MECHATROLINK

Controller Applicable for MECHATROLINK-III

Instruction Manual Fourth Edition

ACON-CB/CGB
DCON-CB/CGB
PCON-CB/CGB/CFB/CGFB
SCON-CA/CB/CGB
MCON-C/CG

IAI America, Inc.

Please Read Before Use

Thank you for purchasing our product.

This Instruction Manual explains the handling methods, structure and maintenance of this product, among others, providing the information you need to know to use the product safely.

Before using the product, be sure to read this manual and fully understand the contents explained herein to ensure safe use of the product.
The DVD that comes with the product contains Instruction manuals for IAI products.
When using the product, refer to the necessary portions of the applicable instruction manual by printing them out or displaying them on a PC.

After reading the Instruction Manual, keep it in a convenient place so that whoever is handling this product can reference it quickly when necessary.

[Important]

- This Instruction Manual is original.
- This product is not to be used for any other purpose from what is noted in this Instruction Manual. IAI shall not be liable whatsoever for any loss or damage arising from the result of using the product for any other purpose from what is noted in the manual.
- The information contained in this Instruction Manual is subject to change without notice for the purpose of production improvement.
- If you have any question or finding regarding the information contained in this Instruction Manual, contact our customer center or our sales office near you.
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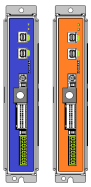
Construction of Instruction Manual for Each Controller Model and This Manual

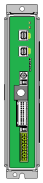
ACON-CB/CGB DCON-CB/CGB



●Operation Pattern
・Motion Control Operation — MECHATROLINK– III (This manual) ME0317

◎Basic Specifications and Function — ACON-CB, DCON-CB ME0343

PCON-CB/CGB PCON-CFB/CGFB



●Operation Pattern
・Motion Control Operation — MECHATROLINK–III (This manual) ME0317

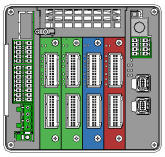
◎Basic Specifications and Function — PCON-CB/CFB ME0342

SCON-CB/CGB SCON-CA

●Operation Pattern
•Motion Control Operation — MECHATROLINK–III (This manual) ME0317

◎Basic Specifications and Function — SCON-CB ME0342; SCON-CA ME0243

MCON-C/CG



●Operation Pattern
•Motion Control Operation — MECHATROLINK–III (This manual) ME0317

◎Basic Specifications and Function — MCON-C/CG ME0341

Teaching Tool

•PC Software — PC Software ME0155

•Teaching Pendant
(i) TB-01 — Touch Panel Teaching ME0324
(ii) TB-02 — Touch Panel Teaching ME0355

Chapter of Contents

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Safety Guide

"Safety Guide" has been written to use the machine safely and so prevent personal injury or property damage beforehand. Make sure to read it 1before the operation of this product.

Safety Precautions for Our Products

The common safety precautions for the use of any of our robots in each operation.

No.	Operation Description	Description
1	Model Selection	● This product has not been planned and designed for the application where high level of safety is required, so the guarantee of the protection of human life is impossible. Accordingly, do not use it in any of the following applications. 1) Medical equipment used to maintain, control or otherwise affect human life or physical health. 2) Mechanisms and machinery designed for the purpose of moving or transporting people (For vehicle, railway facility or air navigation facility) 3) Important safety parts of machinery (Safety device, etc.) ● Do not use the product outside the specifications. Failure to do so may considerably shorten the life of the product. ● Do not use it in any of the following environments. 1) Location where there is any inflammable gas, inflammable object or explosive 2) Place with potential exposure to radiation 3) Location with the ambient temperature or relative humidity exceeding the specification range 4) Location where radiant heat is added from direct sunlight or other large heat source 5) Location where condensation occurs due to abrupt temperature changes 6) Location where there is any corrosive gas (sulfuric acid or hydrochloric acid) 7) Location exposed to significant amount of dust, salt or iron powder 8) Location subject to direct vibration or impact ● For an actuator used in vertical orientation, select a model which is equipped with a brake. If selecting a model with no brake, the moving part may drop when the power is turned OFF and may cause an accident such as an injury or damage on the work piece.

No.	Operation Description	Description
2	Transportation	● When carrying a heavy object, do the work with two or more persons or utilize equipment such as crane. ● When the work is carried out with 2 or more persons, make it clear who is to be the leader and who to be the follower(s) and communicate well with each other to ensure the safety of the workers. ● When in transportation, consider well about the positions to hold, weight and weight balance and pay special attention to the carried object so it would not get hit or dropped. ● Transport it using an appropriate transportation measure. The actuators available for transportation with a crane have eyebolts attached or there are tapped holes to attach bolts. Follow the instructions in the Instruction manual for each model. ● Do not step or sit on the package. ● Do not put any heavy thing that can deform the package, on it. ● When using a crane capable of 1t or more of weight, have an operator who has qualifications for crane operation and sling work. ● When using a crane or equivalent equipments, make sure not to hang a load that weighs more than the equipment's capability limit. ● Use a hook that is suitable for the load. Consider the safety factor of the hook in such factors as shear strength. ● Do not get on the load that is hung on a crane. ● Do not leave a load hung up with a crane. ● Do not stand under the load that is hung up with a crane.
3	Storage and Preservation	● The storage and preservation environment conforms to the installation environment. However, especially give consideration to the prevention of condensation. ● Store the products with a consideration not to fall them over or drop due to an act of God such as earthquake.
4	Installation and Start	(1) Installation of Robot Main Body and Controller, etc. ● Make sure to securely hold and fix the product (including the work part). A fall, drop or abnormal motion of the product may cause a damage or injury. Also, be equipped for a fall-over or drop due to an act of God such as earthquake. ● Do not get on or put anything on the product. Failure to do so may cause an accidental fall, injury or damage to the product due to a drop of anything, malfunction of the product, performance degradation, or shortening of its life. ● When using the product in any of the places specified below, provide a sufficient shield. 1) Location where electric noise is generated 2) Location where high electrical or magnetic field is present 3) Location with the mains or power lines passing nearby 4) Location where the product may come in contact with water, oil or chemical droplets

No.	Operation Description	Description
4	Installation and Start	(2) Cable Wiring ● Use our company's genuine cables for connecting between the actuator and controller, and for the teaching tool. ● Do not scratch on the cable. Do not bend it forcibly. Do not pull it. Do not coil it around. Do not insert it. Do not put any heavy thing on it. Failure to do so may cause a fire, electric shock or malfunction due to leakage or continuity error. ● Perform the wiring for the product, after turning OFF the power to the unit, so that there is no wiring error. ● When the direct current power (+24V) is connected, take the great care of the directions of positive and negative poles. If the connection direction is not correct, it might cause a fire, product breakdown or malfunction. ● Connect the cable connector securely so that there is no disconnection or looseness. Failure to do so may cause a fire, electric shock or malfunction of the product. ● Never cut and/or reconnect the cables supplied with the product for the purpose of extending or shortening the cable length. Failure to do so may cause the product to malfunction or cause fire.
		(3) Grounding ● The grounding operation should be performed to prevent an electric shock or electrostatic charge, enhance the noise-resistance ability and control the unnecessary electromagnetic radiation. ● For the ground terminal on the AC power cable of the controller and the grounding plate in the control panel, make sure to use a twisted pair cable with wire thickness 0.5mm^2 (AWG20 or equivalent) or more for grounding work. For security grounding, it is necessary to select an appropriate wire thickness suitable for the load. Perform wiring that satisfies the specifications (electrical equipment technical standards). ● Perform Class D Grounding (former Class 3 Grounding with ground resistance 100Ω or below).

No.	Operation Description	Description
4	Installation and Start	(4) Safety Measures ● When the work is carried out with 2 or more persons, make it clear who is to be the leader and who to be the follower(s) and communicate well with each other to ensure the safety of the workers. ● When the product is under operation or in the ready mode, take the safety measures (such as the installation of safety and protection fence) so that nobody can enter the area within the robot's movable range. When the robot under operation is touched, it may result in death or serious injury. ● Make sure to install the emergency stop circuit so that the unit can be stopped immediately in an emergency during the unit operation. ● Take the safety measure not to start up the unit only with the power turning ON. Failure to do so may start up the machine suddenly and cause an injury or damage to the product. ● Take the safety measure not to start up the machine only with the emergency stop cancellation or recovery after the power failure. Failure to do so may result in an electric shock or injury due to unexpected power input. ● When the installation or adjustment operation is to be performed, give clear warnings such as "Under Operation; Do not turn ON the power!" etc. Sudden power input may cause an electric shock or injury. ● Take the measure so that the work part is not dropped in power failure or emergency stop. ● Wear protection gloves, goggle or safety shoes, as necessary, to secure safety. ● Do not insert a finger or object in the openings in the product. Failure to do so may cause an injury, electric shock, damage to the product or fire. ● When releasing the brake on a vertically oriented actuator, exercise precaution not to pinch your hand or damage the work parts with the actuator dropped by gravity.
5	Teaching	● When the work is carried out with 2 or more persons, make it clear who is to be the leader and who to be the follower(s) and communicate well with each other to ensure the safety of the workers. ● Perform the teaching operation from outside the safety protection fence, if possible. In the case that the operation is to be performed unavoidably inside the safety protection fence, prepare the "Stipulations for the Operation" and make sure that all the workers acknowledge and understand them well. ● When the operation is to be performed inside the safety protection fence, the worker should have an emergency stop switch at hand with him so that the unit can be stopped any time in an emergency. ● When the operation is to be performed inside the safety protection fence, in addition to the workers, arrange a watchman so that the machine can be stopped any time in an emergency. Also, keep watch on the operation so that any third person can not operate the switches carelessly. ● Place a sign "Under Operation" at the position easy to see. ● When releasing the brake on a vertically oriented actuator, exercise precaution not to pinch your hand or damage the work parts with the actuator dropped by gravity. * Safety protection Fence : In the case that there is no safety protection fence, the movable range should be indicated.

No.	Operation Description	Description
6	Trial Operation	● When the work is carried out with 2 or more persons, make it clear who is to be the leader and who to be the follower(s) and communicate well with each other to ensure the safety of the workers. ● After the teaching or programming operation, perform the check operation one step by one step and then shift to the automatic operation. ● When the check operation is to be performed inside the safety protection fence, perform the check operation using the previously specified work procedure like the teaching operation. ● Make sure to perform the programmed operation check at the safety speed. Failure to do so may result in an accident due to unexpected motion caused by a program error, etc. ● Do not touch the terminal block or any of the various setting switches in the power ON mode. Failure to do so may result in an electric shock or malfunction.
7	Automatic Operation	● Check before starting the automatic operation or rebooting after operation stop that there is nobody in the safety protection fence. ● Before starting automatic operation, make sure that all peripheral equipment is in an automatic-operation-ready state and there is no alarm indication. ● Make sure to operate automatic operation start from outside of the safety protection fence. ● In the case that there is any abnormal heating, smoke, offensive smell, or abnormal noise in the product, immediately stop the machine and turn OFF the power switch. Failure to do so may result in a fire or damage to the product. ● When a power failure occurs, turn OFF the power switch. Failure to do so may cause an injury or damage to the product, due to a sudden motion of the product in the recovery operation from the power failure.

No.	Operation Description	Description
8	Maintenance and Inspection	● When the work is carried out with 2 or more persons, make it clear who is to be the leader and who to be the follower(s) and communicate well with each other to ensure the safety of the workers. ● Perform the work out of the safety protection fence, if possible. In the case that the operation is to be performed unavoidably inside the safety protection fence, prepare the “Stipulations for the Operation” and make sure that all the workers acknowledge and understand them well. ● When the work is to be performed inside the safety protection fence, basically turn OFF the power switch. ● When the operation is to be performed inside the safety protection fence, the worker should have an emergency stop switch at hand with him so that the unit can be stopped any time in an emergency. ● When the operation is to be performed inside the safety protection fence, in addition to the workers, arrange a watchman so that the machine can be stopped any time in an emergency. Also, keep watch on the operation so that any third person can not operate the switches carelessly. ● Place a sign “Under Operation” at the position easy to see. ● For the grease for the guide or ball screw, use appropriate grease according to the Instruction Manual for each model. ● Do not perform the dielectric strength test. Failure to do so may result in a damage to the product. ● When releasing the brake on a vertically oriented actuator, exercise precaution not to pinch your hand or damage the work parts with the actuator dropped by gravity. ● The slider or rod may get misaligned OFF the stop position if the servo is turned OFF. Be careful not to get injured or damaged due to an unnecessary operation. ● Pay attention not to lose the cover or untightened screws, and make sure to put the product back to the original condition after maintenance and inspection works. Use in incomplete condition may cause damage to the product or an injury. * Safety protection Fence : In the case that there is no safety protection fence, the movable range should be indicated.
9	Modification and Dismantle	● Do not modify, disassemble, assemble or use of maintenance parts not specified based at your own discretion.
10	Disposal	● When the product becomes no longer usable or necessary, dispose of it properly as an industrial waste. ● When removing the actuator for disposal, pay attention to drop of components when detaching screws. ● Do not put the product in a fire when disposing of it. The product may burst or generate toxic gases.
11	Other	● Do not come close to the product or the harnesses if you are a person who requires a support of medical devices such as a pacemaker. Doing so may affect the performance of your medical device. ● See Overseas Specifications Compliance Manual to check whether complies if necessary. ● For the handling of actuators and controllers, follow the dedicated Instruction manual of each unit to ensure the safety.

Alert Indication

The safety precautions are divided into “Danger”, “Warning”, “Caution” and “Notice” according to the warning level, as follows, and described in the Instruction Manual for each model.

Level	Degree of Danger and Damage	Symbol
Danger	This indicates an imminently hazardous situation which, if the product is not handled correctly, will result in death or serious injury.	 Danger
Warning	This indicates a potentially hazardous situation which, if the product is not handled correctly, could result in death or serious injury.	 Warning
Caution	This indicates a potentially hazardous situation which, if the product is not handled correctly, may result in minor injury or property damage.	 Caution
Notice	This indicates lower possibility for the injury, but should be kept to use this product properly.	 Notice

1. Overview

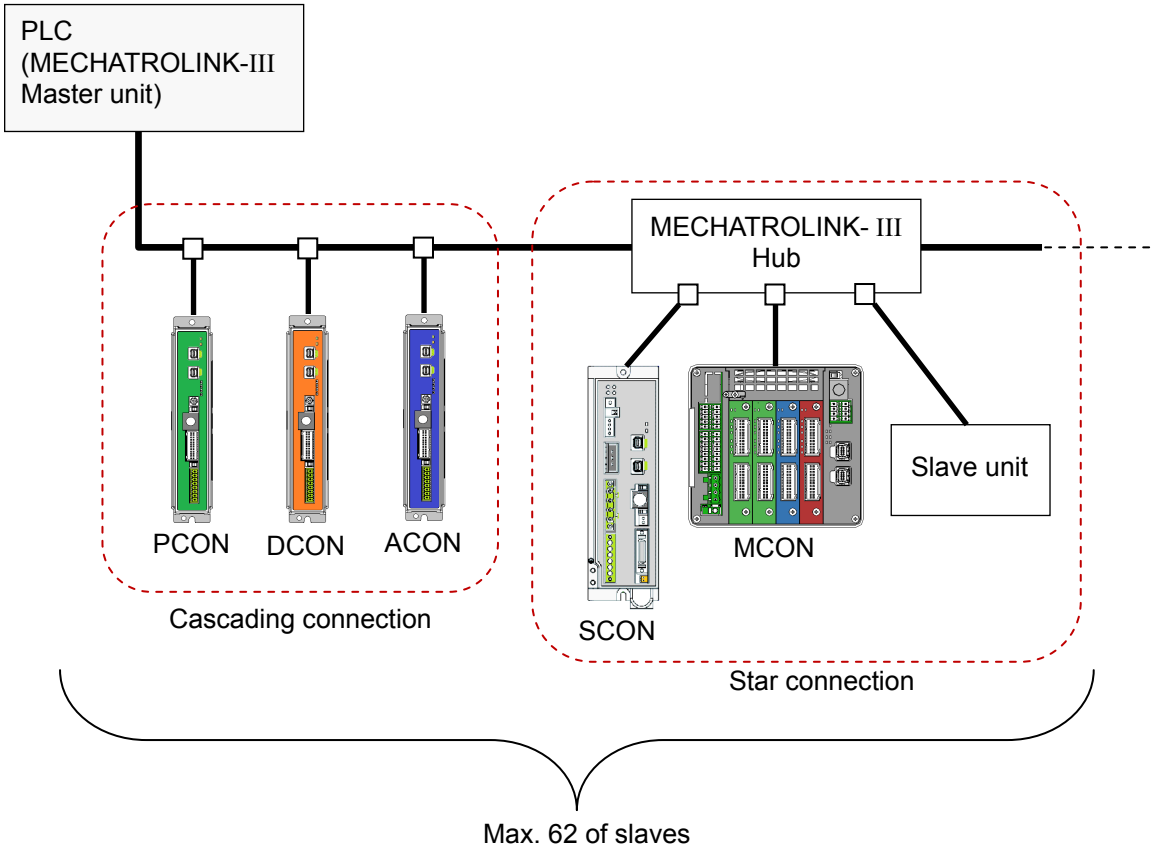
MECHATROLINK is an open field network for communication of both control and data signals of the machine/line control level.
ACON-CB/CGB, DCON-CB/CGB, PCON-CB/CGB/CFB/CGFB, SCON-CA/CB/CGB, and MCON-C/CG (ACON, DCON, PCON, SCON, MCON and hereinafter collectively and individually referred to as “Each controller”) is this wire-saving system can be built by connecting SCON-CA controllers (hereinafter collectively and individually referred to as “Controller”) to a MECHATROLINK-III.

Supported servo profile is standard servo profile. It is not applied for the standard I/O profile.

* For details on MECHATROLINK-III and the command specifications of the servo profile, refer to the operation manual for the programmable controller (hereinafter referred to as “PLC”) in which the master unit is installed and documents offered by MECHATROLINK Members Association. This instruction manual should be used in conjunction with the operation manual for each controller.

You should also assume that any usage not specifically permitted in this instruction manual is prohibited.

Example of a system configuration



1.1 Interface Specifications

Item		Specification
Physical Layer		Ethernet
Transmission Speed		100Mbps
Maximum transmission speed (Between Stations)		100m
Minimum distance between stations		0.2m
Connection Format		Cascading form / Star form / Point-to-point form
Number of connectable stations (Max. Number of Slaves)		62 stations
Transmission cycle		0.5 to 4ms
Communication cycle	Excluding MCON	0.5 to 32ms (0.5ms unit)
	MCON	0.5 to 8ms (1ms unit)
Data length		32 (Sub commands unavailable to use), 48 bytes
Node address		03_H to EF_H
Cable		Cable exclusively for MECHATROLINK-III
Connector	Controller-side	Industrial Mini I/O Connector

2. Setting of Each Controller

2.1 Operation Modes and Functions

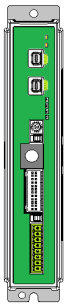
The each controller applicable for MECHATROLINK- III is applied for the standard servo profile.
(Note) It is not applied for the standard I/O profile.

2.2 Models

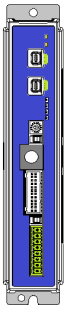
The model names of each controller supporting MECHATROLINK- III are indicated as follows, respectively.

●SCON-CA-□-ML3-□
●SCON-CB-□-ML3-□
●SCON-CGB-□-ML3-□

●PCON-CB-□-ML3-□
●PCON-CGB-□-ML3-□
●PCON-CFB-□-ML3-□
●PCON-CGFB-□-ML3-□

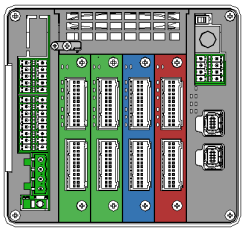


●ACON-CB-□-ML3-□
●ACON-CGB-□-ML3-□



●DCON-CB-□-ML3-□
●DCON-CGB-□-ML3-□

●MCON-C-□-ML3-□
●MCON-CG-□-ML3-□

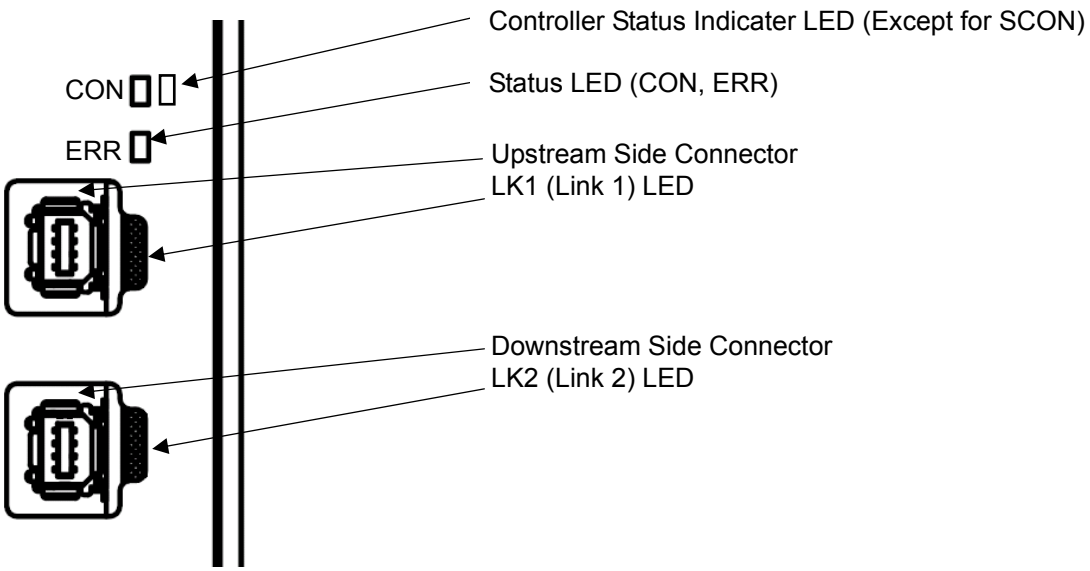


2.3 MECHATROLINK-III Interface

2.3.1 Interface of ACON, DCON, PCON and SCON

2.3.1.1 Name of Each Part

The name of each part relating to MECHATROLINK-III is shown.



2.3.1.2 Status LED Indicators

The operation condition of the communication board, as well as the network condition, can be checked using the LED provided on the front side of the board.

○: Illuminating, ×: OFF

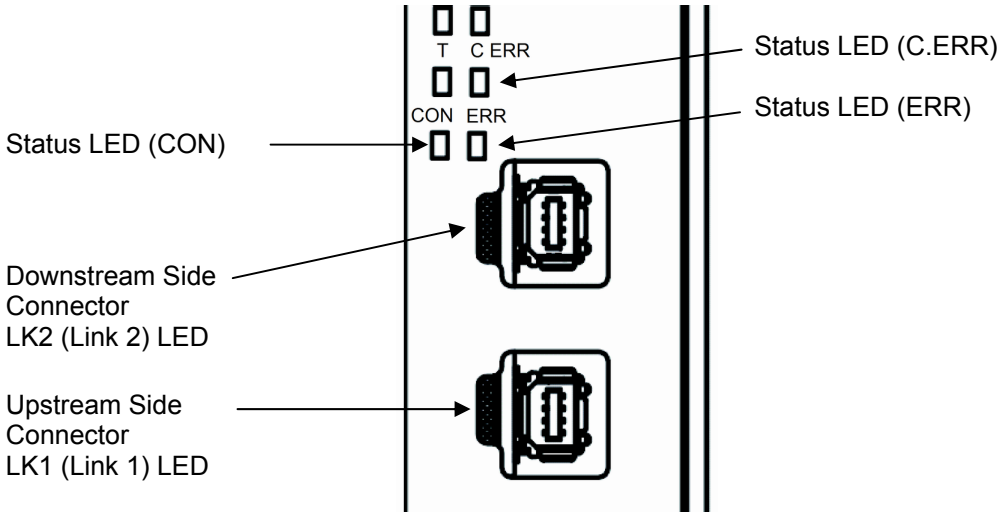
LED	Color	Indicator condition	Description
CON	Green	○	It turns on when receiving CONNECT (connected status with master (P2 (*1) or more), and turns off when receiving DISCONNECT or the controller is in reboot.
	-	×	The board is not connected to the master unit
ERR	Orange	○	Turns on when communication alarm (warning excepted) or command alarm (warning excepted) is generated Turns off when alarm condition is cleared
	-	×	In normal condition (alarm not generated)
LK1 (Link 1)	Green	○	Turns on when physically connected to another device applicable for MECHATROLINK-III (for purpose of error check such as wire damage)
LK2 (Link 2)	Green	○	

*1 Communication Phase: There are three types of status, P1 to P3.
[Refer to section 3.1, “State Transition”]

2.3.2 Interface of MCON

2.3.2.1 Name of Each Part

The name of each part relating to MECHATROLINK-III is shown.



2.3.2.2 Status LED Indicators

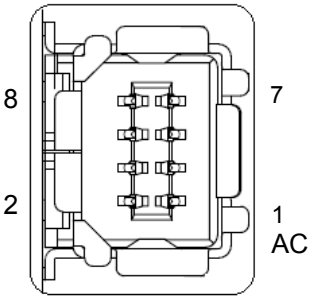
The operation condition of the communication board, as well as the network condition, can be checked using the LED provided on the front side of the board.

○: Illuminating, ×: OFF

LED	Color	Indicator condition	Description
CON	Green	○	It turns on when receiving CONNECT (connected status with master (P2 (*1) or more), and turns off when receiving DISCONNECT or the controller is in reboot. * This lamp turns on when any of the axes is connected.
	-	×	The board is not connected to the master unit * This lamp turns off when all of the axes reach PHASE 1 or less.
ERR	Orange	○	Turns on when command alarm (warning excepted) is generated Turns off when alarm condition is cleared * This lamp turns on when an alarm is generated on any of the axes.
	-	×	In normal condition (alarm not generated)
C.ERR	Orange	○	Turns on when communication alarm (warning excepted) is generated Turns off when alarm condition is cleared * This lamp turns on when an alarm is generated on any of the axes.
	-	×	In normal condition (alarm not generated)
LK1 (Link 1)	Green	○	Turns on when physically connected to another device applicable for MECHATROLINK-III (for purpose of error check such as wire damage)
LK2 (Link 2)	Green	×	

*1 Communication Phase: There are three types of status, P1 to P3.
[Refer to section 3.1, “State Transition”]

2.3.3 Connecter Pin Layout

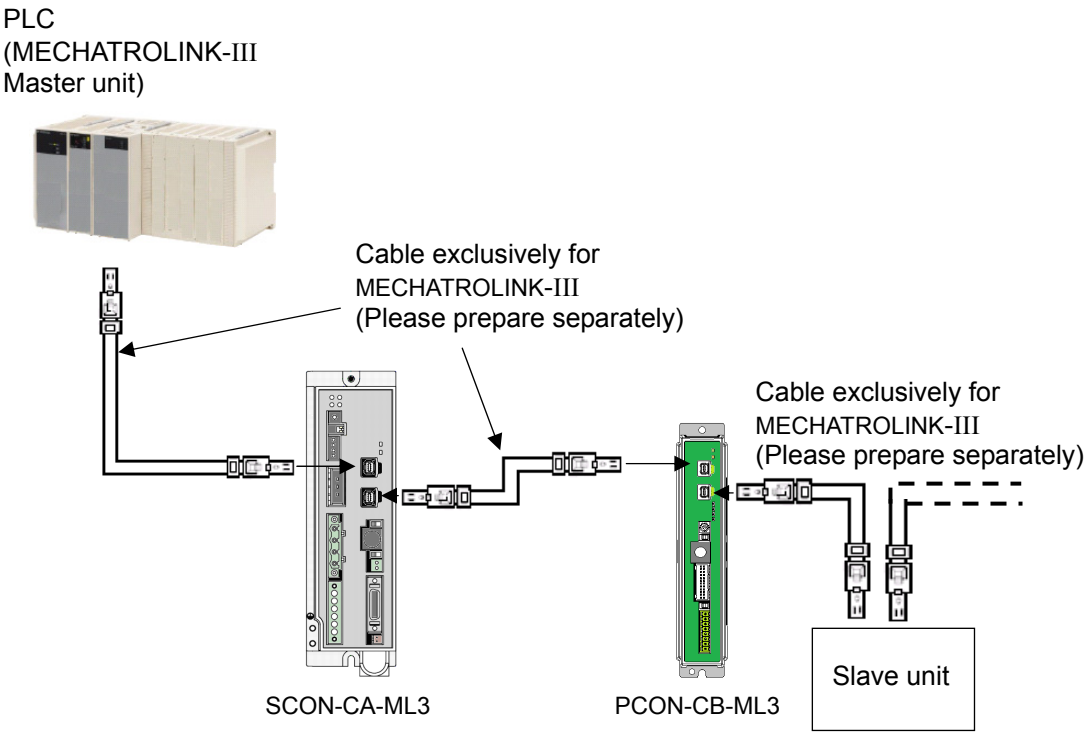


Industrial mini
I/O connector
(Controller side)

Pin No.	Signal Names	Signal Abbreviations
1	Sending data+	TXD+
2	Sending data-	TXD-
3	Received data+	RXD+
4	-	Not used
5	-	Not used
6	Received data -	RXD-
7	-	Not used
8	-	Not used

(Note) Be careful as the posture of the connector differs depending on the controller.

2.4 Example of Wiring



2.5 Setting of ACON, DCON, PCON and SCON

Settings are to be established in a teaching tool in such as PC software (ver. 10.04.00.00 or later) or teaching pendant etc.
When setting the parameters, make sure to set the operation mode setting switch on the front panel to MANU side.

2.5.1 Node Address Setting

Set the node address using a parameter.
Set parameter No. 85, “Fieldbus node address” using the teaching tool.

Settable range: 3 to 239 (The factory setting is 3.)
(Note) Pay attention to duplicate node address settings.
For more details, refer to the operation manual for the master unit or the PLC that is installed.

2.5.2 Data Length Setting

Set a desired data length using a parameter.
Establish the setting considering the data length which uses Parameter No. 86 “Fieldbus Communication Speed” in the teaching tool.
(Note) Sub commands get unavailable when setting to 32 bytes.

Set value	Data length	Baud rate
0	32bytes	100Mbps
1 (factory setting)	48bytes	

(Note) If a greater value is entered, a parameter error will occur.

2.5.3 Setting of Electronic Gear Ratio

The electronic gear ratio is set with parameters.
Set the values in Parameter No. 65 “Electronic Gear Numerator” and No. 66 “Electronic Gear Denominator” in the teaching tool.
The value set in these parameters controls the actuator by doing multiplication to the command from the master.
Therefore, it is necessary to establish the setting that matches to the unit of master commands. In case the unit of commands is unclear, change the value little by little from the initial. Also, it is recommended, if there is a function to convert the unit or set up the gear ratio on the master, to have the parameters set to 1/1 and make an adjustment on the master side.

Make sure the conditions stated below can be satisfied, and establish the setting.

$$\frac{\text{Stroke [mm]}}{\text{Ball screw lead length [mm]}} \times \text{Encoder pulse number [pulse]} \times \frac{\text{Electronic gear denominator}}{\text{Electronic gear numerator}} \leq 2^{31}$$

2.5.4 Check for Direction of Pulse Count

The direction of pulse count can be set in parameters.
Check that the setting value in Parameter No. 62 “Pulse count direction” is the same as that in Parameter No. 5 “Home-return Direction” in the teaching tool, and make it the same in case the different setting is made.
(Note) Reboot the power on the controller after settings are completed, and set the operation mode setting switch on the front panel of the controller to AUTO.

2.6 Setting of MCON

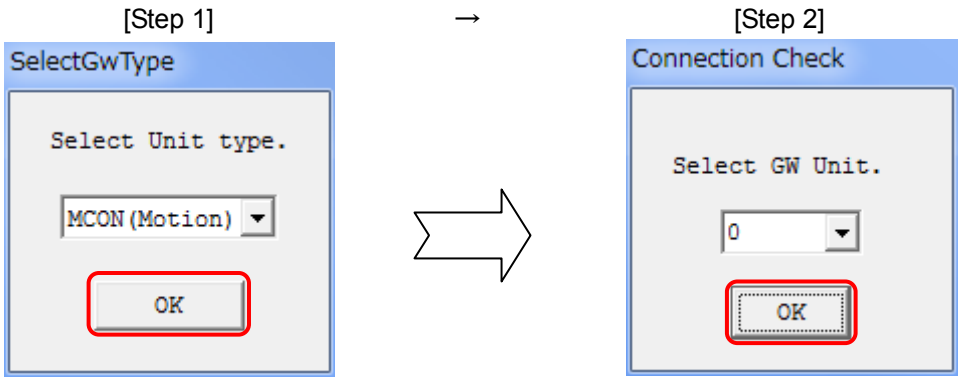
Settings are to be established on Gateway Parameter Setting Tool* (ver. 2.4.0.0 or later) and in a teaching tool in such as PC software (ver. 10.04.00.00 or later) or teaching pendant etc.

* To activate Gateway Parameter Setting Tool, uses the one stored in the CD-ROM of PC Software or download it in IAI's homepage.
  When setting the parameters, make sure to set the operation mode setting switch on the front panel of MSEP to MANU side.

2.6.1 Startup of Gateway Parameter Setting Tool (Preparation for Setting)

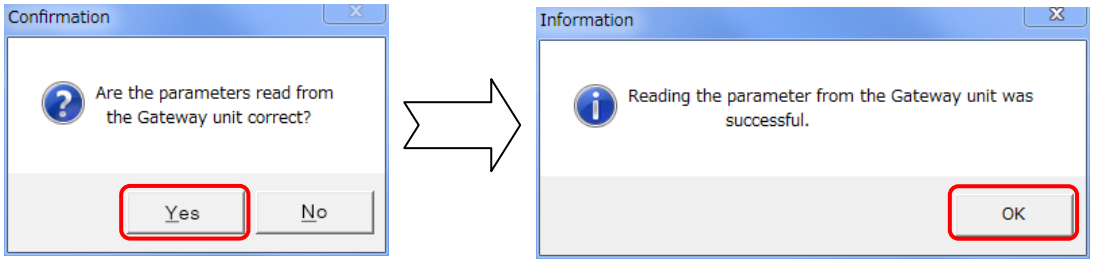
[Step 1] Connect between the PC and SIO connector on MCON with the cable enclosed in the PC Software, and start the gateway parameter setting tool.
As the model select window appears, select "MCON (Motion)" and press the "OK" button.

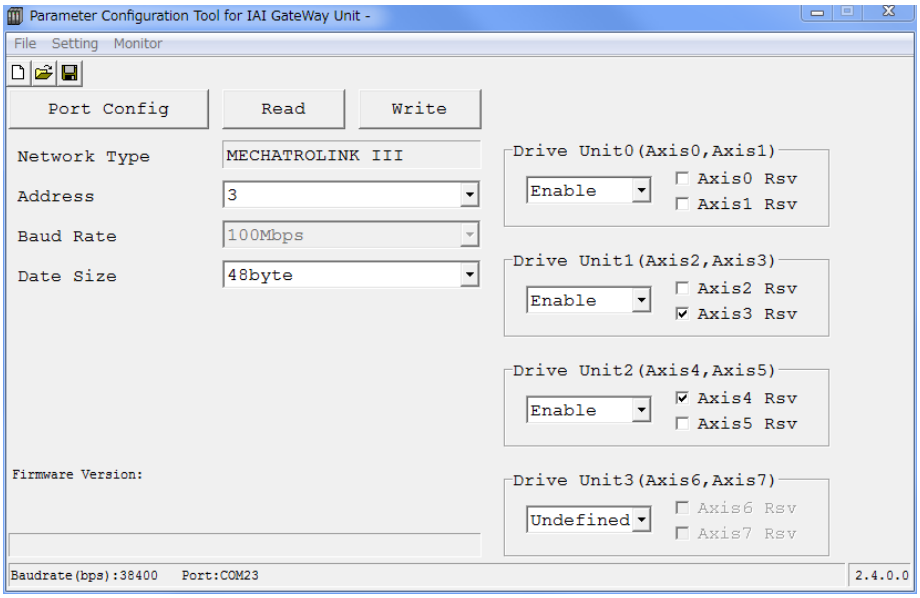
[Step 2] Once MCON is detected the detected unit numbers become available to select.
Select the unit number to be connected and click the "OK" button.
* Unit No. 0 = MCON Axis No. 0 to 7, Unit No. 1 = MCON Axis No. 8 to 15



[Step 3] As the initial screen appears, press the "Read" button to read the parameters from MCON.

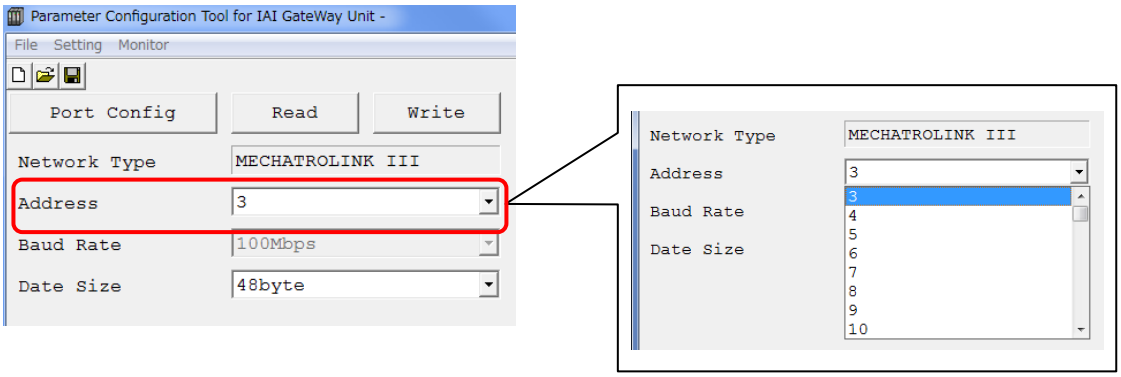
[Step 4] Click on the “Read” button and a confirmation window appears. Click on the “Yes” button.
If the writing is finished in normal condition, writing complete window appears.
Press OK button, and the window that the parameters were read from MCON gets shown.





2.6.2 Setting of Node Address

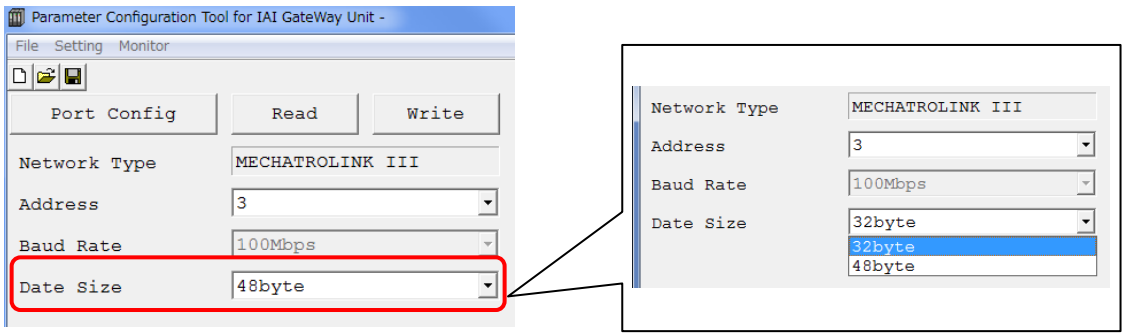
The node address is to be set in “Address” in Gateway Parameter Setting Tool.



Settable Range: 3 to 239 (EF_H) (It is set to “3” when the machine is delivered from the factory.)
(Note) Pay attention not to have duplication of node address.
Refer to the instruction manuals of the master unit and mounted PLC for details.

2.6.3 Setting of Data Size

The data size is to be set in “Data Size” in Gateway Parameter Setting Tool.

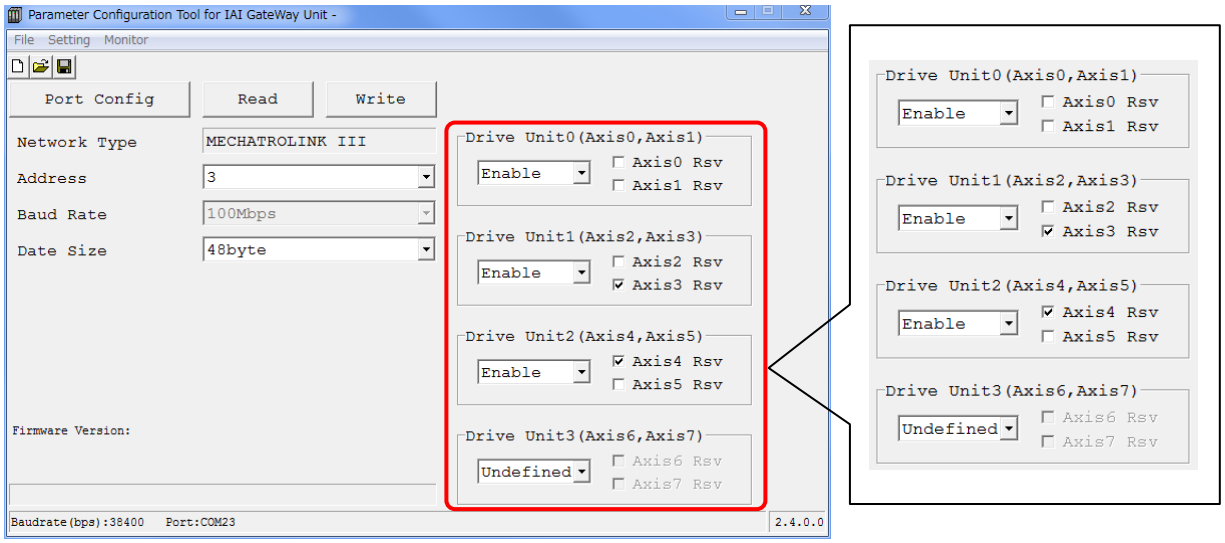


Establish the setting considering the data length (32 bytes or 48 bytes).
It is set to 48 bytes at delivery.
(Note) Sub commands get unavailable when setting to 32 bytes.

2.6.4 Setting of Number of Mounted Axes

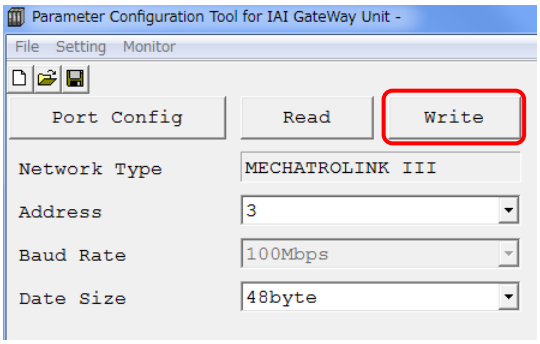
Set to “Use” in case a driver board is mounted on Driver Units 0 to 3, and to “No Setting” when not mounted. (There is no setting for the type of driver boards such as for the pulse motor or servomotor.)

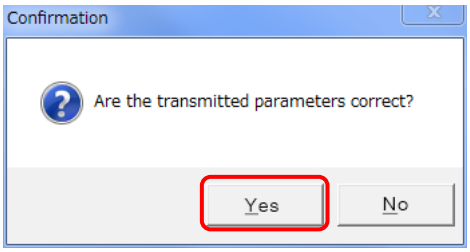
Also, when not using the actuator although a driver board is mounted, put a check mark in the check box for the reservation axis on the left of the axis number (for both cases of actuator connected / disconnected).



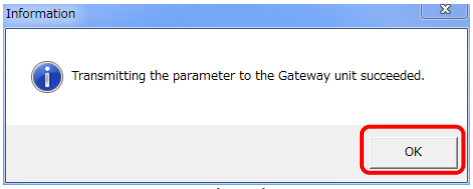
2.6.5 Applying Parameters (Transfer to Controller)

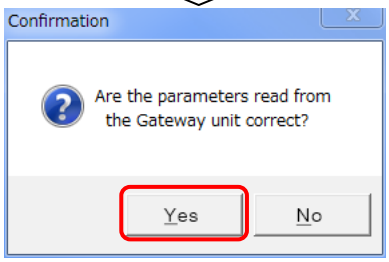
Transfer the edited parameters to the controller. Press “Write” in Gateway Parameter Setting Tool. The confirmation window gets shown once “Transfer” button is pressed. Press “Yes” button.

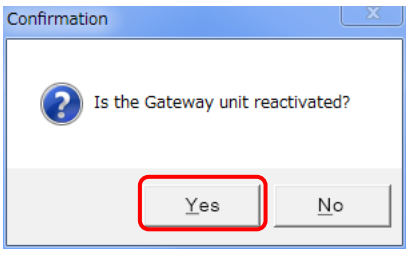




Once transfer is complete, a confirmation window for rebooting appears. The confirmation window for reboot gets shown once “OK” button is pressed. Press “Yes” button to have it rebooted.







Once the reboot is finished, the parameter reading confirmation window is shown so the written contents can be confirmed. Press “Yes” button so the reading process starts.
Check if the written contents are reflected once the reading is complete.

Hereafter, settings are to be performed on PC Software. Close this Gateway Parameter Setting Tool.

2.6.6 Setting of Electronic Gear Ratio

The electronic gear ratio is set with parameters.
Set the values in Parameter No. 38 “Electronic Gear Numerator” and No. 39 “Electronic Gear Denominator” in the teaching tool.
The value set in these parameters controls the actuator by doing multiplication to the command from the master.
Therefore, it is necessary to establish the setting that matches to the unit of master commands.
In case the unit of commands is unclear, change the value little by little from the initial (1/1).
Also, it is recommended, if there is a function to convert the unit or set up the gear ratio on the master, to have the parameters set to 1/1 and make an adjustment on the master side.

(Note) Make sure the conditions stated below can be satisfied, and establish the setting.

$$\frac{\text{Stroke [mm]}}{\text{Ball screw lead length [mm]}} \times \text{Encoder pulse number [pulse]} \times \frac{\text{Electronic gear denominator}}{\text{Electronic gear numerator}} \leq 2^{31}$$

(Note) After establishing the settings, set the operation setting switch on the front panel of MSEP to AUTO side, and reboot the system by turning the power on again.

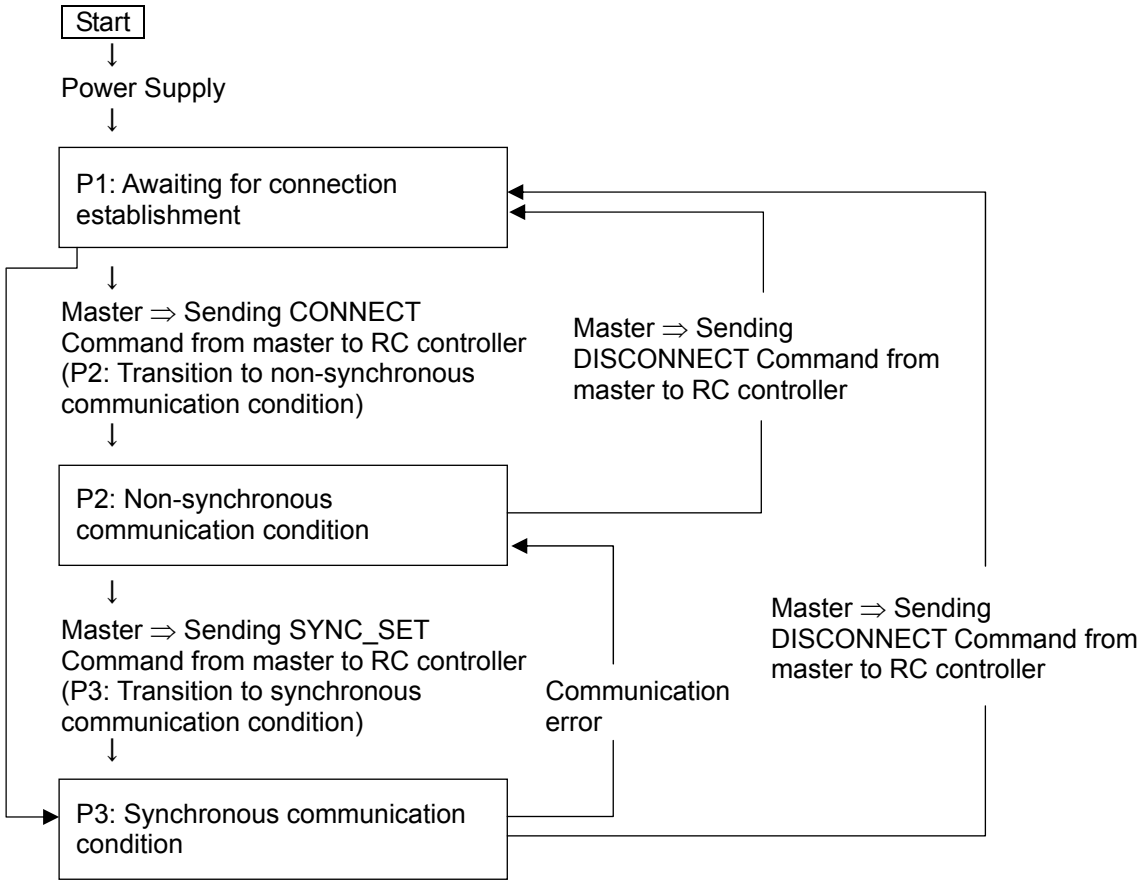
2.6.7 Setting of Pulse Count Direction

The direction of pulse count can be set in parameters.
Check that the setting value in Parameter No. 62 “Pulse Count Direction” is the same as that in Parameter No. 5 “Home-return Direction” in the teaching tool, and make it the same in case the different setting is made.

3. Flow and Commands of Basic MECHATROLINK Communication

3.1 State Transition

Shown below is the state transition diagram.

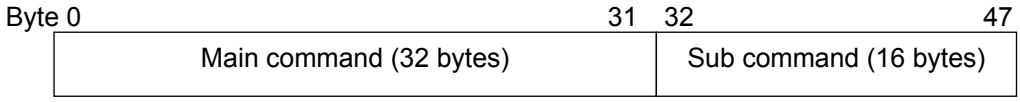


* P1 to P3: Communication Phase (P1: Phase 1, P2: Phase 2, P3: Phase 3)
* For details, refer to the operation manual for the MECHATROLINK master unit.

> ⚠ About Power Supply to MCON
>
> Make sure to have 5 seconds or more on the master side for initializing time when turning the power on (startup).
> Communication cannot be performed during initializing time. Slave units connected below MCON also lose connection to the master side.

3.2 Command Frame Construction and Number of Transmission Bytes

The command frame consists of the combination of the main command and the sub command.
Match the number of the transmission bytes to the setting on the host (master) side.
32-byte Mode is available only in the main command.
48-byte Mode is available not only in the main command, but also in the sub command. Also, it is available not to have the sub command used with 48-byte Mode.



3.3 Endian

If there is the setting of endian on the master side, set to little endian on the master side.

3.4 System of Units

Shown below is the system of units for the data used in the standard servo profile command.

Data	Available Unit
Speed	Command unit/s : Set a value that does not exceed the maximum velocity of the applicable actuator.
Position	Command unit : Set a value within the software stroke range (0 to effective stroke length) of the applicable actuator.
Acceleration•Deceleration	Command unit/s^2 : Set a value that does not exceed the maximum acceleration or maximum deceleration of the applicable actuator.
Torque	Rated torque in % : The unit for torque is 1%. The range of input is 1 to 100%. Setting to a small value may make the operation unstable. * Take the minimum value of the pressing current limit of the applicable actuator as a reference.

4. Command Format

The command frame consists of the combination of main command (32 bytes) and the sub command (16 bytes). The sub command is to be used when adding another command to the main command.
When using the sub command, set to 48 bytes for the number of the transmission bytes on the master side.

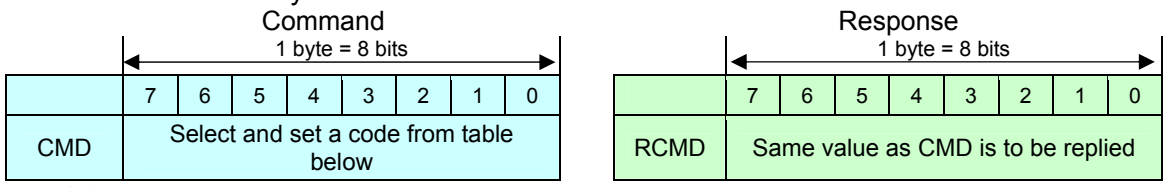
	Command	byte	Response	byte
Main Command	Command Code (CMD)	0	Command Code Response (RCMD)	0
	Watchdog Data (WDT)	1	Watchdog Status (RWDT)	1
	Command Control (CMD_CTRL)	2	Command Status (CMD_STAT)	2
		3		3
	Command Data (CMD_DATA)	4	Response Data (RSP_DATA)	4
		5		5
		6		6
		7		7
		8		8
		9		9
		10		10
		11		11
		12		12
		13		13
		14		14
		15		15
		16		16
		17		17
		18		18
		19		19
		20		20
		21		21
		22		22
		23		23
		24		24
		25		25
		26		26
		27		27
		28		28
		29		29
		30		30
		31		31
Sub Command	Sub Command Code (SUB_CMD)	32	Sub Command Code Response (SUB_RCMD)	32
	Sub Command Control (SUB_CTRL)	33	Sub Command Status (SUB_STAT)	33
		34		34
		35		35
	Sub Command Data (SUB_CMD_DATA)	36	Sub Response Data (SUB_RSP_DATA)	36
		37		37
		38		38
		39		39
		40		40
		41		41
		42		42
		43		43
		44		44
		45		45
		46		46
		47		47

4.1 Command / Response Frame

4.1.1 Command Code / Command Code Response (CMD/RCMD)

Select a command available to conduct from the table below by following the communication flow.

Command Format 0th Byte



Example) For SV_ON Code 31_H → Set value 0011 0001_b

○: Available to conduct, △: Ignored, ×: Unavailable to conduct

Code	Command	Functions	Communication Phase *1		
			P1	P2	P3
Common Commands					
00_H	NOP	Invalid	○	○	○
03_H	ID_RD	ID Reading	×	○	○
04_H	CONFIG	Device Setup Request	×	○	○
05_H	ALM_RD	Alarm / Warning Reading	×	○	○
06_H	ALM_CLR	Alarm / Warning Cleared	×	○	○
$0D_H$	SYNC_SET	Synchronization Establishment Request	×	○	△
$0E_H$	CONNECT	Connection Establishment Request	○	△	△
$0F_H$	DISCONNECT	Connection Release Request	○	○	○
Standard Servo Profile Commands					
23_H	SENS_ON	Sensor-on Request	×	○	○
24_H	SENS_OFF	Sensor-off Request	×	○	○
30_H	SMON	Servo Status Monitor	×	○	○
31_H	SV_ON	Servo ON	×	○	○
32_H	SV_OFF	Servo OFF	×	○	○
34_H	INTERPOLATE	Interpolation Feeding	×	×	○
35_H	POSING	Positioning	×	○	○
36_H	FEED	Constant Speed Feeding	×	○	○
40_H	SVPRM_RD	Servo Parameter Reading	×	○	○
41_H	SVPRM_WR	Servo Parameter Writing	×	○	○

*1 Communication Phase: This shows the current status of communication. There are three types of status, P1 to P3. [Refer to section 3.1, “State Transition”]

Note 1 The unit is not applicable for the commands except for those listed in the table above. It will generate an alarm [CMD_ALM = 8] when a command other than those listed in the table above is received.

Note 2 Even a command listed in the table above may generate an alarm [CMD_ALM = C] if it is received in a communication phase that the command cannot be used (where marked with “×”).

4.1.2 Watchdog Data (WDT/RWDT)

Set the timer to monitor the communication is conducted periodically.
Monitoring starts after the communication phase P3 is established.

Command Format 1st Byte

Command

1 byte = 8 bits

	7	6	5	4	3	2	1	0
WDT	Copy the values in Bit 7 to 4 in RWDT				Add 1 for every communication frequency.			

Response

1 byte = 8 bits

	7	6	5	4	3	2	1	0
RWDT	1 is added for every communication frequency				Values in Bit 3 to 0 in WDT are to be replied			

4.1.3 Command Control / Command Status (CMD_CTRL/CMD_STAT)

Clearing of alarm / warning is commanded, and the current status of the controller is monitored.

(1) Command Control

Command Format 2nd and 3rd Bytes

Command format 3rd byte

1 byte = 8 bits

Command format 2nd byte

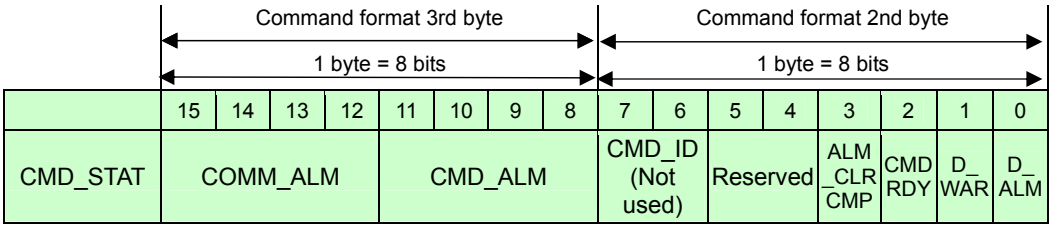
1 byte = 8 bits

	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
CMD_CTRL	Reserved								CMD _ID (Not used)		Reserved		ALM _CLR	Reserved		

● ALM_CLR (Alarm and Warning Clear) :
Generates an alarm when startup edge is detected, or clearing of warning is commanded.
If the operation mode on the controller is set to AUTO, command to clear the alarm / warning occurred to the controller including the communication. For MANU, the command is subject to clear the alarm / warning related only to the communication.

(2) Command Status

Command Format 2nd and 3rd Bytes



Bits	Abbreviations	Names	Contents
0	D_ALM	Device Alarm	It shows the controller is in alarm condition. The servo is off when this bit is 1.
1	D_WAR	Device Warning	It shows the controller is in warning condition. The servo control is available even when this bit is 1.
2	CMDRDY	Command Ready	When 0, it shows the command process is being executed. All the command inputs are ignored except for DISCONNECT Command. The master can issue a new command only after confirmed this bit is 1.
3	ALM _CLR _CMP	Alarm / Warning Clearing Completed	This shows the execution of ALM_CLR in CMD_CTRL is completed. It shows the process is completed when this bit is 1. However, it does not show if the alarm is actually cleard. Check in D_ALM (Bit 0), D_WAR (Bit 1) or COMM_ALM (Bit 12 to 15) to see if the alarm is actually cleared.
4, 5	-	Reserved	
6, 7	CMD_ID	Not Used	
8 to 11	CMD _ALM	Command Alarm	It shows an abnormality in a command. It is cleared automatically once a normal command is received.

Code (bit 8 to 11)	Condition	Contents	Remarks
0_H	In normal condition	In normal condition	
1_H	Warning	Out of data range	Notifies a warning, and have an operation with the command value replaced to the maximum value that is available for operation.
8_H	Alarm	Unsupported command received	It notifies an alarm. No command is to be executed.
9_H		Out of data range	
A_H		Command execution condition error	
B_H		Sub command combination error	
C_H		Phase error	

<table>
<tr><th>Bits</th><th>Abbreviations</th><th>Names</th><th colspan="4">Contents</th></tr>
<tr><td rowspan="11">12 to 15</td><td rowspan="11">COMM _ALM</td><td rowspan="11">Communication Alarm</td><td colspan="4">It shows an abnormality in communication.
It can be cleared with ALM_CLR Bit or ALM_CLR Command in CMD_CTRL.</td></tr>
<tr><td>Code (bit 8 to 11)</td><td>Condition</td><td>Contents</td><td>Remarks</td></tr>
<tr><td>0_H</td><td>In normal condition</td><td>In normal condition</td><td></td></tr>
<tr><td>1_H</td><td rowspan="3">Warning</td><td>FCS error</td><td rowspan="3">It occurs when a communication error in spot is detected.
Communication phase and servo status are continued.</td></tr>
<tr><td>2_H</td><td>Command data not received</td></tr>
<tr><td>3_H</td><td>Synchronizing frame not received</td></tr>
<tr><td>8_H</td><td rowspan="5">Alarm</td><td>FCS error</td><td rowspan="5">It occurs when communication error is detected for the indicated times in a row.
It will be transited to Communication Phase P2 if it is Communication Phase P3.
An alarm is generated when the warning of 1 to 3 above is detected for two times in a row for Alarm Code 8 to A.
An alarm is generated with one time of detection for Alarm Code B and C.
When the controller is in AUTO Mode, the brake is activated with the servo being turned off.</td></tr>
<tr><td>9_H</td><td>Command data not received</td></tr>
<tr><td>A_H</td><td>Synchronizing frame not received</td></tr>
<tr><td>B_H</td><td>Synchronizing frequency error</td></tr>
<tr><td>C_H</td><td>WDT error</td></tr>
</table>

4.1.4 Command Data / Response Data (CMD_DATA/RSP_DATA)

Establish the necessary command settings considering the operation. [Refer to section 5.1, “Main Command”]

(1) Command Data
Command format 4th to 31st bytes

(2) Response Data
Command format 4th to 31st bytes

4.1.5 Sub Command Code / Sub Command Code Response (SUB_CMD/SUB_RCMD)

Select a sub command available to conduct from the table below by following the communication flow. At that time, check on the combination table of the main commands and sub commands that the selected sub command is available for combination with the main command.

Command format 32nd Byte

Command

	1 byte = 8 bits							
	7	6	5	4	3	2	1	0
SUB_ CMD	Select and set a code from table below							

Response

	1 byte = 8 bits							
	7	6	5	4	3	2	1	0
SUB_ RCMD	Same value as SUB_CMD is to be replied							

○: Available to conduct, ×: Unavailable to conduct

Code	Command	Functions	Communication Phase		
			P1	P2	P3
Standard Servo Profile Sub Commands					
00_H	NOP	Ignored	×	○	○
05_H	ALM_RD	Alarm / Warning Reading	×	○	○
30_H	SMON	Servo Status Monitor	×	○	○
40_H	SVPRM_RD	Servo Parameter Reading	×	○	○
41_H	SVPRM_WR	Servo Parameter Writing	×	○	○

Note 1 The unit is not applicable for the sub commands except for those listed in the table above. An alarm [SUBCMD_ALM = 8] is generated when combination is not available with the sub command or main command listed in the table above.

Note 2 When receiving is conducted on the communication phase (P1), the sub command cannot be accepted. There will be no alarm generated in that case.

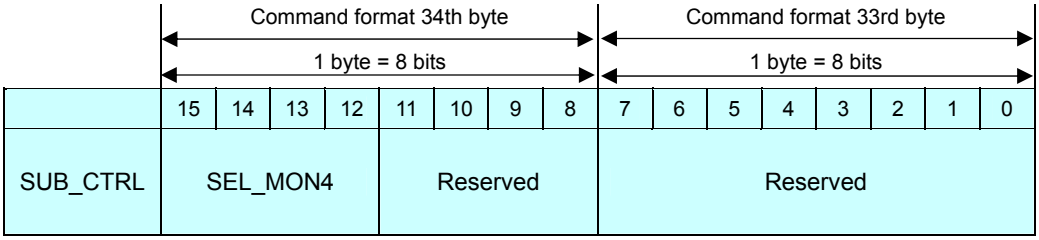
● Combination of Main Command and Sub Command ○: Combination available, ×: Combination Unavailable

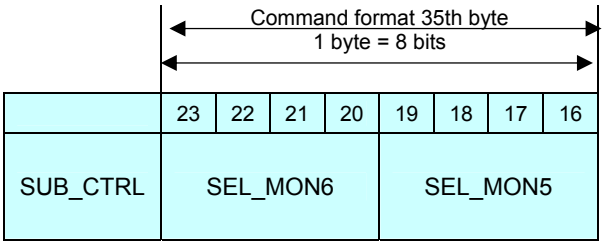
Main Command	Sub Command				
	NOP (00_H)	ALM_RD (05_H)	SMON (30_H)	SVPRM_RD (40_H)	SVPRM_WR (41_H)
NOP(00_H)	○	○	○	○	○
ID_RD(03_H)	○	○	○	○	○
CONFIG(04_H)	○	○	○	×	×
ALM_RD(05_H)	○	○	○	×	×
ALM_CLR(06_H)	○	○	○	×	×
SYNC_SET($0D_H$)	○	○	○	×	×
CONNECT($0E_H$)	○	×	×	×	×
DISCONNECT($0F_H$)	○	×	×	×	×
SENS_ON(23_H)	○	○	○	×	×
SENS_OFF(24_H)	○	○	○	×	×
SMON(30_H)	○	○	○	○	○
SV_ON(31_H)	○	○	○	○	○
SV_OFF(32_H)	○	○	○	○	○
INTERPOLATE(34_H)	○	○	○	○	○
POSING(35_H)	○	○	○	○	○
FEED(36_H)	○	○	○	○	○
SVPRM_RD(40_H)	○	○	○	×	×
SVPRM_WR(41_H)	○	○	○	×	×

4.1.6 Sub Command Control / Sub Command Status (SUB_CTRL/SUB_STAT)

Select the monitor data to have the readout from the monitor information and select a code.

(1) Sub Command Control
Command Format 33rd to 35th Bytes

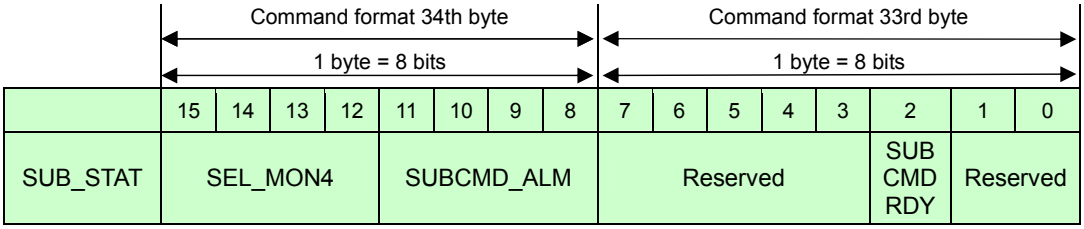


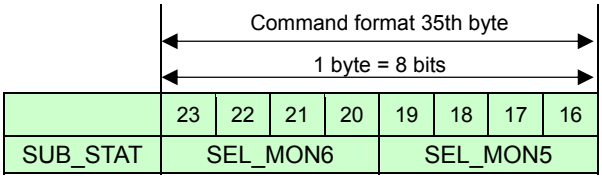


Monitor Information

Code	Monitor Name	Contents	Remarks
0_H	APOS	Feedback position	
1_H	CPOS	Command position	
2_H	PERR	Position deviation	
3, 4_H	-	Reserved	
5_H	FSPD	Feedback speed	
6_H	CSPD	Command speed	
7_H	TRQ	Command torque (Thrust)	
8_H	ALARM	Detailed information for alarm currently generated	It shows the warning on controller or alarm code
9_H	MPOS	Command position	It should be the same value as CPOS (Code 1)
A, B_H	-	Reserved	
C_H	CMN1	Common monitor 1	It is to be indicated in Common Parameter No. 89 Refer to section 5.3.]
D_H	CMN2	Common monitor 2	It is to be indicated in Common Parameter No. 8A [Refer to section 5.3.]
E, F_H	-	Reserved	

(2) Sub Command Status
Command Format 33rd to 35th Bytes





Bits	Abbreviations	Names	Contents
0, 1	-	Reserved	
2	SUBCMDRDY	Sub Command Ready	It shows this bit is 1 and the sub command can be accepted. In 48-Byte Mode, this is always one no matter if the sub command is valid or invalid after the connection is established with CONNECT Command.
3 to 7	-	Reserved	
8 to 11	SUBCMD_ALM	Sub Command Alarm	It shows an abnormality in a command. It is cleared automatically once a normal command is received. [Refer to section 4.1.3(2) for detail of the alarm code]
12 to 15	SEL_MON4	Monitor Select 4	The value set in SEL_MON4 in SUB_CTRL is to be replied.
16 to 19	SEL_MON5	Monitor Select 5	The value set in SEL_MON5 in SUB_CTRL is to be replied.
20 to 23	SEL_MON6	Monitor Select 6	The value set in SEL_MON6 in SUB_CTRL is to be replied.

4.1.7 Sub Command Data / Sub Response Data (SUB_CMD_DATA/SUB_RSP_DATA)

Establish the necessary sub command settings considering the operation. [Refer to section 5.2, “Sub Command”]

(1) Sub Command Data
Command Format 36th to 47th Bytes

(2) Sub Response Data
Command Format 36th to 47th Bytes

5. Command

5.1 Main Command

5.1.1 Specifications of Common Commands

5.1.1.1 Invalid (NOP Code: 00_H)

It is an invalid command.
Current condition is replied as a response.
The response from the power turned on till the completion of the initializing process is NOP, it generates CMDRDY in CMD_STAT bit is 0.
No command but DISCONNECT can be received.

●NOP

Bytes of Command Format	Command	Response	Remarks
0	00_H	00_H	
1	WDT	RWDT	[Refer to section 4.1.2.]
2	CMD_CTRL	CMD_STAT	[Refer to section 4.1.3.]
3			
4 to 31	Reserved	Reserved	

5.1.1.2 ID Reading (ID_RD Code: 03_H)

Readout is held on each ID of the controller.
Set the ID code to be read out in ID_CODE.
An alarm will be generated and will not accept any command in the following cases:
1) Indicated value in ID_CODE is out of the range in ID Code Table. (It generates CMD_ALM = 9)
2) The range shown in OFFSET and SIZE exceeds the range of ID data for readout. (It generates CMD_ALM = 9)
3) SIZE exceeds 24 bytes. (It generates CMD_ALM = 9)
4) The range of OFFSET exceeds the range of ID data for readout. (It generates CMD_ALM = 9)

●ID_RD

Bytes of Command Format	Command	Response	Remarks
0	03_H	03_H	
1	WDT	RWDT	[Refer to section 4.1.2.]
2	CMD_CTRL	CMD_STAT	[Refer to section 4.1.3.]
3			
4	ID_CODE	ID_CODE	
5	OFFSET	OFFSET	If OFFSET is set, only the indicated size can be read out on the way of ID data
6	SIZE	SIZE	
7			
8 to 31	Reserved	ID	

Details of ID data

ID Code	Description	Data Size [bytes]	Data type	Data
01_H	Vendor ID Code	4	Binary	$000000CA_H$
02_H	Device Code (Model Code)	4	Binary	ACON = $0000AC32_H$ DCON = $0000AC52_H$ PCON-CB = $0000AE46_H$ PCON-CFB = $0000AE47_H$ SCON-CA = $0000AA07_H$ SCON-CB = $0000AA08_H$ MCON (Driver unit): •Pulse motor = $AE4CA40B_H$ •Pulse motor (High-output) = $AE4DA40B_H$ •Servo Motor $AC3BA40B_H$ •Brushless DC motor = $AC5BA40B_H$
03_H	Device Version (Version Code on Application)	4	Binary	ACON = $0000****_H$ DCON = $0000****_H$ PCON = $0000****_H$ SCON = $0000****_H$ MCON = $****++++_H$ - **** section: Version on driver board part ++++ section: Version on gateway part
04_H	Device Information File Version	4	Binary	00001000_H
05_H	Extension Address Setting (Number of Used Extension Addresses)	4	Binary	Excluding MCON: 00000001_H (1 axis) MCON: 00000001_H to 00000008_H (Number of axis set in parameter)

ID Code	Description	Data Size [bytes]	Data type	Data
06_H	Serial Number	32	ASCII Code (Delimiter = 00_H)	Serial number on controller
10_H	Profile Type 1 (Primary)	4	Binary	00000010_H (Standard servo)
11_H	Profile Version 1 (Primary)	4	Binary	00000100_H (V1.00)
12_H	Profile Type 2	4	Binary	$000000FF_H$ (Not applicable)
13_H	Profile Version 2	4	Binary	00000000_H
14_H	Profile Type 3	4	Binary	$000000FF_H$ (Not applicable)
15_H	Profile Version 3	4	Binary	00000000_H
16_H	Min. Transmission Frequency (0.01μs)	4	Binary	$0000C350_H$ (0.5ms)
17_H	Max. Transmission Frequency (0.01μs)	4	Binary	$00061A80_H$ (4ms)
18_H	Transmission Frequency Intervals (GRANULARITY)	4	Binary	Excluding MCON: 00000002_H (0.5ms) MCON: 00000001_H (1ms)
19_H	Min. Communication Frequency (0.01μs)	4	Binary	$0000C350_H$ (0.5ms)
$1A_H$	Max. Communication Frequency (0.01μs)	4	Binary	Excluding MCON: $0030D400_H$ (32ms) MCON: $000C3500_H$ (8ms)
$1B_H$	Number of Transmission Bytes (Applicable Bit Patterns)	4	Binary	$0000000C_H$ (32 or 48 bytes)
$1C_H$	Number of Transmission Bytes (Current Settings)	4	Binary	Number of bytes set in parameter
$1D_H$	Profile Type (Current Selections)	4	Binary	
20_H	Communication Mode Correspondence	4	Binary	00000003_H (Cyclic communication Event-driven communication)
21_H	Reserved	-		
30_H	Main Command Correspondence List	32	Array[32]	[0] = 79_H [1] = $E0_H$ [2] = 00_H [3] = 00_H [4] = 18_H [5] = 00_H [6] = 77_H [7] = 00_H [8] = 03_H [9] to [31] = 00_H
38_H	Sub Command Correspondence List	32	Array[32]	[0] = 21_H [1] = 00_H [2] = 00_H [3] = 00_H [4] = 00_H [5] = 00_H [6] = 01_H [7] = 00_H [8] = 01_H [9] to [31] = 00_H
40_H	Common Parameter Correspondence List	32	Array[32]	[0] = FE_H [1] = $1F_H$ [2] = 00_H [3] = 00_H [4] = 66_H [5] = 01_H [6] = 00_H [7] = 00_H [8] = FE_H [9] = 03_H [10] = 00_H [11] = 00_H [12] = $C0_H$ [13] = 00_H [14] = 00_H [15] = 00_H [16] = 80_H [17] = $4F_H$ [18] = $0F_H$ [19] to [31] = 00_H

ID Code	Description	Data Size [bytes]	Data type	Data
80_H	Main Device Name (Controller Product Name)	32	ASCII Code (Delimiter = 00_H)	ACON-CB :“ACON-CB-ML3” DCON-CB :“DCON-CB-ML3” PCON-CB :“PCON-CB-ML3” PCON-CFB :“PCON-CFB-ML3” SCON-CA :“SCON-CA-ML3” SCON-CB :“SCON-CB-ML3” MCON-C :“MCON-C-ML3”
81_H to	Reserved	-		

5.1.1.3 Device Setup Request (CONFIG Code: 04_H)

It is the recalculation of common parameters and setup request command.

Setting of Applicable CONFIG_MOD	
Excluding MCON	0
MCON	0, 1

When CONFIG_MOD is set to 0, CMDRDY = 1 is returned without doing anything.
When CONFIG_MOD is set to 1, the written servo parameters are transferred from the master to the driver board by MODE = 11H in the subcommand SVPRM_WR, and then flash ROM writing starts to be conducted.

(Note) To start writing, it is necessary to satisfy the following conditions;
- The driver board is mounted
- The driver is installed (not the 2nd axis with 1-axis type board)
- Writing is not conducted on another axis in MCON
- Servo is turned off on both 1st and 2nd axes in the driver board

Secure at least 3 seconds or more when setting the timeout on the master side while executing writing. It ordinary finishes in 0.6 to 0.8 seconds. Also, the condition gets to CMDRDY = 0 during writing and the updating of data for other axes in MCON will pause. The condition gets to CMDRDY = 1 when writing is completed, however it gets to CMD_ALM = 1 at the same time when an error has occurred.
To apply the parameters after writing has been executed, it is necessary to have the power turned on to MCON controller.

It generates an alarm for next and command will not be accepted.
1) (Excluding MCON) A value other than 0 is set in CONFIG_MOD (It generates CMD_ALM = 9)
2) (MCON only) A value other than 0 or 1 is set in CONFIG_MOD (It generates CMD_ALM = 9)
3) (MCON only) When writing cannot be executed in CONFIG_MOD = 1 (It generates CMD_ALM = A)
4) (MCON only) When an error has occurred during writing in CONFIG_MOD = 1 (It generates CMD_ALM = 9)
5) (MCON only) The operation mode is MANU mode (It generates CMD_ALM = A)

●CONFIG

Bytes of Command Format	Command	Response	Remarks
0	04_H	04_H	
1	WDT	RWDT	[Refer to section 4.1.2.]
2	CMD_CTRL	CMD_STAT	[Refer to section 4.1.3.]
3			
4	CONFIG_MOD	CONFIG_MOD	Depends on controller
5 to 31	Reserved	Reserved	

5.1.1.4 Alarm / Warning Readout (ALM_RD Code: 05_H)

It is the readout command for the alarms and warnings on the controller.

Setting of Applicable ALM_RD_MOD	
Excluding MCON	0, 3
MCON	0

If ALM_RD_MOD is set to 0, the readout of the alarm code currently generated is conducted. The read out alarm code is stored in Bytes 8 and 9 in the response. When the read out alarm data is 0, it shows that there is no alarm generated.
When ALM_RD_MOD is set to 3 (excluding MCON), the alarm history in the number set in ALM_INDEX *1 is read out.

*1 The setting range of ALM_INDEX is from 0 to 15 for SCON-CA and from 0 to 31 for others. (0 is the latest alarm)

An alarm will be generated and will not accept any command in the following cases:
1) (Excluding MCON) 3 is set in ALM_RD_MOD and a number out of the range is set in ALM_INDEX.
   (It generates CMD_ALM = 9)
2) (Excluding MCON) A value other than 0 or 3 is set in ALM_RD_MOD (It generates CMD_ALM = 9)
3) (MCON only) A value other than 0 is set in ALM_RD_MOD (It generates CMD_ALM = 9)
4) (MCON only) The operation mode is MANU mode (It generates CMD_ALM = A)

●ALM_RD

Bytes of Command Format	Command	Response	Remarks
0	05_H	05_H	
1	WDT	RWDT	[Refer to section 4.1.2.]
2	CMD_CTRL	CMD_STAT	[Refer to section 4.1.3.]
3			
4	ALM_RD_MOD	ALM_RD_MOD	Refer to table below
5			
6	ALM_INDEX	ALM_INDEX	0 to 15 (0 = Latest) * Not to be used in MCON
7			
8 to 31	Reserved	ALM_DATA	

Details of ALM_DATA (For ALM_RD_MOD = 3)

Bytes	Contents	Remarks
8	Alarm Code	Refer to each controller Instruction Manual provided separately for the details of alarm code
9		
10, 11	Reserved	
12	Alarm Occurrence Address	The address is the resistor address inside the controller. (Address is invalid when $FFFF_H$)
13		
14	Alarm Detail Code	The contents of the detail code differ for each alarm code.
15		
16	Alarm Occurrence Clock	If the time setting is activated by turning on the calendar function in Controller Parameter No. 111, it shows the year, month, day and time of the alarm occurrence. If the calendar function is set inactivated in Controller Parameter No. 111, or if the calendar function is set valid, but no clock setting is performed, the timing when the power is turned on to the controller is identified as 00/01/01 00:00:00.
17		
18		
19		

5.1.1.5 Alarm / Warning Clear (ALM_CLR Code: 06_H)

It executes the alarm / warning clearing command.
An alarm currently being generated is available to clear. (Applicable only for ALM_CLR_MOD = 0)
When the operation mode of the controller is set to AUTO, a command is executed to clear alarm / warning being generated on the controller including the communication. When MANU, a command is executed to clear alarm / warning related the communication.
ALM_CLR_MOD is applicable only to 0. It generates an alarm for others and command will not be accepted. (It generates CMD_ALM = 9)

●ALM_CLR

Bytes of Command Format	Command	Response	Remarks
0	06_H	06_H	
1	WDT	RWDT	[Refer to section 4.1.2.]
2	CMD_CTRL	CMD_STAT	[Refer to section 4.1.3.]
3			
4	ALM_CLR_MOD	ALM_CLR_MOD	Applicable only for 0
5			
6 to 31	Reserved	Reserved	

5.1.1.6 Synchronization Establishment Request (SYNC_SET Code: $0D_H$)

It is a command to start the synchronizing communication and request a transition to the communication phase P3.
This command will be ignored if it is executed in a condition that it is already in the communication phase P3.(There is no alarm or warning to be generated.)

●SYNC_SET

Bytes of Command Format	Command	Response	Remarks
0	$0D_H$	$0D_H$	
1	WDT	RWDT	[Refer to section 4.1.2.]
2	CMD_CTRL	CMD_STAT	[Refer to section 4.1.3.]
3			
4 to 31	Reserved	Reserved	

5.1.1.7 Connection Establishment Request (CONNECT Code: $0E_H$)

It is a command to request the establishment of the communication (connection).
This command will be ignored if it is executed in a condition of being in the communication phase P2 or P3. (There is no alarm or warning to be generated.)
An alarm will be generated and will not accept any command in the following cases:

1) A value other than 30_H is set to VER (It generates CMD_ALM = 9)
2) A value other than 0 is set to DTMODE in COM_MODE (It generates CMD_ALM = 9)
3) When in setting of 32-byte Mode, 1 is set to SUBCMD in COM _MODE (It generates CMD_ALM = 9)
4) A value out of the range of 0.5 to 32ms (excluding MCON) or 0.5 to 8ms (MCON) is set in the communication frequency (Transmission frequency × COM_TIME) (It generates CMD_ALM = 9)
5) A value other than 10_H is set in PROFILE_TYPE (It generates CMD_ALM = 9)
6) (MCON only) The operation mode is MANU mode (It generates CMD_ALM = A)
7) (MCON only) Set different values for the communication frequencies of two axes mounted on the same driver board (It generates CMD_ALM = 9)

●CONNECT

Bytes of Command Format	Command	Response	Remarks
0	$0E_H$	$0E_H$	
1	WDT	RWDT	[Refer to section 4.1.2.]
2	CMD_CTRL	CMD_STAT	[Refer to section 4.1.3.]
3			
4	VER	VER	Fixed at 30_H
5	COM_MODE	COM_MODE	Refer to table below
6	COM_TIME	COM_TIME	Establish setting to determine how many times of transmission frequency is to be the communication frequency
7	PROFILE_TYPE	PROFILE_TYPE	Fixed at 10_H
8 to 31	Reserved	Reserved	

Details of COM_MODE Field

Bits	Abbreviations	Names	Contents
0	-	Reserved	
1	SYNC MODE	Synchronizing Setting	0: Non-synchronizing communication (Transited to communication phase P2) 1: Synchronizing communication (Transited to communication phase P3)
2	DTMODE	Communication System	0: Single transmission communication 1: Continuous transmission communication (Not supported)
3			
4 to 6	-	Reserved	
7	SUBCMD	Sub Command Setting	0: Sub command inactivated 1: Sub command activated

5.1.1.8 Connection Release Request (DISCONNECT Code: $0F_H$)

It is a command to request the transition to the communication phase P1 by releasing the communication (connection).
This command is available in any condition.
When the operation mode of the controller is in AUTO, the brake is activated with the servo being turned off once this command is executed.

●DISCONNECT

Bytes of Command Format	Command	Response	Remarks
0	$0F_H$	$0F_H$	
1 to 31	Reserved	Reserved	

5.1.2 Specifications of Standard Servo Profile Commands

5.1.2.1 Servo Status Monitor (SMON Code: 30_H)

It is a command to read out the home-return command and monitor information.
(MCON only) It generates an alarm for the operation mode of the controller is MANU mode and command will not be accepted. (It generates CMD_ALM = A).

●SMON

Bytes of Command Format	Command	Response	Remarks
0	30_H	30_H	
1	WDT	RWDT	[Refer to section 4.1.2.]
2	CMD_CTRL	CMD_STAT	[Refer to section 4.1.3.]
3			
4	SVCMD_CTRL [Refer to section 5.1.2.1-1, “Details of SVCMD_CTRL Field"]	SVCMD_STAT [Refer to section 5.1.2.1-2, “Details of SVCMD_STAT Field"]	
5			
6			
7			
8	SVCMD_IO [Refer to section 5.1.2.1-3, “Details of SVCMD_IO Command Field”]	SVCMD_IO [Refer to section 5.1.2.1-4, “Details of SVCMD_IO Response Field”]	
9			
10			
11			
12	Reserved	CPRM_SEL_MON1	Selected in Common Parameter No. 87 [Refer to section 5.3.]
13			
14			
15			
16		CPRM_SEL_MON2	Selected in Common Parameter No. 88 [Refer to section 5.3.]
17			
18			
19			
20		MONITOR1	Refer to section 5.1.2.1-1, “Details of SVCMD_CTRL Field" and 5.1.2.1-5, “Monitor Information”
21			
22			
23			
24		MONITOR2	
25			
26			
27			
28		MONITOR3	
29			
30			
31			

5.1.2.1-1 Details of SVCMD_CTRL Field

Bits	Abbreviations	Names	Contents
0	CMD_PAUSE	Movement Command Pause	0: None 1: Pause It is available only during POSING, FEED Command or home-return operation. The previous condition is continued in other cases. Because the target position is not changed, a pause during an operation does not complete the discharge (DEN = 1). [Refer to section 5.1.2.1-4 “Details of SVCMD_IO Response Field”] When issued at the same time as CMD_CANCEL, CMD_CANCEL will be prioritized. It will be ignored when the operation mode of the controller is in MANU.
1	CMD_CANCEL	Movement Command Cancel	0: None 1: Movement is cancelled It is available only during POSING, FEED Command or home-return operation. The previous condition is continued in other cases. Because the target position is changed, Completion of the movement cancel completes the discharge (DEN = 1). [Refer to section 5.1.2.1-4 “Details of SVCMD_IO Response Field”] It will be ignored when the operation mode of the controller is in MANU.
2, 3	STOP_MODE	Stop Mode Selection	0: Deceleration and stop (recommended) 1: Sudden stop This indicates the stop mode for CMD_PAUSE and CMD_CANCEL above. Do not attempt to set a number above 2. It will be ignored when the operation mode of the controller is in MANU. ⚠ Caution (Excluding MCON) For sudden stop, the target position is replaced to the current command value to perform a stop. However, CMD_CANCEL during the home-return operation is a stop at the spot no matter what stop mode is selected. (MCON) For sudden stop, the actuator stops with the maximum deceleration. However, in CMD_PAUSE/CMD_CANCEL during the home-return operation, stop will be made at the spot regardless of the stop mode.
4 to 15	-	Reserved	
16 to 19	SEL_MON1	Monitor Select 1	Monitor code to be set in MONITOR1 [Refer to section 5.1.2.1-5, “Monitor Information”]
20 to 23	SEL_MON2	Monitor Select 2	Monitor code to be set in MONITOR2 [Refer to section 5.1.2.1-5, “Monitor Information”]
24 to 27	SEL_MOM3	Monitor Select 3	Monitor code to be set in MONITOR3 [Refer to section 5.1.2.1-5, “Monitor Information”]
28 to 31	-	Reserved	

5.1.2.1-2 Details of SVCMD_STAT Field

Bits	Abbreviations	Names	Contents
0	CMD_PAUSE_CMP	Movement Command Pause Complete	0: None 1: Pause Completed It shows the completion of pause commanded by CMD_PAUSE [Refer to section 5.1.2.1-1, “Details of SVCMD_CTRL Field”] It turns to 1 when CMD_PAUSE = 1 and zero speed (ZSPD = 1) during POSING, FEED Command or the home-return operation. [Refer to section 5.1.2.1-4, “Details of SVCMD_IO Response Field”]
1	CMD_CANCEL_CMP	Movement Command Cancel Complete	0: None 1: Movement cancel completed It shows the completion of movement cancel commanded by CMD_CANCEL [Refer to section 5.1.2.1-1, “Details of SVCMD_CTRL Field”] It turns to 1 if CMD_CANCEL = 1 and also the disposal complete (DEN = 1) [Refer to section 5.1.2.1-4 SVCMD_IO Response Field Detail] when in POSING and FEED Commands. It remains 0 when CMD_CANCEL = 1 during home-return operation.
2 to 9	-	Reserved	
10	POS_RDY	Position Information Valid	● For Absolute Encoder Type 0: Home-return incomplete 1: Home-return completed It turns to 1 when absolute reset is complete (home-return is complete). ● For Incremental Encoder Type 0: Condition of connection not being established 1: Condition of connection being established It turns to 1 when CONNECT Command process completes.
11	PON	Main Power ON	Always 1 is read out
12	M_RDY	Motor Conductivity Ready	0: Driving source OFF 1: Driving source ON
13	SV_ON	Servo ON	0: Servo OFF 1: Servo ON The torque control value is the current control value during movement of the controller parameter when the servo is off.
14、15	-	Reserved	
16 to 19	SEL_MON1	Monitor Select 1	The value set in SEL_MON1 of SVCMD_CTRL is replied.
20 to 23	SEL_MON2	Monitor Select 2	The value set in SEL_MON2 of SVCMD_CTRL is replied.
24 to 27	SEL_MON3	Monitor Select 3	The value set in SEL_MON3 of SVCMD_CTRL is replied.
28	-	Reserved	
29	BALM (Only for Serial Encoder Type in SCON and ACON)	Battery Alarm	0: ABS battery voltage in normal condition 1: ABS battery voltage low warning
30	DALM	Driver Alarm	0: No alarm 1: Alarm being generated (warnings excluded)
31	GALM (MCON only)	Gateway Alarm	0: No alarm of the gateway board 1: Alarm being generated of the gateway board

(Note) As Bit 28 to 31 (in gray for background color) in this command field are defined as the vendor specific domain on the specifications of MECHATROLINK- III, it is necessary to check the way to operate in the manual for the master PLC.

5.1.2.1-3 Details of SVCMD_IO Command Field (Master ⇒ Slave)

Bits	Abbreviations	Names	Contents
0 to 7	-	Reserved	
8 to 11	G_SEL (ACON, SCON only)	Gain Switchover	0 to 3: Servo gain set select Select the servo gain set 0 to 3 in the controller parameter. Do not attempt to set to 4 or higher. It is available only for INTERPOLATE, POSING and FEED Commands, and is reflected immediately if a command is being executed. Home-return operation activates with the setting of servo gain set 0. It will be ignored when the operation mode of the controller is in MANU.
12 to 15	-	Reserved	
16	BKRL	Brake Compulsory Release	0: Not to have the brake compulsorily released when the servo is off 1: To have the brake compulsorily released when the servo is off It will be ignored when the operation mode of the controller is in MANU. ⚠Caution This bit is accepted even when the servo is on. In case of the axis installed in vertical orientation, the transported object or fixture may drop once the servo is turned off in the condition of the brake release command.
17	HOME	Home-Return	Home-return operation starts when the startup edge is detected. The current control value at home-return and the current control value at a movement after the home-return operation are the controller parameter value. It will be ignored when the operation mode of the controller is in MANU or the command is INTERPOLATE, POSING or FEED.
18 to 31	-	Reserved	

(Note) As Bit 16 to 31 (in gray for background color) in this command field are defined as the vendor specific domain on the specifications of MECHATROLINK-III, it is necessary to check the way to operate in the manual for the master PLC.

5.1.2.1-4 Details of SVCMD_IO Response Field (Slave ⇒ Master)

Bits	Abbreviations	Names	Contents
0, 1	-	Reserved	
2	P_OT	Input of Drive in Positive Direction Forbidden	Always 0 is read out.
3	N_OT	Input of Drive in Negative Direction Forbidden	
4 to 6	-	Reserved	
7	ESTP	Emergency Stop	0: Emergency stop released 1: In emergency stop condition
8	-	Reserved	
9	BRK_ON (Excluding MCON)	Brake Output	0: brake release 1: Brake lock It shows the condition of Brake Release/Lock Command. However, the condition of hardware switches (such as the brake release switch on the front of the controller) cannot be reflected.
10	P_SOT	Positive Side Soft Limit	0: Current position is in positive side software limit 1: Current position exceeds positive side software limit
11	N_SOT	Negative Side Soft Limit	0: Current position is in negative side software limit 1: Current position exceeds negative side software limit
12	DEN	Discharge Complete (Position Control Mode)	0: Position command output incomplete 1: Position command output completed
13	NEAR	Near Positioning (Position Control Mode)	0: Current position out of near positioning band 1: Current position in near positioning band * Near positioning band initial setting = positioning band initial setting in parameter
14	PSET	Positioning Complete (Position Control Mode)	0: DEN = 0 (Bit 12) or current position out of positioning complete band 1: DEN = 1 and current position in positioning complete band * Positioning complete band initial setting = positioning band initial setting in parameter
15	ZPOINT	Home Position	0: Home-return incomplete or current position out of home position detection band 1: Home-return completed and current position in home position detection band * Home position detection band initial setting = positioning band initial setting in parameter
16 to 18	-	Reserved	
19	ZSPD	Zero Speed	0: Current speed out of zero speed detection band 1: Current speed in zero speed detection band
20 to 23	-	Reserved	
24	OVLW	Overload Warning	0: Operation in normal condition 1: Driver overload warning generated
25	HEND	Home-return Completed	0: Home-return incomplete 1: Home-return completed
26	ZONE1	Zone 1	0: Current position out of ZONE1 range 1: Current position in ZONE1 range * Because ZONE1 updates the status in the control frequency of the controller, it may not synchronize with the APOS of the monitor [Refer to section 5.1.2.1-5, “Monitor Information”].
27	ZONE2	Zone 2	0: Current position out of ZONE2 range 1: Current position in ZONE2 range * Because ZONE2 updates the status in the control frequency of the controller, it may not synchronize with the APOS of the monitor [Refer to section 5.1.2.1-5, “Monitor Information”].

Bits	Abbreviations	Names	Contents
28	RMDS	Operation Mode	0:AUTO 1:MANU
29 to 31	-	Reserved	

(Note) As Bit 24 to 31 (in gray for background color) in this command field are defined as the vendor specific domain on the specifications of MECHATROLINK- III, it is necessary to check the way to operate in the manual for the master PLC.

5.1.2.1-5 Monitor Information

Code	Monitor Name	Contents	Unit	Symbol	Remarks
0_H	APOS	Feedback Position	Command unit	Exist	
1_H	CPOS	Command Position	Command unit	Exist	
2_H	PERR	Position Deviation	Command unit	Exist	
3, 4_H	-	Reserved			
5_H	FSPD	Feedback Speed	Command unit /s	Exist	
6_H	CSPD	Command Speed	Command unit /s	Exist	
7_H	TRQ	Command Torque (Thrust)	%	Exist	
8_H	ALARM	Detailed Information for Alarm Currently Generated		None	It shows the warning or alarm code
9_H	MPOS	Command Position	Command unit	Exist	It should be the same value as CPOS (Code 1)
A, B_H	-	Reserved			
C_H	CMN1	Common Monitor 1 [Refer to the next table]			It is to be indicated in Common Parameter No. 89 [Refer to section 5.3.]
D_H	CMN2	Common Monitor 2 [Refer to the next table]			It is to be indicated in Common Parameter No. 8A [Refer to section 5.3.]
E, F_H	-	Reserved			

5.1.2.1-6 Common Monitor Data List

Code	Names	Contents	Units	Symbol	Remarks
0	TPOS	Target Position	Command unit	Exist	
1	IPOS	Instruction Position	Command unit	Exist	It is the same value as CPOS (Code 1 in Monitor Information)
2	-	Reserved			
3	TSPD	Target Speed	Command unit /s	None	
4	-	Reserved			
5	TRQ_LIM	Torque Limit	%	None	
6	SV_STAT	Servo Actual Operational Status	-	None	[0]: Communication Phase [1]: Current control mode (0: fixed to position control) [2]: Reserve(fixed to 0) [3]: Extension input signal monitor (Always all bits 0)
7 to 9	-	Reserved			

5.1.2.2 Sensor-on Request (SENS_ON Code: 23_H)

It is the command to request the sensor (encoder) to turn ON. Since it is unable to turn on and off the encoder power with a command, this just replies a normal response.
(The data except for Response Command (23_H) is the same as section 5.1.2.1 SMON Command)
It generates an alarm for the operation mode of the controller is MANU mode and command will not be accepted. (It generates CMD_ALM = A).

●SENS_ON

Bytes of Command Format	Command	Response	Remarks
0	23_H	23_H	
1	WDT	RWDT	[Refer to section 4.1.2.]
2	CMD_CTRL	CMD_STAT	[Refer to section 4.1.3.]
3			
4	SVCMD_CTRL [Refer to section 5.1.2.1-1, "Details of SVCMD_CTRL Field"]	SVCMD_STAT [Refer to section 5.1.2.1-2, "Details of SVCMD_STAT Field"]	
5			
6			
7			
8	SVCMD_IO [Refer to section 5.1.2.1-3, "Details of SVCMD_IO Command Field"]	SVCMD_IO [Refer to section 5.1.2.1-4, "Details of SVCMD_IO Response Field"]	
9			
10			
11			
12	Reserved	CPRM_SEL_MON1	Selected in Common Parameter No. 87 [Refer to section 5.3.]
13			
14			
15			
16		CPRM_SEL_MON2	Selected in Common Parameter No. 88 [Refer to section 5.3.]
17			
18			
19			
20		MONITOR1	Refer to section 5.1.2.1-1 "Details of SVCMD_CTRL Field" and 5.1.2.1-5 "Monitor Information"
21			
22			
23			
24		MONITOR2	
25			
26			
27			
28		MONITOR3	
29			
30			
31			

5.1.2.3 Sensor-off Request (SENS_OFF Code: 24_H)

It is the command to request the sensor (encoder) to turn OFF. Since it is unable to turn on and off the encoder power with a command, this just replies a normal response.
(The data except for Response Command (24_H) is the same as section 5.1.2.1 SMON Command)
It generates an alarm for the operation mode of the controller is MANU mode and command will not be accepted. (It generates CMD_ALM = A).

●SENS_OFF

Bytes of Command Format	Command	Response	Remarks
0	24_H	24_H	
1	WDT	RWDT	[Refer to section 4.1.2.]
2	CMD_CTRL	CMD_STAT	[Refer to section 4.1.3.]
3			
4	SVCMD_CTRL [Refer to section 5.1.2.1-1, "Details of SVCMD_CTRL Field"]	SVCMD_STAT [Refer to section 5.1.2.1-2, "Details of SVCMD_STAT Field"]	
5			
6			
7			
8	SVCMD_IO [Refer to section 5.1.2.1-3, "Details of SVCMD_IO Command Field"]	SVCMD_IO [Refer to section 5.1.2.1-4, "Details of SVCMD_IO Response Field"]	
9			
10			
11			
12	Reserved	CPRM_SEL_MON1	Selected in Common Parameter No. 87 [Refer to section 5.3.]
13			
14			
15			
16		CPRM_SEL_MON2	Selected in Common Parameter No. 88 [Refer to section 5.3.]
17			
18			
19			
20		MONITOR1	Refer to section 5.1.2.1-1 "Details of SVCMD_CTRL Field" and 5.1.2.1-5 "Monitor Information"
21			
22			
23			
24		MONITOR2	
25			
26			
27			
28		MONITOR3	
29			
30			
31			

5.1.2.4 Servo ON Request (SV_ON Code: 31_H)

It is the command to request the servo to turn ON.
For the servo status, check SV_ON in SVCMD_STAT
(The data except for Response Command (31_H) is the same as section 5.1.2.1 SMON Command)
An alarm will be generated and will not accept any command in the following cases:
1) Alarm is generated on the controller (It generates CMD_ALM = A)
2) In emergency stop condition (It generates CMD_ALM = A)
3) Communication alarm is generated (COMM_ALM ≥ 8) (It generates CMD_ALM = A)
4) The operation mode of the controller is MANU mode (It generates CMD_ALM = A)

●SV_ON

Bytes of Command Format	Command	Response	Remarks
0	31_H	31_H	
1	WDT	RWDT	[Refer to section 4.1.2.]
2	CMD_CTRL	CMD_STAT	[Refer to section 4.1.3.]
3			
4	SVCMD_CTRL [Refer to section 5.1.2.1-1, "Details of SVCMD_CTRL Field"]	SVCMD_STAT [Refer to section 5.1.2.1-2, "Details of SVCMD_STAT Field"]	
5			
6			
7			
8	SVCMD_IO [Refer to section 5.1.2.1-3, "Details of SVCMD_IO Command Field"]	SVCMD_IO [Refer to section 5.1.2.1-4, "Details of SVCMD_IO Response Field"]	
9			
10			
11			
12	Reserved	CPRM_SEL_MON1	Selected in Common Parameter No. 87 [Refer to section 5.3.]
13			
14			
15			
16		CPRM_SEL_MON2	Selected in Common Parameter No. 88 [Refer to section 5.3.]
17			
18			
19			
20		MONITOR1	Refer to section 5.1.2.1-1 "Details of SVCMD_CTRL Field" and 5.1.2.1-5 "Monitor Information"
21			
22			
23			
24		MONITOR2	
25			
26			
27			
28		MONITOR3	
29			
30			
31			

5.1.2.5 Servo OFF Request (SV_OFF Code: 32_H)

It is the command to request the servo to turn OFF.
For the servo status, check SV_ON in SVCMD_STAT
(The data except for Response Command (32_H) is the same as section 5.1.2.1 SMON Command)
It generates an alarm for the operation mode of the controller is MANU mode and command will not be accepted. (It generates CMD_ALM = A)

●SV_OFF

Bytes of Command Format	Command	Response	Remarks
0	32_H	32_H	
1	WDT	RWDT	[Refer to section 4.1.2.]
2	CMD_CTRL	CMD_STAT	[Refer to section 4.1.3.]
3			
4	SVCMD_CTRL [Refer to section 5.1.2.1-1, "Details of SVCMD_CTRL Field"]	SVCMD_STAT [Refer to section 5.1.2.1-2, "Details of SVCMD_STAT Field"]	
5			
6			
7			
8	SVCMD_IO [Refer to section 5.1.2.1-3, "Details of SVCMD_IO Command Field"]	SVCMD_IO [Refer to section 5.1.2.1-4, "Details of SVCMD_IO Response Field"]	
9			
10			
11			
12	Reserved	CPRM_SEL_MON1	Selected in Common Parameter No. 87 [Refer to section 5.3.]
13			
14			
15			
16		CPRM_SEL_MON2	Selected in Common Parameter No. 88 [Refer to section 5.3.]
17			
18			
19			
20		MONITOR1	Refer to section 5.1.2.1-1 "Details of SVCMD_CTRL Field" and 5.1.2.1-5 "Monitor Information"
21			
22			
23			
24		MONITOR2	
25			
26			
27			
28		MONITOR3	
29			
30			
31			

5.1.2.6 Interpolation Feeding (INTERPOLATE Code: 34_H)

It is a command to request the interpolation feeding.
For the output complete of the movement command data, check DEN = 1 in SVCMD_IO.
For the positioning complete, check PSET = 1 in SVCMD_IO.
When the target position (TPOS) is out of the soft limit range, the target position makes the soft limit.
In the condition of the home-return operation incomplete, an operation is made with the position at the controller being booted as the datum point.
An alarm will be generated and will not accept any command in the following cases:
1) The operation mode of the controller is MANU mode (It generates CMD_ALM = A)
2) The controller is in a condition of the servo being off (It generates CMD_ALM = A)
3) In home-return operation (It generates CMD_ALM = A)

●INTERPOLATE

Bytes of Command Format	Command	Response	Remarks
0	34_H	34_H	
1	WDT	RWDT	[Refer to section 4.1.2.]
2	CMD_CTRL	CMD_STAT	[Refer to section 4.1.3.]
3			
4	SVCMD_CTRL [Refer to section 5.1.2.1-1, "Details of SVCMD_CTRL Field"]	SVCMD_STAT [Refer to section 5.1.2.1-2, "Details of SVCMD_STAT Field"]	
5			
6			
7			
8	SVCMD_IO [Refer to section 5.1.2.1-3, "Details of SVCMD_IO Command Field"]	SVCMD_IO [Refer to section 5.1.2.1-4, "Details of SVCMD_IO Response Field"]	
9			
10			
11			
12	TPOS (with symbol)	CPRM_SEL_MON1	• Set target position with symbol for TPOS • CPRM_SEL_MON1 to be selected in Common Parameter No. 87 [Refer to section 5.3.]
13			
14			
15			
16	VFF (Not used: Specify 0)	CPRM_SEL_MON2	Selected in Common Parameter No. 88 [Refer to section 5.3.]
17			
18			
19			
20	TFF (Not used: Specify 0)	MONITOR1	• Torque limit [% x 10^0] to be set in TLIM (Operation made with max. value when TLIM = $FFFFFFFF_H$) Alarm (CMD_ARM = 1) to be generated and operation made with maximum value when the value exceeds the maximum value. • For MONITOR*, refer to section 5.1.2.1-1 "Details of SVCMD_CTRL Field" and 5.1.2.1-5 "Monitor Information"
21			
22			
23			
24	Reserved	MONITOR2	
25			
26			
27			
28	TLIM (with no symbol)	MONITOR3	
29			
30			
31			

5.1.2.7 Positioning (POSING Code: 35_H)

It is a command to request positioning to the indicated point.
It is a command to request the interpolation feeding.
For the output complete of the movement command data, check DEN = 1 in SVCMD_IO.
When the positioning operation is to be cancelled, set CMD_CANCEL in SVCMD_CTRL to 1.
When the positioning operation is to be paused, set CMD_PAUSE in SVCMD_CTRL to 1.
For the positioning complete, check PSET = 1 in SVCMD_IO.
When the target position (TPOS) is out of the soft limit range, the target position makes the soft limit.
In the condition of the home-return operation incomplete, an operation is made with the position at the controller being booted as the datum point.
An alarm will be generated and will not accept any command in the following cases:
1) The operation mode of the controller is MANU mode (It generates CMD_ALM = A)
2) The controller is in a condition of the servo being off (It generates CMD_ALM = A)
3) In home-return operation (It generates CMD_ALM = A)
4) Either of ACCR or DECR is set 0 (It generates CMD_ALM = 9)

●POSING

Bytes of Command Format	Command	Response	Remarks
0	35_H	35_H	
1	WDT	RWDT	[Refer to section 4.1.2.]
2	CMD_CTRL	CMD_STAT	[Refer to section 4.1.3.]
3			
4	SVCMD_CTRL [Refer to section 5.1.2.1-1, "Details of SVCMD_CTRL Field"]	SVCMD_STAT [Refer to section 5.1.2.1-2, "Details of SVCMD_STAT Field"]	
5			
6			
7			
8	SVCMD_IO [Refer to section 5.1.2.1-3, "Details of SVCMD_IO Command Field"]	SVCMD_IO [Refer to section 5.1.2.1-4, "Details of SVCMD_IO Response Field"]	
9			
10			
11			
12	TPOS (with symbol)	CPRM_SEL_MON1	• Set target position with symbol for TPOS • CPRM_SEL_MON1 to be selected in Common Parameter No. 87 [Refer to section 5.3.]
13			
14			
15			
16	TSPD (with no symbol)	CPRM_SEL_MON2	• Target speed to be set in TSPD (When exceeds max. value, operation made with max. value and warning to be issued) • CPRM_SEL_MON2 to be selected in Common Parameter No. 88 [Refer to section 5.3.]
17			
18			
19			

Bytes of Command Format	Command	Response	Remarks
20	ACCR (with no symbol)	MONITOR1	• ACCR (acceleration) and DECR (deceleration) to be set (Operation made with max. value when ACCR, DECR = $FFFFFFFF_H$) Alarm (CMD_ARM = 1) to be generated and operation made with maximum value when the value exceeds the maximum value. (when ACCR and DECR = 0_H, operation is to be made with acceleration initial value of the controller parameter for those other than MCON and with acceleration maximum value of the controller parameter for MCON) • Torque limit [% x 10^0] to be set in TLIM (Operation made with max. value when TLIM = $FFFFFFFF_H$) Alarm (CMD_ARM = 1) to be generated and operation made with maximum value when the value exceeds the maximum value. • For MONITOR*, refer to section 5.1.2.1-1 “Details of SVCMD_CTRL Field” and 5.1.2.1-5 “Monitor Information”
21			
22			
23			
24	DECR (with no symbol)	MONITOR2	
25			
26			
27			
28	TLIM (with no symbol)	MONITOR3	
29			
30			
31			

5.1.2.8 Constant Speed Feeding (FEED Code: 36_H)

It is a command to request the constant speed feeding with the indicated speed.
For the output complete of the movement command data, check DEN = 1 in SVCMD_IO.
When having the constant speed feeding cancelled, make CMD_CANCEL to 1 in SVCMD_CTRL.
When having the constant speed feeding paused, make CMD_PAUSE to 1 in SVCMD_CTRL.
For the positioning complete, check PSET = 1 in SVCMD_IO.
For the direction of movement, when the value in the target speed (TSPD) is the positive number, it is the direction opposite the home position, while negative is towards the home position.
In the condition of home-return being complete, the target position is made the soft limit.
An alarm will be generated and will not accept any command in the following cases:
1) The operation mode of the controller is MANU mode (It generates CMD_ALM = A)
2) The controller is in a condition of the servo being off (It generates CMD_ALM = A)
3) In home-return operation (It generates CMD_ALM = A)
4) Either of ACCR or DECR is set 0 (It generates CMD_ALM = 9)

●FEED

Bytes of Command Format	Command	Response	Response
0	36_H	36_H	
1	WDT	RWDT	[Refer to section 4.1.2.]
2	CMD_CTRL	CMD_STAT	[Refer to section 4.1.3.]
3			
4	SVCMD_CTRL [Refer to section 5.1.2.1-1, "Details of SVCMD_CTRL Field"]	SVCMD_STAT [Refer to section 5.1.2.1-2, "Details of SVCMD_STAT Field"]	
5			
6			
7			
8	SVCMD_IO [Refer to section 5.1.2.1-3, "Details of SVCMD_IO Command Field"]	SVCMD_IO [Refer to section 5.1.2.1-4, "Details of SVCMD_IO Response Field"]	
9			
10			
11			
12	Reserved	CPRM_SEL_MON1	• To be selected in Common Parameter No. 87 [Refer to section 5.3.]
13			
14			
15			
16	TSPD (with no symbol)	CPRM_SEL_MON2	• Set the target speed with sign to TSPD (When exceeds max. value, operation made with max. value and warning to be issued) • CPRM_SEL_MON2 to be selected in Common Parameter No. 88 [Refer to section 5.3.]
17			
18			
19			

Bytes of Command Format	Command	Response	Response
20	ACCR (with no symbol)	MONITOR1	• ACCR (acceleration) and DECR (deceleration) to be set (Operation made with max. value when ACCR, DECR = $FFFFFFFF_H$) Alarm (CMD_ARM = 1) to be generated and operation made with maximum value when the value exceeds the maximum value. (when ACCR and DECR = 0_H, operation is to be made with acceleration initial value of the controller parameter for those other than MCON and with acceleration maximum value of the controller parameter for MCON) • Torque limit [% x 10^0] to be set in TLIM (Operation made with max. value e when TLIM = $FFFFFFFF_H$) Alarm (CMD_ARM = 1) to be generated and operation made with maximum value when the value exceeds the maximum value. • For MONITOR*, refer to section 5.1.2.1-1 “Details of SVCMD_CTRL Field” and 5.1.2.1-5 “Monitor Information”
21			
22			
23			
24	DECR (with no symbol)	MONITOR2	
25			
26			
27			
28	TLIM (with no symbol)	MONITOR3	
29			
30			
31			

5.1.2.9 Servo Parameter Reading (SVPRM_RD Code: 40_H)

It is a command to request the readout of the servo parameter.
An alarm will be generated and will not accept any command in the following cases:
1) Readout Parameter No. (NO) indicates a value out of the range (It generates CMD_ALM = 9)
2) Readout Parameter No. does not match with the data size (SIZE) (It generates CMD_ALM = 9)
3) (Excluding MCON) A value other than 00_H or 10_H is set in MODE (It generates CMD_ALM = 9)
4) (MCON only) A value other than 00_H, 10_H or 11_H is set in MODE (It generates CMD_ALM = 9)
5) (MCON only) The operation mode is MANU mode (It generates CMD_ALM = A)

●SVPRM_RD

Bytes of Command Format	Command	Response	Remarks
0	40_H	40_H	
1	WDT	RWDT	[Refer to section 4.1.2.]
2	CMD_CTRL	CMD_STAT	[Refer to section 4.1.3.]
3			
4	SVCMD_CTRL [Refer to section 5.1.2.1-1, "Details of SVCMD_CTRL Field"]	SVCMD_STAT [Refer to section 5.1.2.1-2, "Details of SVCMD_STAT Field"]	
5			
6			
7			
8	SVCMD_IO [Refer to section 5.1.2.1-3, "Details of SVCMD_IO Command Field"]	SVCMD_IO [Refer to section 5.1.2.1-4, "Details of SVCMD_IO Response Field"]	
9			
10			
11			
12	NO	NO	Refer to Common Parameter List and Device Parameter List [Refer to section 5.3.]
13			
14	SIZE	SIZE	04_H: All data 4 bytes
15	MODE	MODE	00_H: Common parameter domain 10_H: Device parameter domain
16	Reserved	PARAMETER	PARAMETER is the common or device parameter that is read out.
17			
18			
19			
20			
21			
22			
23			
24			
25			
26			
27			
28			
29			
30			
31			

5.1.2.10 Servo Parameter Writing (SVPRM_WR Code: 41_H)

It is a command to request the writing of the servo parameter. However, writing into the non-volatile memory is not available.
An alarm will be generated and will not accept any command in the following cases:
1) Writing Parameter No. (NO) indicates a value out of the range (It generates CMD_ALM = 9)
2) Writing Parameter No. does not match with the data size (SIZE) (It generates CMD_ALM = 9)
3) A value other than 00_H is set in MODE (It generates CMD_ALM = 9)
4) (MCON only) The operation mode is MANU mode (It generates CMD_ALM = A)

●SVPRM_WR

Bytes of Command Format	Command	Response	Remarks
0	41_H	41_H	
1	WDT	RWDT	[Refer to section 4.1.2.]
2	CMD_CTRL	CMD_STAT	[Refer to section 4.1.3.]
3			
4	SVCMD_CTRL [Refer to section 5.1.2.1-1, "Details of SVCMD_CTRL Field"]	SVCMD_STAT [Refer to section 5.1.2.1-2, "Details of SVCMD_STAT Field"]	
5			
6			
7			
8	SVCMD_IO [Refer to section 5.1.2.1-3, "Details of SVCMD_IO Command Field"]	SVCMD_IO [Refer to section 5.1.2.1-4, "Details of SVCMD_IO Response Field"]	
9			
10			
11			
12	NO	NO	Refer to Common Parameter List [Refer to section 5.3.]
13			
14	SIZE	SIZE	04_H: All data 4 bytes
15	MODE	MODE	00_H: Common parameter domain
16	PARAMETER	PARAMETER	PARAMETER is the common parameter
17			
18			
19			
20			
21			
22			
23			
24			
25			
26			
27			
28			
29			
30			
31			

5.2 Sub Command

5.2.1 Combination of Main Command and Sub Command

Refer to the table below to check the combinations of the sub commands.

Combination of Main Command and Sub Command

○: Combination available, ×: Combination Unavailable

Main Command	Sub Command				
	NOP (00_H)	ALM_RD (05_H)	SMON (30_H)	SVPRM_RD (40_H)	SVPRM_WR*1 (41_H)
NOP (00_H)	○	○	○	○	○
ID_RD (03_H)	○	○	○	○	○
CONFIG (04_H)	○	○	○	×	×
ALM_RD (05_H)	○	○	○	×	×
ALM_CLR (06_H)	○	○	○	×	×
SYNC_SET ($0D_H$)	○	○	○	×	×
CONNEC T($0E_H$)	○	×	×	×	×
DISCONNECT ($0F_H$)	○	×	×	×	×
SENS_ON (23_H)	○	○	○	×	×
SENS_OFF (24_H)	○	○	○	×	×
SMON (30_H)	○	○	○	○	○
SV_ON (31_H)	○	○	○	○	○
SV_OFF (32_H)	○	○	○	○	○
INTERPOLATE (34_H)	○	○	○	○	○
POSING (35_H)	○	○	○	○	○
FEED (36_H)	○	○	○	○	○
SVPRM_RD (40_H)	○	○	○	×	×
SVPRM_WR (41_H)	○	○	○	×	×

*1 It is applicable only to MCON.

5.2.2 Specifications of Sub Commands

5.2.2.1 Invalid (NOP Code: 00_H)

It is an invalid command.
Current condition is replied as a response.
The response from the power turned on till the completion of the initializing process is NOP, and no command but DISCONNECT can be received.

●NOP

Bytes of Command Format	Command	Response	Remarks
32	00_H	00_H	
33	SUB_CTRL [Refer to section 5.2.2.1-1, "Details of SUB_CTRL Field"]	SUB_STAT [Refer to section 5.2.2.1-2, "Details of SUB_STAT Field"]	
34			
35			
36 to 47	Reserved	Reserved	

5.2.2.1-1 Details of SUB_CTRL Field

Bits	Abbreviations	Names	Contents
0 to 11	-	Reserved	
12 to 15	SEL_MON4	Monitor Select 4	Monitor code set to MONITOR4 in SMON Command of sub command (Refer to section 5.1.2.1-5, Monitor Information)
16 to 19	SEL_MON5	Monitor Select 5	Monitor code set to MONITOR5 in SMON Command of sub command (Refer to section 5.1.2.1-5, Monitor Information)
20 to 23	SEL_MON6	Monitor Select 6	Monitor code set to MONITOR6 in SMON Command of sub command (Refer to section 5.1.2.1-5, Monitor Information)

5.2.2.1-2 Details of SUB_STAT Field

Bits	Abbreviations	Names	Contents
0, 1	-	Reserved	
2	SUBCMDRDY	Sub Command Ready	It shows the status that sub command reception is available. This always shows 1 no matter of sub command valid/invalid after the connection is established in the main command (CONNECT) during 48-byte Mode.
4 to 7	-	Reserved	
8 to 11	SUBCMD_ALM	Sub Command Alarm	It shows an abnormality in a command. It is cleared automatically once a normal command is received. It uses the same alarm code as for CMD_ALM in CMD_STAT in the main command.
12 to 15	SEL_MON4	Monitor Select 4	The value set in SEL_MON4 in SUB_CTRL is to be replied.
16 to 19	SEL_MON5	Monitor Select 5	The value set in SEL_MON5 in SUB_CTRL is to be replied.
20 to 23	SEL_MON6	Monitor Select 6	The value set in SEL_MON6 in SUB_CTRL is to be replied.

5.2.2.2 Alarm / Warning Readout (ALM_RD Code: 05_H)

It is the readout command for the alarms and warnings on the controller.
ALM_RD_MOD is applicable only to 0 that reads out the alarm code currently being generated.
The read out alarm code is stored in Bytes 40 and 41 in the response. When the read out alarm data is 0, it shows that there is no alarm generated.
An alarm will be generated and will not accept any command in the following cases:
1) A value other than 0 is set to ALM_RD_MOD. (It generates SUBCMD_ALM = 9)
2) (MCON only) The operation mode is MANU mode (It generates SUBCMD_ALM = A)

●ALM_RD

Bytes of Command Format	Command	Response	Remarks
32	05_H	05_H	
33	SUB_CTRL [Refer to section 5.2.2.1-1, "Details of SUB_CTRL Field"]	SUB_STAT [Refer to section 5.2.2.1-2, "Details of SUB_STAT Field"]	
34			
35			
36	ALM_RD_MOD	ALM_RD_MOD	Fixed to 0
37			
38	Reserved	Reserved	
39			
40-47	Reserved	ALM_DATA	

5.2.2.3 Servo Status Monitor (SMON Code: 30_H)

It is a command to read out the monitor information.
(MCON only) It generates an alarm for the operation mode of the controller is MANU mode and command will not be accepted. (It generates SUBCMD_ALM = A).

●SMON

Bytes of Command Format	Command	Response	Remarks
32	30_H	30_H	
33	SUB_CTRL [Refer to section 5.2.2.1-1, "Details of SUB_CTRL Field"]	SUB_STAT [Refer to section 5.2.2.1-2, "Details of SUB_STAT Field"]	
34			
35			
36	Reserved	MONITOR4	Refer to section 5.2.2.1-1, "Details of SUB_ CTRL Field"
37			
38			
39			
40		MONITOR5	
41			
42			
43			
44		MONITOR6	
45			
46			
47			

5.2.2.4 Servo Parameter Reading (SVPRM_RD Code: 40_H)

It is a command to request the readout of the servo parameter.
An alarm will be generated and will not accept any command in the following cases:

1) Readout Parameter No. (NO) indicates a value out of the range (It generates SUBCMD_ALM = 9)
2) (Excluding MCON) Readout Parameter No. does not match with the data size (SIZE) (It generates SUBCMD_ALM = 9)
3) (MCON only) A value other than 00_H or 10_H is set in MODE (It generates SUBCMD_ALM = 9)
4) (MCON only) A value other than 00_H, 10_H or 11_H is set in MODE (It generates SUBCMD_ALM = 9)
5) (MCON only) 10_H or 11_H is set in MODE while the servo is ON (It generates SUBCMD_ALM = A)
6) (MCON only) The operation mode is MANU mode (It generates SUBCMD_ALM = A)

●SVPRM_RD

Bytes of Command Format	Command	Response	Remarks
32	$4C0_H$	40_H	
33	SUB_CTRL [Refer to section 5.2.2.1-1, "Details of SUB_CTRL Field"]	SUB_STAT [Refer to section 5.2.2.1-2, "Details of SUB_STAT Field"]	
34			
35			
36	NO	NO	Common parameter list, and Device parameter list
37			
38	SIZE	SIZE	
39	MODE	MODE	00_H: Common parameter domain 10_H: Device parameter domain 11_H: Device parameter non-volatile memory domain indication (MCON only) [Refer to section 5.3.]
40	Reserved	PARAMETER	PARAMETER is the common or device parameter that is read out.
41			
42			
43			
44			
45			
46			
47			

5.2.2.5 Servo Parameter Writing (MCON only) (SVPRM_WR Code: 41_H)

It is a command to request the writing of the servo parameter. It is applicable only for MCON.
An alarm will be generated and will not accept any command in the following cases:
1) Writing Parameter No. (NO) indicates a value out of the range (It generates SUBCMD_ALM = 9)
2) Writing Parameter No. does not match with the data size (SIZE) (It generates SUBCMD_ALM = 9)
3) A value other than 00_H, 10_H or 11_H is set in MODE (It generates SUBCMD_ALM = 9)
4) 10_H or 11_H is set in MODE while the servo is ON (It generates SUBCMD_ALM = A)
5) The operation mode is MANU mode (It generates SUBCMD_ALM = A)

●SVPRM_WR

Bytes of Command Format	Command	Response	Remarks
32	41_H	41_H	
33	SUB_CTRL [Refer to section 5.2.2.1-1, "Details of SUB_CTRL Field"]	SUB_STAT [Refer to section 5.2.2.1-2, "Details of SUB_STAT Field"]	
34			
35			
36	NO	NO	
37			
38	SIZE	SIZE	
39	MODE	MODE	00_H: Common parameter domain 10_H: Device parameter domain 11_H: Device parameter non-volatile memory domain indication [Refer to section 5.3.]
40	PARAMETER	PARAMETER	PARAMETER is the common or device parameter
41			
42			
43			
44			
45			
46			
47			

⚠ About Device Parameter (Non-volatile Memory Domain)

A list of device parameters available to read/write with MODE = 11_H is provided in Section 5.3.4.
Wrong input in this domain can disturb normal operation. Have a process such as to check the match of device code on the master side.
The value in the items not applicable for a driver will be undefined.
To apply the settings, it is necessary to reboot after writing to this domain and executing CONFIG Command. (Readout is executed to this domain when the power is turned on.)

5.3 Common Parameters and Device Parameters

5.3.1 Overview

Common Parameters (Note 1) are those of numbers in common defined by the standard servo profile of MECHATROLINK that is independent from the connected devices. The parameter dependent on the devices is treated as the device parameter (Note 1), and another domain is secured for it.
For setting and reference, select Common Parameter Domain or Device Parameter Domain in section 5.1.2.9 or section 5.2.2.4 SVPRM_RD Command (Note 2) and section 5.1.2.10 or section 5.2.2.5 SVPRM_WR Command.

Note 1 The items relying on the actuator are to be set by the initial values registered in an IAI controller being ready out at the startup.
Note 2 In MCON, only the sub commands are applicable for device parameter settings. The device parameter setting is not available for those other than MCON.

5.3.2 Common Parameter List

Common Parameter List

Effective Timing ◎: Effective Immediately, △: Effective by Executing CONFIG Command, -: Readout Only

Genre	NO	Item	Unit	Setting Range	Setting at Delivery	Effective Timing
Device Information Related	01_H	Selected from Encoder Type (for reference)	-	0_H: Absolute 1_H: Incremental (Note) MCON fixed at 1	In accordance with actuator	-
	02_H	Motor Type (for Reference)	-	0_H: Rotary Motor 1_H: Linear Motor (Note) MCON fixed at 0	In accordance with actuator	-
	03_H	Selection of Semi-closed/Full-closed (for reference)	-	0_H: Semi-closed 1_H: Full-closed (Note) MCON fixed at 0	In accordance with actuator	-
	04_H	Rated Rotary Speed (for Reference)	Rotary: min^{-1} Linear: mm/s	1 to $FFFFFFFF_H$	In accordance with actuator	-
	05_H	Max. Output Available Speed (for Reference)	Rotary: min^{-1} Linear: mm/s	1 to $FFFFFFFF_H$	In accordance with actuator	-
	06_H	Speed Multiplier (for Reference)	—	0	0	-
	07_H	Rated Torque (for Reference)	Rotary: N•m Linear: N	1 to $FFFFFFFF_H$	In accordance with actuator	-
	08_H	Max. Output Available Torque (for Reference)	Rotary: N•m Linear: N	1 to $FFFFFFFF_H$	In accordance with actuator	-
	09_H	Torque Multiplier (for Reference)	-	-3	-3	-
	$0A_H$	Resolution (Rotary) (for Reference)	Pulse／rev	1 to $FFFFFFFF_H$	In accordance with actuator	-
	$0B_H$	Linear Scale Pitch (Linear)	nm	0 to $FFFFFFFF_H$ (Note) MCON fixed at 0	In accordance with actuator	-
	$0C_H$	Number of Pulse per Scale Pitch (Linear) (for Reference)	Pulse／pitch	0 to $FFFFFFFF_H$ (Note) MCON fixed at 0	In accordance with actuator	-
Mechanical Element Related	21_H	Electronic Gear (Numerator)	-	1 to 9999999	1	-
	22_H	Electronic Gear (Denominator)	-	1 to 9999999	1	-
	25_H	Limit Setting	-	0 to FF_H	30_H	-
	26_H	Soft Limit on Positive Side	Command unit	80000000 to $7FFFFFFF_H$	In accordance with actuator	◎
	28_H	Soft Limit on Negative Side	Command unit	80000000 to $7FFFFFFF_H$	In accordance with actuator	◎
Unit System Related	41_H	Selection of Speed Unit	-	0 (Command unit /sec)	0	△
	42_H	Selection of Basic Speed Unit	-	0 (Set multiplier in Selection of speed Unit 41_H)	0	△
	43_H	Selection of Position Unit	Command unit	0	0	△
	44_H	Selection of Basic Position Unit	-	0 (Set multiplier in Selection of Position Unit 43_H)	0	△
	45_H	Selection of Acceleration Unit	-	0 (Command unit /sec^2)	0	△
	46_H	Selection of Basic Acceleration Unit	-	0 (Set multiplier in Selection of Acceleration Unit 45_H)	0	△
	47_H	Selection of Torque Unit	-	1 (% to the rated torque)	1	△
	48_H	Selection of Basic Torque Unit	-	0 (Set multiplier in Selection of Torque Unit 47H)	0	△

Genre	NO	Item	Unit	Setting Range	Setting at Delivery	Effective Timing
Unit System Related	49_H	Applicable Unit System	-	bits0 to 7 = 01_H Unit of velocity: Command unit /s bits8 to 15 = 01_H Unit of position: Command unit bits16 to 23 = 01_H Unit of acceleration: /sec^2 bits24 to 31 = 02_H Unit of torque: Rated torque in %	02010101_H	-
Adjustment Related	66_H	Positioning Complete Band	Command unit	0 to $7FFFFFFF_H$	In accordance with actuator	◎
	67_H	Positioning Vicinity Band	Command unit	0 to $7FFFFFFF_H$	In accordance with actuator	◎
Command Related	87_H	Selection of Fixed Monitor 1	-	[For more details, refer to section 5.1.2.1-5, “Monitor Information”] 0000_H: APOS 0001_H: CPOS 0002_H: PERR 0005_H: FSPD 0006_H: CSPD 0007_H: TRQ 0008_H: ALARM 0009_H: MPOS $000C_H$: CMN1 $000D_H$: CMN2	1	◎
	88_H	Selection of Fixed Monitor 2	-		0	◎
	89_H	Monitor Select 1 in SEL_MON	-	[For more details, refer to section 5.1.2.1-6, “Common Monitor Data List”] 0000_H: TPOS 0001_H: IPOS 0003_H: TSPD 0005_H: TRQ_LIM 0006_H: SV_STAT	0	◎
	$8A_H$	Monitor Select 2 in SEL_MON	-		0	◎
	$8B_H$	Home Position Detection Band	Command unit	0 to $7FFFFFFF_H$	In accordance with actuator	◎
	$8E_H$	Zero Speed Detection Band	Rotary: 10^{-3} min^{-1} Linear: 10^{-3} mm/s	0 to $7FFFFFFF_H$	0	◎
	90_H	Selection of Valid/Invalid for Servo Command Control Field	-	[For more details, refer to section 5.1.2.1-1, “Details of SVCMD_CTRL Field”] Set whether to valid (set to 1) or invalid (set to 0) each function listed below bits0: CMD_PAUSE bits1: CMD_CANCEL bits2, 3: STOP_MODE bits4 to 15: fixed to 0 bits16 to 19: SEL_MON1 bits20 to 23: SEL_MON2 bits24 to 27: SEL_MON3 bits28 to 31: fixed to 0	$0FFF000F_H$	-

Genre	NO	Item	Unit	Setting Range	Setting at Delivery	Effective Timing
Command Related	91_H	Selection of Valid/Invalid for Servo Status Field	-	[For more details, refer to section 5.1.2.1-2,"Details of SVCMD_STAT Field"] Set whether to valid (set to 1) or invalid (set to 2) each function listed below	$6FFF3C03_H$	-
				bits0: CMD_PAUSE_CMP		
				bits1: CMD_CANCEL_CMP		
				bits2 to 9: fixed to 0		
				bits10: POS_RDY		
				bits11: PON		
				bits12: M_RDY		
				bits13: SV_ON		
				bits14, 15: fixed to 0		
				bits16 to 19: SEL_MON1		
				bits20 to 23: SEL_MON2		
				bits24 to 27: SEL_MON3		
				bits28: fixed to 0		
				bits29: BALM		
				bits30: DALM		
				bits31: fixed to 0		
	92_H	Selection of Valid/Invalid for I/O Bit Definition (on Output Side)	-	[For more details, refer to section 5.1.2.1-3, "Details of SVCMD_IO Command Field"] Set whether to valid (set to 1) or invalid (set to 0) each function listed below	$00030F00_H$	-
				bits0 to 7: fixed to 0		
				bits8 to 11: G_SEL		
				bits12 to 15: fixed to 0		
				bits16: BKRL		
				bits17: HOME		
				bits18 to 31: fixed to 0		

Genre	NO	Item	Unit	Setting Range	Setting at Delivery	Effective Timing
Command Related	93_H	Selection of Valid/Invalid for I/O Bit Definition (on Input Side)	-	[For more details, refer to section 5.1.2.1-4, Details of SVCMD_IO Response Field"] Set whether to valid (set to 1) or invalid (set to 0) each function listed below	$1F08FE8C_H$	-
				bits0, 1: fixed to 0		
				bits2: P_OT		
				bits3: N_OT		
				bits4 to 6: fixed to 0		
				bits7: ESTP		
				bits8: fixed to 0		
				bits9: BRK_ON		
				bits10: P_SOT		
				bits11: N_SOT		
				bits12: DEN		
				bits13: NEAR		
				bits14: PSET		
				bits15: ZPOINT		
				bits16 to 18: fixed to 0		
				bits19: ZSPD		
				bits20 to 23: fixed to 0		
				bits24: OVLW		
				bits25: HEND		
				bits26: ZONE1		
				bits27: ZONE2		
				bits28: RMDS		
				bits29 to 31: fixed to 0		

5.3.3 Device Parameter List

Shown below are the device parameters available to be read out by MODE = 10h. Writing of device parameters is not available.

Device Parameters

No.	Symbol	Names	Unit	Size [byte]	Symbol
0	LIMM	Soft limit ＋	0.01mm	4	Exist
1	LIML	Soft limit －	0.01mm	4	Exist
2	MAXV	Max. velocity	0.01mm/s	4	None
3	MAXA	Max. acceleration	0.01G	4	None
4	MAXD	Max. deceleration	0.01G	4	None
5	LEAD	Lead length	0.01mm	4	None
6	EPLS	Encoder pulse number	pulse	4	None
7	RACC	Rated acceleration/deceleration	0.01G	4	None
8	CNUM	Electronic gear numerator	－	4	None
9	CDEN	Electronic gear denominator	－	4	None
20	RSV	Reserved	－	4	－

5.3.4 Device Parameter (Non-volatile Memory) List (MCON Only)

Shown below are the device parameters available to be read out / written in by MODE = 11h.

⚠ Caution Do not attempt to change the reservations in each category. Doing so may disable normal operation.

Genre	No.	Symbol	Item	R/W	Applicable Driver: Pulse Motor	Pulse Motor (High-output)	Servo Motor	Brushless DC Motor
Common	0x0000	-	Total number of readable parameters	R	129	129	140	109
	0x0001	CTCL	Controller type code (Upper word: Controller type Lower word: Version)	R	AE4C xxxx	AE4D xxxx	AC3B xxxx	AC5B xxxx
	0x0002	-	Number of parameter categories	R	4	4	4	4
	0x0003	-	Category 1 parameter start number	R	0x0700			
	0x0004	-	Number of category 1 parameters	R	23	23	18	17
	0x0005	-	Category 2 parameter start number	R	0x0800			
	0x0006	-	Number of category 2 parameters	R	39	39	38	38
	0x0007	-	Category 3 parameter start number	R	0x0900			
	0x0008	-	Number of category 3 parameters	R	52	52	69	39
	0x0009	-	Category 4 parameter start number	R	0x0C00			
	0x000A	-	Number of category 4 parameters	R	4	4	4	4
	0x000B to 0x000E	-	Extension	R	-			

●Category 1: Axis Information

○: With Item, ×: No Item

Genre	No.	Symbol	Item	R/W	Applicable Driver: Pulse Motor	Pulse Motor (High-output)	Servo Motor	Brushless DC Motor
Category 1: Axis Information	0x0700	LIMM	Software stroke limit +	R/W	○	○	○	○
	0x0702	LIML	Software stroke limit -	R/W	○	○	○	○
	0x0704	LEAD	Ball screw lead length	R/W	○	○	○	○
	0x0706 to 0x0710	RSV	Reserved	R/W	○	○	○	○
	0x0712	SLMA	Software limit margin	R/W	○	○	○	○
	0x0714 to 0x0720	RSV	Reserved	R/W	○	○	○	○
	0x0722	RSV	Reserved	R/W	○	○	○	×
	0x0724 to 0x072C	RSV	Reserved	R/W	○	○	×	×

●Category 2: Controller Control Information

○: With Item, ×: No Item

Genre	No.	Symbol	Item	R/W	Applicable Driver: Pulse Motor	Pulse Motor (High-output)	Servo Motor	Brushless DC Motor
Category 2: Controller Control Information	0x0800	FPIO	PIO feature setting flag	R/W	○	○	○	○
	0x0802 to 0x0804	RSV	Reserved	R/W	○	○	○	○
	0x0806	INP	Default positioning width	R/W	○	○	○	○
	0x0808	RSV	Reserved	R/W	○	○	○	○
	0x080A	ACMD	Default acceleration/deceleration	R/W	○	○	○	○
	0x080C	SPOW	Current limit initial value at positioning stop	R/W	○	○	○	○
	0x080E to 0x081A	RSV	Reserved	R/W	○	○	○	○
	0x081C	SAFV	Safety speed	R/W	○	○	○	○
	0x081E to 0x083E	RSV	Reserved	R/W	○	○	○	○
	0x0840	FRTC	RTC feature setting flag	R/W	○	○	○	○
	0x0842	FMNT	Monitoring feature setting flag	R/W	○	○	○	○
	0x0844	TMCT	Total movement count threshold	R/W	○	○	○	○
	0x0846	ODOT	Total operated distance threshold	R/W	○	○	○	○
	0x0848 to 0x084A	RSV	Reserved	R/W	○	○	○	○
	0x084C	RSV	Reserved	R/W	○	○	×	×

●Category 3: Driver Control Information (Pulse Motor)

○: With Item, ×: No Item

Genre	No.	Symbol	Item	R/W	Applicable Driver: Pulse Motor	Pulse Motor (High-output)	Servo Motor	Brushless DC Motor
Category 3: Driver Control Information	0x0900	PHSP	Motor excitation phase signal detection Operation Parameter	R/W	○	○		
	0x0902 to 0x0908	RSV	Reserved	R/W	○	○		
	0x090A	PLG0	Servo gain number	R/W	○	○		
	0x090C	VLPG	Speed loop proportional gain	R/W	○	○		
	0x090E	VLPT	Speed loop integral gain	R/W	○	○		
	0x0910	TRQF	Torque filter time constant	R/W	○	○		
	0x0912	RSV	Reserved	R/W	○	○		
	0x0914	ETYP	Encoder type	R/W	○	○		
	0x0916 to 0x091A	RSV	Reserved	R/W	○	○		
	0x091C	FSTP	Stop status feature setting flag	R/W	○	○		
	0x091E	ORG	Home-return pattern	R/W	○	○		
	0x0920 to 0x0922	RSV	Reserved	R/W	○	○		
	0x0924	ODPW	Current limit at home return	R/W	○	○		
	0x0926	RSV	Reserved	R/W	○	○		
	0x0928	OFST	Home-return offset level	R/W	○	○		
	0x092A to 0x0932	RSV	Reserved	R/W	○	○		
	0x0934	AIOF	Axis I/O feature select	R/W	○	○		
	0x0936 to 0x0938	RSV	Reserved	R/W	○	○		
	0x093A	CNUM	Electronic gear (command pulse magnifications numerator)	R/W	○	○		
	0x093C	CDEN	Electronic gear (command pulse magnifications denominator)	R/W	○	○		
	0x093E	PLFG	Position feed forward gain	R/W	○	○		
	0x0940 to 0x0946	RSV	Reserved	R/W	○	○		
	0x0948	DCET	Current limit extension time at start	R/W	○	○		
	0x094A to 0x0952	RSV	Reserved	R/W	○	○		
	0x0954	GSUL	Gain scheduling upper limit multiplying ratio	R/W	○	○		
	0x0956	GSPC	GS speed loop proportional gain	R/W	○	○		
	0x0958	GSIC	GS speed loop integral gain	R/W	○	○		
	0x095A	OLWL	Overload caution load level ratio	R/W	○	○		
	0x095C	RSV	Reserved	R/W	○	○		
	0x095E	BUPC	BU speed loop proportional gain	R/W	○	○		
	0x0960	BUIC	BU speed loop integral gain	R/W	○	○		
	0x0962 to 0x0966	RSV	Reserved	R/W	○	○		

●Category 3: Driver Control Information (Servo Motor 1/2)

○: With Item, ×: No Item

Genre	No.	Symbol	Item	R/W	Applicable Driver: Pulse Motor	Pulse Motor (High-output)	Servo Motor	Brushless DC Motor
Category 3: Driver Control Information	0x0900	PHSP	Motor excitation phase signal detection operation parameter	R/W			○	
	0x0902	RSV	Reserved	R/W			○	
	0x0904	PLG0	Servo gain number	R/W			○	
	0x0906	VLPG	Speed loop proportional gain	R/W			○	
	0x0908	VLPT	Speed loop integral gain	R/W			○	
	0x090A	TRQF	Torque filter time constant	R/W			○	
	0x090C	RSV	Reserved	R/W			○	
	0x090E	ETYP	Encoder type	R/W			○	
	0x0910 to 0x0914	RSV	Reserved	R/W			○	
	0x0916	FSTP	Stop status feature setting flag	R/W			○	
	0x0918	ORG	Home-return pattern	R/W			○	
	0x091A to 0x091C	RSV	Reserved	R/W			○	
	0x091E	ODPW	Current limit at home return	R/W			○	
	0x0920	RSV	Reserved	R/W			○	
	0x0922	OFST	Home-return offset level	R/W			○	
	0x0924 to 0x092A	RSV	Reserved	R/W			○	
	0x092C	AIOF	Axis I/O feature select	R/W			○	
	0x092E	RSV	Reserved	R/W			○	
	0x0930	CNUM	Electronic gear (command pulse magnifications numerator)	R/W			○	
	0x0932	CDEN	Electronic gear (command pulse magnifications denominator)	R/W			○	
	0x0934	PLFG	Position feed forward gain	R/W			○	
	0x0936	CLPF	Current-control width number	R/W			○	
	0x0938 to 0x093C	RSV	Reserved	R/W			○	
	0x093E	PRST	Home preset value	R/W			○	
	0x0940 to 0x095E	RSV	Reserved	R/W			○	
	0x0960	PLG1	Servo gain number 1	R/W			○	
	0x0962	PLF1	Position feed forward gain 1	R/W			○	
	0x0964	VLG1	Speed loop proportional gain 1	R/W			○	
	0x0966	VLT1	Speed loop integral gain 1	R/W			○	
	0x0968	TRF1	Speed loop integral gain 1	R/W			○	
	0x096A	CLP1	Current-control width number 1	R/W			○	

●Category 3: Driver Control Information (Servo Motor 2/2)

○: With Item, ×: No Item

Genre	No.	Symbol	Item	R/W	Applicable Driver: Pulse Motor	Pulse Motor (High-output)	Servo Motor	Brushless DC Motor
Category 3: Driver Control Information	0x096C	PLG2	Servo gain number 2	R/W			○	
	0x096E	PLF2	Position feed forward gain 2	R/W			○	
	0x0970	VLG2	Speed loop proportional gain 2	R/W			○	
	0x0972	VLT2	Speed loop integral gain 2	R/W			○	
	0x0974	TRF2	Speed loop integral gain 2	R/W			○	
	0x0976	CLP2	Current-control width number 2	R/W			○	
	0x0978	PLG3	Servo gain number 3	R/W			○	
	0x097A	PLF3	Position feed forward gain 3	R/W			○	
	0x097C	VLG3	Speed loop proportional gain 3	R/W			○	
	0x097E	VLT3	Speed loop integral gain 3	R/W			○	
	0x0980	TRF3	Torque filter time constant 3	R/W			○	
	0x0982	CLP3	Current-control width number 3	R/W			○	
	0x0984	GCFT	Servo gain switchover time constant	R/W			○	
	0x0986	OLWL	Overload warning level ratio	R/W			○	
	0x0988	RSV	Reserved	R/W			○	

●Category 3: Driver Control Information (Brushless DC Motor)

○: With Item, ×: No Item

Genre	No.	Symbol	Item	R/W	Applicable Driver: Pulse Motor	Pulse Motor (High-output)	Servo Motor	Brushless DC Motor
Category 3: Driver Control Information	0x0900	PHSP	Motor excitation phase signal detection operation parameter	R/W				○
	0x0902	RSV	Reserved	R/W				○
	0x0904	PLG0	Servo gain number	R/W				○
	0x0906	VLPG	Speed loop proportional gain	R/W				○
	0x0908	VLPT	Speed loop integral gain	R/W				○
	0x090A	TRQF	Torque filter time constant	R/W				○
	0x090C	RSV	Reserved	R/W				○
	0x090E	ETYP	Encoder type	R/W				○
	0x0910 to 0x0914	RSV	Reserved	R/W				○
	0x0916	FSTP	Stop status feature setting flag	R/W				○
	0x0918	ORG	Home-return pattern	R/W				○
	0x091A to 0x091C	RSV	Reserved	R/W				○
	0x091E	ODPW	Current limit at home return	R/W				○
	0x0920	RSV	Reserved	R/W				○
	0x0922	OFST	Home-return offset level	R/W				○
	0x0924 to 0x092A	RSV	Reserved	R/W				○
	0x092C	AIOF	Axis I/O feature select	R/W				○
	0x092E	RSV	Reserved	R/W				○
	0x0930	CNUM	Electronic gear (command pulse magnifications numerator)	R/W				○
	0x0932	CDEN	Electronic gear (command pulse magnifications denominator)	R/W				○
	0x0934	PLFG	Position feed forward gain	R/W				○
	0x0936	CLPF	Current-control width number	R/W				○
	0x0938 to 0x0940	RSV	Reserved	R/W				○
	0x0942	OLWL	Overload caution load level ratio	R/W				○
	0x0944 to 0x094C	RSV	Reserved	R/W				○

●Category 4: Zone Control Information

○: With Item, ×: No Item

Genre	No.	Symbol	Item	R/W	Applicable Driver: Pulse Motor	Pulse Motor (High-output)	Servo Motor	Brushless DC Motor
Category 4 : Zone Control Information	0x0C00	ZNM1	Zone Boundary 1+	R/W	○	○	○	○
	0x0C02	ZNL1	Zone Boundary 1-	R/W	○	○	○	○
	0x0C04	ZNM2	Zone Boundary 2+	R/W	○	○	○	○
	0x0C06	ZNL2	Zone Boundary 2-	R/W	○	○	○	○

6. Example for Operation Sequence

⚠ Restrictions in Operation

Make sure to check the restrictions below and the cautions described in section 6.1 before creating the operation sequence.

1) Position number indication operation cannot be performed. (It performs the direct position indicating operation by commands.)
2) Incremental (relative) operation cannot be performed. (It performs the direct position indicating operation by commands.)
3) Pressing operation cannot be performed.
4) Acceleration/deceleration mode (primary filter acceleration/deceleration and S-shaped acceleration/deceleration) cannot be used.
5) Automatic servo-off function cannot be used.
6) Anti-vibration control function cannot be used.
7) Individual zone (PZONE) function cannot be used. For zone function, use the zones (ZONE 1 and ZONE 2) determined by the boundary setting in the parameter.
8) Index mode cannot be used on the rotary axis.
9) Switchover of the operation mode (AUTO ⇔ MANU) cannot be performed by the host (master).
10) The settings of the electronic gear ratio and the feedback gear ratio cannot be established separately.
11) Force control (SCON only : load cell interface) cannot be used.

Operation is performed after the readout and writing of the common parameters are complete when the power is turned on.

Procedure	Item	Command to Use	Contents	Communication Phase
1	Power supply	NOP	Check on each controller initialization	1
2	Release communication (disconnect)	DISCONNECT	Send this command for more than communication frequency	1
3	Establish connection	CONNECT	Start establishing communication and counting up WDT	2 or 3
4	Check on such as device (Each controller) ID	ID_RD/SVPRM_RD	Read out such as device ID	2 or 3
5	Establish device settings	SVPRM_WR	Transfer parameters necessary for device (Each controller)	2 or 3
6	Servo ON	SV_ON		2 or 3
7	Home-Return	Indicate with HOME (bits17) in SVCMD_IO, and check with HEND (bits25)	Available only in incremental type (Note) ZRET Command cannot be used	2 or 3
8	Operation	Each operation command		2 or 3
9	Servo OFF	SV_OFF		2 or 3
10	Release communication (disconnect)	DISCONNECT	Release the communication	1
11	Power OFF			1

6.1 Cautions in Actuator Operation

6.1.1 Home Return

The home-return operation is a dedicated method. Therefore, Home-Return “ZRET” Command cannot be used.
The home-return operation starts when SVCMD_IO.HOME bit is turned on (to 1) while the servo is turned on.
SVCMD_IO.HEND bit turns on (to 1) once the home-return operation is completed.

(Note) In some cases, depending on the actuator to use, the coordinate is not 0mm for the home-return complete position. Therefore, confirm that SVCMD_IO.HEND bit is on when making a judgment of the home-return complete. Also, home-return operation is ignored during execution of each command of interpolation feeding “INTERPOLATE”, positioning “POSING” and Constant Speed Feeding “FEED”.

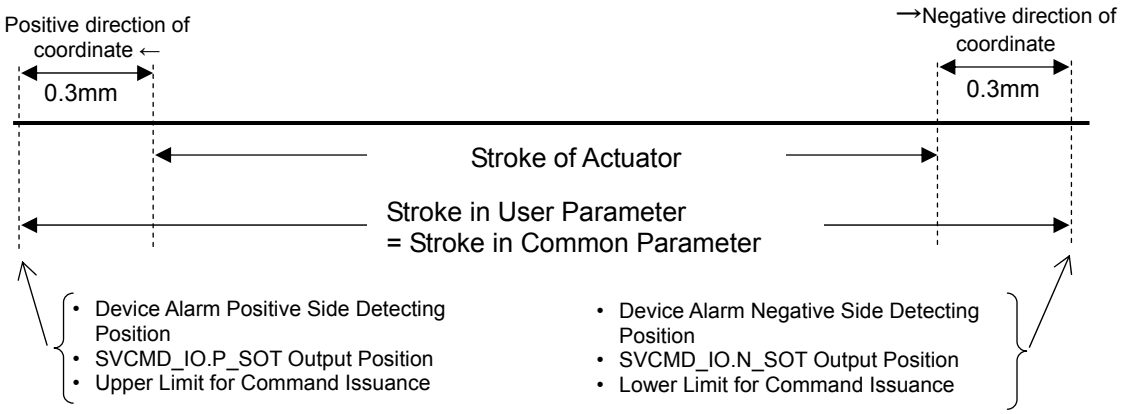
(Note) When a command of INTERPOLATE or POSING is executed with the home-return operation incomplete, the position where the power is turned on is identified as 0 point. Also, the soft limit function becomes invalid.
FEED Command operates with the target position as the soft limit.

6.1.2 Soft Limit

It activates once the home-return complete (SVCMD_IO.HEND) bit turns on (to 1). For the absolute type actuators, it is effective from the controller startup as long as the absolute reset is finished.
The soft limit value in the common parameter at the controller startup is a value that the soft limit positive and negative in each controller User Parameter No.3 and 4 are converted into the unit of command.
(Note) Setting will be applied immediately if the soft limit value is changed in the common parameter. However, the user parameter in the controller will not be changed.

When the soft limit is activated, the target position “TPOS” is limited to the soft limit value in the common parameter, and the value gets replaced.
The following things occur when the soft limit setting is exceeded.

Condition	Alarm Output	
When setting in User Parameter No.3 Soft Limit on Positive Side is exceeded	SVCMD_IO.P_SOT (Positive Side) = 1	Software stroke limit violation in device alarm to be issued
When setting in User Parameter No.4 Soft Limit on Negative Side is exceeded	SVCMD_IO.N_SOT (Negative Side) = 1	Software stroke limit violation in device alarm to be issued
When exceeded setting in Common Parameter No. 26 Positive Side Soft Limit	SVCMD_IO.P_SOT (Positive Side) = 1	
When exceeded setting in Common Parameter No. 28 Negative Side Soft Limit	SVCMD_IO.N_SOT (Negative Side) = 1	



6.1.3 Positioning Complete Band, Positioning Vicinity Band and Home Position Detection Band

The positioning complete band, positioning vicinity band and home position detection band in the common parameters at the controller startup are a value that the initial value in User Parameter No. 10 Positioning band is converted into the unit of command.
Each value in the common parameter above can be changed individually with the servo parameter writing “SVPRM_WR” command.
(Note) Setting will be applied immediately if the positioning band is changed in the common parameter. However, the user parameter in the controller will not be changed.

7. Parameters for Controller

It is the data to make controller that can be applied for MECHATROLINK-III available to operate. Set the parameters considering the system and applications.
When a change is required to the parameters, make sure to back up the data before the change so the settings can be returned anytime. Backup in electronic data is available by using the PC software or teaching pendant (limited to some models). For the models not applicable for backup, it is necessary to keep data by writing on a memo.
After an edit is made on the parameters, it is written in FeRAM. The content of edit can be activated after the software reset or reboot of the power. Note that the change will not be valid only by writing it in a teaching tool such as the PC software.

⚠ Warning: Establishment of parameter setting gives a great influence to operation.
Wrongly established setting could cause not only an operation error or malfunction, but also it is very dangerous.
Settings at the delivery enable the product to operate standardly.
Understand very well about the control logic of controller if making a change or performing a setting suitable to the system. Please contact us if you have anything unclear.
Do not turn off the power to the controller during the parameter writing.

7.1 Parameter List

The categories in the table below indicate whether parameters should be set or not. There are five categories as follows:

A : Check the settings before use.
B : Use parameters of this category depending on their uses.
C : Use parameters of this category with the settings at shipments leaving unchanged as a rule. Normally they may not be set.
D : Parameters of the category are set at shipment in accordance with the specification of the actuator. Normally they may not be set.
E : Parameters of the category are exclusively used by us for convenience of production. Changing their settings may not only cause the actuator to operate improperly but also to be damaged. So, never change the setting of the parameters.

Category do not appear on the teaching tool. Also, the unused parameter numbers are not mentioned in the list.

Parameter List (1/4) * Controller section: A:ACON, D:DCON, P:PCON, S:SCON, MA: MCON Servomotor Type, MD: MCON Brushless DC Motor Type, MP: MCON Pulse Motor Type

No.	Category	Names	Symbol	(Note 1) Unit	Input Range	Factory default	Applicable Controller *						
							A	D	P	S	MA	MD	MP
1	B	Zone 1+	ZNM1	mm (deg)	-9999.99 to 9999.99	Actual stroke on + side (Note 2)	○	○	○	○	○	○	○
2	B	Zone 1-	ZNL1	mm (deg)	-9999.99 to 9999.99	Actual stroke on – side (Note 2)	○	○	○	○	○	○	○
3	A	Soft limit+	LIMM	mm (deg)	-9999.99 to 9999.99	Actual stroke on + side (Note 2)	○	○	○	○	○	○	○
4	A	Soft limit-	LIML	mm (deg)	-9999.99 to 9999.99	Actual stroke on – side (Note 2)	○	○	○	○	○	○	○
5	D	Home return direction	ORG	-	0: Reverse, 1: Normal	In accordance with actuator (Note 2)	○	○	○	○	○	○	○
7	C	Servo gain number	PLGO	-	0 to 31	In accordance with actuator (Note 2)	○	○	○	○	○	○	○
9	B	Default acceleration/deceleration	ACMD	G	0.01 to actuator's max. acceleration/ deceleration	Rated actuator's acceleration/ deceleration speed (Note 2)	○	○	○	○	○	○	○
10	B	Default positioning width	INP	mm (deg)	0.01 to 999.99	In accordance with actuator (Note 2)	○	○	○	○	○	○	○
12	B	Current-limiting value at standstill during positioning	SPOW	%	0 to 70	35	-	-	○	-	-	-	○
13	C	Current limit at home return	ODPW	%	1 to 300 (Note 3)	In accordance with actuator (Note 2)	○	○	○	○	○	○	○
14	E	Dynamic brake	FSTP	-	0: Disabled, 1: Enabled	1	-	-	-	○	-	-	-
16	B	SIO communication speed	BRSL	bps	9600 to 230400	38400	○	○	○	○	-	-	-
17	B	Minimum delay time for slave transmitter activation	RTIM	msec	0 to 255	5	○	○	○	○	-	-	-
18	E	Home position check sensor input polarity	AIOF	-	0 to 2	In accordance with actuator (Note 2)	○	-	○	○	○	-	○
19	E	Overrun sensor input polarity	AIOF	-	0 to 2	In accordance with actuator (Note 2)	-	-	-	○	-	-	-
20	E	Creep sensor input polarity	AIOF	-	0 to 2	In accordance with actuator (Note 2)	-	-	-	○	-	-	-
22	C	Home return offset distance	OFST	mm (deg)	0.00 to 9999.99	In accordance with actuator (Note 2)	○	○	○	○	○	○	○

Note 1 The unit (deg) is for rotary actuator. It is displayed in mm in the teaching tools.
Note 2 The setting values vary in accordance with the specification of the actuator. At shipment, the parameters are set in accordance with the specification.
Note 3 1 to 100 are distributed for PCON and MCON pulse motor type

Parameter List (2/4) * Controller section: A:ACON, D:DCON, P:PCON, S:SCON, MA: MCON Servomotor Type, MD: MCON Brushless DC Motor Type, MP: MCON Pulse Motor Type

No.	Category	Names	Symbol	(Note 1) Unit	Input Range	Factory default	Applicable Controller *						
							A	D	P	S	MA	MD	MP
23	B	Zone boundary 2+	ZNM2	mm (deg)	-9999.99 to 9999.99	Actual stroke on + Side (Note 2)	○	○	○	○	○	○	○
24	B	Zone boundary 2-	ZNL2	mm (deg)	-9999.99 to 9999.99	Actual stroke on - side(Note 2)	○	○	○	○	○	○	○
28	B	Default movement direction for excitation-phase signal detecting movement	PHSP	–	0: Reverse 1: Forward	In accordance with actuator (Note 2)	○	-	○	-	○	-	○
29	B	Exicitation-phase signal detection time	PHSP	msec	50 to 999	128	○	-	-	-	○	-	-
					1 to 999	10	-	-	○	-	-	-	○
30	B	Pole sensing type	PHSP	-	0: Current control 1: Distance control 1 2: Distance control 2	1	○	-	-	-	○	-	-
	B	Excitation detection type	PHSP	-	0: Conventional method 1: New method 1 2: New method 2	1	-	-	○	-	-	-	○
31	C	Speed loop proportional gain	VLPG	—	1 to 99999999	In accordance with actuator (Note 2)	○	○	○	○	○	○	○
32	C	Speed loop integral gain	VLPT	-	1 to 99999999	In accordance with actuator (Note 2)	○	○	○	○	○	○	○
33	C	Torque filter time constant	TRQF	-	0 to 2500	In accordance with actuator (Note 2)	○	○	○	○	○	○	○
35	C	Safety velocity	SAFV	mm/s (deg/s)	1 to 250 (max. for actuator of 250 or less)	100	○	○	○	○	○	○	○
42	C	Enable function	FPICO	-	0: Enabled, 1: Disabled	1	○	○	○	○	-	-	-
43	B	Home position check sensor input polarity	HMC	-	0 to 2	In accordance with actuator (Note 2)	○	-	○	-	○	-	○
45	B	Silent interval magnification	SIVM	time	0 to 10	0	○	○	○	○	-	-	-
53	B	Default stop mode	HSTP	-	0 to 4	0 (Not applicable)	-	-	○	-	-	-	○
54	C	Current-control width number	CLPF	-	0 to 15 (Note 4)	In accordance with actuator (Note 2)	○	○	-	○	○	○	-
62	B	Pulse count direction	FPIO	-	0: Forward motor rotation 1: Reverse motor rotation	In accordance with actuator (Note 2)	○	○	○	○	○	○	○
65	B	Electronic gear numerator	CNUM	-	1 to 9999999	1	○	○	○	○	○	○	○
66	B	Electronic gear denominator	CDEN	-	1 to 9999999	1	○	○	○	○	○	○	○
71	B	Position feed forward gain	PLFG	-	0 to 100	0	○	○	○	○	○	○	○
72	E	Timer period for emergency stop relay fusing monitor	EMWT	msec	0 to 60000	3000	-	-	-	○	-	-	-
73	D	Encoder voltage level	EVLV	-	0 to 3	Depending on encoder cable length (Note 2)	-	-	-	○	-	-	-
75	D	Electromagnetic brake power monitor	FSTP	-	0: Disabled, 1: Enabled	In accordance with actuator (Note 2)	-	-	-	○	-	-	-
76	D	Belt breaking sensor input polarity	AIOF	-	0 to 2	In accordance with actuator (Note 2)	-	-	-	○	-	-	-
77	D	Ball screw lead length	LEAD	mm (deg)	0.01 to 999.99	In accordance with actuator (Note 2)	○	○	○	○	○	○	○

Note 1 The unit (deg) is for rotary actuator. It is displayed in mm in the teaching tools.
Note 2 The setting values vary in accordance with the specification of the actuator. At shipment, the parameters are set in accordance with the specification.
Note 4 0 to 4 are distributed for SCON-CA

Parameter List (3/4) * Controller section: A:ACON, D:DCON, P:PCON, S:SCON, MA: MCON Servomotor Type, MD: MCON Brushless DC Motor Type, MP: MCON Pulse Motor Type

No.	Category	Names	Symbol	(Note 1) Unit	Input Range	Factory default	Applicable Controller *						
							A	D	P	S	MA	MD	MP
83	B	Absolute unit	ETYP	-	0: Not used 1: Used	In accordance with specification at order accepted	○	—	○	—	○	—	○
85	A	Field bus node address	NADR	-	0 to 239 (EF_H)	3 (03_H)	○	○	○	○	-	-	-
86	A	Field bus baud rate	FBRS	-	0: 32 byte mode 1: 48 byte mode	1	○	○	○	○	-	-	-
87	E	Network type	NTYP	-	9:ML3 servo mode	9	○	○	○	○	-	-	-
88	D	Software limit margin	SLMA	mm	0 to 9999.99	In accordance with actuator (Note 2)	○	○	○	○	○	○	○
110	B	Stop method at servo OFF	FSTP	-	0: Rapid stop 1: Deceleration to stop	0	○	○	○	○	○	○	○
111	B	Calendar function	FRTC	-	0: Does not use the calendar timer 1: Use the calendar timer	1	○	○	○	○	-	-	-
112	B	Monitoring mode	FMNT	-	0: Does not use 1: Monitor function 1 2: Monitor function 2 3: Monitor function 3	1	○	○	○	○	○	○	○
113	B	Monitoring period	FMNT	msec	SCON: 1 to 1000	1	-	-	-	○	-	-	-
					Excluding SCON: 1 to 60000	1	○	○	○	-	○	○	○
120	C	Servo gain number 1	PLG1	-	0 to 31	In accordance with actuator (Note 2)	○	-	-	○	○	-	-
121	C	Feed forward gain 1	PLF1	-	0 to 100	In accordance with actuator (Note 2)	○	-	-	○	○	-	-
122	C	Speed loop proportional gain 1	VLG1	-	1 to 99999999	In accordance with actuator (Note 2)	○	-	-	○	○	-	-
123	C	Speed loop integral gain 1	VLT1	-	1 to 99999999	In accordance with actuator (Note 2)	○	-	-	○	○	-	-
124	C	Torque filter time constant 1	TRF1	-	0 to 2500	In accordance with actuator (Note 2)	○	-	-	○	○	-	-
125	C	Current control width number 1	CLP1		0 to 15 (Note 4)	In accordance with actuator (Note 2)	○	-	-	○	○	-	-
126	C	Servo gain number 2	PLG2	-	0 to 31	In accordance with actuator (Note 2)	○	-	-	○	○	-	-
127	C	Feed forward gain 2	PLF2	-	0 to 100	In accordance with actuator (Note 2)	○	-	-	○	○	-	-
128	C	Speed loop proportional gain 2	VLG2	-	1 to 99999999	In accordance with actuator (Note 2)	○	-	-	○	○	-	-
129	C	Speed loop integral gain 2	VLT2	-	1 to 99999999	In accordance with actuator (Note 2)	○	-	-	○	○	-	-
130	C	Torque filter time constant 2	TRF2	-	0 to 2500	In accordance with actuator (Note 2)	○	-	-	○	○	-	-
131	C	Current control width number 2	CLP2		0 to 15 (Note 4)	In accordance with actuator (Note 2)	○	-	-	○	○	-	-
132	C	Servo gain number 3	PLG3	-	0 to 31	In accordance with actuator (Note 2)	○	-	-	○	○	-	-
133	C	Feed forward gain 3	PLF3	-	0 to 100	In accordance with actuator (Note 2)	○	-	-	○	○	-	-

Note 1 The unit (deg) is for rotary actuator. It is displayed in mm in the teaching tools.
Note 2 The setting values vary in accordance with the specification of the actuator. At shipment, the parameters are set in accordance with the specification.
Note 4 0 to 4 are distributed for SCON-CA

Parameter List (4/4) * Controller section: A:ACON, D:DCON, P:PCON, S:SCON, MA: MCON Servomotor Type, MD: MCON Brushless DC Motor Type, MP: MCON Pulse Motor Type

No.	Category	Names	Symbol	(Note 1) Unit	Input Range	Factory default	Applicable Controller *						
							A	D	P	S	MA	MD	MP
134	C	Speed loop proportional gain 3	VLG3	-	1 to 99999999	In accordance with actuator (Note 2)	○	-	-	○	○	-	-
135	C	Speed loop integral gain 3	VLT3	-	1 to 99999999	In accordance with actuator (Note 2)	○	-	-	○	○	-	-
136	C	Torque filter time constant 3	TRF3	-	0 to 2500	In accordance with actuator (Note 2)	○	-	-	○	○	-	-
137	C	Current control width number 3	CLP3	-	0 to 15 (Note 4)	In accordance with actuator (Note 2)	○	-	-	○	○	-	-
138	C	Servo gain switchover time constant	GCFT	ms	10 to 2000	10	○	-	-	○	○	-	-
139	A	Home preset value	PRST	mm	-9999.99 to 9999.99	In accordance with actuator (Note 2)	○	-	-	○	○	-	-
143	B	Overload warning level ratio	OLWL	%	50 to 100	100 (No output of overload warning)	○	○	-	○	○	○	-
144	C	Gain scheduling upper limit multiplying ratio	GSUL	%	0 to 1023	0	-	-	○	-	-	-	○
145	C	GS speed loop proportional gain	GSPC	-	1 to 50000	In accordance with actuator (Note 2)	-	-	○	-	-	-	○
146	B	GS speed oop integral gain	GSIC	-	1 to 500000	In accordance with actuator (Note 2)	-	-	○	-	-	-	○
147	B	Total movement count threshold	TMCT	Time	0 to 999999999	0 (Invalid)	○	○	○	○	○	○	○
148	B	Total operated distance threshold	ODOT	m	0 to 999999999	0 (Invalid)	○	○	○	○	○	○	○
150	A	Linear ABS home preset value	LAPS	mm	-9999.99 to 9999.99	In accordance with actuator (Note 2)	-	-	-	○	-	-	-
152	B	High output setting	BUEN	-	0: Disabling 1: Enabling	In accordance with actuator (Note 2)	-	-	○	-	-	-	(Note 5) ○
153	B	BU speed loop proportional Gain	BUPC	-	1 to 27661	In accordance with actuator (Note 2)	-	-	○	-	-	-	(Note 5) ○
154	B	BU speed loop integral Gain	BUIC	-	1 to 217270	In accordance with actuator (Note 2)	-	-	○	-	-	-	(Note 5) ○
155	A	Absolute battery retention time	AIP	-	0: 20 days 1: 15 days 2: 10 days 3: 5 days	0	○	-	○	-	○	-	○
158	B	Enable/disable axis select	EFCT	-	0: Enabled 1: Disabled	0	-	-	-	-	○	○	○
165	B	Delay time after shutdown release	SDDT	ms	0 to 100	0	-	-	-	○	-	-	-
166	B	Startup current limit extension feature	DCET	-	0: Disabling 1: Enabling	In accordance with actuator (Note 2)	-	-	○	-	-	-	○
184	B	Pressing method	RDSL	-	1 to 3	1	-	-	-	(Note 6) ○	-	-	-

Note 1 The unit (deg) is for rotary actuator. It is displayed in mm in the teaching tools.
Note 2 The setting values vary in accordance with the specification of the actuator. At shipment, the parameters are set in accordance with the specification.
Note 4 0 to 4 are distributed for SCON-CA
Note 5 Only for MCON Pulse Motor High-Output Type
Note 6 Only for SCON-CB

7.2 Detail of Parameters Related to MECHATROLINK-III Settings (ACON, DCON, PCON and SCON)

> ⚠ Caution: • For the parameters other than mentioned below, refer to each controller Instruction Manual provided separately.
> • If parameters are changed, provide software reset or reconnect the power to reflect the setting values.

The parameters related to MECHATROLINK-III are from No. 85 to No. 87.

[1] Field bus node address (No.85 NADR)
Set the node address number.
Node Address Setting Range: 3(03_H) to 239(EF_H) (It is set to 3 at delivery)

[2] Field bus baud rate (No.86 FBRS)
Set the data length.

Parameter No.86 Set value	Mode
0	32 byte mode
1 (factory setting)	48 byte mode

[3] Network Type (No.87 NTYP)
Set the network module type in Parameter No. 87.
Do not change the setting from the initial setting (9).

8. Troubleshooting

8.1 Action to Be Taken upon Occurrence of Problem

Upon occurrence of a problem, take an appropriate action according to the procedure below in order to ensure quick recovery and prevent recurrence of the problem.

1) Check on Controller Status Display LED
   The display of the status LED lamps differs depending on the controller.
   Refer to [2.3 MECHATROLINK-III Interface] for detail.
2) Check whether an alarm occurs on the host controller (PLC, etc.).
3) Check the voltage of the main power supply.
4) Check the voltage of the power supply for brake (For the actuator with the brake).
5) Alarm Check(Note1)
   Check the alarm code on the teaching tool such as PC software.
6) Check the cables for connection error, disconnection or pinching. Before performing a continuity check, turn off the power (to prevent electric shocks) and disconnect the cables of measuring instruments (to prevent accidental power connection due to sneak current path).
7) Check the noise elimination measures (grounding, installation of surge killer, etc.).
8) Check the events leading to the occurrence of problem(Note 1), as well as the operating condition at the time of occurrence.
9) Analyze the cause.
10) Treatment

Note 1 Date and time of an alarm occurrence can be checked on a controller equipped with the calendar feature. Set the date and time from the teaching tool such as PC software at the first power-on of the controller (and gateway parameter setting tool for MCON).
The date and time data set once is retained for about 10 days if the power supply of the controller is OFF. Unless the setting is conducted or the clock data is lost, the clock shows 00/01/01 00:00:00 when the power is turned ON. Even if the date and time data is lost, the generated error code is retained.
Alarms subject to this function only include those in 8.3 Alarm but do not include errors in the teaching tool such as PC software.

> Notice: In troubleshooting, exclude normal portions from suspicious targets to narrow down the causes. Check 1) to 8) described above before contacting us.

8.2 Alarm Level

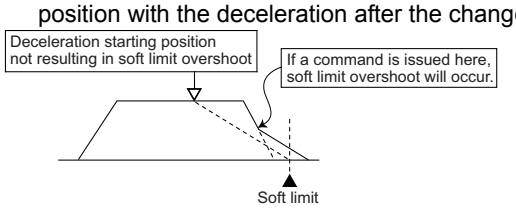
The alarms are classified to 3 types of levels by the content of the error.

Alarm level	ALM lamp	*ALM signal	Status when an error occurred	Cancellation method
Message	OFF	No output	No stop	Alarm from teaching tool such as PC software [Refer to Instruction Manual of each tool for details.]
Operation release	ON	Output	Servo OFF after deceleration to stop	Reset the alarm by the Fieldbus or teaching tool.
Cold start	ON	Output	Servo OFF after deceleration to stop	Software reset or power reconnection by teaching tool. Home return is required for any actuators of other than absolute specification.

⚠ Caution: Caution: Reset each alarm after identifying and removing the cause.
If the cause of the alarm cannot be removed or when the alarm cannot be reset after removing the cause, please contact IAI.
If the same error occurs again after resetting the alarm, it means that the cause of the alarm has not been removed.

8.3 Alarm List

Alarm Code	Alarm Level	Alarm Name	Cause/Treatment
048	Message	Driver Overload Alarm	Cause : The load current exceeded the value set in Parameter No.143 “Overload Level Ratio”. This alarm is kept alarm condition until reset is made. This alarm turns ON when the load current exceeds the setting from a value below the setting. Treatment : Lower the setting of acceleration/deceleration. Also, increase the frequency of pause.
04E		Exceeded movement count threshold	Cause : The total number of the operation times exceeded the value set in Parameter No.147 “Total Movement Count Threshold”.
04F		Exceeded operated distance threshold	Cause : The total number of the operation distance exceeded the value set in Parameter No.148 “Total Operated Distance Threshold”.
068		SRAM access error	Cause : Servo monitor is not operated in the normal condition because of noise or malfunction of consisting parts. Treatment : 1) Take proper measures against noise. 2) When the servo monitoring function is not used, set parameter No.112 “Monitoring mode” to “0”. 3) If the operation is not improved in use of the servo monitoring function in spite of measures against noise, Please contact IAI.
069		Detection of realtime clock oscillation stop	Cause : The calendar function is stopped and the current time data is lost. Treatment : Set the time again. [Refer to the Instruction Manual of PC software.] (Note) This error is not registered in the alarm list.
06A		Realtime clock access error	Cause : The calendar function is not working properly because of noise or malfunction of consisting parts. Treatment : 1) Take proper measures against noise. 2) When the calendar function is not used, set parameter No.111 “Calendar function” to “0”. 3) If the operation is not improved in use of the calendar function in spite of measures against noise, Please contact IAI.
06B		Maintenance information data error	Cause : The maintenance information (total movement count, total operated distance) is lost. Treatment : Please contact IAI.
086	Operation release	Move command while pulse train input is effective	Cause : Actuator operation was commanded via serial communication in pulse train mode. Treatment : Stop the actuator operation command via serial communication in pulse train mode.
090		Software reset during servo ON	Cause : A software reset command was issued when the servo was ON. Treatment : Issue a software reset command after confirming that the servo is OFF (SV signal is 0).
0A1	Cold start	Parameter data error	Cause : The data input range in the parameter area is not appropriate. This error occurs when the magnitude relationship is apparently inappropriate such as when 300mm was incorrectly input as the value of the soft limit negative side while the value of the soft limit positive side was 200.3mm. Treatment : Change the value to the appropriate one.
0A5	Operation release	Electromagnetic brake unreleased error	Cause : The brake cannot be released. Treatment : Supplied the 24V power unit for the electromagnetic brake.

Alarm Code	Alarm Level	Alarm Name	Cause/Treatment
0A6	Cold start	Dynamic brake not released	Cause : The dynamic brake cannot be released when the servo is ON due to noise and electrostatic, etc. Treatment : Implement measures to eliminate noise or electrostatic. There is a concern of circuit breakdown. Please contact IAI.
0A7	Operation release	Command deceleration error	Cause : Because there is not enough deceleration distance when the deceleration is changed to a lower setting during the operation, the actuator exceeded the soft limit when deceleration was made from the current position with the deceleration after the change.  The cause is that the timing to make the next movement command when the speed was changed during the operation was late. Treatment : Make the timing earlier for the movement command for the deceleration speed change.
0A8	Cold start	Unsupported motor/encoder types	Cause : The motor connected to the controller is not applicable or the type of the encoder that the motor is connected is not applicable. Treatment : Please contact us if the alarm is issued even with the applicable actuator and the same problem happens again even after rebooting the power.
0AB	Operation cancel	Command Speed Error	Cause : When INTERPOLATE Command is executed, the command speed exceeds the maximum speed of the actuator. Treatment : Have the command speed setting revised considering the actuator specifications.
0B3	Cold start	Linear ABS error	Cause : Home-return operation was not performed properly. 1) Work is interfering with peripheral equipment in the middle of home return. 2) Encoder Error Treatment : 1) Remove the interference. 2) Please contact IAI.
0B4		Electric angling mismatching	Cause : This alarm indicates that the position deviation counter has overflowed. Treatment : The alarm occurs when the actuator cannot be operated. Confirm about the load conditions, that the work does not interfere with any object nearby or the brake has been released, etc. If the error occurs even when the servo is ON, the cable breakage or disconnection is considered. Check the cable connection. Please contact IAI if there is no failure in the cable and connector connections.
0B5	Operation release	Z-Phase position error	The position where the Z-phase is detected before the home return operation, is out of the specified range. Cause : Encoder Error Treatment : Please contact IAI.

Alarm Code	Alarm Level	Alarm Name	Cause/Treatment
0B7	Cold start	Magnetic pole indeterminate	Cause : The controller detects the magnetic pole phase when the servo is tuned ON for the first time after turning ON the power. This error indicates that the magnetic pole phase cannot be detected after the specified period. 1) Contact error or breakage at the connector of the motor relay cable. 2) Brake cannot be released on a controller equipped with a brake. 3) Detection of the motor is not performed properly because an external force is applied. 4) Large slide resistance of the actuator itself Treatment : 1) Check the wiring condition of the motor relay cable. 2) Check the wiring condition of the brake cable, and also turn on/off the brake release switch to see if the brake makes a “clicking” sound. If the brake is not making any noise, check if the power is supplied to the brake properly. 3) Check for abnormality in the assembly condition. 4) It the transportation weight is in the acceptable range, cut off the power to check the slide resistance manually by moving with hand. If the actuator itself is suspected to be the cause, please contact IAI.
0BA	Operation release	Home sensor non-detection	Cause : This indicates that the home-return operation of the actuator equipped with origin sensor (option except rotary actuator) is not completed in normal condition. 1) Work is interfering with peripheral equipment in the middle of home return. 2) Large slide resistance of the actuator itself 3) Installation failure, breakdown or disconnection of the home sensor Treatment : In the case that the work does not interfere with anything, the cause 2) or 3) is supposed. In such case, please contact IAI.
0BE		Home return timeout	Cause : Home return does not complete after elapse of a certain period after the start of home return. Treatment : This error does not occur in normal operation. The combination of the controller and actuator may be incorrect. Please contact IAI.
0BF		Creep sensor not detected	Cause : This indicates the actuator detected the creep sensor (option) before detecting the origin sensor (option except for rotary actuator), or the actuator reached the mechanical end (or the actuator cannot move anymore because the load is too large). 1) The position to apply the creep sensor is not appropriate. 2) The creep sensor is faulty. 3) The cable is disconnected or the connector is not plugged in properly. 4) The actuator cannot move due to heavy load caused by interference. Treatment : 1) Readjust the sensor installation position. 2) Replace the creep sensor. 3) Perform continuity check to see if the connector is plugged in properly. 4) Check the interference and the transportable weight and make sure there is no external force applied.

Alarm Code	Alarm Level	Alarm Name	Cause/Treatment
0C0	Operation release	Actual speed excessive	Cause : This indicates the number of motor rotation exceeded the number of allowable rotation. 1) The slide resistance of the actuator is locally high. 2) The load is increased too much due to a external force. With the reasons above, it can be considered a sudden speed increase has occurred before detecting the servo error. Treatment : Even though this would not occur in normal operation, check if there is any abnormality in the parts assembly condition. Also check if there is a possibility that an external force may be applied in the direction of the actuator movement.
0C2		Overrun detected	Cause : This indicates that a signal from the OT sensor (option) installed at the mechanical end is detected. 1) The actuator was moved by hand or received external force while the servo was OFF (normal detection). 2) The actuator was jogged or operated by pulse-train in a condition where the home coordinates were not yet established and thus the soft stroke limit did not function correctly (normal detection). 3) The home position achieved by home return is not correct, or in the case of an absolute type controller the coordinates have shifted due to an inappropriate absolute reset position. 4) There is a mismatch between the sensor characteristics and the setting in Parameter No.19 “Overrun sensor input polarity”, or the wiring layout is wrong. 5) There is a mistake in the mating of the controller and actuator, or the settings in Parameters No.3 and 4 “Soft limit value” and Parameter No.77 “Ball screw limit length” are not appropriate. Treatment : If 1) or 2) is suspected, move the actuator in the opposite direction by hand. If this error occurred inside the effective stroke range, 3), 4), or 5) is a likely cause. If 3) is suspected, check the home position. Conduct the absolute reset again if it is the absolute type. If 4) or 5) is suspected, please contact IAI.

Alarm Code	Alarm Level	Alarm Name	Cause/Treatment
0C8	Cold start	Overcurrent	Cause : The output current in the power circuit section is increased abnormally. Treatment : This alarm will not be generated in normal operation. If it occurs, insulation of the motor coil may have deteriorated. Check if there is deterioration in the insulation by measuring the phase resistance between the monitor connection lines U, V and W. The values for the phase resistance should be almost the same. There is a concern the insulation is deteriorated if the values are different in large amount. Please contact IAI.
0CA		Overheat	Cause : This indicates overheat (95°C or more) of the components inside the controller. 1) Operation is performed with the load condition exceeding the specified range. 2) High temperature around the controller. 3) Load to the motor is high due to external force. 4) A faulty part inside the controller. Treatment : 1) Revise the operation condition such as decreasing the acceleration/deceleration speed. 2) Lower the ambient temperature of the controller. 3) Confirm that there is no error in the mechanical part assembly condition. (Note) This error would not normally occur. If it occurs, confirm there is not (1) or (2) above. If the same error is issued again even after confirming (1) or (2) is not in the condition, it is considered to be a malfunction. Please contact IAI.
0CB		Current sensor offset adjustment error	Cause : An error was found to the sensor in the status check of the current detection sensor conducted at the initializing process in the startup. 1) The current detection sensor or any of its surrounding parts is faulty. 2) Inappropriate offset adjustment Treatment : A work (PC board) change or offset adjustment is required. Please contact IAI.
0CD		Emergency-stop relay	Cause : A melt-down of the emergency stop relay inside the controller. Treatment : The relay or controller must be replaced. Please contact IAI.
0CE		Drop in control supply voltage	Cause : 1) The AC power supply voltage is low. 2) Faulty part inside the controller Treatment : Check the voltage of the input power supply. In the case that the voltage is normal, please contact IAI.
0D2		Motor power source voltage excessive	Cause : A breakdown of the part inside the controller is considered. Treatment : If this error occurs frequently, the controller may be faulty at high probability. Please contact IAI.
0D3		Motor power supply voltage low	Cause : 1) If the power source is shut off out of the controller, servo-on command was made during the power is shut. 2) There is a concern of a malfunction of the controller internal components. Treatment : 1) Check the controller external circuit. 2) If this error occurs often, there is a concern of a controller malfunction. Please contact us.
0D7		Belt breaking sensor detected	Cause : The belt of the ultra-high thrust RCS2-RA13R is broken. Treatment : Belt must be replaced. Please contact IAI.

Alarm Code	Alarm Level	Alarm Name	Cause/Treatment
0D8	Operation release	Deviation overflow	Cause : This alarm indicates that the position deviation counter has overflowed. 1) The speed dropped or the actuator stopped due to the effect of external force or overload. 2) The excited-phase detection operation following the power-on is unstable. 3) The power supply voltage dropped. 4) Servo gain number is too small Treatment : 1) This error occurs when the actuator cannot be operated as it is commanded. Check the load conditions such as if the work is touching to the surrounding object, or brake is properly released, and remove the cause. 2) Overload can be concerned. Revise the transportable weight and redo the home-return operation. 3) Check for the source voltage.
0D9		Software stroke limit exceeded	Cause : The current position of the actuator exceeds the software stroke limit. Treatment : Return the actuator to be within the range of the software stroke limit.
0E0	Cold start	Overload	Cause : 1) The work weight exceeds the rated weight, or an external force is applied and the load increased. 2) If the actuator is equipped with a brake, the brake is not released. 3) The slide resistance of the actuator is locally high. Treatment : 1) Check the work and its surrounding area to remove the cause. 2) Turn on the brake release switch to see if the brake is released. If the brake is not released, the brake itself may be faulty, cable may be disconnected, or the controller may be faulty. Please contact IAI. 3) In the case that the work can be moved by hand, move it. Then, check that there is no location where a sliding resistant is too large. Check if the installation face is distorted. When the error occurs in operation of the actuator only, Please contact IAI. ⚠ Caution Restart the operation after making sure to remove the cause. If you cannot determine that the cause is removed completely, wait for at least 30 minutes before turning on the power to prevent the motor coil from burning.
0E4		Encoder send error	Cause : The data sending and receiving between the controller and encoder is conducted by the serial communication. This error indicates that the data sent from the controller was not received properly at the encoder side. 1) Effect of noise 2) One or more communication ICs installed on the encoder board are faulty. 3) One or more communication ICs installed on the controller board are faulty. Treatment : 1) Interrupt the power to the peripheral equipment and activate only the actuator. If any error does not occur, it might be caused by noise. Take proper measures against noise. If 2) or 3) is the case, the encoder or controller must be replaced. If the cause cannot be specified, please contact IAI.

Alarm Code	Alarm Level	Alarm Name	Cause/Treatment
0E5	Cold start	Encoder receipt error	Cause : This shows the data was not received in normal condition from the encoder side to the controller. 1) Cable breakage of encoder cable or connector connection failure. (If the detail code in the error list of the teaching tool is 0002_H.) 2) Effect of noise. (If the detail code in the error list of the teaching tool is 0001_H.) 3) Malfunction of component (communication part) inside the actuator. 4) A faulty part inside the controller (communication part). Treatment : 1) Check if any wire breakage on a connector and the condition of wire connections. 2) Interrupt the power to the peripheral equipment and activate only the actuator. If any error does not occur, it might be caused by noise. Take proper measures against noise. If 3) or 4) is the case, it is necessary to replace the actuator (motor part) or controller. If the cause cannot be specified, please contact IAI.
0E6		Encoder count error	Cause : This error code appears when the encoder cannot detect the position information properly. 1) The encoder relay cable or supplied actuator cable is disconnected or its connector is not plugged in correctly. 2) Foreign matter is deposited on the code wheel. 3) The position relationship between the code wheel and photo sensor changed due to shaft center shift caused by application of excessive external force, etc. 4) Faulty encoder board component Treatment : 1) Check if any wire breakage on a connector and the condition of wire connections. For the case of 2), 3) or 4), it is necessary either to clean the code wheel, adjust the installation position, replace the motor unit or replace the actuator. In any case, please contact IAI.
0E7		A-, B- and Z-phase wire breaking	Cause : Encoder signals cannot be detected correctly. 1) The encoder relay cable or supplied actuator cable is disconnected or its connector is not plugged in correctly. 2) The encoder itself is faulty. Treatment : 1) Check if any wire breakage on a connector and the condition of wire connections. If the cables are normal, faulty encoder is suspected. Please contact IAI.
0EB		BLA encoder error detection	Cause : It is a condition that the battery-less absolute encoder has not detected the position information properly. Treatment : Check if there is any breakage on the connectors and the condition of connections. Malfunction of the encoder can be considered if thecables are in the normal condition. Please contact IAI.

Alarm Code	Alarm Level	Alarm Name	Cause/Treatment
0EE	Cold start	Absolute encoder error detection (2)	Cause : This is the condition where the position information can not be detected in the absolute encoder. 1) When the power is supplied for the first time to Simple Absolute applicable type (before executing absolute reset) 2) Voltage drop of absolute battery. 3) The motor, encoder relay cable or supplied actuator cable is disconnected or its connector is not plugged in correctly. 4) Changed the parameters of controller 5) Position data loss in absolute reset 6) Motor has replaced in battery-less absolute type, and the pairing ID registered in the controller has changed. Treatment : 2) (SCON and ACON serial absolute type) Check the PIO battery alarm output (*BALM) and when it is turned OFF, replace the absolute battery with new one. (PCON, ACON simple absolute type, MCON pulse motor type and MCON servomotor type) Supply the power for 72 hours or more and after charging the battery enough, perform the absolute reset operation. If the same failure occurs often even with enough battery charge, it is considered the end of the battery life. Replace the battery. 3) Check if any wire breakage on a connector and the condition of wire connections. Whichever action is taken under 1) 2) 4) 5), and 6) absolute reset must be performed.
0EF		Absolute encoder error detection (3)	Absolute encoder is not detecting the position information properly. (ABS encoder overspeed error) Cause : This error occurs in such cases as the speed exceeded the tracing acceleration speed limit in the drop by the brake release at the power cutoff of the absolute type vertical axis. (This condition should not occur in normal conditions of use. Take sufficient note on forced brake release.) Treatment : If the error is occurred, it is necessary to absolute reset.
0F0		Driver logic error	Cause : Exceeded load, parameter (motor type) mismatched, noise, malfunction of controller, etc. Treatment : Please contact IAI.
0F2		Field bus module error	Cause : A Field bus Module error was detected. Treatment : Check the Field bus related parameters.
0F3		Field bus module not detected	Cause : 1) Field bus module not detected. 2) Main CPU board is not applicable for MECHATROLINK-Ⅲ. Treatment : If the error cannot be resolved even after putting the power on again, please contact us.
0F4		Mismatched PCB error	This controller uses a different print circuit board depending on the motor capacity. The PCB is not applicable for the connected motor in the startup check. Cause : The actuator may not match the controller. Check the model. Treatment : Should this error occur, please contact IAI.

Alarm Code	Alarm Level	Alarm Name	Cause/Treatment
0F5	Cold start	Nonvolatile memory write verify error	It is verified at the data writing process to the non-volatile memory that the data inside the memory and the data to be written are matched. There was a mismatch detected in this process. Cause : Faulty nonvolatile memory. Treatment : When the error is caused even when the power is re-input, please contact IAI.
0F6		Nonvolatile memory write timeout	There is no response in the specified time duration during the data writing to the non-volatile memory. Cause : Faulty nonvolatile memory. Treatment : When the error is caused even when the power is re-input, please contact IAI.
0F8		Nonvolatile memory data destroyed	Abnormal data was detected during the nonvolatile memory check after starting. Cause : Faulty nonvolatile memory. Treatment : When the error is caused even when the power is re-input, please contact IAI.
0FA		CPU error	The CPU operation is not normal. Cause : 1) Faulty CPU 2) Malfunction due to noise Treatment : When the error is caused even when the power is re-input, please contact IAI.
0FB		FPGA error (Faulty component)	The FPGA is not operating properly. Cause : 1) Malfunction due to the effect of noise, etc. 2) Faulty FPGA 3) Faulty circuit component around the FPGA. 4) Inappropriate board installation in the controller. Treatment : Turn the power off and reboot. If the error occurs again, check for presence of noise. If a spare controller is available, replace the problem controller with the spare controller. A recurring error with the spare controller suggests presence of noise. If the cause cannot be identified, please contact IAI.
100 to 1FF	Message	Alarm on teaching tool	[Refer to the Instruction Manual of teaching tool.]
200 to 2FF	Operation release	Alarm on teaching tool	[Refer to the Instruction Manual of teaching tool.]
300 to 3FF	Cold start	Alarm on teaching tool	[Refer to the Instruction Manual of teaching tool.]

9. Change History

Revision Date	Description of Revision
July 2013	First edition
March 2016	Third edition (Revised overall) ACON-CB, PCON-CB/CFB, DCON-CB, SCON-CB added
April 2016	3B edition Pg. 37 Explanation corrected for HOME Bit in CVCMD_IO Command Field detail (master ⇒ slave)
June 2016	Fourth edition • MCON-C/CG added • Names of model types (ACON-CGB, PCON-CGB/CGFB, DCON-CGB, SCON-CGB) added for category applicable type

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