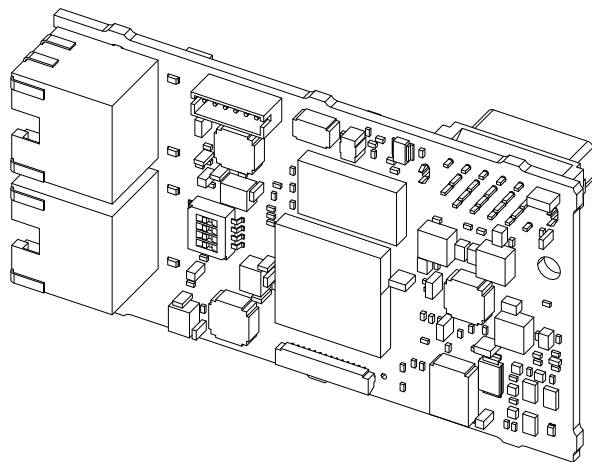# YASKAWA

YASKAWA AC Drive Option

MECHATROLINK-4
Technical Manual

Model   JOHB-SMP3

To correctly use the product, read this manual thoroughly and keep it for easy reference, inspection, and maintenance.
Make sure that the end user receives this manual.

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Table of Contents

1   Preface and Safety

YASKAWA Electric supplies component parts for use in a wide variety of industrial applications. The selection and application of YASKAWA products remain the responsibility of the equipment designer or end user.

YASKAWA accepts no responsibility for the way its products are incorporated into the final system design. Under no circumstances should any YASKAWA product be incorporated into any product or design as the exclusive or sole safety control. Without exception, all controls should be designed to detect faults dynamically and fail safely under all circumstances. All products designed to incorporate a component part manufactured by YASKAWA must be supplied to the end user with appropriate warnings and instructions as to the safe use and operation of that part. Any warnings provided by YASKAWA must be promptly provided to the end user. YASKAWA offers an express warranty only as to the quality of its products in conforming to standards and specifications published in the manual. NO OTHER WARRANTY, EXPRESS OR IMPLIED, IS OFFERED. YASKAWA assumes no liability for any personal injury, property damage, losses, or claims arising from misapplication of its products.

◆ Applicable Documentation

Document	Description
JOHB-SMP3 Multi-Protocol Ethernet Quick Installation Procedure Manual No.: TOBP C730600 0H	Read this manual first. The manual provides information about wiring, settings, functions, and troubleshooting. The manual is packaged together with the product.
YASKAWA AC Drive Option MECHATROLINK-4 Technical Manual Manual No.: SIEP C730600 0N (This book)	The technical manual contains detailed information about the option. Access the following sites to obtain the technical manual: U.S.: http://www.yaskawa.com Europe: http://www.yaskawa.eu.com Japan: http://www.e-mechatronics.com Other areas: Check the back cover of these manuals. For questions, contact Yaskawa or a Yaskawa representative.
YASKAWA AC Drive Manuals	Refer to the drive manual to connect with the option. Drive manuals contain basic installation and wiring information in addition to detailed parameter setting, fault diagnostic, and maintenance information. The manuals also include important information about parameter settings and tuning the drive. The Quick Start Guides are packaged with the drive. The most recent versions of these manuals are available for download on our documentation websites: U.S.: http://www.yaskawa.com Europe: http://www.yaskawa.eu.com Japan: http://www.e-mechatronics.com Other areas: Check the back cover of these manuals. For questions, contact Yaskawa or a Yaskawa representative.

◆ Glossary

Terms	Definition
Option	YASKAWA AC Drive Option JOHB-SMP3 with DIP switches set for MECHATROLINK-4
Keypad	• HOA Operator • LCD Operator • LED Operator • HOA Keypad • LCD Keypad • LED Keypad
Hex. (Example: 900 (Hex.))	Identifies a unit for hexadecimal number format.

◆ Registered Trademarks

- MECHATROLINK-4 is a trademark of the MECHATROLINK Members Association (MMA).
- QR Code is a registered trademark of DENSO WAVE INCORPORATED.
- Ethernet is a registered trademark of FUJIFILM Business Innovation Corp.
- All trademarks are the property of their respective owners.

◆ Supplemental Safety Information

Read and understand this manual before installing, operating, or servicing this option. The option must be installed according to this manual and local codes.

The following conventions are used to indicate safety messages in this manual. Failure to heed these messages could result in serious or possibly even fatal injury or damage to the products or to related equipment and systems.

DANGER *This signal word identifies a hazard that will cause serious injury or death if you do not prevent it.*

WARNING *This signal word identifies a hazard that can cause death or serious injuries if you do not prevent it.*

CAUTION *This signal word identifies a hazard that can cause minor or moderate injuries if you do not prevent it.*

NOTICE *This signal word identifies a property damage message that is not related to personal injury.*

■ Section Safety

General Precautions
• The diagrams in this section may include options and drives without covers or safety shields to illustrate details. Be sure to reinstall covers or shields before operating any devices. The option should be used according to the instructions described in this manual.
• The diagrams in this manual are provided as examples only and may not pertain to all products covered by this manual.
• The products and specifications described in this manual or the content and presentation of the manual may be changed without notice to improve the product and/or the manual.
• Contact Yaskawa or a Yaskawa representative and provide the manual number shown on the front cover to order new copies of the manual.

DANGER *Do not ignore the safety messages in this manual. If you ignore the safety messages in this manual, it will cause serious injury or death. The manufacturer is not responsible for injuries or damage to equipment.*

WARNING *Electrical Shock Hazard. Do not modify the drive or option circuitry. Failure to obey can cause serious injury or death, or cause damage to the drive or option and will void warranty. Yaskawa is not responsible for modifications of the product made by the user.*

NOTICE *Damage to Equipment. Do not use steam or other disinfectants to fumigate wood for packaging the drive. Use alternative methods, for example heat treatment, before you package the components. Gas from wood packaging fumigated with halogen disinfectants, for example fluorine, chlorine, bromine, iodine or DOP gas (phthalic acid ester), can cause damage to the drive.*

2 Overview

This option provides a communications connection between the drive and a MECHATROLINK-4 network. The option connects the drive to a MECHATROLINK-4 network and facilitates the exchange of data.

MECHATROLINK-4 is a communications link to connect industrial devices (such as smart motor controllers, operator interfaces, and variable frequency drives) as well as control devices (such as programmable controllers and computers) to a network.

MECHATROLINK-4 is an open network standard.

Install the option on a drive to do these functions from a MECHATROLINK-4 master device:

- Operate the drive
- Monitor the drive operation status
- Change drive parameter settings

◆ Compatible Products

You can use the option with these products:

Table 2.1 Compatible Products

Drive	Model	Software Version *1
GA500	CIPR-GA50xxxxx	≥ 1021

*1   Refer to "PRG" on the drive nameplate for the software version number.

Note:

Refer to *U6-97 [OPT SPARE 4]* to identify the option software version.

3 Receiving

After you receive the option package:

- Make sure that there is no damage to the option and no parts are missing.
  The Yaskawa warranty does not include damage from shipping. If there is damage to the option or other parts, contact the shipping company immediately.

> **NOTICE** *Damage to Equipment. Do not use damaged parts to connect the drive and the option. Failure to comply could damage the drive and option.*

• Make sure that the model number on the option nameplate and the model number on the purchase order are the same. Refer to Figure 4.1 for more information.

• Contact the distributor where you purchased the option or contact Yaskawa or a Yaskawa representative about any problems with the option.

◆ Option Package Contents

Table 3.1 Contents of Package

Option Contents			Quantity
Option			1
Ground wire *1			1
Screws (M3)			3
LED Labels *2	GA500		1
Quick Installation Procedure			1

*1 GA500 drives do not use the ground wire.
*2 LED labels are located on this label sheet.

Figure 3.1 LED Label Sheet

◆ Installation Tools

You can use these tools to install the option to the drive:

• A Phillips screwdriver or slotted screwdriver *1.

• Non-conductive tweezers or a tool with a tip width of approximately 0.5 mm (0.02 in) to set DIP switch S1.

• A pair of diagonal cutting pliers.

• A small file or medium-grit sandpaper.

*1 Phillips screw sizes are different for different drive capacities. Prepare different screwdrivers for different screw sizes.

4   Option Components

◆ Option PCB Components

A - **Connector (CN5)**
B - **Installation hole**
C - **LED (NS)** *1*
D - **LED (MS)** *1*
E - **Ground terminal (FE) and installation hole** *2*
F - **Port 2 LED (10/100)** *1*

G - **Option modular connector CN1B (Port 2) (RJ45)**
H - **DIP switch S1**
I - **Port 2 LED (LINK/ACT)** *1*
J - **Port 1 LED (10/100)** *1*
K - **Option modular connector CN1A (Port 1) (RJ45)**
L - **Port 1 LED (LINK/ACT)** *1*

Figure 4.1 Option PCB Components

*1   Refer to *Option LED States on page 9* for more information about the LEDs.
*2   Connect the included ground wire during installation. For GA500 drives, connect the included ground wire to the separately-sold communication option case (model: JOHB-GA50).

■ Option LED States

A - **GA500**

Figure 4.2 Option LED Labels

Wait 2 seconds minimum for the power-up diagnostic process to complete before you verify the LED states. The Table 4.1 shows the operating status of the option LEDs after the power-up diagnostic LED sequence is complete.

Table 4.1 Option LED States

LED Name	Indication		Operating State	Description
	Color	Display		
MS (Module Status)	-	OFF	Power supply off	There is no power to the drive.
	Green	ON	Power supply on	• The JOHB-SMP3 has power and is prepared for operation • An internal, self-diagnostic check completed in the option
	Green	Flashing	Option initializing	During the JOHB-SMP3 self-diagnostic check
	Red	ON	JOHB-SMP3 error	Error found during the JOHB-SMP3 self-diagnostic check
	Red	Flashing	Error occurred	Error/alarm occurred
NS (Network Status)	-	OFF	Connection unestablished	Connection with master device is not established
	Green	ON	Connection established	Connection with master device is established
10/100 *1*	-	OFF	Power supply off, or 100 Mbps is not established	-
	Green	ON	100 Mbps is established	
LINK/ACT *1*	-	OFF	Link is not established	
	Green	ON	Link is established	

LED Name	Indication		Operating State	Description
	Color	Display		
	Green	Flashing	Link is established and there is network activity	

*1   To verify LED states, you must remove the drive front cover. Do not touch the drive main circuit terminal or circuit boards when you remove the drive front cover.

◆ Communication Connector

Option connections CN1A (Port 1) and CN1B (Port 2) are connection points for customer-supplied MECHATROLINK-4 network communication cables. These ports accept customer-supplied male 8-way Ethernet modular RJ45 connectors.

Table 4.2 Male 8-way Ethernet Modular Connector (Customer-Supplied)

Male 8-way Ethernet Modular Connector	Pin	Description
	1 (Pair 2)	Transmit data (TXD) +
	2 (Pair 2)	Transmit data (TXD) -
	3 (Pair 3)	Receive data (RXD) +
	4 (Pair 1)	Not used
	5 (Pair 1)	Not used
	6 (Pair 3)	Receive data (RXD) -
	7 (Pair 4)	Not used
	8 (Pair 4)	Not used

5   Installation Procedure

◆ Section Safety

DANGER   *Electrical Shock Hazard. Do not examine, connect, or disconnect wiring on an energized drive. Before servicing, disconnect all power to the equipment and wait for the time specified on the warning label at a minimum. The internal capacitor stays charged after the drive is de-energized. The charge indicator LED extinguishes when the DC bus voltage decreases below 50 Vdc. When all indicators are OFF, measure for dangerous voltages to make sure that the drive is safe. If you do work on the drive when it is energized, it will cause serious injury or death from electrical shock.*

WARNING   *Electrical Shock Hazard. Do not operate the drive when covers are missing. Replace covers and shields before you operate the drive. Use the drive only as specified by the instructions. Some figures in this section include drives without covers or safety shields to more clearly show the inside of the drive. If covers or safety shields are missing from the drive, it can cause serious injury or death.*

WARNING   *Electrical Shock Hazard. Only let approved personnel install, wire, maintain, examine, replace parts, and repair the drive. If personnel are not approved, it can cause serious injury or death.*

WARNING   *Electrical Shock Hazard. Do not remove covers or touch circuit boards while the drive is energized. If you touch the internal components of an energized drive, it can cause serious injury or death.*

WARNING   *Electrical Shock Hazard. Do not use damaged wires, put too much force on the wiring, or cause damage to the wire insulation. Damaged wires can cause serious injury or death.*

WARNING   *Fire Hazard. Tighten all terminal screws to the correct tightening torque. Connections that are too loose or too tight can cause incorrect operation and damage to the drive. Incorrect connections can also cause death or serious injury from fire.*

NOTICE   *Damage to Equipment. When you touch the option, make sure that you observe correct electrostatic discharge (ESD) procedures. If you do not follow procedures, it can cause ESD damage to the drive circuitry.*

NOTICE   *Damage to Equipment. Do not de-energize the drive while the drive is outputting voltage. Incorrect equipment sequencing can cause damage to the drive.*

NOTICE   *Do not operate a drive or connected equipment that has damaged or missing parts. You can cause damage to the drive and connected equipment.*

NOTICE   *Use Yaskawa connection cables or recommended cables only. Incorrect cables can cause the drive or option to function incorrectly.*

NOTICE   *Damage to Equipment. Correctly connect the connectors. Incorrect connections can cause malfunction or damage to the equipment.*

| NOTICE | *Damage to Equipment. Make sure that all connections are correct after you install the drive and connecting peripheral devices. Incorrect connections can cause damage to the option.* |

◆ Install the Option on a GA500 Drive

An option card mounting kit is necessary to install the option on a GA500 drive. The option card mounting kit model is: JOHB-GA50. This kit is sold separately.

Refer to the option card mounting kit manual for more information about installation.

A - Option card mounting kit
    components (sold separately)
B - Option

C - Drive front cover

Figure 5.1 Option Card Mounting Kit (JOHB-GA50)

◆ Settings for DIP Switch S1

Use DIP switch S1 on the option to select the communication protocol.

Use non-conductive tweezers or a tool with a tip width of approximately 0.5 mm (0.02 in) to set DIP switch S1.

Figure 5.2 shows the default settings for DIP switch S1.

Figure 5.2 Default Settings for DIP Switch S1

When you use MECHATROLINK-4, set DIP switch S1 as shown in Figure 5.3.

Figure 5.3 Settings for DIP Switch S1

◆ Communication Cable Specifications

Yaskawa recommends using shielded Cat5e cable. The Yaskawa warranty does not cover other cable types.

■ **Option Connection Diagram**

Figure 5.4 Option Connection Diagram

*1   Connect the specified ground wire for installations on GA500 drives.

6   Related Drive Parameters

These parameters set the drive for operation with the option. Make sure that the parameter settings in this table are correct before you start network communications.

Note:

Hex.: MEMOBUS addresses that you can use to change parameters over network communication are represented in hexadecimal numbers.

No. (Hex.)	Name	Description	Default (Range)
b1-01 (0180)	Frequency Reference Selection 1	Selects the input method for frequency reference. 0 : Keypad 1 : Analog Input 2 : Memobus/Modbus Communications 3 : Option PCB 4 : Pulse Train Input **Note:** • Set *b1-01 = 3* to use the master device to control the frequency reference of the drive. • The default setting is different for different drives. Refer to the instruction manual of your specific drive for more information.	1 (0 - 4)
b1-02 (0181)	Run Command Selection 1	Selects the input method for the Run command. 0 : Keypad 1 : Digital Input 2 : Memobus/Modbus Communications 3 : Option PCB **Note:** • Set *b1-02 = 3* to start and stop the drive with the master device using serial communications. • The setting range and selections are different for different drives. Refer to the instruction manual of your specific drive for more information.	1 (0 - 3)
F6-01 (03A2)	Communication Error Selection	Selects drive response when the drive detects a *bUS [Option Communication Error]* error during communications with the option. 0 : Ramp to Stop 1 : Coast to Stop 2 : Fast Stop (Use C1-09) 3 : Alarm Only 4 : Alarm (Run at *d1-04*) 5 : Alarm - Ramp Stop **Note:** • When you set this parameter to *3* or *4*, the drive will continue operation after it detects a fault. Separately prepare safety protection equipment and systems, for example fast-stop switches. • Refer to the drive manual to know if settings *4* and *5* are available. • Changes to this parameter take effect immediately. It is not necessary to cycle power on the drive.	1 (0 - 5)
F6-02 (03A3)	Comm External Fault (EF0) Detect	Selects the conditions at which *EF0 [Option Card External Fault]* is detected. 0 : Always Detected 1 : Detected during RUN Only	0 (0, 1)

No. (Hex.)	Name	Description	Default (Range)
F6-03 (03A4)	Comm External Fault (EF0) Select	Selects the operation of the drive when *EF0 [Option Card External Fault]* is detected. 0 : Ramp to Stop 1 : Coast to Stop 2 : Fast Stop (Use C1-09) 3 : Alarm Only **Note:** When you set this parameter to *3*, the drive will continue operation after it detects a fault. Separately prepare safety protection equipment and systems, for example fast stop switches.	1 (0 - 3)
F6-06 (03A7)	Torque Reference/Limit by Comm	Sets the function that enables and disables the torque reference and torque limit received from the communication option. 0 : Disabled 1 : Enabled **Note:** • Control method availability of this parameter is different for different product series. GA500 Parameter is available when *A1-02 = 2, 6, 8 [Control Method Selection = Open Loop Vector, PM Advanced Open Loop Vector, EZ Vector Control]*. The drive reads this value as the Torque Limit. • If the PLC does not supply a torque reference or torque limit when *F6-06 = 1 [Torque Reference/Limit by Comm = Enabled]*, the motor cannot rotate.	0 (0, 1)
F6-07 (03A8)	Multi-Step Ref @ NetRef/ComRef	0 : Disable Multi-Step References 1 : Enable Multi-Step References **Note:** Default setting of *F6-07* is *1* for GA500.	0 (0, 1)
F6-08 (036A)	Comm Parameter Reset @Initialize	Selects whether communication-related parameters *F6-xx and F7-xx* are set back to original default values when you use parameter *A1-03 [Initialize Parameters]* to initialize the drive. 0 : No Reset - Parameters Retained 1 : Reset - Back to Factory Default **Note:** When you set *F6-08* to *1* and you then use *A1-03* to initialize the drive, the drive will not change this setting value.	0 (0, 1)
F6-20 (036B)	MECHATROLINK Station Address	Sets the station number **Note:** • Cycle power for setting changes to take effect. • All station addresses must be unique. • When you set this parameter to 0000 (Hex.) , the option uses the station address at the time the previous cyclic communication was established. When cyclic communication is executed for the first time, the station address is 21 (Hex.).	21 (Hex.) (0 - FFEF (Hex.))
F6-23 (036E)	MECHATROLINK Monitor Select (Selection Code: 0E (Hex.))	Sets the MEMOBUS/Modbus register used for the monitor functions of INV_CTL (Inverter Operation Control Command), INV_CTL_EX (Extended Inverter Operation Control Command), and INV_I/O (Inverter I/O Control Command). **Note:** • Cycle power for setting changes to take effect. • Set SEL_MON1/2 (byte 21) of INV_CTL, one of SEL_MON_E1 to SEL_MON_E7 (byte 28 to 34) of INV_CTL_EX, or SEL_MON 3/4 (byte Ofs+6) or SEL_MON 5/6 (byte Ofs+7) of INV_I/O to 0E (Hex.) to enable the register set with *F6-23*. Bytes of the response data enable the register content set with *F6-23*. Refer to the manual packaged with the drive for more information about registers that you can set.	0 (Hex.) (0 - FFFF (Hex.))
F6-24 (036F)	MECHATROLINK Monitor Select (Selection Code: 0F (Hex.))	Sets the MEMOBUS/Modbus register used for the monitor functions of INV_CTL (Inverter Operation Control Command), INV_CTL_EX (Extended Inverter Operation Control Command), and INV_I/O (Inverter I/O Control Command). **Note:** • Cycle power for setting changes to take effect. • Set SEL_MON1/2 (byte 21) of INV_CTL, one of SEL_MON_E1 to SEL_MON_E7 (byte 28 to 34) of INV_CTL_EX, or SEL_MON 3/4 (byte Ofs+6) or SEL_MON 5/6 (byte Ofs+7) of INV_I/O to 0F (Hex.) to enable the register set with *F6-24*. Bytes of the response data enable the register content set with *F6-24*. Refer to the manual packaged with the drive for more information about registers that you can set.	0 (Hex.) (0 - FFFF (Hex.))
F6-25 (03C9)	MECHATROLINK Watchdog Error Sel	0 : Ramp to Stop 1 : Coast to Stop 2 : Fast Stop (Use C1-09) 3 : Alarm Only **Note:** When you set this parameter to *3 [Alarm Only]*., the drive will continue operation after it detects a fault. If you set this parameter to 3, make sure that you install an emergency stop switch.	1 (0 - 3)
F6-26 (03CA)	MECHATROLINK bUS Errors Detected	When the option detects the *bUS* alarm for the number of times set in *F6-26*, it will detect *Option Communication Error [bUS]*.	2 (2 - 10)
F7-80 (0794)	MECHATROLINK Monitor Select (Selection Code: 10 (Hex.))	Set MEMOBUS/Modbus register to monitor INV_CTL_EX (Extended Inverter Operation Control Command). **Note:** • Cycle power for setting changes to take effect. • To enable the register set with *F7-80*, set one of SEL_MON_E1 to SEL_MON_E7 (byte 28 to 34) of INV_CTL_EX to 10 (Hex.). Bytes of the response data enable the register content set with *F7-80*. Refer to the manual packaged with the drive for more information about registers that you can set.	0 (Hex.) (0 - FFFF (Hex.))

No. (Hex.)	Name	Description	Default (Range)
F7-81 (0795)	MECHATROLINK Monitor Select (Selection Code: 11 (Hex.))	Set MEMOBUS/Modbus register to monitor INV_CTL_EX (Extended Inverter Operation Control Command). **Note:** • Cycle power for setting changes to take effect. • To enable the register set with *F7-81*, set one of SEL_MON_E1 to SEL_MON_E7 (byte 28 to 34) of INV_CTL_EX to 11 (Hex.). Bytes of the response data enable the register content set with *F7-81*. Refer to the manual packaged with the drive for more information about registers that you can set.	0 (Hex.) (0 - FFFF (Hex.))
F7-82 (0796)	MECHATROLINK Monitor Select (Selection Code: 12 (Hex.))	Set MEMOBUS/Modbus register to monitor INV_CTL_EX (Extended Inverter Operation Control Command). **Note:** • Cycle power for setting changes to take effect. • To enable the register set with *F7-82*, set one of SEL_MON_E1 to SEL_MON_E7 (byte 28 to 34) of INV_CTL_EX to 12 (Hex.). Bytes of the response data enable the register content set with *F7-82*. Refer to the manual packaged with the drive for more information about registers that you can set.	0 (Hex.) (0 - FFFF (Hex.))
F7-83 (0797)	MECHATROLINK Monitor Select (Selection Code: 13 (Hex.))	Set MEMOBUS/Modbus register to monitor INV_CTL_EX (Extended Inverter Operation Control Command). **Note:** • Cycle power for setting changes to take effect. • To enable the register set with *F7-83*, set one of SEL_MON_E1 to SEL_MON_E7 (byte 28 to 34) of INV_CTL_EX to 13 (Hex.). Bytes of the response data enable the register content set with *F7-83*. Refer to the manual packaged with the drive for more information about registers that you can set.	0 (Hex.) (0 - FFFF (Hex.))
F7-84 (0798)	MECHATROLINK Monitor Select (Selection Code: 14 (Hex.))	Set MEMOBUS/Modbus register to monitor INV_CTL_EX (Extended Inverter Operation Control Command). **Note:** • Cycle power for setting changes to take effect. • To enable the register set with *F7-84*, set one of SEL_MON_E1 to SEL_MON_E7 (byte 28 to 34) of INV_CTL_EX to 14 (Hex.). Bytes of the response data enable the register content set with *F7-84*. Refer to the manual packaged with the drive for more information about registers that you can set.	0 (Hex.) (0 - FFFF (Hex.))
F7-85 (0799)	MECHATROLINK Monitor Select (Selection Code: 15 (Hex.))	Set MEMOBUS/Modbus register to monitor INV_CTL_EX (Extended Inverter Operation Control Command). **Note:** • Cycle power for setting changes to take effect. • To enable the register set with *F7-85*, set one of SEL_MON_E1 to SEL_MON_E7 (byte 28 to 34) of INV_CTL_EX to 15 (Hex.). Bytes of the response data enable the register content set with *F7-85*. Refer to the manual packaged with the drive for more information about registers that you can set.	0 (Hex.) (0 - FFFF (Hex.))
F7-86 (079A)	MECHATROLINK Monitor Select (Selection Code: 16 (Hex.))	Set MEMOBUS/Modbus register to monitor INV_CTL_EX (Extended Inverter Operation Control Command). **Note:** • Cycle power for setting changes to take effect. • To enable the register set with *F7-86*, set one of SEL_MON_E1 to SEL_MON_E7 (byte 28 to 34) of INV_CTL_EX to 16 (Hex.). Bytes of the response data enable the register content set with *F7-86*. Refer to the manual packaged with the drive for more information about registers that you can set.	0 (Hex.) (0 - FFFF (Hex.))

Table 6.1 Option Monitor

No.	Name	Description	Range
U4-75	Communication OPT Protocol	Shows the setting of DIP switch S1. • 73 (Setting to use MECHATROLINK-4 (1: ON, 2: ON, 3: OFF, 4: OFF)) **S1** 1 — O 2 — N 3 4 • 00 to 72, 74 to FF (Setting to use other than MECHATROLINK-4) **Note:** MECHATROLINK-4 will not operate with these setting values. **Note:** This monitor is only shown when you use a drive with the latest software version. Contact Yaskawa or your nearest sales representative for more information.	00 - FF (Hex.)
U4-76 - U4-78	MAC Address 1 - 3	Shows the main MAC address used by MECHATROLINK-4. • *U4-76*: First octet, Second octet • *U4-77*: Third octet, Fourth octet • *U4-78*: Fifth octet, Sixth octet **Note:** These monitors are shown only when you use a drive with the latest software version. Contact Yaskawa or your nearest sales representative for more information.	0000 - FFFF (Hex.)
U6-97	OPT SPARE 4	Shows overall JOHB-SMP3 software version.	-

No.	Name	Description	Range
U6-98	First Fault	Shows first option fault.	-
U6-99	Current Fault	Shows current option fault.	-

7 Transmission Interface

◆ MECHATROLINK-4 Cyclic Transmissions

As a MECHATROLINK-4 station, the JOHB-SMP3 option exchanges control data and I/O data with a control device. The option sends response data timed to the reception of command data for the local station address from the master in each transmission cycle to communicate. The command and response data formats follow the specifications for the MECHATROLINK-4 Drive commands.

◆ Command Format of the Standard Profile Common Commands

This section describes the specifications of the standard profile common commands.

Table 7.1 lists the data format and the common commands and responses.

Standard inverter profile commands fix the data length at 32 bytes for sub-commands. Set the number of command transmission data in the range of 32 to 96 bytes and the number of response transmission data in the range of 32 to 96 bytes from the controller.

Table 7.1 Command Format of the Standard Profile Common Commands (When the Main Command is 64 Bytes and the Sub-Command is 32 Bytes)

-	Byte	Command	Response	Reference
Main Commands Command	0	CMD	RCMD	
	1	WDT	RWDT	
	2	CMD_CTRL	CMD_STAT	
	3			
	4	CMD_DATA	RSP_DATA	• CMD/RCMD Command code specified for individual commands: Refer to page 19. • WDT/RWDT: Watchdog data is usually set automatically. • CMD_CTRL: Refer to page 18. • CMD_STAT: Refer to page 18. • CMD_DATA/RSP_DATA: Specified for individual commands. Refer to page 19.
	5			
	6			
	.			
	.			
	61			
	62			
	63			
Sub-Commands Command	64	SUBCMD	RSUBCMD	
	65	SUB_CTRL	SUB_STAT	
	66			
	67			
	68	SUB_CMD_DATA	SUB_RSP_DATA	• SUBCMD/RSUBCMD: Command code specified for individual commands. Refer to page 41. • SUB_CTRL: Refer to page 41. • SUB_STAT: Refer to page 41. • SUB_CMD_DATA/SUB_RSP_DATA: Specified for individual commands. Refer to page 41.
	69			
	70			
	.			
	.			
	93			
	94			
	95			

◆ Communication Phases

The JOHB-SMP3 option changes status after receiving a command code or fault from the master as shown in the following figure.

The communication phases determine the available commands. Refer to Table 7.4 and Table 7.5 for more information.

Figure 7.1 Communication Phases

■ Phase 1: Initial status after power ON

Operation proceeds with a default transmission cycle of 2 ms. The transmission cycle is changed to the time indicated in the synchronous frame when a CONNECT command is received from the master. Then the phase moves to phase 2 or phase 3 after a response to the CONNECT command is returned.

Even if a transfer fault is detected in phase 1, no fault notification is provided.

■ Phase 2: Asynchronous communications

All JOHB-SMP3 commands can be used. The phase moves to phase 3 when a SYNC_SET command is received, and it moves to phase 1 when a DISCONNECT command is received.

■ Phase 3: Synchronous communications

Watchdog timer faults in the communications frame are detected. The phase moves to phase 1 if the DISCONNECT command is received. The phase moves to phase 2 if a reception fault or a watchdog timer fault is detected.

Table 7.2 Main Command Communication Phases

Command	Code (Hex.)	Operation	Communication Phases		
			1	2	3
NOP	00	No Operation Command	-	○	○
PRM_RD	01	Read Parameter Command	-	○	○
PRM_WR	02	Write Parameter Command	-	○	○
ID_RD	03	Read ID Number Command	-	○	○
CONFIG	04	Setup Device Command	-	○	○
ALM_RD	05	Read Alarm or Warning Command	-	○	○
ALM_CLR	06	Clear Alarm or Warning Command	-	○	○

Command	Code (Hex.)	Operation	Communication Phases		
			1	2	3
SYNC_SET	0D	Start Synchronous Communication Command	-	○	△
CONNECT	0E	Establish Connection Command	○	△	△
DISCONNECT	0F	Release Connection Command	○	○	○
MEM_RD	1D	Read Memory Command	-	○	○
INV_CTL	50	Inverter Operation Control Command	-	○	○
INV_CTL_EX	52	Extended Inverter Operation Control Command	-	○	○

○: Can be executed, △: Ignored, −: Cannot be executed (phase error)

Table 7.3 Sub-Command Communication Phases

Command	Code (Hex.)	Operation	Communication Phases		
			1	2	3
NOP	00	No Operation Command	-	○	○
PRM_RD	01	Read Parameter Command	-	○	○
PRM_WR	02	Write Parameter Command	-	○	○
ALM_RD	05	Read Alarm or Warning Command	-	○	○
INV_IO	51	Drive I/O Control Command	-	○	○

○: Can be executed, −: Cannot be executed (phase error)

◆ Application Layer Specifications

The data format for the application layer conforms to the MECHATROLINK-4 command specifications for standard inverter profile.

The JOHB-SMP3 option uses the main commands and sub-commands in the following tables.

Table 7.4 Main Commands

Code (Hex.)	Name	Function
00	NOP	No Operation Command
01	PRM_RD	Read Parameter Command
02	PRM_WR	Write Parameter Command
03	ID_RD	Read ID Number Command
04	CONFIG	RAM Enter and ROM Enter Command
05	ALM_RD	Read Alarm and Warning Command
06	ALM_CLR	Clear Alarm and Warning Command
0D	SYNC_SET	Start Synchronous Communication Command
0E	CONNECT	Connect Command
0F	DISCONNECT	Release Connection Command
1D	MEM_RD	Read Memory Command
50	INV_CTL	Inverter Operation Control Command
52	INV_CTL_EX	Extended Inverter Operation Control Command

Table 7.5 Sub-Commands

Code (Hex.)	Command	Function
00	NOP	No Operation Command
01	PRM_RD	Read Parameter Command
02	PRM_WR	Write Parameter Command
05	ALM_RD	Read Alarm and Warning Command
51	INV_I/O	Inverter I/O Control Command

If there is a conflict between a request for a main command and a request for a sub-command, the drive will process the main command request.

If the drive is currently processing a main command or a sub-command, the drive gives priority to the command being processed. The sub-command is given priority if an INV_CTL main command and an INV_I/O sub-command conflict.

Refer to *MECHATROLINK-4 Commands on page 18* for more information about command formats. Table 7.6 shows the combinations of main commands and sub-commands.

Table 7.6 Main Commands and Sub-Commands

Code (Hex.)	Main Command	Sub-Command				
		NOP (00 (Hex.))	PRM_RD (01 (Hex.))	PRM_WR (02 (Hex.))	ALM_RD (05 (Hex.))	INV_I/O (51 (Hex.))
00	NOP	OK	OK	OK	OK	OK
01	PRM_RD	OK	-	-	OK	OK
02	PRM_WR	OK	-	-	OK	OK
03	ID_RD	OK	OK	OK	OK	OK
04	CONFIG	OK	-	-	-	-
05	ALM_RD	OK	-	-	-	-
06	ALM_CLR	OK	-	-	-	-
0D	SYNC_SET	OK	OK	OK	OK	OK
0E	CONNECT	OK	-	-	-	-
0F	DISCONNECT	OK	-	-	-	-
1D	MEM_RD	OK	OK	OK	OK	OK
50	INV_CTL	OK	OK	OK	OK	OK
52	INV_CTL_EX	OK	OK	OK	OK	OK

Note:

CMD_ALM = B (Hex.) (sub-command combination error) will result if a main command and sub-command conflict with one another.

8   MECHATROLINK-4 Commands

◆ Command Control (CMD_CTRL)

bit 7	bit 6	bit 5	bit 4	bit 3	bit 2	bit 1	bit 0
CMD_ID		Reserved (0)	Reserved (0)	ALM_CLR	Reserved (0)	Reserved (0)	Reserved (0)

bit 15	bit 14	bit 13	bit 12	bit 11	bit 10	bit 9	bit 8
Reserved (0)							

Command	Description
CMD_ID	This is not used with standard inverter profile commands.
ALM_CLR	0: Clear alarm/warning disabled 1: Clear alarm/warning triggered The same processing as when ALM_CLR_MODE = 0 for the ALM_CLR command (the current alarm/warning state is cleared) is performed.

◆ Command Status (CMD_STAT)

bit 7	bit 6	bit 5	bit 4	bit 3	bit 2	bit 1	bit 0
RCMD_ID		Reserved (0)	Reserved (0)	ALM_CLR_CMP	CMDRDY	D_WAR	D_ALM

bit 15	bit 14	bit 13	bit 12	bit 11	bit 10	bit 9	bit 8
COMM_ALM				CMD_ALM			

Command	Description
RCMD_ID	The slave returns the echo of the CMD_ID as the RCMD_ID.
ALM_CLR_CMP	ALM_CLR_CMP = 1 means that CMD_CTRL.ALM_CLR = 1 has been received and alarm clear processing has been completed.
CMDRDY	0: Other 1: Command reception enabled
D_WAR	0: No Fault 1: The device is in the warning state.
D_ALM	0: No Fault 1: The device is in the alarm state.
COMM_ALM	Notifies the communication error state. COMM_ALM is independent of CMD_ALM, D_ALM and D_WAR. COMM_ALM is cleared at the leading edge of CMD_CTRL.ALM_CLR or by the ALM_CLR command. Refer to page 19 for more information.
CMD_ALM	Notifies the command error state. When the option receives a normal command after the occurrence of a command error, CMD_ALM is automatically cleared. Refer to page 19 for more information.

■ COMM_ALM

Code (Hex.)		Description
-	0000	No Fault
Warning	0001	Frame Check Sequence (FCS) error
	0002	Command data not received
	0003	Synchronous frame not received
Alarm	0008	Frame Check Sequence (FCS) error
	0009	Command data not received
	000A	Synchronous frame not received
	000B	Synchronization interval error
	000C	WDT error
	000D	CDO setting error

■ CMD_ALM

Code (Hex.)		Contents
-	0000	Normal
Warning	0001	Invalid data
Alarm	0008	Unsupported command received
	0009	Invalid data
	000A	Command execution condition error
	000B	Sub-command combination error
	000C	Phase Error

9   Main Commands

Chapter 9 describes the description when the number of transmission bytes for the main command is set to 64 bytes. When using sub-commands, the number of transmission bytes set by the controller must be the size used in the main command, plus 32 bytes.

◆ NOP: 00 (Hex.) (No Operation Command)

The NOP command is used for network control. The current state is returned as a response. You can use this command in all phases.

NOP Command		
Byte	Command	Description
0	NOP (00 (Hex.))	Command code
1	WDT	Watchdog data
2	CMD_CTRL	Refer to page 18.
3		
4	Reserved (0)	Not used
5		
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63		

NOP Response		
Byte	Response	Description
0	NOP (00 (Hex.))	Command code
1	RWDT	Watchdog data
2	CMD_STAT	Refer to page 18.
3		
4	Reserved (0)	Not used
5		
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63		

◆ PRM_RD: 01 (Hex.) (Read Parameter Command)

The PRM_RD command reads the data for SIZE from the MEMOBUS/Modbus register number specified by NO. The command can be used in communication phases 2 and 3. Refer to the drive manual for more information on MEMOBUS/Modbus register numbers.

PRM_RD Command		
Byte	Command	Description
0	PRM_RD (01 (Hex.))	Command code
1	WDT	Watchdog data
2	CMD_CTRL	Refer to page 18.
3		
4	NO	MEMOBUS/Modbus register number (Lower)
5		MEMOBUS/Modbus register number (Upper)
6	SIZE	Data size to read [units: byte] 2, 4, 6, and 8 are available.
7	Reserved (0)	Not used
8		
9		
10		
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PRM_RD Response		
Byte	**Response**	**Description**
0	PRM_RD (01 (Hex.))	Command code
1	RWDT	Watchdog data
2	CMD_STAT	Refer to page 18. If the SIZE data is invalid or MEMOBUS/Modbus register number does not exist, "9" is set for CMD_ ALM.
3		
4	NO	The value (Lower) set in the command.
5		The value (Upper) set in the command.
6	SIZE	The SIZE is the same as the register number set in MEMOBUS/Modbus transfers.
7	Reserved (0)	0 is set.
8	PARAMETER	Sets the data read in the byte set in the command. The option stores the data read for PARAMETER from lower byte (LSB) to upper byte (MSB). 0 is stored when the field is not used. 0 is stored in PARAMETER when command error occurs.
9		
10		
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63		

■ Example: Reading C1-01 (200 (Hex.))

Byte	**Command (Hex.)**	**Response (Hex.)**
4	00	00
5	02	02
6	02	02
7	00	00
8	00	Value set to *C1-01* (Lower)
9	00	Value set to *C1-01* (Upper)

◆ PRM_WR: 02 (Hex.) (Write Parameter Command)

The PRM_WR command writes the internal parameter of the drive for SIZE from the MEMOBUS/Modbus register number above 100 (Hex.) specified by NO. You can use the command in communication phases 2 and 3. To save the setting value in the drive, use the CONFIG command. Refer to the drive manual for more information on MEMOBUS/Modbus register numbers.

PRM_WR Command		
Byte	**Command**	**Description**
0	PRM_WR (02 (Hex.))	Command code
1	WDT	Watchdog data
2	CMD_CTRL	Refer to page 18.
3		
4	NO	MEMOBUS/Modbus register number (Lower)
5		MEMOBUS/Modbus register number (Upper)
6	SIZE	Specify the parameter data size in bytes. 2, 4, 6, and 8 are available.
7	Reserved (0)	Not used
8	PARAMETER	Specify the lower byte (LSB) before the upper byte (MSB) in the size set in the SIZE.
9		
10		
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PRM_WR Response		
Byte	Response	Description
0	PRM_WR (02 (Hex.))	Command code
1	RWDT	Watchdog data
2	CMD_STAT	Refer to page 18.
3		If the SIZE data is invalid, "9" is set for CMD_ALM.
4	NO	The value (Lower) set in the command.
5		The value (Upper) set in the command.
6	SIZE	The value set in the command.
7	Reserved (0)	0 is set.
8	PARAMETER	The value set in the command.
9		0 is stored when the field is not used.
10		
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In the following status, an alarm is detected and the command goes into error.

Error	Operation
Register Number Error	"9" is set for CMD_ALM.
Bit Count Error	"9" is set for CMD_ALM.
Data Setting Error	"9" is set for CMD_ALM.
Write Mode Error	"9" is set for CMD_ALM.
Writing Error during Under Voltage	"9" is set for CMD_ALM.
Writing Error during Parameter Processing	"9" is set for CMD_ALM.

■ Example: Writing C1-01 (200 (Hex.))

Byte	Command (Hex.)	Response (Hex.)
4	00	00
5	02	02
6	02	02
7	00	00
8	Value set to *C1-01* (Lower)	Value set to *C1-01* (Lower)
9	Value set to *C1-01* (Upper)	Value set to *C1-01* (Upper)

◆ ID_RD: 03 (Hex.) (Read ID Number Command)

The ID_RD command reads the product information as ID data to read the ID of a device. The ID_RD command reads the product information as ID data to read the ID of a device.

ID_RD Command		
Byte	Command	Description
0	ID_RD: 03 (Hex.)	Command code
1	WDT	Watchdog data
2	CMD_CTRL	Refer to page 18.
3		
4	ID_CODE	Specifies the ID_CODE. Refer to Table 9.1 for more information.
5	OFFSET	Set the offset in byte.
6	SIZE	Set the size in byte. (Lower)

ID_RD Command		
Byte	**Command**	**Description**
7		Set the size in byte. (Upper)
8	Reserved (0)	Not used
.		
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63		

ID_RD Response		
Byte	**Response**	**Description**
0	ID_RD: 03 (Hex.)	Command code
1	RWDT	Watchdog data
2	CMD_STAT	Refer to page 18.
3		
4	ID_CODE	The value set in the command.
5	OFFSET	The value set in the command.
6	SIZE	The value set in the command.
7		
8	ID	ID data is stored. Refer to Table 9.1 for more information.
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Table 9.1 ID_CODE

ID_CODE (Hex.)	Description	Size	Description
01	Vendor ID Code	4 byte	0000 (Hex.)
02	Device Code	4 byte	04000003 (Hex.)
03	Device Version	4 byte	Version information of device
04	Device Definition File Version	4 byte	0000 (Hex.)
05	Standard + DWEZ Parameters	4 byte	0000 (Hex.)
06	Serial number	32 byte	Serial number of device
10	Profile type 1 (Primary)	4 byte	0021 (Hex.) (Inverter profile)
11	Profile Version 1 (Primary)	4 byte	0100 (Hex.)
12	Profile type 2	4 byte	00FF (Hex.) (Not available)
13	Profile Version 2	4 byte	0000 (Hex.) (Not available)
14	Profile type 3	4 byte	00FF (Hex.) (Not available)
15	Profile Version 3	4 byte	0000 (Hex.) (Not available)
16	Standard + DWEZ Parameters	4 byte	0000 (Hex.)
17	Standard + DWEZ Parameters	4 byte	0000 (Hex.)
18	Transmission Cycle Increment (Granularity)	4 byte	03 (Hex.) (Supports 31.25 [µs], 62.5 [µs], 125 [µs], 250 [µs], 500 [µs], 750 [µs], 1 to 64 [ms] (0.5 ms increment))
19	Standard + DWEZ Parameters	4 byte	0000 (Hex.)
1A	Standard + DWEZ Parameters	4 byte	0000 (Hex.)
1B	Standard + DWEZ Parameters	4 byte	0000 (Hex.)
1C	Standard + DWEZ Parameters	4 byte	0000 (Hex.)
1D	Profile Type (Current Selection)	4 byte	The number of transmission bytes for cyclic communication that is currently set for the device. This is the profile selected with the CONNECT command.
20	Supported Communication Mode	4 byte	00000003 (Hex.) (Cyclic communication/event driven communication)

ID_CODE (Hex.)	Description	Size	Description
21	MAC Address	8 byte	MAC address of device
30	List of Supported Main Commands	32 byte	The list of the sub-commands that the device supports.
38	List of Supported Sub-Commands	32 byte	The list of the sub-commands that the device supports.
40	List of Supported Common Parameters	32 byte	0
48	Speed reference unit/Output reference unit	4 byte	0: 0.01 Hz units (When $o1\text{-}03 = 0$ & $o1\text{-}11 = 2$) 1: 0.01% units (When $o1\text{-}03 = 1$) 2: min⁻¹ (r/min) units (When $o1\text{-}03 = 2$) 3: Units in the product specifications (When other than the above) 4 and above: Reserved
49	Torque Reference Unit	4 byte	0: 0.1% units
4A	Output Current Unit	4 byte	0: 0.1 A units
50	Transmission Data Alignment	4 byte	4
51	Number of Command Transmission Data (Minimum Value)	4 byte	8 (32 byte/4 alignment)
52	Number of Command Transmission Data (Maximum Value)	4 byte	24 (96 byte/4 alignment)
53	Number of Command Transmission Data (Current Value)	4 byte	The number of transmission bytes for cyclic communication that is currently set for the device.
54	Number of Response Transmission Data (Minimum Value)	4 byte	8 (32 byte/4 alignment)
55	Number of Response Transmission Data (Maximum Value)	4 byte	24 (96 byte/4 alignment)
56	Number of Response Transmission Data (Current Value)	4 byte	The number of transmission bytes for cyclic communication that is currently set for the device.
57	Minimum Transmission Cycle (Unit: 1 nsec)	4 byte	250000 (250 usec)
58	Maximum Transmission Cycle (Unit: 1 nsec)	4 byte	8000000 (8 msec)
59	Minimum Value of Communication Cycle (Unit: 1 nsec)	4 byte	250000 (250 usec)
5A	Maximum Value of Communication Cycle (Unit: 1 nsec)	4 byte	32000000 (32 msec)

For details on the ID_CODE, refer to the following document published by the MECHATROLINK Members Association (MMA).

MECHATROLINK-4 Standard Inverter Profile Command Manual (Manual No: MMATDJP044)

◆ CONFIG: 04 (Hex.) (Setup Device Command)

The CONFIG command forces the parameters written using PRM_WR to become effective, and optionally stores the parameters into EEPROM. The command can be used in communication phases 2 and 3.

	CONFIG Command	
Byte	**Command**	**Description**
0	CONFIG (04 (Hex.))	Command code
1	WDT	Watchdog data
2 3	CMD_CTRL	Refer to page 18.
4	CONFIG_MOD	Specify the type of setup. Refer to Table 9.2 for more information.
5 6 7 . . 63	Reserved (0)	Not used

CONFIG Response		
Byte	Response	Description
0	CONFIG (04 (Hex.))	Command code
1	RWDT	Watchdog data
2	CMD_STAT	Refer to page 18.
3		
4	CONFIG_MOD	The value set in the command.
5	Reserved (0)	Not used
6		
7		
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63		

Table 9.2 CONFIG_MOD

CONFIG_MOD	Description
0	RAM Enter The setting value is not stored in EEPROM.
1	ROM Enter The setting value is stored in EEPROM. **Note:** You can only write to EEPROM 100,000 times, so it is recommended to limit the number of times writing to EEPROM. Change all the parameters, then issue the CONFIG command.

◆ ALM_RD: 05 (Hex.) (Read Alarm and Warning Command)

The ALM_RD command reads the alarm or warning state. The command can be used in communication phases 2 and 3. The current alarm or warning state is read from ALM_DATA as an alarm or warning code. Refer to the drive manual for details about ALM_DATA.

ALM_RD Command		
Byte	Command	Description
0	ALM_RD (05 (Hex.))	Command code
1	WDT	Watchdog data
2	CMD_CTRL	Refer to page 18.
3		
4	ALM_RD_MOD	Specify the alarm or warning state. (Lower)
5		Specify the alarm or warning state. (Lower)
6	ALM_INDEX	Specify the alarm index. The command is enabled when ALM_RD_MODE is 2. (Lower)
7		Specify the alarm index. The command is enabled when ALM_RD_MODE is 2. (Upper)
8	Reserved (0)	Not used
9		
10		
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63		

ALM_RD Response		
Byte	Response	Description
0	ALM_RD (05 (Hex.))	Command code
1	RWDT	Watchdog data

ALM_RD Response		
Byte	Response	Description
2	CMD_STAT	Refer to page 18.
3		
4	ALM_RD_MOD	The value set in the command.
5		
6	ALM_INDEX	The value set in the command.
7		
8	ALM_DATA	ALM_DATA specifies an alarm using 2 bytes.
9		
10		
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63		

Table 9.3 ALM_RD_MOD

ALM_RD_MOD	Description	
0	Present fault (Byte 8 - 9), Fault history (Byte 10 - 11)	*U2-01*, *U2-02*
1	Alarm status list (Byte 8 - 27)	*U3-01 - U3-10*
2	Fault history (Alarms are not retained in the history.) (Byte 8 - 9)	*U2-01*, *U3-01 - U3-10*

Table 9.4 ALM_RD_MOD

Byte	ALM_RD_MOD = 0	ALM_RD_MOD = 1	ALM_RD_MOD = 2
4	00 (Hex.)	01 (Hex.)	02 (Hex.)
5	00 (Hex.)	00 (Hex.)	00 (Hex.)
6	-	-	ALM_INDEX (Lower)
7	-	-	ALM_INDEX (Upper)
8	*U2-01* (Lower)	*U3-01* (Lower)	ALM_INDEX = 0: *U2-01* (Lower) ALM_INDEX ≠ 0: U3-(ALM_INDEX) (Lower)
9	*U2-01* (Upper)	*U3-01* (Upper)	ALM_INDEX = 0: *U2-01* (Upper) ALM_INDEX ≠ 0: U3-(ALM_INDEX) (Upper)
10	*U2-02* (Lower)	*U3-02* (Lower)	-
11	*U2-02* (Upper)	*U3-02* (Upper)	-
12	-	*U3-03* (Lower)	-
13	-	*U3-03* (Upper)	-
14	-	*U3-04* (Lower)	-
15	-	*U3-04* (Upper)	-
16	-	*U3-05* (Lower)	-
17	-	*U3-05* (Upper)	-
18	-	*U3-06* (Lower)	-
19	-	*U3-06* (Upper)	-
20	-	*U3-07* (Lower)	-
21	-	*U3-07* (Upper)	-
22	-	*U3-08* (Lower)	-
23	-	*U3-08* (Upper)	-
24	-	*U3-09* (Lower)	-
25	-	*U3-09* (Upper)	-
26	-	*U3-10* (Lower)	-
27	-	*U3-10* (Upper)	-

◆ ALM_CLR: 06 (Hex.) (Clear Alarm and Warning Command)

The ALM_CLR command clears the alarm or warning state after the cause has been removed. The command can be used in communication phases 2 and 3.

This command changes the state of a device station, it does not remove the cause of a fault. After you remove the cause of the alarm or warning, this command clears the status of the alarm or warning.

Byte	Command	Description
	ALM_CLR Command	
0	ALM_CLR (06 (Hex.))	Command code
1	WDT	Watchdog data
2	CMD_CTRL	Refer to page 18.
3		
4	ALM_CLR_MOD	0: Clears the status of present faults and alarms.
5		
6	Reserved (0)	Not used
7		
.		
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63		

Byte	Response	Description
	ALM_CLR Response	
0	ALM_CLR (06 (Hex.))	Command code
1	RWDT	Watchdog data
2	CMD_STAT	Refer to page 18.
3		
4	ALM_CLR_MOD	The value set in the command.
5		
6	Reserved (0)	Not used
7		
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63		

◆ SYNC_SET: 0D (Hex.) (Start Synchronous Communication Command)

The SYNC_SET command starts synchronous communications. The SYNC_SET command starts synchronous communications. This command also restores synchronous if a fault causes communications to become asynchronous. The command can be used in communication phases 2 and 3. Completing this command starts watchdog data error detection.

Byte	Command	Description
	SYNC_SET Command	
0	SYNC_SET (0D (Hex.))	Command code
1	WDT	Watchdog data
2	CMD_CTRL	Refer to page 18.
3		
4	Reserved (0)	Not used
5		
6		

SYNC_SET Command		
Byte	**Command**	**Description**
7		
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63		

SYNC_SET Response		
Byte	**Response**	**Description**
0	SYNC_SET (0D (Hex.))	Command code
1	RWDT	Watchdog data
2	CMD_STAT	Refer to page 18.
3		
4	Reserved (0)	Not used
5		
6		
7		
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63		

◆ CONNECT: 0E (Hex.) (Establish Connection Command)

The CONNECT command establishes a MECHATROLINK connection. The phase moves to communication phase 2 and 3 after the connection is established.

CONNECT Command		
Byte	**Command**	**Description**
0	CONNECT (0E (Hex.))	Command code
1	WDT	Watchdog data
2	CMD_CTRL	Refer to page 18.
3		
4	VER	Specify 40 (Hex.).
5	COM_MOD	Specify the Communication Mode (COM_MOD). Refer to Table 9.5 for more information.
6	COM_TIM	1 - 255 Sets multiples of the transmission cycle as the communication cycle.
7	PROFILE_TYPE	Specify PROFILE_TYPE = 21 (Hex.).
8	Reserved (0)	Not used
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63		

CONNECT Response		
Byte	**Response**	**Description**
0	CONNECT (0E (Hex.))	Command code
1	RWDT	Watchdog data
2	CMD_STAT	Refer to page 18.
3		
4	VER	The value set in the command.
5	COM_MOD	The value set in the command.

CONNECT Response		
Byte	**Response**	**Description**
6	COM_TIM	The value set in the command.
7	PROFILE_TYPE	The value set in the command.
8 . . 63	Reserved (0)	Not used

Table 9.5 COM_MOD

bit7	bit6	bit5	bit4	bit3	bit2	bit1	bit0
SUBCMD	0	0	0	DTMODE		SYNCMODE	0

bit	Name	Value	Description
SUBCMD	Sub-command setting	0	Sub-command disabled
		1	Sub-command enabled
DTMODE	Data transfer method	0	Single data transfer mode
SYNCMODE	Synchronization setting	0	Does asynchronous communication
		1	Does synchronous communication

◆ DISCONNECT: 0F (Hex.) (Release Connection Command)

The DISCONNECT command releases the connection. The communication phase shifts to communication phase 1 after this command is completed.

DISCONNECT Command		
Byte	**Command**	**Description**
0	DISCONNECT (0F (Hex.))	Command code
1 . . 63	Reserved (0)	Not used

DISCONNECT Response		
Byte	**Response**	**Description**
0	DISCONNECT (0F (Hex.))	Command code
1 . . 63	Reserved (0)	Not used

◆ MEM_RD: 1D (Hex.) (Read Memory Command)

The data on the virtual memory is read, by specifying the read head address and read data size of the memory.

You can use the command in communication phases 2 and 3.

MEM_RD Command		
Byte	**Command**	**Description**
0	MEM_RD (1D (Hex.))	Command code
1	WDT	Watchdog data
2 3	CMD_CTRL	

MEM_RD Command		
Byte	**Command**	**Description**
4	Reserved (0)	Not used
5	MODE/DATA_TYPE	Specify the memory type and data type. Refer to Table 9.6 for more information.
6	SIZE	Specify the number of readings. For example, if DATA_TYPE = 2 (2 bytes) and SIZE = 1, 2 bytes of data are read. The specifiable range depends on the DATA_TYPE. • When DATA_TYPE = 1: 1 to 20 • When DATA_TYPE = 2: 1 to 10 • When DATA_TYPE = 3: 1 to 5
7		
8	ADDRESS	Specify the address of virtual memory. Refer to Figure 9.1 for more information.
9		
10		
11		
12	Reserved (0)	Not used
13		
14		
.		
.		
63		

MEM_RD Response		
Byte	**Response**	**Description**
0	MEM_RD (1D (Hex.))	Command code
1	RWDT	Watchdog data
2	CMD_STAT	Refer to page 18.
3		
4	Reserved (0)	Not used
5	MODE/DATA_TYPE	The value set in the command.
6	SIZE	The value set in the command.
7		
8	ADDRESS	The value set in the command.
9		
10		
11		
12	DATA	The data read from virtual memory is stored.
13		
14		
.		
.		
63		

Table 9.6 MODE/DATA_TYPE Bits

MODE				DATA_TYPE			
bit7	**bit6**	**bit5**	**bit4**	**bit3**	**bit2**	**bit1**	**bit0**
1: Volatile memory				1: Byte type (1 byte) 2: Short type (2 bytes) 3: Long type (4 bytes)			

Figure 9.1 Virtual Memory Space

For details on CDO and equipment information, refer to the "MECHATROLINK-4 Standard Inverter Profile Command Manual (Manual No: MMATDJP044)" and "MECHATROLINK-4 Protocol Manual (Manual No: MMATDJP040)" published by the MECHATROLINK Members Association (MMA).

◆ INV_CTL: 50 (Hex.) (Inverter Operation Control Command)

The INV_CTL command sets the drive operation signals, speed references, and others. These bytes do not need to be set every scan. Parameter *o1-03* sets the units for speed reference and output frequency.

You can use the command in communication phases 2 and 3.

INV_CTL Command		
Byte	**Command**	**Description**
0	INV_CTL (50 (Hex.))	Command code
1	WDT	Watchdog data
2	CMD_CTRL	Refer to page 18.
3		
4	INVCMD_CTRL	Refer to page 32.
5		
6		
7		
8	INVCMD_OUT	Refer to page 33.
9		
10		
11		
12	Speed reference	Speed Reference (Lower)
13		Speed Reference (Upper)
14		Not used (Set to 0.)
15		Not used (Set to 0.)
16	Torque reference	Torque Reference (Lower)
17		Torque Reference (Upper)
18		Not used (Set to 0.)
19		Not used (Set to 0.)
20	SEL_REF1/2	Use the SEL_REF1/2 command to select the contents of REF1 with bits 0 to 3 and to select the contents of REF2 with bits 4 to 7. Refer to Table 9.8 for the selection ranges for SEL_REF1/2.
21	SEL_MON1/2	Use the SEL_MON1/2 command to select the contents of MON1 with bits 0 to 3 and to select the contents of MON2 with bits 4 to 7. Refer to Table 9.9 for the selection ranges for SEL_MON1/2.
22	Reserved (0)	Not used
23		
24	Reference selected with SEL_REF1	Reference selected with SEL_REF1 (Lower)
25		Reference selected with SEL_REF1 (Upper)

INV_CTL Command		
Byte	**Command**	**Description**
26		Not used (Set to 0.)
27		Not used (Set to 0.)
28	Reference selected with SEL_REF2	Reference selected with SEL_REF2 (Lower)
29		Reference selected with SEL_REF2 (Upper)
30		Not used (Set to 0.)
31		Not used (Set to 0.)
32	Reserved (0)	Not used
33		
34		
.		
.		
63		

■ INVCMD_CTRL

Vendor Specific						bit 1	bit 0
bit 7	**bit 6**	**bit 5**	**bit 4**	**bit 3**	**bit 2**		
Not used						Reverse operation	Forward operation

Vendor Specific						bit 9	bit 8
bit 15	**bit 14**	**bit 13**	**bit 12**	**bit 11**	**bit 10**		
Not used			External base block reference	Clear the fault history	External Fault (EF0)	Fault reset	Reserved (0)

Vendor Specific							
bit 23	**bit 22**	**bit 21**	**bit 20**	**bit 19**	**bit 18**	**bit 17**	**bit 16**
Not used		Multi-Function Input Terminal 3 - 8					

bit 31	bit 30	bit 29	bit 28	bit 27	bit 26	bit 25	bit 24
Reserved (0)							

Table 9.7 INVCMD_CTRL Bits

Bit	Name	Description
0	Forward operation	0: Stop 1: Forward operation
1	Reverse operation	0: Stop 1: Reverse operation
9	Fault Reset	1: Fault reset
10	External fault (EF0)	1: External fault input (EF0)
11	Clear fault history	1: Clear fault history
12	External base block reference	1: External base block reference ON
16	Multi-function input terminal 3	Terminal S3 Function Input 0: Multi-function input terminal S3 is OFF 1: Multi-function input terminal S3 is ON
17	Multi-function input terminal 4	Terminal S4 Function Input 0: Multi-function input terminal S4 is OFF 1: Multi-function input terminal S4 is ON
18	Multi-function input terminal 5	Terminal S5 Function Input 0: Multi-function input terminal S5 is OFF 1: Multi-function input terminal S5 is ON
19	Multi-function input terminal 6	Terminal S6 Function Input 0: Multi-function input terminal S6 is OFF 1: Multi-function input terminal S6 is ON

Bit	Name	Description
20	Multi-function input terminal 7	Terminal S7 Function Input 0: Multi-function input terminal S7 is OFF 1: Multi-function input terminal S7 is ON
21	Multi-function input terminal 8 *1	Terminal S8 Function Input 0: Multi-function input terminal S8 is OFF 1: Multi-function input terminal S8 is ON

*1   GA500 does not have multi-function digital input 8.

■ INVCMD_OUT

Vendor Specific							
bit7	bit6	bit5	bit4	bit3	bit2	bit1	bit0
Not used							

Vendor Specific							
bit15	bit14	bit13	bit12	bit11	bit10	bit9	bit8
Not used							

Vendor Specific							
bit23	bit22	bit21	bit20	bit19	bit18	bit17	bit16
Not used							

				Vendor Specific			
bit31	bit30	bit29	bit28	bit27	bit26	bit25	bit24
Reserved (0)				Not used			

Table 9.8 SEL_REF Reference Data Codes

Selection Code (Hex.)	Monitor Name	Contents
0	Nothing Selected	-
1	Torque Compensation	Unit: 0.1%
2	Analog output terminal 1 output	Enabled when *H4-01 = 000*
3	Analog output terminal 2 output *1	Enabled when *H4-04 = 000*
4	Drive terminal output	-
5	PID Setpoint	Units: 0.01%
6	Pulse Output	Unit: 1 Hz
7	V/f gain	-
8	Not used	-
9	Command selection setting	Bit 1: PID setpoint enabled

*1   Not available on GA500.

Table 9.9 SEL_MON Monitor Data Codes

Selection Code (Hex.)	Monitor Name	Contents
0	Nothing Selected	-
1	Motor Speed	Displayed in *U1-05* and determined by *o1-03*.
2	Torque Reference (Monitor)	Displayed in *U1-09* (0.1%).
3	Speed Detection PG1 Counter *2	-
4	Frequency reference	Displayed in *U1-01* and determined by *o1-03*.
5	Analog Input terminal A2	Displayed in *U1-14* (0.1%).
6	DC Bus Voltage	Displayed in *U1-07* (1 V).
7	Drive Alarm	-
8	Inverter Warning	-
9	Multi-Function Output Terminal Status	Displayed in *U1-11*.

Selection Code (Hex.)	Monitor Name	Contents
A	Analog Input terminal A3 *2	Displayed in *U1-15* (0.1%).
B	Multi-Function Input Terminal Status S1 - S8 *3	Displayed in *U1-10*.
C	Analog Input terminal A1	Displayed in *U1-13* (0.1%).
D	Speed Detection PG2 Counter *2	-
E	Monitor Data Set in *F6-23*	-
F	Monitor Data Set in *F6-24*	-
10 *1	Monitor Data Set in *F7-80*	-
11 *1	Monitor Data Set in *F7-81*	-
12 *1	Monitor Data Set in *F7-82*	-
13 *1	Monitor Data Set in *F7-83*	-
14 *1	Monitor Data Set in *F7-84*	-
15 *1	Monitor Data Set in *F7-85*	-
16 *1	Monitor Data Set in *F7-86*	-

*1   This code can be selected only by the Extended Inverter Operation Control Command (INV_CTL_EX: 52H), This code cannot be selected by the Inverter Operation Control Command (INV_CTL: 50H) or the Inverter I/O Control Command (INV_I/O: 51H).
*2   Not available on GA500.
*3   For GA500, "Multi-Function Input Terminal Status S1 - S7" is available.

■ INV_CTL Response

	INV_CTL Response	
Byte	**Response**	**Description**
0	INV_CTL (50 (Hex.))	Command code
1	RWDT	Watchdog data
2	CMD_STAT	Refer to page 18.
3		
4	INVCMD_STAT	Refer to page 35.
5		
6		
7		
8	INVCMD_IN	Refer to page 36.
9		
10		
11		
12	Output Frequency	Output Frequency (Lower)
13		Output Frequency (Upper)
14		Not used (Set to 0.)
15		Not used (Set to 0.)
16	Output current	Output current (Lower)
17		Output current (Upper)
18		Not used (Set to 0.)
19		Not used (Set to 0.)
20	SEL_REF1/2	The value set in the command.
21	SEL_MON1/2	The value set in the command.
22	Reserved (0)	Not used (Set to 0.)
23		
24	Monitor data set to SEL_MON1 Monitor Data Set	Monitor data set to SEL_MON1 (Lower)
25		Monitor data set to SEL_MON1 (Upper)

INV_CTL Response		
Byte	**Response**	**Description**
26		Not used (Set to 0.)
27		Not used (Set to 0.)
28		Monitor data set to SEL_MON2 (Lower)
29	Monitor data set to SEL_MON2 Monitor Data Set	Monitor data set to SEL_MON2 (Upper)
30		Not used (Set to 0.)
31		Not used (Set to 0.)
32		
33		
34		
.	Reserved (0)	Not used
.		
63		

■ INVCMD_STAT

Vendor Specific						bit1	bit0
bit7	**bit6**	**bit5**	**bit4**	**bit3**	**bit2**		
oPE Error	Drive Ready	Speed Agree	Zero speed	Main Power Supply ON	Baseblock Released	Reverse Operation	Forward Operation

Vendor Specific						bit9	bit8
bit15	**bit14**	**bit13**	**bit12**	**bit11**	**bit10**		
Not used		Zero Servo	Motor 2 Selection	LOCAL/REMOTE	Power Loss Recovery/ Momentary Power Loss Recovery	Fault Reset Signal being Input	Reserved (0)

Vendor Specific							
bit23	**bit22**	**bit21**	**bit20**	**bit19**	**bit18**	**bit17**	**bit16**
Not used							

bit31	bit30	bit29	bit28	bit27	bit26	bit25	bit24
Reserved (0)						SEL_MON2 Status	SEL_MON1 Status

Table 9.10 INVCMD_STAT Bits

Bit	Name	Description
0	Forward Operation	0: Stop 1: Forward operation in progress
1	Reverse Operation	0: Stop 1: Reverse operation
2	Baseblock Released	0: Baseblock 1: Baseblock released
3	Main Power Supply ON	0: Main power supply OFF 1: Main power supply ON
4	Zero Speed	1: Zero Speed
5	Speed Agree	1: Speed agree
6	Drive Ready	1: Drive ready
7	oPE Error	1: oPE error
9	Fault Reset Signal being Input	1: Fault reset signal being input
10	Power Loss Recovery/Momentary Power Loss Recovery	0: Power loss recovery 1: Momentary power loss recovery
11	LOCAL/REMOTE	0: LOCAL 1: REMOTE

Bit	Name	Description
12	Motor 2 Selection	0: Motor 1 1: Motor 2
13	Zero Servo	1: Zero servo
24	SEL_MON1 Status	0: Disabled 1: SEL_MON1 enabled
25	SEL_MON2 Status	0: Disabled 1: SEL_MON2 enabled

■ **INVCMD_IN**

Vendor Specific							
bit7	bit6	bit5	bit4	bit3	bit2	bit1	bit0
Not used							

Vendor Specific							
bit15	bit14	bit13	bit12	bit11	bit10	bit9	bit8
Not used							

Vendor Specific							
bit23	bit22	bit21	bit20	bit19	bit18	bit17	bit16
Not used							

				Vendor Specific			
bit31	bit30	bit29	bit28	bit27	bit26	bit25	bit24
Reserved (0)				Not used			

◆ INV_CTL_EX: 52 (Hex.) (Extended Inverter Operation Control Command)

The INV_CTL_EX commandsets the drive operation, frequency references. The command also selects the monitor function to monitor.

Up to 7 command functions (SEL_REF_E1 to SEL_REF_E7) and up to 7 monitor functions (SEL_MON_E1 to SEL_MON_E7) are available for the Inverter Operation Control Command (INV_CTL: 50H).

You can use the command in communication phases 2 and 3.

INV_CTL_EX Command		
Byte	**Command**	**Description**
0	INV_CTL_EX (52 (Hex.))	Command code
1	WDT	Watchdog data
2	CMD_CTRL	Refer to page 18.
3		
4	INVCMD_CTRL_EX	Refer to page 38.
5		
6		
7		
8	INVCMD_OUT	Refer to page 33.
9		
10		
11		
12	Speed reference	Speed Reference (Lower)
13		Speed Reference (Upper)
14		Not used (Set to 0.)
15		Not used (Set to 0.)

	INV_CTL_EX Command	
Byte	**Command**	**Description**
16	Torque reference	Torque Reference (Lower)
17		Torque Reference (Upper)
18		Not used (Set to 0.)
19		Not used (Set to 0.)
20	SEL_REF_E1	Refer to Table 9.8 for the selection ranges for SEL_REF_E1 to SEL_REF_E7.
21	SEL_REF_E2	
22	SEL_REF_E3	
23	SEL_REF_E4	
24	SEL_REF_E5	
25	SEL_REF_E6	
26	SEL_REF_E7	
27	Reserved (0)	Not used
28	SEL_MON_E1	Refer to Table 9.9 for the selection ranges for SEL_MON_E1 to SEL_MON_E7.
29	SEL_MON_E2	
30	SEL_MON_E3	
31	SEL_MON_E4	
32	SEL_MON_E5	
33	SEL_MON_E6	
34	SEL_MON_E7	
35	Reserved (0)	Not used
36	Reference selected with SEL_REF_E1	Reference selected with SEL_REF_E1 (Lower)
37		Reference selected with SEL_REF_E1 (Upper)
38		Not used (Set to 0.)
39		Not used (Set to 0.)
40	Reference selected with SEL_REF_E2	Reference selected with SEL_REF_E2 (Lower)
41		Reference selected with SEL_REF_E2 (Upper)
42		Not used (Set to 0.)
43		Not used (Set to 0.)
44	Reference selected with SEL_REF_E3	Reference selected with SEL_REF_E3 (Lower)
45		Reference selected with SEL_REF_E3 (Upper)
46		Not used (Set to 0.)
47		Not used (Set to 0.)
48	Reference selected with SEL_RE_E4	Reference selected with SEL_REF_E4 (Lower)
49		Reference selected with SEL_REF_E4 (Upper)
50		Not used (Set to 0.)
51		Not used (Set to 0.)
52	Reference selected with SEL_REF_E5	Reference selected with SEL_REF_E5 (Lower)
53		Reference selected with SEL_REF_E5 (Upper)
54		Not used (Set to 0.)
55		Not used (Set to 0.)
56	Reference selected with SEL_REF_E6	Reference selected with SEL_REF_E6 (Lower)
57		Reference selected with SEL_REF_E6 (Upper)
58		Not used (Set to 0.)
59		Not used (Set to 0.)
60	Reference selected with SEL_REF_E7	Reference selected with SEL_REF_E7 (Lower)

INV_CTL_EX Command		
Byte	**Command**	**Description**
61		Reference selected with SEL_REF_E7 (Upper)
62		Not used (Set to 0.)
63		Not used (Set to 0.)

■ INVCMD_CTRL_EX

Vendor Specific						bit 1	bit 0
bit 7	**bit 6**	**bit 5**	**bit 4**	**bit 3**	**bit 2**		
Not used						Reverse operation	Forward operation

Vendor Specific						bit 9	bit 8
bit 15	**bit 14**	**bit 13**	**bit 12**	**bit 11**	**bit 10**		
Not used			External base block reference	Clear the fault history	External Fault (EF0)	Fault reset	Reserved (0)

Vendor Specific							
bit 23	**bit 22**	**bit 21**	**bit 20**	**bit 19**	**bit 18**	**bit 17**	**bit 16**
Not used		Multi-Function Input Terminal 3 - 8					

bit 31	**bit 30**	**bit 29**	**bit 28**	**bit 27**	**bit 26**	**bit 25**	**bit 24**
Reserved (0)							

Table 9.11 INVCMD_CTRL_EX Bits

Bit	**Name**	**Description**
0	Forward operation	0: Stop 1: Forward operation
1	Reverse operation	0: Stop 1: Reverse operation
9	Fault Reset	1: Fault reset
10	External fault (EF0)	1: External fault input (EF0)
11	Clear fault history	1: Clear fault history
12	External base block reference	1: External base block reference ON
16	Multi-function input terminal 3	Terminal S3 Function Input 0: Multi-function input terminal S3 is OFF 1: Multi-function input terminal S3 is ON
17	Multi-function input terminal 4	Terminal S4 Function Input 0: Multi-function input terminal S4 is OFF 1: Multi-function input terminal S4 is ON
18	Multi-function input terminal 5	Terminal S5 Function Input 0: Multi-function input terminal S5 is OFF 1: Multi-function input terminal S5 is ON
19	Multi-function input terminal 6	Terminal S6 Function Input 0: Multi-function input terminal S6 is OFF 1: Multi-function input terminal S6 is ON
20	Multi-function input terminal 7	Terminal S7 Function Input 0: Multi-function input terminal S7 is OFF 1: Multi-function input terminal S7 is ON
21	Multi-function input terminal 8 *1	Terminal S8 Function Input 0: Multi-function input terminal S8 is OFF 1: Multi-function input terminal S8 is ON

*1   GA500 does not have multi-function digital input 8.

■ INV_CTL_EX Response

Byte	Response	Description
	INV_CTL_EX Response	
Byte	**Response**	**Description**
0	INV_CTL_EX (52 (Hex.))	Command code
1	RWDT	Watchdog data
2	CMD_STAT	Refer to page 18.
3		
4	INVCMD_STAT_EX	Refer to page 40.
5		
6		
7		
8	INVCMD_IN	Refer to page 36.
9		
10		
11		
12	Output Frequency	Output Frequency (Lower)
13		Output Frequency (Upper)
14		Not used (Set to 0.)
15		Not used (Set to 0.)
16	Output current	Output current (Lower)
17		Output current (Upper)
18		Not used (Set to 0.)
19		Not used (Set to 0.)
20	SEL_REF_E1	The value set in the command.
21	SEL_REF_E2	
22	SEL_REF_E3	
23	SEL_REF_E4	
24	SEL_REF_E5	
25	SEL_REF_E6	
26	SEL_REF_E7	
27	Reserved (0)	Not used (Set to 0.)
28	SEL_MON_E1	The value set in the command.
29	SEL_MON_E2	
30	SEL_MON_E3	
31	SEL_MON_E4	
32	SEL_MON_E5	
33	SEL_MON_E6	
34	SEL_MON_E7	
35	Reserved (0)	Not used (Set to 0.)
36	Monitor data set to SEL_MON_E1 Monitor Data Set	Monitor data set to SEL_MON_E1 (Lower)
37		Monitor data set to SEL_MON_E1 (Upper)
38		Not used (Set to 0.)
39		Not used (Set to 0.)
40	Monitor data set to SEL_MON_E2 Monitor Data Set	Monitor data set to SEL_MON_E2 (Lower)
41		Monitor data set to SEL_MON_E2 (Upper)
42		Not used (Set to 0.)
43		Not used (Set to 0.)

INV_CTL_EX Response		
Byte	**Response**	**Description**
44	Monitor data set to SEL_MON_E3 Monitor Data Set	Monitor data set to SEL_MON_E3 (Lower)
45		Monitor data set to SEL_MON_E3 (Upper)
46		Not used (Set to 0.)
47		Not used (Set to 0.)
48	Monitor data set to SEL_MON_E4 Monitor Data Set	Monitor data set to SEL_MON_E4 (Lower)
49		Monitor data set to SEL_MON_E4 (Upper)
50		Not used (Set to 0.)
51		Not used (Set to 0.)
52	Monitor data set to SEL_MON_E5 Monitor Data Set	Monitor data set to SEL_MON_E5 (Lower)
53		Monitor data set to SEL_MON_E5 (Upper)
54		Not used (Set to 0.)
55		Not used (Set to 0.)
56	Monitor data set to SEL_MON_E6 Monitor Data Set	Monitor data set to SEL_MON_E6 (Lower)
57		Monitor data set to SEL_MON_E6 (Upper)
58		Not used (Set to 0.)
59		Not used (Set to 0.)
60	Monitor data set to SEL_MON_E7 Monitor Data Set	Monitor data set to SEL_MON_E7 (Lower)
61		Monitor data set to SEL_MON_E7 (Upper)
62		Not used (Set to 0.)
63		Not used (Set to 0.)

■ INVCMD_STAT_EX

Vendor Specific						bit1	bit0
bit7	**bit6**	**bit5**	**bit4**	**bit3**	**bit2**		
oPE Error	Drive Ready	Speed Agree	Zero Speed	Main Power Supply ON	Baseblock Released	Reverse Operation	Forward Operation

Vendor Specific						bit9	bit8
bit15	**bit14**	**bit13**	**bit12**	**bit11**	**bit10**		
During Run	Not used	Zero Servo	Motor Selection	LOCAL/REMOTE	Power Loss Recovery/ Momentary Power Loss Recovery	Fault Reset Signal being Input	Reserved (0)

Vendor Specific							
bit23	**bit22**	**bit21**	**bit20**	**bit19**	**bit18**	**bit17**	**bit16**
Not used							

bit31	**bit30**	**bit29**	**bit28**	**bit27**	**bit26**	**bit25**	**bit24**
Reserved (0)	SEL_MON_E7 Status	SEL_MON_E6 Status	SEL_MON_E5 Status	SEL_MON_E4 Status	SEL_MON_E3 Status	SEL_MON_E2 Status	SEL_MON_E1 Status

Table 9.12 INVCMD_STAT_EX Bits

Bit	Name	Description
0	Forward operation	0: Stop 1: Forward operation
1	Reverse operation	0: Stop 1: Reverse operation
2	Baseblock Released	0: Baseblock 1: Baseblock released
3	Main Power Supply ON	0: Main power supply OFF 1: Main power supply ON

Bit	Name	Description
4	Zero Speed	1: Zero Speed
5	Speed Agree	1: Speed agree
6	Drive Ready	1: Drive ready
7	oPE Error	1: oPE error
9	Fault Reset Signal being Input	1: Fault reset signal being input
10	Power Loss Recovery/Momentary Power Loss Recovery	0: Power loss recovery 1: Momentary power loss recovery
11	LOCAL/REMOTE	0: LOCAL 1: REMOTE
12	Motor Selection	0: Motor 1 1: Motor 2
13	Zero Servo Complete	1: Zero servo
15	During Run	1: During Run
24	SEL_MON_E1 Status	0: Disabled 1: SEL_MON_E1 enabled
25	SEL_MON_E2 Status	0: Disabled 1: SEL_MON_E2 enabled
26	SEL_MON_E3 Status	0: Disabled 1: SEL_MON_E3 enabled
27	SEL_MON_E4 Status	0: Disabled 1: SEL_MON_E4 enabled
28	SEL_MON_E5 Status	0: Disabled 1: SEL_MON_E5 enabled
29	SEL_MON_E6 Status	0: Disabled 1: SEL_MON_E6 enabled
30	SEL_MON_E7 Status	0: Disabled 1: SEL_MON_E7 enabled

10   Sub-Command

Sub-commands are used as auxiliary function commands for the main command, using 32 bytes from the next byte after the main command end position in the data field. Therefore, when using sub-commands, the number of transmission bytes set by the controller must be the size used in the main command, plus 32 bytes.

◆ SUB_CTRL (Sub-Command Control Field)

Table 10.1 SUB_CTRL

bit7	bit6	bit5	bit4	bit3	bit2	bit1	bit0
Reserved (0)							

bit15	bit14	bit13	bit12	bit11	bit10	bit9	bit8
Reserved (0)							

bit23	bit22	bit21	bit20	bit19	bit18	bit17	bit16
Reserved (0)							

◆ SUB_STAT (Sub-Command Status)

Table 10.2 SUB_STAT

bit 7	bit 6	bit 5	bit 4	bit 3	bit 2	bit 1	bit 0
Not used				Reserved (0)	SUBCMDRDY	Not used	

bit 15	bit 14	bit 13	bit 12	bit 11	bit 10	bit 9	bit 8
Reserved (0)				SUBCMD_ALM			

bit 23	bit 22	bit 21	bit 20	bit 19	bit 18	bit 17	bit 16
		Reserved (0)		SEL_MON6 Status	SEL_MON5 Status	SEL_MON4 Status	SEL_MON3 Status

Command	Description
SUBCMDRDY	0: Sub-command reception disabled 1: Sub-command reception enabled
SUBCMD_ALM	Notifies the sub-command error state. If a normal sub-command is received after the occurrence of a sub-command error, SUBCMD_ALM is automatically cleared.
SEL_MON3 Status	0: Disabled 1: SEL_MON3 enabled
SEL_MON4 Status	0: Disabled 1: SEL_MON4 enabled
SEL_MON5 Status	0: Disabled 1: SEL_MON5 enabled
SEL_MON6 Status	0: Disabled 1: SEL_MON6 enabled

Table 10.3 SUBCMD_ALM

Code (Hex.)		Description
-	00	Normal
Warning	01	Invalid data
Alarm	08	Unsupported command received
	09	Invalid data
	0A	Command execution condition error
	0B	Sub-command combination error
	0C	Phase Error

◆ NOP: 00 (Hex.) (No Operation Command)

The NOP command is used for network control. The current state is returned as a response. You can use this command in all phases.

NOP Command		
Byte	**Command**	**Description**
Ofs+0	NOP (00 (Hex.))	Command code
Ofs+1	SUB_CTRL	Refer to page 41.
Ofs+2		
Ofs+3		
Ofs+4	Reserved (0)	Not used
Ofs+5		
·		
·		
Ofs+31		

NOP Response		
Byte	**Command**	**Description**
Ofs+0	NOP (00 (Hex.))	Command code
Ofs+1	SUB_STAT	Refer to page 41.
Ofs+2		
Ofs+3		
Ofs+4	Reserved (0)	Not used
Ofs+5		
·		

NOP Response		
Byte	**Command**	**Description**
.		
Ofs+31		

◆ PRM_RD: 01 (Hex.) (Read Parameter Command)

The PRM_RD command reads the data for SIZE from the MEMOBUS/Modbus register number specified by NO. You can use the command in communication phases 2 and 3. This sub-command functions in the same way as the PRM_RD main command. Refer to the drive manual for more information on MEMOBUS/Modbus register numbers.

PRM_RD Command		
Byte	**Command**	**Description**
Ofs+0	PRM_RD (01 (Hex.))	Command code
Ofs+1	SUB_CTRL	Refer to page 41.
Ofs+2		
Ofs+3		
Ofs+4	NO	MEMOBUS/Modbus register number (Lower)
Ofs+5		MEMOBUS/Modbus register number (Upper)
Ofs+6	SIZE	Data size to read [units: byte] 2, 4, 6, and 8 are available.
Ofs+7	Reserved (0)	Not used
Ofs+8		
Ofs+9		
Ofs+10		
.		
.		
Ofs+31		

PRM_RD Response		
Byte	**Response**	**Description**
Ofs+0	PRM_RD (01 (Hex.))	Command code
Ofs+1	SUB_STAT	Refer to page 41.
Ofs+2		
Ofs+3		
Ofs+4	NO	The value (Lower) set in the command.
Ofs+5		The value (Upper) set in the command.
Ofs+6	SIZE	The value set in the command.
Ofs+7	Reserved (0)	0 is set.
Ofs+8	PARAMETER	Sets the data read in the byte set in the command. The option stores the data read for PARAMETER from lower byte (LSB) to upper byte (MSB). 0 is stored when the field is not used. 0 is stored in PARAMETER when command error occurs.
Ofs+9		
Ofs+10		
.		
.		
Ofs+31		

◆ PRM_WR: 02 (Hex.) (Write Parameter Command)

The PRM_WR command specifies the parameter number, data size, and parameter data to write a parameter. You can use the command in communication phases 2 and 3. The CONFIG command must be sent to set up after the parameters are written. Refer to the drive manual for more information on MEMOBUS/Modbus register numbers.

PRM_WR Command		
Byte	**Command**	**Description**
Ofs+0	PRM_WR (02 (Hex.))	Command code
Ofs+1	SUB_CTRL	Refer to page 41.
Ofs+2		
Ofs+3		
Ofs+4	NO	MEMOBUS/Modbus register number (Lower)
Ofs+5		MEMOBUS/Modbus register number (Upper)
Ofs+6	SIZE	Specify the parameter data size in bytes. 2, 4, 6, and 8 are available.
Ofs+7	Reserved (0)	Not used
Ofs+8	PARAMETER	Specify the lower byte (LSB) before the upper byte (MSB) in the size set in the SIZE.
Ofs+9		
Ofs+10		
.		
.		
Ofs+31		

PRM_WR Response		
Byte	**Response**	**Description**
Ofs+0	PRM_WR (02 (Hex.))	Command code
Ofs+1	SUB_STAT	Refer to page 41.
Ofs+2		
Ofs+3		
Ofs+4	NO	The value (Lower) set in the command.
Ofs+5		The value (Upper) set in the command.
Ofs+6	SIZE	The value set in the command.
Ofs+7	Reserved (0)	0 is set.
Ofs+8	PARAMETER	The value set in the command. 0 is stored when the field is not used.
Ofs+9		
Ofs+10		
.		
.		
Ofs+31		

In the following status, an alarm is detected and the command goes into error.

Error	Operation
Register Number Error	"9" is set for SUBCMD_ALM.
Bit Count Error	"9" is set for SUBCMD_ALM.
Data Setting Error	"9" is set for SUBCMD_ALM.
Write Mode Error	"9" is set for SUBCMD_ALM.
Writing Error during Under Voltage	"9" is set for SUBCMD_ALM.
Writing Error during Parameter Processing	"9" is set for SUBCMD_ALM.

◆ ALM_RD: 05 (Hex.) (Read Alarm and Warning Command)

The ALM_RD command reads the alarm or warning state. Refer to *ALM_RD: 05 (Hex.) (Read Alarm and Warning Command) on page 25* for more information on ALM_DATA. You can use the command in communication phases 2 and 3. The current alarm or warning state is read from ALM_DATA as an alarm or warning code. Refer to the drive manual for details about ALM_DATA.

ALM_RD Command		
Byte	**Command**	**Description**
Ofs+0	ALM_RD (05 (Hex.))	Command code
Ofs+1	SUB_CTRL	Refer to page 41.
Ofs+2		
Ofs+3		
Ofs+4	ALM_RD_MOD	Specify the alarm or warning state. (Lower)
Ofs+5		Specify the alarm or warning state. (Lower)
Ofs+6	ALM_INDEX	Specify the alarm index. The command is enabled when ALM_RD_MODE is 2. (Lower)
Ofs+7		Specify the alarm index. The command is enabled when ALM_RD_MODE is 2. (Upper)
Ofs+8	Reserved (0)	Not used
Ofs+9		
Ofs+10		
.		
.		
Ofs+31		

ALM_RD Response		
Byte	**Response**	**Description**
Ofs+0	ALM_RD (05 (Hex.))	Command code
Ofs+1	SUB_STAT	Refer to page 41.
Ofs+2		
Ofs+3		
Ofs+4	ALM_RD_MOD	The value set in the command.
Ofs+5		
Ofs+6	ALM_INDEX	The value set in the command.
Ofs+7		
Ofs+8	ALM_DATA	ALM_DATA specifies an alarm using 2 bytes.
Ofs+9		
Ofs+10		
.		
.		
Ofs+31		

◆ INV_I/O: 51 (Hex.) (Inverter I/O Control Command)

The INV_I/O command sets the drive I/O, displays the monitor value, and executes references.

INV_IO Command		
Byte	**Command**	**Description**
Ofs+0	INV_IO (51 (Hex.))	Command code
Ofs+1	SUB_CTRL	Refer to page 41.
Ofs+2		
Ofs+3		
Ofs+4	SEL_REF 3/4	Use the SEL_REF3/4 command to select the contents of REF3 with bits 0 to 3 and to select the contents of REF4 with bits 4 to 7. Refer to Table 9.8 for the selection ranges for SEL_REF3/4.
Ofs+5	SEL_REF 5/6	Use the SEL REF5/6 command to select the contents of REF5 with bits 0 to 3 and to select the contents of REF6 with bits 4 to 7. Refer to Table 9.8 for the selection ranges for SEL REF5/6.

INV_IO Command		
Byte	**Command**	**Description**
Ofs+6	SEL_MON 3/4	Use the SEL MON3/4 command to select the contents of MON3 with bits 0 to 3 and to select the contents of MON4 with bits 4 to 7. Refer to Table 9.9 for the selection ranges for SEL MON3/4.
Ofs+7	SEL_MON 5/6	Use the SEL MON5/6 command to select the contents of MON5 with bits 0 to 3 and to select the contents of MON6 with bits 4 to 7. Refer to Table 9.9 for the selection ranges for SEL MON5/6.
Ofs+8	Monitor data set to SEL_REF3 Reference selected	Reference selected with SEL_REF3 (Lower)
Ofs+9		Reference selected with SEL_REF3 (Upper)
Ofs+10		Not used (Ignored if a value is set.)
Ofs+11		Not used (Ignored if a value is set.)
Ofs+12	Monitor data set to SEL_REF4 Reference selected	Reference selected with SEL_REF4 (Lower)
Ofs+13		Reference selected with SEL_REF4 (Upper)
Ofs+14		Not used (Set to 0.)
Ofs+15		Not used (Set to 0.)
Ofs+16	Monitor data set to SEL_REF5 Reference selected	Reference selected with SEL_REF5 (Lower)
Ofs+17		Reference selected with SEL_REF5 (Upper)
Ofs+18		Not used (Set to 0.)
Ofs+19		Not used (Set to 0.)
Ofs+20	Monitor data set to SEL_REF6 Reference selected	Reference selected with SEL_REF6 (Lower)
Ofs+21		Reference selected with SEL_REF6 (Upper)
Ofs+22		Not used (Set to 0.)
Ofs+23		Not used (Set to 0.)
Ofs+24 . . Ofs+31	Reserved (0)	Not used

INV_IO Response		
Byte	**Response**	**Description**
Ofs+0	INV_IO (51 (Hex.))	Command code
Ofs+1 Ofs+2 Ofs+3	SUB_STAT	Refer to page 41.
Ofs+4	SEL_REF 3/4	The value set in the command.
Ofs+5	SEL_REF 5/6	The value set in the command.
Ofs+6	SEL_MON 3/4	The value set in the command.
Ofs+7	SEL_MON 5/6	The value set in the command.
Ofs+8	Monitor data set to SEL_MON3 Monitor Data Set	Monitor data set to SEL_MON3 (Lower)
Ofs+9		Monitor data set to SEL_MON3 (Upper)
Ofs+10		Not used (Set to 0.)
Ofs+11		Not used (Set to 0.)
Ofs+12	Monitor data set to SEL_MON4	Monitor data set to SEL_MON4 (Lower)
Ofs+13		Monitor data set to SEL_MON4 (Upper)
Ofs+14		Not used (Set to 0.)
Ofs+15		Not used (Set to 0.)
Ofs+16	Monitor data set to SEL_MON5 Monitor Data Set	Monitor data set to SEL_MON5 (Lower)
Ofs+17		Monitor data set to SEL_MON5 (Upper)
Ofs+18		Not used (Set to 0.)

INV_IO Response		
Byte	**Response**	**Description**
Ofs+19		Not used (Set to 0.)
Ofs+20	Monitor data set to SEL_MON6 Monitor Data Set	Monitor data set to SEL_MON6 (Lower)
Ofs+21		Monitor data set to SEL_MON6 (Upper)
Ofs+22		Not used (Set to 0.)
Ofs+23		Not used (Set to 0.)
Ofs+24 . . Ofs+31	Reserved (0)	Not used

11   Troubleshooting

◆ Drive-Side Error Codes

Drive-side error codes appear on the drive keypad. *Faults on page 47* lists causes of the errors and possible corrective actions. Refer to the drive Technical Manual for additional error codes that can appear on the drive keypad.

■ Faults

bUS [Option Communication Error], *E5 [MECHATROLINK Watchdog Timer Error]*, and *EF0 [Option Card External Fault from the option]* can appear as an alarm or as a fault. When a fault occurs, the keypad ALM LED stays lit. When an alarm occurs, the ALM LED flashes.

If communication stops while the drive is running, use these questions as a guide to help remove the fault:

- Is the communication line properly connected to the option? Is it loose?
- Is the option properly installed?
- Is the PLC program working? Is the controller/PLC CPU stopped?
- Did a momentary power loss interrupt communications?

Code	Name	Causes	Possible Solutions
bUS	Option Communication Error	The drive did not receive a signal from the controller.	• Check for wiring errors. • Correct the wiring.
		The communications cable wiring is incorrect.	
		An existing short circuit or communications disconnection	Check disconnected cables and short circuits and repair as needed
		A data error occurred due to electric interference	• Prevent noise in the control circuit, main circuit, and ground wiring. • If you identify a magnetic contactor as a source of noise, install a surge absorber to the contactor coil. • Use only recommended cables or other shielded line. Ground the shield on the controller side or the drive input power side. • Separate all communication wiring from drive power lines. Install an EMC noise filter to the drive power supply input. • Counteract noise in the master controller (PLC).
		Option is damaged	If there are no problems with the wiring and the error continues to occur, replace the option.
		Connection Time-out	Check if the CPU of the controller (PLC) is not stopped.
E5	MECHATROLINK Watchdog Timer Error	WDT (Watchdog Timer Error) data update of the controller is not normal.	Correctly update WDT data at the controller.
EF0	Option Card External Fault	The option received an external fault from the controller.	1. Find the device that caused the external fault and remove the caus. 2. Clear the external fault input from the controller.
		A programming error occurred on the controller side.	Examine the operation of the controller program.
oFA00	Option Not Compatible with Port	The option connected to connector CN5-A is not compatible.	Connect the option to the correct connector. • Use connector CN5-A when you connect the option. To use other options, refer to those option manuals.

Code	Name	Causes	Possible Solutions
		Invalid DIP switch S1 setting.	Set the option DIP switch S1 as shown in Figure 5.3. Monitor, *U4-75 [Communication OPT Protocol]* will display the DIP switch S1 setting.
oFA01	Option Card Fault (CN5-A)	The option connected to option port CN5-A was changed during run.	1. De-energize the drive. 2. Connect the option to the correct option port.
oFA03, oFA04	Option Card Error (CN5-A)	A fault occurred in the option.	1. De-energize the drive. 2. Make sure that the option is correctly connected to the connector. 3. If the problem continues, replace the option.
oFA30 to oFA43	Option Card Connection Error (CN5-A)	A fault occurred in the option.	1. De-energize the drive. 2. Make sure that the option is correctly connected to the connector. 3. If the problem continues, replace the option.
oFb00	Option Not Compatible with Port	The option connected to connector CN5-B is not compatible.	Connect the option to the correct connector. • Use connector CN5-A when you connect the option. To use other options, refer to those option manuals.
oFb02	Option Fault	An option of the same type is already installed in option port CN5-A, CN5-B, or CN5-C.	Connect the option to the correct option port.
oFC00	Option Fault (CN5-B)	The option connected to connector CN5-C is not compatible.	Connect the option to the correct connector. • Use connector CN5-A when you connect the option. To use other options, refer to those option manuals.
oFC02	Option Fault	An option of the same type is already installed in option port CN5-A, CN5-B, or CN5-C.	Connect the option to the correct option port.
PSE	JOHB-SMP3 Protocol Set Error	Invalid DIP switch S1 setting.	Set the option DIP switch S1 as shown in Figure 5.3. Monitor, *U4-75 [Communication OPT Protocol]* will display the DIP switch S1 setting.

■ Minor Faults and Alarms

Code	Name	Causes	Possible Solutions
CyC	MECHATROLINK Communications Cycle Setting Error	The upper controller is using a communication cycle beyond the allowable setting range for the MECHATROLINK option.	Set the master transmission cycle setting in the range of 250 μs, 500 μs, 750 μs, 1 to 32 ms (in 0.5 ms increments). The communication cycle should not exceed 32 ms.
CyPo	Cycle Power to Active Parameters	Comm. Option Parameter Not Upgraded	Re-energize the drive to update the communication option parameters.

◆ Option Error Codes

■ Option Fault Monitors *U6-98* and *U6-99*

The option can declare error/warning conditions via drive monitor parameters on the drive keypad as shown in Table 11.1.

Table 11.1 Option Fault Monitor Descriptions

Status	Fault Declared	Status Value (*U6-98/U6-99*)	Description
No faults	-	0	No faults
External Fault Input	EF0	3	An external fault was received from the controller.
Default MAC Address	-	1103	MAC Address data was damaged. **Note:** Return the option to Yaskawa or your nearest sales representative and request the setting change.
CDO Data Error	-	1112	CDO data was damaged. **Note:** Cycle power on the drive, and reconfigure the network settings from the controller.
Option FCS Error	bUS	1180	FCS error occurred.
Command data not received	bUS	1181	Command data not received error occurred.
Synchronization frame not received	bUS	1182	A synchronization frame not received error occurred.
Driver Error	oFA30	1183	An error occurred in the MECHATROLINK-4 driver. **Note:** Cycle power on the drive, and reconfigure the network settings from the controller.

Use monitors *U6-98 [First Fault]* and *U6-99 [Current Fault]* to check errors that have occurred in the option.

• *U6-98* displays the first declared fault since the last power cycle. *U6-98* is only cleared upon drive power-up.

• *U6-99* displays the present option status. *U6-99* is cleared upon a network-issued fault reset and upon power-up. If there is another fault while the original fault is still active, *U6-98* retains the original fault value and *U6-99* stores the new fault status value.

◆ Self RAM Check

Use these procedures to do a self RAM check for all areas including unused areas.
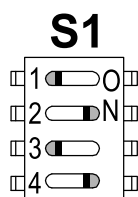
Note:
• The self RAM check completes in approximately 2.5 minutes.
• When you start the self RAM check, the drive will detect *oFA00 [Option Not Compatible with Port]*.

1. Set DIP switch S1 as shown in Figure 11.1.

Note:
Use non-conductive tweezers or a tool with a tip width of approximately 0.5 mm (0.02 in) to set DIP switch S1.

Figure 11.1 DIP Switch S1 Settings for the Self RAM Check

2. Apply power to the option.
   This will start the self RAM check.

3. Look at the LEDs on the option to see the status of the self RAM check.
   Refer to Table 11.2 for more information.

Table 11.2 LED States during Self RAM Check

Self RAM Check Status	LED States	
	MS	NS
Checking	Lit in green	OFF
Successful termination	Lit in green	Lit in green
Abnormal termination	Lit in red	Lit in red

12 European Standards

Figure 12.1 CE Mark

The CE mark indicates compliance with European safety and environmental regulations.

European standards include the Machinery Directive for machine manufacturers, the Low Voltage Directive for electronics manufacturers, and the EMC Directive for controlling noise.

It is required for engaging in business and commerce in Europe.

This option displays the CE mark based on the EMC Directive: 2014/30/EU.

Drives used in combination with this option and devices used in combination with the drive must also be CE certified and display the CE mark.

When using drives displaying the CE mark in combination with other devices, it is ultimately the responsibility of the user to ensure compliance with CE standards. Verify that conditions meet European standards after setting up the device.

◆ EMC Directive Compliance

This option is tested according to European standards EN 61800-3 and complies with EMC Directive. The CE marking is declared based on the harmonized standards.

■ **Option Installation**

Verify the following installation conditions to make sure that other devices and machinery used with this option and drive also comply with EMC guidelines:

1. Use dedicated shielded cable for the option and external device (encoder, I/O device, IO-Controller), or run the wiring through a metal conduit.

2. Keep wiring as short as possible and ground the largest possible surface area of the shield to the metal panel as specified by Figure 12.2.

Figure 12.2 Option Installation for CE Compliance: GA500

3. Ground the largest possible surface area of the shield to the metal panel.

Yaskawa recommends using cable clamps.

| A - Braided shield cable | C - Cable clamp (conductive) |
| B - Metal panel | |

Figure 12.3 Ground Area

13   United Kingdom Conformity Assessed Marking

Figure 13.1 UKCA Mark

The UKCA mark indicates compliance with United Kingdom safety and environmental regulations.

It is required for engaging in business and commerce in the United Kingdom.

United Kingdom standards include the Supply of Machinery (Safety) Regulations (Machinery) for machine manufacturers, the Electrical Equipment (Safety) Regulations (Low voltage) for electronics manufacturers, and the Electromagnetic Compatibility Regulations (EMC) for controlling noise.

This product displays the UKCA mark in accordance with the EMC.

Table 13.1 Designated Standards

Statutory Instruments	Designated Standards
Electromagnetic Compatibility Regulations S.I. 2016 No. 1091	EN 61800-3 *1
Restriction of the Use of Certain Hazardous Substances in Electrical and Electronic Equipment Regulations S.I. 2012 No. 3032	EN IEC 63000 *1

*1   Refer to the "UK Declaration of Conformity" for the year of the Designated Standards.

When using drives displaying the UKCA mark in combination with other devices, it is ultimately the responsibility of the user to ensure compliance with UKCA standards. Verify that conditions meet applicable United Kingdom standards after setting up the device.

14   Korean Radio Waves Act

Figure 14.1 KC Mark

This product confirms to broadcast and communications equipment for business use (Class A) and are designed for use in locations other than in ordinary houses. Products that bear the Korea Certification (KC) mark conform to the Korean Radio Waves Act. Be careful when you use the drive in Korea under the following conditions.

Table 14.1 Precautions when Using This Product

Precautions
This equipment is evaluated for compatibility for use in a business environment and may cause radio interference in a domestic environment.

Note:

The user guide applies only to "Business Broadcasting Communication Equipment". Comply with the EMC Directive to conform to the Korean Radio Act.

15   Specifications

◆ Specifications

Table 15.1 Option Specifications

Items	Specifications
Model	JOHB-SMP3
Access mode	MECHATROLINK-4
Communication Speed	100 Mbps
Minimum transmission cycle	250 µs
Maximum transmission cycle	8 ms
Transmission cycle granularity	03 (Hex.)
Data length	32 byte to 96 byte *1
Event driven communication	Valid
Profile	Compliant with standard inverter profile
Ambient temperature	-10 °C - +50 °C (14 °F - 122 °F)
Humidity	Up to 95% RH (non-condensing)
Storage Temperature	-20°C - +60°C (-4°F to 140°F) allowed for short-term transport of the product
Area of Use	Indoors and not near: • Oil mist, corrosive gas, flammable gas, or dust • Radioactive materials or flammable materials, including wood • Dangerous gases or fluids • Salt • Direct sunlight • Falling objects
Altitude	Up to 1000 m (3280 ft) **Note:** You can use the option at a maximum of 4000 m (13123 ft), depending on the model of the drive and the operating conditions. Refer to the drive manuals for more information.

*1   The data length is set from the controller. Refer to the controller manual for more information.

16   Disposal

◆ Disposal Instructions

Correctly dispose of the product and packing material as specified by applicable regional, local, and municipal laws and regulations.

◆ WEEE Directive

The wheelie bin symbol on this product, its manual, or its packaging identifies that you must recycle it at the end of its product life.

You must discard the product at an applicable collection point for electrical and electronic equipment (EEE). Do not discard the product with usual waste.

Revision History

Date of Publication	Revision Number	Section	Revised Content
May 2024	-	-	First Edition

YASKAWA AC Drive Option
MECHATROLINK-4
Technical Manual

YASKAWA

YASKAWA ELECTRIC
CORPORATION

SIEPC7306000N