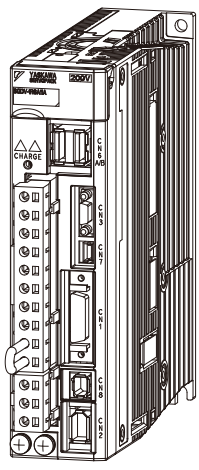
YASKAWA

AC Servo Drives

Σ-V Series
USER'S MANUAL
MECHATROLINK-II Command



MANUAL NO. SIEP S800000 54B

About this Manual

This manual describes the specifications of MECHATROLINK-II commands used for Σ-V series SERVOPACKs model SGDV-□□□□11 and 15 (MECHATROLINK-II communications reference input type), the basic operations using these commands, and the parameters for these commands.

This manual is designed to provide information for:

- People who implement MECHATROLINK-II commands for a controller
- People who prepare the application program for the host controller that directly transmits MECHATROLINK-II commands

Refer to the following manuals for information on Σ-V series SERVOPACKs, including hardware, adjustment methods, and trial operation.

- Σ-V Series Product Catalog (KAEP S800000 42)
- Σ-V Series User's Manual Setup Rotational Motor (SIEP S800000 43)
- Σ-V Series User's Manual Setup Linear Motor (SIEP S800000 44)
- Σ-V Series User's Manual Design and Maintenance Rotational Motor/MECHATROLINK-II Communications Reference (SIEP S800000 46)
- Σ-V Series User's Manual Design and Maintenance Linear Motor/MECHATROLINK-II Communications Reference (SIEP S800000 48)

IMPORTANT

- Be sure that you fully understand each command and use the commands in the order appropriate for your application.

  Incorrect usage of the commands can result not only unexpected motions, but in a serious accident.

  Special care and verification must be taken for usage of the commands in order to avoid accidents.

  Be sure to also establish safety measures for the system.

General Precautions

Observe the following general precautions to ensure safe application.

- The products shown in illustrations in this manual are sometimes shown without covers or protective guards. Always replace the cover or protective guard as specified first, and then operate the products in accordance with the manual.
- The drawings presented in this manual are typical examples and may not match the product you received.
- If the manual must be ordered due to loss or damage, inform your nearest Yaskawa representative or one of the offices listed on the back of this manual.

Warranty

(1) Details of Warranty

■ Warranty Period

The warranty period for a product that was purchased (hereafter called “delivered product”) is one year from the time of delivery to the location specified by the customer or 18 months from the time of shipment from the Yaskawa factory, whichever is sooner.

■ Warranty Scope

Yaskawa shall replace or repair a defective product free of change if a defect attributable to Yaskawa occurs during the warranty period above. This warranty does not cover defects caused by the delivered product reaching the end of its service life and replacement of parts that require replacement or that have a limited service life.
This warranty does not cover failures that result from any of the following causes.

1. Improper handling, abuse, or use in unsuitable conditions or in environments not described in product catalogs or manuals, or in any separately agreed-upon specifications
2. Causes not attributable to the delivered product itself
3. Modifications or repairs not performed by Yaskawa
4. Abuse of the delivered product in a manner in which it was not originally intended
5. Causes that were not foreseeable with the scientific and technological understanding at the time of shipment from Yaskawa
6. Events for which Yaskawa is not responsible, such as natural or human-made disasters

(2) Limitations of Liability

1. Yaskawa shall in no event be responsible for any damage or loss of opportunity to the customer that arises due to failure of the delivered product.
2. Yaskawa shall not be responsible for any programs (including parameter settings) or the results of program execution of the programs provided by the user or by a third party for use with programmable Yaskawa products.
3. The information described in product catalogs or manuals is provided for the purpose of the customer purchasing the appropriate product for the intended application. The use thereof does not guarantee that there are no infringements of intellectual property rights or other proprietary rights of Yaskawa or third parties, nor does it construe a license.
4. Yaskawa shall not be responsible for any damage arising from infringements of intellectual property rights or other proprietary rights of third parties as a result of using the information described in catalogs or manuals.

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1. It is the customer’s responsibility to confirm conformity with any standards, codes, or regulations that apply if the Yaskawa product is used in combination with any other products.
2. The customer must confirm that the Yaskawa product is suitable for the systems, machines, and equipment used by the customer.
3. Consult with Yaskawa to determine whether use in the following applications is acceptable. If use in the application is acceptable, use the product with extra allowance in ratings and specifications, and provide safety measures to minimize hazards in the event of failure.
   - Outdoor use, use involving potential chemical contamination or electrical interference, or use in conditions or environments not described in product catalogs or manuals
   - Nuclear energy control systems, combustion systems, railroad systems, aviation systems, vehicle systems, medical equipment, amusement machines, and installations subject to separate industry or government regulations
   - Systems, machines, and equipment that may present a risk to life or property
   - Systems that require a high degree of reliability, such as systems that supply gas, water, or electricity, or systems that operate continuously 24 hours a day
   - Other systems that require a similar high degree of safety

4. Never use the product for an application involving serious risk to life or property without first ensuring that the system is designed to secure the required level of safety with risk warnings and redundancy, and that the Yaskawa product is properly rated and installed.
5. The circuit examples and other application examples described in product catalogs and manuals are for reference. Check the functionality and safety of the actual devices and equipment to be used before using the product.
6. Read and understand all use prohibitions and precautions, and operate the Yaskawa product correctly to prevent accidental harm to third parties.

(4) Specifications Change

The names, specifications, appearance, and accessories of products in product catalogs and manuals may be changed at any time based on improvements and other reasons. The next editions of the revised catalogs or manuals will be published with updated code numbers. Consult with your Yaskawa representative to confirm the actual specifications before purchasing a product.

CONTENTS

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MECHATROLINK-II Commands

This chapter provides on outline of MECHATROLINK-II commands.

1.1 MECHATROLINK-II Communications

1.1.1 Layers

The MECHATROLINK-II communications layers have functions equivalent to layers 1, 2, and 7 in the OSI (Open System Interconnection) reference model.

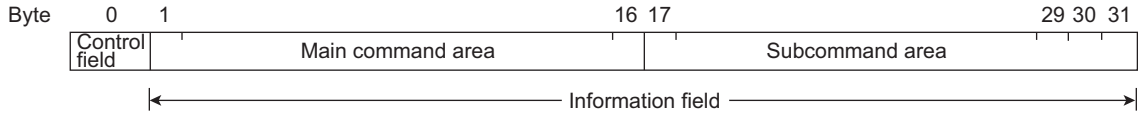
OSI Reference Model and MECHATROLINK-II Model

OSI	MECHATROLINK-II
Layer 7: Application layer	MECHATROLINK-II application layer
Layers 3 to 6	None
Layer 2: Data link layer	MECHATROLINK-II data link layer
Layer 1: Physical layer	MECHATROLINK-II physical layer

This manual describes commands for the application layer.

1.1.2 Frame Structure

A MECHATROLINK-II command is composed of a main command and a subcommand as shown below. It can also be used only with a main command.



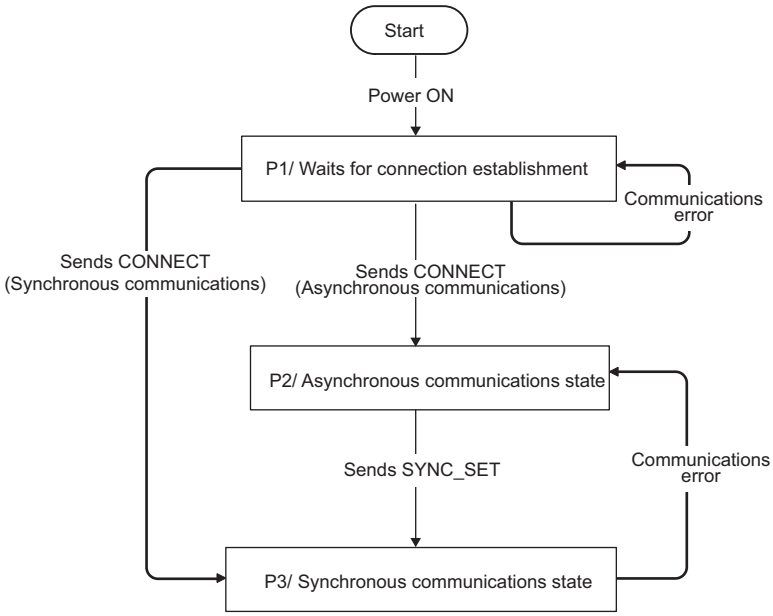
Classification	Byte	Command	Response
Control Field	0	03H (Fixed)	01H (Fixed)
Information Field	1 to 16	Used by main command.	
	17 to 31	Used by subcommands. The subcommands for servo drives use only 17th to 29th byte. Therefore, only 17th to 29th byte are described in this manual. Note: In some main commands, subcommand cannot be used.	

The application layer interfaces with only the information field.

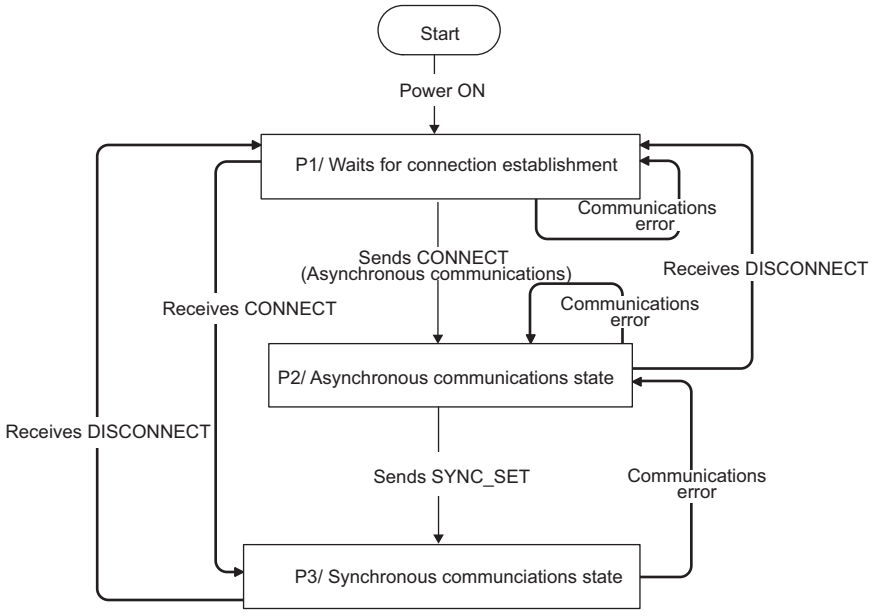
1.1.3 State Transition Diagram

The primary (master) and secondary (slave) station state transitions are shown in the following diagrams.

Primary Station (Master Station) State Transition



Secondary Station (Slave Station) State Transition



Phase	Abbreviation	Description
1	P1	Waiting for establishment of connection.
2	P2	Asynchronous communications enabled. Only asynchronous commands can be used.
3	P3	Synchronous communications enabled. Both synchronous and asynchronous commands can be used.

1.1.4 Terminology

This section defines the terminology used in this manual.

(1) Transmission Cycle and Communications Cycle

■ Transmission Cycle:

The transmission cycle is the cycle in the MAC (Media Access Control) layer. It is the communications cycle for physically sending data to the transmission path.

The transmission cycle is unaffected by the services provided by the application layer.

■ Communications Cycle:

The communications cycle is the cycle for application layer. The communications cycle is set to an integral multiple of the transmission cycle.

(2) Synchronization Classification

MECHATROLINK-II commands include both synchronous and asynchronous commands.

- Synchronous Commands (Classification S):
  For commands of this type, commands are sent and response are received every communications cycle.

  A response to a command that has been sent to a slave station is received at the next communications cycle.

  The WDT (Watchdog Timer) in the frames are refreshed and checked every communications cycle. Synchronous commands can be used only during synchronous communications (Phase 3).

- Asynchronous Commands (Classification A):
  For commands of this type, commands are sent asynchronously to the communications cycle.

  Subsequent commands can be sent after confirming the completion of processing of the slave station that received the command.

  The WDT (Watchdog Timer) in the frames are not checked.

1.2 MECHATROLINK-II Command List

1.2.1 Main Commands (In command code order)

The MECHATROLINK-II main commands used for Σ-V series servodrives are listed below.

Command Code	Command	Function	Reference
00H	NOP	Nothing is performed.	3.2.1
01H	PRM_RD	Reads the specified parameter.	3.2.13
02H	PRM_WR	Saves the specified parameter.	3.2.6
03H	ID_RD	Reads the device ID.	3.2.5
04H	CONFIG	Enables the current parameter settings.	3.2.8
05H	ALM_RD	Reads the current alarm or warning status, and the alarm history.	3.2.15
06H	ALM_CLR	Clears the current alarm or warning status, and the alarm history.	3.2.16
0DH	SYNC_SET	Starts synchronous communications.	3.2.4
0EH	CONNECT	Requests to establish a MECHATROLINK connection.	3.2.3
0FH	DISCONNECT	Requests to releases connection.	3.2.2
1CH	PPRM_WR	Saves the parameters in non-volatile memory.	3.2.7
20H	POS_SET	Sets the coordinates.	3.2.17
21H	BRK_ON	Turns the brake signal off and applies the holding brake.	*Appendix A*
22H	BRK_OFF	Turns the brake signal on and release the holding brake.	*Appendix A*
23H	SENS_ON	Turns the encoder power supply on, and gets the position data.	3.2.9
24H	SENS_OFF	Turns the encoder power supply off.	3.2.11
25H	HOLD	From current motion status, performs a deceleration stop and positioning according to the deceleration value set in the parameter.	4.2.1
28H	LTMOD_ON	Enables the position data latch by the external signal input.	4.2.2
29H	LTMOD_OFF	Disables the position data latch by the external signal input.	4.2.3
30H	SMON	Monitors the SERVOPACK status.	3.2.14
31H	SV_ON	Turns the servo of the motor on.	3.2.10
32H	SV_OFF	Turns the servo of the motor off.	3.2.12
34H	INTERPOLATE	Starts interpolation feeding.	4.2.4
35H	POSING	Starts positioning to the target position (TPOS) at the target speed (TSPD).	4.2.5
36H	FEED	Starts constant speed feeding at the target speed (TSPD)	4.2.6
38H	LATCH	Performs interpolation feeding and latches the position using the specified latch signal.	4.2.7
39H	EX_POSING	Moves toward the target position (TPOS) at the target speed (TSPD). When a latch signal is input midway, positioning is performed according to the final travel distance for external position specified in the parameter from the latch signal input position.	4.2.8
3AH	ZRET	Performs a homing.	4.2.9
3CH	VELCTRL	Controls speed.	4.2.10
3DH	TRQCTRL	Controls torque (force).	4.2.11
3EH	ADJ	Used to monitor and adjust data for maintenance.	3.2.18
3FH	SVCTRL	Performs general-purpose servo control. This command is compatible with MECHATROLINK version 1.0 and earlier.	*Appendix B*

1.2.2 Subcommands (In command code order)

The MECHATROLINK-II subcommands used for Σ-V series servodrives are listed below.

Command Code	Command	Function	Reference
00H	NOP	Same function as of the main command NOP	6.2.1
01H	PRM_RD	Same function as of the main command PRM_RD	6.2.2
02H	PRM_WR	Same function as of the main command PRM_WR	6.2.3
05H	ALM_RD	Same function as of the main command ALM_RD	6.2.4
1CH	PPRM_WR	Same function as of the main command PPRM_WR	6.2.5
28H	LTMOD_ON	Same function as of the main command LTMOD_ON	6.2.6
29H	LTMOD_OFF	Same function as of the main command LTMOD_OFF	6.2.7
30H	SMON	Same function as of the main command SMON	6.2.8

1.2.3 Combination of MECHATROLINK-II Main Commands and Subcommands

Subcommands can be used by combining as listed below.

CODE	Main Command	Subcommand							
		NOP	PRM_RD	PRM_WR	ALM_RD	PPRM_WR	LTMOD_ON	LTMOD_OFF	SMON
00	NOP	√	√	√	√	√	√	√	√
01	PRM_RD	√	×	×	×	×	×	×	√
02	PRM_WR	√	×	×	×	×	×	×	√
03	ID_RD	√	√	√	√	√	√	√	√
04	CONFIG	√	×	×	×	×	×	×	√
05	ALM_RD	√	×	×	×	×	×	×	√
06	ALM_CLR	√	×	×	×	×	×	×	√
0D	SYNC_SET	√	×	×	×	×	×	×	√
0E	CONNECT	√	×	×	×	×	×	×	×
0F	DISCONNECT	√	×	×	×	×	×	×	×
1C	PPRM_WR	√	×	×	×	×	×	×	√
20	POS_SET	√	×	×	×	×	×	×	√
21	BRK_ON	√	×	×	×	×	×	×	√
22	BRK_OFF	√	×	×	×	×	×	×	√
23	SENS_ON	√	×	×	×	×	×	×	√
24	SENS_OFF	√	×	×	×	×	×	×	√
25	HOLD	√	√	√	√	√	√	√	√
28	LTMOD_ON	√	×	×	×	×	×	×	√
29	LTMOD_OFF	√	×	×	×	×	×	×	√
30	SMON	√	√	√	√	√	√	√	√
31	SV_ON	√	√	√	√	√	√	√	√
32	SV_OFF	√	√	√	√	√	√	√	√
34	INTERPOLATE	√	√	√	√	√	√	√	√
35	POSING	√	√	√	√	√	√	√	√
36	FEED	√	√	√	√	√	√	√	√
38	LATCH	√	√	√	√	√	×	×	√
39	EX_POSING	√	√	√	√	√	×	×	√
3A	ZRET	√	√	√	√	√	×	×	√
3C	VELCTRL	√	√	√	√	√	√	√	√
3D	TRQCTRL	√	√	√	√	√	√	√	√
3E	ADJ	√	×	×	×	×	×	×	√
3F	SVCTRL	√	√	√	√	√	×	×	√

Note: √: Can be combined, ×: Cannot be combined

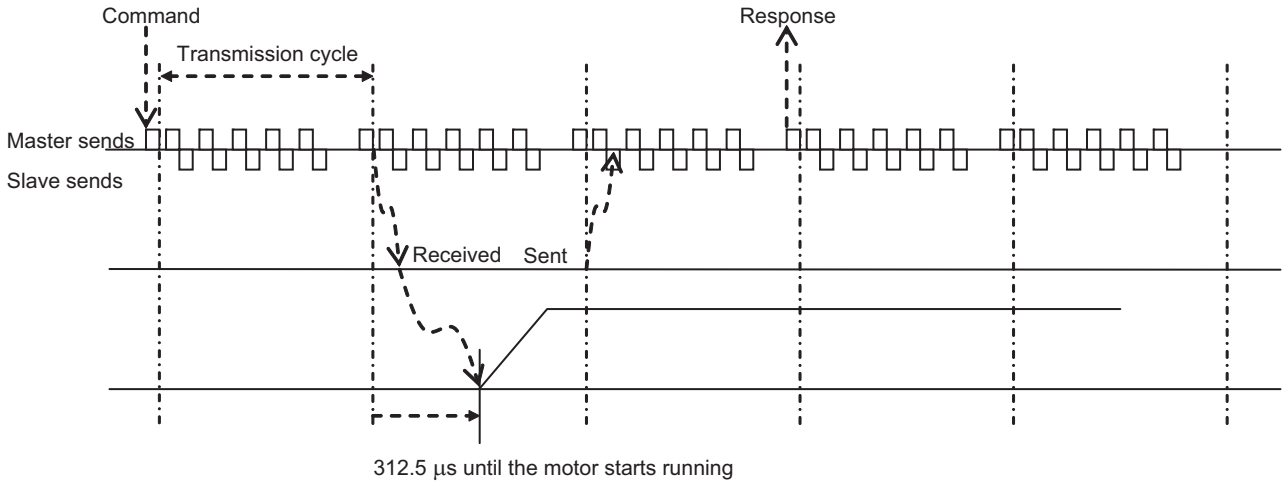
1.3 Command and Response Timing

This section describes command execution timing at a slave station and monitored data input timing at the master station.

These timings are constant, regardless of the transmission cycle and communications cycle.

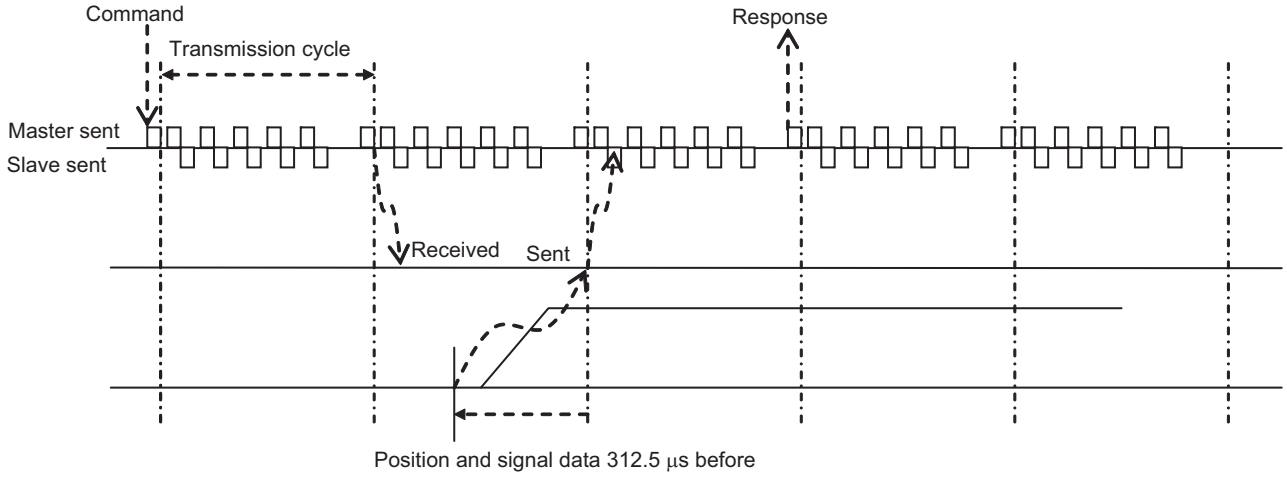
1.3.1 Command Data Execution Timing

Motion commands (such as POSING and INTERPOLATE) and the OPTION in the command data field are executed 312.5 μs after they are received.



1.3.2 Monitored Data Input Timing

The monitor, I/O, and status data are the data of 312.5 μs before the response is sent.



1.4 Data Order

Data in MECHATROLINK-II commands and responses is stored in little endian byte order.
For example, 4-byte data “0x1234ABCD” in hexadecimal is stored from the least significant byte as shown below.

Byte	Data
1	CD
2	AB
3	34
4	12

2

Operation Sequence

This chapter describes basic operation sequences through MECHATROLINK-II communications.

2.1 Preparing for Operation

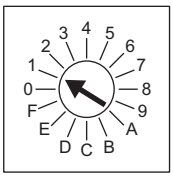
This section describes how to set communications specifications before starting communications, and how to confirm the communications status.

2.1.1 Setting MECHATROLINK-II Communications

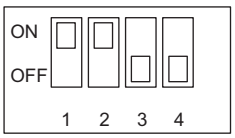
The rotary switch (SW1) and DIP switch (SW2), which are located near the top under the front cover of Σ-V series SERVOPACK, are used as shown below to set the MECHATROLINK-II communications specifications.

SW1 is used to set the lowermost digit of station address. SW2 is used to set the communications specifications as shown in the table below.

SW2	Function	Setting	Description	Factory setting
Pin 1	Sets the baud rate.	OFF	4 Mbps (MECHATROLINK-I)	ON
		ON	10 Mbps (MECHATROLINK-II)	
Pin 2	Sets the number of transmission bytes.	OFF	17 bytes	ON
		ON	32 bytes	
Pin 3	Sets the station address.	OFF	Station address = 40H+SW1	OFF
		ON	Station address = 50H+SW1	
Pin 4	Reserved. (Do not change.)	OFF	–	OFF



SW1(factory setting)



SW2(factory settings)

2.1.2 Checking the Communications Status

Turn ON the control and main circuit power supplies and use the following procedure to confirm that the SERVOPACK is ready for communications.

(1) Operation Procedure

Procedure	Operation
1	Confirm that the wiring is correctly made.
2	Turn ON the SERVOPACK control and main circuit power supplies. When the control power is being normally supplied to the SERVOPACK, POWER LED on the SERVOPACK is lit. When the main circuit power supply is ON, CHARGE is lit.
3	Turn ON the controller power supply and start MECHATROLINK communications.
4	Check the communications status. When communications in the data link layer have started, COM LED on the SERVOPACK is lit. Note: If COM LED is not lit, check the communications settings of SW1, SW2, and the controller, and then turn the power supplies OFF and ON again. When the MECHATROLINK-II connection in the application layer is established, the 7-segment LED indicates the completion of CONNECT execution as shown below.  When lit: CONNECT execution completed When unlit: CONNECT execution not completed

2.2 Operation Sequence for Managing Parameters Using a Controller

When the parameters are managed by a controller, the parameters are automatically transmitted from the controller to the SERVOPACK when the power is turned ON. Therefore, the settings of SERVOPACK do not need to be changed when the SERVOPACK is replaced.

Procedure	Operation	Command to Send
1	Turn on the control and main circuit power supplies.	NOP
2	Reset the previous communications status.	DISCONNECT*
3	Establish communications connection and starts WDT count.	CONNECT
4	Check information such as device ID.	ID_RD
5	Get device setting data such as parameters.	PRM_RD, ADJ
6	Set the parameters required for device.	PRM_WR
7	Enable the parameter settings (Setup).	CONFIG
8	Turn the encoder power supply to the position data.	SENS_ON
9	Turn the servo on.	SV_ON
10	Start operation.	
11	Turn the servo off.	SV_OFF
12	Disconnect the communications connection.	DISCONNECT
13	Turn the control and main circuit power supplies.	–

* If the connection cannot be released normally, send DISCONNECT command for 2 or more communications cycles, and then send CONNECT command.

2.3 Operation Sequence for Managing Parameters Using a SERVOPACK

To manage the parameters by using SERVOPACK's non-volatile memory, save the parameters in the non-volatile memory at setup and use an ordinary operation sequence.

2.3.1 Setup Sequence

Procedure	Operation	Command to Send
1	Turn on the control and main circuit power supply.	NOP
2	Reset the previous communications status.	DISCONNECT*
3	Establish communications connection and start WDT count.	CONNECT
4	Check information such as device ID.	ID_RD
5	Get device setting data such as parameters.	PRM_RD, ADJ
6	Save the parameters required for device in the non-volatile memory.	PPRM_WR Note: Do not use PRM_WR.
7	Disconnect the communications connection.	DISCONNECT
8	Turn off the control and main circuit power supplies.	–

* If the connection cannot be released normally, send a DISCONNECT command for 2 or more communications cycles, and then send a CONNECT command.

2.3.2 Ordinary Operation Sequence

Procedure	Operation	Command to Send
1	Turn on the control and main circuit power supplies.	NOP
2	Reset the previous communications status.	DISCONNECT*
3	Establish communications connection and start WDT count.	CONNECT
4	Check information such as device ID.	ID_RD
5	Get device setting data such as parameters.	PRM_RD, ADJ
6	Turn on the encoder power supply to get the position data.	SENS_ON
7	Turn the servo on.	SV_ON
8	Start operation.	POSING, INTERPOLATE, etc.
9	Turn the servo off.	SV_OFF
10	Disconnect the communications connection.	DISCONNECT
11	Turn off the control and main circuit power supplies.	–

* If the connection cannot be released normally, send a DISCONNECT command for 2 or more communications cycles, and then send a CONNECT command.

2.4 Specific Operation Sequences

This section describes operations that use commands in specific sequences.

2.4.1 Operation Sequence When Turning the Servo ON

Motor control using a host controller is performed using motion commands only during Servo ON (motor power ON).

While the SERVOPACK is in Servo OFF status (while current to the motor is interrupted), the SERVOPACK manages position data so that the reference coordinate system (POS, MPOS) and the feedback coordinate system (APOS) are equal. For correct execution of motion commands, therefore, it is necessary to use the SMON (Status Monitoring) command after the SERVOPACK status changes to Servo ON, to read the servo reference coordinates (POS) and send an appropriate reference position.
Confirm the following bit status before sending the SV_ON command:
STATUS field: PON = 1 and ALM = 0
IO Monitor field: HBB = 0

2.4.2 Operation Sequence When OT (Overtravel Limit Switch) Signal Is Input

When an OT signal is input, the SERVOPACK prohibits the motor from rotating in the way specified in the parameter Pn001. The motor continues to be controlled by the SERVOPACK while its rotation is prohibited.

When an OT signal is input, use the following procedure to process the OT signal.

Procedure	Operation
1	Monitor OT signals (P_OT and N_OT of IO Monitor field). When an OT signal is input, send an appropriate stop command: While an interpolation command (INTERPOLATE, LATCH) is being executed: Leave the interpolation command as it is and stop updating the interpolation position. Or, send a HOLD command and SMON command. While a move command (such as POSING) other than interpolation commands is being executed: Send a HOLD command.
2	Check the output completion flag DEN. If DEN = 1, the SERVOPACK completed the OT processing. At the same time, check the flag PSET. If PSET = 1, the motor is completely stopped. Keep the command used in procedure 1 active until both of the above flags are set to 1.
3	Read out the current reference position (POS) and use it as the start position for retraction processing.
4	Use a move command such as POSING or INTERPOLATE for retraction processing. Continue to use this command until the retraction is finished. If the move command ends without finishing the retraction, restart the move command continuously from the last target position.

Note: When an OT signal is input during execution of motion command ZRET or EX_POSING, the execution of the command will be cancelled. For retraction, always send a stop command described in procedure 1 first, and then send a retraction command (move command).
- In case of OT ON (P-OT or N-OT of IO_MON field = 1) or Software-Limit ON (P_SOT or N_SOT of STATUS field = 1), the motor may not reach the target position that the host controller specified. Make sure that the axis has stopped at a safe position by confirming the feedback position (APOS).

The host controller may not be able to monitor a brief change in the P-OT or N-OT signal to P-OT=1 or N-OT=1. Proper selection, installation and wiring in the limit switch is required to avoid chattering and malfunctions in the OT signal.

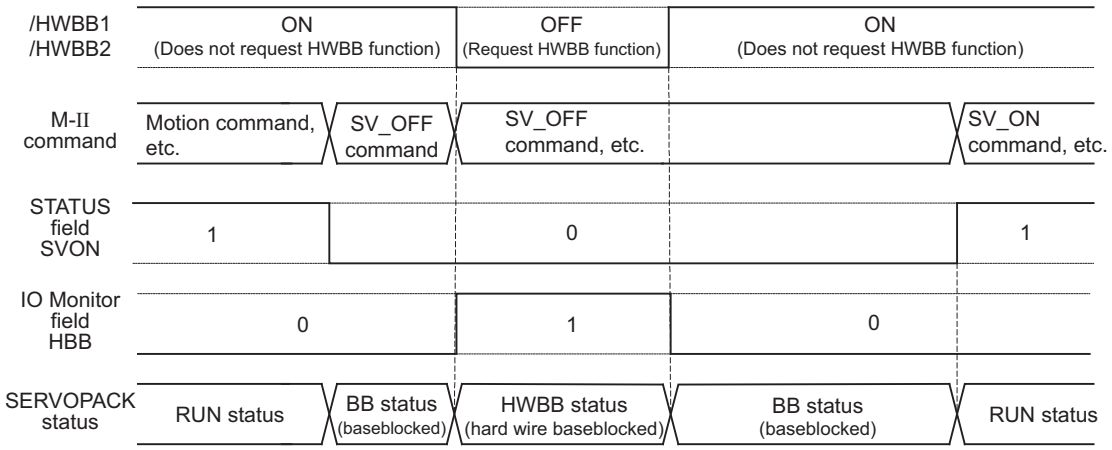
2.4.3 Operation Sequence at Emergency Stop (Main Circuit OFF)

After confirming that SV_ON or PON bit in the response data STATUS field is OFF (= 0), send an SV_OFF command.
During emergency stop, always monitor the SERVOPACK status using a command such as the SMON (Status Monitoring) command.

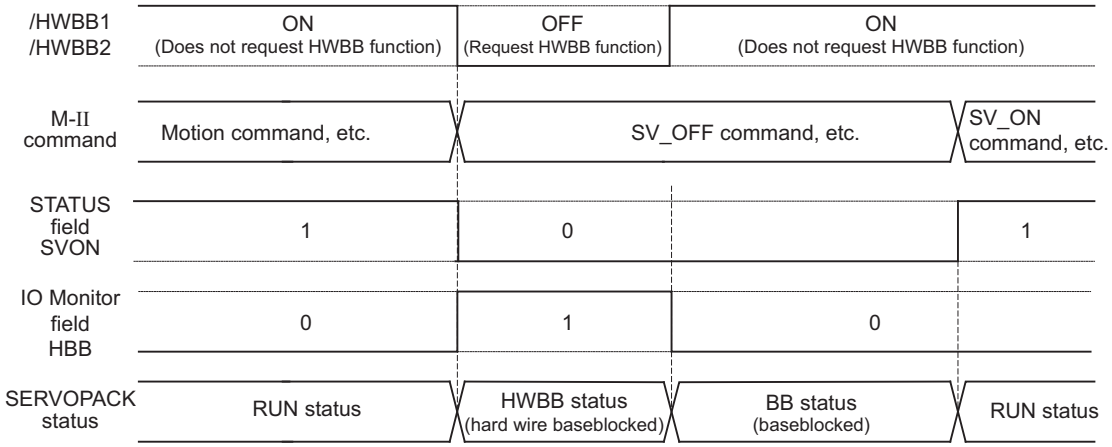
2.4.4 Operation Sequence When a Safety Signal is Input

When an HWBB1 or HWBB2 signal is input while the motor is being operated, current to the motor will be forcibly stopped, and the motor will be stopped according to the setting of the 1st digit of parameter Pn001.

[When an HWBB signal is input after the SERVOPACK stops powering the motor]



[When an HWBB signal is input while the SERVOPACK is powering the motor]



■ When an HWBB Signal is Input:

Monitor the HWBB input signal and SCM output signal status, or HBB signal status in IO Monitor field. If a forced stop status is detected, send a command such as SV_OFF to stop the motor.

■ Restoration from Stop Status:

Reset the HWBB1 or HWBB2 signal, and then send a command other than SV_ON, such as SV_OFF. Then, restore the controller and system. When the controller and system are restored, turn the servo ON using the operation sequence to turn the servo ON.

Note 1. If the SERVOPACK enters HWBB status while sending an SV_ON command, reset the /HWBB1 or /HWBB2 signal and then send a command other than SV_ON, such as SV_OFF. Then, send the SV_ON command again to restore the normal operation status.

2. If the SERVOPACK enters HWBB status during execution of an SV_OFF, INTERPOLATE, LATCH, POSING, FEED, EX_POSING, or ZRET command, a command warning will occur since the SERVOPACK status changes to Servo OFF status. Execute the Clear Alarm or Warning (ALM_CLR) command to restore normal operation.

2.4.5 Operation Sequence At Occurrence of Alarm

When the ALM bit in STATUS field of response turns on (= 1), send SV_OFF command. Use ALM_RD command to check the alarm occurrence status.
To clear the alarm status, send ALM_CLR command after removing the cause of alarm. However, the alarms that require turning the power supply off and then on again to clear the alarm status, sending ALM_CLR command will not clear the alarm status.
If a communications alarm A.E5□or A.E6□ occurs, send ALM_CLR command to reset the alarm and then send SYNC_SET command.

During execution of a Motion command, any one of the following statuses on the SERVOPACK will cause interruption of the motion command and an in-position status of PSET=1.

- Alarm occurrence (ALM of STATUS field =1) causes Servo-Off (SVON of STATUS field =0).
- Main power supply OFF (PON of STATUS field =0) causes Servo-Off (SVON of STATUS field =0).
- OT ON (P-OT or N-OT of IO_MON field = 1) or Software-Limit ON (P_SOT or N_SOT of STATUS field = 1) causes the motor to stop.

Even when PSET is 1 in these cases, the motor may not reach the target position that the host controller specified. Obtain the feedback position (APOS) to make sure that the axis has stopped at a safe position.

2.5 Setting the Origin Before Starting Operation

2.5.1 When Using an Incremental Encoder

When an incremental encoder is used in the slave station, carry out a homing operation after turning ON the power supply.
After the origin is set, set the reference coordinate system to determine the work coordinate origin as required:

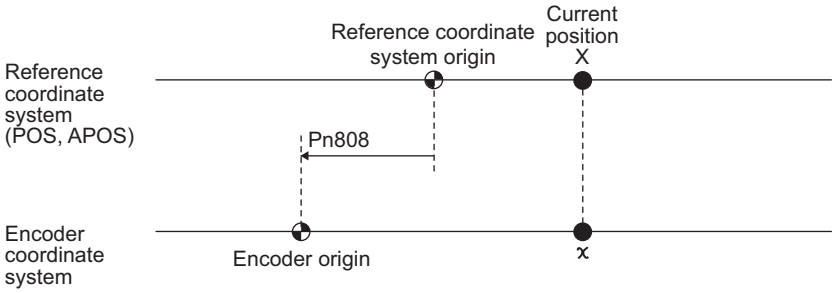
1. Setting the Reference Coordinate System Using ZRET Command
   The master station (controller) uses ZRET command to return the slave station to the origin and sets the reference coordinate system based on the origin.
2. Setting the Reference Coordinate System Using POS_SET Command
   The master station (controller) uses POS_SET command to set the reference coordinate system of the slave station.
   i) Position to the reference position.
   ii) Send the POS_SET command with POS_SET_MODE.POS_SEL = APOS (= 3), POS_SET_MODE.REFE = 1, and POS_DATA = reference position.

ZPOINT and software limits are enabled after the reference coordinate system has been set.

2.5.2 When Using an Absolute Encoder

When an absolute encoder is used in the slave station, SENS_ON command can be used to set the reference coordinate system of the slave station. The reference coordinate system will be set according to the position detected by the absolute encoder and the coordinate system offset of the encoder (i.e., the offset between the encoder's coordinate system and the reference coordinate system (device built-in parameter).
The relationship between the reference coordinate system (POS and APOS), the encoder's coordinate system, and the coordinate system offset of the encoder are shown in the following figure.

POS: Reference position
APOS: Feedback position



X=x+Pn808
Pn808: Absolure Encoder Origin Offset

3

Commands for Preparation Process

This chapter describes the MECHATROLINK-II commands needed to prepare for operation.

3.1 Commands List for Preparation Process

Operation	Command to Send	Description
Confirmation of completion of SERVOPACK initialization	NOP, DISCONNECT	Checks if the SERVOCK has been initialized to be ready for communications or not.
Establishment of MECHA-TROLINK-II connection	CONNECT	Establishes communications connection and starts WDT count.
Synchronous communications start	SYNC_SET	Starts synchronous communications.
Device ID check	ID_RD	Checks information such as device ID.
Parameter setting	PRM_WR	Sets the parameters required for device. (When parameters are managed by a controller)
Parameter setting and saving	PPRM_WR	Sets the parameters required for device and saves them in the non-volatile memory. (When parameters are managed by SERVOPACK.)
Validation of parameter settings (Setup)	CONFIG	Enables the set parameters.
Encoder power supply ON	SENS_ON	Turns on the encoder power supply to get position data.
Servo ON	SV_ON	Turns the servo on.
Encoder power supply OFF	SENS_OFF	Turns off the encoder power supply off.
Servo OFF	SV_OFF	Turns the servo off.
Parameter read-out	PRM_RD	Reads active parameters. (When parameters are managed by a controller)
SERVOPACK status monitoring	SMON	Monitors the SERVOPACK status.
Alarm and warning read-out	ALM_RD	Reads the current alarm or warning and the alarm occurrence history.
Clearing alarm or warning status	ALM_CLR	Clears the current alarm or warning status and the alarm occurrence history.
Coordinate system setting	POS_SET	Sets the coordinate system.
Data monitoring and adjustment	ADJ	Monitors and adjusts the set data.

3.2 Commands Details

3.2.1 No Operation (NOP: 00H)

After turning on the control and main circuit power supplies, send NOP command to check if initialization of SERVOPACK has been completed or not.

(1) NOP Command (00H)

The specifications of the NOP command are shown below.

<table>
<tr><th rowspan="2">Byte</th><th colspan="2">NOP</th><th colspan="4" rowspan="2">Description</th></tr>
<tr><th>Command</th><th>Response</th></tr>
<tr><td>1</td><td>00H</td><td>00H</td><td>Phases in which the command can be executed</td><td>All phases</td><td>Synchronization classification</td><td>Asynchronous command</td></tr>
<tr><td>2</td><td rowspan="15"></td><td>ALARM</td><td>Processing time</td><td>Within communications cycle</td><td>Subcommand</td><td>Can be used.</td></tr>
<tr><td>3</td><td rowspan="2">STATUS</td><td colspan="4" rowspan="29">• Returns the ALM, WARNG, and CMDRDY bits in STATUS field. Other bits will not be specified.
• The response will be NOP from the moment the power is turned on until the initialization of SERVOPACK is completed. During this time, CMDRY = 0.</td></tr>
<tr><td>4</td></tr>
<tr><td>5</td><td rowspan="14"></td></tr>
<tr><td>6</td></tr>
<tr><td>7</td></tr>
<tr><td>8</td></tr>
<tr><td>9</td></tr>
<tr><td>10</td></tr>
<tr><td>11</td></tr>
<tr><td>12</td></tr>
<tr><td>13</td></tr>
<tr><td>14</td></tr>
<tr><td>15</td></tr>
<tr><td>16</td><td>WDT</td><td>RWDT</td></tr>
<tr><td>17</td><td rowspan="13">Subcommand area</td><td rowspan="13">Subcommand area</td></tr>
<tr><td>18</td></tr>
<tr><td>19</td></tr>
<tr><td>20</td></tr>
<tr><td>21</td></tr>
<tr><td>22</td></tr>
<tr><td>23</td></tr>
<tr><td>24</td></tr>
<tr><td>25</td></tr>
<tr><td>26</td></tr>
<tr><td>27</td></tr>
<tr><td>28</td></tr>
<tr><td>29</td></tr>
</table>

(2) ALARM

The uppermost two digits of the SERVOPACK alarm code are set in the ALARM field of the response.
For example, ALARM = 02 when a parameter checksum error 1 (A.020) occurs.
If no alarm occurs, ALARM = 00.

For details on alarms and alarm codes, refer to *Σ-V Series User's Manual Design and Maintenance MECHATROLINK-II Communications Reference/Rotary Servomotors(SIEPS80000046)/Linear Servomotors (SIEPS8000048)*.

(3) Status Field Specifications

The status field is used to monitor the SERVOPACK status.
The following table shows the bit allocation in the status field.

D7	D6	D5	D4	D3	D2	D1	D0
PSET/ V_CMP	ZPOINT	–	PON	SVON	CMDRDY	WARNG	ALM

D15	D14	D13	D12	D11	D10	D9	D8
–	–	N_SOT	P_SOT	NEAR/ V_LIM	L_CMP	T_LIM	DEN/ZSPD

The following table explains each bit value and its status.

Bit	Name	Value	Description
D0	ALM	0	No alarm
		1	Alarm occurs.
D1	WARNG	0	No warning
		1	Warning occurs.
D2	CMDRDY	0	Command cannot be received (busy).
		1	Command can be received (ready).
D3	SVON	0	Servo OFF
		1	Servo ON
D4	PON	0	Main power supply OFF
		1	Main power supply ON
D5			
D6	ZPOINT	0	Out of home position range
		1	Within home position range
D7	PSET (During position control)	0	Out of positioning complete range
		1	Within positioning complete range (The output is completed (DEN = 1) and APOS is within the positioning complete range.)
	V_CMP (During speed control)	0	Speed does not coincide.
		1	Speed coincides.
D8	DEN (During position control)	0	During output
		1	Output completed
	ZSPD (During speed control)	0	Zero speed not detected
		1	Zero speed detected
D9	T_LIM	0	Not during torque (force) limit
		1	During torque (force) limit
D10	L_CMP	0	Latch not completed
		1	Latch completed
D11	NEAR (During position control)	0	Out of positioning proximity
		1	Within positioning proximity
	V_LIM (During speed control)	0	Speed limit not detected
		1	Speed limit detected
D12	P_SOT	0	OT signal is OFF.
		1	OT signal is ON.

Bit	Name	Value	Description
D13	N_SOT	0	OT signal is OFF.
		1	OT signal is ON.
D14			
D15			

(4) Details WDT and RWDT

The watchdog timer data will be set in WDT and RWDT of NOP command and response as shown below.

	D7 to D4	D3 to D0	
WDT	SN: Copy of RSN in RWDT	MN: Incremented by 1 each communications cycle	MN: Master station watchdog timer count
RWDT	RSN: Incremented by 1 each communications cycle	RMN: Copy of MIN in WDT	RSN: SERVOPACK's watchdog timer count

The watchdog timer is checked after synchronous communications has been established.
The SERVOPACK watchdog timer data will be refreshed whether synchronous communications is established or not.

3.2.2 Release MECHATROLINK-II Connection (DISCONNECT: 0FH)

The connection must be released at the end of communications.
Send a DISCONNECT command to release the connection.

(1) DISCONNECT Command (0FH)

The specifications of the DISCONNECT command are shown below.

<table>
<tr><th rowspan="2">Byte</th><th colspan="2">DISCONNECT</th><th colspan="4" rowspan="2">Description</th></tr>
<tr><th>Command</th><th>Response</th></tr>
<tr><td>1</td><td rowspan="2">0FH</td><td>0FH</td><td>Phases in which the command can be executed</td><td>All phases</td><td>Synchronization classification</td><td>Asynchronous command</td></tr>
<tr><td>2</td><td>ALARM</td><td>Processing time</td><td>Communications cycle or more (Within 5 s)</td><td>Subcommand</td><td>Cannot be used</td></tr>
<tr><td>3</td><td rowspan="12"></td><td rowspan="2">STATUS</td><td colspan="4" rowspan="14">• Releases the MECHATROLINK-II connection, and the SERVOPACK changes communications to Phase 1.
• When this command is received, the following operations will be performed.
- The SERVOPACK changes communications to Phase 1.
- The SERVOPACK changes to Servo OFF.
- The reference point setting becomes invalid.
- The position data is initialized.
- BRAKE signal turns ON.
- If an alarm has occurred, releasing the connection will not clear the alarm status. The set parameter data (saved in the volatile memory) will remain valid.
- To re-establish connection, carry out operations in the same sequence as when turning ON the power supply and set the required parameters again.</td></tr>
<tr><td>4</td></tr>
<tr><td>5</td><td rowspan="12"></td></tr>
<tr><td>6</td></tr>
<tr><td>7</td></tr>
<tr><td>8</td></tr>
<tr><td>9</td></tr>
<tr><td>10</td></tr>
<tr><td>11</td></tr>
<tr><td>12</td></tr>
<tr><td>13</td></tr>
<tr><td>14</td></tr>
<tr><td>15</td><td></td></tr>
<tr><td>16</td><td>WDT</td><td>RWDT</td></tr>
</table>

Note: Always send a DISCONNECT command for at least two communications cycles.

3.2.3 Establish MECHATROLINK-II Connection (CONNECT: 0EH)

Send a CONNECT command to establish a MECHATROLINK-II communications connection.
When the connection is established, the WDT (watchdog timer) count starts.

(1) CONNECT Command (0EH)

The specifications of the CONNECT command are shown below.

<table>
<tr><th rowspan="2">Byte</th><th colspan="2">CONNECT</th><th colspan="4" rowspan="2">Description</th></tr>
<tr><th>Command</th><th>Response</th></tr>
<tr><td>1</td><td>0EH</td><td>0EH</td><td>Phases in which the command can be executed</td><td>Phase 1</td><td>Synchronization classification</td><td>Asynchronous command</td></tr>
<tr><td>2</td><td rowspan="3"></td><td>ALARM</td><td>Processing time</td><td>Communications cycle or more (Within 5 s)</td><td>Subcommand</td><td>Cannot be used</td></tr>
<tr><td>3</td><td rowspan="2">STATUS</td><td rowspan="15" colspan="4">• Establishes a MECHATROLINK-II connection and sets the communications mode according to COM_MODE.
• VER: Version. Set VER to 21H (Version 2.1)
• COM_MOD: Sets the communications mode. Refer to (2) Details of COM_MOD for details.
• COM_TIM: Sets the communications cycle. The communications cycle must satisfy the following equation within the range between 1 and 32.
0.25 [ms] ≤ Transmission cycle [ms] × COM_TIM ≤ 32 [ms]
• A warning will occur and the command will be ignored in the following cases.
- If COM_MODE is out of the setting range: Data setting warning 2 (A.94B)
- If COM_TIM is out of the settting range: Data setting warning 2 (A.94B)
- If the transmission bytes is 17 but SUBCMD = 1: Data setting warning 2 (A.94B)
- If the transmission speed is set to 10 Mbps but VER is not set to 21H: Data setting warning 2 (A.94B)
• Slave stations will not accept commands other than CONNECT, DISCONNECT, and NOP before the connection is established. If a command other than CONNECT, DISCONNECT, and NOP is sent before the connection is established, NOP is always returned as the response.</td></tr>
<tr><td>4</td></tr>
<tr><td>5</td><td>VER</td><td>VER</td></tr>
<tr><td>6</td><td>COM_MOD</td><td>COM_MOD</td></tr>
<tr><td>7</td><td>COM_TIM</td><td>COM_TIM</td></tr>
<tr><td>8</td><td rowspan="8"></td><td rowspan="8"></td></tr>
<tr><td>9</td></tr>
<tr><td>10</td></tr>
<tr><td>11</td></tr>
<tr><td>12</td></tr>
<tr><td>13</td></tr>
<tr><td>14</td></tr>
<tr><td>15</td></tr>
<tr><td>16</td><td>WDT</td><td>RWDT</td></tr>
</table>

Note: Slave stations will not accept any MECHATROLINK-II command while a motion command such as JOG is being executed to run the motor through SigmaWin or by digital operator.

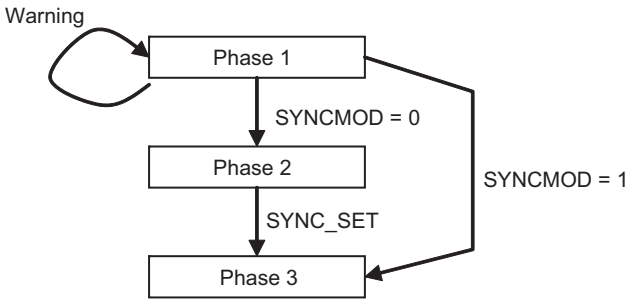
(2) Details of COM_MOD

COM_MOD bit allocation and each bit status are described below.

D7	D6	D5	D4	D3	D2	D1	D0
SUBCMD	0	0	0	DTMOD		SYNCMOD	0

- SYNCMOD: Sets the synchronization mode.
  SYNCMOD = 0: Asynchronous communications
  SYNCMOD = 1: Synchronous communications
- DTMOD: Sets the data transmission method.
  DTMOD = 00 or 11: Single transmission
  DTMOD = 01: Continuous transmission
  Normally, set DTMOD to 00.
- SUBCMD: Specify whether to use subcommands or not.
  SUBCMD = 0: Do not use subcommands
  SUBCMD = 1: Use subcommands

Note: When SYNCMOD = 0, it is necessary to send SYNC_SET command to enter Phase 3.



(3) Transmission Cycle and Communications Cycle

The table below provides the applicable communications cycle and the maximum number of connectable stations for each transmission cycle setting.

Transmission Cycle	Applicable Communications Cycle	Transmission Bytes	
		17-byte	32-byte
		Connectable Max. Number of Stations	
0.25 ms	0.25 ms to 8.00 ms (in 0.25-ms units)	2	1
0.50 ms	0.50 ms to 16.00 ms (in 0.50-ms units)	7	4
0.75 ms	0.75 ms to 24.00 ms (in 0.75-ms units)	11	7
1.00 ms	1.00 ms to 32.00 ms (in 1.00-ms units)	15	9
1.50 ms	1.50 ms to 32.00 ms (in 1.50-ms units)	23	15
2.00 ms	2.00 ms to 32.00 ms (in 2.00-ms units)	30	21
2.50 ms	2.50 ms to 2.00 ms (in 2.50-ms units)	30	26
3.00 ms	3.00 ms to 32.00 ms (in 3.00-ms units)	30	30
3.50 ms	3.50 ms to 32.00 ms (in 3.50-ms units)	30	30
4.00 ms	4.00 ms to 32.00 ms (in 4.00-ms units)	30	30

Note: Communications retry stations can be connected as long as the total number of connected stations, including the retry stations, is within the connectable max. number of stations. The maximum number of retry stations is the difference between the connectable max. number of stations and the number of actually connected slave stations, but limited to 7.
Note that the connectable max. number of stations may differ depending on the controller specifications.

3.2.4 Start Synchronous Communications (SYNC_SET: 0DH)

This section describe how to start synchronization to change a communications phase from phase 2 to phase 3.

When SYNCMOD bit of the COM_MOD of CONNECT command is set to 1, the communications phase will change from phase 1 to phase 3 at the moment the connection is established. In this case, it is not necessary to send a SYNC_SET command.

(1) SYNC_SET Command (0DH)

The specifications of the SYNC_SET command are described below.

<table>
<tr><th rowspan="2">Byte</th><th colspan="2">SYNC_SET</th><th colspan="4" rowspan="2">Description</th></tr>
<tr><th>Command</th><th>Response</th></tr>
<tr><td>1</td><td>0DH</td><td>0DH</td><td>Phases in which the command can be executed</td><td>Phase 2</td><td>Synchronization classification</td><td>Asynchronous command</td></tr>
<tr><td>2</td><td rowspan="15"></td><td>ALARM</td><td>Processing time</td><td>Communications cycle or more (Within 5 s)</td><td>Subcommand</td><td>Cannot be used</td></tr>
<tr><td>3</td><td rowspan="2">STATUS</td><td rowspan="15" colspan="4">• Starts synchronous communications. Switched from phase 2 to phase 3.
• Synchronization is made at the WDT changing edge. However, if WDT errors are masked by parameter Pn800.0, processing is completed when this command is received.
• During phase 3, the slave ignores this command and returns a normal response without a warning.
• If the slave station in Servo ON status receives this command in phase 2, the slave station enters Servo OFF status.
• At occurrence of the following alarms and warnings, this command must be transmitted to restart synchronous communications.
- Command warning 1 (A.95A) occurs when this command is used in phase 1
- MECHATROLINK-II synchronization Error (A.E50)
- MECHATROLINK-II synchronization failed (A.E51)
- MECHATROLINK-II Communications Error (A.E60)
- MECHATROLINK-II Transmission Cycle Error (A.E61)
- Command warning 1 (A.95A) occurs when this command is used while operating the servo using SigmaWin or a digital operator.</td></tr>
<tr><td>4</td></tr>
<tr><td>5</td><td rowspan="13"></td></tr>
<tr><td>6</td></tr>
<tr><td>7</td></tr>
<tr><td>8</td></tr>
<tr><td>9</td></tr>
<tr><td>10</td></tr>
<tr><td>11</td></tr>
<tr><td>12</td></tr>
<tr><td>13</td></tr>
<tr><td>14</td></tr>
<tr><td>15</td></tr>
<tr><td>16</td><td>WDT</td><td>RWDT</td></tr>
</table>

3.2.5 Check Device ID (ID_RD: 03H)

Send ID_RD command to read the device ID for confirmation.

(1) ID_RD Command (03H)

The specifications of the ID_RD command are described below.

<table>
<tr><th>Byte</th><th colspan="2">ID_RD</th><th colspan="4" rowspan="2">Description</th></tr>
<tr><th></th><th>Command</th><th>Response</th></tr>
<tr><td>1</td><td>03H</td><td>03H</td><td>Phases in which the command can be executed</td><td>Phase 2 and 3</td><td>Synchronization classification</td><td>Asynchronous command</td></tr>
<tr><td>2</td><td rowspan="3"></td><td>ALARM</td><td>Processing time</td><td>Within communications cycle</td><td>Subcommand</td><td>Can be used</td></tr>
<tr><td>3</td><td rowspan="2">STATUS</td><td rowspan="15" colspan="4">• Reads the device ID for contirmation.
• Use DEVICE_CODE to specify the device ID to be read.
• Use OFFSET to specify which data of the device ID is to be read out.
• Use SIZE to specify the number of data (bytes) to be read out.
• A warning will occur and the command will be ignored in the following case.
- DEVICE_CODE is set out of the range: Data setting warning 2 (A.94B)</td></tr>
<tr><td>4</td></tr>
<tr><td>5</td><td>DEVICE_ CODE</td><td>DEVICE_ CODE</td></tr>
<tr><td>6</td><td>OFFSET</td><td>OFFSET</td></tr>
<tr><td>7</td><td>SIZE</td><td>SIZE</td></tr>
<tr><td>8</td><td rowspan="8"></td><td rowspan="8">ID</td></tr>
<tr><td>9</td></tr>
<tr><td>10</td></tr>
<tr><td>11</td></tr>
<tr><td>12</td></tr>
<tr><td>13</td></tr>
<tr><td>14</td></tr>
<tr><td>15</td></tr>
<tr><td>16</td><td>WDT</td><td>RWDT</td></tr>
<tr><td>17</td><td rowspan="13">Subcommand area</td><td rowspan="13">Subcommand area</td></tr>
<tr><td>18</td></tr>
<tr><td>19</td></tr>
<tr><td>20</td></tr>
<tr><td>21</td></tr>
<tr><td>22</td></tr>
<tr><td>23</td></tr>
<tr><td>24</td></tr>
<tr><td>25</td></tr>
<tr><td>26</td></tr>
<tr><td>27</td></tr>
<tr><td>28</td></tr>
<tr><td>29</td></tr>
</table>

(2) Device ID Specifications

The specifications of the device ID are described below.

Device Type/Name		OFFSET / DEVICE_CODE	ID Data																				
			00	01	02	03	04	05	06	07	08	09	0A	0B	0C	0E	0D	0F	10	11	12	13	14
SERVOPACK	Model	00H	S	G	D	*1	–	*2	*2	*2	*3	*4	*4	*4	*5	*6	*6	*6	*6	*6	*6	*6	00
	Software version	02H	Ver.																				
Servomotor	Model	20H	S	G	M	*7	*7	–	*8	*8	*9	*10	*11	*12	*13	00							
	Encoder software version	12H	Ver.																				
External Encoder	Model	30H																					
	Software version	32H	Ver.																				
Safety Option Unit	Model	60H																					
	Software version	62H	Ver.																				
Feedback Option Unit	Model	70H																					
	Software version	72H	Ver.																				

- SERVOPACK Model
  *1: Model code, *2: Current capacity, *3: Power supply voltage specifications, *4: Interface specifications, *5: Design revision order, *6: Options
- Servomotor Model
  *7: Model code, *8: Rated output, *9: Power supply voltage, *10: Encoder type, *11: Design revision order, *12: Shaft-end specifications, *13: Options
- Software version is binary data.
- Model is expressed in ASCII code and “00 (NULL)” is added at the end of each character string.
- 50H and 52H of DEVICE_CODE are reserved for system.
- When the Safety Option unit or/and Feedback Option unit are not connected, 0 is set to all the ID data.
- For an external encoder, the ID of the encoder connected to the Feedback Option unit is set. (Therefore, 0 is set to all the ID data when no Feedback Option unit is connected.)
- When an encoder option for fully-closed loop control is connected to the Feedback Option unit, 0 is set to all the ID data of Feedback Option unit.

3.2.6 Set Parameters (PRM_WR: 02H)

Send PRM_WR command to set parameters when parameters are managed by a controller.
Parameters will be set without being saved in the non-volatile memory of SERVOPACK.

(1) PRM_WR Command (02H)

The specifications of the PRM_WR command are described below.

<table>
<tr><th rowspan="2">Byte</th><th colspan="2">PRM_WR</th><th colspan="4" rowspan="2">Description</th></tr>
<tr><th>Command</th><th>Response</th></tr>
<tr><td>1</td><td>02H</td><td>02H</td><td>Phases in which the command can be executed</td><td>Phase 2 and 3</td><td>Synchronization classification</td><td>Asynchronous command</td></tr>
<tr><td>2</td><td rowspan="3"></td><td>ALARM</td><td>Processing time</td><td>Within 200 ms</td><td>Subcommand</td><td>Cannot be used</td></tr>
<tr><td>3</td><td rowspan="2">STATUS</td><td colspan="4" rowspan="15">• Writes parameters.
The parameters will not be saved in the non-volatile memory.
• For parameters that require turning the power supply OFF and ON again to be validated, it is necessary to send a CONFIG command to validate the settings.
• Use NO to specify the parameter to be written.
• Use SIZE to specify the number of data (bytes) of the parameter to be written.
• PARAMETER is the data to be written.
• A warning will occur and the command will be ignored in the following cases.
- When writing parameters that affect utility functions currently being used for operations with SigmaWin or a digital operator: Command warning 1 (A.95A)
- NO is set out of the range: Data setting warning 1 (A.94A)
- SIZE does not match: Data setting warning 4 (A.94D)
- PARAMETER is out of the range: Data setting warning 2 (A.94B)</td></tr>
<tr><td>4</td></tr>
<tr><td>5</td><td rowspan="2">NO</td><td rowspan="2">NO</td></tr>
<tr><td>6</td></tr>
<tr><td>7</td><td>SIZE</td><td>SIZE</td></tr>
<tr><td>8</td><td rowspan="8">PARAMETER</td><td rowspan="8">PARAMETER</td></tr>
<tr><td>9</td></tr>
<tr><td>10</td></tr>
<tr><td>11</td></tr>
<tr><td>12</td></tr>
<tr><td>13</td></tr>
<tr><td>14</td></tr>
<tr><td>15</td></tr>
<tr><td>16</td><td>WDT</td><td>RWDT</td></tr>
</table>

• Example of NO
For the parameter Pn80D, the data is set in little endian as shown below.

Byte	Data
5	0D
6	08

3.2.7 Set and Save Parameters in Non-volatile Memory (PPRM_WR: 1CH)

Send a PPRM_WR command to save parameters in the SERVOPACK.

(1) PPRM_WR Command (1CH)

The specifications of the PPRM-WR command are described below.

<table>
<tr><th rowspan="2">Byte</th><th colspan="2">PPRM_WR</th><th colspan="4" rowspan="2">Description</th></tr>
<tr><th>Command</th><th>Response</th></tr>
<tr><td>1</td><td>1CH</td><td>1CH</td><td>Phases in which the command can be executed</td><td>Phase 2 and 3</td><td>Synchronization classification</td><td>Asynchronous command</td></tr>
<tr><td>2</td><td rowspan="3"></td><td>ALARM</td><td>Processing time</td><td>Within 200 ms</td><td>Subcommand</td><td>Cannot be used</td></tr>
<tr><td>3</td><td rowspan="2">STATUS</td><td rowspan="15" colspan="4">• Saves parameters in the non-volatile memory.
• For parameters that require turning the power supply OFF and ON again to be validated, it is necessary to send a CONFIG command to validate the settings.
• A warning will occur and the command will be ignored in the following cases.
- NO is out of the range: Data setting warning 1 (A.94A)
- SIZE does not match: Data setting warning 4 (A.94D)
- PARAMETER is out of the range: Data setting warning 2 (A.94B)
- When writing parameters that affect utility functions currently being used for operations with SigmaWin or a digital operator: Command warning 1 (A.95A)</td></tr>
<tr><td>4</td></tr>
<tr><td>5</td><td rowspan="2">NO</td><td rowspan="2">NO</td></tr>
<tr><td>6</td></tr>
<tr><td>7</td><td>SIZE</td><td>SIZE</td></tr>
<tr><td>8</td><td rowspan="8">PARAMETER</td><td rowspan="8">PARAMETER</td></tr>
<tr><td>9</td></tr>
<tr><td>10</td></tr>
<tr><td>11</td></tr>
<tr><td>12</td></tr>
<tr><td>13</td></tr>
<tr><td>14</td></tr>
<tr><td>15</td></tr>
<tr><td>16</td><td>WDT</td><td>RWDT</td></tr>
</table>

Do not turn off the power supply while the parameter is being written (CMDRDY = 0).

3.2.8 Validate Parameters (Setup) (CONFIG: 04H)

The set parameters need to be validated (setup) using a CONFIG command.

Executing this command recalculates all currently set parameters and initializes positions, output signals, etc.

(1) CONFIG Command (04H)

The specifications of the CONFIG command are described below.

<table>
<tr><th rowspan="2">Byte</th><th colspan="2">CONFIG</th><th colspan="4" rowspan="2">Description</th></tr>
<tr><th>Command</th><th>Response</th></tr>
<tr><td>1</td><td>04H</td><td>04H</td><td>Phases in which the command can be executed</td><td>Phase 2 and 3</td><td>Synchronization classification</td><td>Asynchronous command</td></tr>
<tr><td>2</td><td rowspan="15"></td><td>ALARM</td><td>Processing time</td><td>Within 5 s</td><td>Subcommand</td><td>Cannot be used</td></tr>
<tr><td>3</td><td rowspan="2">STATUS</td><td colspan="4" rowspan="15">• Recalculates all currently set parameters and initializes position, etc.
• The SERVOPACK will change to Servo OFF if this command is received when the SERVOPACK is Servo ON.
• A warning will occur and the command will be ignored if this command is sent:
- When using SigmaWin or a digital operator to execute utility functions: Command warning 1 (A.95A)
• Refer to (2) Status and Output Signal during CONFIG Command Executionfor details on status and output signal during CONFIG command execution.</td></tr>
<tr><td>4</td></tr>
<tr><td>5</td><td rowspan="13"></td></tr>
<tr><td>6</td></tr>
<tr><td>7</td></tr>
<tr><td>8</td></tr>
<tr><td>9</td></tr>
<tr><td>10</td></tr>
<tr><td>11</td></tr>
<tr><td>12</td></tr>
<tr><td>13</td></tr>
<tr><td>14</td></tr>
<tr><td>15</td></tr>
<tr><td>16</td><td>WDT</td><td>RWDT</td></tr>
</table>

(2) Status and Output Signal during CONFIG Command Execution

The status and output signal during CONFIG command execution are listed below.

Status and Output Signal	Before CONFIG	During CONFIG	After CONFIG
ALM (status)	Current status	Current status	Current status
CMDRDY (status)	1	0	1
Other status	Current status	Not specified	Current status
ALARM (code)	Alarm currently occurred	Alarm currently occurred	Alarm currently occurred
ALM (CN1 output signal)	Current status	Current status	Current status
/S-RDY (CN1 output signal)	Current status	OFF	Current status
Other output signals	Current status	Not specified	Current status

3.2.9 Turn Encoder Power Supply ON (SENS_ON: 23H)

Send SENS_ON command to turn ON the encoder power supply.

(1) SENS_ON Command (23H)

The specifications of the SENS_ON command are described below.

<table>
<tr><th rowspan="2">Byte</th><th colspan="2">SENS_ON</th><th colspan="4" rowspan="2">Description</th></tr>
<tr><th>Command</th><th>Response</th></tr>
<tr><td>1</td><td>23H</td><td>23H</td><td>Phases in which the command can be executed</td><td>Phase 2 and 3</td><td>Synchronization classification</td><td>Asynchronous command</td></tr>
<tr><td>2</td><td rowspan="15"></td><td>ALARM</td><td>Processing time</td><td>Within 2 s</td><td>Subcommand</td><td>Cannot be used</td></tr>
<tr><td>3</td><td rowspan="2">STATUS</td><td colspan="4" rowspan="15">• Obtains the initial position data and creates the present position when an absolute encoder is used.
• The reference point, home position (ZPOINT), and software limits will be enabled when an absolute encoder is used.
• After having used this command, the position data must be monitored and the coordinate system of host controller must be setup.</td></tr>
<tr><td>4</td></tr>
<tr><td>5</td><td rowspan="4">MONITOR1</td></tr>
<tr><td>6</td></tr>
<tr><td>7</td></tr>
<tr><td>8</td></tr>
<tr><td>9</td><td rowspan="4">MONITOR2</td></tr>
<tr><td>10</td></tr>
<tr><td>11</td></tr>
<tr><td>12</td></tr>
<tr><td>13</td><td>SEL_MON1/2</td><td>SEL_MON1/2</td></tr>
<tr><td>14</td><td rowspan="2"></td><td rowspan="2">IO_MON</td></tr>
<tr><td>15</td></tr>
<tr><td>16</td><td>WDT</td><td>RWDT</td></tr>
</table>

(2) Monitor Selection Field Specifications: SEL_MON1/2/3/4

The monitor selection (SEL_MON1/2/3/4) field is used to select the Servo monitor information.

- Applicable Commands:

  SV_ON, SV_OFF, HOLD, INTERPOLATE, POSING, FEED, LATCH, EX_POSING, ZRET, VELCTRL, TRQCTRL, SMON, SENS_ON, SENS_OFF, BRK_ON, BRK_OFF, LTMOD_ON, LTMOD_OFF

- Setting Method:

  Set MONITOR 1/2/3/4 monitor codes in SEL_MON1/2/3/4 allocated in the thirteenth byte of the main command or in the reserved area of the nineteenth byte of the subcommand.

  SEL_MON1/2/3/4 allocation is shown below.

D7	D6	D5	D4	D3	D2	D1	D0
SEL_MON2				SEL_MON1			

D7	D6	D5	D4	D3	D2	D1	D0
SEL_MON4				SEL_MON3			

(3) Monitor Information Field Specifications: MONITOR 1/2/3/4

The monitor information (MONITOR 1/2/3/4) field is used to monitor information selected by the monitor codes in the monitor selection field.

- Applicable Commands:

  SV_ON, SV_OFF, HOLD, INTERPOLATE, POSING, FEED, LATCH, EX_POSING, ZRET, VELCTRL, TRQCTRL, SMON, SENS_ON, SENS_OFF, BRK_ON, BRK_OFF, LTMOD_ON, LTMOD_OFF

The MONITOR 1/2/3/4 monitor codes are listed below.

Monitor Code	Name	Description	Unit
0	POS	Reference position in reference coordinate system (position after reference filtering)	Reference unit
1	MPOS	Reference position	Reference unit
2	PERR	Position error	Reference unit
3	APOS	Feedback position in machine coordinate system	Reference unit
4	LPOS	Feedback latch position in machine coordinate system	Reference unit
5	IPOS	Reference position in reference coordinate system (position before reference filtering)	Reference unit
6	TPOS	Target position in reference coordinate system	Reference unit
7			
8	FSPD	Feedback speed	Position/torque (force) control: reference units/s Speed control: Maximum speed/ 40000000H
9	CSPD	Reference speed	Position control: Reference units/s Speed control: Maximum speed/ 40000000H
A	TSPD	Target speed	Position control: Reference units/s Speed control: Maximum speed/ 40000000H
B	TRQ	Torque (force) reference (The rated torque is 100%.)	Position/speed control: % (The rated torque is 100%.) Torque (force) control: Maximum torque (force)/40000000H
C			
D			
E	OMN1	Option monitor 1 selected in Pn824	
F	OMN2	Option monitor 2 selected in Pn825	

(4) IO Monitor Field Specifications: IO_MON

The IO monitor field is used to monitor the I/O signal status of the SERVOPACK.

I/O signal allocation is shown below.

D7	D6	D5	D4	D3	D2	D1	D0
EXT2	EXT1	PC	PB	PA	DEC	N_OT	P_OT

D15	D14	D13	D12	D11	D10	D09	D08
IO15	IO14	IO13	IO12	–	HBB	BRK	EXT3

Bit	Name	Contents	Value	Status
D0	P_OT	Forward run prohibited input	0	OFF
			1	ON
D1	N_OT	Reverse run prohibited input	0	OFF
			1	ON
D2	DEC	Homing deceleration LS input	0	OFF
			1	ON
D3	PA	Encoder phase A input	0	OFF
			1	ON
D4	PB	Encoder phase B input	0	OFF
			1	ON
D5	PC	Encoder phase C input	0	OFF
			1	ON
D6	EXT1	First external latch signal input	0	OFF
			1	ON
D7	EXT2	Second external latch signal input	0	OFF
			1	ON
D8	EXT3	Third external latch signal input	0	OFF
			1	ON
D9	BRK	Brake output	0	Released
			1	Locked
D10	HBB	Stop signal input, OR of HWBB1 signal and HWBB2 signal	0	OFF (Forced stop released)
			1	ON (Forced stop)
D11		Reserved	0	
D12	IO12	CN1 input signal selected in Pn81E.0	0	OFF (open)
			1	ON (closed)
D13	IO13	CN1 input signal selected in Pn81E.1	0	OFF (open)
			1	ON (closed)
D14	IO14	CN1 input signal selected in Pn81E.2	0	OFF (open)
			1	ON (closed)
D15	IO15	CN1 input signal selected in Pn81E.3	0	OFF (open)
			1	ON (closed)

3.2.10 Turn Servo ON (SV_ON: 31H)

Send the SV_ON command to power the servomotor and make it ready for operation.

(1) SV_ON Command (31H)

The specifications of the SV_ON command are described below.

<table>
<tr><th rowspan="2">Byte</th><th colspan="2">SV_ON</th><th colspan="4" rowspan="2">Description</th></tr>
<tr><th>Command</th><th>Response</th></tr>
<tr><td>1</td><td>31H</td><td>31H</td><td>Phases in which the command can be executed</td><td>Phase 2 and 3</td><td>Synchronization classification</td><td>Asynchronous command</td></tr>
<tr><td>2</td><td></td><td>ALARM</td><td>Processing time</td><td>Normally 50 ms (10 s max.)</td><td>Subcommand</td><td>Can be used</td></tr>
<tr><td>3</td><td rowspan="2">OPTION</td><td rowspan="2">STATUS</td><td colspan="4" rowspan="16">• Powers the servomotor and makes it ready for operation.
• Command warning 1 (A.95A) will occur and the command will be ignored if the command is sent:
- During alarm occurrence (When ALM of STATUS is 1)
- When the main power supply is OFF (PON of STATUS is 0)
- When the HWBB signal is ON (HWBB of IO_MON is 1)
- Before completion of execution of SENS_ON when an absolute encoder is used
• OPTION field can be selected
• Upon completion of execution of this command, the reference position (POS) must be read, and the controller coordinate system must be set up.</td></tr>
<tr><td>4</td></tr>
<tr><td>5</td><td rowspan="8"></td><td rowspan="4">MONITOR1</td></tr>
<tr><td>6</td></tr>
<tr><td>7</td></tr>
<tr><td>8</td></tr>
<tr><td>9</td><td rowspan="4">MONITOR2</td></tr>
<tr><td>10</td></tr>
<tr><td>11</td></tr>
<tr><td>12</td></tr>
<tr><td>13</td><td>SEL_MON1/2</td><td>SEL_MON1/2</td></tr>
<tr><td>14</td><td rowspan="2"></td><td rowspan="2">IO_MON</td></tr>
<tr><td>15</td></tr>
<tr><td>16</td><td>WDT</td><td>RWDT</td></tr>
<tr><td>17</td><td rowspan="13">Subcommand area</td><td rowspan="13">Subcommand area</td></tr>
<tr><td>18</td></tr>
<tr><td>19</td></tr>
<tr><td>20</td></tr>
<tr><td>21</td></tr>
<tr><td>22</td></tr>
<tr><td>23</td></tr>
<tr><td>24</td></tr>
<tr><td>25</td></tr>
<tr><td>26</td></tr>
<tr><td>27</td></tr>
<tr><td>28</td></tr>
<tr><td>29</td></tr>
</table>

(2) OPTION Field Specifications

The option field is used to add functions to a motion command.

Set the functions to be added to a motion command in the main command third and forth bytes reserved for the option field.

The option field of the Σ-V series SERVOPACK is set by default as shown below.

To change the default setting, set the parameter Pn81F as Pn81F = □□□1, and set the bits to which functions are to be allocated using the parameters Pn82A to Pn82E. The change must be validated by turning the power supply OFF and then ON again or by sending a CONFIG command.

• OPTION Field Default Setting.

D7	D6	D5	D4	D3	D2	D1	D0
0	0	0	ACCFIL		0	0	0

D15	D14	D13	D12	D11	D10	D9	D8
N_CL	P_CL	P_PI_CLR	V_PPI	0	0	G_SEL	

• Functions That Can Be Allocated to Bits of the OPTION Field

Name	Description		Value	Details	Default Setting
ACCFIL (2 bits)	Acceleration/Deceleration filter		0	No acceleration/deceleration filter	D3, D4
			1	Exponential function acceleration/deceleration	
			2	S-curve acceleration/deceleration	
			3	Do not set.	
G_SEL (2 bits)	Gain switching		0	First gain	D8, D9
			1	Second gain	
			2	Reserved (invalid)	
			3	Reserved (invalid)	
V_PPI (1 bit)	Speed loop P/PI control		0	PI control	D12
			1	P control	
P_PI_CLR (1 bit)	Position loop position integral clear		0	Does not clear.	D13
			1	Clears.	
P_CL (1 bit)	Forward torque (force) limit		0	Does not control torque (force).	D14
			1	Controls torque (force).	
N_CL (1 bit)	Reverse torque (force) limit		0	Does not control torque (force).	D15
			1	Controls torque (force).	
LT_DISABLE (1 bit)	Latch signal input disabled		0	Enables latch signal input.	Not allocated
			1	Disables latch signal input.	
BANK_SEL1 (4 bits)	Bank selector 1 (Bank for acceleration/deceleration parameter switching)		0 to 15	Bank 0 to Bank 15	Not allocated
OUT_SIGNAL (3 bits)	I/O signal output command	BIT 0	0	SO1 output signal OFF	Not allocated
			1	SO1 output signal ON	
		BIT 1	0	SO2 output signal OFF	
			1	SO2 output signal ON	
		BIT 2	0	SO3 output signal OFF	
			1	SO3 output signal ON	

Note 1. Do not allocate more than one signal to one bit. Otherwise, multiple signals will be controlled by one bit.
2. The bits to which no function is allocated will act as it is set to 0 (zero).
3. To enable the OUT_SIGNAL function, set the following parameters to Zero: Pn50E, Pn50F, amd Pn510.

3.2.11 Turn Encoder Power Supply OFF (SENS_OFF: 24H)

Send a SENS_OFF command to turn OFF the encoder power supply.

(1) SENS_OFF Command (24H)

The specifications of the SENS_OFF command are described below.

<table>
<tr><th rowspan="2">Byte</th><th colspan="2">SENS_OFF</th><th colspan="4" rowspan="2">Description</th></tr>
<tr><th>Command</th><th>Response</th></tr>
<tr><td>1</td><td>24H</td><td>24H</td><td>Phases in which the command can be executed</td><td>Phase 2 and 3</td><td>Synchronization classification</td><td>Asynchronous command</td></tr>
<tr><td>2</td><td rowspan="15"></td><td>ALARM</td><td>Processing time</td><td>Within 2 sec</td><td>Subcommand</td><td>Cannot be used</td></tr>
<tr><td>3</td><td rowspan="2">STATUS</td><td colspan="4" rowspan="15">• Turn the encoder OFF. The position data will be not specified when an absolute encoder is used.
• The reference point, origin (ZPOINT), and software limits will be invalid.
• Command warning 1 (A.95A) will occur and the command will be ignored if the command is sent:
- While the servo is ON</td></tr>
<tr><td>4</td></tr>
<tr><td>5</td><td rowspan="4">MONITOR1</td></tr>
<tr><td>6</td></tr>
<tr><td>7</td></tr>
<tr><td>8</td></tr>
<tr><td>9</td><td rowspan="4">MONITOR2</td></tr>
<tr><td>10</td></tr>
<tr><td>11</td></tr>
<tr><td>12</td></tr>
<tr><td>13</td><td>SEL_MON1/2</td><td>SEL_MON1/2</td></tr>
<tr><td>14</td><td rowspan="2"></td><td rowspan="2">IO_MON</td></tr>
<tr><td>15</td></tr>
<tr><td>16</td><td>WDT</td><td>RWDT</td></tr>
</table>

3.2.12 Turn Servo OFF (SV_OFF: 32H)

Send an SV_OFF command to stop current flow through the servomotor.

(1) SV_OFF Command (32H)

The specifications of the SV_OFF command are described below.

<table>
<tr><th rowspan="2">Byte</th><th colspan="2">SV_OFF</th><th colspan="4" rowspan="2">Description</th></tr>
<tr><th>Command</th><th>Response</th></tr>
<tr><td>1</td><td>32H</td><td>32H</td><td>Phases in which the command can be executed</td><td>Phase 2 and 3</td><td>Synchronization classification</td><td>Asynchronous command</td></tr>
<tr><td>2</td><td rowspan="28"></td><td>ALARM</td><td>Processing time</td><td>The time set in Pn506
(500 ms max.)</td><td>Subcommand</td><td>Can be used</td></tr>
<tr><td>3</td><td rowspan="2">STATUS</td><td colspan="4" rowspan="28">• Stops current flow through the servomotor.
• When Pn829 (SVOFF waiting time at deceleration to stop) is set to a value other than 0, the servo will be turned OFF after the servomotor decelerates to a stop according to the deceleration constant for stopping set by the parameter. (The servomotor decelerates to a stop in position control mode.)
• When Pn829 (SVOFF waiting time at deceleration to a stop) is set to 0, the servo will be turned OFF immediately after reception of this command.
(The control mode before receiving SV_OFF command remains unchanged.)
• Executing the SV_OFF command will cancel the speed reference, speed feed forward, torque (force) feed forward, and torque (force) limits set by a position/speed control command.</td></tr>
<tr><td>4</td></tr>
<tr><td>5</td><td rowspan="4">MONITOR1</td></tr>
<tr><td>6</td></tr>
<tr><td>7</td></tr>
<tr><td>8</td></tr>
<tr><td>9</td><td rowspan="4">MONITOR2</td></tr>
<tr><td>10</td></tr>
<tr><td>11</td></tr>
<tr><td>12</td></tr>
<tr><td>13</td><td>SEL_MON1/2</td><td>SEL_MON1/2</td></tr>
<tr><td>14</td><td rowspan="2"></td><td rowspan="2">IO_MON</td></tr>
<tr><td>15</td></tr>
<tr><td>16</td><td>WDT</td><td>RWDT</td></tr>
<tr><td>17</td><td rowspan="13">Subcommand area</td><td rowspan="13">Subcommand area</td></tr>
<tr><td>18</td></tr>
<tr><td>19</td></tr>
<tr><td>20</td></tr>
<tr><td>21</td></tr>
<tr><td>22</td></tr>
<tr><td>23</td></tr>
<tr><td>24</td></tr>
<tr><td>25</td></tr>
<tr><td>26</td></tr>
<tr><td>27</td></tr>
<tr><td>28</td></tr>
<tr><td>29</td></tr>
</table>

3.2.13 Read Parameters (PRM_RD: 01H)

Send a PRM_RD command to read out parameters.

(1) PRM_RD Command (01H)

The specifications of the PRM_RD command are described below.

<table>
<tr><th rowspan="2">Byte</th><th colspan="2">PRM_RD</th><th colspan="4" rowspan="2">Description</th></tr>
<tr><th>Command</th><th>Response</th></tr>
<tr><td>1</td><td>01H</td><td>01H</td><td>Phases in which the command can be executed</td><td>Phase 2 and 3</td><td>Synchronization classification</td><td>Asynchronous command</td></tr>
<tr><td>2</td><td rowspan="3"></td><td>ALARM</td><td>Processing time</td><td>Within 200 ms</td><td>Subcommand</td><td>Can be used</td></tr>
<tr><td>3</td><td rowspan="2">STATUS</td><td colspan="4" rowspan="15">• Reads out parameters.
• A warning will occur and the command will be ignored in the following cases.
- NO is out of the range: Data setting warning 1 (A.94A)
- SIZE does not match: Data setting warning 4 (A.94D)</td></tr>
<tr><td>4</td></tr>
<tr><td>5</td><td rowspan="2">NO</td><td rowspan="2">NO</td></tr>
<tr><td>6</td></tr>
<tr><td>7</td><td>SIZE</td><td>SIZE</td></tr>
<tr><td>8</td><td rowspan="8"></td><td rowspan="8">PARAMETER</td></tr>
<tr><td>9</td></tr>
<tr><td>10</td></tr>
<tr><td>11</td></tr>
<tr><td>12</td></tr>
<tr><td>13</td></tr>
<tr><td>14</td></tr>
<tr><td>15</td></tr>
<tr><td>16</td><td>WDT</td><td>RWDT</td></tr>
</table>

3.2.14 Check SERVOPACK Status (SMON: 30H)

Send a SMON command to check the SERVOPACK status.

(1) SMON Command (30H)

The specifications of the SMON command are described below.

<table>
<tr><th rowspan="2">Byte</th><th colspan="2">SMON</th><th colspan="4" rowspan="2">Description</th></tr>
<tr><th>Command</th><th>Response</th></tr>
<tr><td>1</td><td>30H</td><td>30H</td><td>Phases in which the command can be executed</td><td>Phase 2 and 3</td><td>Synchronization classification</td><td>Asynchronous command</td></tr>
<tr><td>2</td><td rowspan="12"></td><td>ALARM</td><td>Processing time</td><td>Within communications cycle</td><td>Subcommand</td><td>Can be used</td></tr>
<tr><td>3</td><td rowspan="2">STATUS</td><td colspan="4" rowspan="15">• Reads the current status of the SERVOPACK.</td></tr>
<tr><td>4</td></tr>
<tr><td>5</td><td rowspan="4">MONITOR1</td></tr>
<tr><td>6</td></tr>
<tr><td>7</td></tr>
<tr><td>8</td></tr>
<tr><td>9</td><td rowspan="4">MONITOR2</td></tr>
<tr><td>10</td></tr>
<tr><td>11</td></tr>
<tr><td>12</td></tr>
<tr><td>13</td><td>SEL_MON1/2</td><td>SEL_MON1/2</td></tr>
<tr><td>14</td><td rowspan="2"></td><td rowspan="2">IO_MON</td></tr>
<tr><td>15</td></tr>
<tr><td>16</td><td>WDT</td><td>RWDT</td></tr>
<tr><td>17</td><td rowspan="13">Subcommand area</td><td rowspan="13">Subcommand area</td></tr>
<tr><td>18</td></tr>
<tr><td>19</td></tr>
<tr><td>20</td></tr>
<tr><td>21</td></tr>
<tr><td>22</td></tr>
<tr><td>23</td></tr>
<tr><td>24</td></tr>
<tr><td>25</td></tr>
<tr><td>26</td></tr>
<tr><td>27</td></tr>
<tr><td>28</td></tr>
<tr><td>29</td></tr>
</table>

3.2.15 Read Alarm or Warning (ALM_RD: 05H)

Send an ALM_RD command to read out the current alarm/warning and the alarm history.

(1) ALM_RD Command (05H)

The specifications of the ALM_RD command are described below.

<table>
<tr><th rowspan="2">Byte</th><th colspan="2">ALM_RD</th><th colspan="4" rowspan="2">Description</th></tr>
<tr><th>Command</th><th>Response</th></tr>
<tr><td>1</td><td>05H</td><td>05H</td><td>Phases in which the command can be executed</td><td>Phase 2 and 3</td><td>Synchronization classification</td><td>Asynchronous command</td></tr>
<tr><td>2</td><td rowspan="3"></td><td>ALARM</td><td>Processing time</td><td>See ALM_RD_MOD Specifications on the next page.</td><td>Subcommand</td><td>Cannot be used</td></tr>
<tr><td>3</td><td rowspan="2">STATUS</td><td colspan="4" rowspan="15">• Reads the following alarm and warning status.
- Current alarm/warning status
- Alarm history* (Warnings and communications alarms A.E50 and A.E60 will not be read out since they are not preserved in the history.)
• See (2) ALM_RD_MOD Specifications for details on ALM_RD_MOD.
• Alarm and warning codes are set in ALM_DATA from byte 6 in order from the most recent, and 0 is set in the bytes that are blank. Accordingly, the data in byte 6 is the latest alarm or warning code.
• A warning will occur and the command will be ignored in the following cases.
-If ALM_RD_MOD is out of the range: Data setting warning 2 (A.94B)</td></tr>
<tr><td>4</td></tr>
<tr><td>5</td><td>ALM_RD_MOD</td><td>ALM_RD_MOD</td></tr>
<tr><td>6</td><td rowspan="10"></td><td rowspan="10">ALM_DATA</td></tr>
<tr><td>7</td></tr>
<tr><td>8</td></tr>
<tr><td>9</td></tr>
<tr><td>10</td></tr>
<tr><td>11</td></tr>
<tr><td>12</td></tr>
<tr><td>13</td></tr>
<tr><td>14</td></tr>
<tr><td>15</td></tr>
<tr><td>16</td><td>WDT</td><td>RWDT</td></tr>
</table>

* Alarm history is saved in the non-volatile memory, and will not be lost if the control power goes OFF.

(2) ALM_RD_MOD Specifications

<table>
<tr><th>ALM_RD_MOD</th><th>Description</th><th>Processing Time</th></tr>
<tr><td>0</td><td>Read current alarm/warning status
10 items max. (sixth to fifteenth byte)</td><td>Within communications cycle</td></tr>
<tr><td>1</td><td>Read alarm history (warnings and communications alarms A.E50 and A.E60 are not preserved in the history.)
10 records max. (sixth to fifteenth byte)</td><td>Within 60 ms</td></tr>
<tr><td>2</td><td>Gets the detailed information of current alarm or warning one by one.
Set the occurrence order from 0 (the latest) to 9 for the alarm index.
<table>
<tr><th>Byte</th><th>Command</th><th>Response</th></tr>
<tr><td>6</td><td>Alarm index</td><td>Alarm index</td></tr>
<tr><td>7</td><td>0</td><td rowspan="2">Alarm code</td></tr>
<tr><td>8</td><td>0</td></tr>
</table></td><td rowspan="2">Within 12 m</td></tr>
<tr><td>3</td><td>Gets the detailed information of alarm history one by one.
Set the occurrence order from 0 (the latest) to 9 for the alarm index.
<table>
<tr><th>Byte</th><th>Command</th><th>Response</th></tr>
<tr><td>6</td><td>Alarm index</td><td>Alarm index</td></tr>
<tr><td>7</td><td>0</td><td rowspan="2">Alarm code</td></tr>
<tr><td>8</td><td>0</td></tr>
</table></td></tr>
</table>

1. When ALM_RD_MOD=0 or 1
   An alarm code of 1-byte length is returned.
   Example) The warning A.960 occurred and then, the communications error alarm A.E61 occurred.

1) Current warning/alarm (ALM_RD_MOD = 0)

Byte	ALM_DATA
6	E6H
7	96H
8	0
⋮	
15	

2) Alarm history (ALM_RD_MOD = 1)

Byte	ALM_DATA	
6	E6H	Latest alarm
7		Earlier alarms
8		
9		
⋮		
15		

Note 1. The current warning or alarm status can be cleared by executing the ALM_CLR (ALM_CLR_MOD = 0) command.
2. The alarm history will not be cleared until the ALM_CLR(ALM_CLR_MOD = 1) command is executed.
3. When ALM_RD_MOD = 1, warnings and communications alarms A.E50 and A.E60 are not preserved in the history.

2. When ALM_RD_MOD = 2 or 3
   An alarm code of 2-byte length is returned.
   If ALM_RD_MOD is set to 2 in the above example, the following alarm codes will be read out.
   0x960 for alarm index 0, and
   0xE61 for alarm index 1

3.2.16 Clear Warning or Alarm (ALM_CLR: 06H)

Send an ALM_CLR command to clear the warning/alarm status and the alarm history.

(1) ALM_CLR Command (06H)

The specifications of the ALM_CLR command are described below.

<table>
<tr><th rowspan="2">Byte</th><th colspan="2">ALM_CLR</th><th colspan="4" rowspan="2">Description</th></tr>
<tr><th>Command</th><th>Response</th></tr>
<tr><td>1</td><td>06H</td><td>06H</td><td>Phases in which the command can be executed</td><td>Phase 2 and 3</td><td>Synchronization classification</td><td>Asynchronous command</td></tr>
<tr><td>2</td><td></td><td>ALARM</td><td>Processing time</td><td>See (2) ALM_CLR_MOD Specifications.</td><td>Subcommand</td><td>Cannot be used</td></tr>
<tr><td>3</td><td></td><td rowspan="2">STATUS</td><td colspan="4" rowspan="14">• Clears the followings.
- Current alarm/warning status
- Alarm history *
• A warning will occur and the command will be ignored in the following cases.
- When using SigmaWin or a digital operator to execute utility functions: Command warning 1 (A.95A)
- ALM_CLR_MOD is out of the setting range: Data setting warning 2 (A.94B)
• The alarm status will not be cleared in the following cases.
- An alarm that cannot be reset occurs.
- An alarm that cannot be reset occurs but the cause of the alarm has not yet been removed.</td></tr>
<tr><td>4</td><td></td></tr>
<tr><td>5</td><td>ALM_CLR_MOD</td><td>ALM_CLR_MOD</td></tr>
<tr><td>6</td><td rowspan="10"></td><td rowspan="10"></td></tr>
<tr><td>7</td></tr>
<tr><td>8</td></tr>
<tr><td>9</td></tr>
<tr><td>10</td></tr>
<tr><td>11</td></tr>
<tr><td>12</td></tr>
<tr><td>13</td></tr>
<tr><td>14</td></tr>
<tr><td>15</td></tr>
<tr><td>16</td><td>WDT</td><td>RWDT</td></tr>
</table>

* Alarm history is saved in the non-volatile memory, and will not be lost if the control power goes OFF.

(2) ALM_CLR_MOD Specifications

ALM_CLR_MOD	Description	Processing Time
0	Clears current alarm/warning status.	Within 200 ms
1	Clears alarm history.	Within 2 s

3.2.17 Set Coordinate System (POS_SET: 20H)

Send a POS_SET command to set the position coordinate system.

(1) POS_SET Command (20H)

The specifications of the POS_SET command are described below.

<table>
<tr><th rowspan="2">Byte</th><th colspan="2">POS_SET</th><th colspan="4" rowspan="2">Description</th></tr>
<tr><th>Command</th><th>Response</th></tr>
<tr><td>1</td><td>20H</td><td>20H</td><td>Phases in which the command can be executed</td><td>Phase 2 and 3</td><td>Synchronization classification</td><td>Asynchronous command</td></tr>
<tr><td>2</td><td rowspan="3"></td><td>ALARM</td><td>Processing time</td><td>Within communications cycle</td><td>Subcommand</td><td>Cannot be used</td></tr>
<tr><td>3</td><td rowspan="2">STATUS</td><td colspan="4" rowspan="14">• Sets the current position to the position specified by POS_DATA.
• The origin (ZPOINT) and software limit settings are enabled by setting a reference point .
• See (2) PS_SUBCMD Specifications for details on PS_SUBCMD.
• Specify the position (coordinates) in POS_DATA.
• A warning will occur and the command will be ignored in the following cases.
- A number out of the range is set in PS_SUBCMD: Data setting warning 2 (A.94B)</td></tr>
<tr><td>4</td></tr>
<tr><td>5</td><td>PS_SUBCMD</td><td>PS_SUBCMD</td></tr>
<tr><td>6</td><td rowspan="4">POS_DATA</td><td rowspan="4">POS_DATA</td></tr>
<tr><td>7</td></tr>
<tr><td>8</td></tr>
<tr><td>9</td></tr>
<tr><td>10</td><td rowspan="6"></td><td rowspan="6"></td></tr>
<tr><td>11</td></tr>
<tr><td>12</td></tr>
<tr><td>13</td></tr>
<tr><td>14</td></tr>
<tr><td>15</td></tr>
<tr><td>16</td><td>WDT</td><td>RWDT</td></tr>
</table>

(2) PS_SUBCMD Specifications

The specifications of PS_SUBCMD are described below.

D7	D6	D5	D4	D3	D2	D1	D0
REFE	0	0	0	POS_SEL			

- REFE (Reference Point Setting)

  0: Does not set reference point.

  1: Sets reference point. The coordinates will be determined and the zero point position (ZPOINT) and software limit setting will be enabled.

- POS_SEL (Coordinate system selection)

  3: Sets APOS (feedback position in machine coordinate system), and sets the positions of all coordinate systems (TPOS, IPOS, POS, MPOS, APOS) to POS_DATA.

3.2.18 Monitor and Adjust Settings (ADJ: 3EH)

Send an ADJ command to monitor and adjust settings.

(1) ADJ Command (3EH)

The specifications of the ADJ command are described below.

<table>
<tr><th rowspan="2">Byte</th><th colspan="2">ADJ</th><th colspan="4" rowspan="2">Description</th></tr>
<tr><th>Command</th><th>Response</th></tr>
<tr><td>1</td><td>3EH</td><td>3EH</td><td>Phases in which the command can be executed</td><td>Phase 2 and 3</td><td>Synchronization classification</td><td>Asynchronous command</td></tr>
<tr><td>2</td><td>SUBCODE=01</td><td>ALARM</td><td>Processing time</td><td>Depends on processing</td><td>Subcommand</td><td>Cannot be used</td></tr>
<tr><td>3</td><td rowspan="2"></td><td rowspan="2">STATUS</td><td colspan="4" rowspan="11">• Use this command as SUBCODE = 01H.
The SERVOPACK will be in maintenance mode.
And, data monitoring and adjustment will be enabled.
• See (2) How to Send an ADJ Command for Adjustment for details on ADJ for adjustment.
• See (3) How to Send an ADJ Command for Monitoring Data for details on ADJ for monitoring data.
• A warning will occur and the command will be ignored in the following cases.
- While editing using SigmaWin or digital operator: Command warning 1 (A.95A)
- CADDRESS is out of the range: Parameter setting warning 1 (A.94A)
- CSIZE does not match: Parameter setting warning 4 (A.94D)
- CCMD and/or CDATA are out of the range: Parameter setting warning 2 (A.94B)</td></tr>
<tr><td>4</td></tr>
<tr><td>5</td><td rowspan="2">CCMD</td><td rowspan="2">CANS</td></tr>
<tr><td>6</td></tr>
<tr><td>7</td><td rowspan="2">CADDRESS</td><td rowspan="2">CADDRESS</td></tr>
<tr><td>8</td></tr>
<tr><td>9</td><td rowspan="2">CSIZE</td><td rowspan="2">CSIZE/
ERRCODE</td></tr>
<tr><td>10</td></tr>
<tr><td>11</td><td rowspan="5">CDATA</td><td rowspan="5">RDATA</td></tr>
<tr><td>12</td></tr>
<tr><td>13</td></tr>
<tr><td>14</td></tr>
<tr><td>15</td></tr>
<tr><td>16</td><td>WDT</td><td>RWDT</td></tr>
</table>

(2) How to Send an ADJ Command for Adjustment

The table below lists the adjustments that can be executed by sending an ADJ command.

List of Executable Adjustments

Adjustment	Request Code	Preparation Before Execution	Processing Time	Execution Conditions
Normal mode	0000H	None	200 ms max.	
Parameter initialization	1005H	None	20 s max.	Initialization is impossible while the servo is ON. After initialization, the power supply must be turned OFF and then ON again.
Absolute encoder reset	1008H	Required	5 s max.	When using an incremental encoder, it is impossible to reset the encoder while the servo is ON. After initialization, the power supply must be turned OFF and then ON again.
Automatic offset adjustment of motor current detection signals	100EH	None	5 s max.	Adjustment is disabled: • While the main circuit power supply is OFF • While the servo is ON • While the servomotor is running

List of Executable Adjustments (cont'd)

Adjustment	Request Code	Preparation Before Execution	Processing Time	Execution Conditions
Multiturn limit setting	1013H	Required	5 s max.	When using an incremental encoder, the setting is disabled unless A.CC0 (Multiturn limit disagreement) occurs. After initialization, the power supply must be turned OFF and then ON again.

ADJ Command Execution Procedure for Adjustment:

Details of Command for Adjustment

	Command	Response
CCMD/CANS	CCMD = 04H	CANS = 04H (copy of the command)
CADDRESS	Setting address	Reference address (copy of the command)
CSIZE/ ERRCODE	2 or 4	At normal reception: 0000H At error occurrence: A value other than 0
CDATA/RDATA	Setting data	Setting data (copy of the command)

1. Send the following data and set the request code of the adjustment to be executed.
   CCMD = 0004H
   CADDRESS = 2000H
   CSIZE = 0002H
   CDATA = Request code of the adjustment to be executed
   When the slave station receives the command normally, CMDRDY of status field will be set to 1. Also check ERRCODE. If an error occurs, carry out the operation in step 4 to abort execution.
2. For adjustment that requires a preparation process, send the following data.
   CCMD = 0004H
   CADDRESS = 2001H
   CSIZE = 0002H
   CDATA = 0002H
   When the slave station receives the command normally, CMDRDY of status field will be set to 1. Also check ERRCODE. If an error occurs, carry out the operation in step 4 to abort execution.
3. Send the following data to execute adjustment.
   CCMD = 0004H
   CADDRESS = 2001H
   CSIZE = 0002H
   CDATA = 0001H
   When the slave station receives the command normally, CMDRDY of status field will be set to 1. Also check ERRCODE. If an error occurs, carry out the operation in step 4 to abort execution.
4. Send the following data to abort the execution.
   CCMD = 0004H
   CADDRESS = 2000H
   CSIZE = 0002H
   CDATA = 0000H
   When the execution is aborted, CMDRDY of status field will be set to 1.

Note: If a communications alarm (A.E50 or A.E60) occurs after the request code has been set and before adjustment has been executed, the adjustment can not be carried out. Remove the cause of the alarm and restart the adjustment procedure.

(3) How to Send an ADJ Command for Monitoring Data

The table below lists the data that can be monitored.

List of Data that Can be Monitored

Name	Reference Address	Data Size	Unit	Remarks
Motor capacity	C00FH (Lower-most) C010H (Upper-most)	2 bytes	[W]	
Motor voltage	C011H	2 bytes	[V]	
Motor rated speed	C01CH	2 bytes	Rotary motor: [×10 C01EH reference value min^{-1}] Linear motor: [×10 C01EH reference value mm / s]	
Motor max. speed	C01DH	2 bytes	Rotary motor: [×10 C01EH reference value min^{-1}] Linear motor: [×10 C01EH reference value mm / s]	
Motor speed exponent	C01EH	2 bytes	–	
Motor rated torque (force)	C01FH	2 bytes	Rotary servomotor: [×10 C021H reference value N.m] Linear servomotor: [×10 C021H reference value N]	
Motor torque (force) exponent	C021H	2 bytes	–	
Encoder resolution	C022H (Lower-most) C023H (Upper-most)	2 bytes	Rotary servomotor: [pulse / rev] Linear servomotor: [pulse / pitch]	Note: When fully-closed setting is enabled (Pn002.3≠0), the unit is [pulse / pitch]
Maximum motor torque (force) that can be output	E701H	2 bytes	[%]	
Motor max. output speed	C027H	2 bytes	Rotary servomotor: [×10 C01EH reference value min^{-1}] Linear servomotor: [×10 C01EH reference value mm / s]	
Linear scale pitch	E084H	4 bytes	[×10 E 086H reference value pm / pitch]	For linear servo-motors only
Linear scale pitch exponent	E086H	2 bytes	–	For linear servo-motors only

ADJ Command Execution Procedure for Monitoring Data:

Details of Command to Monitor Data

	Command	Response
CCMD/CANS	CCMD = 03H	CANS = 03H (copy of the command)
CADDRESS	Reference address	Reference address (copy of the command)
CSIZE/ ERRCODE	– (Not required)	At normal reception: SIZE (2 or 4) At error occurrent: A value other than 2 and 4
CDATA/RDATA	– (Not required)	Reference data

1. Set the reference address to be monitored, and send the ADJ command.
   CCMD = 0003H
   CADDRESS = Reference address
   When the slave station receives the command normally, CMDRDY of status field will be see to 1. Also check ERRCODE.
2. When the command transmission is completed normally, CDATA of RSP will be read out for CSIZE to obtain the data.

Speed/Torque (Force) Data Normalization

The following data used in position, speed, or torque (force) control commands will be normalized:

Speed data:	VREF, VLIM :[maximum motor speed/40000000H]
Torque (force) data:	TFF/P_TLIM/N_TLIM/TLIM [maximum motor torque (force)/4000H] TQREF [maximum motor torque (force)/40000000H]

The maximum motor speed and maximum motor torque (force) used in the above data can be obtained by the following equations.

Maximum motor speed = C027H reference value $\times 10^{\text{C01EH reference value}}$ [Rotational servomotor: min^{-1}, Linear servomotor: mm/s]

Maximum motor torque (force) = C01FH reference value $\times 10^{\text{C021H reference value}} \times$ E701H reference value/100 [Rotational servomotor: N.m, Linear servomotor: N]

4

Motion Commands for Operation

This chapter describes the MECHATROLINK-II commands needed to control motions.

4.1 Motion Commands List

The motion commands described in this chapter are listed below.

Items		Command to Send	Description
Position Control	Stop Motion	HOLD	From current motion status, performs a deceleration stop in the set pattern and positioning.
	Set Latch Mode	LTMOD_ON	Requests the latch mode. If a latch signal is input in latch mode, position latching will be performed.
	Release Latch Mode	LTMOD_OFF	Releases the latch mode.
	Interpolation Feed	INTERPOLATE	Starts interpolation feeding.
	Positioning	POSING	Performs positioning to the target position (TPOS) at the target speed (TSPD).
	Constant Speed Feed	FEED	Performs constant speed feeding in position by position control.
	Interpolation Feeding with Position Detection	LATCH	Performs interpolation feeding and latches the position when a external signal is input.
	External Input Positioning	EX_POSING	Moves toward the target position (TPOS) at the target speed (TSPD). When a latch signal is input midway, positioning is performed according to the final travel distance for external position specified in the parameter from the latch signal input position.
	Homing	ZRET	Performs a homing.
Speed Control	Velocity Control	VELCTRL	Controls speed. (The SERVOPACK does not perform position control, but directly controls the speed of the speed loop.)
Torque (Force) Control	Torque (Force) Control	TRQCTRL	Controls torque (force). (The SERVOPACK does not perform position control and speed control, but directly performs torque (force) control.)

4.2 Motion Commands Details

4.2.1 Stop Motion (HOLD: 25H)

(1) HOLD Command (25H)

The HOLD command is used to perform a deceleration to stop from the current run status, at a deceleration ratio specified by the parameter for positioning.

<table>
<tr><th rowspan="2">Byte</th><th colspan="2">HOLD</th><th colspan="4" rowspan="2">Description</th></tr>
<tr><th>Command</th><th>Response</th></tr>
<tr><td>1</td><td>25H</td><td>25H</td><td>Phases in which the command can be executed</td><td>Phase 2 and 3</td><td>Synchronization classification</td><td>Asynchronous command</td></tr>
<tr><td>2</td><td></td><td>ALARM</td><td>Processing time</td><td>Within communications cycle</td><td>Subcommand</td><td>Cannot be used</td></tr>
<tr><td>3</td><td rowspan="2">OPTION</td><td rowspan="2">STATUS</td><td colspan="4" rowspan="16">• From the current state, performs a stop specified by the HOLD_MOD command.
• Use DEN (output complete) to confirm position data output completion.
• Option field can be used.
• This command will cancel the latch processing specified by the LATCH or EX_POSING command.
• This command will cancel ZRET latch processing and ZRET homing.
• Upon completion of execution of this command, the reference position (POS) must be read, and the controller coordinate system must be setup.
• The stopping method can be selected using HOLD_MOD.
0 = Stop according to the 1st or 2nd linear deceleration constant.
1 = Stop immediately (stop reference output)
2 = Stop according to the linear deceleration constant for stopping</td></tr>
<tr><td>4</td></tr>
<tr><td>5</td><td>HOLD_MOD</td><td rowspan="4">MONITOR1</td></tr>
<tr><td>6</td><td rowspan="7"></td></tr>
<tr><td>7</td></tr>
<tr><td>8</td></tr>
<tr><td>9</td><td rowspan="4">MONITOR2</td></tr>
<tr><td>10</td></tr>
<tr><td>11</td></tr>
<tr><td>12</td></tr>
<tr><td>13</td><td>SEL_MON1/2</td><td>SEL_MON1/2</td></tr>
<tr><td>14</td><td rowspan="2"></td><td rowspan="2">IO_MON</td></tr>
<tr><td>15</td></tr>
<tr><td>16</td><td>WDT</td><td>RWDT</td></tr>
<tr><td>17</td><td rowspan="13">Subcommand area</td><td rowspan="13">Subcommand area</td></tr>
<tr><td>18</td></tr>
<tr><td>19</td></tr>
<tr><td>20</td></tr>
<tr><td>21</td></tr>
<tr><td>22</td></tr>
<tr><td>23</td></tr>
<tr><td>24</td></tr>
<tr><td>25</td></tr>
<tr><td>26</td></tr>
<tr><td>27</td></tr>
<tr><td>28</td></tr>
<tr><td>29</td></tr>
</table>

(2) Related Parameters

Deceleration is specified by the following parameters.

Parameter No.	Name
Pn80D (Pn83A)	1st Linear Deceleration Constant
Pn80E (Pn83C)	2nd Linear Deceleration Constant
Pn80F (Pn83E)	Deceleration Constant Switching Speed
Pn827 (Pn840)	Linear Deceleration Constant for Stopping

Parameter number in parenthesis is when Pn833 = 1.

4.2.2 Set Latch Mode (LTMOD_ON: 28H)

(1) LTMOD_ON Command (28H)

The LTMOD_ON command is used to start latching the external signal input position data. Execution on the LTMOD_ON command allows latch operation while a command such as POSING and VELCTRL is being executed.

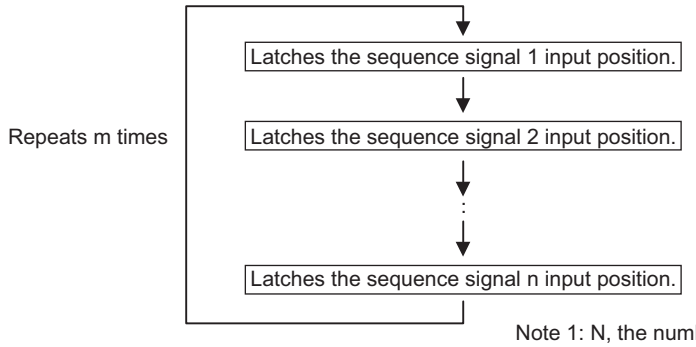
<table>
<tr><th rowspan="2">Byte</th><th colspan="2">LTMOD_ON</th><th colspan="4" rowspan="2">Description</th></tr>
<tr><th>Command</th><th>Response</th></tr>
<tr><td>1</td><td>28H</td><td>28H</td><td>Phases in which the command can be executed</td><td>Phase 2 and 3</td><td>Synchronization classification</td><td>Asynchronous command</td></tr>
<tr><td>2</td><td>LT_SGNL</td><td>ALARM</td><td>Processing time</td><td>Within communications cycle</td><td>Subcommand</td><td>Can be used</td></tr>
<tr><td>3</td><td rowspan="2"></td><td rowspan="2">STATUS</td><td colspan="4" rowspan="27">• Starts latch operation.
• Use LT_MOD to switch the latch mode:
= 0: Normal latch mode (Latches the position data when a signal selected by LT_SGNL is input)
= 1: Continuous latch (Latches the position data according to the values set in Pn850 to Pn853
Note: When LT_MOD ≠ 1, the normal latch mode is always selected.
• When CMDRDY = 1, this command has been received.
• Confirm that L_CMP of status field is set to 1 at completion of latching.
• When there is monitor data such as SMON and POSING appended to the command response, LPOS is forcefully returned to MONITOR 2 for one communications cycle.
• When there is no monitor data such as PRM_RD or ALM_RD appended to the command response, confirm that L_CMP of status field is set 1, then use a command that has monitor data such as SMON in the response and select LPOS to confirm.
• A warning will occur and the command will not be executed.
- Interference with another latch mode command (If this command is sent while another latch mode command such as EX_POSING, LATCH, ZRET, and SVCTRL is being executed): Command warning 4 (A.95D)
- LT_MOD = 1 and Pn850 = 0: Data setting warning 5 (A.94E)
• Latch time lag
- From reception of the command to latching start: 250ms max.
- From completion of latching to transmission of a response: One communications cycle max.</td></tr>
<tr><td>4</td></tr>
<tr><td>5</td><td>LT_MOD</td><td rowspan="4">MONITOR1</td></tr>
<tr><td>6</td><td rowspan="7"></td></tr>
<tr><td>7</td></tr>
<tr><td>8</td></tr>
<tr><td>9</td><td rowspan="4">MONITOR2</td></tr>
<tr><td>10</td></tr>
<tr><td>11</td></tr>
<tr><td>12</td></tr>
<tr><td>13</td><td>SEL_MON1/2</td><td>SEL_MON1/2</td></tr>
<tr><td>14</td><td rowspan="2"></td><td rowspan="2">IO_MON</td></tr>
<tr><td>15</td></tr>
<tr><td>16</td><td>WDT</td><td>RWDT</td></tr>
<tr><td>17</td><td rowspan="13">Subcommand area</td><td rowspan="13">Subcommand area</td></tr>
<tr><td>18</td></tr>
<tr><td>19</td></tr>
<tr><td>20</td></tr>
<tr><td>21</td></tr>
<tr><td>22</td></tr>
<tr><td>23</td></tr>
<tr><td>24</td></tr>
<tr><td>25</td></tr>
<tr><td>26</td></tr>
<tr><td>27</td></tr>
<tr><td>28</td></tr>
<tr><td>29</td></tr>
</table>

(2) Normal Latch Mode

In normal latch mode, the latch operation is started by sending an LTMOD_ON command, and it is completed when the input position of the latch signal LT_SGNL specified in the LTMOD_ON command is latched
To restart the latch operation, send the LTMOD_OFF command once, then send the LTMODE_ON command again. Use LT_MOD in the LTMOD_ON command to select either normal or continuous latch mode.

(3) Continuous Latch Mode

This function sequentially latches the input positions of sequence signal 1 to sequence signal n (n = 1 to 8) for a specified number of times. The continuous latch operation can be aborted by executing the LTMOD_OFF command. This function can shorten the time between latch completion and the start of the next latch, and enables sequential latch operations at high speed.



Note 1: N, the number of sequence signals, is specified by Pn850.
2: The signals for sequence signal n are selected by Pn852 and Pn853.
3: The number of times of continuous latching m is set by Pn851.

[How to Start and Stop Continuous Latch Operation]

Set the following parameters, and then set LT_MOD to 1 to execute the LTMOD_ON command. The continuous latch operation will start. To abort the operation, execute the LTMOD_OFF command.

Pn850: Latch Sequence Number n

Pn851: Continuous Latch Count m (When m = 0, the continuous latch operation will be infinitely repeated.)

Pn852: Latch Sequence Signal 1 to 4 Setting

Pn853: Larch Sequence Signal 5 to 8 Setting

Note: If the LTMOD_ON command is executed by setting Pn850 to 0 and LT_MOD to 1, the latch mode error warning (A.94E) will occur and the latch operation will not start.

[Latch Status]

Latch completion can be confirmed by the following status.

[STATUS Field: The 3rd and 4th byte]

L_CMP (D10): L_CMP is set to 1 for one communications cycle every time the external signal is input.

[EX_STATUS Field: The 28th and 29th byte]

L_SEQ_NO (D8-D11): The latch sequence signal number (value n) at latch completion

L_CMP_CNT (D0-D7): The continuous latch count (value m)
(Added at completion of position latch when the latch sequence signal n is input.)

Note: LPOS is forcibly output to MONITOR 2 for one communications cycle while L_CMP = 1 every time the external signal is input.

[Latched Position Data]

The latest latched position data at completion of latching can be obtained by using the following monitor.

Name	Code	Remarks
Feedback Latch Position	LPOS	The latest latch signal input position

The previously latched position data can be obtained by using the following option monitor.

Name	Code	Option Monitor Selection (Pn824 and Pn825)
Option Monitor 1 and 2	OMN1, 2	80H: Previous latch signal input position

(4) LT_SGNL Specifications

- Applicable Commands:

LATCH, EX_POSING, ZRET, LTMOD_ON (when Pn850=0), SVCTRL

The latch signals can be specified in the following latch signal (LT_SGNL) field.

D7	D6	D5	D4	D3	D2	D1	D0
0	0	0	0	0	0	LT_SGNL	

D1	D0	Latch Signal	Signal Details
0	0	Phase C	Encoder origin signal
0	1	EXT1	External input signal 1
1	0	EXT2	External input signal 2
1	1	EXT3	External input signal 3

(5) Related Parameters

The parameters related to latch operation are listed below.

Parameter No.	Name
Pn820	Forward Latching Allowable Area
Pn822	Reverse Latching Allowable Area
Pn850	Latch Sequence Number
Pn851	Continuous Latch Count
Pn852 and Pn853	Latch Sequence Signal Setting

Note 1. EXT1, EXT2, and EXT3 signals must be assigned as the input signals of CN1 by using the parameter Pn511. If they are not assigned, the latch operation will be undefined.
2. If encoders without phase C (origin signal) and linear scales are used and the phase C is selected, the latch operation will be undefined.

4.2.3 Release Latch Mode (LTMOD_OFF: 29H)

(1) LTMOD_OFF Command (29H)

The LTMOD_OFF command is used to release the latch mode.

<table>
<tr><th rowspan="2">Byte</th><th colspan="2">LTMOD_OFF</th><th colspan="4" rowspan="2">Description</th></tr>
<tr><th>Command</th><th>Response</th></tr>
<tr><td>1</td><td rowspan="2">29H</td><td rowspan="2">29H</td><td>Phases in which the command can be executed</td><td>Phase 2 and 3</td><td>Synchronization classification</td><td>Asynchronous command</td></tr>
<tr><td>2</td><td>Processing time</td><td>Within communications cycle</td><td>Subcommand</td><td>Can be used</td></tr>
<tr><td>3</td><td rowspan="27"></td><td rowspan="2">STATUS</td><td colspan="4" rowspan="27">• Check that CMDRDY is 1 to confirm that this command has been received.
• It takes 250 µs max. to release the latch mode.
• This command cannot be used while LATCH, ZRET, EX_POSING, or SVCTRL command is being executed.
If used, the command warning 4 (A.95D) will occur.</td></tr>
<tr><td>4</td></tr>
<tr><td>5</td><td rowspan="4">MONITOR1</td></tr>
<tr><td>6</td></tr>
<tr><td>7</td></tr>
<tr><td>8</td></tr>
<tr><td>9</td><td rowspan="4">MONITOR2</td></tr>
<tr><td>10</td></tr>
<tr><td>11</td></tr>
<tr><td>12</td></tr>
<tr><td>13</td><td>SEL_MON1/2</td><td>SEL_MON1/2</td></tr>
<tr><td>14</td><td rowspan="2"></td><td rowspan="2">IO_MON</td></tr>
<tr><td>15</td></tr>
<tr><td>16</td><td>WDT</td><td>RWDT</td></tr>
<tr><td>17</td><td rowspan="13">Subcommand area</td><td rowspan="13">Subcommand area</td></tr>
<tr><td>18</td></tr>
<tr><td>19</td></tr>
<tr><td>20</td></tr>
<tr><td>21</td></tr>
<tr><td>22</td></tr>
<tr><td>23</td></tr>
<tr><td>24</td></tr>
<tr><td>25</td></tr>
<tr><td>26</td></tr>
<tr><td>27</td></tr>
<tr><td>28</td></tr>
<tr><td>29</td></tr>
</table>

4.2.4 Interpolation Feeding (INTERPOLATE: 34H)

(1) INTERPOLATE Command (34H)

The INTERPOLATE command is used to start interpolation feeding. Speed feed forward and torque (force) feed forward can be specified simultaneously.

<table>
<tr><th rowspan="2">Byte</th><th colspan="2">INTERPOLATE</th><th colspan="4" rowspan="2">Description</th></tr>
<tr><th>Command</th><th>Response</th></tr>
<tr><td>1</td><td>34H</td><td>34H</td><td>Phases in which the command can be executed</td><td>Phase 3</td><td>Synchronization classification</td><td>Asynchronous command</td></tr>
<tr><td>2</td><td></td><td>ALARM</td><td>Processing time</td><td>Within communications cycle</td><td>Subcommand</td><td>Can be used</td></tr>
<tr><td>3</td><td rowspan="2">OPTION</td><td rowspan="2">STATUS</td><td colspan="4" rowspan="16">• OPTION field can be selected.
• Interpolation feeding is performed by specifying the target position (TPOS) every communications cycle.
The target position (TPOS) is a signed 4-byte data.
Note: The target position is not an incremental value (travel amount), but the absolute position in the reference coordinate system.
• The speed feed forward (VEF [reference units/s]) is a signed 4-byte data.
• Either torque (force) feed forward (TFF) or torque (force) limit (TLIM) can be used. It can be selected by setting Pn81F and Pn002.
- TFF setting range: A signed 2-byte data [maximum motor torque (force)/ 4000H]
Use the ADJ command to obtain the maximum motor torque (force).
- TLIM setting range: 0 to 4000H [maximum motor torque (force)/ 4000H]
(If a value between 4000H and FFFFH is set, the maximum motor torque (force) will be applied as the limit.
• Use DEN (output complete) to confirm the completion of position reference output.
• When a command in execution is switched to another command, the feed forward value (VFF or TFF) will be cleared.
• A warning will occur and the command will not be executed in the following cases.
- If this command is used in communications phase other than phase 3: Command warning 1 (A.95A)
- If this command is sent while the servo is OFF: Command warning1 (A.95A)
- The travel amount (Target position (TPOS) - Current position (IPOS)) exceeds the limit value: Data setting warning 2 (A.94B)
- When using SigmaWin or a digital operator for motor operations such as JOG: Command warning 1 (A.95A)</td></tr>
<tr><td>4</td></tr>
<tr><td>5</td><td rowspan="4">TPOS</td><td rowspan="4">MONITOR1</td></tr>
<tr><td>6</td></tr>
<tr><td>7</td></tr>
<tr><td>8</td></tr>
<tr><td>9</td><td rowspan="4">VFF</td><td rowspan="4">MONITOR2</td></tr>
<tr><td>10</td></tr>
<tr><td>11</td></tr>
<tr><td>12</td></tr>
<tr><td>13</td><td>SEL_MON1/2</td><td>SEL_MON1/2</td></tr>
<tr><td>14</td><td rowspan="2">TFF/TLIM</td><td rowspan="2">IO_MON</td></tr>
<tr><td>15</td></tr>
<tr><td>16</td><td>WDT</td><td>RWDT</td></tr>
<tr><td>17</td><td rowspan="13">Subcommand area</td><td rowspan="13">Subcommand area</td></tr>
<tr><td>18</td></tr>
<tr><td>19</td></tr>
<tr><td>20</td></tr>
<tr><td>21</td></tr>
<tr><td>22</td></tr>
<tr><td>23</td></tr>
<tr><td>24</td></tr>
<tr><td>25</td></tr>
<tr><td>26</td></tr>
<tr><td>27</td></tr>
<tr><td>28</td></tr>
<tr><td>29</td></tr>
</table>

(2) Related Parameters

Either torque (force) feed forward (TFF) or torque (force) limit (TLIM) can be selected by setting the following parameters.

Parameter No.	Set Value	Meaning
Pn81F	n.□□1□	Enables the torque (force) feed forward (TFF).
Pn002	n.□□□2	
Pn81F	n.□□1□	Enables forward/reverse torque (force) limit using TLIM.
Pn002	n.□□□1	
Pn81F	n.□□1□	When P_CL of OPTION field is set to 1: Uses TLIM as positive torque (force) limit. When N_CL of OPTION field is set to 1: Uses TLIM as negative torque (force) limit.
Pn002	n.□□□3	

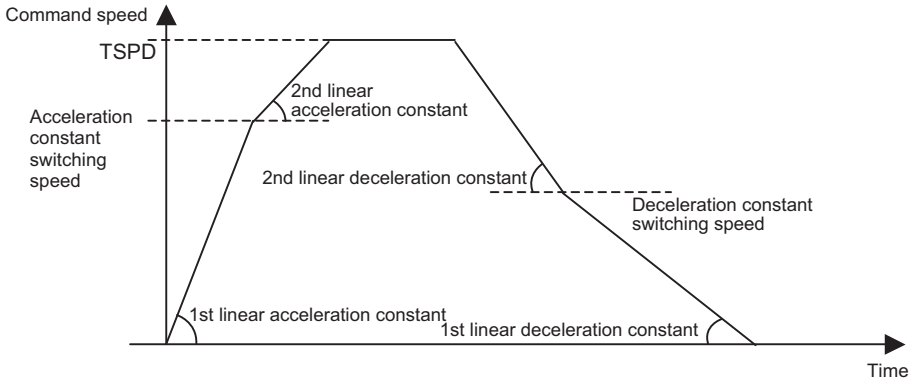
4.2.5 Positioning (POSING: 35H)

(1) POSING Command (35H)

The POSING command is used to start positioning to the target position (TPOS) at the target speed (TSPD).

<table>
<tr><th rowspan="2">Byte</th><th colspan="2">POSING</th><th colspan="4" rowspan="2">Description</th></tr>
<tr><th>Command</th><th>Response</th></tr>
<tr><td>1</td><td>35H</td><td>35H</td><td>Phases in which the command can be executed</td><td>Phase 2 and 3</td><td>Synchronization classification</td><td>Asynchronous command</td></tr>
<tr><td>2</td><td></td><td>ALARM</td><td>Processing time</td><td>Within communications cycle</td><td>Subcommand</td><td>Can be used</td></tr>
<tr><td>3</td><td rowspan="2">OPTION</td><td rowspan="2">STATUS</td><td colspan="4" rowspan="16">• OPTION field can be selected.
• The target position (TPOS) is a signed 4-byte data.
It is sent by using an absolute position in the reference coordinate system.
Set the target position (TPOS) so that the movement distance (TPOS - IPOS) is 2,147,483,647 (= 2^{31}-1) or less.
• Set the target speed (TSPD) to a value between 0 and the motor max. speed [reference unit/s].
• Changes can be made to the target position and target speed during movement.
• The torque (force) limit (TLIM) can be used by setting Pn81F and Pn002.
- TLIM setting range: 0 to 4000H [maximum motor torque (force)/ 4000H]
If TLIM is set to a value between 4000H and FFFFH, the maximum motor torque (force) will be applied as the limit.
Use the ADJ command to obtain the maximum motor torque (force).
• Use DEN (output complete) to confirm the completion of position reference output.
• A warning will occur and the command will be ignored in the following case.
- This command is used while the servo is OFF: Command warning 1 (A.95A)
- The target speed (TSPD) exceeds the limit: Data setting warning 2 (A.94B)
- When using SigmaWin or a digital operator for motor operations such as JOG: Command warning 1 (A.95A)</td></tr>
<tr><td>4</td></tr>
<tr><td>5</td><td rowspan="4">TPOS</td><td rowspan="4">MONITOR1</td></tr>
<tr><td>6</td></tr>
<tr><td>7</td></tr>
<tr><td>8</td></tr>
<tr><td>9</td><td rowspan="4">TSPD</td><td rowspan="4">MONITOR2</td></tr>
<tr><td>10</td></tr>
<tr><td>11</td></tr>
<tr><td>12</td></tr>
<tr><td>13</td><td>SEL_MON1/2</td><td>SEL_MON1/2</td></tr>
<tr><td>14</td><td rowspan="2">TLIM</td><td rowspan="2">IO_MON</td></tr>
<tr><td>15</td></tr>
<tr><td>16</td><td>WDT</td><td>RWDT</td></tr>
<tr><td>17</td><td rowspan="13">Subcommand area</td><td rowspan="13">Subcommand area</td></tr>
<tr><td>18</td></tr>
<tr><td>19</td></tr>
<tr><td>20</td></tr>
<tr><td>21</td></tr>
<tr><td>22</td></tr>
<tr><td>23</td></tr>
<tr><td>24</td></tr>
<tr><td>25</td></tr>
<tr><td>26</td></tr>
<tr><td>27</td></tr>
<tr><td>28</td></tr>
<tr><td>29</td></tr>
</table>

Positioning will be performed as illustrated below.



(2) Related Parameters

The parameters related to the execution of POSING command are listed below.

Parameter number in parentheses is when Pn833=1.

Parameter No.	Name
Pn80A (Pn834)	1st Linear Acceleration Constant
Pn80B (Pn836)	2nd Linear Acceleration Constant
Pn80C (Pn838)	Acceleration Constant Switching Speed
Pn80D (Pn83A)	1st Linear Deceleration Constant
Pn80E (Pn83C)	2nd Linear Deceleration Constant
Pn80F (Pn83E)	Deceleration Constant Switching Speed
Pn81F	Position Control Command TFF/TLIM Function Allocation
Pn002	Torque (Force) Reference Option During Speed/Position Control

Set the parameters as shown below to use TLIM.

Parameter No.	Set Value	Meaning
Pn81F	n.□□1□	Enables forward/reverse torque (force) limit using TLIM.
Pn002	n.□□□1	
Pn81F	n.□□1□	When P_CL of OPTION field is set to 1: Uses TLIM as positive torque (force) limit. When N_CL of OPTION field is set to 1: Uses TLIM as negative torque (force) limit
Pn002	n.□□□3	

4.2.6 Constant Speed Feeding (FEED: 36H)

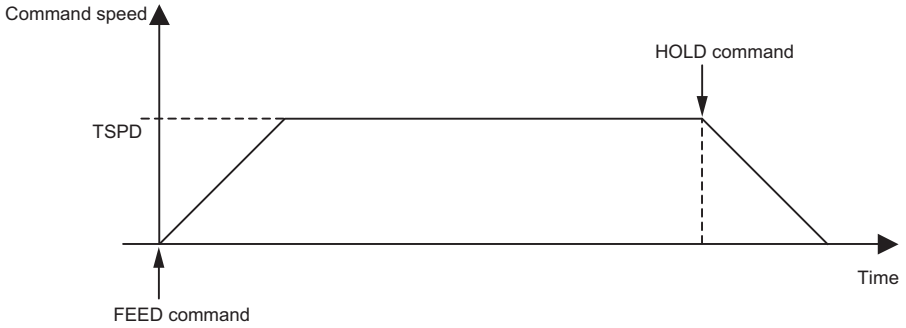
(1) FEED Command (36H)

The FEED command is used to start constant speed feeding at the specified target speed (TSPD) by position control.

Use Stop Motion command (HOLD: 25H) to stop constant speed feeding executed by this command.

<table>
<tr><th rowspan="2">Byte</th><th colspan="2">FEED</th><th colspan="4" rowspan="2">Description</th></tr>
<tr><th>Command</th><th>Response</th></tr>
<tr><td>1</td><td>36H</td><td>36H</td><td>Phases in which the command can be executed</td><td>Phase 2 and 3</td><td>Synchronization classification</td><td>Asynchronous command</td></tr>
<tr><td>2</td><td></td><td>ALARM</td><td>Processing time</td><td>Within communications cycle</td><td>Subcommand</td><td>Can be used</td></tr>
<tr><td>3</td><td rowspan="2">OPTION</td><td rowspan="2">STATUS</td><td colspan="4" rowspan="16">• OPTION field can be selected.
• The target speed (TSPD) is a signed 4-byte data. The feeding direction is determined by the sign.
Constant speed feeding is carried out at the specified target speed.
TSPD setting range: From the negative (-) motor max. speed to the positive (+) motor max. speed [reference unit/s]
• Changes can be made to the target speed during movement.
Change the target speed as required and send this command.
• The torque (force) limit (TLIM) can be used by setting Pn81F and Pn002.
- TLIM setting range: 0 to 4000H [maximum motor torque (force)/ 4000H]
If TLIM is set to a value between 4000H and FFFFH, the maximum motor torque (force) will be applied as the limit.
Use the ADJ command to obtain the maximum motor torque (force).
• Use the DEN (output complete) to confirm the completion of position reference output.
• A warning will occur and the command will not be executed in the following cases.
- The command is used while the servo is OFF: Command warning 1 (A.95A)
- The target speed (TSPD) exceeds the limit: Data setting warning 2 (A.94B)
- When using SigmaWin or a digital operator for motor operations such as JOG: Command warning 1 (A.95A)</td></tr>
<tr><td>4</td></tr>
<tr><td>5</td><td rowspan="4"></td><td rowspan="4">MONITOR1</td></tr>
<tr><td>6</td></tr>
<tr><td>7</td></tr>
<tr><td>8</td></tr>
<tr><td>9</td><td rowspan="4">TSPD</td><td rowspan="4">MONITOR2</td></tr>
<tr><td>10</td></tr>
<tr><td>11</td></tr>
<tr><td>12</td></tr>
<tr><td>13</td><td>SEL_MON1/2</td><td>SEL_MON1/2</td></tr>
<tr><td>14</td><td rowspan="2">TLIM</td><td rowspan="2">IO_MON</td></tr>
<tr><td>15</td></tr>
<tr><td>16</td><td>WDT</td><td>RWDT</td></tr>
<tr><td>17</td><td rowspan="13">Subcommand area</td><td rowspan="13">Subcommand area</td></tr>
<tr><td>18</td></tr>
<tr><td>19</td></tr>
<tr><td>20</td></tr>
<tr><td>21</td></tr>
<tr><td>22</td></tr>
<tr><td>23</td></tr>
<tr><td>24</td></tr>
<tr><td>25</td></tr>
<tr><td>26</td></tr>
<tr><td>27</td></tr>
<tr><td>28</td></tr>
<tr><td>29</td></tr>
</table>

Constant speed feeding is performed as illustrated below.



(2) Related Parameters

The parameters related to the execution of this command are listed below.

Parameter number in parentheses is when Pn833 = 1.

Parameter No.	Name
Pn80A (Pn834)	1st Linear Acceleration Constant
Pn80B (Pn836)	2nd Linear Acceleration Constant
Pn80C (Pn838)	Acceleration Constant Switching Speed
Pn81F	Position Control Command TFF/TLIM Function Allocation
Pn002	Torque (Force) Reference Option During Speed/Position Control

Set the parameters as shown below to use TLIM.

Parameter No.	Set Value	Meaning
Pn81F	□□1□	Enables torque (force) limit (TLIM).
Pn002	n.□□□1	
Pn81F	n.□□1□	When P_CL of OPTION field is set to 1: Uses TLIM as positive torque (force) limit. When N_CL of OPTION field is set to 1: Uses TLIM as negative torque (force) limit.
Pn002	n.□□□3	

4.2.7 Interpolation Feeding with Position Detection (LATCH: 38H)

(1) LATCH Command (38H)

The LATCH command is used to start interpolation feeding and to latch the current position when the external signal is input during positioning.
Speed feed forward, torque (force) feed forward, and torque (force) limit can be applied.

<table>
<tr><th rowspan="2">Byte</th><th colspan="2">LATCH</th><th colspan="4" rowspan="2">Description</th></tr>
<tr><th>Command</th><th>Response</th></tr>
<tr><td>1</td><td>38H</td><td>38H</td><td>Phases in which the command can be executed</td><td>Phase 3</td><td>Synchronization classification</td><td>Asynchronous command</td></tr>
<tr><td>2</td><td>LT_SGNL</td><td>ALARM</td><td>Processing time</td><td>Within communications cycle</td><td>Subcommand</td><td>Can be used</td></tr>
<tr><td>3</td><td rowspan="2">OPTION</td><td rowspan="2">STATUS</td><td colspan="4" rowspan="16">• Use LT_SGNL to select the latch signal.
The position data when the latch signal is input is stored in the feedback latch position (LPOS) and is forcibly output to MONITOR2 for one communications cycle.
• OPTION field can be used.
• Interpolation feeding is performed by specifying the target position (TPOS) every communications cycle.
The target position (TPOS) is a signed 4-byte data.
Note: The target position is not an incremental value (travel amount), but the absolute position in the reference coordinate system.
• The speed feed forward (VEF [reference units/s]) is a signed 4-byte data.
• Either torque (force) feed forward (TFF) or torque (force) limit (TLIM) can be used. It can be selected by setting Pn81F and Pn002.
- TLIM setting range: 0 to 4000H [maximum motor torque (force)/4000H]
(If a value between 4000H and FFFFH is set, the maximum motor torque (force) will be applied as the limit.)
Use the ADJ command to obtain the maximum motor torque (force).
- TFF setting range: A signed 2-byte data [maximum motor torque (force)/4000H]
• Use DEN (output complete) to confirm the completion of position reference output.
• When a command in execution is switched to another command, the feed forward values (VFF and TFF) will be cleared.
• A warning will occur and the command will not be executed in the following cases.
- The command is used in a phase other than phase 3: Command warning 1 (A.95A)
- The command is sent while the servo is OFF: Command warning 1 (A.95A)
- The travel amount (Target position (TPOS) - Current position (IPOS)) exceeds the limit: Data setting warning 2 (A.94B)
- When using SigmaWin or a digital operator for motor operations such as JOG: Command warning 1 (A.95A)
• Latch time lag
- From reception of the command to latching start: 250 µs max.
- From completion of latching to transmission of a response: One communications cycle max.</td></tr>
<tr><td>4</td></tr>
<tr><td>5</td><td rowspan="4">TPOS</td><td rowspan="4">MONITOR1</td></tr>
<tr><td>6</td></tr>
<tr><td>7</td></tr>
<tr><td>8</td></tr>
<tr><td>9</td><td rowspan="4">VFF</td><td rowspan="4">MONITOR2</td></tr>
<tr><td>10</td></tr>
<tr><td>11</td></tr>
<tr><td>12</td></tr>
<tr><td>13</td><td>SEL_MON1/2</td><td>SEL_MON1/2</td></tr>
<tr><td>14</td><td rowspan="2">TFF/TLIM</td><td rowspan="2">IO_MON</td></tr>
<tr><td>15</td></tr>
<tr><td>16</td><td>WDT</td><td>RWDT</td></tr>
<tr><td>17</td><td rowspan="13">Subcommand area</td><td rowspan="13">Subcommand area</td></tr>
<tr><td>18</td></tr>
<tr><td>19</td></tr>
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<tr><td>26</td></tr>
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<tr><td>29</td></tr>
</table>

(2) Related Parameters

The parameters related to the execution of LATCH command are listed below.

Parameter No.	Name
Pn820	Forward Latching Allowable Area
Pn822	Reverse Latching Allowable Area
Pn81F	Position Control Command TFF/TLIM Function Allocation
Pn002	Torque (Force) Reference Option during Speed/Position Control

Either torque (force) feed forward (TFF) or torque (force) limit (TLIM) can be selected by setting the following parameters.

Parameter No.	Set Value	Meaning
Pn81F	n.□□1□	Enables the torque (force) feed forward (TFF).
Pn002	n.□□□2	
Pn81F	n.□□1□	Enables forward/reverse torque (force) limit using TLIM.
Pn002	n.□□□1	
Pn81F	n.□□1□	When P_CL of OPTION field is set to 1: Uses TLIM as positive torque (force) limit. When N_CL of OPTION field is set to 1: Uses TLIM as negative torque (force) limit.
Pn002	n.□□□3	

4.2.8 External Input Positioning (EX_POSING: 39H)

(1) EX_POSING Command (39H)

The EX_POSING command is used to start positioning to the target position (TPOS) at the target speed (TSPD). When a latch signal is input midway, positioning is performed according to the final travel distance for external positioning from the latch signal input position. When no latch signal is input, positioning is performed for the target position (TPOS).

<table>
<tr><th rowspan="2">Byte</th><th colspan="2">EX_POSING</th><th colspan="4" rowspan="2">Description</th></tr>
<tr><th>Command</th><th>Response</th></tr>
<tr><td>1</td><td>39H</td><td>39H</td><td>Phases in which the command can be executed</td><td>Phase 2 and 3</td><td>Synchronization classification</td><td>Asynchronous command</td></tr>
<tr><td>2</td><td>LT_SGNL</td><td>ALARM</td><td>Processing time</td><td>Within communications cycle</td><td>Subcommand</td><td>Can be used</td></tr>
<tr><td>3</td><td rowspan="2">OPTION</td><td rowspan="2">STATUS</td><td colspan="4" rowspan="17">• Use LT_SGNL to select the latch signal.
When the latch signal is input, positioning is performed according to the final travel distance for external positioning specified in Pn814 from the latch signal input position. And, the latch signal input position is stored in the feedback latch position (LPOS) and is forcibly output to MONITOR2 for one communications cycle.
When no latch signal is input, positioning is performed for the specified target position (TPOS).
• OPTION field can be used.
• The target position (TPOS) is a signed 4-byte data, and the absolute position in reference coordinate system.
Set the target position (TPOS) so that the travel distance (TPOS - IPOS) is a value of 31 bits (24...) or less.
• The target speed (TSPD) is an unsigned 4-byte data.
Set a value in the range between 0 and the motor max. speed [reference unit/s].
• The target position and target speed can be changed during positioning executed by this command.
However, any change in the target position and/or target speed after the latch signal input will be invalid.
• The torque (force) limit (TLIM) can be used by setting Pn81F and Pn002.
- TLIM setting range: 0 to 4000H [maximum motor torque (force)/ 4000H]
If a value between 4000H and FFFFH is set, the maximum motor torque (force) will be applied as the limit.
Use the ADJ command to obtain the maximum motor torque (force).
• Use DEN (output complete) to confirm the completion of position reference output.
• When the command in execution is switched from this command to another command, latching will be cancelled and positioning will be performed for the specified target position (TPOS).
• A warning will occur and the command will not be executed in the following cases.
- This command is used when the servo is OFF: Command warning 1 (A.95A)
- The target speed (TSPD) exceeds the limit: Data setting warning 2 (A.94B)
- When using SigmaWin or a digital operator for motor operations such as JOG: Command warning 1 (A.95A)</td></tr>
<tr><td>4</td></tr>
<tr><td>5</td><td rowspan="4">TPOS</td><td rowspan="4">MONITOR1</td></tr>
<tr><td>6</td></tr>
<tr><td>7</td></tr>
<tr><td>8</td></tr>
<tr><td>9</td><td rowspan="4">TSPD</td><td rowspan="4">MONITOR2</td></tr>
<tr><td>10</td></tr>
<tr><td>11</td></tr>
<tr><td>12</td></tr>
<tr><td>13</td><td>SEL_MON1/2</td><td>SEL_MON1/2</td></tr>
<tr><td>14</td><td rowspan="2">TLIM</td><td rowspan="2">IO_MON</td></tr>
<tr><td>15</td></tr>
<tr><td>16</td><td>WDT</td><td>RWDT</td></tr>
<tr><td>17</td><td rowspan="13">Subcommand area</td><td rowspan="13">Subcommand area</td></tr>
<tr><td>18</td></tr>
<tr><td>19</td></tr>
<tr><td>20</td></tr>
<tr><td>21</td></tr>
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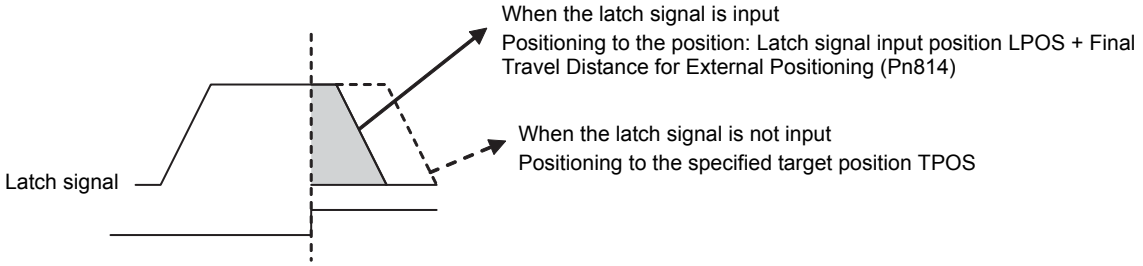
<tr><td>26</td></tr>
<tr><td>27</td></tr>
<tr><td>28</td></tr>
<tr><td>29</td></tr>
</table>

(2) Operation

The operation executed by EX_POSING command is illustrated below.



(3) Related Parameters

The parameters related to the execution of EX_POSING command are listed below.

Parameter number in parentheses is when Pn833 = 1.

Parameter No.	Name	Parameter No.	Name
Pn80A (Pn834)	1st Linear Acceleration Constant	Pn80F (Pn83E)	Deceleration Constant Switching Speed
Pn80B (Pn836)	2nd Linear Acceleration Constant	Pn814	Final Travel Distance for External Positioning
Pn80C (Pn838)	Acceleration Constant Switching Speed	Pn820	Forward Latching Allowable Area
Pn80D (Pn83A)	1st Linear Deceleration Constant	Pn822	Reverse Latching Allowable Area
Pn80E (Pn83C)	2nd Linear Deceleration Constant	Pn81F	Position Control Command TLIM Function Allocation
		Pn002	Torque (Force) Reference Option during Speed/ Position Control

Set the parameters as shown below to use TLIM.

Parameter No.	Set Value	Meaning
Pn81F	n.□□1□	Enables positive/negative torque (force) limit (TLIM).
Pn002	n.□□□1	
Pn81F	n.□□1□	When P_CL of OPTION field is set to 1: Uses TLIM as positive torque (force) limit. When N_CL of OPTION field is set to 1: Uses TLIM as negative torque (force) limit.
Pn002	n.□□□3	

4.2.9 Homing (ZRET: 3AH)

(1) ZRET Command (3AH)

The ZRET command is used to perform homing motion in the following sequence.

1. Accelerates to the target speed (TSPD) in the direction specified in Pn816 (Homing Direction).
2. Decelerates to the homing approach speed 1 (Pn817) at the DEC = 1.
3. Latch operation will start at the DEC = 0.
4. When a latch signal is input, positioning is performed to define the target position at the homing approach speed 2 (Pn818). The target position is calculated by adding the final travel distance for homing (Pn819). After the completion of positioning, the coordinate system is set so that the position reached is 0.

<table>
<tr><th rowspan="2">Byte</th><th colspan="2">ZRET</th><th colspan="4" rowspan="2">Description</th></tr>
<tr><th>Command</th><th>Response</th></tr>
<tr><td>1</td><td>3AH</td><td>3AH</td><td>Phases in which the command can be executed</td><td>Phase 2 and 3</td><td>Synchronization classification</td><td>Asynchronous command</td></tr>
<tr><td>2</td><td>LT_SGNL</td><td>ALARM</td><td>Processing time</td><td>Within communications cycle</td><td>Subcommand</td><td>Can be used</td></tr>
<tr><td>3</td><td rowspan="2">OPTION</td><td rowspan="2">STATUS</td><td colspan="4" rowspan="16">• Use LT_SGNL to select the latch signal.
When the latch signal is input, positioning is performed to define the target position at the homing approach speed 2 (Pn818). The target position is calculated by adding the homing final travel distance (Pn819).
The position data is recorded as the feedback latch position (LPOS) of the machine coordinate system, and the LPOS will forcibly be indicated as the MONITOR2 for one communications cycle.
When the latch signal is input, L_CMP of STATUS field is set to 1, and then reset to 0 at the completion of homing. Therefore, when the homing final travel distance is short, the duration L_CMP = 1 is too short so that the status L_CMP = 1 can not be confirmed.
• OPTION field can be used.
• Set the target speed (TSPD) to a value in the range between 0 and the motor max. speed [reference unit/s].
• The target speed during motion can be changed until DEC is input.
• The torque (force) limit (TLIM) can be used by setting Pn81F and Pn002.
- TLIM setting range: 0 to 4000H [maximum motor torque (force/ 4000H]
If a value between 4000H and FFFFH is set, the maximum motor torque will be applied as the limit.
Use the ADJ command to obtain the maximum motor torque (force).
• Use DEN (output complete) and ZPOINT (home position) to confirm the completion of position reference output.
• If any of the following commands is received during execution of ZRET command, homing motion will be interrupted.
DISCONNECT, SYNC_SET, CONFIG, HOLD, SV_OFF, INTERPOLATE, POSING, FEED, LATCH, EX_POSING, VELCTRL, TRQCTRL, SVCTRL
When a command other than the above commands is received, homing operation will continue.
• A warning will occur and the command will be ignored in the following cases.
- This command is used while the servo is OFF.: Command warning 1 (A.95A)
- The target speed (TSPD) exceeds the limit: Data setting warning 2 (A.94B)
- When using SigmaWin or a digital operator for motor operations such as JOG: Command warning 1 (A.95A)</td></tr>
<tr><td>4</td></tr>
<tr><td>5</td><td rowspan="4"></td><td rowspan="4">MONITOR1</td></tr>
<tr><td>6</td></tr>
<tr><td>7</td></tr>
<tr><td>8</td></tr>
<tr><td>9</td><td rowspan="4">TSPD</td><td rowspan="4">MONITOR2</td></tr>
<tr><td>10</td></tr>
<tr><td>11</td></tr>
<tr><td>12</td></tr>
<tr><td>13</td><td>SEL_MON1/2</td><td>SEL_MON1/2</td></tr>
<tr><td>14</td><td rowspan="2">TLIM</td><td rowspan="2">IO_MON</td></tr>
<tr><td>15</td></tr>
<tr><td>16</td><td>WDT</td><td>RWDT</td></tr>
<tr><td>17</td><td rowspan="13">Subcommand area</td><td rowspan="13">Subcommand area</td></tr>
<tr><td>18</td></tr>
<tr><td>19</td></tr>
<tr><td>20</td></tr>
<tr><td>21</td></tr>
<tr><td>22</td></tr>
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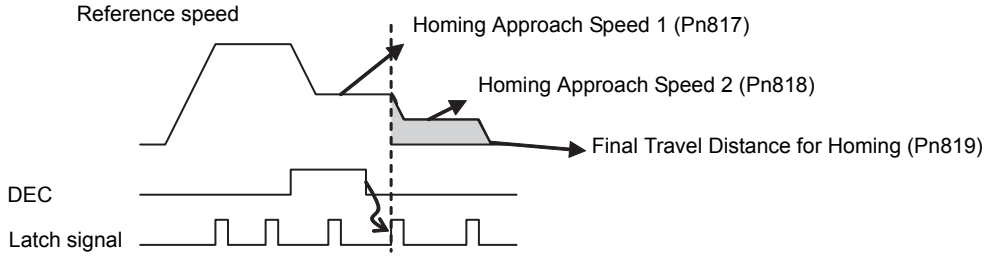
<tr><td>25</td></tr>
<tr><td>26</td></tr>
<tr><td>27</td></tr>
<tr><td>28</td></tr>
<tr><td>29</td></tr>
</table>

(2) Operation

The motion executed by ZRET command is illustrated below.



(3) Related Parameters

The parameters related to ZRET command are listed below.

Parameter number in parentheses is when Pn833 = 1.

Parameter No.	Name	Parameter No.	Name
Pn816	Homing Direction	Pn80A (Pn834)	1st Linear Acceleration Constant
Pn817	Homing Approach Speed 1	Pn80B (Pn836)	2nd Linear Acceleration Constant
Pn818	Homing Approach Speed 2	Pn80C (Pn838)	Acceleration Constant Switching Speed
Pn819	Final Travel Distance for Homing	Pn80D (Pn83A)	1st Linear Deceleration Constant
Pn820	Forward Latching Allowable Area	Pn80E (Pn83C)	2nd Linear Deceleration Constant
Pn822	Reverse Latching Allowable Area	Pn80F (Pn83E)	Deceleration Constant Switching Speed
Pn002	Torque (Force) Reference Option during Speed/Position Control	Pn81F	Position Control Command TLIM Function Allocation

Set the parameters as shown below to use TLIM.

Parameter No.	Set Value	Meaning
Pn81F	n.□□1□	Enables positive/negative torque (force) limit (TLIM).
Pn002	n.□□□1	
Pn81F	n.□□1□	When P_CL of OPTION field is set to 1: Uses TLIM as positive torque (force) limit. When N_CL of OPTION field is set to 1: Uses TLIM as negative torque (force) limit.
Pn002	n.□□□3	

4.2.10 Velocity Control (VELCTRL: 3CH)

(1) VELCTRL Command (3CH)

The VELCTRL command is used to control speed. (The Servo does not perform position control, but directly controls the speed of the speed loop.)

<table>
<tr><th rowspan="2">Byte</th><th colspan="2">VELCTRL</th><th colspan="4" rowspan="2">Description</th></tr>
<tr><th>Command</th><th>Response</th></tr>
<tr><td>1</td><td>3CH</td><td>3CH</td><td>Phases in which the command can be executed</td><td>Phase 2 and 3</td><td>Synchronization classification</td><td>Asynchronous command</td></tr>
<tr><td>2</td><td></td><td>ALARM</td><td>Processing time</td><td>Within communications cycle</td><td>Subcommand</td><td>Can be used</td></tr>
<tr><td>3</td><td rowspan="2">OPTION</td><td rowspan="2">STATUS</td><td colspan="4" rowspan="15">• OPTION field can be used.
• VREF is a speed reference and has a signed 4-byte data. The unit for speed reference is [maximum motor speed/40000000H]. The direction is specified by the sign.
• Soft-start function can be used. See (2)Soft Start Functionon the next page for details on soft-start.
• Either torque (force) limit (P_TLIM, N_TLIM) or torque (force) feed forward (TFF) can be used. Use Pn002 to select.
- TLIM setting range: 0 to 4000H [maximum motor torque (force)/4000H]
(If a value between 4000H to FFFFH is set, the maximum motor torque (force) will be applied as the limit.
Use the ADJ command to obtain the maximum motor torque (force).
- TFF setting range: A signed 2-byte data [maximum motor torque (force)/4000H]
• During execution of this command, the following bits for STATUS are allocated.
D8: ZSPD (zero speed bit)
0: Zero speed not detected
1: Zero speed detected
D7: V_CMP (speed coincidence bit)
0: Speed coincidence not detected
1: Speed coincidence detected
• Monitor (MONITOR 1, 2, 3, 4)
The units for TSPD, CSPD, and FSDP is [maximum motor speed / 40000000H].</td></tr>
<tr><td>4</td></tr>
<tr><td>5</td><td rowspan="2">P_TLIM /TFF</td><td rowspan="4">MONITOR1</td></tr>
<tr><td>6</td></tr>
<tr><td>7</td><td rowspan="2">N_TLIM</td></tr>
<tr><td>8</td></tr>
<tr><td>9</td><td rowspan="4">VREF</td><td rowspan="4">MONITOR2</td></tr>
<tr><td>10</td></tr>
<tr><td>11</td></tr>
<tr><td>12</td></tr>
<tr><td>13</td><td>SEL_MON1/2</td><td>SEL_MON1/2</td></tr>
<tr><td>14</td><td rowspan="2"></td><td rowspan="2">IO_MON</td></tr>
<tr><td>15</td></tr>
<tr><td>16</td><td>WDT</td><td>RWDT</td></tr>
<tr><td>17</td><td rowspan="13">Subcommand area</td><td rowspan="13">Subcommand area</td></tr>
<tr><td>18</td></tr>
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<tr><td>20</td></tr>
<tr><td>21</td></tr>
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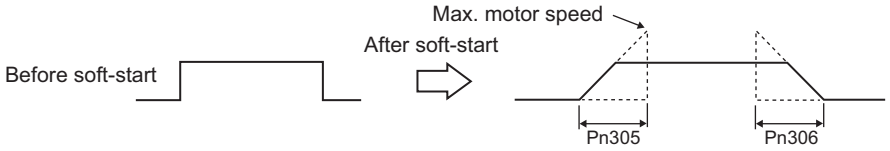
<tr><td>28</td></tr>
<tr><td>29</td></tr>
</table>

(2) Soft Start Function

The soft start function converts input speed references from sudden step progression to steady diagonal progression. Set the acceleration speed and deceleration speed in the following parameters.

Use this function to achieve a smooth speed control in speed control mode (including internal set speed selection).

Pn305	Soft Start Acceleration Time: Time of period the motor speed reaches the maximum from zero (the stop status)			
	Setting Range	Unit	Factory Setting	When Enabled
	0 to 10000	1 ms	0	Immediately
Pn306	Soft Start Deceleration Time: Time of period the motor speed decreases to zero (stop status) from the maximum.			
	Setting Range	Unit	Factory Setting	When Enabled
	0 to 10000	1 ms	0	Immediately



Note: For normal speed control, set Pn305 and Pn306 to 0 (factory setting).

(3) Torque (Force) Reference Option

The settings of the parameters related to the torque (force) reference option for VELCTRL command are listed below.

Parameter		Description
Pn002	n.□□□0	The set values of P_TLIM and N_TLIM are invalid. (factory setting)
	n.□□□1	Uses the set value of P_TLIM/N_TLIM as forward/reverse torque (force) limit.
	n.□□□2	Uses TFF as the torque (force) feed forward. Set N_TLIM to 0.
	n.□□□3	When P_CL of OPTION field is set to 1, uses P_TLIM as the torque (force) limit. When N_CL of OPTION field is set to 1, uses N_TLIM as the torque (force) limit.

4.2.11 Torque (Force) Control (TRQCTRL: 3DH)

(1) TRQCTRL (3DH)

The TRQCTRL command is used to control torque (force). (The Servo does not perform position control and speed control, but directly performs torque (force) control.)

<table>
<tr><th rowspan="2">Byte</th><th colspan="2">TRQCTRL</th><th colspan="4" rowspan="2">Description</th></tr>
<tr><th>Command</th><th>Response</th></tr>
<tr><td>1</td><td>3DH</td><td>3DH</td><td>Phases in which the command can be executed</td><td>Phase 2 and 3</td><td>Synchronization classification</td><td>Asynchronous command</td></tr>
<tr><td>2</td><td></td><td>ALARM</td><td>Processing time</td><td>Within communications cycle</td><td>Subcommand</td><td>Can be used</td></tr>
<tr><td>3</td><td rowspan="2">OPTION</td><td rowspan="2">STATUS</td><td colspan="4" rowspan="15">• OPTION field can be used.
• VLIM is a speed limit value and has an unsigned 4-byte data.
The unit for the speed limit is [maximum motor speed /40000000H].
(Set Pn002 to enable VLIM.)
Use the ADJ command to obtain the maximum motor speed.
• TQREF is a torque (force) reference and has a signed 4-byte data.
The unit for torque (force) reference is [maximum motor torque (force)/ 40000000H]. The direction is specified by the sign.
When the designation for TQREF exceeds the maximum motor torque (force), it is clamped at the maximum motor torque (force).
Use ADJ command to obtain the maximum motor torque (force).
• During execution of this command, the following bits of STATUS field are allocated.
D11: V_LIM (speed limit bit)
0: Speed limit not detected
1: Speed limit detected
• Monitor (MONITOR 1, 2, 3, 4)
The unit for TRQ is [maximum motor torque (force)/40000000H].</td></tr>
<tr><td>4</td></tr>
<tr><td>5</td><td rowspan="4">VLIM</td><td rowspan="4">MONITOR1</td></tr>
<tr><td>6</td></tr>
<tr><td>7</td></tr>
<tr><td>8</td></tr>
<tr><td>9</td><td rowspan="4">TQREF</td><td rowspan="4">MONITOR2</td></tr>
<tr><td>10</td></tr>
<tr><td>11</td></tr>
<tr><td>12</td></tr>
<tr><td>13</td><td>SEL_MON1/2</td><td>SEL_MON1/2</td></tr>
<tr><td>14</td><td rowspan="2"></td><td rowspan="2">IO_MON</td></tr>
<tr><td>15</td></tr>
<tr><td>16</td><td>WDT</td><td>RWDT</td></tr>
<tr><td>17</td><td rowspan="13">Subcommand area</td><td rowspan="13">Subcommand area</td></tr>
<tr><td>18</td></tr>
<tr><td>19</td></tr>
<tr><td>20</td></tr>
<tr><td>21</td></tr>
<tr><td>22</td></tr>
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<tr><td>26</td></tr>
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<tr><td>29</td></tr>
</table>

(2) Speed Limit Option 1

■ When Using a Rotational Servomotor

Use Pn407(Speed Limit during Torque Control) to set the speed limit.

Pn407	Speed Limit during Torque Control			
	Setting Range	Unit	Factory Setting	When Enabled
	0 to 10000	1 min^{-1}	10000	Immediately

Note: If a speed higher than the maximum speed of the connected servomotor is set, the servomotor speed will be limited to its maximum speed.

■ When Using a Linear Servomotor

Use Pn480 (Speed Limit during Force Control) to set the speed limit.

Pn480	Speed Limit during Force Control			
	Setting Range	Unit	Factory Setting	When Enabled
	0 to 5000	mm/s	5000	Immediately

Note: If a speed higher than the maximum speed of the connected linear servomotor is set, the linear servomotor speed will be limited to its maximum speed.

(3) Speed Limit Option 2

Set the following parameter to enable VLIM (Speed Limit) specified in TRQCTRL command.

Parameter		Description
Pn002	n.□□0□	Disables VLIM. (factory setting)
	n.□□1□	Enables VLIM (Uses VLIM as the speed limit.)

5

Command Related Parameters

This chapter describes parameter settings related to each command action.

5.1 Command Related Parameters List

This chapter describes the following parameters related to command actions.

Classification	Parameter	Name	Description
Settings According to Machine	Pn20E, Pn210	Electronic Gear Ratio	Sets the unit of position data.
	Pn000	Direction Selection	Sets the servomotor rotation direction.
	Pn50A, Pn50B	Overtravel Signal Setting	Sets the overtravel function and software limit operation.
	Pn801	Software Limit Function Setting	
	Pn804, Pn806	Software Limit	
	Pn808	Absolute Encoder Origin Offset	Sets the origin when using an absolute encoder.
Motion Acceleration/ Deceleration Function Settings	Pn833	Motion Setting	Sets the acceleration/deceleration speed for POSING, EX_POSING, FEED, ZRET, HOLD commands
	Pn80A, Pn834	1st Linear Acceleration Constant	
	Pn80B, Pn836	2nd Linear Acceleration Constant	
	Pn80C, Pn838	Acceleration Constant Switching Speed	
	Pn80D, Pn83A	1st Linear Deceleration Constant	
	Pn80E, Pn83C	2nd Linear Deceleration Constant	
	Pn80F, Pn83E	Deceleration Constant Switching Speed	
	Pn827, Pn840	Linear Deceleration Constant for Stopping	Sets the deceleration speed for HOLD, SV_OFF commands.
	Pn829	SVOFF Waiting Time	
	Pn810	Exponential Function Acceleration/Deceleration Bias	Sets the position reference filter.
	Pn811	Exponential Function Acceleration/Deceleration Time Constant	
	Pn812	Movement Average Time	
Motion Sequence Setting	Pn814	Final Travel Distance for External Positioning	Sets the travel distance after the external signal is input for positioning.
	Pn816	Homing Mode Setting	Sets the homing operation.
	Pn817, Pn818	Homing Approach Speed	
	Pn819	Final Travel Distance for Homing	
Command Data Option Setting	Pn81F, Pn002	Torque (Force) Reference Options for Speed/Position Control	Sets the usage of torque (force) limit and torque (force) feed forward during position/ speed control.
	Pn002 Pn407, Pn480	Speed Limit during Torque (Force) Control	Sets the usage of speed limit during torque (force) control.
	Pn81F, Pn82A to Pn82E	OPTION Field Allocation	Selects function bits to be assigned in OPTION field.
Position Data Latch Function Setting	Pn820, Pn822	Latching Allowable Area	Sets the range to latch position data.
	Pn850	Latch Sequence Number	Sets continuous latch operation executed by LTMOD_ON command.
	Pn851	Continuous Latch Count	
	Pn852, Pn853	Latch Sequence Signal Selection	
Acceleration/ Deceleration Parameter High-speed Switching Function Setting	Pn900	Parameter Bank Number	Sets the acceleration/deceleration parameter high-speed switching function.
	Pn901	Parameter Bank Member Number	
	Pn902 to Pn910	Parameter Bank Member Definition	
	Pn920 to Pn95F	Parameter Bank Data	

Classification	Parameter	Name	Description
STATUS Field and Monitor Related Settings	Pn803	Origin Range	Sets the following monitoring items. • STATUS field signal status detection level • Input signal allocation to the D12 to D15 bits of I/O Monitor field • Data mapping to option monitors
	Pn522	Positioning Completed Width	
	Pn524	NEAR Signal Width	
	Pn502, Pn581	Rotation Detection Level	
	Pn503, Pn582	Speed Coincidence Signal Output Width	
	Pn81E	Input Signal Monitor Selection	
	Pn824, Pn825	Option Monitor Selection	

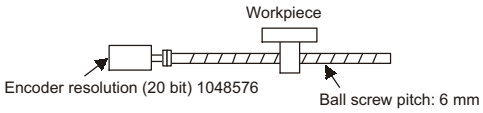
5.2 Command Related Parameters Details

5.2.1 Electronic Gear Setting

(1) Electronic Gear

The electronic gear enables the workpiece travel distance per input reference pulse from the host controller to be set to any value. The minimum position data moving a load is called a reference unit.

To move a workpiece 10 mm:



When the Electronic Gear is Not Used:

① Calculate the revolutions.
1 revolution is 6 mm. Therefore, 10 ÷ 6 = 1.6666 revolutions.

② Calculate the required reference pulses.
1048576 pulses is 1 revolution. Therefore, 1.6666 × 1048576 = 1746928 pulses.

③ Input 1746928 pulses as reference pulses.

Reference pulses must be calculated per reference. → complicated

When the Electronic Gear is Used:

The reference unit is 1 μm. Therefore, to move the workpiece 10 mm (10000μm),
1 pulse = 1μm, so 10000 ÷ 1 = 10000 pulses.
Input 10000 pulses as reference pulses.

Calculation of reference pulses per reference is not required. → simplified

(2) Setting the Electronic Gear Ratio

Use the parameters Pn20E and Pn210 to set the electronic gear ratio.

Pn20E	Electronic Gear Ratio (Numerator)			Position	Classification
	Setting Range	Setting Unit	Factory Setting	When Enabled	
	1 to 1073741824 (2^{30})	–	4	After restart	Setup
Pn210	Electronic Gear Ratio (Denominator)			Position	Classification
	Setting Range	Setting Unit	Factory Setting	When Enabled	
	1 to 1073741824 (2^{30})	–	1	After restart	Setup

If the decelerator ratio of the motor and load shaft is given as n/m, where m is the rotation of the motor and n is the rotation of the load shaft,

$$\text{Electronic gear ratio } \frac{B}{A} = \frac{Pn20E}{Pn210} = \frac{\text{Encoder resolution}}{\text{Travel distance per load shaft rotation (reference unit)}} \times \frac{m}{n}$$

■ Encoder Resolution

Encoder resolution can be checked with servomotor model designation.

SGM□V-□□□□□□□□

Symbol	Specification	Encoder Resolutions
3	20-bit absolute	1048576
D	20-bit incremental	1048576
A	13-bit incremental	8192

SGMPS -□□□□□□□□

Symbol	Specification	Encoder Resolutions
2	17-bit absolute	131072
C	17-bit incremental	131072

Electronic gear ratio setting range: 0.001 ≤ Electronic gear ratio (B/A) ≤ 4000

If the electronic gear ratio is outside this range, a parameter setting error (A.040) will be output.

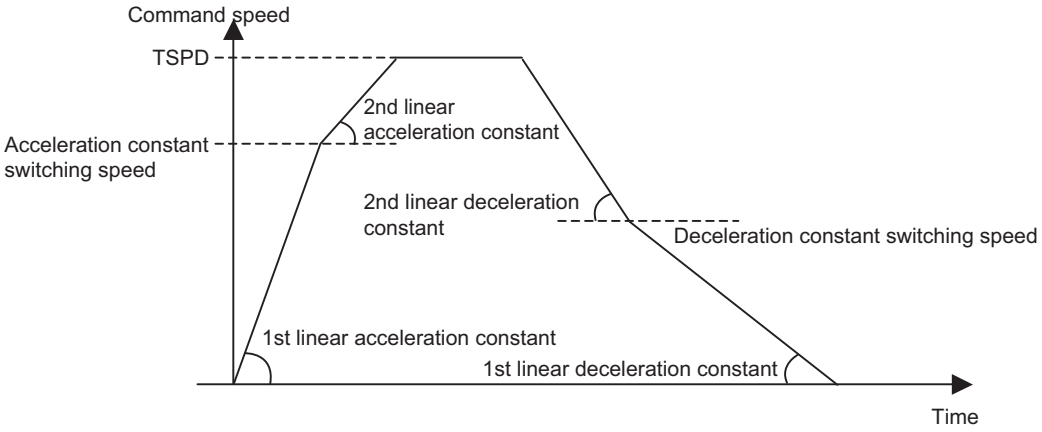
5.2.2 Motion Acceleration/Deceleration Function Setting

This section describes the parameters used to set the acceleration/deceleration function for motion commands for positioning.

(1) Linear Acceleration/Deceleration Function

Use the following parameters to set the acceleration/deceleration constants used to execute POSING, FEED, EX_POSING, ZRET, or HOLD commands.

The 1st digit of Pn833 is used to switch the parameters used for acceleration/deceleration: the parameters Pn80A to Pn80F and Pn827 or the parameters Pn834 to Pn840.



■ Acceleration/Deceleration Constant Switching Setting

Parameter		Meaning	Factory Setting
Pn833	n.□□□0	Use parameters Pn80A to Pn80F and Pn827. (Parameters Pn834 to Pn840 are invalid.)	n.□□□0
	n.□□□1	Use parameters Pn834 to Pn840. (Parameters Pn80A to Pn80F and Pn827 are invalid.)	

Note: The setting will be validated by turning the power supply OFF and then ON again, or by executing the CONFIG command.

■ Acceleration/Deceleration Parameters when Pn833=n.□□□0

Parameter No.	Name	Data Size (byte)	Setting Range	Unit	Factory Setting
Pn80A	1st Linear Acceleration Constant 1	2	1 to 65535	10000 reference units/s^2	100
Pn80B	2nd Linear Acceleration Constant 1	2	1 to 65535	10000 reference units/s^2	100
Pn80C	Acceleration Constant Switching Speed 1	2	0 to 65535	100 reference units/s	0
Pn80D	1st Linear Deceleration Constant 1	2	1 to 65535	10000 reference units/s^2	100
Pn80E	2nd Linear Deceleration Constant 1	2	1 to 65535	10000 reference units/s^2	100
Pn80F	Deceleration Constant Switching Speed 1	2	0 to 65535	100 reference units/s	0
Pn827	Linear Deceleration Constant 1 for Stopping	2	0 to 65535	10000 reference units/s^2	100

■ Acceleration/Deceleration Parameters when Pn833=n.□□□1

Parameter No.	Name	Data Size (byte)	Setting Range	Unit	Factory Setting
Pn834	1st Linear Acceleration Constant 2	4	1 to 20971520	10000 reference units/s^2	100
Pn836	2nd Linear Acceleration Constant 2	4	1 to 20971520	10000 reference units/s^2	100
Pn838	Acceleration Constant Switching Speed 2	4	0 to 2097152000	Reference unit/s	0
Pn83A	1st Linear Deceleration Constant 2	4	1 to 20971520	10000 reference units/s^2	100
Pn83C	2nd Linear Deceleration Constant 2	4	1 to 20971520	10000 reference units/s^2	100
Pn83E	Deceleration Constant Switching Speed 2	4	0 to 2097152000	Reference unit/s	0
Pn840	Linear Deceleration Constant 2 for Stopping	4	0 to 20971520	10000 reference units/s^2	100

Note: If the deceleration distance exceeds 1073741823 reference units during positioning, the motor cannot be accelerated to the target speed TSPD specified in the motion command. Set the parameter for deceleration speed to a value that satisfies the following equation.

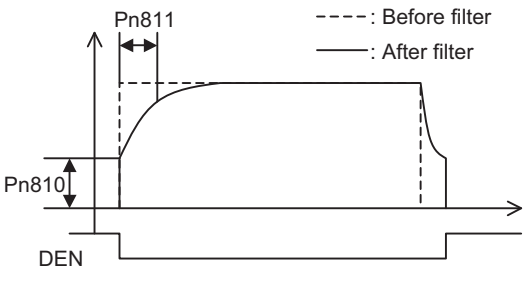
Deceleration speed [reference unit/s^2]≥Max. command speed^2 [reference unit/s] / (Max. deceleration distance [reference unit] × 2)

(2) Position Reference Filter

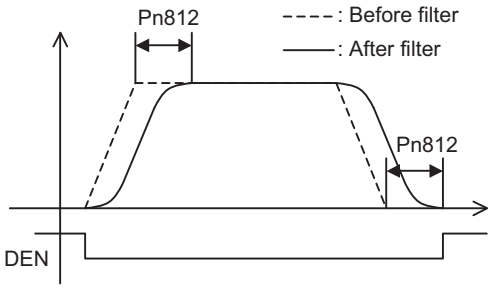
A filter can be applied to the position reference output of a positioning command such as INTERPOLATE, LATCH, POSING, FEED, EX_POSINT, ZRET, and HOLD.

■ Position Reference Filter Setting Parameters

Parameter No.	Name	Data Size (byte)	Setting Range	Unit	Factory Setting
Pn810	Exponential Function Acceleration/Deceleration Bias	2	0 to 65535	100 reference units/s	0
Pn811	Exponential Function Acceleration/Deceleration Time Constant	2	0 to 5100	0.1 ms	0
Pn812	Movement Average Time	2	0 to 5100	0.1 ms	0



Exponential Function Acceleration/Deceleration Curve



Movement Average Time Curve

■ Position Reference Filter Type Selection

Use the ACCFIL bit of the OPTION field to specify the position reference filter type.

ACCFIL	Meaning
0	Without position reference filter
1	Exponential function acceleration/deceleration position reference filter
2	Movement average time position reference filter

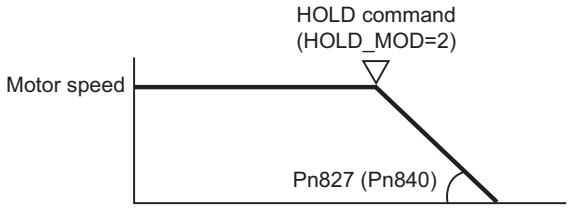
Information: While a position reference is being output (STATUS.DEN = 0), the parameter or the filter type cannot be changed. Wait for completion of the position reference output (STATUS.DEN = 1) to change the setting.

(3) Linear Deceleration Speed Setting for Commands to Stop a Motor

Set the deceleration speed when using either of the following commands to stop a motor.

- HOLD (When HOLD_MOD = 2)
- SV_OFF (When Pn829 ≠ 0)

■ Setting for Deceleration to a Stop by Executing HOLD Command (HOLD_MOD = 2)

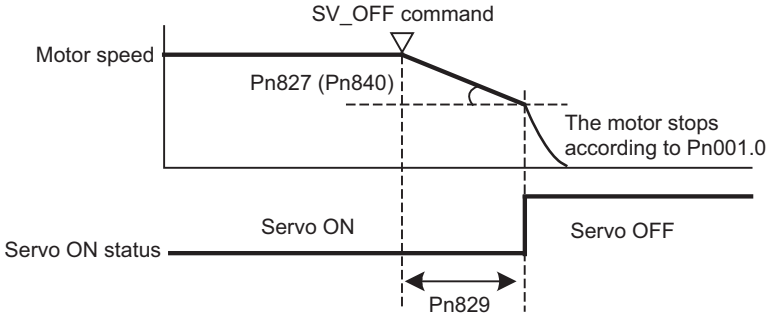


The parameter number in parentheses is when Pn833 = 1.

Parameter No.	Name	Data Size (byte)	Setting Range	Unit	Factory Setting
Pn827	Linear Deceleration Constant 1 for Stopping	2	0 to 65535	10000 reference units/s^2	100
Pn840	Linear Deceleration Constant 2 for Stopping	4	0 to 20971520	10000 reference units/s^2	100

■ Setting for Deceleration to a Stop by Executing SV_OFF Command

When SV_OFF command is executed while a motor is running, the servo can be turned OFF after deceleration to a stop.
When Pn829 is set to 0 (factory setting), the servo will turn OFF immediately upon reception of the SV_OFF command.



The parameter number in parentheses is when Pn833 = 1.

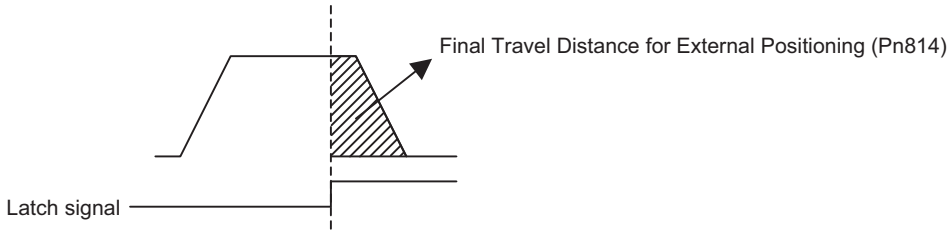
Parameter No.	Name	Data Size (byte)	Setting Range	Unit	Factory Setting
Pn827	Linear Deceleration Constant 1 for Stopping	2	0 to 65535	10000 reference units/s^2	100
Pn829	SVOFF Waiting Time (SVOFF at deceleration to stop)	2	0 to 65535	10 ms	0
Pn840	Linear Deceleration Constant 2 for Stopping	4	0 to 20971520	10000 reference units/s^2	100

5.2.3 Motion Sequence Setting

This section describes parameters related to the actions of EX_POSING and ZRET commands.

(1) Settings for EX_POSING Command

Set the travel distance from the external signal input position to the final target position for execution of an EX_POSING command. If a negative value (distance to the negative direction) or a small value is set, the axis will decelerate to a stop and then move to the reverse direction for positioning.

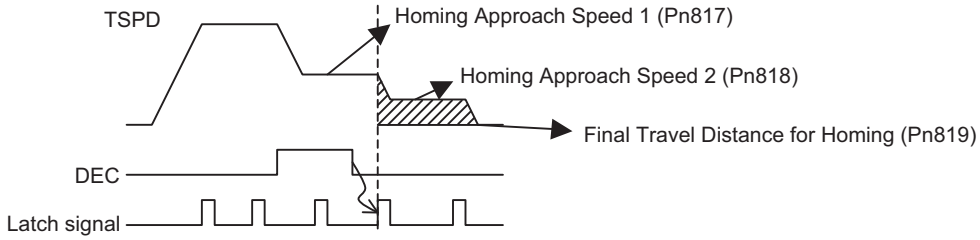


Parameter No.	Name	Data Size (byte)	Setting Range	Unit	Factory Setting
Pn814	Final Travel Distance for External Positioning	4	–1073741823 to 1073741823	Reference unit	100

(2) Settings for ZRET Command

This section describes the parameters to set the following items for ZRET command.

- Pn816: Homing direction selection
- Pn817: Approach speed after the origin limit signal is input (DEC signal turns ON)
- Pn818: Approach (creep) speed after the latch signal is input
- Pn819: Final travel distance from the latch signal input position to the origin



Parameter		Meaning	Factory Setting
Pn816	n.□□□0	Forward direction homing	n.□□□0
	n.□□□1	Reverse direction homing	

Parameter No.	Name	Data Size (byte)	Setting Range	Unit	Factory Setting
Pn817	Homing Approach Speed 1	2	0 to 65535	100 reference units/s	50
Pn818	Homing Approach Speed 2	2	0 to 65535	100 reference units/s	5
Pn819	Final Travel Distance for Homing	4	–1073741823 to 1073741823	Reference unit	100

Information: Set Pn819 (Final Travel Distance for Homing) to a value that satisfies the following equation.
When Pn816=n.□□□0: Origin = Latch signal input position + Pn819
When Pn816=n.□□□1: Origin = Latch signal input position – Pn819

5.2.4 Command Data Options

(1) Torque (Force) Limiting Function

The torque (force) limiting function limits the output torque (force) to protect the connected machine, etc. There are three ways to limit the output torque (force).

1. Internal torque (force) limit
2. External torque (force) limit using P_CL/N_CL signal of OPTION field
3. Torque (force) limit by position/speed control command

Note: If all of the above three methods are used, the smallest torque (force) limit will be applied.

■ Internal Torque (Force) Limit

This method always limits the maximum output torque (force) to the set values of the following parameters.

Parameter No.	Name	Data Size (byte)	Setting Range	Unit	Factory Setting
Pn402	Forward Torque Limit (For rotational servomotors)	2	0 to 800	%	800
Pn403	Reverse Torque Limit (For rotational servomotors)	2	0 to 800	%	800
Pn483	Forward Force Limit (For linear servomotors)	2	0 to 800	%	30
Pn484	Reverse Force Limit (For linear servomotors)	2	0 to 800	%	30

Note: Set the limit value in percentage (%) of the motor rated torque (force).

■ External Torque (Force) Limit Using P_CL/N_CL Signal of OPTION Field

This method uses the P_CL/N_CL signal of the OPTION field to limit the output torque (force) to the set values of the following parameters.

Parameter No.	Name	Data Size (byte)	Setting Range	Unit	Factory Setting
Pn404	Forward External Torque (Force) Limit	2	0 to 800	%	100
Pn405	Reverse External Torque (Force) Limit	2	0 to 800	%	100

Note: Set the limit value in percentage (%) of the motor rated torque (force).

■ Torque (Force) Limit By Position/Speed Control Command

This methods limits the output torque (force) by setting a desired limit value in the command data (TLIM/P_TLIM/N_TLIM).

[Torque (Force) Limiting Function Settable Commands]
INTERPOLATE, LATCH, FEED, EX_POSING, ZRET, and VELCTRL

[Setting Parameters]

Set the following parameters to apply a torque (force) limit from a position/speed control command.

Pn81F	Position Control Command TFF/TLIM Function Allocation	
	n.□□1□	Enables allocation (Set TFF/TLIM operation using Pn002.)
Pn002	Torque (force) Reference Option During Speed/Position Control	
	n.□□□1	Enables positive/negative torque (force) limit by *TLIM.
	n.□□□3	Uses TLIM/P_TLIM as positive torque (force) limit when OPTION.P_CL=1. Uses TLIM/N_TLIM as negative torque (force) limit when OPTION.N_CL=1.

Note 1. When using a torque (force) limit set in a position control command, set Pn81F and Pn002 as follows:
Pn81F = n.□□1□, and Pn002 = n.□□□1 or n.□□□3
If Pn81F = n.□□0□, the torque (force) limit set in the position control command will not applied.
2. When using a torque (force) limit set in a speed control command, set Pn002 as follows.
Pn002 = n.□□□1 or n.□□□3
3. When a command other than the commands listed in [Torque (Force) Limiting Function Settable Commands], the torque (force) limit of the previously executed TLIM/P_TILM/N_TLIM remains valid. During execution of HOLD, SV_OFF, SVCTRL, or TRQCTRL command, the torque (force) limit specified by TLIM/P_TRIM/ N_TLIM is invalid.

(2) Torque (Force) Feed Forward Function

This function is used to apply a torque (force) feedforward (TFF) from a position/speed control command to shorten positioning time. The host controller differentiates a position reference to generate a torque (force) feedforward reference.

[Torque (Force) Feed Forward Reference Settable Commands]

INTERPOLATE, LATCH, and VELCTRL

[Setting Parameters]

Set the following parameters to use TFF as the torque (force) feed forward.

Pn81F	Position Control Command TFF/TLIM Function Allocation	
	n.□□1□	Enables allocation (Set TFF/TLIM operation using Pn002.)
Pn002	Torque (force) Reference Option During Speed/Position Control	
	n.□□□2	Enables the torque (force) feed forward by TFF.

Note 1. To use the torque (force) feed forward in a position control command, set the parameters as follows.
Pn81F = n.□□1□ and Pn002 = n.□□□2
If Pn81F = n.□□0□, the torque (force) feed forward by a position control command is disabled.
2. To use the torque (force) feed forward in a speed control command, set the parameter as follows.
Pn002 = n.□□□2

(3) Speed Limiting Function During Torque (Force) Control

This function limits the servomotor speed during torque (force) control to protect the connected machine, etc.

There are two ways to control the speed during torque control:

1. Internal speed limit
2. Speed limit by the torque (force) control command TRQCTRL

Note: If both of the above methods are used, the smaller speed limit will be applied.

■ Internal Speed Limit

This method always limits the servomotor speed to either of the following set parameter values.

Parameter No.	Name	Data Size (byte)	Setting Range	Unit	Factory Setting
Pn407	Speed Limit during Toque Control (For rotational servomotors)	2	0 to 10000	min^{-1}	10000

Parameter No.	Name	Data Size (byte)	Setting Range	Unit	Factory Setting
Pn480	Speed Limit during Force Control (For linear servomotors)	2	0 to 10000	mm/s	10000

■ Speed Limit by Torque (Force) Control Command TRQCTRL

This method limits the speed by setting a desired speed limit value in the command data (VLIM).

[Setting Parameter]

Set the following parameter to use the speed limit set in TRQCTRL command.

	Torque (Force) Reference Option	
Pn002	n.□□0□	Disables the speed limit set in the VLIM. (Factory setting)
	n.□□1□	Enables the speed limit set in the VLIM.

(4) OPTION Field Allocation

The commands can be allocated to the OPTION field using the following parameters. To change the factory setting, set Pn81F = □□□1 and allocate the function bits using parameters Pn82A to Pn82E. The setting will be validated by turning the power supply OFF and then ON again, or by executing CONFIG.

[Setting Parameters]

Parameter No.	Digit	Name		Setting Range	Factory Setting
Pn81F		Command Data Allocation		0000h to 0011h	0000h
	0	OPTION Field Allocation		0 or 1	0
		0	Disables OPTION field allocation.		
		1	Enables OPTION field allocation.		
Pn82A		OPTION Field Allocation 1		0000H to 1E1EH	1813H
	0	0 to E	ACCFIL bit position		3
	1	0	Disables ACCFIL bit allocation.		1
		1	Enables ACCFIL bit allocation.		
	2	0 to E	GSEL bit position		8
	3	0	Disables GSEL bit allocation.		1
		1	Enables GSEL bit allocation.		
Pn82B		OPTION Field Allocation 2		0000H to 1F1FH	1D1CH
	0	0 to F	V_PPI bit position		C
	1	0	Disables V_PPI bit allocation		1
		1	Enables V_PPI bit allocation.		
	2	0 to F	P_PI_CLR bit position		D
	3	0	Disables P_PI_CLR bit allocation.		1
		1	Enables P_PI_CLR bit allocation.		
Pn82C		OPTION Field Allocation 3		0000H to 1F1FH	1F1EH
	0	0 to F	P_CL bit position		E
	1	0	Disables P_CL bit allocation.		1
		1	Enables P_CL bit allocation.		
	2	0 to F	N_CL bit position		F
	3	0	Disables N_CL bit allocation.		1
		1	Enables N_CL bit allocation.		

Parameter No.	Parameter Digit	Name		Setting Range	Factory Setting
Pn82D		OPTION Field Allocation 4		0000H to 1F1CH	0000H
	0	0 to C	BANK_SEL1 bit position		0
	1	0	Disables BANK_SEL1 bit allocation.		0
		1	Enables BANK_SEL1 bit allocation.		
	2	0 to F	LT_DISABLE bit position		0
	3	0	Disables LT_DISABLE bit allocation.		0
		1	Enables LT_DISABLE bit allocation.		
Pn82E		OPTION Field Allocation 5		0000H to 1D1FH	0000H
	0	0 to F	Reserved		0
	1	0	Reserved		0
		1	Reserved		
	2	0 to D	OUT_SIGNAL bit position		0
	3	0	Disables OUT_SIGNAL bit allocation.		0
		1	Enables OUT_SIGNAL bit allocation.		

Note: 1. Do not allocate more than one signal to one bit. If more than one signal is allocated to one bit, the bit will control more than one signal.
2. An unallocated function bit acts as if it is set to 0.
3. Set the bit to the least significant bit position to be allocated.
4. To enable the OUT_SIGNAL function, set the following parameters to ZERO: Pn50E, Pn50F, and Pn510.

5.2.5 Position Data Latch Function Setting

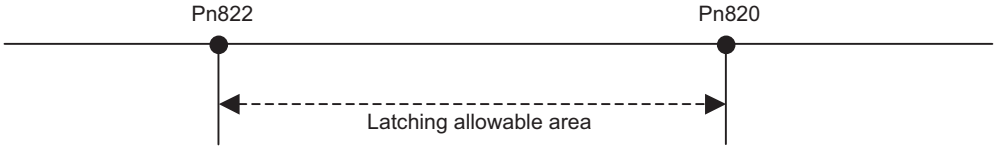
This section describes the parameters for setting the position data latch function.

(1) Latching Allowable Area

Use the following parameters to set the range to input the latch signal for position data latching by LTMOD_ON, LATCH, EX_POSING, or ZRET command. If the latch signal is input out of the set range, position data will not be latched.

Parameter No.	Name	Data Size (byte)	Setting Range	Unit	Factory Setting
Pn820	Forward Latching Allowable Area	4	–2147483648 to 2147483647	Reference unit	0
Pn822	Reverse Latching Allowable Area	4	–2147483648 to 2147483647	Reference unit	0

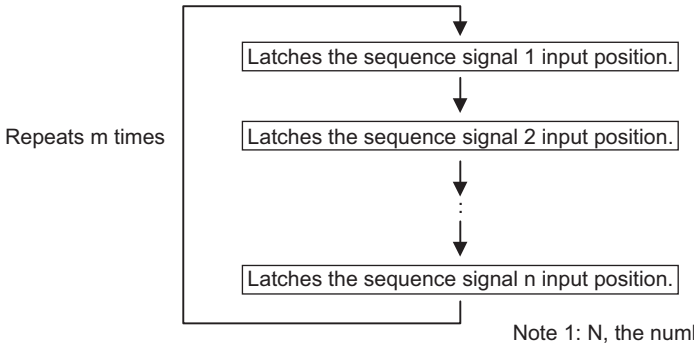
■ When Pn820 > Pn822



■ When Pn820 ≤ Pn822

(2) Continuous Latch Function

This function sequentially latches the input positions of sequence signal 1 to sequence signal n (n = 1 to 8) for a specified number of times. The continuous latch operation can be aborted by executing the LTMOD_OFF command. This function can shorten the time between latch completion and the start of the next latch, and enables sequential latch operations at high speed.



Note 1: N, the number of sequence signals, is specified by Pn850.
2: The signals for sequence signal n are selected by Pn852 and Pn853.
3: The number of times of continuous latching m is set by Pn851.

[How to Start and Stop Continuous Latch Operation]

Set the following parameters, and then set LT_MOD to 1 to execute the LTMOD_ON command. The continuous latch operation will start. To abort the operation, execute the LTMOD_OFF command.

Pn850: Latch Sequence Number n

Pn851: Continuous Latch Count m (When m = 0, the continuous latch operation will be infinitely repeated.)

Pn852: Latch Sequence Signal 1 to 4 Setting

Pn853: Larch Sequence Signal 5 to 8 Setting

Note: If the LTMOD_ON command is executed by setting Pn850 to 0 and LT_MOD to 1, the latch mode error warning (A.94E) will occur and the latch operation will not start.

[Latch Status]

Latch completion can be confirmed by the following status.

[STATUS Field: The 3rd and 4th byte]

L_CMP (D10): L_CMP is set to 1 for one communications cycle every time the external signal is input.

[EX_STATUS Field: The 28th and 29th byte]

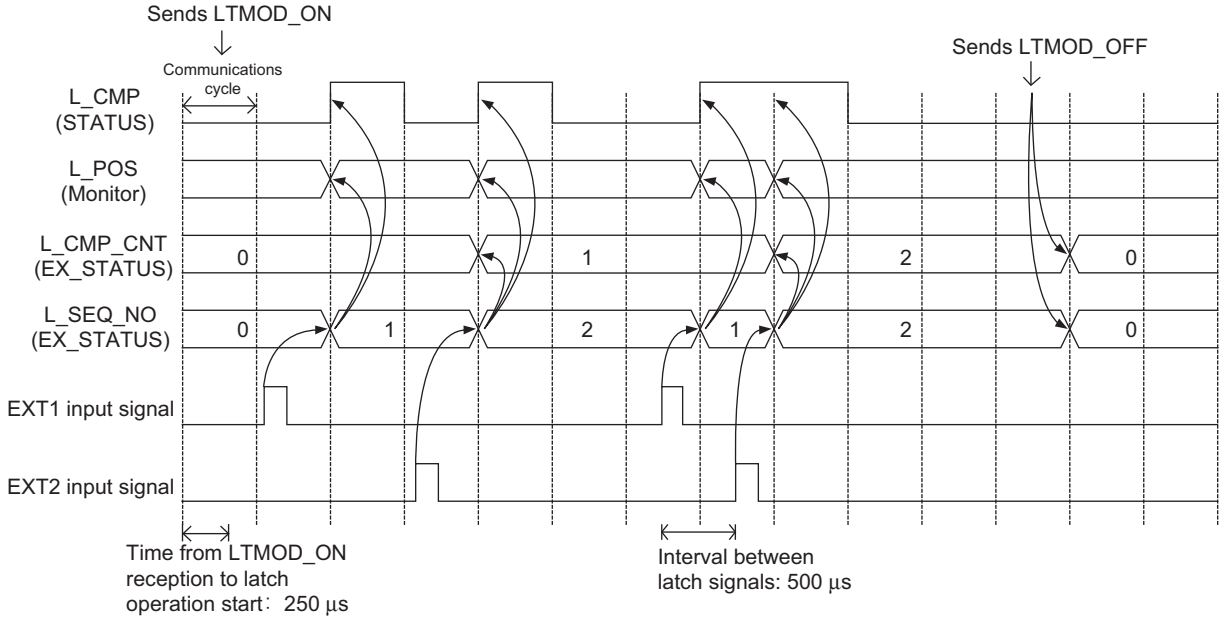
L_SEQ_NO (D8-D11): The latch sequence signal number (value n) at latch completion

L_CMP_CNT (D0-D7): The continuous latch count (value m)
(Added at completion of position latch when the latch sequence signal n is input.)

Note: LPOS is forcibly output to MONITOR 2 for one communications cycle while L_CMP = 1 every time the external signal is input.

[Operation Example]

An example of a continuous latch operation using two latch sequence signals EXT1 and EXT2 is illustrated below. (The parameters are set as follows: Pn850 = 2, Pn851 = 2 or more, Pn852 = 0021H, Pn853 = any)



[Setting Parameters]

Parameter No.	Digit	Name			Data Size (byte)	Setting Range	Unit	Factory Setting
Pn850		Latch Sequence Number			2	0 to 8	–	0
Pn851		Continuous Latch Count			2	0 to 255	–	0
Pn852		Latch Sequence Signal 1 to 4 Setting			2	0000H to 3333H	–	0000H
	0	Latch sequence 1 signal selection	0	Phase C		0 to 3	–	0
			1	EXT1 signal				
			2	EXT2 signal				
			3	EXT3 signal				
	1	Latch sequence 2 signal selection	0	Phase C		0 to 3	–	0
			1	EXT1 signal				
			2	EXT2 signal				
			3	EXT3 signal				
	2	Latch sequence 3 signal selection	0	Phase C		0 to 3	–	0
			1	EXT1 signal				
			2	EXT2 signal				
			3	EXT3 signal				
	3	Latch sequence 4 signal selection	0	Phase C		0 to 3	–	0
			1	EXT1 signal				
			2	EXT2 signal				
			3	EXT3 signal				
Pn853		Latch Sequence Signal 5 to 8 Setting			2	0000H to 3333H	–	0000H
	0	Latch sequence 5 signal selection	0	Phase C		0 to 3	–	0
			1	EXT1 signal				
			2	EXT2 signal				
			3	EXT3 signal				
	1	Latch sequence 6 signal selection	0	Phase C		0 to 3	–	0
			1	EXT1 signal				
			2	EXT2 signal				
			3	EXT3 signal				
	2	Latch sequence 7 signal selection	0	Phase C		0 to 3	–	0
			1	EXT1 signal				
			2	EXT2 signal				
			3	EXT3 signal				
	3	Latch sequence 8 signal selection	0	Phase C		0 to 3	–	0
			1	EXT1 signal				
			2	EXT2 signal				
			3	EXT3 signal				

[Application Notes]

1. The minimum interval between latch signals is 500 μs. An interval between latch signals that is longer than the communications cycle is required to continuously obtain latched position data.
2. If two latch signals are input without allowing the minimum required interval, only the first latch signal input position will be latched. The second latch signal will be ignored.
3. Use a subcommand to monitor completion status of continuous latch count.etc.
4. The parameters Pn850 to Pn853 can be changed only while the continuous latch operation is stopped.

5.2.6 Acceleration/Deceleration Parameter High-speed Switching Function

This function switches, at high-speed, the acceleration/deceleration parameters that are used for positioning executed by the POSING, FEED, EX_POSING, ZRET, or HOLD commands.

Register the acceleration/deceleration parameter settings in a bank before starting operation, and execute the bank selector BANK_SEL to switch the acceleration/deceleration parameter settings to those of the registered bank.

[Bank Selector Allocation]

Allocate the following bank selector BANK_SEL1 in the OPTION field. (The allocation is disabled by default. Refer to *(5) OPTION Field Specifications* of *chapter 7 Data Field* for details on bit allocation methods.)

Name	Description	Setting Data
BANK_SEL1	Bank selector	Bank 0 to 15

[Parameter Bank Setting]

Set the following parameters.

Parameter No.	Name	Data Size (byte)	Setting Range	Factory Setting
Pn900	Parameter Bank Number	2	0 to 16	0
Pn901	Parameter Bank Member Number	2	0 to 15	0
Pn902 to Pn910	Parameter Bank Member Definition	2	0000H to 08FFH	0
Pn920 to Pn95F *	Parameter Bank Data	2	0000H to FFFFH Depends on bank member.	0

* The parameters Pn920 to Pn95F will not be stored in the non-volatile memory. They need to be set every time the power is turned ON.

[Parameters that Can be Registered as Bank Members]

The following parameters can be registered as parameter bank members among parameters Pn902 to Pn910. For 4-byte parameters, one parameter must be registered as two consecutive members.
(See Setting Example 2.)

Parameter No.	Name	Data Size (byte)	Setting Range	Unit	Factory Setting
Pn80A	1st Linear Acceleration Constant 1	2	1 to 65535	10000 reference units/s^2	100
Pn80B	2nd Linear Acceleration Constant 1	2	1 to 65535	10000 reference units/s^2	100
Pn80C	Acceleration Constant Switching Speed 1	2	0 to 65535	100 reference units/s	0
Pn80D	1st Linear Deceleration Constant 1	2	1 to 65535	10000 reference units/s^2	100
Pn80E	2nd Linear Deceleration Constant 1	2	1 to 65535	10000 reference units/s^2	100
Pn80F	Deceleration Constant Switching Speed 1	2	0 to 65535	100 reference units/s	0
Pn834	1st Linear Acceleration Constant 2	4	1 to 20971520	10000 reference units/s^2	100
Pn836	2nd Linear Acceleration Constant 2	4	1 to 20971520	10000 reference units/s^2	100
Pn838	Acceleration Constant Switching Speed 2	4	0 to 2097152000	Reference unit/s	0

Parameter No.	Name	Data Size (byte)	Setting Range	Unit	Factory Setting
Pn83A	1st Linear Deceleration Constant 2	4	1 to 20971520	10000 reference units/s^2	100
Pn83C	2nd Linear Deceleration Constant 2	4	1 to 20971520	10000 reference units/s^2	100
Pn83E	Deceleration Constant Switching Speed 2	4	0 to 2097152000	Reference unit/s	0
Pn810	Exponential Function Acceleration/Deceleration Bias	2	0 to 65535	100 reference units/s	0
Pn811	Exponential Function Acceleration/Deceleration Time Constant	2	0 to 5100	0.1 ms	0
Pn812	Movement Average Time	2	0 to 5100	0.1 ms	0

[Setting Procedure]

STEP 1:

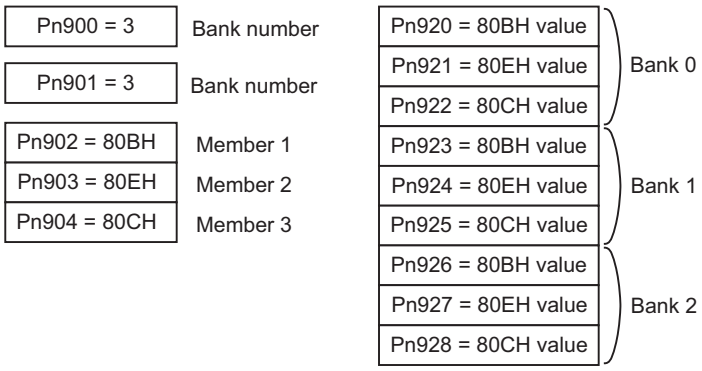
1. Set Pn900 (Parameter Bank Number) to m.
2. Set Pn901 (Parameter Bank Member Number) to n.
   Set Pn900 and Pn901 so that Pn900 × Pn901 ≤ 64.
3. Register bank member parameter numbers using parameters Pn902 to Pn910.
4. To enable the bank function, execute the CONFIG command or turn the power supply OFF and then ON again.

STEP 2:

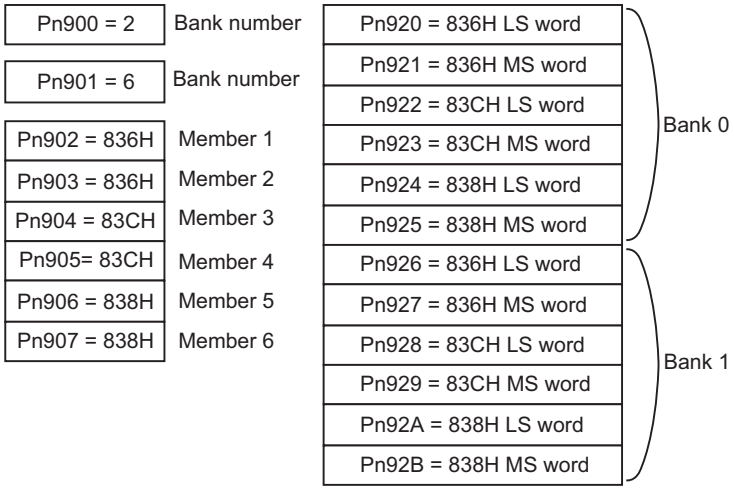
5. Set the data of each bank in the parameter bank data area from the leading parameter Pn920 in order as shown below.
   Bank 0: Pn920 to Pn (920+n-1)
   Bank 1: Pn (920+n) to Pn (920+2n-1)
   …
   Bank m-1: Pn {920+(m-1)×n} to Pn (920+m×n-1)

Note: 1. If parameters Pn900 to Pn910 set in STEP 1.1, 1.2, and 1.3 are saved in the non-volatile memory, carry out STEP 2.5 only after power up.
However, if you turn the power supply OFF and then ON again after saving parameters Pn900 to Pn910 in the non-volatile memory, and start the operation without setting parameters Pn920 to Pn95F, the operation will be carried out under the condition that all bank data is set to 0 (zero) or the minimum setting.
2. If parameters Pn900 to Pn910 set in STEP 1.1, 1.2, and 1.3 are not saved in the non-volatile memory, carry out STEP 1.1 to 2.5 each time the power supply is turned ON.

Setting Example 1: Switching three banks of members Pn80B, Pn80E, and Pn80C



Setting Example 2: Switching two banks of members Pn836, Pn83C, and Pn838



[Application Notes]

1. If Pn900 (Parameter Bank Number) or Pn901 (Parameter Bank Member Number) is set to 0, the bank function will be disabled.
2. If one parameter is registered for more than one bank member definition, the bank data of the biggest bank member definition parameter number will be applied.
3. If the bank selector BANK_SEL is not allocated to the function bit of the OPTION field, the data of Bank 0 will be always applied.
4. The acceleration/deceleration parameter high-speed switching function is enabled only while DEN = 1 (Distribution Completed). The parameters will not switch while DEN = 0 (Distributing).
5. In the following cases, error A.04A (parameter setting error 2) will occur when the power supply is turned ON or CONFIG command is executed.
   • One 4-byte parameter is not registered for two bank members.
   • The total number of bank data entries exceeds 64 (Pn900 × Pn901 > 64).
6. If a parameter that is not allowed to be a bank member is registered, the bank data of the parameter-registered member will become invalid.
7. Bank data that exceeds the setting range of the registered bank member parameter will be clamped to a value within the setting range.
8. If a bank number larger than the bank number set in Pn900 is specified (BANK_SEL1≥Pn900), the parameter bank will not switch and the currently active bank will be used.
9. Parameters Pn920 to Pn95F will not be saved in the non-volatile memory. Therefore, they must be set each time the power supply is turned ON.

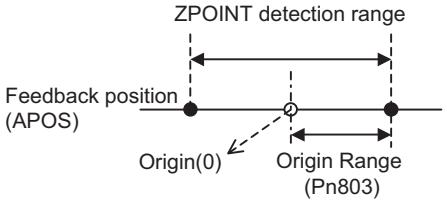
5.2.7 STATUS Field and Monitor Related Settings

(1) STATUS Field Status Detection Level Setting

This section describes the parameters for setting the status detection levels for the STATUS field data.

■ Origin (ZPOINT) Range Setting

Set the ZPOINT signal status detection range.



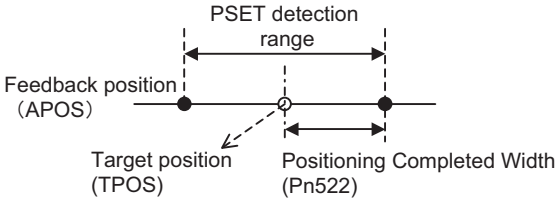
Parameter No.	Name	Data Size (byte)	Setting Range	Unit	Factory Setting
Pn803	Origin Range	2	0 to 250	Reference unit	10

Note: ZPOINT detection will be performed only after completion of the following operations. Otherwise, it will not be performed.

- When an incremental encoder is connected
  - Homing operation by ZRET command is completed.
  - The coordinate setting is completed after reference point setting (REFE = 1) by executing POS_SET command.
- When an absolute encoder is connected
  - Execution of SENS_ON command is completed.

■ Positioning Completed (PSET) Width Setting

Set the PSET signal status detection range.

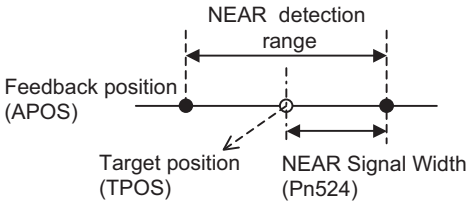


Parameter No.	Name	Data Size (byte)	Setting Range	Unit	Factory Setting
Pn522	Positioning Completed Width	4	0 to 1073741824	Reference unit	7

Note: PSET = 1 when output is completed (DEN = 1) and the feedback position (APOS) is within the positioning completed (PSET) detection range.

■ NEAR Signal Width Setting

Set the NEAR signal status detection range.



Parameter No.	Name	Data Size (byte)	Setting Range	Unit	Factory Setting
Pn524	NEAR Signal Width	4	0 to 1073741824	Reference unit	7

Note: NEAR = 1 when the feedback position (APOS) is within the NEAR signal detection range.

■ Zero-speed (ZSPD) Detection Level Setting

Set the ZSPD signal status detection level during speed control (VELCTRL command).

Parameter No.	Name	Data Size (byte)	Setting Range	Unit	Factory Setting
Pn502	Rotation Detection Level (For rotational servomotors)	2	1 to 10000	min^{-1}	20
Pn581	Travel Detection Level (For linear servomotors)	2	1 to 5000	mm/s	20

■ Speed Coincidence (VCMP) Detection Level Setting

Set the VCMP signal status detection level during speed control (VELCTRL command).

Parameter No.	Name	Data Size (byte)	Setting Range	Unit	Factory Setting
Pn503	Speed Coincidence Signal Output Width (For rotational servomotors)	2	0 to 100	min^{-1}	10
Pn582	Speed Coincidence Signal Output Width (For linear servomotors)	2	0 to 100	mm/s	10

(2) I/O Monitor Field Signal Allocation

Allocate CN1 connector input signals SI0 to SI6 to bits D12 to D15 of the I/O monitor field.

Parameter		Function	Setting	Allocation	Factory Setting
No.	Digit				
Pn81E	0	IO12 Signal Mapping	0	No mapping	0
			1	Monitors SI0 signal (CN1)	
			2	Monitors SI1 signal (CN1)	
			3	Monitors SI2 signal (CN1)	
			4	Monitors SI3 signal (CN1)	
			5	Monitors SI4 signal (CN1)	
			6	Monitors SI5 signal (CN1)	
			7	Monitors SI6 signal (CN1)	
	1	IO13 Signal Mapping	1 to 7	Refer to IO12 signal mapping	0
	2	IO14 Signal Mapping	1 to 7	Refer to IO12 signal mapping	0
	3	IO15 Signal Mapping	1 to 7	Refer to IO12 signal mapping	0

(3) Option Monitor Setting

Set the contents to be monitored when Option Monitor 1 and Option Monitor 2 are selected for MONITOR 1/2/3/4.

Parameter No.	Name		Remarks
Pn824	Option Monitor 1 Selection		–
	0000H	Motor rotation speed [1000000H/OS]	
	0001H	Speed reference [1000000H/OS]	
	0002H	Torque (Force) [1000000H/max. torque (force)]	
	0003H	Position error (lowermost 32 bits) [reference unit]	
	0004H	Position error (uppermost 32 bits) [reference unit]	
	0005H	System reserved	
	0006H	System reserved	
	000AH	Encoder count (lowermost 32 bits) [reference unit]	
	000BH	Encoder count (uppermost 32 bits) [reference unit]	
	000CH	External encoder count (lowermost 32 bits) [reference unit]	For fully-closed loop control
	000DH	External encoder count (uppermost 32 bits) [reference unit]	For fully-closed loop control
	0010H	Un000: Motor rotation speed [min^{-1}]	
	0011H	Un001: Speed reference [min^{-1}]	
	0012H	Un002: Torque (Force) reference [%]	
	0013H	Un003: Rotation angle 1 [pulse]	
	0014H	Un004: Rotation angle 2 [degree]	
	0015H	Un005: Input signal monitor	
	0016H	Un006: Output signal monitor	
	0017H	Un007: Input position reference speed [min^{-1}]	
	0018H	Un008: Position error [reference unit]	
	0019H	Un009: Accumulated load ratio [%]	
	001AH	Un00A: Regenerative load ratio [%]	
	001BH	Un00B: DB resistance consumption power [%]	
	001CH	Un00C: Input reference pulse [reference unit]	
	001DH	Un00D: Feedback pulse [pulse]	
	001EH	Un00E: Fully-closed loop feedback pulse [pulse]	For fully-closed loop control
	0023H	Initial multiturn data [rev]	For rotational servomotors
	0024H	Initial incremental pulse	For rotational servomotors
	0025H	Initial absolute position data lowermost 32 bits [pulse]	For linear servomotors
	0026H	Initial absolute position data uppermost 32 bits [pulse]	For linear servomotors
	0080H	Previous value of latched feedback position (LPOS)	
Pn825	Option Monitor 2 Selection (Same as for Pn824)		–

6

MECHATROLINK-II Subcommands

This chapter describes MECHATROLINK-II subcommands.

6.1 MECHATROLINK-II Subcommands List

The MECHATROLINK-II subcommands can be used by specifying them with the CONNECT command when MECHATROLINK-II communications starts.

The specifications of each MECHATROLINK-II subcommand are described below.

Refer to *1.2.3 Combination of MECHATROLINK-II Main Commands and Subcommands* for information on applicable combinations with main commands.

6.2 MECHATROLINK-II Subcommands Details

6.2.1 No Operation (NOP: 00H)

Byte	NOP		Description
	Command	Response	
17	00H	00H	• Not operation command
18		SUBSTATUS	
19			
20			
21			
22			
23			
24			
25			
26			
27			
28			
29			

(1) Substatus Field Specification

This substatus field is used to monitor status of subcommands.

- Substatus Field

Byte	D7	D6	D5	D4	D3	D2	D1	D0
18	Reserved	Reserved	Reserved	Reserved	Reserved	SBCM-DRDY	SBWARNG	SBALM

Bit	Name	Description	Value	Status
D0	SBALM	Subcommand alarm occurs.	0	No alarm
			1	Alarm occurs
D1	SBWARNG	Subcommand warning occurs.	0	No warning
			1	Warning
D2	SBCMDRDY	Subcommand Ready (Subcommand can be received)	0	Busy
			1	Ready

6.2.2 Read Parameter (PRM_RD: 01H)

Byte	PRM_RD		Description
	Command	Response	
17	01H	01H	• Reads the parameters. This command has the same function as the main command PRM_RD.
18		SUBSTATUS	
19	NO	NO	
20			
21	SIZE	SIZE	
22		PARAMETER	
23			
24			
25			
26			
27			
28			
29			

6.2.3 Write Parameter (PRM_WR: 02H)

Byte	PRM_WR		Description
	Command	Response	
17	02H	02H	• Writes the parameters. This command has the same function as the main command PRM_WR.
18		SUBSTATUS	
19	NO	NO	
20			
21	SIZE	SIZE	
22	PARAMETER	PARAMETER	
23			
24			
25			
26			
27			
28			
29			

6.2.4 Read Alarm or Warning (ALM_RD: 05H)

Byte	ALM_RD		Description
	Command	Response	
17	05H	05H	• Reads the alarm or warning. This command has the same function as the main command ALM_RD. • When ALM_RD_MOD is set to 2 or 3, an alarm index will be assigned to byte 20 in the command and the response. An alarm code is assigned to both byte 21 and byte 22 in the response.
18		SUBSTATUS	
19	ALM_RD_MOD	ALM_RD_MOD	
20		ALM_DATA	
21			
22			
23			
24			
25			
26			
27			
28			
29			

6.2.5 Write Non-volatile Parameter (PPRM_WR: 1CH)

Byte	PPRM_WR		Description
	Command	Response	
17	1CH	1CH	• Writes the parameters. This command has the same function as the main command PPRM_WR.
18		SUBSTATUS	
19	NO	NO	
20			
21	SIZE	SIZE	
22	PARAMETER	PARAMETER	
23			
24			
25			
26			
27			
28			
29			

6.2.6 Set Latch Mode (LTMOD_ON: 28H)

Byte	PPRM_WR		Description
	Command	Response	
17	28H	28H	• Enables the latch mode. This command has the same function as the main command LTMOD_ON.
18	LT_SGN	SUBSTATUS	
19	SEL_MON3/4	SEL_MON3/4	
20	LT_MOD	MONITOR3	
21			
22			
23			
24		MONITOR4	
25			
26			
27			
28		EX_STATUS	
29			

(1) Extention Status Field Specifications

This field is used to monitor extension status.

The SMON, LTMOD_ON, and LTMOD_OFF subcommands can be used to enable monitoring.

Byte 28	D7	D6	D5	D4	D3	D2	D1	D0
	L_CMP_CNT							
Byte 29	D15	D14	D13	D12	D11	D10	D9	D8
	–	–	–	–	L_SEQ_NO			

- L_CMP_CNT (D0-D7)
  This counter indicates how many times the latch sequence has been completed during continuous latch operation. It remains 0 during a normal latch operation.
- L_SEQ_NO (D8-D11)
  This number indicates the number of latch sequence being completed during a continuous latch operation. It remains 0 during a normal latch operation.

6.2.7 Release Latch Mode (LTMOD_OFF: 29H)

Byte	LTMOD_OFF		Description
	Command	Response	
17	29H	29H	• Releases the latch mode. This command has the same function as the main command LTMOD_OFF.
18		SUBSTATUS	
19	SEL_MON3/4	SEL_MON3/4	
20		MONITOR3	
21			
22			
23			
24		MONITOR4	
25			
26			
27			
28		EX_STATUS	
29			

6.2.8 Status Monitoring (SMON: 30H)

Byte	SMON		Description
	Command	Response	
17	30H	30H	• Reads the monitoring information specified in SEL_MON3/4. This command has the same function as the main command SMON.
18		SUBSTATUS	
19	SEL_MON3/4	SEL_MON3/4	
20		MONITOR3	
21			
22			
23			
24		MONITOR4	
25			
26			
27			
28		EX_STATUS	
29			

7

Data Field

This chapter describes the data field to be used for the main commands and subcommands. Descriptions in this chapter are also contained in the previous chapter describing each command.

7.1 Main Command Data Field

The data of each field in the main commands or subcommands is described below.

(1) Status Field Specifications

The status field is used to monitor the SERVOPACK status.
The following table shows the bit allocation in the status field.

D7	D6	D5	D4	D3	D2	D1	D0
PSET/ V_CMP	ZPOINT	–	PON	SVON	CMDRDY	WARNG	ALM

D15	D14	D13	D12	D11	D10	D9	D8
–	–	N_SOT	P_SOT	NEAR/ V_LIM	L_CMP	T_LIM	DEN/ZSPD

The following table explains each bit value and its status.

Bit	Name	Value	Description
D0	ALM	0	No alarm
		1	Alarm occurs.
D1	WARNG	0	No warning
		1	Warning occurs.
D2	CMDRDY	0	Command cannot be received (busy).
		1	Command can be received (ready).
D3	SVON	0	Servo OFF
		1	Servo ON
D4	PON	0	Main power supply OFF
		1	Main power supply ON
D5			
D6	ZPOINT	0	Out of home position range
		1	Within home position range
D7	PSET (During position control)	0	Out of positioning complete range
		1	Within positioning complete range (The output is completed (DEN = 1) and APOS is within the positioning complete range.)
	V_CMP (During speed control)	0	Speed does not coincide.
		1	Speed coincides.
D8	DEN (During position control)	0	During output
		1	Output completed
	ZSPD (During speed control)	0	Zero speed not detected
		1	Zero speed detected
D9	T_LIM	0	Not during torque (force) limit
		1	During torque (force) limit
D10	L_CMP	0	Latch not completed
		1	Latch completed

Bit	Name	Value	Description
D11	NEAR (During position control)	0	Out of positioning proximity
		1	Within positioning proximity
	V_LIM (During torque control)	0	Speed limit not detected
		1	Speed limit detected
D12	P_SOT	0	OT signal is off.
		1	OT signal is on.
D13	N_SOT	0	OT signal is OFF.
		1	OT signal is ON.
D14			
D15			

(2) OPTION Field Specifications

The option field is used to add functions to a motion command.

- Applicable Commands:

SV_ON, HOLD, INTERPOLATE, POSING, FEED, LATCH, EX_POSING, ZRET, VELCTRL, TRQCTRL, SVCTRL

Set the functions to be added to a motion command in the main command third and forth bytes reserved for the option field.

The option field of the Σ-V series SERVOPACK is set by default as shown below.

To change the default setting, set the parameter Pn81F as Pn81F = □□□1, and set the bits to which functions are to be allocated using the parameters Pn82A to Pn82E. The change must be validated by turning the power supply OFF and then ON again or by sending a CONFIG command.

OPTION Field Default Setting.

D7	D6	D5	D4	D3	D2	D1	D0
0	0	0	ACCFIL		0	0	0

D15	D14	D13	D12	D11	D10	D9	D8
N_CL	P_CL	P_PI_CLR	V_PPI	0	0	G_SEL	

• Functions That Can Be Allocated to Bits of the OPTION Field

Name	Description	Value	Details	Default Setting
ACCFIL (2 bits)	Acceleration/Deceleration filter	0	No acceleration/deceleration filter	D3, D4
		1	Exponential function acceleration/deceleration	
		2	S-curve acceleration/deceleration	
		3	Do not set.	
G_SEL (2 bits)	Gain switching	0	First gain	D8, D9
		1	Second gain	
		2	Reserved (invalid)	
		3	Reserved (invalid)	
V_PPI (1 bit)	Speed loop P/PI control	0	PI control	D12
		1	P control	
P_PI_CLR (1 bit)	Position loop position integral clear	0	Does not clear.	D13
		1	Clears.	

Name	Description		Value	Details	Default Setting
P_CL (1 bit)	Forward torque (force) limit		0	Does not control torque (force).	D14
			1	Controls torque (force).	
N_CL (1 bit)	Reverse torque (force) limit		0	Does not control torque (force).	D15
			1	Controls torque (force).	
LT_DISABLE (1 bit)	Latch signal input disabled		0	Enables latch signal input.	Not allocated
			1	Disables latch signal input.	
BANK_SEL1 (4 bits)	Bank selector 1 (Bank for acceleration/deceleration parameter switching)		0 to 15	Bank 0 to Bank 15	Not allocated
OUT_SIGNAL (3 bits)	I/O signal output command	BIT 0	0	SO1 output signal OFF	Not allocated
			1	SO1 output signal ON	
		BIT 1	0	SO2 output signal OFF	
			1	SO2 output signal ON	
		BIT 2	0	SO3 output signal OFF	
			1	SO3 output signal ON	

Note 1. Do not allocate more than one signal to one bit. Otherwise, multiple signals will be controlled by one bit.
2. The bits to which no function is allocated will act as it is set to 0 (zero).

(3) Monitor Selection Field Specifications: SEL_MON1/2/3/4

The monitor selection (SEL_MON1/2/3/4) field is used to select the Servo monitor information.

- Applicable Commands:

SV_ON, SV_OFF, HOLD, INTERPOLATE, POSING, FEED, LATCH, EX_POSING, ZRET, VELCTRL, TRQCTRL, SMON, SENS_ON, SENS_OFF, BRK_ON, BRK_OFF, LTMOD_ON, LTMOD_OFF

- Setting Method:

Set MONITOR 1/2/3/4 monitor codes in SEL_MON1/2/3/4 allocated in the thirteenth byte of the main command or in the reserved area of the nineteenth byte of the subcommand.

SEL_MON1/2/3/4 allocation is shown below.

D7	D6	D5	D4	D3	D2	D1	D0
SEL_MON2				SEL_MON1			

D7	D6	D5	D4	D3	D2	D1	D0
SEL_MON4				SEL_MON3			

(4) Monitor Information Field Specifications: MONITOR 1/2/3/4

The monitor information (MONITOR 1/2/3/4)field is used to monitor information selected by the monitor codes in the monitor selection field.

- Applicable Commands:

SV_ON, SV_OFF, HOLD, INTERPOLATE, POSING, FEED, LATCH, EX_POSING, ZRET, VELCTRL, TRQCTRL, SMON, SENS_ON, SENS_OFF, BRK_ON, BRK_OFF, LTMOD_ON, LTMOD_OFF

The MONITOR 1/2/3/4 monitor codes are listed below.

Monitor Code	Name	Description	Unit
0	POS	Reference position in reference coordinate system (position after reference filtering)	Reference unit
1	MPOS	Reference position	Reference unit
2	PERR	Position error	Reference unit

Monitor Code	Name	Description	Unit
3	APOS	Feedback position in machine coordinate system	Reference unit
4	LPOS	Feedback latch position in machine coordinate system	Reference unit
5	IPOS	Reference position in reference coordinate system (position before reference filtering)	Reference unit
6	TPOS	Target position in reference coordinate system	Reference unit
7			
8	FSPD	Feedback speed	Position/torque (force) control: reference units/s Speed control: Maximum speed/ 40000000H
9	CSPD	Reference speed	Position control: Reference units/s Speed control: Maximum speed/ 40000000H
A	TSPD	Target speed	Position control: Reference units/s Speed control: Maximum speed/ 40000000H
B	TRQ	Torque (force) reference (The rated torque is 100%.)	Position/speed control: % (The rated torque is 100%.) Torque (force) control: Maximum torque (force)/40000000H
C			
D			
E	OMN1	Option monitor 1 selected in Pn824	
F	OMN2	Option monitor 2 selected in Pn825	

(5) IO Monitor Field Specifications: IO_MON

The IO monitor field is used to monitor the I/O signal status of the SERVOPACK.

- Applicable Commands:

SMON, SV_ON, SV_OFF, HOLD, INTERPOLATE, POSING, ZRET, LATCH, EX_POSING, ZRET, VELCTRL, TRQCTRL, SENS_ON, SENS_OFF, BRK_ON, BRK_OFF, LTMOD_ON, LTMOD_OFF

I/O signal allocation is shown below.

D7	D6	D5	D4	D3	D2	D1	D0
EXT2	EXT1	PC	PB	PA	DEC	N_OT	P_OT

D15	D14	D13	D12	D11	D10	D09	D08
IO15	IO14	IO13	IO12	–	HBB	BRK	EXT3

Bit	Name	Contents	Value	Status
D0	P_OT	Forward run prohibited input	0	OFF
			1	ON
D1	N_OT	Reverse run prohibited input	0	OFF
			1	ON
D2	DEC	Homing deceleration LS input	0	OFF
			1	ON
D3	PA	Encoder phase A input	0	OFF
			1	ON

Bit	Name	Contents	Value	Status
D4	PB	Encoder phase B input	0	OFF
			1	ON
D5	PC	Encoder phase C input	0	OFF
			1	ON
D6	EXT1	First external latch signal input	0	OFF
			1	ON
D7	EXT2	Second external latch signal input	0	OFF
			1	ON
D8	EXT3	Third external latch signal input	0	OFF
			1	ON
D9	BRK	Brake output	0	Released
			1	Locked
D10	HBB	Stop signal input, OR of HWBB1 signal and HWBB2 signal	0	OFF (Forced stop released)
			1	ON (Forced stop)
D11		Reserved	0	
D12	IO12	CN1 input signal selected in Pn81E.0	0	OFF (open)
			1	ON (closed)
D13	IO13	CN1 input signal selected in Pn81E.1	0	OFF (open)
			1	ON (closed)
D14	IO14	CN1 input signal selected in Pn81E.2	0	OFF (open)
			1	ON (closed)
D15	IO15	CN1 input signal selected in Pn81E.3	0	OFF (open)
			1	ON (closed)

(6) LT_SGNL Specifications

- Applicable Commands:

LATCH, EX_POSING, ZRET, LTMOD_ON(When Pn850 = 0), SVCTRL

The latch signal can be specified in the following latch signal (LT_SGNL) field.

D7	D6	D5	D4	D3	D2	D1	D0
0	0	0	0	0	0	LT_SGNL	

D1	D0	Latch Signal	Signal Details
0	0	Phase C	Encoder origin signal
0	1	EXT1	External input signal 1
1	0	EXT2	External input signal 2
1	1	EXT3	External input signal 3

7.2 Substatus Data Field

(1) Substatus Field Specification

The substatus field is used to monitor status of subcommands.

- Substatus Field

	D7	D6	D5	D4	D3	D2	D1	D0
Byte 18	Reserved	Reserved	Reserved	Reserved	Reserved	SBCM-DRDY	SBWARNG	SBALM

Bit	Name	Description	Value	Status
D0	SBALM	Subcommand alarm occurs.	0	No alarm
			1	Alarm occurs
D1	SBWARNG	Subcommand warning occurs.	0	No warning
			1	Warning
D2	SBCMDRDY	Subcommand Ready (Subcommand can be received)	0	Busy
			1	Ready

(2) Extention Status Field Specifications

This field is used to monitor extension status.

The SMON, LTMOD_ON, and LTMOD_OFF subcommands can be used to enable monitoring.

	D7	D6	D5	D4	D3	D2	D1	D0
Byte 28	L_CMP_CNT							
	D15	D14	D13	D12	D11	D10	D9	D8
Byte 29	–	–	–	–	L_SEQ_NO			

- L_CMP_CNT (D0-D7)
  This counter indicates how many times the latch sequence has been completed during continuous latch operation. It remains 0 during a normal latch operation.
- L_SEQ_NO (D8-D11)
  This number indicates the number of latch sequence being completed during a continuous latch operation. It remains 0 during a normal latch operation.

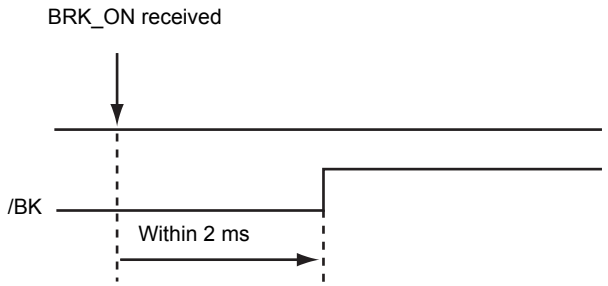
Appendix

A Brake Control Commands

Command Code	Command	Function
21H	BRK_ON	Turns the brake signal off and applies the holding brake.
22H	BRK_OFF	Turns the brake signal on and releases the holding brake.

(1) Apply Brake (BRK_ON: 21H)

The specifications of BRK_ON (21H) command are described below.

<table>
<tr><th rowspan="2">Byte</th><th colspan="2">BRK_ON</th><th colspan="4" rowspan="2">Description</th></tr>
<tr><th>Command</th><th>Response</th></tr>
<tr><td>1</td><td>21H</td><td>21H</td><td>Phases in which the command can be executed</td><td>Phase 2 and 3</td><td>Synchronization classification</td><td>Asynchronous command</td></tr>
<tr><td>2</td><td rowspan="14"></td><td>ALARM</td><td>Processing time</td><td>Within communications cycle</td><td>Subcommand</td><td>Cannot be used</td></tr>
<tr><td>3</td><td rowspan="2">STATUS</td><td colspan="4" rowspan="14">• Turns the brake signal (/BK) off and apply brake.
• This command is enabled only while the servo is OFF.
• This command is enabled when the parameter Pn50F.2is not set to 0.
• Brake signal output timing
 
</td></tr>
<tr><td>4</td></tr>
<tr><td>5</td><td rowspan="4">MONITOR1</td></tr>
<tr><td>6</td></tr>
<tr><td>7</td></tr>
<tr><td>8</td></tr>
<tr><td>9</td><td rowspan="4">MONITOR2</td></tr>
<tr><td>10</td></tr>
<tr><td>11</td></tr>
<tr><td>12</td></tr>
<tr><td>13</td><td>SEL_MON1/2</td><td>SEL_MON1/2</td></tr>
<tr><td>14</td><td rowspan="2"></td><td rowspan="2">IO_MON</td></tr>
<tr><td>15</td></tr>
<tr><td>16</td><td>WDT</td><td>RWDT</td></tr>
</table>

(2) Combination of BRK_ON Command (21H) and Subcommands

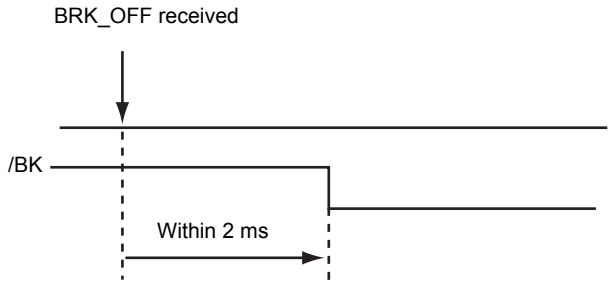
The following table shows which subcommands can be combined with BRK-ON command.

Main Command	Subcommand							
	NOP	PRM_RD	PRM_WR	ALM_RD	PPRM_WR	LTMOD_ON	LTMOD_OFF	SMON
BRK_ON	√	×	×	×	×	×	×	√

Note: √: Can be combined, ×: Can not be combined

(3) Release Brake (BRK_OFF: 22H)

The specifications of BRK_OFF command (22H) are described below.

<table>
<tr><th rowspan="2">Byte</th><th colspan="2">BRK_OFF</th><th colspan="4" rowspan="2">Description</th></tr>
<tr><th>Command</th><th>Response</th></tr>
<tr><td>1</td><td>22H</td><td>22H</td><td>Phases in which the command can be executed</td><td>Phase 2 and 3</td><td>Synchronization classification</td><td>Asynchronous command</td></tr>
<tr><td>2</td><td rowspan="12"></td><td>ALARM</td><td>Processing time</td><td>Within communications cycle</td><td>Subcommand</td><td>Cannot be used</td></tr>
<tr><td>3</td><td rowspan="2">STATUS</td><td colspan="4" rowspan="14">• Turns the brake signal (/BK) ON and releases the brake.
• This command is enabled when Pn50F.2 is not set to 0
• Brake signal output timing
 
</td></tr>
<tr><td>4</td></tr>
<tr><td>5</td><td rowspan="4">MONITOR1</td></tr>
<tr><td>6</td></tr>
<tr><td>7</td></tr>
<tr><td>8</td></tr>
<tr><td>9</td><td rowspan="4">MONITOR2</td></tr>
<tr><td>10</td></tr>
<tr><td>11</td></tr>
<tr><td>12</td></tr>
<tr><td>13</td><td>SEL_MON1/2</td><td>SEL_MON1/2</td></tr>
<tr><td>14</td><td rowspan="2"></td><td rowspan="2">IO_MON</td></tr>
<tr><td>15</td></tr>
<tr><td>16</td><td>WDT</td><td>RWDT</td></tr>
</table>

IMPORTANT

BRK_ON and BRK_OFF commands are always valid as command as long as no warning occurs.

Therefore, sending BRK_OFF command while the servomotor is being powered (Servo ON) will not change the operation status.

However, it is very dangerous to send SV_OFF command in the above status since the brake is kept released.

Always make sure of the status of brake control command when using BRK_ON or BRK_OFF command.

(4) Combination of BRK_OFF Command (22H) and Subcommands

The following table shows which subcommands can be combined with BRK-OFF command.

Main Command	Subcommand							
	NOP	PRM_RD	PRM_WR	ALM_RD	PPRM_WR	LTMOD_ON	LTMOD_OFF	SMON
BRK_OFF	√	×	×	×	×	×	×	√

Note: √: Can be combined, ×: Can not be combined

B General-purpose Servo Control Command

The specifications of general-purpose servo control command are described below.

<table>
<tr><th rowspan="2">Byte</th><th colspan="2">SVCTRL</th><th colspan="4" rowspan="2">Description</th></tr>
<tr><th>Command</th><th>Response</th></tr>
<tr><td>1</td><td>3FH</td><td>3FH</td><td>Phases in which the command can be executed</td><td>Phase 2 and 3</td><td>Synchronization classification</td><td>Asynchronous command</td></tr>
<tr><td>2</td><td>SUBCTRL</td><td>ALARM</td><td>Processing time</td><td>Depends on processing</td><td>Subcommand</td><td>Can be used</td></tr>
<tr><td>3</td><td rowspan="2">OPTION</td><td rowspan="2">STATUS</td><td colspan="4" rowspan="16">• This command is compatible with MECHATROLINK versions before Ver 1.0. It is used to perform the general-purpose servo control.
• Latch Processing
Supported.
Select the latch signal using L_SGN in SUBCTRL and set SET_L to 1.
When the selected latch signal is input, L_CMP in STATUS field will become 1.
Perform latch processing again after setting SET_L to 0.
The latch signal cannot be changed while SET_L = 1.
• Motion
Any of the motions selected for Motion Selection is executed.
• Sequence Signals
Any of the sequence signals listed in the following table is input.</td></tr>
<tr><td>4</td></tr>
<tr><td>5</td><td rowspan="4">TOPS</td><td rowspan="4">MONITOR1</td></tr>
<tr><td>6</td></tr>
<tr><td>7</td></tr>
<tr><td>8</td></tr>
<tr><td>9</td><td rowspan="4">TSPD/
VFF</td><td rowspan="4">MONITOR2</td></tr>
<tr><td>10</td></tr>
<tr><td>11</td></tr>
<tr><td>12</td></tr>
<tr><td>13</td><td>SEL_MON1/2</td><td>SEL_MON1/2</td></tr>
<tr><td>14</td><td rowspan="2">SQ_CMD</td><td rowspan="2">IO_MON</td></tr>
<tr><td>15</td></tr>
<tr><td>16</td><td>WDT</td><td>RWDT</td></tr>
<tr><td>17</td><td rowspan="13">Subcommand area</td><td rowspan="13">Subcommand area</td></tr>
<tr><td>18</td></tr>
<tr><td>19</td></tr>
<tr><td>20</td></tr>
<tr><td>21</td></tr>
<tr><td>22</td></tr>
<tr><td>23</td></tr>
<tr><td>24</td></tr>
<tr><td>25</td></tr>
<tr><td>26</td></tr>
<tr><td>27</td></tr>
<tr><td>28</td></tr>
<tr><td>29</td></tr>
</table>

• Sub-control (SUBCTRL)

D7	D6	D5	D4	D3	D2	D1	D0
RESERVE 0	MOTION Select motion			RESERVE 0	SET_L Latch command	L_SGN Select latch signal	

Select Motion (MOTION)

D6	D5	D4	Motion	
0	0	0	HOLD	• During phase 1, Command warning 1 (A.95A) will occur for POSING and FEED, and the command will be ignored. • For INTERPOLATED, in all other phases except phase 3, Command warning 1 (A.95A) will occur and the command will be ignored.
0	0	1	INTERPOLATE	
0	1	0	FEED	
0	1	1	POSING	

Select Latch Signal (L_SGN)

D1	D0	Latch Signal	Meaning
0	0	Phase C	Encoder zero-point signal
0	1	EXT1	External latch signal 1
1	0	EXT2	External latch signal 2
1	1	EXT3	External latch signal 2

• Sequence Signals: SQ_CMD

D7	D6	D5	D4	D3	D2	D1	D0
Reserved	Reserved	Reserved	Reserved	ACLR Alarm clear	SEN Sensor ON	BRK Brake ON	SON Servo ON

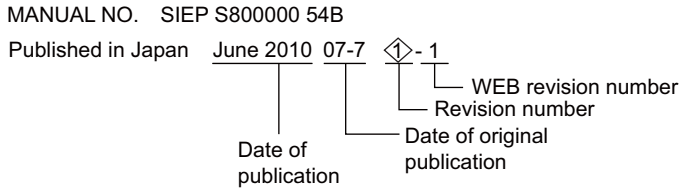
• Combination of SVCTRL (3F) and Subcommands

CODE	Main Command	Subcommand						
		NOP	PRM_WR	ALM_RD	PPRM_ WR	LTMOD_ ON	LTMOD_ OFF	SMON
3F	SVCTRL	√	√	√	√	×	√	√

Note: √: Can be combined, ×: Can not be combined

Revision History

The revision dates and numbers of the revised manuals are given on the bottom of the back cover.



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			Back cover	Addition: Address
				Addition: The words “Original instructions”
February 2010		0	All chapters	Completely revised
July 2007	–	–	–	First edition

AC Servo Drives

Σ-V Series
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MECHATROLINK-II Command

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