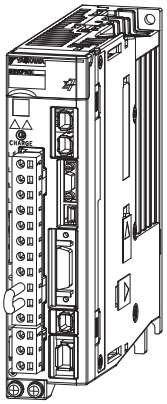
YASKAWA

Σ-7-Series AC Servo Drive

# MECHATROLINK-II Communications Command Manual




Settings for MECHATROLINK-II Communications 1

Data Field 2

Main Commands 3

Subcommands 4

Operation Sequence 5

Command Related Parameters 6

Detecting Alarms/Warnings Related to Communications or Commands 7

Appendix 8



MANUAL NO. SIEP S800001 30A

# About this Manual

This manual describes the specifications of MECHATROLINK-II commands used in MECHATROLINK-II communications for the following MECHATROLINK-II communications reference input type SERVOPACKs, the basic operations using these commands, and the parameters for these commands.

• Σ-7-Series Σ-7S SERVOPACKs (Models: SGD7S-□□□□10□)

Read and understand this manual to ensure correct usage of the Σ-7-Series AC Servo Drives.

Keep this manual in a safe place so that it can be referred to whenever necessary.

• Targeted Readers

Users who incorporate the MECHATROLINK-II commands in controllers
Users who design applications for host controllers that use MECHATROLINK-II commands directly

# Outline of Manual

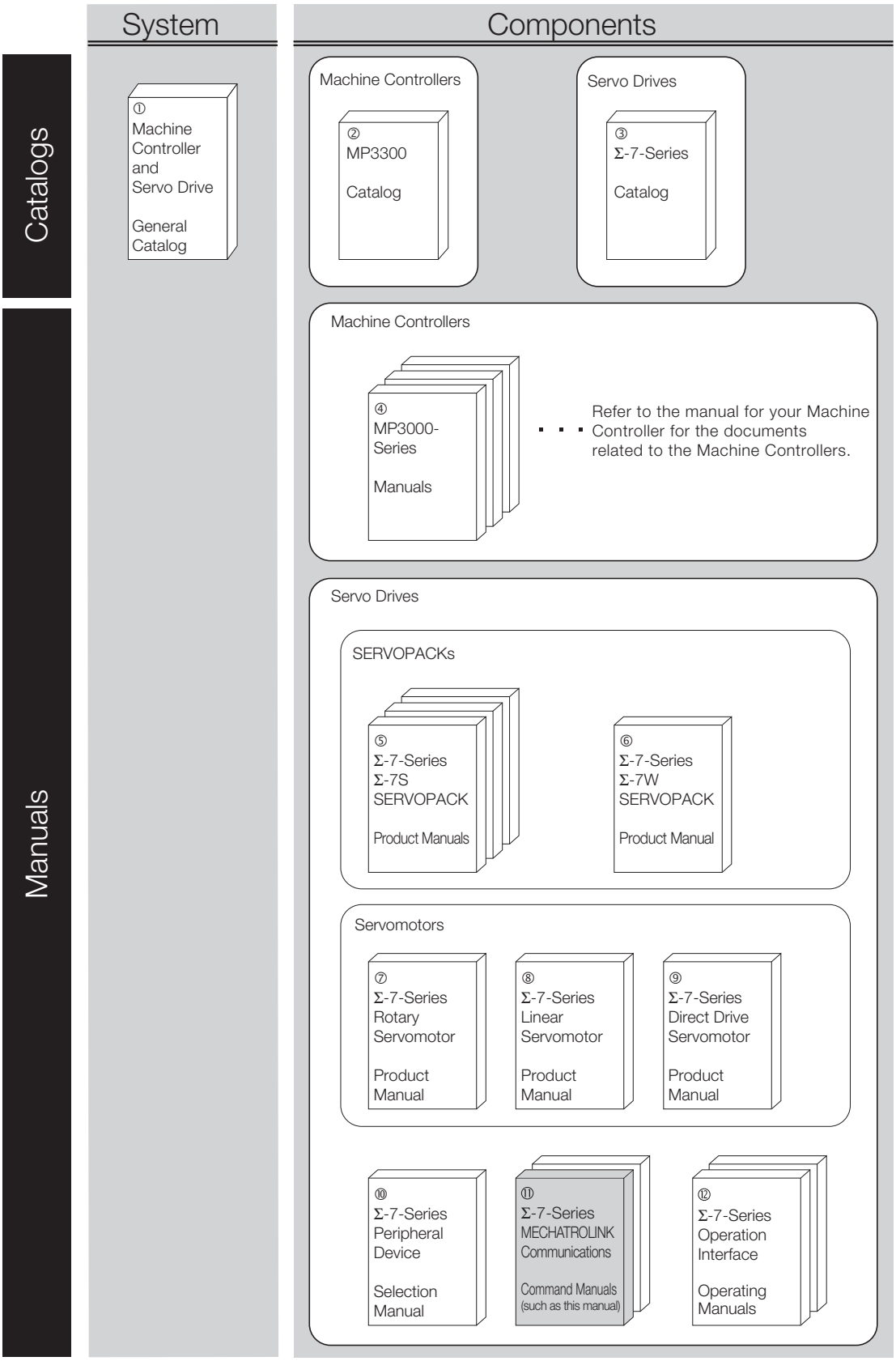
The contents of the chapters of this manual are described in the following table.

Refer to these chapters as required.

| Chapter | Chapter Title | Contents |
|---|---|---|
| 1 | Settings for MECHATROLINK-II Communications | Provides detailed information on MECHATROLINK-II communications. |
| 2 | Data Fields | Describes the common specifications for all commands and the command format. |
| 3 | Main Commands | Provides detailed information on the main commands. |
| 4 | Subcommands | Provides detailed information on the subcommands. |
| 5 | Operation Sequence | Describes basic operation sequences using MECHATROLINK-II communications. |
| 6 | Command Related Parameters | Describes the functions. |
| 7 | Detecting Alarms/Warnings Related to Communications or Commands | Describes the alarms and warnings that may occur in MECHATROLINK-II communications. |
| 8 | Appendices | Describes the brake control commands and the general-purpose servo control commands. |

# Related Documents

The relationships between the documents that are related to the Servo Drives are shown in the following figure. The numbers in the figure correspond to the numbers in the table on the following pages. Refer to these documents as required.



| Classification | Document Name | Document No. | Description |
|---|---|---|---|
| ①<br>Machine Controller and Servo Drive General Catalog | Machine Controller and Servo Drive Solutions Catalog | KAEP S800001 22 | Provides detailed information required to select MP3000-Series Machine Controllers and Σ-7-Series AC Servo Drives. |
| ②<br>MP3300 Catalog | Machine Controller<br>MP3300 | KAEP C880725 03 | Provides detailed information on MP3300 Machine Controllers, including features and specifications. |
| ③<br>Σ-7-Series Catalog | AC Servo Drives<br>Σ-7 Series | KAEP S800001 23 | Provides detailed information on Σ-7-Series AC Servo Drives, including features and specifications. |
| ④<br>MP3000-Series Manuals | Machine Controller<br>MP3000 Series<br>MP3300<br>Product Manual | SIEP C880725 21 | Describes the functions, specifications, operating methods, maintenance, inspections, and troubleshooting of the MP3000-series MP3300 Machine Controllers. |
| ⑤<br>Σ-7-Series<br>Σ-7S SERVOPACK<br>Product Manuals | Σ-7-Series AC Servo Drive<br>Σ-7S SERVOPACK with MECHATROLINK-III Communications References<br>Product Manual | SIEP S800001 28 | Provide detailed information on selecting Σ-7-Series SERVOPACKs and information on installing, connecting, setting, performing trial operation for, tuning, and monitoring the Servo Drives. |
| | Σ-7-Series AC Servo Drive<br>Σ-7S SERVOPACK with MECHATROLINK-II Communications References<br>Product Manual | SIEP S800001 27 | |
| | Σ-7-Series AC Servo Drive<br>Σ-7S SERVOPACK with Analog Voltage/Pulse Train References<br>Product Manual | SIEP S800001 26 | |
| ⑥<br>Σ-7-Series<br>Σ-7W SERVOPACK<br>Product Manual | Σ-7-Series AC Servo Drive<br>Σ-7W SERVOPACK with MECHATROLINK-III Communications References<br>Product Manual | SIEP S800001 29 | |
| ⑦<br>Σ-7-Series<br>Rotary Servomotor<br>Product Manual | Σ-7-Series AC Servo Drive<br>Rotary Servomotor<br>Product Manual | SIEP S800001 36 | Provide detailed information on selecting, installing, and connecting the Σ-7-Series Servomotors. |
| ⑧<br>Σ-7-Series<br>Linear Servomotor<br>Product Manual | Σ-7-Series AC Servo Drive<br>Linear Servomotor<br>Product Manual | SIEP S800001 37 | |
| ⑨<br>Σ-7-Series<br>Direct Drive Servomotor<br>Product Manual | Σ-7-Series AC Servo Drive<br>Direct Drive Servomotor<br>Product Manual | SIEP S800001 38 | |

Continued on next page.

Continued from previous page.

| Classification | Document Name | Document No. | Description |
|---|---|---|---|
| ⑩ Σ-7-Series Peripheral Device Selection Manual | Σ-7-Series AC Servo Drive Peripheral Device Selection Manual | SIEP S800001 32 | Describes the peripheral devices for a Σ-7-Series Servo System. |
| ⑪ Σ-7-Series MECHATROLINK Communications Command Manuals | Σ-7-Series AC Servo Drive MECHATROLINK-II Communications Command Manual | This manual (SIEP S800001 30) | Provides detailed information on the MECHATROLINK-II communications commands that are used for a Σ-7-Series Servo System. |
| | Σ-7-Series AC Servo Drive MECHATROLINK-III Communications Standard Servo Profile Command Manual | SIEP S800001 31 | Provides detailed information on the MECHATROLINK-III communications standard servo profile commands that are used for a Σ-7-Series Servo System. |
| ⑫ Σ-7-Series Operation Interface Operating Manuals | Σ-7-Series AC Servo Drive Digital Operator Operating Manual | SIEP S800001 33 | Describes the operating procedures for a Digital Operator for a Σ-7-Series Servo System. |
| | AC Servo Drives Engineering Tool SigmaWin+ Online Manual Σ-7 Component | SIEP S800001 48 | Provides detailed operating procedures for the SigmaWin+ Engineering Tool for a Σ-7-Series Servo System. |

# Using This Manual

## ◆ Technical Terms Used in This Manual

The following terms are used in this manual.

| Basic Term | Meaning |
|---|---|
| Transmission Cycle | The transmission cycle is the cycle in the MAC (Media Access Control) layer. It is the communication cycle for physically sending data to the transmission path. The transmission cycle is unaffected by the services provided by the application layer. |
| Communication Cycle | The communication cycle is the cycle for application layer. The communication cycle is set to an integral multiple of the transmission cycle. |
| Synchronous Commands (Classification S) | For commands of this type, commands are sent and response are received every communication cycle.<br>The WDT (Watchdog Timer) in the frames are refreshed and checked every communication cycle. Synchronous commands can be used only during synchronous communications (Phase 3). |
| Asynchronous Commands (Classification A) | For commands of this type, commands are sent and response are received asynchronously to the communication cycle.<br>Subsequent commands can be sent after confirming the completion of processing of the slave station that received the command.<br>The WDT (Watchdog Timer) in the frames are not checked. |


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.
This manual does not apply to users who use MP-series motion controllers for controlling Σ-7-Series SERVOPACKs.

## ◆ Differences in Terms for Rotary Servomotors and Linear Servomotors

There are differences in the terms that are used for Rotary Servomotors and Linear Servomotors. This manual primarily describes Rotary Servomotors. If you are using a Linear Servomotor, you need to interpret the terms as given in the following table.

| Rotary Servomotors | Linear Servomotors |
|---|---|
| torque | force |
| moment of inertia | mass |
| rotation | movement |
| forward rotation and reverse rotation | forward movement and reverse movement |
| CW and CCW pulse trains | forward and reverse pulse trains |
| rotary encoder | linear encoder |
| absolute rotary encoder | absolute linear encoder |
| incremental rotary encoder | incremental linear encoder |
| unit: $min^{-1}$ | unit: mm/s |
| unit: N·m | unit: N |

## ◆ Notation Used in this Manual

### ■ Notation for Reverse Signals

The names of reverse signals (i.e., ones that are valid when low) are written with a forward slash (/) before the signal abbreviation.

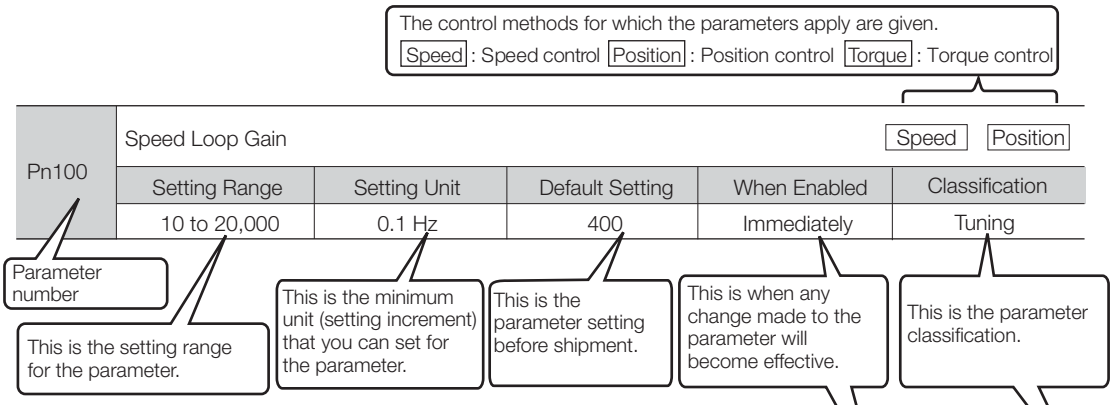
Notation Example

$\overline{BK}$ is written as /BK.

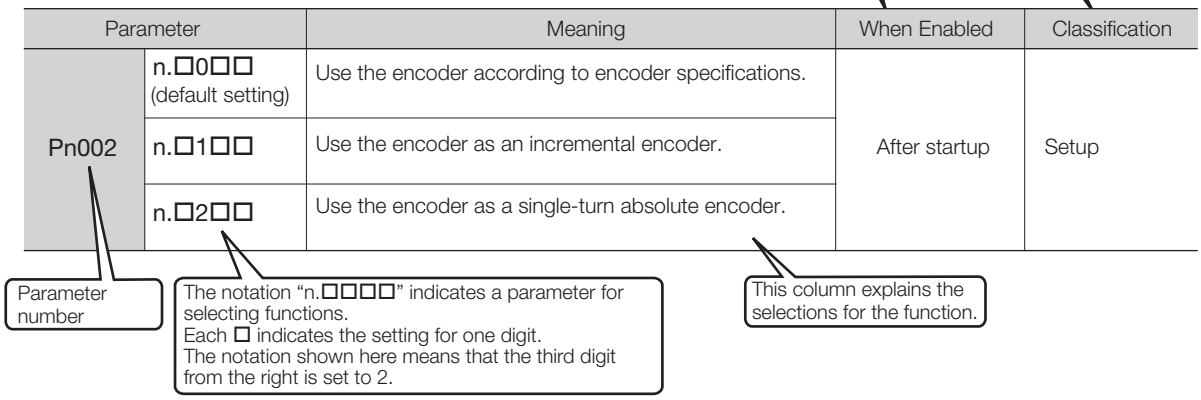
### ■ Notation for Parameters

The notation depends on whether the parameter requires a numeric setting (parameter for numeric setting) or requires the selection of a function (parameter for selecting functions).

- Parameters for Numeric Settings

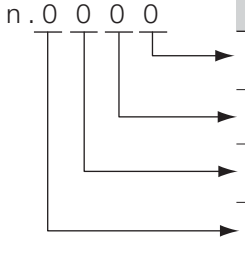



- Parameters for Selecting Functions




Notation Example

Notation Examples for Pn002




| Digit Notation | | Numeric Value Notation | |
|---|---|---|---|
| Notation | Meaning | Notation | Meaning |
| Pn002 = n.□□□X | Indicates the first digit from the right in Pn002. | Pn002 = n.□□□1 | Indicates that the first digit from the right in Pn002 is set to 1. |
| Pn002 = n.□□X□ | Indicates the second digit from the right in Pn002. | Pn002 = n.□□1□ | Indicates that the second digit from the right in Pn002 is set to 1. |
| Pn002 = n.□X□□ | Indicates the third digit from the right in Pn002. | Pn002 = n.□1□□ | Indicates that the third digit from the right in Pn002 is set to 1. |
| Pn002 = n.X□□□ | Indicates the fourth digit from the right in Pn002. | Pn002 = n.1□□□ | Indicates that the fourth digit from the right in Pn002 is set to 1. |

## ◆ Trademarks

- MECHATROLINK is a trademark of the MECHATROLINK Members Association.
- Other product names and company names are the trademarks or registered trademarks of the respective company. “TM” and the ® mark do not appear with product or company names in this manual.

## ◆ Visual Aids

The following aids are used to indicate certain types of information for easier reference.


Important

Indicates precautions or restrictions that must be observed.
Also indicates alarm displays and other precautions that will not result in machine damage.


Term

Indicates definitions of difficult terms or terms that have not been previously explained in this manual.

Example Indicates operating or setting examples.

Information Indicates supplemental information to deepen understanding or useful information.

# Safety Precautions

## ◆ Safety Information

To prevent personal injury and equipment damage in advance, the following signal words are used to indicate safety precautions in this document. The signal words are used to classify the hazards and the degree of damage or injury that may occur if a product is used incorrectly. Information marked as shown below is important for safety. Always read this information and heed the precautions that are provided.

**⚠ DANGER**

- Indicates precautions that, if not heeded, are likely to result in loss of life, serious injury, or fire.

**⚠ WARNING**

- Indicates precautions that, if not heeded, could result in loss of life, serious injury, or fire.

**⚠ CAUTION**

- Indicates precautions that, if not heeded, could result in relatively serious or minor injury, or in fire.

**NOTICE**

- Indicates precautions that, if not heeded, could result in property damage.

## ◆ Safety Precautions That Must Always Be Observed

### ■ General Precautions

**⚠ DANGER**

- Read and understand this manual to ensure the safe usage of the product.
- Keep this manual in a safe, convenient place so that it can be referred to whenever necessary. Make sure that it is delivered to the final user of the product.
- Do not remove covers, cables, connectors, or optional devices while power is being supplied to the SERVOPACK.
  There is a risk of electric shock, operational failure of the product, or burning.

**⚠ WARNING**

- Use a power supply with specifications (number of phases, voltage, frequency, and AC/DC type) that are appropriate for the product.
  There is a risk of burning, electric shock, or fire.
- Connect the ground terminals on the SERVOPACK and Servomotor to ground poles according to local electrical codes (100 Ω or less for a SERVOPACK with a 100-VAC or 200-VAC power supply, and 10 Ω or less for a SERVOPACK with a 400-VAC power supply).
  There is a risk of electric shock or fire.
- Do not attempt to disassemble, repair, or modify the product.
  There is a risk of fire or failure.
  The warranty is void for the product if you disassemble, repair, or modify it.

**⚠ CAUTION**

- The SERVOPACK heat sinks, regenerative resistors, Servomotors, and other components can be very hot while power is ON or soon after the power is turned OFF. Implement safety measures, such as installing covers, so that hands and parts such as cables do not come into contact with hot components.
  There is a risk of burn injury.
- For a 24-VDC power supply, use a power supply device with double insulation or reinforced insulation.
  There is a risk of electric shock.
- Do not damage, pull on, apply excessive force to, place heavy objects on, or pinch cables.
  There is a risk of failure, damage, or electric shock.
- The person who designs the system that uses the hard wire base block safety function must have a complete knowledge of the related safety standards and a complete understanding of the instructions in this document.
  There is a risk of injury, product damage, or machine damage.
- Do not use the product in an environment that is subject to water, corrosive gases, or flammable gases, or near flammable materials.
  There is a risk of electric shock or fire.

## NOTICE

- Do not attempt to use a SERVOPACK or Servomotor that is damaged or that has missing parts.
- Install external emergency stop circuits that shut OFF the power supply and stops operation immediately when an error occurs.
- In locations with poor power supply conditions, install the necessary protective devices (such as AC reactors) to ensure that the input power is supplied within the specified voltage range.
  There is a risk of damage to the SERVOPACK.
- Use a Noise Filter to minimize the effects of electromagnetic interference.
  Electronic devices used near the SERVOPACK may be affected by electromagnetic interference.
- Always use a Servomotor and SERVOPACK in one of the specified combinations.
- Do not touch a SERVOPACK or Servomotor with wet hands.
  There is a risk of product failure.

■ Storage Precautions

## ⚠ CAUTION

- Do not place an excessive load on the product during storage. (Follow all instructions on the packages.)
  There is a risk of injury or damage.

## NOTICE

- Do not install or store the product in any of the following locations.
  - Locations that are subject to direct sunlight
  - Locations that are subject to ambient temperatures that exceed product specifications
  - Locations that are subject to relative humidities that exceed product specifications
  - Locations that are subject to condensation as the result of extreme changes in temperature
  - Locations that are subject to corrosive or flammable gases
  - Locations that are near flammable materials
  - Locations that are subject to dust, salts, or iron powder
  - Locations that are subject to water, oil, or chemicals
  - Locations that are subject to vibration or shock that exceeds product specifications
  - Locations that are subject to radiation

  If you store or install the product in any of the above locations, the product may fail or be damaged.

■ Transportation Precautions

## ⚠ CAUTION

- Transport the product in a way that is suitable to the mass of the product.
- Do not use the eyebolts on a SERVOPACK or Servomotor to move the machine.
  There is a risk of damage or injury.
- When you handle a SERVOPACK or Servomotor, be careful of sharp parts, such as the corners.
  There is a risk of injury.
- Do not place an excessive load on the product during transportation. (Follow all instructions on the packages.)
  There is a risk of injury or damage.

## NOTICE

- Do not hold onto the front cover or connectors when you move a SERVOPACK.
  There is a risk of the SERVOPACK falling.
- A SERVOPACK or Servomotor is a precision device. Do not drop it or subject it to strong shock.
  There is a risk of failure or damage.
- Do not subject connectors to shock.
  There is a risk of faulty connections or damage.
- If disinfectants or insecticides must be used to treat packing materials such as wooden frames, plywood, or pallets, the packing materials must be treated before the product is packaged, and methods other than fumigation must be used.
  Example: Heat treatment, where materials are kiln-dried to a core temperature of 56°C for 30 minutes or more.
  If the electronic products, which include stand-alone products and products installed in machines, are packed with fumigated wooden materials, the electrical components may be greatly damaged by the gases or fumes resulting from the fumigation process. In particular, disinfectants containing halogen, which includes chlorine, fluorine, bromine, or iodine can contribute to the erosion of the capacitors.
- Do not overtighten the eyebolts on a SERVOPACK or Servomotor.
  If you use a tool to overtighten the eyebolts, the tapped holes may be damaged.

■ Installation Precautions

## ⚠ CAUTION

- Install the Servomotor or SERVOPACK in a way that will support the mass given in technical documents.
- Install SERVOPACKs, Servomotors, and regenerative resistors on nonflammable materials.
  Installation directly onto or near flammable materials may result in fire.
- Provide the specified clearances between the SERVOPACK and the control panel as well as with other devices.
  There is a risk of fire or failure.
- Install the SERVOPACK in the specified orientation.
  There is a risk of fire or failure.
- Do not step on or place a heavy object on the product.
  There is a risk of failure, damage, or injury.
- Do not allow any foreign matter to enter the SERVOPACK or Servomotor.
  There is a risk of failure or fire.

## NOTICE

- Do not install or store the product in any of the following locations.
  - Locations that are subject to direct sunlight
  - Locations that are subject to ambient temperatures that exceed product specifications
  - Locations that are subject to relative humidities that exceed product specifications
  - Locations that are subject to condensation as the result of extreme changes in temperature
  - Locations that are subject to corrosive or flammable gases
  - Locations that are near flammable materials
  - Locations that are subject to dust, salts, or iron powder
  - Locations that are subject to water, oil, or chemicals
  - Locations that are subject to vibration or shock that exceeds product specifications
  - Locations that are subject to radiation

  If you store or install the product in any of the above locations, the product may fail or be damaged.
- Use the product in an environment that is appropriate for the product specifications.
  If you use the product in an environment that exceeds product specifications, the product may fail or be damaged.
- A SERVOPACK or Servomotor is a precision device. Do not drop it or subject it to strong shock.
  There is a risk of failure or damage.
- Always install a SERVOPACK in a control panel.
- Do not allow any foreign matter to enter a SERVOPACK or a Servomotor with a Cooling Fan and do not cover the outlet from the Servomotor's cooling fan.
  There is a risk of failure.

### ■ Wiring Precautions

## ⚠ DANGER

- Do not change any wiring while power is being supplied.
  There is a risk of electric shock or injury.

## ⚠ WARNING

- Wiring and inspections must be performed only by qualified engineers.
  There is a risk of electric shock or product failure.
- Check all wiring and power supplies carefully.
  Incorrect wiring or incorrect voltage application to the output circuits may cause short-circuit failures. If a short-circuit failure occurs as a result of any of these causes, the holding brake will not work. This could damage the machine or cause an accident that may result in death or injury.
- Connect the AC and DC power supplies to the specified SERVOPACK terminals.
  - Connect an AC power supply to the L1, L2, and L3 terminals and the L1C and L2C terminals on the SERVOPACK.
  - Connect a DC power supply to the B1/⊕ and ⊖2 terminals and the L1C and L2C terminals on the SERVOPACK.

  There is a risk of failure or fire.

## ⚠ CAUTION

- Wait for six minutes after turning OFF the power supply and then make sure that the CHARGE indicator is not lit before starting wiring or inspection work. Do not touch the power supply terminals while the CHARGE lamp is lit after turning OFF the power supply because high voltage may still remain in the SERVOPACK.
  There is a risk of electric shock.
- Observe the precautions and instructions for wiring and trial operation precisely as described in this document.
  Failures caused by incorrect wiring or incorrect voltage application in the brake circuit may cause the SERVOPACK to fail, damage the equipment, or cause an accident resulting in death or injury.
- Check the wiring to be sure it has been performed correctly.
  Connectors and pin layouts are sometimes different for different models. Always confirm the pin layouts in technical documents for your model before operation.
  There is a risk of failure or malfunction.
- Connect wires to power supply terminals and motor connection terminals securely with the specified methods and tightening torque.
  Insufficient tightening may cause wires and terminal blocks to generate heat due to faulty contact, possibly resulting in fire.
- Use shielded twisted-pair cables or screened unshielded multi-twisted-pair cables for I/O Signal Cables and Encoder Cables.
- Observe the following precautions when wiring the SERVOPACK's main circuit terminals.
  - Turn ON the power supply to the SERVOPACK only after all wiring, including the main circuit terminals, has been completed.
  - If a connector is used for the main circuit terminals, remove the main circuit connector from the SERVOPACK before you wire it.
  - Insert only one wire per insertion hole in the main circuit terminals.
  - When you insert a wire, make sure that the conductor wire (e.g., whiskers) does not come into contact with adjacent wires.
- Install molded-case circuit breakers and other safety measures to provide protection against short circuits in external wiring.
  There is a risk of fire or failure.

## NOTICE

- Whenever possible, use the Cables specified by Yaskawa.
  If you use any other cables, confirm the rated current and application environment of your model and use the wiring materials specified by Yaskawa or equivalent materials.
- Securely tighten cable connector screws and lock mechanisms.
  Insufficient tightening may result in cable connectors falling off during operation.
- Do not bundle power lines (e.g., the Main Circuit Cable) and low-current lines (e.g., the I/O Signal Cables or Encoder Cables) together or run them through the same duct. If you do not place power lines and low-current lines in separate ducts, separate them by at least 30 cm.
  If the cables are too close to each other, malfunctions may occur due to noise affecting the low-current lines.
- Install a battery at either the host controller or on the Encoder Cable.
  If you install batteries both at the host controller and on the Encoder Cable at the same time, you will create a loop circuit between the batteries, resulting in a risk of damage or burning.
- When connecting a battery, connect the polarity correctly.
  There is a risk of battery rupture or encoder failure.

■ Operation Precautions

## ⚠ WARNING

- Before starting operation with a machine connected, change the settings of the switches and parameters to match the machine.
  Unexpected machine operation, failure, or personal injury may occur if operation is started before appropriate settings are made.
- Do not radically change the settings of the parameters.
  There is a risk of unstable operation, machine damage, or injury.
- Install limit switches or stoppers at the ends of the moving parts of the machine to prevent unexpected accidents.
  There is a risk of machine damage or injury.
- For trial operation, securely mount the Servomotor and disconnect it from the machine.
  There is a risk of injury.
- Forcing the motor to stop for overtravel is disabled when the Jog (Fn002), Origin Search (Fn003), or Easy FFT (Fn206) utility function is executed. Take necessary precautions.
  There is a risk of machine damage or injury.
- When an alarm occurs, the motor will coast to a stop or stop with the dynamic brake according to a setting in the SERVOPACK. The coasting distance will change with the moment of inertia of the load. Check the coasting distance during trial operation and implement suitable safety measures on the machine.
- Do not enter the machine's range of motion during operation.
  There is a risk of injury.
- Do not touch the moving parts of the Servomotor or machine during operation.
  There is a risk of injury.

## ⚠ CAUTION

- Design the system to ensure safety even when problems, such as broken signal lines, occur. For example, the P-OT and N-OT signals are set in the default settings to operate on the safe side if a signal line breaks. Do not change the polarity of this type of signal.
- When overtravel occurs, the power supply to the motor is turned OFF and the brake is released. If you use the Servomotor to drive a vertical load, set the Servomotor to enter a zero-clamped state after the Servomotor stops. Also, install safety devices (such as an external brake or counterweight) to prevent the moving parts of the machine from falling.
- Always turn OFF the servo before you turn OFF the power supply. If you turn OFF the main circuit power supply or control power supply during operation before you turn OFF the servo, the Servomotor will stop as follows:
  - If you turn OFF the main circuit power supply during operation without turning OFF the servo, the Servomotor will stop abruptly with the dynamic brake.
  - If you turn OFF the control power supply without turning OFF the servo, the stopping method that is used by the Servomotor depends on the model of the SERVOPACK. For details, refer to the manual for the SERVOPACK.

## NOTICE

- When you adjust the gain during system commissioning, use a measuring instrument to monitor the torque waveform and speed waveform and confirm that there is no vibration.
  If a high gain causes vibration, the Servomotor will be damaged quickly.
- Do not frequently turn the power supply ON and OFF. After you have started actual operation, allow at least one hour between turning the power supply ON and OFF (as a guideline).
  Do not use the product in applications that require the power supply to be turned ON and OFF frequently.
  The elements in the SERVOPACK will deteriorate quickly.
- An alarm or warning may occur if communications are performed with the host controller while the SigmaWin+ or Digital Operator is operating.
  If an alarm or warning occurs, it may interrupt the current process and stop the system.
- After you complete trial operation of the machine and facilities, use the SigmaWin+ to back up the settings of the SERVOPACK parameters. You can use them to reset the parameters after SERVOPACK replacement.
  If you do not copy backed up parameter settings, normal operation may not be possible after a faulty SERVOPACK is replaced, possibly resulting in machine or equipment damage.

### ■ Maintenance and Inspection Precautions

## ⚠ DANGER

- Do not change any wiring while power is being supplied.
  There is a risk of electric shock or injury.

## ⚠ WARNING

- Wiring and inspections must be performed only by qualified engineers.
  There is a risk of electric shock or product failure.

## ⚠ CAUTION

- Wait for six minutes after turning OFF the power supply and then make sure that the CHARGE indicator is not lit before starting wiring or inspection work. Do not touch the power supply terminals while the CHARGE lamp is lit after turning OFF the power supply because high voltage may still remain in the SERVOPACK.
  There is a risk of electric shock.
- Before you replace a SERVOPACK, back up the settings of the SERVOPACK parameters. Copy the backed up parameter settings to the new SERVOPACK and confirm that they were copied correctly.
  If you do not copy backed up parameter settings or if the copy operation is not completed normally, normal operation may not be possible, possibly resulting in machine or equipment damage.

## NOTICE

- Discharge all static electricity from your body before you operate any of the buttons or switches inside the front cover of the SERVOPACK.
  There is a risk of equipment damage.

## ■ Troubleshooting Precautions

### ⚠ WARNING

- The product may suddenly start to operate when the power supply is recovered after a momentary power interruption. Design the machine to ensure human safety when operation restarts.
  There is a risk of injury.

### ⚠ CAUTION

- When an alarm occurs, remove the cause of the alarm and ensure safety. Then reset the alarm or turn the power supply OFF and ON again to restart operation.
  There is a risk of injury or machine damage.
- If the Servo ON signal is input to the SERVOPACK and an alarm is reset, the Servomotor may suddenly restart operation. Confirm that the servo is OFF and ensure safety before you reset an alarm.
  There is a risk of injury or machine damage.
- Always insert a magnetic contactor in the line between the main circuit power supply and the main circuit power supply terminals on the SERVOPACK so that the power supply can be shut OFF at the main circuit power supply.
  If a magnetic contactor is not connected when the SERVOPACK fails, a large current may flow, possibly resulting in fire.
- If an alarm occurs, shut OFF the main circuit power supply.
  There is a risk of fire due to a regenerative resistor overheating as the result of regenerative transistor failure.
- Install a ground fault detector against overloads and short-circuiting or install a molded-case circuit breaker combined with a ground fault detector.
  There is a risk of SERVOPACK failure or fire if a ground fault occurs.
- The holding brake on a Servomotor will not ensure safety if there is the possibility that an external force (including gravity) may move the current position and create a hazardous situation when power is interrupted or an error occurs. If an external force may cause movement, install an external braking mechanism that ensures safety.

## ■ General Precautions

- Figures provided in this document are typical examples or conceptual representations. There may be differences between them and actual wiring, circuits, and products.
- The products shown in illustrations in this document are sometimes shown without covers or protective guards. Always replace all covers and protective guards before you use the product.
- If you need a new copy of this document because it has been lost or damaged, contact your nearest Yaskawa representative or one of the offices listed on the back of this document.
- This document is subject to change without notice for product improvements, specifications changes, and improvements to the manual itself.
  We will update the document number of the document and issue revisions when changes are made.
- Any and all quality guarantees provided by Yaskawa are null and void if the customer modifies the product in any way. Yaskawa disavows any responsibility for damages or losses that are caused by modified products.

# Warranty

## ◆ Details of Warranty

### ■ Warranty Period

The warranty period for a product that was purchased (hereinafter called the “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 charge if a defect attributable to Yaskawa occurs during the above warranty period.
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.

- 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
- Causes not attributable to the delivered product itself
- Modifications or repairs not performed by Yaskawa
- Use of the delivered product in a manner in which it was not originally intended
- Causes that were not foreseeable with the scientific and technological understanding at the time of shipment from Yaskawa
- Events for which Yaskawa is not responsible, such as natural or human-made disasters

## ◆ Limitations of Liability

- 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.
- 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.
- 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.
- 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.

## ◆ Suitability for Use

- 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.
- The customer must confirm that the Yaskawa product is suitable for the systems, machines, and equipment used by the customer.
- 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
- 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.
- 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.
- Read and understand all use prohibitions and precautions, and operate the Yaskawa product correctly to prevent accidental harm to third parties.

## ◆ 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

About this Manual . . . . . iii
Outline of Manual . . . . . iii
Related Documents . . . . . iv
Using This Manual . . . . . vii
Safety Precautions . . . . . x
Warranty . . . . . xix

## 1 Settings for MECHATROLINK-II Communications

1.1 MECHATROLINK-II Communications . . . . . 1-2
1.1.1 Layers . . . . . 1-2
1.1.2 Frame Structure . . . . . 1-2
1.1.3 State Transition Diagram . . . . . 1-3

1.2 Command and Response Timing . . . . . 1-4
1.2.1 Command Data Execution Timing . . . . . 1-4
1.2.2 Monitored Data Input Timing . . . . . 1-4

1.3 Data Order . . . . . 1-5

1.4 MECHATROLINK-II Command List . . . . . 1-6
1.4.1 Main Commands (In command code order) . . . . . 1-6
1.4.2 Subcommands (In command code order) . . . . . 1-7
1.4.3 Combination of MECHATROLINK-II Main Commands and Subcommands . 1-8

## 2 Data Field

2.1 Main Command Data Field . . . . . 2-2
2.1.1 Status Field Specifications . . . . . 2-2
2.1.2 OPTION Field Specifications . . . . . 2-3
2.1.3 Monitor Selection Field Specifications: SEL_MON1/2/3/4 . . . . . 2-4
2.1.4 Monitor Information Field Specifications: MONITOR 1/2/3/4 . . . . . 2-5
2.1.5 IO Monitor Field Specifications: IO_MON . . . . . 2-6
2.1.6 LT_SGNL Specifications . . . . . 2-7

2.2 Substatus Data Field . . . . . 2-8
2.2.1 Substatus Field Specification . . . . . 2-8
2.2.2 Extension Status Field Specifications . . . . . 2-8

## 3 Main Commands

3.1 Commands Used to Prepare for Operation . . . . . 3-3
3.1.1 NOP (No Operation) Command: 00 Hex . . . . . 3-3
3.1.2 DISCONNECT (Release Connection) Command: 0F Hex . . . . . 3-5
3.1.3 CONNECT (Establish MECHATROLINK-II Connection) Command: 0E Hex . 3-6
3.1.4 SYNC_SET (Start Synchronous Communications) Command: 0D Hex . . . . 3-8
3.1.5 ID_RD (Check Device ID) Command: 03 Hex . . . . . 3-9
3.1.6 PRM_WR (Set Parameter) Command: 02 Hex . . . . . 3-11

3.1.7 PPRM_WR (Set and Save Parameters in Non-volatile Memory) Command: 1C Hex . . . . . 3-12
3.1.8 CONFIG (Enable Parameters) Command: 04 Hex . . . . . 3-13
3.1.9 SENS_ON (Turn ON Encoder Power Supply) Command: 23 Hex . . . . . 3-14
3.1.10 SV_ON (Turn ON Servo) Command: 31 Hex . . . . . 3-15
3.1.11 SENS_OFF (Turn OFF Encoder Power Supply) Command: 24 Hex . . . . . 3-16
3.1.12 SV_OFF (Turn Servo OFF) Command: 32 Hex . . . . . 3-17
3.1.13 PRM_RD (Read Parameter) Command: 01 Hex . . . . . 3-18
3.1.14 SMON (Check SERVOPACK Status) Command: 30 Hex . . . . . 3-19
3.1.15 ALM_RD (Read Alarm or Warning) Command: 05 Hex . . . . . 3-20
3.1.16 ALM_CLR (Clear Warnings and Alarms) Command: 06 Hex . . . . . 3-22
3.1.17 POS_SET (Set Coordinate System) Command: 20 Hex . . . . . 3-23
3.1.18 ADJ (Monitor and Adjust Settings) Command: 3E Hex . . . . . 3-24

3.2 Motion Commands . . . . . 3-28

3.2.1 HOLD (Stop Motion) Command: 25 Hex . . . . . 3-28
3.2.2 LTMOD_ON (Set Latch Mode) Command: 28 Hex . . . . . 3-30
3.2.3 LTMOD_OFF (Release Latch Mode) Command: 29 Hex . . . . . 3-33
3.2.4 INTERPOLATE (Interpolation Feeding) Command: 34 Hex . . . . . 3-34
3.2.5 POSING (Positioning) Command: 35 Hex . . . . . 3-36
3.2.6 FEED (Constant Speed Feeding) Command: 36 Hex . . . . . 3-38
3.2.7 LATCH (Interpolation Feeding with Position Detection) Command: 38 Hex. 3-40
3.2.8 EX_POSING (External Input Positioning) Command: 39 Hex . . . . . 3-42
3.2.9 ZRET (Origin Return) Command: 3A Hex . . . . . 3-44
3.2.10 VELCTRL (Velocity Control) Command: 3C Hex . . . . . 3-46
3.2.11 TRQCTRL (Torque Control) Command: 3D Hex . . . . . 3-48
3.2.12 Restrictions in Using Servo Commands . . . . . 3-50

4 Subcommands

4.1 MECHATROLINK-II Subcommands List . . . . . 4-2

4.2 MECHATROLINK-II Subcommands Details . . . . . 4-3

4.2.1 NOP (No Operation) Command: 00 Hex . . . . . 4-3
4.2.2 PRM_RD (Read Parameter) Command: 01 Hex . . . . . 4-3
4.2.3 PRM_WR (Write Parameter) Command: 02 Hex . . . . . 4-4
4.2.4 ALM_RD (Read Alarm or Warning) Command: 05 Hex . . . . . 4-4
4.2.5 PPRM_WR (Write Non-volatile Parameter) Command: 1C Hex . . . . . 4-5
4.2.6 LTMOD_ON (Set Latch Mode) Command: 28 Hex . . . . . 4-5
4.2.7 LTMOD_OFF (Release Latch Mode) Command: 29 Hex . . . . . 4-6
4.2.8 SMON (Status Monitoring) Command: 30 Hex . . . . . 4-6

5 Operation Sequence

5.1 Preparing for Operation . . . . . 5-2

5.1.1 Setting MECHATROLINK-II Communications . . . . . 5-2
5.1.2 Checking the Communications Status . . . . . 5-4

5.2 Operation Sequence for Managing Parameters Using a Controller . . . . 5-5

5.3 Operation Sequence for Managing Parameters Using a SERVOPACK . 5-6

5.3.1 Setup Sequence . . . . . 5-6
5.3.2 Ordinary Operation Sequence . . . . . 5-6

5.4 Specific Operation Sequences . . . . . 5-7
5.4.1 Operation Sequence When Turning the Servo ON . . . . . 5-7
5.4.2 Operation Sequence When OT (Overtravel Limit Switch) Signal Is Input . . . 5-7
5.4.3 Operation Sequence at Emergency Stop (Main Circuit OFF) . . . . . 5-8
5.4.4 Operation Sequence When a Safety Signal is Input . . . . . 5-8
5.4.5 Operation Sequence at Occurrence of Alarm . . . . . 5-9
5.4.6 When Motion Command Is Interrupted and Servomotor Is in Position . . . . . 5-9
5.5 Setting the Origin Before Starting Operation . . . . . 5-10
5.5.1 When Using an Incremental Encoder . . . . . 5-10
5.5.2 When Using an Absolute Encoder . . . . . 5-10

6 Command Related Parameters

6.1 Command Related Parameters List . . . . . 6-2
6.2 Command Related Parameters Details . . . . . 6-4
6.2.1 Electronic Gear Settings . . . . . 6-4
6.2.2 Motion Acceleration/Deceleration Function Setting . . . . . 6-8
6.2.3 Motion Sequence Setting . . . . . 6-12
6.2.4 Command Data Options . . . . . 6-14
6.2.5 Position Data Latch Function Setting . . . . . 6-20
6.2.6 Settings for Acceleration/Deceleration Parameter High-speed Switching . 6-23
6.2.7 STATUS Field and Monitor Related Settings . . . . . 6-26

7 Detecting Alarms/Warnings Related to Communications or Commands

7.1 List of Alarms . . . . . 7-2
7.2 List of Warnings . . . . . 7-5
7.3 Monitoring Communication Data on Occurrence of an Alarm or Warning . .7-7

8 Appendix

8.1 Brake Control Commands . . . . . 8-2
8.2 General-purpose Servo Control Command . . . . . 8-6

Revision History

# Settings for MECHATROLINK-II Communications

1

This chapter outlines the settings that are required for MECHATROLINK-II communications.


1.1 MECHATROLINK-II Communications . . . . . 1-2
1.1.1 Layers . . . . . 1-2
1.1.2 Frame Structure . . . . . 1-2
1.1.3 State Transition Diagram . . . . . 1-3

1.2 Command and Response Timing . . . . . 1-4
1.2.1 Command Data Execution Timing . . . . . 1-4
1.2.2 Monitored Data Input Timing . . . . . 1-4

1.3 Data Order . . . . . 1-5

1.4 MECHATROLINK-II Command List . . . . . 1-6
1.4.1 Main Commands (In command code order) . . . . 1-6
1.4.2 Subcommands (In command code order) . . . . . 1-7
1.4.3 Combination of MECHATROLINK-II Main Commands and Subcommands . . . . . 1-8

# 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.

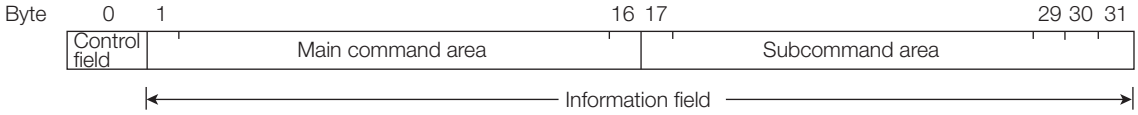
OSI Reference Model and MECHATROLINK-II Model

| 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.

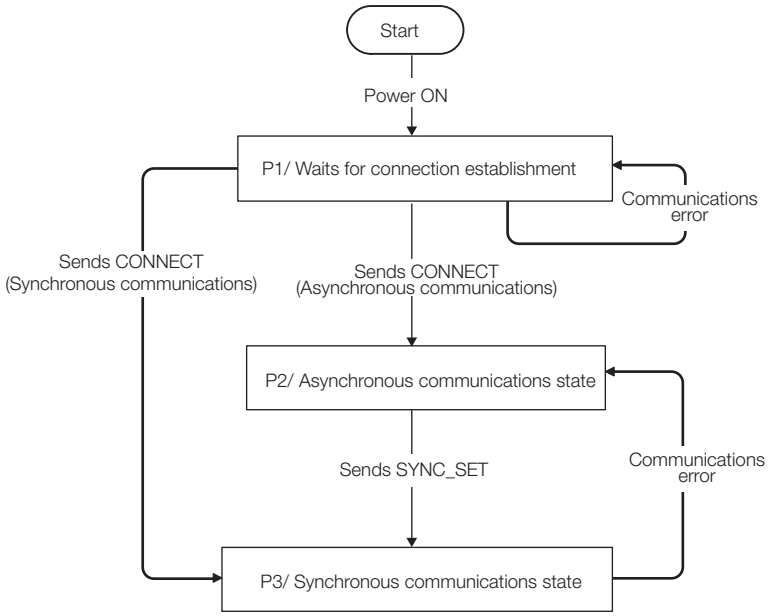



| Classification | Byte | Command | Response |
|---|---|---|---|
| Control Field | 0 | 03 hex (Fixed) | 01 hex (Fixed) |
| Information Field | 1 to 16 | Used by main command. | |
| | 17 to 31 | Used by subcommands. The subcommands for servo drives use only 17th to 29th byte. Therefore, only 17th to 29th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

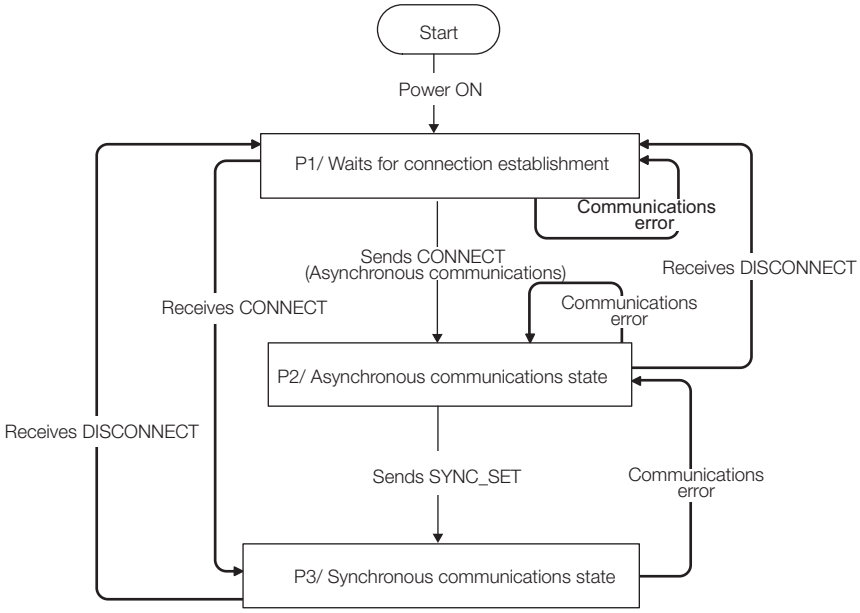
The application layer interfaces with only the information field.

## 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. |

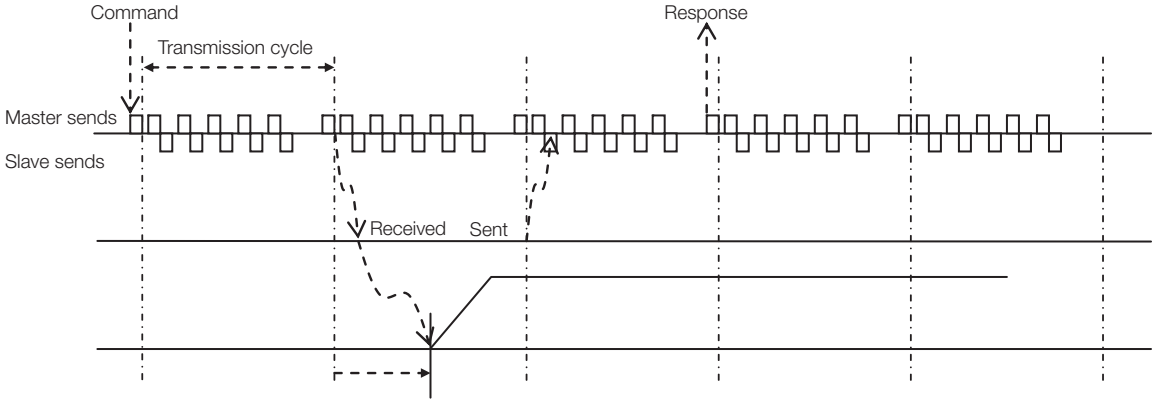
# 1.2 Command and Response Timing

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.

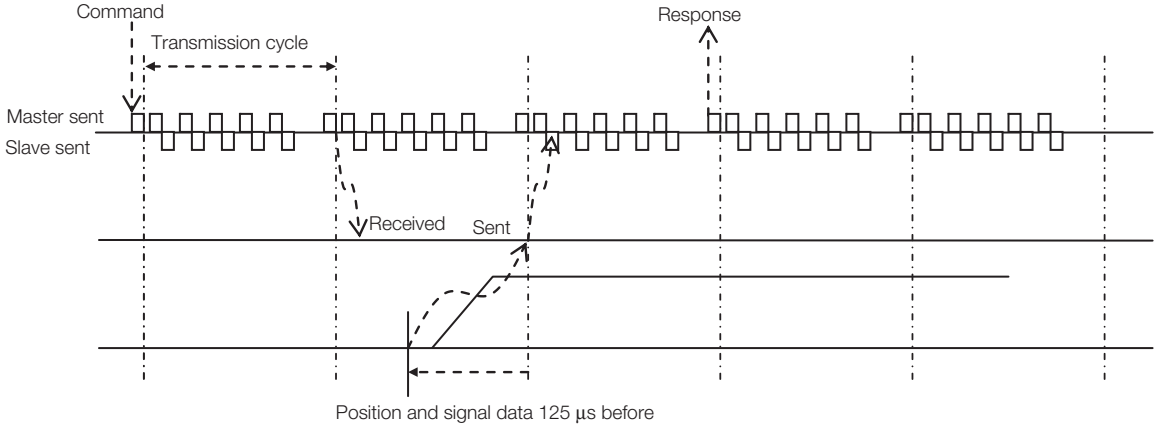
## 1.2.1 Command Data Execution Timing

Motion commands (such as POSING and INTERPOLATE) and the OPTION in the command data field are executed 125 μs after they are received.




## 1.2.2 Monitored Data Input Timing

The monitor, I/O, and status data are the data of 125 μs before the response is sent.



# 1.3 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 |

# 1.4 MECHATROLINK-II Command List

## 1.4.1 Main Commands (In command code order)

This section provides a table of the main MECHATROLINK-II communications commands used for Σ-7-Series Servo Drives.

| Command Code | Command | Function | Reference |
|---|---|---|---|
| 00 hex | NOP | Nothing is performed. | 3.1.1 |
| 01 hex | PRM_RD | Reads the specified parameter. | 3.1.13 |
| 02 hex | PRM_WR | Saves the specified parameter. | 3.1.6 |
| 03 hex | ID_RD | Reads the device ID. | 3.1.5 |
| 04 hex | CONFIG | Enables the current parameter settings. | 3.1.8 |
| 05 hex | ALM_RD | Reads the current alarm or warning status, and the alarm history. | 3.1.15 |
| 06 hex | ALM_CLR | Clears the current alarm or warning status, and the alarm history. | 3.1.16 |
| 0D hex | SYNC_SET | Starts synchronous communications. | 3.1.4 |
| 0E hex | CONNECT | Requests to establish a MECHATROLINK connection. | 3.1.3 |
| 0F hex | DISCONNECT | Requests to releases connection. | 3.1.2 |
| 1C hex | PPRM_WR | Saves the parameters in non-volatile memory. | 3.1.7 |
| 20 hex | POS_SET | Sets the coordinates. | 3.1.17 |
| 21 hex | BRK_ON | Turns the brake signal off and applies the holding brake. | 8.1 |
| 22 hex | BRK_OFF | Turns the brake signal on and release the holding brake. | 8.1 |
| 23 hex | SENS_ON | Turns the encoder power supply on, and gets the position data. | 3.1.9 |
| 24 hex | SENS_OFF | Turns the encoder power supply off. | 3.1.11 |
| 25 hex | HOLD | From current motion status, performs a deceleration stop and positioning according to the deceleration value set in the parameter. | 3.2.1 |
| 28 hex | LTMOD_ON | Enables the position data latch by the external signal input. | 3.2.2 |
| 29 hex | LTMOD_OFF | Disables the position data latch by the external signal input. | 3.2.3 |
| 30 hex | SMON | Monitors the SERVOPACK status. | 3.1.14 |
| 31 hex | SV_ON | Turns the servo of the motor on. | 3.1.10 |
| 32 hex | SV_OFF | Turns the servo of the motor off. | 3.1.12 |
| 34 hex | INTERPOLATE | Starts interpolation feeding. | 3.2.4 |
| 35 hex | POSING | Starts positioning to the target position (TPOS) at the target speed (TSPD). | 3.2.5 |
| 36 hex | FEED | Starts constant speed feeding at the target speed (TSPD) | 3.2.6 |
| 38 hex | LATCH | Performs interpolation feeding and latches the position using the specified latch signal. | 3.2.7 |
| 39 hex | 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. | 3.2.8 |
| 3A hex | ZRET | Performs an origin return operation. | 3.2.9 |
| 3C hex | VELCTRL | Controls speed. | 3.2.10 |
| 3D hex | TRQCTRL | Controls torque. | 3.2.11 |
| 3E hex | ADJ | Used to monitor and adjust data for maintenance. | 3.1.18 |
| 3F hex | SVCTRL | Performs general-purpose servo control. This command is compatible with MECHATROLINK version 1.0 and earlier. | 8.2 |

## 1.4.2 Subcommands (In command code order)

The MECHATROLINK-II subcommands used for Σ-7-Series Servo Drives are listed below.

| Command Code | Command | Function | Reference |
|---|---|---|---|
| 00 hex | NOP | Same function as of the main command NOP | 4.2.1 |
| 01 hex | PRM_RD | Same function as of the main command PRM_RD | 4.2.2 |
| 02 hex | PRM_WR | Same function as of the main command PRM_WR | 4.2.3 |
| 05 hex | ALM_RD | Same function as of the main command ALM_RD | 4.2.4 |
| 1C hex | PPRM_WR | Same function as of the main command PPRM_WR | 4.2.5 |
| 28 hex | LTMOD_ON | Same function as of the main command LTMOD_ON | 4.2.6 |
| 29 hex | LTMOD_OFF | Same function as of the main command LTMOD_OFF | 4.2.7 |
| 30 hex | SMON | Same function as of the main command SMON | 4.2.8 |

## 1.4.3 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 | DISCON- NECT | √ | × | × | × | × | × | × | × |
| 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 | INTERPO- LATE | √ | √ | √ | √ | √ | √ | √ | √ |
| 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

# Data Field

2

This chapter describes the data field to be used for the main commands and subcommands.


2.1 Main Command Data Field . . . . . 2-2
2.1.1 Status Field Specifications . . . . . 2-2
2.1.2 OPTION Field Specifications . . . . . 2-3
2.1.3 Monitor Selection Field Specifications: SEL_MON1/2/3/4 . . . . . 2-4
2.1.4 Monitor Information Field Specifications: MONITOR 1/2/3/4 . . . . . 2-5
2.1.5 IO Monitor Field Specifications: IO_MON . . . . . 2-6
2.1.6 LT_SGNL Specifications . . . . . 2-7

2.2 Substatus Data Field . . . . . 2-8
2.2.1 Substatus Field Specification . . . . . 2-8
2.2.2 Extension Status Field Specifications . . . . . 2-8

# 2.1 Main Command Data Field

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

## 2.1.1 Status Field Specifications

The STATUS field gives the current status of the SERVOPACK.
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 limit |
| | | 1 | During torque 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 torque control) | 0 | Speed limit not detected |
| | | 1 | Speed limit detected |

Continued on next page.

Continued from previous page.

| Bit | Name | Value | Description |
|---|---|---|---|
| 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 | – | – | – |

## 2.1.2 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

### ■ Setting Method

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

The default allocations for Σ-7-Series SERVOPACKs are described below.

To change the default settings, set Pn81F to n.□□□1, and set the bits to which to allocate functions in Pn82A to Pn82E. (Any changes must be enabled by turning the power supply OFF and 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 limit | | 0 | Does not control torque. | D14 |
| | | | 1 | Controls torque. | |
| N_CL (1 bit) | Reverse torque limit | | 0 | Does not control torque. | D15 |
| | | | 1 | Controls torque. | |
| 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, and Pn510.

## 2.1.3 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 | | | |

## 2.1.4 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 |
| 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 control: Reference units/s<br>Speed control: Maximum speed/ 40000000 hex |
| 9 | CSPD | Reference speed | Position control: Reference units/s<br>Speed control: Maximum speed/ 40000000 hex |
| A | TSPD | Target speed | Position control: Reference units/s<br>Speed control: Maximum speed/ 40000000 hex |
| B | TRQ | Torque reference (The rated torque is 100%.) | Position/speed control:<br>% (The rated torque is 100%.)<br>Torque control: Maximum torque/ 40000000 hex |
| C | – | – | – |
| D | – | – | – |
| E | OMN1 | Option monitor 1 selected in Pn824 | – |
| F | OMN2 | Option monitor 2 selected in Pn825 | – |

# 2.1.5 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, SV_CTRL, FEED, HOLD, INTERPOLATE, POSING, 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 |
| 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 = n.□□□X | 0 | OFF (open) |
| | | | 1 | ON (closed) |
| D13 | IO13 | CN1 input signal selected in Pn81E = n.□□X□ | 0 | OFF (open) |
| | | | 1 | ON (closed) |
| D14 | IO14 | CN1 input signal selected in Pn81E = n.□X□□ | 0 | OFF (open) |
| | | | 1 | ON (closed) |
| D15 | IO15 | CN1 input signal selected in Pn81E = n.X□□□ | 0 | OFF (open) |
| | | | 1 | ON (closed) |

## 2.1.6 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 |

# 2.2 Substatus Data Field

## 2.2.1 Substatus Field Specification

The substatus field is used to monitor status of subcommands.

| | 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 |

## 2.2.2 Extension Status Field Specifications

The EX_STATUS field gives the current extended 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.

# Main Commands

3

This chapter describes the MECHATROLINK-II main commands.


**3.1 Commands Used to Prepare for Operation . . . . 3-3**

3.1.1 NOP (No Operation) Command: 00 Hex . . . . . 3-3
3.1.2 DISCONNECT (Release Connection) Command: 0F Hex . . . . . 3-5
3.1.3 CONNECT (Establish MECHATROLINK-II Connection) Command: 0E Hex . . . . . 3-6
3.1.4 SYNC_SET (Start Synchronous Communications) Command: 0D Hex . . . . . 3-8
3.1.5 ID_RD (Check Device ID) Command: 03 Hex . . . 3-9
3.1.6 PRM_WR (Set Parameter) Command: 02 Hex . . 3-11
3.1.7 PPRM_WR (Set and Save Parameters in Non-volatile Memory) Command: 1C Hex . . . 3-12
3.1.8 CONFIG (Enable Parameters) Command: 04 Hex . . . . . 3-13
3.1.9 SENS_ON (Turn ON Encoder Power Supply) Command: 23 Hex . . . . . 3-14
3.1.10 SV_ON (Turn ON Servo) Command: 31 Hex . . . 3-15
3.1.11 SENS_OFF (Turn OFF Encoder Power Supply) Command: 24 Hex . . . . . 3-16
3.1.12 SV_OFF (Turn Servo OFF) Command: 32 Hex . . 3-17
3.1.13 PRM_RD (Read Parameter) Command: 01 Hex . . . . . 3-18
3.1.14 SMON (Check SERVOPACK Status) Command: 30 Hex . . . . . 3-19
3.1.15 ALM_RD (Read Alarm or Warning) Command: 05 Hex . . . . . 3-20
3.1.16 ALM_CLR (Clear Warnings and Alarms) Command: 06 Hex . . . . . 3-22
3.1.17 POS_SET (Set Coordinate System) Command: 20 Hex . . . . . 3-23
3.1.18 ADJ (Monitor and Adjust Settings) Command: 3E Hex . . . . . 3-24

3.2 Motion Commands . . . . . 3-28
3.2.1 HOLD (Stop Motion) Command: 25 Hex . . . . . 3-28
3.2.2 LTMOD_ON (Set Latch Mode) Command: 28 Hex . . . . . 3-30
3.2.3 LTMOD_OFF (Release Latch Mode) Command: 29 Hex . . . . . 3-33
3.2.4 INTERPOLATE (Interpolation Feeding) Command: 34 Hex . . . . . 3-34
3.2.5 POSING (Positioning) Command: 35 Hex . . . . . 3-36
3.2.6 FEED (Constant Speed Feeding) Command: 36 Hex . . . . . 3-38
3.2.7 LATCH (Interpolation Feeding with Position Detection) Command: 38 Hex . . . . . 3-40
3.2.8 EX_POSING (External Input Positioning) Command: 39 Hex . . . . . 3-42
3.2.9 ZRET (Origin Return) Command: 3A Hex . . . . . 3-44
3.2.10 VELCTRL (Velocity Control) Command: 3C Hex . . . . . 3-46
3.2.11 TRQCTRL (Torque Control) Command: 3D Hex . . . . . 3-48
3.2.12 Restrictions in Using Servo Commands . . . . . 3-50

# 3.1 Commands Used to Prepare for Operation

## 3.1.1 NOP (No Operation) Command: 00 Hex

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

### NOP Command

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>00 hex</td><td>00 hex</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="15">• Returns the ALM, WARNG, and CMDRDY bits in STATUS field. Other bits will not be specified.<br>• 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>

### ALARM

The uppermost two digits of the SERVOPACK alarm code are set in the ALARM field of the response. For example, ALARM = 02 when an A.020 alarm (Parameter Checksum Error) occurs.
If no alarm occurs, ALARM = 00.

Refer to your SERVOPACK manual for details on alarms and alarm codes.

## Status Field Specifications

The STATUS field gives the current status of the SERVOPACK.
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 limit |
| | | 1 | During torque 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. |
| D13 | N_SOT | 0 | OT signal is OFF. |
| | | 1 | OT signal is ON. |
| D14 | – | – | – |
| D15 | – | – | – |

## Details WDT and RWDT

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

| | D7 | D4 | D3 | 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.

# 3.1.2 DISCONNECT (Release Connection) Command: 0F Hex

The DISCONNECT command releases a connection at the end of communications.

## DISCONNECT Command

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">0F hex</td><td>0F hex</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>Communica-tions 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.<br>• When this command is received, the following operations will be performed.<br>• The SERVOPACK changes communications to Phase 1.<br>• The SERVOPACK changes to Servo OFF.<br>• The reference point setting becomes invalid.<br>• The position data is initialized.<br>• BRAKE signal turns ON.<br>• 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.<br>• 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="11">–</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.

# 3.1.3 CONNECT (Establish MECHATROLINK-II Connection) Command: 0E Hex

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

## CONNECT Command

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>0E hex</td><td>0E hex</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="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="2">STATUS</td><td colspan="4" rowspan="15">• Establishes a MECHATROLINK-II connection and sets the communications mode according to COM_MODE.<br>• VER: Version. Set VER to 21 hex (Version 2.1)<br>• COM_MOD: Sets the communications mode. Refer to the following section for details.<br>☞ Details of COM_MOD on page 3-7<br>• COM_TIM: Sets the communications cycle. The communications cycle must satisfy the following equation within the range between 1 and 32.<br>0.25 [ms] ≤ Transmission cycle [ms] × COM_TIM ≤ 32 [ms]<br>• A warning will occur and the command will be ignored in the following cases.<br>• If COM_MODE is out of the setting range: A.94B alarm (Data Setting Warning 2)<br>• If COM_TIM is out of the settting range: A.94B alarm (Data Setting Warning 2)<br>• If the transmission bytes is 17 but SUBCMD = 1: A.94B alarm (Data Setting Warning 2)<br>• If the transmission speed is set to 10 Mbps but VER is not set to 21 hex: A.94B alarm (Data Setting Warning 2)<br>• 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.

## 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

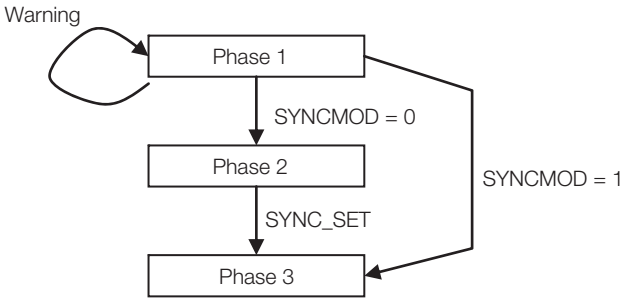
### ■ DTMOD

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.




## 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 32.00 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.

# 3.1.4 SYNC_SET (Start Synchronous Communications) Command: 0D Hex

This command is used to start synchronous communications and change 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.

## SYNC_SET Command

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>0D hex</td><td>0D hex</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 colspan="4" rowspan="15">• Starts synchronous communications. Switched from phase 2 to phase 3.<br>• Synchronization is made at the WDT changing edge. However, if WDT errors are masked (Pn800 = n.□□□2), processing is completed when this command is received.<br>• During phase 3, the slave ignores this command and returns a normal response without a warning.<br>• If the slave station in Servo ON status receives this command in phase 2, the slave station enters Servo OFF status.<br>• At occurrence of the following alarms and warnings, this command must be transmitted to restart synchronous communications.<br>  • An A.95A alarm (Command Warning 1) will occur if this command is used in phase 1.<br>  • A.E50 alarm (MECHATROLINK Synchronization Error)<br>  • A.E51 alarm (MECHATROLINK Synchronization Failed)<br>  • A.E60 alarm (MECHATROLINK Communications Error)<br>  • A.E61 alarm (MECHATROLINK Transmission Cycle Error)<br>• An A.95A alarm (Command Warning 1) will occur if this command is used while operating the SERVOPACK with 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>

# 3.1.5 ID_RD (Check Device ID) Command: 03 Hex

Send ID_RD command to read the device ID for confirmation.

## ID_RD Command

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>03 hex</td><td>03 hex</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 colspan="4" rowspan="28">• Reads the device ID for confirmation.<br>• Use DEVICE_CODE to specify the device ID to be read.<br>• Use OFFSET to specify which data of the device ID is to be read out.<br>• Use SIZE to specify the number of data (bytes) to be read out.<br>• A warning will occur and the command will be ignored in the following case.<br>• DEVICE_CODE is set out of the range: A.94B alarm (Data Setting Warning 2)</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>

## Device ID Specifications

The specifications of the device ID are described below.

| Device Type/Name | | DEVICE_ CODE | OFFSET | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | 00 | 01 | 02 | 03 | 04 | 05 | 06 | 07 | 08 | 09 | 0A | 0B | 0C | 0D | 0E | 0F | 10 | 11 | 12 |
| SERVO-PACK | Model | 00 hex | S | G | D | *1 | *1 | *2 | *2 | *2 | *3 | *4 | *4 | *5 | *6 | *6 | *6 | *6 | *6 | *6 | 00 |
| | Soft-ware version | 02 hex | Ver. | | | | | | | | | | | | | | | | | | |
| Servo-motor | Model | 20 hex | S | G | M | *7 | *7 | – | *8 | *8 | *9 | *10 | *11 | *12 | *13 | 00 | | | | | |
| | Encoder soft-ware version | 12 hex | Ver. | | | | | | | | | | | | | | | | | | |
| External Encoder | Model | 30 hex | | | | | | | | | | | | | | | | | | | |
| | Soft-ware version | 32 hex | Ver. | | | | | | | | | | | | | | | | | | |
| Safety Option Unit | Model | 60 hex | | | | | | | | | | | | | | | | | | | |
| | Soft-ware version | 62 hex | Ver. | | | | | | | | | | | | | | | | | | |
| Feed-back Option Unit | Model | 70 hex | | | | | | | | | | | | | | | | | | | |
| | Soft-ware version | 72 hex | 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.
- The models are given in ASCII characters and 00 (null) is added to the end of each character string.
- 50 hex and 52 hex 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.

# 3.1.6 PRM_WR (Set Parameter) Command: 02 Hex

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

## PRM_WR Command

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>02 hex</td><td>02 hex</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="2">–</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="14" colspan="4">• Writes parameters.<br>The parameters will not be saved in the non-volatile memory.<br>• 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.<br>• Use NO to specify the parameter to be written.<br>• Use SIZE to specify the number of data (bytes) of the parameter to be written.<br>• PARAMETER is the data to be written.<br>• A warning will occur and the command will be ignored in the following cases.<br>• When writing parameters that affect utility functions currently being used for operations with SigmaWin or a digital operator: A.95A alarm (Command Warning 1)<br>• NO is set out of the range: A.94A alarm (Data Setting Warning 1)<br>• SIZE does not match: A.94D alarm (Data Setting Warning 4)<br>• PARAMETER is out of the range: A.94B alarm (Data Setting Warning 2)</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 |

# 3.1.7 PPRM_WR (Set and Save Parameters in Non-volatile Memory) Command: 1C Hex

This command is used to set parameters and save them in nonvolatile memory in the SERVOPACK.

## PPRM_WR Command

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>1C hex</td><td>1C hex</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">• Saves parameters in the non-volatile memory.<br>• 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.<br>• A warning will occur and the command will be ignored in the following cases.<br>• NO is out of the range: A.94A alarm (Data Setting Warning 1)<br>• SIZE does not match: A.94D alarm (Data Setting Warning 4)<br>• PARAMETER is out of the range: A.94B alarm (Data Setting Warning 2)<br>• When writing parameters that affect utility functions currently being used for operations with SigmaWin or a digital operator: A.95A alarm (Command Warning 1)</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).

# 3.1.8 CONFIG (Enable Parameters) Command: 04 Hex

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.

## CONFIG Command

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>04 hex</td><td>04 hex</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 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="14">• Recalculates all currently set parameters and initializes position, etc.<br>• The SERVOPACK will change to Servo OFF if this command is received when the SERVOPACK is Servo ON.<br>• A warning will occur and the command will be ignored if this command is sent:<br>• When using SigmaWin or a digital operator to execute utility functions: A.95A alarm (Command Warning 1)<br>• Refer to the following section for details on status and output signals during command execution.<br>☞ Status and Output Signal during CONFIG Command Execution on page 3-13</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></tr>
<tr><td>16</td><td>WDT</td><td>RWDT</td></tr>
</table>

## 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 |

# 3.1.9 SENS_ON (Turn ON Encoder Power Supply) Command: 23 Hex

This command turns ON the power supply to the encoder.

## SENS_ON Command

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>23 hex</td><td>23 hex</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 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="14">• Obtains the initial position data and creates the present position when an absolute encoder is used.<br>• The reference point, home position (ZPOINT), and software limits will be enabled when an absolute encoder is used.<br>• 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>

# 3.1.10 SV_ON (Turn ON Servo) Command: 31 Hex

This command supplies power to the Servomotor to enable operation.

## SV_ON Command

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>31 hex</td><td>31 hex</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<br>(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="15">• Powers the servomotor and makes it ready for operation.<br>• An A.95A alarm (Command Warning 1) will occur and the command will be ignored if the command is sent:<br>• During alarm occurrence (When ALM of STATUS is 1)<br>• When the main power supply is OFF (PON of STATUS is 0)<br>• When the HWBB signal is ON (HWBB of IO_MON is 1)<br>• Before completion of execution of SENS_ON when an absolute encoder is used<br>• OPTION field can be selected<br>• 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">Subcom-mand area</td><td rowspan="13">Subcom-mand 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>

# 3.1.11 SENS_OFF (Turn OFF Encoder Power Supply) Command: 24 Hex

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

## SENS_OFF Command

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>24 hex</td><td>24 hex</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 2 sec</td><td>Subcommand</td><td>Cannot be used</td></tr>
<tr><td>3</td><td rowspan="2">STATUS</td><td rowspan="14" colspan="4">• Turn the encoder OFF. The position data will not be specified when an absolute encoder is used.<br>• The reference point, origin (ZPOINT), and software limits will be invalid.<br>• An A.95A alarm (Command Warning 1) will occur and the command will be ignored if the command is sent:<br>• 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>

# 3.1.12 SV_OFF (Turn Servo OFF) Command: 32 Hex

This command turns OFF the power supply to the Servomotor.

## SV_OFF Command

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>32 hex</td><td>32 hex</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>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 rowspan="15" colspan="4">• Stops current flow through the servomotor.<br>• When Pn829 (SVOFF Waiting Time (for SVOFF 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.)<br>• When Pn829 (SVOFF Waiting Time (for SVOFF at Deceleration to Stop) is set to 0, the servo will be turned OFF immediately after reception of this command.<br>(The control mode from before receiving the SV_OFF command is not changed.)<br>• Executing the SV_OFF command will cancel the speed reference, speed feed forward, torque feed forward, and torque 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>

# 3.1.13 PRM_RD (Read Parameter) Command: 01 Hex

This command reads parameters.

## PRM_RD Command

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>01 hex</td><td>01 hex</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="14">• Reads out parameters.<br>• A warning will occur and the command will be ignored in the following cases.<br>• NO is out of the range: A.94A alarm (Data Setting Warning 1)<br>• SIZE does not match: A.94D alarm (Data Setting Warning 4)</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>

# 3.1.14 SMON (Check SERVOPACK Status) Command: 30 Hex

This command reads SERVOPACK status.

## SMON Command

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>30 hex</td><td>30 hex</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="27">• 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>

# 3.1.15 ALM_RD (Read Alarm or Warning) Command: 05 Hex

This command reads the current alarms and warnings and the alarm history.

## ALM_RD Command

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>05 hex</td><td>05 hex</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.<br>• Current alarm/warning status<br>• Alarm history* (Warnings and communications alarms A.E50 and A.E60 will not be read out since they are not preserved in the history.)<br>• Refer to the following section for the specifications for ALM_RD_MOD.<br>☞ ALM_RD_MOD Specifications on page 3-21<br>• 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.<br>• A warning will occur and the command will be ignored in the following cases.<br>• If ALM_RD_MOD is out of the range: A.94B alarm (Data Setting Warning 2)</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.

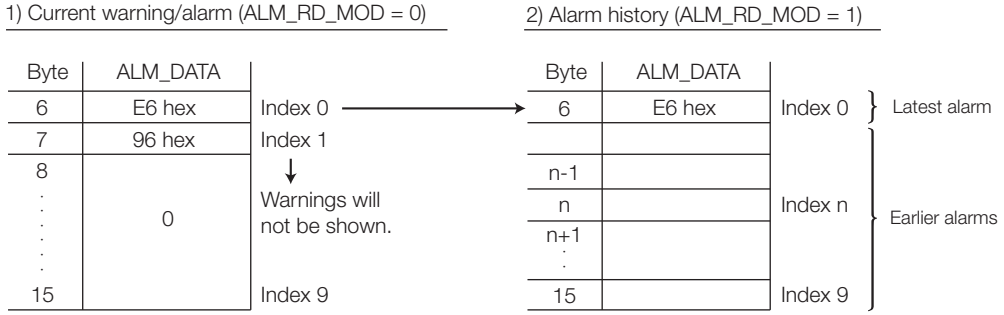
# ALM_RD_MOD Specifications

<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<br>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.)<br>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.<br>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 ms</td></tr>
<tr><td>3</td><td>Gets the detailed information of alarm history one by one.<br>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>

## ■ When ALM_RD_MOD=0 or 1

An alarm code of 1-byte length is returned.

**Example** The A.960 alarm (MECHATROLINK Communications Warning) occurred and then, the A.E61 alarm (MECHATROLINK Transmission Cycle Error) occurred.




**Example**

- The current warning or alarm status can be cleared by executing the ALM_CLR (ALM_CLR_MOD = 0) command.
- The alarm history will not be cleared until the ALM_CLR(ALM_CLR_MOD = 1) command is executed.

## ■ 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.
0xE61 for alarm index 0, and
0x960 for alarm index 1

# 3.1.16 ALM_CLR (Clear Warnings and Alarms) Command: 06 Hex

This command clears the current alarms and warnings and the alarm history.

## ALM_CLR Command

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>06 hex</td><td>06 hex</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 (2) ALM_CLR_MOD Specifications.</td><td>Subcommand</td><td>Cannot be used</td></tr>
<tr><td>3</td><td rowspan="2">STATUS</td><td rowspan="14" colspan="4">• Clears the followings.<br>• Current alarm/warning status<br>• Alarm history *<br>• A warning will occur and the command will be ignored in the following cases.<br>• When using SigmaWin or a digital operator to execute utility functions: A.95A alarm (Command Warning 1)<br>• ALM_CLR_MOD is out of the setting range: A.94B alarm (Data Setting Warning 2)<br>• The alarm status will not be cleared in the following cases.<br>• An alarm that cannot be reset occurs.<br>• An alarm that cannot be reset occurs but the cause of the alarm has not yet been removed.</td></tr>
<tr><td>4</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.

## 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 |

# 3.1.17 POS_SET (Set Coordinate System) Command: 20 Hex

This command sets the position coordinate system.

## POS_SET Command

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>20 hex</td><td>20 hex</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.<br>• The origin (ZPOINT) and software limit settings are enabled by setting a reference point.<br>• Refer to the following section for the specifications for PS_SUBCMD.<br>☞ PS_SUBCMD Specifications on page 3-23<br>• Specify the position (coordinates) in POS_DATA.<br>• A warning will occur and the command will be ignored in the following cases.<br>• A number out of the range is set in PS_SUBCMD: A.94B alarm (Data Setting Warning 2)</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>

## PS_SUBCMD Specifications

| 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.

# 3.1.18 ADJ (Monitor and Adjust Settings) Command: 3E Hex

This command is used to monitor and adjust settings.

## ADJ Command

The specifications of the ADJ command are described below.

<table>
<tr><th>Byte</th><th colspan="2">ADJ</th><th colspan="4" rowspan="2">Description</th></tr>
<tr><th></th><th>Command</th><th>Response</th></tr>
<tr><td>1</td><td>3E hex</td><td>3E hex</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>SUB-CODE=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 = 01 hex.<br>The SERVOPACK will be in maintenance mode.<br>And, data monitoring and adjustment will be enabled.<br>• Refer to the following section for details on using the ADJ command for adjustments.<br>☞ How to Send an ADJ Command for Adjustment on page 3-24<br>• Refer to the following section for details on using the ADJ command to monitor data.<br>☞ How to Send an ADJ Command for Monitoring Data on page 3-26<br>• A warning will occur and the command will be ignored in the following cases.<br>• While editing using SigmaWin or digital operator: A.95A alarm (Command Warning 1)<br>• CADDRESS is out of the range: A.94A alarm (Data Setting Warning 1)<br>• CSIZE does not match: A.94D alarm (Data Setting Warning 4)<br>• CCMD and/or CDATA are out of the range: A.94B alarm (Data Setting Warning 2)</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>

## How to Send an ADJ Command for Adjustment

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

| Adjustment | Request Code | Preparation Before Execution | Processing Time | Execution Conditions |
|---|---|---|---|---|
| Normal mode | 0000 hex | None | 200 ms max. | – |
| Parameter initialization | 1005 hex | None | 20 s max. | Initialization is impossible while the servo is ON.<br>After initialization, the power supply must be turned OFF and then ON again. |
| Absolute encoder reset | 1008 hex | Required | 5 s max. | When using an incremental encoder, it is impossible to reset the encoder while the servo is ON.<br>After initialization, the power supply must be turned OFF and then ON again. |

Continued on next page.

Continued from previous page.

| Adjustment | Request Code | Preparation Before Execution | Processing Time | Execution Conditions |
|---|---|---|---|---|
| Automatic offset adjustment of motor current detection signals | 100E hex | None | 5 s max. | Adjustment is disabled:<br>• While the main circuit power supply is OFF<br>• While the servo is ON<br>• While the servomotor is running |
| Multiturn limit setting | 1013 hex | Required | 5 s max. | When using an incremental encoder, the setting is disabled unless A.CC0 (Multiturn Limit Disagreement) occurs.<br>After initialization, the power supply must be turned OFF and then ON again. |

Details of Command for Adjustment to Monitor Data

| | Command | Response |
|---|---|---|
| CCMD/CANS | CCMD = 04 hex | CANS = 04 hex (copy of the command) |
| CADDRESS | Setting address | Reference address (copy of the command) |
| CSIZE/<br>ERRCODE | 2 or 4 | At normal reception: 0000 hex<br>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 = 0004 hex
CADDRESS = 2000 hex
CSIZE = 0002 hex
CDATA = Request code of the adjustment to be executed
STATUS.CMDRDY is set to 1 when execution is completed. Use this to confirm completion. 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 = 0004 hex
CADDRESS = 2001 hex
CSIZE = 0002 hex
CDATA = 0002 hex
STATUS.CMDRDY is set to 1 when execution is completed. Use this to confirm completion. 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 = 0004 hex
CADDRESS = 2001 hex
CSIZE = 0002 hex
CDATA = 0001 hex
STATUS.CMDRDY is set to 1 when execution is completed. Use this to confirm completion. 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 = 0004 hex
CADDRESS = 2000 hex
CSIZE = 0002 hex
CDATA = 0000 hex
STATUS.CMDRDY is set to 1 when execution is completed. Use this to confirm completion.

Example If an A.E50 alarm (MECHATROLINK Synchronization Error) or A.E60 alarm (MECHATROLINK Communications Error) occurs after the request code has been set for step 1 and before adjustment has been executed for step 3, the adjustment operation cannot be performed. If an alarm occurs, remove the cause of the alarm and then restart the adjustment operation.

# 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 | C00F hex (Lowermost)<br>C010 hex (Uppermost) | 2 bytes | [W] | |
| Motor voltage | C011 hex | 2 bytes | [V] | |
| Motor rated speed | C01C hex | 2 bytes | Rotary motor: [×10 $^{\text{C01E hex reference value}}$ $\text{min}^{-1}$]<br>Linear motor: [×10 $^{\text{C01E hex reference value}}$ mm/s] | |
| Maximum motor speed | C01D hex | 2 bytes | Rotary motor: [×10 $^{\text{C01E hex reference value}}$ $\text{min}^{-1}$]<br>Linear motor: [×10 $^{\text{C01E hex reference value}}$ mm/s] | |
| Motor speed exponent | C01E hex | 2 bytes | – | |
| Motor rated torque | C01F hex | 2 bytes | Rotary servomotor: [×10 $^{\text{C021 hex reference value}}$ N.m]<br>Linear servomotor: [×10 $^{\text{C021 hex reference value}}$ N] | |
| Motor torque exponent | C021 hex | 2 bytes | – | |
| Encoder resolution | C022 hex (Lowermost)<br>C023 hex (Uppermost) | 2 bytes | Rotary servomotor: [pulse/rev]<br>Linear servomotor: [pulse/pitch] | Note: When fully-closed setting is enabled (Pn002.3≠0), the unit is pulse/pitch. |
| Maximum motor torque that can be output | E701 hex | 2 bytes | [%] | |
| Motor max. output speed | C027 hex | 2 bytes | Rotary servomotor: [×10 $^{\text{C01E hex reference value}}$ $\text{min}^{-1}$]<br>Linear servomotor: [×10 $^{\text{C01E hex reference value}}$ mm/s] | |
| Linear scale pitch | E084 hex | 4 bytes | [×10 $^{\text{E 086 hex reference value}}$ pm / pitch] | For linear servomotors only |
| Linear scale pitch exponent | E086 hex | 2 bytes | – | For linear servomotors only |

**Information**

The following data units are used for position, speed, and torque control that is performed with commands.

Speed data: Maximum motor speed/40000000 hex (VREF and VLIM)
Torque data: TFF, P_TLIM, N_TLIM, and TLIM: Maximum motor torque/4000 hex
TQREF: Maximum motor torque/40000000 hex

You can determine the maximum motor speed and maximum motor torque using the above units with the following formulas.

Maximum motor speed = C027 hex reference value × $10^{\text{C01E hex reference value}}$ [Rotary Servomotor: $\text{min}^{-1}$, Linear Servomotor: mm/s]

Maximum motor torque = C01F hex reference value × $10^{\text{E701 hex reference value}}$ [Rotary Servomotor: N·m, Linear Servomotor: N]

Details of Command to Monitor Data

| | Command | Response |
|---|---|---|
| CCMD/CANS | CCMD = 03 hex | CANS = 03 hex (copy of the command) |
| CADDRESS | Reference address | Reference address (copy of the command) |
| CSIZE/<br>ERRCODE | – (Not required) | At normal reception: SIZE (2 or 4)<br>At error occurrence: 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 = 0003 hex
   CADDRESS = Reference address
   STATUS.CMDRDY is set to 1 when execution is completed. Use this to confirm completion. Use ERRCODE to check for errors.

2. When the command transmission is completed normally, CDATA of RSP will be read out for CSIZE to obtain the data.

# 3.2 Motion Commands

## 3.2.1 HOLD (Stop Motion) Command: 25 Hex

### HOLD Command

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>25 hex</td><td>25 hex</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="25">• From the current state, performs a stop specified by the HOLD_MOD command.<br>• Use DEN (output complete) to confirm position data output completion.<br>• Option field can be used.<br>• This command will cancel the latch processing specified by the LATCH or EX_POSING command.<br>• This command will cancel ZRET latch processing and ZRET origin return processing.<br>• Upon completion of execution of this command, the reference position (POS) must be read, and the controller coordinate system must be setup.<br>• The stopping method can be selected using HOLD_MOD.<br>0 = Stop according to the 1st or 2nd linear deceleration constant.<br>1 = Stop immediately (stop reference output)<br>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="8">–</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>

## Related Parameters

Deceleration is specified by the following parameters.

| Parameter No. | Name |
|---|---|
| Pn80D (Pn83A*) | First Stage Linear Deceleration Constant (First Stage Linear Deceleration Constant 2) |
| Pn80E (Pn83C*) | Second Stage Linear Deceleration Constant (Second Stage Linear Deceleration Constant 2) |
| Pn80F (Pn83E*) | Deceleration Constant Switching Speed (Deceleration Constant Switching Speed 2) |
| Pn827 (Pn840*) | Linear Deceleration Constant 1 for Stopping (Linear Deceleration Constant 2 for Stopping) |

* Parameters in parentheses are used when Pn833 is set to 1.

# 3.2.2 LTMOD_ON (Set Latch Mode) Command: 28 Hex

## LTMOD_ON Command

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>28 hex</td><td>28 hex</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="28">• Starts latch operation.<br>• Use LT_MOD to switch the latch mode:<br>= 0: Normal latch mode (Latches the position data when a signal selected by LT_SGNL is input)<br>= 1: Continuous latch (Latches the position data according to the values set in Pn850 to Pn853<br>Note: When LT_MOD ≠ 1, the normal latch mode is always selected.<br>• When CMDRDY = 1, this command has been received.<br>• L_CMP in STATUS is set to 1 when the latch is completed. Use this to confirm completion.<br>• 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.<br>• 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.<br>• A warning will occur and the command will not be executed.<br>• 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): A.95D alarm (Command Warning 4)<br>• LT_MOD = 1 and Pn850 = 0: A.94E alarm (Data Setting Warning 5)<br>• Latch time lag<br>• From reception of the command to latching start: 250ms max.<br>• 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>

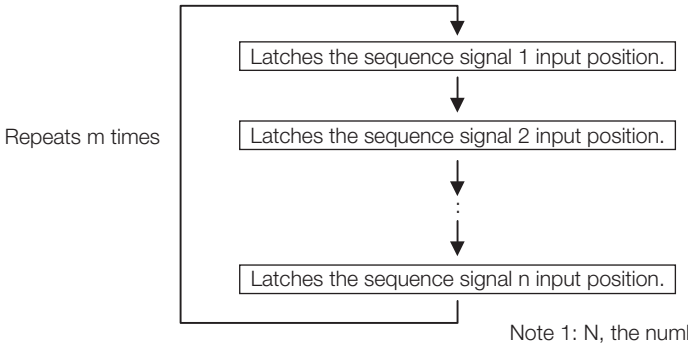
## Normal Latch Mode

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.

## 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 in Pn850.
2: The signals for sequence signal n are selected with Pn852 and Pn853.
3: M, the number of continuous latches, is set in 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: Number of Latch Sequences n

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

Pn852: Latch Sequence 1 to 4 Settings

Pn853: Latch Sequence 5 to 8 Settings

Note: If the LTMOD_ON command is executed by setting Pn850 to 0 and LT_MOD to 1, the (A.94E alarm (Data Setting Warning 5 (Latch Mode Error)) 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 | 80 hex: Previous latch signal input position |

## Related Parameters

The parameters related to latch operation are listed below.

| Parameter No. | Name |
|---|---|
| Pn820 | Forward Latching Area |
| Pn822 | Reverse Latching Area |
| Pn850 | Number of Latch Sequences |
| Pn851 | Continuous Latch Sequence Count |
| Pn852 and Pn853 | Latch Sequence 1 to 4 Settings and Latch Sequence 5 to 8 Settings |

Information
- 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.
- If encoders without phase C (origin signal) and linear scales are used and the phase C is selected, the latch operation will be undefined.

# 3.2.3 LTMOD_OFF (Release Latch Mode) Command: 29 Hex

## LTMOD_OFF Command

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>29 hex</td><td>29 hex</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>Can be used</td></tr>
<tr><td>3</td><td rowspan="2">STATUS</td><td colspan="4" rowspan="27">• Check that CMDRDY is 1 to confirm that this command has been received.<br>• It takes 250 μs max. to release the latch mode.<br>• This command cannot be used while LATCH, ZRET, EX_POSING, or SVCTRL command is being executed.<br>If used, an A.95D alarm (Command Warning 4) 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>

# 3.2.4 INTERPOLATE (Interpolation Feeding) Command: 34 Hex

## INTERPOLATE Command

The INTERPOLATE command is used to start interpolation feeding. Speed feed forward and torque 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>34 hex</td><td>34 hex</td><td>Phases in which the command can be executed</td><td>Phase 3</td><td>Synchronization classification</td><td>Synchronous 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="29">• OPTION field can be selected.<br>• Interpolation feeding is performed by specifying the target position (TPOS) every communications cycle.<br>The target position (TPOS) is a signed 4-byte data.<br>Note: The target position is not an incremental value (travel amount), but the absolute position in the reference coordinate system.<br>• The speed feed forward (VEF [reference units/s]) is a signed 4-byte data.<br>• Either torque feed forward (TFF) or torque limit (TLIM) can be used. It can be selected by setting Pn81F and Pn002.<br>• TFF setting range: A signed 2-byte data [maximum motor torque/4000 hex]<br>Use the ADJ command to obtain the maximum motor torque.<br>• TLIM setting range: 0 to 4000 hex [maximum motor torque/4000 hex]<br>(If a value between 4000 hex and FFFF hex is set, the maximum motor torque will be applied as the limit.<br>• Use DEN (output complete) to confirm the completion of position reference output.<br>• When a command in execution is switched to another command, the feed forward value (VFF or TFF) will be cleared.<br>• A warning will occur and the command will not be executed in the following cases.<br>• If this command is used in communications phase other than phase 3: A.95A alarm (Command Warning 1)<br>• If this command is sent while the servo is OFF: A.95A alarm (Command Warning1)<br>• The travel amount (Target position (TPOS) - Current position (IPOS)) exceeds the limit value: A.94B alarm (Data Setting Warning 2)<br>• When using SigmaWin or a digital operator for motor operations such as JOG: A.95A alarm (Command Warning 1)</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>

## Related Parameters

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

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

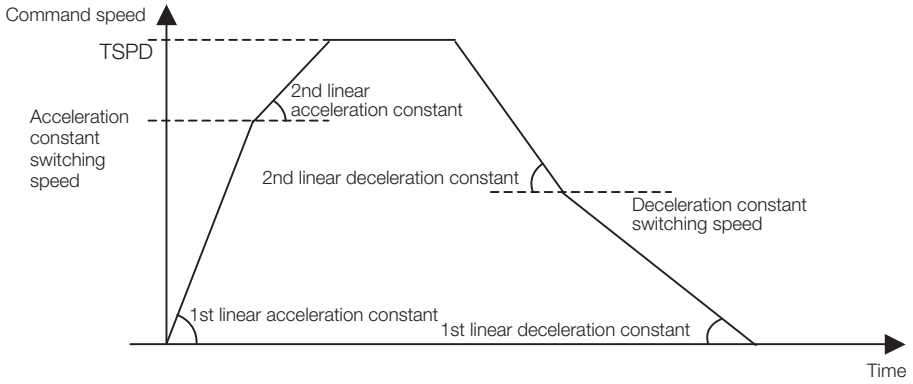
# 3.2.5 POSING (Positioning) Command: 35 Hex

## POSING Command

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>35 hex</td><td>35 hex</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="17">• OPTION field can be selected.<br>• The target position (TPOS) is a signed 4-byte data.<br>It is sent by using an absolute position in the reference coordinate system.<br>Set the target position (TPOS) so that the movement distance (TPOS - IPOS) is 2,147,483,647 (= $2^{31}$-1) or less.<br>• Set the target speed (TSPD) to a value between 0 and the motor max. speed [reference unit/s].<br>• Changes can be made to the target position and target speed during movement.<br>• The torque limit (TLIM) can be used by setting Pn81F and Pn002.<br>• TLIM setting range: 0 to 4000 hex [maximum motor torque/4000 hex]<br>If TLIM is set to a value between 4000 hex and FFFF hex, the maximum motor torque will be applied as the limit.<br>Use the ADJ command to obtain the maximum motor torque.<br>• Use DEN (output complete) to confirm the completion of position reference output.<br>• A warning will occur and the command will be ignored in the following case.<br>• This command is used while the servo is OFF: A.95A alarm (Command Warning 1)<br>• The target speed (TSPD) exceeds the limit: A.94B alarm (Data Setting Warning 2)<br>• When using SigmaWin or a digital operator for motor operations such as JOG: A.95A alarm (Command Warning 1)</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.




## Related Parameters

The parameters related to this command are listed below.

| Parameter No. | Name |
|---|---|
| Pn80A (Pn834*) | First Stage Linear Acceleration Constant (First Stage Linear Acceleration Constant 2) |
| Pn80B (Pn836*) | Second Stage Linear Acceleration Constant (Second Stage Linear Acceleration Constant 2) |
| Pn80C (Pn838*) | Acceleration Constant Switching Speed (Acceleration Constant Switching Speed 2) |
| Pn80D (Pn83A*) | First Stage Linear Deceleration Constant (First Stage Linear Deceleration Constant 2) |
| Pn80E (Pn83C*) | Second Stage Linear Deceleration Constant (Second Stage Linear Deceleration Constant 2) |
| Pn80F (Pn83E*) | Deceleration Constant Switching Speed (Deceleration Constant Switching Speed 2) |
| Pn81F = n.□□X□ | Position Control Command TFF/TLIM Allocation |
| Pn002 = n.□□□X | MECHATROLINK Command Position and Speed Control Option |

* Parameters in parentheses are used when Pn833 is set to 1.

Set the parameters as shown below to use TLIM.

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

# 3.2.6 FEED (Constant Speed Feeding) Command: 36 Hex

## FEED Command

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

Use the HOLD (Stop Motion) command to stop constant-speed feeding that is being executed for 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>36 hex</td><td>36 hex</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="29">• OPTION field can be selected.<br>• The target speed (TSPD) is a signed 4-byte data. The feeding direction is determined by the sign.<br>Constant speed feeding is carried out at the specified target speed.<br>TSPD setting range: Negative (-) maximum motor speed to positive (+) maximum motor speed [reference unit/s]<br>• Changes can be made to the target speed during movement.<br>Change the target speed as required and send this command.<br>• The torque limit (TLIM) can be used by setting Pn81F and Pn002.<br>• TLIM setting range: 0 to 4000 hex [maximum motor torque/4000 hex]<br>If TLIM is set to a value between 4000 hex and FFFF hex, the maximum motor torque will be applied as the limit.<br>Use the ADJ command to obtain the maximum motor torque.<br>• Use the DEN (output complete) to confirm the completion of position reference output.<br>• A warning will occur and the command will not be executed in the following cases.<br>• The command is used while the servo is OFF: A.95A alarm (Command Warning 1)<br>• The target speed (TSPD) exceeds the limit: A.94B alarm (Data Setting Warning 2)<br>• When using SigmaWin or a digital operator for motor operations such as JOG: A.95A alarm (Command Warning 1)</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.


## Related Parameters

The parameters related to this command are listed below.

| Parameter No. | Name |
|---|---|
| Pn80A (Pn834*) | First Stage Linear Acceleration Constant<br>(First Stage Linear Acceleration Constant 2) |
| Pn80B (Pn836*) | Second Stage Linear Acceleration Constant<br>(Second Stage Linear Acceleration Constant 2) |
| Pn80C (Pn838*) | Acceleration Constant Switching Speed<br>(Acceleration Constant Switching Speed 2) |
| Pn81F = n.□□X□ | Position Control Command TFF/TLIM Allocation |
| Pn002 = n.□□□X | MECHATROLINK Command Position and Speed Control Option |

* Parameters in parentheses are used when Pn833 is set to 1.

Set the parameters as shown below to use TLIM.

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

# 3.2.7 LATCH (Interpolation Feeding with Position Detection) Command: 38 Hex

## LATCH Command

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 feed forward, and torque 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>38 hex</td><td>38 hex</td><td>Phases in which the command can be executed</td><td>Phase 3</td><td>Synchronization classification</td><td>Synchronous 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.<br>Refer to the following section for details on LT_SGNL.<br>☞ 2.1.6 LT_SGNL Specifications on page 2-7<br><br>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.<br>• OPTION field can be used.<br>• Interpolation feeding is performed by specifying the target position (TPOS) every communications cycle.<br>The target position (TPOS) is a signed 4-byte data.<br>Note: The target position is not an incremental value (travel amount), but the absolute position in the reference coordinate system.<br>• The speed feed forward (VEF [reference units/s]) is a signed 4-byte data.<br>• Either torque feed forward (TFF) or torque limit (TLIM) can be used. It can be selected by setting Pn81F and Pn002.<br>• TLIM setting range: 0 to 4000 hex [maximum motor torque/4000 hex]<br>(If a value between 4000 hex and FFFF hex is set, the maximum motor torque will be applied as the limit.)<br>Use the ADJ command to obtain the maximum motor torque.<br>• TFF setting range: A signed 2-byte data [maximum motor torque/4000 hex]<br>• Use DEN (output complete) to confirm the completion of position reference output.<br>• When a command in execution is switched to another command, the feed forward values (VFF and TFF) will be cleared.<br>• A warning will occur and the command will not be executed in the following cases.<br>• The command is used in a phase other than phase 3: A.95A alarm (Command Warning 1)<br>• The command is sent while the servo is OFF: A.95A alarm (Command Warning 1)<br>• The travel amount (Target position (TPOS) - Current position (IPOS)) exceeds the limit: A.94B alarm (Data Setting Warning 2)<br>• When using SigmaWin or a digital operator for motor operations such as JOG: A.95A alarm (Command Warning 1)<br>• Latch time lag<br>• From reception of the command to latching start: 250 μs max.<br>• 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>
<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>

## Related Parameters

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

| Parameter No. | Name |
|---|---|
| Pn820 | Forward Latching Area |
| Pn822 | Reverse Latching Area |
| Pn81F = n.□□X□ | Position Control Command TFF/TLIM Allocation |
| Pn002 = n.□□□X | MECHATROLINK Command Position and Speed Control Option |

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

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

# 3.2.8 EX_POSING (External Input Positioning) Command: 39 Hex

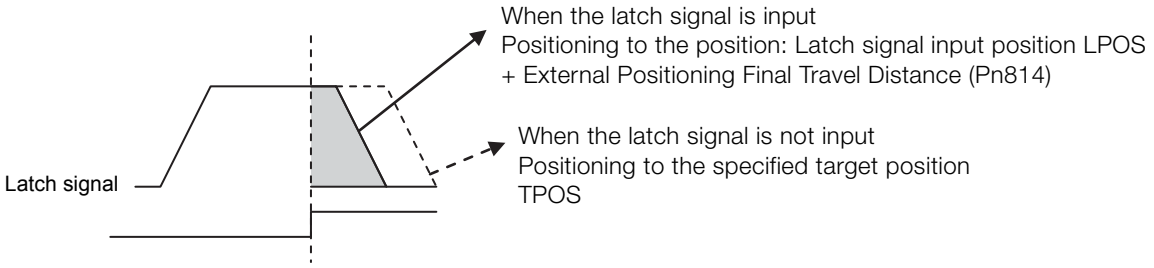
## EX_POSING Command

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>39 hex</td><td>39 hex</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="29">• Use LT_SGNL to select the latch signal.<br>Refer to the following section for details on LT_SGNL.<br>☞ 2.1.6 LT_SGNL Specifications on page 2-7<br><br>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.<br>When no latch signal is input, positioning is performed for the specified target position (TPOS).<br>• OPTION field can be used.<br>• The target position (TPOS) is a signed 4-byte data, and the absolute position in reference coordinate system.<br>Set the target position (TPOS) so that the travel distance (TPOS - IPOS) is a value of 31 bits (24...) or less.<br>• The target speed (TSPD) is an unsigned 4-byte data.<br>You can specify between 0 and the maximum motor speed [reference units/s].<br>• The target position and target speed can be changed during positioning executed by this command.<br>However, any change in the target position and/or target speed after the latch signal input will be invalid.<br>• The torque limit (TLIM) can be used by setting Pn81F and Pn002.<br>• TLIM setting range: 0 to 4000 hex [maximum motor torque/4000 hex]<br>If a value between 4000 hex and FFFF hex is set, the maximum motor torque will be applied as the limit.<br>Use the ADJ command to obtain the maximum motor torque.<br>• Use DEN (output complete) to confirm the completion of position reference output.<br>• 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).<br>• A warning will occur and the command will not be executed in the following cases.<br>• This command is used when the servo is OFF: A.95A alarm (Command Warning 1)<br>• The target speed (TSPD) exceeds the limit: A.94B alarm (Data Setting Warning 2)<br>• When using SigmaWin or a digital operator for motor operations such as JOG: A.95A alarm (Command Warning 1)</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>

## Operation

The operation executed by EX_POSING command is illustrated below.




## Related Parameters

The parameters related to this command are listed below.

| Parameter No. | Name | Parameter No. | Name |
|---|---|---|---|
| Pn80A (Pn834*) | First Stage Linear Acceleration Constant (First Stage Linear Acceleration Constant 2) | Pn80F (Pn83E) | Deceleration Constant Switching Speed (Deceleration Constant Switching Speed 2) |
| Pn80B (Pn836*) | Second Stage Linear Acceleration Constant (Second Stage Linear Acceleration Constant 2) | Pn814 | External Positioning Final Travel Distance |
| Pn80C (Pn838*) | Acceleration Constant Switching Speed (Acceleration Constant Switching Speed 2) | Pn820 | Forward Latching Area |
| Pn80D (Pn83A*) | First Stage Linear Deceleration Constant (First Stage Linear Deceleration Constant 2) | Pn822 | Reverse Latching Area |
| Pn80E (Pn83C*) | Second Stage Linear Deceleration Constant (Second Stage Linear Deceleration Constant 2) | Pn81F = n.□□X□ | Position Control Command TFF/TLIM Allocation |
| – | – | Pn002 = n.□□□X | MECHATROLINK Command Position and Speed Control Option |

* Parameters in parentheses are used when Pn833 is set to 1.

Set the parameters as shown below to use TLIM.

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

# 3.2.9 ZRET (Origin Return) Command: 3A Hex

## ZRET Command

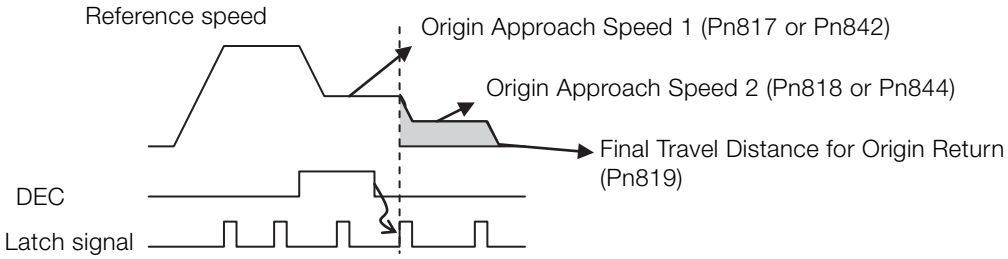
The ZRET command is used to perform an origin return operation in the following sequence.

1. Accelerates to the target speed (TSPD) in the direction specified in Pn816 = n.□□□X (Origin Return Direction).
2. Decelerates to the origin approach speed 1 (Pn817 or Pn842) 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 origin approach speed 2 (Pn818 or Pn844). The target position is calculated by adding the final travel distance for origin approach (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>3A hex</td><td>3A hex</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="29">• Use LT_SGNL to select the latch signal.<br>Refer to the following section for details on LT_SGNL.<br>☞ 2.1.6 LT_SGNL Specifications on page 2-7<br><br>When the latch signal is input, positioning is performed to define the target position at the origin approach speed 2 (Pn818). The target position is calculated by adding the final travel distance for origin return (Pn819).<br>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.<br>When the latch signal is input, L_CMP of STATUS field is set to 1, and then reset to 0 at the completion of the origin return operation. Therefore, when the origin final travel distance is short, the duration L_CMP = 1 is too short so that the status L_CMP = 1 can not be confirmed.<br>• OPTION field can be used.<br>• You can specify between the target speed (TSPD) and the maximum motor speed [reference units/s].<br>• The target speed during motion can be changed until DEC is input.<br>• The torque limit (TLIM) can be used by setting Pn81F and Pn002.<br>• TLIM setting range: 0 to 4000 hex [maximum motor torque/4000 hex]<br>If a value between 4000 hex and FFFF hex is set, the maximum motor torque will be applied as the limit.<br>Use the ADJ command to obtain the maximum motor torque.<br>• Use DEN (output complete) and ZPOINT (home position) to confirm the completion of position reference output.<br>• If any of the following commands is received during execution of ZRET command, the origin return operation will be interrupted.<br>DISCONNECT, SYNC_SET, CONFIG, HOLD, SV_OFF, INTERPOLATE, POSING, FEED, LATCH, EX_POSING, VELCTRL, TRQCTRL, SVCTRL<br>When a command other than the above commands is received, the origin return operation will continue.<br>• A warning will occur and the command will be ignored in the following cases.<br>• This command is used while the servo is OFF.: A.95A alarm (Command Warning 1)<br>• The target speed (TSPD) exceeds the limit: A.94B alarm (Data Setting Warning 2)<br>• When using SigmaWin or a digital operator for motor operations such as JOG: A.95A alarm (Command Warning 1)</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>

## Operation

The motion executed by ZRET command is illustrated below.




## Related Parameters

The parameters related to this command are listed below.

| Parameter No. | Name | Parameter No. | Name |
|---|---|---|---|
| Pn816 = n.□□□X | Origin Return Direction | Pn002 = n.□□□X | MECHATROLINK Command Position and Speed Control Option |
| Pn817 | Origin Approach Speed 1 (Second Origin Approach Speed 1)*1 | Pn80A (Pn834*3) | First Stage Linear Acceleration Constant (First Stage Linear Acceleration Constant 2) |
| Pn842 | | Pn80B (Pn836*3) | Second Stage Linear Acceleration Constant (Second Stage Linear Acceleration Constant 2) |
| Pn818 | Origin Approach Speed 2 (Second Origin Approach Speed 2)*2 | Pn80C (Pn838*3) | Acceleration Constant Switching Speed (Acceleration Constant Switching Speed 2) |
| Pn844 | | Pn80D (Pn83A*3) | First Stage Linear Deceleration Constant (First Stage Linear Deceleration Constant 2) |
| Pn819 | Final Travel Distance for Origin Return | Pn80E (Pn83C*3) | Second Stage Linear Deceleration Constant (Second Stage Linear Deceleration Constant 2) |
| Pn820 | Forward Latching Area | Pn80F (Pn83E*3) | Deceleration Constant Switching Speed (Deceleration Constant Switching Speed 2) |
| Pn822 | Reverse Latching Area | Pn81F = n.□□X□ | Position Control Command TFF/TLIM Allocation |

*1. The value of Pn842 is effective only when the value of Pn817 is 0.
*2. The value of Pn844 is effective only when the value of Pn818 is 0.
*3. Parameters in parentheses are used when Pn833 is set to 1.

Set the parameters as shown below to use TLIM.

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

# 3.2.10 VELCTRL (Velocity Control) Command: 3C Hex

## VELCTRL Command

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

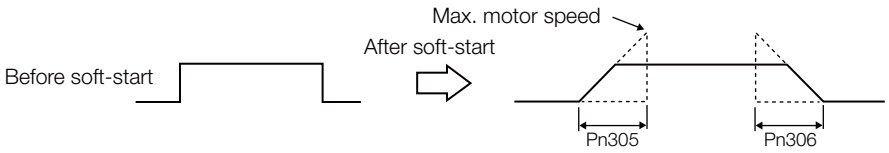
<table>
<tr><th rowspan="2">Byte</th><th colspan="2">VELCTRL</th><th colspan="4" rowspan="2">Description</th></tr>
<tr><th>Command</th><th>Response</th></tr>
<tr><td>1</td><td>3C hex</td><td>3C hex</td><td>Phases in which the command can be executed</td><td>Phase 2 and 3</td><td>Synchronization classification</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 used.<br>• VREF is a speed reference and has a signed 4-byte data. The unit for speed reference is [maximum motor speed/40000000 hex]. The direction is specified by the sign.<br>• Soft-start function can be used. Refer to the following section for details on soft starts.<br>☞ Soft Start Function on page 3-47<br>• Either torque limit (P_TLIM, N_TLIM) or torque feed forward (TFF) can be used. Use Pn002 to select.<br>• TLIM setting range: 0 to 4000 hex [maximum motor torque/4000 hex]<br>(If a value between 4000 hex to FFFF hex is set, the maximum motor torque will be applied as the limit.<br>Use the ADJ command to obtain the maximum motor torque.<br>• TFF setting range: A signed 2-byte data [maximum motor torque/4000 hex]<br>• During execution of this command, the following bits for STATUS are allocated.<br>D8: ZSPD (zero speed bit)<br>0: Zero speed not detected<br>1: Zero speed detected<br>D7: V_CMP (speed coincidence bit)<br>0: Speed coincidence not detected<br>1: Speed coincidence detected<br>• Monitor (MONITOR 1, 2, 3, 4)<br>The units for TSPD, CSPD, and FSDP is [maximum motor speed / 40000000 hex].</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>
<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>

## 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 (excluding 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 10,000 | 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 10,000 | 1 ms | 0 | Immediately |




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

## Torque Reference Option

The settings of the parameters related to the torque 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 limit. |
| | n.□□□2 | Uses TFF as the torque 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 limit.<br>When N_CL of OPTION field is set to 1, uses N_TLIM as the torque limit. |

# 3.2.11 TRQCTRL (Torque Control) Command: 3D Hex

## TRQCTRL

The TRQCTRL command is used to control torque. (The Servo does not perform position control and speed control, but directly performs torque 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>3D hex</td><td>3D hex</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 used.<br>• VLIM is a speed limit value and has an unsigned 4-byte data.<br>The unit for the speed limit is [maximum motor speed /40000000 hex].<br>(Set Pn002 to enable VLIM.)<br>Use the ADJ command to obtain the maximum motor speed.<br>• TQREF is a torque reference and has a signed 4-byte data.<br>The unit for torque reference is [maximum motor torque/40000000 hex]. The direction is specified by the sign.<br>When the designation for TQREF exceeds the maximum motor torque, it is clamped at the maximum motor torque.<br>Use ADJ command to obtain the maximum motor torque.<br>• During execution of this command, the following bits of STATUS field are allocated.<br>D11: V_LIM (speed limit bit)<br>0: Speed limit not detected<br>1: Speed limit detected<br>• Monitor (MONITOR 1, 2, 3, 4)<br>The unit for TRQ is maximum motor torque/40000000 hex.</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>
<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>

# Speed Limit Option 1

## ◆ When Using a Rotational Servomotor

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

| | Speed Limit during Torque Control | | | |
|---|---|---|---|---|
| Pn407 | Setting Range | Unit | Factory Setting | When Enabled |
| | 0 to 10,000 | 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.

| | Speed Limit during Force Control | | | |
|---|---|---|---|---|
| Pn480 | Setting Range | Unit | Factory Setting | When Enabled |
| | 0 to 5,000 | 1 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.

# 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.) |

# 3.2.12 Restrictions in Using Servo Commands

## Travel Distance Restrictions for the ZRET (Zero Point Return) Command

If you use the ZRET (Zero Point Return) command for a Σ-7-Series Rotary Servomotor, the following restrictions apply according to the setting of the electronic gear ratio.

| Electric Gear Ratio (Pn20E/Pn210) | Travel Distance |
|---|---|
| 1/1 | Distance equivalent to ±64 rotations |
| 2/1 | Distance equivalent to ±128 rotations |
| 4/1 | Distance equivalent to ±256 rotations |
| 16/1 | Distance equivalent to ±1,024 rotations |

## Travel Distance Restrictions for the EX_POSING (External Input Positioning) and EX_FEED (External Input Feed) Commands

If you use the EX_POSING (External Input Positioning) or EX_FEED (External Input Feed) command for a Σ-7-Series Rotary Servomotor, the following restrictions apply according to the setting of the electronic gear ratio.

| Electric Gear Ratio (Pn20E/Pn210) | Travel Distance |
|---|---|
| 1/1 | Distance equivalent to ±64 rotations |
| 2/1 | Distance equivalent to ±128 rotations |
| 4/1 | Distance equivalent to ±256 rotations |
| 16/1 | Distance equivalent to ±1,024 rotations |

## Travel Distance Restrictions for the TPOS (Target Position)

If you use TPOS (Target Position) for a Σ-7-Series Rotary Servomotor, the following restrictions apply according to the setting of the electronic gear ratio.

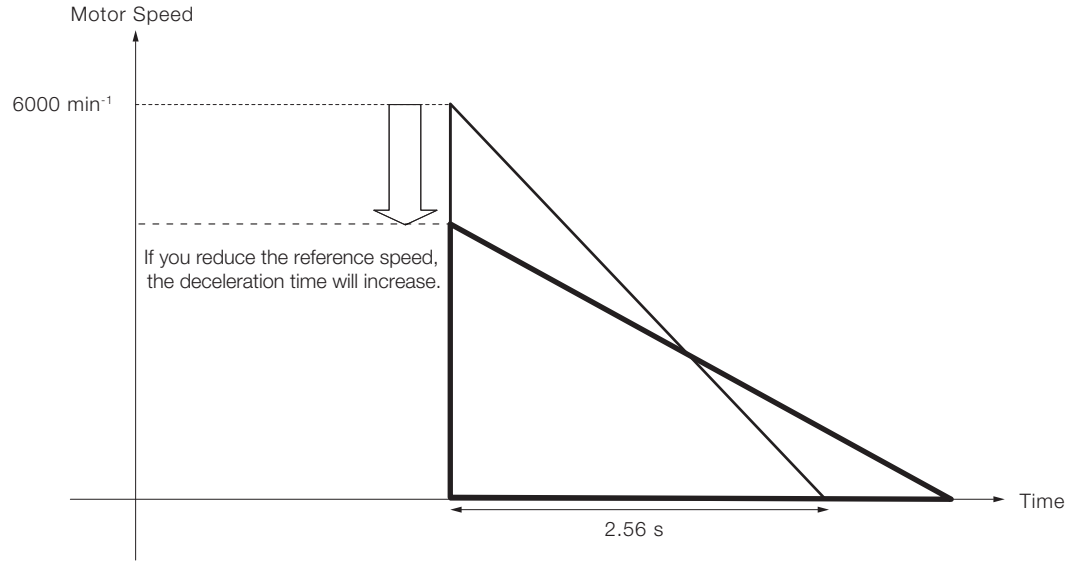
| Electric Gear Ratio (Pn20E/Pn210) | Travel Distance |
|---|---|
| 1/1 | Distance equivalent to ±128 rotations |
| 2/1 | Distance equivalent to ±256 rotations |
| 4/1 | Distance equivalent to ±512 rotations |
| 16/1 | Distance equivalent to ±2,048 rotations |

## Deceleration Time Restrictions during Position Control

If you use a positioning command (i.e., POSING, FEED, EX_FEED, EX_POSING, or ZRET) for a Σ-7-Series Rotary Servomotor, the following restrictions apply to the deceleration time.

| Electric Gear Ratio (Pn20E/Pn210) | Deceleration Time at 750 $min^{-1}$ [s] | Deceleration Time at 1,500 $min^{-1}$ [s] | Deceleration Time at 3,000 $min^{-1}$ [s] | Deceleration Time at 6,000 $min^{-1}$ [s] |
|---|---|---|---|---|
| 1/1 | 20.48 | 10.24 | 5.12 | 2.56 |
| 2/1 | 40.96 | 20.48 | 10.24 | 5.12 |
| 4/1 | 81.92 | 40.96 | 20.48 | 10.24 |
| 16/1 | 327.68 | 163.84 | 81.92 | 40.96 |

The following figure shows the relationship between the reference speed and deceleration time.



# Subcommands

4

This chapter describes MECHATROLINK-II subcommands.


4.1 MECHATROLINK-II Subcommands List . . . 4-2

4.2 MECHATROLINK-II Subcommands Details . 4-3

4.2.1 NOP (No Operation) Command: 00 Hex . . . . . 4-3
4.2.2 PRM_RD (Read Parameter) Command: 01 Hex . . 4-3
4.2.3 PRM_WR (Write Parameter) Command: 02 Hex . 4-4
4.2.4 ALM_RD (Read Alarm or Warning) Command: 05 Hex . . . . . 4-4
4.2.5 PPRM_WR (Write Non-volatile Parameter) Command: 1C Hex . . . . . 4-5
4.2.6 LTMOD_ON (Set Latch Mode) Command: 28 Hex . . . . . 4-5
4.2.7 LTMOD_OFF (Release Latch Mode) Command: 29 Hex . . . . . 4-6
4.2.8 SMON (Status Monitoring) Command: 30 Hex . . 4-6

# 4.1 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 the following section for information on applicable combinations with main commands.

☞ *1.4.3 Combination of MECHATROLINK-II Main Commands and Subcommands* on page 1-8

| Command Code | Command | Function |
|---|---|---|
| 00 hex | NOP | Same function as of the main command NOP |
| 01 hex | PRM_RD | Same function as of the main command PRM_RD |
| 02 hex | PRM_WR | Same function as of the main command PRM_WR |
| 05 hex | ALM_RD | Same function as of the main command ALM_RD |
| 1C hex | PPRM_WR | Same function as of the main command PPRM_WR |
| 28 hex | LTMOD_ON | Same function as of the main command LTMOD_ON |
| 29 hex | LTMOD_OFF | Same function as of the main command LTMOD_OFF |
| 30 hex | SMON | Same function as of the main command SMON |

# 4.2 MECHATROLINK-II Subcommands Details

## 4.2.1 NOP (No Operation) Command: 00 Hex

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

## 4.2.2 PRM_RD (Read Parameter) Command: 01 Hex

| Byte | PRM_RD | | Description |
|---|---|---|---|
| | Command | Response | |
| 17 | 01 hex | 01 hex | • Reads the parameters.<br>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 | | | |

## 4.2.3 PRM_WR (Write Parameter) Command: 02 Hex

| Byte | PRM_WR | | Description |
|---|---|---|---|
| | Command | Response | |
| 17 | 02 hex | 02 hex | • Writes the parameters.<br>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 | | | |

## 4.2.4 ALM_RD (Read Alarm or Warning) Command: 05 Hex

| Byte | ALM_RD | | Description |
|---|---|---|---|
| | Command | Response | |
| 17 | 05 hex | 05 hex | • Reads the alarm or warning.<br>This command has the same function as the main command ALM_RD.<br>• 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 | | | |

## 4.2.5 PPRM_WR (Write Non-volatile Parameter) Command: 1C Hex

| Byte | PPRM_WR | | Description |
|---|---|---|---|
| | Command | Response | |
| 17 | 1C hex | 1C hex | • Writes the parameters.<br>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 | | | |

## 4.2.6 LTMOD_ON (Set Latch Mode) Command: 28 Hex

| Byte | PPRM_WR | | Description |
|---|---|---|---|
| | Command | Response | |
| 17 | 28 hex | 28 hex | • Enables the latch mode.<br>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 | | – | |

## 4.2.7 LTMOD_OFF (Release Latch Mode) Command: 29 Hex

| Byte | LTMOD_OFF | | Description |
|---|---|---|---|
| | Command | Response | |
| 17 | 29 hex | 29 hex | • Releases the latch mode.<br>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 | | | |

## 4.2.8 SMON (Status Monitoring) Command: 30 Hex

| Byte | SMON | | Description |
|---|---|---|---|
| | Command | Response | |
| 17 | 30 hex | 30 hex | • Reads the monitoring information specified in SEL_MON3/4.<br>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 | | | |

# Operation Sequence

5

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


5.1 Preparing for Operation . . . . . 5-2
5.1.1 Setting MECHATROLINK-II Communications . . . 5-2
5.1.2 Checking the Communications Status . . . . . 5-4

5.2 Operation Sequence for Managing Parameters Using a Controller . . . . . 5-5

5.3 Operation Sequence for Managing Parameters Using a SERVOPACK . . . 5-6
5.3.1 Setup Sequence . . . . . 5-6
5.3.2 Ordinary Operation Sequence . . . . . 5-6

5.4 Specific Operation Sequences . . . . . 5-7
5.4.1 Operation Sequence When Turning the Servo ON . . . . 5-7
5.4.2 Operation Sequence When OT (Overtravel Limit Switch) Signal Is Input . . . . . 5-7
5.4.3 Operation Sequence at Emergency Stop (Main Circuit OFF) . . . . . 5-8
5.4.4 Operation Sequence When a Safety Signal is Input . . . 5-8
5.4.5 Operation Sequence at Occurrence of Alarm . . . 5-9
5.4.6 When Motion Command Is Interrupted and Servomotor Is in Position . . . . . 5-9

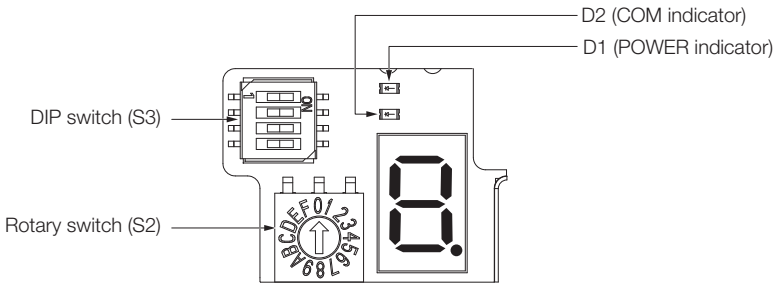
5.5 Setting the Origin Before Starting Operation . . 5-10
5.5.1 When Using an Incremental Encoder . . . . . 5-10
5.5.2 When Using an Absolute Encoder . . . . . 5-10

# 5.1 Preparing for Operation

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

## 5.1.1 Setting MECHATROLINK-II Communications

The rotary switch (S2) and DIP switch (S3) that are located near the top under the front cover of the SERVOPACK are used to set communications specifications.




### Setting the Communications Specifications

Use the DIP switch (S3) to make the communications settings.

| DIP Switch (S3) | 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 = 40 hex + Setting of S2 | OFF |
| | | ON | Station address = 50 hex + Setting of S2 | |
| Pin 4 | Reserved. (Do not change.) | OFF | – | OFF |

Important

- When connecting to a MECHATROLINK-I network, turn OFF pins 1 and 2.
- When using a MECHATROLINK-I network (Baud rate: 4 Mbps), the settings for the number of transmission bytes is disabled and the number of transmission bytes is always 17.

## Setting the Station Address

Use the following settings table to set the station address. The station address is set on the rotary switch (S2) and the DIP switch (S3).

The default setting of the station address is 41 hex (pin 3 on S3 = OFF, S2 = 1).

| Pin 3 on S3 | S2 | Station Address | Pin 3 on S3 | S2 | Station Address |
|---|---|---|---|---|---|
| OFF | 0 | Disabled | ON | 0 | 50 hex |
| OFF | 1 | 41 hex | ON | 1 | 51 hex |
| OFF | 2 | 42 hex | ON | 2 | 52 hex |
| OFF | 3 | 43 hex | ON | 3 | 53 hex |
| OFF | 4 | 44 hex | ON | 4 | 54 hex |
| OFF | 5 | 45 hex | ON | 5 | 55 hex |
| OFF | 6 | 46 hex | ON | 6 | 56 hex |
| OFF | 7 | 47 hex | ON | 7 | 57 hex |
| OFF | 8 | 48 hex | ON | 8 | 58 hex |
| OFF | 9 | 49 hex | ON | 9 | 59 hex |
| OFF | A | 4A hex | ON | A | 5A hex |
| OFF | B | 4B hex | ON | B | 5B hex |
| OFF | C | 4C hex | ON | C | 5C hex |
| OFF | D | 4D hex | ON | D | 5D hex |
| OFF | E | 4E hex | ON | E | 5E hex |
| OFF | F | 4F hex | ON | F | 5F hex |

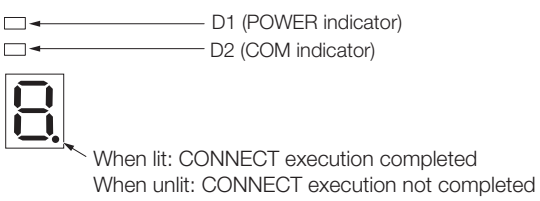

Important

Turn the power OFF and then ON again to validate the new settings.

# 5.1.2 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.

## Operation Procedure

| Procedure | Operation |
|---|---|
| 1 | Confirm that the wiring is correctly made. |
| 2 | Turn ON the SERVOPACK control and main circuit power supplies.<br>If the control power is supplied normally to the SERVOPACK, the D1 (POWER) indicator on the SERVOPACK will light.<br>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.<br>When communications in the data link layer have started, the D2 (COM) indicator on the SERVOPACK will light.<br>Note: If the D2 (COM) indicator does not light, check the communications settings on S2 and S3, check the controller's communications settings, and then turn the power supply OFF and ON again.<br>When the MECHATROLINK-II connection in the application layer is established, the 7-segment LED indicates the completion of CONNECT execution as shown below.<br>  <br> |

# 5.2 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.

# 5.3 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.

## 5.3.1 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<br>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.

## 5.3.2 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.

# 5.4 Specific Operation Sequences

This section describes operations that use commands in specific sequences.

## 5.4.1 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

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

When the OT signal is input, the SERVOPACK will prohibit the motor from operation with the method specified in Pn001. The SERVOPACK continues to control the motor while motor operation 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:<br>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.<br>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.<br>At the same time, check the flag PSET. If PSET = 1, the motor is completely stopped.<br>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: 1. 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).
2. 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.

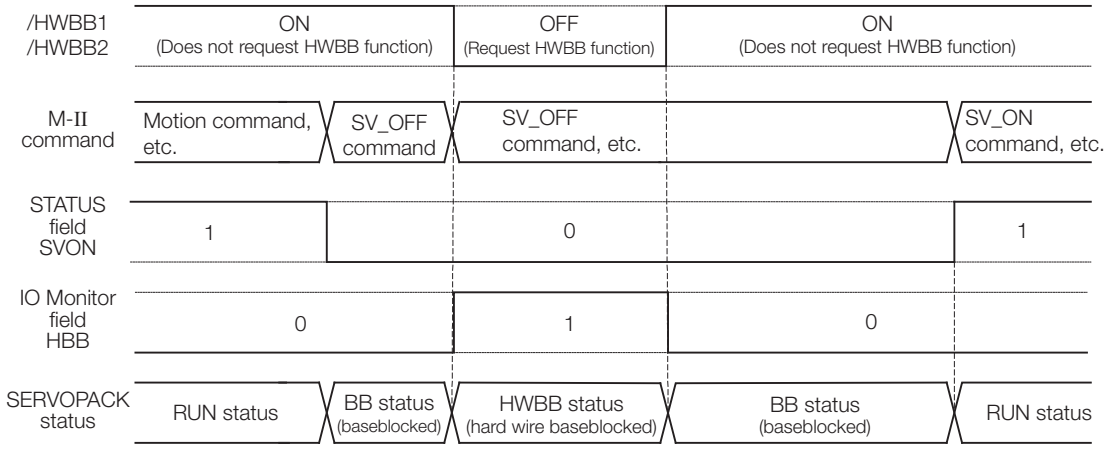
## 5.4.3 Operation Sequence at Emergency Stop (Main Circuit OFF)

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.

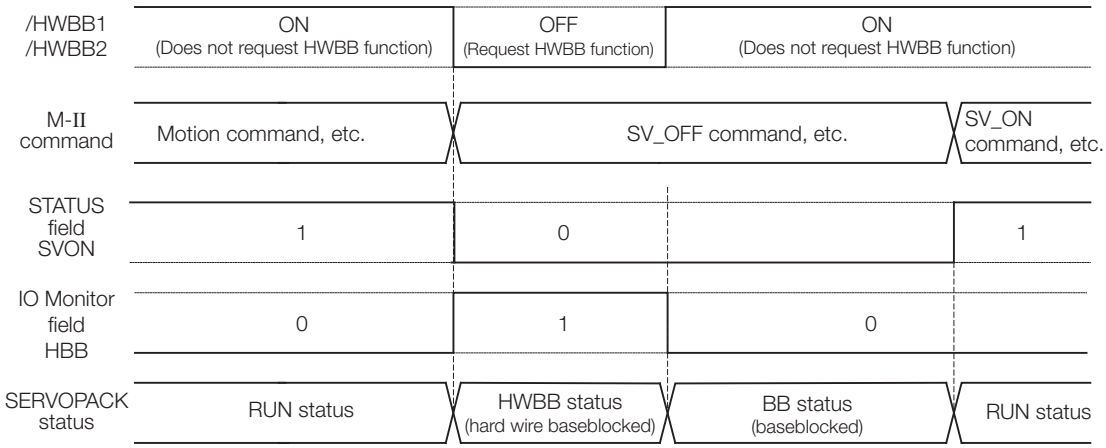
## 5.4.4 Operation Sequence When a Safety Signal is Input

When the HWBB1 or HWBB2 signal is input while the motor is operating, power to the motor will be forcibly shut OFF and the motor will be stopped according to the setting of Pn001 = n.□□□X.

■ 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.

## 5.4.5 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.

## 5.4.6 When Motion Command Is Interrupted and Servomotor Is in Position

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.


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.

# 5.5 Setting the Origin Before Starting Operation

## 5.5.1 When Using an Incremental Encoder

When an incremental encoder is used in the slave station, carry out an origin return 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:

### ■ 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.

### ■ 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.

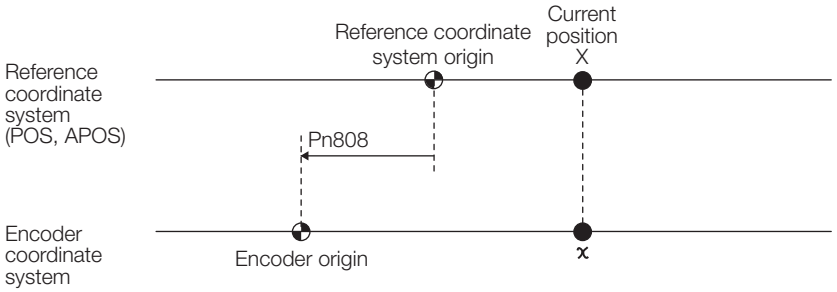
1. Position to the reference position.
2. Send the POS_SET command with POS_SET_MODE.POS_SEL = APOS (= 3), POS_SET_MODE.REFE = 1, and POS_DATA = reference position.

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

## 5.5.2 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: Absolute Encoder Origin Offset

# Command Related Parameters

6

This chapter describes parameter settings related to each command action.


6.1 Command Related Parameters List . . . . . 6-2

6.2 Command Related Parameters Details . . . . 6-4

6.2.1 Electronic Gear Settings . . . . . 6-4
6.2.2 Motion Acceleration/Deceleration Function Setting . . . . . 6-8
6.2.3 Motion Sequence Setting . . . . . 6-12
6.2.4 Command Data Options . . . . . 6-14
6.2.5 Position Data Latch Function Setting . . . . . 6-20
6.2.6 Settings for Acceleration/Deceleration Parameter High-speed Switching . . . . . 6-23
6.2.7 STATUS Field and Monitor Related Settings . . . 6-26

# 6.1 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 (Numerator), Electronic Gear Ratio (Denominator) | Sets the unit of position data. |
| | Pn000 = n.□□□X | Rotation Direction Selection | Sets the servomotor rotation direction. |
| | Pn50A = n.X□□□, Pn50B = n.□□□X | P-OT (Forward Drive Prohibit) Signal Allocation, N-OT (Reverse Drive Prohibit) Signal Allocation | Sets the overtravel function and software limit operation. |
| | Pn801 = n.□□□X | Software Limit Selection | |
| | Pn804, Pn806 | Forward Software Limit, Reverse Software Limit | |
| | Pn808 | Absolute Encoder Origin Offset | Sets the origin when using an absolute encoder. |
| Motion Acceleration/ Deceleration Function Settings | Pn833 | Motion Settings | Sets the acceleration/deceleration speed for POSING, EX_POSING, FEED, ZRET, HOLD commands |
| | Pn80A, Pn834 | First Stage Linear Acceleration Constant, First Stage Linear Acceleration Constant 2 | |
| | Pn80B, Pn836 | Second Stage Linear Acceleration Constant, Second Stage Linear Acceleration Constant 2 | |
| | Pn80C, Pn838 | Acceleration Constant Switching Speed, Acceleration Constant Switching Speed 2 | |
| | Pn80D, Pn83A | First Stage Linear Deceleration Constant, First Stage Linear Deceleration Constant 2 | |
| | Pn80E, Pn83C | Second Stage Linear Deceleration Constant, Second Stage Linear Deceleration Constant 2 | |
| | Pn80F, Pn83E | Deceleration Constant Switching Speed, Deceleration Constant Switching Speed 2 | |
| | Pn827, Pn840 | Linear Deceleration Constant 1 for Stopping, Linear Deceleration Constant 2 for Stopping | Sets the deceleration speed for HOLD, SV_OFF commands. |
| | Pn829 | SVOFF Waiting Time (for SVOFF at Deceleration to Stop) | |
| | Pn810 | Exponential Acceleration/ Deceleration Bias | Sets the position reference filter. |
| | Pn811 | Exponential Acceleration/ Deceleration Time Constant | |
| | Pn812 | Movement Average Time | |
| Motion Sequence Setting | Pn814 | External Positioning Final Travel Distance | Sets the travel distance after the external signal is input for positioning. |
| | Pn816 | Origin Return Mode Settings | Sets the origin return operation. |
| | Pn817, Pn818, Pn842, Pn844 | Origin Approach Speed 1, Origin Approach Speed 2, Second Origin Approach Speed 1, Second Origin Approach Speed 2 | |
| | Pn819 | Final Travel Distance for Origin Return | |

Continued on next page.

Continued from previous page.

| Classification | Parameter | Name | Description |
|---|---|---|---|
| Command Data Option Setting | Pn81F = n.□□X□, Pn002 = n.□□□X | Position Control Command TFF/TLIM Allocation, MECHATROLINK Command Position and Speed Control Option | Sets the usage of torque limit and torque feed forward during position/speed control. |
| | Pn002 = n.□□X□, Pn407, Pn480 | Torque Control Option, Speed Limit during Torque Control, Speed Limit during Force Control | Sets the usage of speed limit during torque control. |
| | Pn81F = n.□□□X, Pn82A to Pn82E | Option Field Allocation | Selects function bits to be assigned in OPTION field. |
| Position Data Latch Function Setting | Pn820, Pn822 | Forward Latching Area, Reverse Latching Area | Sets the range to latch position data. |
| | Pn850 | Number of Latch Sequences | Sets continuous latch operation executed by LTMOD_ON command. |
| | Pn851 | Continuous Latch Sequence Count | |
| | Pn852, Pn853 | Latch Sequence 1 to 4 Settings, Latch Sequence 5 to 8 Settings | |
| Acceleration/ Deceleration Parameter High-speed Switching Function Setting | Pn900 | Number of Parameter Banks | Sets the acceleration/deceleration parameter high-speed switching function. |
| | Pn901 | Number of Parameter Bank Members | |
| | Pn902 to Pn910 | Parameter Bank Member Definition | |
| | Pn920 to Pn95F | Parameter Bank Data | |
| STATUS Field and Monitor Related Settings | Pn803 | Origin Range | Sets the following monitoring items.<br>• STATUS field signal status detection level<br>• Input signal allocation to the D12 to D15 bits of I/O Monitor field<br>• Data mapping to option monitors |
| | Pn522 | Positioning Completed Width | |
| | Pn524 | Near Signal Width | |
| | Pn502, Pn581 | Rotation Detection Level, Zero Speed Level | |
| | Pn503, Pn582 | Speed Coincidence Detection Signal Output Width | |
| | Pn81E | Input Signal Monitor Selections | |
| | Pn824, Pn825 | Option Monitor 1 Selection, Option Monitor 2 Selection, | |

# 6.2 Command Related Parameters Details

## 6.2.1 Electronic Gear Settings

The minimum unit of the position data that is used to move a load is called the reference unit. The reference unit is used to give travel amounts, not in pulses, but rather in distances or other physical units (such as μm or °) that are easier to understand.

The electronic gear is used to convert the travel distances that are specified in reference units to pulses, which are required for actual movements.

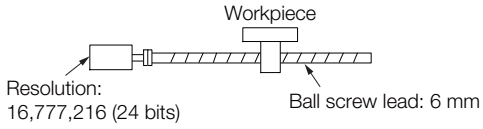
With the electronic gear, one reference unit is equal to the workpiece travel distance per reference pulse input to the SERVOPACK. In other words, if you use the SERVOPACK's electronic gear, pulses can be read as reference units.

Note: If you set an electronic gear in the host controller, normally set the electronic gear ratio in the SERVOPACK to 1:1.

The difference between using and not using the electronic gear is shown below.

- Rotary Servomotors

In this example, the following machine configuration is used to move the workpiece 10 mm.




When the Electronic Gear Is Not Used

To move a workpiece 10 mm:
①Calculate the number of revolutions.
The motor will move 6 mm for each revolution, so 10/6 revolutions are required to move 10 mm.
②Calculate the required number of reference pulses.
One revolution is 16,777,216 pulses, therefore 10/6 × 16,777,216 = 27,962,026.66 pulses.
③Input 27,962,027 pulses as the reference.

Calculating the number of reference pulses for each reference is troublesome.

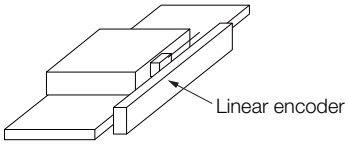
When the Electronic Gear Is Used

If you use reference units to move the workpiece when one reference unit is set to 1 μm, the travel distance is 1 μm per pulse.
To move the workpiece 10 mm (10,000 μm), 10,000 ÷ 1 = 10,000 pulses, so 10,000 pulses would be input.

Calculating the number of reference pulses for each reference is not necessary.

- Linear Servomotors

In this example, the following machine configuration is used to move the load 10 mm. We'll assume that the resolution of the Serial Converter Unit is 256 and that the linear encoder pitch is 20 μm.



When the Electronic Gear Is Not Used

To move the load 10 mm:
10 × 1000 ÷ 20 × 256 = 128,000 pulses, so 128,000 pulses are input as the reference.

Calculating the number of reference pulses for each reference is troublesome.

When the Electronic Gear Is Used

To use reference units to move the load 10 mm: If we set the reference unit to 1 μm, the travel distance is 1 μm per pulse. To move the load 10 mm (10,000 μm), 10,000/1 = 10,000 pulses, so 10,000 pulses would be input as the reference.

Calculating the number of reference pulses for each reference is not necessary.

## Electronic Gear Ratio Settings

Set the electronic gear ratio using Pn20E and Pn210.

Important

Set the electronic gear ratio within the following range.
0.001 ≤ Electronic gear ratio (B/A) ≤ 64,000
If the electronic gear ratio is outside of this range, an A.040 alarm (Parameter Setting Error) will occur.

| | Electronic Gear Ratio (Numerator) | | | Position | |
|---|---|---|---|---|---|
| Pn20E | Setting Range | Setting Unit | Default Setting | When Enabled | Classification |
| | 1 to 1,073,741,824 | 1 | 64 | After restart | Setup |
| | Electronic Gear Ratio (Denominator) | | | Position | |
| Pn210 | Setting Range | Setting Unit | Default Setting | When Enabled | Classification |
| | 1 to 1,073,741,824 | 1 | 1 | After restart | Setup |

## Calculating the Settings for the Electronic Gear Ratio

### ◆ Rotary Servomotors

If the gear ratio between the Servomotor shaft and the load is given as n/m, where n is the number of load rotations for m Servomotor shaft rotations, the settings for the electronic gear ratio can be calculated as follows:

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

#### ■ Encoder Resolution

You can check the encoder resolution in the Servomotor model number.

SGM7A, SGM7J, SGM7G -□□□□□□□

| Code | Specification | Encoder Resolution |
|---|---|---|
| 7 | 24-bit multiturn absolute encoder | 16,777,216 |
| F | 24-bit incremental encoder | 16,777,216 |

SGMCS -□□□□□□□

| Code | Specification | Encoder Resolution |
|---|---|---|
| 3 | 20-bit single-turn absolute encoder | 1,048,576 |
| D | 20-bit incremental encoder | 1,048,576 |

SGMCV -□□□□□□□

| Code | Specification | Encoder Resolution |
|---|---|---|
| E | 22-bit single-turn absolute encoder | 4,194,304 |
| I | 22-bit multiturn absolute encoder | 4,194,304 |

## ◆ Linear Servomotors

You can calculate the settings for the electronic gear ratio with the following equation:

When Not Using a Serial Converter Unit

Use the following formula if the linear encoder and SERVOPACK are connected directly or if a linear encoder that does not require a Serial Converter Unit is used.

$$\text{Electronic gear ratio } \frac{B}{A} = \frac{Pn20E}{Pn210} = \frac{\text{Travel distance per reference unit (reference units)} \times \text{Linear encoder resolution}}{\text{Linear encoder pitch (the value from the following table)}}$$

When Using a Serial Converter Unit

$$\text{Electronic gear ratio } \frac{B}{A} = \frac{Pn20E}{Pn210} = \frac{\text{Travel distance per reference unit (reference units)} \times \text{Resolution of the Serial Converter Unit}}{\text{Linear encoder pitch (setting of Pn282)}}$$

### ■ Feedback Resolution of Linear Encoder

The linear encoder pitches and resolutions are given in the following table.

Calculate the electronic gear ratio using the values in the following table.

| Type of Linear Encoder | Manufacturer | Linear Encoder Model | Linear Encoder Pitch [μm] | Model of Serial Converter Unit or Model of Head with Interpolator | Resolution | Resolution |
|---|---|---|---|---|---|---|
| Incremental | Heidenhain Corporation | LIDA48□ | 20 | JZDP-D003-□□□-E*1 | 256 | 0.078 μm |
| | | | | JZDP-G003-□□□-E*1 | 4,096 | 0.0049 μm |
| | | LIF48□ | 4 | JZDP-D003-□□□-E*1 | 256 | 0.016 μm |
| | | | | JZDP-G003-□□□-E*1 | 4,096 | 0.00098 μm |
| | Renishaw PLC | RGH22B | 20 | JZDP-D005-□□□-E*1 | 256 | 0.078 μm |
| | | | | JZDP-G005-□□□-E*1 | 4,096 | 0.0049 μm |
| | Magnescale Co., Ltd. | SR75-□□□□□LF*4 | 80 | – | 8,192 | 0.0098 μm |
| | | SR75-□□□□□MF | 80 | – | 1,024 | 0.078 μm |
| | | SR85-□□□□□LF*4 | 80 | – | 8,192 | 0.0098 μm |
| | | SR85-□□□□□MF | 80 | – | 1,024 | 0.078 μm |
| | | SL700*4, SL710*4, SL720*4, SL730*4 | 800 | PL101-RY*2 | 8,192 | 0.0977 μm |
| | | | | MJ620-T13*3 | | |
| Absolute | Heidenhain Corporation | LIC4100 Series | 20.48 | EIB3391Y*3 | 4,096 | 0.005 μm |
| | Mitutoyo Corporation | ST781A/ST781AL | 256 | – | 512 | 0.5 μm |
| | | ST782A/ST782AL | 256 | – | 512 | 0.5 μm |
| | | ST783/ST783AL | 51.2 | – | 512 | 0.1 μm |
| | | ST784/ST784AL | 51.2 | – | 512 | 0.1 μm |
| | | ST788A/ST788AL | 51.2 | – | 512 | 0.1 μm |
| | | ST789A/ST789AL | 25.6 | – | 512 | 0.05 μm |
| | Magnescale Co., Ltd. | SR77-□□□□□LF*4 | 80 | – | 8,192 | 0.0098 μm |
| | | SR77-□□□□□MF | 80 | – | 1,024 | 0.078 μm |
| | | SR87-□□□□□LF*4 | 80 | – | 8,192 | 0.0098 μm |
| | | SR87-□□□□□MF | 80 | – | 1,024 | 0.078 μm |

*1. This is the model of the Serial Converter Unit.

*2. This is the model of the Head with Interpolator.

*3. This is the model of the Interpolator.

*4. If you use an encoder pulse output with this linear encoder, the setting range of the encoder output resolution (Pn281) is restricted. Refer to the following section for details on the encoder output resolution (Pn281).

☞ *Σ-7-Series Σ-7S SERVOPACK with Analog Voltage/Pulse Train References Product Manual* (Manual No.: SIEP S800001 26)

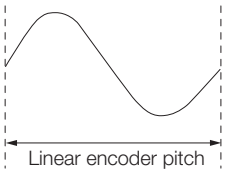
Information

**Resolution**

You can calculate the resolution that is used inside the SERVOPACK (i.e., the travel distance per feedback pulse) with the following formula.

$$\text{Resolution (travel distance per feedback pulse)} = \frac{\text{Linear encoder pitch}}{\text{Resolution of Serial Converter Unit or linear encoder}}$$

The SERVOPACK uses feedback pulses as the unit to control a Servomotor.

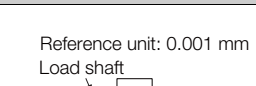
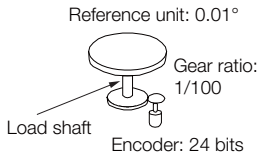
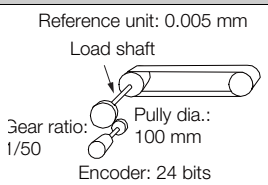



Linear encoder pitch
=Distance for one cycle of the analog voltage feedback signal from the linear encoder

# Electronic Gear Ratio Setting Examples

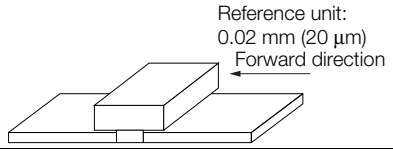
Setting examples are provided in this section.

• Rotary Servomotors

| Step | Description | Machine Configuration | | |
|---|---|---|---|---|
| | | Ball Screw | Rotary Table | Belt and Pulley |
| | |  |  |  |
| 1 | Machine Specifications | • Ball screw lead: 6 mm<br>• Gear ratio: 1/1 | • Rotation angle per revolution: 360°<br>• Gear ratio: 1/100 | • Pully dia.: 100 mm (Pully circumference: 314 mm)<br>• Gear ratio: 1/50 |
| 2 | Encoder Resolution | 16,777,216 (24 bits) | 16,777,216 (24 bits) | 16,777,216 (24 bits) |
| 3 | Reference Unit | 0.001 mm (1 μm) | 0.01° | 0.005 mm (5 μm) |
| 4 | Travel Distance per Load Shaft Revolution (Reference Units) | 6 mm/0.001 mm = 6,000 | 360°/0.01° = 36,000 | 314 mm/0.005 mm = 62,800 |
| 5 | Electronic Gear Ratio | $\frac{B}{A} = \frac{16,777,216}{6,000} \times \frac{1}{1}$ | $\frac{B}{A} = \frac{16,777,216}{36,000} \times \frac{100}{1}$ | $\frac{B}{A} = \frac{16,777,216}{62,800} \times \frac{50}{1}$ |
| 6 | Parameters | Pn20E: 16,777,216 | Pn20E: 1,677,721,600 | Pn20E: 838,860,800 |
| | | Pn210: 6,000 | Pn210: 36,000 | Pn210: 62,800 |

• Linear Servomotors

A setting example for a Serial Converter Unit resolution of 256 is given below.

| Step | Description | Machine Configuration |
|---|---|---|
| | |  |
| 1 | Linear encoder pitch | 0.02 mm (20 μm) |
| 2 | Reference Unit | 0.001 mm (1 μm) |
| 3 | Electronic Gear Ratio | $\frac{B}{A} = \frac{1\ (\mu m)}{20\ (\mu m)} \times 256$ |
| 4 | Setting Parameters | Pn20E: 256 |
| | | Pn210: 20 |

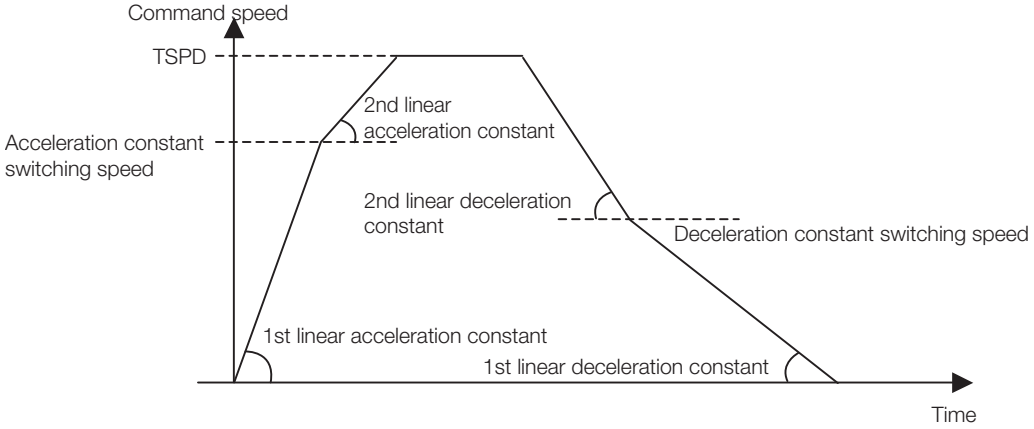
# 6.2.2 Motion Acceleration/Deceleration Function Setting

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

## 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 setting of Pn833 = n.□□□X determines whether the settings of Pn80A to Pn80F and Pn827 are used or the settings of Pn834 to Pn840 are used.




### ◆ Acceleration/Deceleration Constant Switching Setting

| Parameter | | Meaning | Factory Setting |
|---|---|---|---|
| Pn833 = n.□□□X | n.□□□0 | Use Pn80A to Pn80F and Pn827. (The settings of Pn834 to Pn840 are ignored.) | n.□□□0 |
| | n.□□□1 | Use Pn834 to Pn840. (The settings of Pn80A to Pn80F and Pn827 are ignored.) | |

Note: Any changes must be enabled by turning the power supply OFF and ON again or by sending a CONFIG command.

### ◆ Acceleration/Deceleration Parameters when Pn833=n.□□□0

| Parameter No. | Name | Data Size (byte) | Setting Range | Unit | Factory Setting |
|---|---|---|---|---|---|
| Pn80A | First Stage Linear Acceleration Constant | 2 | 1 to 65,535 | 10,000 reference units/s$^2$ | 100 |
| Pn80B | Second Stage Linear Acceleration Constant | 2 | 1 to 65,535 | 10,000 reference units/s$^2$ | 100 |
| Pn80C | Acceleration Constant Switching Speed | 2 | 0 to 65,535 | 100 reference units/s | 0 |
| Pn80D | First Stage Linear Deceleration Constant | 2 | 1 to 65,535 | 10,000 reference units/s$^2$ | 100 |
| Pn80E | Second Stage Linear Deceleration Constant | 2 | 1 to 65,535 | 10,000 reference units/s$^2$ | 100 |
| Pn80F | Deceleration Constant Switching Speed | 2 | 0 to 65,535 | 100 reference units/s | 0 |
| Pn827 | Linear Deceleration Constant 1 for Stopping | 2 | 0 to 65,535 | 10,000 reference units/s$^2$ | 100 |

## ◆ Acceleration/Deceleration Parameters when Pn833=n.□□□1

| Parameter No. | Name | Data Size (byte) | Setting Range | Unit | Factory Setting |
|---|---|---|---|---|---|
| Pn834 | First Stage Linear Acceleration Constant 2 | 4 | 1 to 20,971,520 | 10,000 reference units/s$^2$ | 100 |
| Pn836 | Second Stage Linear Acceleration Constant 2 | 4 | 1 to 20,971,520 | 10,000 reference units/s$^2$ | 100 |
| Pn838 | Acceleration Constant Switching Speed 2 | 4 | 0 to 2,097,152,000 | 1 reference unit/s | 0 |
| Pn83A | First Stage Linear Deceleration Constant 2 | 4 | 1 to 20,971,520 | 10,000 reference units/s$^2$ | 100 |
| Pn83C | Second Stage Linear Deceleration Constant 2 | 4 | 1 to 20,971,520 | 10,000 reference units/s$^2$ | 100 |
| Pn83E | Deceleration Constant Switching Speed 2 | 4 | 0 to 2,097,152,000 | 1 reference unit/s | 0 |
| Pn840 | Linear Deceleration Constant 2 for Stopping | 4 | 0 to 20,971,520 | 10,000 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.

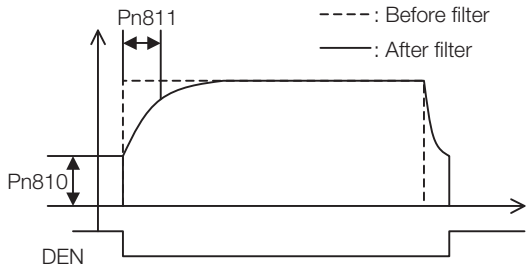
$$\text{Deceleration speed [reference unit/s}^2\text{]} \geq \text{Max. command speed}^2\text{ [reference unit/s] / (Max. deceleration distance [reference unit] × 2)}$$

# Position Reference Filter

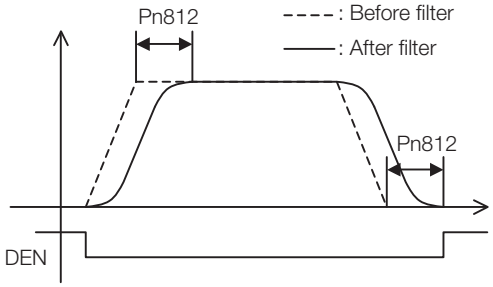
A filter can be applied to the position reference output of a positioning command such as INTERPOLATE, LATCH, POSING, FEED, EX_POSINT, ZRET, and HOLD.

## ◆ Position Reference Filter Setting Parameters

| Parameter No. | Name | Data Size (byte) | Setting Range | Unit | Factory Setting |
|---|---|---|---|---|---|
| Pn810 | Exponential Acceleration/Deceleration Bias | 2 | 0 to 65,535 | 100 reference units/s | 0 |
| Pn811 | Exponential Acceleration/Deceleration Time Constant | 2 | 0 to 5,100 | 0.1 ms | 0 |
| Pn812 | Movement Average Time | 2 | 0 to 5,100 | 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 |

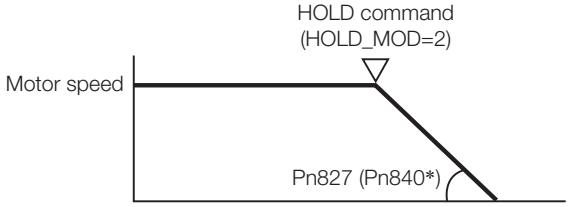
Information While a position reference is being output (STATUS.DEN = 0), the parameter or the filter type cannot be changed. Wait for completion of the position reference output (STATUS.DEN = 1) to change the setting.

# 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)

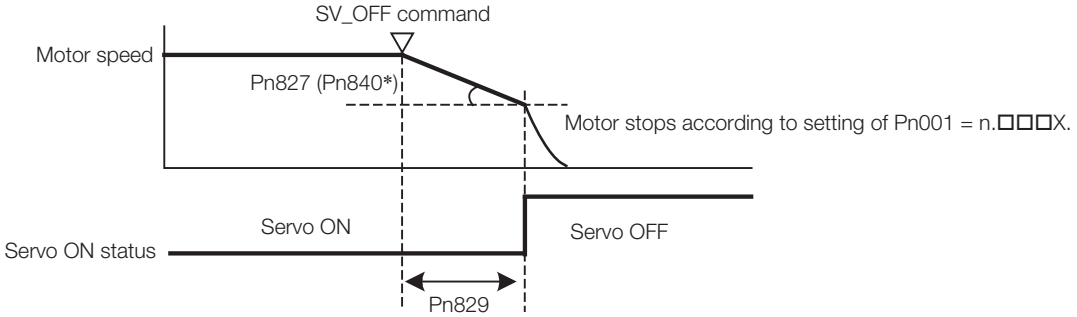



* Parameters in parentheses are used when Pn833 is set to 1.

| Parameter No. | Name | Data Size (byte) | Setting Range | Unit | Factory Setting |
|---|---|---|---|---|---|
| Pn827 | Linear Deceleration Constant 1 for Stopping | 2 | 0 to 65,535 | 10,000 reference units/s$^2$ | 100 |
| Pn840 | Linear Deceleration Constant 2 for Stopping | 4 | 0 to 20,971,520 | 10,000 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.




* Parameters in parentheses are used when Pn833 is set to 1.

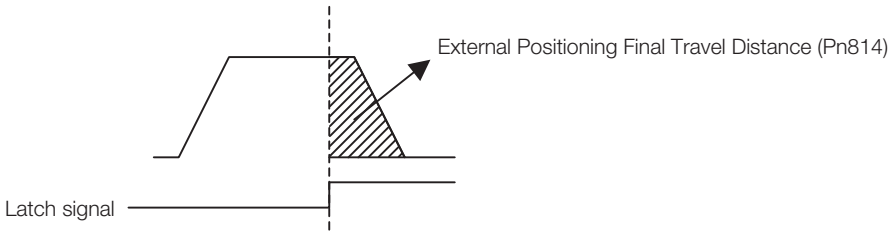
| Parameter No. | Name | Data Size (byte) | Setting Range | Unit | Factory Setting |
|---|---|---|---|---|---|
| Pn827 | Linear Deceleration Constant 1 for Stopping | 2 | 0 to 65,535 | 10,000 reference units/s$^2$ | 100 |
| Pn829 | SVOFF Waiting Time (for SVOFF at Deceleration to Stop) | 2 | 0 to 65,535 | 10 ms | 0 |
| Pn840 | Linear Deceleration Constant 2 for Stopping | 4 | 0 to 20,971,520 | 10,000 reference units/s$^2$ | 100 |

# 6.2.3 Motion Sequence Setting

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

## 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.

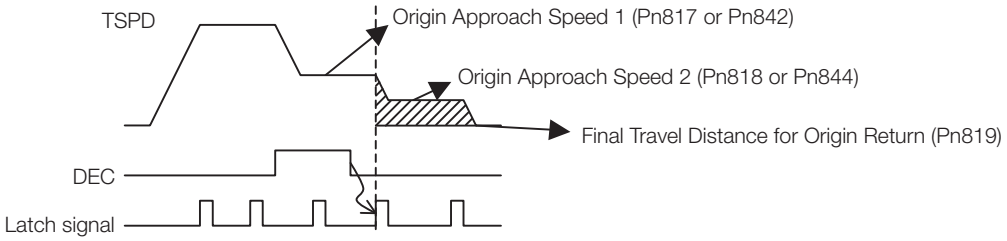



| Parameter No. | Name | Data Size (byte) | Setting Range | Unit | Factory Setting |
|---|---|---|---|---|---|
| Pn814 | External Positioning Final Travel Distance | 4 | -1,073,741,823 to 1,073,741,823 | 1 reference unit | 100 |

## Settings for ZRET Command

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

- Pn816: Origin return direction selection
- Pn817 or Pn842: Approach speed after the origin limit signal is input (DEC signal turns ON)
- Pn818 or Pn844: 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 | Return in forward direction. | n.□□□0 |
| | n.□□□1 | Return in reverse direction. | |

| Parameter No. | Name | Data Size (byte) | Setting Range | Unit | Factory Setting |
|---|---|---|---|---|---|
| Pn817 | Origin Approach Speed 1, Second Origin Approach Speed 1*1 | 2 | 0 to 65,535 | 100 reference units/s | 50 |
| Pn842 | | 4 | 0 to 20,971,520 | | 0 |
| Pn818 | Origin Approach Speed 2, Second Origin Approach Speed 2*2 | 2 | 0 to 65,535 | 100 reference units/s | 5 |
| Pn844 | | 4 | 0 to 20,971,520 | | 0 |
| Pn819 | Final Travel Distance for Origin Return | 4 | -1,073,741,823 to 1,073,741,823 | 1 reference unit | 100 |

*1. The value of Pn842 is effective only when the value of Pn817 is 0.
*2. The value of Pn844 is effective only when the value of Pn818 is 0.

Information Set Pn819 (Final Travel Distance for Origin Return) 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

# 6.2.4 Command Data Options

## Torque Limiting Function

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

- Internal torque limit
- External torque limit using P_CL/N_CL signal of OPTION field
- Torque limit by position/speed control command

Information If all of the above three methods are used, the smallest torque limit will be applied.

### ◆ Internal Torque Limit

This method always limits the maximum output torque 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 | 1% | 800 |
| Pn403 | Reverse Torque Limit (For rotational servomotors) | 2 | 0 to 800 | 1% | 800 |
| Pn483 | Forward Force Limit (For linear servomotors) | 2 | 0 to 800 | 1% | 30 |
| Pn484 | Reverse Force Limit (For linear servomotors) | 2 | 0 to 800 | 1% | 30 |

Information Set the limit value in percentage (%) of the motor rated torque.

### ◆ External Torque 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 to the set values of the following parameters.

| Parameter No. | Name | Data Size (byte) | Setting Range | Unit | Factory Setting |
|---|---|---|---|---|---|
| Pn404 | Forward External Torque Limit | 2 | 0 to 800 | 1% | 100 |
| Pn405 | Reverse External Torque Limit | 2 | 0 to 800 | 1% | 100 |

Information Set the limit value in percentage (%) of the motor rated torque.

### ◆ Torque Limit By Position/Speed Control Command

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

#### ■ Torque Limiting Function Settable Commands

INTERPOLATE, LATCH, FEED, EX_POSING, ZRET, and VELCTRL

#### ■ Setting Parameters

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

| | | |
|---|---|---|
| Pn81F = n.□□X□ | Position Control Command TFF/TLIM Allocation | |
| | n.□□1□ | Enable allocation (Set TFF/TLIM operation using Pn002.) |
| Pn002 = n.□□□X | MECHATROLINK Command Position and Speed Control Option | |
| | n.□□□1 | Enable positive/negative torque limit by *TLIM. |
| | n.□□□3 | Use TLIM/P_TLIM as positive torque limit when OPTION.P_CL=1.<br>Use TLIM/N_TLIM as negative torque limit when OPTION.N_CL=1. |

Information

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

## Torque Feed Forward Function

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

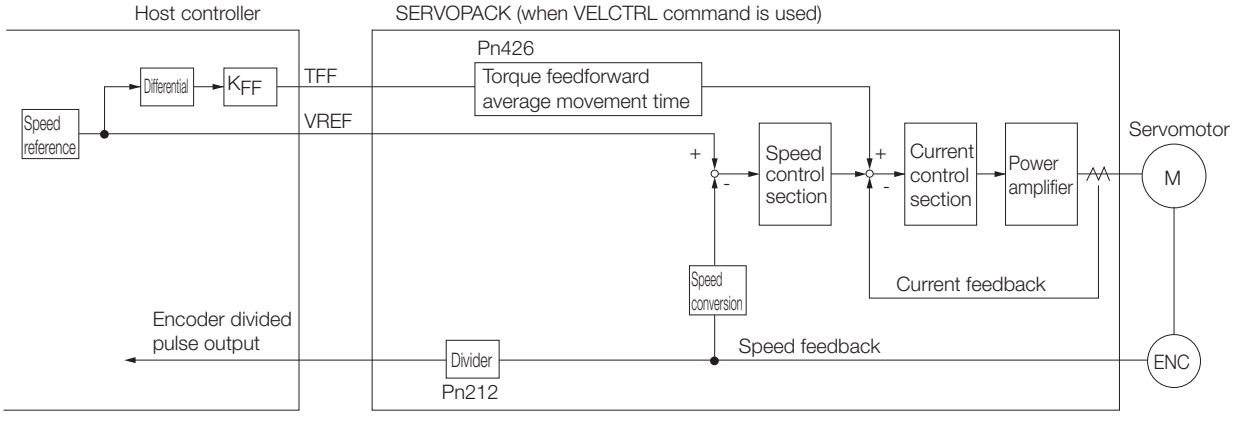
#### ■ Torque Feed Forward Reference Settable Commands

INTERPOLATE, LATCH, and VELCTRL

#### ■ Relationship between the Host Controller and SERVOPACK

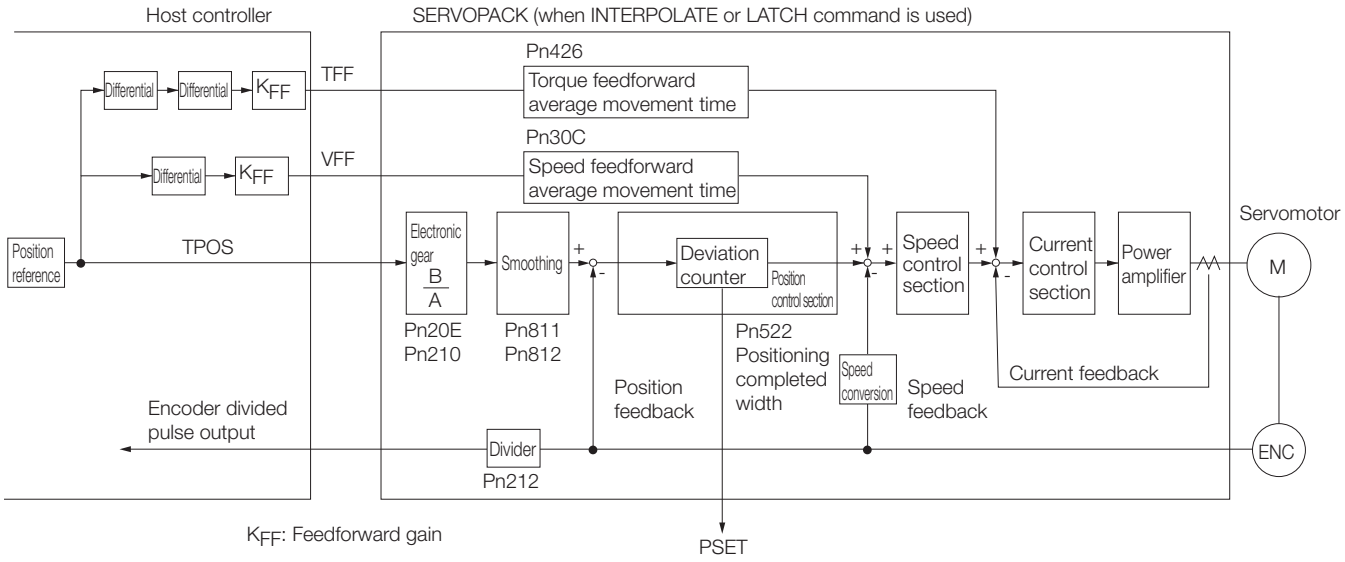
The following figures illustrate specifying torque feedforward in commands from the host controller when the SERVOPACK is performing speed control or position control.

- When SERVOPACK Performs Speed Control




$K_{FF}$: Feedforward gain

• When SERVOPACK Performs Position Control




## ■ Setting Parameters

This section describes the parameters that are related to the torque feedforward reference.

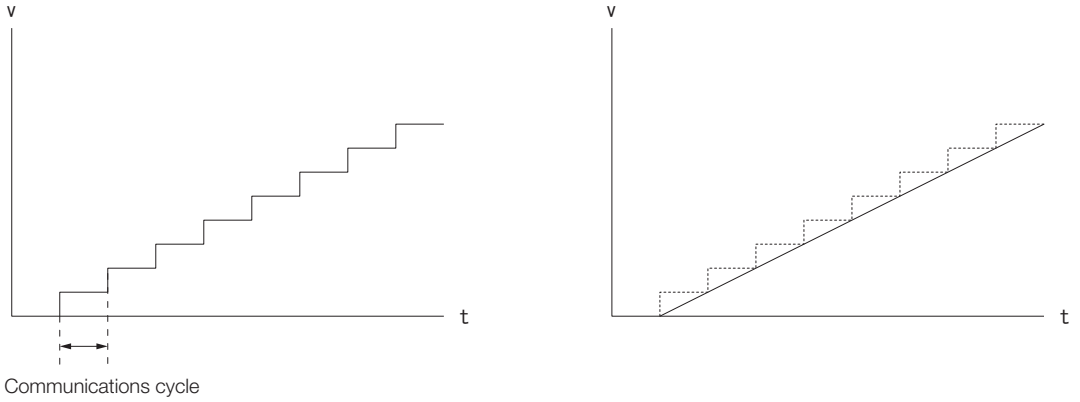
• Pn81F (Position Control Command TFF/TLIM Allocation)

You must set Pn81F (Position Control Command TFF/TLIM Allocation) to use the torque feedforward reference. (The torque limit is enabled for the default setting.)

| Parameter | Meaning | |
|---|---|---|
| Pn81F | Position Control Command TFF/TLIM Allocation | |
| | n.□□1□ | Enable allocation. (The operation for TFF/TLIM is set in Pn002.) |

• Pn426 (Torque Feedforward Average Movement Time)

If the communications cycle with the host controller is slow, the torque feedforward reference may be applied stepwise as shown on the left in the following figure.




You can set Pn426 (Torque Feedforward Average Movement Time) to a suitable value to create a smooth torque feedforward reference, as shown on the right in the above figure.

As a guideline, set Pn426 to the same value as the communications cycle.

| Pn426 | Torque Feedforward Average Movement Time | | | Speed | Position |
|---|---|---|---|---|---|
| | Setting Range | Setting Unit | Default Setting | When Enabled | Classification |
| | 0 to 5,100 | – | 0 | Immediately | Setup |

# Speed Feedforward Function

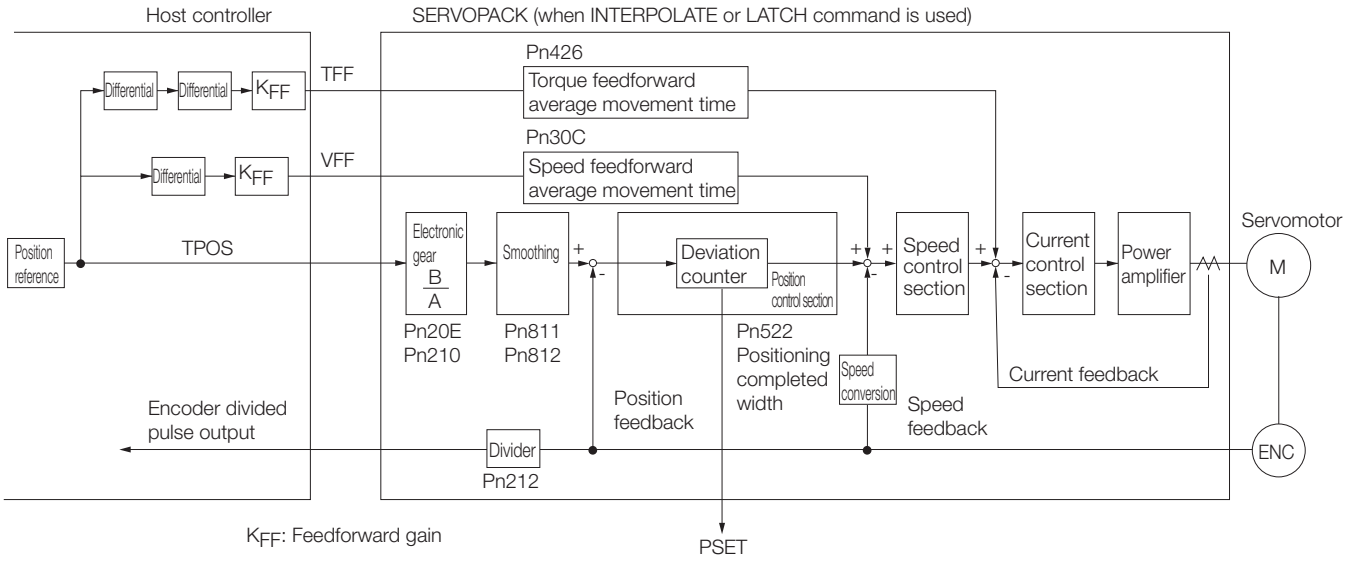
The speed feedforward function applies feedforward compensation to position control to shorten the positioning time. The speed feedforward reference is created from the differential of the position reference at the host controller. Speed feedforward is specified with VFF (speed feedforward) in the position control command.

## ■ Commands That Allow Speed Feedforward References

INTERPOLATE, LATCH

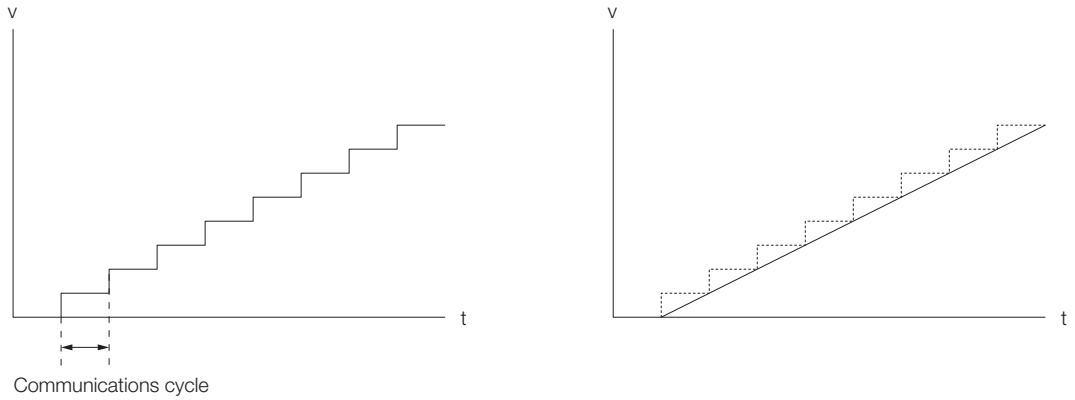
## ■ Relationship between the Host Controller and SERVOPACK

The following figure illustrates specifying speed feedforward in a command from the host controller when the SERVOPACK is performing speed control.




## ■ Pn30C (Speed Feedforward Average Movement Time)

If the communications cycle with the host controller is slow, the speed feedforward reference may be applied stepwise as shown on the left in the following figure.




You can set Pn30C (Speed Feedforward Average Movement Time) to a suitable value to create a smooth speed feedforward reference, as shown on the right in the above figure.

As a guideline, set Pn30C to the same value as the communications cycle.

| Pn30C | Speed Feedforward Average Movement Time | | | Position | |
|---|---|---|---|---|---|
| | Setting Range | Setting Unit | Default Setting | When Enabled | Classification |
| | 0 to 5,100 | – | 0 | Immediately | Setup |

# Speed Limiting Function During Torque Control

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

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

- Internal speed limit
- Speed limit by the torque control command TRQCTRL

Information 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 10,000 | 1 $min^{-1}$ | 10,000 |
| Pn480 | Speed Limit during Force Control (For linear servomotors) | 2 | 0 to 10,000 | 1 mm/s | 10,000 |

## ◆ Speed Limit by Torque Control Command TRQCTRL

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

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

| | Torque Control Option | |
|---|---|---|
| Pn002 = n.□□X□ | n.□□0□ | Ignore the setting of the speed limit for torque control (VLIM). |
| | n.□□1□ | Use the speed limit for torque control (VLIM) as the speed limit. |

# 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. Any changes must be enabled by turning the power supply OFF and ON again or by sending a CONFIG command.

| Parameter | | Name | | Setting Range | Factory Setting |
|---|---|---|---|---|---|
| No. | Digit | | | | |
| Pn81F | | Command Data Allocations | | 0000 hex to 0011 hex | 0000 hex |
| | 0 | Option Field Allocation | | 0 or 1 | 0 |
| | | 0 | Disable option field allocation. | | |
| | | 1 | Enable option field allocation. | | |
| Pn82A | | Option Field Allocations 1 | | 0000 hex to 1E1E hex | 1813 hex |
| | 0 | 0 to E | ACCFIL bit position | – | 3 |
| | 1 | 0 | Disable ACCFIL bit allocation. | – | 1 |
| | | 1 | Enable ACCFIL bit allocation. | | |
| | 2 | 0 to E | G_SEL bit position | – | 8 |
| | 3 | 0 | Disable G_SEL bit allocation. | – | 1 |
| | | 1 | Enable G_SEL bit allocation. | | |

Continued on next page.

Continued from previous page.

| Parameter No. | Digit | | Name | Setting Range | Factory Setting |
|---|---|---|---|---|---|
| Pn82B | | Option Field Allocations 2 | | 0000 hex to 1F1F hex | 1D1C hex |
| | 0 | 0 to F | V_PPI bit position | – | C |
| | 1 | 0 | Disable V_PPI bit allocation | – | 1 |
| | | 1 | Enable V_PPI bit allocation. | | |
| | 2 | 0 to F | P_PI_CLR bit position | – | D |
| | 3 | 0 | Disable P_PI_CLR bit allocation. | – | 1 |
| | | 1 | Enable P_PI_CLR bit allocation. | | |
| Pn82C | | Option Field Allocation 3 | | 0000 hex to 1F1F hex | 1F1E hex |
| | 0 | 0 to F | P_CL bit position | – | E |
| | 1 | 0 | Disable P_CL bit allocation. | – | 1 |
| | | 1 | Enable P_CL bit allocation. | | |
| | 2 | 0 to F | N_CL bit position | – | F |
| | 3 | 0 | Disable N_CL bit allocation. | – | 1 |
| | | 1 | Enable N_CL bit allocation. | | |
| Pn82D | | Option Field Allocation 4 | | 0000 hex to 1F1C hex | 0000 hex |
| | 0 | 0 to C | BANK_SEL1 bit position | – | 0 |
| | 1 | 0 | Disable BANK_SEL1 bit allocation. | – | 0 |
| | | 1 | Enable BANK_SEL1 bit allocation. | | |
| | 2 | 0 to F | LT_DISABLE bit position | – | 0 |
| | 3 | 0 | Disable LT_DISABLE bit allocation. | – | 0 |
| | | 1 | Enable LT_DISABLE bit allocation. | | |
| Pn82E | | Option Field Allocation 5 | | 0000 hex to 1D1F hex | 0000 hex |
| | 0 | 0 to F | Reserved | – | 0 |
| | 1 | 0 | Reserved | – | 0 |
| | | 1 | Reserved | | |
| | 2 | 0 to D | OUT_SIGNAL bit position | – | 0 |
| | 3 | 0 | Disable OUT_SIGNAL bit allocation. | – | 0 |
| | | 1 | Enable 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.

# 6.2.5 Position Data Latch Function Setting

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

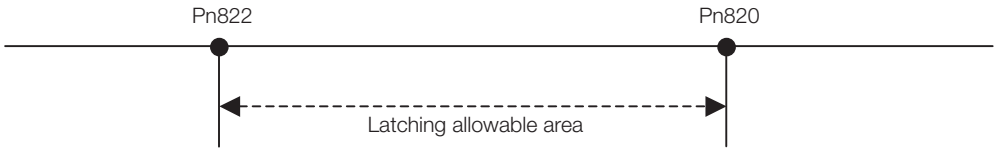
## Latching Allowable Area

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.

The latchable region is set with the following parameters.

| Parameter No. | Name | Data Size (byte) | Setting Range | Unit | Factory Setting |
|---|---|---|---|---|---|
| Pn820 | Forward Latching Area | 4 | -2,147,483,648 to 2,147,483,647 | 1 reference unit | 0 |
| Pn822 | Reverse Latching Area | 4 | -2,147,483,648 to 2,147,483,647 | 1 reference unit | 0 |

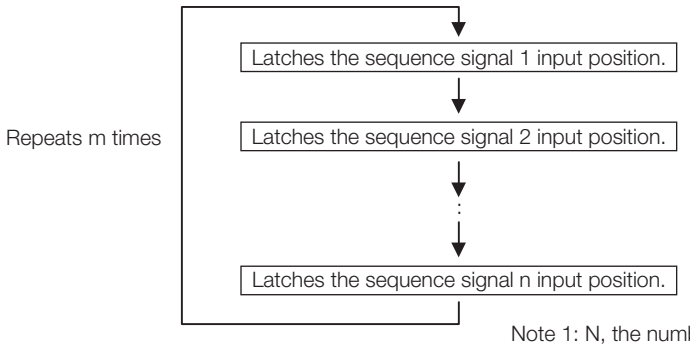
■ When Pn820 > Pn822




■ When Pn820 ≤ Pn822


## 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 in Pn850.
2: The signals for sequence signal n are selected with Pn852 and Pn853
3: M, the number of continuous latches is set in 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: Number of Latch Sequences n

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

Pn852: Latch Sequence 1 to 4 Settings

Pn853: Latch Sequence 5 to 8 Settings

Note: If the LTMOD_ON command is sent when Pn850 is set to 0 and LT_MOD is 1, an A.94E alarm (Data Setting Warning 5 (Latch Mode Error )) will occur and latching will not be started.

### ■ 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

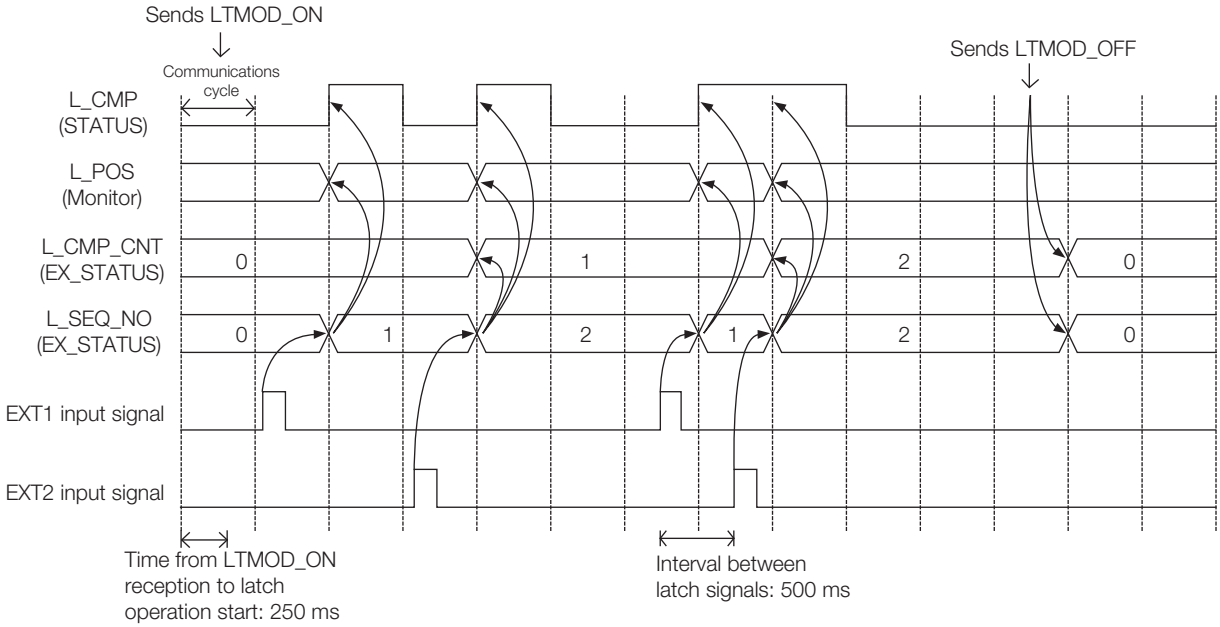
L_SEQ_NO (D8-D11): The latch sequence signal number (value n) at latch completion

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. (Parameter settings: Pn850 = 2, Pn851 = 2 or higher, Pn852 = 0021 hex, and Pn853 = any value)



## ■ Setting Parameters

| Parameter No. | Digit | Name | | | Data Size (byte) | Setting Range | Unit | Factory Setting |
|---|---|---|---|---|---|---|---|---|
| Pn850 | | Number of Latch Sequences | | | 2 | 0 to 8 | – | 0 |
| Pn851 | | Continuous Latch Sequence Count | | | 2 | 0 to 255 | – | 0 |
| Pn852 | | Latch Sequence 1 to 4 Settings | | | 2 | 0000 hex to 3333 hex | – | 0000 hex |
| | 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 5 to 8 SettingS | | | 2 | 0000 hex to 3333 hex | – | 0000 hex |
| | 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

- 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.
- 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.
- Use a subcommand to monitor completion status of continuous latch count, etc.
- If you change the settings of Pn850 to Pn853, do so while consecutive latching is stopped.

# 6.2.6 Settings for Acceleration/Deceleration Parameter High-speed Switching

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 *2.1.2 OPTION Field Specifications* on page 2-3

| 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 | Number of Parameter Banks | 2 | 0 to 16 | 0 |
| Pn901 | Number of Parameter Bank Members | 2 | 0 to 15 | 0 |
| Pn902 to Pn910 | Parameter Bank Member Definition | 2 | 0000 hex to 08FF hex | 0 |
| Pn920 to Pn95F * | Parameter Bank Data | 2 | 0000 hex to FFFF hex 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 | First Stage Linear Acceleration Constant | 2 | 1 to 65,535 | 10,000 reference units/s$^2$ | 100 |
| Pn80B | Second Stage Linear Acceleration Constant | 2 | 1 to 65,535 | 10,000 reference units/s$^2$ | 100 |
| Pn80C | Acceleration Constant Switching Speed | 2 | 0 to 65,535 | 100 reference units/s | 0 |
| Pn80D | First Stage Linear Deceleration Constant | 2 | 1 to 65,535 | 10,000 reference units/s$^2$ | 100 |
| Pn80E | Second Stage Linear Deceleration Constant | 2 | 1 to 65,535 | 10,000 reference units/s$^2$ | 100 |
| Pn80F | Deceleration Constant Switching Speed | 2 | 0 to 65,535 | 100 reference units/s | 0 |
| Pn834 | First Stage Linear Acceleration Constant 2 | 4 | 1 to 20,971,520 | 10,000 reference units/s$^2$ | 100 |

Continued on next page.

Continued from previous page.

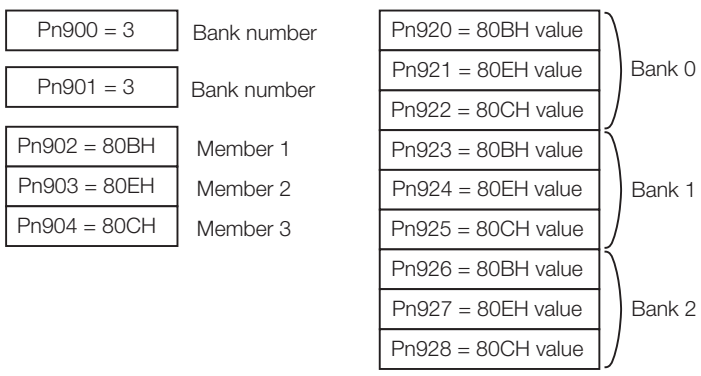
| Parameter No. | Name | Data Size (byte) | Setting Range | Unit | Factory Setting |
|---|---|---|---|---|---|
| Pn836 | Second Stage Linear Acceleration Constant 2 | 4 | 1 to 20,971,520 | 10,000 reference units/s$^2$ | 100 |
| Pn838 | Acceleration Constant Switching Speed 2 | 4 | 0 to 2,097,152,000 | 1 reference unit/s | 0 |
| Pn83A | First Stage Linear Deceleration Constant 2 | 4 | 1 to 20,971,520 | 10,000 reference units/s$^2$ | 100 |
| Pn83C | Second Stage Linear Deceleration Constant 2 | 4 | 1 to 20,971,520 | 10,000 reference units/s$^2$ | 100 |
| Pn83E | Deceleration Constant Switching Speed 2 | 4 | 0 to 2,097,152,000 | 1 reference unit/s | 0 |
| Pn810 | Exponential Acceleration/Deceleration Bias | 2 | 0 to 65,535 | 100 reference units/s | 0 |
| Pn811 | Exponential Acceleration/Deceleration Time Constant | 2 | 0 to 5,100 | 0.1 ms | 0 |
| Pn812 | Movement Average Time | 2 | 0 to 5,100 | 0.1 ms | 0 |

## ◆ Setting Procedure

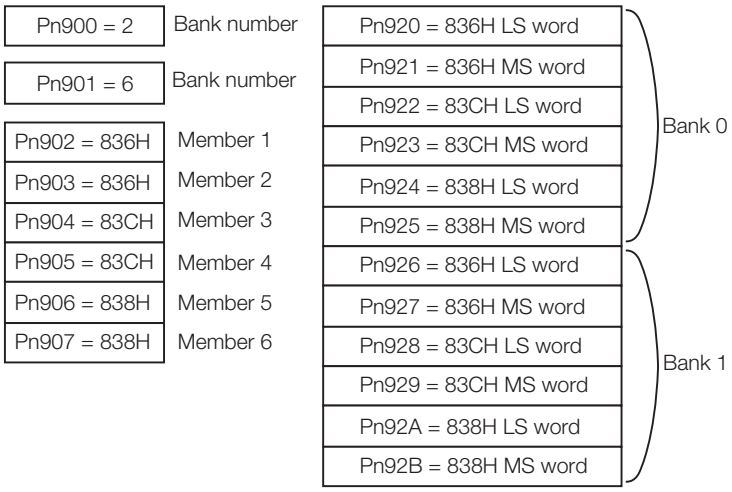
1. Set Pn900 (Number of Parameter Banks) to m.
2. Set Pn901 (Number of Parameter Bank Members) to n.
   Set Pn900 and Pn901 so that Pn900 × Pn901 ≤ 64.
3. Register bank member parameter numbers using parameters Pn902 to Pn910.
4. To enable the bank function, execute the CONFIG command or turn the power supply OFF and then ON again.
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, 2, and 3 are saved in the non-volatile memory, carry out STEP 5 only after power up.
However, if bank data is set in Pn920 to Pn95F and you turn the power supply OFF and ON again after setting Pn900 to Pn910 (banks enabled), operation will be performed with all bank data set to 0 or to 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.

Example Switching Three Banks with the Following Members: Pn80B, Pn80E, and Pn80C



Example Switching Two Banks with the Following Members: Pn836, Pn83C, and Pn838




## ■ Application Notes

- If Pn900 (Number of Parameter Banks) or Pn901 (Number of Parameter Bank Members) is set to 0, the bank function will be disabled.
- 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.
- 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.
- 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).
- In the following cases, an A.04A alarm (Parameter Setting Error 2) will occur when the power supply is turned ON or the 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).
- 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.
- Bank data that exceeds the setting range of the registered bank member parameter will be clamped to a value within the setting range.
- 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.
- 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.

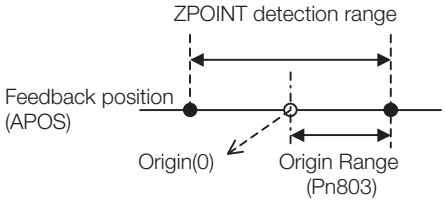
# 6.2.7 STATUS Field and Monitor Related Settings

## 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 | 1 reference unit | 10 |

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

■ When an incremental encoder is connected

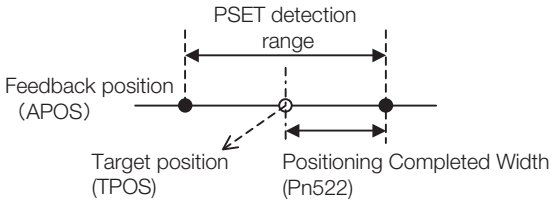
- The origin return operation by ZRET command is completed.
- The coordinate setting is completed after reference point setting (REFE = 1) by executing POS_SET command.

■ 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.

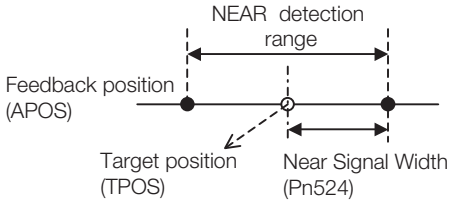



| Parameter No. | Name | Data Size (byte) | Setting Range | Unit | Factory Setting |
|---|---|---|---|---|---|
| Pn522 | Positioning Completed Width | 4 | 0 to 1,073,741,824 | 1 reference unit | 7 |

Information 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 1,073,741,824 | 1 reference unit | 7 |

Information 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 10,000 | 1 $min^{-1}$ | 20 |
| Pn581 | Zero Speed Level (For linear servomotors) | 2 | 1 to 5,000 | 1 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 Detection Signal Output Width (For rotational servomotors) | 2 | 0 to 100 | 1 $min^{-1}$ | 10 |
| Pn582 | Speed Coincidence Detection Signal Output Width (For linear servomotors) | 2 | 0 to 100 | 1 mm/s | 10 |

## I/O Monitor Field Signal Allocation

You can allocate CN1 connector input signals 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 | Do not map. | 0 |
| | | | 1 | Monitor the CN1-13 input terminal | |
| | | | 2 | Monitor the CN1-7 input terminal | |
| | | | 3 | Monitor the CN1-8 input terminal | |
| | | | 4 | Monitor the CN1-9 input terminal | |
| | | | 5 | Monitor the CN1-10 input terminal | |
| | | | 6 | Monitor the CN1-11 input terminal | |
| | | | 7 | Monitor the CN1-12 input terminal | |
| | 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 |

## 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 | | – |
| | 0000 hex | Motor speed [1000000 hex/overspeed detection speed] | – |
| | 0001 hex | Speed reference [1000000 hex/overspeed detection speed] | – |
| | 0002 hex | Torque [1000000 hex/maximum torque] | – |
| | 0003 hex | Position deviation (lower 32 bits) [reference units] | – |
| | 0004 hex | Position deviation (upper 32 bits) [reference units] | – |
| | 0005 hex | System reserved | – |
| | 0006 hex | System reserved | – |
| | 000A hex | Encoder count (lower 32 bits) [reference units] | – |
| | 000B hex | Encoder count (upper 32 bits) [reference units] | – |
| | 000C hex | FPG count (lower 32 bits) [reference units] | For fully-closed loop control |
| | 000D hex | FPG count (upper 32 bits) [reference units] | For fully-closed loop control |
| | 0010 hex | Un000: Motor speed [$min^{-1}$] | – |
| | 0011 hex | Un001: Speed Reference [$min^{-1}$] | – |
| | 0012 hex | Un002: Torque Reference [%] | – |
| | 0013 hex | Un003: Rotational Angle 1 [encoder pulses] | – |
| | 0014 hex | Un004: Rotational Angle 2 [deg] | – |
| | 0015 hex | Un005: Input Signal Monitor | – |
| | 0016 hex | Un006: Output Signal Monitor | – |
| | 0017 hex | Un007: Input Reference Speed [$min^{-1}$] | – |
| | 0018 hex | Un008: Position Deviation [reference units] | – |
| | 0019 hex | Un009: Accumulated Load Ratio [%] | – |
| | 001A hex | Un00A: Regenerative Load Ratio [%] | – |
| | 001B hex | Un00B: Dynamic Brake Resistor Power Consumption [%] | – |

Continued on next page.

Continued from previous page.

| Parameter No. | Name | | Remarks |
|---|---|---|---|
| Pn824 | 001C hex | Un00C: Input Reference Pulse Counter [reference units] | – |
| | 001D hex | Un00D: Feedback Pulse Counter [encoder pulses] | – |
| | 001E hex | Un00E: Fully-Closed Loop Feedback Pulse Counter [external encoder resolution] | For fully-closed loop control |
| | 0023 hex | Initial multiturn data [rev] | For rotational servomotors |
| | 0024 hex | Initial incremental data [pulses] | For rotational servomotors |
| | 0025 hex | Initial absolute position data (lower 32 bits) [pulses] | For linear servomotors |
| | 0026 hex | Initial absolute position data (upper 32 bits) [pulses] | For linear servomotors |
| | 0027 hex | Reserved parameter (Do not use.) | – |
| | 002A hex | Un032: Instantaneous Power | – |
| | 002B hex | Un033: Power Consumption | – |
| | 002C hex | Un034: Cumulative Power Consumption | – |
| | 0030 hex | Reference position in reference coordinate system after reference filter (upper 32 bits) | – |
| | 0031 hex | Reference position (upper 32 bits) | – |
| | 0032 hex | Position deviation (upper 32 bits) | – |
| | 0033 hex | Feedback position in machine coordinate system (upper 32 bits) | – |
| | 0034 hex | Latched feedback position in machine coordinate system (upper 32 bits) | – |
| | 0035 hex | Reference position in reference coordinate system before reference filter (upper 32 bits) | – |
| | 0036 hex | Reference position in reference coordinate system (upper 32 bits) | – |
| | 003A hex | Un025: SERVOPACK installation Environment Monitor | – |
| | 003B hex | Un026: Servomotor installation Environment Monitor | – |
| | 0040 hex | Built-in fan consumed life ratio | – |
| | 0041 hex | Capacitor consumed life ratio | – |
| | 0042 hex | Surge prevention circuit consumed life ratio | – |
| | 0043 hex | Dynamic brake circuit consumed life ratio | – |
| | 0080 hex | Previous value of latched feedback position (LPOS) [encoder pulses] | – |
| | Others | Reserved parameters (Do not use.) | – |
| Pn825 | Option Monitor 2 Selection (Same as for Pn824) | | – |

# Detecting Alarms/ Warnings Related to Communications or Commands

7

This chapter describes the alarms and warnings that may occur in MECHATROLINK-II communications. Refer to your SERVOPACK manual for details on alarms and alarm codes that are not given in this manual.


7.1 List of Alarms . . . . . 7-2

7.2 List of Warnings . . . . . 7-5

7.3 Monitoring Communication Data on Occurrence of an Alarm or Warning . 7-7

# 7.1 List of Alarms

The following table shows alarms that are related to communications or commands and that may occur in MECHATROLINK-II communications.

If an error is found in the command or data that a SERVOPACK has received, the SERVOPACK returns the corresponding alarm number.

At the same time, the alarm number is displayed on the SERVOPACK.

## ◆ Servomotor Stopping Method

If an alarm occurs, the servomotor can be stopped by doing either of the following operations.

Gr.1: If an alarm occurs, the Servomotor is stopped according to the setting of Pn001 = n.□□□X. Pn001.0 is factory-set to stop the servomotor by applying the DB.

Gr.2: If an alarm occurs, the Servomotor is stopped according to the setting of Pn00B = n.□□X□. Pn00B.1 is factory-set to stop the servomotor by setting the speed reference to "0." The servomotor under torque control will always use the Gr.1 method to stop. If you set Pn00B to n.□□1□, the same stopping method as for Gr.1 is used. When coordinating a number of servomotors, use this stopping method to prevent machine damage that may result due to differences in the stop method.

## ◆ Alarm Reset

Available:Removing the cause of alarm and then executing the alarm reset can clear the alarm.
N/A:Executing the alarm reset cannot clear the alarm.

| Alarm Number: Alarm Name (Alarm Description) | Cause | Investigative Actions | Corrective Actions | SERVOPACK Side | |
|---|---|---|---|---|---|
| | | | | Servomotor Stopping Method | Alarm Reset |
| A.b6A: MECHATROLINK Communications ASIC Error 1 | SERVOPACK MECHATROLINK communication section fault. | – | Replace the SERVOPACK. | Gr.1 | N/A |
| A.E02: MECHATROLINK Internal Synchronization Error 1 | MECHATROLINK-II transmission cycle fluctuated. | – | Remove the cause of transmission cycle fluctuation at host controller. | Gr.1 | Available |
| | A SERVOPACK fault occurred. | – | Turn the power supply OFF and then ON again. If the alarm still occurs, the SERVOPACK may be faulty. Replace the SERVOPACK. | | |
| A.E40: MECHATROLINK Transmission Cycle Setting Error | Setting of MECHATROLINK-II transmission cycle is out of specifications range. | Check the MECHATROLINK-II transmission cycle setting. | Set the transmission cycle to the proper value. | Gr.2 | Available |
| A.E50: MECHATROLINK Synchronization Error | WDT data of host controller was not updated correctly. | Check the WDT data updating for the host controller. | Update the WDT data at the host controller correctly. | Gr.2 | Available |
| | A SERVOPACK fault occurred. | – | Turn the power supply OFF and then ON again. If the alarm still occurs, the SERVOPACK may be faulty. Replace the SERVOPACK. | | |

Continued on next page.

Continued from previous page.

| Alarm Number: Alarm Name (Alarm Description) | Cause | Investigative Actions | Corrective Actions | SERVOPACK Side | |
|---|---|---|---|---|---|
| | | | | Servomotor Stopping Method | Alarm Reset |
| A.E51: MECHATROLINK Synchronization Failed | WDT data of host controller was not updated correctly at the synchronization communications start, and synchronization communications could not start. | Check the WDT data updating for the host controller. | Update the WDT data at the host controller correctly. | Gr.2 | Available |
| | A SERVOPACK fault occurred. | – | Turn the power supply OFF and then ON again. If the alarm still occurs, the SERVOPACK may be faulty. Replace the SERVOPACK. | | |
| A.E60: Reception Error in MECHATROLINK Communications | MECHATROLINK-II wiring is incorrect. | Check the MECHATROLINK-II wirings. | Correct the MECHATROLINK-II wiring. Connect the terminator correctly. | Gr.2 | Available |
| | MECHATROLINK-II data reception error occurred due to noise interference. | – | Take measures against noise. Check the MECHATROLINK-II communications cable and FG wiring and take measures such as adding ferrite core on the MECHATROLINK-II communications cable. | | |
| | A SERVOPACK fault occurred. | – | Turn the power supply OFF and then ON again. If the alarm still occurs, the SERVOPACK may be faulty. Replace the SERVOPACK. | | |
| A.E61: Synchronization Interval Error in MECHATROLINK Transmission Cycle | MECHATROLINK-II transmission cycle fluctuated. | Check the MECHATROLINK-II transmission cycle setting. | Remove the cause of transmission cycle fluctuation at host controller. | Gr.2 | Available |
| | A SERVOPACK fault occurred. | – | Turn the power supply OFF and then ON again. If the alarm still occurs, the SERVOPACK may be faulty. Replace the SERVOPACK. | | |
| A.EA2: DRV Alarm 2 (SERVOPACK WDC Error) | MECHATROLINK-II transmission cycle fluctuated. | Check the MECHATROLINK-II transmission cycle setting. | Remove the cause of transmission cycle fluctuation at host controller. | Gr.2 | Available |
| | A SERVOPACK fault occurred. | – | Turn the power supply OFF and then ON again. If the alarm still occurs, the SERVOPACK may be faulty. Replace the SERVOPACK. | | |

Continued on next page.

Continued from previous page.

| Alarm Number: Alarm Name (Alarm Description) | Cause | Investigative Actions | Corrective Actions | SERVOPACK Side | |
|---|---|---|---|---|---|
| | | | | Servomotor Stopping Method | Alarm Reset |
| A.ED1: Command Execution Timeout | A timeout error occurred when using an MECHATROLINK command. | Check the motor status when the command is executed. | Execute the SV_ON or SENS_ON command only when the motor is not running. | Gr.2 | Available |
| | | Check the external encoder status when the command is executed. | Execute the SENS_ON command only when an external scale is connected. | | |

# 7.2 List of Warnings

The following table shows warnings that are related to communications or commands and that may occur in MECHATROLINK-II communications.

If an error is found in the command or data that a SERVOPACK has received, the SERVOPACK returns the corresponding warning number.

At the same time, the warning number is displayed on the SERVOPACK.

| Warning Number: Warning Name (Warning Description) | Cause | Investigative Actions | Corrective Actions |
|---|---|---|---|
| A.94A<br>Data Setting Warning 1<br>(Parameter Number Error) | Disabled parameter number was used. | Determine the command that caused the alarm.<br>Refer to the following section for the determination method.<br>☞ *7.3 Monitoring Communication Data on Occurrence of an Alarm or Warning* on page 7-7 | Use the correct parameter number. |
| A.94B<br>Data Setting Warning 2<br>(Out of Range) | Attempted to send values outside the range to the command data. | Determine the command that caused the alarm.<br>Refer to the following section for the determination method.<br>☞ *7.3 Monitoring Communication Data on Occurrence of an Alarm or Warning* on page 7-7 | Set the value of the parameter within the allowable range. |
| A.94C<br>Data Setting Warning 3<br>(Calculation Error) | Calculation result of set value is incorrect. | Determine the command that caused the alarm.<br>Refer to the following section for the determination method.<br>☞ *7.3 Monitoring Communication Data on Occurrence of an Alarm or Warning* on page 7-7 | Set the value of the parameter within the allowable range. |
| A.94D<br>Data Setting Warning 4<br>(Parameter Size) | Parameter size set in command is incorrect. | Determine the command that caused the alarm.<br>Refer to the following section for the determination method.<br>☞ *7.3 Monitoring Communication Data on Occurrence of an Alarm or Warning* on page 7-7 | Use the correct parameter size. |
| A.94E<br>Data Setting Warning 5<br>(Latch Mode Error) | Latch mode error is detected. | Determine the command that caused the alarm.<br>Refer to the following section for the determination method.<br>☞ *7.3 Monitoring Communication Data on Occurrence of an Alarm or Warning* on page 7-7 | Change the setting value of Pn850 or the LT_MOD data for the LTMOD_ON command sent by the host controller to the proper value. |
| A.95A<br>Command Warning 1<br>(Unsatisfied Command Conditions) | Command sending condition is not satisfied. | Determine the command that caused the alarm.<br>Refer to the following section for the determination method.<br>☞ *7.3 Monitoring Communication Data on Occurrence of an Alarm or Warning* on page 7-7 | Send a command after command sending condition is satisfied. |
| A.95B<br>Command Warning 2<br>(Unsupported Command) | SERVOPACK received unsupported command. | Determine the command that caused the alarm.<br>Refer to the following section for the determination method.<br>☞ *7.3 Monitoring Communication Data on Occurrence of an Alarm or Warning* on page 7-7 | Do not sent an unsupported command. |

Continued on next page.

Continued from previous page.

| Warning Number: Warning Name (Warning Description) | Cause | Investigative Actions | Corrective Actions |
|---|---|---|---|
| A.95D Command Warning 4 (Command Interference) | Command sending condition for latch-related commands is not satisfied. | Determine the command that caused the alarm. Refer to the following section for the determination method. ☞ *7.3 Monitoring Communication Data on Occurrence of an Alarm or Warning* on page 7-7 | Send a command after command sending condition is satisfied. |
| A.95E Command Warning 5 (Subcommand Not Possible) | Subcommand sending condition is not satisfied. | Determine the command that caused the alarm. Refer to the following section for the determination method. ☞ *7.3 Monitoring Communication Data on Occurrence of an Alarm or Warning* on page 7-7 | Send a command after command sending condition is satisfied. |
| A.95F Command Warning 6 (Undefined Command) | Undefined command was sent. | Determine the command that caused the alarm. Refer to the following section for the determination method. ☞ *7.3 Monitoring Communication Data on Occurrence of an Alarm or Warning* on page 7-7 | Do not use an undefined command. |
| A.960 MECHATROLINK Communications Warning | MECHATROLINK-II wiring is incorrect. | Confirm the wiring. | Correct the MECHATROLINK-II wiring. Or, connect a terminal to the terminal station. |
| | MECHATROLINK-II data reception error occurred due to noise interference. | Confirm the installation conditions. | Take measures against noise. Check the MECHATROLINK-II communications cable and FG wiring and take measures such as adding ferrite core on the MECHATROLINK-II communications cable. |
| | A SERVOPACK fault occurred. | – | A fault occurred in the SERVOPACK. Replace the SERVOPACK. |

Note: Use Pn800 = n.□X□□ to control warning detection.

# 7.3 Monitoring Communication Data on Occurrence of an Alarm or Warning

You can monitor the command data that is received when an alarm or warning occurs, such as a data setting warning (A.94□) or a command warning (A.95□) by using the following parameters. The following is an example of the data when an alarm or warning has occurred in the normal state.

Command Data during Alarms and Warnings: PPn890 to Pn89E

Response Data during Alarms and Warnings: Pn8A0 to Pn8AE

| Command Byte Sequence | Command Data Storage When an Alarm or Warning Occurs | |
|---|---|---|
| | CMD | RSP |
| 1 | Pn890 = n.□□□□□□XX | Pn8A0 = n.□□□□□□XX |
| 2 | Pn890 = n.□□□□XX□□ | Pn8A0 = n.□□□□XX□□ |
| 3 | Pn890 = n.□□XX□□□□ | Pn8A0 = n.□□XX□□□□ |
| 4 | Pn890 = n.XX□□□□□□ | Pn8A0 = n.XX□□□□□□ |
| 5 to 8 | Pn892 | Pn8A2 |
| 9 to 12 | Pn894 | Pn8A4 |
| 13 to 16 | Pn896 | Pn8A6 |
| 17 to 20 | Pn898 | Pn8A8 |
| 21 to 24 | Pn89A | Pn8AA |
| 25 to 28 | Pn89C | Pn8AC |
| 29 to 32 | Pn89E | Pn8AE |

Note: Data is stored in little endian byte order and displayed in the hexadecimal.

# Appendix

8

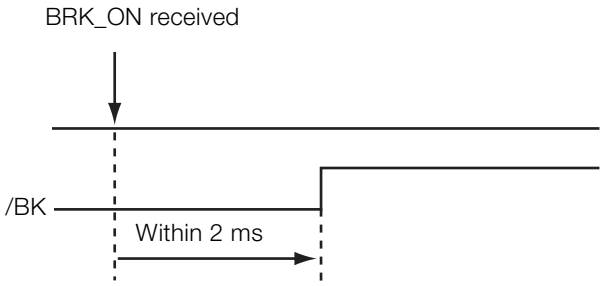
8.1 Brake Control Commands . . . . . 8-2
8.2 General-purpose Servo Control Command 8-6

# 8.1 Brake Control Commands

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

## BRK_ON (Apply Brake) Command: 21 Hex

The specifications of the BRK_ON 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>21 hex</td><td>21 hex</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) off and apply brake.<br>• This command is enabled only while the servo is OFF.<br>• This command is enabled while Pn50F is not set to n.□0□□.<br>• Brake signal output timing<br>  <br></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>

## Combinations of BRK_ON (21 Hex) with Subcommands

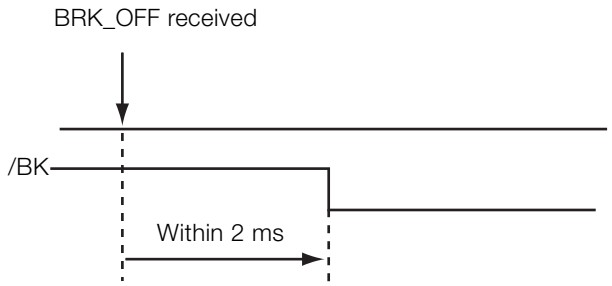
The following table shows which subcommands can be combined with the BRK_ON command.

| 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

## BRK_OFF (Release Brake) Command: 22 Hex

The specifications of the BRK_OFF command 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>22 hex</td><td>22 hex</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.<br>• This command is enabled while Pn50F is not set to n.□0□□.<br>• Brake signal output timing<br>  <br></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.

## Combinations of BRK_OFF (22 Hex) with Subcommands

The following table shows which subcommands can be combined with the 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

## Operation for MECHATROLINK Communications Errors

If any of the MECHATROLINK communications errors listed in the following table occurs while the brake signal is being controlled by the BRK_OFF or BRK_ON command, the brake signal will be output according to the setting of Pn884 = n.□□□X (MECHATROLINK Communications Error Holding Brake Signal Setting). If any other alarm occurs, the status that is set by the BRK_ON or BRK_OFF command will be maintained regardless of the setting of Pn884 = n.□□□X.

Note: Software version 0029 or higher is required to use this function. You can confirm the software version with Fn012.
Refer to the following manual for details.
📖 *Σ-V Series User's Manual Design and Maintenance Rotational Motor/MECHATROLINK-II Communications Reference* (Manual No. SIEP S800000 46).

| Alarm Number | Alarm Name |
|---|---|
| A.E50 | MECHATROLINK Synchronization Error |
| A.E60 | Reception Error in MECHATROLINK Communications |
| A.E61 | Synchronization Interval Error in MECHATROLINK Transmission Cycle |

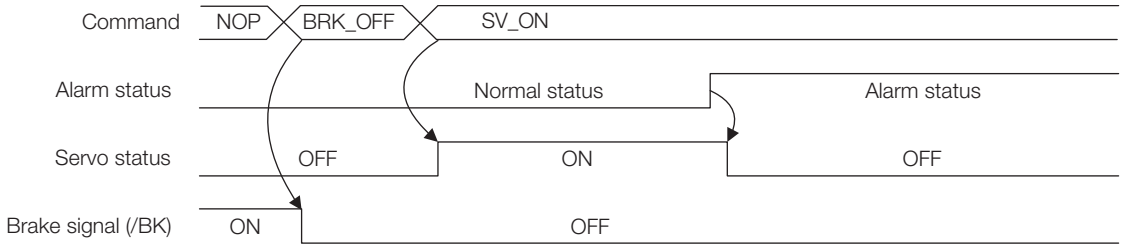
### ◆ Parameter Setting

Set the operation for a MECHATROLINK communications error using the following parameter.

| Parameter | | Meaning | When Enabled | Classification |
|---|---|---|---|---|
| Pn884 | n.□□□0 [Factory setting] | Maintain the status set by the BRK_ON or BRK_OFF command when a MECHATROLINK communications error occurs. | Immediately | Setup |
| | n.□□□1 | Apply the holding brake when a MECHATROLINK communications error occurs. | | |

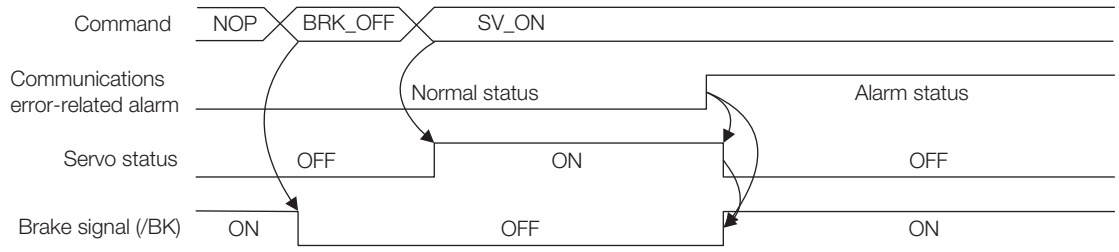
### ◆ Brake Signal Timing Charts for MECHATROLINK Communications Error Operation Settings

■ When Pn884 = n.□□□X Is Set to 0 and for Software Version 0028 or Lower

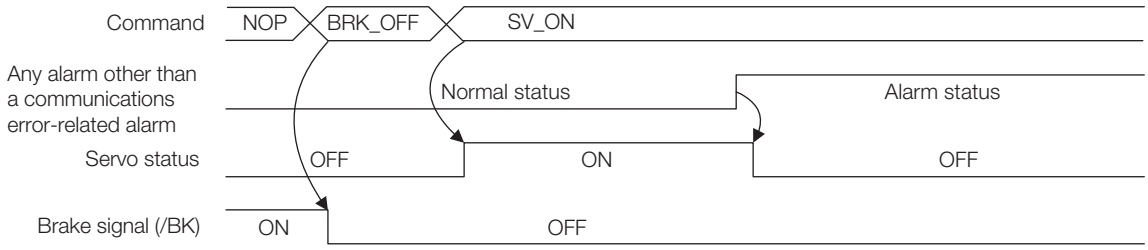



■ When Pn884 = n.□□□X Is Set to 1

- The following timing chart applies when a MECHATROLINK communications error-related alarm occurs.



- The following timing chart applies when any alarm other than a MECHATROLINK communications error-related alarm occurs.



# 8.2 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>3F hex</td><td>3F hex</td><td>Phases in which the command can be executed</td><td>Phase 2 and 3</td><td>Synchroniza-tion classifica-tion</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="15">• This command is compatible with MECHATROLINK versions before Ver 1.0. It is used to perform the general-purpose servo control.<br>• Latch Processing<br>Supported.<br>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.<br>Perform latch processing again after setting SET_L to 0.<br>The latch signal cannot be changed while SET_L = 1.<br>• Motion<br>Any of the motions selected for Motion Selection is executed.<br>• Sequence Signals<br>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/<br>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">Subcom-mand area</td><td rowspan="13">Subcom-mand 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<br>Select motion | | | RESERVE 0 | SET_L<br>Latch com-mand | L_SGN<br>Select latch signal | |

Select Motion (MOTION)

| D6 | D5 | D4 | Motion |
|---|---|---|---|
| 0 | 0 | 0 | HOLD |
| 0 | 0 | 1 | INTERPOLATE |
| 0 | 1 | 0 | FEED |
| 0 | 1 | 1 | POSING |

• During phase 1, an A.95 alarm (Command Warning 1) will occur for POSING and FEED, and the command will be ignored.
• For INTERPOLATED, in all other phases except phase 3, an A.95A alarm (Command Warning 1) will occur and the command will be ignored.

### ■ 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<br>Alarm clear | SEN<br>Sensor ON | BRK<br>Brake ON | SON<br>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.

MANUAL NO. SIEP S800001 30A

Published in Japan April 2014 14-4

Date of publication

Date of original publication

| Date of Publication | Rev. No. | Section | Revised Contents |
|---|---|---|---|
| April 2014 | – | – | First edition |

Σ-7-Series AC Servo Drive

# MECHATROLINK-II Communications Command Manual


**IRUMA BUSINESS CENTER (SOLUTION CENTER)**
480, Kamifujisawa, Iruma, Saitama 358-8555, Japan
Phone 81-4-2962-5151 Fax 81-4-2962-6138
http://www.yaskawa.co.jp

**YASKAWA AMERICA, INC.**
2121 Norman Drive South, Waukegan, IL 60085, U.S.A.
Phone 1-800-YASKAWA (927-5292) or 1-847-887-7000 Fax 1-847-887-7310
http://www.yaskawa.com

**YASKAWA ELÉTRICO DO BRASIL LTDA.**
Avenida Piraporinha 777, Diadema, São Paulo, 09950-000, Brasil
Phone 55-11-3585-1100 Fax 55-11-3585-1187
http://www.yaskawa.com.br

**YASKAWA EUROPE GmbH**
Hauptstraβe 185, Eschborn 65760, Germany
Phone 49-6196-569-300 Fax 49-6196-569-398
http://www.yaskawa.eu.com

**YASKAWA ELECTRIC KOREA CORPORATION**
9F, Kyobo Securities Bldg. 26-4, Yeouido-dong, Yeongdeungpo-gu, Seoul, 150-737, Korea
Phone 82-2-784-7844 Fax 82-2-784-8495
http://www.yaskawa.co.kr

**YASKAWA ELECTRIC (SINGAPORE) PTE. LTD.**
151 Lorong Chuan, #04-02A, New Tech Park 556741, Singapore
Phone 65-6282-3003 Fax 65-6289-3003
http://www.yaskawa.com.sg

**YASKAWA ELECTRIC (CHINA) CO., LTD.**
12F, Carlton Bld., No.21 HuangHe Road, HuangPu District, Shanghai 200003, China
Phone 86-21-5385-2200 Fax 86-21-5385-3299
http://www.yaskawa.com.cn

**YASKAWA ELECTRIC (CHINA) CO., LTD. BEIJING OFFICE**
Room 1011, Tower W3 Oriental Plaza, No.1 East Chang An Ave.,
Dong Cheng District, Beijing 100738, China
Phone 86-10-8518-4086 Fax 86-10-8518-4082

**YASKAWA ELECTRIC TAIWAN CORPORATION**
9F, 16, Nanking E. Rd., Sec. 3, Taipei 104, Taiwan
Phone 886-2-2502-5003 Fax 886-2-2505-1280



YASKAWA ELECTRIC CORPORATION





MANUAL NO. SIEP S800001 30A

Published in Japan April 2014 14-4
13-6-9
Original instructions