

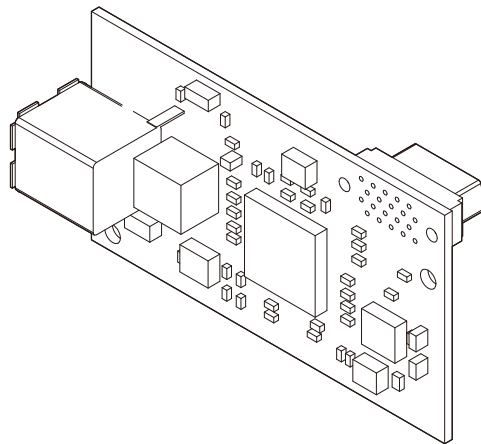


YASKAWA

YASKAWA AC Drive-Option Card **MECHATROLINK-II** Technical Manual

Type: SI-T3

To properly use the product, read this manual thoroughly and retain for easy reference, inspection, and maintenance. Ensure the end user receives this manual.



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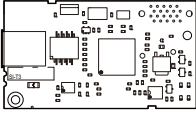
1 Preface and Safety

Yaskawa manufactures products used as components in a wide variety of industrial systems and equipment. The selection and application of Yaskawa products remain the responsibility of the equipment manufacturer 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 systems or equipment designed to incorporate a product 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 Yaskawa 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

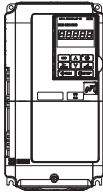
The following manuals are available for SI-T3 MECHATROLINK-II Option card:

Option Card

	<p>YASKAWA AC Drive-Option Card MECHATROLINK-II Installation Manual Manual No. : TOBPC73060050</p>
	<p>Read this manual first. The installation manual is packaged with the MECHATROLINK-II Option and contains a basic overview of wiring, settings, functions, and fault diagnoses.</p>
	<p>YASKAWA AC Drive-Option Card MECHATROLINK-II Technical Manual (this book) Manual No. : SIEPC73060050</p>
	<p>The technical manual contains detailed information. To obtain the technical manual, access these sites. Europe: http://www.yaskawa.eu.com Japan: http://www.e-mechatronics.com U.S.: http://www.yaskawa.com Other areas: contact a Yaskawa representative.</p>

For the drive setup, refer to one of the documentation listed below.

Yaskawa Drive

	<p>Refer to the manual of the drive this option card is being used with. The instruction manual for the drive covers basic installation, wiring, operation procedures, functions, troubleshooting, and maintenance information. It also includes important information on parameter settings and how to tune the drive. A Quick Start Guide is included with the drive. For the more detailed Technical Manual, visit Yaskawa's homepage or contact a Yaskawa representative.</p>
	<p>Europe: http://www.yaskawa.eu.com Japan: http://www.e-mechatronics.com U.S.: http://www.yaskawa.com Other areas: contact a Yaskawa representative</p>

◆ Terms

Note: Indicates supplementary information that Yaskawa highly recommends be followed, even though equipment may not be at risk.

MECHATROLINK-II Option: Yaskawa AC Drive -SI-T3 MECHATROLINK-II option card

◆ Registered Trademarks

- MECHATROLINK-I/MECHATROLINK-II is a registered trademark of the MECHATROLINK Members Association (MMA).
- Other company names and product names listed in this manual are registered trademarks of those companies.

◆ Supplemental Safety Information

Read and understand this manual before installing, operating, or servicing this option card. The option card 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

Indicates a hazardous situation, which, if not avoided, will result in death or serious injury.

WARNING

Indicates a hazardous situation, which, if not avoided, could result in death or serious injury.

CAUTION

Indicates a hazardous situation, which, if not avoided, could result in minor or moderate injury.

NOTICE

Indicates an equipment damage message.

■ General Safety

General Precautions

- The diagrams in this section may include drives without covers or safety shields to illustrate details. Be sure to reinstall covers or shields before operating any devices. The option board should be used according to the instructions described in this manual.
- Any illustrations, photographs, or examples used in this manual are provided as examples only and may not apply to all products to which this manual is applicable.
- 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.
- When ordering a new copy of the manual due to damage or loss, contact your Yaskawa representative or the nearest Yaskawa sales office and provide the manual number shown on the front cover.

DANGER

Heed the safety messages in this manual.

Failure to comply will result in death or serious injury.

The operating company is responsible for any injuries or equipment damage resulting from failure to heed the warnings in this manual.

NOTICE

Do not expose the drive to halogen group disinfectants.

Failure to comply may cause damage to the electrical components in the option card.

Do not pack the drive in wooden materials that have been fumigated or sterilized.

Do not sterilize the entire package after the product is packed.

Do not modify the drive circuitry.

Failure to comply could result in damage to the drive and will void warranty.

YASKAWA is not responsible for any modification of the product made by the user. This product must not be modified.

2 Product Overview

◆ About This Product

MECHATROLINK-II Option (Model: SI-T3) is designed for connecting a drive to a field network using the MECHATROLINK protocol.

By installing the MECHATROLINK-II Option to a drive, it is possible to do the following from a MECHATROLINK master device:

- operate the drive
- monitor the operation status of the drive
- change parameter settings

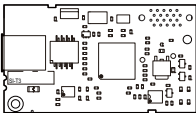



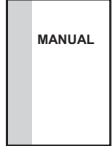
3 Receiving

Please perform the following tasks after receiving the MECHATROLINK-II Option:

- Inspect the MECHATROLINK-II Option for damage.
If the MECHATROLINK-II Option appears damaged upon receipt, contact the shipper immediately.
- Verify receipt of the correct model by checking the information on the PCB (see [Figure 1](#)).
- If you have received the wrong model or the MECHATROLINK-II Option does not function properly, contact your supplier.

◆ Contents and Packaging

Table 1 Contents of Package

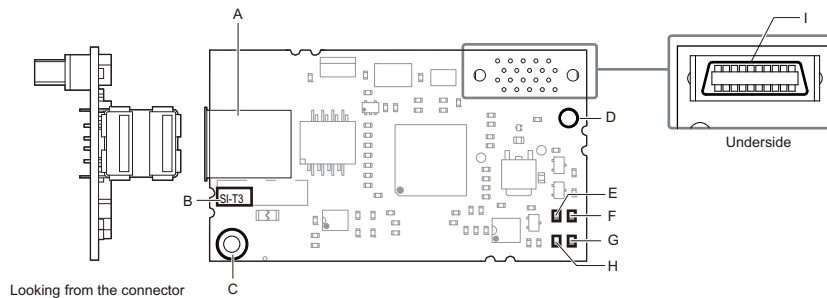
Description:	Option Card	Ground Cable	Screws (M3)	LED Label	Installation Manual
					
Quantity:	1	1	3	1	1

◆ Tool Requirements

A Phillips screwdriver (#2 (M3)) U.S. standard size is required to install the MECHATROLINK-II Option.

4 MECHATROLINK-II Option Components

◆ MECHATROLINK-II Option



- A – Communication cable connector**
B – Model number
C – Ground terminal (installation hole)
D – Installation hole
E – LED (ERR)
F – LED (RUN)
G – LED (TX)
H – LED (RX)
I – Connector (CN101)

Figure 1 Option Card

For details on the LEDs, Refer to [MECHATROLINK-II Option LED Display on page 9](#).

◆ Communication connector

Table 2 Communication connector

MECHATROLINK-II Connector	Pin No.	Signal Name	I/O	Function
	A1	(NC)	–	Not used.
	A2	SRD–	I/O	Send/receive data (–)
	A3	SRD+	I/O	Send/receive data (+)
	A4	(NC)	–	Not used.
	Shell	SLD	–	Shield
	B1	(NC)	–	Not used.
	B2	SRD–	I/O	Send/receive data (–)
	B3	SRD+	I/O	Send/receive data (+)
	B4	(NC)	–	Not used.
	Shell	SLD	–	Shield

◆ MECHATROLINK-II Option LED Display

The MECHATROLINK-II Option has four LEDs that indicate the option card or communication status.

■ Checking LED Operation

Table 3 MECHATROLINK-II Operation LED Status

LED	Display	Status	Remarks
RUN	ON	Power supply on	SI-T3 has been successfully powered up
	OFF	No power	<ul style="list-style-type: none"> The drive has no power SI-T3 is not properly connected to the drive, or SI-T3 has no power An internal, self-diagnostic error occurred in the SI-T3
ERR	ON	Connection error	<ul style="list-style-type: none"> SI-T3 is not properly connected to the drive Communication error <I>
	Flashing	SI-T3 error	Error found during SI-T3's self-diagnostic check
	OFF	Normal operation	<ul style="list-style-type: none"> SI-T3 is properly connected to the drive Communication normal
TX	ON	Sending data	Data is being sent (LED may appear to be flashing)
	OFF	Not sending data	<ul style="list-style-type: none"> No data is being sent During reset
RX	ON	Receiving data	Data is being received (LED may appear to be flashing)
	OFF	Not receiving data	<ul style="list-style-type: none"> No data is being received During reset

<I> For details on the communication error, refer to [Troubleshooting on page 30](#).

5 Installation Procedure

◆ Section Safety

DANGER

Electric Shock Hazard

Power to the drive must be shut off when installing this option card.

Even though the power has been shut off, voltage still remains in the drive's DC bus. Wait before removing the front cover once the drive has been turned off.

The CHARGE light on the drive will go out after voltage in the DC bus drops below 50 V, at which point it is safe to remove the front cover.

Due to the risk of electric shock, be sure that all LEDs have gone out and that the DC bus voltage has reached a safe level prior to performing any work on the drive.

WARNING

Electrical Shock Hazard

Do not remove the front cover of the drive while the power is on.

Failure to comply could result in death or serious injury.

The diagrams in this section may include drives without covers or safety shields to show details. Be sure to reinstall covers or shields before operating any devices. The option board should be used according to the instructions described in this manual.

Do not allow unqualified personnel to use equipment.

Failure to comply could result in death or serious injury.

Maintenance, inspection, and replacement of parts must be performed only by authorized personnel familiar with installation, adjustment, and maintenance of this product.

Do not touch the option card while the power supply to the drive is switched on.

Failure to comply could result in death or serious injury.

Do not use damaged wires, place excessive stress on wiring, or damage the wire insulation.

Failure to comply could result in death or serious injury.

NOTICE

Damage to Equipment

Observe proper electrostatic discharge procedures (ESD) when handling the option card, drive, and circuit boards.

Failure to comply may result in ESD damage to circuitry.

Never shut the power off while the drive is outputting voltage.

Failure to comply may cause the application to operate incorrectly or damage the drive.

Do not operate damaged equipment.

Failure to comply may cause further damage to the equipment.

Do not connect or operate any equipment with visible damage or missing parts.

Do not use unshielded cable for control wiring.

Failure to comply may cause electrical interference resulting in poor system performance.

Use shielded twisted-pair wires and ground the shield to the ground terminal of the drive.

NOTICE

Damage to Equipment

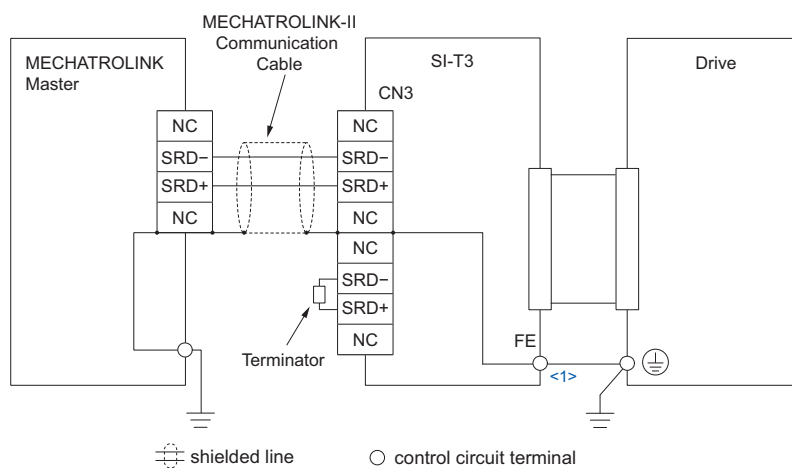
Properly connect connectors.

Failure to comply may prevent proper operation and possibly damage equipment.

Check wiring to ensure that all connections are correct after installing the option card and connecting any other devices.

Failure to comply may result in damage to the option card.

◆ Wiring the Network Cable Connectors



<1> The FE terminal on the MECHATROLINK-II Option is supplied with a ground cable that should be connected to the ground terminal on the drive. If there are noise influences on communication, remove the grounding cable.

Figure 2 Wiring Diagram

◆ Prior to Installing the Option Card

Prior to installing the MECHATROLINK-II Option, wire the drive and make necessary connections to the drive terminals. For more information on wiring and connecting the drive, refer to the technical manual for the drive the MECHATROLINK-II option card is connected to. Verify that the drive runs normally without the option installed.

◆ Installing the Option Card

Insert the option card in the CN5-A connector located on the drive's control board.
See the drive manual for directions on removing the front cover.

1. Shut off power to the drive, wait the appropriate amount of time for voltage to dissipate, then remove the operator and front cover. Refer to the drive technical manual for direction on removing the front cover.
2. Insert the CN101 connector on the option card into the CN5-A connector on the drive, then fasten it into place using one of the screws included with the option card.

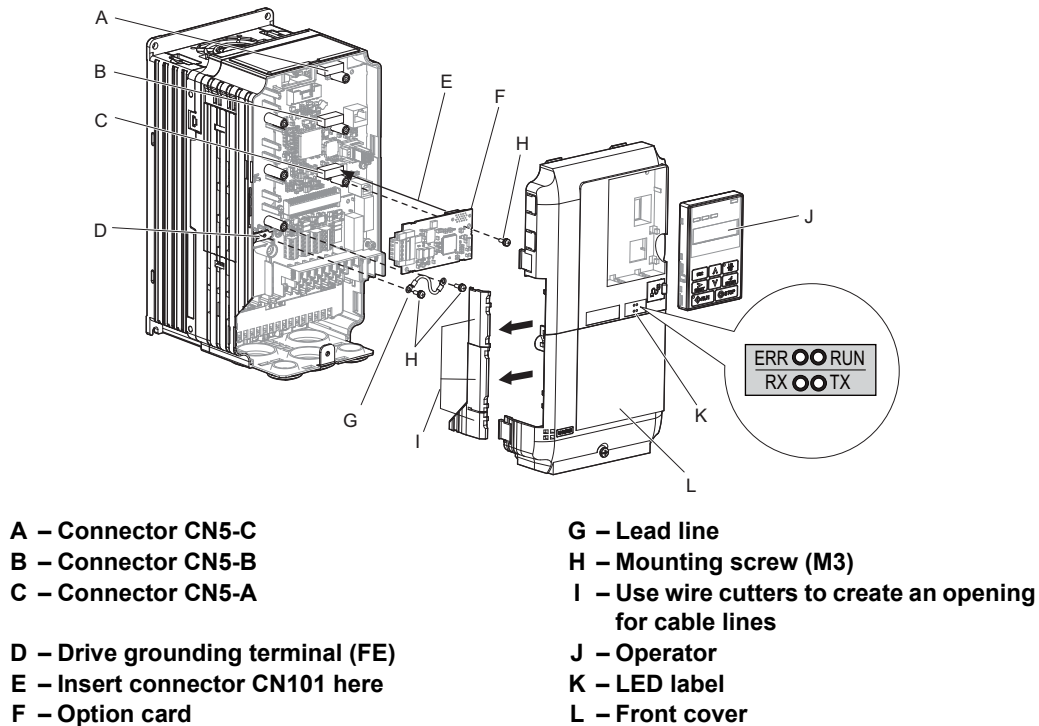


Figure 3 Installing the Option Card

3. Connect the ground lead line to the ground terminal using one of the screws delivered with the option card.

Note: There are only two screw holes on the drive for ground terminals. If three option cards are connected, two of the lead lines will need to share the same ground terminal.

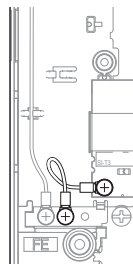


Figure 4 Connecting the Ground Terminal

4. Wire the MECHATROLINK-II to the connector on the option card.
 When installing option cards to drive models CIMR-A□2A0004 through 0040 and to models CIMR-A□4A0002 through 0023, the cables connected to the option might need to be routed through the top cover to the outside. In this case, cut out the perforated openings on the left side of the drive top cover. Make sure no sharp edges are left that may damage the cable.
 Models CIMR-A□2A0056 through 0211 and 4A0031 through 0165 have enough space to keep all wiring inside the unit.

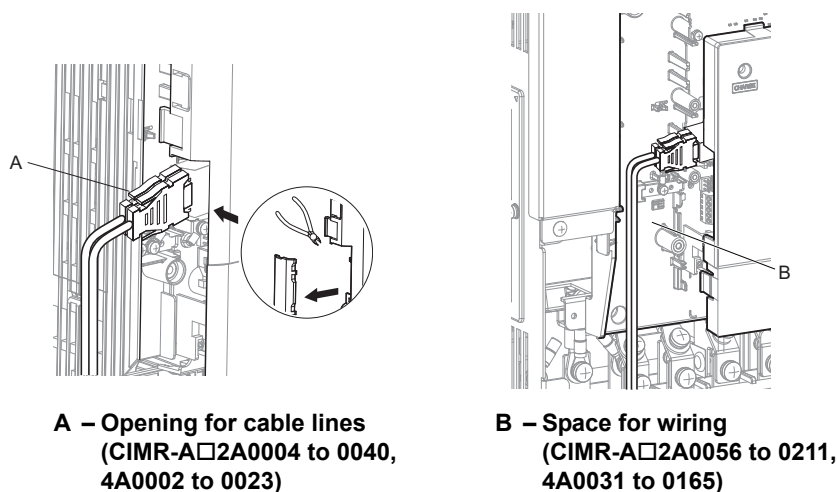


Figure 5 Wiring space

5. Place the front cover back onto the drive as it was before.

- Note:**
1. Take care when wiring the option card so that the front cover easily fits back onto the drive.
 2. Install Cable Cover option to maintain the drive Enclosure Type.
6. Attach the LED label packaged with the option card as shown in [Figure 3](#).

◆ MECHATROLINK-II Communications Cables

Wire the MECHATROLINK-II communications cables to the communications connector (CN3). Install MECHATROLINK-II communications cables apart from main-circuit wiring and other electrical and power lines.

- Note:**
1. For communications cables, use special shielded twisted-pair cables for MECHATROLINK communications.
 Recommended cable: JEPMC-W6002-□□-E <1>
 JEPMC-W6003-□□-E (with a core) <1>
 2. Connect the terminator (model No.: JEPMC-W6022-E) on the end of the communication lines.
 3. Maximum transmission distance is 50 m. Minimum wiring distance between stations is 0.5 m.

<1> □□ is the length (m).

6 MECHATROLINK Option Drive Parameters

Confirm proper setting of the all parameters in [Table 4](#) before starting network communications.

Table 4 Parameter Settings

No.	Name	Description	Default
b1-01 <1>	Frequency Reference Selection 1	Selects the frequency reference input source 0: Operator - Digital preset speed d1-01 to d1-17 1: Terminals - Analog input terminal A1 or A2 2: MEMOBUS/Modbus communications 3: Option PCB 4: Pulse Input (Terminal RP)	1
b1-02 <1>	Run Command Selection 1	Selects the run command input source 0: Digital Operator - RUN and STOP keys 1: Digital input terminals S1 to S8 2: MEMOBUS/Modbus communications 3: Option PCB	1
F6-01 <2>	Communications Error Operation Selection	Determines drive response when a bUS error is detected during communications with the MECHATROLINK-II Option 0: Ramp to Stop. Decelerate to stop using the deceleration time in C1-02. 1: Coast to Stop 2: Fast-Stop. Decelerate to stop using the deceleration time in C1-09. 3: Alarm Only	1
F6-02	External Fault from Comm. Option Detection Selection	Sets the condition for external fault detection (EF0) 0: Always detected. 1: Detection during run only.	0
F6-03 <2>	External Fault from Comm. Option Operation Selection	Determines drive response for external fault input (EF0) detection during MECHATROLINK-II communication 0: Ramp to Stop. Decelerate to stop using the deceleration time in C1-02. 1: Coast to Stop 2: Fast-Stop. Decelerate to stop using the deceleration time in C1-09. 3: Alarm Only	1
F6-07	Multi-Step Speed Enable/Disable Selection when NetRef/ComRef is Selected	0: Multi-step speed reference disabled (Same as F7) 1: Multi-step speed reference enabled (Same as V7)	0
F6-08	Reset Communication Parameters	Determines which communication-related parameters are set back to their original default values when the drive is initialized. 0: Do not reset F6-□□ parameters when the drive is initialized using parameter A1-03. 1: Rest F6-□□ parameters when the drive is initialized using parameter A1-03. Note: Setting this parameter does not affect communication-related parameters.	0
F6-20 <3> <4>	MECHATROLINK Station Address	20 to 3FH	21
F6-21 <3>	MECHATROLINK Frame Size	0: 32 byte 1: 17 byte	0
F6-22 <3>	MECHATROLINK Link Speed	0: 10 Mbps 1: 4 Mbps	0
F6-23 <3> <4>	MECHATROLINK Monitor Selection (E)	0 to FFFFH	0
F6-24 <3> <6>	MECHATROLINK Monitor Selection (F)	0 to FFFFH	0
F6-25	Operation Selection at Watchdog Error (E5)	0: Ramp to stop. Decelerate to stop using the deceleration time in C1-02. 1: Coast to stop. 2: Fast Stop. Decelerate to stop using the deceleration time in C1-09. 3: Alarm only.	1
F6-26	MECHATROLINK bUS Errors Detected	Sets the number of option communication errors (bUS). 2 to 10	2

<1> To start and stop the drive with the MECHATROLINK master device using serial communications, set b1-02 to 3. To control the frequency reference of the drive via the master device, set b1-01 to 3.

<2> If set to 3, then the drive will continue to operate when a fault is detected. Take proper measures such as installing an emergency stop switch.

<3> Power must be cycled in order for any setting changes to take affect.

<4> All station addresses must be unique. If set to 20 or 3F, a Station Address Error (AEr) will occur and the ERR light will turn on.

<5> Setting byte 10 of INV_CTL to 0EH enables the register set by F6-23. Byte 11 and 12 of the response data enable the register content set by F6-23.

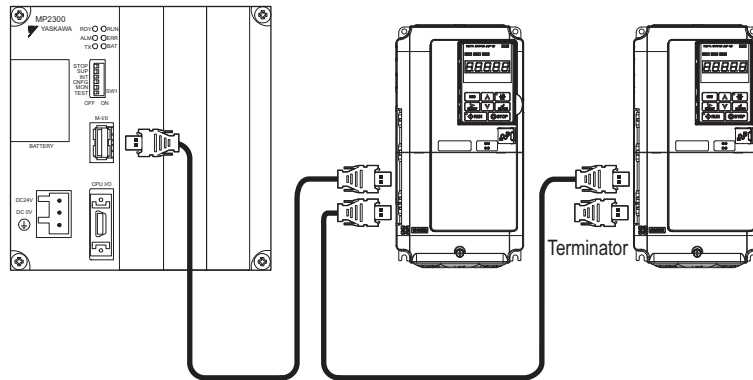
<6> Setting byte 10 of INV_CTL to 0FH enables the register set by F6-24. Byte 11 and 12 of the response data enable the register content set by F6-24.

7 Transmission Interface

◆ MECHATROLINK-II Cyclic Transmissions

As a MECHATROLINK-I/MECHATROLINK-II station, the SI-T3 exchanges control data and I/O data with a control device, such as a controller. Communications with the master are executed by sending response data timed to the reception of command data for the local station address from the master in each transmission cycle. The formats for the command and response data follow the specifications for the MECHATROLINK Drive commands.

Master: MP2300 Controller (Example)



◆ Basic Format of Data Transfer

The basic format for transferring data is as follows.

The size of the header for a data link layer is fixed at two bytes.

By setting, either 17 bytes (17-byte data transmission) or 32 bytes (32-byte data transmission) can be selected as the data size for the data link layer. If 32-byte data transmission is selected, only the first 29 bytes <1> are used as application data.

<1> The first 30 bytes are used only when the INV_I/O sub-command is used.

Command data		Response data		
+00H	Station address	+00H	Station address	Header of data link layer
+01H	Control code	+01H	Control code	
+02H	Command code	+02H	Response code	Data link layer data and application layer
+03H	—	+03H	Alarm	
+04H	Data	+04H	Status	
		+06H	Data	
+11H	WDT	+11H	EWDT	
+12H		+12H		

Figure 6 Basic format of data transfer (17-byte data transmission)

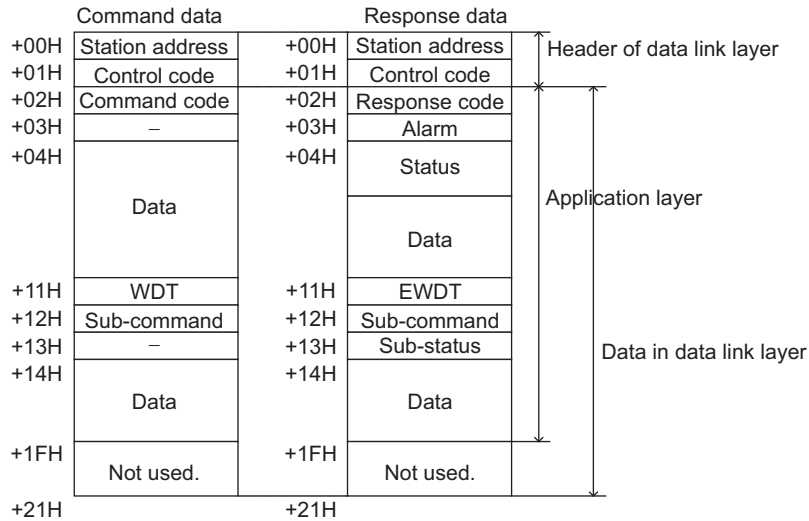


Figure 7 Basic format of data transfer (32-byte data transmission)

◆ Communications Phases

The SI-T3 changes status as described here when a command code or fault is received from the master.

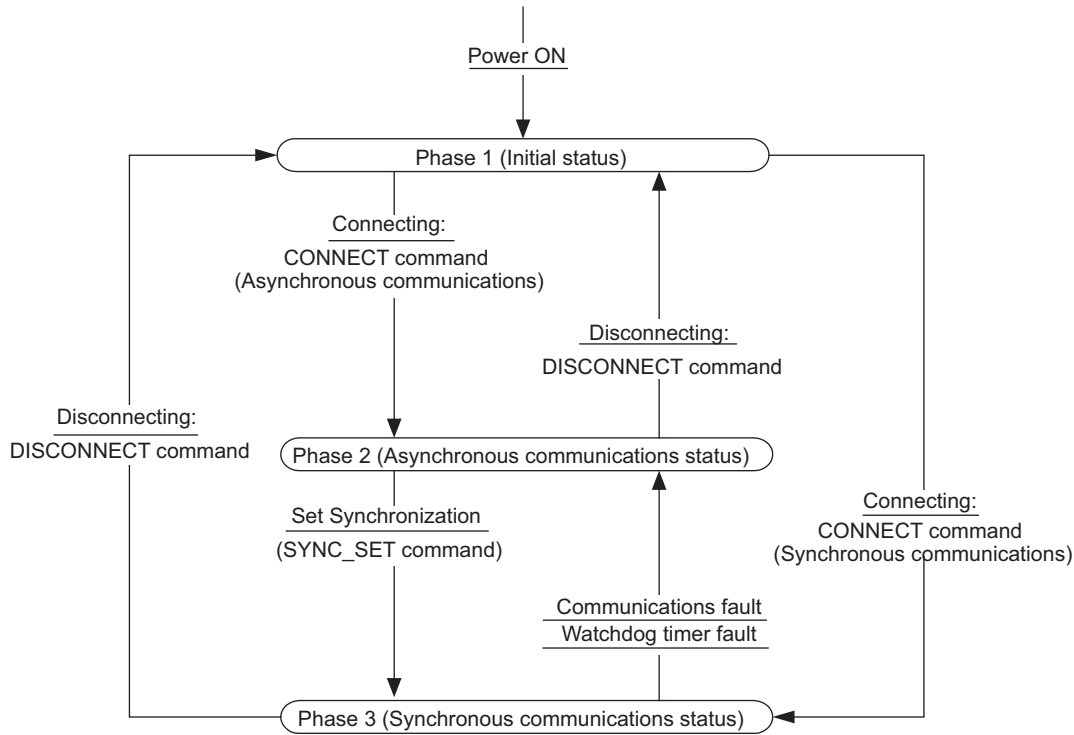


Figure 8 Communication phases

■ 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 SI-T3 commands can be used. Phase 2 starts to count the watchdog timer in the communications frame. 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. If the DISCONNECT command is received, the phase moves to phase 1. If a reception fault or a watchdog timer fault is detected, the phase moves to phase 2.

◆ Application Layer Specifications

The data format for the application layer conforms to the MECHATROLINK-II link command specifications.

SI-T3 has the following main commands and sub-commands.

Table 5 Main Commands

Code	Name	Function
00H	NOP	No Operation
01H	PRM_RD	Read Parameter
02H	PRM_WR	Write Parameter
03H	ID_RD	Read ID Number
04H	CONFIG	RAM Write and EEPROM Write
05H	ALM_RD	Read Alarm and Warning
06H	ALM_CLR	Clear Alarm and Warning
0DH	SYNC_SET	Start Synchronous Communications
0EH	CONNECT	Connect
0FH	DISCONNECT	Disconnect
40H	INV_CTL	Drive Operation Control

Table 6 Sub-commands

Code	Name	Function
00H	NOP	No Operation
01H	PRM_RD	Read Parameter
02H	PRM_WR	Write Parameter
05H	ALM_RD	Read Alarm and Warning
41H	INV_I/O	Drive I/O Control

The main commands are used in both the 17-byte and 32-byte data transmissions for MECHATROLINK-II and with MECHATROLINK-I. The sub-commands can be used only when the 32-byte data transmission (F6-21 = 0) has been selected. If a conflict occurs between a request for a main command and a request for a sub-command, the request for the main command is processed. If either a main command or a sub-command is already being processed, the command being processed is given priority. If an INV_CTL main command and an INV_I/O sub-command conflict, the sub-command is given priority.

For details on command formats, refer to [MECHATROLINK-II Commands on page 18](#).

The following table shows the combination of Main Commands and Sub-commands.

Table 7 Main Command and Sub-command

Code	Main Command	Sub-command				
		NOP (00H)	PRM_RD (01H)	PRM_WR (02H)	ALM_RD (05H)	INV_I/O (41H)
00H	NOP	OK	OK	OK	OK	OK
01H	PRM_RD	OK	NG (A.95)	NG (A.95)	OK	OK
02H	PRM_WR	OK	NG (A.95)	NG (A.95)	OK	OK
03H	ID_RD	OK	OK	OK	OK	OK
04H	CONFIG	OK	NG (A.95)	NG (A.95)	NG (A.95)	NG (A.95)
05H	ALM_RD	OK	NG (A.95)	NG (A.95)	NG (A.95)	NG (A.95)
06H	ALM_CLR	OK	NG (A.95)	NG (A.95)	NG (A.95)	NG (A.95)
0DH	SYNC_SET	OK	OK	OK	OK	OK
0EH	CONNECT	OK	NG (A.95)	NG (A.95)	NG (A.95)	NG (A.95)
0FH	DISCONNECT	OK	NG (A.95)	NG (A.95)	NG (A.95)	NG (A.95)
40H	INV_CTL	OK	OK	OK	OK	OK

Note: Command warning (A.95) will result if a main command and sub-command conflict with one another. For details on the alarm, refer to [Other Faults on page 31](#).

8 MECHATROLINK-II Commands

◆ Main Commands

■ NOP: 00H (No Operation)

Byte	Command	Response
1	NOP	NOP
2	0	ALARM
3, 4		STATUS
5 to 15		0
16	WDT	RWDT

Only the ALARM and STATUS fields of the response data can be monitored. This command can be used in all phases.

■ PRM_RD: 01H (Read Parameter)

Byte	Command	Response
1	PRM_RD	PRM_RD
2	0	ALARM
3, 4		STATUS
5, 6	NO	NO
7	SIZE	SIZE
8 to 15	0	PARAMETER
16	WDT	RWDT

The PRM_RD command is used to read the Drive internal parameters. For offline parameters, it reads the most recently updated setting values. This command can be used in all phases.

In the following cases, a warning (STATUS (WARNG) = 1) is generated and the command is ignored. If a warning is generated, the values that are read are undefined.

- If a register number (NO) fault occurs: Data setting warning (A.94)
- If SIZE is an odd number or is not between 2 and 8: Data setting warning (A.94)

The register number (NO) is the same as the register number that is set and referenced in MEMOBUS/Modbus transfers. Set the lower byte (LSB) before setting the upper byte (MSB). The SI-T3 stores the data read for PARAMETER from lower byte (LSB) to upper byte (MSB). Refer to drive technical manual for detail.

For SIZE, set the number of bytes to be read as an even numbers. Eight bytes can be specified.

The values for the number (NO) and the size (SIZE) in the response data are copies of the values in the command data.

Example when reading C1-01 (200H):

Table 8 Example when reading C1-01 (200H)

Byte	Command	Response
5	00	00
6	02	02
7	02	02
8	00	Lower byte of C1-01
9	00	Upper byte of C1-01

■ PRM_WR: 02H (Write Parameter)

Byte	Command	Response
1	PRM_WR	PRM_WR
2	0	ALARM
3, 4		STATUS
5, 6	NO	NO
7	SIZE	SIZE
8 to 15	DATA	DATA
16	WDT	RWDT

The PRM_WR command is used to write the drive internal parameters.

To save the setting value in the drive EEPROM, set the CONFIG_MOD in the CONFIG command to 1. For details, refer to the section describing the CONFIG command.

In the following cases, a warning is generated and the command is ignored.

- If a register number (NO) fault occurs: Data setting warning (A.94)
- If SIZE is an odd number or is not between 2 and 8: Data setting warning (A.94)
- Data upper/lower limit fault: Data setting warning (A.94)
- While using the Operator to change settings: Command warning (A.95)
- If not in phase 2 or 3: Command warning (A.95)
- During an undervoltage fault: Command warning (A.95)

The register number (NO) is the same as the register number that is set and referenced in MEMOBUS/Modbus transfers. Set the lower byte (LSB) before setting the upper byte (MSB). Refer to Drive Technical Manual for detail.

Set the values for DATA from lower byte (LSB) to upper byte (MSB). For SIZE, set the number of bytes to be written as an even number. Eight bytes can be specified.

The values for the NO, SIZE, and DATA in the response are copies of values in the command.

Example when writing in C1-01 (200H):

Table 9 Example when writing in C1-01 (200H)

Byte	Command	Response
5	00	00
6	02	02
7	02	02
8	Setting value (Lower byte)	Setting value (Lower byte)
9	Setting value (Upper byte)	Setting value (Upper byte)

■ ID_RD: 03H (Read ID Number)

Byte	Command	Response
1	ID_RD	ID_RD
2	0	ALARM
3, 4		STATUS
5	DEVICE_CODE	DEVICE_CODE
6	OFFSET	OFFSET
7	SIZE	SIZE
8 to 15	0	ID
16	WDT	RWDT

The ID_RD command is used to read the ID number.

The following table shows the applicable DEVICE_CODE.

Because of ID area limitations, no more than eight bytes can be read, so use the OFFSET and SIZE to specify the range.

The leading ID data that corresponds to the specified OFFSET and returned is shown in the [Table 10](#) and [Table 11](#).

Up to eight bytes can be used for SIZE. This command can be used in all phases.

Table 10 DEVICE_CODE

	DEVICE_CODE	ID content <1>															
	OFFSET	00	01	02	03	04	05	06	07	08	09	0A	0B	0C	0D	0E	0F
Drive Model	00H	C	I	M	R	-	A	<2>	<3>	<4>	0	0	0	6			
Software Version	02H			S	1	2	3	4		S	5	6	7	8			

- <1> The codes are expressed in ASCII, and end in 00H.
- <2> The portions showing the region are represented by spaces.
- <3> Indicates the voltage class. 2: Three Phase 200 V, 4: Three Phase 400 V, 5: Three Phase 575 V
- <4> The portions showing the structure are represented by spaces.
- <5> Four digits indicating any customized specifications.
- <6> Indicates the SI-T3 software version.
- <7> Indicates the Drive software version.

Table 11 Vender Code (DEVICE_CODE = 0FH)

		ID content <1>															
Vender ID	OFFSET	00	01	02	03	04	05	06	07	08	09	0A	0B	0C	0D	0E	0F
		ASCII	0	8	1	0	0	0	0	0	00						
Vender Name	OFFSET	10	11	12	13	14	15	16	17	18	19	1A	1B	1C	1D	1E	1F
	ASCII	Y	A	S	K	A	W	A		E	L	E	C	T	R	I	C
	OFFSET	20	21	22	23	24	25	26	27	28	29	2A	2B	2C	2D	2E	2F
	ASCII		C	O	R	P	O	R	A	T	I	O	N	00			

<1> Vender IDs and vender names are expressed in ASCII, and end in 00H.

■ CONFIG: 04H (RAM Write and EEPROM Write)

Byte	Command	Response
1	CONFIG	CONFIG
2	0	ALARM
3, 4		STATUS
5	CONFIG_MOD	CONFIG_MOD
6 to 15	0	0
16	WDT	RWDT

The CONFIG command is used to enable the data for which parameters have been written.

Error codes such as matching of parameters cannot be checked by the responses to this command. They must be checked with the STATUS field's oPE fault bit. This command can be used in phases 2 and 3.

In the following cases, a warning is generated and the command is ignored.

- If CONFIG_MOD is not a set value: Data setting warning (A.94)
- If not in phase 2 or 3: Command warning (A.95)

The following values can be assigned to CONFIG_MOD.

Table 12 CONFIG_MOD

CONFIG_MOD	Description
0	Write RAM The setting value is not saved in EEPROM.
1	The setting value is saved in EEPROM. Note: With the A1000, the maximum number of writes to non-volatile memory is 100,000, so do not use the CONFIG command too frequently. If changing several parameters, carry out the CONFIG command only after all the parameters have been changed.

■ ALM_RD: 05H (Read Alarm and Warning)

Byte	Command	Response
1	ALM_RD	ALM_RD
2	0	ALARM
3, 4		STATUS
5	ALM_RD_MOD	ALM_RD_MOD
6 to 15	0	ALM_DATA
16	WDT	RWDT

Table 13 ALM_RD_MOD

Byte	ALM_RD_MOD = 0	ALM_RD_MOD = 1	ALM_RD_MOD = 2
5	00H	01H	02H
6	U2-01	U3-01	Alarm Index
7	U2-02	U3-02	Lower byte of U3-(Alarm Index + 1)
8		U3-03	Upper byte of U3-(Alarm Index + 1)
9		U3-04	
10		U3-05	
11		U3-06	
12		U3-07	
13		U3-08	
14		U3-09	
15		U3-10	

The ALM_RD command is used to read the following information about the status of faults and alarms.

- Present fault and alarm status list
- Fault history (Alarms are not saved in the history.)
- Details of faults

In the following case, a warning is generated and the command is ignored.

- If ALM_RD_MOD is other than a set value: Data setting warning (A.94)

The fault history is saved in EEPROM and is kept even when the control power is interrupted.

- If ALM_RD_MOD is set to 0: Fault code (1 byte) is entered to byte 6 of ALM_DATA, and byte 7 becomes the value of the previous fault.
- If ALM_RD_MOD is set to 1: Fault code is entered in order of detection from ALM_DATA byte 6 so that byte 6 is the most recent fault.
- When ALM_RD_MOD is set to 2: Fault code detected by the value set by the Alarm Index +1 is entered to bytes 7 and 8.

During normal operation (i.e., when no fault has occurred), the value is 00H.

Table 14 ALM_DATA

ALM_RD_MOD	ALM_DATA	Max. Processing Time	Parameter No.
0	Present fault (byte 6), past fault (byte 7)	0.1 s	U2-01 and U2-02
1	Fault history trace 10 max. (byte 6 to 15)	0.1 s	U3-01 to U3-10
2	Fault history (Alarms are not retained in the history.) (bytes 7 and 8)	0.1 s	U3-01 to U3-10

■ ALM_CLR: 06H (Clear Alarm and Warning)

Byte	Command	Response
1	ALM_CLR	ALM_CLR
2	0	ALARM
3, 4		STATUS
5	ALM_CLR_MOD	ALM_CLR_MOD
6 to 15	0	0
16	WDT	RWDT

The ALM_CLR command is used to clear the alarm and warning status.

This command changes the status of the station. It does not remove the cause of a fault. After the cause of the alarm or warning has been removed, this command is then used to clear the status of the alarm or warning.

In the following cases, a warning is generated and the command is ignored.

- If ALM_CLR_MOD is other than a set value: Data setting warning (A.94)
- If not in phase 2 or 3: Command warning (A.95)

Table 15 ALM_CLR_MOD

ALM_CLR_MOD	Description
0	Clears the status of present faults and alarms.

Note: Drive faults and alarms cannot be reset while the Drive RUN command is ON.

■ SYNC_SET: 0DH (Start Synchronous Communications)

Byte	Command	Response
1	SYNC_SET	SYNC_SET
2	0	ALARM
3, 4		STATUS
5 to 15	0	0
16		WDT

The SYNC_SET command is used to request the start of synchronous communications. After this command is issued, synchronous communications are carried out. If communications become asynchronous due to any fault such as a communications fault, this command can be used to restore synchronous communications.

In the following case, a warning is generated and the command is ignored.

- If not in phase 2 or 3: Command warning (A.95)

■ CONNECT: 0EH (Connect)

Byte	Command	Response
1	CONNECT	CONNECT
2	0	ALARM
3, 4		STATUS
5	VER	VER
6	COM_MOD	COM_MOD
7	COM_TIM	COM_TIM
8 to 15	0	0
16	WDT	RWDT

The CONNECT command is used to set the communications mode and establish a connection. After the connection is established, the phase moves to phase 2 or 3.

If a transfer fault is detected after moving to phase 2 or phase 3, notification is given of the fault. In phase 1, no notification is given even if a transfer fault is detected. Set VER (version) to 21H (Ver. 2.1) for MECHATROLINK-II, and to 10H (Ver. 1.0) for MECHATROLINK-I.

The communications mode is set by the COM_MOD. For details on the settings, refer to the following description.

MECHATROLINK-II (VER: 21H)**COM_MOD**

Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
SUBCMD	0	0	0	DTMOD		SYNCMOD	0

SUBCMD	Sub-command setting	0	Sub-command not used
		1	Sub-command used
DTMOD	Communication Mode	00	Single data transfer mode
SYNCMOD	Transmission Synchronization	0	Move to phase 2
		1	Move to phase 3

Note: If Bit6, Bit5, Bit4, or Bit0 is set to 1, a warning will be generated (Data setting warning: A.94).

COM_TIM

Set the factor of the transmission cycle to COM_TIM (communications time) so that the setting range satisfies the following formulas.

When the transmission cycle is equal to the communications time (COM_TIM = 1):

- 32-byte data transmission
 $1 \text{ [ms]} \leq \text{transmission cycle [ms]} \leq 8 \text{ [ms]}$
 If the transmission cycle is set to a fractional value, a warning (Data setting warning: A.94) is generated.
- 17-byte data transmission
 $0.5 \text{ [ms]} \leq \text{transmission cycle [ms]} \leq 8 \text{ [ms]}$
 If the transmission cycle is not set to a multiple of 0.5 ms, such as 0.75, a warning (Data setting warning: A.94) is generated.

When the transmission cycle is not equal to the communications time (1 < COM_TIM ≤ 32):

$$2 \text{ [ms]} \leq \text{transmission cycle [ms]} \times \text{COM_TIM} \leq 100 \text{ [ms]}$$

If the transmission cycle is less than 2 ms and is set to a fractional value, a warning (Data setting warning: A.94) is generated. If the communications cycle is set to a fractional value, a warning (Data setting warning: A.94) is generated.

MECHATROLINK-I (VER: 10H)**COM_MOD**

Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
0	0	0	0	DTMOD		SYNCMOD	EXMOD

DTMOD	Communication Mode	00	Single data transfer mode
SYNCMOD	Transmission Synchronization	0	Move to phase 2 (Asynchronous communications status)
		1	Move to phase 3 (Synchronous communications status)
EXMOD	Request to establish expanded/standard connection	0	Standard connection
		1	Expanded connection Even if SYNCMOD = 1 (synchronous comm.), SYNCMOD will be set to 0 for asynchronous data transmission.

In the following cases, a warning is generated and the command is ignored. Commands are also ignored in phase 2 (with no alarm).

- If COM_MOD is set out of range: Data setting warning (A.94)
- If SUBCMD is set to 1 in 17-byte data transmission: Data setting warning (A.94)
- If SUBCMD is set to 1 for Ver. 1.0 (VER: 10H): Data setting warning (A.94)
- If Bit6, Bit5, Bit4, Bit3, or Bit0 is set to 1: Data setting warning (A.94)

COM_TIM

In MECHATROLINK-I, COM_TIM was set in multiples of two because the units for COM_TIM were 1 = 1 ms and transmission cycles were fixed at 2 ms.

$$2 [\text{ms}] \leq \text{COM_TIM} \leq 64 [\text{ms}]$$

When transferring data in 2 ms cycles, set COM_TIM = 2. To use 4 ms cycles, set COM_TIM = 4.

In the following cases, a warning is generated and the command is ignored. Commands are also ignored in phase 2 (with no alarm).

- If COM_TIM is set out of range: Data setting warning (A.94)

■ DISCONNECT: 0FH (Disconnect)

Byte	Command	Response
1	DISCONNECT	DISCONNECT
2	0	ALARM
3, 4		STATUS
5 to 15		
16	WDT	RWDT

The DISCONNECT command is used to close the connection and move to phase 1.

After moving to phase 1, no check for transmission faults is executed. This command can be used in phases 2 and 3.

If this command is received while in phase 2 or 3, the data for the control command to the Drive is cleared to 0, and a fault reset command is carried out for the Drive.

■ INV_CTL: 40H (Drive Operation Control)

Byte	Command	Response
1	INV_CTL	INV_CTL
2	0	ALARM
3, 4	Operation signals	STATUS
5, 6	Speed reference	Output frequency
7, 8	Torque reference	Output current
9	SEL REF1/2	SEL REF1/2
10	SEL MON1/2	SEL MON1/2
11, 12	Reference selected by SEL REF1	Monitor selected by SEL MON1
13, 14	Reference selected by SEL REF2	Monitor selected by SEL MON2
15	0	0
16	WDT	RWDT

The INV_CTL command is used to set the drive operation signals, speed references, and so on.

These bytes do not need to be set every scan. The settings are saved in the drive until the next data is received or until the power is turned OFF. For details on operation signals, refer to [Table 16](#).

The speed reference and the output frequency units can be selected with o1-03.

Table 16 Operation Signals

Bit	Name	Description	Remarks
0	Forward run	0: Stop 1: Forward run	
1	Reverse run	0: Stop 1: Reverse run	
2	Multi-function terminal input 3	Terminal S3 input function 0: Terminal S3 function OFF 1: Terminal S3 function ON	H1-03 (Default = 24: External fault (EF3))
3	Multi-function terminal input 4	Terminal S4 input function 0: Terminal S4 function OFF 1: Terminal S4 function ON	H1-04 (Default = 14: Fault reset)
4	Multi-function terminal input 5	Terminal S5 input function 0: Terminal S5 function OFF 1: Terminal S5 function ON	H1-05 (Default = 3: Multi-step speed reference 1)
5	Multi-function terminal input 6	Terminal S6 input function 0: Terminal S6 function OFF 1: Terminal S6 function ON	H1-06 (Default = 4: Multi-step speed reference 2)
6	Multi-function terminal input 7	Terminal S7 input function 0: Terminal S7 function OFF 1: Terminal S7 function ON	H1-07 (Default = 6: Jog command)
7	Multi-function terminal input 8	Terminal S8 input function 0: Terminal S8 function OFF 1: Terminal S8 function ON	H1-08 (Default = 7: External bb command)
8	External fault (EF0)	1: External fault (EF0)	
9	Fault reset <1> <2>	1: Fault reset	
A to D	Reserved		
E	Fault history trace clear	1: Fault history trace clear	
F	External BB command	1: External bb command ON	

<1> Check that the faults has been successfully reset by confirming that the STATUS (RESET) bit has turned OFF.

<2> Errors are not reported while the fault reset signal is ON.

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.

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.

Table 17 and Table 18 show the selection ranges for SEL REF1/2 (3/4, 5/6) and SEL MON1/2 (3/4, 5/6).

Table 17 SEL REF1/2 (3/4, 5/6) Selection Range

Bit	Item	Remarks
0	Nothing selected	
1	Torque Compensation	Unit: 0.1%
2	Analog output terminal 1 output	Enable when H4-01=000
3	Analog output terminal 2 output	Enable when H4-04=000
4	Drive terminal output Bit0: terminal M1-M2 Bit1: terminal P1-PC Bit2: terminal P2-PC	terminal M1-M2 (Enable when H2-01=F) terminal P1-PC (Enable when H2-02=F) terminal P2-PC (Enable when H2-03=F)
5	PID target	Unit: 0.01%
6	Pulse train output	Unit: 1 Hz
7	V/f gain	
8	Reserved	
9	Command selection Bit1: PID target value enable	
A to F	Not used.	

Table 18 SEL MON1/2 (3/4, 5/6) Selection Range

MON1/2	Item	Remarks
0	Nothing selected	
1	Motor Speed	Same as U1-05, determined by o1-03
2	Torque reference (Monitor)	Same as U1-09, 0.1%
3	Speed Detection PG 1 Counter	
4	Frequency reference	Same as U1-01, determined by o1-03
5	Analog input terminal A2	Same as U1-14, 0.1%
6	Main circuit current voltage	Same as U1-07, 1V
7	Drive alarm	Refer to Table 26 Drive Alarm Codes on page 32.
8	Drive warning	Refer to Table 27 Drive Minor Fault and Alarm on page 34.
9	Multi-function output terminal status	Same as U1-11
A	Analog input terminal A3	Same as U1-15, 0.1%
B	Multi-function input terminal S1 to S8	Same as U1-10
C	Analog input terminal A1	Same as U1-13, 0.1%
D	Speed Detection PG 2 Counter	
E	Monitor data set in F6-23	
F	Monitor data set in F6-24	

In the following case, a warning is generated and the command is ignored.

- If not in phase 2 or 3: Command warning (A.95)

◆ Sub-commands

Sub-commands can be used only with MECHATROLINK-II when the 32-byte data transmission (F6-21 = 0) has been selected.

■ NOP: 00H (No Operation)

Byte	Command	Response
17	NOP	NOP
18	0	SUBSTATUS
19 to 29		0

This is the format of No Operation sub-command.

■ PRM_RD: 01H (Read Parameter)

Byte	Command	Response
17	PRM_RD	PRM_RD
18	0	SUBSTATUS
19, 20	NO	NO
21	SIZE	SIZE
22 to 29	0	PARAMETER

The PRM_RD sub-command is used to read internal Drive parameters. This sub-command functions in the same way as the PRM_RD main command.

In the following cases, a warning is generated and the command is ignored. If a warning is generated, the values that were read are undefined.

- If a register number (NO) fault occurs: Data setting warning (A.94)
- If SIZE is an odd number or is not between 2 and 8: Data setting warning (A.94)
- If a main command is PRM_RD or PRM_WR: Command warning (A.95)

■ PRM_WR: 02H (Write Parameter)

Byte	Command	Response
17	PRM_WR	PRM_WR
18	0	SUBSTATUS
19, 20	NO	NO
21	SIZE	SIZE
22 to 29	PARAMETER	PARAMETER

The PRM_WR sub-command is used to write internal Drive parameters. This sub-command functions in the same way as the PRM_WR main command.

In the following cases, a warning is generated and the command is ignored. If a warning is generated, the values that were read are undefined.

- If a register number (NO) fault occurs: Data setting warning (A.94)
- If SIZE is an odd number or is not between 2 and 8: Data setting warning (A.94)
- Data upper and lower limit fault: Data setting warning (A.94)
- During an undervoltage error: Command warning (A.95)
- While using the operator to change settings: Command warning (A.95)
- If not in phase 2 or 3: Command warning (A.95)
- If a main command is PRM_RD or PRM_WR: Command warning (A.95)

■ ALM_RD: 05H (Read Alarm and Warning)

Byte	Command	Response
17	ALM_RD	ALM_RD
18	0	SUBSTATUS
19	ALM_RD_MOD	ALM_RD_MOD
20 to 29	0	ALM_DATA

The ALM_RD sub-command is used to read the fault and alarm status. This sub-command functions in the same way as the ALM_RD main command.

In the following case, a warning is generated and the command is ignored.

- If ALM_RD_MOD is not set: Data setting warning (A.94)

■ INV_I/O: 41H (Drive I/O Control)

Byte	Sub-Command	Response
17	INV_I/O	INV_I/O
18	0	SUBSTATUS
19	SEL REF3/4	SEL REF3/4
20	SEL REF5/6	SEL REF5/6
21	SEL MON3/4	SEL MON3/4
22	SEL MON5/6	SEL MON5/6
23, 24	Reference selected by SEL REF3	Monitor selected by SEL MON3
25, 26	Reference selected by SEL REF4	Monitor selected by SEL MON4
27, 28	Reference selected by SEL REF5	Monitor selected by SEL MON5
29, 30	Reference selected by SEL REF6	Monitor selected by SEL MON6

The INV_I/O sub-command is used to select the type of output from the Drive's terminals and refers to the values from the Drive's internal monitors.

These settings do not need to be set every scan. The settings are saved in the Drive until the next data is received or until the power is turned OFF.

8 MECHATROLINK-II Commands

The SEL REF3/4 sub-command is used to select the contents of REF3 with bits 0 to 3, and select the contents of REF4 with bits 4 to 7.

The SEL REF5/6 sub-command is used to select the contents of REF5 with bits 0 to 3, and select the contents of REF6 with bits 4 to 7.

Refer to [Table 17](#) for detail on the selection range for SEL REF 3 to 6.

The SEL MON3/4 sub-command is used to select the contents of MON3 with bits 0 to 3, and select the contents of MON4 with bits 4 to 7.

The SEL MON5/6 sub-command is used to select the contents of MON5 with bits 0 to 3, and select the contents of MON6 with bits 4 to 7.

Refer to [Table 18](#) for detail on the selection range for SEL MON 3 to 6.

In the following cases, a warning is generated and the command is ignored.

- If not in phase 2 or 3: Command warning (A.95)

◆ Status

This section describes the STATUS field for main commands and the SUBSTATUS field for sub-commands.

■ STATUS Field

Bit	Name	Description	Value	Setting
0	ALM	Alarm (fault) status	0	No alarm
			1	Alarm (fault)
1	WARNG	Warning status	0	No warning
			1	Warning
2	CMDRDY	Command ready	0	Busy
			1	Ready
3	BB OFF	Baseblock OFF (OFF when output voltage is being output from the drive or during baseblock.)	0	Baseblock ON
			1	Baseblock OFF
4	PON	Main power supply ON (OFF during undervoltage)	0	Main power supply OFF
			1	Main power supply ON
5	RUNX	Running	0	–
			1	Running
6	0SP	Zero speed	0	–
			1	Zero speed
7	REV	Reverse RUN	0	Forward RUN
			1	Reverse RUN
8	RESET	Fault reset signal input	0	–
			1	Fault reset signal input
9	AGREE	Speed agreement	0	–
			1	Speed agreement
A	INV_READY	Drive ready	0	–
			1	Drive ready
B	OPE	oPE fault	0	–
			1	oPE fault
C	UV_R	Recovery after power loss or recovery after momentary power loss	0	Recovery after power loss
			1	Recovery after momentary power loss
D	REMOTE	Local or Remote	0	Local
			1	Remote (Transfer)
E	SEL_M	Motor Selection	0	Motor 1
			1	Motor 2
F	0_SERVO	Zero Servo Complete	0	–
			1	Zero Servo complete

Note: With the PRM_RD command, only the settings for the STATUS (CMDRDY) is valid. Other bits are not used.

■ SUBSTATUS Field

Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
0	0	0	0	0	SUBCMDRDY	SUBWARNG	SUBALM

SUBALM	Sub-command alarm	0	No alarm
		1	Alarm
SUBWARNG	Sub-command warning	0	No warning
		1	Warning
SUBCMDRDY	Sub-command ready (Sub-command can be received.)	0	Busy
		1	Ready

9 Troubleshooting

◆ Fault Detection Processing

Faults can be detected by two methods: Drive fault detection and SI-T3 fault detection.

The SI-T3 is notified of drive faults by the internal interface, and the SI-T3 sends the response data, ALARM or STATUS.

The SI-T3 notifies drive of SI-T3 faults by the internal interface, and the faults are simultaneously sent the response data, ALARM or STATUS.

The following four types of faults can be detected. The subsequent operation varies depending on the type of fault.

Table 19 Fault Type

Fault Type		Location	Description
Alarm	Drive alarm	Drive	Fault that causes damage to the drive or machinery
	Communications alarm	SI-T3	Interference related to MECHATROLINK-II communications
Warning	Drive warning	Drive	Illegal operation or minor fault not posing any immediate danger
	Communications warning	SI-T3	MECHATROLINK-II communications fault warning

Table 20 Fault Type and SI-T3 Processing

Fault Type	SI-T3 Processing				Processing	Direction of Communications	Reset
	MECHATROLINK Response		LED (ERR)	STATUS			
	ALARM	STATUS					
		WARNG	ALM				
Drive alarm	CODE <I>	–	1	–	No special processing	←	Required
Communications alarm		–	1	ON	Notification to drive	←	Required
Drive warning		1	–	–	No special processing	←	Required
Communications warning		1	–	–	No special processing	None	Not required

<I> Refer to [Drive Fault Notification on page 32](#) for detail.

Note:The meanings of each symbol are as follows.

– : No change

←: Fault notification from Drive

When consecutive alarms occur, the SI-T3 provides notification of the most recent alarm with a MECHATROLINK response data. If warnings occur simultaneously, notification priority is given to the warning with the lowest warning code. If alarms and warnings are mixed together, the SI-T3 gives notification priority to alarms.

The [Table 21](#) shows the response data when consecutive alarms or warnings occurs.

Table 21 Response Data for Consecutive Alarms and/or Warnings

Fault Detection		MECHATROLINK-II Response Data Contents		
Previous Value	Most Recent Value	Alarm	STATUS	
			WARNG	ALM
Alarm	Alarm	Most recent alarm code	0	1
Alarm	Warning	Most recent alarm code	1	1
Warning	Alarm	Most recent alarm code	1	1
Warning	Warning	Warning with the smaller warning code	1	0

◆ Alarm Processing

■ SI-T3 Communications Fault Detection

The following tables show the communications faults detected by the SI-T3 and the conditions in which they can be detected.

Table 22 Reception Failures in Each Phase

Communications Phase	Reception Failure		Transmission cycle
	First	Second (Consecutive)	Fault
Phase 1	–	–	–
Phase 2	96	E6	E6
Phase 3	96	E6	E6

Table 23 Alarm Code (MECHATROLINK-II Response ALARM Value)

ALARM	Description	Fault Type
96	MECHATROLINK-II communications fault warning	Communications warning
E5	MECHATROLINK-II WDT Error	Communications alarm
E6	MECHATROLINK-II communications fault	Communications alarm

Table 24 Fault Types

Fault	Description
Communications failure	Transmission LSI detected a data reception failure.
Transmission cycle fault	A timing fault of a synchronous frame in a transmission cycle was detected.
Watchdog timer error	A WDT count fault in a synchronous frame was detected.

■ Other Faults

The following table shows other faults that can be detected by the SI-T3. If a warning occurs, operation will follow the previous command.

Table 25 Other fault detected by SI-T3

ALARM	Description	Fault Type	Operation when Fault Occurs
94	Data setting warning	Communications warning	Received commands are ignored.
95	Command warning	Communications warning	Received commands are ignored.
EC	WDC fault with drive	Communications alarm	Waits for power supply to be reset.
ED	Drive access permission fault (Access not possible 10 consecutive times)	Communications alarm	Waits for power supply to be reset.
EE	Drive monitor timer over (1 s elapsed)	Communications alarm	Waits for power supply to be reset. Received commands are ignored. <I>

<I> If the ERR indicator is not lit or flashing, any commands that are received will be ignored.

■ Drive Fault Notification

If a fault is detected in the drive, SI-T3 stores the alarm or warning code in the MECHATROLINK-II ALARM command and simultaneously turns ON the relevant bit in the STATUS field.

The following tables show the alarm codes for SI-T3 notification if a fault is detected in the drive.

Table 26 Drive Alarm Codes

ALRM Code (Hex)	Display		Description
02	<i>Uv1</i>	Uv1	Undervoltage
03	<i>Uv2</i>	Uv2	Control Power Supply Undervoltage
04	<i>Uv3</i>	Uv3	Soft Charge Circuit Fault
06	<i>GF</i>	GF	Ground Fault
07	<i>oC</i>	oC	Overcurrent
08	<i>ov</i>	ov	Overvoltage
09	<i>oH</i>	oH	Heatsink Overheat
0A	<i>oH1</i>	oH1	Heatsink Overheat
0B	<i>oL1</i>	oL1	Motor Overload
0C	<i>oL2</i>	oL2	Drive Overload
0D	<i>oL3</i>	oL3	Overtorque Detection 1
0E	<i>oL4</i>	oL4	Overtorque Detection 2
0F	<i>rr</i>	rr	Dynamic Braking Transistor
10	<i>rH</i>	rH	Dynamic Braking Resistor
11	<i>EF3</i>	EF3	External Fault (input terminal S3)
12	<i>EF4</i>	EF4	External Fault (input terminal S4)
13	<i>EF5</i>	EF5	External Fault (input terminal S5)
14	<i>EF6</i>	EF6	External Fault (input terminal S6)
15	<i>EF7</i>	EF7	External Fault (input terminal S7)
16	<i>EF8</i>	EF8	External Fault (input terminal S8)
18	<i>oS</i>	oS	Overspeed
19	<i>dEv</i>	dEv	Excessive Speed Deviation
1A	<i>PGo</i>	PGo	PG Disconnect
1B	<i>PF</i>	PF	Input Phase Loss
1C	<i>LF</i>	LF	Output Phase Loss
1D	<i>oH3</i>	oH3	Motor Overheat 1 (PTC input)
1E	<i>oPr</i>	oPr	Operator Connection Fault
1F	<i>Err</i>	Err	EEPROM Write Error
20	<i>oH4</i>	oH4	Motor Overheat 2 (PTC input)
21	<i>CE</i>	CE	MEMOBUS/Modbus Communication Error
22	<i>bUS</i>	bUS	Option Communication Error
25	<i>CF</i>	CF	Control Fault
26	<i>SvE</i>	SvE	Zero-Servo Fault
27	<i>EF0</i>	EF0	Option Card External Fault
28	<i>FbL</i>	FbL	PID Feedback Loss
29	<i>UL3</i>	UL3	Undertorque Detection 1
2A	<i>UL4</i>	UL4	Undertorque Detection 2
2B	<i>oL7</i>	oL7	High Slip Braking oL
32	<i>dv1</i>	dv1	Z Pulse Fall Detection
33	<i>dv2</i>	dv2	Z Pulse Noise Fault Detection
34	<i>dv3</i>	dv3	Inversion Detection

ALRM Code (Hex)	Display		Description
35	<i>dv4</i>	dv4	Inversion Prevention Detection
36	<i>LF2</i>	LF2	Output current imbalance
37	<i>STo</i>	STo	Motor Pull Out or Step Out Detection
38	<i>PGoH</i>	PGoH	PG Hardware Fault (when using PG-X3)
39	<i>E5</i>	E5	SI-T3 Watchdog Timer Error
3B	<i>SEr</i>	SEr	Too Many Speed Search Restarts
41	<i>FbH</i>	FbH	Excessive PID Feedback
42	<i>EF1</i>	EF1	External Fault (input terminal S1)
43	<i>EF2</i>	EF2	External Fault (input terminal S2)
44	<i>oL5</i>	oL5	Mechanical Weakening Detection 1
45	<i>UL5</i>	UL5	Mechanical Weakening Detection 2
46	<i>CoF</i>	CoF	Current Offset Fault
49	<i>dWFL</i>	dWFL	DriveWorksEZ Fault
4A	<i>dWF1</i>	dWF1	DriveWorksEZ EEPROM Fault
4D	<i>voF</i>	voF	Output Voltage Detection Fault
4E	<i>rF</i>	rF	Braking Resistor Fault
4F	<i>boL</i>	boL	Braking Transistor Overload Fault
52	<i>nSE</i>	nSE	Station Setup Fault
83	<i>CPF02</i>	CPF02	A/D Conversion Error
84	<i>CPF03</i>	CPF03	Control Board Connection Error
87	<i>CPF06</i>	CPF06	EEPROM Memory Data Error
88	<i>CPF07, CPF08</i>	CPF07, CPF08	Terminal Board Communication Error
89			
8C	<i>CPF11 to CPF21</i>	CPF11 to CPF21	Control Circuit Error
8D			
8E			
8F			
91			
92			
93			
94			
95			
96			
97	<i>CPF22</i>	CPF22	Hybrid IC Error
98	<i>CPF23</i>	CPF23	Control Board Connection Error
99	<i>CPF24</i>	CPF24	Drive Unit Signal Fault
9B	<i>CPF26 to CPF35</i>	CPF26 to CPF35	Control Circuit Error
9C			
9D			
9E			
9F			
A0			
A1			
A2			
A3			
A4			
FA	<i>oFA00 to oFA43</i>	oFA00 to oFA43	Option Card Error

Table 27 Drive Minor Fault and Alarm

ALRM Code (Hex)	Display		Description
01	<i>Uu</i>	Uv	Undervoltage
02	<i>ou</i>	ov	Overvoltage
03	<i>oH</i>	oH	Heatsink Overheat
04	<i>oH2</i>	oH2	Drive Overheat
05	<i>oL3</i>	oL3	Overtorque 1
06	<i>oL4</i>	oL4	Overtorque 2
07	<i>EF</i>	EF	Run Command Input Error
08	<i>bb</i>	bb	Drive Baseblock
09	<i>EF3</i>	EF3	External Fault (input terminal S3)
0A	<i>EF4</i>	EF4	External Fault (input terminal S4)
0B	<i>EF5</i>	EF5	External Fault (input terminal S5)
0C	<i>EF6</i>	EF6	External Fault (input terminal S6)
0D	<i>EF7</i>	EF7	External Fault (input terminal S7)
0E	<i>EF8</i>	EF8	External Fault (input terminal S8)
0F	<i>FAn</i>	FAn	Cooling Fan Error
10	<i>oS</i>	oS	Overspeed
11	<i>dEv</i>	dEv	Excessive Speed Deviation
12	<i>PGo</i>	PGo	PG Disconnect
14	<i>CE</i>	CE	MEMOBUS/Modbus Communication Error
15	<i>bUS</i>	bUS	Option Communication Error
1A	<i>EF0</i>	EF0	Option Card External Fault
1B	<i>rUn</i>	rUn	During Run 2, Motor Switch Command Input
1D	<i>CALL</i>	CALL	Serial Communication Transmission Error
1E	<i>UL3</i>	UL3	Undertorque 1
1F	<i>UL4</i>	UL4	Undertorque 2
20	<i>SE</i>	SE	MEMOBUS/Modbus Communication Test Mode Error
22	<i>oH3</i>	oH3	Motor Overheat
27	<i>FbL</i>	FbL	PID Feedback Loss
28	<i>FbH</i>	FbH	Excessive PID Feedback
2A	<i>dnE</i>	dnE	Drive Disabled
2B	<i>PGoH</i>	PGoH	PG Hardware Fault (when using PG-X3)
31	<i>E5</i>	E5	SI-T3 Watchdog Timer Error
32	<i>AEr</i>	AEr	SI-T3 Station Address Setting Error
33	<i>CyC</i>	CyC	SI-T3 Transmission Cycle Error
34	<i>HCA</i>	HCA	Current Alarm
35	<i>LT-1</i>	LT-1	Cooling Fan Maintenance Time
36	<i>LT-2</i>	LT-2	Capacitor Maintenance Time
39	<i>EF1</i>	EF1	External Fault (input terminal S1)
3A	<i>EF2</i>	EF2	External Fault (input terminal S2)
3B	<i>HbbF</i>	HbbF	Safe Disable Signal Input
3C	<i>Hbb</i>	Hbb	Safe Disable Signal Input
3D	<i>oL5</i>	oL5	Mechanical Weakening Detection 1
3E	<i>UL5</i>	UL5	Mechanical Weakening Detection 2
41	<i>voF</i>	voF	Output Voltage Detection Fault
42	<i>TrPC</i>	TrPC	IGBT Maintenance Time (90%)
43	<i>LT-3</i>	LT-3	Soft Charge Bypass Relay Maintenance Time

ALRM Code (Hex)	Display		Description
44	<i>LT-4</i>	LT-4	IGBT Maintenance Time (50%)
45	<i>boL</i>	boL	Breaking Transistor Overload Fault
49	<i>dWAL</i>	dWAL	DriveWorksEZ Alarm

◆ Drive-Side Error Codes

Drive-side error codes appear on the drive’s operator. Causes of the errors and corrective actions are listed in [Table 28](#). For additional error codes that may appear on the operator screen, refer to the technical manual for the drive the MECHATROLINK-II Option is connected to.

■ Faults

Both bUS (MECHATROLINK-II Option Communication Error), EF0 (External Fault Input from the MECHATROLINK-II Option) and E5 (SI-T3 Watchdog Timer Error) can appear as an alarm or as a fault. When a fault occurs, the digital operator ALM LED remains. When an alarm occurs, the digital operator ALM LED flashes.

If communication stops while the drive is running, answer the following questions to help remedy the fault:

- Is the MECHATROLINK-II Option properly installed?
- Is the communication line properly connected to the MECHATROLINK-II Option? Is it loose?
- Is the PLC program working? Has the PLC CPU stopped?
- Did a momentary power loss interrupt communications?

Table 28 Fault Display and Possible Solutions

Operator Display		Fault Name
bUS	bUS	MECHATROLINK-II Option Communication Error
		After establishing initial communication, the connection was lost. Only detected when the run command or frequency reference is assigned to the option (b1-03 = 3 or b1-02 = 3).
Cause		Possible Solution
Master controller (PLC) has stopped communicating.		Check for faulty wiring. ⇒ Correct any wiring problems.
Communication cable is not connected properly.		
A data error occurred due to noise		Check the various options available to minimize the effects of noise. ⇒ Take steps to counteract noise in the control circuit wiring, main circuit lines, and ground wiring. ⇒ If a magnetic contactor is identified as a source of noise, install a surge absorber to the contactor coil. ⇒ Use cables specified.
MECHATROLINK-II Option is damaged.		⇒ If there are no problems with the wiring and the error continues to occur, replace the MECHATROLINK-II Option.
Operator Display		Fault Name
E5	E5	SI-T3 Watchdog Timer Error
		The watchdog has timed out.
Cause		Possible Solution
Data has not been received from the PLC, triggering the watchdog timer.		⇒ Execute DISCONNECT or ALM_CLR, then issue a CONNECT command or SYNC_SET command and proceed to phase 3.
Operator Display		Fault Name
EF0	EF0	External Fault Input from MECHATROLINK-II Option
		The alarm function for an external device has been triggered.
Cause		Possible Solution
An external fault is being sent from the master controller (PLC).		⇒ Remove the cause of the external fault. ⇒ Reset the external fault input from the PLC device.
Problem with the PLC program		⇒ Check the program used by the PLC and make the appropriate corrections.
Operator Display		Fault Name
oFA00	oFA00	MECHATROLINK-II Option Fault (CN5-A)
		MECHATROLINK-II Option is not properly connected.
Cause		Possible Solution
Non-compatible option connected to the drive		⇒ Connect an option that is compatible with the drive.
Operator Display		Fault Name
oFA01	oFA01	MECHATROLINK-II Option Fault (CN5-A)
		MECHATROLINK-II Option is not properly connected.
Cause		Possible Solution
Problem with the connectors between the drive and MECHATROLINK-II Option		⇒ Turn the power off and check the connectors between the drive and MECHATROLINK-II Option.

Operator Display		Fault Name
<i>oFA30</i> to <i>oFA43</i>	oFA30 to oFA43	MECHATROLINK-II Option Fault (CN5-A) Communication ID error
Cause		Possible Solution
MECHATROLINK-II Option hardware fault		⇒ Replace the MECHATROLINK-II Option. Contact Yaskawa for assistance.
Operator Display		Fault Name
<i>oFb00</i>	oFb00	MECHATROLINK-II Option Fault (CN5-B) Non-compatible option card is connected.
Cause		Possible Solution
Non-compatible option connected to the drive.		⇒ Connect the correct option card to CN5-A.
Operator Display		Fault Name
<i>oFb02</i>	oFb02	MECHATROLINK-II Option Fault (CN5-B) Two of the same option cards are connected at the same time.
Cause		Possible Solution
Option cards AI-A3 or DI-A3 were connected to the CN5-B port while an option card was already connected to CN5-A.		⇒ Only one type of option input card AI-A3 or DI-A3 can be connected to the drive. Only this option card for MECHATROLINK-II can be connected to CN5-A.
Operator Display		Fault Name
<i>oFc00</i>	oFc00	MECHATROLINK-II Option Fault (CN5-C) Non-compatible option card is connected.
Cause		Possible Solution
Non-compatible option connected to the drive.		⇒ Connect the correct option card to CN5-A.
Operator Display		Fault Name
<i>oFc02</i>	oFc02	MECHATROLINK-II Option Fault (CN5-C) Two of the same option cards are connected at the same time.
Cause		Possible Solution
Option cards AI-A3 or DI-A3 were connected to the CN5-C port while an option card was already connected to CN5-A.		⇒ Only one type of option input card AI-A3 or DI-A3 can be connected to the drive. Only this option card for MECHATROLINK-II can be connected to CN5-A.

■ Minor Faults and Alarms

Operator Display		Minor Fault Name	
<i>AEr</i>	AEr	Station Address Error MECHATROLINK-II Option is set to an address outside the allowable setting range.	
Cause		Possible Solution	Minor Fault (H2-□□ = 10)
Address outside the specified address range		⇒ Set F6-20 to an address within the specified range.	YES
Operator Display		Minor Fault Name	
<i>CALL</i>	CALL	Serial Communication Transmission Error Communication has not yet been established.	
Cause		Possible Solution	Minor Fault (H2-□□ = 10)
Communication wiring is faulty, there is a short circuit, or something is not connected properly.		Check for wiring errors. ⇒ Correct the wiring. ⇒ Remove and ground shorts and reconnect loose wires.	YES
Programming error on the master side		⇒ Check communications at start-up and correct programming errors.	
Communication circuitry is damaged.		Perform a self-diagnostics check. ⇒ Replace the drive if the fault continues to occur.	YES

10 Specifications

◆ Specifications

Table 29 Option Specifications

Items	Specifications
Model	SI-T3
Access mode	Start-stop synchronization, master/slave method
Communication Speed	10 Mbps (MECHATROLINK-II), 4 Mbps (MECHATROLINK-I)
Transmission cycle	500 μs to 8 ms <1>
Maximum transmission distance	50 m <2>
Minimum wiring distance between stations	0.5 m
Data length	17-byte data transmission or 32-byte data transmission <3>
Maximum number of stations	30 <4>
Ambient Temperature	-10°C to +50°C
Humidity	up to 95% RH (no condensation)
Storage Temperature	-20°C to +60°C (allowed for short-term transport of the product)
Area of Use	Indoors (free of corrosive gas, airborne particles, etc.)
Altitude	Up to 1000 m

<1> For MECHATROLINK-I, a cycle is 2 ms.

For MECHATROLINK-II, a cycle is 1 ms to 8 ms for a 32-byte data transmission, and 500 μs to 8 ms for a 17-byte data transmission.

<2> At the maximum transmission distance of 50 m, the maximum number of stations is 15.

<3> For MECHATROLINK-I, only a 17-byte data transmission can be selected.

<4> The maximum number of connectable stations changes depending on the types and settings of the host controller, baud rate, or communications cycle. For details, refer to the manuals of your controller.

Communications cycle: Integral multiple of transmission cycles (depending on the host controller settings).

Example: If the host controller is an MP2300

· For MECHATROLINK-II (32-byte transmission, 2.0 ms communications cycle): 21 stations max. (21 stations can be set, but then the maximum number of connectable drives will be 16.)

· For MECHATROLINK-II (32-byte transmission, 1.0 ms communications cycle): 9 stations max.

· For MECHATROLINK-II (17-byte transmission, 1.0 ms communications cycle): 15 stations max.

· For MECHATROLINK-I: 14 stations max.

◆ Revision History

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

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Errata

Listed below are corrections for the MECHATROLINK-II (SI-T3) Technical Manual (SIEP C730600 50A). Please correct your manual accordingly.

(1) MECHATROLINK-II Commands CONNECT:0EH(Connect) MECHATROLINK-II (VER=21H) (p.23)

(ERROR)

When the transmission cycle is equal to the communications time (COM_TIM = 1):

- 32-byte data transmission
 $1 \text{ [ms]} \leq \text{transmission cycle [ms]} \leq 8 \text{ [ms]}$
If the transmission cycle is set to a fractional value, a warning (Data setting warning: A.94) is generated.
- 17-byte data transmission
 $0.5 \text{ [ms]} \leq \text{transmission cycle [ms]} \leq 8 \text{ [ms]}$
If the transmission cycle is not set to a multiple of 0.5 ms, such as 0.75, a warning (Data setting warning: A.94) is generated.

When the transmission cycle is not equal to the communications time ($1 < \text{COM_TIM} \leq 32$):

$$2 \text{ [ms]} \leq \text{transmission cycle [ms]} \times \text{COM_TIM} \leq 100 \text{ [ms]}$$

If the transmission cycle is less than 2 ms and is set to a fractional value, a warning (Data setting warning: A.94) is generated. If the communications cycle is set to a fractional value, a warning (Data setting warning: A.94) is generated.

(CORRECTION)

When the transmission cycle is equal to the communications time (COM_TIM = 1):

- 32-byte data transmission
 $1 \text{ [ms]} \leq \text{transmission cycle [ms]} \leq 8 \text{ [ms]}$
If the transmission cycle is set to a fractional value, a warning (Data setting warning: A.94) is generated.
- 17-byte data transmission
 $0.5 \text{ [ms]} \leq \text{transmission cycle [ms]} \leq 8 \text{ [ms]}$
If the transmission cycle is not set to a multiple of 0.5 ms, such as 0.75, a warning (Data setting warning: A.94) is generated.

When the transmission cycle is not equal to the communications time ($\text{COM_TIM} \neq 1$):

A warning (Data setting warning: A.94) is generated.

(2) MECHATROLINK-II Commands CONNECT:0EH(Connect) MECHATROLINK-I (VER=10H) (p.24)

(ERROR)

COM_TIM

In MECHATROLINK-I, COM_TIM was set in multiples of two because the units for COM_TIM were 1 = 1 ms and transmission cycles were fixed at 2 ms.

$$2 \text{ [ms]} \leq \text{COM_TIM} \leq 64 \text{ [ms]}$$

When transferring data in 2 ms cycles, set COM_TIM = 2. To use 4 ms cycles, set COM_TIM = 4.

In the following cases, a warning is generated and the command is ignored. Commands are also ignored in phase 2 (with no alarm).

- If COM_TIM is set out of range: Data setting warning (A.94)

(CORRECTION)

COM_TIM

In MECHATROLINK-I, COM_TIM = 2 the units for COM_TIM were 1 = 1 ms and transmission cycles were fixed at 2 ms.

If COM_TIM \neq 2: Data setting warning (A.94)