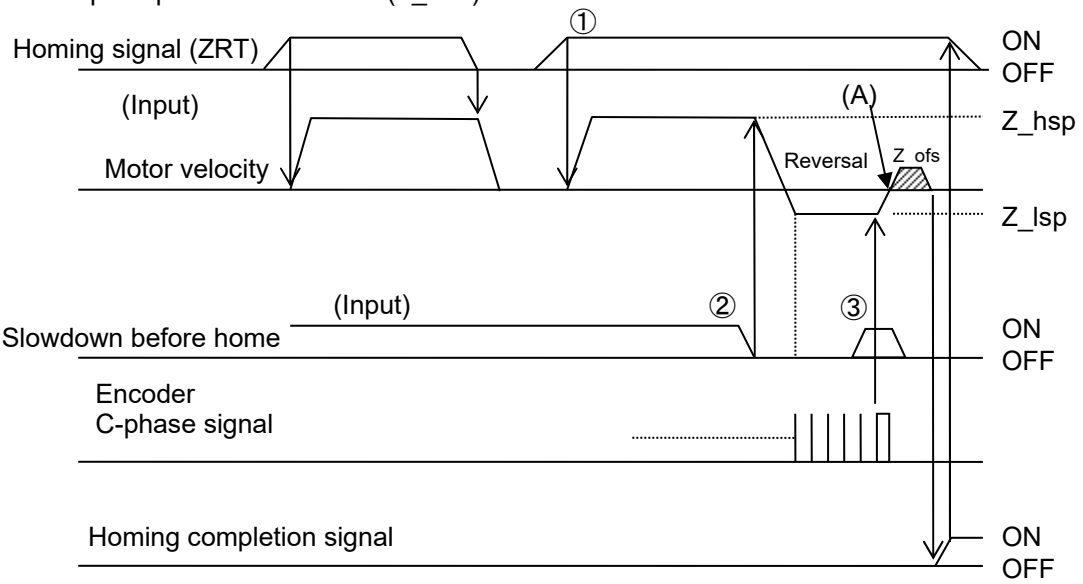
◆ Homing procedure is below.

It can perform with conditions of "servo on input valid" and "Command reception permission state".

①ON of a homing signal (ZRT) will start movement in the direction (Z_dir) of the origin point at the velocity set up at the homing high speed (Z_hsp).

②Once carries out a slowdown stop in OFF of a slowdown before home signal (SDN), and the direction of operation is reversed.
After reversal, moves at the velocity set up at the homing low speed (Z _lsp).

③After the slowdown before home signal (SDN) turns ON again, continues move and searches C-phase signal. Motor stops at the coordinate that first C-phase signal ON position and the origin point offset value (Z_ofs) addition, and that position becomes origin. The coordinates of a origin point position serve as a value set as the origin point position coordinate (Z_add).



* Homing signal is accepted only when other operational signals (RUN, JOG, 1 STEP) are all OFF.

* In actual movement, since the position of the actually stopped position (A) differs from the position decided by C-phase signal, it performs movement of the amount of compensation +Z_ofs.
Movement of the amount of compensation is performed also Z_ofs=0.

－GroupA－

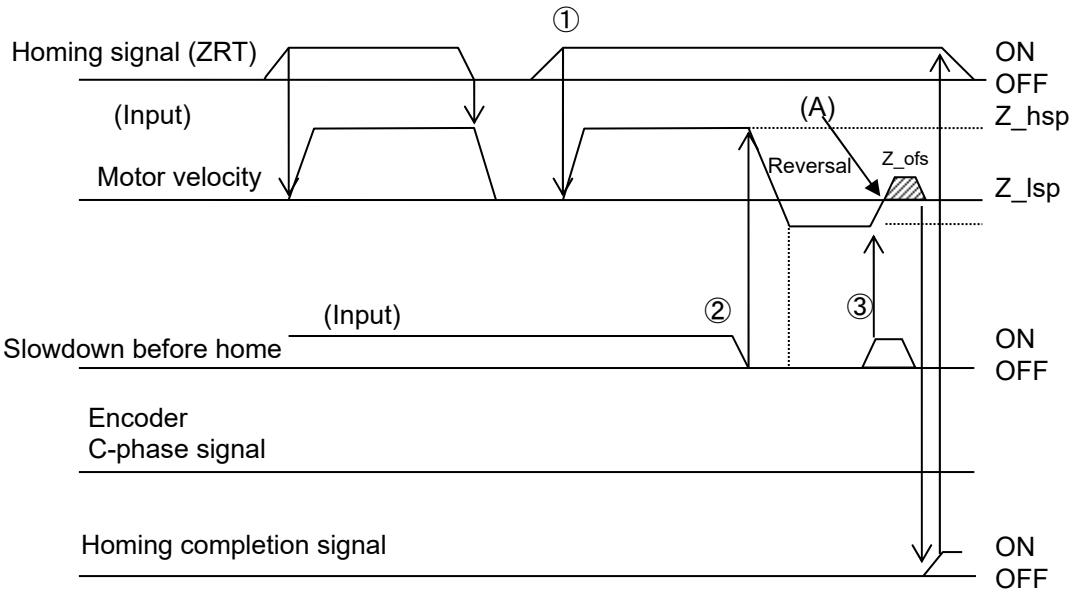
0E

■ Homing type 1 (SDN OFF selected)

◆ Homing procedure is below.
It can perform with conditions of "servo on input valid" and "Command reception permission state".

① and ② are the same as that of the homing type 0.

③Motor stops at the coordinate that the slowdown before home signal (SDN) turns ON again and the origin point offset value (Z_ofs) addition, and that position becomes origin.
The coordinates of a origin point position serve as a value set as the origin point position coordinate (Z_add).



* Homing signal is accepted only when other operational signals (RUN, JOG, 1 STEP) are all OFF.

* In actual movement, since the position of the actually stopped position (A) differs from the position decided by C-phase signal, it performs movement of the amount of compensation +Z_ofs.
Movement of the amount of compensation is performed also Z_ofs=0.

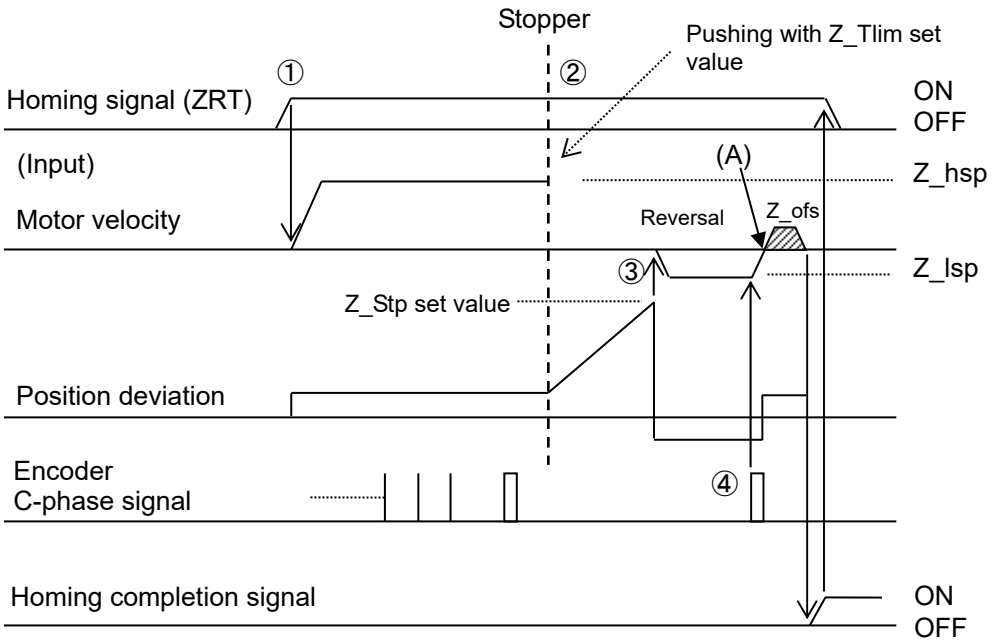
－GroupA－

0E

■ Homing type 2 (STP-C-Signal selected)

◆ Homing procedure is below.
It can perform with conditions of "servo on input valid" and "Command reception permission state".

①ON of the homing signal (ZRT) will start movement in the direction (Z_dir) of the origin point at the velocity set up at the homing high speed (Z_hsp).
②When application hits a stopper and motor stops rotating, the pushing operation will perform with the pushing current limit value at homing (Z_Tlim).
③When difference between internal command position and actual motor position becomes larger than the pushing depth at homing (Z_Stp), the pushing operation will end and rotation direction will be reversed.
Then, movement will start with the homing low speed (Z_lsp).
④After rotation direction is reversed, motor stops at the coordinate that first C-phase signal ON position and the origin point offset value (Z_ofs) addition, and that position becomes origin.
The coordinates of a origin point position serve as a value set as the origin point position coordinate (Z_add).
After Homing completion signal is ON, the Homing signal (ZRT) will be OFF and the Homing operation is end.



* Homing signal is accepted only when other operational signals (RUN, JOG, 1 STEP) are all OFF.

* In actual movement, since the position of the actually stopped position (A) differs from the position decided by C-phase signal, it performs movement of the amount of compensation +Z_ofs.
Movement of the amount of compensation is performed also Z_ofs=0.

－GroupA－

<table>
<tr><th>ID</th><th colspan="3">Description</th></tr>
<tr><td rowspan="4">0F</td><td rowspan="2">Homing direction
[Z_dir]</td><td>Standard value</td><td>01:Negative</td></tr>
<tr><td>Setting range</td><td>00 to 01</td></tr>
<tr><td>Unit</td><td>—</td></tr>
<tr><td colspan="3">■ Sets a direction of homing.

<table>
<tr><th colspan="2">Selection</th><th>Contents</th></tr>
<tr><td>00</td><td>Positive</td><td>Positive rotation at high speed, negative rotation at low speed</td></tr>
<tr><td>01</td><td>Negative</td><td>Negative rotation at high speed, positive rotation at low speed</td></tr>
</table>
* When this parameter is changed, origin position shall be checked after homing.</td></tr>
<tr><td rowspan="4">10</td><td rowspan="3">Homing with high speed
[Z_hsp]</td><td>Standard value</td><td>1670</td></tr>
<tr><td>Setting range</td><td>1 to 2147483647</td></tr>
<tr><td>Unit</td><td>UV (User Velocity Unit)</td></tr>
<tr><td colspan="3">■ Sets a high speed of homing.

◆ In case incremental encoder use
Velocity at which it moves to the Homing direction (Z_dir) without SDN signal input (contact-open) after homing start.
◆ In case absolute encoder in incremental system use
Velocity at which it moves to the Homing direction (Z_dir) without SDN signal input (contact-open) after homing start.
◆ In case absolute encoder in absolute system use
Velocity of homing.

* The parameter requiring unit decision.</td></tr>
<tr><td rowspan="4">11</td><td rowspan="3">Homing with low speed
[Z_lsp]</td><td>Standard value</td><td>80</td></tr>
<tr><td>Setting range</td><td>1 to 2147483647</td></tr>
<tr><td>Unit</td><td>UV (User Velocity Unit)</td></tr>
<tr><td colspan="3">■ Sets a low speed of homing.

◆ In case incremental encoder use
At homing operation, it performs deceleration stop from (Z_hsp) by SDN signal and later reverses and get away from the SDN signal area. It is the velocity after reverse.
◆ In case absolute encoder in incremental system use
At homing operation, it performs deceleration stop from (Z_hsp) by SDN signal and later reverses and get away from the SDN signal area. It is the velocity after reverse.
◆ In case absolute encoder in absolute system use
This parameter is not used.

* The parameter requiring unit decision.
* When this parameter is changed, origin position shall be checked after homing.</td></tr>
</table>

3. Positioning function parameters

－GroupA－

<table>
<tr><th>ID</th><th colspan="3">Description</th></tr>
<tr><td rowspan="5">12</td><td rowspan="3">Origin position coordinate
[Z_add]</td><td>Standard value</td><td>0</td></tr>
<tr><td>Setting range</td><td>-2147483648 to 2147483647</td></tr>
<tr><td>Unit</td><td>UP (User Position Unit)/sec^2</td></tr>
<tr><td colspan="3">■ Sets the origin of user coordinate.

◆ In case incremental encoder use
At homing completion, the coordinate set here becomes user coordinate value.
◆ In case absolute encoder in incremental system use
At homing completion, the coordinate set here becomes user coordinate value.
◆ In case absolute encoder in absolute system use
At origin setting, the coordinate set here becomes user coordinate value.

* The parameter requiring unit decision.
* Homing or origin set is necessary when this value is changed.</td></tr>
<tr><td rowspan="5">13</td><td rowspan="3">Origin-offset value
[Z_ofs]</td><td>Standard value</td><td>0</td></tr>
<tr><td>Setting range</td><td>-2147483648 to 2147483647</td></tr>
<tr><td>Unit</td><td>UP (User Position Unit)</td></tr>
<tr><td colspan="3">■ At a homing operation, this value is used as correction amount between home reference signal (C-phase or SDN signal) position and user reference position.

◆ In case incremental encoder use
This parameter is used.
◆ In case absolute encoder in incremental system use
This parameter is used.
◆ In case absolute encoder in absolute system use
This parameter is not used.

* The parameter requiring unit decision.</td></tr>
<tr><td rowspan="5">14</td><td rowspan="3">Origin in-position width
[Z_inp]</td><td>Standard value</td><td>100</td></tr>
<tr><td>Setting range</td><td>1 to 65535</td></tr>
<tr><td>Unit</td><td>Pulse</td></tr>
<tr><td colspan="3">■ Sets a in-position width at homing operation.

◆ Reducing this value improves the homing accuracy.

* It becomes valid by control power cycle after setting change.</td></tr>
</table>

－GroupA－

<table>
<tr><th>ID</th><th colspan="3">Description</th></tr>
<tr><td rowspan="4">15</td><td rowspan="2">+STROKE
[+STROKE]</td><td>Standard value</td><td>0</td></tr>
<tr><td>Setting range</td><td>-2147483648 to 2147483647</td></tr>
<tr><td>Unit</td><td>UP (User Position Unit)</td></tr>
<tr><td colspan="3">■ Sets a maximum value of coordinate towards plus axis.

◆ This parameter is used for infinite rotation specification.
Refer the section 4.4 for details.

* The parameter requiring unit decision.
* It becomes valid by control power cycle after setting change.</td></tr>
<tr><td rowspan="4">16</td><td rowspan="2">Effective stroke length of absolute encoder
(-STROKE)
[A_ofs]</td><td>Standard value</td><td>-10000</td></tr>
<tr><td>Setting range</td><td>-2147483648 to 2147483647</td></tr>
<tr><td>Unit</td><td>UP (User Position Unit)</td></tr>
<tr><td colspan="3">■ Sets a valid stroke length from the origin set position, at absolute encoder.

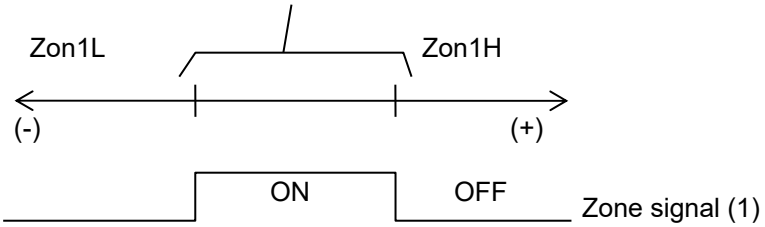
◆ Uses this parameter as effective stroke length at absolute encoder.
Set this value adding margin (±α) to mechanical effective stroke.
(If it exceeds this effective stroke length, normal positioning is impossible because it exceeds the region of absolute encoder.)
When the effective stroke of encoder is larger than a mechanism's stroke enough (twice or more), it can be used with A_ofs=0.
(It is preset automatically in the center position of encoder stroke at the time of A_ofs=0.)

◆ This parameter is used as -STROKE, for infinite rotation specification.
Sets a minimum value of coordinate towards minus axis.
Refer the section 4.4 for details.

* The parameter requiring unit decision.
* Must be performed origin set when this value is changed.
Position gap comes if performing control power cycle without origin set.
* It becomes valid by control power cycle after setting change.</td></tr>
</table>

3. Positioning function parameters

GroupA－

ID	Description		
17 18	Zone (1), negative end, positive end [Zon1L] , [Zon1H]	Standard value	0
		Setting range	-2147483648 to 2147483647
		Unit	UP (User Position Unit)/sec^2
	■ Sets the valid negative direction coordinates for the zone signal (1). ■ Sets the valid positive direction coordinates for the zone signal (1). ◆ Set the zone that outputs zone signal (1) with Zon1L and Zon1H. ◆ It shall be set as relation of Zon1L<Zon1H. ◆ It is not output if the time when it is within the zone is too short. (t≧40ms) ◆ In case incremental encoder use Zone signal is enabled after homing completion. ◆ In case absolute encoder in incremental system use Zone signal is enabled after homing completion. ◆ In case absolute encoder use Zone signal is enabled anytime. Zone signal output turns ON when current position comes into this zone.  * The parameter requiring unit decision. In case parallel interface use, it should be selected to a zone signal output at the output selection 1 to 3 (SEL1 to 3).		
19 1A 1B 1C 1D 1E 1F 20 21 22 23 24 25 26	Zone (2) to (8), negative end, positive end [Zon2L] to [Zon8L] [Zon2H] to [Zon8H]	Standard value	0
		Setting range	-2147483648 to 2147483647
		Unit	UP (User Position Unit)/sec^2
	■ Sets the valid negative direction coordinates for the zone signal (2). ■ Sets the valid positive direction coordinates for the zone signal (2). ■ Sets the valid negative direction coordinates for the zone signal (3). ■ Sets the valid positive direction coordinates for the zone signal (3). ■ Sets the valid negative direction coordinates for the zone signal (4). ■ Sets the valid positive direction coordinates for the zone signal (4). ■ Sets the valid negative direction coordinates for the zone signal (5). ■ Sets the valid positive direction coordinates for the zone signal (5). ■ Sets the valid negative direction coordinates for the zone signal (6). ■ Sets the valid positive direction coordinates for the zone signal (6). ■ Sets the valid negative direction coordinates for the zone signal (7). ■ Sets the valid positive direction coordinates for the zone signal (7). ■ Sets the valid negative direction coordinates for the zone signal (8). ■ Sets the valid positive direction coordinates for the zone signal (8). ◆ Refer the description of zone signal (1). * The parameter requiring unit decision. * In case parallel interface use, it should be selected to a zone signal output at the output selection 1 to 3 (SEL1 to 3).		

－GroupA－

ID	Description		
27	Manual high speed [H_jog]	Standard value	1670
		Setting range	1 to 2147483647
		Unit	UV (User Velocity Unit)
	■ Sets a velocity when it moves at high speed when rapid signal (RAP) is input with manual (JOG) operation or 1 step feeding operation. * The parameter requiring unit decision.		
28	Manual low speed [L_jog]	Standard value	80
		Setting range	1 to 2147483647
		Unit	UV (User Velocity Unit)
	■ Sets a velocity when rapid signal (RAP) is not input with manual (JOG) operation or 1 step feeding operation. * The parameter requiring unit decision.		
29	High speed 1step travel distance [H_stp]	Standard value	1000
		Setting range	1 to 2147483647
		Unit	UP (User Position Unit)/sec^2
	■ Sets a 1 step travel distance when it performs 1step feeding at high speed with rapid signal (RAP) is input. * The parameter requiring unit decision.		
2A	Low speed 1step travel distance [L_stp]	Standard value	100
		Setting range	1 to 2147483647
		Unit	UP (User Position Unit)/sec^2
	■ Sets a 1 step travel distance when rapid signal (RAP) is not input. * The parameter requiring unit decision.		

3. Positioning function parameters

－GroupA－

<table>
<tr><th>ID</th><th colspan="3">Description</th></tr>
<tr><td rowspan="4">2B</td><td rowspan="3">Override 0
[Ovride0]</td><td>Standard value</td><td>100</td></tr>
<tr><td>Setting range</td><td>1 to 255</td></tr>
<tr><td>Unit</td><td>%</td></tr>
<tr><td colspan="3">■ This setting ratio is multiplied by travel velocity by this override input.

◆ It operates at the velocity multiplied by this percentage with the set value as 100% to velocity set value of point data.
Example) If apply Ovride0=10% to the set velocity 10mm/s, execution speed will be 1mm/s.

◆ The time when override 0 is enabled is when “Homing, point movement” when OVRID input is OFF.
It is disabled for manual (JOG) operation.</td></tr>
<tr><td rowspan="4">2C</td><td rowspan="3">Override 1
[Ovride1]</td><td>Standard value</td><td>150</td></tr>
<tr><td>Setting range</td><td>1 to 255</td></tr>
<tr><td>Unit</td><td>%</td></tr>
<tr><td colspan="3">■ This setting ratio is multiplied by travel velocity by this override input.

◆ The time when override 1 is enabled is when “Homing, point movement” when OVRID input is OFF.
It is disabled for manual (JOG) operation.</td></tr>
<tr><td rowspan="4">2D
2E
2F
30
31
32
33
34
35
36
37
38
39
3A</td><td rowspan="3">Override 2 to 15
[Ovride2] to [Ovride15]</td><td>Standard value</td><td>100</td></tr>
<tr><td>Setting range</td><td>1 to 255</td></tr>
<tr><td>Unit</td><td>%</td></tr>
<tr><td colspan="3">■ This setting ratio is multiplied by travel velocity by this override input.

◆ In case interface type [F: MODBUS communication] use
It is selected by input values of OVRD 0 to 3.
◆ In case interface type [C: I/O] use
Set "01:type2" to Sw2_bit6.
Some point number specified input is allocated for override number specified input.
In this setting, usable point numbers are limited to 0 to 31.

<Input allocation>

<table>
<tr><th>Item</th><th>Sw2_bit6=00:type1</th><th>Sw2_bit6=01:type2</th></tr>
<tr><td>CN1-31</td><td>RAP/OVRID</td><td>RAP/OVRID(1)</td></tr>
<tr><td>CN1-47</td><td>IN(32): Point number</td><td>OVRID(2)</td></tr>
<tr><td>CN1-48</td><td>IN(64): Point number</td><td>OVRID(4)</td></tr>
<tr><td>CN1-49</td><td>IN(128): Point number</td><td>OVRID(8)</td></tr>
<tr><td>Effective point number</td><td>0 to 253</td><td>0 to 31</td></tr>
<tr><td>Effective override number</td><td>0, 1</td><td>0 to 15</td></tr>
</table>

Select override number specification in combinations of the above four inputs.
The total of “a” will be override number at input OVRID (a) that is ON. (”a”=1.2.4.8)
Only CN1-47”OVRID (2)” is ON in the above four inputs, for specify override 2.
CN1-47”OVRID (2)” and CN1-49 ”OVRID(8)” are ON and the other two inputs are OFF in the above four inputs, for specify override 10.</td></tr>
</table>

－GroupA－

<table>
<tr><th>ID</th><th colspan="3">Description</th></tr>
<tr><td rowspan="5">3B</td><td rowspan="3">System division number
[S_pls]</td><td>Standard value</td><td>8000</td></tr>
<tr><td>Setting range</td><td>1 to 131072</td></tr>
<tr><td>Unit</td><td>—</td></tr>
<tr><td colspan="3">■ Sets a division number per one turn of motor.

◆ In case incremental encoder use
Sets quadruple of the value in system parameter ID17.
Example: For 2000P/R, set 8000 to S_pls.
◆ In case absolute encoder use
Sets the value of system parameter ID15.
Example: For 131072_FMT, set 131072 to S_pls.

* Parameter to be basis for positioning unit.
* For a positioning function amplifier, select an encoder settable with system division number.
* It becomes valid by control power cycle after setting change.</td></tr>
<tr><td rowspan="4">3C</td><td rowspan="3">User division number
[U_pls]</td><td>Standard value</td><td>1000</td></tr>
<tr><td>Setting range</td><td>1 to 131072</td></tr>
<tr><td>Unit</td><td>—</td></tr>
<tr><td colspan="3">■ Sets a travel distance per one turn of motor seen from user.

◆ Sets this parameter by deciding input setting unit.
Refer to the section 4.3 for detail of unit decision.

* Parameter to be basis for positioning unit.
* Perform setting so as to be “S_pls>=U_pls”.
* It becomes valid by control power cycle after setting change.</td></tr>
<tr><td rowspan="5">3E</td><td rowspan="3">Decimal point of velocity/position data
[D_dpo]</td><td>Standard value</td><td>2</td></tr>
<tr><td>Setting range</td><td>0 to 5</td></tr>
<tr><td>Unit</td><td>—</td></tr>
<tr><td colspan="3">■ Sets a decimal point for velocity/position data setting.

<table>
<tr><th>Selection</th><th>Contents</th></tr>
<tr><td>0</td><td>No decimal point</td></tr>
<tr><td>1</td><td>One place of decimals</td></tr>
<tr><td>2</td><td>Two places of decimals</td></tr>
<tr><td>3</td><td>Three places of decimals</td></tr>
<tr><td>4</td><td>Four places of decimals</td></tr>
<tr><td>5</td><td>Five places of decimals</td></tr>
</table>
* Parameter to be basis for positioning unit.
* It becomes valid by control power cycle after setting change.</td></tr>
<tr><td rowspan="5">3F</td><td rowspan="3">Setting unit
[Unit]</td><td>Standard value</td><td>01: mm</td></tr>
<tr><td>Setting range</td><td>00 to 02</td></tr>
<tr><td>Unit</td><td>—</td></tr>
<tr><td colspan="3">■ Sets a setting unit.

<table>
<tr><th colspan="2">Selection</th><th>Contents</th></tr>
<tr><td>00</td><td>pls</td><td>Pulse</td></tr>
<tr><td>01</td><td>mm</td><td>mm</td></tr>
<tr><td>02</td><td>deg</td><td>deg</td></tr>
</table>
* Parameter to be basis for positioning unit.
* It becomes valid by control power cycle after setting change.</td></tr>
</table>

3. Positioning function parameters

－GroupA－

<table>
<tr><th>ID</th><th colspan="3">Description</th></tr>
<tr><td rowspan="5">50</td><td rowspan="4">Pushing depth at homing
[Z_Stp]</td><td>Standard value</td><td>100</td></tr>
<tr><td>Setting range</td><td>1 to 2147483647</td></tr>
<tr><td>Unit</td><td>Pulse</td></tr>
<tr><td colspan="3">■ Sets pulses after contact at homing with pushing operation.

◆ When motor stops and pushing operation is started, the operation will be judged completion if the difference between internal position command and motor actual position (pulse conversion) exceeds this value, and next operation will be started.</td></tr>
<tr><td rowspan="5">51</td><td rowspan="4">Pushing current limit value at homing
[Z_Tlim]</td><td>Standard value</td><td>0</td></tr>
<tr><td>Setting range</td><td>0 to 799</td></tr>
<tr><td>Unit</td><td>%</td></tr>
<tr><td colspan="3">■ Sets a pushing current limit value at homing.

* If zero is set, it is treated as no limitation and performs pushing with motor maximum torque.</td></tr>
<tr><td rowspan="5">52</td><td rowspan="4">Index tool count
[N_Tool]</td><td>Standard value</td><td>30</td></tr>
<tr><td>Setting range</td><td>0 to 120</td></tr>
<tr><td>Unit</td><td>—</td></tr>
<tr><td colspan="3">■ Sets an index tool count.</td></tr>
</table>

－GroupA－

<table>
<tr><th>ID</th><th colspan="4">Description</th></tr>
<tr><td rowspan="4">60</td><td colspan="2" rowspan="3">External data setting
[Sw1_bit0]</td><td>Standard value</td><td>00:type1</td></tr>
<tr><td>Setting range</td><td>00 to 01</td></tr>
<tr><td>Unit</td><td>—</td></tr>
<tr><td colspan="4">■ Selects allowed/not allowed of external data setting.

<table><tr><th colspan="2">Selection</th><th>Contents</th></tr><tr><td>00</td><td>type1</td><td>External data setting not allowed</td></tr><tr><td>01</td><td>type2</td><td>External data setting allowed</td></tr></table></td></tr>
<tr><td rowspan="4">61</td><td colspan="2" rowspan="3">Coordinate at external data set teaching
[Sw1_bit1]</td><td>Standard value</td><td>00:type1</td></tr>
<tr><td>Setting range</td><td>00 to 01</td></tr>
<tr><td>Unit</td><td>—</td></tr>
<tr><td colspan="4">■ Sets a coordinate at external data set teaching.

<table><tr><th colspan="2">Selection</th><th>Contents</th></tr><tr><td>00</td><td>type1</td><td>Ideal position coordinate</td></tr><tr><td>01</td><td>type2</td><td>Current position coordinate</td></tr></table></td></tr>
<tr><td rowspan="5">63</td><td colspan="2" rowspan="3">Coordinate switching
[Sw1_bit3]</td><td>Standard value</td><td>00:type1</td></tr>
<tr><td>Setting range</td><td>00 to 01</td></tr>
<tr><td>Unit</td><td>—</td></tr>
<tr><td colspan="4">■ Selects a coordinate.

<table><tr><th colspan="2">Selection</th><th>Contents</th></tr><tr><td>00</td><td>type1</td><td>Normal coordinate</td></tr><tr><td>01</td><td>type2</td><td>Infinite coordinate</td></tr></table>
* It becomes valid by control power cycle after setting change.</td></tr>
<tr><td rowspan="4">64</td><td colspan="2" rowspan="3">Shortcut function switching
[Sw1_bit4]</td><td>Standard value</td><td>00:type1</td></tr>
<tr><td>Setting range</td><td>00 to 01</td></tr>
<tr><td>Unit</td><td>—</td></tr>
<tr><td colspan="4">■ Selects a shortcut function.

<table><tr><th colspan="2">Selection</th><th>Contents</th></tr><tr><td>00</td><td>type1</td><td>Shortcut disabled</td></tr><tr><td>01</td><td>type2</td><td>Shortcut enabled</td></tr></table>
* It becomes valid by control power cycle after setting change.</td></tr>
<tr><td rowspan="4">65</td><td colspan="2" rowspan="3">Zone signal function extension
[Sw1_bit5]</td><td>Standard value</td><td>00:type1</td></tr>
<tr><td>Setting range</td><td>00 to 01</td></tr>
<tr><td>Unit</td><td>—</td></tr>
<tr><td colspan="4">■ Selects functions of zone signal.

<table><tr><th colspan="2">Selection</th><th>Contents</th></tr><tr><td>00</td><td>type1</td><td>Normal function</td></tr><tr><td>01</td><td>type2</td><td>Expands functions of zone signal.</td></tr></table></td></tr>
</table>

3. Positioning function parameters

－GroupA－

ID	Description		
66	Absolute encoder clear function External I/O mode [Sw1_bit6]	Standard value	00:Disabled
		Setting range	00 to 01
		Unit	—

■ Selects performing an absolute encoder clear function via external I/O mode or not.

◆ Selectable with interface type [C: I/O] only

Selection		Contents
00	Disabled	Invalid
01	Enabled	Valid

Usually, although absolute encoder clear is performed via SANMOTION MOTOR Setup software, absolute encoder clear can be also performed from CN1 input signal by the following method.

-The absolute encoder clear method-

- Sw2_bit4 =”0” setting (without absolute encoder homing)
- Sw1_bit6 =”1” setting
  (Absolute encoder clear function external I/O mode: Valid)
- ALM state

With the above-mentioned setup and a state, absolute encoder clear is performed by "turning on" of simultaneously CN1 incoming-signal SDN (19 pins) and ZRT (28 pins).

* SANMOTION MOTOR Setup software can substitute to this function with serial encoder clear function of test operation.

* However, if an absolute encoder clear is performed, multi-turn part of coordinates will also be cleared and a coordinate system will be unfixed.
Be sure to perform home position setting after execution of this function.

67	Deviation clear at pushing stop [Sw1_bit7]	Standard value	00:type1
		Setting range	00 to 01
		Unit	—

■ Selects how to clear a deviation at pushing stop.

Selection		Contents
00	type1	Clear a deviation
01	type2	Clear a deviation not

－GroupA－

ID	Description		
70	Hardware overtravel (-OT) [Sw2_bit0]	Standard value	01:type2
		Setting range	00 to 01
		Unit	—

■ Selects valid/invalid of Hardware overtravel (-OT).

◆ Selectable with interface type [C: I/O] only

Selection		Contents
00	type1	Externally valid.
01	type2	Internally forced ON. (Function invalid)

* For use of interface type [F: MODBUS communication], select with the function of Group9 ID01.

ID	Description		
71	Hardware overtravel (+OT) [Sw2_bit1]	Standard value	01:type2
		Setting range	00 to 01
		Unit	—

■ Selects valid/invalid of Hardware overtravel (+OT).

◆ Selectable with interface type [C: I/O] only

Selection		Contents
00	type1	Externally valid.
01	type2	Internally forced ON. (Function invalid)

* For use of interface type [F: MODBUS communication], select with the function of Group9 ID01.

ID	Description		
72	Hardware overtravel logic [Sw2_bit2]	Standard value	00:type1
		Setting range	00 to 01
		Unit	—

■ Selects a hardware overtravel logic.

◆ Selectable with interface type [C: I/O] only

Selection		Contents
00	type1	Normally Closed contact (external signal)
01	type2	Normally opened contact (external signal)

3. Positioning function parameters

－GroupA－

<table>
<tr><th>ID</th><th colspan="3">Description</th></tr>
<tr><td rowspan="2">73</td><td rowspan="3">Home position set input switching
[Sw2_bit3]</td><td>Standard value</td><td>00:type1</td></tr>
<tr><td>Setting range</td><td>00 to 01</td></tr>
<tr><td></td><td>Unit</td><td>—</td></tr>
<tr><td colspan="4">■ Selects how to input a home position set.

◆ Selectable with interface type [C: I/O] only

<table>
<tr><th colspan="2">Selection</th><th>Contents</th></tr>
<tr><td>00</td><td>type1</td><td>Home position setting execution by point movement of a point 254.
E_STR signal is used for external data.</td></tr>
<tr><td>01</td><td>type2</td><td>Home position setting is executed with "E_STR is ON" and "RUN turns from OFF to ON" (RUN startup)</td></tr>
</table>

* Usually, although home position setting is performed by point move specification of a point 254, by changing a setup, home position setting can be performed also by E_STR "ON" and RUN "OFF->ON" (RUN starting).
However, since E_STR is used as an external data setting function, only when Sw1: Bit0 is [0] (mode which does not use an external data setting function) and Sw2:Bit3 setup is [1], this change function becomes valid.
* To perform “origin setting” on the display of SANMOTION MOTOR Setup software, you need to perform the setting (SW2_Bit3 = “0”) to use point 254.
* For use of interface type [F: MODBUS communication], HOME signal is used.</td></tr>
<tr><td rowspan="2">74</td><td rowspan="3">Homing function of absolute encoder
[Sw2_bit4]</td><td>Standard value</td><td>00:type1</td></tr>
<tr><td>Setting range</td><td>00 to 01</td></tr>
<tr><td></td><td>Unit</td><td>—</td></tr>
<tr><td colspan="4">■ Selects a homing function of absolute encoder.

<table>
<tr><th colspan="2">Selection</th><th>Contents</th></tr>
<tr><td>00</td><td>type1</td><td>Invalid</td></tr>
<tr><td>01</td><td>type2</td><td>Valid</td></tr>
</table>

◆ In case absolute encoder in incremental system use
In this case, homing becomes available selecting 01:type2.
Although the Homing type 0 and type 1 can be performed similarly, type 0 comes to stop at "0" in one revolution of absolute coordinates because there is no C-phase signal like incremental encoder.

* The parameter which becomes valid: Z_typ, Z_dir, Z_hsp, Z_lsp, Z_ofs
* The parameter which becomes invalid: A_ofs</td></tr>
</table>

－GroupA－

ID	Description		
75	External error detection [Sw2_bit5]	Standard value	01:type2
		Setting range	00 to 01
		Unit	—

■ Selects a detection of external error.

◆ Selectable with interface type [C: I/O] only

Selection		Contents
00	type1	Externally valid.
01	type2	Internally forced ON. (Function invalid)

* For use of interface type [F: MODBUS communication], select with the function of Group9 ID40.

ID	Description		
76	Override selection [Sw2_bit6]	Standard value	00:type1
		Setting range	00 to 01
		Unit	—

■ Selects an input for the override.

◆ Selectable with interface type [C: I/O] only

Selection		Contents
00	type1	Input selection (choice: 2)
01	type2	Input selection (choice: 16)

* For use of interface type [F: MODBUS communication], choice is fixed to 16. Select with OVRD_0 to OVRD_3.

ID	Description		
77	SDN signal switching [Sw2_bit7]	Standard value	00:type1
		Setting range	00 to 01
		Unit	—

■ Selects an input logic of SDN signal.

◆ Selectable with interface type [C: I/O] only

Selection		Contents
00	type1	Normally Closed contact (external signal)
01	type2	Normally Opened contact (external signal)

* For use of interface type [F: MODBUS communication], select with the function of Group9 ID42.

ID	Description		
79	Fixed position stop JOG function [Sw2_bit9]	Standard value	00:Disabled
		Setting range	00 to 01
		Unit	—

■ Selects valid/invalid of Fixed position stop JOG function.

Selection		Contents
00	Disabled	Invalid
01	Enabled	Valid

3. Positioning function parameters

－GroupA－

ID	Description		
80	Function switch 3 (Reserved) [Sw3]	Standard value	0000
		Setting range	0000 to FFFF
		Unit	—
	■ Sets a Function switch 3. ◆ Reserved area. Set 0000.		
81	Function switch 4 (Reserved) [Sw4]	Standard value	0000
		Setting range	0000 to FFFF
		Unit	—
	■ Sets a Function switch 4. ◆ Reserved area. Set 0000.		

4

Positioning function

In this chapter, positioning function is explained.

4.1 Point data description 4-1
4.2 Operations by external input 4-16
4.3 Basic parameters for positioning 4-26
4.4 Infinite motor rotation specification 4-33
4.5 Fixed position stop JOG function 4-36
4.6 Error sequence and software limit sequence 4-39

4. Positioning function

4.1 Point data description

Each role/function of point data is explained below.

Point number	Velocity	Position	Move mode								Acceleration data	S-shape accel/decel time	Torque limit	M output delay	M output type	M output code	IP	Dwell time	Jump destination point	Repetition count
			Mode 1	Mode 2	Mode 3	ABS / INC	Pushing	V-change: stop/continuous	Servo gain switching	Loop mode selection										
	*	*									*	ms	%		*			ms		
0	100.0	0.0	1	0	0	0	0	0	0	0	250	10	350	0.0	0	0	0	0	0	0
1	214748364.7	-214748364.7	0	0	0	0	1	0	0	0	65535	32767	510	214748364.7	2	15	1	32767	0	0
to																				
253	10.0	50.0	1	0	0	1	0	0	0	0	200	0	150	0.0	0	0	253	100	0	0

* SANMOTION MOTOR Setup software is used for a setup of point data.
* Refer to another document M0010842 for detail of SANMOTION MOTOR Setup software.
* Explanation of Point Data tables described later may omit the columns of “Servo gain switching” and “Loop mode selection”.

■ Point number
- Specify this point number to perform settings and operations. Setting range is 0 to 253.
- For external operation, specify with binary code, using 8 bits external input.

■ Velocity (UV)
- Setting range: 0 to 2147483647 ･･･(Without decimal points)
  0.0 to 214748364.7 ･･･(With one place for decimals)
- Set this below motor maximum rotation speed.

■ Position data (UP)
- Setting range: -2147483648 to +2147483647 ･･･(Without decimal points)
  -214748364.8 to +214748364.7 ･･･(With one place for decimals)
  However, this must be within effective stroke.
- Whether this data is treated as an incremental amount (incremental command) or as a coordinate (absolute command) is determined by operation patterns.

■ Acceleration (UV/ ms)
- Acceleration and deceleration are the same. Setting range is 0 to 65535.

■ S-shaped accel/decel time (ms)
- Acceleration and deceleration are the same. Setting range is 0 to 32767.

■ Current limit value (%)
- Setting range: 0 to 799 (%)･･･At every 1 (%)
- To set this to “0” does not mean 0 (%) but without a current limit. (For rotation type motors, current limit is treated the same as torque limit.)
  In other words, operation is possible up until motor peak torque.
  Set this to “0” for usual positioning.
- In general, set this current limit only when pushing stop operation is performed.
  Setting this current limit will cause overflow or unfinish operations.
  Larger current than the maximum current determined by motors will be limited by instantaneous maximum current inside amplifier.

■ Move mode

● Move mode is set with items below.

Mode 1	00: Point data is not set 10: Reserved	01: Positioning operation effective 11: Reserved
Mode 2	00: Last move 10: Reserved	01: Continuous move 11: Reserved
Mode 3	Set zero.	
ABS/ INC	0: Position data is treated as absolute command. 1: Position data is treated as incremental command.	
Pushing: Without/With	0: Normal move (Without pushing) 1: Move with “pushing stop“	
Velocity change: Stop/Continuous	0: Stop and change speed operation (This is called the operation pattern 0.) 1: Continuous speed change operation (This is called the operation pattern 1.)	

a) Mode 1
Whether the point data is valid or invalid (not set) is set at “Mode 1”.
When ”Mode 1” is “01”, data is valid and execution is possible.
When “Mode 1” is “00”, “10” and “11”, data is invalid and operation becomes unfixed.

< Combination examples of operation patterns >

Data valid	Continuous or not	Command position data	With pushing or not	Operation pattern
Mode 1	Mode 2	ABS/ INC	Pushing	Velocity change
Valid “01”	Complete “00” Continue “01”	Absolute command ”0”	Normal move (Without pushing) ”0”	Stop and change velocity "0"
		Incremental command ”1”		Stop and change velocity "0"
		Absolute command ”0”		Continuous velocity change "1"
		Incremental command ”1”		Continuous velocity change "1"
		Absolute command ”0”	Move with pushing “1”	Stop and change velocity "0"
		Incremental command ”1”		Stop and change velocity "0"
		Absolute command ”0”		Continuous velocity change "1"
		Incremental command ”1”		Continuous velocity change "1"

* Make sure to set a move point of “Mode 2” with a completion code “00” at the end of move pattern.

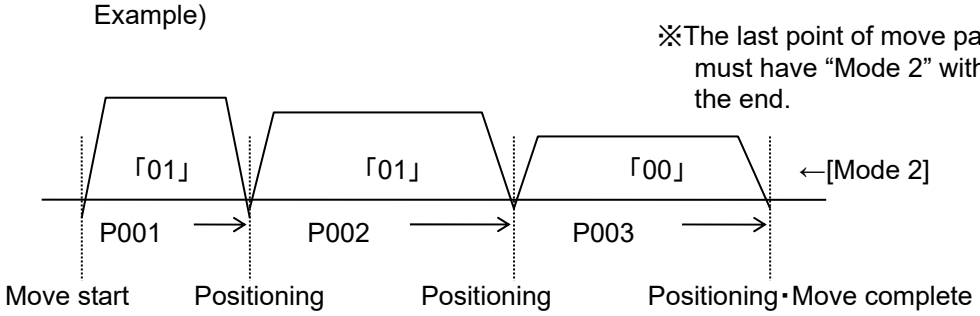
b) Mode 2 and f) Velocity change (operation)

Operation pattern is according to "Mode 2" (With/Without of continuous point execution). When “Mode 2” is “00”, the move is complete.
When “Mode 2” is “01”, the move continues.
When “Mode 2”is “10” and “11”, there will be “error 18” at execution.

0: Stop and change velocity

After moving by a certain point, decelerates and stops, and makes positioning to the next point.
When “Mode 2”is “01”, the move continues, and when “Mode 2” is “00”, the move is complete at the point.

Example)

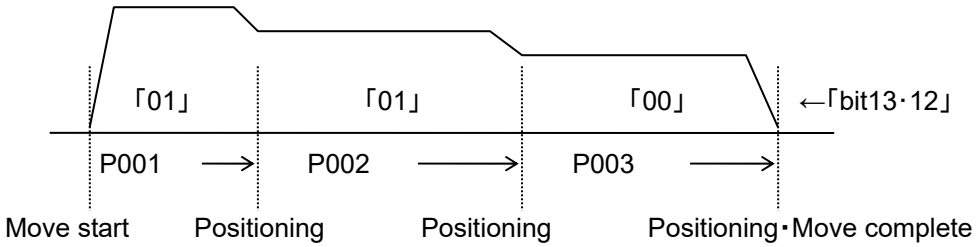


Move starts at P001, then to P001 -> P002 -> P003 (temporarily stops at each point). Since “Mode 2” at P003 is “00”, positioning and move is complete here.
Thus, when “Mode 2” is set to “01” in the point setting, the move continues to the next point (the point with 1 added to the currently moving point) up until “00” of “Mode 2” appears.

1: Continuous velocity change operation

Set at a certain point, the move does not stop at the next point, but accelerates or decelerates according to the set speed and then moves. When “Mode 2” is “01”, the move continues and when “Mode 2” is “00”, the move is complete at the point. It is the same as "stop and change velocity operation".

Example)



Move starts at P001, and then to P001 -> P002 -> P003 with continuous velocity change, and the move is complete at P003.
The point where the speed change is complete point where is a set position as the moving point.

<Notes for continuous velocity change operation>
Continuous velocity change does not occur in the following cases:

① The direction of move changes in the position data setting.(e.g. Positive -> Negative)
② Continuous velocity change point is more than 8.
③ Point operation to be executed is stop and change velocity operation.
④ The next point operation is stop and change velocity operation.
⑤ "Mode 2" includes “00” (feeding complete).
⑥ Pushing stop operation is being set.
⑦ Dwell time is being set (to other than 0).

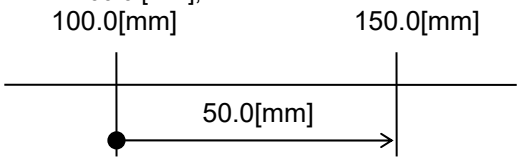
On the other hand, the following functions are restricted when continuous velocity change is used:

⑧ S-shaped accel/decel; At all the point numbers where continuous velocity change is set, the move is a straight accel/decel even if parameters for S-shaped accel/decel are set.
⑨ Handshaking of M output; At the point where continuous speed change is orerated, M output handshaking is not executed even if it is set.
However, in the cases from ① to ⑦ shown above where continuous velocity change does not actually occur in spite of the setting, M output handshaking is executed.
Customers are requested, generally, not to set M output handshaking under continuous velocty change operation configuration.

c) Mode 3
Set "0", as this is a reserved zone.

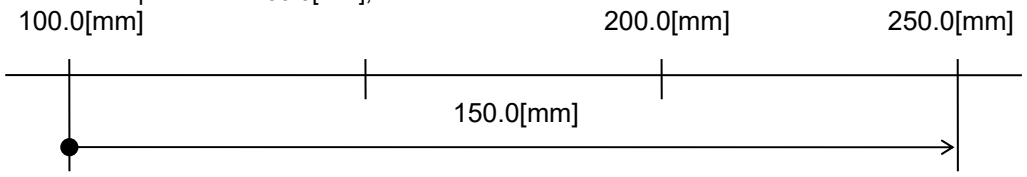
d) ABS/ INC
This determines as what kind of command the value set by position data will be treated.
0: Absolute command: Position data is treated as absolute coordinate system (user coordinate system).

Example) When positioning by absolute command at the position data of 50.0 [mm], assuming that the current position is 100.0 [mm];



Thus, moves forward by 50.0[mm] and gets positioned at 150.0[mm].
Therefore, the move amount varies depending on the current position.

1: Incremental command: Position data is treated as amount of feeding (user coordinate system).
Example) When positioning by incremental command at the position data of 150.0[mm], assuming that the current position is 100.0[mm];



Thus, moves positive by 150.0[mm] and gets positioned at 250.0[mm].
Therefore, the position varies depending on the current position.

e) Pushing: Without/With

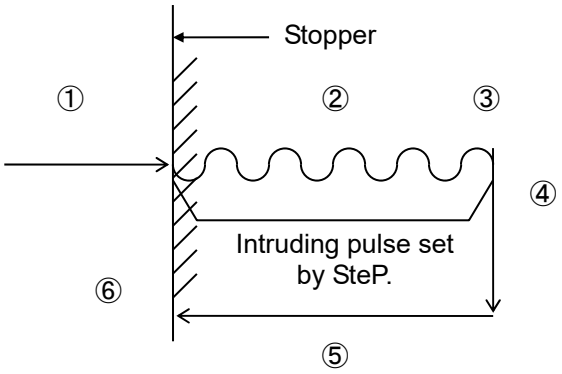
Sets with / without pushing stop in the point move.

0: Normal move (without pushing) setting

1: Pushing stop setting

- About pushing stop

  When pushing stop is set, see the actual operation of pushing stop as follows:



① Positioning move toward the stopper

② Reaches to a stopper, the current position value stops, the ideal value keeps moving, and deviation accumulates.

③ Stops moving at the condition of intruding pulse(deviation) ≧ Stp_P (parameter).
(Even if not reaching positioning point.)

④ During dwell time, pushing operation with intruding pulse (deviation).

⑤ After dwell time, intruded pulse is cleared.

⑥ Positioning complete or next move.

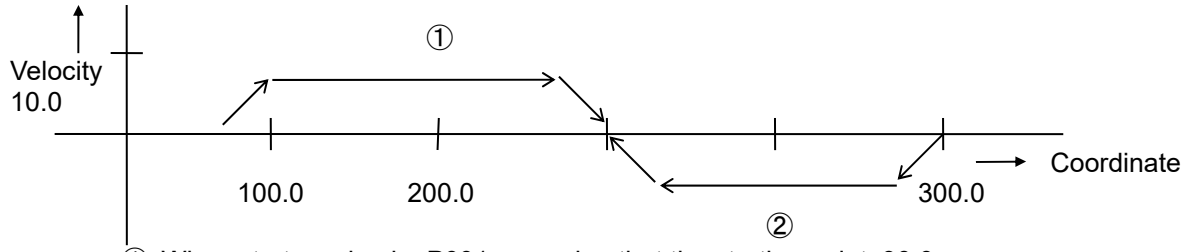
- Notes -

- When pushing stop is used, set the current limit (torque limit) as well as this setting. Pushing operation without current limit may cause overloading.
- In the normal positioning, make sure to set "the current limit = 0".
- When Stp_P (parameter) is small, or when deviation is large during move due to high speed/acceleration (deviation≧Stp_P), pushing stop may occur accidentally during move. Make sure to keep the speed low.

- Move example1 (Action)

a) Absolute command single move

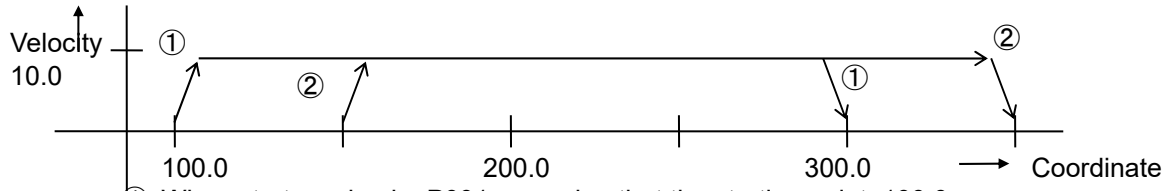
Point number	Velocity	Position	Move mode								Acceleration data	S-shape accel/decel time	Torque limit	M output delay	M output type	M output code	IP	Dwell time	Jump destination point	Repetition count
			Mode 1	Mode 2	Mode 3	ABS / INC	Pushing	V-change: stop/continuous	Servo gain switching	Loop mode selection										
	*	*									*	ms	%		*			ms		
1	10.0	200.0	1	0	0	0	0	0	0	0	250	0	0	0.0	0	0	0	0	0	0



① When start moving by P001 assuming that the strating point: 90.0
② When start moving by P001 assuming that the starting point: 300.0

b) Incremental command single move

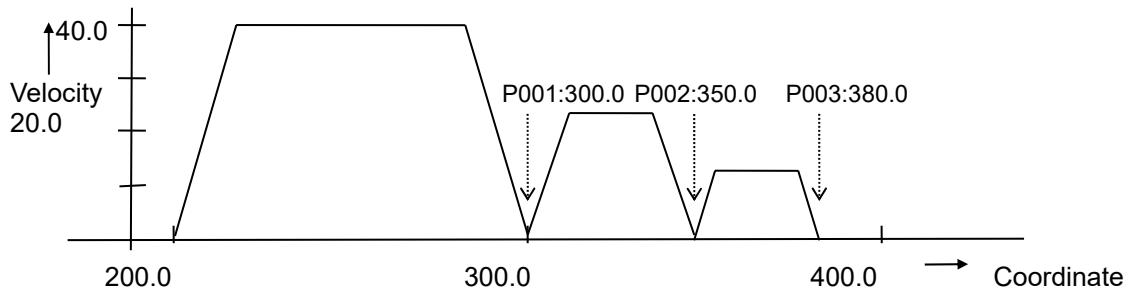
Point number	Velocity	Position	Move mode								Acceleration data	S-shape accel/decel time	Torque limit	M output delay	M output type	M output code	IP	Dwell time	Jump destination poi	Repetition count
			Mode 1	Mode 2	Mode 3	ABS / INC	Pushing	V-change: stop/continuous	Servo gain switching	Loop mode selection										
	*	*									*	ms	%		*			ms		
1	10.0	200.0	1	0	0	1	0	0	0	0	250	0	0	0.0	0	0	0	0	0	0



① When start moving by P001 assuming that the starting point: 100.0
② When start moving by P001 assuming that the starting point: 150.0

c) Incremental command stop-and-change-velocity

Point number	Velocity	Position	Move mode								Acceleration data	S-shape accel/decel time	Torque limit	M output delay	M output type	M output code	IP	Dwell time	Jump destination point	Repetition count
			Mode 1	Mode 2	Mode 3	ABS / INC	Pushing	V-change: stop/continuous	Servo gain switching	Loop mode selection										
	*	*									*	ms	%		*			ms		
1	40.0	100.0	1	1	0	1	0	0	0	0	250	0	0	0.0	0	0	0	0	0	0
2	20.0	50.0	1	1	0	1	0	0	0	0	250	0	0	0.0	0	0	0	0	0	0
3	10.0	30.0	1	0	0	1	0	0	0	0	250	0	0	0.0	0	0	0	0	0	0

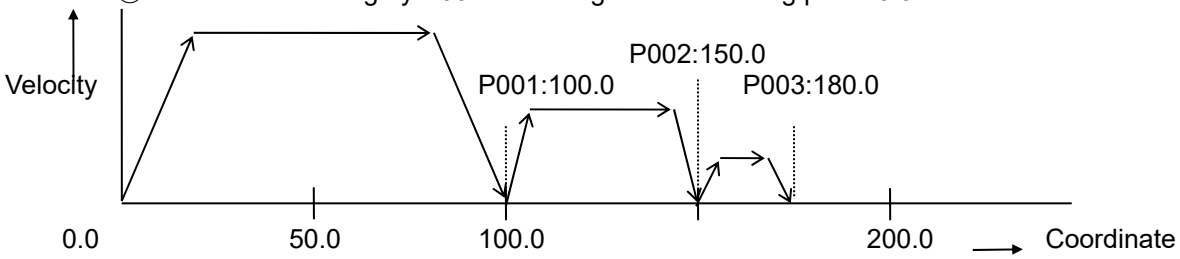


① When start moving by P001 assuming that the starting point: 200.0
* Even if the starting point is changed, move distance does not change.

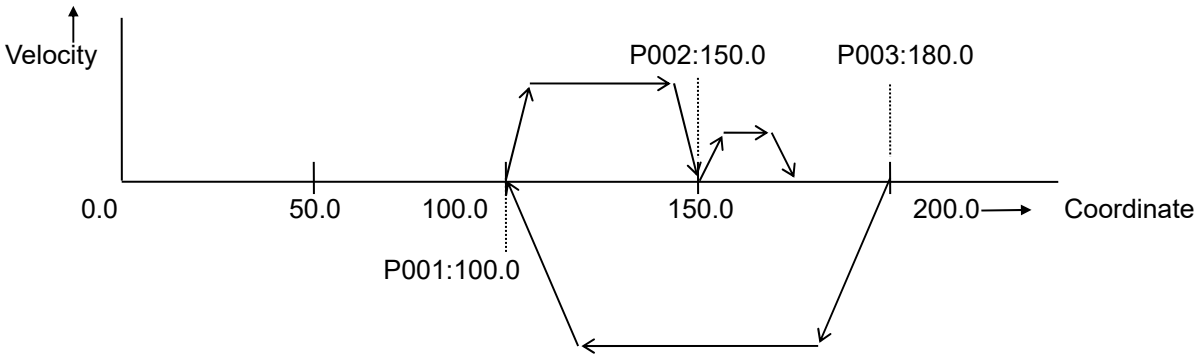
d) Absolute command stop-and-change-velocity

Point number	Velocity	Position	Move mode								Acceleration data	S-shape accel/decel time	Torque limit	M output delay	M output type	M output code	IP	Dwell time	Jump destination point	Repetition count
			Mode 1	Mode 2	Mode 3	ABS / INC	Pushing	V-change: stop/continuous	Servo gain switching	Loop mode selection										
	*	*									*	ms	%		*			ms		
1	40.0	100.0	1	1	0	0	0	0	0	0	250	0	0	0.0	0	0	0	0	0	0
2	20.0	150.0	1	1	0	0	0	0	0	0	250	0	0	0.0	0	0	0	0	0	0
3	10.0	180.0	1	0	0	0	0	0	0	0	250	0	0	0.0	0	0	0	0	0	0

① When start moving by P001 assuming that the starting point: 0.0

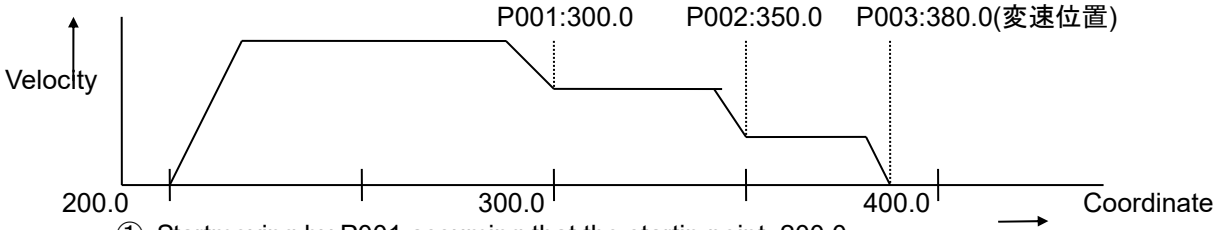


② With the same setting, moves P002 -> P003 reversely after moving by P001 assuming that the starting point: 200



e) Incremental command continuous velocity change

Point number	Velocity	Position	Move mode								Acceleration data	S-shape accel/decel time	Torque limit	M output delay	M output type	M output code	IP	Dwell time	Jump destination point	Repetition count
			Mode 1	Mode 2	Mode 3	ABS / INC	Pushing	V-change: stop/continuous	Servo gain switching	Loop mode selection										
	*	*									*	ms	%		*			ms		
1	40.0	100.0	1	1	0	1	0	1	0	0	250	0	0	0.0	0	0	0	0	0	0
2	20.0	50.0	1	1	0	1	0	1	0	0	250	0	0	0.0	0	0	0	0	0	0
3	10.0	30.0	1	0	0	1	0	1	0	0	250	0	0	0.0	0	0	0	0	0	0

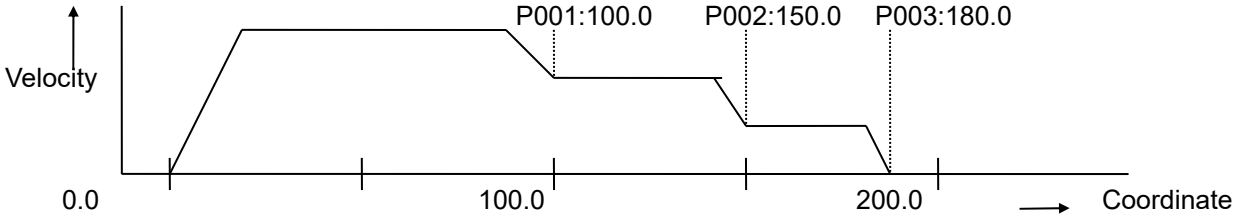


① Startmoving by P001 assuming that the startin point: 200.0
Speed change point of P001 and P002 is a registered position, however, it changes a little due to CPU sampling delay, motor speed or acceleration/deceleration setting.
When accuracy for velocity change point is desired, use a stop-and-change-velocity operation.

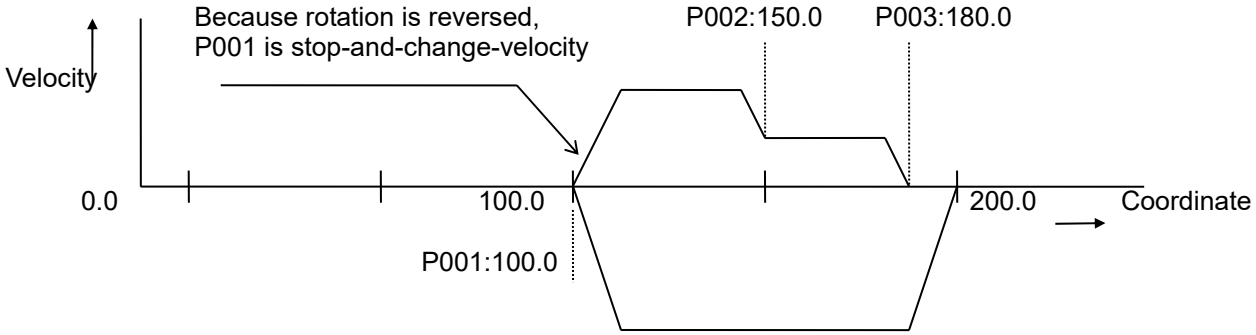
f) Absolute command continuous velocity change

Point number	Velocity	Position	Move mode								Acceleration data	S-shape accel/decel time	Torque limit	M output delay	M output type	M output code	IP	Dwell time	Jump destination point	Repetition count
			Mode 1	Mode 2	Mode 3	ABS / INC	Pushing	V-change: stop/continuous	Servo gain switching	Loop mode selection										
	*	*									*	ms	%		*			ms		
1	40.0	100.0	1	1	0	0	0	1	0	0	250	0	0	0.0	0	0	0	0	0	0
2	20.0	150.0	1	1	0	0	0	1	0	0	250	0	0	0.0	0	0	0	0	0	0
3	10.0	180.0	1	0	0	0	0	1	0	0	250	0	0	0.0	0	0	0	0	0	0

① Start moving by P001 assuming that the starting point: 0.0



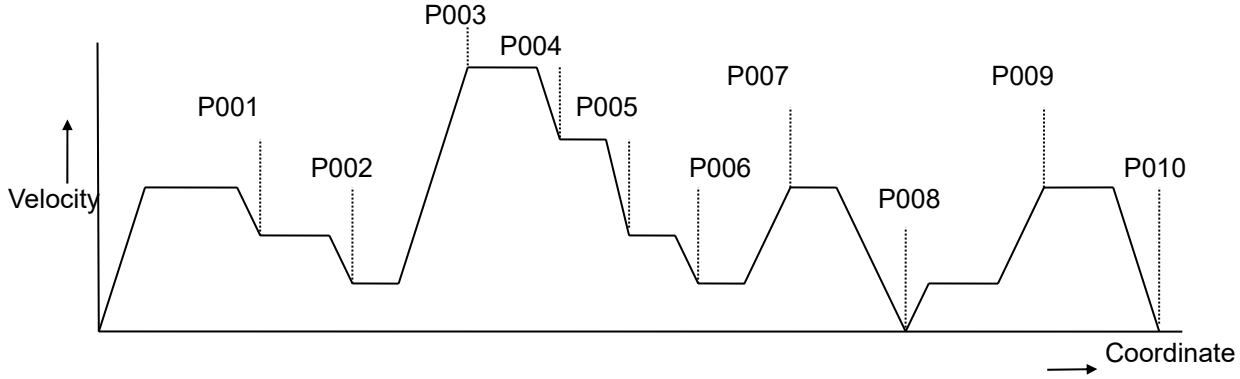
② Startmoving by P001 assuming that the starting point: 200.0
Stop-and-change-velocity operation up to P001: 100.0, continuous speed change P002 -> P003.



g) Continuous velocity change for more than 8 points

① When operation is "continuous speed change" at P001 to P010

* Continuous velocity change for P001 to P007, stop-and-change-speed for P008, and again continuous velocity change for P009 -> P010.



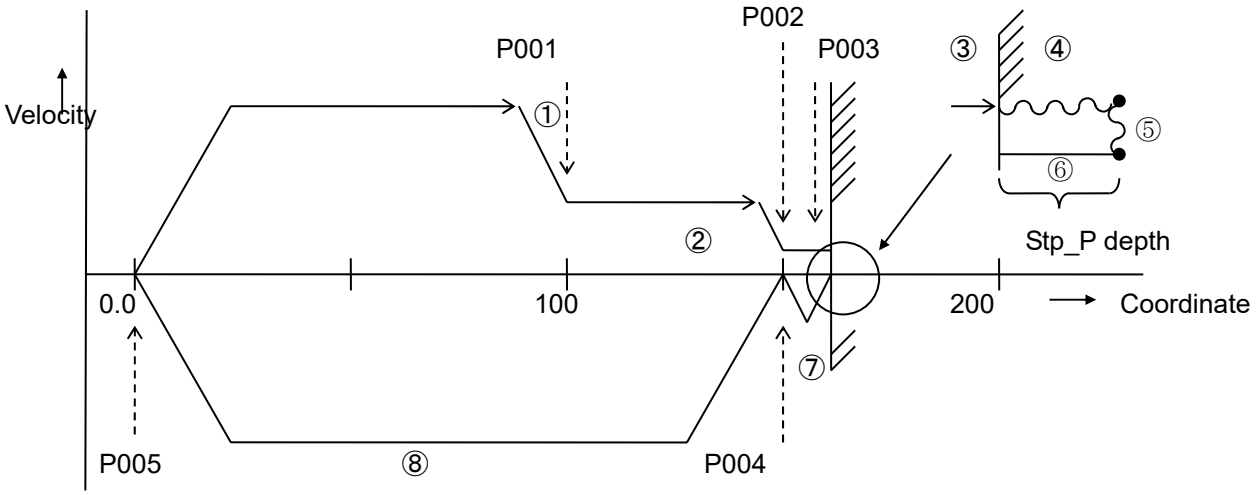
■ Starting point "Ip" at interruption start
When an interruption start is input during move, the point set here will be started as an interruption start.
In other words, when an interruption start is input, the move being executed is aborted and start moving by the point number "Ip" which is set at the point data.
However, during interruption start, another interruption start cannot be input.

■ Dwell time (msec)
Dwell time function is that when the move is complete and current position is in-position, wait for the time set here and then perform positioning complete or the next move.

- ◆ For example, in the case of 1 point move:
  After the point move is complete, wait for dwell time, and positioning complete is output.
  And in the middle of continous move, wait for the dwell time and then to the next move.
- ◆ As a special treatment, when "Pushing stop" is performed with the dwell time being set, pushing control is performed for the intruded pulse of the dwell time, and after that deviation is cleared.
- ◆ If the dwell time other than 0 is set in the continuous speed change mode, the point is for stop-and-change-velocity, not for continuous velocity change.

■ Move example 2 (Pushing·Interruption Move)
he moves below are applications of pushing stop and interruption move.

Point number	Velocity	Position	Move mode								Acceleration data	S-shape accel/decel time	Torque limit	M output delay	M output type	M output code	IP	Dwell time	Jump destination point	Repetition count
			Mode 1	Mode 2	Mode 3	ABS / INC	Pushing	V-change: stop/continuous	Servo gain switching	Loop mode selection										
	*	*									*	ms	%		*			ms		
1	40.0	100.0	1	1	0	0	0	1	0	0	250	0	0	0.0	0	0	11	0	0	0
2	20.0	150.0	1	1	0	0	0	1	0	0	250	0	0	0.0	0	0	11	0	0	0
3	5.0	180.0	1	1	0	0	1	1	0	0	250	0	40	0.0	0	0	10	10000	0	0
4	5.0	-5.0	1	1	0	1	0	0	0	0	250	0	40	0.0	0	0	10	0	0	0
5	40.0	0.0	1	0	0	0	0	0	0	0	250	0	0	0.0	0	0	11	0	0	0
~																				
10	5.0	-5.0	1	1	0	1	0	0	0	0	250	0	40	0.0	0	0	0	0	0	0
11	40.0	0.0	1	0	0	0	0	0	0	0	250	0	0	0.0	0	0	0	0	0	0



① From Starting position: 0.0, start by P001 and change velocity, then to P002.
② Move by P002, change velocity, then to P003.
③ During move by P003, reach the stopper and the current position value is stopped (with 40% current limt hereafter).
④ With the command value being output as is, idial position is allowed to enter and deviation pulse of Stp_P (intrudeded pulse) accumulates, then the move is cancelled.
⑤ During the dwell time (10.0 ms), pushing operation for the intruded pulse.
⑥ After the dwell time, deviation pulse is cleared.
⑦ Go back just "5.0" by P004 with an incremental command. (With 40% current limit so far.)
⑧ Return to the starting position by P005 high speed move.
This is the end of a series of operations. However, you can return to the starting position during move by interruption start.

* When an interruption is started during move by P001, P002 and P005, return to the origin with high speed by P011. When an interruption is started during move by P003 andP004, continuous move is performed from P010 -> P011, with current limit first and then return with high speed.
Even if motor rotating direction when interruption starts up and the target position of the interruption are the same, moving to target position starts after once the motor stops.

4. Positioning function

■ M-output

a) Code

b) Type

c) Delay

Functions of M output are determined by the 3 parameters above. See the descriptions of each parameter below.

a) Code

Sets the data for M output. M output is 4 bits from "00 to 15".

b) Type

Sets the function of M output as follows:

0: Without M output operations. No change from the previous M output.

1: When the move is complete with handshaking mode, MSTR signal is output and wait until MFIN signal is input. When MFIN signal is input, the next move is performed.

2: Only M output, without handshaking.

c) Delay

Sets the timing for outputting in M output as follows:

0: M output along with the start of the point move.

-1: M output when the point move is complete.

Positive value: M output after the move value set here (incremental value).
However, if this is larger than the value of point move, M output after the move is complete.

* Notes

a) M output must be selected at general output selection.
(SEL1 and SEL2 are ON, and SEL3 is OFF.)

b) When M output type is "1", M output is output at the M output timing. However, M output becomes “0” once after handshaking is complete.

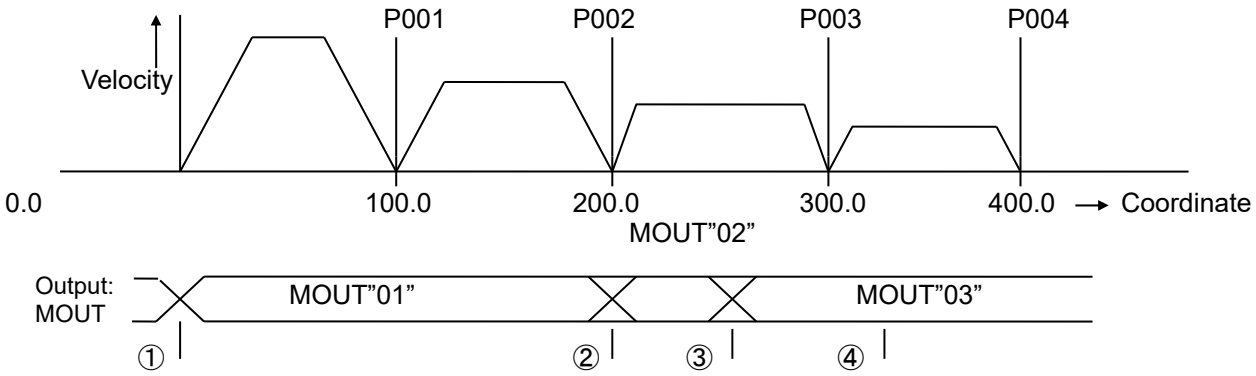
c) When operation pattern is continuous velocity change, do not use M output type "1", Handshaking type.

d) M output is not output at the final point move.
When the move is complete with 1-point move, there is no M output. Therefore, set a dummy point (the same position) for output setting.

■ Move example 3 (M output function)

a) In the case of M output type -> "2"

Point number	Velocity	Position	Move mode								Acceleration data	S-shape accel/decel time	Torque limit	M output delay	M output type	M output code	IP	Dwell time	Jump destination point	Repetition count
			Mode 1	Mode 2	Mode 3	ABS / INC	Pushing	V-change: stop/continuous	Servo gain switching	Loop mode selection										
	*	*									*	ms	%		*			ms		
1	40.0	100.0	1	1	0	0	0	0	0	0	250	0	0	0.0	2	1	0	0	0	0
2	30.0	200.0	1	1	0	0	0	0	0	0	250	0	0	-0.1	2	2	0	0	0	0
3	20.0	300.0	1	1	0	0	0	0	0	0	250	0	0	50.0	2	3	0	0	0	0
4	10.0	400.0	1	0	0	0	0	0	0	0	250	0	0	0.0	0	0	0	0	0	0

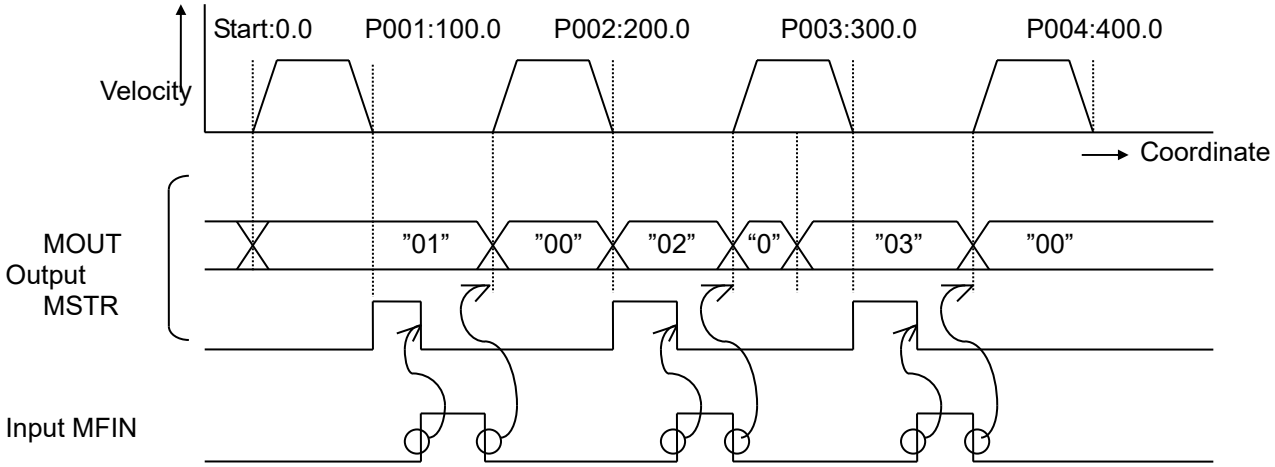


① Since M output timing for P001 is “0”, M output along with start.
② Since M output timing for P002 is “-0.1 (negative value)”, M output along with positioning complete.
③ Since M output timing for P003 is “50.0”, M output in "50" incremental feeding after move by P003.
④ When M output type is “0”, no change in M output.

4. Positioning function

b) In the case of M outputType -> "1"

Point number	Velocity	Position	Move mode								Acceleration data	S-shape accel/decel time	Torque limit	M output delay	M output type	M output code	IP	Dwell time	Jump destination point	Repetition count
			Mode 1	Mode 2	Mode 3	ABS / INC	Pushing	V-change: stop/continuous	Servo gain switching	Loop mode selection										
	*	*									*	ms	%		*			ms		
1	20.0	100.0	1	1	0	0	0	0	0	0	250	0	0	0.0	1	1	0	0	0	0
2	20.0	200.0	1	1	0	0	0	0	0	0	250	0	0	-0.1	1	2	0	0	0	0
3	20.0	300.0	1	1	0	0	0	0	0	0	250	0	0	50.0	1	3	0	0	0	0
4	20.0	400.0	1	0	0	0	0	0	0	0	250	0	0	0.0	0	0	0	0	0	0



In the case of M output type: "1", handshaking is performed using input/output of MSTR and MFIN.
For example, in case of P001, M output timing is “0”, therefore, M output is output along with the start.
When the move by P001 is complete, MSTR outputs ON and waits.
When input MFIN turns “OFF -> ON”, M output outputs“00”and enters the next move, and then M output is executeed according to the next move setting.

■ Servo gain selection
By setting up servo gain selection of point data, four kinds of gains can be changed for every point.

The setting list of gains is as follows.

Servo gain selection	Position loop proportional gain	Position loop integral time constant	Velocity loop proportional gain	Velocity loop integral time constant	Load inertia ratio	Torque command filter
0	The various functional effective conditions of the usual function become effective.					
1	KP1	TPI1	KVP1	TVI1	JRAT1	TCFIL1
2	KP2	TPI2	KVP2	TVI2	JRAT2	TCFIL2
3	KP3	TPI3	KVP3	TVI3	JRAT3	TCFIL3
4	KP4	TPI4	KVP4	TVI4	JRAT4	TCFIL4

* Movement is performed by the above-mentioned servo gain setup according to setting up servo gain selection with point data. However, it is continuously used by servo gain selection of the first point performed, at the time of continuation movement in variable speed.

* Servo gain selection cannot be used together with auto tuning. Priority is given to auto tuning when auto tuning is effective.

■ A jump / loop function of a point

(1) Overview

A jump/loop of a point are possible by setting each up by the following point-data setup.
(A) Loop mode select: The kind of a jump/loop
(B) JP: The point number of a jump place
(C) Repeat times: The number of times which does a loop

(A) (B) (C)

Number	Velocity	Position	Moving mode								Acceleration data	S-curve acceleration / deceleration time	Torque limit	M output delay	M output type	M output code	Interrupt start point	dwell time	jump point	repeat number
			Travel mode1	Travel mode2	Travel mode3	Travel mode ABS/INC	Travel mode with uft/without butt	Travel mode shift: stop / continuou	Servo gain select	Loop mode selection										
	Pulse/s	Pulse										ms	%	Pulse				ms		
0	40960	8192	1	0	0	0	0	0	0	1	4096	0	0	0	0	0	0	0	253	0
1	100	0	0	0	0	0	0	0	0	0	100	0	0	0	0	0	0	0	0	0
2	409600	1000	1	1	0	1	0	0	0	0	4096	0	0	0	0	0	0	0	0	0
3	40960	100	1	0	0	1	0	0	0	2	4096	0	0	0	0	0	0	0	0	100
4	100	0	0	0	0	0	0	0	0	0	100	0	0	0	0	0	0	0	0	0
5	100	0	0	0	0	0	0	0	0	0	100	0	0	0	0	0	0	0	0	0
6	409600	0	1	1	0	0	0	0	0	0	4096	0	0	0	0	0	0	0	0	0
7	409600	-100	1	1	0	1	0	0	0	0	4096	0	0	0	0	0	0	0	0	0
8	409600	110	1	1	0	1	0	0	0	3	4096	0	0	0	0	0	0	0	7	3
9	409600	1000	1	0	0	1	0	0	0	3	4096	0	0	0	0	0	0	0	7	3
10	400000	0	1	1	0	0	0	0	0	0	100	0	0	-1	1	8	0	0	0	0

(2) Data setting guideline of a jump / loop function

(A) Kinds of loop (loop mode select)

(a) Normal mode (Setting value: 0)
No jump. No loop.

(b) Unconditional jump (Setting value: 1)
Unconditional jump is done to other points. Only FEED_END (Mode 2:00) of move mode is effective, it does not jump when other.

(c) 1 point jump (Setting value: 2)
This point is repeatedly performed by the number of times of repetition.
Only stop operation (operation pattern: 0) of move mode in variable speed is effective, it does not perform except it.

(d) Condition jump (Setting value: 3)
Only the number of times of specification is jumped on other points. Only stop operation (operation pattern: 0) in variable speed is effective, and move mode does not jump it other than it.

The nest to a maximum of 15 is possible for a condition jump. However, when other jumps are in a loop, it becomes to a maximum of 15 including that jump.
When the jump place which does not become a nest in a condition jump is specified: It is set to ERR 1A.
Moreover, when the number of nested (other jumps are included) is 15 or more: It is set to ERR19.

(B) JP
The point number of a jump place is set up.

(C) Repeat times
The number of times of a repeat in 1 point jump and conditional jump is specified.

Relation of each data of point data

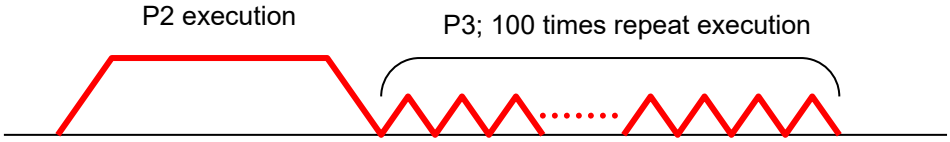
	Loop mode selection	JP	Repetition	Operation conditions
Normal mode	0	-	-	—
Unconditional jump	1	○	-	Mode2: 0 (When the last moving)
1 point jump	2	-	○	Speed change: 0 (When changing speed and stopping)
Conditional jump	3	○	○	Speed change: 0 (When changing speed and stopping)

○: Data requiring set up.
-: Data which does not need a setup, and it is ignored even if it puts in data.
Loop command is not executed when loop command is inputted except a condition of operation.

(3) Example of operation
Below shows a functional explanation of each jump/loop, using a point-data setup of the previous page for an example.

(A) Unconditional jump
Execution of the point [0] will perform the point [253] after point [0] execution.
* That makes it Infinite loop operation available. But, commands such as a cancel command need to be input to stop it.

(B) 1 point jump
If the point [2] is performed, after point [2] execution, the point [3] will be repeated and performed 100 times.



* Execution by one point is also possible, and when the point [3] is performed, P3 is repeated and performed 100 times, then it ends.

(C) Conditional jump

Number	Velocity	Position	Moving mode							Acceleration data	S-curve acceleration / deceleration time	Torque limit	M output delay	M output type	M output code	Interrupt start point	dwell time	jump point	repeat number
			Travel mode1	Travel mode2	Travel mode3	Travel mode ABS/INC	Travel mode with ut/without butt	Travel mode shift, stop / continuous	Servo gain select	Loop mode selection										
	Pulse/s	Pulse									ms	%	Pulse				ms		
5	100	0	0	0	0	0	0	0	0	0	100	0	0	0	0	0	0	0	0	0
6	409600	0	1	1	0	0	0	0	0	0	4096	0	0	0	0	0	0	0	0	0
7	409600	-100	1	1	0	1	0	0	0	0	4096	0	0	0	0	0	0	0	0	0
8	409600	110	1	1	0	1	0	0	0	3	4096	0	0	0	0	0	0	0	7	3
9	409600	1000	1	0	0	1	0	0	0	3	4096	0	0	0	0	0	0	0	7	3
10	400000	0	1	1	0	0	0	0	0	0	100	0	0	-1	1	8	0	0	0	0

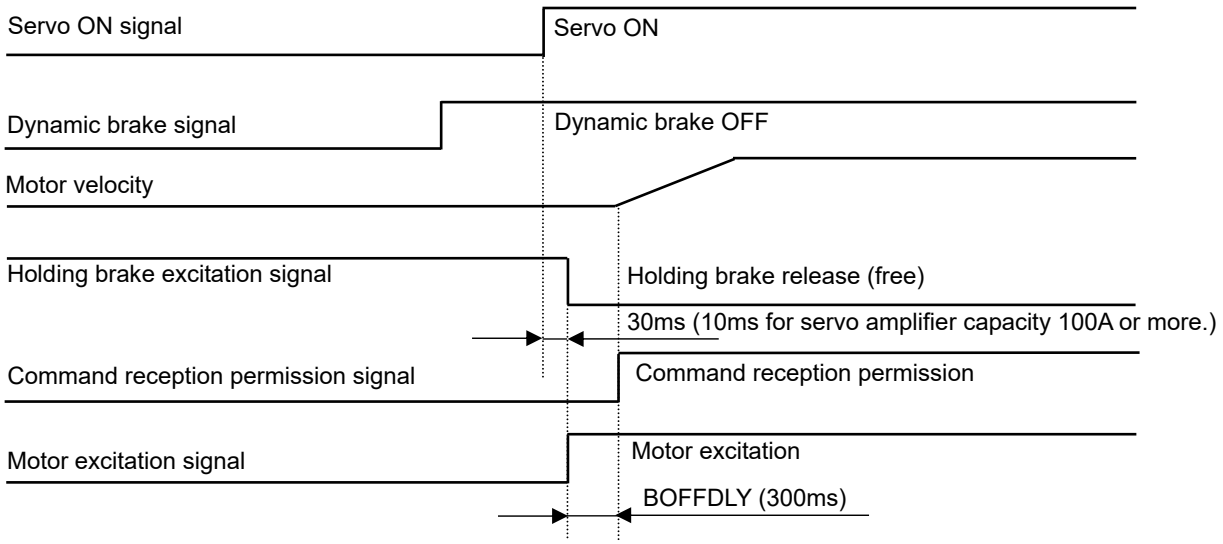
Execution of the point [6] will perform the point [7 to 8] 3 times after point [6] execution, and the point [7 to 9] is performed 3 times. Since it is in the nest state, finally, the point [7 and 8] are performed 9 times and the point [9] is performed 3 times.

Each 3 times

4.2 Operations by external input

Below show the descriptions of operations by external input. This is mainly operated by outputs such as sequencer.

■ The sequence from servo ON to command reception permission
For an external operation input (RUN, ZRT, +JOG, -JOG, +1step, -1step), input servo ON (S-ON) and wait a state of command reception permission before input.



* Figures after next page show each moves with command reception permission.
* OFF -> ON positive edge, inputted with command reception inhibition condition, becomes invalid.
OFF -> ON positive edge, inputted with command reception permission condition, becomes valid.

■ Command reception permission
Output port of command reception permission timing differs due to interface type.
Below table shows comparison against conventional products (RS1 built-in positioning function amplifier).

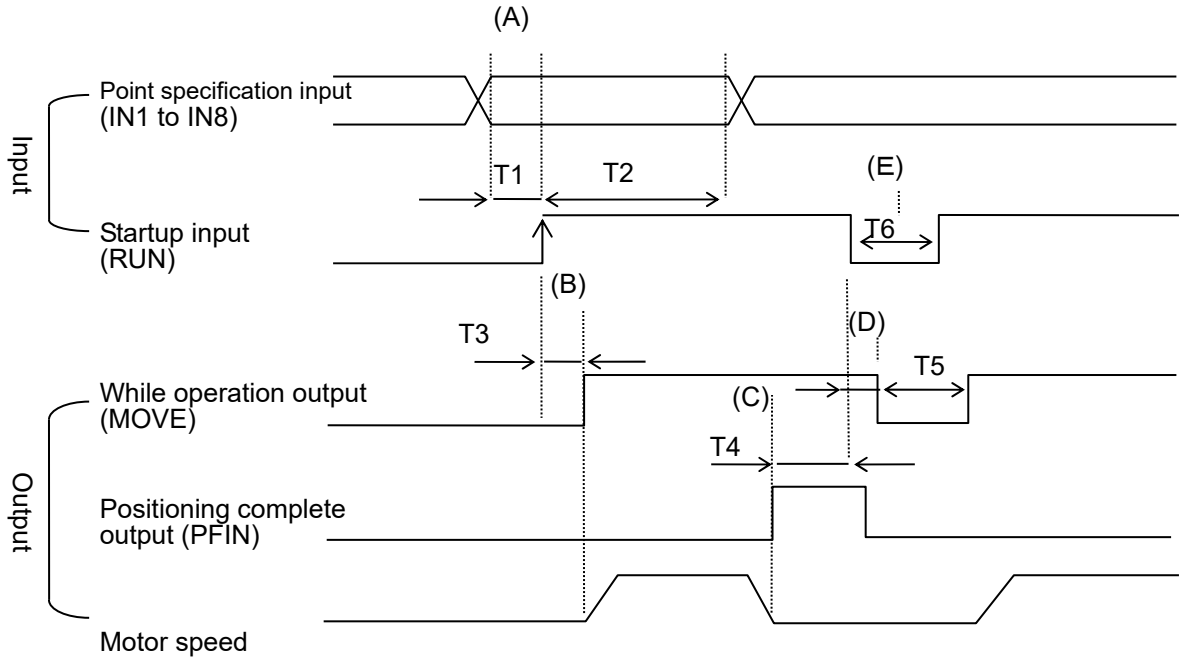
Interface type	RS1 [C:I/O]	RS1 [F:MODBUS]	RS3 [C:I/O]	RS3 [F:MODBUS]
Command reception inhibition	No signal	SVACT=0	SVACT=0	SVACT=0
Command reception permission	No signal	SVACT=1	SVACT=1	SVACT=1

* For conventional products with C: I/O interface type, monitoring signal of command reception permission signal is not output.
For RS3, SVACT is output to general output OUT(4) by selecting a secondary control signal output.
* For the products with F: MODBUS interface type, command reception permission signal is output to SVACT.

4. Positioning function

■ Point specification move 1
It can move with command reception permission state.

(A) Input a point number at the external point specification input (IN1 to 8) and after data establishing, turn the startup input (RUN) OFF -> ON.
(B) MOVE (while operation output) becomes ON, and the move starts. (Startup input remains ON.)
(C) After the move completes and the positioning complete output (PFIN) turns ON, turn OFF the startup input (RUN).
(D) Startup input (RUN) turns OFF, therefore, MOVE (while operation output) and PFIN (positioning complete output) turn OFF.
(E) Startup in the same way as (A).

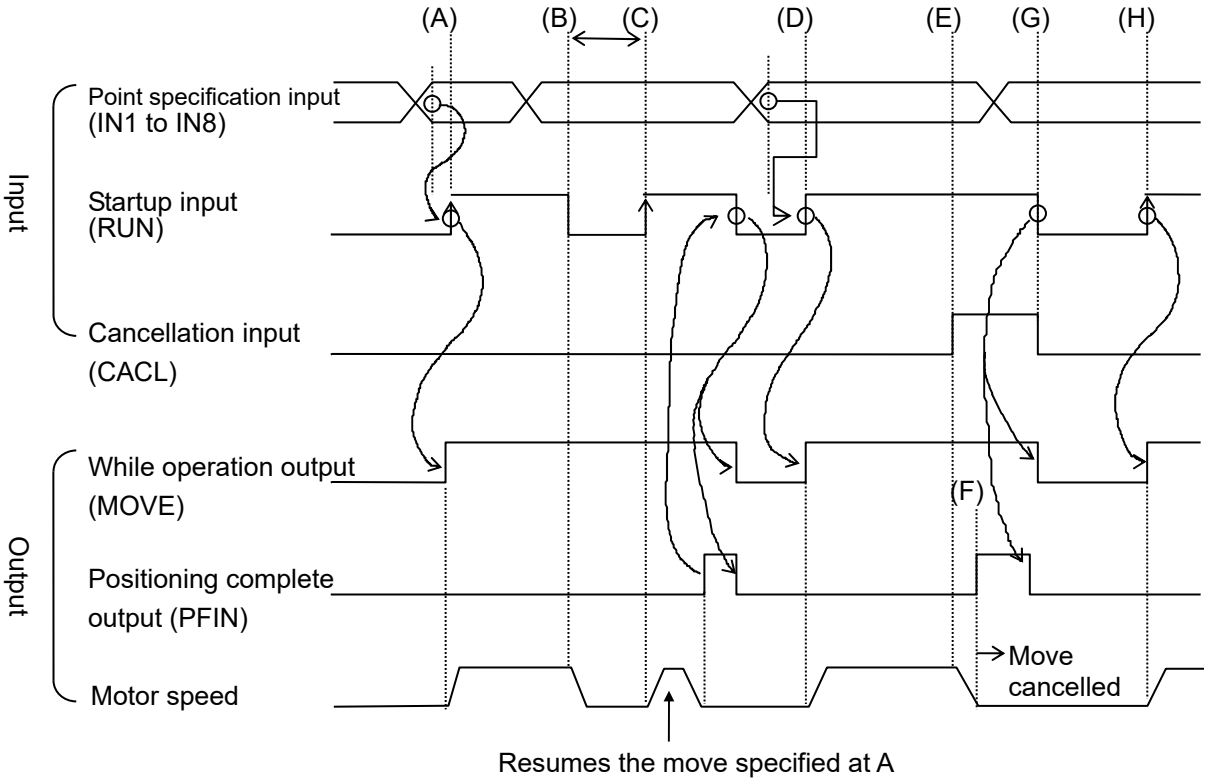


T1≧0ms (Data set up time)
T2≧40ms (Data hold time)
T3,T5≧20ms (Startup reception delay time)
T4≧0ms (Startup signal holding time)
T6≧40ms (Startup signal OFF time)

■ Point specification move 2
It can move with command reception permission state.

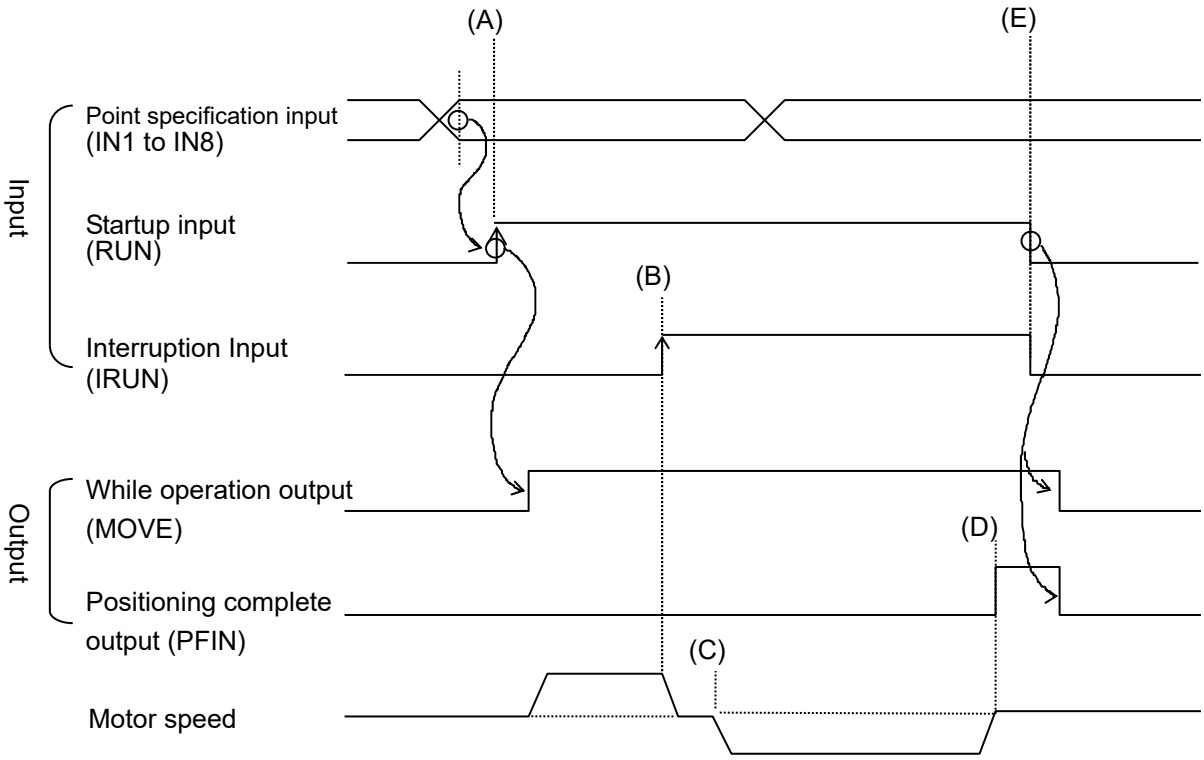
This section describes the feeding stop and move cancellation.

(A) Input a point number at the external point specification input (IN1 to 8) and after data establishing, turn the startup input (RUN) OFF -> ON. MOVE (while operation output) turns ON and the move starts.
(B) Turning OFF the startup input (RUN) during operation decelerates and stops the motor. (This status is called feeding stop.)
(C) Turning on the startup input (RUN) again in the feeding stop status resumes the point move set at (A) and positioning is performed (continues).
(D) Startup in the same way as (A).
(E) Turn ON the cancellation input (CACL) during move, move cancellation mode makes the motor decelerate.
(F) When the move cancellation is complete with the motor decelerating and stopping, positioning complete output (PFIN) turns ON, which means the completion of cancellation.
(G) When positioning complete output (PFIN) turns ON, turn OFF the startup input (RUN).
If MOVE (during operation input) and PFIN (positioning complete) are OFF, cancellation is complete.
(H) Then, input a desired point number at the point specification input, to startup.



■ Point specification move 3
It can move with command reception permission state.

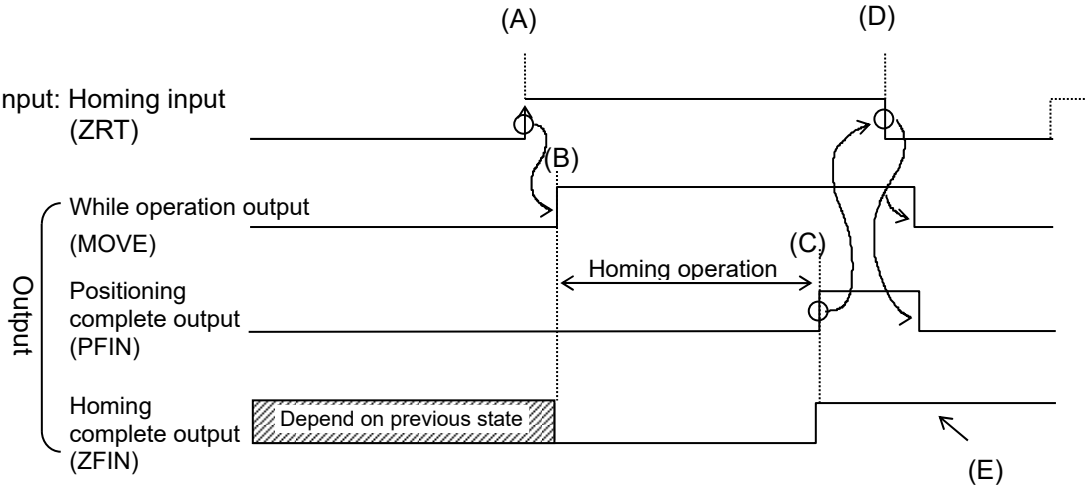
This section describes interruption move, which is very useful for forced return operation.
(A) Input a point number at the external point specification input (IN1 to 8) and after data establishing, turn the start input (RUN) OFF -> ON. MOVE (while operation output) turns ON and the move starts.
(B) If it interrupts during operation and a startup input (IRUN) is turned on, it will become interruption move mode and a motor will be a slowdown stop.
(C) After a motor slowdown stop, reads the interruption point (IP) from the point data of the specified point, and starts movement to an interruption point.
* Beforehand, interruption point (IP) must be set up in point data.
(D) Turns the completion output (PFIN) of positioning on in the place which completed point movement of an interruption point.
(E) After the completion output (PFIN) of positioning turns on, interruption movement will be completed if a startup input (RUN) and an interruption startup input (IRUN) are turned off.



■ Homing
It can move with command reception permission state.

1) For incremental encoder
(A) Turning homing input (ZRT) OFF -> ON makes the homing operation start.
(B) When homing operation starts, while operation output (MOVE) turns ON.
(C) Upon completion of the home-position return, positioning complete output (PFIN) and homing complete output (ZFIN) turn ON.
(D) When homing input (ZRT) turns OFF, while operation output (MOVE) and positioning complete output (PFIN) turn OFF.
(E) Homing output (ZFIN) remains ON, however, it is OFF in the following cases:
(In other words, home-position return operation is necessary for the following cases.)
- When homing is started again.
- When alarms are issued.
- When the main power source turns OFF. (The same for main power cycle.)
- When control power turns OFF. (The same for control power cycle.)

* Do not apply cancellation, feed hold and servo OFF during homing from low speed feeding until operation complete (the point (D)).



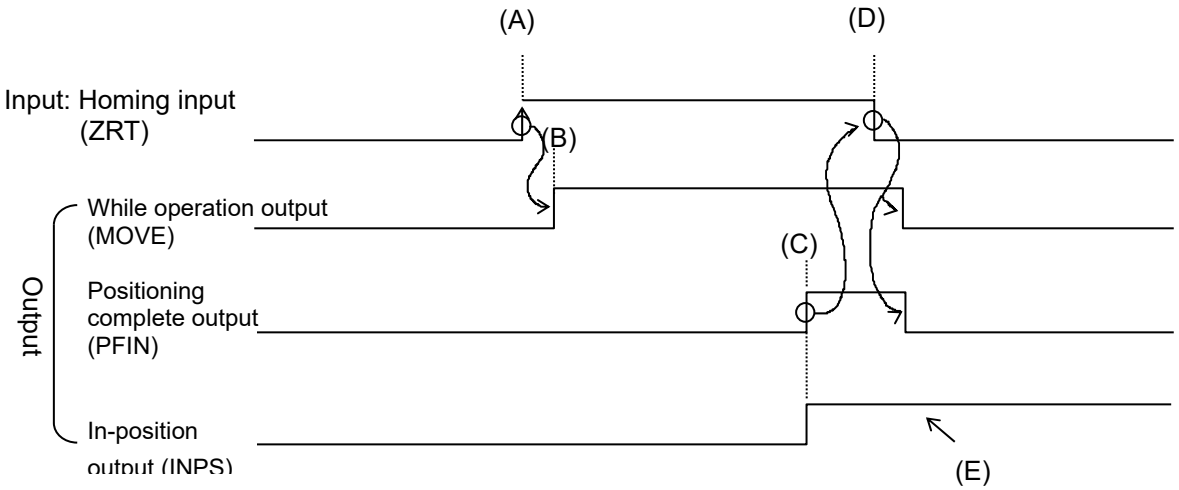
2) For absolute encoder

When an absolute encoder is used, homing operation like as for incremental encoder use is not necessary. Therefore, homing related Inputs/Outputs are changed as follows.

	Incremental encoder	Absolute encoder
CN1- pin 28	Homing input (ZRT)	Home-return Input (ZRT)
CN1- pin 28	Homing complete output (ZFIN)	Low battery warning output (WARN)

And functions are;

(A) Turning the home-return Input (ZRT) OFF -> ON starts the home-return operation.
Home-return operation makes the move to the position (coordinate) whose origin has been set.
(B) The while operation output (MOVE) turns ON as same as normal point move.
(C) Positioning complete (PFIN) and in-position output (INPS) turn ON when the positioning is complete to the origin set coordinate.
(D) When turn OFF the home-return input (ZRT), the while operation output (MOVE) and positioning complete output (PFIN) also turn OFF.
(E) In-position output (INPS) remains ON. However, it turns OFF when the position deviation becomes larger than in-position width in the next move, because conditions for this output are that current position coordinate should match the one with its origin set and also be within in-position.

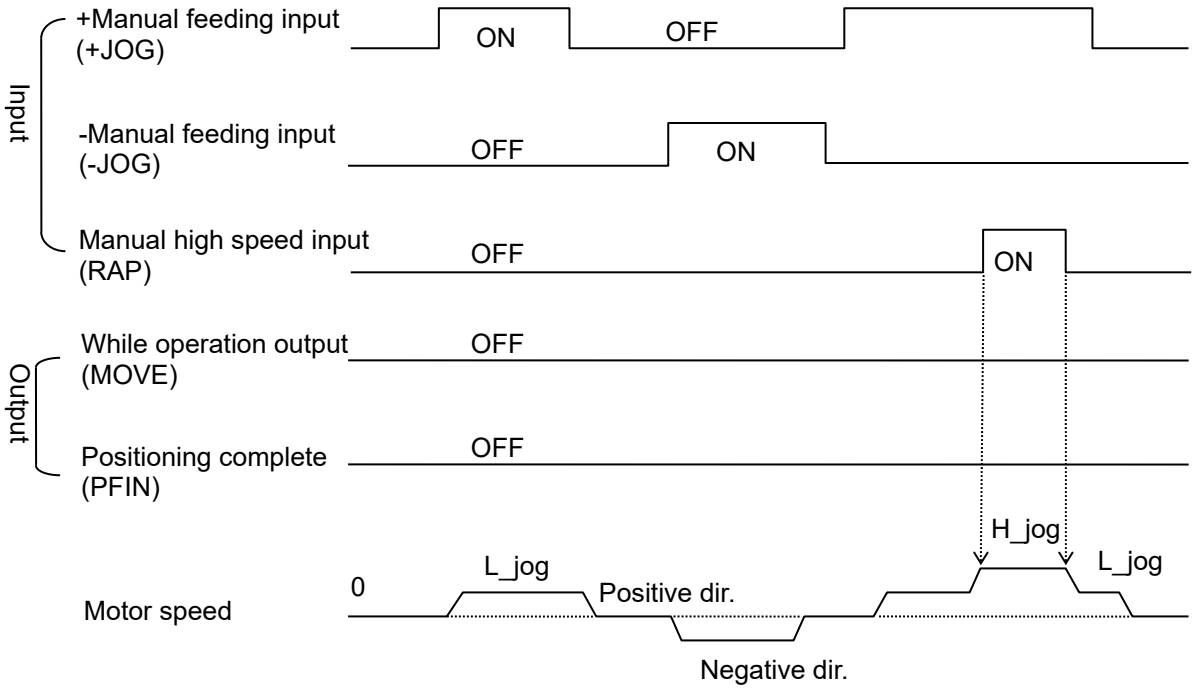


* When absolute encoder homing function is selected, the movement and the method become the same as the case of "1) For incremental encoder".

■ JOG feeding (Manual feeding)
It can move with command reception permission state.

1) For incremental encoder

- While positive manual feeding (+JOG) Input is ON, the move is toward positive direction of the coordinate at the speed of (L_jog) set by a parameter.
- While negative manual feeding (-JOG) Input is ON, the move is toward negative direction of the coordinate.
- When manual high speed (RAP) is input during +JOG (or -JOG) is being input, the move is at the speed of parameter (H_jog).



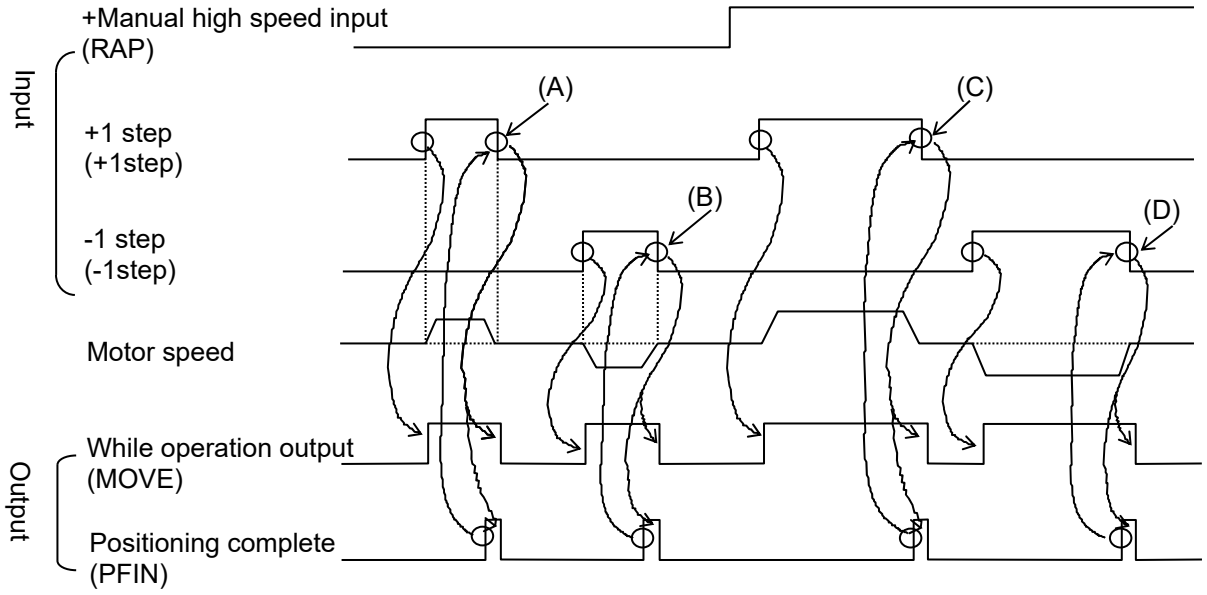
4. Positioning function

■ 1-step feeding
It can move with command reception permission state.

Turning OFF -> ON the +1step or the -1step makes the move by a certain pulse numbers set by a parameter.

(A) Turning OFF -> ON the +1 step input (+1step) with manual high speed input (RAP) OFF state makes the move toward positive direction by the “L_stp” set amount at the “L_jog” set speed.
(B) In the same way, turning OFF -> ON the -1 step input (-1step) makes the move toward negative direction.
(C) Turning OFF -> ON the +1 step input (+1step) with manual high speed input(RAP) ON state makes the move toward positive direction by the “H_stp” set amount at the "H_jog" set speed.
(D) In the same way, turning OFF -> ON the -1 step input (-1step) makes the move toward negative direction.

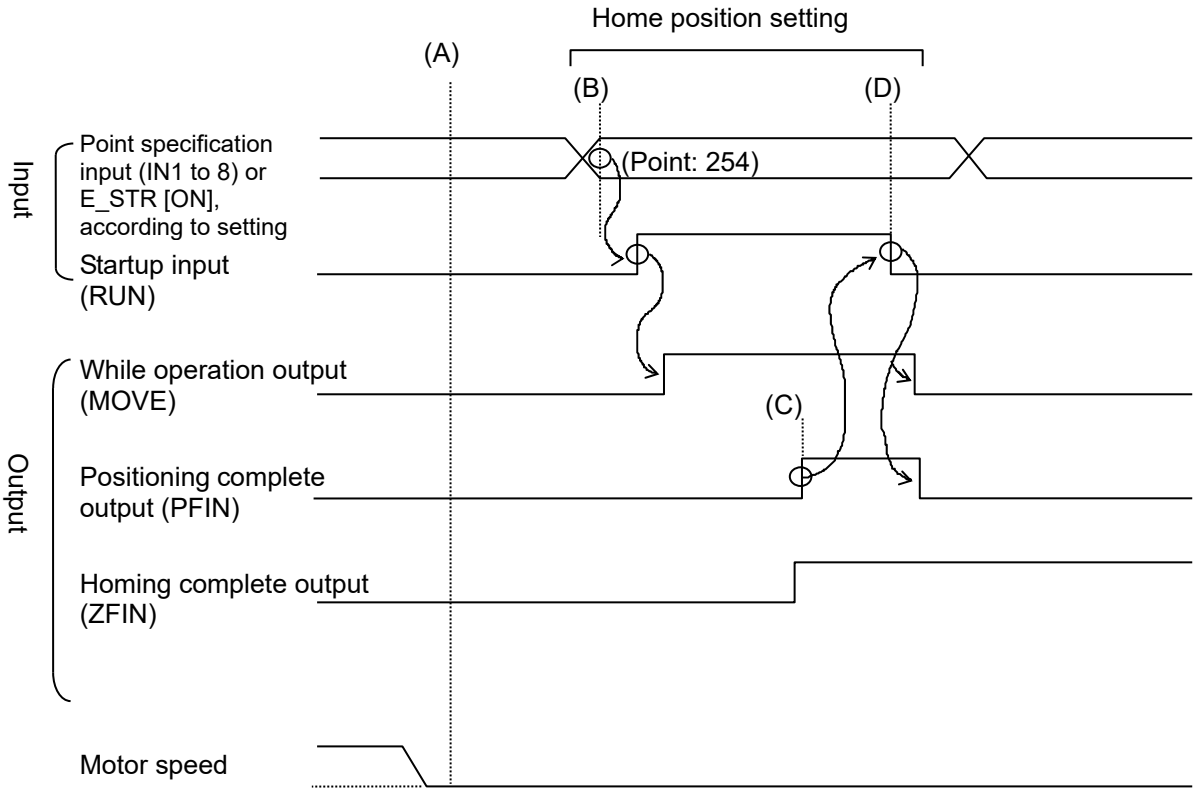
- Keep the 1 step input ON during move. If it is OFF during move, the motor decelerates and stops into feed hold status. And when the input is turned ON again, the move continues.
- Cancellation input (CACL) is also effective.



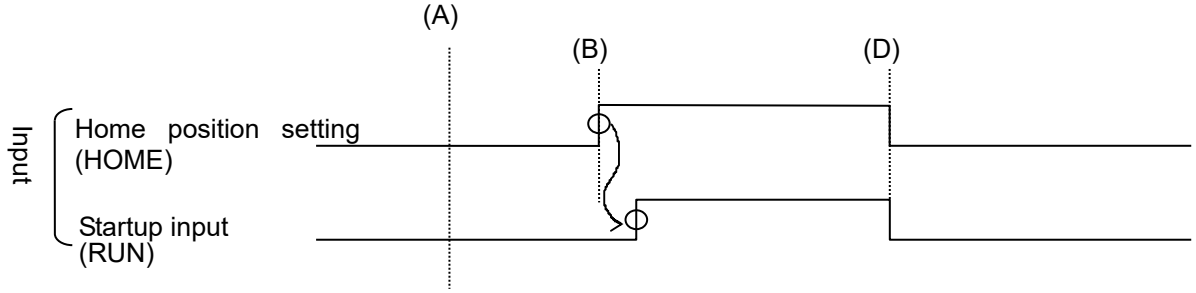
■ Home position setting (Origin setting)
It can set home position (origin) with command reception permission state.

Home position setting is the way to set the current position as an origin, and used for both incremental and absolute encoder.
Move to the position where you want to set as an origin by JOG feeding or others, specify the point at “254” (home position setting), and the current position is set as an origin without any move.

(A) Move to where you want to set as an origin by JOG feeding or others.
(B) Set “254” at the point specification input, and after the data establishing, turn the startup input (RUN) OFF -> ON.
(Turn the HOME ON, and after the data establishing, turn the startup input (RUN) OFF -> ON. (for [F: MODBUS communication]))
(C) When origin setting is complete, the positioning complete output (PFIN) and homing complete (ZFIN) turn ON.
(D) Turning OFF the startup input makes the during operation output (MOVE) and positioning complete output (PFIN) OFF, and home position setting is complete.



* Do not apply cancellation or servo OFF during home position setting.
* For the interface type [F: MODBUS communication], use HOME input as below.



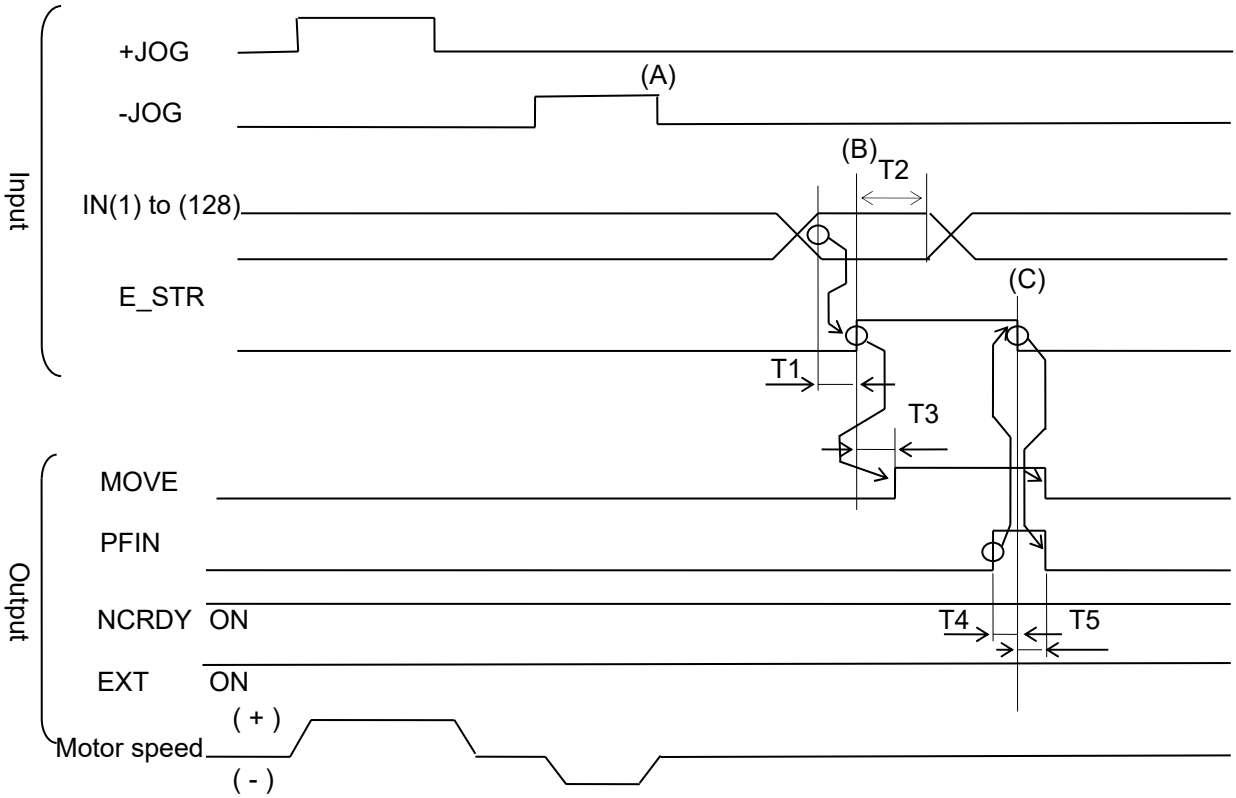
4. Positioning function

■ External data setting

It can set external data with command reception permission state.

- As external data setting, external point teaching setting can be performed.
- External data setting permission: To accept external data, set "1" to [SW1_bit0] and also "0" to [SW2_bit3] in the parameter Group A.
  For the interface type [F: MODBUS communication], it is fixed to [SW2_bit3 = 0].
- The point to be teaching must set previously that point with conditions of speed, positioning operation active and absolute command.
  Input a specified point number and then turn ON the external input signal E_STR, a position where the motor is currently stopped (Ideal position) can be registered as the coordinate value with that specified point number.

  External data setting can perform/register with external operation input mode, if not a state of while move or alarm.



T1 ≧ 0 ms (data/command set up time)
T2 ≧ 40 ms (data/command holding time)
T3,T5 ≧ 20 ms (startup reception delay time)
T4 ≧ 0 ms (startup holding time)

(A) In External operation mode, using JOG feeding or others, move to the position desired to teaching.
(B) Set the point number to be teaching, and then turn input signal (E_STR) OFF -> ON.
(C) Turn OFF input signal (E_STR) when output signal (PFIN) turns ON.
Then, output signal (PFIN, MOVE) are turned ON -> OFF. (Complete External teaching data setting.)

4.3 Basic parameters for positioning

■ Read through before performing any of the procedures in Positioning Function.
- **Mandatory parameters of Positioning Function are as shown below.** -

◆ Parameters for positioning function (NC parameters) are a group of parameters that set up positioning system.
If it does not match to data input or machinery part, it makes different actions from intended ones. So be sure to make a confirmation.

- Make the power OFF once and ON again after altering parameters “0A M_dir”, “3B S_pls”, “3C U_pls”, “3E D_dpo”, and “3F Unit”.

- Parameters that are setup at first
  0A “M_dir” Operation direction
  3B “S_pls” Number of system divisions
  3C “U_pls” Number of user divisions
  3E “D_dpo” Velocity, Position data decimal point
  3F “Unit” Setting unit

- 「————」 Encoder function
- 「————」 Encoder resolution
- 「————」 Motor parameter

Refer to system/motor parameters

1) Encoder function, resolution, and motor parameter should be set according to system construction.

2) 3E “D_dpo”: Decimal point for velocity/position data is designated.
“0”･･･without decimal points
“1”･･･one place of decimals
“2”･･･two places of decimals
“3”･･･three places of decimals
“4”･･･four places of decimals
“5”･･･five places of decimals

* Perform power cycle after setting parameters 1), 4), 5), and 6).
* Decimal point is indicated to point data setting.
* Decimal point is not indicated to the setting in GroupA Positioning function parameter.

3) 3F “Unit”: Setting unit is decided.
“00”･･･pulse
“01”･･･mm
“02”･･･deg

4) 0A “M_dir”: Motor operation direction is decided.
“00”: Against positive direction in coordinate, rotary motor is CCW turn seen from shaft side.
“01”: Against positive direction in coordinate, rotary motor is CW turn seen from shaft side.

5) 3B “S_pls”: Division number per one turn of motor is set.
"S_pls" = "Absolute encoder resolution" (during use of absolute encoder)
"S_pls" = "Incremental encoder resolution" × 4 (during use of incremental encoder)
↑
(Fixed value: Detection multiplication)

<Encoder setting example>
① PA-035 (131,072 P/R)･･･”S_pls” = 131,072
② Incremental (2,000 P/R)･･･”S_pls” = 8,000

6) 3C "U_pls": Travel distance per turn of a motor seen from user.
Input setting unit of position data is determined at the above "D_dpo", "S_pls", and "U_pls".

* Setting in GroupA Positioning function parameter, please set with the internal value ignoring decimal point.

e.g.1) System that travels 5mm per turn of a motor at incremental encoder (8000 division).
Position data setting unit 0.001 mm
Unit = 1
D_dpo = 3
S_pls = 8000
U_pls = 5000 (Set as 5000, ignoring decimal point of 5.000.)

Those settings can edit with GroupA Positioning function parameter but also clicking Parameter setting+ at point data window.
Settings in point data window shows with reflection of specified unit and decimal point.

If you want to set 7.354mm as travel distance, setup “7.354”.
In addition, if you want to set 8mm/s as velocity, setup “8.000mm/s”.

* Internal value is a value when removing a decimal point.
  5000 becomes an internal value when expressed as 5.000.
* Please set up to become S_pls>=U_pls (internal value).

e.g. 2) System that travels 10mm per turn of a motor at absolute encoder (131072 division).
Unit = 0
D_dpo = 4
S_pls = 131072
U_pls = 100000 (Set as 100000, ignoring decimal point of 10.0000.)

If you want to set 1.235plse as travel distance, setup “1.2350”.
In addition, if you want to set 4mm/s as velocity, setup “4.0000mm/s”.

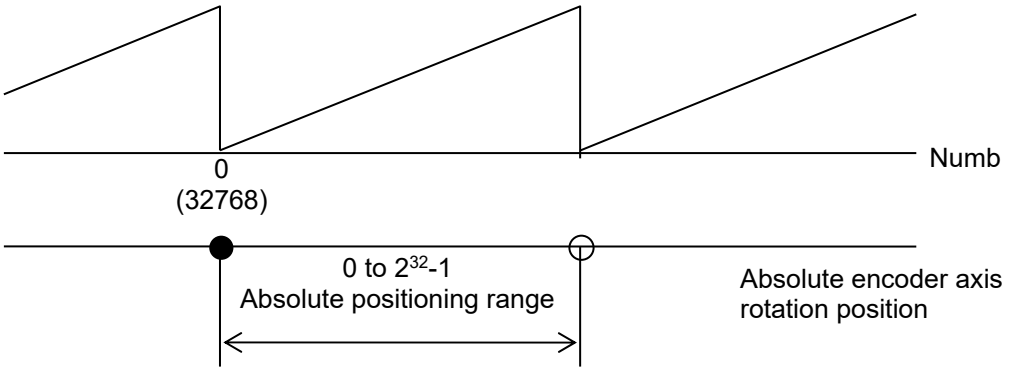
* Please set up to become S_pls>=U_pls (internal value).
* Since the variation in a positioning position arises on a motor encoder resolution level, 1/20 or less should be the gear ratio of S_pls/U_pls.

Perform power cycle after setting the above-mentioned parameter. Then, set up S_ovf and T_ovf. Although it changes with a load condition and gains, set up and adjust 4 times of U_pls to a standard as a standard.
Moreover, from determined U_pls, set up the following;
S_vmx, T_vmx, Accel, S_rat, S__inp, Z_inp, H_jog, L_jog, H_stp, L_stp, S_+OT, S_-OT.
Then confirm about Chapter 6.

◆ Origin setting of absolute encoders

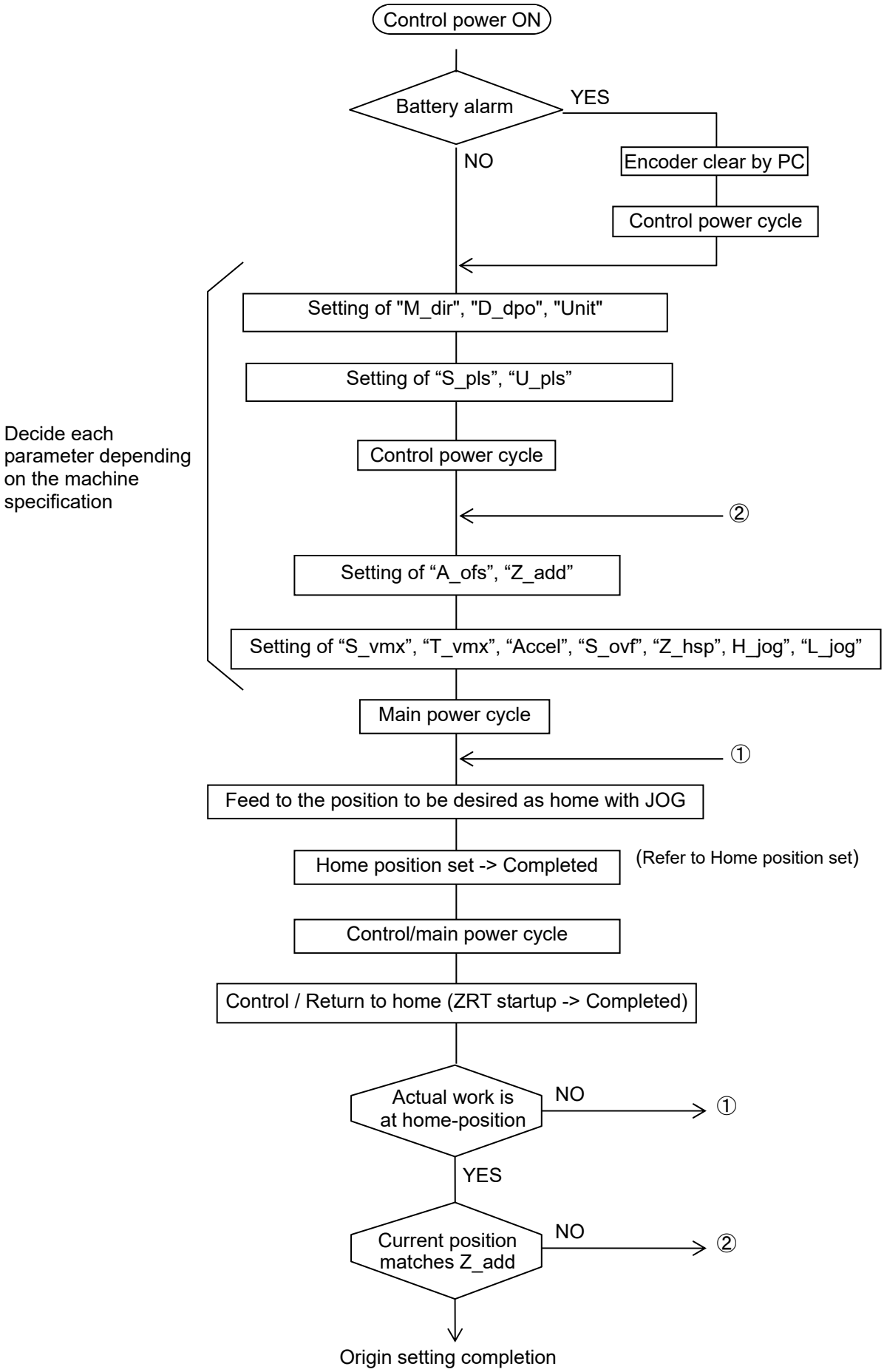
(A) Absolute encoder (PA035)

- Position output signal of PA035 is 33 bits and you can use in 32 bits range with this servo amplifier.
- Division number: 131072 division/one rotation…17 bits
- Multi-turn number: 32768 turns…15 bits Total 32 bits



In other words, 0 to (2^{32}-1) [0 to 4294967295] is effective stroke.
You can determine the position in this range.

(B) Zero set flow chart of absolute encoder



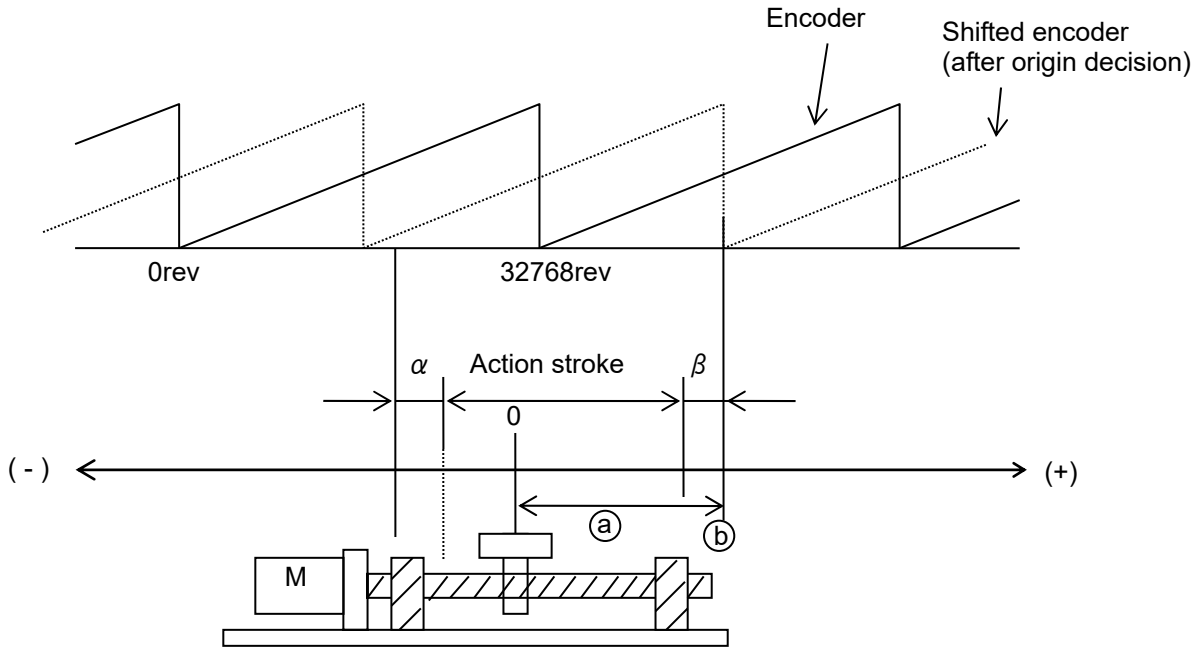
(C) Example of home determination
Ball screw drive: Direct-coupled, P=10mm, I=800 mm
Travel distance set unit: 0.001mm, Velocity unit: 0.0001 mm/s

* Setting in GroupA Positioning function parameter, please set with the internal value ignoring decimal point.

① M_dir="0"·····Increase directions of encoder and user coordinate are identical.
D_dpo = “4” (Four places of decimals)・0.0001 mm, 0.0001 mm/s
Unit = “1” (mm)
Set above parameters.

② S_pls = 131072···by number of division
U_pls = 100000・・・・・Define that 10mm (10.0000) per rotation travels.
S_ovf = 400000・・・・・Set 40mm (40.0000).
After setting the above parameter, perform control power cycle.
③ S_vmx = 7500000・・・・・750.0000 (mm/s) by Nmax = 4500min^{-1}
T_vmx = 2000000・・・・・200.0000 (mm/s) by T_vmx < S_vmx
H_jog = 200000・・・・・20.0000 (mm/s) start with slow velocity
L_jog = 10000・・・・・1.0000 (mm/s) start with slow velocity
Z_hsp = 200000・・・・・20.0000 (mm/s) start with slow velocity
Accel = 2500000・・・・・250.0000 (mm/s) The setting of rising 0 -> 4500 min-1 within 300 ms.
A_ofs = 20000000・・・・・Amount of a = 2000.0000mm (β: margin> 0)

Note: This sets A_ofs for the functional description in the example, but it is possible to use A_ofs=0 as it is, when effective encoder stroke is sufficiently larger (2 times larger) than mechanical stroke.
It is preset at the center of encoder stroke automatically when parameter is A_ofs=0.



Z_add = 0·····User coordinate is 0 when 0.0000 (mm) is set to origin.

④ Travel to the position you want to make it home-position by JOG.
⑤ Zero position setting -> complete…Encoder coordinates system turns to a dotted line part.
⑥ Zero-position setting is completed with above all operation.
⑦ Check (α + Action Stroke + β) < 32768rev
It cannot be applied when it exceeds encoder stroke.
(It acts in the next area and damages the mechanism.)

* **Note**
M_dir, D_dpo, Unit, S_pls, U_pls,
Please make sure to set the Home-position when M_dir, D_dpo, Unit, S_pls, U_pls, A_ofs, Z_add change/ operate motor conversion / release the battery alarm.

■ Origin setting of incremental encoders

For the incremental encoder, it needs homing to correspond electrical zero-point with mechanical zero-point at the time of power-on operation.
When zero-return operation is required, ZFIN output of I/O turn OFF. Therefore, please operate homing.
When homing is completed normally, ZFIN output turn ON.

The parameter being required minimum setting for homing are as follows.

Z_hsp: High speed on homing (Uu)
This is the velocity set at "Z_dir", having no deceleration signal (contact point closed), as this is start after homing.

Z_lsp: Slow speed on homing (UV)
This is the reversed velocity when escaping from deceleration signal by rotating in negative direction, after decelerating in response of deceleration signal (Z_hsp) in homing operation.

Z_typ: Homing type (-)
Set a type of homing. Two types, type 0 and 1, are available.

Z_dir: Homing direction (-)
Set rotational direction for homing.

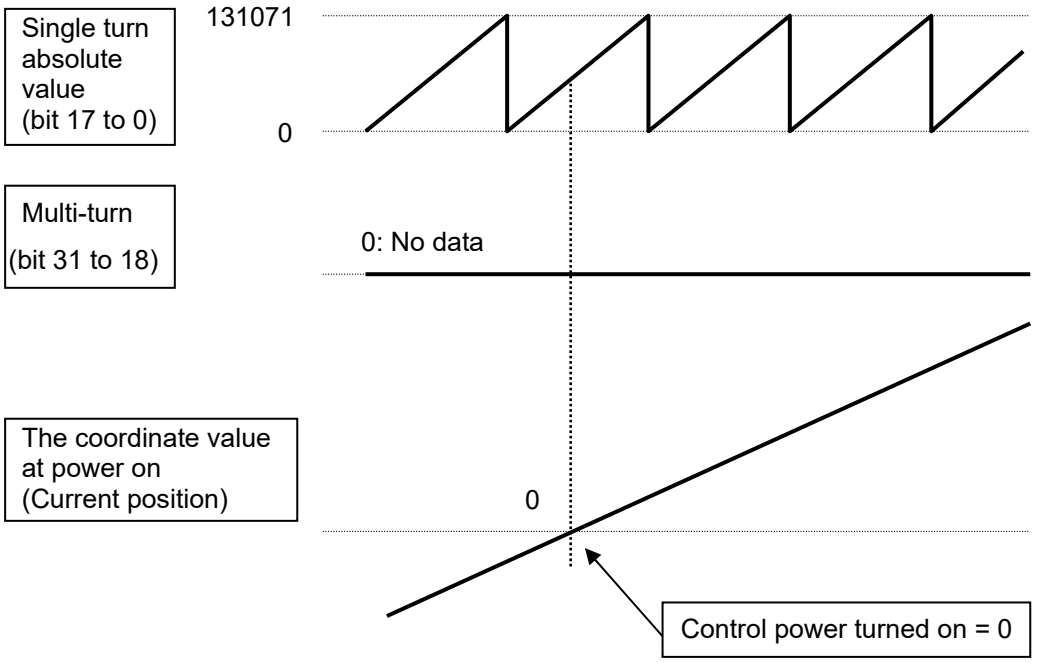
Z_add: Origin position coordinates (UP)
The value set at this parameter when homing completed becomes user coordinates value.

Set the above parameters to perform homing.

* Normal operation
- Only after positioning reference parameters setting and origin setting, point setting and external point move become available.
- If any changes to positioning reference parameters setting and origin setting occurred, perform settings after change point again.

■ The coordinate value with incremental system use at power on

In case that using battery backup absolute encoder as incremental system without multi-turn data or using single-turn absolute encoder, initial coordinate at power on is zero.
Below shows example of absolute encoder with division number 131072 /turn (17 bits/turn).



* In case that unit is pulse and gear ratio is 1:1.
In this case, coordinate range is -2147483648 to 2147483647.

4. Positioning function

4.4 Infinite motor rotation specification

■ Outline

Specification for infinite rotation is a mode used for rotating solids such as rotating table. Specifically, if coordinates rotating in positive direction exceeds the values of “+ stroke,” the coordinates changes to the value of “- stroke.”

Permanent rotation in positive direction is available by processing coordinate system in the above way. (This can be applied equally to reversed rotation.)

For example, if in the condition that + stroke=1000, - stroke = -1000,” rotation is in positive direction, and coordinates exceeds 999, the coordinates changes to –1000. (Move range: -1000 to 999)

Function of rotation in the shortest way is also supported, if “+” travel distance exceeds 1/2 of whole coordinates (figures after the decimal point rounded up), the move is in the shortest way. (When in “-“ travel distance exceeds 1/2 of whole coordinates (figures after the decimal point rounded down), the move is in the shortest way.)

For example above, When 1000- (-1000)/2 = 1000, rotation is in the shortest way.

For example, if present position is - 500 and target value is 999, rotation is in the shortest way. (Rotation is in negative direction instead of positive direction.)

Against present position -500, rotation is in the normal way if target value is 500, and rotation is in the shortest way if target value is 501.

Functions for zone signal is also extended to support infinite coordinate system. You can set zone signals including unique points in the range “- 900 to 900” that could not be set in usual, due to function SW.

In this case, if present position is within the range either “- 900 to - 1000 or “900 to 999,” zone signal is turned on.

■ Positioning function parameter to be added or changed

GroupA ID	Name	Description
15	+STROKE [+ Stroke]	Set the maximum values of coordinates in + direction. (The value less than this value becomes maximum coordinates value, exactly.)
16	A_ofs [- Stroke]	Set the minimum values of coordinates in - direction, for infinite rotation specification.
63	Coordinates switching [Sw1_bit3]	0: Normal coordinates 1: Infinite coordinates
64	Shortcut function switching [Sw1_bit4]	0: Shortcut off 1: Shortcut on
65	Zone signal (zon) function extension [Sw1_bit5]	0: Normal function 1: Extended zone signal function

4.4 Infinite motor rotation specification

■ Explanation of operation in usage example

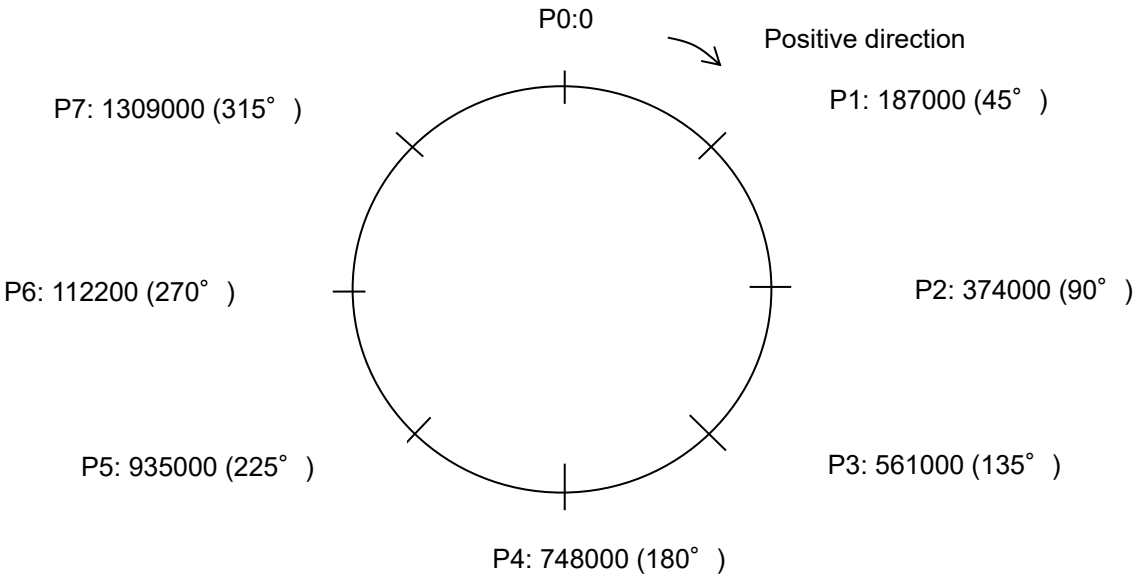
Condition: Motor resolution: 8000 P/R
Mechanical gear ratio: 187:1
3B: S_pls = 8000 [P/R]
3C: U_pls = 8000 [u_pls]

Since motor rotates 187 times per 1 mechanical rotation, so 187*8000 = 1496000 [u_pls]
The traveling range is 0 to 1496000 (Exactly 1496000=0, so it is 0 to 1495999)
15: + Stroke = 1496000
16: - Stroke = 0

Velocity in mechanical conversion 10 min-1: 10*187*8000/60=249333
27: H_jog = 249333
28: L_jog = 249

As 1-step feed is 360/8=45 degree, 1496000/ 8 = 187000
29: H_stp = 187000
2A: L_stp = 1

Sets to a shortcut rotation with infinite coordinates system. (Sw1_bit3=1, Sw1_bit4=1)
The above are system parameters, the following are point data.



4. Positioning function

Operational modes that can rotate in the shortcut are as follows only:
Mode2: 00 (completed)
Positioning command data: 0 (absolute command)
Operating pattern:0 (Stop and change speed operation)
Position setting within coordinates (0 to 1495999).
So, point data are as follows:

N	Velocity	Position	Mode 1	Mode 2	ABS/INC	Accel	S curve acceleration	Current limit	M output	IP	Dwell
0	249333	0	1	0	0	510	0	0	0	0	0
1	249333	187000	1	0	0	510	0	0	0	0	0
2	249333	374000	1	0	0	510	0	0	0	0	0
3	249333	561000	1	0	0	510	0	0	0	0	0
4	249333	748000	1	0	0	510	0	0	0	0	0
5	249333	935000	1	0	0	510	0	0	0	0	0
6	249333	1122000	1	0	0	510	0	0	0	0	0
7	249333	1309000	1	0	0	510	0	0	0	0	0

Shortcut judgement:
When rotating in negative direction and “travel distance > whole coordinate/2 (the figures after the decimal fractions rounded down),” motor rotates with shortcut.
When rotating in positive direction and “travel distance ≧ whole coordinate － (1/2 of whole coordinate (the figures after the decimal fractions rounded down),” in actual operation, when moving in positive direction and travel distance ≧ 1531904 - (1531904/2), motor also rotates with shortcut.
Specifically, rotations by moving from P0 to P4 and from P4 to P0 are in positive direction. If position is in P4 with the state 1-pulse moved at L_stp in negative direction, and in that condition if you want to rotate to P0, motor rotates in negative direction to the point.
If you want to rotate moving parts more than single turn, set with incremental command.
For example, if the position is designated as 1914880 in incremental command, the moving part stops in the same coordinate after rotating 10 times in positive direction.

■ Extended function of zone signal
When setting “SW1_bit5 = 1”, extended function of zone signal activated.
Operating condition: sw1 (bit5=1),
zone signal: zon□L > zon□H (□: 1 to 8),
and "zon□L≦present position" or "present position < zon□H".
The zone signal set in the above condition is turned on.

Set zone signal of ”0-position±100” in setting of usage example.
Set as follows:
Sw1_bit5 = 1
zon1L: 1531804
zon1H: 100.
(zon1L > zon1H)
After setting, zone signal 1 turns on at “1531804≦present position” or “present position <100.”

4.5 Fixed position stop JOG function

■ Outline of operation

The stop position after JOG-feeding operation can be “specific” position designated by point data by enabling fixed position stop JOG function, instead of “any” decelerating stop position.

(1) Turning on the signal +/-JOG starts JOG-feeding operation.
During the operation, switching high- velocity JOG/ low-velocity JOG is enabled by turning on/off of RAP signal.

(2) When turning on signal RUN during JOG-operation, JOG-feeding mode changes to positioning mode while continuing to rotate motor, and then performs positioning by referring to target position and acceleration (deceleration) of applicable point data from the information of IN_1 to IN_128 at the time of RUN signal turnes on.

■ Parameters used for this function

(1) Performs setting for infinite motor rotation specifications. (-> Refer to “Description of infinite motor rotation specification.”)

(2) Sets "1"(valid) to Sw2_bit9 [Fixed position stop JOG function].

■ Restrictions on this function

(1) When Fixed position stop JOG function is enabled, the S-shaped curve acceleration and deceleration time (0C: S_rat) of normal JOG-feeding is not applied.

(2) In Fixed position stop operation, the velocity setting value set to point data and S-shaped curve acceleration and deceleration time are not used. Set the acceleration value to be set to that point data at 50[UV/ms] or over.

(3) To smooth velocity change incline, set position command smoothing time constant (parameter Group1, ID00).

(4) Use point data designated by this function in the following moving mode:

Mode 2 = 00:	Final move,
ABS/ INC= 0:	ABS,
Pushing = 0:	No pushing,
Velocity chage = 0:	Stop.

4. Positioning function

■ Operation explanations of by usage examples

Condition: motor resolution 131072 P/R
Setting of positioning function parameter GroupA, in case without gear mechanism
(1) Setting of basic units

GroupA ID	Symbol	Name	Set value	Description
3B	S_pls	System division number	131072	Division per motor single rotation
3C	U_pls	User division number	36000	Travel distance per motor single rotation Positioning accuracy: 0.01°→ 360.00
3E	D_dpo	Decimal point of velocity/position data	2	Two places of decimals
3F	Unit	Setting unit	02	degree

(2) Setting of stroke and functions

ID	Symbol	Name	Set value	Description
GroupA 15	+STROKE	[+Stroke]	36000	Maximum value of + direction coordinates (360.00)
GroupA 16	A_ofs	[-Stroke]	0	Minimum value of - direction coordinates (0.00)
GroupA 63	[Sw1_bit3]	Coordinate switching	1	Infinite coordinate
GroupA 70	[Sw2_bit0]	-OT	1	Function invalid (for C: I/O)
GroupA 71	[Sw2_bit1]	+OT	1	Function invalid (for C: I/O)
Group9 00	F-OT	Positive overtravel	00	Function invalid (for F: MODBUS)
Group9 01	R-OT	Negative overtravel	00	Function invalid (for F: MODBUS)
GroupA 79	[Sw2_bit9]	Fixed position stop JOGfunction	1	Fnction valid

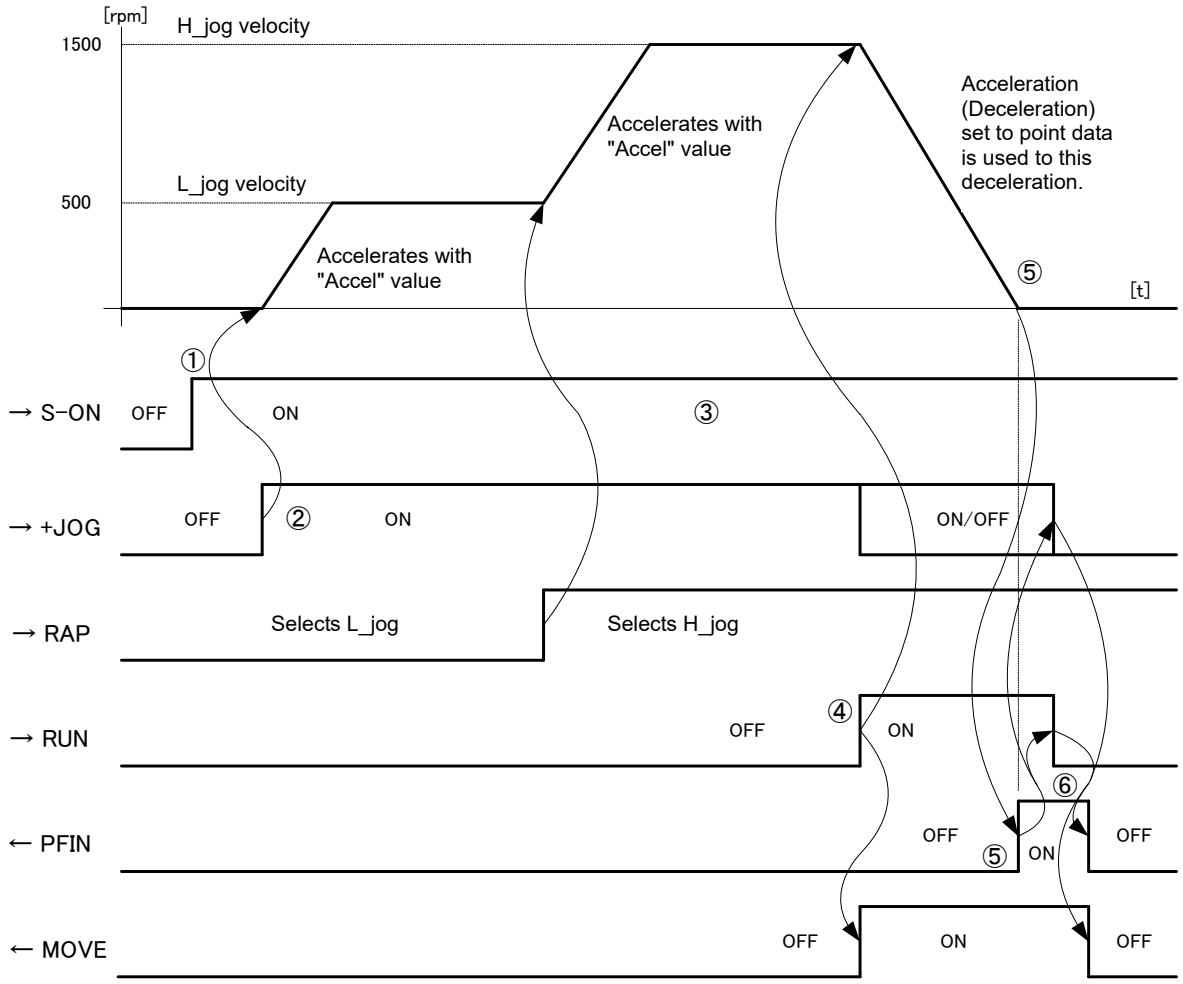
(3) Setting of JOG-velocity and acceleration

GroupA ID	Symbol	Name	Set value	Description
27	H_jog	Manual high speed	900000	9000.00deg/ s (Equivalent to 1500 rpm)
28	L_jog	Manual low speed	300000	3000.00deg /s (Equivalent to 500 rpm)
0B	Accel	Acceleration/deceleration constant	300	300deg/s / ms (Velocity increases in increments of 2s up to 1000rpm.)

Setting example of point data

N	Velocity	Position	Mode1	Mode2	ABS/INC	Accel	S curve acceleration	Current limit	M output	IP	Dwell
0	6000.00	0.00	1	0	0	300	0	0	0	0	0
1	6000.00	45.00	1	0	0	300	0	0	0	0	0
2	6000.00	90.00	1	0	0	300	0	0	0	0	0
3	6000.00	135.00	1	0	0	300	0	0	0	0	0
4	6000.00	180.00	1	0	0	300	0	0	0	0	0
5	6000.00	225.00	1	0	0	300	0	0	0	0	0
6	6000.00	270.00	1	0	0	300	0	0	0	0	0
7	6000.00	315.00	1	0	0	300	0	0	0	0	0

■ Example of operational sequence



(The allows "->" previous of signal name in the figure above mean input signal into servo amplifier.)
(The allows "<-" in the figure above mean output signal from servo amplifier.)

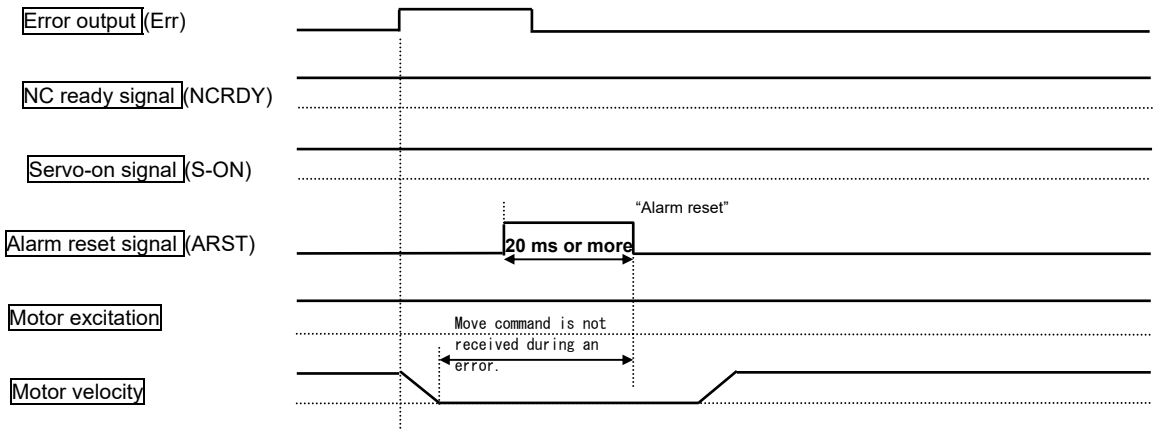
■ Explanation of sequence

① Turns servo ON.
② Turning on signal +/-JOG starts and accelerates the motor up to the set L_jog velocity.
③ Turning on signal RAP switches JOG velocity to H_jog from L_jog.
④ Turning on signal RUN during JOG operation reads out point data set to IN (1) to IN (128) at the time, and starts deceleration at the acceleration (deceleration) parameters set to point data.
ignal MOVE is turned on at the same time of fixed position stop operation start. At this point, no differences would be made on fixed position stop function whether +/-JOG signal turned on in the above ② is ON or OFF.
⑤ PFIN is turned on after positioning to the target point designated by point data is competed.
⑥ Controller turns off signal RUN and +/-JOG, after confirming that PFIN is ON.
Servo amplifier turns off signal PFIN and MOVE, after detecting that signal RUN and +/-JOG are turned off.

4. Positioning function

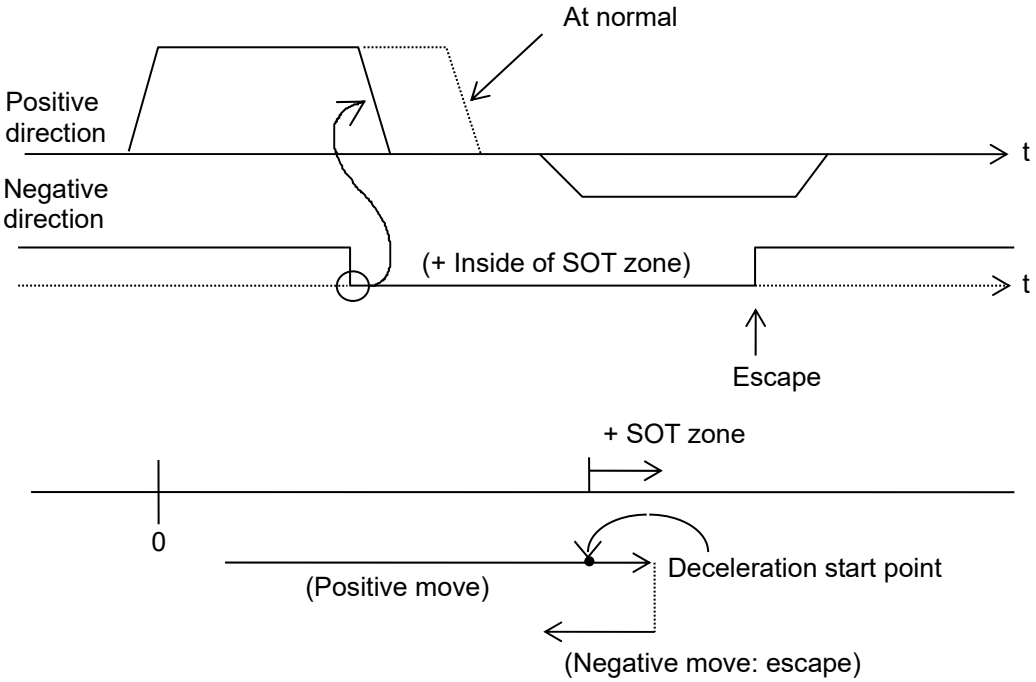
4.6 Error sequence and software limit sequence

■ Error sequence



* Although motor excitation state is maintained in an error condition, move command is not received until error is reset.
  However, software limit is an exception. Refer to software limit sequence.
* To confirm error code at error, please follow sequence below.
  For interface type (C: I/O), set output selection of general output OUT(1) to (8) to "Error/alarm code". For interface type (F: MODBUS), check [PF_CODE].
* Please cope with it by troubleshooting at the time of Chapter 8 error code generating.

■ Software limit sequence



* The command for positive move in +SOT zone (and negative move in -SOT zone) are not acceptable. In addition, movement in the escape direction is based on manual movement (JOG).

5

Operations

In this chapter, each item for servo motor operation is explained.

5.1 Basic setting of the system 5-1

5.1.1 Specification check 5-1

5.1.2 System parameters 5-3

5.1.3 Servo motor setting 5-6

5.1.4 Motor encoder setting 5-9

5.1.5 Main circuit power setting 5-13

5.1.6 Regenerative resistor setting 5-13

5.1.7 Control method selection 5-14

5.1.8 Positioning function parameter setting 5-14

5.2 Test operation 5-14

5.3 Servo amplifier status display 5-15

5.3.1 Normal display 5-15

5.3.2 Alarm display 5-15

5.3.3 Error display 5-15

5.4 Operation sequence 5-16

5.4.1 The operation sequence with factory setting from "turn power on" to "turn power off" 5-16

5.4.2 Stop sequence at alarm 5-18

5.4.3 Sequence of alarm reset 5-20

5.4.4 Sequence when power is turned OFF during operation (During servo ON) 5-21

5.5 Monitor function 5-22

5.5.1 Monitor list 5-22

5.5.2 Descriptions of each monitor 5-23

5.5.3 Positioning function monitor list 5-33

5.5.4 Positioning function monitor description 5-34

5.6 Analog monitor and digital monitor 5-37

5.7 Setting parameters 5-38

5.7.1 Parameters list 5-38

5.8 Parameter functions 5-47

5.9 Control block diagram 5-115

5.10 SEMI F47 supporting function 5-118

5.10.1 Parameter setting 5-118

5.10.2 Operational sequence 5-118

5.10.3 Notes 5-119

5.11 Virtual motor operation function 5-120

5.11.1 Setting 5-120

5.11.2 Restrictions 5-121

5.11.3 Digital operator display 5-122

5.11.4 Operating precautions 5-122

5. Operations

5.1 Basic setting of the system

Basic settings of the system that needed to the operation are explained.

5.1.1 Specification check

Check the specification of servo amplifier through the setup software "SANMOTION MOTOR SETUP (hereinafter referred to as setup software)".

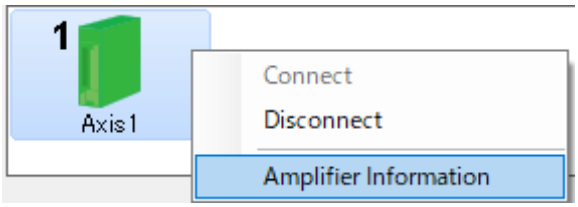
[Step 1: Check for the servo amplifier spec]

Check by 4 items below whether your product is fit to the target system spec.

- Motor structure
- Main power supply voltage
- Amplifier capacity code
- Encoder type

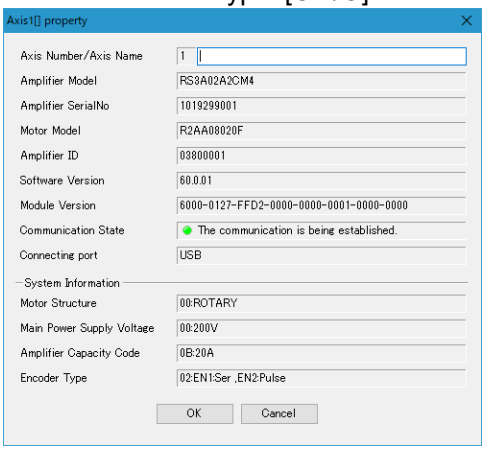
1) Check by the setup software

- Connect the servo amplifier by USB cable to a PC which installed setup software, and then turn on control power (r, t).
- Run the setup software and start communication with the servo amplifier.
- Select the target axis from upper side of main window, and then show the popup menu by right click.

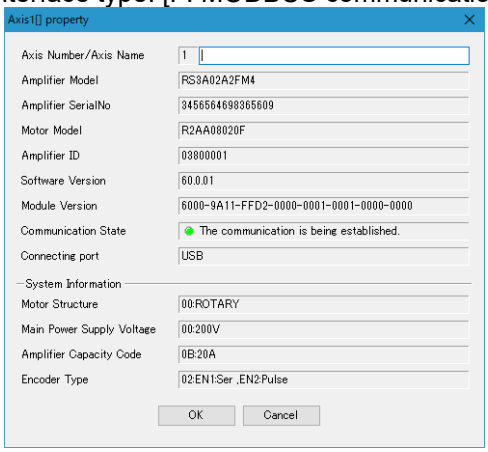


- Property window for the axis will open when Amplifier information in the popup menu is selected.
  The codes of "Motor structure", "Main power supply voltage", "Amplifier capacity" and "Encoder type" are shown in System Information area. (See below)

Interface type: [C: I/O]



Interface type: [F: MODBUS communication]



■ Check each item above by following description of step 2 or later.

* See the manual: M0010842 for detail of the setup software operation.

[Step 2: Check for motor structure]

This shows available motor structure with the servo amplifier. Please confirm that motor structure code is 00 (rotary motor).

motor structure code	Description
00	Rotary
01	Linear

* Factory setting of motor structure code is 00: Rotary.
* When motor structure code is 01, refer the section of linear motor in chapter 5.

[Step 3: Check for main power supply voltage]

This shows applicable input voltage (into R/S/T terminals of CNA or terminal block) with the servo amplifier. Please confirm that main power supply voltage code is match to your system.

Main power supply voltage code	Description
00	200V AC
01	100V AC
02	400V AC

[Step 4: Check for amplifier capacity]

This shows servo amplifier capacity of output current.
Please confirm that the amplifier capacity code is match to combined motor.

Amplifier capacity code	Description	Servo amplifier model number
0D	10A	RS3#01A####
0B	20A (for 100V, 200V AC) 25A (for 400V AC)	RS3#02A####
0A	30A	RS3#03A####
09	50A	RS3A05A####
08	75A	RS3A07A####
07	100A	RS3A10A####
06	150A	RS3A15A####
04	300A	RS3A30A####
03	600A	RS3W60A####
02	800A	RS3D80A####

[Step 5: Check for encoder type]

This shows the allowable encoder for the amplifier. Please confirm that combined motor encoder and external encoder you use are available.

Servo amplifier model number	Encoder type code	The motor encoder allowed by EN1	The external encoder allowed by EN2
RS3###A0##	00	Absolute encoder	N/A
RS3###A1##	01	Absolute encoder	Absolute encoder
RS3###A2##	02	Absolute encoder	Incremental encoder
RS3###A8##	08	Incremental encoder	N/A
RS3###AA##	0A	Incremental encoder	Incremental encoder

* In case of the code 02, incremental encoder is able to connect and use at EN2.

5.1.2 System parameters

System parameters decide basic specs and functions such as servo motor setting, selection of motor encoder, main power supply and control method.
See details of each parameter through page reference table below.

1) System parameter list

ID	Parameter name	Description	Page
01	Main circuit power input type	Selecting input spec of main circuit power.	5-12
02	Operation mode selection	Selecting mode of motor operation.	5-119
03	Regenerative resistor selection	Selecting regenerative resistor.	5-4, 5-12
04	Main power discharge selection	Selecting about electric discharge of main circuit power.	5-4, 5-12
07	Position control selection	Selecting position control method.	5-13
09	Motor parameter automatic set function selection	Selecting valid/invalid of motor parameter automatic set function.	5-7
0B	External regenerative resistor value	Setting external regenerative resistor value.	5-12
10	Motor encoder input selection	Selecting connector of motor encoder to use.	5-8, 5-10
11	EN1 encoder type	Selecting encoder type of EN1 connection.	5-8, 5-10
12	EN2 encoder type	Selecting encoder type of EN2 connection.	5-10
13	EN1 absolute encoder baud rate selection	Selecting communication speed of absolute encoder of EN1 connection.	5-8
14	Battery backup absolute encoder function selection	Selecting function of battery backup absolute encoder.	5-9
15	Absolute encoder resolution	Selecting resolution of absolute encoder.	5-9
16	Absolute encoder multi turn count	Selecting multi turn count of absolute encoder.	5-9
17	Incremental encoder resolution	Selecting resolution of incremental encoder.	5-10
0E	Motor structure selection	Selecting motor structure.	5-2
19	CS normalization method selection	Selecting CS position normalization method of linear motor.	Refer the chapter 5 of main manual.
1B	Z-phase CS normalization offset	Setting offset value from U-phase electric angle 0 [deg] to Z-phase signal output position, with electric angle conversion.	Refer the chapter 5 of main manual.
20	Position loop control, position loop encoder selection	Selecting encoder for position control.	Refer the chapter 9 of main manual.
22	External encoder resolution	Selecting resolution of external encoder.	Refer the chapter 9 of main manual.

* The item which is not applicable due to the servo amplifier model number you bought is not shown.
* For the parameter related to linear motor or full-closed control etc, refer the chapter 5 or 9.

2) Factory setting value
Part of system parameters at factory setting are different depending on product model number.

RS3 △ ##A □ # ◇ #

Input power voltage
A･･･200V AC
C･･･400V AC
D･･･Main circuit: 560 DC, control: 24V DC
E･･･100V AC
W･･･280V DC

Option 1
A･･･With regenerative resistor/ With DB reisitor
L･･･Without regenerative resistor/ With DB reisitor
M･･･Without regenerative resistor and DB reisitor

Encoder type

	EN1 (for motor encoder only)	EN2 (for motor encoder or external encoder)
0	Absolute encoder	―
1	Absolute encoder	Absolute encoder
2	Absolute encoder	Incremental encoder
8	Incremental encoder	―
A	Incremental encoder	Incremental encoder

* "#" will be any number or alphabet.

■ The system parameter shared to all model number
The system parameters shown in below table are shared to all model number

ID	Parameter name	Common item
02	Operation mode	00:Normal
07	Position control selection	00:Standard
10	Motor encoder input selection	00:EN1

■ Main circuit power input type
Set value of main circuit power input type depends on its voltage.

ID	Parameter name	Symbol at "△" part that shows input power voltage	
		A, C, D, W	E
01	Main circuit power input type	00:AC_3-phase	01:AC_Single-phase

■ Regenerative resistor selection
Set value of regenerative resistor selection depends on option 1.

ID	Parameter name	Symbol at "◇" part that shows option 1	
		A	L, M
03	Regenerative resistor selection	01:Built-in_R	00:Not_connect

■ Main circuit power electric discharge selection
Set value of main circuit power electric discharge selection depends on option 1.

ID	Parameter name	Symbol at "◇" part that shows option 1	
		A	L, M
04	Main circuit power electric discharge selection	01:Discharge	00:Not_Discharge

■ System parameter related to encoder
Set value of system parameter related to encoder depends on encoder type.

ID	Parameter name	Symbol at "□" part that shows encoder type				
		0	1	2	8	A
09	Motor parameter automatic set function selection	00:Enabled			-	
11	EN1 encoder type	11:PA_C-ABS			80:Pulse	
12	EN2 encoder type	-	22:EnDat _ABS	82:Pulse_ without_CS	-	82:Pulse_ without_CS
13	EN1 absolute encoder baud rate selection	02:2.5Mbps			-	
14	Battery backup absolute encoder function selection	00:Absolute_System			-	
15	Absolute encoder resolution	06:131,072_FMT			-	
16	Absolute encoder multi turn value	06:65,536_ROT			-	
17	Incremental encoder resolution	-		2,000	2,000	
20	Position loop control, position loop encoder selection	-	01:External_Enc		-	01:External_Enc
21	EN2 absolute encoder baud rate selection	-	01:2Mbps	-	-	-
22	External encoder resolution	-	-	2,000	-	2,000
26	External absolute encoder resolution	-	10,000	-	-	-

* "-" in table means "not applicable for the product", so these parameters don't show at the setup software and the digital operator.

5.1.3 Servo motor setting

Combination servo motor can set by three ways below.

- ◆ Connected servo motor set automatically at power on. (Motor automatic set)
- ◆ Setting by the digital operator for the servo motor in use.
- ◆ Setting by the setup software for the servo motor in use.

■ Servo motor setting availability

Allowable setting method differs like as below table depending on the specs of servo motor and motor encoder.
Please select applicable method for the product in use.

Servo motor	Motor encoder	Setting method	
		Motor automatic set	Setting by the setup software
Applicable motor	Absolute encoder	○	○
	Incremental encoder	×	○
Except above	Absolute encoder	×	○
	Incremental encoder	×	○

* ○: Available, ×: Not abailable
* For applicable motor, see next "Applicable motor list".
* Even if your servo motor or motor encoder is on the list, motor automatic set is disabled to some product by production date. In this case, please use the digital operator or the setup software to set the motor.

■ Applicable motor list

This is the list of servo motor model number and motor code that are able to set by the motor automatic set.

Combination servo amplifier	Servo motor model number	Motor code	Servo motor model number	Motor code	Servo motor model number	Motor code
RS3A01	R1AA04005F	057C	R1AA04010F	0533	R2AA04003F	0181
	R2AA04005F	0182	R2AA04010F	0183	R2AA06010F	0184
	R5AA06020H	049D	—	—	—	—
RS3A02	R1AA06020F	0579	R1AA06040F	0534	R2AA06020F	0185
	R2AA06040F	0186	R2AA06040H	0189	R2AA08020F	018A
	R2AA08040F	0188	R5AA06020F	049E	R5AA06040F	02BB
	R5AA06040H	049F	—	—	—	—
RS3A03	R1AA08075V	0576	R1AA10100H	0515	R1AA10150H	0512
	R2AA08075F	0187	R2AAB8100H	0194	R2AA10075F	019F
	R2AA13050D	018C	R2AA13050H	018F	R2AA13120B	0191
	R5AA08075D	02BA	R5AA08075F	04A0	—	—
RS3A05	R1AA08075F	0577	R1AA10100F	0516	R1AA10150F	04FA
	R1AA10200H	0513	R1AA10250H	0517	R2AAB8075F	01B1
	R2AAB8100F	0193	R2AA10100F	019E	R2AA10150H	011A
	R2AA13120D	018D	R2AA13120L	018E	R2AA13180H	01B6
	R2AA13200L	0192				
RS3A07	R1AA10200F	050F	R1AA10250F	0518	R1AA13300H	0511
	R2AA13180D	04FB	R2AA13200D	04FC	R2AA18350V	04FD
RS3A10	R1AA13300F	0508	R1AA13400H	0519	R1AA13500H	050E
	R2AA13180D	011B	R2AA13200D	0190	R2AA18350L	011C
RS3A15	R1AA13400F	051A	R1AA13500F	051B	R2AA18350D	011D
	R2AA18450H	011E	R2AA18550R	01B8	R2AA22500L	0195
	R2AA22700S	0484	—	—	—	—

5. Operations

Combination servo amplifier	Servo motor model number	Motor code	Servo motor model number	Motor code	Servo motor model number	Motor code
RS3A30	R1AA18550H	0109	R1AA18750L	010F	R1AA1811KR	010D
	R1AA1815KB	010E	R2AA18550H	011F	R2AA18750H	01B9
	R2AA1811KR	0120	R2AA2211KB	0483	R2AA2215KB	0117
RS3E01	R2EA04003F	0197	—	—	—	—
RS3E02	R1EA04005F	0581	R1EA04010F	0582	R2EA04005F	0198
	R2EA04008F	019D	R2EA06010F	019A	—	—
RS3E03	R1EA06020F	057B	R2EA06020F	019B	—	—
RS3C02	R1CA10150V	04BC	R2CA10075F	04EC	R2CA13050D	012D
	R2CA13120R	012F	R2CA13180H	0130	R2CA13200L	0133
RS3C05	R1CA10200V	04BD	R1CA13300V	04E7	R2CA10100F	04ED
	R2CA13120F	012E	R2CA13180D	0521	R2CA13200H	0135
	R2CA18350L	051E	—	—	—	—
RS3C10	R2CA18350D	013C	R2CA18450H	0138	R2CA18550R	0522
RS3C15	R1CA18550H	053F	R1CA18750L	0540	R1CA1811KR	0561
	R1CA1815KB	0562	R2CA18550H	053C	R2CA18750H	013F
	R2CA2211KB	04E4	R2CA2215KV	0140	—	—
RS3C30	R1CA2220KV	056D	R2CA2220KV	056E	R2CA2830KV	056A
RS3D80	R2CA3255KB	056B	—	—	—	—
RS3W60	R1AA2220KV	010B	R2AA2220KB	0481	R2AA2830KV	0499

1) How to use motor automatic set function

[Step 1: Connecting motor encoder]

Connect the motor encoder to servo amplifier, and then turn control power on.

[Step 2: Enabling the motor parameter automatic set function]

Check the system parameter ID09 through the setup software or the digital operator that is set to "00: Enabled" or not.

- Go Step 3, if "00: Enabled" is set to the system parameter ID09.
- If "01: Disabled" is set, change to "00: Enabled", and then power-cycle and go Step 3.

Group	ID	Name	Value	Description
System	09	Motor parameter automatic set function selection	00:Enabled	Motor automatic set function is available.

[Step 3: Checking alarm]

Check alarm of AL.EE(Motor Parameter Automatic Setting Error 1) and AL.EF(Motor Parameter Automatic Setting Error 2).
If these alarms are there, please follow the way below.

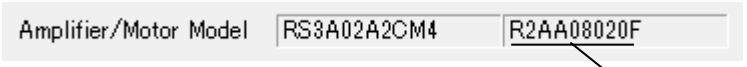
Alarm	Reason	Motor setting method
Motor Parameter Automatic Setting Error 1 (AL.EE)	Connected servo motor does not support to motor automatic set function.	Setting by the digital operator or the setup software.
Motor Parameter Automatic Setting Error 2 (AL.EF)	The servo amplifier does not support connected servo motor.	Setting by the setup software.
	Wrong combination of servo amplifier and servo motor.	Confirm model number of servo amplifier and servo motor, and then correct a combination.

[Step 4: Rechecking the motor set by automatic set]

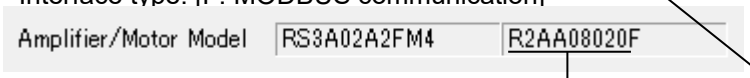
Double check the motor through the setup software or the digital operator.

■ Check through the setup software
Decided motor model number is shown in upper of each function window.

Interface type: [C: I/O]



Interface type: [F: MODBUS communication]



Decided motor model number

* See another manual: M0010842 for the setup software operation.

5.1.4 Motor encoder setting

The motor encoder that will be used is set. Available encoder differs by encoder type of the servo amplifier. Please set the system parameter concerned with motor encoder by following table reference below.

Target motor encoder	Applicable encoder type by servo amplifier model number				Reference
	RS3xxxx0xxx	RS3xxxx2xxx	RS3xxxx8xxx	RS3xxxxAxxx	
Absolute encoder	○	○	×	×	1)
Incremental encoder	×	○	○	○	2)

* ○: Combination available, ×: Combination not available

1) Absolute encoder (Applicable amplifier model number: RS3xxxx0xxx, RS3xxxx2xxx)

■ Motor encoder connector selection
Select the connector for connecting motor encoder. Must set "00: EN1".

Group	ID	Selection		Description
System	10	00	EN1	Uses EN1 for connecting motor encoder.
		01	EN2	Uses EN2 for connecting motor encoder.

* RS3xxxx0xxx allows "00:EN1" only.

■ EN1 encoder type
Select the encoder type that will be connected to EN1.
Please select absolute encoder type that will be used.

Group	ID	Selection		Description
System	11	10	PA S-ABS	Single-turn absolute encoder (Encoder code: H)
		11	PA C-ABS	Battery backup absolute encoder (Encoder code: P)
		12	RA C-ABS	Battery-less absolute encoder (Encoder code: R, W)

* It will be set automatically if motor automatic set function is effective.

■ EN1 absolute encoder baud rate selection
Select the baud rate of absolute encoder that will be used.

Group	ID	Selection		Description
System	13	02	2.5Mbps	2.5Mbps
		03	4Mbps	4Mbps

* It will be set automatically if motor automatic set function is effective.

■ Battery backup absolute encoder function selection
Select a use of battery backup absolute encoder as an absolute system with multi turn value or as an incremental system without multi turn value.
- ◆ Must connect battery if use as an absolute system.
- ◆ Battery is not necessary if use as an incremental system. As note, multi turn value does not back up.

Group	ID	Selection		Description
System	14	00	Absolute_System	Use as absolute system
		01	Incremental_System	Use as incremental system

■ Absolute encoder resolution
Select the resolution of single turn of motor.

Group	ID	Selection		Description	Selection		Description
System	15	00	2048_FMT	2048 division	07	262144_FMT	262144 division
		01	4096_FMT	4096 division	08	524288_FMT	524288 division
		02	8192_FMT	8192 division	09	1048576_FMT	1048576 division
		03	16384_FMT	16384 division	0A	2097152_FMT	2097152 division
		04	32768_FMT	32768 division	0B	4194304_FMT	4194304 division
		05	65536_FMT	65536 division	0C	8388608_FMT	8388608 division
		06	131072_FMT	131072 division			

* It will be set automatically if motor automatic set function is effective.
* For a positioning function built-in servo amplifier, 131072_FMT (17bit) absolute encoder must be used.

■ Absolute encoder multi turn value
Select the multi turn value of absolute encoder.

Group	ID	Selection		Description	Selection		Description
System	16	00	1_ROT	1 turn	07	131072_ROT	131072 turns
		01	2048_ROT	2048 turns	08	262144_ROT	262144 turns
		02	4096_ROT	4096 turns	09	524288_ROT	524288 turns
		03	8192_ROT	8192 turns	0A	1048576_ROT	1048576 turns
		04	16384_ROT	16384 turns	0B	2097152_ROT	2097152 turns
		05	32768_ROT	32768 turns	0C	4194304_ROT	4194304 turns
		06	65536_ROT	65536 turns			

* It will be set automatically if motor automatic set function is effective.

2) Incremental encoder
(Applicable amplifier model number: RS3xxxx2xxx, RS3xxxx8xxx, RS3xxxxAxxx)

■ Motor encoder connector selection
Select the connector for connecting motor encoder. Must set "00: EN1".
- ◆ Select "01:EN2" if "RS3xxxx2xxx" is used.
- ◆ Select "00:EN1" if "RS3xxxx8xxx or RS3xxxxAxxx" is used.

Group	ID	Selection		Description
System	10	00	EN1	Uses EN1 for connecting motor encoder.
		01	EN2	Uses EN2 for connecting motor encoder.

* RS3xxxx8xxx and RS3xxxxAxxx allow "00:EN1" only.

■ EN1 encoder type
Select the encoder type that will be connected to EN1.
Please select incremental encoder type that will be used.
- ◆ For RS3xxxx2xxx, select encoder type at "EN2 encoder type".
- ◆ For RS3xxxx8xxx and RS3xxxxAxxx, select encoder type at this parameter.

Group	ID	Selection		Description
System	11	80	Pulse	Wire-saving incremental encoder
		81	Pulse_with_CS	Incremental encoder with CS
		82	Pulse_without_CS	Incremental encoder (without CS)

■ EN2 encoder type
Select the encoder type that will be connected to EN2.
Please select incremental encoder type that will be used.
- ◆ For RS3xxxx2xxx, select encoder type at this parameter.
- ◆ For RS3xxxx8xxx and RS3xxxxAxxx, this parameter is not shown because it is not necessary.

Group	ID	Selection		Description
System	12	80	Pulse	Wire-saving incremental encoder
		82	Pulse_without_CS	Incremental encoder (without CS)

■ Incremental encoder resolution
Set the motor encoder resolution that will be used. Please set one-multiplied value.

Group	ID	Setting range	Unit
System	17	500 to 65,535 (one-multiplied)	P/R

3) System parameters setting list related to motor encoder due to encoder types each

ID	System paramer	Motor model number			
		RxxxxxxxxxxHxx	RxxxxxxxxxxPxx	RxxxxxxxxxxRxx	RxxxxxxxxxxSxx
10	Motor encoder input selection	00: EN1	00: EN1	00: EN1	00: EN1 or 01: EN2 Note 1)
11	EN1 encoder type	10: PA S-ABS	11: PA C-ABS	12: RA C-ABS	80: Pulse Note 2)
12	EN2 encoder type	Setting is just required for full-closed system use.			80:Pulse Note 2) Note 3)
13	EN1 absolute encoder baud rate selection	Set according to encoder spec in use.			Setting not required
14	Battery backup absolute encoder function selection	01: Incremental_ System	00: Absolute_ System or 01: Incremental_ System Note 4)	00: Absolute_ System or 01: Incremental_ System Note 4)	Setting not required
15	Absolute encoder resolution	Set according to encoder spec in use.			Setting not required
16	Absolute encoder multi turn count	Set according to encoder spec in use.			Setting not required
17	Incremental encoder resolution	Setting not required			Set according to encoder spec in use.

Note 1) Motor encoder input connector is able to select from EN1 or EN2 when servo amplifier model number is RS3□□□A2□□□ (eighth digit from left is "2").
Set "00:EN1" for a use of absolute encoder, "01:EN2" for a use of incremental encoder.

Note 2) Set "80:Pulse" to "EN1 encoder type" when servo amplifier model number is RS3□□□A8□□□ (eighth digit from left is "8").
Set "80:Pulse" to "EN2 encoder type", when servo amplifier model number is RS3□□□A2□□□ (eighth digit from left is "2") and "01:EN1" is set to the motor encoder input selection.

Note 3) It is not shown because the setting is not required when servo amplifier model number is RS3□□□A8□□□ (eighth digit from left is "8" or "A").

Note 4) For a use of battery backup absolute encoder as incremental system without multi-turn data, select "01:Incremental_System". In this case, battery connection is not required.

4) Homing function setting for absolute encoder
For a positioning function built-in servo amplifier, setting of GroupA ID74 as below table is necessary.

ID	Positioning function parameter	Motor model number			
		RxxxxxxxxxxHxx	RxxxxxxxxxxPxx	RxxxxxxxxxxRxx	RxxxxxxxxxxSxx
74	Homing function of absolute encoder Note 5)	It cannot use as Absolute_System	Set 00 if Absolute_System selected	Set 00 if Absolute_System selected	Setting not required
		Set 01 if Incremental_ System selected	Set 01 if Incremental_ System selected	Set 01 if Incremental_ System selected	

Note 5) To use absolute encoder as Incremental_System, homing function must be enabled. Set 01 to SW2_bit4.

5.1.5 Main circuit power setting

Set the parameters about main circuit power.

■ Main circuit power input type selection
Set the type of power that will connect to main circuit power terminal (R/S/T of CNA or terminal block) of servo amplifier.
- ◆ For 200VAC, please select the type by power spec that will be used.
- ◆ For 100VAC, please select "01:AC_Single_phase".

Group	ID	Selection		Description
System	01	00	AC_3-phase	3-phase AC power is supplied to the main circuit.
		01	AC_Single-phase	Single-phase AC power is supplied to the main circuit.

* For single-phase 200VAC power, AL.63 (Main Power Supply phase loss) will occur if "00:AC_3-phase" is selected. So, must select "01:AC_Single-phase".

■ Main power discharge selection
When cutting off the main power supply, select whether discharging or not a energy of DC bus capacitor through regenerative resistor.

Group	ID	Selection		Description
System	04	00	Not_Discharge	No discharge.
		01	Discharge	Will discharge.

* When regenerative resistor is not connected, discharge will be not occur even if "01:Discharge" is selected.
* When cut off the control power, discharge will be occur even if "00:Not_Discharge" is selected.

5.1.6 Regenerative resistor setting

Sets about a regenerative resistor.

■ Regenerative resistor selection
Select the regenerative resistor that will connect to the terminal (RB1/RB2 of CNA or terminal block) of servo amplifier.

Group	ID	Selection		Description
System	03	00	Not_Connect	No regenerative resistor connection.
		01	Built-in_R	Using internal regenerative resistor.
		02	External_R	Using external regenerative resistor.

■ External regenerative resistor value

Group	ID	Setting range	Unit
System	0B	1.0 to 100.0	ohm

* The value of regenerative resistor shall be set when selecting "02: External R (use external regenerative resistor)". This setting will invalid when selecting except "02: External R (use external regenerative resistor)".

* Accurate value is not able to calculate in the average power monitor, if wrong value is set to regenerative resistor.

5.1.7 Control method selection

Set the basic control method to use.

■ Control cycle
This servo amplifier cannot select control cycle.
It will be fixed to "00:Standard_Sampling".

■ Control mode selection
This servo amplifier cannot select control mode.
It will be fixed to "02:Position ".

■ Position control selection
Select the type of position control.

Group	ID	Selection		Type
System	07	00	Standard	Standard position control
		01	Model1	Model-following control
		02	Model2	Model-following vibration suppression control
		03	Model3	Model-following / standard position control switching
		04	Model4	Model-following vibration suppression / standard position control switching

5.1.8 Positioning function parameter setting

For a positioning function built-in servo amplifier, the setting related to positioning function parameter is necessary.
Set with referring the chapter 3 Positioning function parameters.

5.2 Test operation

For a positioning function built-in servo amplifier, refer the chapter 6 Supporting function and test operation.

5. Operation

5.3 Servo amplifier status display

5.3.1 Normal display

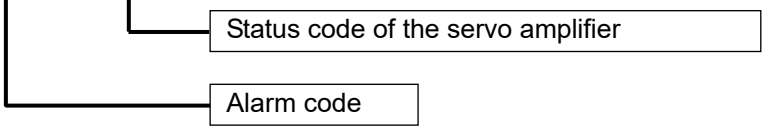
Marking	Description	Status code
	Control power supply established. Control power supply (r, t) is established and amplifier (RDY) is on.	1
	Main circuit power supply established. Main power supply (R, S and T) is established, but operation preparation completion signal is off.	2
	Safe torque off working status. Main circuit power supply (R, S and T) is established and either safe torque off input 1 or 2 is “off”. “ --> --> ” are shown sequentially.	2
	Operation setup is completed. Main power supply (R, S and T) is established and operation setup completion signal is on.	3
	Servo is on. Continue drawing of character "8", sequentially.	4

* See "7.4.3 Warning status display" about display of warning status.

5.3.2 Alarm display

When an alarm occurs, the display shows the alarm code and the status code of the Servo amplifier.

Marking	Description
	When an alarm occurs, take corrective actions as instructed in "8. Maintenance".

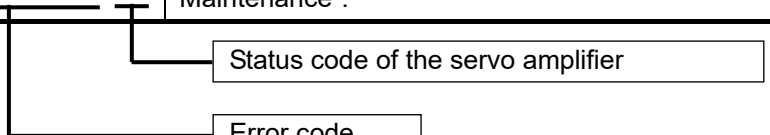


Code	Status	
1	Power OFF status	(P-OFF)
2	Power ON status	(P-ON)
3	Servo ready status	(S-RDY)
4	Servo ON status	(S-ON)
5	Servo OFF and stop status	(S-OFF)
6	Emergency stop status	(EMR)
F	Initial status	

5.3.3 Error display

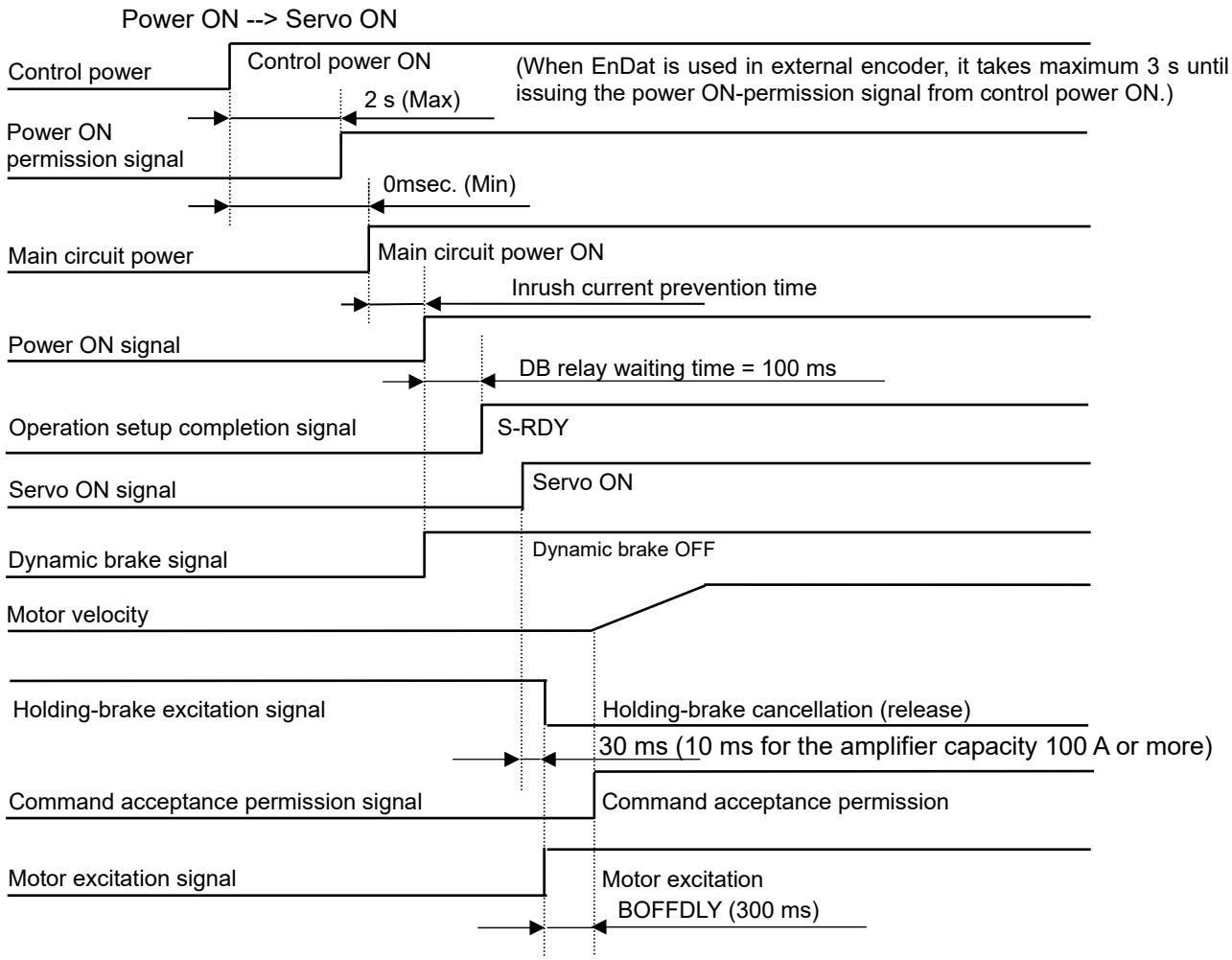
When an error occurs, the display shows the error code and the status code of the Servo amplifier.

Marking	Description
	When an error occurs, take corrective actions as instructed in "8. Maintenance".



5.4 Operation sequence

5.4.1 The operation sequence with factory setting from "turn power on" to "turn power off"



* Turn on power to an external encoder at same time or before of a servo amplifier control power.
* The frequency of the power ON/OFF of the servo amplifier shall be 5 times/hour or less and 30 times/day or less. Please set 10 minutes or more to power ON/OFF interval.
* See below for inrush current suppression time and servo amplifier capacity.

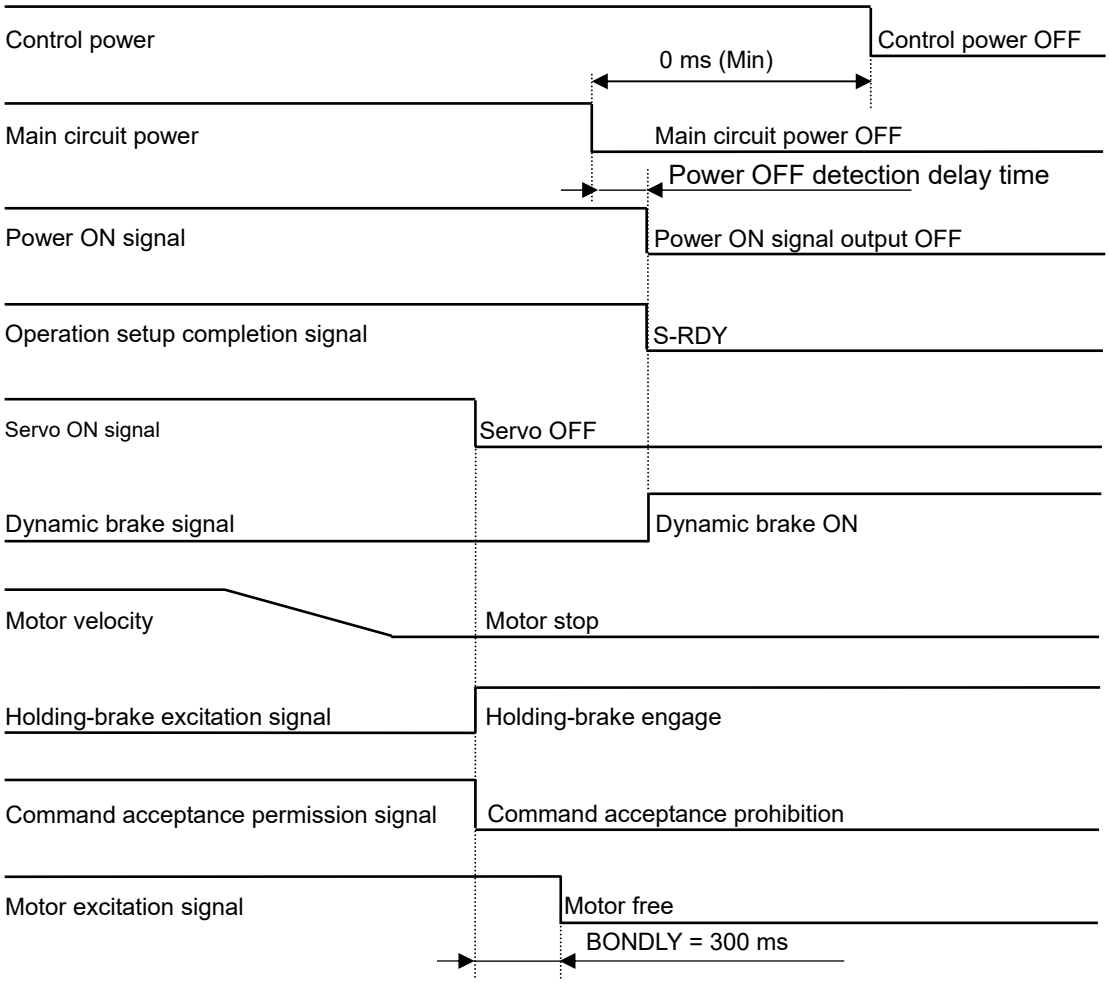
■ 200 VAC input model

Servo amplifier capacity	Inrush current suppression time	
	3-phase	Single-phase
RS3A01#	900 [ms]	1800 [ms]
RS3A02#	900 [ms]	1800 [ms]
RS3A03#	900 [ms]	1800 [ms]
RS3A05#	900 [ms]	1800 [ms]
RS3A07#	1200 [ms]	---
RS3A10#	1200 [ms]	---
RS3A15#	1200 [ms]	---
RS3A30#	1200 [ms]	---

■ 100 VAC input model

Servo amplifier capacity	Inrush current suppression time
RS3E01#	900 [ms]
RS3E02#	900 [ms]
RS3E03#	900 [ms]

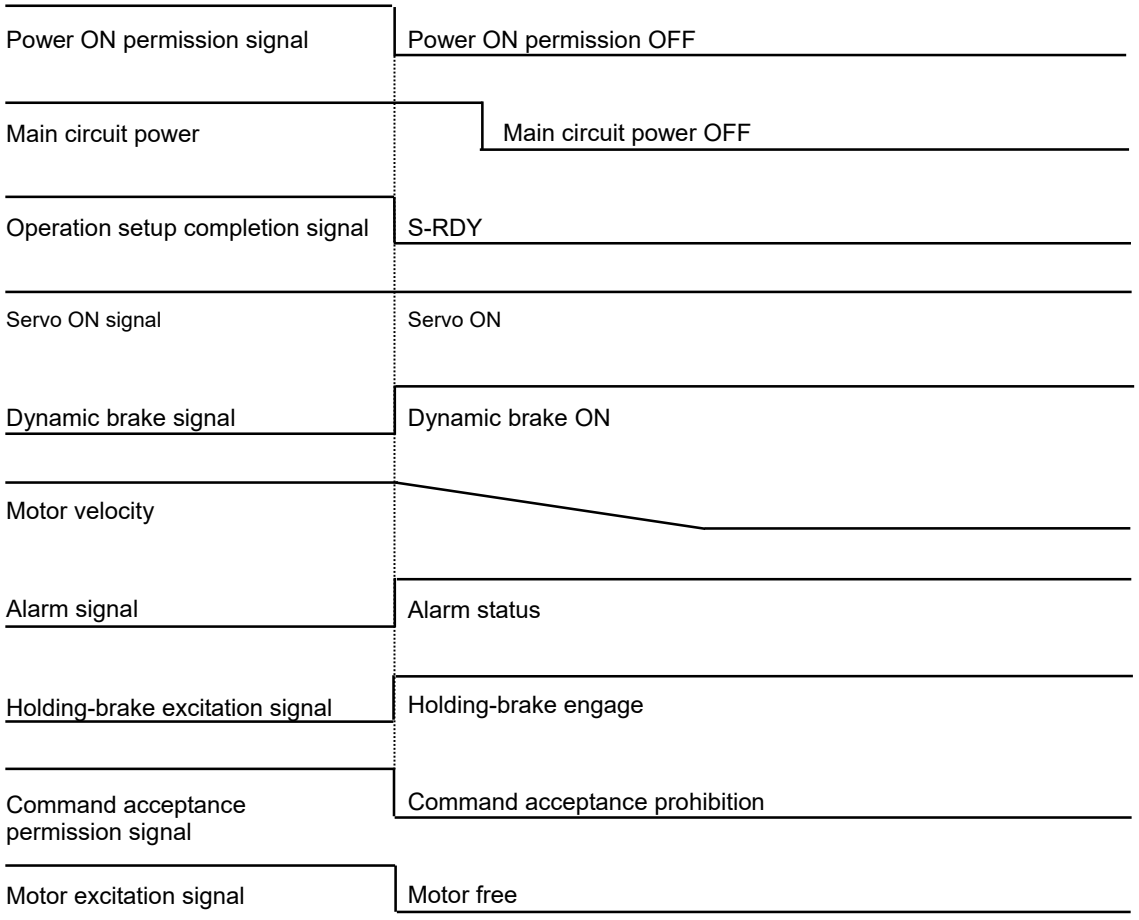
Servo OFF --> Power OFF



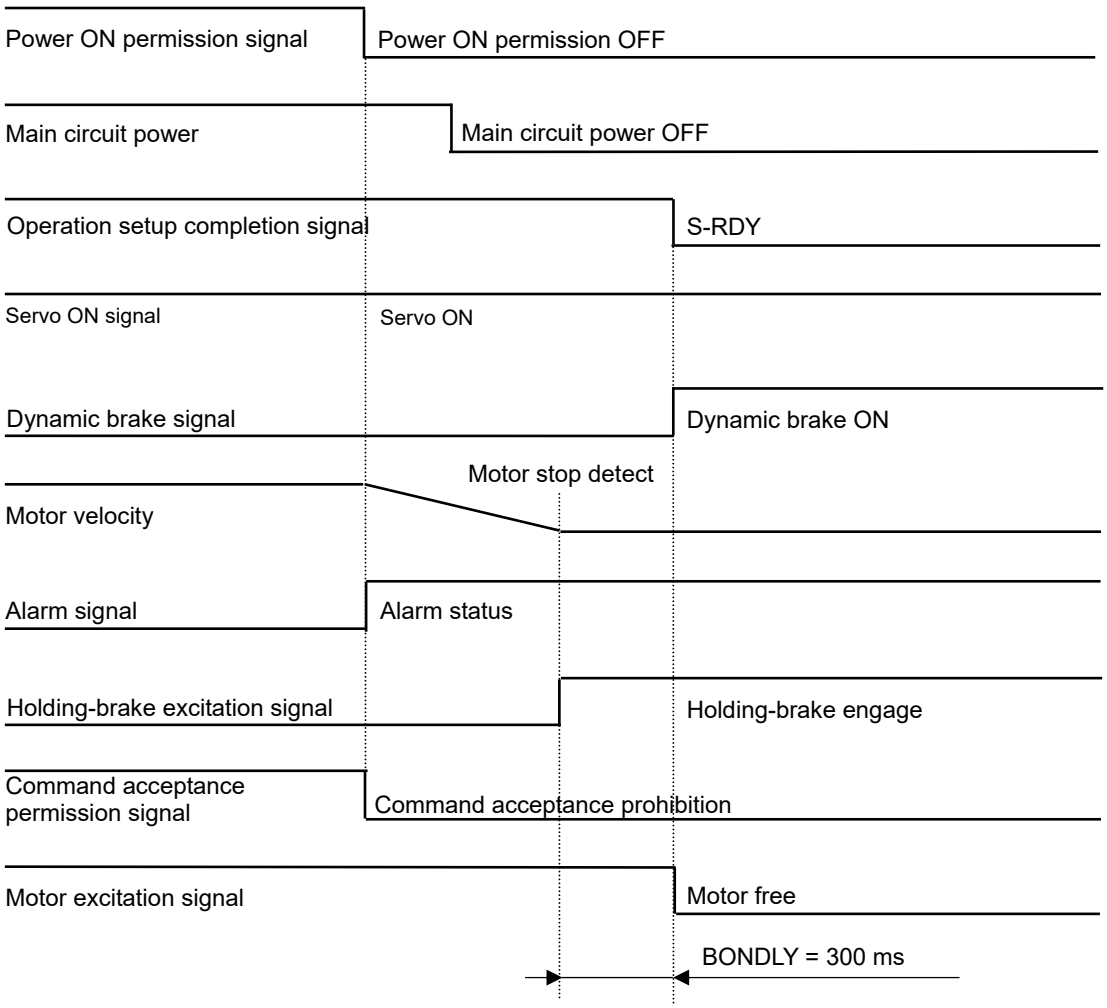
5.4.2 Stop sequence at alarm

When an alarm occurs, the servo motor is stopped by either dynamic brake or servo brake. Which brake is to be used is depending on alarm. See "8.2 List of warning and alarm".

Stop by dynamic brake at alarm



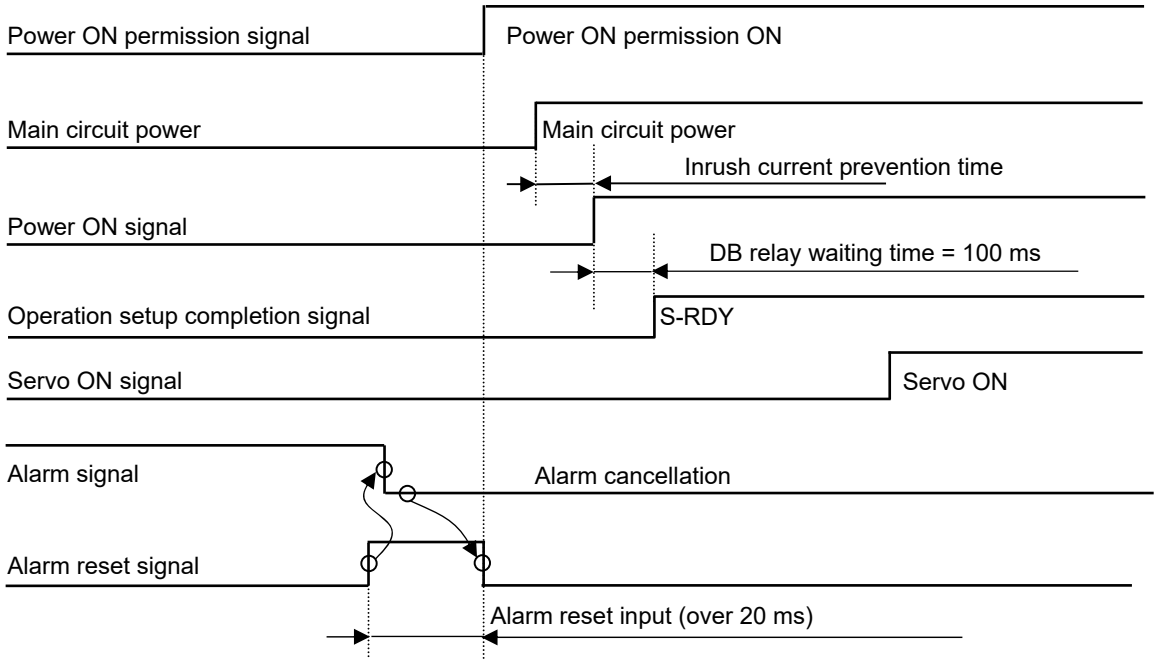
Stop by servo brake at alarm



* The above sequence is the one when protective circuit is installed. Install a protective circuit seeing the chapter 4.

5.4.3 Sequence of alarm reset

Inputting alarm reset signal from general input signal can reset alarms.

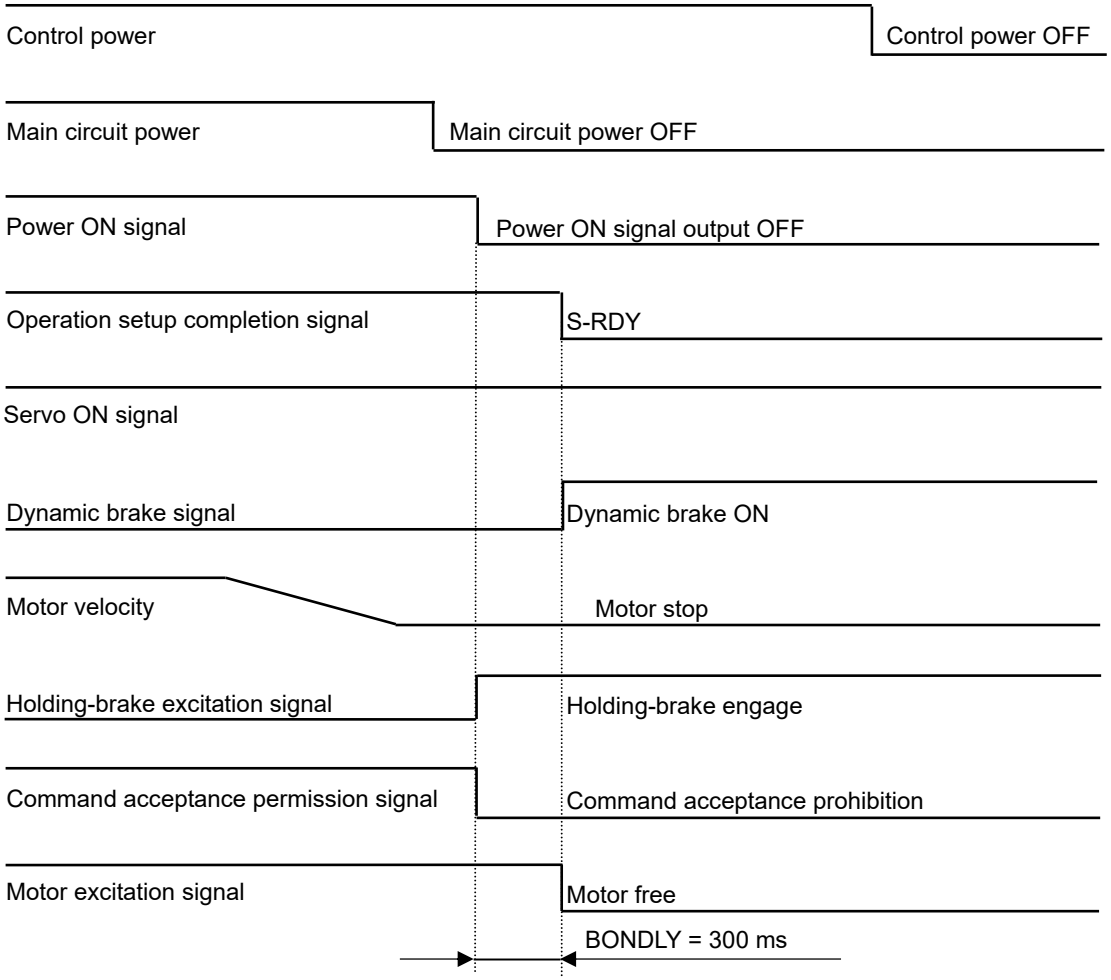


* Some alarms cannot be reset unless the power is reset (control power is turned OFF and ON again), or encoder is cleared.
See "8.2 List of warning and alarm".

* Turn the alarm reset signal off after checking if the alarm signal is cleared. The alarm signal cannot be cleared when the alarm condition is continued, therefore, set a timeout period of 20ms or more to clear “alarm reset signal”.
Also, it is necessary to input the time of 20 ms or more when the alarm reset signal is input without checking for the alarm signal output.

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

Stop by servo brake



* This is the sequence when "00: SERVO-BRAKE" is selected at GroupB ID02 "Emergency Stop Operation".

5.5 Monitor function

5.5.1 Monitor list

ID	Symbol	Name		Unit
00	STATUS	Servo amplifier status monitor		---
01	WARNING1	Warning status 1 monitor		---
02	WARNING2	Warning status 2 monitor		---
03	WARNING3	Warning status 3 monitor		---
04	WARNING4	Warning status 4 monitor		---
05	CONT8-1	General Purpose Input CONT7 to 1 monitor		---
06	OUT8-1	General Purpose Output OUT2 to 1 monitor		---
07	INC-E MON	Incremental encoder signal monitor		---
10	APMON	Present position monitor (Motor encoder)	Digital operator: Displays upper data	$\times 2^{32}$ Pulse
11			Digital operator: Displays lower data	Pulse
12	CPMON	Command position monitor	Digital operator: Displays upper data	$\times 2^{32}$ Pulse
13			Digital operator: Displays lower data	Pulse
14	PMON	Position deviation monitor		Pulse
15	VMON	Velocity monitor		min^{-1}
16	VCMON	Velocity command monitor		min^{-1}
17	TMON	Torque monitor		%
18	TCMON	Torque command monitor		%
19	ACCMON	Acceleration monitor		rad/s^2
1A	MTLMON-EST	Load Torque monitor (Estimate value)		%
33	ABSPS	Absolute encoder PS data monitor	Digital operator: Displays upper data	$\times 2^{32}$ Pulse
34			Digital operator: Displays lower data	Pulse
35	MMOENCF	Motor Encoder frequency monitor		kPulse/s
36	CSU	U-phase electric angle monitor		degree
40	RegP	Regenerative resistor operation percentage monitor		%
41	TRMS	Effective torque monitor		%
42	ETRMS	Effective torque monitor (Estimated value)		%
44	VBUS	Vbus monitor		V
45	ENTMP	Encoder temperature monitor		degreeC
46	MATEMP	Amplifier temperature monitor		degreeC
47	RUNTIM	Amplifier Operation Time		h:mm:ss.ms
4A	MAVEPOW1	Average electric power monitor		W
4C	RegPOW	Regenerative power monitor		W
50	JRAT MON	Load Inertia Moment Ratio monitor		%
51	MKP MON	Model Control Gain monitor		1/s
52	KP MON	Position Loop Proportional Gain monitor		1/s
53	TPI MON	Position Loop Integral Time Constant monitor		ms
54	KVP MON	Velocity Loop Proportional Gain monitor		Hz
55	TVI MON	Velocity Loop Integral Time Constant monitor		ms
56	TCFIL MON	Torque Command Filter monitor		Hz
57	ADNFD MON	Frequency monitor D for adaptive notch filter		Hz
58	ADNFE MON	Frequency monitor E for adaptive notch filter		Hz
61	EX-APMON	Present position monitor (External encoder)	Digital operator: Displays upper data	$\times 2^{32}$ Pulse
62			Digital operator: Displays lower data	Pulse
63	EX-ABSPS	External absolute encoder PS data monitor	Digital operator: Displays upper data	$\times 2^{32}$ Pulse
64			Digital operator: Displays lower data	Pulse
65	MEXENCF	Ext. Encoder frequency monitor		kPulse/s
67	PDEVID	Position deviation difference monitor		Pulse
70	RSRLYLF	Remaining life of relay for an inrush current prevention		%
71	DBRLYLF	Remaining life of relay for a dynamic brake		%
73	MOTE-ERRAT	Error rate of motor encoder communication		---
74	EXTE-ERRAT	Error rate of external encoder communication		---
77	HBLF	Remaining life of a holding brake		%

* The item which is not applicable due to the servo amplifier model number you bought is not shown.

5.5.2 Descriptions of each monitor

<table>
<tr><th>ID</th><th>Description</th></tr>
<tr><td>00</td><td>Servo amplifier status monitor [STATUS]
<table>
<tr><th>Code</th><th colspan="2">Status</th></tr>
<tr><td>1</td><td>Power OFF state</td><td>(P-OFF)</td></tr>
<tr><td>2</td><td>Power ON state</td><td>(P-ON)</td></tr>
<tr><td>3</td><td>Servo ready state</td><td>(S-RDY)</td></tr>
<tr><td>4</td><td>Servo ON state</td><td>(S-ON)</td></tr>
<tr><td>5</td><td>Servo OFF and stop status</td><td>(S-OFF)</td></tr>
<tr><td>6</td><td>Emergency stop state</td><td>(EMR)</td></tr>
<tr><td>11</td><td>Alarm and power OFF state</td><td>(ALARM_P-OFF)</td></tr>
<tr><td>12</td><td>Alarm and power ON state</td><td>(ALARM_P-ON)</td></tr>
<tr><td>16</td><td>Alarm and emergency stop state</td><td>(ALARM_EMR)</td></tr>
<tr><td>22</td><td>Gate off and power-on state</td><td>(GATE OFF_P-ON)</td></tr>
</table></td></tr>
<tr><td>01</td><td>Warning status 1 monitor [WARNING1]
■ Displays warning status. "1" or "ON" shows that the warning is active.
<table>
<tr><th>Bit</th><th>3</th><th>2</th><th>1</th><th>0</th></tr>
<tr><td>Function</td><td>Regenerative overload</td><td>Overload</td><td>---</td><td>Servo amplifier temperature</td></tr>
</table>
<table>
<tr><th>Bit</th><th>7</th><th>6</th><th>5</th><th>4</th></tr>
<tr><td>Function</td><td>Excessive deviation</td><td>Control power decrease</td><td>Velocity command under limit</td><td>Torque command under limit</td></tr>
</table></td></tr>
<tr><td>02</td><td>Warning status 2 monitor [WARNING2]
■ Displays warning status. "1" or "ON" shows that the warning is active.
<table>
<tr><th>Bit</th><th>3</th><th>2</th><th>1</th><th>0</th></tr>
<tr><td>Function</td><td>---</td><td>---</td><td>---</td><td>Main circuit power being charged</td></tr>
</table>
<table>
<tr><th>Bit</th><th>7</th><th>6</th><th>5</th><th>4</th></tr>
<tr><td>Function</td><td>---</td><td>Absolute encoder warning</td><td>---</td><td>---</td></tr>
</table></td></tr>
<tr><td>03</td><td>Warning status 3 monitor [WARNING3]
■ Displays warning status. "1" or "ON" shows that the warning is active.
<table>
<tr><th>Bit</th><th>3</th><th>2</th><th>1</th><th>0</th></tr>
<tr><td>Function</td><td>---</td><td>---</td><td>---</td><td>---</td></tr>
</table>
<table>
<tr><th>Bit</th><th>7</th><th>6</th><th>5</th><th>4</th></tr>
<tr><td>Function</td><td>---</td><td>---</td><td>External encoder warning</td><td>---</td></tr>
</table></td></tr>
<tr><td>04</td><td>Warning status 4 monitor [WARNING4]
■ Displays warning status. "1" or "ON" shows that the warning is active.
<table>
<tr><th>Bit</th><th>3</th><th>2</th><th>1</th><th>0</th></tr>
<tr><td>Function</td><td>---</td><td>---</td><td>---</td><td>---</td></tr>
</table>
<table>
<tr><th>Bit</th><th>7</th><th>6</th><th>5</th><th>4</th></tr>
<tr><td>Function</td><td>---</td><td>---</td><td>---</td><td>---</td></tr>
</table></td></tr>
</table>

<table>
<tr><th>ID</th><th>Description</th></tr>
<tr><td>05</td><td>
General input CONT8 to 1 monitor [CONT8-1]
■ Displays generic input terminal status. It will be in a photo coupler excitation state by "1" or "ON".
<table>
<tr><td>Bit</td><td>3</td><td>2</td><td>1</td><td>0</td></tr>
<tr><td>Function</td><td>CONT4</td><td>CONT3</td><td>CONT2</td><td>CONT1</td></tr>
</table>
<table>
<tr><td>Bit</td><td>7</td><td>6</td><td>5</td><td>4</td></tr>
<tr><td>Function</td><td>---</td><td>CONT7</td><td>CONT6</td><td>CONT5</td></tr>
</table>
* Shown with interface type [F: MODBUS] only. Not shown with [C: I/O].
</td></tr>
<tr><td>06</td><td>
General output OUT8 to 1 monitor [OUT8-1]
■ Displays generic output terminal status. It will be in a photo coupler excitation state by "1" or "ON".
<table>
<tr><td>Bit</td><td>3</td><td>2</td><td>1</td><td>0</td></tr>
<tr><td>Function</td><td>---</td><td>---</td><td>OUT2</td><td>OUT1</td></tr>
</table>
<table>
<tr><td>Bit</td><td>7</td><td>6</td><td>5</td><td>4</td></tr>
<tr><td>Function</td><td>---</td><td>---</td><td>---</td><td>---</td></tr>
</table>
* Shown with interface type [F: MODBUS] only. Not shown with [C: I/O].
</td></tr>
<tr><td>07</td><td>
Incremental encoder signal monitor [INC-E MON]
■ Displays incremental encoder signal status. "1" or "ON" shows an incoming signal level “H” state.
<table>
<tr><td>Bit</td><td>3</td><td>2</td><td>1</td><td>0</td></tr>
<tr><td>Function</td><td>---</td><td>EN1 encoder Z-phase signal</td><td>EN1 encoder B-phase signal</td><td>EN1 encoder A-phase signal</td></tr>
</table>
<table>
<tr><td>Bit</td><td>7</td><td>6</td><td>5</td><td>4</td></tr>
<tr><td>Function</td><td>---</td><td>EN2 encoder Z-phase signal</td><td>EN2 encoder B-phase signal</td><td>EN2 encoder A-phase signal</td></tr>
</table>
</td></tr>
</table>

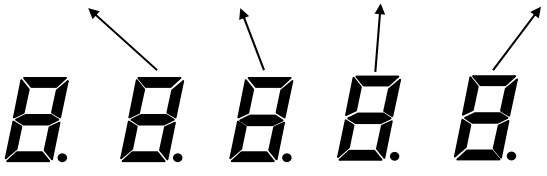
See tables below because display format of ID01 to 07 is different at the setup software and the digital operator.

■ Display of the setup software

Bit	7	6	5	4	3	2	1	0
0 or 1	0/1	0/1	0/1	0/1	0/1	0/1	0/1	0/1

■ Display of the Digital operator

Bit	7	6	5	4	3	2	1	0
ON								
OFF								
-	LED4		LED3		LED2		LED1	



Digital operator at the front of servo amplifier

<table>
<tr><th>ID</th><th>Description</th></tr>
<tr><td>10
11</td><td>
Actual position monitor (Motor encoder) [APMON]
■ Displays the current position of the motor encoder that has the origin as the position at the time the control power was turned ON.
As this is a free run counter, if the current position exceeds the displayed range, the maximum reverse polarity value will be displayed.
◆ Setup software displays the data to ID10.
<table>
<tr><th>Display range</th><th>Unit</th></tr>
<tr><td>-9223372036854775808 to 9223372036854775807</td><td>Pulse</td></tr>
</table>
◆ Digital operator displays the data to ID10, ID11 by hexadecimal notation (32-bit data).
<table>
<tr><th>ID</th><th>Data range</th><th>Display range</th><th>Unit</th></tr>
<tr><td>10</td><td>Bit63 to Bit32</td><td>H.8000 L.0000 to H.7FFF L.FFFF</td><td>×2^{32} Pulse</td></tr>
<tr><td>11</td><td>Bit31 to Bit0</td><td>H.0000 L.0000 to H.FFFF L.FFFF</td><td>Pulse</td></tr>
</table>
</td></tr>
<tr><td>12
13</td><td>
Command position monitor [CPMON]
■ Displays the current position of the pulse command that has the origin as the position at the time the control power was turned ON.
As this is a free run counter, if the current position exceeds the displayed range, the maximum reverse polarity value will be displayed.
◆ Setup software displays the data to ID12.
<table>
<tr><th>Display range</th><th>Unit</th></tr>
<tr><td>-9223372036854775808 to 9223372036854775807</td><td>Pulse</td></tr>
</table>
◆ Digital operator displays the data to ID12, ID13 by hexadecimal notation (32-bit data).
<table>
<tr><th>ID</th><th>Data range</th><th>Display range</th><th>Unit</th></tr>
<tr><td>12</td><td>Bit63 to Bit32</td><td>H.8000 L.0000 to H.7FFF L.FFFF</td><td>×2^{32} Pulse</td></tr>
<tr><td>13</td><td>Bit31 to Bit0</td><td>H.0000 L.0000 to H.FFFF L.FFFF</td><td>Pulse</td></tr>
</table>
</td></tr>
<tr><td>14</td><td>
Position deviation monitor [PMON]
■ Displays the position deviation value.
◆ Setup software displays values in decimal notation.
<table>
<tr><th>Display range</th><th>Unit</th></tr>
<tr><td>-2147483648 to 2147483647</td><td>Pulse</td></tr>
</table>
◆ Digital operator displays values in hexadecimal notation.
<table>
<tr><th>ID</th><th>Data range</th><th>Display range</th><th>Unit</th></tr>
<tr><td>14</td><td>Bit31 to Bit0</td><td>H.8000 L.0000 to H.7FFF L.FFFF</td><td>Pulse</td></tr>
</table>
</td></tr>
</table>

<table>
<tr><th>ID</th><th>Description</th></tr>
<tr><td>15</td><td>
Velocity monitor [VMON]
■ Displays the rotation speed of the servo motor.
◆ Setup software displays values in decimal notation.
<table>
<tr><th>Display range</th><th>Unit</th></tr>
<tr><td>-2147483648 to 2147483647</td><td>min^{-1}</td></tr>
</table>
◆ Digital operator displays values in hexadecimal notation.
<table>
<tr><th>ID</th><th>Data range</th><th>Display range</th><th>Unit</th></tr>
<tr><td>15</td><td>Bit31 to Bit0</td><td>H.8000 L.0000 to H.7FFF L.FFFF</td><td>min^{-1}</td></tr>
</table>
</td></tr>
<tr><td>16</td><td>
Velocity command monitor [VCMON]
■ Displays the velocity command value.
◆ Setup software displays values in decimal notation.
<table>
<tr><th>Display range</th><th>Unit</th></tr>
<tr><td>-2147483648 to 2147483647</td><td>min^{-1}</td></tr>
</table>
◆ Digital operator displays values in hexadecimal notation.
<table>
<tr><th>ID</th><th>Data range</th><th>Display range</th><th>Unit</th></tr>
<tr><td>16</td><td>Bit31 to Bit0</td><td>H.8000 L.0000 to H.7FFF L.FFFF</td><td>min^{-1}</td></tr>
</table>
</td></tr>
<tr><td>17</td><td>
Torque monitor [TMON]
■ Displays the output torque of servo motor.
<table>
<tr><th>Display range</th><th>Unit</th></tr>
<tr><td>-499.9 to 499.9</td><td>%</td></tr>
</table>
</td></tr>
<tr><td>18</td><td>
Torque command monitor [TCMON]
■ Displays the torque command value.
<table>
<tr><th>Display range</th><th>Unit</th></tr>
<tr><td>-499.9 to 499.9</td><td>%</td></tr>
</table>
</td></tr>
<tr><td>19</td><td>
Acceleration monitor [ACCMON]
■ Displays the servo motor acceleration.
◆ Setup software displays values in decimal notation.
<table>
<tr><th>Display range</th><th>Unit</th></tr>
<tr><td>-2147483648 to 2147483647</td><td>rad/s^2</td></tr>
</table>
◆ Digital operator displays values in hexadecimal notation.
<table>
<tr><th>ID</th><th>Data range</th><th>Display range</th><th>Unit</th></tr>
<tr><td>19</td><td>Bit31 to Bit0</td><td>H.8000 L.0000 to H.7FFF L.FFFF</td><td>rad/s^2</td></tr>
</table>
</td></tr>
</table>

<table>
<tr><th>ID</th><th>Description</th></tr>
<tr><td>1A</td><td>Load Torque monitor (Estimate value) [MTLMON-EST]
■ Displays the estimated value of load torque.
<table>
<tr><th>Display range</th><th>Unit</th></tr>
<tr><td>-499.9 to 499.9</td><td>%</td></tr>
</table></td></tr>
<tr><td>33
34</td><td>Absolute encoder PS data monitor (motor encoder) [ABSPS]
■ Displays position data of absolute encoder.
◆ Setup software displays the data to ID33.
<table>
<tr><th>Display range</th><th>Unit</th></tr>
<tr><td>0 to FFFFFFFFFFFFFFFF</td><td>Pulse</td></tr>
</table>
(Actual display range varies depending on the encoder specifications.)
◆ Digital operator displays the data to ID33, ID34 by hexadecimal notation (32-bit data).
<table>
<tr><th>ID</th><th>Data range</th><th>Display range</th><th>Unit</th></tr>
<tr><td>33</td><td>Bit63 to Bit32</td><td>H.0000 L.0000 to H.FFFF L.FFFF</td><td>×2^{32} Pulse</td></tr>
<tr><td>34</td><td>Bit31 to Bit0</td><td>H.0000 L.0000 to H.FFFF L.FFFF</td><td>Pulse</td></tr>
</table></td></tr>
</table>

<table>
<tr><th>ID</th><th>Description</th></tr>
<tr><td>35</td><td>
Motor Encoder frequency monitor [MMOENCF]
■ Displays the motor encoder frequency of incremental encoder.
◆ Setup software displays values in decimal notation.
<table>
<tr><th>Display range</th><th>Unit</th></tr>
<tr><td>-2147483648 to 2147483647</td><td>kPulse/s</td></tr>
</table>
◆ Digital operator displays values in hexadecimal notation.
<table>
<tr><th>ID</th><th>Data range</th><th>Display range</th><th>Unit</th></tr>
<tr><td>35</td><td>Bit31 to Bit0</td><td>H.8000 L.0000 to H.7FFF L.FFFF</td><td>kPulse/s</td></tr>
</table>
</td></tr>
<tr><td>36</td><td>
U-phase electric angle monitor [CSU]
■ Displays U-phase electric angle. Always displayed except when encoder errors.
<table>
<tr><th>Display range</th><th>Unit</th></tr>
<tr><td>0 to 359</td><td>deg</td></tr>
</table>
</td></tr>
<tr><td>40</td><td>
Regenerative resistor operation percentage monitor [RegP]
■ Displays the working ratio of regenerative resistor.
<table>
<tr><th>Display range</th><th>Unit</th></tr>
<tr><td>0.00 to 99.99</td><td>%</td></tr>
</table>
</td></tr>
<tr><td>41</td><td>
Effective torque monitor [TRMS]
■ Displays effective torque. Depending on the operation pattern, it may take some hours to become stable.
<table>
<tr><th>Display range</th><th>Unit</th></tr>
<tr><td>0 to 499</td><td>%</td></tr>
</table>
</td></tr>
<tr><td>42</td><td>
Effective torque monitor (Estimated value) [ETRMS]
■ Displays the effective torque estimation value. Estimates from short time operation. This can be confirmed shortly if the same operation pattern is repeated.
<table>
<tr><th>Display range</th><th>Unit</th></tr>
<tr><td>0 to 499</td><td>%</td></tr>
</table>
</td></tr>
<tr><td>44</td><td>
Vbus monitor [VBUS]
■ Displays the dc value at main circuit.
<table>
<tr><th>Display range</th><th>Unit</th></tr>
<tr><td>0 to 1000</td><td>V</td></tr>
</table>
</td></tr>
<tr><td>45</td><td>
Encoder temperature monitor [ENTMP]
■ Displays internal temperature of encoder.
<table>
<tr><th>Display range</th><th>Unit</th></tr>
<tr><td>-40 to 127</td><td>degree C</td></tr>
</table>
* Not shown with incremental encoder.
</td></tr>
</table>

* Please use following conversion to convert "Effective torque monitor" or "Effective torque monitor (Estimated value)" to Motor Operating Rate Monitor which used for RS1 amplifier.

Motor Operating Rate Monitor [%] = (Effective torque monitor display value [%] / 100)^2 x 100

<table>
<tr><th>ID</th><th>Description</th></tr>
<tr><td>46</td><td>Amplifier temperature monitor [MATEMP]
■ Displays internal temperature of servo amplifier.
<table><tr><th>Display range</th><th>Unit</th></tr><tr><td>-15 to 150</td><td>degree C</td></tr></table>
◆ Internal temperature of servo amplifier is the point near to power device.</td></tr>
<tr><td>47</td><td>Amplifier Operation Time [RUNTIM]
■ Displays the total time of control power ON.
<table><tr><th>Display format</th></tr><tr><td>Hour (h) : Minute (mm) : Second (ss) . Millisecond (ms)</td></tr></table>
◆ See "7.3 Setting and display range" for the digital operator display.</td></tr>
<tr><td>4A</td><td>Average electric power monitor [MAVEPOW1]
■ Average electric power monitor shows a measurement result every 1 minute.
<table><tr><th>Display range</th><th>Unit</th></tr><tr><td>-999,999.9 to 999,999.9</td><td>[W]</td></tr></table>
◆ Refer to "7.3 Setting and display range" for the display of the digital operator.

* Not shown with the motor except standard spec R series.
* When 3-phase 200V AC is used to the 200V AC input type, accuracy will be ±25% (at the accel/decel operation with 100% effective torque).
* When single-phase 200V AC is used to the 200V AC input type, accuracy will be ±30% (at the accel/decel operation with 100% effective torque).
* For the 100V AC input type, accuracy will be ±30% (at the accel/decel operation with 100% effective torque).
(Accuracy may be worse when it is used at the instantaneous area of Velocity-torque characteristics.)</td></tr>
<tr><td>4C</td><td>Regenerative power monitor [RegPOW]
■ Displays the consumption power of regenerative resistor.
<table><tr><th>Display range</th><th>Unit</th></tr><tr><td>0 to 4294967.295</td><td>W</td></tr></table></td></tr>
</table>

<table>
<tr><th>ID</th><th>Description</th></tr>
<tr><td>50</td><td>Load inertia moment ratio monitor [JRAT MON]
■ Displays the present load inertia moment ratio.
Value can check when using gain switching and auto-tuning function.</td></tr>
<tr><td>51</td><td>Model Control Gain monitor [MKP MON]
■ Displays the present Model Control Gain.
Value can check when using gain switching and auto-tuning function.</td></tr>
<tr><td>52</td><td>Position Loop Proportional Gain monitor [KP MON]
■ Displays the present Position Loop Proportional Gain.
Value can check when using gain switching and auto-tuning function.</td></tr>
<tr><td>53</td><td>Position Loop Integral Time Constant monitor [TPI MON]
■ Displays the present Position Loop Integral Time Constant.
Value can check when using gain switchinga function.</td></tr>
<tr><td>54</td><td>Velocity Loop Proportional Gain monitor [KVP MON]
■ Displays the present Velocity Loop Proportional Gain.
Value can check when using gain switching and auto-tuning function.</td></tr>
<tr><td>55</td><td>Velocity Loop Integral Time Constant monitor [TVI MON]
■ Displays the present Velocity Loop Integral Time Constant.
Value can check when using gain switching and auto-tuning function.</td></tr>
<tr><td>56</td><td>Torque Command Filter monitor [TCFIL MON]
■ Displays the present Torque Command Filter.
Value can check when using gain switching and auto-tuning function.</td></tr>
<tr><td>57</td><td>Frequency monitor D for adaptive notch filter [ADNFD MON]
■ Displays the adaptive notch filter frequency.
<table><tr><th>Display range</th><th>Unit</th></tr><tr><td>100 to 1000,4000</td><td>Hz</td></tr></table></td></tr>
<tr><td>58</td><td>Frequency monitor E for adaptive notch filter [ADNFE MON]
■ Displays the adaptive notch filter frequency.
<table><tr><th>Display range</th><th>Unit</th></tr><tr><td>100 to 1000,4000</td><td>Hz</td></tr></table></td></tr>
</table>

<table>
<tr><th>ID</th><th>Description</th></tr>
<tr><td>61
62</td><td>
Present position monitor (External encoder) [EX-APMON]
■ Displays the current position of the external encoder that has the origin as the position at the time the control power was turned ON.
As this is a free run counter, if the current position exceeds the displayed range, the maximum reverse polarity value will be displayed.
◆ Setup software displays the data to ID61.
<table>
<tr><th>Display range</th><th>Unit</th></tr>
<tr><td>-9223372036854775808 to 9223372036854775807</td><td>Pulse</td></tr>
</table>
◆ Digital operator displays the data to ID61, ID62 by hexadecimal notation (32-bit data).
<table>
<tr><th>ID</th><th>Data range</th><th>Display range</th><th>Unit</th></tr>
<tr><td>61</td><td>Bit63 to Bit32</td><td>H.8000 L.0000 to H.7FFF L.FFFF</td><td>×2^{32} Pulse</td></tr>
<tr><td>62</td><td>Bit31 to Bit0</td><td>H.0000 L.0000 to H.FFFF L.FFFF</td><td>Pulse</td></tr>
</table>
</td></tr>
<tr><td>63
64</td><td>
External absolute encoder PS data monitor [EX-ABSPS]
■ Displays position data of external absolute encoder.
◆ Setup software displays the data to ID63.
<table>
<tr><th>Display range</th><th>Unit</th></tr>
<tr><td>0 to FFFFFFFFFFFFFFFF</td><td>Pulse</td></tr>
</table>
(Actual display range varies depending on the encoder specifications.)
◆ Digital operator displays the data to ID63, ID64 by hexadecimal notation (32-bit data).
<table>
<tr><th>ID</th><th>Data range</th><th>Display range</th><th>Unit</th></tr>
<tr><td>63</td><td>Bit63 ～ Bit32</td><td>H.0000 L.0000 to H.FFFF L.FFFF</td><td>× 2^{32} Pulse</td></tr>
<tr><td>64</td><td>Bit31 ～ Bit0</td><td>H.0000 L.0000 to H.FFFF L.FFFF</td><td>Pulse</td></tr>
</table>
</td></tr>
<tr><td>65</td><td>
Ext. Encoder frequency monitor [MEXENCF]
■ Displays the external encoder frequency of incremental encoder.
◆ Setup software displays values in decimal notation.
<table>
<tr><th>Display range</th><th>Unit</th></tr>
<tr><td>-2147483648 to 2147483647</td><td>kPulse/s</td></tr>
</table>
◆ Digital operator displays values in hexadecimal notation (32-bit data).
<table>
<tr><th>ID</th><th>Data range</th><th>Display range</th><th>Unit</th></tr>
<tr><td>65</td><td>Bit31 to Bit0</td><td>H.8000 L.0000 to H.7FFF L.FFFF</td><td>kPulse/s</td></tr>
</table>
</td></tr>
</table>

<table>
<tr><th>ID</th><th>Description</th></tr>
<tr><td>70</td><td>Remaining life of relay for an inrush current prevention [RSRLYLF]
■ Displays the remaining life of relay for an inrush current prevention.
<table><tr><th>Display range</th><th>Unit</th></tr><tr><td>0 to 100.00</td><td>%</td></tr></table></td></tr>
<tr><td>71</td><td>Remaining life of relay for a dynamic brake [DBRLYLF]
■ Displays the remaining life of relay for a dynamic brake.
<table><tr><th>Display range</th><th>Unit</th></tr><tr><td>0 to 100.00</td><td>%</td></tr></table></td></tr>
<tr><td>73</td><td>Error rate of motor encoder communication [MOTE-ERRAT]
■ Displays the error rate of motor encoder communication.
It shows error count ratio against communication count per second.
<table><tr><th>Display range</th><th>Unit</th></tr><tr><td>0.000000 to 1.000000</td><td>-</td></tr></table></td></tr>
<tr><td>74</td><td>Error rate of external encoder communication [EXTE-ERRAT]
■ Displays the Error rate of external encoder communication.
It shows error count ratio against communication count per second.
<table><tr><th>Display range</th><th>Unit</th></tr><tr><td>0.000000 to 1.000000</td><td>-</td></tr></table></td></tr>
<tr><td>77</td><td>Remaining life of a holding brake [HBLF]
■ Displays the remaining life of a holding brake.
<table><tr><th>Display range</th><th>Unit</th></tr><tr><td>0 to 100.00</td><td>%</td></tr></table>
* Displays just when the servo motor with holding brake is used.
* It doesn't display if combining the servo motor which is not support this function.</td></tr>
</table>

5.5.3 Positioning function monitor list

ID	Symbol	Name	Unit
80	EXE_POINT	Execution point number	---
81	AD_REAL	Current position (User Coordinate)	
82	AD_MACH	Command position (User Coordinate)	
83	PAERR	Position deviation (User Coordinate)	
84	IN_G1	Input (Group1) monitor	---
85	IN_G2	Input (Group2) monitor	---
86	IN_G3	Input (Group3) monitor	---
87	IN_POINT	Input (Point number) monitor	---
88	OUT_G1	Output (Group1) monitor	---
89	OUT_G2	Output (Group2) monitor	---
8A	OUT_G3	Output (Group3) monitor	---
8B	OUT_G4	Output (Group4) monitor	---
8C	PF_CODE	Internal operation state	---
8D	OUT_SEL	Output selection 1 to 3	---
8E	G_OUT	General output monitor	---
8F	ZOUT	Zone output monitor	---
90	MOUT	M output monitor	---

5.5.4 Positioning function monitor description

<table>
<tr><th>ID</th><th>Description</th></tr>
<tr><td>80</td><td>Execution point number [EXE_POINT]
■ Displays the point number of executioning or execution completed.</td></tr>
<tr><td>81</td><td>Current position (User Coordinate) [AD_REAL]
■ Displays the current position on user coordinate system.</td></tr>
<tr><td>82</td><td>Command position (User Coordinate) [AD_MACH]
■ Displays the command position on user coordinate system.</td></tr>
<tr><td>83</td><td>Position deviation (User Coordinate) [AD_REAL]
■ Displays the position deviation on user coordinate system.</td></tr>
<tr><td>84</td><td>Input (Group1) monitor [IN_G1]
■ Displays the input condition of input (Group1). Input condition is shown with "0" or "1".
<table>
<tr><td>Bit</td><td>3</td><td>2</td><td>1</td><td>0</td></tr>
<tr><td>Abbrev</td><td>+JOG</td><td>ZRT</td><td>RUN</td><td>S-ON</td></tr>
</table>
<table>
<tr><td>Bit</td><td>7</td><td>6</td><td>5</td><td>4</td></tr>
<tr><td>Abbrev</td><td>CACL</td><td>ARST</td><td>RAP</td><td>-JOG</td></tr>
</table>
◆ Refer the chapter 2 for detail of each monitor signal (abbreviation).
* It is not a function indication. User input signal condition is shown.
* Monitor will be update when External operation mode output (EXT) is "1".</td></tr>
<tr><td>85</td><td>Input (Group2) monitor [IN_G2]
■ Displays the input condition of input (Group2). Input condition is shown with "0" or "1".
<table>
<tr><td>Bit</td><td>3</td><td>2</td><td>1</td><td>0</td></tr>
<tr><td>Abbrev</td><td>OVRD_3</td><td>OVRD_2</td><td>OVRD_1</td><td>OVRD_0</td></tr>
</table>
<table>
<tr><td>Bit</td><td>7</td><td>6</td><td>5</td><td>4</td></tr>
<tr><td>Abbrev</td><td>M_FIN</td><td>IRUN</td><td>-1step</td><td>+1step</td></tr>
</table>
◆ Refer the chapter 2 for detail of each monitor signal (abbreviation).
* It is not a function indication. User input signal condition is shown.
* Monitor will be update when External operation mode output (EXT) is "1".</td></tr>
<tr><td>86</td><td>Input (Group3) monitor [IN_G3]
■ Displays the input condition of input (Group3). Input condition is shown with "0" or "1".
<table>
<tr><td>Bit</td><td>3</td><td>2</td><td>1</td><td>0</td></tr>
<tr><td>Abbrev</td><td>HOME</td><td>---</td><td>EXT-E</td><td>BATCLR</td></tr>
</table>
<table>
<tr><td>Bit</td><td>7</td><td>6</td><td>5</td><td>4</td></tr>
<tr><td>Abbrev</td><td>E_STR</td><td>-OT</td><td>+OT</td><td>SDN</td></tr>
</table>
◆ Refer the chapter 2 for detail of each monitor signal (abbreviation).
* It is not a function indication. User input signal condition is shown.
* Monitor will be update when External operation mode output (EXT) is "1".
* EXT-E, SDN, +OT and -OT are not shown with interface type [F: MODBUS]. Assign it to general input 7-1 by an each function effective condition in group9. Function assigned input signal is able to check with ID05 CONT7-1.</td></tr>
</table>

<table>
<tr><th>ID</th><th>Description</th></tr>
<tr><td>87</td><td>Input (Point number) monitor [IN_POINT]
■ Displays the input condition of input (Point number).
* Monitor will be update when External operation mode output (EXT) is "1".</td></tr>
<tr><td>88</td><td>Output (Group1) monitor [OUT_G1]
■ Displays the output condition of output (Group1). Output condition is shown with "0" or "1".
<table>
<tr><td>Bit</td><td>3</td><td>2</td><td>1</td><td>0</td></tr>
<tr><td>Abbrev</td><td>EXT</td><td>ERR</td><td>HBON</td><td>NCRDY</td></tr>
</table>
<table>
<tr><td>Bit</td><td>7</td><td>6</td><td>5</td><td>4</td></tr>
<tr><td>Abbrev</td><td>WAR/ZFIN</td><td>INPS</td><td>PFIN</td><td>MOVE</td></tr>
</table>
◆ Refer the chapter 2 for detail of each monitor signal (abbreviation).
* For WAR/ZFIN, the value of selected function is shown.</td></tr>
<tr><td>89</td><td>Output (Group2) monitor [OUT_G2]
■ Displays the output condition of output (Group2). Output condition is shown with "0" or "1".
<table>
<tr><td>Bit</td><td>3</td><td>2</td><td>1</td><td>0</td></tr>
<tr><td>Abbrev</td><td>SVACT</td><td>SVRDY</td><td>A_RDY</td><td>ALM</td></tr>
</table>
<table>
<tr><td>Bit</td><td>7</td><td>6</td><td>5</td><td>4</td></tr>
<tr><td>Abbrev</td><td>C_RDY</td><td>T_LIM_FLG</td><td>IN_FEED</td><td>IN_STOP</td></tr>
</table>
◆ Refer the chapter 2 for detail of each monitor signal (abbreviation).
* External operation mode output (EXT) becomes "0", while using supporting function (test operation/homing/point move) of the setup software. SVACT does not become "1" during that time. It becomes user command inhibition state.</td></tr>
<tr><td>8A</td><td>Output (Group3) monitor [OUT_G3]
■ Displays the output condition of output (Group3). Output condition is shown with "0" or "1".
<table>
<tr><td>Bit</td><td>3</td><td>2</td><td>1</td><td>0</td></tr>
<tr><td>Abbrev</td><td>MOUT_3</td><td>MOUT_2</td><td>MOUT_1</td><td>MOUT_0</td></tr>
</table>
<table>
<tr><td>Bit</td><td>7</td><td>6</td><td>5</td><td>4</td></tr>
<tr><td>Abbrev</td><td>MSTR</td><td>---</td><td>---</td><td>---</td></tr>
</table>
◆ Refer the chapter 2 for detail of each monitor signal (abbreviation).</td></tr>
<tr><td>8B</td><td>Output (Group4) monitor [OUT_G4]
■ Displays the output condition of output (Group4). Output condition is shown with "0" or "1".
<table>
<tr><td>Bit</td><td>3</td><td>2</td><td>1</td><td>0</td></tr>
<tr><td>Abbrev</td><td>ZOUT_4</td><td>ZOUT_3</td><td>ZOUT_2</td><td>ZOUT_1</td></tr>
</table>
<table>
<tr><td>Bit</td><td>7</td><td>6</td><td>5</td><td>4</td></tr>
<tr><td>Abbrev</td><td>ZOUT_8</td><td>ZOUT_7</td><td>ZOUT_6</td><td>ZOUT_5</td></tr>
</table>
◆ Refer the chapter 2 for detail of each monitor signal (abbreviation).</td></tr>
</table>

ID: 8C

Internal operation state [PF_CODE]

Code	Display	Description
00	Reset	Reset condition
01	Run	Point move
02	Feed	While move
03	Feed_Hold	While pause
04	Jog	JOG move
05	1step	Step feed
06	I_Run	Interruption move
07	Home	Home position set
08	Z-Return	Homing
09	Z-Finish	Homing completion
0A	Waiting	Command input waiting with servo on
0B	Cancel	Move cancel
0C	Normal-End	Command input-off waiting with move completion
0D	Servo-OFF	Servo off state
0E	M_STR	MFIN waiting
0F	Dwell	While dwell
10	Z-Slow_down	Homing while SDN
16	ERR_Soft+OT	Error: + software limit
17	ERR_Soft-OT	Error: - software limit
18	ERR_Point_D	Error: Point data setting error
19	ERR_Loop	Error: Point loop count setting error
1A	ERR_Nesting	Error: Point loop nest setting error
1B	ERR_Z_Return	Error: Homing operation error

* Some transition may not show if transition time between each state is short.

ID: 8D

Output selection 1 to 3 [OUT_SEL]

■ Displays the input condition of output selected by SEL1/SEL2/SEL3.

Code	Display	Selection
00	Zone	Zone signal
01	Err_Alm	Error code, alarm code
02	ExePoint	Execution point number
03	Mout	M output
04	Warning	Warning
05	Out2	Secondary control signal
06	ExeFinPoint	Execution completion point number
07	Reserve	(Reserved)

◆ Refer the section 2.1.2 in chapter 2 for detail of general output (1) to (8).

* Shown with interface type [C: I/O] only. Not shown with [F: MODBUS].

ID: 8E

General output monitor [G_OUT]

■ Displays the output condition of item selected by SEL1/SEL2/SEL3.

✔ Shown with interface type [C: I/O] only. Not shown with [F: MODBUS].

✔ Display can switch with decimal or hexadecimal.

ID	Description
8F	Zone output monitor [ZOUT] ■ Displays the output condition of zone output. Applicable bit turns "1" when into a zone. * Set a zone using parameters of Zon1L to Zon8H in GroupA ID17 to 26. * Refer output (Group4) monitor for bit indication. It is the data to measure by analog channel of operation trace. * Display can switch with decimal or hexadecimal.
90	M output monitor [MOUT] ■ Displays the output condition of M output. Outputs by M code/M output type, set at point data. * Refer output (Group3) monitor for bit indication. It is the data to measure by analog channel of operation trace. * Display can switch with decimal or hexadecimal.

5.6 Analog monitor and digital monitor

All signals and internal status of the servo amplifier can be monitored by using the dedicated Monitor Box and cable. See main manual "12.6 Optional parts" for the details of monitor box and dedicated cable.

■ Selection of output signal
Selecting and changing the output signal to be used from the parameters list below.

General parameters Group9 ID60	DMON: Digital Monitor Output Signal Selection
General parameters Group9 ID61	MON1: Analog Monitor Selection for Output 1
General parameters Group9 ID62	MON2: Analog Monitor Selection for Output 2

5.7 Setting parameters

5.7.1 Parameters list

Below is the parameters list that classified to each Group and put in ID order.
See another manual: M0010842 for the setup software operation.

■ General parameters group list

Group	Classification of the parameters in the group
Group0	Auto-tuning settings
Group1	Basic control parameter settings
Group2	FF (feed forward) vibration suppression control/ Notch filter/ Disturbance observer settings
Group3	Model following control settings
Group4	Gain switching control/ Vibration suppression frequency switching settings
Group5	Fast-settling control settings
Group7	Communication/function selection settings
Group8	Control system settings
Group9	Function enabling condition/ General output terminal output condition/ Monitor output selection settings
GroupA	Positioning function settings
GroupB	Sequence/alarm related settings
GroupC	Encoder related settings
GroupD	Support function related settings

* Parameters vary depending on the servo amplifier to be used.
* Setup software does not display invalid parameters.
The Digital Operator cannot change the setting value.
* Refer the section 2.2 in chapter 2 for Group7 Communication/function settings.
* Refer the chapter 3 for GroupA Positioning function settings.

■ General parameters Group0 "Auto-tuning settings"

ID	Symbol	Name	Control mode	Default value	Unit	Setting range
00	TUNMODE	Tuning Mode	M,P,V,T	00:AutoTun	—	00 to 02
01	ATCHA	Auto-Tuning Characteristic	M,P,V,T	00:Positioning1	—	00 to 06
02	ATRES	Auto-Tuning Response	M,P,V,T	5	—	1 to 40
03	ATSAVE	Auto-Tuning Automatic Parameter Saving	M,P,V,T	00:Auto_Saving	—	00 to 01
04	ATCSEL	Auto-Tuning characteristic compatible mode	M,P,V,T	00:Disable	—	00 to 01
10	ANFILTC	Auto-Notch Filter Tuning Torque Command	M,P,V,T	50.0	%	10.0 to 100.0
20	ASUPTC	Auto-FF Vibration Suppression Frequency Tuning Torque Command	M,P	25.0	%	10.0 to 100.0
21	ASUPFC	Auto-FF Vibration Suppression Frequency Tuning Friction Compensation Value	M,P	5.0	%	0.0 to 50.0
34	ADNFE	Adaptive notch filter function E	M,P,V	00:Adp_Filter Disable	—	00 to 01
35	ADNFUE	Adaptive notch filter frequency upper limit E	M,P,V	1000	Hz	100 to 1000
36	ADNFLE	Adaptive notch filter frequency lower limit E	M,P,V	100	Hz	100 to 1000
37	ADNSVE	Adaptive notch filter E auto saving	M,P,V	00:Auto_Saving	—	00 to 01

* M = Model following control type, P = Position control type, V = Velocity control type, T = Torque control type

■ General parameters Group1 "Basic control parameter settings"

ID	Symbol	Name	Control mode	Default value	Unit	Setting range
00	PCSMT	Position Command Smoothing Constant	M,P	0.0	ms	0.0 to 500.0
01	PCFIL	Position Command Filter	M,P	0.0	ms	0.0 to 2000.0
02	KP1	Position Loop Proportional Gain 1	M,P	30	1/s	1 to 3000
03	TPI1	Position Loop Integral Time Constant 1	M,P	1000.0	ms	0.3 to 1000.0
04	PLPHLK	Position loop phase lead compensation gain	M,P	0	%	0 to 100
05	PLPHLF	Position loop phase lead compensation frequency	M,P	500	Hz	10 to 4000
06	FFGN	Velocity Feed Forward Gain	P	0	%	0 to 100
07	FFFIL	Velocity Feed Forward Filter	P	4000	Hz	1 to 4000
08	TRCPGN	Higher Tracking Control Position Compensation Gain	M (※) ,P	0	%	0 to 100
10	VCFIL	Velocity Command Filter	M,P,V	4000	Hz	1 to 4000
11	VDFIL	Velocity Detection Filter	M,P,V	1500	Hz	1 to 4000
12	KVP1	Velocity Loop Proportional Gain 1	M,P,V	50	Hz	1 to 2000
13	TVI1	Velocity Loop Integral Time Constant 1	M,P,V	20.0	ms	0.3 to 1000.0
14	JRAT1	Load Inertia Moment Ratio 1	M,P,V	100	%	0 to 15000
15	VLPHLK	Velocity loop phase lead compensation gain	M,P,V	0	%	0 to 100
16	VLPHLF	Velocity loop phase lead compensation frequency	M,P,V	500	Hz	10 to 4000
17	HKVIK	High order integral control gain	M,P,V	0	%	0 to 100
18	HKVIF	High order integral control frequency	M,P,V	500	Hz	10 to 4000
19	TFFK	Torque feedforward gain	P,V	0	%	0 to 100
1A	TFFAVE	Torque feedforward averaging	P,V	01:4timesAverage	—	00 to 01
1B	TFFOUT	Torque feedforward output selection	P,V	00:Before_Filter	—	00 to 01
1C	AFBK	Acceleration Feedback Gain	M,P,V	0.0	%	-100.0 to 100.0
1D	AFBFIL	Acceleration Feedback Filter	M,P,V	500	Hz	1 to 4000
1E	TRCVGN	Higher Tracking Control Velocity Compensation Gain	P,V	0	%	0 to 100
20	TCFIL1	Torque Command Filter 1	M,P,V,T	600	Hz	1 to 4000
21	TCFILOR	Torque Command Filter Order	M,P,V,T	2	Order	1 to 3

* M = Model following control type, P = Position control type, V = Velocity control type, T = Torque control type

※: It can not use when Model-following/standard position control or Model-following vibration suppression/standard position control is selected.

■ General parameters Group2 "FF (Feed forward) vibration suppression control/ Notch filter/ Disturbance observer settings"

ID	Symbol	Name	Control mode	Default value	Unit	Setting range
00	SUPFRQA1	FF Vibration Suppression Frequency A1	M,P	500.0	Hz	1.0 to 500.0
01	SUPLVA	FF Vibration Suppression Level Selection A	M,P	00	-	00 to 03
02	SUPFRQB1	FF Vibration Suppression Frequency B1	M,P	500.0	Hz	1.0 to 500.0
03	SUPCRB	FF Vibration Suppression Level Selection B	M,P	00	-	00 to 01
10	VCNFIL	Velocity Command Notch Filter	M,P,V	1000	Hz	50 to 1000
20	TCNFILA	Torque Command Notch Filter A	M,P,V,T	4000	Hz	100 to 4000
21	TCNFPA	TCNFILA, Low Frequency Phase Delay Improvement	M,P,V,T	0	-	0 to 2
22	TCNFILB	Torque Command Notch Filter B	M,P,V,T	4000	Hz	100 to 4000
23	TCNFDB	TCNFILB, Depth Selection	M,P,V,T	0	-	0 to 15
24	TCNFILC	Torque Command Notch Filter C	M,P,V,T	4000	Hz	100 to 4000
25	TCNFDC	TCNFILC, Depth Selection	M,P,V,T	0	-	0 to 15
26	TCNFILD	Torque Command Notch Filter D	M,P,V,T	4000	Hz	100 to 4000
27	TCNFDD	TCNFILD, Depth Selection	M,P,V,T	0	-	0 to 15
28	TCNFILE	Torque Command Notch Filter E	M,P,V,T	4000	Hz	100 to 4000
29	TCNFDE	TCNFILE, Depth Selection	M,P,V,T	0	-	0 to 15
30	OBCHA	Observer Characteristic	M,P,V	00:Low	-	00 to 02
31	OBG	Observer Compensation Gain	M,P,V	0	%	0 to 100
32	OBLPF	Observer Output Low-pass Filter	M,P,V	50	Hz	1 to 4000
33	OBNFIL	Observer Output Notch Filter	M,P,V	4000	Hz	100 to 4000
40	STV	Effective velocity for compensating stick-slip behavior	M,P,V,T	10.0	min^{-1}	0.1 to 128.0
41	STHLD	Retention time for compensating stick-slip behavior	M,P,V,T	20	ms	1 to 500
42	STTVI	Velocity loop integral time constant for stick-slip behavior compensation	M,P,V,T	3.0	ms	0.3 to 1000
50	CPVSFQ	CP vibration suppression control frequency	P,V	100.0	Hz	10.0 to 100.0
51	CPVSLV	CP vibration suppression control level	P,V	00	-	00 to 03
52	CPVSCR	CP vibration suppression control characteristics selection	P,V	01	-	00 to 02
60	FBHPLS	Minor vibration suppression pulse compensation value	M,P,V,T	1	Pulse	1 to 100
61	FBHTIM	Minor vibration suppression pulse compensation frequency	M,P,V,T	1	times	1 to 100

* M = Model following control type, P = Position control type, V = Velocity control type, T = Torque control type

■ General parameters Group3 "Model following control settings"

ID	Symbol	Name	Control mode	Default value	Unit	Setting range
00	KM1	Model Control Gain 1	M	30	1/s	1 to 3000
01	MZETA	Model control damping coefficient	M	100	%	0 to 100
02	MFFGN	Model velocity feedforward gain	M	0	%	0 to 100
03	MTFFD	Model velocity feedforward differential time constant	M	0.00	ms	0.00 to 10.00
04	MFFFIL	Model velocity feedforward filter	M	4000	Hz	1 to 4000
05	OSSFIL	Overshoot Suppression Filter	M	1500	Hz	1 to 4000
06	ANRFRQ1	Model Control Antiresonance Frequency 1	M	80.0	Hz	10.0 to 80.0
07	RESFRQ1	Model Control Resonance Frequency 1	M	80.0	Hz	10.0 to 80.0

* M = Model following control type, P = Position control type, V = Velocity control type, T = Torque control type

■ General parameters Group4 "Gain switching control/ Vibration suppression frequency switching settings"

ID	Symbol	Name	Control mode	Default value	Unit	Setting range
00	KM2	Model Control Gain 2	M	30	1/s	1 to 3000
01	KP2	Position Loop Proportional Gain 2	M,P	30	1/s	1 to 3000
02	TPI2	Position Loop Integral Time Constant 2	M,P	1000.0	ms	0.3 to 1000.0
03	KVP2	Velocity Loop Proportional Gain 2	M,P,V	50	Hz	1 to 2000
04	TVI2	Velocity Loop Integral Time Constant 2	M,P,V	20.0	ms	0.3 to 1000.0
05	JRAT2	Load Inertia Moment Ratio 2	M,P,V	100	%	0 to 15000
06	TCFIL2	Torque Command Filter 2	M,P,V,T	600	Hz	1 to 4000
10	KM3	Model Control Gain 3	M	30	1/s	1 to 3000
11	KP3	Position Loop Proportional Gain 3	M,P	30	1/s	1 to 3000
12	TPI3	Position Loop Integral Time Constant 3	M,P	1000.0	ms	0.3 to 1000.0
13	KVP3	Velocity Loop Proportional Gain 3	M,P,V	50	Hz	1 to 2000
14	TVI3	Velocity Loop Integral Time Constant 3	M,P,V	20.0	ms	0.3 to 1000.0
15	JRAT3	Load Inertia Moment Ratio 3	M,P,V	100	%	0 to 15000
16	TCFIL3	Torque Command Filter 3	M,P,V,T	600	Hz	1 to 4000
20	KM4	Model Control Gain 4	M	30	1/s	1 to 3000
21	KP4	Position Loop Proportional Gain 4	M,P	30	1/s	1 to 3000
22	TPI4	Position Loop Integral Time Constant 4	M,P	1000.0	ms	0.3 to 1000.0
23	KVP4	Velocity Loop Proportional Gain 4	M,P,V	50	Hz	1 to 2000
24	TVI4	Velocity Loop Integral Time Constant 4	M,P,V	20.0	ms	0.3 to 1000.0
25	JRAT4	Load Inertia Moment Ratio 4	M,P,V	100	%	0 to 15000
26	TCFIL4	Torque Command Filter 4	M,P,V,T	600	Hz	1 to 4000
30	GCFIL	Gain Switching Filter	M,P,V	0	ms	0 to 100
40	SUPFRQA2	FF Vibration Suppression Frequency A2	M,P	500.0	Hz	1.0 to 500.0
41	SUPFRQA3	FF Vibration Suppression Frequency A3	M,P	500.0	Hz	1.0 to 500.0
42	SUPFRQA4	FF Vibration Suppression Frequency A4	M,P	500.0	Hz	1.0 to 500.0
43	SUPFRQB2	FF Vibration Suppression Frequency B2	M,P	500.0	Hz	1.0 to 500.0
44	SUPFRQB3	FF Vibration Suppression Frequency B3	M,P	500.0	Hz	1.0 to 500.0
45	SUPFRQB4	FF Vibration Suppression Frequency B4	M,P	500.0	Hz	1.0 to 500.0
50	ANRFRQ2	Model Control Antiresonance Frequency 2	M	80.0	Hz	10.0 to 80.0
51	RESFRQ2	Model Control Resonance Frequency 2	M	80.0	Hz	10.0 to 80.0
52	ANRFRQ3	Model Control Antiresonance Frequency 3	M	80.0	Hz	10.0 to 80.0
53	RESFRQ3	Model Control Resonance Frequency 3	M	80.0	Hz	10.0 to 80.0
54	ANRFRQ4	Model Control Antiresonance Frequency 4	M	80.0	Hz	10.0 to 80.0
55	RESFRQ4	Model Control Resonance Frequency 4	M	80.0	Hz	10.0 to 80.0

* M = Model following control type, P = Position control type, V = Velocity control type, T = Torque control type

■ General parameters Group5 "Fast-settling control settings"

ID	Symbol	Name	Control mode	Default value	Unit	Setting range
00	CVFIL	Command Velocity Low-pass Filter	P	1000	Hz	1 to 4000
01	CVTH	Command Velocity Threshold	P	20	min^{-1}	0 to 65535
02	ACCCO	Acceleration Compensation	P	0	×50 Pulse	-9999 to 9999
03	DECCO	Deceleration Compensation	P	0	×50 Pulse	-9999 to 9999

* P = Position control type

■ General parameters Group8 "Control system settings"

ID	Symbol	Name	Control mode	Default value	Unit	Setting range
17	EDGEPOS	Positioning Methods	M,P	00:Pulse_Interval	—	00 to 01
18	PDEVMON	In-Position Signal/ Position Deviation Monitor	P	00:After_Filter	—	00 to 01
19	CLR	Deviation Clear Selection	M,P	00:Type1	—	00 to 03
1A	PCDLY	Time to judge position command distribution completion	M,P	0.0	ms	0.0 to 1000.0
28	V-COMP	Preset Velocity Compensation Command	P	0	min-1	-9999 to 9999
2B	TVCACC	Velocity Command Acceleration Time Constant	V	0	ms	0 to 16000
2C	TVCDEC	Velocity Command Deceleration Time Constant	V	0	ms	0 to 16000
2D	VCLM	Velocity Limit Command	P,V	65535	min-1	1 to 65535
31	T-COMP1	Preset Torque Compensation Command 1	P,V	0.0	%	-500.0 to 500.0
32	T-COMP2	Preset Torque Compensation Command 2	P,V	0.0	%	-500.0 to 500.0
37	TCLM-F	Forward Direction Internal Torque Limit Value	M,P,V,T	100.0	%	10.0 to 500.0
38	TCLM-R	Reverse Direction Internal Torque Limit Value	M,P,V,T	100.0	%	10.0 to 500.0
39	SQTCLM	Sequence Operation Torque Limit Value	M,P,V,T	120.0	%	10.0 to 500.0
3A	CPETLSEL	Selection of Torque Limit Input Under Voltage Sag	M,P,V,T	00:No_Limit	—	00 to 03
3B	TASEL	Torque Attainment function select	M,P,V,T	00:TA/TR	—	00 to 01
3C	TA	Torque attainment setting	M,P,V,T	100.0	%	0.0 to 500.0
3D	TLMREST	The amounts of torque limit value restoration when power restored.	M,P,V,T	10.0	%	0.0 to 500.0
3E	BDLY_TCMP	Torque compensation command at holding brake operation cancellation delay	M,P,V	0.0	%	-100.0 to 100.0
40	NEAR	Near Range	M,P	500	Pulse	1 to 2147483647
42	ZV	Speed Zero Range	M,P,V,T	50	min-1	50 to 500
43	LOWV	Low Speed Range	M,P,V,T	50	min-1	0 to 65535
44	VA	Speed Attainment Setting (High Speed Range)	M,P,V,T	1000	min-1	0 to 65535
45	VCMPUS	Speed Matching Unit Selection	M,P,V	00:min-1	—	00 to 01
46	VCMP	Speed Matching Range	M,P,V	50	min-1	0 to 65535
47	VCMPR	Speed Matching Range Ratio	M,P,V	5.0	%	0.0 to 100.0
80	SYNCDIR	Polarity selection of axes-sync compensation input	P	00:Not_Reversed	—	00 to 01

* M = Model following control type, P = Position control type, V = Velocity control type, T = Torque control type

■ General parameters Group9 "Function enabling condition/ General output terminal output condition/ Monitor output selection settings"

ID	Symbol	Name	Control mode	Default value	Setting range
00	F-OT	Positive Over Travel Function	M,P,V,T	0D:CONT6_OFF	00 to 29
01	R-OT	Negative Over Travel Function	M,P,V,T	0B:CONT5_OFF	00 to 29
02	AL-RST	Alarm Reset Function	M,P,V,T	10:CONT8_ON	00 to 29
03	ECLR	Encoder Clear Function	M,P,V,T	06:CONT3_ON	00 to 29
04	CLR	Deviation Clear Function	M,P	08:CONT4_ON	00 to 29
05	S-ON	Servo-ON Function	M,P,V,T	02:CONT1_ON	00 to 29
13	GC1	Gain Switching Condition 1	M,P,V,T	00:Always_Disable	00 to 29
14	GC2	Gain Switching Condition 2	M,P,V,T	00:Always_Disable	00 to 29
15	SUPFSELA1	FF Vibration Suppression Frequency Select Input A1	M,P	00:Always_Disable	00 to 29
16	SUPFSELA2	FF Vibration Suppression Frequency Select Input A2	M,P	00:Always_Disable	00 to 29
17	SUPFSELB1	FF Vibration Suppression Frequency Select Input B1	M,P	00:Always_Disable	00 to 29
18	SUPFSELB2	FF Vibration Suppression Frequency Select Input B2	M,P	00:Always_Disable	00 to 29
19	PLPCON	Position Loop Proportional Control Switching Function	P	01:Always_Enable	00 to 29
1A	MODEL	Model following (vibration suppression) control/ standard position control switching function	M	00:Always_Disable	00 to 11
1B	MDLFSEL1	Model Vibration Suppression Frequency Select Input 1	M	00:Always_Disable	00 to 29
1C	MDLFSEL2	Model Vibration Suppression Frequency Select Input 2	M	00:Always_Disable	00 to 29
27	VLPCON	Velocity Loop Proportional Control Switching Function	P,V	04:CONT2_ON	00 to 29
28	V-COMPS	Velocity Compensation Function	P	00:Always_Disable	00 to 29
30	T-COMPS1	Torque Compensation Function 1	P,V	00:Always_Disable	00 to 29
31	T-COMPS2	Torque Compensation Function 2	P,V	00:Always_Disable	00 to 29
33	OBS	Disturbance Observer Function	M,P,V	00:Always_Disable	00 to 29
34	STC	Stick-slip behavior compensation function	M,P,V,T	00:Always_Disable	00 to 29
35	FBHYST	Minor vibration (oscillation) suppression function	M,P,V,T	00:Always_Disable	00 to 29
40	EXT-E	External Trip Input Function	M,P,V,T	00:Always_Disable	00 to 29
41	EMR	Emergency Stop Function	M,P,V,T	00:Always_Disable	00 to 29
42	SDN	Slowdown before home signal	P	00:Always_Disable	00 to 29
50	OUT1	General Output 1	M,P,V,T	0A:MBR-ON_ON	00 to 87
51	OUT2	General Output 2	M,P,V,T	39:ALM_OFF	00 to 87
60	DMON	Digital Monitor Output Signal Selection	M,P,V,T	00:Always_OFF	00 to 85
61	MON1	Analog Monitor Select Output 1	M,P,V,T	05:VMON_2mV/ min^{-1}	00 to 36
62	MON2	Analog Monitor Select Output 2	M,P,V,T	02:TCMON_2V/TR	00 to 36
63	MONPOL	Analog Monitor Output Polarity	M,P,V,T	00:MON1+_MON2+	00 to 08
64	DMONSEL	Digital monitor extended output selection	P	00:FOUT	00 to 41
65	F-JOG	Positive manual feeding signal function	P	00:Always_Disable	00 to 29
66	R-JOG	Negative manual feeding signal function	P	00:Always_Disable	00 to 29

* M = Model following control type, P = Position control type, V = Velocity control type, T = Torque control type

■ General parameters GroupB "Sequence/Alarm related settings"

ID	Symbol	Name	Control mode	Default value	Unit	Setting range
00	DBOPE	Servo-OFF stop behavior	M,P,V,T	04:SB_Free	—	00 to 07
01	ACTOT	Over-Travel Action	M,P,V,T	00:CMDINH_ SB_SON	—	00 to 08
02	ACTEMR	Emergency Stop Operation	M,P,V	00:SERVO-BRAKE	—	00 to 02
03	BONDLY	Delay Time of Engaging Holding Brake (Holding Brake Holding Delay Time)	M,P,V,T	300	ms	0 to 1000
04	BOFFDLY	Delay Time of Releasing Holding Brake (Holding Brake Release Delay Time)	M,P,V,T	300	ms	0 to 1000
05	BONBGN	Brake Operation Beginning Time	M,P,V,T	10000	ms	0 to 65535
06	PFDDLY	Power Failure Detection Delay Time	M,P,V,T	32	ms	20 to 1000
07	INTTIM	Initial timeout wait time	M,P,V,T	00:Disabled	—	00 to 07
10	OFWLV	Excessive Deviation Warning Level	M,P	2147483647	Pulse	1 to 2147483647
12	OLWLV	Overload Warning Level	M,P,V,T	90	%	20 to 100
13	VFBALM	Velocity Feedback Alarm (ALM_C3) Detection	M,P,V,T	01:Enabled	—	00 to 01
14	VCALM	Velocity Control Alarm (ALM_C2) Detection	M,P,V,T	00:Disabled	—	00 to 01
15	SOFDEC	Deceleration Time Constant at Servo off Stopping	M,P,V,T	0	ms	0 to 16000
16	EMRDEC	Deceleration Time Constant at Emergency Stopping	M,P,V,T	0	ms	0 to 16000
17	SONFALL	External command effectivity selection at holding brake operation cancellation delay time	M,P,V	00:Disabled	—	00 to 01
18	SOFFFALL	External command effectivity selection at holding brake operation delay time	M,P,V	00:Disabled	—	00 to 01

* M = Model following control type, P = Position control type, V = Velocity control type, T = Torque control type

■ General parameters GroupC "Encoder related settings"

ID	Symbol	Name	Control mode	Default value	Unit	Setting range
00	ENFIL	Motor Incremental Encoder Digital Filter	M,P,V,T	01:220ns	—	00 to 07
01	EX-ENFIL	External Incremental Encoder Digital Filter	M,P,V,T	01:220ns	—	00 to 07
02	EX-ENPOL	External Encoder Polarity Selection	M,P,V,T	00:Type1	—	00 to 07
08	ECLRFUNC	Encoder Clear Function Selection	M,P,V,T	00:Status_ MultiTurn	—	00 to 01
0B	EX-SENPOL	External Absolute Encoder polarity selection	M,P,V,T	00:Standard	—	00 to 01
10	DE1MSKLVL	Broken wire mask level at Encoder connector 1	M,P,V,T	0	kHz	0 to 65535
11	DE3MSKLVL	Broken wire mask level at Encoder connector 2	M,P,V,T	0	kHz	0 to 65535

* M = Model following control type, P = Position control type, V = Velocity control type, T = Torque control type

■ General parameters GroupD "Support function related settings"

ID	Symbol	Name	Control mode	Default value	Unit	Setting range
02	TSTTCLM	Support function torque limit value	M,P,V,T	120.0	%	10.0 to 500.0
10	COMAXIS	Serial Communication Axis Number	M,P,V,T	01:#1	—	01 to 0F
11	MONDISP	Monitor Display Selection	M,P,V,T	00:STATUS	—	00 to 77
20	SAMPDIV	Drec. sampling rate	M,P,V,T	20	—	0 to 65535
21	SAMPNUM	Drec. sampling mode	M,P,V,T	00:256point	—	00 to 02
22	TRGCHSEL	Drec. Trigger Channel	M,P,V,T	83:DIGITAL_4	—	00 to 83
23	TRGEDGSEL	Drec. Trigger Slope	M,P,V,T	00:POS_EDGE	—	00 to 02
24	TRGHPOS	Drec. Trigger Horizontal Position	M,P,V,T	80	%	0 to 100
25	TRGLVL	Drec. Trigger Level	M,P,V,T	1	—	-9223372036854775808 to 9223372036854775807
31	CH1SEL	Drec. Analog CH1 selection	M,P,V,T	08:PCMDF1	—	00 to 23, FF
32	CH2SEL	Drec. Analog CH2 selection	M,P,V,T	01:VCMON	—	00 to 23, FF
33	CH3SEL	Drec. Analog CH3 selection	M,P,V,T	03:TCMON	—	00 to 23, FF
34	CH4SEL	Drec. Analog CH4 selection	M,P,V,T	15:VBUS	—	00 to 23, FF
35	CH5SEL	Drec. Analog CH5 selection	M,P,V,T	05:POSITION	—	00 to 23, FF
36	CH6SEL	Drec. Analog CH6 selection	M,P,V,T	00:VMON	—	00 to 23, FF
37	DCH1SEL	Drec. Digital CH1 selection	M,P,V,T	16:SRDY	—	00 to 20, FF
38	DCH2SEL	Drec. Digital CH2 selection	M,P,V,T	15:SACT	—	00 to 20, FF
39	DCH3SEL	Drec. Digital CH3 selection	M,P,V,T	1B:WRG-DF	—	00 to 20, FF
3A	DCH4SEL	Drec. Digital CH4 selection	M,P,V,T	1C:ALM	—	00 to 20, FF

* M = Model following control type, P = Position control type, V = Velocity control type, T = Torque control type

5. Operation

5.8 Parameter functions

Each parameter function is explained below.

■ Group0 "Auto-tuning settings"

<table>
<tr><th>ID</th><th colspan="4">Contents</th></tr>
<tr><td rowspan="3">00</td><td rowspan="2">Tuning mode
[TUNMODE]</td><td>Setting range</td><td>Unit</td><td>Default</td></tr>
<tr><td>00 to 02</td><td>-</td><td>00:AutoTun</td></tr>
<tr><td colspan="4">■ Set the validity/ invalidity of Auto-tuning and Load inertia moment rate estimation.
<table>
<tr><th colspan="2">Selection</th><th>Contents</th></tr>
<tr><td>00</td><td>AutoTun</td><td>Automatic Tuning</td></tr>
<tr><td>01</td><td>AutoTun_JRAT-Fix</td><td>Automatic Tuning (JRAT Manual Setting)</td></tr>
<tr><td>02</td><td>ManualTun</td><td>Manual Tuning</td></tr>
</table>
◆ Under the following operating conditions, Load inertia rate is not estimated properly: at low velocity, at low acceleration and at low acceleration/deceleration torque.
In these cases, please set “Automatic Tuning (JRAT Manual Setting)” and set proper value to JRAT 1.

◆ In addition, under the following machine operating conditions, Load inertia rate is not estimated properly: machine with large disturbance torque, with big backlash and with a machine in which movable parts vibrate.
In these cases, set at “Automatic Tuning (JRAT Manual Setting)” and set proper value to JRAT1.

* When “Model following vibration suppression control” is set to “ID07 Position Control Selection“ of system parameter, set “02: Manual tuning”.</td></tr>
</table>

－Group0－

ID	Contents			
01	Auto-Tuning Characteristic [ATCHA]	Setting range	Unit	Default
		00 to 06	-	00:Positioning1

■ Set the suitable parameters for each control method.

Selection		Contents
00	Positioning1	Positioning Control 1 (General Purpose)
01	Positioning2	Positioning Control 2 (High Response)
02	Positioning3	Positioning Control 3 (High Response, FFGN Manual Setting)
03	Positioning4	Positioning Control 4 (High Response, Horizontal Axis Limited)
04	Positioning5	Positioning Control 5 (High Response, Horizontal Axis Limited, FFGN Manual Setting)
05	Trajectory1	Trajectory Control 1
06	Trajectory2	Trajectory Control 2 (KP,FFGN Manual Setting)

◆ “Positioning Control 1”
- Select for general purpose positioning.
- Use this parameter at Velocity control mode or Torque control mode.
- Can be used for an axis which affected by gravity or external forces.

◆ “Positioning Control 2”
- Use this parameter at Position control mode.
- Can be suppressed overshoot at positioning use, it will shorten positioning settling time.
- Can be used for an axis which affected by gravity or external forces.

◆ “Positioning Control 3”
- Select for the purpose of manual tuning of FFGN.

◆ “Positioning Control 4”
- Select this mode when the machine movement is in horizontal axis and receives no impacts from external force.
- Positioning-settling time may shorten compared to “Positioning Control 2”.
- Use this parameter at Position control mode.
- Do not use for an axis which affected by gravity or external forces.
- This parameter may give shock to the application.

◆ “Positioning Control 5”
- Select for the purpose of manual tuning of FFGN when the machine movement is in horizontal axis and receives no impacts from external force.
- Positioning-settling time may shorten compared to “Positioning Control 3”.
- This parameter may give shock to the application.

◆ “Trajectory Control 1”
- This is the setting for tracking a position command from host unit as machining.
- Use this parameter at Position control mode.
- Can be used for an axis which affected by gravity or external forces.
- Select this parameter for single axis or asynchronous use.
- Select "Trajectory Control 2" when cooperating with other axes.
- The positioning characteristics will change when the “Position Loop Gain” is altered with fluctuation of the estimated inertia moment. If you want to avoid this change, please adopt “Trajectory Control 2” or use manual tuning.

◆ “Trajectory Control 2”
- This is the setting for syncing a response of each axis position loop as cooperation with the other axes.
- Use this parameter at Position control mode.
- Can be used for an axis which affected by gravity or external forces.

* When "Trajectory control" is used, do not set "Model following vibration suppression control" to “ID07 Position Control Selection”. By setting "Model following vibration suppression control", trajectory will get deviation.

－Group0－

<table>
<tr><th>ID</th><th>Contents</th></tr>
<tr><td>02</td><td>
<table>
<tr><td>Auto-Tuning Response [ATRES]</td><td>Setting range
1 to 40</td><td>Unit
-</td><td>Default
5</td></tr>
</table>
■ Sets the Auto-Tuning Response.
◆ The larger the set value, the higher the response.
◆ Caution, if the response is set too high, the machine may oscillate.
◆ Make the setting suited to rigidity of the device.
■ In case of following, set value will be 30 even if 31 to 40 are set.
◆ When "00: Positioning1" is set to Group0 ID01 Auto-Tuning Characteristic [ATCHA].
◆ When "01: Enable" is set to Group0 ID04 Auto-Tuning characteristic compatible mode [ATCSEL].
</td></tr>
<tr><td>03</td><td>
<table>
<tr><td>Auto-Tuning Automatic Parameter Saving [ATSAVE]</td><td>Setting range
00 to 01</td><td>Unit
-</td><td>Default
00:Auto_Saving</td></tr>
</table>
■ Select if the automatic parameter saving function is valid to save the Load inertia moment ratio estimated by the servo amplifier Auto-tuning function in the Group1 ID14 Load Inertia Moment Ratio 1 [JRAT1].
◆ This setting is valid when Group0 ID00 Tuning Mode is at "00: AutoTun Auto-tuning".
◆ Automatic save is done in every 30 minutes.
<table>
<tr><th colspan="2">Selection</th><th>Contents</th></tr>
<tr><td>00</td><td>Auto_Saving</td><td>Automatically Saves in JRAT1</td></tr>
<tr><td>01</td><td>No_Saving</td><td>Automatic Saving is Invalid</td></tr>
</table>
</td></tr>
<tr><td>04</td><td>
<table>
<tr><td>Auto-Tuning characteristic compatible mode [ATCSEL]</td><td>Setting range
00 to 01</td><td>Unit
-</td><td>Default
00:Disable</td></tr>
</table>
■ Set "01: Enable Valid (RS2 compatible)" to set auto-tuning characteristic compatible with RS1/RS2 amplifier. In this case, gain set value will be 30 even if 31 to 40 are set.
<table>
<tr><th colspan="2">Selection</th><th>Contents</th></tr>
<tr><td>00</td><td>Disable</td><td>Invalid</td></tr>
<tr><td>01</td><td>Enable</td><td>Valid (RS2 compatible)</td></tr>
</table>
</td></tr>
<tr><td>10</td><td>
<table>
<tr><td>Auto-Notch Filter Tuning Torque Command [ANFILTC]</td><td>Setting range
10.0 to 100.0</td><td>Unit
%</td><td>Default
50.0</td></tr>
</table>
■ Sets the torque value for excite the mechanical system during operation under "Auto-Notch Filter Tuning".
* Larger value makes the tuning more accurate; however, note that it also makes the movement of the machine greater.
</td></tr>
<tr><td>20</td><td>
<table>
<tr><td>Auto-FF Vibration Suppression Frequency Tuning Torque Command [ASUPTC]</td><td>Setting range
10.0 to 100.0</td><td>Unit
%</td><td>Default
25.0</td></tr>
</table>
■ Sets the torque value for excite the mechanical system during operation under "Auto-FF Vibration Suppression Frequency Tuning".
* Larger value makes the tuning more accurate; however, note that it also makes the movement of the machine greater.
</td></tr>
<tr><td>21</td><td>
<table>
<tr><td>Auto-FF Vibration Suppression Frequency Tuning Friction Compensation Value [ASUPFC]</td><td>Setting range
0.0 to 50.0</td><td>Unit
%</td><td>Default
5.0</td></tr>
</table>
■ Sets the friction torque compensation added to the motor torque to excite the mechanical system at the time of Auto-FF Vibration Suppression Frequency Tuning.
◆ By setting this value close to actual friction torque, Auto-FF vibration suppression frequency tuning will be more accurate.
* When the set value is low, there may be cases that the vibration frequency of the mechanical system cannot be detected, or the wrong value is detected. Raise the value until the detected value settles.
</td></tr>
</table>

－Group0－

<table>
<tr><th>ID</th><th>Contents</th></tr>
<tr><td>34</td><td>
Adaptive notch filter function E [ADNFE]
<table>
<tr><th>Setting range</th><th>Unit</th><th>Default</th></tr>
<tr><td>00 to 01</td><td>-</td><td>00: Adp_Filter Disable</td></tr>
</table>
■ This is the parameter which selects function of torque command notch filter E.
By setting "01: Adp_Filter Enable Adaptation at all times", notch filter E will be adjusted to mechanical resonant frequency.
When adaptive notch filter function is valid, Group2 ID29 will be fixed to 0. Group2 ID28 will work as initial value of adaptive notch filter.
<table>
<tr><th colspan="2">Selection</th><th>Contents</th></tr>
<tr><td>00</td><td>Adp_Filter Disable</td><td>Adaptation invalid (TCNFILE manual setting)</td></tr>
<tr><td>01</td><td>Adp_Filter Enable</td><td>Adaptation at all times</td></tr>
</table>
</td></tr>
<tr><td>35</td><td>
Adaptive notch filter frequency upper limit E [ADNFUE]
<table>
<tr><th>Setting range</th><th>Unit</th><th>Default</th></tr>
<tr><td>100 to 1000</td><td>Hz</td><td>1000</td></tr>
</table>
■ Sets adaptive notch filter frequency upper limit.
Sets upper limit of mechanical variation.
Please set higher value than ADNFLE.
</td></tr>
<tr><td>36</td><td>
Adaptive notch filter frequency lower limit E [ADNFLE]
<table>
<tr><th>Setting range</th><th>Unit</th><th>Default</th></tr>
<tr><td>100 to 1000</td><td>Hz</td><td>100</td></tr>
</table>
■ Sets adaptive notch filter frequency lower limit.
Sets lower limit of mechanical variation.
Please set lower value than ADNFUE.
</td></tr>
<tr><td>37</td><td>
Adaptive notch filter E auto saving [ADNSVE]
<table>
<tr><th>Setting range</th><th>Unit</th><th>Default</th></tr>
<tr><td>00 to 01</td><td>-</td><td>00:Auto_Saving</td></tr>
</table>
■ Selects valid/invalid of the function that saves mechanical resonant frequency automatically which is estimated by the servo amplifier to torque command notch filter E set value.
◆ This setting is valid when "01: Adp_Filter_Enable" is set to Group0 ID34.
◆ Estimation result is automatically saved in torque command notch filter E in every 30 minutes.
<table>
<tr><th colspan="2">Selection</th><th>Contents</th></tr>
<tr><td>00</td><td>Auto_Saving</td><td>Save automatically</td></tr>
<tr><td>01</td><td>No_Saving</td><td>Without save</td></tr>
</table>
</td></tr>
</table>

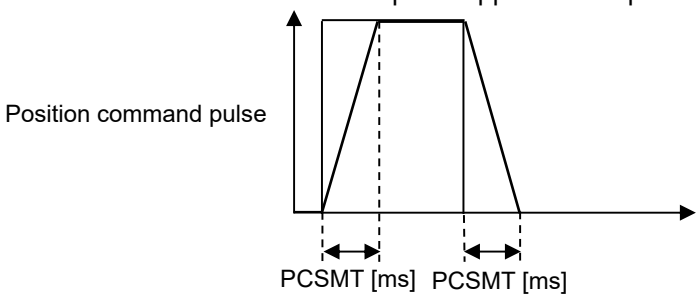
■ Group1 "Basic control parameter settings"

ID	Contents			
00	Position Command Smoothing Constant [PCSMT]	Setting range	Unit	Default
		0.0 to 500.0	ms	0.0

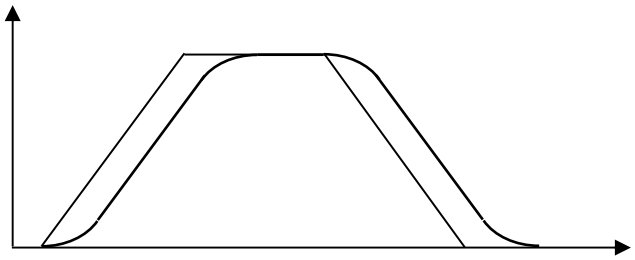
■ This is the moving-average filter which makes smooth the position command pulse.

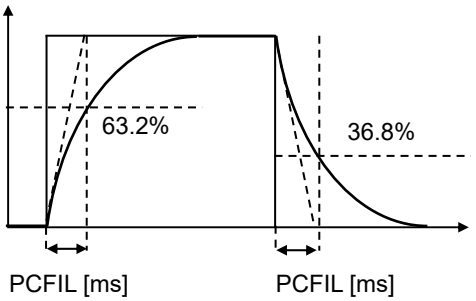
- ◆ Sets time constants.
- ◆ Applies ramp to the step form position command pulse.
- ◆ Applies S curve to the ramp form position command pulse.
- ◆ Smoothes the position command pulse when the electronic gear ratio is greater or the position command pulse is coarse. (This may decrease the operating noise from servo motor.)
- ◆ Set the value 0.3 ms or more.
- ◆ When the set value is “0.0 to 0.2 ms”, this filter is invalid.
- ◆ Set in increments of 0.5ms. (Under the set value “0.4ms and less”, there may be cases where the set value cannot be applied to the operation.)

● Position command pulse applied as step form



● Position command pulse applied as ramp form



<table>
<tr><th>ID</th><th>Contents</th></tr>
<tr><td>01</td><td>
<table>
<tr><td>Position Command Filter
[PCFIL]</td><td>Setting range
0.0 to 2000.0</td><td>Unit
ms</td><td>Default
0.0</td></tr>
</table>
■ This primary low-pass filter suppresses any sudden change of the position control pulse.
Sets time constants.
◆ This parameter setting is valid when the value of Group1 ID08 Higher Tracking Control Position Compensation Gain is set at 0%.
◆ When Higher Tracking Control Position Compensation Gain is 0%, and this value is set at 0.0ms, the filter becomes invalid.
◆ This filter can suppress overshoot caused by the rise of the feed forward compensation gain.


</td></tr>
<tr><td>02</td><td>
<table>
<tr><td>Position Loop Proportional Gain 1
[KP1]</td><td>Setting range
1 to 3000</td><td>Unit
1/s</td><td>Default
30</td></tr>
</table>
■ Proportional gain for position controller.
◆ Automatically overwrite by Auto-tuning result saving.
◆ When Auto-tuning function is valid, this setting value is not applied.
◆ When Gain switching function is valid, this setting value is applied by selecting gain 1.
◆ When Gain switching function is invalid, this setting value is applied.
</td></tr>
<tr><td>03</td><td>
<table>
<tr><td>Position Loop Integral Time Constant 1
[TPI1]</td><td>Setting range
0.3 to 1000.0</td><td>Unit
ms</td><td>Default
1000.0</td></tr>
</table>
■ Integral time constant for position controller.
This setting is valid when the Position Loop Proportional Control Switching Function is invalid.
◆ Integral term is invalid (proportional control) at the setting value 1000.0ms.
◆ When Gain switching function is valid, this setting value is applied by selecting gain 1.
◆ When Gain switching function is invalid, this setting value is applied.
</td></tr>
<tr><td>04</td><td>
<table>
<tr><td>Position loop phase lead compensation gain
[PLPHLK]</td><td>Setting range
0 to 100</td><td>Unit
%</td><td>Default
0</td></tr>
</table>
■ Sets the phase improving value of Position loop phase lead compensation.
◆ For position loop, adds the function that shifts phase on phase lead compensation frequency (PLPHLF) as 17deg by 50% and 35deg by 100%. Pay attention for gain increment after PLPHLF.
◆ This parameter will be disabled when 0% is set.
</td></tr>
<tr><td>05</td><td>
<table>
<tr><td>Position loop phase lead compensation frequency
[PLPHLF]</td><td>Setting range
10 to 4000</td><td>Unit
Hz</td><td>Default
500</td></tr>
</table>
■ Sets the frequency that is wanted to improve the phase of position loop.
◆ Set value will limit 1,000Hz even if 1,000Hz or more is set.
◆ This parameter can set in 1 Hz unit, but it will be rounded down to the 10 Hz internally.
* Please stop servo motor if change this value.
</td></tr>
</table>

5. Operation

－Group1－

<table>
<tr><th>ID</th><th>Contents</th></tr>
<tr><td>06</td><td>
Velocity Feed Forward Gain [FFGN]
Setting range: 0 to 100 | Unit: % | Default: 0
■ Sets the feed forward compensation gain to position control system.
■ When "Model following control" is enabling, model velocity feed forward gain will be enabled and this parameter value will be disabled.
◆ This parameter will be valid when "Higher Tracking Control Position Compensation Gain" is set to 0%.
◆ Automatically overwrite by Auto-tuning result saving.
◆ The setting value is not applied when using the Auto-Tuning Characteristics listed below.
<table>
<tr><td>Positioning1</td><td>Positioning Control 1 (General Purpose)</td></tr>
<tr><td>Positioning2</td><td>Positioning Control 2 (High Response)</td></tr>
<tr><td>Positioning4</td><td>Positioning Control 4 (High Response, Horizontal Axis Limited)</td></tr>
<tr><td>Trajectory1</td><td>Trajectory Control 1</td></tr>
</table>
</td></tr>
<tr><td>07</td><td>
Velocity Feed Forward Filter [FFFIL]
Setting range: 1 to 4000 | Unit: Hz | Default: 4000
■ This is primary low-pass filter to eliminate pulsed ripple caused by the position command pulse included in the feed forward command. Sets the cutoff frequency.
■ When "Model following control" is enabling, model velocity feed forward will be enabled and this parameter value will be disabled.
<table>
<tr><th colspan="2">Control cycle</th><th>Setting value</th><th>Valid/ Invalid</th></tr>
<tr><td rowspan="2">00</td><td rowspan="2">Standard_Sampling</td><td>1 to 1999Hz</td><td>Set value valid</td></tr>
<tr><td>2000 to 4000Hz</td><td>Filter invalid</td></tr>
<tr><td rowspan="2">01</td><td rowspan="2">High-freq_Sampling</td><td>1 to 1999Hz</td><td>Set value valid</td></tr>
<tr><td>2000 to 4000Hz</td><td>Filter invalid</td></tr>
</table>
</td></tr>
<tr><td>08</td><td>
Higher Tracking Control Position Compensation Gain [TRCPGN]
Setting range: 0 to 100 | Unit: % | Default: 0
■ Adjusts command tracking performance of position control system.
The larger value can raise command tracking performance higher.
◆ When set the value except 0%, "Position command filter" and "Velocity Feed forward gain" are set automatically in the servo amplifier.
◆ Automatically overwrite by Auto-tuning result saving.
◆ When Auto-tuning function is valid, this setting value not applied.
</td></tr>
<tr><td>10</td><td>
Velocity Command Filter [VCFIL]
Setting range: 1 to 4000 | Unit: Hz | Default: 4000
■ This is primary low-pass filter to suppress sudden change of velocity command.
Sets the cutoff frequency.
Use External Velocity Command Filter when eliminating Analog velocity command noise.
◆ Setting range varies depending on the setting of the system parameter ID00 Control Cycle.
<table>
<tr><th colspan="2">Control cycle</th><th>Setting value</th><th>Valid/ Invalid</th></tr>
<tr><td rowspan="2">00</td><td rowspan="2">Standard_Sampling</td><td>1 to 1999Hz</td><td>Set value valid</td></tr>
<tr><td>2000 to 4000Hz</td><td>Filter invalid</td></tr>
<tr><td rowspan="2">01</td><td rowspan="2">High-freq_Sampling</td><td>1 to 3999Hz</td><td>Set value valid</td></tr>
<tr><td>4000Hz</td><td>Filter invalid</td></tr>
</table>
</td></tr>
</table>

－Group1－

<table>
<tr><th>ID</th><th colspan="4">Contents</th></tr>
<tr><td rowspan="2">11</td><td>Velocity Feedback Filter
[VDFIL]</td><td>Setting range</td><td>Unit</td><td>Default</td></tr>
<tr><td>1 to 4000</td><td>Hz</td><td>1500</td></tr>
<tr><td colspan="4">■ This is primary low-pass filter to eliminate ripples caused by encoder pulse included in the velocity control system feedback. Sets the cutoff frequency.
◆ When the encoder resolution is low, lowering the setting value and suppressing the ripples may suppress motor drive noise. In addition, when the encoder resolution is high, raising the setting value may improve the response of the velocity control system. For general use, set at the Standard value.
◆ Setting range varies depending on the setting of the system parameter ID00 Control Cycle.
<table>
<tr><th colspan="2">Control cycle</th><th>Setting value</th><th>Valid/ Invalid</th></tr>
<tr><td rowspan="2">00</td><td rowspan="2">Standard_Sampling</td><td>1 to 1999Hz</td><td>Set value valid</td></tr>
<tr><td>2000 to 4000Hz</td><td>Filter invalid</td></tr>
<tr><td rowspan="2">01</td><td rowspan="2">High-freq_Sampling</td><td>1 to 3999Hz</td><td>Set value valid</td></tr>
<tr><td>4000Hz</td><td>Filter invalid</td></tr>
</table></td></tr>
<tr><td rowspan="2">12</td><td>Velocity Loop Proportional Gain 1
[KVP1]</td><td>Setting range</td><td>Unit</td><td>Default</td></tr>
<tr><td>1 to 2000</td><td>Hz</td><td>50</td></tr>
<tr><td colspan="4">■ Proportional gain of velocity controller.
When Load Inertia Moment Ratio 1 is same as the actual load inertia moment, this setting value response is performed.
◆ Automatically overwrite by Auto-tuning result saving.
◆ When Auto-tuning function is valid, this setting value is not applied.
◆ When Gain switching function is valid, this setting value is applied by selecting gain 1.
◆ While system analysis function is active, this value is applied even if Auto-tuning is valid.</td></tr>
<tr><td rowspan="2">13</td><td>Velocity Loop Integral Time Constant 1
[TVI1]</td><td>Setting range</td><td>Unit</td><td>Default</td></tr>
<tr><td>0.3 to 1000.0</td><td>ms</td><td>20.0</td></tr>
<tr><td colspan="4">■ Integral time constant of velocity controller.
This setting value is valid when Velocity Loop Proportional Control Switching Function is invalid.
◆ Integral term is invalid (proportional control) with the setting value of 1000.0ms.
◆ Automatically overwrite by Auto-tuning result saving.
◆ When Auto-tuning function is valid, this setting value is not applied.
◆ When Gain switching function is valid, this setting value is applied by selecting gain 1.
◆ While system analysis function is active, this value is applied even if Auto-tuning is valid.</td></tr>
</table>

－Group1－

<table>
<tr><th>ID</th><th>Contents</th></tr>
<tr><td>14</td><td>
Load Inertia Moment Ratio 1 [JRAT1]
Setting range: 0 to 15000 | Unit: % | Default: 100
■ Sets the inertia moment of the loading device to the servo motor inertia moment.
◆ Setting value=$J_L/J_M \times 100\%$
● J_L : Load inertia moment
● J_M : Motor inertia moment
◆ Automatically overwrite by Auto-tuning result saving.
◆ If this value matches the actual mechanical system, setting value of KVP will be the response frequency of the velocity control system.
◆ When Auto-Tuning Automatic Parameter Saving function is valid, this parameter is overwriting with an estimated result.
◆ When Auto-tuning Function is valid, this value is not applied.
◆ Use between the range of 100 to 3000% when driven with Model following vibration suppression control.
◆ When Gain switching function is valid, this setting value is applied by selecting gain 1.
◆ While system analysis function is active, this value is applied even if Auto-tuning is valid.
</td></tr>
<tr><td>15</td><td>
Velocity loop phase lead compensation gain [VLPHLK]
Setting range: 0 to 100 | Unit: % | Default: 0
■ Sets the phase improving value of Velocity loop phase lead compensation.
◆ For velocity loop, adds the function that shifts phase on phase lead compensation frequency as 17deg by 50% and 35deg by 100%. Pay attention for gain increment after VLPHLF.
◆ This parameter will be disabled when 0% is set.
</td></tr>
<tr><td>16</td><td>
Velocity loop phase lead compensation frequency [VLPHLF]
Setting range: 10 to 4000 | Unit: Hz | Default: 500
■ Sets the frequency that is wanted to improve the phase of velocity loop.
◆ This parameter can set in 1 Hz unit, but it will be rounded down to the 10 Hz internally.
* Please stop servo motor if change this value.
<table>
<tr><th colspan="2">Control cycle</th><th>Setting value</th><th>Compensation frequency</th></tr>
<tr><td rowspan="2">00</td><td rowspan="2">Standard_Sampling
Standard sampling mode</td><td>1 to 1000Hz</td><td>Set value valid</td></tr>
<tr><td>1001 to 4000Hz</td><td>1000Hz</td></tr>
<tr><td rowspan="2">01</td><td rowspan="2">High-freq_Sampling
Hi-speed sampling mode</td><td>1 to 2000Hz</td><td>Set value valid</td></tr>
<tr><td>2001 to 4000Hz</td><td>2000Hz</td></tr>
</table>
</td></tr>
<tr><td>17</td><td>
High order integral control gain [HKVIK]
Setting range: 0 to 100 | Unit: % | Default: 0
■ Sets the phase improving value of Velocity loop phase lead compensation.
◆ The larger value can change shorter velocity loop integral time constant.
◆ This parameter will be disabled when 0% is set.
</td></tr>
<tr><td>18</td><td>
High order integral control frequency [HKVIF]
Setting range: 10 to 4000 | Unit: Hz | Default: 500
■ Sets when velocity loop integral time constant wants to be shorter. Sets the frequency that is wanted to improve the phase.
* This parameter can set in 1 Hz unit, but it will be rounded down to the 10 Hz internally.
* Please stop servo motor if change this value.
<table>
<tr><th colspan="2">Control cycle</th><th>Setting value</th><th>Compensation frequency</th></tr>
<tr><td rowspan="2">00</td><td rowspan="2">Standard_Sampling
Standard sampling mode</td><td>1 to 1000Hz</td><td>Set value valid</td></tr>
<tr><td>1001 to 4000Hz</td><td>1000Hz</td></tr>
<tr><td rowspan="2">01</td><td rowspan="2">High-freq_Sampling
Hi-speed sampling mode</td><td>1 to 2000Hz</td><td>Set value valid</td></tr>
<tr><td>2001 to 4000Hz</td><td>2000Hz</td></tr>
</table>
</td></tr>
</table>

－Group1－

<table>
<tr><th>ID</th><th colspan="4">Contents</th></tr>
<tr><td rowspan="3">19</td><td>Torque Feed Forward Gain
[TFFK]</td><td>Setting range
0 to 100</td><td>Unit
%</td><td>Default
0</td></tr>
<tr><td colspan="4">■ Sets feed forward compensation gain to velocity control system.
◆ The setting value is not applied when "Position control selection " is "Model following control".</td></tr>
<tr><td colspan="4"></td></tr>
<tr><td rowspan="3">1A</td><td>Torque feedforward averaging
[TFFAVE]</td><td>Setting range
00 to 01</td><td>Unit
-</td><td>Default
01: 4timesAverage</td></tr>
<tr><td colspan="4">■ Selects the average count of torque feedforward compensation.
<table>
<tr><th colspan="2">Selection</th><th>Contents</th></tr>
<tr><td>00</td><td>2timesAverage</td><td>2 times</td></tr>
<tr><td>01</td><td>4timesAverage</td><td>4 times</td></tr>
</table></td></tr>
<tr><td colspan="4"></td></tr>
<tr><td rowspan="3">1B</td><td>Torque feedforward output selection
[TFFOUT]</td><td>Setting range
00 to 01</td><td>Unit
-</td><td>Default
00:Before_filter</td></tr>
<tr><td colspan="4">■ Select the point that is to be added torque feed forward compensation.
<table>
<tr><th colspan="2">Selection</th><th>Contents</th></tr>
<tr><td>00</td><td>Before_filter</td><td>Before torque command filter</td></tr>
<tr><td>01</td><td>After_filter</td><td>After torque command filter</td></tr>
</table></td></tr>
<tr><td colspan="4"></td></tr>
</table>

－Group1－

<table>
<tr><th>ID</th><th>Contents</th></tr>
<tr><td>1C</td><td>
Acceleration Feedback Gain [AFBK]
Setting range: -100.0 to 100.0 | Unit: % | Default: 0.0
■ Sets acceleration feedback compensation gain to make the velocity loop stable.
Multiply this gain with the detected acceleration to compensate torque command.
◆ Automatically overwrite by Auto-tuning result saving.
◆ When Auto-tuning function is valid, this setting value not applied.
◆ If the value is too large, the motor may oscillate. Sets within range ±15.0% for general use.
</td></tr>
<tr><td>1D</td><td>
Acceleration Feedback Filter [AFBFIL]
Setting range: 1 to 4000 | Unit: Hz | Default: 500
■ This is primary low-pass filter to eliminate ripples caused by encoder pulse included in acceleration feedback compensation. Sets the cutoff frequency.
◆ Lower this setting value when the encoder resolution is low.
◆ Setting range varies depending on the setting of the system parameter ID00 Control Cycle.
<table>
<tr><th colspan="2">Control cycle</th><th>Setting value</th><th>Valid/ Invalid</th></tr>
<tr><td rowspan="2">00</td><td rowspan="2">Standard_Sampling
Standard sampling mode</td><td>1 to 1999Hz</td><td>Set value valid</td></tr>
<tr><td>2000 to 4000Hz</td><td>Filter invalid</td></tr>
<tr><td rowspan="2">01</td><td rowspan="2">High-freq_Sampling
Hi-speed sampling mode</td><td>1 to 3999Hz</td><td>Set value valid</td></tr>
<tr><td>4000Hz</td><td>Filter invalid</td></tr>
</table>
</td></tr>
<tr><td>1E</td><td>
Higher Tracking Control Velocity Compensation Gain [TRCVGN]
Setting range: 0 to 100 | Unit: % | Default: 0
■ Adjusts command tracking performance of velocity control system.
◆ The larger value can raise command tracking performance higher.
◆ When using Velocity Loop Proportional Control Switching Function, set 0%.
◆ When synchronizing with other axes, set 0%.
◆ When corresponding with Q series servo amplifier, set 100%.
◆ Automatically overwrite by Auto-tuning result saving.
◆ When Auto-tuning function is valid, this setting value not applied.
◆ The setting value is invalid with "Model following control" or "Model following vibration suppression control".
</td></tr>
</table>

－Group1－

ID	Contents			
20	Torque Command Filter 1 [TCFIL1]	Setting range	Unit	Default
		1 to 4000	Hz	600

■ This is Low-pass filter to eliminate high frequency component included in the torque command. Sets cutoff frequency.

- ◆ Automatically overwrite by Auto-tuning result saving.
- ◆ When Auto-tuning function is valid, this setting value is not applied.
- ◆ When Gain switching function is valid, this setting value is applied by selecting gain 1.
- ◆ While system analysis function is active, this value is applied even if Auto-tuning is valid.
- ◆ Setting range varies depending on the setting of the system parameter ID00 Control Cycle.
  (Torque command filter cannot be disabled)

Control cycle		Setting value	Cutoff frequency
00	Standard_Sampling Standard sampling mode	1 to 1999Hz	Set value valid
		2000 to 4000Hz	2000Hz
01	High-freq_Sampling Hi-speed sampling mode	1 to 4000Hz	Set value valid

Use within 1 to 1,000Hz with Model following control.
Use within 100 to 1,000Hz with Model following vibration suppression control.

ID				
21	Torque Command Filter Order [TCFILOR]	Setting range	Unit	Default
		1 to 3	Order	2

■ Sets order of the torque command filter.
The order will be fixed with the set value even if the cut off frequency of torque command filter is changed by Gain switching.

■ Group2 "FF (Feed Forward) vibration suppression control/ Notch filter/ Disturbance observer settings"

<table>
<tr><th>ID</th><th colspan="4">Contents</th></tr>
<tr><td rowspan="2">00</td><td>FF Vibration Suppression Frequency A1
[SUPFRQA1]</td><td>Setting range
1.0 to 500.0</td><td>Unit
0.1Hz</td><td>Default
500.0</td></tr>
<tr><td colspan="4">■ Sets the frequency of the machine vibration to be suppressed by FF vibration suppressor function.
Please stop servo motor if change this value.
◆ This parameter will be overwritten by executing Auto-FF Vibration Suppression Frequency Tuning.
◆ Tuning result will be saved to this parameter automatically.
◆ This setting value works when "FF Vibration Suppression Frequency Select Input A1" is enabled.
◆ Do not use while synchronizing with other axis such as controlling XY table trajectory for cutting operation.
<table>
<tr><th>Setting range</th><th>Unit and process inside servo amplifier</th></tr>
<tr><td>1.0 to 9.9Hz</td><td>Valid by 0.1Hz</td></tr>
<tr><td>10.0 to 99.9Hz</td><td>Valid by 0.5Hz and drop less than 0.5</td></tr>
<tr><td>100.0 to 499.9Hz</td><td>Valid by 5Hz and drop less than 5</td></tr>
<tr><td>500.0Hz</td><td>FF vibration suppression control is invalid</td></tr>
</table>
* FF vibration suppression control will be invalid during this parameter change, and servo motor will rotate until rest of internal position command of FF vibration suppression control has outputted.
* If FF vibration suppression frequency is changed, the time which will be valid of changed value varies depending on the frequency before change.
<table>
<tr><th>The frequency before change</th><th>The time which will be valid of changed value</th></tr>
<tr><td>5.0Hz or more</td><td>1 sec.</td></tr>
<tr><td>3.0Hz</td><td>3 sec.</td></tr>
<tr><td>1.0Hz</td><td>7 sec.</td></tr>
</table></td></tr>
<tr><td rowspan="2">01</td><td>FF Vibration Suppression Level Selection A
[SUPLVA]</td><td>Setting range
00 to 03</td><td>Unit
—</td><td>Default
00</td></tr>
<tr><td colspan="4">■ Sets the FF vibration suppression control effect level.
◆ Please stop servo motor if change this value.
◆ The delay for position command will be improved by enlarging this parameter value but vibration suppression effects become weak.
◆ FF vibration suppressor frequency switching function does not affect this.</td></tr>
<tr><td rowspan="2">02</td><td>FF Vibration Suppression Frequency B1
[SUPFRQB1]</td><td>Setting range
1.0 to 500.0</td><td>Unit
0.1Hz</td><td>Default
500.0</td></tr>
<tr><td colspan="4">■ See FF Vibration Suppression Frequency A1.
* It is not set automatically by Auto-FF Vibration Suppression Frequency Tuning.</td></tr>
<tr><td rowspan="2">03</td><td>FF Vibration Suppression Level Selection B
[SUPCRB]</td><td>Setting range
00 to 01</td><td>Unit
—</td><td>Default
00</td></tr>
<tr><td colspan="4">■ Vibration suppression frequency range will be narrow at set frequency when 01 is set.</td></tr>
</table>

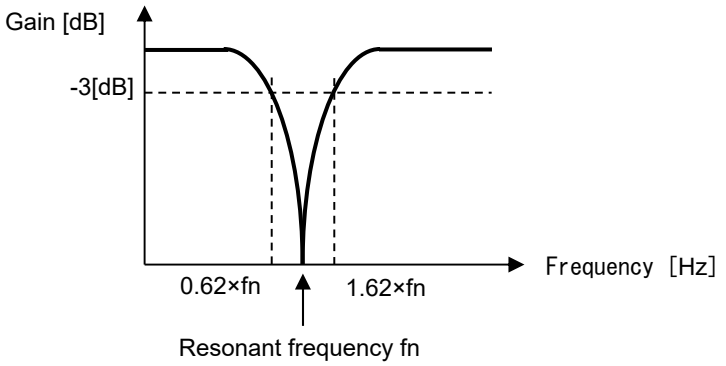
－Group2－

ID	Contents			
10	Velocity Command Notch Filter [VCNFIL]	Setting range	Unit	Default
		50 to 1000	Hz	1000

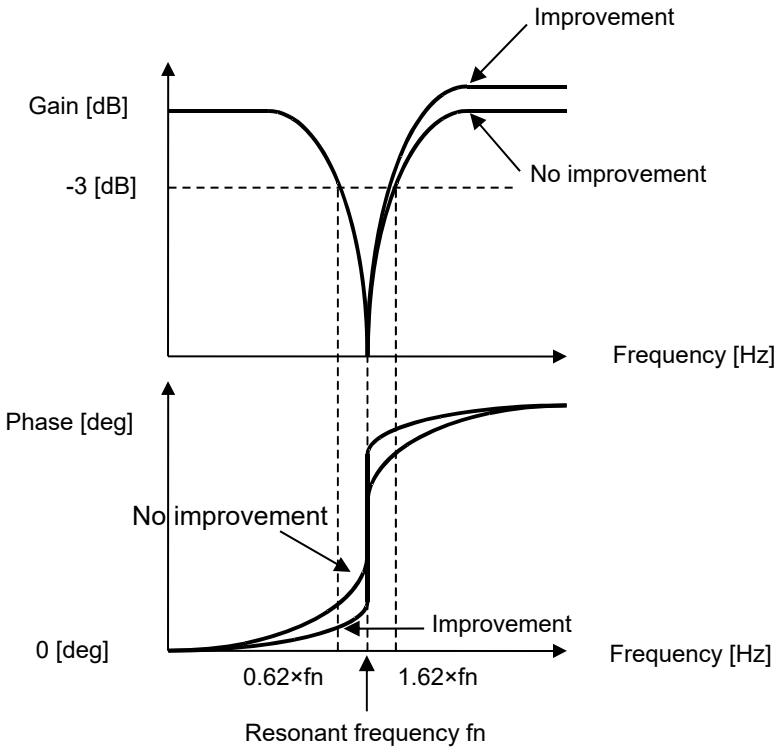
■ This is notch filter to eliminate frequency element arbitrarily set from velocity command.
Sets the resonant frequency.

- ◆ When sympathetic vibration occurs in velocity control system, the gain will be able to raise by setting the resonance frequency.
- ◆ Do not use while synchronizing with other axis such as controlling XY table trajectory for cutting operation.
- ◆ Invalid setting value varies depending on the setting of the system parameter ID00 Control Cycle. This parameter can set in 1 Hz unit, but the units listed below are applied internally.

Control cycle		Setting value	Unit and process inside servo amplifier
00	Standard_Sampling Standard sampling mode	50 to 99Hz	Valid by 1Hz
		100 to 499Hz	Valid by 5Hz and drop less than 5
		500 to 1000Hz	Filter invalid
01	High-freq_Sampling Hi-speed sampling mode	50 to 199Hz	Valid by 1Hz
		200 to 999Hz	Valid by 10Hz and drop less than 10
		1000Hz	Filter invalid



－Group2－

<table>
<tr><th>ID</th><th>Contents</th></tr>
<tr><td>20</td><td>
<table>
<tr><td>Torque Command Notch Filter A
[TCNFILA]</td><td>Setting range
100 to 4000</td><td>Unit
Hz</td><td>Default
4000</td></tr>
</table>
■ This is notch filter to eliminate sympathetic vibration element included in torque command. Sets the resonant frequency.
◆ Invalid setting value varies depending on the setting of the system parameter ID00 Control Cycle.
<table>
<tr><th colspan="2">Control cycle</th><th>Setting value</th><th>Unit and process inside servo amplifier</th></tr>
<tr><td rowspan="2">00</td><td rowspan="2">Standard_Sampling
Standard sampling mode</td><td>100 to 1999Hz</td><td>Valid by 1Hz</td></tr>
<tr><td>2000 to 4000Hz</td><td>Filter invalid</td></tr>
<tr><td rowspan="2">01</td><td rowspan="2">High-freq_Sampling
Hi-speed sampling mode</td><td>100 to 3999Hz</td><td>Valid by 1Hz</td></tr>
<tr><td>4000Hz</td><td>Filter invalid</td></tr>
</table>
This parameter is automatically saved by executing Notch filter tuning.
</td></tr>
<tr><td>21</td><td>
<table>
<tr><td>TCNFILA, Low Frequency Phase Delay Improvement
[TCNFPA]</td><td>Setting range
00 to 02</td><td>Unit
-</td><td>Default
00</td></tr>
</table>
■ Improves phase delay at lower frequency than resonant frequency of the Torque Command Notch Filter A.
◆ The larger the value is, the greater the improvement.
◆ Characteristic is same as the standard notch filter when the setting value is 0.
◆ Caution, other than the setting value 0, higher frequencies than the resonant frequency will be amplified.


</td></tr>
</table>

－Group2－

ID	Contents			
22	Torque Command Notch Filter B [TCNFILB]	Setting range	Unit	Default
		100 to 4000	Hz	4000
24	Torque Command Notch Filter C [TCNFILC]	Setting range	Unit	Default
		100 to 4000	Hz	4000
26	Torque Command Notch Filter D [TCNFILD]	Setting range	Unit	Default
		100 to 4000	Hz	4000
28	Torque Command Notch Filter E [TCNFILE]	Setting range	Unit	Default
		100 to 4000	Hz	4000

■ This is notch filter to eliminate sympathetic vibration element included in torque command. Sets the resonant frequency.

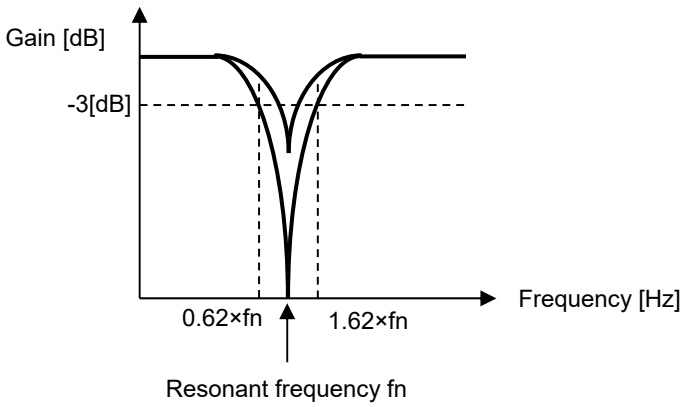
◆ Invalid "Torque command notch filter" setting value varies depending on the setting of the system parameter ID00 Control Cycle.

Control cycle		Setting value	Unit and process inside servo amplifier
00	Standard_Sampling	100 to 1999Hz	Valid by 1Hz
		2000 to 4000Hz	Filter invalid
01	High-freq_Sampling	100 to 3999Hz	Valid by 1Hz
		4000Hz	Filter invalid

◆ The value set to Torque Command Notch Filter E will be valid when “00: Adp_Filter Disable Adaptation invalid” is set to Group0 ID34 “Adaptive notch filter function E”.

ID	Contents			
23	TCNFILB, Depth Selection [TCNFDB]	Setting range	Unit	Default
		0 to 15	-	0
25	TCNFILC, Depth Selection [TCNFDC]	Setting range	Unit	Default
		0 to 15	-	0
27	TCNFILD, Depth Selection [TCNFDD]	Setting range	Unit	Default
		0 to 15	-	0
29	TCNFILE, Depth Selection [TCNFDE]	Setting range	Unit	Default
		0 to 15	-	0

■ Parameters to set the depth of each Torque Command Notch Filter (TCNFILB to E). The larger the value is, the shallower the depth.

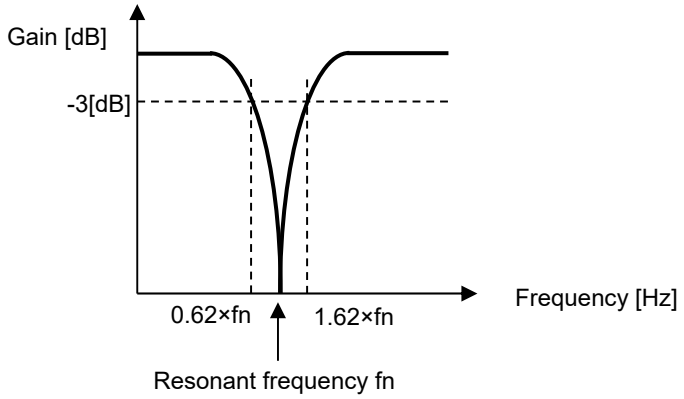


◆ The value set to TCNFILE, Depth Selection will be valid when “00: Adp_Filter Disable Adaptation invalid” is set to Group0 ID34 “Adaptive notch filter function E”.

－Group2－

<table>
<tr><th>ID</th><th colspan="4">Contents</th></tr>
<tr><td rowspan="2">30</td><td>Observer Characteristic
[OBCHA]</td><td>Setting range
00 to 02</td><td>Unit
—</td><td>Default
00:Low</td></tr>
<tr><td colspan="4">■ Selects frequency characteristic of the disturbance observer.
<table>
<tr><th colspan="2">Selection</th><th>Contents</th></tr>
<tr><td>00</td><td>Low</td><td>For Low Frequency</td></tr>
<tr><td>01</td><td>Middle</td><td>For Middle Frequency</td></tr>
<tr><td>02</td><td>High</td><td>For High Frequency</td></tr>
</table>
◆ Select “00: Low, Low Frequency Disturbance Observer Suppressor” for Load torque monitor (estimate value).
◆ Select 02: High, High Frequency Disturbance Observer Suppressor, when the encoder resolution is over 1048576P/R.</td></tr>
<tr><td rowspan="2">31</td><td>Observer Compensation Gain
[OBG]</td><td>Setting range
0 to 100</td><td>Unit
%</td><td>Default
0</td></tr>
<tr><td colspan="4">■ This is Compensation gain for Disturbance Observer.
The larger the value is, the higher the suppression performance. However, if the value is too large, oscillation may sometimes occur.</td></tr>
<tr><td rowspan="2">32</td><td>Observer Output Low-pass Filter
[OBLPF]</td><td>Setting range
1 to 4000</td><td>Unit
Hz</td><td>Default
50</td></tr>
<tr><td colspan="4">■ This is primary low-pass filter to eliminate high frequency elements included in the observer compensation.
Sets the cutoff frequency.
◆ The larger the value is, the faster the response of disturbance observer suppression. However, it may cause a louder driving sound depending on the ripple components included in disturbance observer output.
◆ Filter is invalid at the setting value more than 2,000Hz.
◆ Filter is invalid when observer characteristic is set to “01: Middle, For Middle Frequency”, or “02: High, For High Frequency”.</td></tr>
</table>

－Group2－

<table>
<tr><th>ID</th><th>Contents</th></tr>
<tr><td>33</td><td>
<table>
<tr><td>Observer Output Notch Filter
[OBNFIL]</td><td>Setting range
100 to 4000</td><td>Unit
Hz</td><td>Default
4000</td></tr>
</table>
■ This is notch filter to eliminate arbitrarily selected frequency from observer compensation.
Sets the resonant frequency.
When resonance appears in disturbance observer output, such as sympathetic vibration with the mechanical system, this notch filter sometimes suppresses the vibration.
◆ This parameter can set in 1 Hz unit, but the units listed below are applied internally.
<table>
<tr><th>Setting value</th><th>Unit and process inside servo amplifier</th></tr>
<tr><td>100 to 1999Hz</td><td>Valid by 10Hz and drop less than 10</td></tr>
<tr><td>2000 to 4000Hz</td><td>Filter invalid</td></tr>
</table>


</td></tr>
<tr><td>40</td><td>
<table>
<tr><td>Effective velocity for compensating stick-slip behavior
[STV]</td><td>Setting range
0.1 to 128.0</td><td>Unit
min^{-1}</td><td>Default
10.0</td></tr>
</table>
■ Sets the velocity at which stick-slip behavior compensatory function works.
◆ Stick-slip behavior compensatory function works when the velocity command inside of servo amplifier is the set value or less.
◆ Stick-slip behavior compensation is effective when the valid condition of stick-slip behavior compensatory function (Group9 ID34) is satisfied.
</td></tr>
<tr><td>41</td><td>
<table>
<tr><td>Retention time for compensating stick-slip behavior
[STHLD]</td><td>Setting range
1 to 500</td><td>Unit
ms</td><td>Default
20</td></tr>
</table>
■ Sets the time to retain stick-slip behavior compensation.
◆ Stick-slip behavior compensation continues till the above set time elapses even if the velocity command inside of servo amplifier exceeds the effective velocity for compensating stick-slip behavior.
◆ Increase the value of the time if velocity loop responsiveness is low.
◆ Stick-slip behavior compensation is effective when the valid condition of stick-slip behavior compensatory function (Group9 ID34) is satisfied.
</td></tr>
<tr><td>42</td><td>
<table>
<tr><td>Velocity loop integral time constant for stick-slip behavior compensation
[STTVI]</td><td>Setting range
0.3 to 1000</td><td>Unit
ms</td><td>Default
3.0</td></tr>
</table>
■ Sets the Velocity loop integral time constant for stick-slip behavior compensation.
◆ The above set value applies to velocity loop integral time constant while stick-slip behavior compensation is being performed.
◆ This velocity loop integral time constant for stick-slip behavior compensation sets smaller velocity loop integral time constant values than the ones normally used. If you set the value larger than the above, stick-slip behavior compensation doesn't work.
◆ Stick-slip behavior compensation doesn't work when velocity loop is in proportional control. Please carefully set the effective condition of "Velocity loop proportional control switching function" (Group9 ID27) when applying P-PI control switching to velocity control system.
◆ Stick-slip behavior compensation is effective when the valid condition of stick-slip behavior compensatory function (Group9 ID34) is satisfied.
</td></tr>
</table>

－Group2－

<table>
<tr><th>ID</th><th colspan="4">Contents</th></tr>
<tr><td rowspan="3">50</td><td>CP vibration suppression control frequency
[CPVSFQ]</td><td>Setting range
10.0 to 100.0</td><td>Unit
0.1Hz</td><td>Default
100.0</td></tr>
<tr><td colspan="4">■ Sets the vibration frequency of Machine stand.
◆ The filter will invalid if set value is 100.0 Hz or more.
◆ This function will valid if in conditions below.
・In case of standard position control.
・In case of "Model-following / standard position control switching (Model 3)" is set and Standard position control is valid.
・In case of "Model-following vibration suppression / standard position control switching (Model 4)" is set and Standard position control is valid.
* Please stop servo motor if change this value.</td></tr>
<tr><td colspan="4"></td></tr>
<tr><td rowspan="3">51</td><td>CP vibration suppression control level
[CPVSLV]</td><td>Setting range
00 to 03</td><td>Unit
-</td><td>Default
00</td></tr>
<tr><td colspan="4">■ This is the parameter which sets impact of CP vibration suppression control.
◆ The larger value can be impact of CP vibration suppression control big.
* Please stop servo motor if change this value.</td></tr>
<tr><td colspan="4"></td></tr>
<tr><td rowspan="3">52</td><td>CP vibration suppression control characteristics selection
[CPVSCR]</td><td>Setting range
00 to 02</td><td>Unit
-</td><td>Default
01</td></tr>
<tr><td colspan="4">■ Sets the effective frequency range of CP vibration suppression control.
◆ The larger value will be narrower the effective frequency range of CP vibration suppression control.
* Please stop servo motor if change this value.</td></tr>
<tr><td colspan="4"></td></tr>
<tr><td rowspan="3">60</td><td>Minor vibration suppression pulse compensation value
[FBHPLS]</td><td>Setting range
1 to 100</td><td>Unit
Pulse</td><td>Default
1</td></tr>
<tr><td colspan="4">■ Sets the compensation amount of Minor vibration suppression function for velocity feedback.
Unit of set value is 1 pulse of encoder.
* Sets by multiple of FBHTIM. If not multiple of FBHTIM, the actual Minor vibration suppression pulse compensation frequency will have deviation with FBHTIM.</td></tr>
<tr><td colspan="4"></td></tr>
<tr><td rowspan="3">61</td><td>Minor vibration suppression pulse compensation frequency
[FBHTIM]</td><td>Setting range
1 to 100</td><td>Unit
times</td><td>Default
1</td></tr>
<tr><td colspan="4">■ Sets the number of Minor vibration suppression.
* This value will be valid if Minor vibration suppression function is valid.</td></tr>
<tr><td colspan="4"></td></tr>
</table>

■ Group3 "Model following control settings"

ID	Contents			
00	Model Control Gain 1 [KM1]	Setting range 1 to 3000	Unit 1/s	Default 30
	■ Proportional gain for model position controller. ◆ Use within the range of 15 to 315 (1/s) if operate with Model-following vibration suppression control. ◆ Automatically overwrite by Auto-tuning result saving. ◆ When Auto-tuning function is valid, this setting value is not applied. ◆ When Gain switching function is valid, this setting value is applied by selecting gain 1. ◆ Please stop servo motor if change this value.			
01	Model control damping coefficient [MZETA]	Setting range 0 to 100	Unit %	Default 100
	■ This is parameter which changes velocity proportional gain of Model following control. ◆ The parameter value will be ζ=0.866 by the set value 0% and ζ=1.0 by 100%.			
02	Model velocity feedforward gain [MFFGN]	Setting range 0 to 100	Unit %	Default 0
	■ This is FF compensation gain for Model position control system. ◆ Automatically overwrite by Auto-tuning result saving. ◆ When Auto-tuning function is valid, this setting value is not applied.			
03	Model velocity feedforward differential time constant [MTFFD]	Setting range 0.00 to 10.00	Unit ms	Default 0.00
	■ This is the parameter which improves command-following capability of Model position control system. The function is invalid when set value is 0.00msec.			
04	Model velocity feedforward filter [MFFFIL]	Setting range 1 to 4000	Unit Hz	Default 4000
	■ This is primary low-pass filter to eliminate pulsed ripple caused by the position command pulse included in the feed forward command. Sets the cutoff frequency. ◆ The function is Invalid at 1,000Hz or more.			

* Please stop the servo motor when Gain switching function is acting.
* Please stop the servo motor if Model vibration suppression frequency switching is used.
* When alarm "Model Following Vibration Suppression Control Error (AL.C5)" occurs while working, please make accel/ decel gently by reducing "Model control gain (KM)" or changing operation pattern.
* Model Following Vibration Suppression Control function does not work at JOG operation.

－Group3－

ID	Contents			
05	Overshoot Suppression Filter [OSSFIL]	Setting range 1 to 4000	Unit Hz	Default 1500
	■ Filter to suppress overshoot with Model following control or Model following vibration suppression control. Sets cutoff frequency. ◆ Lower the setting value when overshoot on position deviation occurs. ◆ Filter is invalid at the setting value of 2,000Hz or more.			
06	Model Control Antiresonance Frequency 1 [ANRFRQ1]	Setting range 10.0 to 80.0	Unit Hz	Default 80.0
	■ Sets the antiresonance frequency of the mechanical model in Model following vibration suppression control. Actual measurement antiresonance frequency value of the mechanical system is able to set by using System Analysis function of the setup software. ◆ This value does not apply with “Model following control”. ◆ Vibration suppression control is invalid if larger value than "Model Control Resonance Frequency" has set. ◆ Please stop servo motor if change this value.			
07	Model Control Resonance Frequency 1 [RESFRQ1]	Setting range 10.0 to 80.0	Unit Hz	Default 80.0
	■ Sets the resonance frequency of the mechanical model in Model-following vibration suppression control. Actual measurement resonance frequency value of the mechanical system is able to set by using System Analysis function of the setup software. ◆ This value does not apply with “Model following control”. ◆ Vibration suppression control is invalid if smaller value than "Model Control Antiresonance Frequency" has set, or if 80 Hz is set. ◆ Please stop servo motor if change this value.			

* Please stop the servo motor when Gain switching function is acting.
* Please stop the servo motor if Model vibration suppression frequency switching is used.
* When alarm "Model Following Vibration Suppression Control Error (AL.C5)" occurs while working, please make accel/ decel gently by reducing "Model control gain (KM)" or changing operation pattern.
* Model Following Vibration Suppression Control function does not work at JOG operation.

■ Group4 "Gain switching control/ vibration suppression frequency switching settings"

ID	Contents			
00	Model Control Gain 2 [KM2]	Setting range	Unit	Default
		1 to 3000	1/s	30
10	Model Control Gain 3 [KM3]	Setting range	Unit	Default
		1 to 3000	1/s	30
20	Model Control Gain 4 [KM4]	Setting range	Unit	Default
		1 to 3000	1/s	30
	■ Proportional gain for Model position controller which is selected in the Gain switching function 1 or 2. ◆ This parameter is excepted from Auto-tuning result saving. ◆ Please stop servo motor if change this value.			
01	Position Loop Proportional Gain 2 [KP2]	Setting range	Unit	Default
		1 to 3000	1/s	30
11	Position Loop Proportional Gain 3 [KP3]	Setting range	Unit	Default
		1 to 3000	1/s	30
21	Position Loop Proportional Gain 4 [KP4]	Setting range	Unit	Default
		1 to 3000	1/s	30
	■ Proportional gain for Position controller which is selected in the Gain switching function 1 or 2. ◆ This parameter is excepted from Auto-tuning result saving.			
02	Position Loop Integral Time Constant 2 [TPI2]	Setting range	Unit	Default
		0.3 to 1000.0	ms	1000.0
12	Position Loop Integral Time Constant 3 [TPI3]	Setting range	Unit	Default
		0.3 to 1000.0	ms	1000.0
22	Position Loop Integral Time Constant 4 [TPI4]	Setting range	Unit	Default
		0.3 to 1000.0	ms	1000.0
	■ Integral time constant for Position controller which is selected in the Gain switching function 1 or 2. ◆ This parameter is excepted from Auto-tuning result saving. ◆ Integral term will be invalid (Proportional control) at 1,000.0 ms. ◆ This setting will be valid if Position loop proportional control switching function is invalid.			
03	Velocity Loop Proportional Gain 2 [KVP2]	Setting range	Unit	Default
		1 to 2000	Hz	50
13	Velocity Loop Proportional Gain 3 [KVP3]	Setting range	Unit	Default
		1 to 2000	Hz	50
23	Velocity Loop Proportional Gain 4 [KVP4]	Setting range	Unit	Default
		1 to 2000	Hz	50
	■ Proportional gain for Velocity controller which is selected in the Gain switching function 1 or 2. ◆ This parameter is excepted from Auto-tuning result saving. ◆ This value will be response frequency if corresponding Load inertia moment ratio (JRAT2, JRAT3 and JRAT4) matches actual Load inertia moment ratio.			

－Group4－

ID	Contents			
04	Velocity Loop Integral Time Constant 2 [TVI2]	Setting range	Unit	Default
		0.3 to 1000.0	ms	20.0
14	Velocity Loop Integral Time Constant 3 [TVI3]	Setting range	Unit	Default
		0.3 to 1000.0	ms	20.0
24	Velocity Loop Integral Time Constant 4 [TVI4]	Setting range	Unit	Default
		0.3 to 1000.0	ms	20.0
	■ Integral time constant for Velocity controller which is selected in the Gain switching function 1 or 2. ◆ This parameter is excepted from Auto-tuning result saving. ◆ This setting is valid when Velocity Loop Proportional Control Switching Function is invalid. ◆ Integral term will be invalid (Proportional control) at 1,000.0 ms.			
05	Load Inertia Moment Ratio 2 [JRAT2]	Setting range	Unit	Default
		0 to 15000	%	100
15	Load Inertia Moment Ratio 3 [JRAT3]	Setting range	Unit	Default
		0 to 15000	%	100
25	Load Inertia Moment Ratio 4 [JRAT4]	Setting range	Unit	Default
		0 to 15000	%	100
	■ Load inertia ratio for rotor inertia of servo motor which is selected in the Gain switching function 1 or 2. ◆ If this value matches the actual mechanical system, the corresponding value of Velocity Loop Proportional Gain (KVP2, KVP3, or KVP4) will be response frequency of the velocity control system. ◆ This parameter is excepted from Auto-tuning result saving. ◆ Setting value=J_L/J_M×100% ● J_L: Load inertia moment ● J_M: Motor inertia moment			
06	Torque Command Filter 2 [TCFIL2]	Setting range	Unit	Default
		1 to 4000	Hz	600
16	Torque Command Filter 3 [TCFIL3]	Setting range	Unit	Default
		1 to 4000	Hz	600
26	Torque Command Filter 4 [TCFIL4]	Setting range	Unit	Default
		1 to 4000	Hz	600

■ This is low-pass filter to eliminate high frequency component in torque command which is selected in the Gain switching function 1 or 2. Sets the cutoff frequency.

◆ This parameter is excepted from Auto-tuning result saving.

◆ Setting range varies depending on the setting of the system parameter ID00 Control Cycle.
(Torque command filter cannot be disabled)

Control cycle		Setting value	Cutoff frequency
00	Standard_Sampling Standard sampling mode	1 to 2000Hz	Set value valid
		2001 to 4000Hz	2000Hz
01	High-freq_Sampling Hi-speed sampling mode	1 to 4000Hz	Set value valid

－Group4－

ID	Contents			
30	Gain Switching Filter [GCFIL]	Setting range	Unit	Default
		0 to 100	ms	0
	■ This is primary Low-pass filter which makes gain change gently at Gain switching. Sets time constant. ◆ When the mechanical system is shocked by the change of gain resulted from gain switching, making a gentle gain change will soften the shock. ◆ The larger the value, the gentler the gain changes.			
40	FF Vibration Suppression Frequency A2 [SUPFRQA2]	Setting range	Unit	Default
		1.0 to 500.0	Hz	500.0
41	FF Vibration Suppression Frequency A3 [SUPFRQA3]	Setting range	Unit	Default
		1.0 to 500.0	Hz	500.0
42	FF Vibration Suppression Frequency A4 [SUPFRQA4]	Setting range	Unit	Default
		1.0 to 500.0	Hz	500.0
	■ Sets the mechanical vibration frequency which is wanted to suppress by FF vibration suppression function. Selects in FF vibration suppression frequency selection 1 or 2. ◆ Please stop servo motor if change this value. ◆ This parameter is excepted from Auto-tuning result saving. ◆ This parameter can set in 0.1 Hz unit, but the units listed below are applied internally.			

Setting range	Unit and process inside servo amplifier
1.0 to 9.9Hz	Valid by 0.1Hz
10.0 to 99.9Hz	Valid by 0.5Hz and drop less than 0.5
100.0 to 499.9Hz	Valid by 5Hz and drop less than 5
500.0Hz	FF vibration suppression control is invalid

* FF vibration suppression control will be invalid when this parameter is changed. After outputting rest of internal position command, FF vibration suppression control will be valid with the frequency changed after.

* The time which will be valid of changed value varies depending on the frequency before change as follows.

The frequency before change	The time which will be valid of changed value
5.0Hz or more	1 sec.
3.0Hz	3 sec.
1.0Hz	7 sec.

43	FF Vibration Suppression Frequency B2 [SUPFRQB2]	Setting range	Unit	Default
		1.0 to 500.0	Hz	500.0
44	FF Vibration Suppression Frequency B3 [SUPFRQB3]	Setting range	Unit	Default
		1.0 to 500.0	Hz	500.0
45	FF Vibration Suppression Frequency B4 [SUPFRQB4]	Setting range	Unit	Default
		1.0 to 500.0	Hz	500.0
	■ See FF Vibration Suppression Frequency A2 to A4. Selects these in FF Vibration Suppression Frequency Select Input B1/ B2.			

－Group4－

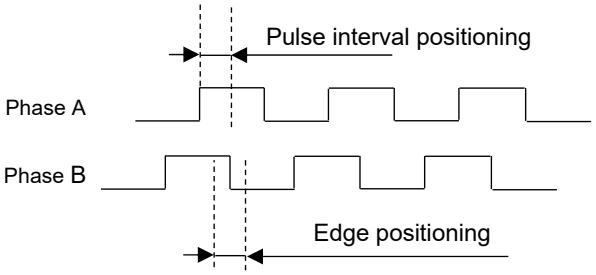
ID	Contents			
50	Model Control Antiresonance Frequency 2 [ANRFRQ2]	Setting range	Unit	Default
		10.0 to 80.0	Hz	80.0
52	Model Control Antiresonance Frequency 3 [ANRFRQ3]	Setting range	Unit	Default
		10.0 to 80.0	Hz	80.0
54	Model Control Antiresonance Frequency 4 [ANRFRQ4]	Setting range	Unit	Default
		10.0 to 80.0	Hz	80.0
	■ Sets the antiresonance frequency of the mechanical device at Model-following vibration suppression control. Selects in Model Vibration Suppression Frequency Select Input 1 or 2. ◆ This value does not apply with Model following control. ◆ Vibration suppression control is invalid if larger value than "Model Control Resonance Frequency" has set. ◆ Setting by using “system analysis” function cannot be performed. ◆ Please stop servo motor if change this value.			
51	Model Control Resonance Frequency 2 [RESFRQ2]	Setting range	Unit	Default
		10.0 to 80.0	Hz	80.0
53	Model Control Resonance Frequency 3 [RESFRQ3]	Setting range	Unit	Default
		10.0 to 80.0	Hz	80.0
55	Model Control Resonance Frequency 4 [RESFRQ4]	Setting range	Unit	Default
		10.0 to 80.0	Hz	80.0
	■ Sets the resonance frequency of the mechanical device at Model-following vibration suppression control. Selects in Model Vibration Suppression Frequency Select Input 1 or 2. ◆ This value does not apply with Model following control. ◆ Vibration suppression control is invalid if smaller value than "Model Control Antiresonance Frequency" has set, or if 80 Hz is set. ◆ Setting by using “system analysis” function cannot be performed. ◆ Please stop servo motor if change this value.			

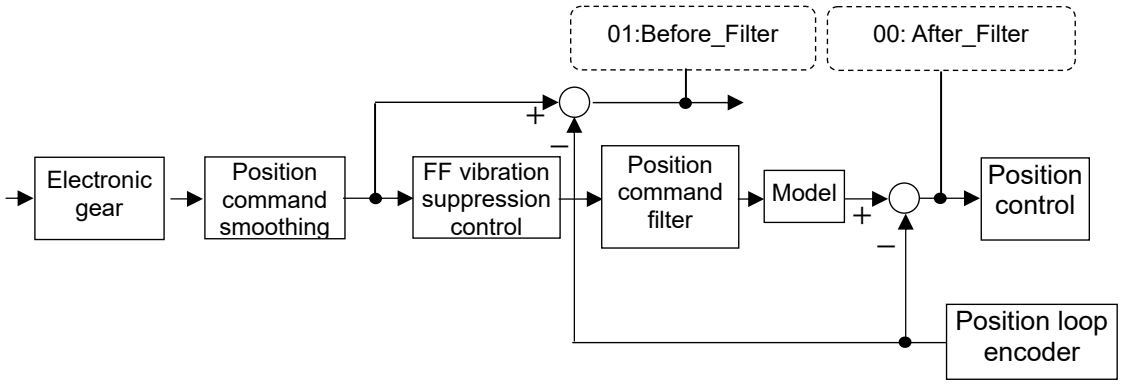
■ Group5 " Fast-settling control settings"

<table>
<tr><th>ID</th><th colspan="4">Contents</th></tr>
<tr><td rowspan="2">00</td><td>Command Velocity Low-pass Filter
[CVFIL]</td><td>Setting range
1 to 4000</td><td>Unit
Hz</td><td>Default
1000</td></tr>
<tr><td colspan="4">■ This is primary low-pass filter to eliminate high frequency component such as ripples included in the velocity (command velocity) calculated from position command pulse inside of fast-settling control.
◆ Lower this setting value when the encoder resolution is low.
◆ Filter is invalid at the setting value of 2,000Hz or more.</td></tr>
<tr><td rowspan="2">01</td><td>Command Velocity Threshold
[CVTH]</td><td>Setting range
0 to 65535</td><td>Unit
min^{-1}</td><td>Default
20</td></tr>
<tr><td colspan="4">■ Sets the velocity threshold value that activates fast-settling control compensation (Acceleration Compensation and Deceleration Compensation).
◆ Acceleration Compensation or Deceleration Compensation will be done when velocity (command velocity) calculated from the position command pulse is larger than this value.</td></tr>
<tr><td rowspan="2">02</td><td>Acceleration Compensation
[ACCCO]</td><td>Setting range
-9999 to 9999</td><td>Unit
×50 Pulse</td><td>Default
0</td></tr>
<tr><td colspan="4">■ Sets the Acceleration Compensation value in fast-settling control.
◆ Sets in units of position deviation pulse (In case of incremental encoder, four-multiplied to encoder resolution is it).
◆ Compensation will be done to a position deviation.
◆ The larger the setting value, the greater the compensation value.
◆ The larger the acceleration value calculated from position command pulse, compensation value increases.
◆ The larger the Load inertia moment, the greater the compensation value is.
◆ Position deviation decreases by fast-settling control.
◆ The setting value is invalid with "Model following control" or "Model following vibration suppression control".</td></tr>
<tr><td rowspan="2">03</td><td>Deceleration Compensation
[DECCO]</td><td>Setting range
-9999 to 9999</td><td>Unit
×50 Pulse</td><td>Default
0</td></tr>
<tr><td colspan="4">■ Sets the Deceleration Compensation value in fast-settling control.
◆ Sets in units of position deviation pulse (In case of incremental encoder, four-multiplied to encoder resolution is it).
◆ Compensation will be done to a position deviation.
◆ The larger the setting value, the greater the compensation value.
◆ The larger the acceleration value calculated from position command pulse, compensation value increases.
◆ The larger the Load inertia moment, the greater the compensation value is.
◆ Position deviation decreases by fast-settling control.
◆ The setting value is invalid with "Model following control" or "Model following vibration suppression control".</td></tr>
</table>

■ Group8 "Control system settings"

－Group8－

<table>
<tr><th>ID</th><th>Contents</th></tr>
<tr><td>17</td><td>
<table>
<tr><td>Positioning Methods
[EDGEPOS] “Power cycle for control after setting”</td><td>Setting range
00 to 01</td><td>Unit
-</td><td>Default
00:Pulse_Interval</td></tr>
</table>
■ Selects the Encoder pulse positioning.
◆ Positioning accuracy may improve by selecting Edge positioning when the encoder resolution is coarse. However, this may cause the driving sound of the mechanical system to increase as this edge is always the center of vibration.
◆ Select standard value in usual operation.
<table>
<tr><th colspan="2">Selection</th><th>Contents</th></tr>
<tr><td>00</td><td>Pulse_Interval</td><td>Specify Pulse Interval</td></tr>
<tr><td>01</td><td>Pulse_Edge</td><td>Specify Pulse Edge</td></tr>
</table>


</td></tr>
<tr><td>18</td><td>
<table>
<tr><td>In-Position Signal/ Position Deviation Monitor
[PDEVMON]</td><td>Setting range
00 to 01</td><td>Unit
-</td><td>Default
00:After_Filter</td></tr>
</table>
■ Selects in-position signal (INP) and Position deviation monitor output before or after passing through the Position Command Filter.
◆ For "00: After_Filter", use the Position deviation value of the Position controller.
◆ For "01: Before_Filter", use the Position deviation value based on Position command before FF vibration suppression control.
◆ This parameter works as "01: Before_Filter" even if the other value is selected when "01: Model 1 Model Following Control" or "02: Model 2 Model Following Vibration Suppression Control" is set to the system parameter ID07 Position Control Selection.
<table>
<tr><th colspan="2">Selection</th><th>Contents</th></tr>
<tr><td>00</td><td>After_Filter</td><td>Compare Position command value with Feedback value after passing through the filter.</td></tr>
<tr><td>01</td><td>Before_Filter</td><td>Compare Position command value with Feedback value before passing through the filter.</td></tr>
</table>


</td></tr>
</table>

－Group8－

ID	Contents			
19	Deviation Clear Selection [CLR]	Setting range	Unit	Default
		00 to 03	-	00:Type1

■ Sets whether a position deviation will be cleared or not during servo OFF, and how to treat deviation clear signal.
- ◆ Selects operation during servo OFF. Deviation cleared/ Deviation not cleared
- ◆ Selects deviation clear signal treatment. Level detection/ Edge detection
- ◆ Select proper setting corresponding to above combination from the list below.

Selection		Contents	
00	Type1	At servo OFF → Deviation cleared Clear input = Level detection	Deviation clear is continuing during servo OFF. Deviation clear is continuing during Clear input is ON.
01	Type2	At servo OFF → Deviation cleared Clear input = Edge detection	At the edge of OFF to ON of Deviation clear input, Deviation clear is executed.
02	Type3	At servo OFF → Deviation not cleared Clear input = Level detection	During servo OFF, Deviation clear is not executed. (After servo ON, the motor might operate suddenly.)
03	Type4	At servo OFF → Deviation not cleared Clear input = Edge detection	During servo OFF, Deviation clear is not executed. (After servo ON, the motor might operate suddenly.)

1A	Time to judge position command distribution completion [PCDLY]	Setting range	Unit	Default
		0.0 to 1000.0	ms	0.0

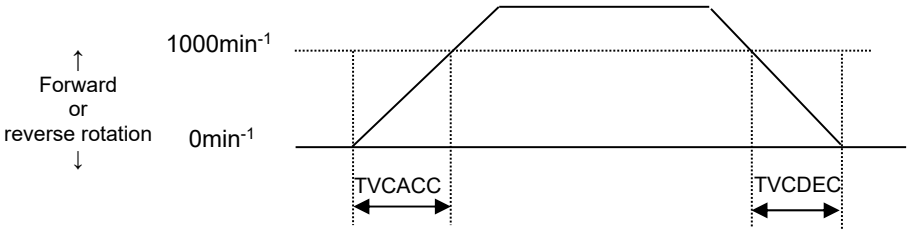
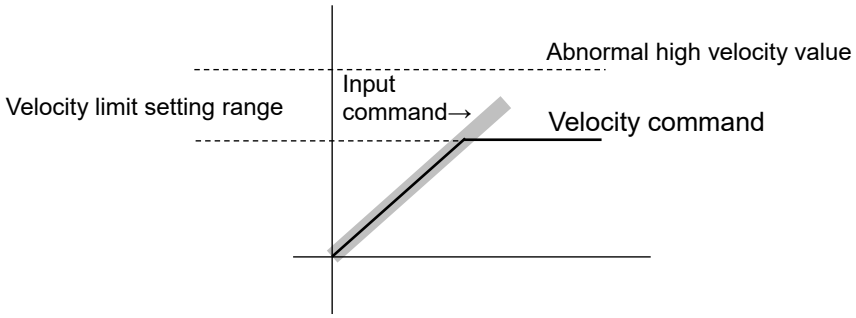
■ Sets the time till judging position command distribution completion.
- ◆ Distribution completion is judged if command position does not change (means previous and present command position are same) even if spending this setting time.
- ◆ State will change to "during position command distribution" instantly with no matter to this setting time, when new position command is input during count of position command distribution completion.

28	Preset Velocity Compensation Command [V-COMP]	Setting range	Unit	Default
		-9999 to 9999	min^{-1}	0.0

■ Sets the Velocity if the velocity compensation command is used as fixed value in Velocity Compensation Function.

－Group8－

<table>
<tr><th>ID</th><th colspan="4">Contents</th></tr>
<tr><td rowspan="2">2B</td><td rowspan="2">Velocity Command Acceleration Time Constant [TVCACC]</td><td>Setting range</td><td>Unit</td><td>Default</td></tr>
<tr><td>0 to 16000</td><td>ms</td><td>0</td></tr>
<tr><td rowspan="2">2C</td><td rowspan="2">Velocity Command Deceleration Time Constant [TVCDEC]</td><td>Setting range</td><td>Unit</td><td>Default</td></tr>
<tr><td>0 to 16000</td><td>ms</td><td>0</td></tr>
<tr><td></td><td colspan="4">■ These are parameters to restrict Acceleration and Deceleration commands of the Analog velocity command input, Preset velocity command, Analog velocity compensation input, Preset compensation, and JOG operation.
Acceleration: 0 min^{-1} --> forward, reverse rotation
Deceleration: forward, reverse rotation --> 0 min^{-1}
Sets the acceleration, deceleration per 1000 min^{-1}.

■ These parameters can give accel/decel to a step type velocity command input.
 
</td></tr>
<tr><td rowspan="2">2D</td><td rowspan="2">Velocity Limit Command [VCLM]</td><td>Setting range</td><td>Unit</td><td>Default</td></tr>
<tr><td>1 to 65535</td><td>min^{-1}</td><td>65535</td></tr>
<tr><td></td><td colspan="4">■ Set to restrict Velocity command.
◆ Sets the maximum value of Velocity command.
◆ Restricts Velocity command at the setting range with position control mode or Velocity control mode.
◆ If the setting value is 50000 or more, Velocity command limit will be set to 1.1 times of maximum speed of the combination motor.
Set this parameter to limit motor rotational velocity to the value lower than 1.1 times the maximum rotational velocity. Use the standard value for normal use.
 
</td></tr>
</table>

<table>
<tr><th>ID</th><th>Contents</th></tr>
<tr><td>30</td><td>
<table>
<tr><td>Torque Compensation Command Input Selection [TCOMSEL]</td><td>Setting range</td><td>Unit</td><td>Default</td></tr>
<tr><td></td><td>01 to 02</td><td>-</td><td>02:T-COMP</td></tr>
</table>
■ Select Torque compensation command input from the list below.
<table>
<tr><th colspan="2">Selection</th><th>Contents</th></tr>
<tr><td>01</td><td>Analog_Input</td><td>Analog torque compensation command value is used when torque compensation function is valid.</td></tr>
<tr><td>02</td><td>T-COMP</td><td>Preset torque compensation command 1, 2 are used when torque compensation function is valid.</td></tr>
</table>
</td></tr>
<tr><td>31</td><td>
<table>
<tr><td>Preset Torque Compensation Command 1 [T-COMP1]</td><td>Setting range</td><td>Unit</td><td>Default</td></tr>
<tr><td></td><td>-500.0 to +500.0</td><td>%</td><td>0.0</td></tr>
</table>
■ This is parameter for using torque compensation command with fixed value if T-COMPS1 is activated.
◆ This value will be added to the Torque command When Torque Compensation Command Input Selection is set at 02: T-COMP.
</td></tr>
<tr><td>32</td><td>
<table>
<tr><td>Preset Torque Compensation Command 2 [T-COMP2]</td><td>Setting range</td><td>Unit</td><td>Default</td></tr>
<tr><td></td><td>-500.0 to +500.0</td><td>%</td><td>0.0</td></tr>
</table>
■ This is parameter for using torque compensation command with fixed value if T-COMPS2 is activated.
◆ This value will be added to the Torque command When Torque Compensation Command Input Selection is set at 02: T-COMP.
</td></tr>
<tr><td></td><td>
■ About Torque Compensation Function
The Torque Compensation Function is a feed forward function for the Torque control system. There are settings of preset torque compensation command for Torque compensation command input function. It can use preset torque compensation command to keep the Torque compensation command fixed.

◆ Sets Preset Torque Compensation Command Value
<table>
<tr><th>Group</th><th>ID</th><th>Symbol</th><th>Contents</th></tr>
<tr><td>8</td><td>31</td><td>T-COMP1</td><td>Preset Torque Compensation Command 1</td></tr>
<tr><td>8</td><td>32</td><td>T-COMP2</td><td>Preset Torque Compensation Command 2</td></tr>
</table>
◆ Sets the condition of Torque Compensation Function being Valid
<table>
<tr><th>Group</th><th>ID</th><th>Symbol</th><th>Contents</th></tr>
<tr><td>9</td><td>30</td><td>T-COMPS1</td><td>Torque Compensation Function 1</td></tr>
<tr><td>9</td><td>31</td><td>T-COMPS2</td><td>Torque Compensation Function 2</td></tr>
</table>
</td></tr>
</table>

－Group8－

ID	Contents			
37	Forward Direction Internal Torque Limit Value [TCLM-F]	Setting range	Unit	Default
		10.0 to 500.0	%	100.0
38	Reverse Direction Internal Torque Limit Value [TCLM-R]	Setting range	Unit	Default
		10.0 to 500.0	%	100.0

■ Limits the Torque output at this setting value when Preset torque limit value is valid.

◆ Limits the torque by the ratio for the torque rating (100.0%= torque rating)

◆ When the Torque Limit Function (TL) is valid, the torque output is limited by the Preset torque limit setting value appropriate to the polarity of the Torque command.

◆ When the following conditions are set, the torque output is limited by a rate of "Peak armature current at stall (IP) / Rated armature current (IR)".
- In case of exceeding Peak torque at stall (Tp) of combination motor.
- In case of setting of exceeding a rate of "Peak armature current at stall (IP) / Rated armature current (IR)".

* For a positioning function built-in servo amplifier, torque limit due to input from positioning function is selected. This is a maintenance function. User cannot enable the torque limit function (TL).

■ About Torque limit function

There are two input systems of restricting Torque function:
Preset torque limit and External torque limit.

◆ To use preset torque limit (Maintenance function)

● Restricts the maximum output torque by using preset torque limit.
Change a torque limit input selection at maintenance mode.

Selection		Contents
00	TCLM	Use preset torque limit value Forward side/TCLM-F Reverse side/TCLM-R

● Sets torque limit value.

Group	ID	Symbol	Contents
8	37	TCLM-F	Forward Direction Internal Torque Limit Value
8	38	TCLM-R	Reverse Direction Internal Torque Limit Value

● Torque limit function becomes always enabled.

* When setting, be cautious about acceleration/deceleration time. If the setting value is too small, enough Acceleration/Deceleration torque can not get, and normal operation can not get.
* Set at: Preset torque limit value > Acceleration/Deceleration torque.
* Preset torque limit can set individually to Forward and Reverse direction.

◆ To use external torque limit (For positioning function built-in servo amplifier)

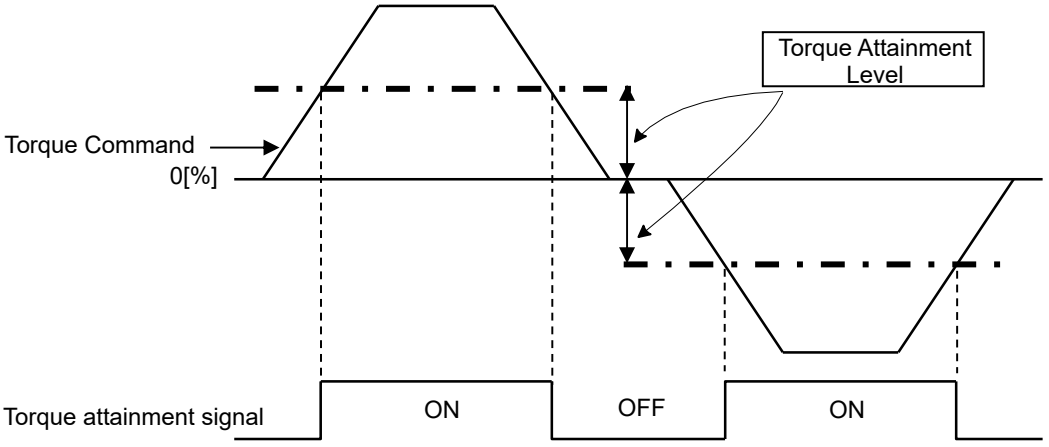
● Restricts the maximum output torque by using external torque limit.

* For a positioning function built-in servo amplifier, torque limit parameter exists into point data. Maximum output torque is limited when that torque limit parameter is set.
* Refer the section 4.1 in chapter 4 for point data.

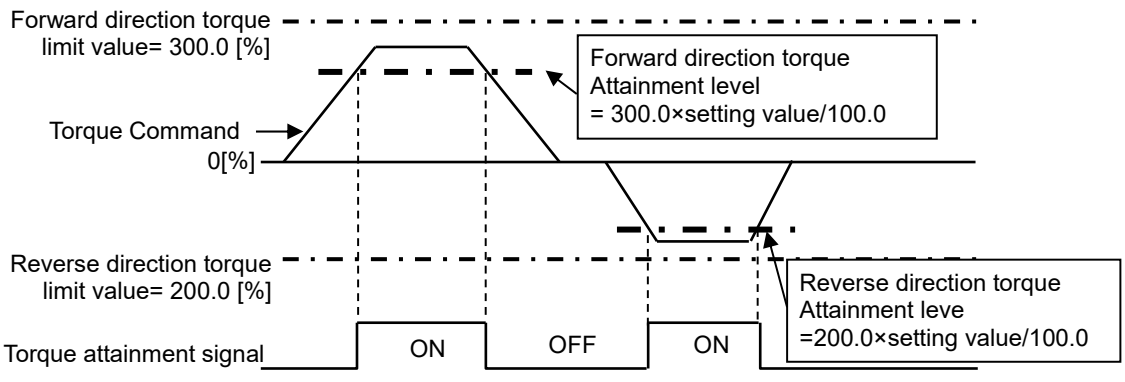
－Group8－

<table>
<tr><th>ID</th><th colspan="4">Contents</th></tr>
<tr><td rowspan="2">39</td><td>Sequence Operation Torque Limit Value [SQTCLM]</td><td>Setting range</td><td>Unit</td><td>Default</td></tr>
<tr><td></td><td>10.0 to 500.0</td><td>%</td><td>120.0</td></tr>
<tr><td colspan="4">■ Limits the output torque at sequence operation.
◆ Sets the limiting torque by the ratio of rated output torque. (100.0%=rated torque)
◆ When the following conditions are set, the torque output is limited by a rate of "Peak armature current at stall (IP) / Rated armature current (IR)".
- In case of exceeding Peak torque at stall (Tp) of combination motor.
- In case of setting of exceeding a rate of "Peak armature current at stall (IP) / Rated armature current (IR)".
◆ This parameter corresponds to Holding brake stand-by time and Servo brake action.</td></tr>
<tr><td rowspan="2">3A</td><td>Selection of Torque Limit Input Under Voltage Sag [CPETLSEL]</td><td>Setting range</td><td>Unit</td><td>Default</td></tr>
<tr><td></td><td>00 to 03</td><td>-</td><td>00:No_Limit</td></tr>
<tr><td colspan="4">■ Selects the input system of Torque command limit function at voltage sag from list below.
<table>
<tr><th colspan="2">Selection</th><th>Contents</th><th></th></tr>
<tr><td>00</td><td>No_Limit</td><td rowspan="3">Use external torque limit input</td><td rowspan="3">Forward (forward direction)/ Reverse (reverse direction): Limit with a torque limit within point data.</td></tr>
<tr><td>01</td><td>TCLM_1</td></tr>
<tr><td>02</td><td>TCLM_2</td></tr>
<tr><td>03</td><td>SQTCLM</td><td>Use torque limit with sequence operation</td><td>Limit torque with Sequence Operation Torque Limit Value.</td></tr>
</table>
* For a positioning function built-in servo amplifier, external torque limit is used even if "00: No_Limit" select.
Limit with a torque limit within point data.</td></tr>
</table>

－Group8－

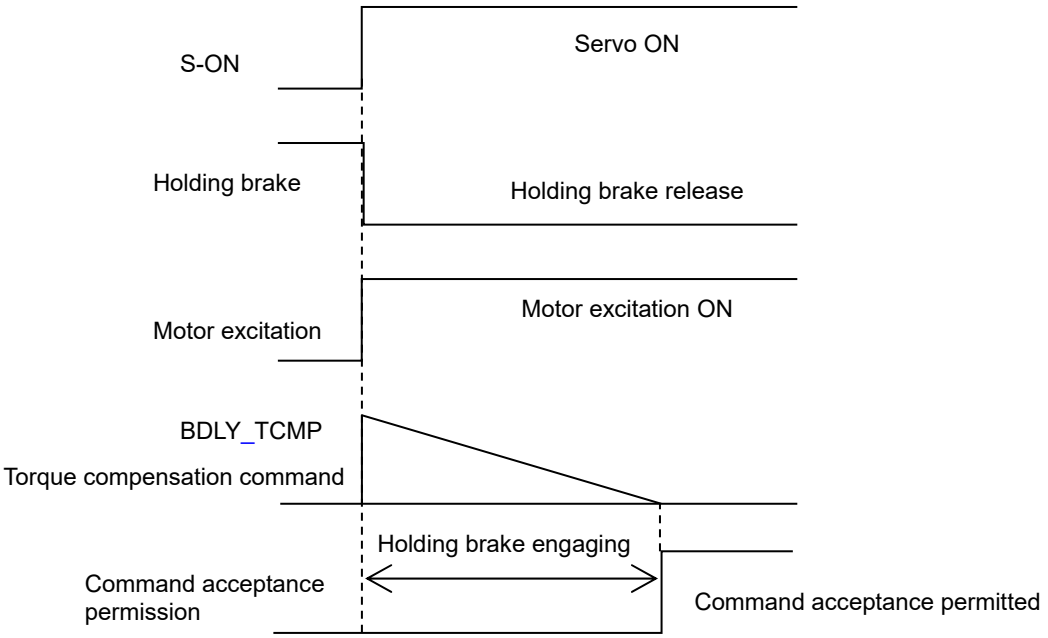
<table>
<tr><th>ID</th><th>Contents</th></tr>
<tr><td>3B</td><td>
Torque Attainment select [TASEL]
Setting range: 00 to 01 | Unit: - | Default: 00
■ To select a setting rate type of attaining torque
<table>
<tr><th colspan="2">Selection</th><th>Contents</th></tr>
<tr><td>00</td><td>TA/TR</td><td>Sets the rate against rated torque.
(Rated torque is 100%)</td></tr>
<tr><td>01</td><td>TA/TCLM</td><td>Sets the rate against Torque limit value.</td></tr>
</table>
</td></tr>
<tr><td>3C</td><td>
Torque Attainment Setting [TA]
Setting range: 0.0 to 500.0 | Unit: % | Default: 100.0
■ Sets the rate of Torque attainment.
Target data of the ratio set in this parameter varies depending on Group8 3B "Torque attainment function selection".
◆ ["Torque attainment function selection": 00]
● Sets the rate against rated torque: 100%.
Therefore, once the commanded torque exceeds the setting value, Torque attainment signal is output.


◆ ["Torque attainment function selection": 01]
● Sets the rate against Torque limit value.
The level of attaining torque is calculated from the following formula.
Torque attainment level = Torque limit value x setting value / 100.0 [%]

Therefore, once the commanded torque exceeds the level of attaining torque that is calculated from the above formula, torque attainment signal is output.
Even if the setting value is set more than 100.0 [%], that is limited to 100.0[%].
If forward direction and reverse direction torque limit value are different, torque attainment level will be setup based on values of each of limited torque.


</td></tr>
</table>

－Group8－

<table>
<tr><th>ID</th><th>Contents</th></tr>
<tr><td>3D</td><td>
The amounts of torque limit value restoration when power restored [TLMREST]
<table>
<tr><th>Setting range</th><th>Unit</th><th>Default</th></tr>
<tr><td>0.0 to 500.0</td><td>%</td><td>10.0</td></tr>
</table>
■ Sets the torque-recovering value per 1ms which is used to normal torque from limited torque of power supply drop.
◆ Sets the ratio to rated torque. (100.0% = rated torque)
◆ When setting “0.0%”, operate as 10.0%.
</td></tr>
<tr><td>3E</td><td>
Torque compensation command at holding brake operation cancellation delay [BDLY_TCMP]
<table>
<tr><th>Setting range</th><th>Unit</th><th>Default</th></tr>
<tr><td>-100 to 100</td><td>%</td><td>0.0</td></tr>
</table>
■ Sets the Torque compensation command at holding-brake operation cancellation delay to avoid self weight fall at the time of servo OFF to ON.
◆ Self weight fall at servo ON is able to suppress by setting the torque compensation value which is correspond to gravity load or external load.
◆ Torque compensation command will be linear-interpolated as to be zero after spending the time of GroupB ID04 "Delay Time of Releasing Holding Brake (Holding Brake Release Delay Time)".


</td></tr>
</table>

－Group8－

ID	Contents			
40	Near Range [NEAR]	Setting range 1 to 2147483647	Unit Pulse	Default 500

■ Sets the output range of near range (near in-position) signal.

◆ Outputs the Near range signal if the Position deviation counter is lower than this set value.

◆ Sets at the encoder pulse resolution without relation to Electronic gear ratio. (Not the Position command pulse resolution.)

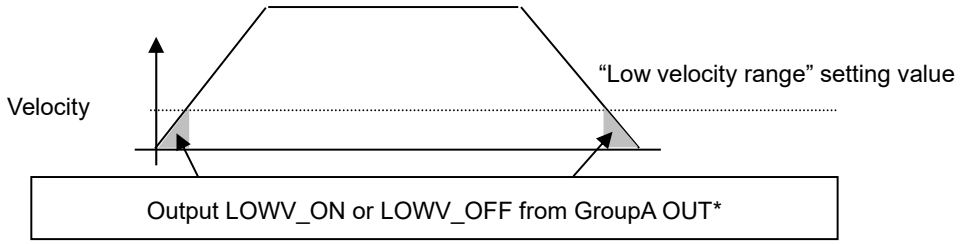
■ Generally, near range signal is used as auxiliary of In-position signal. For example, by setting this value larger than the range of In-position, the upper device receives the NEAR signal before the In-position signal (INP), and then necessary action can smoothly be accomplished when In-position completed.

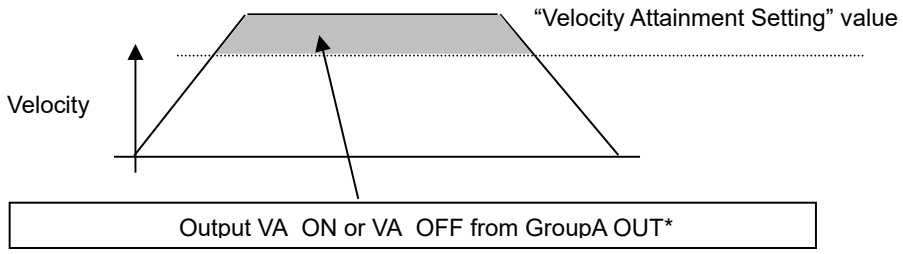
◆ Sets Near Range signal output

Group	ID	Symbol	Contents
A	0*	OUT*	Generic Purpose output*

Selection		Contents
1A	NEAR_ON	Near Range Status, Output ON
1B	NEAR _OFF	Near Range Status, Output OFF

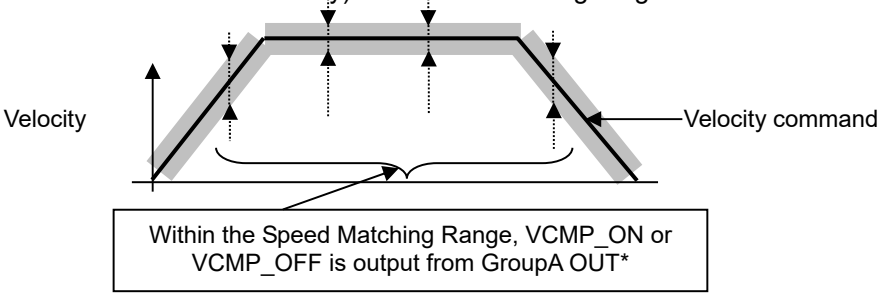
－Group8－

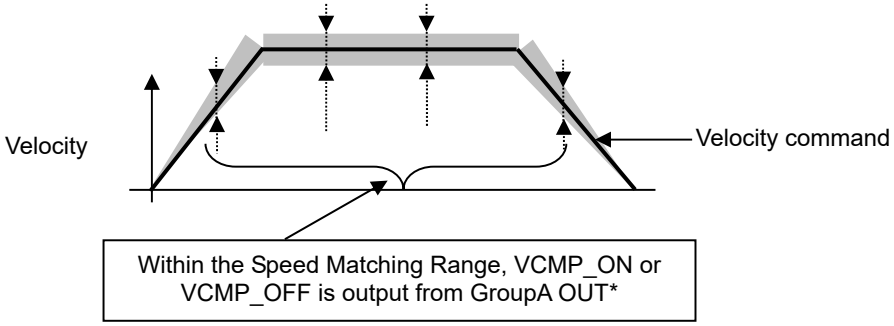
<table>
<tr><th>ID</th><th>Contents</th></tr>
<tr><td>42</td><td>
Speed Zero Range [ZV]
<table>
<tr><th>Setting range</th><th>Unit</th><th>Default</th></tr>
<tr><td>50 to 500</td><td>min^{-1}</td><td>50</td></tr>
</table>
■ Setting value for detecting Zero-speed status (motor stop).
◆ When the speed becomes lower than this value, Zero-speed status is out.
</td></tr>
<tr><td>43</td><td>
Low Speed Range [LOWV]
<table>
<tr><th>Setting range</th><th>Unit</th><th>Default</th></tr>
<tr><td>0 to 65535</td><td>min^{-1}</td><td>50</td></tr>
</table>
■ Parameter for setting Low speed output range.
◆ When the speed is lower than this value, Low speed status is output.


◆ Automatically overwrite by Auto-tuning result saving.
◆ When Auto-tuning function is valid, this setting value is not applied.
</td></tr>
<tr><td>44</td><td>
Speed Attainment Setting (High Speed Range) [VA]
<table>
<tr><th>Setting range</th><th>Unit</th><th>Default</th></tr>
<tr><td>0 to 65535</td><td>min^{-1}</td><td>1000</td></tr>
</table>
■ Parameters for setting speed attainment output range.
◆ When the speed exceeds this setting value, Speed attainment is output.
◆ When the operation is switched to torque control mode by using control mode switching function, in other words, when enabling “control model switching function (MS)” after setting ”03:Velo-Torq” or “04:Posi-Torq” of system parameter ID06 ”control mode selection”,simplified velocity limitation is controlled by this parameter. However, this method can not control with constant speed because a torque is forced to be zero when Motor speed exceeds this setting value. Avoid the use of such status to continue.


</td></tr>
</table>

－Group8－

<table>
<tr><th>ID</th><th>Contents</th></tr>
<tr><td>45</td><td>
Speed Matching Unit Selection [VCMPUS] “Power cycle for control after setting”
Setting range: 00 to 01 | Unit: — | Default: 00:min^{-1}
■ Selects Speed Matching Unit setting method.
<table>
<tr><th colspan="2">Selection</th><th>Contents</th></tr>
<tr><td>00</td><td>min^{-1}</td><td>Sets by [min^{-1}] unit.
Uses the setting value of ID46 [VCMP] Speed Matching Range</td></tr>
<tr><td>01</td><td>Percent</td><td>Sets the ratio to velocity command by [%] unit.
Uses the setting value of ID47 [VCMPR] Speed Matching Range Ratio.</td></tr>
</table>
</td></tr>
<tr><td>46</td><td>
Speed Matching Range [VCMP]
Setting range: 0 to 65535 | Unit: min^{-1} | Default: 50
■ Sets the range regarded as Speed matching by the [min^{-1}] unit.
◆ Use this setting value when ID45 [VCMPUS] Speed Matching Unit Selection is ”00:min^{-1}”.
◆ Velocity matching is output when the Velocity deviation (difference between the velocity command and actual velocity) is within this setting range.


</td></tr>
<tr><td>47</td><td>
Speed Matching Range Ratio [VCMPR]
Setting range: 0.0 to 100.0 | Unit: % | Default: 5.0
■ Sets the range regarded as Speed matching ratio to Velocity command by the [%] unit.
◆ This setting is used when “01: Percent” is set to ID45 ”[VCMPUS] Speed Matching Unit Selection”.
◆ The value that multiplied the velocity command by this setting value is a Speed matching range.
◆ Speed matching is outputted when a velocity deviation (difference of commanded velocity and real one) is in this setting range.
◆ When this value is less than 1[min^{-1}], the Speed matching range is treated as 1[min^{-1}].


</td></tr>
</table>

ID	Contents

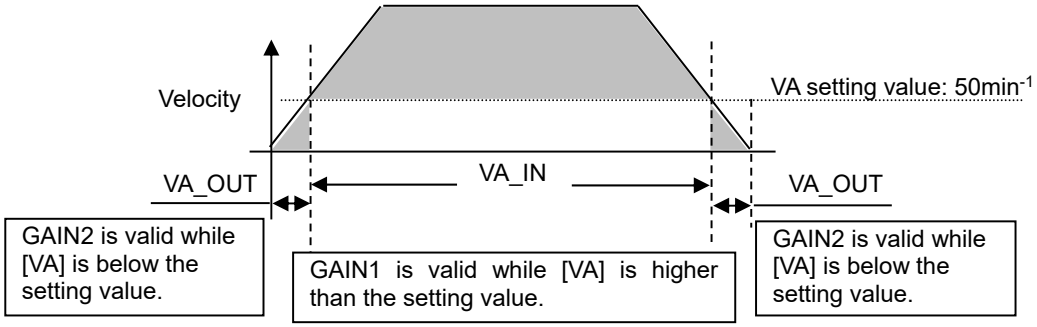
■ By combining with Group9 "Condition Settings for Enabling Functions", ID42 to ID47 will make the functions of Group9 valid.

Selection		Contents
12	LOWV_IN	Function is valid while in low speed status (speed is lower than the LOWV Setting Value).
13	LOWV_OUT	Function is valid while not in low speed status (speed is lower than the LOWV Setting Value).
14	VA_IN	Function is valid while in speed attainment status (speed is higher than the VA Setting Value).
15	VA_OUT	Function is valid while not in speed attainment status (speed is higher than the VA Setting Value).
16	VCMP_IN	Function is valid while in speed matching status (within command-actual velocity consistent range).
17	VCMP_OUT	Function is valid while not in speed matching status (within command-actual velocity consistent range).
18	ZV_IN	Function is valid while in zero speed status (speed is lower than the ZV Setting Value)
19	ZV_OUT	Function is valid while not in zero speed status (speed is lower than the ZV Setting Value)

* Speed Matched Range is depending on “Group8 ID45 to ID47” setting.

◆ Example: The servo amplifier sets the GAIN1 and GAIN2 switching without using input signal from the host unit.

- Sets 15: VA_OUT to Group9 ID13 Gain Switching Condition 1 [GC1].
- Sets 00: Always_Disable to Group9 ID14 Gain Switching Condition 2 [GC2].
- Sets 50min^{-1} (arbitrary value) to Group8 ID44 Speed Attainment (High Speed setting) [VA].



* For a positioning function built-in servo amplifier, selects a gain by servo gain switching within point data. Each function valid condition reflects just in case selecting servo gain selection 0.

80

Polarity selection of axes-sync compensation input [SYNCDIR]	Setting range	Unit	Default
	00 to 01	-	00: Not_Reversed

■ Fit a polarity of position deviation each other.

◆ Set "01: Reversed" to one axis if rotation directions of combination axes are different.

Selection		Contents
00	Not_Reversed	Without reversing
01	Reversed	With reversing

■ General parameters Group9 "Function enabling condition settings"

ID	Name	Setting range	Default value	Functions-enabled input time
00	Positive Over Travel Function [F-OT]	00 to 29	0D:CONT6_OFF	20ms
01	Negative Over Travel Function [R-OT]	00 to 29	0B:CONT5_OFF	20ms
02	Alarm Reset Function [AL-RST]	00 to 29	10:CONT8_ON	20ms
03	Encoder Clear Function [ECLR]	00 to 29	06:CONT3_ON	200ms
04	Deviation Clear Function [CLR]	00 to 29	08:CONT4_ON	2ms
05	Servo-ON Function [S-ON]	00 to 29	02:CONT1_ON	20ms
13	Gain Switching Condition 1 [GC1]	00 to 29	00:Always_Disable	2ms
14	Gain Switching Condition 2 [GC2]	00 to 29	00:Always_Disable	2ms
15	FF Vibration Suppressor Frequency Select Input A1 [SUPFSELA1]	00 to 29	00:Always_Disable	20ms
16	FF Vibration Suppressor Frequency Select Input A2 [SUPFSELA2]	00 to 29	00:Always_Disable	20ms
17	FF Vibration Suppressor Frequency Select Input B1 [SUPFSELB1]	00 to 29	00:Always_Disable	20ms
18	FF Vibration Suppressor Frequency Select Input B2 [SUPFSELB2]	00 to 29	00:Always_Disable	20ms
19	Position Loop Proportional Control Switching Function [PLPCON]	00 to 29	01:Always_Enable	20ms
1A	Model following (vibration suppression) control/ standard position control switching function [MODEL]	00 to 11	00:Always_Disable	2ms
1B	Model Vibration Suppressor Frequency Select Input 1 [MDLFSEL1]	00 to 29	00:Always_Disable	20ms
1C	Model Vibration Suppressor Frequency Select Input 2 [MDLFSEL2]	00 to 29	00:Always_Disable	20ms
27	Velocity Loop Proportional Control Switching Function [VLPCON]	00 to 29	04:CONT2_ON	2ms
28	Velocity Compensation Function [V-COMPS]	00 to 29	00:Always_Disable	2ms
30	Torque Compensation Function 1 [T-COMPS1]	00 to 29	00:Always_Disable	2ms
31	Torque Compensation Function 2 [T-COMPS2]	00 to 29	00:Always_Disable	2ms
33	Disturbance Observer Function [OBS]	00 to 29	00:Always_Disable	20ms
34	Compensatory function for stick-slip behavior [STC]	00 to 29	00:Always_Disable	20ms
35	Minor vibration (oscillation) suppression function [FBHYST]	00 to 29	00:Always_Disable	20ms
40	External Trip Input Function [EXT-E]	00 to 29	00:Always_Disable	20ms
41	Emergency Stop Function [EMR]	00 to 29	00:Always_Disable	20ms
42	Slowdown before home signal [SDN]	00 to 29	00:Always_Disable	20ms
50	General Output 1 [OUT1]	00 to 87	0A:MBR-ON_ON	20ms
51	General Output 2 [OUT2]	00 to 87	39:ALM_OFF	20ms
60	Digital Monitor Output Signal Selection [DMON]	00 to 85	00:Always_OFF	20ms
61	Analog Monitor Select Output 1 [MON1]	00 to 36	05:VMON_2mV/ min^{-1}	20ms
62	Analog Monitor Select Output 2 [MON2]	00 to 36	02:TCMON_2V/TR	20ms
63	Analog Monitor Output Polarity [MONPOL]	00 to 08	00:MON1+_MON2 +	20ms
64	Digital monitor extended output selection [DMONSEL]	00 to 41	00:FOUT	20ms
65	Positive manual feeding signal function [F-JOG]	00 to 29	00:Always_Disable	20ms
66	Negative manual feeding signal function [R-JOG]	00 to 29	00:Always_Disable	20ms

Group9 List of selection contents

■ Keeping the function always valid or invalid

Selection		Contents
00	Always_Disable	Function is always invalid
01	Always_Enable	Function is always valid

■ Using function with the generic input signals

Selection		Contents
02	CONT1_ON	Function is valid when generic input, CONT1, is ON
03	CONT1_OFF	Function is valid when generic input, CONT1, is OFF
04	CONT2_ON	Function is valid when generic input, CONT2, is ON
05	CONT2_OFF	Function is valid when generic input, CONT2, is OFF
06	CONT3_ON	Function is valid when generic input, CONT3, is ON
07	CONT3_OFF	Function is valid when generic input, CONT3, is OFF
08	CONT4_ON	Function is valid when generic input, CONT4, is ON
09	CONT4_OFF	Function is valid when generic input, CONT4, is OFF
0A	CONT5_ON	Function is valid when generic input, CONT5, is ON
0B	CONT5_OFF	Function is valid when generic input, CONT5, is OFF
0C	CONT6_ON	Function is valid when generic input, CONT6, is ON
0D	CONT6_OFF	Function is valid when generic input, CONT6, is OFF
0E	CONT7_ON	Function is valid when generic input, CONT7, is ON
0F	CONT7_OFF	Function is valid when generic input, CONT7, is OFF

* Selectable with interface type [F: MODBUS] only. Cannot select with [C: I/O].

■ Activating the functions conditioning the rotational speed of servomotor

Selection		Contents
12	LOWV_IN	Function is valid while in low speed status (speed is lower than the LOWV Setting Value).
13	LOWV_OUT	Function is valid while not in low speed status (speed is lower than the LOWV Setting Value).
14	VA_IN	Function is valid while in speed attainment status (speed is higher than the VA Setting Value).
15	VA_OUT	Function is valid while not in speed attainment status (speed is higher than the VA Setting Value).
16	VCMP_IN	Function is valid while in speed matching status (within command-actual velocity consistent range).
17	VCMP_OUT	Function is valid while not in speed matching status (within command-actual velocity consistent range).
18	ZV_IN	Function is valid while in zero speed status (speed is lower than the ZV Setting Value).
19	ZV_OUT	Function is valid while not in zero speed status (speed is lower than the ZV Setting Value).

－Group9－

■ Activating the functions using the positioning signals

Selection		Contents
20	NEAR_IN	Function is valid while in Near range status
21	NEAR_OUT	Function is valid while not in Near range status
1A	INP_IN	Function is valid while in In-Position status (position deviation < INP)
1B	INP_OUT	Function is valid while not in In-Position status (position deviation < INP)
26	INPZ_IN	Function is valid while in Position command 0 and In-Position status (position deviation < INP)
27	INPZ_OUT	Function is valid while not in Position command 0 and In-Position status (position deviation < INP)
28	TRJCMP_IN	Function is valid while in Position command distribution completion (including delay time)
29	TRJCMP_OUT	Function is valid while not in Position command distribution completion (including delay time)

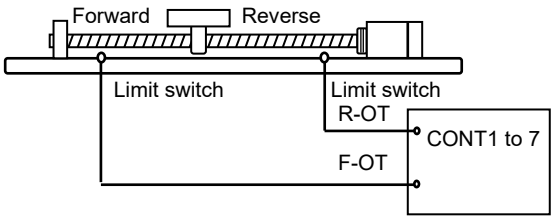
■ Activating the functions using the torque / speed limit

Selection		Contents
1C	TLC_IN	Function is valid while in torque limit status
1D	TLC_OUT	Function is valid while not in torque limit status
1E	VLC_IN	Function is valid while in velocity limit status
1F	VLC_OUT	Function is valid while not in velocity limit status

■ Activating the functions by the rotating direction or zero-speed state of servo motor

Selection		Contents
22	VMON_>_+LV	Function is valid while rotation direction is forward (VMON>+LOWV)
23	VMON_<=_+LV	Function is valid while rotation direction is not forward (VMON≦+LOWV)
24	VMON_<_-LV	Function is valid while rotation direction is reverse (VMON<-LOWV)
25	VMON_>=_-LV	Function is valid while rotation direction is not reverse (VMON≧-LOWV)

－Group9－

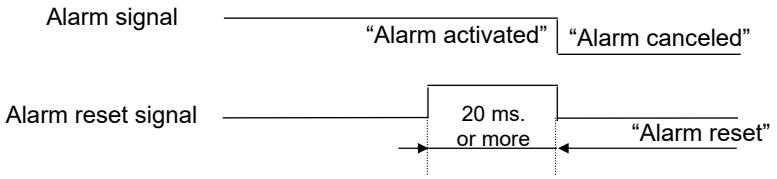
ID	Contents
00 01	Forward Over-Travel Function [F-OT] Reverse Over-Travel Function [R-OT] ■ The over travel function uses limit switch to prevent damage to the unit. This function forcedly stops the unit when the movement range of the moving part is exceeded. ◆ Allocating over-travel input signal to CONT1 to CONT7.  ◆ For a positioning function built-in servo amplifier, it becomes dynamic brake stop operation when occurring overtravel or alarm detection. * Assign to CONT1 to CONT7 with interface type [F: MODBUS] only. This function cannot assign with [C: I/O]. Pin number is decided due to CN1 I/O specification. Wire to applicable pin number. Refer the section 2.1.1 in chapter 2.

－Group9－

<table>
<tr><th>ID</th><th>Contents</th></tr>
<tr><td>02</td><td>Alarm reset function
[AL-RST]
■ This function enables inputting alarm reset signal from host equipment. Alarm is cleared by enabling alarm reset function (AL-RST).

◆ Allocating conditions to enable alarm reset function. When AL-RST signal enabled, this function clears alarms.

* Please note that the alarms which needs control power-cycle for alarm reset are not able to clear by alarm reset signal.

* It can assign to CONT1 to CONT7 with interface type [F: MODBUS] only.
Alarm reset can perform via MODBUS communication. Dedicated wiring is not required when controlling this function via MODBUS communication.
This function cannot assign with [C: I/O]. Pin number is decided due to CN1 I/O specification. Wire to applicable pin number.
Refer the section 2.1.1 in chapter 2.</td></tr>
<tr><td>05</td><td>Servo-on function [S-ON]
[S-ON]
■ This function is to input servo-on signal from host equipment. Enabling servo-on function (SON) can put servo motor into current-applied state.

◆ Allocating conditions to enable servo-on function. When SON signal is enabled, the servo motor will be into current-applied state.

* It can assign to CONT1 to CONT7 with interface type [F: MODBUS] only.
Servo on can perform via MODBUS communication. Dedicated wiring is not required when controlling this function via MODBUS communication.
This function cannot assign with [C: I/O]. Pin number is decided due to CN1 I/O specification. Wire to applicable pin number.
Refer the section 2.1.1 in chapter 2.</td></tr>
</table>

－Group9－

ID	Contents
13 14	Gain switching condition 1 [GC1] Gain switching condition 2 [GC2]

■ 4 types of gain can be used by switching them.

◆ Allocating conditions to enable gain switching condition. You can switch GAIN 1 to 4 by combination of GC1 and GC2 setting.

GC1 : Gain switching condition 1	Invalid	Valid	Invalid	Valid
GC2 : Gain switching condition 2	Invalid	Invalid	Valid	Valid
	↓	↓	↓	↓
Gain becoming valid	GAIN1	GAIN2	GAIN3	GAIN4

* For a positioning function built-in servo amplifier, servo gain switching selection condition within point data has priority.
For a gain switching, use the servo gain switching of point data.
The condition selected by this function is applied to the point move which select servo gain selection 0 at servo gain switching.

－Group9－

<table>
<tr><th>ID</th><th>Contents</th></tr>
<tr><td>15
16</td><td>
FF vibration suppression frequency selecting input A1 [SUPFSELA1]
FF vibration suppression frequency selecting input A2 [SUPFSELA2]
■ 4 types of FF vibration suppression frequency can be used by switching them.

◆ Allocating conditions to enable FF vibration suppression frequency selecting input. You can switch FF vibration suppression frequency A1 to A4 by combination of SUPFSELA1 and SUPFSELA2 setting.
<table>
<tr><td>SUPFSELA1: FF vibration suppression frequency selecting input A1</td><td>Invalid</td><td>Valid</td><td>Invalid</td><td>Valid</td></tr>
<tr><td>SUPFSELA2: FF vibration suppression frequency selecting input A2</td><td>Invalid</td><td>Invalid</td><td>Valid</td><td>Valid</td></tr>
<tr><td></td><td>↓</td><td>↓</td><td>↓</td><td>↓</td></tr>
<tr><td>Vibration suppression becoming valid</td><td>FF vibration suppression frequency A1
Group 2
ID00</td><td>FF vibration suppression frequency A2
Group 4
ID40</td><td>FF vibration suppression frequency A3
Group 4
ID41</td><td>FF vibration suppression frequency A4
Group 4
ID42</td></tr>
</table>
</td></tr>
<tr><td>17
18</td><td>
FF vibration suppression frequency selecting input B1 [SUPFSELB1]
FF vibration suppression frequency selecting input B2 [SUPFSELB2]
■ 4 types of FF vibration suppression frequency can be used by switching them.

◆ Allocating conditions to enable FF vibration suppression frequency selecting input. You can switch FF vibration suppression frequency B1 to B4 by combination of SUPFSELB1 and SUPFSELB2 setting.
<table>
<tr><td>SUPFSELB1: FF vibration suppression frequency selecting input B1</td><td>Invalid</td><td>Valid</td><td>Invalid</td><td>Valid</td></tr>
<tr><td>SUPFSELB2: FF vibration suppression frequency selecting input B2</td><td>Invalid</td><td>Invalid</td><td>Valid</td><td>Valid</td></tr>
<tr><td></td><td>↓</td><td>↓</td><td>↓</td><td>↓</td></tr>
<tr><td>Vibration suppression becoming valid</td><td>FF vibration suppression frequency B1
Group 2
ID02</td><td>FF vibration suppression frequency B2
Group 4
ID43</td><td>FF vibration suppression frequency B3
Group 4
ID44</td><td>FF vibration suppression frequency B4
Group 4
ID45</td></tr>
</table>
</td></tr>
</table>

－Group9－

<table>
<tr><th>ID</th><th>Contents</th></tr>
<tr><td>19</td><td>
Position loop proportional control switching function
[PLPCON]
■ You can switch between position loop PI control and P control. Enabling position loop proportional control switching function (PLPCON) enable switching.

◆ Allocating conditions to enable position loop proportional control switching function. When PLPCON signal enabled, the control is switched to proportional control.

● PI control (proportional･integral control)･･Position loop proportional gain (KP)/ integral time constant (TPI)
● P control (proportional control)･････ Position loop proportional gain (KP)

* In the standard setting, position loop integral time constant (TPI) is 1000.0ms, so integration function is disabled.

◆ Automatically overwrite by Auto-tuning result saving.
◆ When Auto-tuning function is valid, this setting value is not applied.
</td></tr>
<tr><td>1A</td><td>
Model following (vibration suppression) control/ standard position control switching function
[MODEL]
■ Enabling Model following (vibration suppression) control.
◆ This setting value is valid only when Control mode selection is "03: Velocity / Torque control switching type" or "04: Position / Torque control switching type".
* Valid condition is limited to 00 to 11.
* Do not perform switching of the model following (vibration suppression) control and the standard position control, during servo motor operation. Alarm (Model Following Vibration Suppression Control Error (AL.C5)) may occur.
</td></tr>
<tr><td>1B
1C</td><td>
Model vibration suppression frequency selecting input 1 [MDLFSEL1]
Model vibration suppression frequency selecting input 2 [MDLFSEL2]
■ 4 types of model vibration suppression frequency can be used by switching them.

◆ Allocating conditions to enable model control antiresonant frequency selecting input. You can switch model control antiresonant frequency 1 to 4/ model control antiresonant frequency 1 to 4 by combination of MDLFSEL1 with MDLFSEL2.
<table>
<tr><td>MDLFSEL1: Model vibration suppression frequency selecting input 1</td><td>Invalid</td><td>Valid</td><td>Invalid</td><td>Valid</td></tr>
<tr><td>MDLFSEL2: Model vibration suppression frequency selecting input 2</td><td>Invalid</td><td>Invalid</td><td>Valid</td><td>Valid</td></tr>
<tr><td></td><td>↓</td><td>↓</td><td>↓</td><td>↓</td></tr>
<tr><td>Vibration suppression frequency becoming valid</td><td>Model control antiresonant frequency 1
Group 3 ID06
Model control resonant frequency 1
Group 3 ID07</td><td>Model control antiresonant frequency 2
Group 4 ID50
Model control resonant frequency 2
Group 4 ID51</td><td>Model control antiresonant frequency 3
Group 4 ID52
Model control resonant frequency 3
Group 4 ID53</td><td>Model control antiresonant frequency 4
Group 4 ID54
Model control resonant frequency 4
Group 4 ID55</td></tr>
</table>
</td></tr>
</table>

－Group9－

ID	Contents
27	Velocity loop proportional control switching function [VLPCON] ■ You can switch between velocity loop PI control and P control. ◆ Enabling velocity loop proportional control switching function (VLPCON) enables switching. ◆ Allocating conditions to enable velocity loop proportional control switching function. When VLPCON signal is enabled, the control is switched to proportional control. ● PI control (proportional･integral control)･･Velocity loop proportional gain (KVP)/ integral time constant (TVI) ● P control (proportional control)･･････ Velocity loop proportional gain (KVP) * Switching to proportional control decreases servo gain, and servo system becomes easy to stable. * In the default setting, the velocity loop integral time constant (TVI) is 1000.0ms, so the integral function is invalid. ◆ Automatically overwrite by Auto-tuning result saving. ◆ When Auto-tuning function is valid, this setting value is not applied.
34	Stick-slip behavior compensation function [STC] ■ This enables stick motion compensation function in quadrant to compensate trajectory error occurred due to quadrant switching, for use in applications for arc-shape or curved surface process, such as NC machining equipments. ◆ The conditions for enabling compensatory function for stick-slip behavior are assigned. The compensatory function for stick-slip behavior becomes enabled If the STC signal is valid.
35	Minor vibration suppression function [FBHYST] ■ Minor vibration suppression function to suppress mechanical system-induced vibration caused by encoder pulse modulation is enabled when motor stops. ◆ The conditions for enabling minor vibration suppression function are assigned. The minor vibration suppression function becomes enabled If the FBHYST signal is valid.
40	External trip input function [EXT-E] ■ Contact input such as external thermal device can be taken in servo amplifier, and then output as an alarm (AL.55). ◆ Allocating conditions to enable external trip function. When EXT-E signal is enabled, this becomes alarm (AL.55). * Assign to CONT1 to CONT7 with interface type [F: MODBUS] only. This function cannot assign with [C: I/O]. Pin number is decided due to CN1 I/O specification. Wire to applicable pin number. Refer the section 2.1.1 in chapter 2.

ID	Contents
41	Emergency stop function [EMR] ■ This can urgently stop servo motor by taking unit emergency signal into servo amplifier. ◆ Allocating conditions to enable unit emergency signal. When EMR signal is enabled, motor urgently stops. * Assign to CONT1 to CONT7 with interface type [F: MODBUS] only.
42	Slowdown before home signal [SDN] ■ It controls a homing operation by receiving a slowdown before home signal. ◆ Assigns the valid condition of slowdown before home signal. * Assign to CONT1 to CONT7 with interface type [F: MODBUS] only. This function cannot assign with [C: I/O]. Pin number is decided due to CN1 I/O specification. Wire to applicable pin number. Refer the section 2.1.1 in chapter 2.
50	General Output 1 [OUT1] ■ The function selecting the output signal of general output 1. ◆ Outputs the signal set to general output 1. Refer next page for setting selection list. * Function selectable with interface type [F: MODBUS] only.
51	General Output 2 [OUT2] ■ The function selecting the output signal of general output 2. ◆ Outputs the signal set to general output 2. Refer next page for setting selection list. * Function selectable with interface type [F: MODBUS] only.

－Group9－

ID	Contents	Setting range	Unit	Default value
60	Digital Monitor Output Signal Selection [DMON]	00 to 81	—	00:Always_OFF

■ Selects output signal for Output digital monitor.
- ◆ The logic is reversed with the Digital monitor.
- ◆ Output voltage is approximately 5V when OFF, and 0V when ON.

■ Selection Contents list for General Output 1/General Output 2/Digital monitor output selection

◆ Fix Output to either selection.

01:Always_ON	00:Always_OFF

◆ When General input signal status is to be Output

General Input, CONT1 is ON	3A:CONT1_ON	3B:CONT1_OFF
General Input, CONT2 is ON	3C:CONT2_ON	3D:CONT2_OFF
General Input, CONT3 is ON	3E:CONT3_ON	3F:CONT3_OFF
General Input, CONT4 is ON	40:CONT4_ON	41:CONT4_OFF
General Input, CONT5 is ON	42:CONT5_ON	43:CONT5_OFF
General Input, CONT6 is ON	44:CONT6_ON	45:CONT6_OFF
General Input, CONT7 is ON	46:CONT7_ON	47:CONT7_OFF

* Selectable with interface type [F: MODBUS] only.

◆ When Servo amplifier Preset status is to be output.

While Servo Ready Complete	02:S-RDY_ON	03:S-RDY_OFF
While Power Supply ON	04:P-ON_ON	05:P-ON_OFF
While Power Supply ON Permission	06:A-RDY_ON	07:A-RDY_OFF
While Motor Excitation	08:S-ON_ON	09:S-ON_OFF
While Holding Brake Excitation Signal Output	0A:MBR-ON_ON	0B:MBR-ON_OFF
While Torque Limiting	0C:TLC_ON	0D:TLC_OFF
While Velocity Limiting	0E:VLC_ON	0F:VLC_OFF
While Low Speed Status	10:LOWV_ON	11:LOWV_OFF
While Speed Attainment Status	12:VA_ON	13:VA_OFF
While Speed Matching Status	14:VCMP_ON	15:VCMP_OFF
While Speed Zero Status	16:ZV_ON	17:ZV_OFF
While Command Acceptance Permission Status	1C:CMD-ACK_ON	1D:CMD-ACK_OFF
While Velocity Loop Proportional Control Switching Status	1E:GC-ACK_ON	1F:GC-ACK_OFF
While Electronic Gear Switching Status	20:PCON-ACK_ON	21:PCON-ACK_OFF
While Control Mode Switching Status	22:GERS-ACK_ON	23:GERS-ACK_OFF
While Forward Over-Travel Status	24:MS-ACK_ON	25:MS-ACK_OFF
While Reverse Over-travel Status	26:F-OT_ON	27:F-OT_OFF
While Main Circuit Power Supply Charging	28:R-OT_ON	29:R-OT_OFF
While Dynamic Braking	4A:CHARGE_ON	4B:CHARGE_OFF
While Torque Attainment Status	4C:DB_OFF	4D:DB_ON
While Model control/ Model vibration suppression control Status	5E:TA_ON	5F:TA_OFF
While Velocity command zero status	68:MODLCH_ON	69:MODLCH_OFF
While Velocity Loop Proportional Control Switching Status	6A:VCZV_ON	6B:VCZV_OFF

◆ When Positioning signal is to be output

While In-Position Status	18:INP_ON	19:INP_OFF
While Near Range Status	1A:NEAR_ON	1B:NEAR_OFF
While In-Position with Position Command 0 Status	5A:INPZ_ON	5B:INPZ_OFF
While position command distribution completion status	60:TRJCMP_ON	61: TRJCMP_OFF

◆ When Alarm signals are to be output

While Alarm Status	38:ALM_ON	39:ALM_OFF

◆ When Digital monitor extended output signal is to be output

Digital monitor extended output	84:DMON_ON	85:DMON_OFF

◆ When Host communication output selection signals are to be output

Host communication output selection 1	84:MODOUT1_ON	85:MODOUT1_OFF
Host communication output selection 2	86:MODOUT2_ON	87:MODOUT2_OFF

* "Torque limiting" is performed at "before torque limit filter" and "after torque command filter/torque FF compensation", by equipping the torque FF compensation function. "While Torque Limiting" is output when either condition is established. Therefore, confirm each state of the torque command monitor and the torque command monitor (before filter), for "Torque limiting".

－Group9－

ID	Contents	Setting range	Unit	Default value
61	Analog Monitor Select Output 1 [MON1]	00 to 36	—	05:VMON_2mV/min^{-1}
62	Analog Monitor Select Output 2 [MON2]	00 to 36	—	02:TCMON_2V/TR

■ Selects output signals to output to Analog monitor 1 and 2 from the list below.

00:RESERVE	Monitor mode for manufacturer only	—
01:TMON_2V/TR	Torque Monitor	2V/Rated torque
02:TCMON_2V/TR	Torque Command Monitor	2V/Rated torque
03:VMON_0.2mV/ min^{-1}	Velocity Monitor	0.2mV/min^{-1}
04:VMON_1mV/ min^{-1}	Velocity Monitor	1mV/min^{-1}
05:VMON_2mV/ min^{-1}	Velocity Monitor	2mV/min^{-1}
06:VMON_3mV/ min^{-1}	Velocity Monitor	3mV/min^{-1}
07:VCMON_0.2mV/ min^{-1}	Velocity Command Monitor	0.2mV/min^{-1}
08:VCMON_1mV/ min^{-1}	Velocity Command Monitor	1mV/min^{-1}
09:VCMON_2mV/ min^{-1}	Velocity Command Monitor	2mV/min^{-1}
0A:VCMON_3mV/ min^{-1}	Velocity Command Monitor	3mV/min^{-1}
0B:PMON_0.01mV/P	Position Deviation Counter Monitor	0.01mV/Pulse
0C:PMON_0.1mV/P	Position Deviation Counter Monitor	0.1mV/Pulse
0D:PMON_1mV/P	Position Deviation Counter Monitor	1mV/Pulse
0E:PMON_10mV/P	Position Deviation Counter Monitor	10mV/Pulse
0F:PMON_20mV/P	Position Deviation Counter Monitor	20mV/Pulse
10:PMON_50mV/P	Position Deviation Counter Monitor	50mV/Pulse
11:FMON1_2mV/kP/s	Position Command Pulse Frequency Monitor 1 (Position Command Pulse Input Frequency)	2mV/kPulse/s
12:FMON1_10mV/kP/s	Position Command Pulse Frequency Monitor 1 (Position Command Pulse Input Frequency)	10mV/kPulse/s
13:FMON2_0.05mV/kP/s	Position Command Pulse Frequency Monitor 2 (Position Command Pulse Frequency for Position Controller)	0.05mV/kPulse/s
14:FMON2_0.5mV/kP/s	Position Command Pulse Frequency Monitor 2 (Position Command Pulse Frequency for Position Controller)	0.5mV/kPulse/s
15:FMON2_2mV/kP/s	Position Command Pulse Frequency Monitor 2 (Position Command Pulse Frequency for Position Controller)	2mV/kPulse/s
16:FMON2_10mV/kP/s	Position Command Pulse Frequency Monitor 2 (Position Command Pulse Frequency for Position Controller)	10mV/kPulse/s
17:TLMON_EST_2V/TR	Load Torque Monitor (Estimated Value)	2V/Rated torque
18:Sine-U	U Phase Electronic Angle Sine	8Vpeak
19:ACMON_0.01mV/rad/s^2	Acceleration monitor	0.01mV/rad/s^2

1A:ACMON_0.1mV/rad/s^2	Acceleration monitor	0.1mV/rad/s^2
1B:ACMON_1mV/rad/s^2	Acceleration monitor	1mV/rad/s^2
1C:ACMON_10mV/rad/s^2	Acceleration monitor	10mV/rad/s^2
1D:VBUS_ 1V/DC100V	Bus voltage monitor	1V/DC100V
1E:VBUS_ 1V/DC10V	Bus voltage monitor	1V/DC10V
23:OLRAT_0.5V/%	Overload detection temperature reach rate monitor	0.5V/%
24:FMON1_0.01mV/kP/s	Position command pulse frequency monitor 1 (Position command pulse input frequency)	0.01mV/kPulse/s
25:FMON1_0.05mV/kP/s	Position command pulse frequency monitor 1 (Position command pulse input frequency)	0.05mV/kPulse/s
26:FMON1_0.5mV/kP/s	Position command pulse frequency monitor 1 (Position command pulse input frequency)	0.5mV/kPulse/s
27:FMON2_0.01mV/kP/s	Position command pulse frequency monitor 2 (Position command pulse input frequency)	0.01mV/kPulse/s
28:MAVEPOW_1V/10W	Average power monitor	1V/ 10W
29:MAVEPOW _1V/100W	Average power monitor	1V/ 100W
2A:MAVEPOW _1V/1kW	Average power monitor	1V/ 1kW
2B:MAVEPOW _1V/10kW	Average power monitor	1V/ 10kW
2C:MAVEPOW _1V/100kW	Average power monitor	1V/ 100kW
2D:TMON2_2V/TR	Torque Command Monitor (before filter)	2V/Rated torque
34:JRAT_10mV/%	Load inertia moment ratio monitor	10mV/%
35:JRAT_5mV/%	Load inertia moment ratio monitor	5mV/%
36:JRAT_0.5mV/%	Load inertia moment ratio monitor	0.5mV/%

- Position command pulse frequency monitor 1 monitors Position command pulse before the Electronic gear.
- Position command pulse frequency monitor 2 monitors Position command pulse after passing through the Electronic gear and Position command smoothing.

  * Position command pulse frequency monitor 1, 2 will be generated in pulse-state when the position command pulse is 10 kHz or less. When converting it to position command frequency, use it after averaging.

- The following low-pass filters are placed into torque monitor, acceleration monitor, and load torque monitor.

Torque monitor	250Hz
Velocity monitor	250Hz
Load torque monitor	50Hz

- Torque Command Monitor (before filter) outputs the state before filter, so torque command is shown with ripple. However, motor is driven by the torque command after filter. Therefore, it differs from motor behavior.

－Group9－

ID	Contents			
63	Analog Monitor Output Polarity [MONPOL]	Setting range	Unit	Default value
		00 to 08	-	00:MON1+_MON2+

■ Selects Output polarity of Analog monitor output, MON1and MON2 from below.

◆ For both MON1 and MON2, set from any of the followings:
+ No Polarity Rotation, - Polarity Rotation, ABS Absolute Value Output

Selection	Contents
00:MON1+_MON2+	MON1: Output positive voltage at Forward (Positive) Rotation. Output positive/negative voltage. MON2: Output positive voltage at Forward (Positive) Rotation. Output positive/negative voltage.
01:MON1-_MON2+	MON1: Output negative voltage at Forward (Positive) Rotation. Output positive/negative voltage. MON2: Output positive voltage at Forward (Positive) Rotation. Output positive/negative voltage.
02:MON1+_MON2-	MON1: Output positive voltage at Forward (Positive) Rotation. Output positive/negative voltage. MON2: Output negative voltage at Forward (Positive) Rotation. Output positive/negative voltage.
03:MON1-_MON2-	MON1: Output negative voltage at Forward (Positive) Rotation. Output positive/negative voltage. MON2: Output negative voltage at Forward (Positive) Rotation. Output positive/negative voltage.
04:MON1ABS_MON2+	MON1: Output positive voltage at Forward (Positive) and Reverse (Negative) Rotation. MON2: Output negative voltage at Forward (Positive) Rotation. Output positive/negative voltage.
05:MON1ABS_MON2-	MON1: Output positive voltage at Forward (Positive) and Reverse (Negative) Rotation. MON2: Output negative voltage at Forward (Positive) Rotation. Output positive/negative voltage.
06:MON1+_MON2ABS	MON1: Output positive voltage at Forward (Positive) Rotation. Output positive/negative voltage. MON2: Output positive voltage at Forward (Positive) and Reverse (Negative) Rotation.
07:MON1-_MON2ABS	MON1: Output negative voltage at Forward (Positive) Rotation. Output positive/negative voltage. MON2: Output positive voltage at Forward (Positive) and Reverse (Negative) Rotation.
08:MON1ABS_MON2ABS	MON1: Output positive voltage at Forward (Positive) and Reverse (Negative) Rotation. MON2: Output positive voltage at Forward (Positive) and Reverse (Negative) Rotation.

－Group9－

ID	Contents
64	Digital monitor extended output selection [DMONSEL] ■ Outputs the signal with set condition to digital monitor. ◆ Selection below are available if 84, 85 are set to selection of digital monitor output selection.

Selection	Selection	Selection	Selection	Selection
00:FOUT	10:M_FIN	20:IN(128)	30:CRDY	40:ZOUT_8
01:S-ON	11:BATCLR	21:NCRDY	31:MOUT_0	41:CSET
02:RUN	12:EXE-E	22:HBON	32:MOUT_1	
03:ZRT	13:BRK_FREE	23:ERR	33:MOUT_2	
04:+JOG	14:HOME	24:EXT	34:MOUT_3	
05:-JOG	15:SDN	25:MOVE		
06:RAP	16:+OT	26:PFIN		
07:ARST	17:-OT	27:INPS		
08:CACL	18:E_STR	28:WAR/ZFIN	38:MSTR	
09:OVRD_0	19:IN(1)	29:ALM	39:ZOUT_1	
0A:OVRD_1	1A:IN(2)	2A:A_RDY	3A:ZOUT_2	
0B:OVRD_2	1B:IN(4)	2B:SVRDY	3B:ZOUT_3	
0C:OVRD_3	1C:IN(8)	2C:SVACT	3C:ZOUT_4	
0D:+1STEP	1D:IN(16)	2D:IN_STOP	3D:ZOUT_5	
0E:-1STEP	1E:IN(32)	2E:IN_FEED	3E:ZOUT_6	
0F:IRUN	1F:IN(64)	2F:T_LIM_FLG	3F:ZOUT_7	

* Nothing select if 00:FOUT is set.
For interface type [F: MODBUS], the control signal through MODBUS communication is output target.
The signal (for CN2 wiring) assigned by each function effective condition in Group9 is excepted from output target.
For interface type [C: I/O], the signal connected by CN1 wiring is output target.

－Group9－

ID	Contents
65 66	Positive manual feeding signal function [F-JOG] Negative manual feeding signal function [R-JOG] ■ This is supporting function performs manual positive move by receiving Positive manual feeding signal. ■ This is supporting function performs manual negative move by receiving Negative manual feeding signal. ◆ Assigns the condition of enabling Positive manual feeding signal. ◆ Assigns the condition of enabling Negative manual feeding signal. ◆ Do not enabling Positive/Negative function simultaneous. ◆ It operates with the value of Manual low speed (L_jog) in Group9 ID28. To use this supporting function, do not change except zero the value of JOG speed at register address 0x1000 through MODBUS communication. If set except zero, the value set via MODBUS communication has priority and the value of Manual low speed (L_jog) in Group9 ID28 will be not used. * It can assign to CONT1 to CONT7 with interface type [F: MODBUS] only.

■ GroupB "Sequence/Alarm related settings"

ID	Contents			
00	Servo-OFF stop behavior [DBOPE]	Setting range	Unit	Default value
		00 to 07	-	04:SB_Free

■ Sets the stop behavior when state changed to servo OFF from servo ON, and the dynamic brake operation during servo OFF.

Selection		Contents
00	Free_Free	Free run works, at servo OFF. Motor gets free state, after motor stop.
01	Free_DB	Free run works, at servo OFF. Dynamic brake works, after motor stop.
02	DB_Free	Dynamic brake works, at servo OFF. Motor gets free state, after motor stop.
03	DB_DB	Dynamic brake works, at servo OFF. Dynamic brake works, after motor stop.
04	SB_Free	Servo brake works, at servo OFF. Motor gets free state, after motor stop.
05	SB_DB	Servo brake works, at servo OFF. Dynamic brake works, after motor stop.
06	Dec_Free	Stop after deceleration, at servo OFF. Motor gets free state, after motor stop.
07	Dec_DB	Stop after deceleration, at servo OFF. Dynamic brake works, after motor stop.

◆ Set the deceleration time constant of decelerate stop, into GroupB ID15.

* Motor stops by the action which set in GroupB ID02 "Emergency Stop Operation" if Main circuit power is shut down, and dynamic brake will work after stop. However if "Main Circuit Under-voltage" or "BONBGN passing" are detected during stopping, motor stops by dynamic brake operation.

－GroupB－

ID	Contents			
01	Over-Travel Action [ACTOT]	Setting range	Unit	Default value
		00 to 08	-	00:CMDINH_SB_SON

■ Selects operations at over-travel (OT) action.

Selection		Contents
00	CMDINH_SB_SON	Command input is disabled, and motor is stopped by servo-braking (with peak torque) when OT occurs. Servo is turned on after motor stops. (Command from either positive or negative direction in which OT occurs, command disabled = velocity limit command = 0) (Torque command for OT side is limited by the sequence torque limit.)
01	CMDINH_DB_SON	Command input is disabled, and motor is stopped by dynamic-braking when OT occurs. Servo is turned on after motor stops. (Command from either positive or negative direction in which OT occurs, command disabled = velocity limit command = 0)
02	CMDINH_Free_SON	Command input is disabled, and motor is free-running when OT occurs. Servo is turned on after motor stops. (Command from either positive or negative direction in which OT occurs, command disabled = velocity limit command = 0)
03	CMDINH_SB_SOFF	Command input is disabled, and motor is stopped by servo-braking when OT occurs. Servo is turned off after motor stops. (Torque command for both side is limited by the sequence torque limit.)
04	CMDINH_DB_SOFF	Command input is disabled, and motor is stopped by dynamic-braking when OT occurs. Servo is turned off after motor stops.
05	CMDINH_Free_SOFF	Command input is disabled, and motor is free-running when OT occurs. Servo is turned off after motor stops.
06	CMDACK_VCLM=0	Velocity limit command for the direction on which OT occured becomes zero when OT occurs.
08	CMDINH_SB_SON2	Command input is disabled, and motor is stopped by servo-brake operation (with sequence torque limit) when OT occurs. Servo is turned on after motor stops. (Command from either positive or negative direction in which OT occurs, command disabled = velocity limit command = 0) (Torque command for both side is limited by the sequence torque limit.)

◆ For a positioning function built-in servo amplifier, it detects alarm when occurring overtravel. So, it becomes dynamic brake stop operation regardless of overtravel operation set value.

ID	Contents			
02	Emergency Stop Operation [ACTEMR]	Setting range	Unit	Default value
		00 to 02	-	00:SERVO-BRAKE

■ Sets operation at Emergency Stop

◆ Selects operation at the time of emergency stop.
In case of vertical axis use, please use it with default setting (00: SERVO-BRAKE).

Selection		Contents
00	SERVO-BRAKE	Stops servo motor by operating servo brake at Emergency stop.
01	DYNAMIC-BRAKE	Stops servo motor by operating dynamic brake at Emergency stop.
02	DEC-STOP	Stops servo motor after deceleration at Emergency stop.

◆ Under Torque control mode, dynamic brake stops servo motor regardless of the setting value.

◆ If the alarm that has DB in "Detection operations" at 8.2.2 Alarm list occurs, and no Safe Torque Off function (servo amplifier model number option 2 is 0), stops servo motor by dynamic brake regardless of this setting.

◆ Sets the deceleration time constant of deceleration stop at GroupB ID16.

* Forced stop operation means “emergency stop function enabled”, “main circuit power shutoff“, ”alarm activated” and “safe-torque-off operation”.

ID				
03	Delay Time of Engaging Holding Brake (Holding Brake Holding Delay time) [BONDLY]	Setting range	Unit	Default value
		0 to 1000	ms	300

■ Sets the holding-brake-activation delay time from when power distribution to holding brake stopped till when holding torque generated.

◆ While shifting from servo ON to servo OFF, during the setting time, Excitation command 0 is given to servo motor. (Even when servo is turned OFF, power is supplied to the motor until the setting time is over).
By this, until Holding brake functions, servo motor generates Holding torque.

◆ Setting unit is 4ms. When the setting value is 0ms, after servo OFF, command is invalid (command 0) for approximately 4ms.

◆ At the setting, GroupB ID00 [DBOPR] Servo-OFF stop behavior, when servo brake is ON at servo OFF, (04 SB_Free or 05 SB_DB), this is valid.
(This function is invalid in Dynamic brake operation and Free-run operation.)

ID				
04	Delay Time of Releasing Holding Brake (Holding Brake Releasing Delay time) [BOFFDLY]	Setting range	Unit	Default value
		0 to 1000	ms	300

■ Sets the holding-brake-release delay time from when power distribution to holding brake started till when holding torque disappeared.

◆ While shifting from servo OFF to servo ON, during the setting time, Excitation command 0 is given to servo motor. (Even when servo is turned ON, command is not accepted until the setting time is complete.)
Therefore, until Holding brake is released, servo motor does not operate.

◆ Setting unit is 4ms. When the setting value is 0ms, after servo ON, command is invalid (command 0) for approximately 4ms.

ID				
05	Brake Operation Beginning Time [BONBGN]	Setting range	Unit	Default value
		0 to 65535	ms	10000

■ Sets permissible time from servo OFF until servo motor stop.

◆ While shifting servo ON to servo OFF, even after the selected time passed and the servo motor does not stop. Servo motor is forced to stop with Holding brake and Dynamic brake.

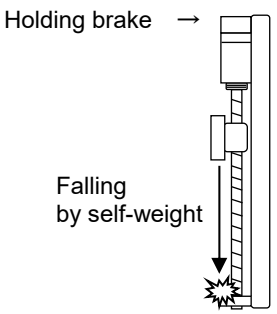
◆ When the servo motor stops this setting does not function.

◆ When servo motor does not stop after servo OFF at gravity axis, set this parameter.

◆ When forced to stop by holding brake, the Holding brake may possibly be broken.
Be cautious about device specifications and sequence when using this function.

■ About Holding Brake

Servo motor with Holding brake function is usually used with an axis that is always affected by gravity and external forces in order to avoid movable parts falling off from its position when main circuit power is OFF, or servo OFF. Holding brake is to support the movable parts against gravity and other external force when at rest.
Do not use it to stop a moving machine.



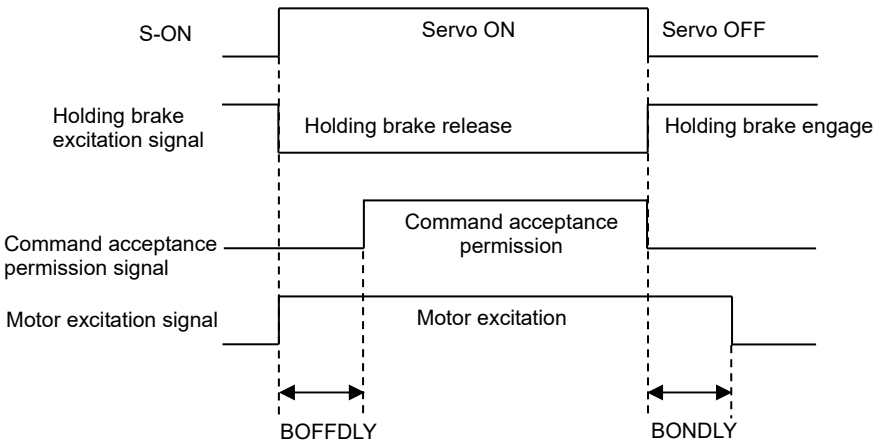
◆ For interface type [F: MODBUS], Holding brake excitation signal output setting

Group	ID	Symbol	Contents
9	50	OUT1	General Output 1
9	51	OUT2	General Output 2

Selection		Contents
0A	MBR-ON_ON	While Holding brake excitation signal output, output ON.
0B	MBR-ON_OFF	While Holding brake excitation signal output, output OFF.

◆ For interface type [C: I/O], Holding brake excitation timing output

CN1	Symbol	Signal name	Contents
4	HBON	Holding brake excitation timing output	While Holding brake excitation signal output, output ON.



<table>
<tr><th>ID</th><th>Contents</th></tr>
<tr><td>06</td><td>
Power Failure Detection Delay Time [PFDDLY] “Power cycle for control after setting”
Setting range: 20 to 1000 | Unit: ms | Default value: 32
■ Sets the delay time from Control power OFF to Control power error detection.
The larger value makes the detection of Instantaneous stop slower.
(Control power holding time:
200V ac input type: about 100 ms
100V ac input type: about 80 ms
Larger set value will only result in slower detections of errors. In case of power failure of Internal logic circuit, operation is same as when Control power is turned ON again. In case of energy shortage of Main circuit power, other errors such as Main circuit power loss may be detected.)
In this setting, actual detection delay time varies by -12ms to +6ms.
</td></tr>
<tr><td>07</td><td>
Initial timeout wait time [INTTIM] “Power cycle for control after setting”
Setting range: 00 to 07 | Unit: - | Default value: 00:Disabled
■ Selects the time till initialization completion.
<table>
<tr><th colspan="2">Selection</th><th>Contents</th></tr>
<tr><td>00</td><td>Disabled</td><td>Without wait time</td></tr>
<tr><td>01</td><td>1000 ms</td><td>Insert 1000 ms wait</td></tr>
<tr><td>02</td><td>1400 ms</td><td>Insert 1400 ms wait</td></tr>
<tr><td>03</td><td>1800 ms</td><td>Insert 1800 ms wait</td></tr>
<tr><td>04</td><td>2000 ms</td><td>Insert 2000 ms wait</td></tr>
<tr><td>05</td><td>3000 ms</td><td>Insert 3000 ms wait</td></tr>
<tr><td>06</td><td>5000 ms</td><td>Insert 5000 ms wait</td></tr>
<tr><td>07</td><td>10000 ms</td><td>Insert 10000 ms wait</td></tr>
</table>
</td></tr>
<tr><td>10</td><td>
Excessive Deviation Warning Level [OFWLV]
Setting range: 1 to 2147483647 | Unit: Pulse | Default value: 2147483647
■ Sets Warning output level before Excessive position deviation alarm is output.
◆ Sets at Encoder pulse resolution regardless of Electronic gear.
* It will be limited to 1073741823 [Pulse] if the value is set exceeding 1073741823[Pulse].
</td></tr>
<tr><td>12</td><td>
Overload Warning Level [OLWLV] “Power cycle for control after setting”
Setting range: 20 to 100 | Unit: % | Default value: 90
■ Sets the Warning output level before Overload alarm output.
◆ The possible level to be set is from 20%-99%, assuming that the Overload Warning Level is 100%. When set to 100%, Overload warning and Overload alarm are output at one time.
◆ Overload detection is assumed and set as 75%, of a rated load when Control power is turned ON (hot start). Therefore, Overload warning may be output when Control power is turned ON.
</td></tr>
<tr><td>13</td><td>
Velocity Feedback Alarm (ALM_C3) Detection [VFBALM]
Setting range: 00 to 01 | Unit: - | Default value: 01:Enabled
■ Selects Valid/Invalid Velocity feedback error detection.
<table>
<tr><th colspan="2">Selection</th><th>Contents</th></tr>
<tr><td>00</td><td>Disabled</td><td>Invalid</td></tr>
<tr><td>01</td><td>Enabled</td><td>Valid</td></tr>
</table>
</td></tr>
</table>

－GroupB－

<table>
<tr><th>ID</th><th>Contents</th></tr>
<tr><td>14</td><td>
<table>
<tr><td>Velocity Control Alarm (ALM_C2) Detection [VCALM]</td><td>Setting range</td><td>Unit</td><td>Default value</td></tr>
<tr><td></td><td>00 to 01</td><td>-</td><td>00:Disabled</td></tr>
</table>
■ Selects Valid/Invalid Velocity control error detection.
<table>
<tr><th colspan="2">Selection</th><th>Contents</th></tr>
<tr><td>00</td><td>Disabled</td><td>Invalid</td></tr>
<tr><td>01</td><td>Enabled</td><td>Valid</td></tr>
</table>
In such an operation pattern as causing a servo motor overshoot to the command, Velocity control error may be detected by mistake. For this, set this parameter to invalid.
</td></tr>
<tr><td>15</td><td>
<table>
<tr><td>Deceleration Time Constant at Servo off Stopping [SOFDEC]</td><td>Setting range</td><td>Unit</td><td>Default value</td></tr>
<tr><td></td><td>0 to 16000</td><td>ms</td><td>0</td></tr>
</table>
■ This is the parameter which sets the deceleration time constant in case of servo OFF during servo motor rotation.
Sets deceleration time per 1000 min^{-1}.
Will be valid when 06 or 07 is set to GroupB ID00.
</td></tr>
<tr><td>16</td><td>
<table>
<tr><td>Deceleration Time Constant at Emergency Stopping [EMRDEC]</td><td>Setting range</td><td>Unit</td><td>Default value</td></tr>
<tr><td></td><td>0 to 16000</td><td>ms</td><td>0</td></tr>
</table>
■ This is the parameter which sets the deceleration time constant in case of Emergency stop (Status of "emergency stop function enabled", "main circuit power shutoff", "alarm activated" and "safe-torque-off operation") during servo motor rotation.
Sets deceleration time per 1000 min^{-1}.
Will be valid when 02 is set to GroupB ID02.

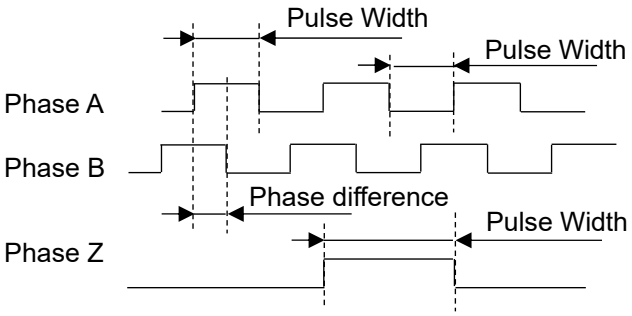
◆ Operation will shift to dynamic brake stop sequence when main circuit power falls lower or safe torque-off time has passed during deceleration stop.
</td></tr>
<tr><td>17</td><td>
<table>
<tr><td>External command effectivity selection at holding brake operation cancellation delay time [SONFALL]</td><td>Setting range</td><td>Unit</td><td>Default value</td></tr>
<tr><td></td><td>00 to 01</td><td>-</td><td>00:Disabled</td></tr>
</table>
■ Selects valid/invalid of external position/velocity command during the holding-brake-release delay time.
Self weight fall can suppress at servo ON by setting of position/velocity command that corresponded to gravity load or external load.
<table>
<tr><th colspan="2">Selection</th><th>Contents</th></tr>
<tr><td>00</td><td>Disabled</td><td>Invalid</td></tr>
<tr><td>01</td><td>Enabled</td><td>Valid</td></tr>
</table>
◆ As notes, when the command that exceeds gravity load or external load is given, servo motor will rotate and it may cause of holding-brake failure.
</td></tr>
<tr><td>18</td><td>
<table>
<tr><td>External command effectivity selection at holding brake operation delay time [SOFFFALL]</td><td>Setting range</td><td>Unit</td><td>Default value</td></tr>
<tr><td></td><td>00 to 01</td><td>-</td><td>00:Disabled</td></tr>
</table>
■ Selects valid/invalid of external position/velocity command during the holding-brake-activation delay time.
Self weight fall can suppress at servo OFF by setting of position/velocity command that corresponded to gravity load or external load.
<table>
<tr><th colspan="2">Selection</th><th>Contents</th></tr>
<tr><td>00</td><td>Disabled</td><td>Invalid</td></tr>
<tr><td>01</td><td>Enabled</td><td>Valid</td></tr>
</table>
◆ As notes, when the command that exceeds gravity load or external load is given, servo motor will rotate and it may cause of holding-brake failure.
</td></tr>
</table>

■ GroupC "Encoder related settings"

ID	Contents			
00	Motor Incremental Encoder Digital Filter [ENFIL]	Setting range	Unit	Default value
		00 to 07	-	01:220ns

■ This parameter is settable only when using incremental encoder.
Sets Digital filter to motor Incremental Encoder.
Pulse lower than the set value is eliminated as noise when noise superposition occurs in encoder signals. Consider Encoder resolution and Maximum rotation velocity of the servo motor in operation when selecting value. Set the value roughly less than 1/4 of the Encoder pulse width at Maximum rotation velocity.

Selection		Contents
00	110 ns	Minimum Pulse Width =110 ns (Minimum pulse Phase Difference = 37.5 ns)
01	220 ns	Minimum Pulse Width = 220 ns
02	440 ns	Minimum Pulse Width = 440 ns
03	880 ns	Minimum Pulse Width = 880 ns
04	75 ns	Minimum Pulse Width = 75 ns (Minimum pulse Phase Difference = 37.5 ns)
05	150 ns	Minimum Pulse Width = 150 ns
06	300 ns	Minimum Pulse Width = 300 ns
07	600 ns	Minimum Pulse Width = 600 ns



ID	Contents			
01	External Incremental Encoder Digital Filter [EX-ENFIL]	Setting range	Unit	Default value
		00 to 07	-	01:220ns

■ This parameter is settable only when using fully closed control function.
Sets Digital filter to External Incremental Encoder.
Pulse lower than the set value is eliminated as noise when noise superposition occurred in encoder signals. Consider Encoder resolution and Maximum rotation velocity of the servo motor in operation when selecting value. Set the value roughly less than 1/4 of the Encoder pulse width at Maximum rotation velocity.

Selection		Contents
00	110 ns	Minimum Pulse Width =110 ns (Minimum pulse Phase Difference = 37.5nsec)
01	220 ns	Minimum Pulse Width = 220 ns
02	440 ns	Minimum Pulse Width = 440 ns
03	880 ns	Minimum Pulse Width = 880 ns
04	75 ns	Minimum Pulse Width = 75 ns (Minimum pulse Phase Difference = 37.5nsec)
05	150 ns	Minimum Pulse Width = 150 ns
06	300 ns	Minimum Pulse Width = 300 ns
07	600 ns	Minimum Pulse Width = 600 ns

－GroupC－

ID	Contents			
02	External Encoder Polarity Selection [EX-ENPOL] “Power cycle for control after setting”	Setting range 00 to 07	Unit -	Default value 00:Type1

■ This parameter is settable only when using fully closed control function.

◆ Select External encoder signal polarity.

Selection		Contents		
00	Type1	EX-Z/Not Reversed	EX-B/ Not Reversed	EX-A/ Not Reversed
01	Type2	EX-Z/Not Reversed	EX-B/ Not Reversed	EX-A/ Reversed
02	Type3	EX-Z/Not Reversed	EX-B/ Reversed	EX-A/ Not Reversed
03	Type4	EX-Z/Not Reversed	EX-B/ Reversed	EX-A/ Reversed
04	Type5	EX-Z/Reversed	EX-B/ Not Reversed	EX-A/ Not Reversed
05	Type6	EX-Z/Reversed	EX-B/ Not Reversed	EX-A/ Reversed
06	Type7	EX-Z/Reversed	EX-B/ Reversed	EX-A/ Not Reversed
07	Type8	EX-Z/Reversed	EX-B/ Reversed	EX-A/ Reversed

ID	Contents			
08	Encoder Clear Function Selection [ECLRFUNC]	Setting range 00 to 01	Unit -	Default value 00:Status_MultiTurn

■ This parameter is settable only when using absolute encoder.

◆ This is effective when using battery backup absolute encoder (Encoder code: P) and battery-less absolute encoder (Encoder code: R, W).

◆ When using single-turn absolute encoder (Encoder code: H) for incremental system, “clear only encoder status” is set even if “00: Status_MultiTurn” is selected.

◆ For the case an absolute encoder with multi-turn is used, clearing the encoder cannot clear the single turn part of the absolute encoder

Selection		Contents
00	Status_MultiTurn	Clear Encoder Status (Alarm and Warning) and Multi Turn Data
01	Status	Clear Only Encoder Status (Alarm and Warning)

<table>
<tr><th>ID</th><th>Contents</th></tr>
<tr><td>0B</td><td>
External absolute encoder polarity selection [EX-SENPOL] “Power cycle for control after setting”
Setting range: 00 to 01 | Unit: - | Default value: 00:Standard
■ Selects the count polarity of external encoder against motor rotation direction.
◆ Select the polarity to match between the increment/decrement of monitor of ID61/62 (EX-APMON) and the ID10/11 (APMON).
It becomes valid after control power cycle.
◆ It is valid when an absolute encoder is used as external encoder.
<table>
<tr><th colspan="2">Selection</th><th>Contents</th></tr>
<tr><td>00</td><td>Standard</td><td>Inverts not an encoder operation direction.</td></tr>
<tr><td>01</td><td>Reversed</td><td>Inverts an encoder operation direction.</td></tr>
</table>
</td></tr>
<tr><td>10</td><td>
Broken wire mask level at Encoder connector 1 [DE1MSKLVL]
Setting range: 0 to 65535 | Unit: kHz | Default value: 0
■ Sets the encoder pulse frequency (1-multiplied) which masks the detection of "Encoder Connector Disconnection 1 (AL.81)" if the motor encoder is incremental encoder and connect to encoder connector 1 (EN1).
◆ For high resolution incremental encoder, "Encoder Connector Disconnection 1 (AL.81)" might detect at high frequency range depending on its specs. In that case, please change this setting value.
◆ "Encoder Connector Disconnection 1 (AL.81)" does not detect while encoder frequency exceeds this setting value.
◆ "Encoder Connector Disconnection 1 (AL.81)" is detected at all frequency if 0 [kHz] is set.
</td></tr>
<tr><td>11</td><td>
Broken wire mask level at Encoder connector 2 [DE3MSKLVL]
Setting range: 0 to 65535 | Unit: kHz | Default value: 0
■ Sets the encoder pulse frequency (1-multiplied) which masks the detection of "Encoder Connector Disconnection 2 (AL.83)" if the encoder is incremental encoder or external encoder and connect to encoder connector 2 (EN2).
◆ For high resolution incremental encoder, "Encoder Connector Disconnection 2 (AL.83)" might detected at high frequency range depending on its specs. In that case, please change this setting value.
◆ "Encoder Connector Disconnection 2 (AL.83)" does not detect while encoder frequency exceeds this setting value.
◆ "Encoder Connector Disconnection 2 (AL.83)" is detected at all frequency if 0 [kHz] is set.
</td></tr>
</table>

■ GroupD "Supporting function related settings"

<table>
<tr><th>ID</th><th>Contents</th></tr>
<tr><td>00</td><td>
JOG velocity command [JOGVC]
<table>
<tr><th>Setting range</th><th>Unit</th><th>Default value</th></tr>
<tr><td>0 to 32767</td><td>min^{-1}</td><td>50</td></tr>
</table>
■ Sets the velocity command value for JOG operation.
◆ This value will be initial setting value of JOG velocity command in the Setup software.
</td></tr>
<tr><td>02</td><td>
Support function torque limit [TSTTCLM]
<table>
<tr><th>Setting range</th><th>Unit</th><th>Default value</th></tr>
<tr><td>10.0 to 500.0</td><td>%</td><td>120.0</td></tr>
</table>
■ Sets the limit value of torque command at the support function (JOG, positioning and homing) operation.
◆ This value will be initial setting value of torque command limit for the support function operation in the Setup software.
</td></tr>
<tr><td>10</td><td>
Serial Communication Axis Number [COMAXIS] “Power cycle for control after setting”
<table>
<tr><th>Setting range</th><th>Unit</th><th>Default value</th></tr>
<tr><td>01 to 0F</td><td>-</td><td>01:#1</td></tr>
</table>
■ Selects axis number when communicating with the setup software.
◆ Please set different number for each axis when multi axes are connecting at once because the setup software identifies servo amplifiers by this number.
<table>
<tr><th colspan="2">Selection</th><th colspan="2">Selection</th><th colspan="2">Selection</th><th colspan="2">Selection</th><th colspan="2">Selection</th></tr>
<tr><td>01</td><td>#1</td><td>04</td><td>#4</td><td>07</td><td>#7</td><td>0A</td><td>#A</td><td>0D</td><td>#D</td></tr>
<tr><td>02</td><td>#2</td><td>05</td><td>#5</td><td>08</td><td>#8</td><td>0B</td><td>#B</td><td>0E</td><td>#E</td></tr>
<tr><td>03</td><td>#3</td><td>06</td><td>#6</td><td>09</td><td>#9</td><td>0C</td><td>#C</td><td>0F</td><td>#F</td></tr>
</table>
</td></tr>
<tr><td>11</td><td>
Monitor Display Selection [MONDISP]
<table>
<tr><th>Setting range</th><th>Unit</th><th>Default value</th></tr>
<tr><td>00 to 77</td><td>-</td><td>00:STATUS</td></tr>
</table>
■ Selects the contents of status display of the digital operator.
<table>
<tr><th colspan="2">Selection</th><th>Contents</th></tr>
<tr><td>00</td><td>STATUS</td><td>Shows the status of servo amplifier.
See "5.3 Servo amplifier status display" for details.</td></tr>
<tr><td>01
to
77</td><td>WARNING1
to
HBLF</td><td>Selects the monitor data showing at monitor function.
See "5.5 Monitor function" for details.</td></tr>
</table>
</td></tr>
</table>

<table>
<tr><th>ID</th><th>Contents</th></tr>
<tr><td>20</td><td>
Drec. sampling rate [SAMPDIV]
Setting range: 0 to 65535 | Unit: - | Default value: 20
■ Sets the sampling rate of the Drive recorder.
◆ Minimum sampling rate (Ts) is fixed to 112 μs.
◆ Sampling timing (T) is shown by T=Ts*n, and this parameter sets "n".
◆ Drive recorder will stop if 0 is set.
</td></tr>
<tr><td>21</td><td>
Drec. sampling mode [SAMPNUM]
Setting range: 00 to 02 | Unit: - | Default value: 00:256 point
■ Selects total data points per channel that will record by the Drive recorder.
◆ Recordable channel numbers will limit if larger data point is selected.
<table>
<tr><th colspan="2">Selection</th><th>Maximum recordable channel at once</th></tr>
<tr><td>00</td><td>256 point</td><td>6 channels</td></tr>
<tr><td>01</td><td>512 point</td><td>3 channels</td></tr>
<tr><td>02</td><td>1024 point</td><td>1 channel</td></tr>
</table>
</td></tr>
<tr><td>22</td><td>
Drec. Trigger Channel [TRGCHSEL]
Setting range: 00 to 83 | Unit: - | Default value: 83:DIGITAL_4
■ Selects the channel for trigger on the Drive recorder.
◆ Digital ch. and analog ch. can set.
<table>
<tr><th colspan="2">Selection</th><th>Setting value</th><th colspan="2">Selection</th><th>Setting value</th></tr>
<tr><td>00</td><td>ANALOG_1</td><td>Analog CH1</td><td>05</td><td>ANALOG_6</td><td>Analog CH6</td></tr>
<tr><td>01</td><td>ANALOG_2</td><td>Analog CH2</td><td>80</td><td>DIGITAL_1</td><td>Digital CH1</td></tr>
<tr><td>02</td><td>ANALOG_3</td><td>Analog CH3</td><td>81</td><td>DIGITAL_2</td><td>Digital CH2</td></tr>
<tr><td>03</td><td>ANALOG_4</td><td>Analog CH4</td><td>82</td><td>DIGITAL_3</td><td>Digital CH3</td></tr>
<tr><td>04</td><td>ANALOG_5</td><td>Analog CH5</td><td>83</td><td>DIGITAL_4</td><td>Digital CH4</td></tr>
</table>
</td></tr>
<tr><td>23</td><td>
Drec. Trigger Slope [TRGEDGSEL]
Setting range: 00 to 02 | Unit: - | Default value: 00:POS_EDGE
■ Sets the trigger edge condition on the Drive recorder.
<table>
<tr><th colspan="2">Selection</th><th>Setting value</th></tr>
<tr><td>00</td><td>POS_EDGE</td><td>↑ edge</td></tr>
<tr><td>01</td><td>NEG_EDGE</td><td>↓ edge</td></tr>
<tr><td>02</td><td>BOTH_EDGE</td><td>↑ edge or ↓ edge</td></tr>
</table>
</td></tr>
<tr><td>24</td><td>
Drec. Trigger Horizontal Position [TRGHPOS]
Setting range: 0 to 100 | Unit: % | Default value: 80
■ Sets the horizontal position of trigger on the Drive recorder.
◆ Set the rate of the total sampling time and the trigger position from sampling start by [0 -100%].
</td></tr>
<tr><td>25</td><td>
Drec. Trigger Level [TRGLVL]
Setting range: -9223372036854775808 to 9223372036854775807 | Unit: - | Default value: 1
■ Set the trigger level on the Drive recorder.
◆ Shows by hexadecimal (32 bit data) at ID25 and ID26 of the Digital operator.
<table>
<tr><th>ID</th><th>Data range</th><th>Display range</th></tr>
<tr><td>25</td><td>Bit63 to Bit32</td><td>H.8000 L.0000 to H.7FFF L.FFFF</td></tr>
<tr><td>26</td><td>Bit31 to Bit0</td><td>H.0000 L.0000 to H.FFFF L.FFFF</td></tr>
</table>
</td></tr>
</table>

－GroupD－

ID	Contents			
31	Drec. Analog CH1 selection [CH1SEL]	Setting range	Unit	Default value
		00 to 23, FF	-	08:PCMDF1
32	Drec. Analog CH2 selection [CH2SEL]	Setting range	Unit	Default value
		00 to 23, FF	-	01:VCMON
33	Drec. Analog CH3 selection [CH3SEL]	Setting range	Unit	Default value
		00 to 23, FF	-	03:TCMON
34	Drec. Analog CH4 selection [CH4SEL]	Setting range	Unit	Default value
		00 to 23, FF	-	15:VBUS
35	Drec. Analog CH5 selection [CH5SEL]	Setting range	Unit	Default value
		00 to 23, FF	-	05:POSITION
36	Drec. Analog CH6 selection [CH6SEL]	Setting range	Unit	Default value
		00 to 23, FF	-	00:VMON

■ Selects the data which is measured as Analog channel on the Drive recorder.

◆ The datas below will need 2 ch data capacity when it set.

- Present position monitor (Motor encoder/ External encoder)
- Command position monitor
- PS data monitor (Motor encoder/ External encoder)

* For example, ch.2 setting will invalid if encoder PS data is set to ch.1.
Above channels will be invalid if sampling point: 1024 is selected.

◆ Do not set FF because it is for Manufacturer only.

ID		Setting value	ID		Setting value
00	VMON	Velocity monitor	0F	JRAT	Load Inertia Moment Ratio monitor
01	VCMON	Velocity command monitor	10	MTL-EST	Load Torque monitor (Estimate value)
02	TMON	Torque monitor	11	SINEU	U-phase electric angle monitor
03	TCMON	Torque command monitor	12	DFERR	Dual position error monitor
04	PMON	Position deviation monitor	13	ACCMON	Acceleration monitor
05	POSITION	Present position monitor (Motor encoder)	14	ENTEMP	Encoder temperature monitor
06	POSITION-EXT	Present position monitor (External encoder)	15	VBUS	Main circuit bus voltage monitor
07	PCMDSUM	Command position integration value	16	OLRAT	Reaching rate of OL detection level of motor temperature rise estimation value
08	PCMDF1	Position command pulse frequency monitor 1	17	MAVEPOW1	Average power monitor
09	PCMDF2	Position command pulse frequency monitor 2	18	TCMON2	Torque command filter (before filter)
0A	PS_MOT	Absolute encoder PS data monitor (Motor encoder)	19	SYNERR	Axes-sync error monitor
0B	PS_EXT	Absolute encoder PS data monitor (External encoder)	21	RegPOW	Regenerative power monitor
0C	RegR	Regenerative resistor operation percentage monitor	22	MOTE-ERRAT	Error rate of motor encoder communication
0D	TRMS	Effective torque monitor	23	EXTE-ERRAT	Error rate of external encoder communication
0E	ETRMS	Effective torque monitor (Estimated value)	FF	RESERVE	Monitor mode, for manufacturer only

－GroupD－

ID	Contents			
37	Drec. Digital CH1 selection [DCH1SEL]	Setting range	Unit	Default value
		00 to 20, FF	-	16:SRDY
38	Drec. Digital CH2 selection [DCH2SEL]	Setting range	Unit	Default value
		00 to 20, FF	-	15:SACT
39	Drec. Digital CH3 selection [DCH3SEL]	Setting range	Unit	Default value
		00 to 20, FF	-	1B:WRG-OL
3A	Drec. Digital CH4 selection [DCH4SEL]	Setting range	Unit	Default value
		00 to 20, FF	-	1C:ALM

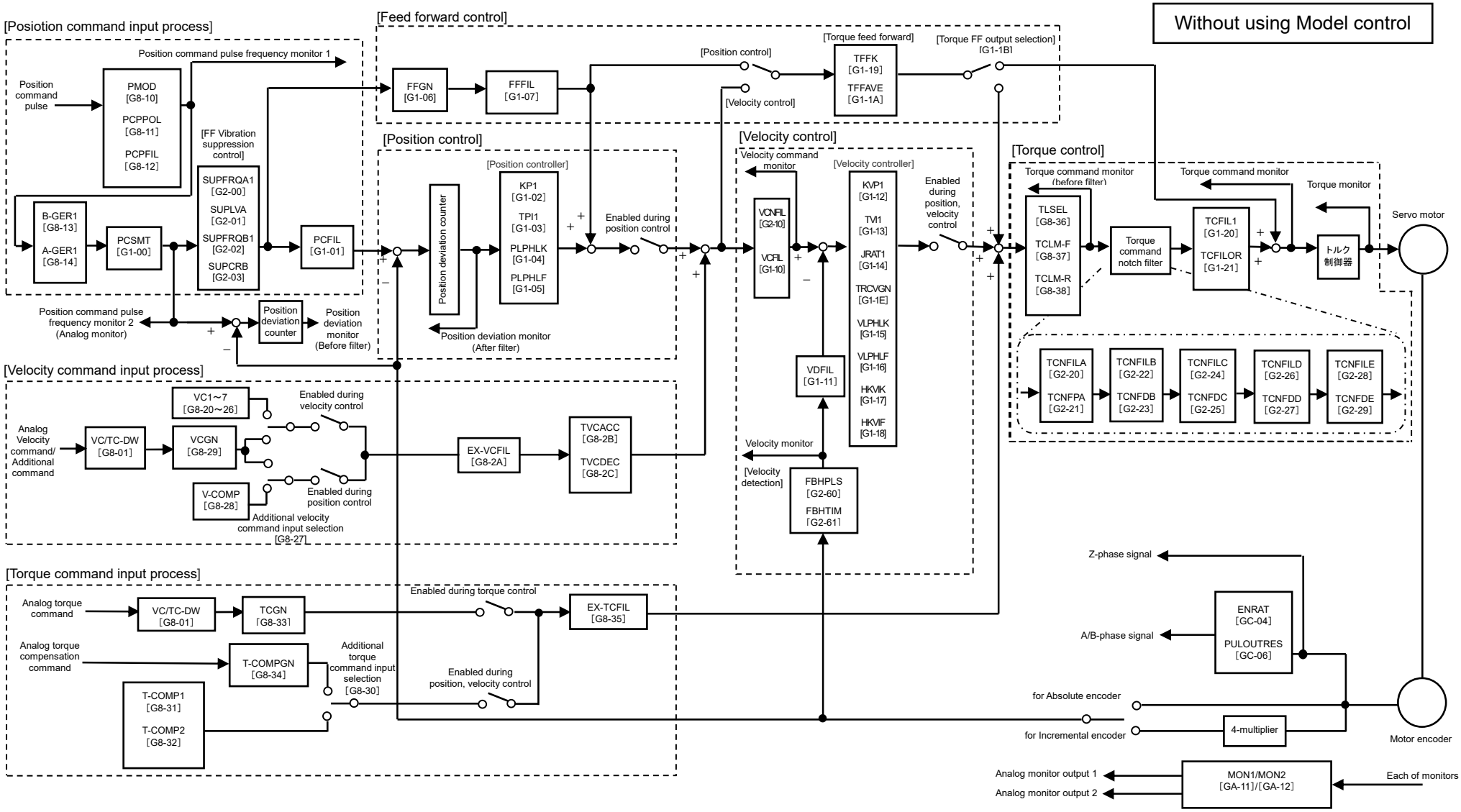
■ Selects the data which is measured as Digital channel on the Drive recorder.

◆ Do not set FF because it is for Manufacturer only.

ID		Setting value	ID		Setting value
00	GIN1	General input 1	10	INP	While In-Position Status
01	GIN2	General input 2	11	NEAR	While Near Range Status
02	GIN3	General input 3	12	VCMP	While Speed Matching Status
03	GIN4	General input 4	13	TLIM	While Torque Limiting
04	GIN5	General input 5	14	VLIM	While Velocity Limiting
05	GIN6	General input 6	15	SACT	While Motor Excitation
06	GIN7	General input 7	16	SRDY	While Servo Ready Status
07	GIN8	General input 8	17	CMD-ACK	While Command Acceptance Permission Status
08	GOUT1	General output 1	18	PCON-ACK	While Velocity Loop Proportional Control Switching Status
09	GOUT2	General output 2	19	GC-ACK	While Electronic Gear Switching Status
0A	GOUT3	General output 3	1A	WRG-OVF	While Excessive Deviation Warning Status
0B	GOUT4	General output 4	1B	WRG-OL	While Overload Warning Status
0C	GOUT5	General output 5	1C	ALM	While Alarm Status
0D	GOUT6	General output 6	1D	WRG-DF	While dual position error excess warning
0E	GOUT7	General output 7	1E	TRJCMP	While position command distribution completion status (Delay time included)
0F	GOUT8	General output 8	20	WRG-SY	While Axes-sync Error Excess Warning
			FF	RESERVE	Monitor mode, for manufacturer only

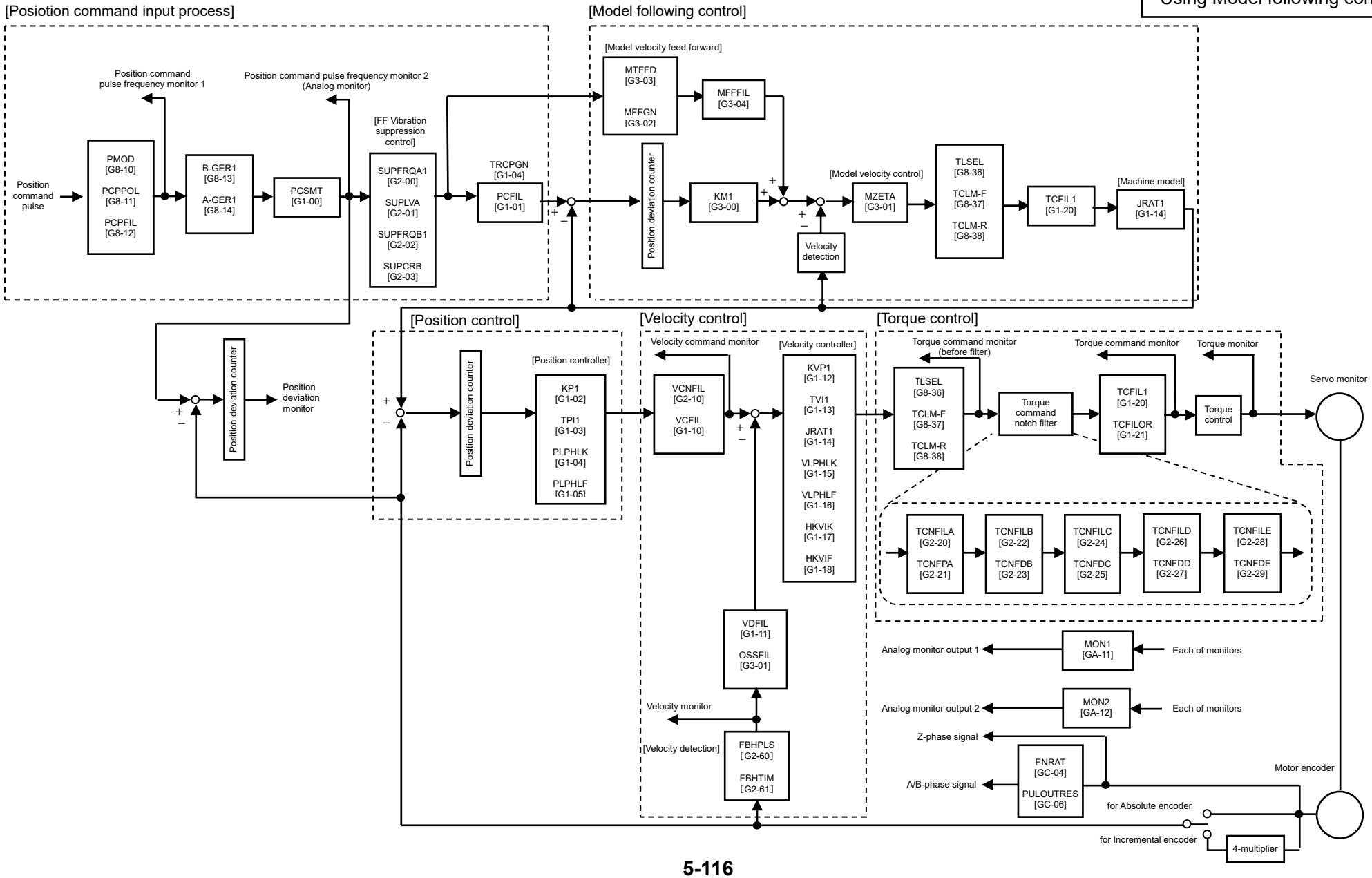
5. Operation

5.9 Control block diagram

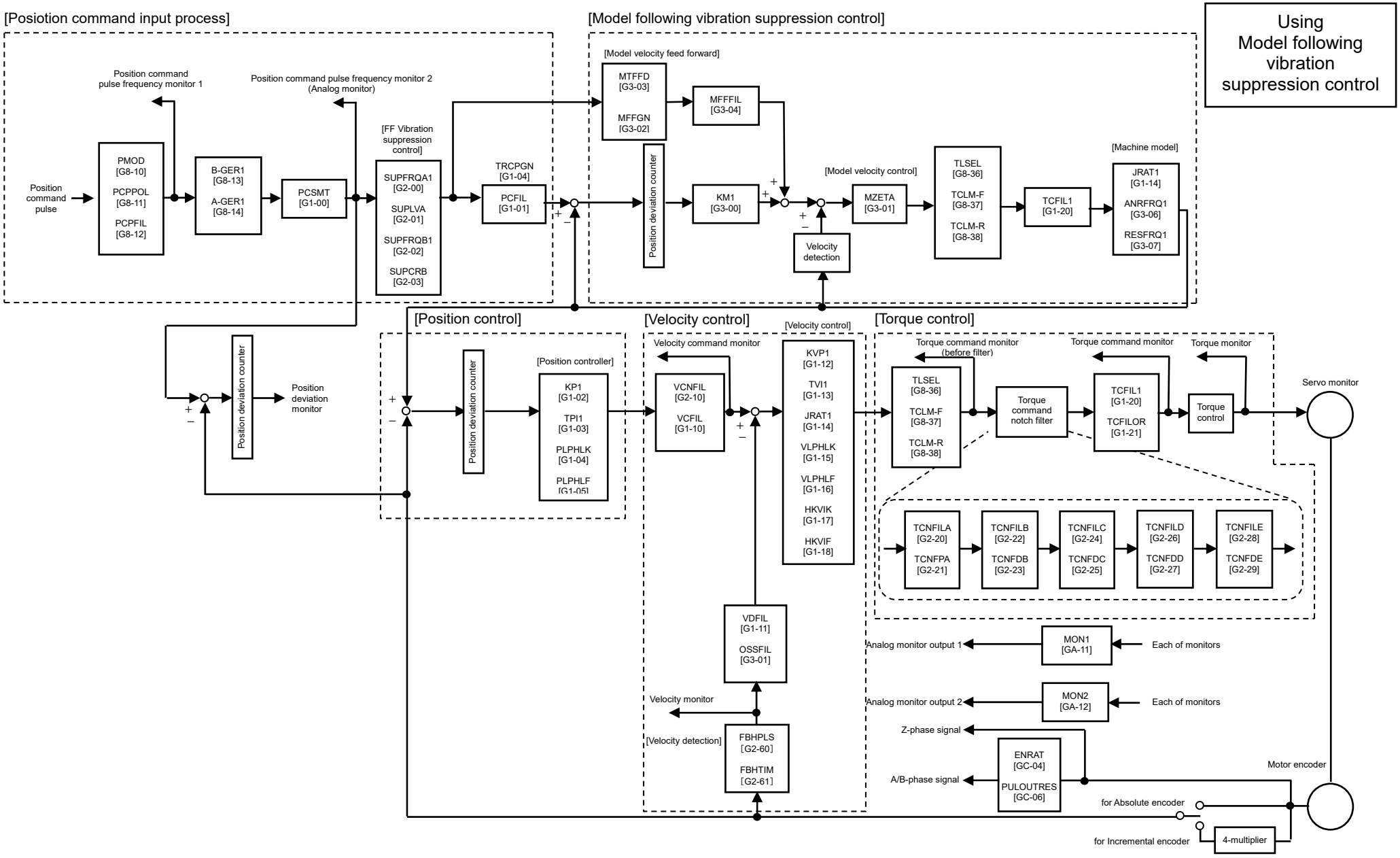


5.9 Control block diagram

Using Model following control



5. Operation


[Posiotion command input process]
[Model following vibration suppression control]
Using Model following vibration suppression control
Position command pulse frequency monitor 1
Position command pulse frequency monitor 2 (Analog monitor)
[FF Vibration suppression control]
[Model velocity feed forward]
Position command pulse
PMOD [G8-10]
PCPPOL [G8-11]
PCPFIL [G8-12]
B-GER1 [G8-13]
A-GER1 [G8-14]
PCSMT [G1-00]
SUPFRQA1 [G2-00]
SUPLVA [G2-01]
SUPFRQB1 [G2-02]
SUPCRB [G2-03]
TRCPGN [G1-04]
PCFIL [G1-01]
MTFFD [G3-03]
MFFGN [G3-02]
MFFFIL [G3-04]
Position deviation counter
KM1 [G3-00]
[Model velocity control]
Velocity detection
MZETA [G3-01]
TLSEL [G8-36]
TCLM-F [G8-37]
TCLM-R [G8-38]
TCFIL1 [G1-20]
[Machine model]
JRAT1 [G1-14]
ANRFRQ1 [G3-06]
RESFRQ1 [G3-07]
[Position control]
[Velocity control]
[Torque control]
Position deviation counter
Position deviation monitor
[Position controller]
KP1 [G1-02]
TPI1 [G1-03]
PLPHLK [G1-04]
PLPHLF [G1-05]
Velocity command monitor
VCNFIL [G2-10]
VCFIL [G1-10]
[Velocity control]
KVP1 [G1-12]
TVI1 [G1-13]
JRAT1 [G1-14]
VLPHLK [G1-15]
VLPHLF [G1-16]
HKVIK [G1-17]
HKVIF [G1-18]
Torque command monitor (before filter)
Torque command monitor
Torque monitor
TLSEL [G8-36]
TCLM-F [G8-37]
TCLM-R [G8-38]
Torque command notch filter
TCFIL1 [G1-20]
TCFILOR [G1-21]
Torque control
Servo monitor
TCNFILA [G2-20]
TCNFPA [G2-21]
TCNFILB [G2-22]
TCNFDB [G2-23]
TCNFILC [G2-24]
TCNFDC [G2-25]
TCNFILD [G2-26]
TCNFDD [G2-27]
TCNFILE [G2-28]
TCNFDE [G2-29]
VDFIL [G1-11]
OSSFIL [G3-01]
Velocity monitor
[Velocity detection]
FBHPLS [G2-60]
FBHTIM [G2-61]
Analog monitor output 1
MON1 [GA-11]
Each of monitors
Analog monitor output 2
MON2 [GA-12]
Each of monitors
Z-phase signal
A/B-phase signal
ENRAT [GC-04]
PULOUTRES [GC-06]
Motor encoder
for Absolute encoder
for Incremental encoder
4-multiplier

5.10 SEMI F47 supporting function

This function limits motor current when it detects voltage sag warning due to instantaneous power failure (when voltage dropped to 135 - 152VAC).
This function is provided to support acquiring “SEMI F47 Standard” that is requisite for semiconductor equipments.
Combined with Power Failure Detection Delay Time [GroupB ID16], it prevents motor stop with alarm when in instantaneous power failure and enables to continue operation.

5.10.1 Parameter setting

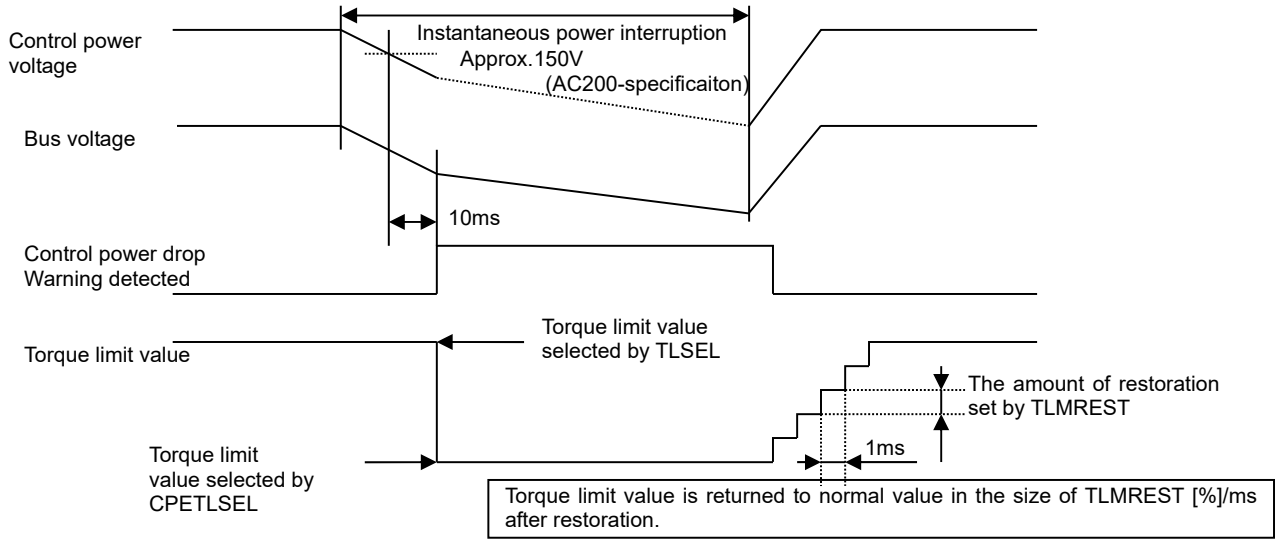
■ General parameters Group8 “Control system”

ID	Symbol	Name	Default value	Unit	Setting range
3A	CPETLSEL	Torque limit input selection during power drop	00	-	00 to 03
3D	TLMREST	The amounts of torque limit value restoration when power restored	0.0	%	0.0 to 500.0

* TLMREST works as 10% if 0.0% is set.

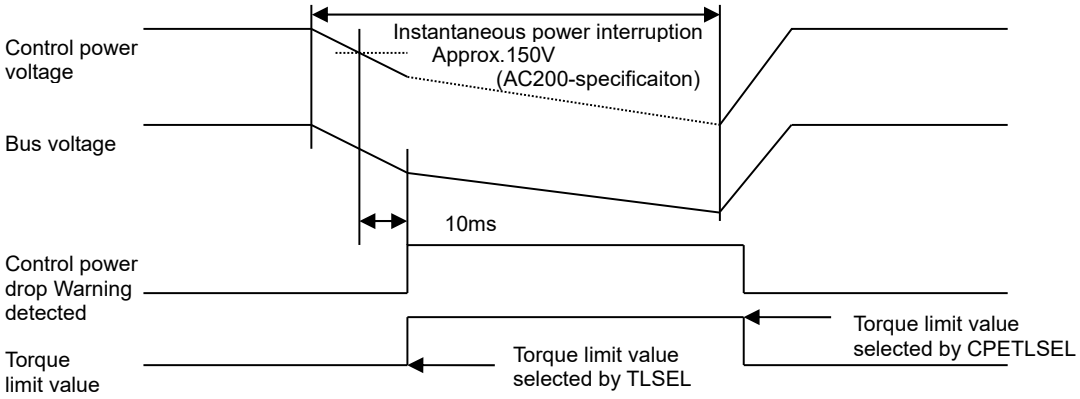
5.10.2 Operational sequence

This shows the operational sequence from detecting warning of low control power voltage to restoration of control power voltage.



5.10.3 Notes

Set torque limit value under voltage sag warning smaller than that of normal operation.
Even if the torque limit value of voltage sag is greater than that of normal operation, it limits the torque at the set value when in voltage sag. After power restoration, the limiting value goes back to that of normal operation.



5.11 Virtual motor operation function

This is the function which simulates servo motor behavior and servo amplifier status at internal of the servo amplifier. This function is able to check a sequence with output signal and check a wiring with upper controller, without actual motor operation. Thus, safer and faster start-up of a system is available by this function.
As note, servo motor and encoder connection is not necessary for this function use.

5.11.1 Setting

Sets the system parameter below for this function use.

<table>
<tr><th>ID</th><th>Contents</th></tr>
<tr><td>02</td><td>
Operation mode selection
■ Selects the operation mode.
<table>
<tr><th colspan="2">Selection</th><th>Contents</th></tr>
<tr><td>00</td><td>Normal</td><td>Normal operation mode</td></tr>
<tr><td>01</td><td>Virtual1</td><td>Virtual operation mode (virtual P_ON valid)</td></tr>
<tr><td>02</td><td>Virtual2</td><td>Virtual operation mode (virtual P_ON invalid)</td></tr>
</table>
* “Power cycle for control after setting”

■ Operation mode action

◆ 01：Virtual1 Virtual operation mode (virtual P_ON valid)
In this mode, servo motor operation can simulate by control power supply only.
Automatically change state to main power ON, after control power supplied.

◆ 02：Virtual2 Virtual operation mode (virtual P_ON invalid)
In this mode, servo motor operation can simulate after main circuit power supplied.
Main circuit power supply is necessary, after control power supplied.
</td></tr>
</table>

5.11.2 Restrictions

There are restrictions below for this function.

■ Load model for virtual motor operation is rigid body sysytem by load inertia moment.

Item	Conditions
Load torque	0 [N・m]
Load inertia moment	Load inertia moment ratio × Servo motor inertia moment
Mechanical stiffness	Rigid body

* Load inertia moment ratio is used from Group1 ID14.
The value set by the parameter below is used depending on gain switching condition if gain switching function is used.

Selection	Used Load inertia moment ratio		
	Group	ID	Name
1	1	14	Load inertia moment ratio 1
2	4	05	Load inertia moment ratio 2
3	4	15	Load inertia moment ratio 3
4	4	25	Load inertia moment ratio 4

■ Encoder position data does not backuped. Position data is zero when power is on.

■ Multi-turn part of encoder position data does not clear even if encoder clear function is executed.

■ Detection of alarm and warning for encoder does not work.

■ In use of incremental encoder, output pulse resolution will be 8192 [P/R] regardless of the encoder resolution setting.
Dividing is available for this resolution by the setting of GroupC ID04 Encoder Output Pulse Division.

■ U-phase electric angle monitor might show wrong value if incremental encoder is used.

■ Position, velocity and torque of servo motor is simulated to response of control system against virtual motor operation load model.

■ Action of servo motor and load model is stop at servo OFF. Free-run operation at servo OFF can not simulate.

■ When "01: Virtual" is set to Operation mode selection, main circuit power is supplied virtually, and regard as supplying rated power. As note, Alarm and regenerative operation for main power can not simulate.

■ Dynamic brake does not work. Stop operation by servo OFF or dynamic brake of emergency stop can not simulate. However, the signal of While Dynamic Braking is output from general purpose output.

■ When external encoder is absolute encoder (EnDat), it works as angle encoder (resolution 28bit).

5.11.3 Digital operator display

Digital operator display will change during virtual motor operation.

Display	Description
	Alphabet "t" shows at second LED from right, during virtual motor operation. The other LEDs show same as normal status display. In case except status display mode, also the same as normal.

5.11.4 Operating precautions

■ Holding-brake release signal outputs same as normal operation even if virtual motor operation is executed. At vertical axis use, avoid holding-brake release as follows: Cancel the allocation of holding-brake release signal for general output. Shut off the holding-brake power. etc.

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6

Supporting function and test operation

In this chapter, installation of servo amplifier and servo motor are explained.

6.1 Point data setting (Supporting function) 6-1

6.1.1 Point data 6-2

6.1.2 Test operation 6-2

6.1.3 Homing 6-2

6.1.4 Point move 6-2

6.1.5 Test operation/Homing/Point move 6-2

6.2 Test operation 6-3

6.2.1 Check of installation and wiring 6-3

6.2.2 Check of operation 6-3

6.2.3 I/O signal setting 6-4

6.2.4 Check of device operation 6-5

6. Supporting function and test operation

6.1 Point data setting (Supporting function)

For a positioning function built-in servo amplifier, there is supporting function for point data setting with SANMOTION MOTOR Setup software (abbreviated to "the setup software" hereinafter).

Refer the chapter 11 of instruction manual of the setup software M0010842 for supporting function for point data setting.

■ Supporting function for point data setting has switching of valid/invalid against external operation.
Do not operate by host device at the condition of external operation invalid.

Item	External operation mode output (EXT)	Operation by host device
Point data	Valid (EXT=ON)	Operation enabled
Test operation	Invalid (EXT=OFF)	Operation disabled
Homing	Invalid (EXT=OFF)	Operation disabled
Point move	Invalid (EXT=OFF)	Operation disabled
At window change with tab-click	Invalid (EXT=OFF→ON→ OFF)	Operation disabled
After closing point data setting window	Valid (EXT=ON)	Operation enabled

* At window change or window switching with tab-click, outputs a signal of external operation valid, a moment.

■ Input signals below are available even if the condition of external operation invalid.

For interface type [F: MODBUS], input below assigned to CONT1 to CONT7 with each function valid condition in Group9 becomes operation enabled.

CN2 (CONT1 to CONT7)	Name	Operation by host device
F-OT	Positive overtravel function	Operation enabled
R-OT	Negative overtravel function	Operation enabled
AL-RST	Alarm reset function	Operation enabled
EXT-E	External trip input function	Operation enabled
SDN	Slowdown before home signal function	Operation enabled

* F-JOG and R-JOG become operation disabled.

For interface type [C: I/O], input below becomes operation enabled.

CN1 symbol	Signal name	Operation by host device
+OT	+ overtravel	Operation enabled
-OT	- overtravel	Operation enabled
ARST	Alarm reset	Operation enabled
EXT-E	External error	Operation enabled
SDN	Slowdown before home	Operation enabled

6.1 Point data setting (Supporting function)

6.1.1 Point data

To set a point data, please perform GroupA Positioning function setting, base of positioning function, at first.

Refer chapter 3 and the section 4.3 for positioning function parameter setting.

6.1.2 Test operation

In the test operation window, there are the functions of servo on, JOG operation, 1-step move, Homing and Origin setting.

6.1.3 Homing

In the homing window, there are the functions of servo on and Homing.

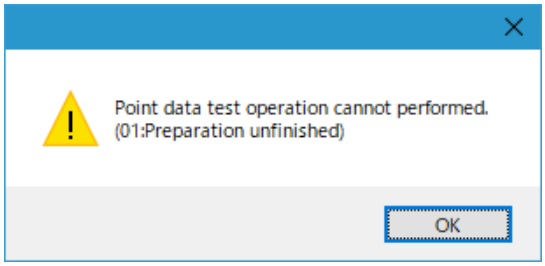
6.1.4 Point move

In the point move window, there are the functions of servo on, Point execution and Origin setting.

6.1.5 Test operation/Homing/Point move

When problem occurs at clicking those function tab, at servo on or while operation, please take corrective actions due to each cause.

* When message window below is opened, close the window by clicking OK and take corrective actions due to each cause.



■ Cause and corrective actions when operation disabled or preparation unfinished

Cause	Corrective actions
Error code is issued	Performs the section 8.4 Trouble shooting when error code activated.
Alarm code is issued	Performs the section 8.3 Trouble shooting when alarm activated.
Main circuit power is not established	“☰” does not blink in 7-segment LED even if main power is ON. Performs the section 8.1 Trouble shooting.
Wiring	Check a wiring referring chapter 4.
Safe Torque Off function	In case using the product applying Safe Torque Off function, check operation referring the section 10.6 Verification test in main manual.

6. Supporting function and test operation

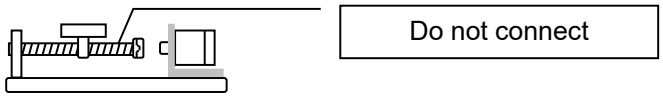
6.2 Test operation

6.2.1 Check of installation and wiring

Check the installation and wiring of servo motor.

[Step 1: installation]

- Set the servo amplifier and motor by following "3. Installation" in main manual.
- Do not connect servo motor shaft to any mechanism, keep free from a load.



[Step 2: Wiring/Connection --> Turn power on]

- Please wire the servo amplifier, motor and host unit by following "4. Wiring" in main manual. As note, do not connect CN1 to the amplifier.
- Supply power. Check that the display of upper of servo amplifier front face does not show alarm code. If alarm code is shown, please take corrective action by following "8.3 Trouble shooting when alarm activated".
- If "☰" is not shown at 7-segment LED even if main power turns on, please take corrective action by following " 8.1 Trouble shooting".
- "Absolute encoder Internal Error 1 (AL.A1)" may blink when turning power on at the first time with servo amplifier and servo motor that has battery backup absolute encoder.
  The reason why alarm occurs is the data loss of absolute position in encoder by running out of battery.

6.2.2 Check of operation

[Step 1: JOG operation]

- Run the JOG operation without connection of a load to servo motor shaft.
- Check whether the servo motor shaft is able to rotate to positive and negative direction.
  - How to operate through the setup software
    Select JOG operation at the menu of Test Operation. See the manual: M0010842, "7.1 JOG operation" for detail of the setup software operation.
  - How to operate through CN1 I/O signals (for interface type [C: I/O])
    See "4.2 Operations by external input" for detail of JOG operation.
  - How to operate through MODBUS communication (for interface type [F: MODBUS])
    See "2.2 MODBUS communication" for detail of MODBUS communication operation.

6.2.3 I/O signal setting

Do the I/O signal setting, and then operation check by command from host controller.

[Step 1: Input signal setting]

■ For interface type [F: MODBUS], set the functions to be used.
Select the function to be used from parameter Group9, and then set it to CONT1 to CONT7.
Factory settings are function disabled.

Input signal	CN2 pin number	The function in general parameter Group9	Factory settings
		Set value	Set value
CONT1	3, 4	Select a function to be used.	00:Always_Disable
CONT2	5, 6	Select a function to be used.	00:Always_Disable
CONT3	7, 8	Select a function to be used.	00:Always_Disable
CONT4	9, 10	Select a function to be used.	00:Always_Disable
CONT5	11, 12	Select a function to be used.	00:Always_Disable
CONT6	14, 15	Select a function to be used.	00:Always_Disable
CONT7	1, 2	Select a function to be used.	00:Always_Disable

[Step 2: Output signal setting]

■ For interface type [F: MODBUS], set the output signals to be used.
Select the output signal to be used from parameter Group9, and then set it to OUT1 to OUT2.
Factory settings are written in table below.

Output signal	CN2 pin number	Factory settings
OUT1	16, 17	0A:MBR-ON_ON
OUT 2	18, 19	39:ALM_OFF

[Step 3: Double check of I/O signal setting]

■ Through monitor function, check that the I/O signal that has set works correctly.
See "5.5 Monitor function" for detail of the monitor.

◆ How to check through the setup software
For interface type [F: MODBUS], check the I/O signals connected to CN2 by ID05 and ID06 in Monitor function menu.

ID	Symbol	Parameter Name	Present Value	Unit	
05	CONT7-1	General Purpose Input CONT8 to 1 monitor	1000-0000	-	Detail
06	OUT2-1	General Purpose Output OUT8 to 1 monitor	1111-1100	-	Detail

◆ How to check through the setup software
Check the I/O signals by ID84 to ID8B in Monitor function menu.
For interface type [F: MODBUS], check the coil input/output information.
For interface type [C: I/O], check the I/O signals connected to CN1.

ID	Symbol	Parameter Name	Present Value	Unit	
84	IN_G1	Input(group1) monitor	0000-0000	-	Detail
85	IN_G2	Input(group2) monitor	0000-0000	-	Detail
86	IN_G3	Input(group3) monitor	0000-0000	-	Detail
87	IN_POINT	Input(group4) monitor	0	-	Detail
88	OUT_G1	Output(group1) monitor	0100-1001	-	Detail
89	OUT_G2	Output(group2) monitor	0000-0110	-	Detail
8A	OUT_G3	Output(group3) monitor	0000-0000	-	Detail
8B	OUT_G4	Output(group4) monitor	0000-0000	-	Detail

[Step 4: Input servo ON signal]

Input servo ON signal. Confirm that the servo motor is excited and the digital operator display on the servo amplifier front is drawing the character “8”.

[Step 5: Perform JOG operation]

- Run the JOG operation without load, by inputting manual (JOG) signal of + /- directions.
- Confirm that the shaft of the servo motor rotates to commanded direction.
- If the servo amplifier does not receive the command from the host device, the value displayed on the monitor does not change.
  Any of these cases could be the result of wrong wiring. Please double check the wiring.
- Input JOG command after receiving command acceptance permission signal from servo amplifier.
  Refer the section “4.2 Operations by external input” for the details.

[Step 6: Power shut off]

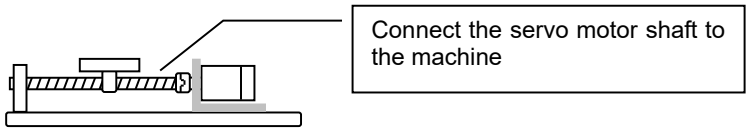
- Turn off the servo-on signal. Then turn off the power supply.

6.2.4 Check of device operation

Connect the servo motor shaft with the machine and check the operation.

[Step 1: Connection to the machine]

- Connect the servo motor shaft with the machine and check the operation.



- Input the command (low speed); check the operation direction, distance, emergency stop and over-travel (F-OT･R-OT) to make sure they are operating properly.
- Prepare to stop soon in the event of something abnormal operation.

[Step 2: Operation]

- Input the pattern for the actual operation and start the machine.
- At the time of shipment, Auto-tuning (auto-adjustment for servo gain and filter, etc.) is valid.
  If there is nothing wrong with operation and the characteristic, manual tuning is not necessary.
  See "6. Servo tuning" for the Servo Tuning.

7

Digital Operator

In this chapter, details of the Digital operator are explained.

7.1 Parallel interface 7-1
7.1.1 Digital Operator names and functions 7-1
7.1.2 Modes 7-1
7.1.2.1 Changing modes 7-1
7.1.2.2 Mode contents 7-2
7.1.3 Setting and display range 7-3
7.1.4 Status display mode 7-6
7.1.4.1 Status display mode 7-6
7.1.4.2 Linear motor magnetic pole position detection process display 7-6
7.1.4.3 Status display of warning 7-7
7.1.4.4 Alarm code and servo amplifier status code when alarm occurs 7-8
7.1.4.5 Alarm reset when alarm activated 7-8
7.1.4.6 How to check the servo amplifier information 1 to 3 7-9
7.1.4.7 How to set pass ward 7-10
7.1.4.8 How to cancel password 7-11
7.1.5 Editing parameters 7-12
7.1.5.1 Basic parameters, editing system parameters 7-12
7.1.5.2 Editing general parameters 7-13
7.1.6 How to tune automatic notch frequency 7-14
7.1.7 Auto FF vibration suppression frequency tuning 7-15
7.1.8 Encoder Clear 7-16
7.1.9 Automatic tuning result writing 7-16
7.1.10 Alarm history display 7-17
7.1.11 How to clear alarm history 7-18
7.1.12 Monitor display 7-19
7.1.13 Fixed monitor display 7-20
7.1.14 Motor code-setting of servo motor used 7-20
7.1.15 Holding brake control (disabled) 7-20
7.2 Serial interface communication 7-21
7.2.1 Serial interface communication indicator 7-21
7.2.2 Servo amplifier indicator 7-22
7.2.2.1 Main Circuit Power Supply Indicator Code: CHARGE 7-22
7.2.2.2 Control Power Supply Establish Indicator Code: POW 7-22
7.2.3 Digital Operator Indicator 7-23
7.2.3.1 Digital Operator Names and Functions 7-23
7.2.3.2 Mode changes 7-23

7.2.4 Digital Operator Display Form 7-24
7.2.5 Status Display Mode 7-24
7.2.5.1 Alarm Display 7-25
7.2.5.2 How to Reset Alarm When Alarm Occurring 7-25
7.2.5.3 Encoder Clear 7-26
7.2.5.4 Automatic Tuning Result Writing 7-26
7.2.6 Holding brake control (disabled) 7-26
7.2.7 Alarm History Mode 7-27
7.2.7.1 Alarm History Display Mode 7-27
7.2.7.2 Clear Alarm History 7-27
7.2.8 Monitor Display Mode 7-28
7.2.9 Fixed monitor display 7-28

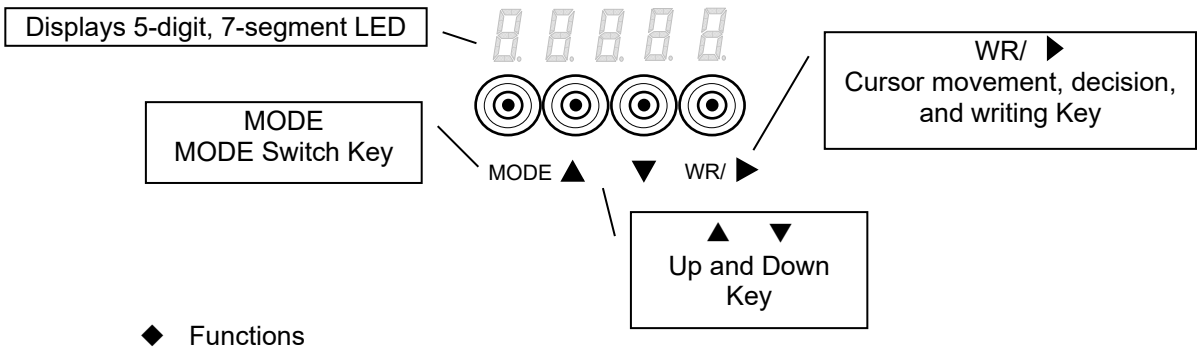
[C: Parallel interface] 7.1.1 Digital Operator names and functions

7.1 Parallel interface

7.1.1 Digital Operator names and functions

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

■ Names



◆ Functions

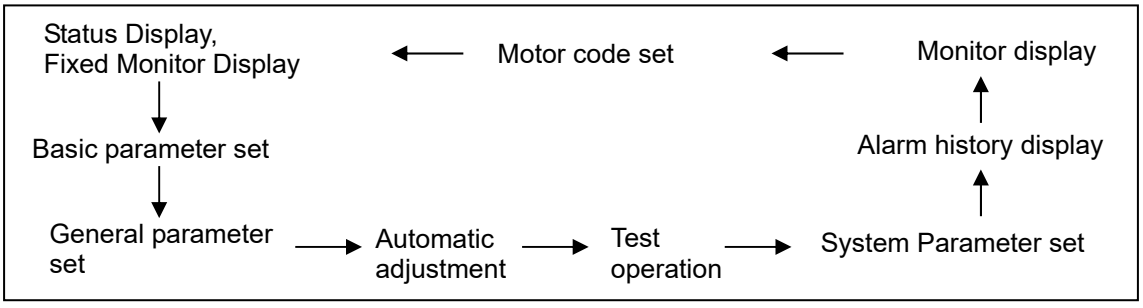
Displayed marks	Functions	Input time
WR	To input selections and write edited data.	More than 1 second
MODE	Changes the Mode.	Less than 1 second
▶	Cursor Key Changes the cursor position when editing	Less than 1 second
▲ ▼	Up/ Down key. Changes the numeric value.	Less than 1 second
7 segment LED	Displays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

7.1.2 Modes

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

7.1.2.1 Changing modes

Change in the mode presses the "MODE key." The mode switches in order of the following figure.



7. Digital Operator

7.1.2.2 Mode contents

Mode	Contents
Status Display	■ Displays the establishment of control or main power supply, Servo ON, over-travel, warning and alarm status.
Basic parameter bA.00	■ Parameters necessary for test operations by JOG and auto-tuning. Can be set at general parameter mode.
General parameter 0F.000	■ Settings can be made suitable for machines and equipment. Parameters for adjusting servo gain can be changed. Classified into 12 groups according to the functions.
Automatic adjustment AU.00	■ Enables Adjustment for Torque Command Notch Filter A and Vibration Suppression frequency 1.
Test operation Ad.00	■ Encoder clear and auto tuning result writing are available.
System parameter SY.00	■ Sets the parameters related to servo amplifier - motor encoder.
Alarm history ALH.1	■ Displays the latest 15 alarm events.
Monitor db.00	■ Displays the servo amplifier status such as Velocity, Velocity Command, Torque, Torque command, Position Deviation and Servo Adjustment Gain when using auto-tuning.
Motor code set CoSEt	■ Sets the motor cord corresponding to servo motor, and changes the servo motor to be used.

Group	Description of Group
Group0	Settings of automatic tuning.
Group1	Settings of basic control parameters.
Group2	Settings of damping control/notch filter/disturbance observer.
Group3	Settings of model following control.
Group4	Settings of gain switching control/damping frequency switching.
Group5	To set fast settling control.
Group8	Settings of control system.
Group9	Settings of various functional effective conditions / general output terminal output condition / monitor output selection.
GroupA	Setting of positioning function.
GroupB	Setting related to sequence / alarm.
GroupC	Settings related to encoder.
GroupD	Settings related to supporting function.

Note) To set Group9 and GroupA, use SANMOTION MOTOR Setup software.

7.1.3 Setting and display range

Digital operator displays data becomes the following form.

■ Data of 0 to +65535

Symbol	Digital operator display	Range of a digit display	
Plus	0	Position of 1 display	0 to 9
Plus	10	Position of 10 display	10 to 99
Plus	100	Position of 100 display	100 to 999
Plus	1000	Position of 1000 display	1000 to 9999
Plus	10000	Position of 10000 display	10000 to 99999

■ Data of -9999 to +9999

Symbol	Digital operator display	Range of a digit display	
Plus	0	Position of 1 display	0 to 9
Plus	10	Position of 10 display	10 to 99
Plus	100	Position of 100 display	100 to 999
Plus	9999	Position of 1000 display	1000 to 9999
Minus	-9999	Position of 10000 display	1000 to 9999

* Left end – expresses minus.

■ Data of 0 to +4199999999

Symbol	Digital operator display	Range of a digit display	
Plus	1000	Low position of 1 to 1000 display	0 to 9999
Plus	=1000	Middle position of 10000 to 10000000 display	0 to 9999
Plus	E41	High position of 100000000 to 1000000000 display	0 to 41

* Left end LED expresses low position, middle position, and high position.
Press and hold MODE for 1 sec or more to switch.

7. Digital Operator

■ Hexadecimal data

Data size	Digital operator display	Range of a digit display
1 byte		00 to FF
2 byte		0000 to FFFF
4 byte Low		0000 to FFFF (Bit15 to Bit0) display
4 byte High		0000 to FFFF (Bit31 to Bit16) display

■ Example display of decimal point data

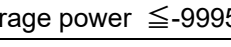
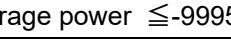
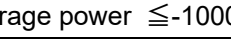
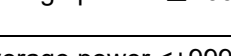
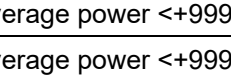
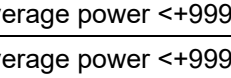
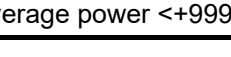
First position of a decimal point	
Second position of a decimal point	

■ The data of servo amplifier operating time

Digits of the data	Digital operator display	Range of a digit display
Digits of millisec unit		0 to 999
Digits of sec unit		0 to 59
Digits of minute unit		0 to 59
Lower 4 digits of hour unit		0 to 9999
Upper 4 digits of hour unit		0 to 9999

* Left end LED expresses digits of the data. Press and hold MODE for 1 sec or more to switch.

■ Average power monitor display (Monitor ID: 4A)
Display range of average power is automatically changed depending on the value, to indicate optimum range.
When average power exceed 1000W, "H" is indicated to highest digit and unit is changed to [kW].
Also, decimal point moves a position depending on average power.

Average power range		Example display	Unit
-999999.9 W	< Average power ≦-99950.0 W		kW
-99950.0 W	< Average power ≦-9995.0 W		kW
-9995.0 W	< Average power ≦-1000.0 W		kW
-999.9 W	≦ Average power ≦+999.9 W	 	W
1000.0 W	≦ Average power <+9995.0 W		kW
9995.0 W	≦ Average power <+99950.0 W		kW
99950.0 W	≦ Average power <+999999.9 W		kW

■ Regenerative power monitor display (Monitor ID: 4C)
Display range of regenerative power is automatically changed depending on the value, to indicate optimum range.

Regenerative power range			Example display	Unit
0.000 W	≦ Regenerative power ≦	99.999 W	9 9.9 9 9	W
100.000 W	≦ Regenerative power <	999.995 W	9 9 9.9 9	W
999.995 W	≦ Regenerative power <	9,999.950 W	9 9 9 9.9	W
9,999.950 W	≦ Regenerative power		9 9 9 9 9	W

7. Digital Operator

7.1.4 Status display mode

In this mode, the state of servo amplifier and the display of the alarm number when alarm occurring can be checked. In addition to these, reset of alarm, the software version check of servo amplifier, and setup of a password can be performed at the time of an alarm number display.

7.1.4.1 Status display mode

Marking	Description	Status code
	Control power supply established. Control power supply (r, t) is established and amplifier (RDY) is ON.	1
	Main circuit power supply established. Main power supply (R, S, and T) is established, but operation preparation completion signal is OFF.	2
	Safe Torque Off working status. Main circuit power supply (R, S, and T) is established and either safe torque off input 1 or 2 is “OFF”. “ → → ” are shown sequentially.	2
	Operation preparation completion signal established. Main power supply (R, S, T) is established and operation preparation completion signal is ON.	3
	Servo is ON. Rotates after displaying the character“8”.	4

7.1.4.2 Linear motor magnetic pole position detection process display

Marking	Servo amplifier status
	・Magnetic pole position not detected state (flashing) Linear motor CS-position setting is needed when Hall effect sensor is not used for detecting magnetic pole. The display changes from flashing to lighting showing operation preparation completed, after completing magnetic pole position detection via CS-position setting.
	・Magnetic pole position not detected state (CS-position setting being performed) Shows magnetic pole position not detected during CS-position setting.
	・Magnetic pole position detection completed state (CS-position setting being performed) Shows the state magnetic pole position detection completed during CS-position setting.

7.1.4.3 Status display of warning

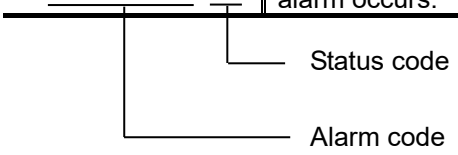
Marking	Description
	Encoder system warning status Occurred warning below ■ Battery voltage sag
	Load system warning status Occurred one of warnings below ■ Regeneration overload ■ Overload ■ Servo amplifier internal temperature
	Power system warning status Occurred warning below ■ Battery voltage sag
	Control system warning status Occurred one of warnings below ■ Restricting torque command ■ Restricting velocity command ■ Excessive position deviation ■ Dual position error excess ■ Sync error excess ■ Adaptive notch filter E frequency

* Descriptions of each warning are shown at "8.2.1 Warning List".
* Confirm occurring warning by the digital operator referring "7.1.12 Monitor display" or by warning information of the setup software. For operation of the setup software, see another document: M0010842.
* For a positioning function built-in servo amplifier, warning of Dual position error excess, Sync error excess and Adaptive notch filter E frequency are not occurred.

Note 1) For RS3D80#, it occurs when either of power unit and amplifier unit is into warning condition.

7.1.4.4 Alarm code and servo amplifier status code when alarm occurs

Marking	Description
AL.85.F	Please take a measure according to the contents of "Maintenance" when alarm occurs.



7.1.4.5 Alarm reset when alarm activated

Alarm can be reset from the digital operator. However, the alarm that needs to perform power supply reset cannot be reset from the digital operator. About the alarm that performs power supply reset, can check by [8.2 Warning and Alarm List]

Step	Displayed Character, number, code	Input button				How to operate
1	AL.55.4					Make the state where the alarm number is displayed.
2		● MODE	○ ▲	○ ▼	○ WR/►	Push MODE for more than 1 second.
3	AL.rSt					Display changes as the left.
4		○ MODE	○ ▲	○ ▼	● WR/►	Push WR for more than 1 second.
5	0.run.0.					Display changes as the left for 2 seconds.
6	0.0.0.0.3					When the cause of alarm is removed, the state of servo amplifier is displayed.

7.1.4.6 How to check the servo amplifier information 1 to 3

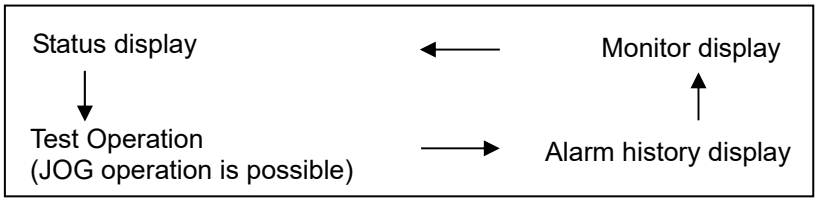
Step	Displayed Character, number code	Input button				How to operate
1	8.8.8.8.3					Make the state of servo amplifier, or the state where alarm is displayed.
2		MODE	▲	● ▼	WR/►	Push the subtraction button for more than 1 second.
3	C.P.U.n.o.					Display changes as the left.
4		MODE	● ▲	● ▼	WR/►	Push addition and subtraction button.
5	1.nF.o.1 1.nF.o.2 1.nF.o.3					Display changes as the left.
6		MODE	▲	▼	● WR/►	Push WR for more than 1 second.
7	8.8.8.8.8.					The selected information is displayed.
8		● MODE	▲	▼	WR/►	Push MODE once.
9	1.nF.o.1 1.nF.o.2 1.nF.o.3					Returns to Process 5.
10		● MODE	▲	▼	WR/►	Push MODE once.
11	8.8.8.8.3					Returns to Process 1.

* The contents of display information 1, information 2, and information 3 are described to “5.1.1 Specification check”.

7. Digital Operator

7.1.4.7 How to set pass ward

The function that can be used by setting up a password from digital operator can be restricted, and change of a parameter etc. can be forbidden. The function and the setting method can be used is the following.



Step	Displayed character, number, code	Input button				How to operate
1	8.8.8.8.3					Make the state of servo amplifier, or the state where alarm is displayed.
2		MODE	▲	▼	WR/►	Push addition button for more than 1 second.
3	-PAS-					Display switches as the left and the whole display blinks. When setup of the password has ended, display does not blink.
4	8.0.0.0.0	MODE	▲	▼	WR/►	Push WR for more than 1 second.
5						Display changes as the left and right end LED blinks.
6	8.1.2.3.4	MODE	▲	▼	WR/►	Display arbitrary numerical values with addition and subtraction and the cursor button. 0000 and FFFF cannot be set up.
7		MODE	▲	▼	WR/►	Push WR for more than 1 second.
8	8.1.2.3.4					Display blinks 3 times, and setup will be completed if blink stops.
9		MODE	▲	▼	WR/►	Push MODE once.
10						Returns to process 1.
11	8.8.8.8.3					Password will become effective if power supply is turned on again.

7.1.4.8 How to cancel password

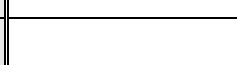
Step	Displayed character, number, code	Input button				How to operate
3	-PAS-					Display switches as the left and the whole display lights up. Password is not set up when the display is blinking.
4	0000	MODE	▲	▼	WR/►	Push WR for more than 1 second.
5						Display switches as the left and right end LED blinks.
6	1234	MODE	▲	▼	WR/►	Set up password is displayed with addition and subtraction and the cursor button.
7		MODE	▲	▼	WR/►	Push WR for more than 1 second.
8	1234					Display blinks 3 times, and cancel will be completed if blink stops.
9		MODE	▲	▼	WR/►	Push MODE once. Then returns to Process 1.
10						After cancel does not need to turn on power supply again.

7. Digital Operator

7.1.5 Editing parameters

The parameter inside servo amplifier can be changed into a setup put together with equipment and the machine of usage in fundamental parameter edit mode, general parameter edit mode, and system-parameter edit mode.

7.1.5.1 Basic parameters, editing system parameters

Step	Displayed character, number, code	Input button				How to operate
1		● MODE	○ ▲	○ ▼	○ WR/►	Push MODE until it displays the left.
2						Display changes as left, and right end LED blinks.
3		○ MODE	● ▲	● ▼	● WR/►	Display ID of the parameter changed with addition and subtraction and the cursor button.
4		○ MODE	○ ▲	○ ▼	● WR/►	Push WR for more than 1 second.
5						The data set up is displayed.
6		○ MODE	● ▲	● ▼	● WR/►	Display a value to set up with addition and subtraction and the cursor button.
7		○ MODE	○ ▲	○ ▼	● WR/►	Push WR for more than 1 second.
8						Setup is completion when blink stops, after a display blinks 3 times. When the set-up value is outside a setting range, setting of Process 5 is display without a display blinking 3 times.
9		● MODE	○ ▲	○ ▼	○ WR/►	Push MODE.
10						Display switches ad the left. When you set other parameters continuously, repeat from Process 3.
11		● MODE	○ ▲	○ ▼	○ WR/►	Push MODE.
12						Changes to the left display.

5		When reservation parameter cannot be set, the left is displayed in Process 5.

* When operating in system parameter editing mode, the displayed character in step 1 shall be “SY.”

7.1.5.2 Editing general parameters

As how to edit a general parameter, for example, below shows reset of alarm with Group9 ID02 “Alarm Reset Function [AL-RST] is as follows.

For the alarm reset function, change 00 (always invalid) to 01 (always valid) and then change to 00 (always invalid) again.

Step	Displayed character, number, code	Input button				How to operate
1	0 r	● MODE	▲	▼	WR/►	Hold down MODE until the figure left is displayed.
2	0 r 0.0 0					Display changes as left, and right end LED blinks.
3	0 r 9.0 2	MODE	● ▲	● ▼	● WR/►	Display ID of parameter to be changed by addition/ subtraction, cursor button.
4	0 r 9.0 2	MODE	▲	▼	● WR/►	Hold down WR for over a second.
5	0 0					“00” is displayed.
6	0 1	MODE	● ▲	● ▼	● WR/►	Set figure “01” by addition/ subtraction, cursor button.
7		MODE	▲	▼	● WR/►	Hold down WR for over a second.
8						Wait a stop of blink.
9		● MODE	▲	▼	WR/►	Press MODE.
10	0 r 9.0 2	MODE	▲	▼	● WR/►	Hold down WR for over a second.
11	0 0	MODE	● ▲	● ▼	● WR/►	Set figure “00” by addition/ subtraction, cursor button.
12		MODE	▲	▼	● WR/►	Hold down WR for over a second.
13						Wait a stop of blink.
14		● MODE	▲	▼	WR/►	Press MODE.
15	0 r 9.0 2					Display to be switched to the display left.

7. Digital Operator

7.1.6 How to tune automatic notch frequency

Step	Displayed character, number, code	Input button				How to operate
1	AU	● MODE	▲	▼	WR/►	Push MODE until it displays the left.
2	AU 00					Display changes and right end LED blinks.
3	AU 00	MODE	● ▲	● ▼	● WR/►	Make as the left display with addition and subtraction and the cursor button.
4		MODE	▲	▼	● WR/►	Push WR for more than 1 second.
5	nOtCH					Changes to the left display.
6		MODE	▲	▼	● WR/►	Push WR for more than 1 second.
7	8					The character of 8 is drawn and servo is on.
8		MODE	▲	▼	● WR/►	Push WR for more than 1 second.
9	.r.u.n.					A display change as the left and it performs.
10	8					Changes to the display of the left after a normal end.
11		● MODE	▲	▼	WR/►	Push MODE.
12	nOtCH					Servo is off and changes to the left display.
13		● MODE	▲	▼	WR/►	Push MODE.
14	AL.dF.4					Completes and changes to the left display.

■ For stopping during operation, please push the MODE button.

MODE is pushed in Process 2.	
Ad	Changes to the left display.
MODE is pushed in Process 5.	
AU 00	Changes to the left display and return to Process 2.
MODE is pushed in Process 7.	
nOtCH	Changes to the left display and return to Process 5.
Mode is pushed again.	
AL.dF.4	Complete and changes to the left display.
MODE is pushed in Process 9.	
AL.dF.4	Complete and changes to the left display.

■ Error is displayed when cannot end normally.

E.rr	Changes to the left display.
Will end, if MODE is pushed.	
AL.dF.4	Complete to the left display.

7.1.7 Auto FF vibration suppression frequency tuning

Step	Displayed character, number, code	Input button				How to operate
1	AU	● MODE	▲	▼	WR/►	Push MODE until it displays the left.
2	AU 00					Display changes and right end LED blinks.
3	AU 01	MODE	● ▲	● ▼	● WR/►	Make as the left display with addition and subtraction and the cursor button.
4		MODE	▲	▼	● WR/►	Push WR for more than 1 second.
5	SUPr					Changes to the left display.
6		MODE	▲	▼	● WR/►	Push WR for more than 1 second.
7	8					The character of 8 is drawn and servo is on.
8		MODE	▲	▼	● WR/►	Push WR for more than 1 second.
9	.r.u.n.					A display change as the left and it performs.
10	B					Changes to the display of the left after a normal end.
11		● MODE	▲	▼	WR/►	Push MODE.
12	SUPr					Servo is off and changes to the left display.
13		● MODE	▲	▼	WR/►	Push MODE.
14	ALdF.4					Completes and changes to the left diaplay.

■ For stopping during operation, please push the MODE button.

MODE is pushed in Process 2.	
Ad	Changes to the left display.
MODE is pushed in Process 5.	
AU 01	Changes to the left display and return to Process 2.
MODE is pushed in Process 7.	
SUPr	Changes to the left display and return to Process 5.
MODE is pushed again.	
ALdF.4	Complete and changes to the left display.
MODE is pushed in Process 9.	
ALdF.4	Complete and changes to the left display.

■ Error is displayed when cannot end normally.

Error	Changes to the left display.
Will end, if MODE is pushed.	
ALdF.4	Completes and changes to the left display.

7. Digital Operator

7.1.8 Encoder Clear

Step	Displayed character, number, code	Input button				How to operate
1	Ad	● MODE	▲	▼	WR/►	Push MODE until it displays the left.
2						Display changes and right end LED blinks.
3	Ad00	MODE	● ▲	● ▼	● WR/►	Make as the left display with addition and subtraction and the cursor button.
4	Ad01	MODE	▲	▼	● WR/►	Push WR for more than 1 second.
5	EnCLr					Changes to the left display.
8		MODE	▲	▼	● WR/►	Push WR for more than 1 second.
9	.r.un.					A display change as the left and it performs.
10	EnCLr					Changes to the display of the left after a normal end.
11		● MODE	▲	▼	WR/►	Push MODE.
12	Ad01					Changes to the left display.
13		● MODE	▲	▼	WR/►	Push MODE.
14	Sy					Changes to the left display.

7.1.9 Automatic tuning result writing

Step	Displayed character, number, code	Input button				How to operate
1	Ad	● MODE	▲	▼	WR/►	Push MODE until it displays the left.
2	Ad00					Display changes and right end LED blinks.
3	Ad02	MODE	● ▲	● ▼	● WR/►	Make as the left display with addition and subtraction and the cursor button.
4		MODE	▲	▼	● WR/►	Push WR for more than 1 second.
5	tunSL					Changes to the left display.
8		MODE	▲	▼	● WR/►	Push WR for more than 1 second.
9	.r.un.					A display change as the left and it performs.
10	tunSL					Changes to the display of the left after a normal end.
11		● MODE	▲	▼	WR/►	Push MODE.
12	Ad02					Changes to the left display.
13		● MODE	▲	▼	WR/►	Push MODE.
14	Sy					Changes to the left display.

7.1.10 Alarm history display

Step	Displayed character, number, code	Input button				How to operate
1	AL.H	● MODE	○ ▲	○ ▼	○ WR/►	Push MODE until it displays the left.
2	AL.H.1					Display changes and right end LED blinks.
3	AL.H.3	○ MODE	● ▲	● ▼	○ WR/►	Display the number of an alarm history to check with an addition-and-subtraction button. The history of 15 times past before can be displayed.
4		○ MODE	○ ▲	○ ▼	● WR/►	Push WR for more than 1 second.
5	AL.85.0					The alarm of 3 times ago is displayed.
6		○ MODE	○ ▲	○ ▼	● WR/►	Push WR for more than 1 second.
7	.802					The passed time of alarm generating is displayed. Digits of milisec unit.
8		● MODE	○ ▲	○ ▼	○ WR/►	Press and hold MODE for more than 1 second.
9	.29					The passed time of alarm generating is displayed. Digits of sec unit.
10		● MODE	○ ▲	○ ▼	○ WR/►	Press and hold MODE for more than 1 second.
11	-.1					The passed time of alarm generating is displayed. Digits of minute unit
12		● MODE	○ ▲	○ ▼	○ WR/►	Press and hold MODE for more than 1 second.
13	-.0					The passed time of alarm generating is displayed. Lower 4 digits of hour unit
14		● MODE	○ ▲	○ ▼	○ WR/►	Press and hold MODE for more than 1 second.
15	-.0					The passed time of alarm generating is displayed. Upper 4 digits of hour unit
16		● MODE	○ ▲	○ ▼	○ WR/►	Push MODE.
17	AL.85.F					Returns to Process 5.
18		● MODE	○ ▲	○ ▼	○ WR/►	Push MODE.
19	AL.H.3					Returns to Process 3.
20	ob					Changes to the left display.

7. Digital Operator

7.1.11 How to clear alarm history

Step	Displayed character, number, code	Input button				How to operate
1	AL H	● MODE	○ ▲	○ ▼	○ WR/►	Push MODE until it displays the left.
2	AL H 1					Display changes and right end LED blinks.
3	AL H.CL	○ MODE	● ▲	● ▼	○ WR/►	Display the left with the addition-and-subtraction button.
4		○ MODE	○ ▲	○ ▼	● WR/►	Push WR for more than 1 second.
5	rdy					Changes to the left display and it blinks.
7		○ MODE	○ ▲	○ ▼	● WR/►	Push WR for more than 1 second.
8	.run.					A display change as the left and it performs.
9	AL H 1					Changes to the display of the left after a normal end.
10		● MODE	○ ▲	○ ▼	○ WR/►	Push MODE.
11	ob					Changes to the left display.

7.1.12 Monitor display

Step	Displayed character, number, code	Input button				How to operate
1		● MODE	○ ▲	○ ▼	○ WR/►	Push MODE until it displays the left.
2						Display changes and right end LED blinks.
3		○ MODE	● ▲	● ▼	● WR/►	Display ID of the monitor with addition and subtraction and the cursor button.
4		○ MODE	○ ▲	○ ▼	● WR/►	Push WR for more than 1 second.
5						The data is displayed.
6		● MODE	○ ▲	○ ▼	○ WR/►	Push MODE.
7						Changes to the left display. When you monitor other data continuously, repeat from Process 3.
8		● MODE	○ ▲	○ ▼	○ WR/►	Push MODE.
9						Changes to the left display.

Note)		When it is a monitor that cannot be displayed, the left is displayed in Process 5.

* See "5.5.1 Monitor list" for ID of monitor items.

7. Digital Operator

7.1.13 Fixed monitor display

The display shows monitoring value in 2 seconds after powering up.
It shows monitoring value set at Group D ID11 “Monitor Display Selection [MONDISP]” in status display mode.
“Monitor” to be displayed is the same as parameter ID in monitor display mode, but in the setting value “00 STATUS servo amplifier status monitor”, the display will be different from the code display in the monitor mode and will show the amplifier status in the status display mode (- or Ξ).
In the state of alarm occurring, requiring safety function input, requiring motor magnetic pole detection or detecting the poles, the monitor display prioritize these statuses over the fixed display.

7.1.14 Motor code-setting of servo motor used

Step	Displayed character, number, code	Input button				How to operate
1	Co	● MODE	○ ▲	○ ▼	○ WR/►	Push MODE until it displays the left.
2	CoSEt					Display changes and right end LED blinks.
3		○ MODE	○ ▲	○ ▼	● WR/►	Push WR for more than 1 second.
4	3001	○ MODE	● ▲	● ▼	● WR/►	Display the motor cord of the servo motor used with addition and subtraction and the cursor button.
5		○ MODE	○ ▲	○ ▼	● WR/►	Push WR for more than 1 second.
6	run					A display changes as the left and it performs.
7	oFF					Changes to the display of the left after a normal end.
8						Turn on the power supply again.

Note)	non	The servomotor that cannot be combined or used displays the left in Process 5. In this display, please set up by “Setup Software”.

* Check the Applicable motor list at "5.1.3 Servo motor setting" about applicable servo motor and motor code.

7.1.15 Holding brake control (disabled)

* For servo motor R2CA3255KB, there is no specification with brake.
* For amplifier unit RS3D80#, there is no output of holding brake excitation.

7.2 Serial interface communication

7.2.1 Serial interface communication indicator

This servo amplifier has four (4) indicators.
There are 2 LEDs in green and 2 LED in red for indicators.

■ Indicator arrangement



■ Indicator description
Each indicator condition description is below.

Symbol	(Light/Extinguish)	Description
STA	ON (Light with green)	Lights when normal request message is received once at least, after power on. It means communication startup.
	OFF (Extinguish)	Extinguishes while normal request message is not received once at least, after power on. It means communication is not start.
ERR	ON (Light with red)	Lights while error message processing.
	OFF (Extinguish)	Extinguishes while no message processing.
T/O	ON (Light with red)	Lights when communication timeout occurred with timeout detection permission condition.
	OFF (Extinguish)	Extinguishes while communication timeout is not occurred. After communication timeout occurred, transits to light from extinguish by alarm clearing after communication restart.
RUN	ON (Light with green)	Lights while normal response message processing.
	OFF (Extinguish)	Extinguishes while no message processing.

7.2.2 Servo amplifier indicator

This servo amplifier has three types of indicator characteristics for the R 3E MODEL.

- Main circuit power charge indicator: LED (RED)
- Control power supply establish indicator: LED (BLUE)
- Digital Operator indicator: 7-segment LED×5 (RED)

The details of the Digital Operator are explained in 7.2.3.

7.2.2.1 Main Circuit Power Supply Indicator Code: CHARGE

Main Circuit Power Supply Indicator (Red LED) shows the main circuit power (R,S,T) has been input and power is charging in the main circuit power supply smoothing capacitor.
The LED stays ON until electric discharge has completed even after the main circuit power supply has shut down.

* Make sure not to touch the servo amplifier until this LED goes OFF. Electric shock may result.

7.2.2.2 Control Power Supply Establish Indicator Code: POW

Control Power Supply Establish Indicator (Blue LED) shows the control power supply (r/t or 24 VDC) has been input and the 5V control power supply has been established through the switching power supply inside the amplifier.

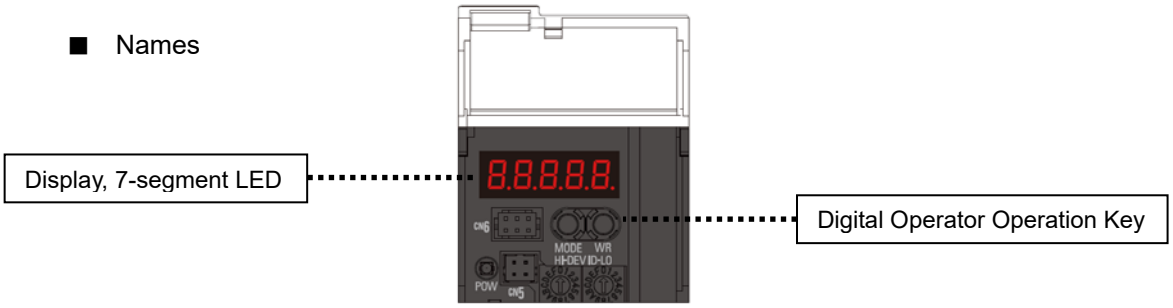
[F: Serial interface] 7.2.3 Digital Operator Indicator

7.2.3 Digital Operator Indicator

7.2.3.1 Digital Operator Names and Functions

Status display, Alarm history and Monitor can be confirmed with the 5-digit, 7-segment Red LED on the upper front of the servo amplifier.

■ Names

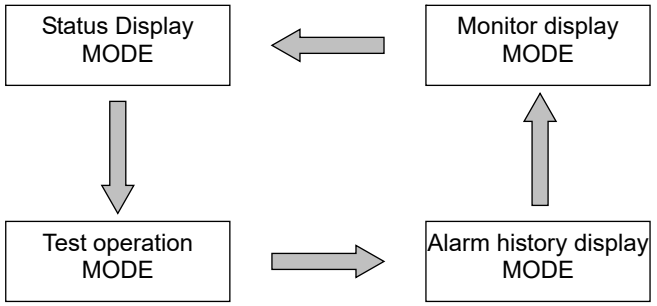


■ Functions of each parts

Functions	Description	Operation method	
1 [MODE]	MODE Switch / Cancel	MODE key ON (once):	Keeps ON for more than 100ms and less than 1s, then turns OFF.
2 [WR]	MODE / Page Data Determination	WR key ON (once):	Keeps ON for more than 100ms and less than 1s, then turns OFF.
3 [INC]	Increment value	MODE key pushed long (once):	ON for more than 1s causes page increment.
4 [DEC]	Decrement value	WR key pushed long (once):	ON for more than 1s causes page decrement.

7.2.3.2 Mode changes

MODE Change is performed by “MODE” operation of the Push Button Switch.
Switches as following order.



MODE Switching Order

■ Status Display MODE
Displays the establishment of control or main power supply, Servo ON, over-travel, warning and alarm status.
Also performs Alarm Reset.

■ Test operation MODE
JOG Operation, Auto-Tuning Result Writing and Encoder Clear can be executed.

■ Alarm history display MODE
Alarm history for the previous 15 times can be checked and can clear alarm history.

■ Monitor MODE
Displays the servo amplifier status such as Velocity, Velocity Command, Torque, Torque command, Position Deviation and Servo Adjustment Gain when using auto-tuning.

7.2.4 Digital Operator Display Form

Refer the section 7.1.3 for data indicated by the digital operator. It is same.

7.2.5 Status Display Mode

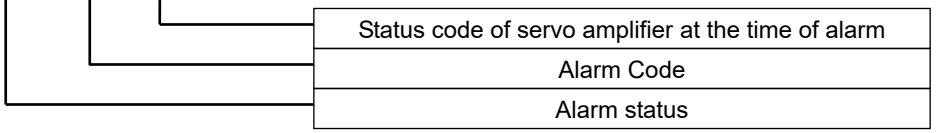
Refer the section 7.1.4 for the status display mode. It is same.

[F: Serial interface] 7.2.5 Status Display Mode

7.2.5.1 Alarm Display

Alarm number can be confirmed at the time of alarm occurrence.

Marking	Servo amplifier status
	Displays Alarm Code with “2 digits” following “AL.” and Status Code at the time of alarm occurrence with “1 digit” after the alarm code. Please take a measure according to the contents of "Maintenance" when alarm occurring.



Code	State	
1	Power OFF	(P-OFF)
2	Power ON	(P-ON)
3	Servo Ready	(S-RDY)
4	Servo ON	(S-ON)
5	Servo OFF Stop	(S-OFF)
6	Emergency Stop	(EMR)
F	Initialized	

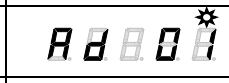
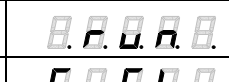
7.2.5.2 How to Reset Alarm When Alarm Occurring

Alarm can be reset with the Digital Operator, except for alarms necessary for re-input of power.

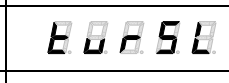
Process	Displayed character, number, code	MODE key operation	How to operate
1		[MODE]	Make the state (Status Display) where the alarm No. is displayed.
2		[WR]	Changes to as the left after turn ON MODE key 1sec or more. Alarm will be cleared by pushing WR key.
3		-	Display changes as the left for 2 seconds.
4		-	When the cause of alarm is removed, the state of servo amplifier is displayed.
-		[MODE]	When pushing “MODE” once in the status of Process 2, it will be cancelled and revert to Process 1.

7. Digital Operator

7.2.5.3 Encoder Clear

Process	Displayed character, number, code	Key input operation	How to operate
1		[MODE]	Push MODE key until it shows display the left. Display changes and right end LED blinks.
2		[INC]	Push MODE key more than 1 sec to display "Ad 01" on left.
3		[WR]	Displays “EnCLr” mode by pushing WR key.
4		[WR]	Display changes to that on the left and executes Encoder Clear by pushing WR key.
5			Displays image on left “EnCLr” after normal completion
6		[MODE]	Returns to Process 2 by pushing MODE key.
7		[MODE]	Displays Alarm History mode by pushing MODE key.

7.2.5.4 Automatic Tuning Result Writing

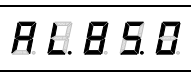
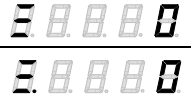
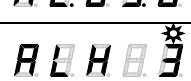
Process	Displayed character, number, code	Key input operation	How to operate
1		[MODE]	Push MODE key until it shows display on the left. Display changes and right end LED blinks.
2		[INC]	Push MODE key more than 1 sec to display "Ad 02"on left.
3		[WR]	Displays “turSL” mode by pushing WR key.
4		[WR]	Display changes to that on the left and executes Automatic Tuning Result Writing by pushing WR key.
5			Displays image on left “turSL” after normal completion
6		[MODE]	Returns to Process 2 by pushing MODE key.
7		[MODE]	Displays Alarm History mode by pushing MODE key.

7.2.6 Holding brake control (disabled)

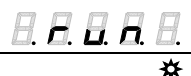
* For servo motor R2CA3255KB, there is no specification with brake.
* For amplifier unit RS3D80#, there is no output of holding brake excitation.

7.2.7 Alarm History Mode

7.2.7.1 Alarm History Display Mode

Process	Displayed character, number, code	Key input operation	How to operate
1		[MODE]	Push MODE key until it shows display on the left. Display changes and right end LED blinks.
2		[INC]	Displays an Alarm History number that requests to be checked. Previous 7 alarms can be checked.
3		[WR]	Displays the previous 3 alarms from the current by pushing WR key.
4		[WR]	Displays elapsed time until alarm occurrence by pushing WR key. msec unit digits.
5		[INC]	Displays elapsed time until alarm occurrence by pushing WR key. Second unit digits.
6		[INC]	Displays elapsed time until alarm occurrence by pushing WR key. Minute unit digits.
7		[INC]	Displays elapsed time until alarm occurrence by pushing WR key. Hour unit lower 4 digits.
8		[INC]	Displays elapsed time until alarm occurrence by pushing WR key. Hour unit higher 4 digits.
9		[MODE]	Returns to Process 3 by pushing MODE key once.
10		[MODE]	Returns to Process 3.
11		[MODE]	Changes to the next monitor display mode.

7.2.7.2 Clear Alarm History

Process	Displayed character, number, code	Key input operation	How to operate
1		[MODE]	Displays Clear mode after Alarm History number 7 has been checked by MODE key.
2		[WR]	Clears preparations screen (as shown on the left) will be displayed by pushing WR key until the display changes.
3		[WR]	Displays as shown on the left by pushing WR key until the display changes, and executes Alarm History Clear.
4		–	Returns to History Selection Screen automatically after normal completion.
5		[MODE]	Pushing MODE key in Process 3 cancels the corresponding operation and returns to Process 1.
7		[MODE]	Changes to the next monitor display mode.

7. Digital Operator

7.2.8 Monitor Display Mode

Process	Displayed character, number, code	Key input operation	How to operate
1		[MODE]	Press MODE key until you see the display on the left, then you can change the display. The right end of the LED blinks after the change.
2		[INC], [DEC]	Displays ID that requests monitoring.
3		[WR]	Displays set data and status.
4		[WR]	Displays as on the left. Repeat from Process 2 when another parameter setting is following.
5		[MODE]	Changes to the next status display mode.
–		Displays as on the left in Process 3 for reserved parameters that cannot be shown.	

7.2.9 Fixed monitor display

The display shows monitoring value after initialization completion.
It shows monitoring value set at Group D ID11 “Monitor Display Selection [MONDISP]” in status display mode. Set it referring the section "5.5.1 Monitor list".

"Monitor" to be displayed is the same as parameter ID in monitor display mode, but in the setting value “00 STATUS servo amplifier status monitor”, the display will be different from the code display in the monitor mode and will show the amplifier status in the status display mode (- or Ξ).
In the state of alarm occurring, requiring safety function input, requiring motor magnetic pole detection or detecting the poles, the monitor display prioritize these status over the fixed display.
In case that the digital operator of servo amplifier is "Status display mode" and Group D ID11 “Monitor Display Selection [MONDISP]” has set via the setup software, perform power cycle or show "Status display mode" again by pushing "MODE" button of the digital operator.

8 Maintenance

In this chapter, troubleshooting, inspection and service parts are explained.

8.1 Troubleshooting 8-1
8.2 List of warning and alarm 8-4
8.2.1 Warning List 8-4
8.2.2 Alarm list 8-5
8.2.3 Alarm list (Additional for Positioning function built-in servo amplifier) 8-9
8.3 Troubleshooting when alarm activated 8-10
8.3.1 Alarm display 8-10
8.3.2 Corrective action for alarm 8-10
8.3.3 Corrective action for alarm (Additional for Positioning function built-in servo amplifier) 8-41
8.3.4 Correspondence table for EnDat Error message and alarm code 8-42
8.4 Troubleshooting when error code activated 8-43
8.4.1 Error code display 8-43
8.4.2 Corrective action for error code 8-44
8.5 Troubleshooting of status history display 8-46
8.5.1 Status history display example 8-46
8.5.2 Status history display list 8-47
8.6 Encoder clear and alarm reset 8-48
8.7 Inspection 8-49
8.8 Service parts 8-50
8.8.1 The parts requiring Inspection 8-50
8.8.2 Replacing battery for motor encoder 8-52

8. Maintenance

8.1 Troubleshooting

When troubles occurred without any alarm displayed, check and take corrective actions for them by referring to the description below. When alarm occurs, take corrective measures referring to “8.3 Troubleshooting when alarm is activated “.

■ “≡“ does not blink in 7-segment LED even if main power is ON.

Investigation	Assumed causes and corrective actions
Check the voltage at the power input terminal.	■ If voltage is low, check the power supply. ■ Check that wires and screws are fastened properly.
Red “CHARGE“ LED goes out.	■ Internal power circuit of servo amplifier is defective, so replace the servo amplifier.
Over-travel status. Emergency Stop status.	■ Stop the input of Over-travel or the input of Emergency Stop. ■ Check of “Functions enabling condition settings “.
Safe Torque Off working status	■ Turn on /HWGOFF1 and /HWGOFF2 inputs.

■ The motor does not rotate although 7-segment LED is drawing a character “8 “.

Investigation	Assumed causes and corrective actions
Check the servo motor is locked or not.	■ Check that the power line of a servo motor is connected.
Check the positioning function parameters.	■ Check whether input command value has no problem against set command unit. ■ Check whether velocity is limited by system velocity limit or PC operation velocity limit.
Check the I/O signal conditions due to external operation input. (In case of Point specification move)	■ Check the point data set value. ■ Check specified point data. ■ Check that startup signal (RUN) inputs after becoming command effective condition.
Check the I/O signal conditions due to external operation input. (In case of Homing, JOG and 1-step feed etc.)	■ Check that external operation input signal (Homing, JOG and 1-step feed etc.) inputs after becoming command effective condition.
Check if torque limit is input.	■ When torque restriction is inputted, a servo motor cannot output the torque beyond the load torque. ■ Check of “Functions enabling condition settings “
Check the deviation clear input status.	■ Stop the input of deviation clear if the signal is in. ■ Check of “Functions enabling condition settings “
Check the encoder clear input status.	■ Stop the input of encoder clear if the signal is in. ■ Check of “Functions enabling condition settings “

* When performing the work for correction and investigation processing about wiring, be sure to intercept power supply.

■ Servo motor operation is unstable or lower speed than the specified velocity command.

Investigation	Assumed causes and corrective actions
Check the status of proportional control input signal.	■ Stop the input of proportional control if the signal is in. ■ Check of "Functions enabling condition settings "
Check the status of torque limit input signal.	■ Stop the input of torque limit if the signal is in. ■ Check of "Functions enabling condition settings "

■ Servo motor rotates only moment, and stops.

Investigation	Assumed causes and corrective actions
Check the servo motor power line.	■ Some of the servo motor power line is not connected.
Check a setup of combination motor.	■ Change the settings and turn ON the power again.
Check a setup of encoder resolution. (in System parameter)	

* When performing the work for correction and investigation processing about wiring, be sure to intercept power supply.

■ Servo motor runs away.

Investigation	Assumed causes and corrective actions
Check the servo motor power line.	■ Phase order of servo motor power line is wrong.
Check the wiring of encoder cable.	■ Wiring of the encoder is incorrect.

* When performing the work for correction and investigation processing about wiring, be sure to intercept power supply.

■ Servo motor is vibrating.

Investigation	Assumed causes and corrective actions
Check that motor is vibrating over 200Hz.	■ Reduce the loop gain speed, or set the torque command low-pass filter / torque command notch filter.

■ Occurs over shoot/ under shoot when starting / stopping.

Assumed causes and corrective actions
■ Adjust the auto tuning "response ". ■ Reduce the velocity loop gain. ■ Increase the velocity integral time constant. ■ Loose the slope of acceleration / deceleration command. ■ Use position command low-pass filter

■ Abnormal sound occurs

Investigation	Assumed causes and corrective actions
Check whether there is any problem in mechanical attachment.	■ Observe by operating servo motor by stand alone. ■ Check that the coupling does not have core shift or unbalance.
Operate at a low speed and check whether abnormal sound has periodicity.	■ Confirm that the twisted pair and shield processing of motor encoder signal line are correct. ■ Confirm that the wiring for motor encoder line and servo motor power line are not installed in the same duct. ■ Confirm that the power supply voltage is sufficient.

■ The multi-turn part of the absolute encoder cannot be cleared by clearing the encoder although the absolute encoder that has multi-turn is used.

Investigation	Assumed causes and corrective actions
Check the setting value of system parameter.	■ Check that the set value of the system parameter ID11 ”EN1 encoder type” is “11: PA_C-ABS” or ”12: RA_C-ABS”.

8.2 List of warning and alarm

Names, contents and stopping operation of warning/ alarm, and alarm-reset methods are listed below.

8.2.1 Warning List

	Name	Contents
Load system	Overload Warning	■ When the effective torque exceeds the Overload Warning Level
	Regeneration Overload Warning	■ In case of overload of regenerative resistance
	Amplifier Temperature Warning	■ Ambient temperature of the amplifier is out of range of the operation temperature
Power supply system	Control power voltage sag warning	■ Voltage of control power is below AC152V (AC200V input type), or AC76V (AC100V input type).
Encoder system	Absolute encoder warning	■ Battery voltage is below 3.2 V (typ.) (with battery backup) ■ State of detecting LED deterioration (battery-less)
	External absolute encoder warning	■ While occurring the external absolute encoder (EnDat) warning
Control system	Restricting torque command	■ While restricting the torque command by torque restriction value
	Restricting velocity command	■ While restricting the velocity command by velocity restriction value
	Excessive position deviation	■ While position deviation exceeds warning setting value.
	Dual position error excess	■ The difference between servo motor position and load position is exceeding the warning set value.
	Adaptive notch filter E frequency warning	■ Estimated frequency of the adaptive notch filter E is out of setting range.
	Axes-sync error excess	■ While position deviation error between own axis and counterpart axis exceeds warning setting value.

* For a positioning function built-in servo amplifier, warning of Dual position error excess, Adaptive notch filter E frequency warning and Axes-sync error excess are not occurred.

8. Maintenance

8.2.2 Alarm list

Operation at detecting: "DB" performs the slowdown stop of the servo motor by dynamic brake operation at the alarm generating.
(However, it performs free-run operation if alarm 53H (DB resistor overheat) is issued while stop with dynamic brake.)
Operation at detecting: "SB" performs the slowdown stop of the servo motor with sequence current limiting value.
When dynamic brake is selected by Emergency Stop Operation selection, the servo motor is decelerating stopped for the dynamic brake operation regardless of the operation when detecting it. (However, it stops in free servo brake operation at the time of alarm 53H (DB resistor overheating) detection.)
Operation at detecting: "FR" stops with free servo brake operation. (However, it stops with holding brake operation if holding brake is equipped to motor.)

	Alarm code	Alarm name	Alarm contents	Detection Operations	Alarm reset
Abnormality related to drive	21	Main Circuit Power Device Error (Over current)	■ Over current of drive module ■ Abnormality in drive power supply ■ Overheating of drive module	DB	Yes
	22	Current Detection Error 0	■ Abnormality of electric current detection value	DB	Yes
	23	Current Detection Error 1	■ Abnormality of Electric current detection circuit	DB	Yes
	24	Current Detection Error 2	■ Abnormality in communication with Electric current detection circuit	DB	Yes
	25	Safe Torque Off Error 1	■ Logic unmatched in safe torque off input	DB	No
	26	Safe Torque Off Error 2	■ Failure of safe torque off circuit	DB	No
	27	Fan stop	■ Speed reduction of fan	DB	No
Abnormality related to load	41	Overload 1	■ Excessive effective torque	SB	Yes
	42	Overload 2	■ Stall over load	DB	Yes
	43	Regenerative Overload	■ Regeneration load ratio exorbitance	DB	Yes
	45	Average continuous over speed	■ Over speed in average rotational speed	SB	Yes
	52	RS Overheat	■ Detection of in-rush prevention resistance overheating	SB	Yes
	53	Dynamic Brake Resistance Overheat	■ Overheating detection of dynamic brake resistor	SB	Yes
	54	Internal Regenerative Resister Overheat	■ Overheating detection of Internal regenerative resistor	DB	Yes
	55	External Error	■ Overheating detection of External regenerative resistor	DB	Yes
	56	Servo Amplifier Temperature Error	■ Overheating detection of Drive module	DB	Yes
Abnormality in power supply	61	Over-voltage	■ DC Excess voltage of main circuit	DB	Yes
	62	Main Circuit Under-voltage Note1)	■ DC Main circuit low voltage	DB	Yes
	63	Main Power Supply Fail Phase Note1)	■ 1 phase of the 3 phase main circuit power supply disconnected	SB	Yes
	68	Main circuit voltage detection error	■ Failure of VBUS detection circuit	DB	No
	71	Control Power Supply Under-voltage Note2)	■ Control power supply low voltage	DB	Yes Note 3)
	72	Control Circuit Under-voltage 1	■ Under voltage of ±12V	SB	Yes
	73	Control Circuit Under-voltage 2	■ Under voltage of +5V	DB	No

	Alarm code	Alarm name	Alarm contents	Detection Operations	Alarm reset
Abnormality related to encoder wiring	81	Encoder Connector 1 Disconnection	■ Incremental encoder (A, B, Z) signal line break ■ Power supply break	DB	No
	83	Encoder Connector 2 Disconnection Note 7)	■ Incremental encoder (A, B, Z) signal line break ■ Power supply break	DB	No/Yes
	84	Absolute encoder Communication Error	■ Encoder serial signal time out ■ Serial communication data error	DB	No
	85	Encoder Initial Process Error	■ Failed to read CS data of Incremental encoder ■ Abnormality in initial process of Absolute encoder	—	No
	87	CS Signal Disconnection	■ CS signal line break	DB	No
	88	External Absolute Encoder Communication Error	■ Encoder serial signal time out ■ Serial communication data error	DB	No
	89	External Encoder Initial Process Error	■ Abnormality in initial process of absolute encoder	-	No
	8D	External encoder (EnDat) combination error	■ External encoder (EnDat) is out of applicable range.	-	No
Abnormality in encoder main body	A0	Absolute Encoder Internal Error 0	■ Encoder failure	DB	No
	A1	Absolute Encoder Internal Error 1	■ Encoder internal error	DB	Note 4)
	A2	Absolute Encoder Internal Error 2	■ Encoder internal error	DB	Note 4)
	A3	Absolute Encoder Internal Error 3	■ Encoder internal error	DB	Note 4)
	A4	Absolute Encoder Internal Error 4	■ Encoder internal error	DB	Note 4)
	A5	Absolute Encoder Internal Error 5	■ Encoder internal error	DB	Note 4)
	A6	Absolute Encoder Internal Error 6	■ Encoder internal error	DB	Note 4)
	A9	Absolute Encoder Internal Error 9	■ Encoder internal error	DB	Note 4)
	AA	Absolute Encoder Internal Error 10	■ Encoder internal error	DB	Note 4)
	AC	Absolute Encoder Internal Error 12	■ Encoder internal error	DB	Note 4)
	AD	Absolute Encoder Internal Error 13	■ Encoder internal error	DB	Note 4)
	AF	Absolute Encoder Internal Error 15	■ Encoder internal error	DB	Note 4)

	Alarm code	Alarm name	Alarm contents	Detection Operations	Alarm reset
External abnormality in encoder main body	B0	External Absolute Encoder Internal Error 0	■ Encoder failure	DB	No
	B1	External Absolute Encoder Internal Error 1	■ Encoder internal error	DB	Note 4)
	B2	External Absolute Encoder Internal Error 2	■ Encoder internal error	DB	Note 4)
	B3	External Absolute Encoder Internal Error 3	■ Encoder internal error	DB	Note 4)
	B4	External Absolute Encoder Internal Error 4	■ Encoder internal error	DB	Note 4)
	B5	External Absolute Encoder Internal Error 5	■ Encoder internal error	DB	Note 4)
	B6	External Absolute Encoder Internal Error 6	■ Encoder internal error	DB	Note 4)
	B7	External Absolute Encoder Internal Error 7	■ Encoder internal error	DB	Note 4)
	B8	External Absolute Encoder Internal Error 8	■ Encoder internal error	DB	Note 4)
	B9	External Absolute Encoder Internal Error 9	■ Encoder internal error	DB	Note 4)
	BA	External Absolute Encoder Internal Error 10	■ Encoder internal error	DB	Note 4)
	BB	External Absolute Encoder Internal Error 11	■ Encoder internal error	DB	Note 4)
	BC	External Absolute Encoder Internal Error 12	■ Encoder internal error	DB	Note 4)
	BD	External Absolute Encoder Internal Error 13	■ Encoder internal error	DB	Note 4)
	BE	External Absolute Encoder Internal Error 14	■ Encoder internal error	DB	Note 4)
	BF	External Absolute Encoder Internal Error 15	■ Encoder internal error	DB	Note 4)

	Alarm code	Alarm name	Alarm contents	Detection Operations	Alarm reset
Control system abnormality	C1	Over-speed	■ Motor rotation speed reaches 120 % of the highest speed limit.	DB	Yes
	C2	Velocity Control Error	■ Torque command and acceleration direction are not matching.	DB	Yes
	C3	Velocity Feedback Error	■ Servo motor power disconnection Note 5)	DB	Yes
	C5	Model tracking vibration suppression control error	■ Operation pattern is not match with model tracking vibration suppression control.	DB	Yes
	D1	Excessive Position Deviation	■ Position Deviation exceeds setup value.	DB	Yes
	D2	Faulty Position Command Pulse Frequency 1	■ Frequency of entered position command pulse is excessive	SB	Yes
	D3	Faulty Position Command Pulse Frequency 2	■ Position command frequency after electronic gear is high.	SB	Yes
	D4	Axes-sync error excess Note 10)	■ Position deviation error between own axis and counterpart axis exceeds setting value.	DB	Yes
	D5	Dual position error excess Note 10)	■ The difference of servo motor position and load position exceeds the setting value.	DB	Yes
	D6	Dual position error feedback error Note 10)	■ The motor encoder frequency after feedback electronic gear is too high.	DB	Yes
	D7	Amplifier communication error Note 10)	■ Amplifier communication error during axes-sync operation	DB	No
	DF	Test Run Close Note 6)	■ Detection in ‘Test mode end’ status	DB	Yes
Control system/Memory system abnormality	E1	Memory Error 1	■ Abnormality of amplifier with built-in EEPROM	DB	No
	E2	Memory Error 2	■ Error in check sum of EEPROM (entire area)	–	No
	E3	CPU error 1	■ Access error in CPU built in RAM	–	No
	E4	CPU error 2	■ Checksum error of FLASH memory with built in CPU	–	No
	E5	System Parameter Error 1	■ System parameter is outside a setting range.	–	No
	E6	System Parameter Error 2	■ The combination of a system parameter is abnormal.	–	No
	E7	Motor Parameter Error	■ Setup of a motor parameter is abnormal.	–	No
	E8	Control circuit error 1	■ Access abnormality in CPU to ASIC	–	No
	E9	Control circuit error 2	■ Abnormalities of control circuit.	–	No
	EA	Memory Error 3	■ Abnormality of FLASH memory in servo amplifier.	SB	No
	EB	Control circuit error 3	■ Abnormalities of control circuit.	–	No
	EE	Motor Parameter Automatic Setting Error 1	■ Motor parameter automatic setting function cannot be performed.	–	No
	EF	Motor Parameter Automatic Setting Error 2	■ The result of motor parameter automatic setting is abnormal.	–	No
	F1	Task Process Error	■ Error in interruption process of CPU	DB	No
	F2	Initial Process Time-Out	■ Initial process does not end within initial process time	–	No
	F3	CPU error 3	■ Abnormality of CPU setting	–	No

8.2.3 Alarm list (Additional for Positioning function built-in servo amplifier)

	Alarm code	Alarm name	Alarm contents	Detection Operations	Alarm reset
Abnormality related to communication	01	Host communication timeout	■ Host communication timeout error	DB	Yes
Abnormality related to load	31	Positive overtravel	■ Positive overtravel condition	DB	Yes
	32	Negative overtravel	■ Negative overtravel condition	DB	Yes

Note 1) When the main power voltage increases or decreases gradually or is suspended, main circuit low voltage or main power failed phase may be detected.
Note 2) Control power supply under-voltage or servo ready OFF is detected during instantaneous break of 1.5 to 2 cycles. Detection of control power supply under-voltage and servo ready OFF can be delayed by setting larger value of Group B ID16 ”Power Failure Detection Delay Time [PFDDLY]”.
Note 3) When moment cutting of a control power source is long, it regards in power supply interception and re-input, and does not leave detected control power supply under-voltage to an alarm history. (If cutting exceeds 1 second at the moment, it will be certainly judged as power supply interception.)
Note 4) Due to abnormality in encoder main body, encoder clear may sometimes be needed. “An encoder clear and the alarm reset method“ change with motor encoders in use. Please refer to “8.4 Encoder clear and the alarm reset method. “
Note 5) When there is a rapid motor slow down simultaneous with servo ON, there is a possibility that a break in the motor’s power line cannot be detected.
Note 6) Alarm that occurs in ‘Test mode end’ status is not recorded in the alarm history.
Note 7) When encoder connector EN2 is used as motor encoder input, "Alarm reset" is "No". When encoder connector EN2 is used as external encoder input, "Alarm reset" is "Yes".
Note 8) For the servo amplifier with functional safety module, all alarms are treated as diagnosis function, so Safe Torque Off function is performed simultaneously with alarm occurring. That is reason why Safe Torque Off state continues after alarm resetting. To start operation again, turn off the servo ON input and return to servo ready state.
Note 9) Alarm code "01" is detected with serial interface type only.
Note 10) For a positioning function built-in servo amplifier, D4 to D7 alarm are not occurred.

8.3 Troubleshooting when alarm activated

8.3.1 Alarm display

When an alarm occurs, the display shows the alarm code and the servo amplifier status code.

Display	Description
AL.85 *	Take appropriate action based on "8.3.2 Corrective action for alarm".

Servo amplifier status code

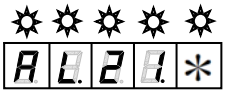
Alarm code

■ Status code

Code	Status	
1	Power OFF status	(P-OFF)
2	Power ON status	(P-ON)
3	Servo ready status	(S-RDY)
4	Servo ON status	(S-ON)
5	Servo OFF status	(S-OFF)
6	Emergency stop status	(EMR)
F	Initial status	

8.3.2 Corrective action for alarm

■ Alarm code 21 (Main Circuit Power Device Error)



Status at the time of alarm	Cause			
	1	2	3	4
Issued when control power is turned ON.	✔		✔	✔
Issued at input of servo ON.	✔	✔	✔	
Issued while starting and stopping the servo motor.	✔	✔	✔	
Issued after operation for some time.	✔	✔	✔	✔

◆ Corrective actions

	Cause	Investigation and corrective actions
1	■ Short circuit is there at U/V/W-phases of amplifier, or wiring between amplifier and motor. Otherwise, U/V/W-phases are grounded to the earth.	■ Check the wiring conditions and correct it if improper.
2	■ Short circuit or earth fault in U/V/W phases on servo motor side.	■ Replace the servo motor.
3	■ Defect in internal circuit of servo amplifier.	■ Replace the servo amplifier.
4	■ Overheating detection of the main circuit power device functioned. (50A or more of models only)	■ Confirm temperature in cabinet (or ambient of the amplifier), then refine installation method of the servo amplifier and ventilation of the cabinet.

8. Maintenance

■ Alarm code 22 (Current Detection Error 0)



Status at the time of alarm	Cause	
	1	2
Issued at input of servo ON.	✔	✔

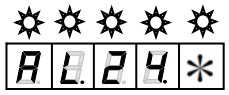
◆ Corrective actions

	Cause	Investigation and corrective actions
1	■ Defect in internal circuit of servo amplifier.	■ Replace the servo amplifier.
2	■ Servo amplifier and motor are not combined properly.	■ Check that the servo motor is fit to the motor code, if not, change motor correctly.

■ Alarm code 23 (Current Detection Error 1)



■ Alarm code 24 (Current Detection Error 2)



Status at the time of alarm	Cause	
	1	2
Issued during operation.	✔	✔

◆ Corrective actions

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

■ Alarm code 25 (Safe Torque Off error 1)



Status at the time of alarm	Cause	
	1	2
Occurred in about 10 sec. after control power turned on.	✔	✔
Occurred during operation.	✔	

◆ Corrective actions

	Cause	Investigation and corrective actions
1	■ Discrepancy of the input logic level between /HWGOFF1 and /HWGOFF2.	■ Match the input logic level of /HWGOFF1 and /HWGOFF2. ■ Check the wiring of both the HWGOFF1 and /HWGOFF2 signals, and correct the wiring if needed. ■ After switching the logic level of either /HWGOFF1 or /HWGOFF2 signal, make sure to switch the logic of the other signal also within 10 seconds.
2	■ Defect in internal circuit of servo amplifier.	■ Replace the servo amplifier.

8.3 Troubleshooting when alarm activated

■ Alarm code 26 (Safe Torque Off error 2)

Status at the time of alarm	Cause	
	1	2
Occurred when control power is turned on.	✔	✔
Occurred during the operation.		✔



◆ Corrective actions

	Cause	Investigation and corrective actions
1	■ Defect in internal circuit of servo amplifier.	■ Replace the servo amplifier.
2	■ Malfunction due to noise.	■ Check grounding of the amplifier. ■ Take care of noise by adding ferrite core etc.

■ Alarm code 27 (Fan stop)

Status at the time of alarm	Cause	
	1	2
Occurred during the operation.	✔	✔

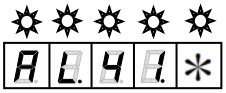


◆ Corrective actions

	Cause	Investigation and corrective actions
1	■ Defect in internal circuit of servo amplifier.	■ Replace the servo amplifier.
2	■ The end of fan life.	■ Replace the cooling fan.

8. Maintenance

■ Alarm code 41 (Overload 1)



Status at the time of alarm	Cause								
	1	2	3	4	5	6	7	8	9
Issued at input of servo ON.	✔	✔							✔
After command input, issued without rotating the motor.		✔			✔	✔	✔		✔
After command input, brief motor rotation			✔	✔	✔		✔	✔	

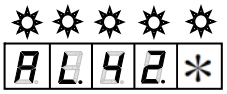
◆ Corrective actions

	Cause	Investigation and corrective actions
1	■ Defect in internal circuit of servo amplifier.	■ Replace the servo amplifier.
2	■ Defect in internal circuit of motor encoder.	■ Replace the servo motor.
3	■ Effective torque exceeds the rated torque.	■ Monitor the load status using the monitor function ID41 Effective torque monitor [TRMS]", and check if effective torque exceeds the rated value. Or, calculate the motor effective torque from load conditions and operation conditions. If the effective torque is excessive, check the operation or load condition, or replace to the capacity of the large motor.
4	■ Defect in servo motor and servo amplifier combination.	■ Check if the motor in use matches with the recommended type, and replace if it is improper.
5	■ Holding brake of servo motor has not released.	■ Check that the wiring and voltage of the holding brake are correct; if not, correct it. If the above are OK, replace the servo motor.
6	■ Wiring of U/V/W −phase between servo amplifier and motor is wrong.	■ Check the wiring conditions and correct it if improper.
7	■ One or all connections of U/V/W -phase wiring of servo amplifier / motor is disconnected.	■ Check the wiring conditions and correct it if improper.
8	■ Application collided to something.	■ Check the operating conditions and limit switch.
9	■ Motor encoder resolution setting does not match with the servo motor.	■ Set correct value depending on actual motor encoder to the System parameter ID15 "Absolute encoder resolution" or the System parameter ID17 "Incremental encoder resolution".

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

8.3 Troubleshooting when alarm activated

■ Alarm code 42 (Overload 2)



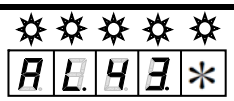
Status at the time of alarm	Cause										
	1	2	3	4	5	6	7	8	9	10	11
Issued at input of servo ON.	✔	✔							✔		
After command input, issued without rotating the servo motor.		✔			✔	✔	✔		✔	✔	✔
After command input, brief motor rotation.			✔	✔	✔		✔	✔			

◆ Corrective actions

	Cause	Investigation and corrective actions
1	■ Defect in internal circuit of servo amplifier.	■ Replace the servo amplifier.
2	■ Defect in internal circuit of motor encoder.	■ Replace the servo motor.
3	■ Rotation is less than 50min^{-1} and torque command exceeds approx. 2 times of rated torque.	■ Check if torque command exceeds approx. 2 times of the rated torque by the monitor function ID18 "Torque command monitor [TCMON]". If any of the conditions (load condition when motor stops, operation condition at low velocity, and static load condition) exceed twice of rated torque, review an operation or load condition. Or replace with larger sized servo motor.
4	■ Defect in servo motor and servo amplifier combination.	■ Check if the motor in use matches with the recommended type, and replace if it is improper.
5	■ Holding brake of servo motor has not released.	■ Check that the wiring and voltage of the holding brake are correct; if not, correct it. If the above are OK, replace the servo motor.
6	■ Wiring of U/V/W −phase between servo amplifier and motor is wrong.	■ Check the wiring conditions and correct it if improper.
7	■ One or all connections of U/V/W -phase wiring of servo amplifier / motor is disconnected.	■ Check the wiring conditions and correct it if improper.
8	■ Application collided to something.	■ Check the operating conditions and limit switch.
9	■ Motor encoder resolution setting does not match with the servo motor.	■ Set correct value depending on actual motor encoder to the System parameter ID15 "Absolute encoder resolution" or the System parameter ID17 "Incremental encoder resolution".
10	■ Rotation directions of 2 axes are different, in the tandem operation.	■ Set "04: PC-_VC+_TC+" to Group8 ID00 "Position, Velocity, Torque Command Input Polarity". Change to "01: Reversed ", in Group8 ID00 "Position, Velocity, Torque Command Input Polarity".
11	■ Wiring of servo motor and encoder is wrong, in the tandem operation.	■ Check the wiring and fix if wrong.

8. Maintenance

■ Alarm code 43 (Regenerative Overload)



Status at the time of alarm	Cause							
	1	2	3	4	5	6	7	8
Issued when control power supply is turned ON.							✔	
Issued when main circuit power supply is turned ON.		✔	✔	✔		✔	✔	✔
Issued during operation.	✔			✔	✔		✔	

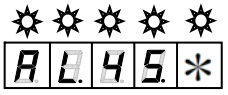
◆ Corrective actions

	Cause	Investigation and corrective actions
1	■ Exceeds a permitted value of the regenerative power at built-in regenerative resistance model. ■ Excessive load inertia moment, or tact time is short.	■ Check the load and operating conditions. ■ Change to external regenerative resistor. ■ Set to be the load inertia moment within the specified range. ■ Increase the deceleration time. ■ Increase the tact time.
2	■ Regenerative resistor is connected to the model without regenerative resistor.	■ Remove regenerative resistor.
3	■ Resistor wiring is wrong at built-in or external regenerative resistor model.	■ Check the wiring conditions and correct it if improper.
4	■ Regenerative resistor wire breaks.	■ For built-in regeneration resistor specifications, replace the servo amplifier. ■ For external regeneration resistor specifications, replace the regeneration resistor.
5	■ Resistance value of external regenerative resistor is excessive.	■ Replace to the resister that matching the specifications.
6	■ Input power supply voltage exceeds the specified range.	■ Check the input power supply voltage level.
7	■ Defect in internal circuit of servo amplifier.	■ Replace the servo amplifier.
8	■ External regenerative resistor does not connect although "02: External_R" is set in the system parameter ID03 "Regenerative resistor selection".	■ Connect external regenerative resistor. ■ Set "00: Not_connect" in the system parameter ID03 "Regenerative resistor selection".

* If the setting of system parameter ID03 “Regenerative Resistor Selection” is incorrect, regeneration overload is not detected properly, and the amplifier and surrounding circuit may be damaged or burnt.

■ Alarm code 45 (Average continuous over speed)

Status at the time of alarm	Cause
	1
Occurred during operation.	✔



◆ Corrective actions

	Cause	Investigation and corrective actions
1	■ The average speed exceeds the maximum speed of continuous rotation speed range.	■ Review the operating conditions. ■ Resize the servo motor.

8.3 Troubleshooting when alarm activated

■ Alarm Code 52 (In-rush prevention resistance Overheat)

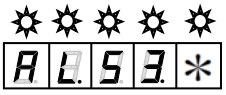


Status at the time of alarm	Cause		
	1	2	3
Issued when control power supply is turned ON.	✔		
Issued when main circuit power supply is turned ON.		✔	
Issued during operation.			✔

◆ Corrective actions

	Cause	Investigation and corrective actions
1	■ Defect in internal circuit of servo amplifier.	■ Replace the servo amplifier.
2	■ Power turning ON is repeated too frequently.	■ Turn ON/OFF the power less frequently.
3	■ Ambient temperature is high.	■ Confirm temperature in cabinet (or ambient of the amplifier), then refine installation method of the servo amplifier and ventilation of the cabinet.

■ Alarm Code 53 (Dynamic Brake Resistor Overheat)



Status at the time of alarm	Cause	
	1	2
Issued when control power supply is turned ON..	✔	
Issued during operation.	✔	✔

◆ Corrective actions

	Cause	Investigation and corrective actions
1	■ Defect in internal circuit of servo amplifier.	■ Replace the servo amplifier.
2	■ Dynamic Brake operation is repeated too frequently.	■ Use the dynamic brake so as not to exceed the permissive frequency.

8. Maintenance

■ Alarm Code 54 (Built-in Regenerative Resistance Overheat)



Status at the time of alarm	Cause		
	1	2	3
Issued when control power supply is turned ON.	✔		✔
Issued during operation.	✔	✔	✔

◆ Corrective actions

	Cause	Investigation and corrective actions
1	■ Defect in internal circuit of servo amplifier.	■ Replace the servo amplifier.
2	■ Regenerative power excessive.	■ Check the built-in regenerative resistor allowable power. ■ Check the operating conditions to keep that consumption power is below of allowable power. ■ Use an external regenerative resistor.
3	■ Resistor wiring is wrong at built-in regenerative resistor model.	■ Check the wiring conditions and correct it if improper.

* When using a regenerative resistor built in the servo amplifier, make sure to set “01: Built-in_R“ at the system parameter ID03 “Regenerative Resistor Selection”. This setting decides enabled/disabled of the overheating protection detection treatment of the built-in regeneration resistance.

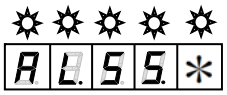
* Built-in regenerative resistance overheat does not detected when “02 External_R“ is selected. Therefore, there is a danger that built-in regenerative resistance will burn out or be damaged.

8.3 Troubleshooting when alarm activated

■ Alarm Code 55 (External Error)

When host device or thermal output signal of external regenerative resistor are not connected

Status at the time of alarm	Cause	
	1	2
Issued when control power is turned ON.	✔	✔



◆ Corrective actions

	Cause	Investigation and corrective actions
1	■ Validity condition for external trip function is set to ‘Valid’.	■ When not used, set "00:_Always_Disable” at Group9 ID40 "External Trip Input Function [EXT-E]".
2	■ Defect in internal circuit of servo amplifier.	■ Replace the servo amplifier.

When thermal signal of the external regenerative resistor is connected

Status at the time of alarm	Cause		
	1	2	3
Issued when control power is turned ON.	✔		✔
Issued after operation for some time.		✔	✔

◆ Corrective actions

	Cause	Investigation and corrective actions
1	■ Improper wiring of external regenerative resistance.	■ Check the wiring conditions and correct it if improper.
2	■ External regenerative resistor is operating.	■ Check the operating conditions. ■ Increase the capacity of the external regeneration resistor.
3	■ Defect in internal circuit of servo amplifier.	■ Replace the servo amplifier.

* When output terminal of upper level device is connected, eliminate the alarm trigger of the host level device.

8. Maintenance

■ Alarm Code 56 (Servo Amplifier Temperature Error)



Status at the time of alarm	Cause			
	1	2	3	4
Issued when control power is turned ON.	✔		✔	✔
Issued at input of servo ON.	✔	✔	✔	
Issued while starting and stopping the servo motor.	✔	✔	✔	
Issued after operation for some time.	✔	✔	✔	✔

◆ Corrective actions

	Cause	Investigation and corrective actions
1	■ U/V/W-phase of amplifier is short circuited due to the wiring in amplifier and motor. Or, U/V/W-phases have earth fault.	■ Check the wiring conditions and correct it if improper.
2	■ Short circuit or earth fault of U/V/W phases, at servo motor side.	■ Replace the servo motor.
3	■ Defect in internal circuit of servo amplifier.	■ Replace the servo amplifier.
4	■ Ambient temperature is high.	■ Confirm temperature in cabinet (or ambient of the amplifier), then refine installation method of the servo amplifier and ventilation of the cabinet to keep 55℃ or lower of ambient temperature.

* This temperature is measured at the point very near to driving module.
It is different from measurement point of temperature monitor for R ADVANCED MODEL (at the point near to control IC of control board).

■ Alarm Code 61 (Over-Voltage)



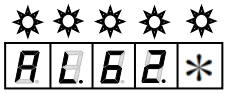
Status at the time of alarm	Cause			
	1	2	3	4
Issued when control power is turned ON.	✔			
Issued when main circuit power supply is turned ON.	✔	✔		
Issued while starting and stopping the servo motor.		✔	✔	✔

◆ Corrective actions

	Cause	Investigation and corrective actions
1	■ Defect in internal circuit of servo amplifier.	■ Replace the servo amplifier.
2	■ The power supply voltage of main circuit is out of the specification.	■ Reduce the power supply voltage to within the specified range.
3	■ Excessive load inertia moment.	■ Reduce the load inertia moment to within the specified range.
4	■ Incorrect wiring of regenerative resistor. ■ Built-in regenerative circuit is not functioning.	■ Wire the regenerative resistor correctly. ■ Check the wiring and resistance value if using the external regenerative resistor. ■ Replace the servo amplifier if any abnormality occurs after countermeasure above.

8.3 Troubleshooting when alarm activated

■ Alarm Code 62 (Main Circuit Under-voltage)



Status at the time of alarm	Cause				
	1	2	3	4	5
Issued when control power is turned ON.				✔	✔
Issued when main circuit power supply is turned ON.	✔	✔	✔		
Issued during operation.		✔	✔		

◆ Corrective actions

	Cause	Investigation and corrective actions
1	■ Input power supply voltage is below the specified range.	■ Check the power supply and set it within the specified range.
2	■ Rectifier of main circuit is broken.	■ Replace the servo amplifier.
3	■ Input power supply voltage is reduced, or instantaneous power interruption is occurred.	■ Check the power supply, and confirm that there is no instantaneous power interruption or low voltage.
4	■ Low voltage outside of the specified range is supplied to the main circuit (R/S/T).	■ Check the main circuit voltage. Confirm that there is no external power supply to R/S/T when the main circuit is OFF.
5	■ Defect in internal circuit of servo amplifier.	■ Replace the servo amplifier.

■ Alarm Code 63 (Main Power Supply phase loss)

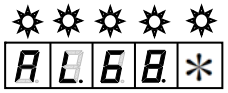


Status at the time of alarm	Cause		
	1	2	3
Issued when control power is turned ON.		✔	
Issued when main circuit power supply is turned ON	✔	✔	✔
Issued during operation.	✔	✔	

◆ Corrective actions

	Cause	Investigation and corrective actions
1	■ One of 3 phases (R/S/T) is not connected.	■ Check the wiring conditions and correct it if improper.
2	■ Defect in internal circuit of servo amplifier.	■ Replace the servo amplifier.
3	■ Servo amplifier is not specified for single phase.	■ Change the system parameter ID01 " Main circuit power input type" to ”01：AC_Single-phase”.

■ Alarm Code 68 (Main circuit voltage detection error)



Status at the time of alarm	Cause
	1
Issued when control power is turned ON.	✔

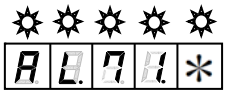
◆ Corrective actions

	Cause	Investigation and corrective actions
1	■ Defect in internal circuit of servo amplifier.	■ Replace the servo amplifier.

8. Maintenance

■ Alarm Code 71 (Control Power Supply Under-voltage)

Status at the time of alarm	Cause		
	1	2	3
Issued when control power is turned ON.	✔	✔	
Issued during operation.	✔		✔

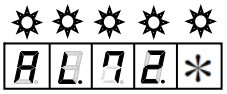


◆ Corrective actions

	Cause	Investigation and corrective actions
1	■ Defect in internal circuit of servo amplifier.	■ Replace the servo amplifier.
2	■ Input power supply voltage is below the specified range.	■ Confirm that the power supply is set within the specified range.
3	■ Input power supply voltage is fluctuating or having phase loss.	■ Confirm power supply to avoid phase loss or voltage reduction.

■ Alarm Code 72 (Control Circuit voltage reduction 1)

Status at the time of alarm	Cause	
	1	2
Issued when control power is turned ON.	✔	✔

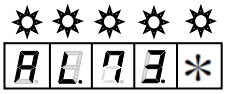


◆ Corrective actions

	Cause	Investigation and corrective actions
1	■ Defect in internal circuit of servo amplifier.	■ Replace the servo amplifier.
2	■ Defect in external circuit.	■ Restart the power supply after removing the connector: CN1. Check the external circuit if alarm is not issued.

■ Alarm Code 73 (Control Circuit voltage reduction 2)

Status at the time of alarm	Cause	
	1	2
Issued when control power is turned ON.	✔	✔

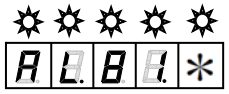


◆ Corrective actions

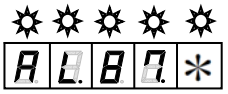
	Cause	Investigation and corrective actions
1	■ Defect in internal circuit of servo amplifier.	■ Replace the servo amplifier.
2	■ Defect in external circuit.	■ Restart the power supply after removing the connector: CN1. Check the external circuit if alarm is not issued. ■ Restart the power supply after replacing the servo motor; if alarm is not issued, there is defect in internal circuit of motor encoder. Replace the servo motor.

8.3 Troubleshooting when alarm activated

■ Alarm Code 81 (Encoder Connector 1 Disconnection)



■ Alarm Code 87 (CS Signal Disconnection)

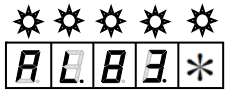


Status at the time of alarm	Cause			
	1	2	3	4
Issued when control power is turned ON.	✔	✔	✔	✔
Issued during operation.	✔		✔	✔

◆ Corrective actions

	Cause	Investigation and corrective actions
1	■ For motor encoder wiring: ◆ Improper wiring. ◆ Connector is removed. ◆ Loose connection. ◆ Encoder cable is too long. ◆ Encoder cable is too thin.	■ Check the wiring conditions and correct it if improper. ■ Confirm that the encoder power supply voltage at the motor side is above 4.75 V, correct it if improper.
2	■ Servo amplifier and motor encoder are not combined properly.	■ Replace with servo motor equipped with proper encoder.
3	■ Defect in internal circuit of servo amplifier.	■ Replace the servo amplifier.
4	■ Defect in internal circuit of motor encoder.	■ Replace the servo motor.

■ Alarm Code 83 (Encoder Connector 2 Disconnection)



[Use of EN1 with motor encoder in the semi-closed system]

Status at the time of alarm	Cause	
	1	2
Issued when control power is turned ON.	✔	✔

◆ Corrective actions

	Cause	Investigation and corrective actions
1	■ Parameter setting is for full-closed system.	■ Change the system parameter ID20 to "00:Motor_Enc".
2	■ EN2 is selected as encoder connector. (In case of that the 8th digit of servo amplifier model number (encoder type) is "2".)	■ Change the system parameter ID10 to "00:EN1".

[Use of EN2 with motor encoder in the semi-closed system]

Status at the time of alarm	Cause			
	1	2	3	4
Issued when control power is turned ON.	✔	✔	✔	✔
Issued during operation.	✔		✔	✔

◆ Corrective actions

	Cause	Investigation and corrective actions
1	■ For motor encoder wiring: ◆ Improper wiring. ◆ Connector is removed. ◆ Loose connection. ◆ Encoder cable is too long. ◆ Encoder cable is too thin.	■ Check the wiring conditions and correct it if improper. ■ Confirm that the encoder power supply voltage at the motor side is above 4.75 V, correct it if improper.
2	■ Servo amplifier and motor encoder are not combined properly.	■ Replace with servo motor equipped with proper encoder.
3	■ Defect in internal circuit of servo amplifier.	■ Replace the servo amplifier.
4	■ Defect in internal circuit of motor encoder.	■ Replace the servo motor.

[Use of EN2 with external encoder]

Status at the time of alarm	Cause			
	1	2	3	4
Issued when control power is turned ON.	✔	✔	✔	✔
Issued during operation.	✔		✔	✔

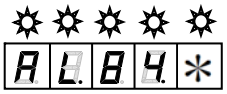
◆ Corrective actions

	Cause	Investigation and corrective actions
1	■ For external encoder wiring, ◆ Improper wiring. ◆ Connector is removed. ◆ Loose connection. ◆ Encoder cable is too long. ◆ Encoder cable is too thin.	■ Check the wiring conditions and correct it if improper. ■ Confirm that the power supply voltage for the external encoder is above 4.75 V, and correct it if improper.
2	■ Turn-on timing of external encoder power is delayed.	■ Confirm that the power supply voltage for the external encoder soon after turning on control power, and bring forward the timing of turning on the power for external encoder if it is not established.
3	■ Defect in internal circuit of servo amplifier.	■ Replace the servo amplifier.
4	■ Defect in internal circuit of motor encoder.	■ Replace the servo motor.

8.3 Troubleshooting when alarm activated

■ Alarm Code 84 (Absolute Encoder Communication Error)

Status at the time of alarm	Cause		
	1	2	3
Issued when control power is turned ON.	✔	✔	✔
Issued during operation.		✔	

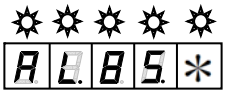


◆ Corrective actions

	Cause	Investigation and corrective actions
1	■ Defect in internal circuit of motor encoder.	■ Replace the servo motor.
2	■ Malfunction due to noise.	■ Confirm proper grounding of the amplifier. ■ Check the shielding of the encoder cable. ■ Add ferrite core or similar countermeasures to against noise.
3	■ Motor encoder wiring has abnormalities.	■ Check the wiring conditions and correct it if improper.

■ Alarm Code 85 (Encoder Initial Process Error)

Status at the time of alarm	Cause				
	1	2	3	4	5
Issued when control power is turned ON.	✔	✔	✔	✔	✔

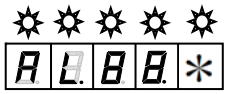


◆ Corrective actions

	Cause	Investigation and corrective actions
1	■ For motor encoder wiring: ◆ Improper wiring. ◆ Connector is removed. ◆ Loose connection. ◆ Encoder cable is too long. ◆ Encoder cable is too thin.	■ Check the wiring conditions and correct it if improper. ■ Confirm that the encoder power supply voltage at the motor side is above 4.75 V, and correct it if improper.
2	■ Servo amplifier and motor encoder are not combined properly.	■ Replace with servo motor equipped with proper encoder.
3	■ Defect in internal circuit of servo amplifier.	■ Replace the servo amplifier.
4	■ Defect in internal circuit of motor encoder.	■ Replace the servo motor.
5	■ Initial position data could not be set because the number of rotations of the motor is more than 250 min^{-1} when power has been supplied.	■ Restart the power supply after motor is stopped. (Only when absolute encoder is used.)

8. Maintenance

■ Alarm Code 88 (External Absolute Encoder Communication Error)

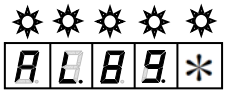


Status at the time of alarm	Cause			
	1	2	3	4
Issued when control power is turned ON.	✔	✔	✔	
Issued during operation.		✔		✔

◆ Corrective actions

	Cause	Investigation and corrective actions
1	■ Defect in internal circuit of external encoder.	■ Replace the external encoder.
2	■ Malfunction due to noise.	■ Confirm proper grounding of the amplifier. ■ Check the shielding of the encoder cable. ■ Add ferrite core or similar countermeasures to against noise.
3	■ External encoder wiring has abnormalities.	■ Check the wiring conditions and correct it if improper.
4	■ External encoder power supply voltage reduction.	■ Confirm that the external encoder power supply voltage is above 4.75V, and correct it if improper.

■ Alarm Code 89 (External Encoder Initial Process Error)



Status at the time of alarm	Cause			
	1	2	3	4
Issued during operation.	✔	✔	✔	✔

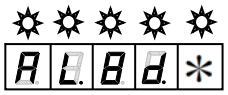
◆ Corrective actions

	Cause	Investigation and corrective actions
1	■ For external encoder wiring: ◆ Improper wiring. ◆ Connector is removed. ◆ Loose connection. ◆ Encoder cable is too long. ◆ Encoder cable is too thin.	■ Check the wiring conditions and correct it if improper. ■ Confirm that the encoder power supply voltage at the motor side is above 4.75 V, and correct it if improper.
2	■ Turn-on timing of external encoder power is delayed.	■ Confirm that the power supply voltage for the external encoder soon after turning on control power, and bring forward the timing of turning on the power for external encoder if it is not established.
3	■ Defect in internal circuit of servo amplifier.	■ Replace the servo amplifier.
4	■ Defect in internal circuit of external encoder.	■ Replace the external encoder.

8.3 Troubleshooting when alarm activated

■ Alarm Code BD (External encoder (EnDat) combination error)

Status at the time of alarm	Cause
	1
Issued when control power is turned ON.	✔

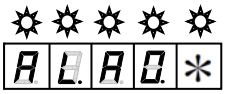


◆ Corrective actions

	Cause	Investigation and corrective actions
1	■ Combined external encoder is not apply to servo amplifier.	■ Replace to our recommended encoder. (Refer the section 9.1.3 in main manual.)

■ Alarm Code A0 (Absolute Encoder Internal Error 0)

Status at the time of alarm	Cause	
	1	2
Issued when control power is turned ON.	✔	✔
Issued during operation.	✔	✔

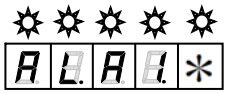


◆ Corrective actions

	Cause	Investigation and corrective actions
1	■ Defect in internal circuit of motor encoder.	■ Turn ON the power supplies again, if not corrected, replace the servo motor.
2	■ Malfunction due to noise.	■ Confirm proper grounding of the amplifier. ■ Check the shielding of the encoder cable. ■ Add ferrite core or similar countermeasures to against noise.

8. Maintenance

■ Alarm Code A1 (Absolute Encoder Internal Error 1)



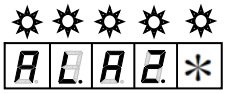
Status at the time of alarm	Cause			
	1	2	3	4
Issued when control power is turned ON.	✔	✔		
Issued during operation.			✔	✔

◆ Corrective actions

	Cause	Investigation and corrective actions
1	■ Loose connection of battery cable.	■ Check the battery connector of encoder cable attachment.
2	■ Battery voltage reduction.	■ Check the voltage of battery.
3	■ Loose connection of encoder connector.	■ Check the wiring conditions and correct it if improper.
4	■ Defect in internal circuit of motor encoder.	■ Turn ON the power supplies again, if not corrected, replace the servo motor.

* “Encoder clear and alarm reset methods“ vary depending on the motor encoder in use. Please refer to "8.6 Encoder Clear and Alarm Reset Methods".

■ Alarm Code A2 (Absolute Encoder Internal Error 2)



Status at the time of alarm	Cause		
	1	2	3
Issued while stopping the servo motor.	✔	✔	
Issued while rotating the servo motor.	✔	✔	✔

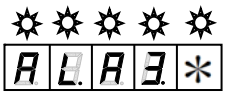
◆ Corrective actions

	Cause	Investigation and corrective actions
1	■ Defect in internal circuit of motor encoder.	■ Turn ON the power supplies again, if not corrected, replace the servo motor.
2	■ Malfunction due to noise.	■ Confirm proper grounding of the amplifier. ■ Check the shielding of the encoder cable. ■ Take care of noise by adding ferrite core etc.
3	■ Motor acceleration exceeds the permitted value.	■ Check the operation condition and increase the accel/decel time.

* “Encoder clear and alarm reset methods“ vary depending on the motor encoder in use. Please refer to "8.6 Encoder Clear and Alarm Reset Methods".

8.3 Troubleshooting when alarm activated

■ Alarm Code A3 (Absolute Encoder Internal Error 3)



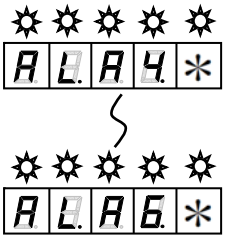
Status at the time of alarm	Cause		
	1	2	3
Issued when control power is turned ON.	✔		✔
Issued while stopping the servo motor.	✔	✔	
Issued while rotating the servo motor.	✔	✔	✔

◆ Corrective actions

	Cause	Investigation and corrective actions
1	■ Defect in internal circuit of motor encoder.	■ Turn ON the power supplies again, if not corrected, replace the servo motor.
2	■ Malfunction due to noise	■ Confirm proper grounding of the amplifier. ■ Check the shielding of the encoder cable. ■ Add ferrite core or similar countermeasures to against noise.
3	■ Motor rotation speed exceeds the permitted velocity.	■ Check the operation condition and reduce the maximum rotation speed.

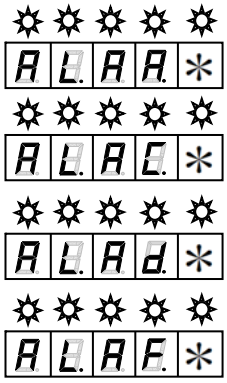
* “Encoder clear and alarm reset methods“ vary depending on the motor encoder in use. Please refer to "8.6 Encoder Clear and Alarm Reset Methods".

■ Alarm Code A4 to A6 (Absolute Encoder Internal Error 4 to 6)



■ Alarm Code AA, AC, AD, AF (Absolute Encoder Internal Error 10, 12, 13, 15)

Status at the time of alarm	Cause	
	1	2
Issued when control power is turned ON.	✔	
Issued during operation.	✔	✔



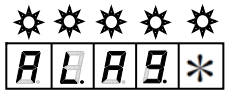
◆ Corrective actions

	Cause	Investigation and corrective actions
1	■ Defect in internal circuit of motor encoder.	■ Turn ON the power supplies again, if not corrected, replace the servo motor.
2	■ Malfunction due to noise	■ Confirm proper grounding of the amplifier. ■ Check the shielding of the encoder cable. ■ Add ferrite core or similar countermeasures to against noise.

* "Encoder clear and alarm reset methods" vary depending on the motor encoder in use. Please refer to "8.6 Encoder Clear and Alarm Reset Methods".

■ Alarm Code A9 (Absolute Encoder Internal Error 9)

Status at the time of alarm	Cause		
	1	2	3
Issued when control power is turned ON.	✔	✔	
Issued while stopping the servo motor.	✔	✔	
Issued while rotating the servo motor.		✔	✔



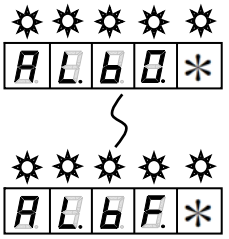
◆ Corrective actions

	Cause	Investigation and corrective actions
1	■ Defect in internal circuit of motor encoder.	■ Turn ON the power supplies again, if not corrected, replace the servo motor.
2	■ Servo motor is not generating heat, but encoder ambient temperature is too high.	■ Confirm that the cooling method keeps the motor encoder ambient temperature as below 80℃.
3	■ Servo motor is overheated.	■ Confirm the cooling procedure of the servo motor.

* "Encoder clear and alarm reset methods" vary depending on the motor encoder in use. Please refer to "8.6 Encoder Clear and Alarm Reset Methods".

8.3 Troubleshooting when alarm activated

■ Alarm Code B0 to BF (External absolute encoder Internal Error 0 to 15)

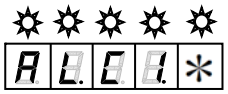


Status at the time of alarm	Cause	
	1	2
Issued when control power is turned ON.	✔	
Issued during operation.	✔	✔

◆ Corrective actions

	Cause	Investigation and corrective actions
1	■ Defect in internal circuit of external encoder.	■ Turn ON the power supplies again, if not corrected, replace the external encoder.
2	■ Malfunction due to noise	■ Confirm proper grounding of the amplifier. ■ Check the shielding of the encoder cable. ■ Add ferrite core or similar countermeasures to against noise.

■ Alarm Code C1 (Over-speed)

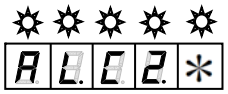


Status at the time of alarm	Cause				
	1	2	3	4	5
Issued when command is entered after Servo ON.	✔	✔			
Issued when the servo motor is started.			✔	✔	✔
Issued other than operating and starting the motor.		✔	✔		

◆ Corrective actions

	Cause	Investigation and corrective actions
1	■ Defect in internal circuit of servo amplifier.	■ Replace the servo amplifier.
2	■ Defect in internal circuit of motor encoder.	■ Replace the servo motor.
3	■ Excessive overshoot while starting.	■ Adjust the servo parameters. ■ Loose the slope of acceleration / deceleration command. ■ Reduce the load inertia moment, or change motor capacity.
4	■ Wiring of U/V/W −phase between servo amplifier and motor is wrong.	■ Check the wiring conditions and correct it if improper.
5	■ Wiring of A and B phase of Incremental encoder is wrong.	■ Check the wiring conditions and correct it if improper.

■ Alarm Code C2 (Velocity Control Error)



Status at the time of alarm	Cause			
	1	2	3	4
Issued while due to input of Servo ON.	✔		✔	
Issued when command has entered.	✔	✔	✔	
Issued while starting and stopping the servo motor.				✔

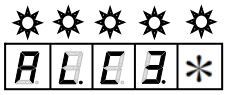
◆ Corrective actions

	Cause	Investigation and corrective actions
1	■ Wiring of U/V/W −phase between servo amplifier and motor is wrong.	■ Check the wiring conditions and correct it if improper.
2	■ Wiring of A and B phase of Incremental encoder is wrong.	■ Check the wiring conditions and correct it if improper.
3	■ The servo motor is vibrating (oscillating).	■ Adjust the servo parameters so that servo motor will not vibrate (oscillate).
4	■ Excessive overshoot and undershoot.	■ Adjust the servo parameters to reduce overshoot and undershoot. ■ Loose the slope of acceleration / deceleration command. ■ Change Group B ID14 "Velocity Control Alarm (ALM_C2) Detection" to "00: Disabled".

* Velocity control error alarm is set to "00:Disabled" as default because the alarm may be detected if it is available in case of accel/decel with large load inertia or vertical application. If its detection is needed, consult our representatives.

8.3 Troubleshooting when alarm activated

■ Alarm Code C3 (Velocity Feedback Error)

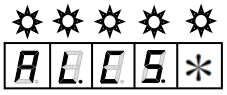


Status at the time of alarm	Cause		
	1	2	3
Issued when command has entered.	✔	✔	✔
Issued when control power is turned ON.		✔	

◆ Corrective actions

	Cause	Investigation and corrective actions
1	■ Motor is not rotating.	■ Check the wiring conditions of servo motor power line and correct it if improper. ■ Replace the servo motor.
2	■ Defect in internal circuit of servo amplifier.	■ Replace the servo amplifier.
3	■ The servo motor is vibrating (oscillating).	■ Adjust the servo parameters so that servo motor will not vibrate (oscillate).

■ Alarm Code C5 (Model Following Vibration Suppression Control Error)



Status at the time of alarm	Cause			
	1	2	3	4
Issued when position command pulse is entered.	✔	✔	✔	✔

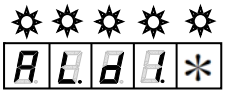
◆ Corrective actions

	Cause	Investigation and corrective actions
1	■ Setup of model control gain is high.	■ Lower model control gain.
2	■ The accel/decel time of a position command is short.	■ Loose the slope of acceleration / deceleration command.
3	■ Torque limiting value is low.	■ Enlarge a torque limit value, or disable a torque limitation.
4	■ Switched from the standard position control to the model following vibration suppression control.	■ Switch it at the state of servo motor stop.

* Other alarms are generated, and this alarm might be generated if a servo brake performs alarm reset during a slowdown.

8. Maintenance

■ Alarm Code D1 (Excessive Position Deviation)



Status at the time of alarm	Cause													
	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Issued when control power is turned ON.												✔		
Issued when servo ON and while motor stopping.						✔							✔	
Issued immediately after entering the command.	✔	✔	✔	✔	✔		✔	✔	✔	✔	✔		✔	
Issued during starting / stopping at high speed.	✔	✔					✔	✔	✔				✔	✔
Issued during the operations by lengthy command.		✔					✔	✔					✔	

◆ Corrective actions

	Cause	Investigation and corrective actions
1	■ Position command frequency is too high.	■ Correct the position command of the controller.
2	■ Excessive load inertia moment or low motor capacity.	■ Correct the load condition or increase the motor capacity.
3	■ Holding brake is not released.	■ Check the wiring conditions and correct it if improper. Replace the servo motor even brake is not released if brake is excited with proper voltage.
4	■ Application collided to something or locked mechanically.	■ Refine application system.
5	■ One or all phases of U/V/W -phase of the servo amplifier and motor has disconnected.	■ Check the wiring conditions and correct it if improper.
6	■ Motor is being rotated by an external force (Gravity, etc.) during stopping (positioning completion).	■ Check the load, or increase the servo motor capacity.
7	■ Valid torque limit command is entered by the controller, and its setting is too small. ■ Setting of a velocity limit command is too small. ■ Motor encoder pulse setting is not match with actual servo motor.	■ Enlarge a torque limit value, or disable a torque limitation. ■ Enlarge setting value of velocity limit command. ■ Sets a correct value to the system parameter ID15 "Absolute encoder resolution" or the system parameter ID17 "Incremental encoder resolution", for matching with servo motor encoder.
8	■ Settings of servo parameters (Position Loop Gain, etc.) are not appropriate.	■ Adjust the servo parameter settings (Raise the position loop gain, etc.).
9	■ Setting of a excessive position deviation is too small.	■ Set a value larger of GroupB ID11 "Deviation Counter Overflow Value".
10	■ Rotation directions of 2 axes are different, in the tandem operation.	■ Set "04: PC-_VC+_TC+" to Group8 ID00 "Position, Velocity, Torque Command Input Polarity". Change to "01: Reversed ", in Group8 ID00 "Position, Velocity, Torque Command Input Polarity".
11	■ Wiring of servo motor and encoder is wrong, in the tandem operation.	■ Check the wiring and fix if wrong.
12	■ Defect in internal circuit of servo amplifier.	■ Replace the servo amplifier.
13	■ Defect in internal circuit of motor encoder.	■ Replace the servo motor.
14	■ Power supply voltage is low.	■ Check the power supply voltage.

8.3 Troubleshooting when alarm activated

■ Alarm Code D2 (Faulty Position Command Pulse Frequency 1)

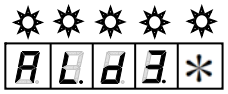


Status at the time of alarm	Cause
	1
Issued after entering position command pulse.	✔

◆ Corrective actions

	Cause	Investigation and corrective actions
1	■ The command that exceeded digital filter setting for command pulse is entered.	■ Decrease the frequency of the command pulse. ■ Decrease minimum pulse width of digital filter setting in Group 8 ID12 "Position command pulse digital filter [PCPFIL]".

■ Alarm Code D3 (Faulty Position Command Pulse Frequency 2)

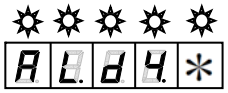


Status at the time of alarm	Cause	
	1	2
Issued after entering position command pulse.	✔	✔

◆ Corrective actions

	Cause	Investigation and corrective actions
1	■ Frequency of command pulse input is too high.	■ Reduce the frequency of command pulse input.
2	■ Setting value of electronic gear is excessive.	■ Decrease the electronic gear setting value in ID 13 to 16: Electric gear, Group 8 parameter.

■ Alarm Code D4 (Axes-sync error excess)



Status at the time of alarm	Cause				
	1	2	3	4	5
Issued immediately after entering the command.	✔	✔	✔	✔	✔
Issued during starting / stopping at high speed.	✔		✔	✔	✔

◆ Corrective actions

	Cause	Investigation and corrective actions
1	■ Parameter settings of 2 axes are different.	■ Sets the parameters follow 9.2.5.
2	■ Same command is not entered to both axes.	■ Check the wiring and fix if wrong.
3	■ Axes-sync error set value is too small.	■ Increase setting of GroupB ID81 "Axes-sync error warning level".
4	■ Defect in internal circuit of servo amplifier.	■ Replace the servo amplifier.
5	■ Defect in internal circuit of motor encoder.	■ Replace the servo motor.

* For a positioning function built-in servo amplifier, alarm of Axes-sync error excess is not occurred.

■ Alarm Code D5 (Dual position error excess)

Status at the time of alarm	Cause									
	1	2	3	4	5	6	7	8	9	10
Issued immediately after entering the command.	✔		✔	✔	✔		✔	✔	✔	✔
Issued during starting / stopping at high speed.	✔	✔					✔	✔	✔	✔
Issued during the operations by lengthy command.						✔				

◆ Corrective actions

	Cause	Investigation and corrective actions
1	■ Servo motor and load (external encoder) are not connected mechanically. Or the connection is not rigid.	■ Review the mechanical connection status.
2	■ Servo parameters are not correct. (Position loop gain, Position feedback gain, etc)	■ Adjust the servo parameter according to "9.1.5.7 Dual position feedback compensation".
3	■ Motor encoder pulse setting does not match with the servo motor.	■ Fit to the motor encoder pulse number of the servo motor.
4	■ External encoder resolution does not match to servo motor encoder resolution after feedback electronic gear.	■ Review the system parameter ID22 "External encoder resolution", ID24/ 25 "Feedback electronic gear numerator/ denominator", according to "9.1.5.4 Feedback pulse setting".
5	■ The polarity of external encoder does not match to the motor encoder.	■ Check the wiring conditions of external encoder and correct it if improper. ■ Set the parameter GroupC ID02 "External Encoder Polarity Selection", according to "9.1.5.5 Rotation direction setting for servo motor ".
6	■ Rounded off a rest, at the setting of ID24/ 25 "Feedback electronic gear numerator/ denominator".	■ Invalid the alarm by setting 0 pulse to GroupB ID1A "Dual position error excess value".
7	■ Setting value of Dual position error excess error is too small.	■ Larger the setting of GroupB ID1A "Dual position error excess value".
8	■ Defect in internal circuit of servo amplifier.	■ Replace the servo amplifier.
9	■ Defect in internal circuit of motor encoder.	■ Replace the servo motor.
10	■ Defect in internal circuit of external encoder.	■ Replace the external encoder.

* For a positioning function built-in servo amplifier, alarm of Dual position error excess is not occurred.

■ Alarm Code D6 (Dual position error feedback error)



Status at the time of alarm	Cause		
	1	2	3
Issued after entering position command pulse.	✔	✔	✔

8.3 Troubleshooting when alarm activated

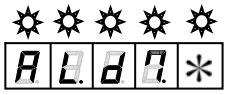
◆ Corrective actions

	Cause	Investigation and corrective actions
1	■ Motor rotation speed is too high.	■ Lower a frequency of command pulse input.
2	■ Motor encoder pulse setting does not match with the servo motor.	■ Fit to the motor encoder pulse number of the servo motor.
3	■ Feedback electronic gear ratio is too large.	■ Review the setting value of system parameter ID24/ 25 "Feedback electronic gear numerator/ denominator".

* Maximum velocity of servo motor will be limited at the system which has larger motor encoder resolution and feedback electronic gear ratio.
* For a positioning function built-in servo amplifier, alarm of Dual position error feedback error is not occurred.

■ Alarm Code D7 (Amplifier communication error)

Status at the time of alarm	Cause				
	1	2	3	4	5
Issued when control power is turned ON.	✔	✔	✔	✔	
Issued during operation.					✔



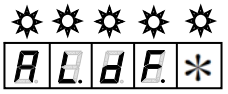
◆ Corrective actions

	Cause	Investigation and corrective actions
1	■ Wiring between amplifiers ◆ wrong wiring ◆ connector is unplugged ◆ connector has contact failure ◆ cable is too long	■ Check the wiring and fix if wrong. ■ Use our recommendation cables.
2	■ With tandem operation Tandem operation is not set to the parameter of counterpart axis.	■ Change to "01: Tandem operation" in counterpart axis system parameter ID08 "Amplifier communication function".
3	■ Without tandem operation Tandem operation is set to the parameter of own axis.	■ Change to "00: Invalid" in own axis system parameter ID08 "Amplifier communication function".
4	■ Defect in internal circuit of servo amplifier.	■ Replace the servo amplifier.
5	■ Malfunction due to noise.	■ Confirm proper grounding of the amplifier. ■ Add ferrite core or similar countermeasures to against noise.

* For a positioning function built-in servo amplifier, alarm of Amplifier communication error is not occurred.

■ Alarm Code DF (Test mode has closed)

Status at the time of alarm	Cause
	1
Occurred after execution of test mode.	✔

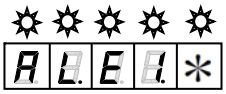


◆ Corrective actions

	Cause	Investigation and corrective actions
1	■ Normal operation.	■ Return to normal operation by alarm clear. (This is caution because test mode might have some deviation in control side after finish.)

8. Maintenance

■ Alarm Code E1 (Memory Error 1)



Status at the time of alarm	Cause
	1
Issued during display key operation or setup software operation.	✔

◆ Corrective actions

	Cause	Investigation and corrective actions
1	■ Defect in internal circuit of servo amplifier.	■ Replace the servo amplifier.

■ Alarm Code E2 (Memory Error 2)

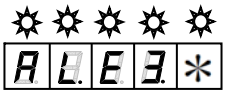


Status at the time of alarm	Cause	
	1	2
Issued when control power is turned ON.	✔	✔

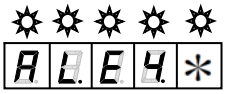
◆ Corrective actions

	Cause	Investigation and corrective actions
1	■ Correct value did not read to CPU from EEPROM of servo amplifier.	■ Replace the servo amplifier.
2	■ Failed to write into the EEPROM during last power supply cutoff.	■ Replace the servo amplifier.

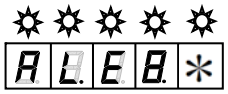
■ Alarm Code E3 (CPU error 1)



■ Alarm Code E4 (CPU error 2)



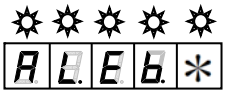
■ Alarm Code E8 (Control power circuit error 1)



■ Alarm Code E9 (Control power circuit error 2)



■ Alarm Code EB (Control power circuit error 3)



Status at the time of alarm	Cause
	1
Issued when control power is turned ON.	✔

◆ Corrective actions

	Cause	Investigation and corrective actions
1	■ Defect in internal circuit of servo amplifier.	■ Replace the servo amplifier.

8.3 Troubleshooting when alarm activated

■ Alarm Code E5 (System Parameter Error 1)

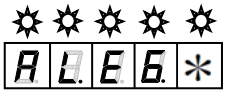


Status at the time of alarm	Cause	
	1	2
Issued when control power is turned ON.	✔	✔

◆ Corrective actions

	Cause	Investigation and corrective actions
1	■ The data out of setting range was given to system parameter.	■ Confirm the model number of the servo amplifier. Check and correct the setting value of system parameter. Turn ON the control power again and confirm that alarm is cleared.
2	■ Defect in internal circuit of servo amplifier.	■ Replace the servo amplifier.

■ Alarm Code E6 (System Parameter Error 2)

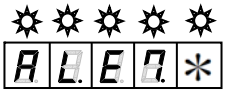


Status at the time of alarm	Cause	
	1	2
Issued when control power is turned ON.	✔	✔

◆ Corrective actions

	Cause	Investigation and corrective actions
1	■ Wrong combination of system parameter setting value and actual hardware. ■ Wrong combination of motor parameter and servo amplifier parameter. ■ Wrong combination between system parameters.	■ Confirm the model number of the servo amplifier. ■ Set a correct parameter applying to servo amplifier capacity. ■ Check and correct the setting value of system parameter. Turn ON the control power again and confirm that alarm is cleared.
2	■ Defect in internal circuit of servo amplifier.	■ Replace the servo amplifier.

■ Alarm Code E7 (Motor Parameter Error)



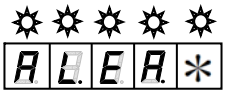
Status at the time of alarm	Cause	
	1	2
Issued when control power is turned ON.	✔	✔

◆ Corrective actions

	Cause	Investigation and corrective actions
1	■ Correct value did not read to CPU from non-volatile memory of servo amplifier.	■ If alarm recurs by control power cycle after re-setting the motor parameter, replace servo amplifier.
2	■ Failed to write into the non-volatile memory when changing motor parameter.	■ If alarm recurs by control power cycle after re-setting the motor parameter, replace servo amplifier.

8. Maintenance

■ Alarm Code EA (Memory Error 3)

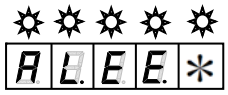


Status at the time of alarm	Cause
	1
Issued during display key operation or setup software operation.	✔

◆ Corrective actions

	Cause	Investigation and corrective actions
1	■ Defect in internal circuit of servo amplifier.	■ Replace the servo amplifier.

■ Alarm Code EE (Motor Parameter Automatic Setting Error 1)

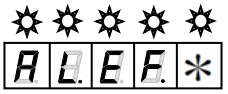


Status at the time of alarm	Cause		
	1	2	3
Issued when control power is turned ON.	✔	✔	✔

◆ Corrective actions

	Cause	Investigation and corrective actions
1	■ The connected encoder is not supported by the servo amplifier.	■ Replace with the supported servo motor.
2	■ The connected encoder does not support a motor parameter automatic setting function.	■ Change the system parameter ID09 "Motor parameter automatic set function selection" to "01:Disabled". Then download a motor parameter from setup software.
3	■ Defect in internal circuit of motor encoder.	■ Replace the servo motor.

■ Alarm Code EF (Motor Parameter Automatic Setting Error 2)



Status at the time of alarm	Cause		
	1	2	3
Issued when control power is turned ON.	✔	✔	✔

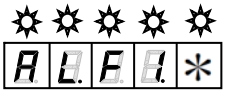
◆ Corrective actions

	Cause	Investigation and corrective actions
1	■ Combination of servo amplifier and servo motor is wrong.	■ Please correct combination by checking the model number of servo amplifier and servo motor.
2	■ The connected encoder does not support a motor parameter automatic setting function.	■ Change ID09 of system parameter to “01:Disabled“. Then download a motor parameter from setup software.
3	■ Defect in internal circuit of motor encoder.	■ Replace the servo motor.

8.3 Troubleshooting when alarm activated

■ Alarm Code F1 (Task Process Error)

Status at the time of alarm	Cause
	1
Issued during operation.	✔

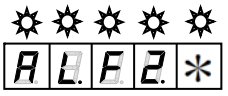


◆ Corrective actions

	Cause	Investigation and corrective actions
1	■ Defect in internal circuit of servo amplifier.	■ Replace the servo amplifier.

■ Alarm Code F2 (Initial Process Time-Out)

Status at the time of alarm	Cause	
	1	2
Issued when control power is turned ON.	✔	✔

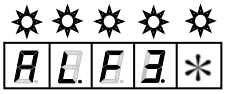


◆ Corrective actions

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

■ Alarm Code F3 (CPU error 3)

Status at the time of alarm	Cause
	1
Issued after firmware updating.	✔

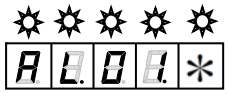


◆ Corrective actions

	Cause	Investigation and corrective actions
1	■ CPU setting was wrong at firmware updating.	■ Correcting CPU setting of firmware updating tool.

8.3.3 Corrective action for alarm (Additional for Positioning function built-in servo amplifier)

■ Alarm code 01 (Host communication timeout)



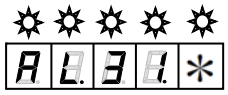
Status at the time of alarm	Cause				
	1	2	3	4	5
Issued after communication start.	✔	✔	✔	✔	✔
Issued during communication.	✔	✔	✔	✔	✔

◆ Corrective actions

	Cause	Investigation and corrective actions
1	■ There is loose connection or disconnection of serial communication line.	■ Check the hardware of communication line (connector, cable).
2	■ Communication command does not issue periodic from host device.	■ Change a communication command issuing cycle within the set value of communication timeout.
3	■ Serial communication line gets noise.	■ Confirm that the twisted pair and shield processing of communication line are correct. ■ Leave communication line from noise source if there. Do not bundle communication line with motor power cable.
4	■ Termination resistor is not installed at end of serial communication line.	■ Confirm that termination resistor is installed at both end of multi-drop network.
5	■ Defect in control PCB of servo amplifier.	■ Replace the servo amplifier.

* Detects with serial interface type only.

■ Alarm code 31 (Positive overtravel)
■ Alarm code 32 (Negative overtravel)





Status at the time of alarm	Cause	
	1	2
Issued when control power is turned ON.	✔	
Issued during operation.	✔	✔

◆ Corrective actions

	Cause	Investigation and corrective actions
1	■ Power source failure for external input signal ■ External wiring failure ■ ■ Overtravel signal logic is wrong. ■ Defect in internal circuit of servo amplifier.	■ Provides power source for external input signal. ■ Check the external wiring conditions and correct it if improper. ■ Correct a logic setting of overtravel signal. ■ Replace the servo amplifier.
2	■ Overtravel condition. ■ Malfunction due to noise.	■ Move to effective operation area. (Escape from overtravel condition.) ■ Confirm proper grounding of the amplifier. ■ Add ferrite core or similar countermeasures to against noise.

* It can move by disabling overtravel. However in that case, overtravel does not work so perform after finding cause of runaway from effective operation area.

8.3 Troubleshooting when alarm activated

8.3.4 Correspondence table for EnDat Error message and alarm code

EnDat Error message		RS3 Servo Amplifier	
Bit		Alarm Code	Priority
0	Light Source	B0	1
1	Signal amplitude	B1	2
2	Position	B2	3
3	Overvoltage	B3	4
4	Undervoltage	B4	5
5	Overcurrent	B5	6
6	Battery	B6	7
7	Currently not allocated Extension planned	B7	8
8		B8	9
9		B9	10
10		B10	11
11		B11	12
12		B12	13
13		B13	14
14		B14	15
15		B15	16

* "Error message" means Operation Status Word0 of EnDat.

* "Alarm Code" means the alarm code output from servo amplifier against applicable Error Message.

* "Priority" is given to alarm codes to be output when Error Messages are received simultaneously. Alarm Code output from servo amplifier is only one (which has higher priority) even if Error Messages are received multiple.

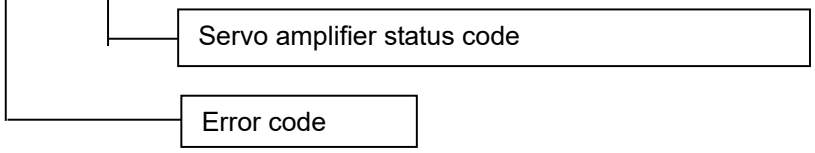
8. Maintenance

8.4 Troubleshooting when error code activated

8.4.1 Error code display

When an error code occurs, the display shows the error code and the servo amplifier status code.

Display	Description
E. F. 1 6. *	Take appropriate action based on "8.4.2 Corrective action for error code".



■ Status code

Code	Status	
1	Power OFF status	(P-OFF)
2	Power ON status	(P-ON)
3	Servo ready status	(S-RDY)
4	Servo ON status	(S-ON)
5	Servo OFF status	(S-OFF)
6	Emergency stop status	(EMR)
F	Initial status	

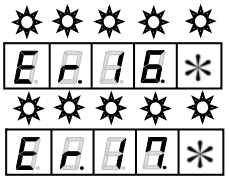
* Alarm code display has priority if alarm occurs during error code occur. Error code display will be switched to alarm code display.

8.4 Troubleshooting when error code activated

8.4.2 Corrective action for error code

■ Error code 16 (+ Software limit, OT_FRD)

■ Error code 17 (- Software limit, OT_RVS)

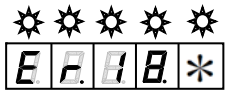


Status at the time of error code issued	Cause
	1
Issued during operation.	✔

◆ Corrective actions

	Cause	Investigation and corrective actions
1	■ It traveled beyond positive software limit coordinates. ■ It traveled beyond negative software limit coordinates.	■ Move back within software limit by JOG operation. ■ Change the software limit setting of positioning function parameter.

■ Error code 18 (Point data error, POINT_DATA)



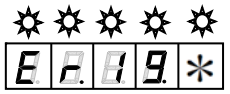
Status at the time of error code issued	Cause	
	1	2
Issued at starting a point move.	✔	
Issued during a point move.		✔

◆ Corrective actions

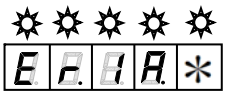
	Cause	Investigation and corrective actions
1	■ Applicable point data is not registered for point move.	■ Register the point. ■ Input an Alarm-reset for resetting error code.
2	■ Applicable point data on the way is not registered for continuous point move.	

8. Maintenance

■ Error code 19 (Point loop count setting error, Loop)



■ Error code 1A (Point loop nest setting error, Nesting)

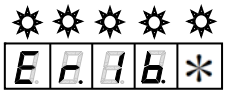


Status at the time of error code issued	Cause	
	1	2
Issued at starting a point move.	✔	✔
Issued during a point move.	✔	✔

◆ Corrective actions

	Cause	Investigation and corrective actions
1	■ The number of the nest is over 15 in Point jump/loop function.	■ Follow the specification of point jump/loop function to set a point.
2	■ It is specified the jump destination which does not nest, in condition jump of Point jump/loop function.	

■ Error code 1B (Homing operation error, ZRT)



Status at the time of error code issued	Cause
	1
Issued at starting a homing operation.	✔

◆ Corrective actions

	Cause	Investigation and corrective actions
1	■ Speed reduction time while homing operation is too short.	■ Expand the area of deceleration signal to secure the enough time for reducing speed (Travel distance).

8.5 Troubleshooting of status history display

It is possible to see up to 64 Status Histories. While power establishment, it updates if update condition occurs of status history. Latest 64 items are displayed.
However, status history clears to initial condition when control power turns on or reset. History does not store at power turns off.

8.5.1 Status history display example

	Number	Status	
New	Last01	WAIT_ON	Traveling completion
↑	Last02	Move_point:007	Travel to P007
	Last03	Move_point:006	Travel to P006
	Last04	Move_point:005	Travel to P005
	Last05	WAIT_ON	Traveling completion
	Last06	STEP_ON	1STEP travel
	Last07	WAIT_ON	Traveling completion
	Last08	JOG_ON	JOG travel (When stop traveling in JOG operation, the cancellation shall be recorded as a history.)
	Last09	CANCEL_ON	
	Last10	WAIT_ON	Cancellation completion
	Last11	CANCEL_ON	Cancel traveling while travel to P004.
	Last12	Move_point:004	Sequential traveling to P004
	Last13	Move_point:003	Travel to P003
	Last14	ALM_None	Reset
	Last15	ALM:55	External overheat alarm issues after completion.
	Last16	WAIT_ON	Traveling completion
	Last17	Move_point:002	Travel to P002
	Last18	WAIT_ON	Traveling completion
	Last19	Move_point:001	Travel to P001
	Last20	WAIT_ON	Servo ON
Old	Last21	SV_OFF	Control power/Main power ON

As mentioned above, the status before and after alarm occurrences are recorded as a history, it is useful to investigate a cause of alarm.
However, the status history can be stored only up to 64 histories, therefore, it is recommended to check the history immediately when alarm occurs.

8.5.2 Status history display list

Display	Description
Move_Point: DEC [***]	Traveled to [***]. ***: Point number
WAIT_ON	Status of positioning completion. (Waiting for traveling signal on the status of servo-on.)
Cancel_ON	CANCEL (Cancellation) has been input, or, the status of stop JOG traveling.
ZRT_ON	Homing startup (ZRT input signal) has been input.
SDN_ON	Slowdown before home signal (SDN input signal) has been input.
JOG_ON	Manual feeding (±JOG input signal) has been input.
STP_ON	1 step feeding (±1step input signal) has been input.
HOME_ON	Homing operation has been completed.
DWEL	Dwell (Intermission) time is performing.
SV_OFF	The status of servo-off: Servo-on signal (S-ON input signal) is turned OFF.
PRG_STR	External data setting input (E_STR input signal) has been input.
Err_Non	Error code has been canceled.
Err_POINT_DATA	Error code occurrence. Activated with non-registered point number (RUN input signal).
Alm_Non	Alarm reset (ARST input signal) has been input.
Alm:**	Alarm is issued. Alarm code "**".
_Alm_None	Status of a history data clear. Initial state after history reset.

8.6 Encoder clear and alarm reset

Procedure of "encoder clear and alarm reset method" varies depending on motor encoder you use.
See table below and return to normal operation from alarm state. Please operate "alarm reset" after solving alarm cause.

Alarm reset method

Alarm code	Single-turn Absolute Encoder (Encoder code: H)	Battery Backup Absolute Encoder (Encoder code: P)	Battery-less Absolute Encoder (Encoder code: R)	Resolver Type Battery-less Absolute Encoder (Encoder code: W)
A1	—	・ “Alarm reset“ after “Encoder clear“	・ “Alarm reset“ after “Encoder clear“ ・ “Power-cycle”	・ “Alarm reset“ after “Encoder clear“ ・ “Power-cycle”
A2	—	—	—	・ “Alarm reset“ after “Encoder clear“ ・ “Power-cycle”
A3	・ “Alarm reset“ after “Encoder clear“ ・ “Power-cycle”	・ “Alarm reset“ after “Encoder clear“ ・ “Power-cycle”	・ “Alarm reset“ after “Encoder clear“ ・ “Power-cycle”	・ “Alarm reset“ after “Encoder clear“ ・ “Power-cycle”
A4	・ “Alarm reset“ after “Encoder clear“ ・ “Power-cycle”	・ “Alarm reset“ after “Encoder clear“ ・ “Power-cycle”	・ “Alarm reset“ after “Encoder clear“ ・ “Power-cycle”	・ “Alarm reset“ after “Encoder clear“ ・ “Power-cycle”
A5	・ “Power-cycle”	・ “Power-cycle”	・ “Alarm reset“ after “Encoder clear“ ・ “Power-cycle”	・ “Alarm reset“ after “Encoder clear“ ・ “Power-cycle”
A6	・ Power-cycle	・ “Power-cycle”	・ Perform “Power-cycle”. Then perform "Alarm reset" after “Encoder clear“.	・ “Power-cycle”
A9	・ “Alarm reset“	・ “Power-cycle”	・ “Alarm reset“	・ "Alarm reset"
AA	—	—	・ “Alarm reset“ after “Encoder clear“ ・ “Power-cycle”	・ “Alarm reset“ after “Encoder clear“ ・ “Power-cycle”
AC	—	—	—	・ “Power-cycle”
AD	—	—	—	・ “Power-cycle”
AF	—	—	・ “Alarm reset“ after “Encoder clear“ ・ “Power-cycle”	・ “Power-cycle”

* 7Multi-turn part of encoder position data will be cleared when "encoder clear" is performed. Adjust the relations between position data and machine coordinate system, and then perform operation.

* Encoder clear is able to perform by the method below.

1) Absolute encoder clearing function in "Test operation" mode of the setup software.
Refer another document M0010842 for how to operate the setup software.

2) Encoder Clear Function of servo amplifier
Encoder Clear Function is able to perform via a general input. Set a function valid condition to Group9 ID03 "Encoder Clear Function". Factory setting is " Always_Disable: Function is always invalid ".

8. Maintenance

8.7 Inspection

For maintenance purposes, a daily inspection is typically sufficient. Upon inspection, refer to the following description.

Inspection target	Conditions			Items	Methods	Solution if abnormal
	Time	During operation	While stopping			
Servo motor	Daily	✔		Vibration	Check for excessive vibration than usual.	Contact dealer or sales office.
	Daily	✔		Sound	Check for abnormal sound than usual.	
	Periodic		✔	cleanliness	Check for dirt and dust.	Clean with cloth or air. Note 1)
	Yearly		✔	Measure a insulation resistance	Contact dealer or sales office.	
	5000 hours Note 2)		✔	Replacement of oil seal		
Servo amplifier	Periodic		✔	Cleaning	Check for dust accumulated in the accessories.	Clean with air. Note 1)
	Yearly		✔	Loose screws	Check for loose connections.	Fasten the screws properly.
Battery for Absolute encoder	Regularly Note 3)		✔	Battery voltage	Confirm that battery voltage is more than DC3.6V.	Replace the Battery.
Temperature	Periodic	✔		Measure temperature	Ambient temperature Motor frame temperature	Set the ambient temperature within the specified range. Check the load condition.

Note 1) Before cleaning, confirm that there is no oil content and/or moisture in compression air.

Note 2) This inspection and replacement period is when water- or oil-proof functions are required.

Note 3) The life expectancy of the battery is approximately 3 years at continuous backup of encoder. For replacement, a lithium battery (ER3VLY: 3.6V, 1000mAh) manufactured by Toshiba Lifestyle Products & Services Corporation is recommended.

8.8 Service parts

8.8.1 The parts requiring Inspection

Some parts have aging degradation.
Please request us an overhaul by referring to the periods below for preventive maintenance.

No.	Part name	Number of average replacement periods	Corrective measures / usage conditions
1	Aluminum electrolytic capacitor for smoothing main circuit	5 Years	Replacement with new part is necessary. Load ratio: 50% of rated output current of amplifier. Usage condition: Yearly average 40°C
2	Cooling Fan motor	5 Years	Replacement with new part is necessary. Usage condition: Yearly average 40°C
3	Lithium battery for absolute encoder [ER3VLY]	3 Years	Replacement with new part is necessary.
4	Aluminum electrolytic capacitor (other than capacitor for smoothing main circuit)	5 Years	Replacement with new part is necessary. Usage condition: Yearly average 40°C Annual total usage time is 4800 hours.
5	Fuse	10 Years	Replacement with new part is necessary.
6	Relays	(Power-cycle: a hundred thousand times)	Replacement with new part is necessary.

■ Capacitor for smoothing the main circuit, and relays

- ◆ Inspection is needed if the servo amplifier has stored for more than 3 years. Contact the dealer or sales office.
- ◆ It is necessary to replace the capacitor that is earlier than 5 years when it is used to exceed yearly average 40°C or exceed more than 50% of the rated output current of servo amplifier.
- ◆ It is necessary to replace the capacitor or relays that are earlier than periods above where the main power-cycle is repeated more than 30 times per day or 5 times per hour. Capacity reduction or early failure of relays is considered.

8. Maintenance

■ Cooling Fan motor

◆ The servo amplifier is designed corresponding to the pollution degree specified in EN61800-5-1 or IEC 664-1. It is not for dust proof or oil proof, so use it in an environment at Pollution Level 2 or less (i.e., Pollution Level 1, 2).

◆ RS3 series servo amplifier models RS3□02, RS3□03, RS3A05, RS3A07, RS3A10, RS3A15 and RS3A30 have a built-in cooling fan; therefore be sure to maintain a space of 50mm on the upper and lower side of the amplifier for airflow.
Installation in a narrow space may cause failure due to a static pressure reduction of the cooling fan and/or electronic parts degradation. Replacement is necessary if abnormal noise occurs or oil / dust are observed on the parts. Also, at an average temperature of 40°C year-round, the life expectancy is 5 years.

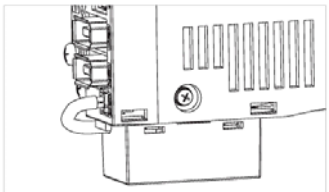
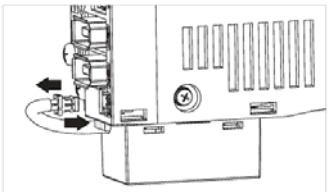
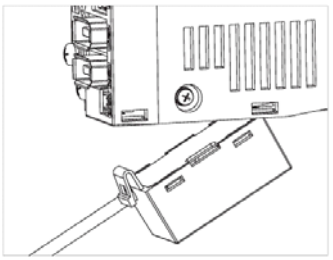
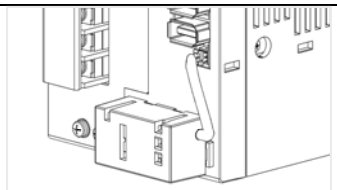
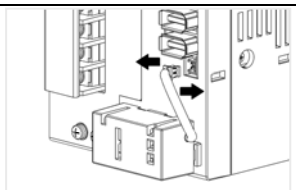
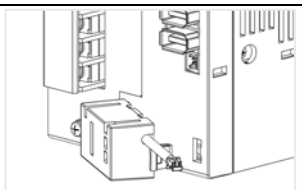
■ Lithium battery for absolute encoder

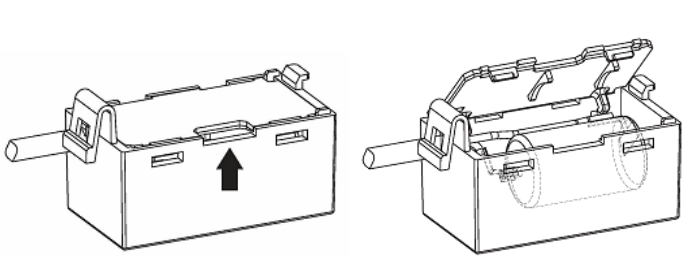
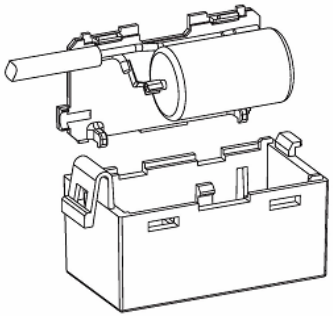
◆ The standard replacement period recommended by our company is the life expectancy of lithium battery based on normal usage conditions. However, if the motor is not used for a long period, the life of lithium battery is reduced. If the battery power is less than 3.6 V during inspection, replace it with new one.

8.8.2 Replacing battery for motor encoder

■ Battery box attached to the servo amplifier

Process	Description
1	Turn ON the servo amplifier control power supply.
2	Prepare the replacement lithium battery. [Our model number: AL-00879511-01]
3	Detach the battery connector from servo amplifier.
4	Detach the battery box from servo amplifier.
5	Open the battery box.
6	Take out the old lithium battery and insert prepared new one to the battery box.
7	Close the battery box.
8	Attach the battery box to the bottom of servo amplifier.
9	Attach the connector in the right direction.

	Battery case position	Process 3 and 9	Process 4 and 8
RS3□01 RS3□02 RS3□03 RS3A05 RS3A07	 Bottom of amplifier		
RS3A10 RS3A15 RS3A30	 Front of amplifier		

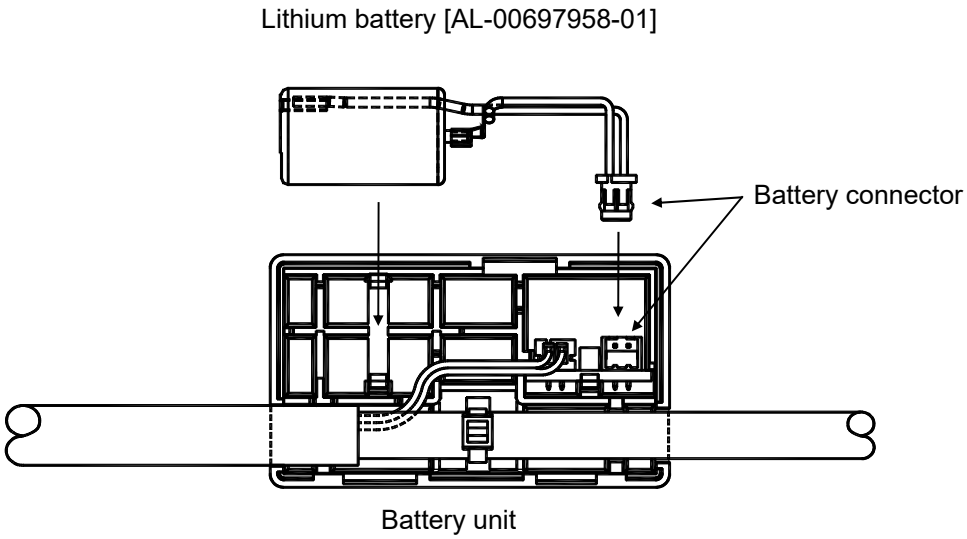
	Process 5 and 7	Process 6
Common		

* If the battery is replaced while the control power is OFF, multiple rotation counter (position data) of the motor encoder might be instable. When the amplifier control power is turned ON in this status, an alarm (AL_A1: Absolute Encoder Internal Error 1) might be issued. For this case, execute encoder clear and alarm reset to release the alarm status. Also, absolute encoder position data might be instable. So adjust the relations between a position data and a machine coordinate system to match, and then perform operation.

8. Maintenance

■ Battery unit attached to junction cable for motor encoder

Process	Description
1	Turn ON the servo amplifier control power supply.
2	Prepare the replacement lithium battery. [Our model number: AL-00697958-01]
3	Open the battery unit.
4	Detach the battery connector from the battery case.
5	Take out the old lithium battery and insert prepared new one to the battery case.
6	Attach the connector in the right direction.
7	Close the battery unit.



Release
Revision B Jun. 2020

ECO PRODUCTS

■ECO PRODUCTS

Sanyo Denki's ECO PRODUCTS are designed with the concept of lessening impact on the environment in the process from product development to waste. The product units and packaging materials are designed for reduced environmental impact.
We have established our own assessment criteria on the environmental impacts applicable to all processes, ranging from design to manufacture.

■Precautions For Adoption

Failure to follow the precautions on the right may cause moderate injury and property damage, or in some circumstances, could lead to a serious accident.
Always follow all listed precautions.

⚠ Cautions

- Read the accompanying Instruction Manual carefully prior to using the product.
- If applying to medical devices and other equipment affecting people's lives please contact us beforehand and take appropriate safety measures.
- If applying to equipment that can have significant effects on society and the general public, please contact us beforehand.
- Do not use this product in an environment where vibration is present, such as in a moving vehicle or shipping vessel.
- Do not perform any retrofitting, re-engineering, or modification to this equipment.
- The Products presented in this Instruction Manual are meant to be used for general industrial applications. If using for special applications related to aviation and space, nuclear power, electric power, submarine repeaters, etc., please contact us beforehand.

* For any question or inquiry regarding the above, contact our Sales Department.

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