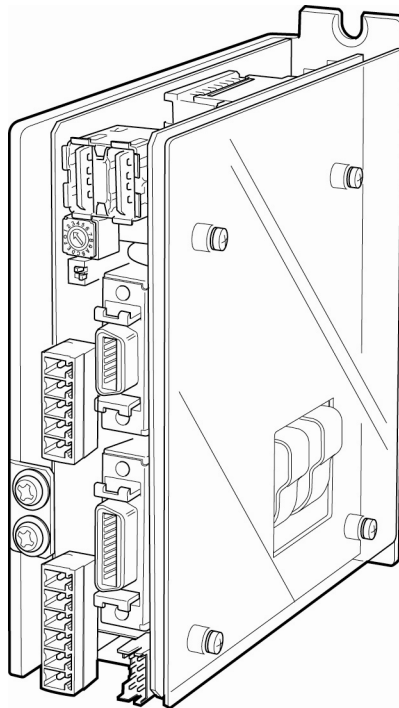


# Harmonic Drive<sup>®</sup>

AC Servo Driver for  
24 VDC Power Supply

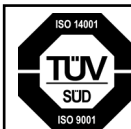
## **HA-680ML Series Manual**

( For FHA-8C, 11C, 14C/RSF-3B, 5A, 8B, 11B, and 14B )



This manual covers the following software versions:

Ver 1.x



ISO14001  
(Hotaka plant)  
ISO9001

# Introduction

Thank you very much for purchasing our AC Servo Driver HA-680ML series for DC24V power supply. Wrong handling or use of this product may result in unexpected accidents or shorter life of the product. Read this document carefully and use the product correctly so that the product can be used safely for many years.

Product specifications are subject to change without notice for improvement purposes.

Keep this manual in a convenient location and refer to it whenever necessary in operating or maintaining the units.




The end user of the driver should have a copy of this manual.

# SAFETY GUIDE

To use this driver safely and correctly, be sure to read SAFETY GUIDE and other parts of this document carefully and fully understand the information provided herein before using the driver.

## NOTATION

Important safety information you must note is provided herein. Be sure to observe these instructions.


 <b>WARNING</b>	Indicates a potentially hazardous situation, which, if not avoided, could result in death or serious personal injury.
 <b>CAUTION</b>	Indicates a potentially hazardous situation, which, if not avoided, may result in minor or moderate personal injury and/or damage to the equipment.
 <b>Caution</b>	Indicates what should be performed or avoided to prevent non-operation or malfunction of the product or negative effects on its performance or function.

## LIMITATION OF APPLICATIONS

The equipment listed in this document may not be used for the applications listed below:

- Space equipment
- Aircraft, aeronautic equipment
- Nuclear equipment
- Household apparatus
- Vacuum equipment
- Automobile, automotive parts
- Amusement equipment, sport equipment, game machines
- Machine or devices acting directly on the human body
- Instruments or devices to transport or carry people
- Apparatus or devices used in special environments

If the above list includes your intending application for our products, please consult us.

 <b>CAUTION</b>	<p><b>Safety measures are essential to prevent accidents resulting in death, injury or damage of the equipment due to malfunction or faulty operation.</b></p>
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## SAFETY NOTE

### ● CAUTIONS FOR ACTUATORS AT APPLICATION DESIGNING



**Always use under followings conditions:**

The actuator is designed to be used indoors. Observe the following conditions:

- Ambient temperature: 0°C to 40°C
- Ambient humidity: 20% to 80%RH (Non-condensation)
- Vibration: Max 24.5 m/S<sup>2</sup>
- No contamination by water, oil
- No corrosive or explosive gas

**Follow exactly the instructions in the relating manuals to install the actuator in the equipment.**

- Ensure exact alignment of motor shaft center and corresponding center in the application.
- Failure to observe this caution may lead to vibration, resulting in damage of output elements.

### ● CAUTION FOR ACTUATORS IN OPERATIONS



**Never connect cables directly to a power supply socket.**

- Each actuator must be operated with a proper driver.
- Failure to observe this caution may lead to injury, fire or damage of the actuator.

**Do not apply impacts and shocks.**

- Do not use a hammer during installation.
- Failure to observe this caution could damage the encoder and may cause uncontrollable operation.

**Avoid handling of actuators by cables.**

- Failure to observe this caution may damage the wiring, causing uncontrollable or faulty operation.

**● CAUTIONS FOR DRIVERS AT APPLICATION DESIGNING****Always use drivers under followings conditions:**

- Mount in a vertical position keeping sufficient distance to other devices to let heat generated by the driver radiate freely.
- 0°C to 50°C, 95% RH or below (Non condensation)
- No vibration or physical shock
- No corrosive, inflammable or explosive gas

**Use sufficient noise suppressing means and safe grounding.**

- Keep signal and power leads separated.
- Keep leads as short as possible.
- Ground actuator and driver at one single point, minimum ground resistance class: D (less than 100 ohms)
- Do not use a power line filter in the motor circuit.

**Pay attention to negative torque by inverse load.**

- Inverse load may cause damages of drivers.
- Please consult our sales office, if you intent to apply products for inverse load.

**Use a fast-response type ground-fault detector designed for PWM inverters.**

- Do not use a time-delay-type ground-fault detector.

**Safety measures are essential to prevent accidents resulting in death, injury or damage of the equipment due to malfunction or faulty operation.**

**● CAUTION FOR DRIVERS IN OPERATIONS****Never change wiring while power is active.**

**Make sure of power non-active before servicing the products. Failure to observe this caution may result in electric shock or personal injury.**

**Do not touch terminals or inspect products at least 15 minutes after turning OFF power.**

- Otherwise residual electric charges may result in electric shock. In order to prevent electric shock, perform inspections 15 minutes after the power supply is turned OFF and confirming the CHARGE lamp is turned OFF.
- Make installation of products not easy to touch their inner electric components.



**Do not make a voltage resistance test.**

- Failure to observe this caution may result in damage of the control unit.
- Please consult our sales office, if you intent to make a voltage resistance test.

**Do not operate control units by means of power ON/OFF switching.**

- Start/stop operation should be performed via input signals.
- Failure to observe this caution may result in deterioration of electronic parts.

**DISPOSAL OF AN ACTUATOR, A MOTOR, A CONTROL UNIT AND/OR THEIR PARTS**



**All products or parts have to be disposed of as industrial waste.**

Since the case or the box of drivers have a material indication, classify parts and dispose them separately.

**CAUTIONS FOR DRIVERS AT APPLICATION****● DESIGNING****CAUTION****Always use drivers under followings conditions:**

The driver generates heat. Use the driver under the following conditions by paying due attention to radiation:

- Mount in a vertical position keeping sufficient distance to other devices to let heat generated by the driver radiate freely.
- 0°C to 50°C, 95% RH or below (Non condensation)
- No vibration or physical shock
- No corrosive, inflammable or explosive gas

**Use sufficient noise suppressing means and safe grounding.**

Any noise generated on a signal wire will cause vibration or improper motion. Be sure to observe the following conditions.

- Keep signal and power leads separated.
- Keep leads as short as possible.
- Ground motor and driver at one single point, minimum ground resistance class: D (less than 100 ohms)
- Do not use a power line filter in the motor circuit.

**Pay attention to negative torque by inverse load.**

- Inverse load may cause damages of drivers.  
Please consult our sales office, if you intent to apply products for inverse load.

**Use a fast-response type ground-fault detector designed for PWM inverters.**

Do not use a time-delay-type ground-fault detector.

**Safety measures are essential to prevent accidents resulting in death, injury or damage of the equipment due to malfunction or faulty operation.**

**● CAUTION FOR DRIVERS IN OPERATIONS****CAUTION****Never change wiring while power is active.**

Make sure of power non-active before servicing the products. Failure to observe this caution may result in electric shock or personal injury.

**Do not touch terminals or inspect products at least 5 minutes after turning OFF power.**

- Even after the power supply is turned OFF, electric charge remains in the driver. In order to prevent electric shock, perform inspections 5 minutes after the power supply is turned OFF.
- Make installation of products not easy to touch their inner electric components.

**Do not use a power supply other than DC24V.**

- The driver may be damaged or burnt.



**Do not make a voltage resistance test.**

- Failure to observe this caution may result in damage of the control unit.  
Please consult our sales office, if you intent to make a voltage resistance test.

**Do not operate control units by means of power ON/OFF switching.**

- Start/stop operation should be performed via input signals.
- Failure to observe this caution may result in deterioration of electronic parts.

**DISPOSAL OF AN ACTUATOR, A MOTOR, A CONTROL UNIT AND/OR THEIR PARTS**



**All products or parts have to be disposed of as industrial waste.**

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## Related manual

The table below lists related manual. Check each item as necessary.

Title	Description
AC Servo Actuator FHA-Cmini series manual	The specifications and characteristics of FHA-8C to FHA-14C actuators are explained.
AC Servo Actuator RSFsupermini series manual	The specifications and characteristics of RSF-3B and RSF-5A actuators are explained.
AC Servo Actuator RSF-Bmini series manual	The specifications and characteristics of RSF-8B to RSF-14B actuators are explained.

# Chapter 1

## Overview of drivers

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This chapter explains the features, functions and specifications of the driver.

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## 1-1 Main features

The AC Servo Driver HA-680ML for DC24V power supply is a dedicated MECHATROLINK driver designed to drive: the ultra-thin/hollow shaft structure 24-V actuator FHA-C mini combining a ultra-thin/speed reducer harmonic drive<sup>®</sup> for precision control and flat AC servo motor; the ultra-small AC Servo Actuator RSF supermini series combining an ultra-small HarmonicDrive<sup>®</sup> and ultra-small AC servo motor; and the RSF-B series.

The HA-680ML drivers provide many superior functions to allow the 24-V FHA-C mini type, RSF supermini series, and RSF-B series to excel in performance.

### Small and compact design

With the available MECHATROLINK communication function, the HA-680ML driver is as slim as our standard 24-VDC input driver. It is also an ultra-light design, weighing just 260 g, so it can help for size reduction of an equipment and space-saving.

### Full set of functions

Conforming to MECHATROLINK II, the HA-680ML driver supports commands recommended by the MECHATROLINK Members Association.

### Simple function settings by PC

Parameters can be set and changed easily on a PC via EIA232 communication using the dedicated communication software PSF-520.

### Displaying many information on operating status

You can use the dedicated communication software PSF-520 to monitor the I/O signals, rotation speed, deviation, etc.

You can also easily diagnose errors, should they occur, because up to 8 most recent alarm history can be displayed.

### Separate main circuit power and control circuit power

The control circuit power is separate from the main circuit power, which allows for safe diagnosis in the event of an error.

### Electronic gears appropriate for mechanical systems

The electronic gear function lets you adjust the feed pitch of your servo system to the unit of reduction ratio/feed mechanism of the load machine.

### Regenerative circuit provided as standard

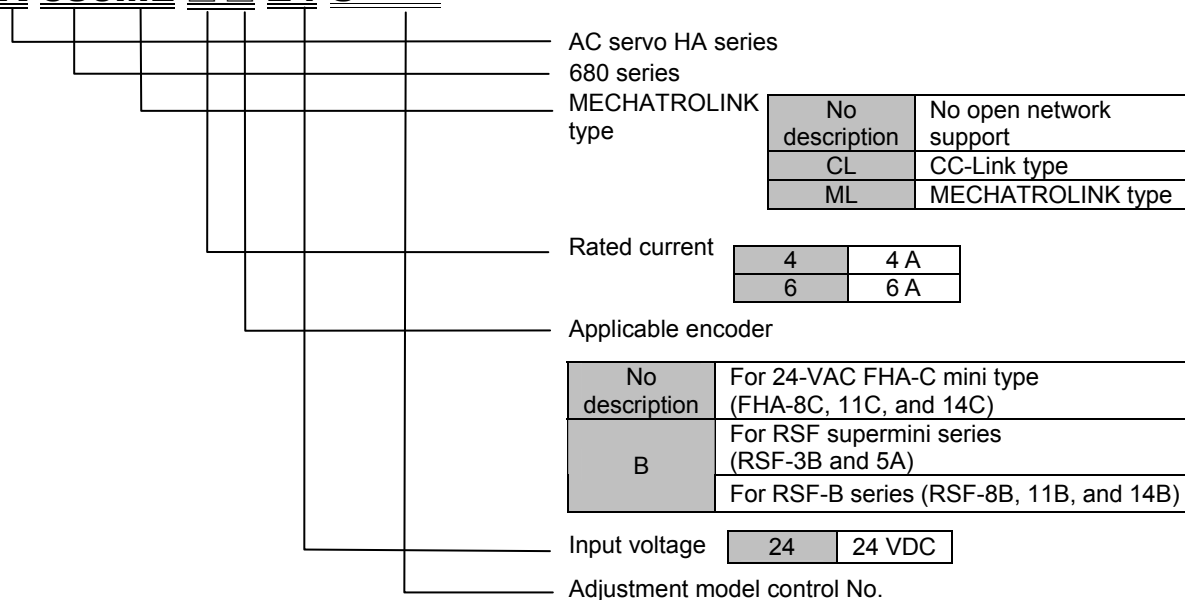
A regenerative circuit is provided as standard with the driver, so you can use it in applications requiring large inertia moments without worrying about regeneration.

## 1-2 Model of HA-680ML driver

Model names for the HA-680ML drivers and how to read the symbols are explained below.

Take note that the model varies depending on the actuator used.

**HA-680ML-□□-24-S●●●**



Adjustment model control No. and list of applicable actuators

Adjustment model control No.	Driver	Adjustment models	Actuator code
S000	HA-680ML-4-24	FHA-8C-30-E200-CE	6254
S001		FHA-8C-50-E200-CE	6255
S002		FHA-8C-100-E200-CE	6256
S003		FHA-11C-30-E200-CE	6454
S004		FHA-11C-50-E200-CE	6455
S005		FHA-11C-100-E200-CE	6456
S006	HA-680ML-6-24	FHA-14C-30-E200-CE	6654
S007		FHA-14C-50-E200-CE	6655
S008		FHA-14C-100-E200-CE	6656
S018	HA-680ML-4B-24	RSF-3B-30-E020-C	7809
S019		RSF-3B-50-E020-C	7819
S020		RSF-3B-100-E020-C	7829
S012	HA-680ML-4B-24	RSF-5A-30-E050-C	7739
S013		RSF-5A-50-E050-C	7749
S014		RSF-5A-100-E050-C	7759
S015		RSF-5A-30-E050-BC	7769
S016		RSF-5A-50-E050-BC	7779
S017		RSF-5A-100-E050-BC	7789

Adjustment model control No.	Driver	Adjustment models	Actuator code
S021	HA-680ML-4B-24	RSF-8B-30-F100-24B-C	7001
S022		RSF-8B-50-F100-24B-C	7011
S023		RSF-8B-100-F100-24B-C	7021
S024	HA-680ML-6B-24	RSF-11B-30-F100-24B-C	7031
S025		RSF-11B-50-F100-24B-C	7041
S026		RSF-11B-100-F100-24B-C	7051
S027		RSF-14B-30-F100-24B-C	7061
S028		RSF-14B-50-F100-24B-C	7071
S029		RSF-14B-100-F100-24B-C	7081

## Option

- **Extension cable: For 24-VAC FHA-C mini type (option)**

	For HA-680
For motors	EWC-MB** - A06 – TN2
For encoders	EWC-E** - M06 - 3M14

\*\* indicates the cable length; 03: 3m, 05: 5m, 10: 10m (Select a desired length from the following 3 types.)

- **Extension cable: For RSF supermini series (option)**

\* Required when connecting the actuator and driver.

	For HA-680
For motors	EWA-M** - JST04 – TN2
For encoders	EWA-E** - M09 - 3M14

\*\* indicates the cable length; 03: 3m, 05: 5m, 10: 10m (Select a desired length from the following 3 types.)

- **Extension cable: For RSF-B mini series (option)**

\* Required when connecting the actuator and driver.

	For HA-680
For motors	EWC-MB** - A06 - TN2
For encoders + pole sensors	EWB-F** - M0809 - 3M14

\*\* indicates the cable length; 03: 3m, 05: 5m, 10: 10m (Select a desired length from the following 3 types.)

- **Connector (option): CNK-HA68ML-S1/CNK-HA68ML-S2**

- **Communication cable**

For EIA-232: HDM-RS232C (cable length: 1.5m)

- **Dedicated communication software (provided free of charge)**

PSF-520 All parameters are set and changed using this dedicated communication software PSF-520.

You can download the dedicated communication software PSF-520 from our web site [<http://www.hds.co.jp/>]. If you do not have the necessary environment to download the software, contact our sales office.

# 1-3 Actuator combinations

HA-680ML drivers are available in following models having different rated output current and input voltage. Combinations of HA-680ML drivers and actuators are specified below.

Model	Actuator model
HA-680ML-4-24-S000	FHA-8C-30-E200-CE
HA-680ML-4-24-S001	FHA-8C-50-E200-CE
HA-680ML-4-24-S002	FHA-8C-100-E200-CE
HA-680ML-4-24-S005	FHA-11C-30-E200-CE
HA-680ML-4-24-S004	FHA-11C-50-E200-CE
HA-680ML-4-24-S005	FHA-11C-100-E200-CE
HA-680ML-6-24-S006	FHA-14C-30-E200-CE
HA-680ML-6-24-S007	FHA-14C-50-E200-CE
HA-680ML-6-24-S008	FHA-14C-100-E200-CE

Model	Actuator model
HA-680ML-4B-24-S018	RSF-3B-30-E020-C
HA-680ML-4B-24-S019	RSF-3B-50-E020-C
HA-680ML-4B-24-S020	RSF-3B-100-E020-C
HA-680ML-4B-24-S012	RSF-5A-30-E020-C
HA-680ML-4B-24-S013	RSF-5A-50-E020-C
HA-680ML-4B-24-S014	RSF-5A-100-E020-C
HA-680ML-4B-24-S015	RSF-5A-30-E020-BC
HA-680ML-4B-24-S016	RSF-5A-50-E020-BC
HA-680ML-4B-24-S017	RSF-5A-100-E020-BC

Model	Actuator model
HA-680ML-4B-24-S021	RSF-8B-30-F100-24B-C
HA-680ML-4B-24-S022	RSF-8B-50-F100-24B-C
HA-680ML-4B-24-S023	RSF-8B-100-F100-24B-C
HA-680ML-6B-24-S024	RSF-11B-30-F100-24B-C
HA-680ML-6B-24-S025	RSF-11B-50-F100-24B-C
HA-680ML-6B-24-S026	RSF-11B-100-F100-24B-C
HA-680ML-6B-24-S027	RSF-14B-30-F100-24B-C
HA-680ML-6B-24-S028	RSF-14B-50-F100-24B-C
HA-680ML-6B-24-S029	RSF-14B-100-F100-24B-C

# 1-4 Ratings and specifications of HA-680ML driver

Driver model		HA-680ML-4 -24-S●●●		HA-680ML-6 -24-S●●●	HA-680ML-4B-24-S●●●			HA-680ML-6B -24-S●●●	
Item		FHA-8C	FHA-11C	FHA-14C	RSF-3B	RSF-5A	RSF-8B	RSF-11B	RSF-14B
Combined actuator		FHA-8C	FHA-11C	FHA-14C	RSF-3B	RSF-5A	RSF-8B	RSF-11B	RSF-14B
Allowable continuous current (Arms) <small>Note 2</small>		1.8	3.9	6.0	0.65	2.0	2.0	5.0	4.9
Instantaneous max. current (Arms) <small>Note 2</small>		3.4	8.4	16.5	1.2	3.9	3.9	15.8	17.2
Supply voltage	Control circuit power (CP)	24VDC (20 to 28V)							
	Main circuit power (MP)	24VDC (20 to 28V)							
Control method		Sinusoidal PWM control Switching frequency 12.5kHz							
Encoder		4-wire specification Serial transmission method Line driver input			14-wire specification Line driver input		18-wire specification Line driver input		
Pole sensor		—————			—————		8-wire specification Line driver input		
Input/output signal		DI: 5 points (insulated by opt-isolators) DO: 4 points (insulated by opt-isolators)							
Encoder monitor		Phase-A, B, Z line driver output							
Display		Driver status monitor: LED 2 points (green: 1 point, red: 1 point), power-ON, servo-ON, alarm MECHATROLINK module: LED 3 points (green: 2 points, red: 1 point), communication error, sending/receiving data							
Protective functions		Overload, excessive deviation, encoder break detection, encoder receiving error, UVW error, regenerative failure, operating temperature error, system error, overcurrent, load short circuit, memory failure, overspeed							
Connector		I/O :3M half-pitch 20-pin Encoder :3M half-pitch 14-pin RS-232C :Small-type 8-pin MECHATROLINK :USB-type connector (specified by MECHATROLINK)							
Regenerative absorption circuit		Incorporated (with external capacitor/resistor installation terminal) The incorporated resistor comes with a fuse.							
Structure		Semi-cover type (with aluminum base, plastic cover)							
Installation method		Base mount (wall installation)							
Mass		260 g							
Allowed environment		Operating temperature: 0 to 50°C Storage temperature: -20 to 85°C Operating humidity/storage humidity: 95%RH or less (no condensation) No vibration or physical shock No dust, metal powder, corrosive gas, inflammable gas, or oil mist. No water or oil splashed. To be used indoors, no direct sunlight.							

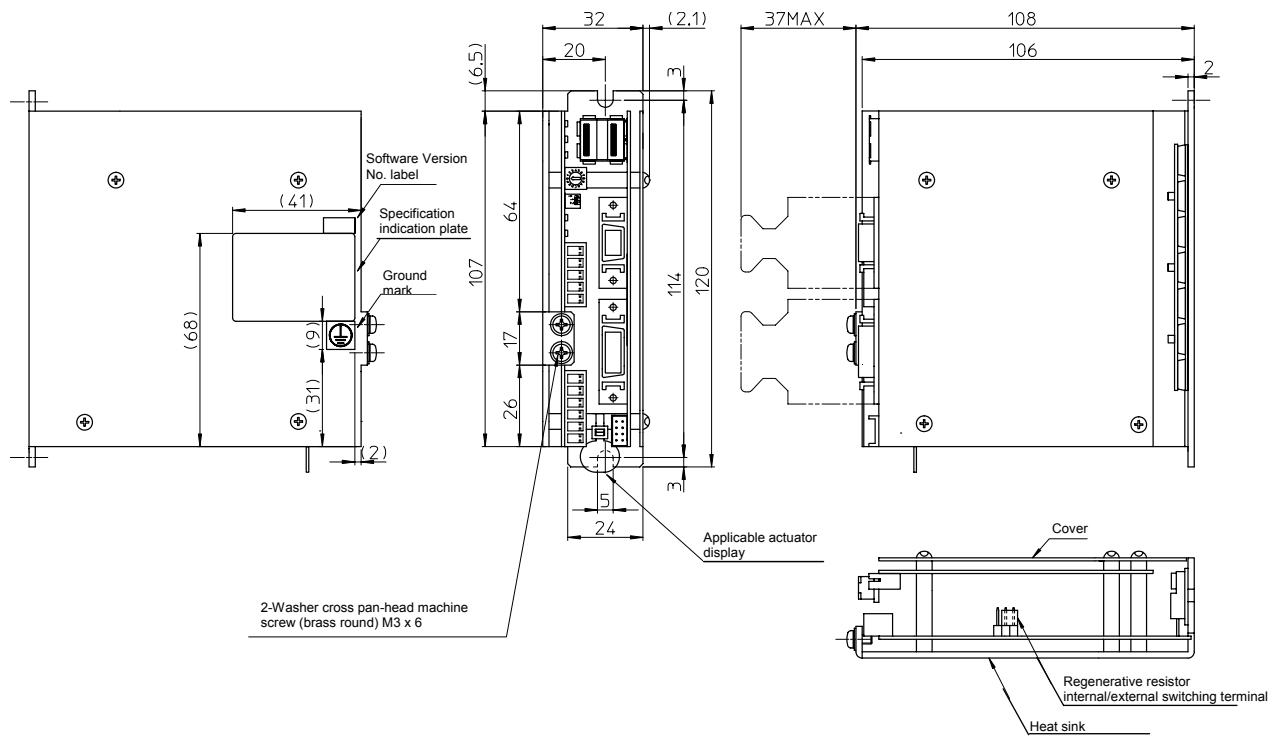
Note 1: This driver sets parameters in accordance with the combined actuator. It cannot be used with any actuators other than the one that has been set.

Note 2: This value may be limited depending on the combined actuator.

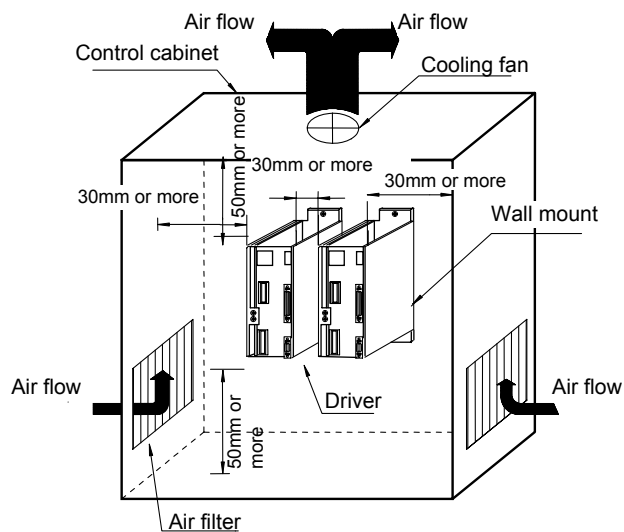
# 1-5 External drawing of HA-680ML driver

The external dimensions of the HA-680ML driver are shown below.

Unit: mm  
Mass: 260 g



When installing the HA-680ML driver inside a control cabinet, provide enough space for cooling as shown below.



# 1-6 Name and function of each part

**LED display 2**

These LEDs indicate the status of the MECHATROLINK line.

**Station address setting switch**

This switch is used to set the MECHATROLINK station address.

**Transfer-byte selector switch**

This switch is used to change the number of data bytes transferred via MECHATROLINK.

**LED display 1**

The operating status of the HA-680ML driver is indicated by green and red LEDs.

**TB2: Power supply connection terminal**

This terminal is used to supply power. The pins are divided into those for the control circuit power and others for the main circuit power.

**Ground connection terminal**

This terminal is used to connect to ground. Be sure to connect a ground wire to this terminal to prevent electric shock.

**TB1: Actuator, terminals for connecting external regenerative resistor**

Connect the actuator lead lines and external regenerative resistor.

**CN4: MECHATROLINK communication connector**

This connector is used for MECHATROLINK communication. Be sure to use the cable specified by the MECHATROLINK Members Association. Never use any commercial USB cable. For details, refer to the MECHATROLINK Members Association's web site [<http://www.mechatrolink.org/>].

**CN1: Encoder connector**

Connect the encoder cable used for actuator position detection.

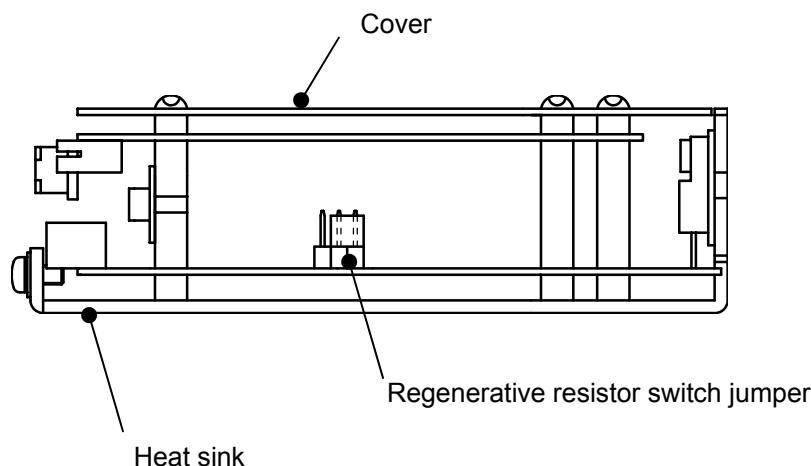
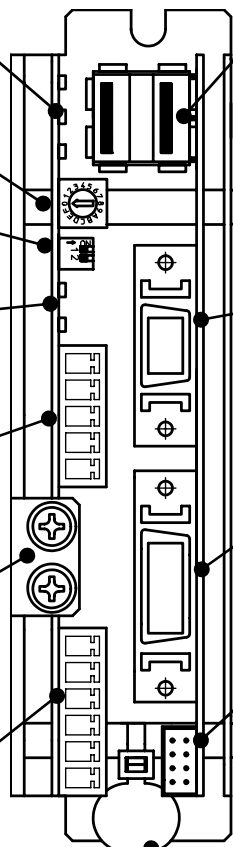
**CN2: I/O connector**

This connector is used to communicate with the host controller.

**CN3: Serial port connector 1**

This connector is used to connect PSF-520. It is used to monitor the output current and set various parameters. The dedicated communication cable HDM-RS232C is required to connect to a PC. The dedicated communication software PSF-520 is required to set various parameters.

**Applicable actuator display tag**



# 1-7 Connector pin layout

## TB2: Power supply connection terminal

Pin No.	Signal name	Explanation
1	CP+	Control circuit power+ (+24VDC)
2	CP-	Control circuit power- (0V)
3	MP+	Main circuit power+ (+24VDC)
4	MP-	Main circuit power- (0V)
5	NC	Do not connect.

For details, refer to 3-5.

## TB1: Actuator connection terminal

Pin No.	Signal name	Explanation
1	VM	External capacitor connection terminal
2	R	Terminals for connecting external regenerative resistor
3	GND	External capacitor, regenerative resistor connection terminal
4	U	Actuator U-side connection terminal
5	V	Actuator V-side connection terminal
6	W	Actuator W-side connection terminal

For details, refer to 3-8.

For details, refer to 3-7.

## CN1: Encoder connector

### (1) 24-VDC FHA-C mini type actuator

Pin No.	Signal name	Explanation
1	Vcc	The +5V power supply to the encoder is used to supply power from inside the servo amplifier.
2	NC	Do not connect.
3		
4		
5		
5	SD+	Encoder data input terminal+ (LD)
6	NC	Do not connect.
7	SD-	Encoder data input terminal- (LD)
8	GND	This is a common terminal of the +5V power supply to the encoder.
9	NC	Do not connect.
10		
11		
12		
13		
14		

### (2) RSF supermini series actuator

Pin No.	Signal name	Explanation
1	Vcc	The +5V power supply to the encoder is used to supply power from inside the servo amplifier.
2	B+	Phase-B signal input+ (LD)
3	Z+	Phase-Z signal input+ (LD)
4	B-	Phase-B signal input- (LD)
5	A+	Phase-A signal input+ (LD)
6	Z-	Phase-Z signal input- (LD)
7	A-	Phase-A signal input- (LD)
8	GND	This is a common terminal of the +5V power supply to the encoder.
9	U+	Phase-U signal input+ (LD)
10	U-	Phase-U signal input- (LD)
11	V+	Phase-V signal input+ (LD)
12	V-	Phase-V signal input- (LD)
13	W+	Phase-W signal input+ (LD)
14	W-	Phase-W signal input- (LD)

Note 1: LD: Line driver

**(3) RSF-B mini series actuator**

Pin No.	Signal name	Explanation
1	Vcc	The +5V power supply to the encoder and pole sensor is used to supply power from inside the servo amplifier.
2	B+	Phase-B signal input+ (LD)
3	Z+	Phase-Z signal input+ (LD)
4	B-	Phase-B signal input- (LD)
5	A+	Phase-A signal input+ (LD)
6	Z-	Phase-Z signal input- (LD)
7	A-	Phase-A signal input- (LD)
8	GND	This is a common terminal of the +5V power supply to the encoder and pole sensor.
9	U+	Phase-U signal input+ (LD)
10	U-	Phase-U signal input- (LD)
11	V+	Phase-V signal input+ (LD)
12	V-	Phase-V signal input- (LD)
13	W+	Phase-W signal input+ (LD)
14	W-	Phase-W signal input- (LD)

Note 1: LD: Line driver

**CN3: Serial port connector 1** (parameter setting, waveform monitoring, etc.)

Pin No.	Signal name	Explanation
1	FG	Frame ground
2	RXD	Transmitted data
3	TXD	Received data
4	DTR	Data terminal ready
5	GND	Signal ground
6	DSR	Data set ready
7	NC	Do not connect.
8	NC	Do not connect.

(The dedicated communication cable HDM-RS232C is required.)

**CN4: MECHATROLINK connector**

Pin No.	Signal name	Explanation
A1	—	—
A2	SRD-	This is the negative terminal of the MECHATROLINK data line.
A3	SRD+	This is the plus terminal of the MECHATROLINK data line.
A4	SLD	This is the GND terminal of the MECHATROLINK data line.
B1	—	—
B2	SRD-	This is the negative terminal of the MECHATROLINK data line.
B3	SRD+	This is the plus terminal of the MECHATROLINK data line.
B4	SLD	This is the GND terminal of the MECHATROLINK data line.

## 1-8 Outlines of I/O signal

The CN2 connector is used to input/output control signals from/to the host control device. The connector has 20 pins that are assigned as shown in the table below.

Pin No.	Signal	Symbol	Input Output
1	FWD inhibit	FWD-IH	Input
2	REV inhibit	REV-IH	Input
3	Origin signal	ORG	Input
4	Latch input 1	LATCH1	Input
5	Latch input 2	LATCH2	Input
6	Input signal common	IN-COM	—
7	Operation preparation complete	READY	Output
8	Origin return complete	ORG-END	Output
9	Operation completion	FINISH	Output
10	Alarm	ALARM	Output
11	Output signal common	OUT-COM	—
12	Encoder phase A+ output signal (LD)	A+	Output
13	Encoder phase A- output signal (LD)	A-	Output
14	Encoder phase B+ output signal (LD)	B+	Output
15	Encoder phase B- output signal (LD)	B-	Output
16	Encoder phase Z+ output signal (LD)	Z+	Output
17	Encoder phase Z- output signal (LD)	Z-	Output
18	Encoder monitor ground	MON-GND	—
19	—	—	—
20	—	—	—



**Do not connect external lines to the pins denoted by [-] in the signal field. These pins are connected to the internal circuit, so connecting them to external lines may result in damage.**

# 1-9 LED display

## LED display 1

The status of the HA-680ML driver is indicated by the 2 LEDs of LED 4 and 5.

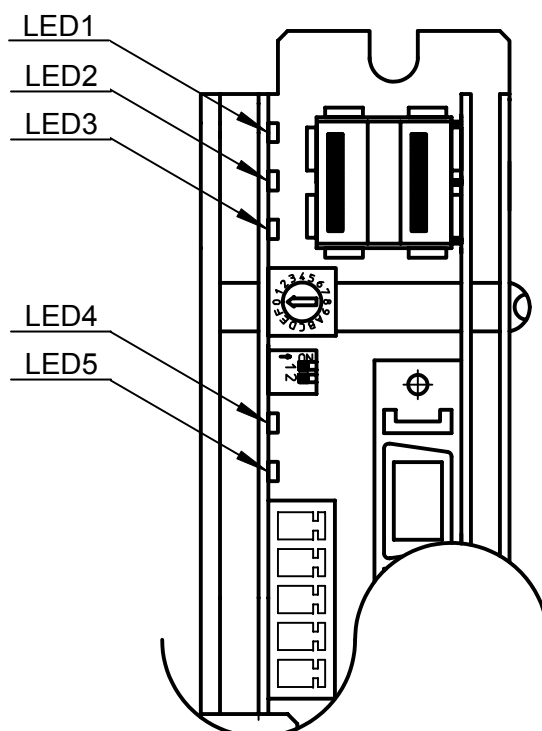
Status	LED4	LED5	Remarks
Control power supply ON	Unlit	Lit	
The connected actuator is different from the actuator set for the driver.	Unlit	Flickering	
Servo-ON	Lit	Lit	
Alarm (*1)	Flickering	Lit	The number of flickers varies depending on the content of the alarm. Refer to 1-10.
CPU error	Flickering	Flickering	LED4 and LED5 flicker alternatively.

\*1 If multiple alarms occur, only the latest alarm is displayed.

## LED display 2

The status of the MECHATROLINK line is indicated by 3 LEDs.

Status LED	Remarks
RXMON (LED3)	Lit: Data is being received from the MECHATROLINK line.
TXMON (LED2)	Lit: Data is being sent to the MECHATROLINK line.
ERR (LED1)	Lit: An error occurred in the MECHATROLINK line.



# 1-10 Outlines of protective functions

The HA-680ML driver has various protective functions. When an error occurs in the system, the servo circuit turns OFF immediately and an alarm is output to the CN2 signal output.

If any of these protective functions actuates, the actuator drive is stopped (motor servo turns OFF) and the indicator LED flickers at 0.5-second intervals.

(Steady green, flickering red: The number of flickers varies depending on the content of the alarm. See below.)

If multiple alarms occur, only the latest alarm is displayed.

Up to 8 most recent alarms are stored. They can be checked via MECHATROLINK communication and the dedicated communication software PSF-520.

Alarm name	Description	Number of LED flickers	Alarm clear
Overload	The electronic thermal detected an overload status.	1	Permitted *1
Excessive deviation	The value of the deviation counter exceeded the value set in the allowable position deviation parameter.	2	Permitted *1
Encoder break detection	The encoder line is broken.	3	Not permitted *2
Encoder receiving error	Serial encoder data could not be received 10 times consecutively.	4	Not permitted *2
	Serial encoder data could not be received consecutively, and it can no longer be output normally to encoder monitor.	5	
UVW error	All encoder UVW signals have become the same level.	6	Not permitted *2
Regenerative failure	The main-circuit voltage detection circuit detected an overvoltage.	7	Not permitted *2
Operating temperature error	The HA-680ML temperature rose and the temperature sensor actuated.	8	Not permitted *2
System error	An error was detected in the current detection circuit.	9	Not permitted *2
Overcurrent	The current detection circuit detected an excessive current.	10	Not permitted *2
Load short circuit	An excessive current flowed to the FET.	11	Not permitted *2
Memory failure	An attempt to read/write the EEPROM failed.	12	Not permitted *2
Overspeed	The motor shaft speed exceeded the max. rotational speed by 100 r/min for 0.5 s or more.	13	Not permitted *2

\*1 The alarm can be reset by clearing the alarm using the main MECHATROLINK command [Error/warning clear command (ALM\_CLR: 06H)] or cutting off the main power supply and power supply for control power circuit, and then turning on the power again.

\*2 This alarm cannot be reset via MECHATROLINK. Cut off the main power supply and control power supply, remove the cause of the alarm, and then turn on the power again according to the power ON sequence.

Given below is an example of how the LED flickers when an alarm occurs.



In the above example, the LED flickers 4 times at 0.5-second intervals, which indicates [Encoder receiving error].

# 1-11 Protective functions

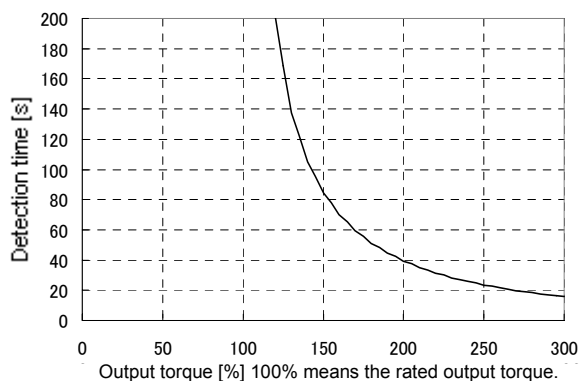
The HA-680ML driver provides the following protective functions and indicates alarms according to Outlines of protective functions.

## Overload

It always monitors the actuator current, and if the current and its discharge time exceed the curve shown below, an overload alarm occurs. How an overload alarm occurs varies depending on the actuator.

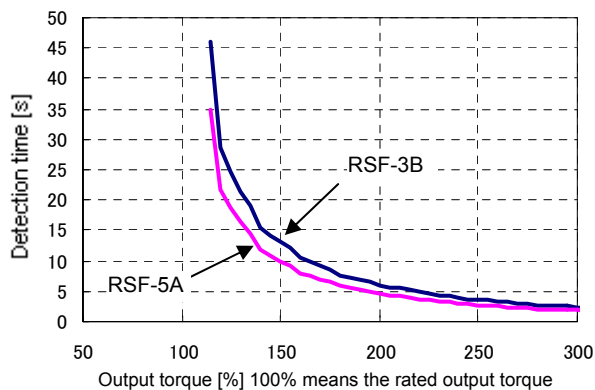
Overload alarm occurrence time

24-VAC FHA-C mini type



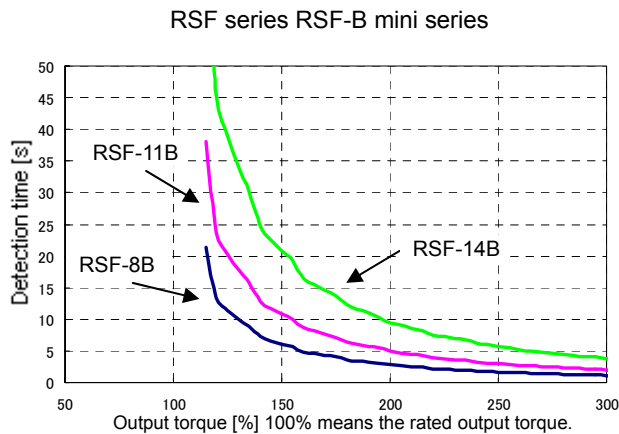
- | 24-VAC FHA-C mini type |   |
|------------------------|---|
| (1)                    | An alarm occurs if 1.25 times the allowable continuous current of the actuator flows for approx. 170 seconds. |
| (2)                    | An alarm occurs if 3 times the allowable continuous current of the actuator flows for approx. 16 seconds.     |

RSF supermini series



- | RSF supermini series (RSF-5A) |  |
|-------------------------------|--|
| (1)                           | An alarm occurs if 1.2 times the allowable continuous current of the actuator flows for approx. 35 (45) seconds. |
| (2)                           | An alarm occurs if twice the allowable continuous current of the actuator flows for approx. 5 (6) seconds.       |

The value for the RSF-3B is shown in parentheses.

**RSF-8B**

- (1) An alarm occurs if at least 1.2 times the allowable continuous current of the actuator flows for approx. 13 seconds.
- (2) An alarm occurs if 1.5 times the allowable continuous current of the actuator flows for approx. 6 seconds.

**RSF-11B**

- (1) An alarm occurs if at least 1.2 times the allowable continuous current of the actuator flows for approx. 23 seconds.
- (2) An alarm occurs if 1.5 times the allowable continuous current of the actuator flows for approx. 10 seconds.

**RSF-14B**

- (1) An alarm occurs if at least 1.2 times the allowable continuous current of the actuator flows for approx. 45 seconds.
- (2) An alarm occurs if 2.5 times the allowable continuous current of the actuator flows for approx. 5 seconds.

The alarm can be reset by clearing the alarm using the main MECHATROLINK command [Error/warning clear command (ALM\_CLR: 06H)] or cutting off the main power supply and power supply for control power circuit, and then turning on the power again.

**Excessive deviation**

An alarm occurs if the value of the deviation counter exceeds the value set in the applicable parameter (PSF-520 No. 21: Allowable position deviation). This alarm can be reset by sending [ALM\_CLR: 06H] via MECHATROLINK, or by cutting off the control circuit power and then turning on the power again.

**Encoder break detection**

An alarm occurs if encoder signals are cut off. The alarm can be reset by investigating and removing the cause, cutting off the control circuit power, and then turning on the power again.

**Encoder receiving error**

An alarm occurs when data cannot be received normally from the encoder. This alarm also occurs when encoder signals are no longer output.

**UVW error**

An alarm occurs if encoder phase UVW signals become abnormal. The alarm can be reset by investigating and removing the cause, cutting off the control circuit power, and then turning on the power again.

## Regenerative failure

An alarm occurs if the main circuit voltage exceeds 50V. If the inertia moment of the load is high, the main circuit voltage rises due to energy generated by actuator deceleration. The alarm can be reset by cutting off the control circuit power and then turning on the power again.

Also note that the regenerative resistor in the regenerative absorption circuit has a built-in fuse. If the regenerative resistor temperature rises as a result of excessive regeneration and the fuse blows, the regenerative circuit will no longer operate and the main circuit voltage will rise. Cut off the control circuit power and turn on the power again. If a regenerative failure occurs again immediately after the start of subsequent operation, the fuse may have blown. In this case, connect an external regenerative resistor and switch the jumper setting.

For connection of external regenerative resistor and switching of jumper setting, refer to 3-8.

## Operating temperature error

An alarm occurs when the HA-680ML temperature rises and temperature sensor actuates. The alarm can be reset by investigating and removing the cause, cutting off the control circuit power, and then turning on the power again.

## System error

An alarm occurs when an error is detected in the motor current detection circuit. The alarm can be reset by investigating and removing the cause, cutting off the control circuit power, and then turning on the power again.

## Overcurrent

An alarm occurs when the motor current detection circuit detects an overcurrent. The alarm can be reset by investigating and removing the cause, cutting off the control circuit power, and then turning on the power again.

## Load short circuit

An alarm occurs when an excessive current flows to the FET. The alarm can be reset by investigating and removing the cause, cutting off the control circuit power, and then turning on the power again.

## Memory failure

An alarm occurs if an attempt to read/write fails due to an error in the driver's EEPROM memory. The alarm can be reset by cutting off the control circuit power and then turning on the power again. If the same phenomenon occurs again, a breakdown is suspected. Contact our sales office.

## Overspeed

This alarm occurs if the actuator rotation speed exceeds the max. rotational speed of the motor shaft by 100 r/min for 0.5 second or more. The alarm can be reset by cutting off the control circuit power and then turning on the power again.

# Chapter 2

## I/O signal

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Details of I/O signal conditions and signal functions are explained in this chapter.

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2-1	Pin numbers and names of I/O signals .....	2-1
2-2	Connection of I/O signals .....	2-2
2-3	Functions of I/O signals .....	2-4
2-4	Connection example .....	2-8

# 2-1 Pin numbers and names of I/O signals

The HA-680ML driver lets you check the operating status or instruct operations via the CN2 connector (20-pin half-pitch connector).


## Pin numbers and names of I/O signals

The pin numbers and names of pins used for position control are shown in the table below.

Pin No.	Signal	Symbol	Input Output	Pin No.	Signal	Symbol	Input Output
1	FWD inhibit	FWD-IH	Input	11	Output signal common	OUT-COM	—
2	REV inhibit	REV-IH	Input	12	Encoder phase A+ output signal (LD)	A+	Output
3	Origin signal	ORG	Input	13	Encoder phase A- output signal (LD)	A-	Output
4	Latch input 1	LATCH1	Input	14	Encoder phase B+ output signal (LD)	B+	Output
5	Latch input 2	LATCH2	Input	15	Encoder phase B- output signal (LD)	B-	Output
6	Input signal common (24VDC)	IN-COM	Input	16	Encoder phase Z+ output signal (LD)	Z+	Output
7	Operation preparation complete	READY	Output	17	Encoder phase Z- output signal (LD)	Z-	Output
8	Origin return complete	ORG-END	Output	18	Encoder monitor ground	MON-GND	Output
9	Operation completion	FINISH	Output	19	—	—	—
10	Alarm	ALARM	Output	20	—	—	—

Note 1: The logic can be changed for I/O signals other than output 5 (phase-Z OC output) using [13: Input pin logical setting] and [14: Output pin logical setting] accessible from [Parameters].

Note 2: The HA-680ML driver has no built-in power supply for input signals. +24V power must be supplied externally to input signals.



**CAUTION**

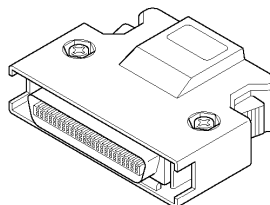
Do not connect external lines to the pins denoted by [-] in the signal field. These pins are connected to the internal circuit, so connecting them to external lines may result in damage.

## Models of I/O signal connector CN2

The models of CN2 connector are shown as follows:

Connector :10120-3000PE...3M

Cover :10320-52F0-008...3M



# 2-2 Connection of I/O signals

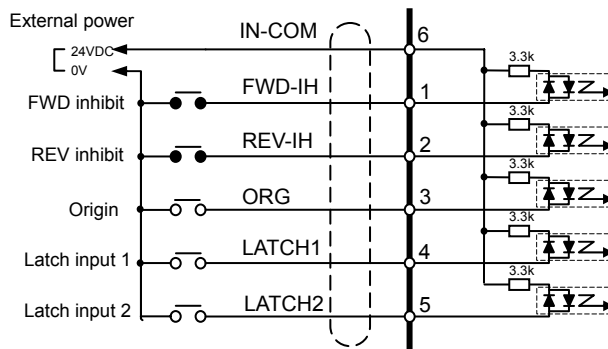
The following explains how to connect the I/O signal ports used in position control to the host device.

## Input signals

The HA-680ML driver has 5 input signal ports as shown to the right.

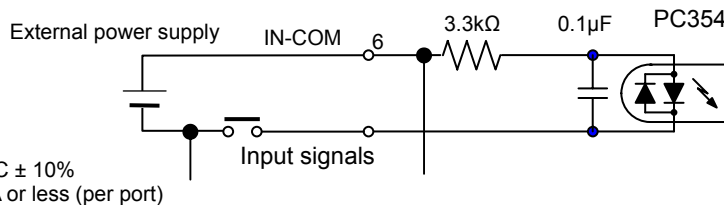
### Specifications of input ports

Voltage 24VDC  $\pm$  10%  
 Current 20 mA or less (per port)



- Connection method**

The HA-680ML driver has no built-in power supply for input signals. Connect the +24V side of the external power supply for input signals, to [CN2-6: Input signal common].



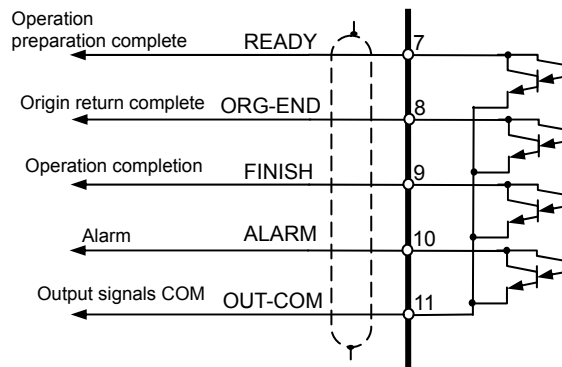
Voltage 24VDC  $\pm$  10%  
 Current 20 mA or less (per port)

## Output signals

The HA-680ML driver has 4 output signal ports as shown to the right.

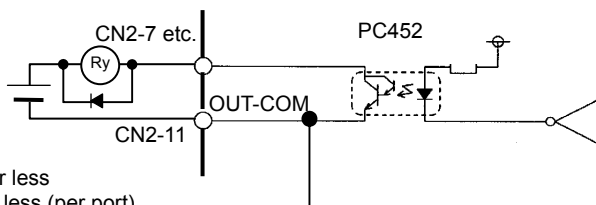
### Specifications of output ports

Signal output: Open collector  
 Voltage 24VDC or less  
 Current 40 mA or less (per port)  
 All ports are insulated by an opt-isolator.



- Connection method**

Connect an output signal between each output port and [CN2-11: Output signal common OUT-COM].



Voltage 24VDC or less  
 Current 40 mA or less (per port)

2

I/O signal

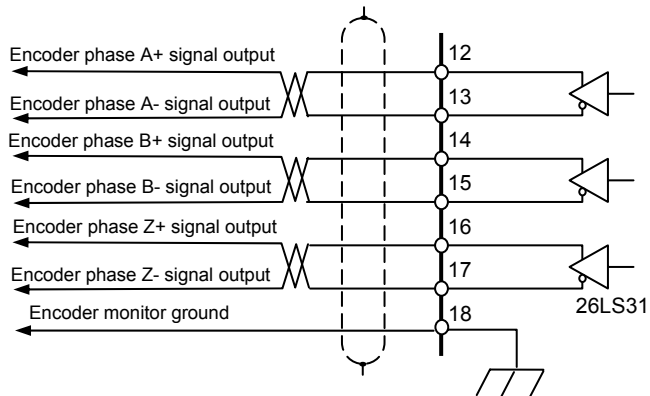
**Output signals for monitor**

The HA-680ML driver has 6 output ports and 3 output signals for encoder signal monitor, as shown to the right.

**Specifications of output ports**

The encoder's phase-A, B, and Z signals are output via a line driver (26LS31).

- **Connection method**  
Receive the signals using a line receiver (AM26LS32 or equivalent).



## 2-3 Functions of I/O signals

2

I/O signal

### CN2-1 FWD inhibit: FWD-IH (input signal)

### CN2-2 REV inhibit: REV-IH (input signal)

#### Function

FWD inhibit: With the default setting, turning OFF the input signal does not cause the actuator to generate torque in the forward direction.

REV inhibit: With the default setting, turning OFF the input signal does not cause the actuator to generate torque in the reverse direction.

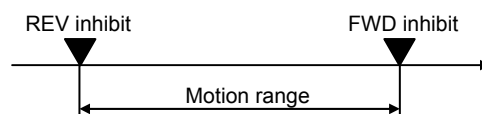
With the default setting, turning OFF both input signals does not cause the actuator to generate torque in both the forward and reverse directions.

This input is used to limit the motion range using a limit sensor signal set at the operation limit of the drive system.

The logic can be changed by [13: Input pin logical setting] accessible from [Parameters]. If this signal is not used, you can change the logic to do away with CN2 wiring. With the default setting, the inhibit status can be cancelled by turning ON the input signal.

#### Connection method

Connect the NC contact (contact b) signal. Connect +24V of the external power supply for input signals, to [CN2-12: Input signal common].



### CN2-3 Origin signal: ORG (input signal)

#### Function

Connect the wires of the sensor installed at the position you want to use as the origin of the system mechanism.

The logic can be changed by [13: Input pin logical setting] accessible from [Parameters]. With the default setting, the origin signal has been detected when the input signal turns ON.

#### Connection method

Connect the NO contact (contact a) signal. Connect +24V of the external power supply for input signals, to [CN2-12: Input signal common].

**CN2-4 latch input 1: LATCH1 (input signal)****CN2-5 latch input 2: LATCH2 (input signal)****Function**

This input signal indicates the event occurrence condition (selected by LT-SGN) to be applied when the [Interpolated feed with position latch function: (LATCH: 38H)], [Positioning by external input: (EX\_POSING: 39H)] or [Originating (ZRET: 3AH)] command is executed.

The logic can be changed by [13: Input pin logical setting] accessible from [Parameters]. With the default setting, the origin signal has been detected when the input signal turns ON.

**Connection method**

Connect the NO contact (contact a) signal. Connect +24V of the external power supply for input signals, to [CN2-12: Input signal common].

**CN2-6 Input signal common: IN-COM (input signal)****Function**

This is a common terminal for input signals: CN2-1, 2, 3, 4 and 5. It supplies power to the external power supply for input signals.

**Connection method**

Connect the +24V side of the external power supply for input signals.

**CN2-7 Operation preparation complete: READY (output signal)****Function**

With the default setting, this signal turns ON when the motor is excited and becomes ready following the [Servo-ON (SV\_ON: 31H)] command. It turns OFF if an alarm occurs.

The logic can be changed by [14: Output pin logical setting] accessible from [Parameters]. With the default setting, the output transistor turns ON in the ready state.

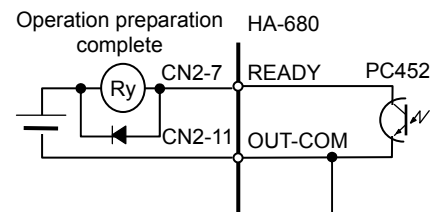
**Connection method**

Shown to the right is an example of connection of [CN2-7 Operation preparation complete: READY].

Voltage 24VDC or less

Current 40 mA or less (per port)

Configure the output circuit accordingly.



## CN2-8 Origin return complete: ORG-END (output signal)

### Function

With the default setting, this signal turns ON when the current value is recognized after originating.

It turns OFF when the power is turned on or an alarm occurs.

The logic can be changed by [14: Output pin logical setting] accessible from [Parameters]. With the default setting, the transistor turns ON when the system is operating normally after origin return complete.

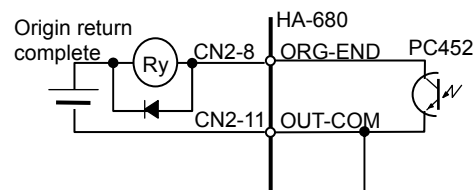
### Connection method

Shown to the right is an example of origin return complete connection of [CN2-8 Origin return complete: ORG-END].

Voltage 24VDC or less

Current 40 mA or less (per port)

Configure the output circuit accordingly.



## CN2-9 Operation completion: FINISH (output signal)

### Function

With the default setting, this signal turns ON to indicate completion of positioning when the command operation has completed and the value of the deviation counter changes to or below the value set in [22: In-position range] accessible from [Parameters]. Use this signal for confirmation of in-position etc. at the host device.

The logic can be changed by [14: Output pin logical setting] accessible from [Parameters]. With the default setting, the output transistor turns ON when the command operation has completed and the accumulated pulses in the deviation counter drop to or below the set value of in-position range.

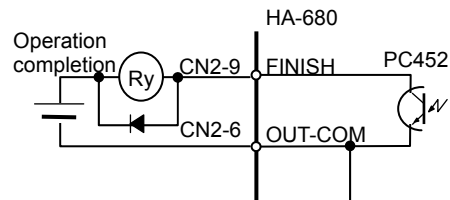
### Connection method

Shown to the right is an example of connection of [CN2-9 Operation completion: FINISH].

Voltage 24VDC or less

Current 40 mA or less (per port)

Configure the output circuit accordingly.



## CN2-10 Alarm: ALARM (output signal)

### Function

With the default setting, this signal turns OFF when an alarm occurs following an error detection by the HA-680ML driver. This is a normally closed signal (NC, contact b).

The logic can be changed by [14: Output pin logical setting] accessible from [Parameters]. With the default setting, the transistor turns ON when the system is operating normally, and OFF if an error is detected.

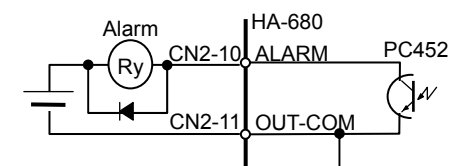
### Connection method

Shown to the right is an example of connection of [CN2-10 Alarm: ALARM].

Voltage 24VDC or less

Current 40 mA or less (per port)

Configure the output circuit accordingly.



(I/O signal functions in position control)

**CN2-11 Output signal common: OUT-COM (output signal)****Function**

This is a common terminal for output signals CN2-7, 8, 9 and 10.

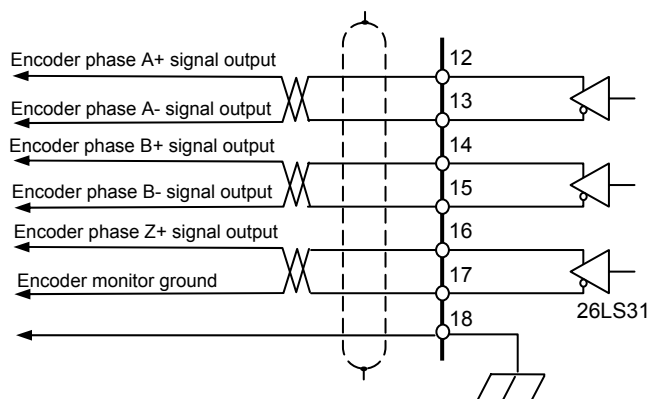
**CN2-12 Encoder phase A+ output signal (LD): A+ (output signal)****CN2-13 Encoder phase A- output signal (LD): A- (output signal)****CN2-14 Encoder phase B+ output signal (LD): B+ (output signal)****CN2-15 Encoder phase B- output signal (LD): B- (output signal)****CN2-16 Encoder phase Z+ output signal (LD): Z+ (output signal)****CN2-17 Encoder phase Z- output signal (LD): Z- (output signal)****Function**

The encoder's phase-A, B, and Z signals are output via a line driver (26LS31).

**Connection method**

Receive the signals using a line receiver (AM26LS32 or equivalent).

**Note:** Use EIA-422A standard for line receiver.

**CN2-18 Encoder monitor ground: MON-GND (output signal)****Function**

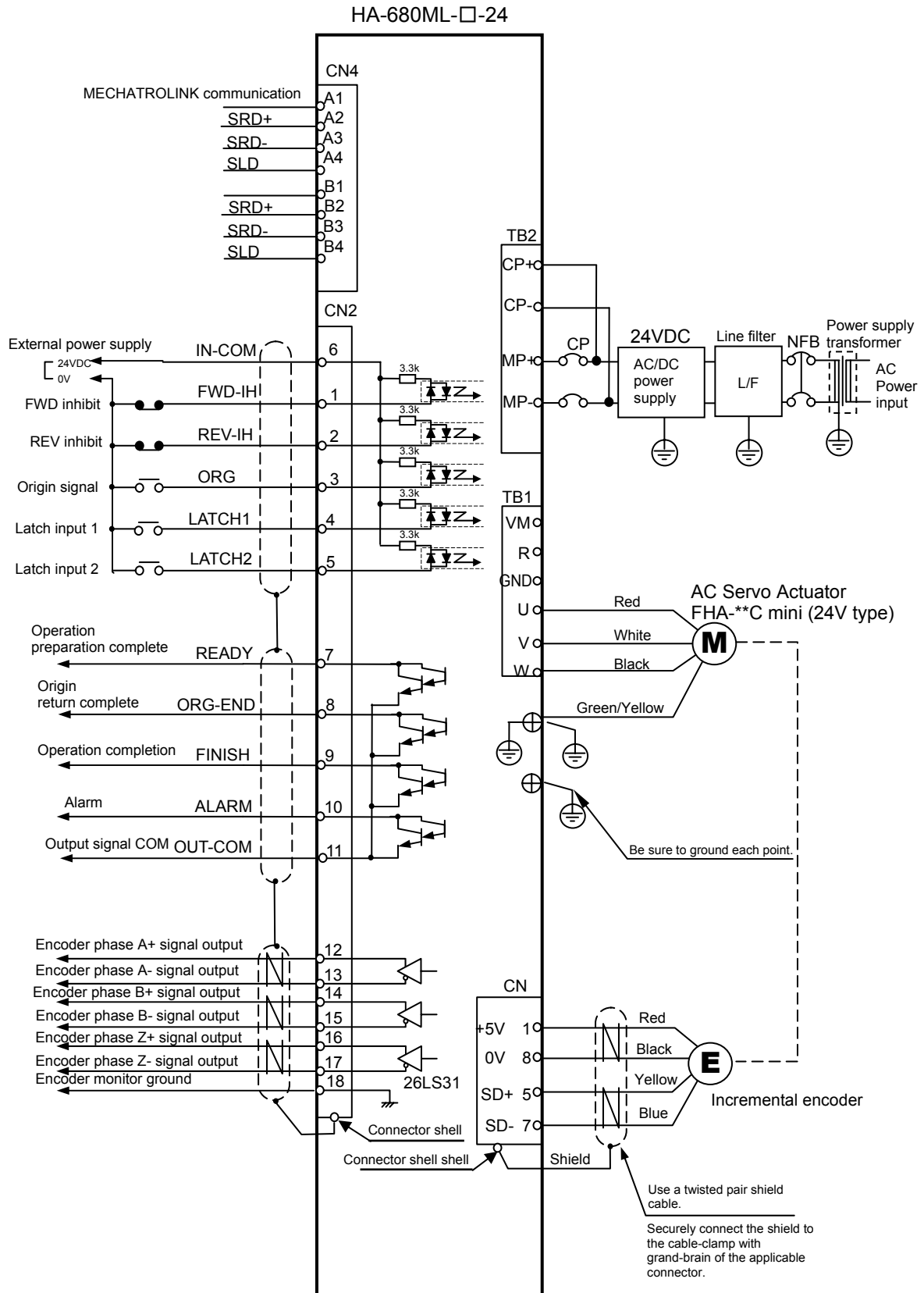
This is a common terminal for CN2-12 to 17 of the encoder monitor terminal.

**Connection method**

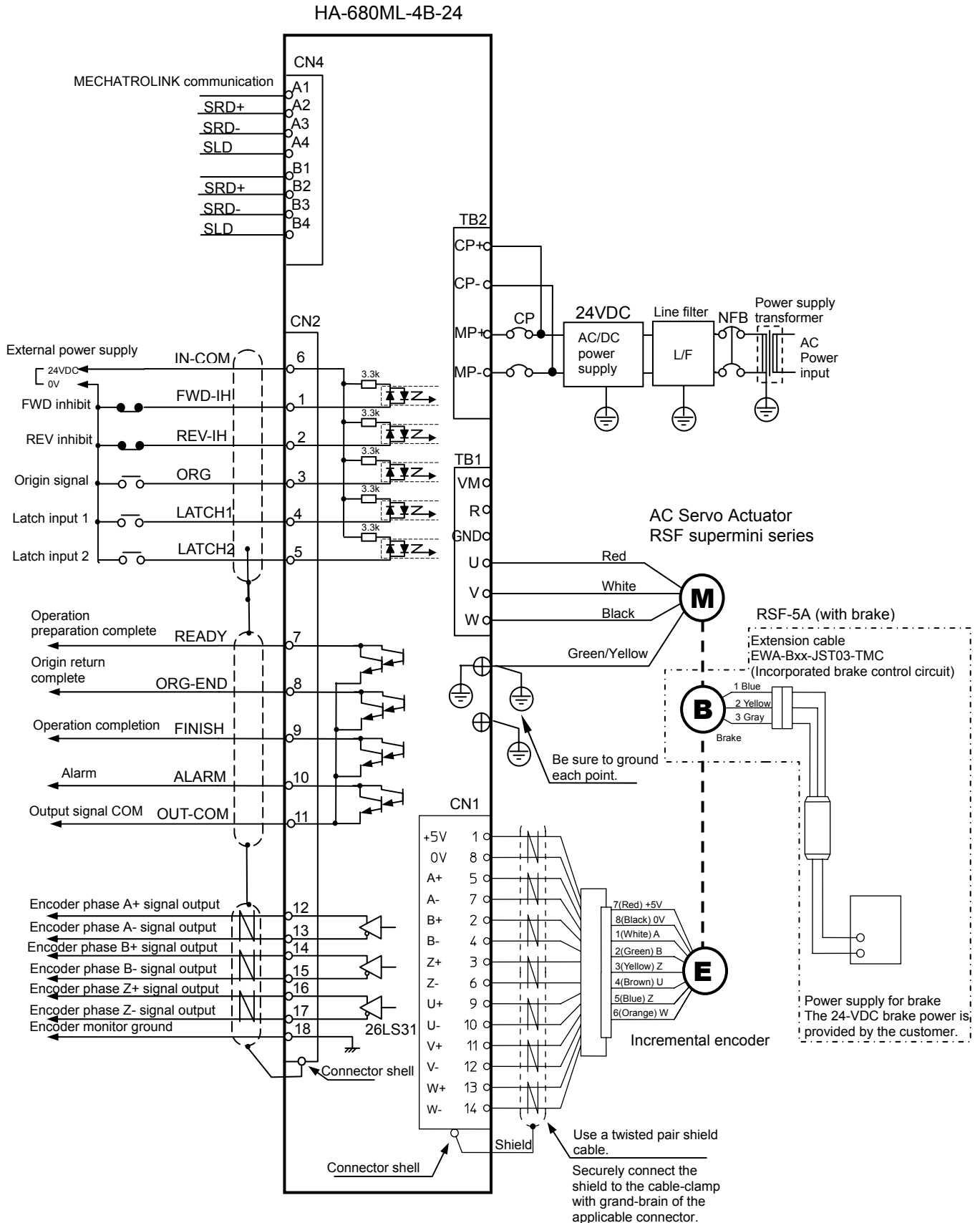
Connect it as a ground for CN2-12 to 17 of the encoder monitor terminal.

# 2-4 Connection example

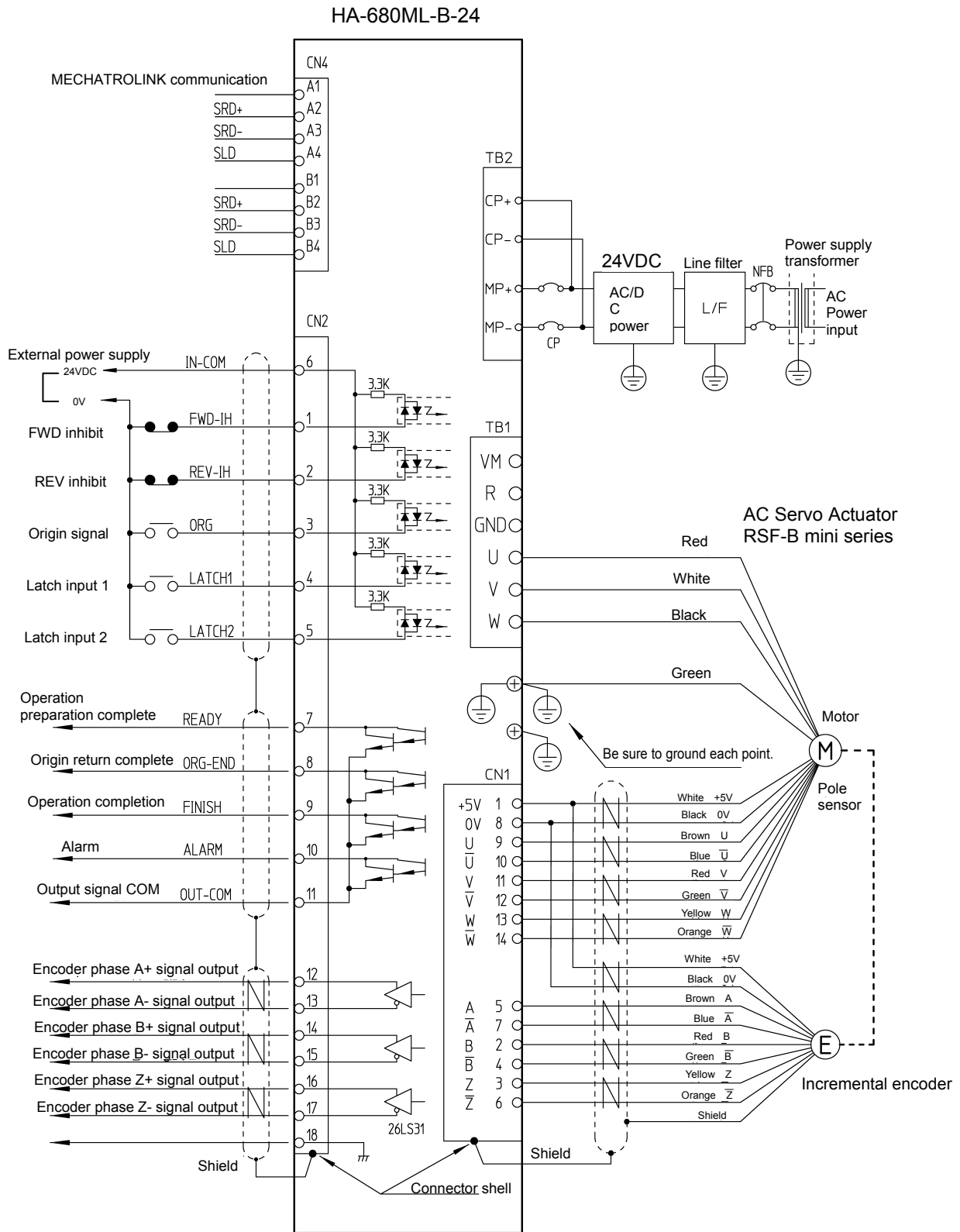
Connection diagram for FHA-XXXC mini (24V type)



Connection diagram for RSF supermini encoder (14 lines)



Connection diagram for RSF B-mini encoder (14 lines)



**2**

**I/O signal**

# Chapter 3

## Installing the driver

---

Receiving inspection, environment, power wiring, noise suppression and connector wiring are explained in this chapter.

---

3-1	Receiving inspection .....	3-1
3-2	Notices on handling of driver .....	3-3
3-3	Location and installation .....	3-4
3-4	Suppressing noise .....	3-7
3-5	Connecting power cables .....	3-10
3-6	Connection of the regenerative absorption resistor/capacitor .....	3-14
3-7	Connection of encoder cable and I/O cable .....	3-16
3-8	Power ON/OFF sequence .....	3-19

# 3-1 Receiving inspection

Check the following items after unpacking the package.

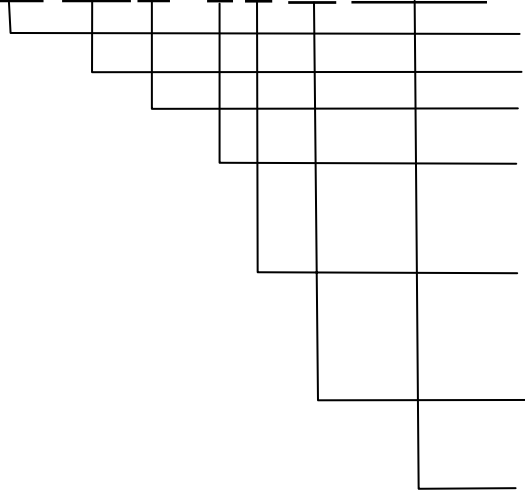
## Inspection procedure

3

Installing the driver

- 1 Check the items thoroughly for damage sustained during transportation.**  
If any item is damaged, immediately contact our sales office.
- 2 A nameplate is attached at the heat sink of the HA-680ML driver.**  
**Check the nameplate to confirm that the driver is what you have ordered.**  
If any item is different, immediately contact the dealer.  
The model code indicates the following information:

**HA-680ML-□□-24-S□□□**



AC Servo Driver  
680 series  
Network type

4	4 A
6	6 A

No description	For 24-VAC FHA-C mini type (FHA-8C, 11C, and 14C)
B	For RSF supermini series (RSF-3B and 5A) For RSF-B series (RSF-8B, 11B, and 14B)

24	24 VDC
----	--------

Adjustment model control No.

- 3 The [ADJ.] field of the nameplate specifies the actuator model that should be combined with this HA-680ML driver. At that time, make sure your actuator is combined with the correct actuator.**



**Do not combine the actuator other than the one specified on the nameplate.**

The characteristics of the HA-680ML driver have been adjusted according to the actuator. Wrong combinations of HA-680ML drivers and actuators may cause insufficient torque or overcurrent that may lead to actuator burnout, resulting in injury or fire.

- 4** The [INPUT VOL.] field of the aforementioned nameplate indicates the input voltage of this HA-680ML driver.  
24: indicates a 24-VDC power.  
If the input voltage to be supplied is different from the label voltage, immediately contact the dealer it was purchased from.



**Do not connect the power supply other than the voltage specified on the nameplate.**

The power supply voltage different from the voltage specified on the nameplate may damage the HA-680ML driver, resulting in injury or fire.

## 3-2 Notices on handling of driver

The HA-680ML driver is an electronic device. Handle it with care by observing the notices below.

### 3

#### Installing the driver



- (1) Be careful not to let screws, solder balls, wire chips and other foreign matters enter the HA-680ML driver.
- (2) Do not insert cables, steel wires, screwdrivers, etc., into the HA-680ML driver.



- (1) The cover is made of plastic. Do not apply an undue force or impact.
- (2) The vibration resistance of the HA-680ML driver is up to  $5 \text{ m/s}^2$  (10 to 55Hz). Do not deliver the HA-680ML driver by carrying it directly on a vehicle or other transportation equipment subject to vibration.
- (3) Do not put the HA-680ML driver on a table, shelf, etc., from which the driver may fall.
- (4) Do not put objects on the HA-680ML driver. The case may be damaged.
- (5) The allowable storage temperature is  $-20$  to  $+85^\circ\text{C}$ . Do not expose the actuator to direct sunlight for long periods of time or store it in areas in low or high temperature.
- (6) The allowable storage humidity is 95% RH or below. In particular, do not store the actuator in a very humid place or in areas where temperatures are likely to fluctuate greatly during day and night.
- (7) Do not handle or store the driver in locations exposed to corrosive gases and powder dust.

## 3-3 Location and installation

### Environment of location

The environmental conditions of the installation location for the HA-680ML driver must be as follows. Determine an appropriate installation location by observing these conditions without fail.

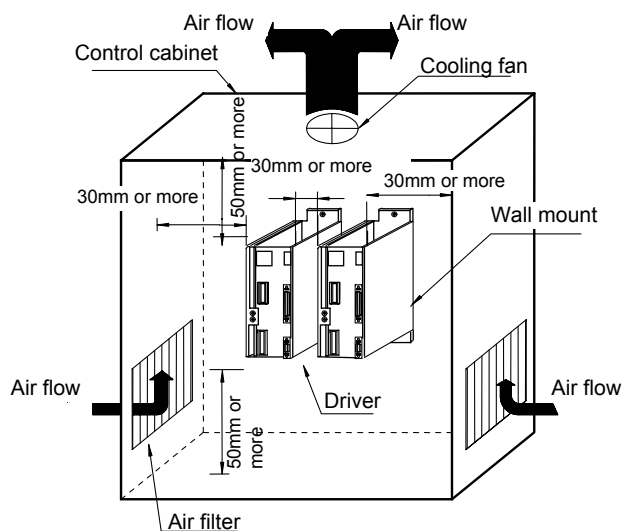
- **Operating temperature: 0°C to 50°C**  
Store the driver in a cabinet and use. The temperature in the cabinet may be higher than the outside air temperature due to power losses of the built-in devices, size of the cabinet, etc. Consider an appropriate cabinet size, cooling and layout to make sure the temperature around the driver does not exceed 50°C.
- **Operating humidity: Relative humidity of 95% or less. Make sure no condensation occurs.**  
Take note that condensation is likely to occur in a place where there is a large temperature change between day and night or when the actuator is started/stopped frequently.
- **Vibration: 4.9 m/s<sup>2</sup> (0.5G) (10 to 55Hz) or less**  
If there is a source of vibration nearby, install the driver on a base via a shock absorber to prevent the vibration from transmitting directly to the driver.
- **Impact: Impact: 98 m/s<sup>2</sup> (10G) or less**  
Install the driver in a location not subject to impact.
- **Free from powder dust, condensation, metal powder, corrosive gases, water, water droplets, oil mist, etc.**  
Avoid an ambience of corrosive gases because the contact parts (connectors, etc.) may suffer contact failures, leading to accidents.
- **Locate the driver indoors or within an enclosure. Do not expose it to the sunlight.**

## Notices on installation

Install the driver vertically and provide enough space around it to ensure desirable flows of air. When installing the driver, provide a clearance of at least 30mm from a wall or adjacent machine, at least 50mm from the floor, and at least 100mm from the ceiling as shown below.

The table below shows the power losses of HA-680 ML drivers for reference when planning the cooling system.

Driver	HA-680ML-4	HA-680ML-4	HA-680ML-6	HA-680ML-4B			HA-680ML-6B	
Actuator	FHA-8C	FHA-11C	FHA-14C	RSF-3B	RSF-5A	RSF-8B	RSF-11B	RSF-14B
Power loss	10W	20W	40W	10W			15W	20W



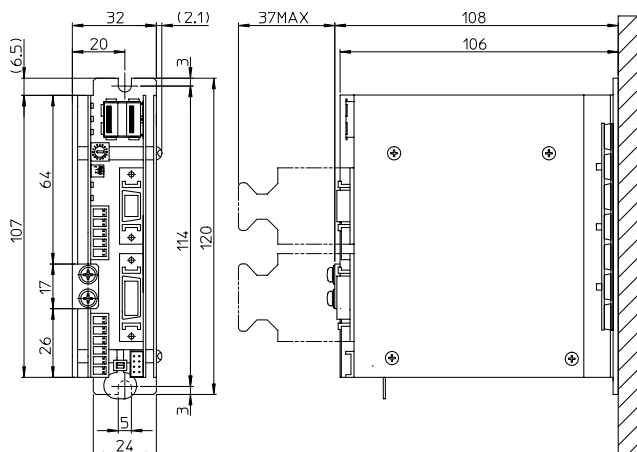
## Installation

The HA-680ML driver is installed on its rear.

Two mounting holes are provided on the rear as installation positions. The wall on which to install the driver should be made of an iron sheet of 2mm or more in thickness.

### Installation procedure

- 1** Screw a M4 screw into the middle of the tapped hole provided at the bottom of the mounting surface.
- 2** Hook the mounting hole (cut hole) provided at the bottom of the HA-680ML driver onto the M4 screw installed in (1).
- 3** Securely tighten a M4 screw through the mounting hole at the top of the driver and hole in the mounting surface.
- 4** Securely tighten the M4 screw at the bottom.



## 3-4 Suppressing noise

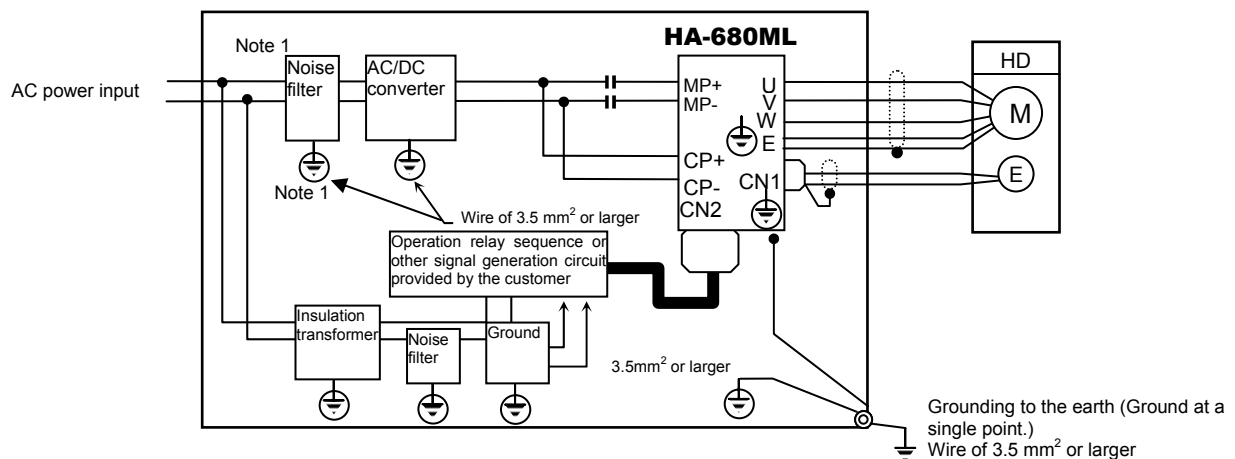
The main circuit of the HA-680ML driver uses a power element (FET) based on PWM control. Switching noise may generate due to a sudden change in current/voltage that occurs when this element is switched, and if the wiring or grounding is incorrect, other external device may malfunction or suffer radio interference.

Also, the HA-680ML driver has incorporated electronic circuits such as a CPU, so the driver must be wired and other necessary actions taken to minimize malfunction caused by entry of external noise.

To prevent troubles caused by external noise, be sure to provide wiring and grounding as follows.

### Grounding of system devices

Refer to the figure below to ground all devices comprising the system.



Note 1: For grounding of noise filters, refer to [3-4-2 Installation of noise filters].

### Grounding motor frame

When the actuator is grounded on the driven machine side through the frame, current flows through the floating capacity (Cf) of the motor from the power circuit of the driver. To avoid negative influence of the current, always connect the ground terminal (motor frame) of the actuator to the ground terminal of the driver, and connect the ground terminal of the driver directly to ground.

### Grounding ducts

When the motor cables are housed in a metal conduit or a metal box, be sure to ground their metal parts. Always connect the ground at a single point.

## Installation of noise filters

Use of noise filters is recommended to prevent malfunctions caused by impulse noise that may enter from the power line and to prevent noise generating inside the driver from emitting to the power line at the same time.

When multiple drivers are used, install noise filters for each driver.

Select bi-directional noise filters that can suppress both external noise and internal noise.

Recommended noise filters are shown in the table below.

Driver	Model	Manufacturer
All model No.	SUP-P8H-EPR-4	Okaya Electric Industries

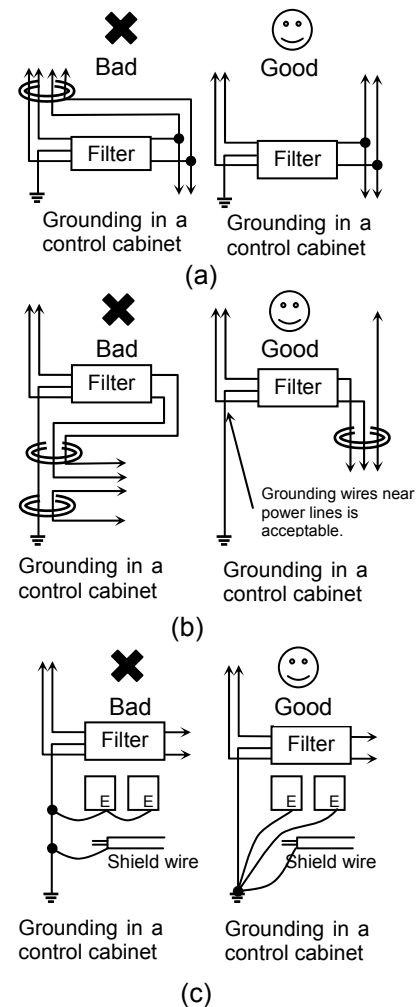
### Caution

- Install the noise filters and HA-680ML driver as close as possible with one another.
- Also install noise filters to the power source cables of electric devices other than the HA-680ML driver in the same manner. In particular, always install noise filters to sources of high-frequency, such as electric welders and electrical-discharge processing machines.
- Incorrect use of noise filters can reduce its effectiveness by half. Install noise filters by referring to the cautionary information provided below.

- Separate the filtered wires and unfiltered wires from each other. Do not place them in the same pipe or duct, or bundle them together.

- Do not place the ground wire and filtered wires in the same pipe or duct, or bundle them together.

- Do not daisy-chain ground wires, but connect one ground wire separately to each device or to a single point on the control cabinet or ground plate.



## Other wiring cautions

In addition to implementing the above noise suppressing measures, also abide by the following notices:

### 3

#### Installing the driver

#### Caution

- Use twisted pair shield cables with the necessary number of cores for the I/O signal cable and encoder signal cable. If multiple drivers are used, provide a separate I/O signal cable for each driver.
  - Shorten the wiring length as much as possible, as specified below:
    1. I/O signal cable: 3m or less
    2. Encoder signal cable (provided by the customer): 10m or less (FHA-C mini series only) However, make sure the conductivity of the cable is 0.04Ω/m or less. We have optional cables of 3m/5m/10m long.  
**When using the RSF supermini series, data must be converted from open collector type to line driver type.**  
**Use of our optional extension cable EWA-E\*\*-M09-3M14 is recommended.**
  - Be sure to install surge protector devices to coils of magnetic relays, magnetic switches (conductor), solenoids, etc.
  - Separate power cables (power source cables, motor wires and other circuits subject to strong electric power) and I/O signal cables by more than 30cm. Do not encase them in the same pipe or duct, nor bundle them together.
  - Do not open the end of cables for analog input signals, such as speed signals in particular.
  - Since the HA-680ML driver is designed for industrial use, it incorporates no measures to prevent radio interference.  
Accordingly, install line filters on the input side of power source cables if the following conditions apply:
    - Used near houses
    - Where radio interference may present problems
-

## 3-5 Connecting power cables

### Caution about power supply



Before connecting the power cable to the HA-680ML driver, completely unplug the power cable from the main power supply.



- (1) Connect the power cable to the HA-680ML driver after installing the driver on the specified wall.
- (2) Ground the HA-680ML driver to avoid electric shock, malfunctions caused by external noise, and for the suppression of radio noise emissions.

3

Installing the driver

### Allowable cable size

The table below lists the minimum allowable wire sizes of power cables, ground cables and other cables. Using the thickest wires possible is recommended.

Cable	Symbol	Min. allowable wire size (mm <sup>2</sup> )				
		HA-680ML-4	HA-680ML-6	HA-680ML-4B	HA-680ML-4B	HA-680ML-6B
		FHA-8C FHA-11C	FHA-14C	RSF-3B RSF-5A	RSF-8B	RSF-11B RSF-14B
Main circuit power	MP+, MP-	1.25				
Control circuit power	CP+, CP-	1.25				
Motor cable Note 3	U, V, W, E	0.5	0.75	0.33	0.5	0.75
Ground (FG) wire	Ground mark	1.25				
For external resistor/capacitor	VM, R, GND	1.25				
Encoder cable Note 3	CN1	Twisted pair shield cable of 0.3 mm <sup>2</sup> or larger			AWG26 to 28 (0.12 to 0.08 mm <sup>2</sup> )	
Control signal wire	CN2	Twisted pair wire or twisted pair whole-shield cable of 0.35 mm <sup>2</sup> or larger				
MECHATROLINK communication cable	CN4	Dedicated cable specified by the MECHATROLINK Members Association				

Note 1: When bundling wires or placing them into ducts, rigid plastic conduits or metal pipes, use wires of the next larger size.

Note 2: If the ambient temperature (temperature in cabinet) is high, use heat-resistant wires such as IV wires (600V heat-resistant vinyl wires) and HIV wires (special heat-resistant vinyl wires).

Note 3: We provide following extension cables (3m/5m/10m) for motors and encoders. Take note that the model varies depending on the actuator used.

● **For 24-VAC FHA-C mini type**

Motor cable model : EWC-MB\*\*-A06-TN2

Encoder cable model : EWC-E\*\*-M06-3M14

● **For RSF supermini series**

Motor cable model : EWA-M\*\*-JST04-TN2

Encoder cable model : EWA-E\*\*-M09-3M14

● **For RSF-B mini series**

Motor cable model : EWC-MB\*\*-A06-TN2

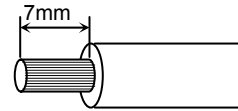
For encoder + pole sensor cable model : EWBF\*\*-M0809-3M14

Cable length

03	3m
05	5m
10	10m

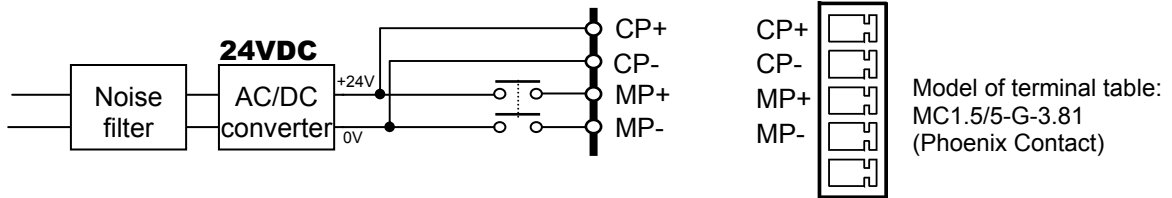
## Turning on the power supply

The terminal block for power connection, shown on the right side of the figure below, is provided on the display panel on the front face of the HA-680ML driver. Connect the power source cables to the respective terminals as shown below.

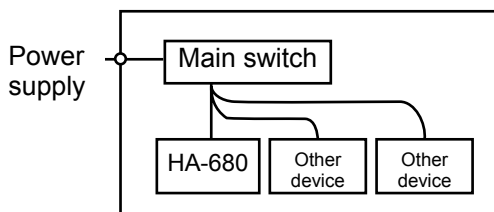


When supplying power to the driver or motor, process the end of each connection cable as shown to the right and securely connect the cable to the terminal table. When processing the connection cables, exercise due caution not to damage the wire materials.

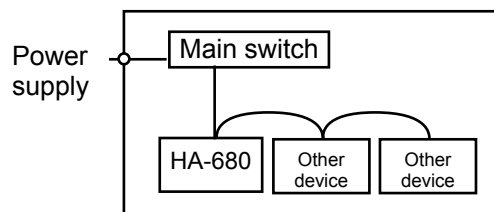
Be sure to install noise filters on the power line to prevent malfunction of the HA-680ML driver due to external noise.



The power-receiving part of the HA-680ML driver adopts a capacitor-type surge-current-suppress-circuit. Accordingly, although this circuit prevents extreme voltage drops when the power is input, avoid daisy-chain wiring between the power supply and devices, and wire each device separately from the main power supply switch.



Good wiring example



Bad wiring example

The HA-680ML driver is of DC power input type. Use a power supply having the power capacity specified below.

Driver	Actuator	Power capacity (W)	
		Continuous rating	Instantaneous
HA-680ML-4	FHA-8C	40	120
	FHA-11C	80	240
HA-680ML-6	FHA-14C	120	360
HA-680ML-4B	RSF-3B, RSF-5A	20	50
	RSF-8B	40	120
HA-680CL-6B	RSF-11B	60	320
	RSF-14B	80	

The following products are recommended.

Driver	Actuator	Recommended AC/DC power supply	Manufacturer
HA-680ML-4	FHA-8C	JWS70P-24	TDK-Lambda
	FHA-11C	JWS120P-24	
HA-680ML-6	FHA-14C	JWS240P-24	
HA-680ML-4B	RSF-3B, RSF-5A	JWS70P-24	
	RSF-8B		
HA-680CL-6B	RSF-11B	JWS240P-24	
	RSF-14B		



**WARNING**

When supplying power, be sure to use the power supply on the secondary side insulated from the primary side by means of double insulation.

## Connection of ground wire

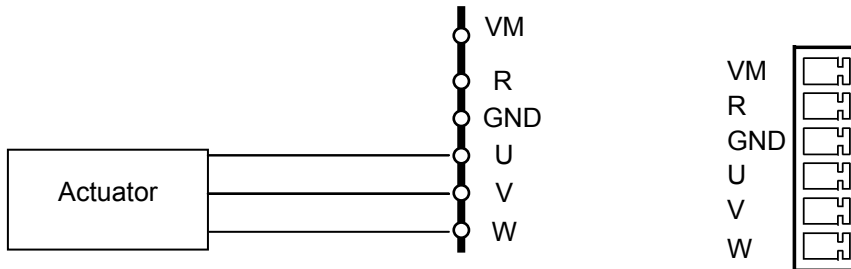
Use a ground wire of an appropriate size selected from the table below, or larger.

Terminal/connector	Min. allowable wire size(mm <sup>2</sup> )
PE wire	1.25

The HA-680ML driver has a ground terminal.

### Connection of motor cable

Connect the motor cable to the U, V and W terminals of the HA-680ML driver as shown below. Refer to the actuator manual to check the phase order of motor cable wires beforehand, and connect each pair of terminals that have the same symbol. Take note that even if the phase order is wrong or any of the phases is missing, alarms etc., will not occur. For the processing of cable ends, refer to [Turning on the power supply].



Model of terminal table:MC1.5/6-G-3.81  
(Phoenix Contact)



If the phase order of the motor cable is wrong or any wire is disconnected or connected during operation, an uncontrollable operation may result.

## 3-6 Connection of the regenerative absorption resistor/capacitor

The HA-680ML comes standard with a built-in regenerative absorption circuit. The capacity of the built-in regenerative resistor is 2 W. Operating conditions that are feasible only with the driver should be set so that the tact time becomes equal to or longer than the calculation result according to the table below.

The capacity of the standard incorporated regenerative absorption circuit is sufficient for actuators in the RSF supermini series. You need not connect any external resistor/capacitor.

Driver	Actuator	Formula
HA-680ML-4	FHA-8C	0.3 x load inertia + 0.1 (second)
	FHA-11C	0.6 x load inertia + 0.5 (second)
HA-680ML-6	FHA-14C	1.7 x load inertia + 2.0 (second)
HA-680ML-4B	RSF-8B	0.1 x load inertia (second)
HA-680ML-6B	RSF-11B	0.2 x load inertia (second)
	RSF-14B	0.3 x load inertia + 0.5 (second)



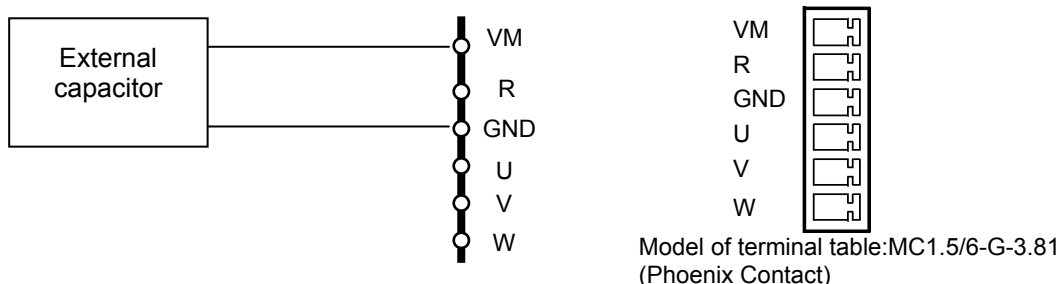
- (1) If the tact time is shorter than the calculation result, connect an external resistor or capacitor.
- (2) If the tact time is shorter than the calculation result and an external resistor or capacitor is not connected, the built-in fuse of the regenerative resistor may blow during operation.
- (3) Once blown, the built-in fuse will no longer recover, and consequently the regenerative circuit will stop and a regenerative failure alarm will occur.
- (4) If an alarm occurs, refer to [7-1 Alarms and remedial actions].

**For the capacity of the external resistor/capacitor to be connected, use the following reference.**

- (1) When the load inertia is x 2 or less and an external capacitor is connected

Driver	Actuator	Recommended model of capacitor	Capacity x Quantity	Manufacturer
HA-680ML-4	FHA-8C	UPJ1H102MHH	1000µF x 1 pc	Nichicon
	FHA-11C	UPJ1H222MHH	2200µF x 1 pc	
HA-680ML-6	FHA-14C	UPJ1H222MHH	2200µF x 4 pc	
HA-680ML-4B	RSF-8B	UPJ1H102MHH	1000µF x 1 pc	
HA-680ML-6B	RSF-11B	UPJ1H222MHH	2200µF x 1 pc	
	RSF-14B	UPJ1H222MHH	2200µF x 2 pc	

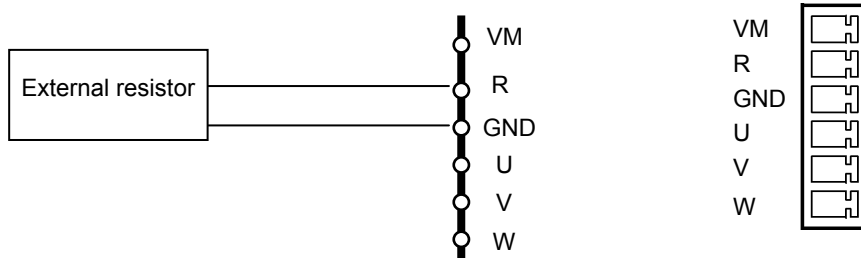
Connect to the VM and GND terminals of the HA-680ML driver as shown below.



- (2) When an external resistor is connected or the load inertia is x 2 or more  
 The resistance shall be 30Ω. For the capacity, refer to the formula below.

$$2 \times \frac{\text{Calculation result of tact time}}{\text{Actual tact time}} \quad (\text{W})$$

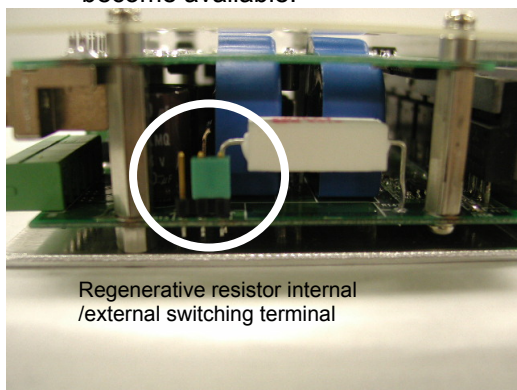
Connect to the R and GND terminals of the HA-680ML driver as shown below.



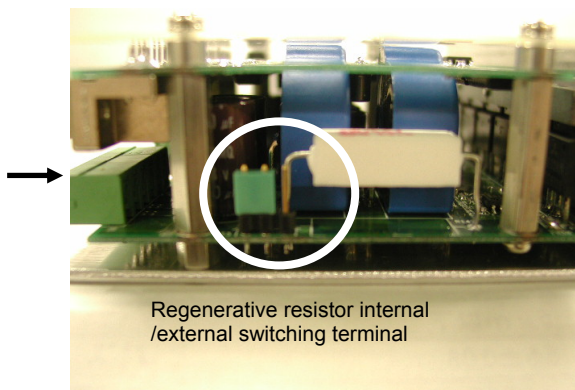
Model of terminal table:MC1.5/6-G-3.81  
 (Phoenix Contact)

**Switch the jumper setting.**

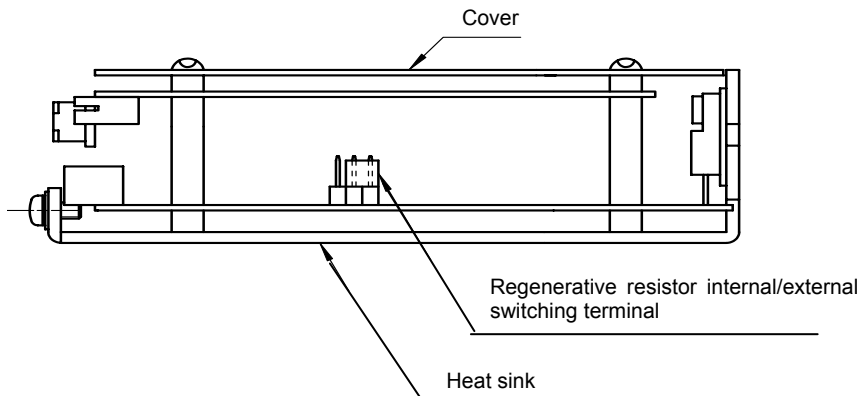
Change the settings of the regenerative resistor internal/external switching terminal of the HA-680ML driver, as shown below. If the setting is not changed, the external resistor will not become available.



Default status (internal regenerative resistor)



When an external resistor is connected



## 3-7 Connection of encoder cable and I/O cable

### Preparation for encoder cable and I/O cable

Observe the following items when preparing and wiring the encoder cable and I/O cable:

- (1) Use twisted pair shield cables with the necessary number of cores for the I/O signal cable and encoder signal cable. If multiple drivers are used, provide a separate I/O signal cable for each driver.
- (2) Shorten the wiring length as much as possible, as specified below:
  1. I/O signal cable: 3m or less
  2. Encoder signal cable (provided by the customer): 10m or less/Cable conductivity: 0.04Ω/m or less  
We have optional cables of 3m/5m/10m long.
- (3) Separate power cables (power source cables, motor wires and other circuits subject to strong electric power) and I/O signal cables by more than 30cm. Do not encase them in the same pipe or duct, nor bundle them together.
- (4) Do not open the end of cables for analog input signals, such as speed signals in particular.

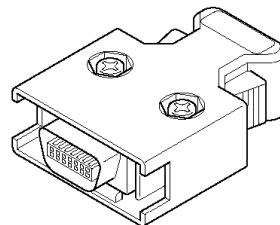
Terminal/connector	Symbol	Min. allowable wire size(mm <sup>2</sup> )
Encoder cable	CN1	Twisted pair shield cable of 0.3 mm <sup>2</sup> or larger
I/O signal cable	CN2	Twisted pair wire or twisted pair whole-shield cable of 0.35 mm <sup>2</sup> or larger

### Pin layout of encoder connector (CN1)

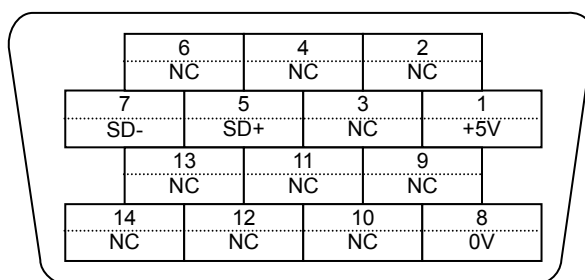
#### Pin layout 1 24-VAC FHA-C mini type

The model and pin layout of the encoder connector are shown below. Take note that the pin layout varies depending on the actuator used.

Connector : Model: 10114-3000PE    Manufacture: 3M  
Cover : Model: 10314-52F0-008    Manufacture: 3M



Encoder connector



The pin layout shown below is viewed from the soldering side.

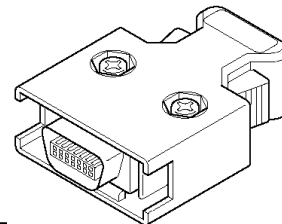


**The NC terminal is reserved. Do not connect anything to this terminal. If NC terminals are connected by mistake, malfunctions may result.**

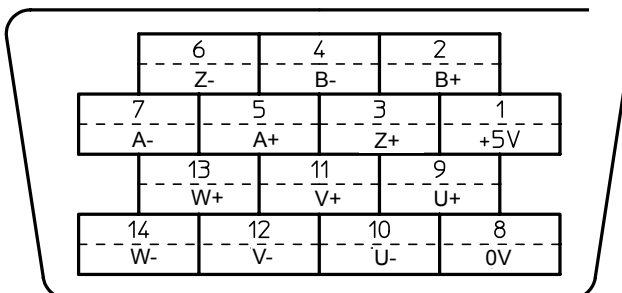
### Pin layout 2 RSF supermini, RSF-B mini series

The model and pin layout of the encoder connector are shown below. Take note that the pin layout varies depending on the actuator used.

Connector : Model: 10114-3000PE    Manufacture: 3M  
 Cover : Model: 10314-52F0-008    Manufacture: 3M



Encoder connector

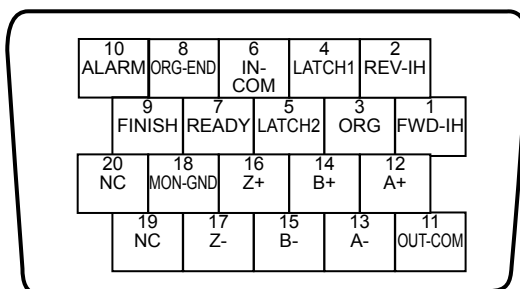
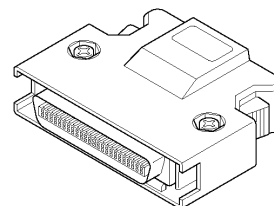


The pin layout shown below is viewed from the soldering side.

### Pin layout of I/O signal cable connector (CN2)

The model and pin layout of the I/O signal connector are shown below.

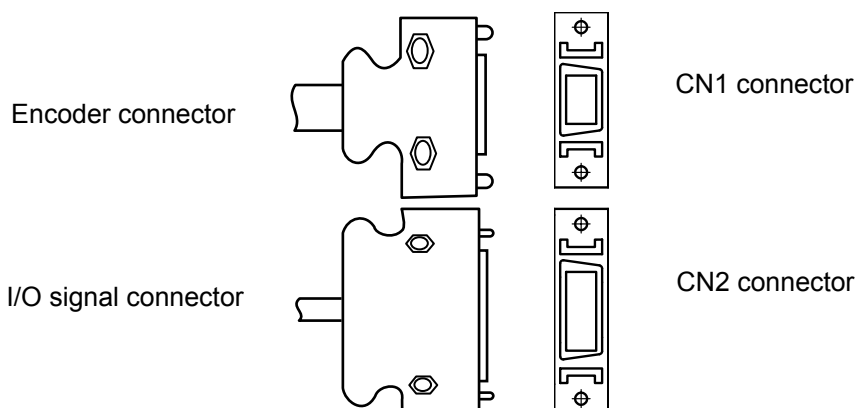
Connector : Model: 10120-3000PE    Manufacture: 3M  
 Cover : Model: 10320-52F0-008    Manufacture: 3M



The pin layout shown below is viewed from the soldering side.

## Connection of encoder cable and I/O cable

Securely insert the encoder cable connector and I/O cable connector into the CN1 and CN2 connectors of the HA-680ML driver as shown below.



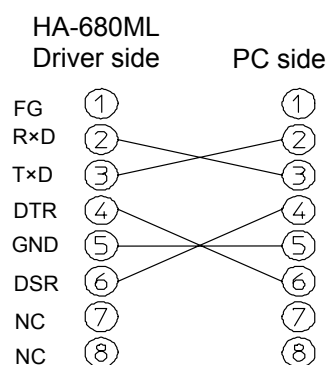
## EIA-232 (RS-232C) cable specifications (common to CN3)

The dedicated cable HDM-RS232C (cable length: 1.5m) is available for use in an EIA-232 (RS-232C) environment.

To provide any other cable, refer to the specifications below:

- (1) Applicable terminal type for cables (driver end)  
 Socket terminal : DF11-2428-SCF (by Hirose)  
 Socket : DF11-8DS-2C (by Hirose)
- (2) Applicable cable wire: 0.2mm<sup>2</sup> shield wire
- (3) Maximum wiring length: Within 10m

Pin assignments: Refer to the figure on the right.



## MECHATROLINK cable specifications

For the MECHATROLINK cable, be sure to use the cable specified by the MECHATROLINK Members Association. Never use any commercial USB cable.

For details, refer to the MECHATROLINK Members Association's web site [<http://www.mechatrolink.org/>].

## 3-8 Power ON/OFF sequence

Provide a sequence circuit that cuts off the main circuit power ON/OFF switch in response to an emergency stop signal or the HA-680ML driver's [CN2-3 Alarm: ALARM] signal. Also, turn ON/OFF the power supply after switching the [CN2-7 Servo-ON: S-ON] signal of the HA-680ML driver to OFF.

3

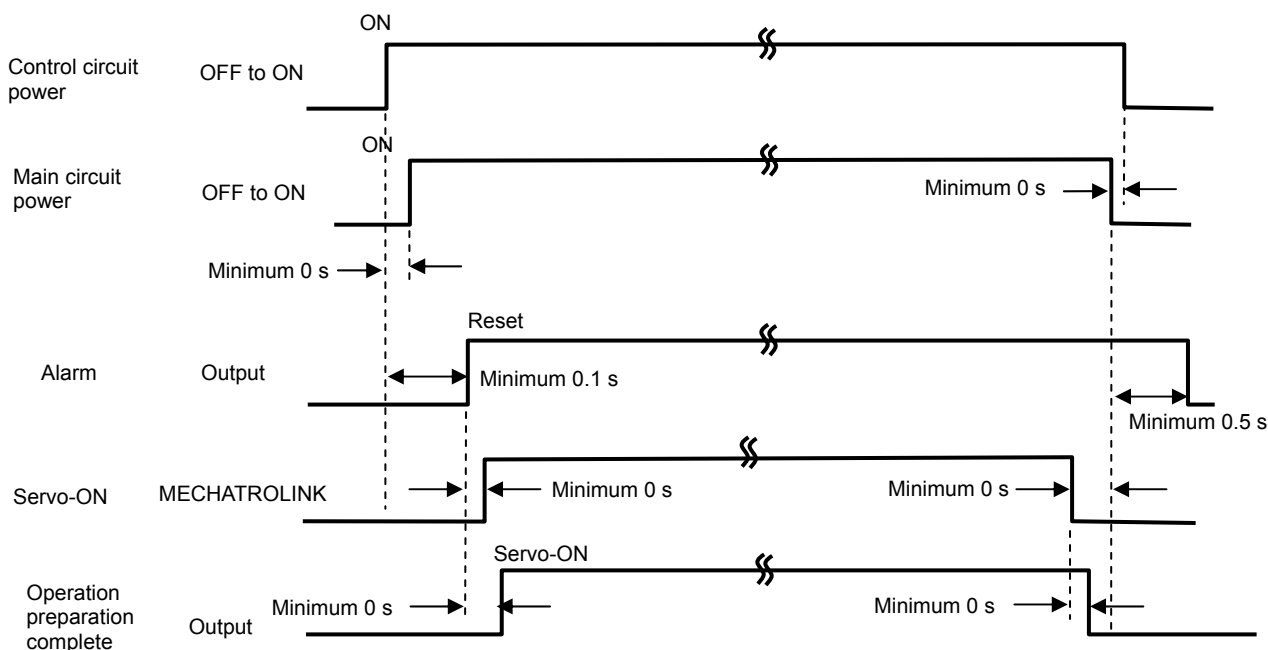
Installing the driver

### Frequency of power ON/OFF

The power input of the HA-680ML driver is of capacitor-input type, so a large surge current flows when the input power is turned on. Accordingly, if the power is turned ON/OFF too frequently, the surge-current limiting resistor in the internal circuit may deteriorate. The power ON/OFF frequency should not exceed 5 times in an hour and 30 times in a day. Furthermore, the interval between turning OFF and ON the power should keep more than 30 seconds.

### Power ON/OFF sequence

Create a sequence program on the host device so that the power to the HA-680ML driver will be turned ON/OFF at the timings shown below.



# Chapter 4

## MECHATROLINK communication function

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The communication function of MECHATROLINK is explained in this chapter.

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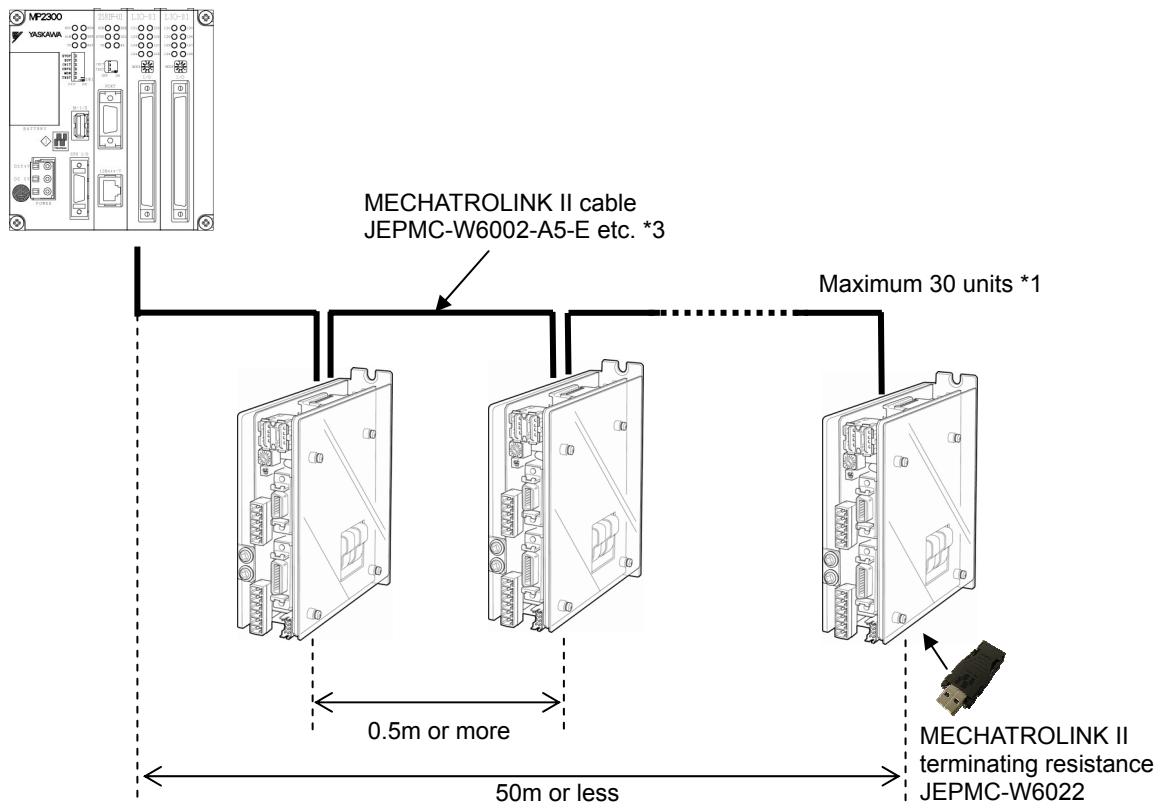
4-1	Communication specifications	4-1
4-2	System configuration	4-2
4-3	Communication setting	4-3
4-4	Main command	4-4
4-5	Subcommand	4-30
4-6	Command data field	4-34

## 4-1 Communication specifications

MECHATROLINK version	MECHATROLINK II
Transmission rate	10Mbps
Maximum transmission distance	50m
Minimum inter-station distance	0.5m
Transmission medium	2-core twisted pair cable with shield
Number of mobile units connected	Maximum 30 slave stations
Topology	Bus
Communication cycle	1, 2, 3, 4, 5ms
Communication method	Fully synchronized master/slave communication
Coding	Manchester encoding
Data length	17 bytes or 32 bytes, selectable

# 4-2 System configuration

Controller MP2000  
(by YASKAWA Electric Corporation) \*2



\*1 When 17 or more units communicate with one another or 16 units are connected over the total extension distance of 30m or more, repeaters are required. The maximum connectable number of units is limited by the communication cycle, retry count and other settings. For details, refer to the MECHATROLINK Members Association's web site [<http://www.mechatrolink.org/>].

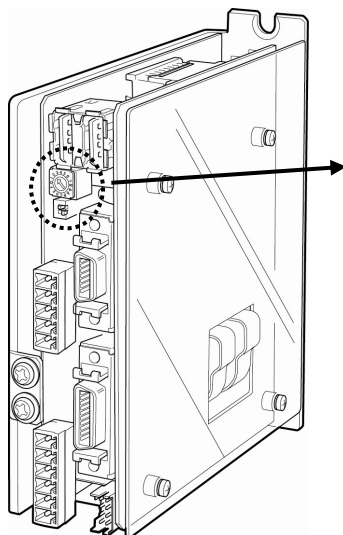
\*2 For the host controller, use MP2000 series by YASKAWA Electric Corporation. To connect to a controller by any other manufacturer, please consult us.

HA-680ML is used as a wildcard servo when combined with the MP2000 series. When used as a wildcard servo, some functions are limited. For details, refer to the MP series manual.

\*3 For the MECHATROLINK cable, be sure to use the cable specified by the MECHATROLINK Members Association.

## 4-3 Communication setting

On the HA-680ML, communication settings are specified using the 2-bit DIP switch and rotary switch. The new settings will become effective the next time the control power supply for HA-680ML is turned on.



DIP switch : Set the station address and transfer bytes.  
Rotary switch : Set the station address.

### 1 Setting the transfer bytes

The transfer bytes are set by the second bit of the DIP switch, as follows.

ON	32 byte
OFF	17 byte

### 2 Setting the station address

For the HA-680ML, the station address can be set in a range of 41H to 5FH. The upper digit of the station address is set by the first bit of the DIP switch, while the lower digit is set by the rotary switch.

Dip-SW bit1	Rotary switch	Station address	Dip-SW bit1	Rotary switch	Station address
OFF	0	Disable	ON	0	50H
OFF	1	41H	ON	1	51H
OFF	2	42H	ON	2	52H
OFF	3	43H	ON	3	53H
OFF	4	44H	ON	4	54H
OFF	5	45H	ON	5	55H
OFF	6	46H	ON	6	56H
OFF	7	47H	ON	7	57H
OFF	8	48H	ON	8	58H
OFF	9	49H	ON	9	59H
OFF	A	4AH	ON	A	5AH
OFF	B	4BH	ON	B	5BH
OFF	C	4CH	ON	C	5CH
OFF	D	4DH	ON	D	5DH
OFF	E	4EH	ON	E	5EH
OFF	F	4FH	ON	F	5FH

## 4-4 Main command

Main commands of the HA-680ML are explained.

Bytes 1 to 29 of command/response data are used. Byte 0 of the command is set to 03H, and 01H is returned in byte 0 of the response.

### List of main commands

No.	Name	Command	Description
1	NOP	00H	Disable command: Processing is not performed.
2	PRM_RD	01H	Read user parameters.
3	PRM_WR	02H	Write user parameters (change the setting in the RAM).
4	ID_RD	03H	Read the ID and control software version of the HA-680ML.
5	CONFIG	04H	Enable the parameter written by the device setup command PRM_WR.
6	ALM_RD	05H	Read the present alarms or warnings, or up to 8 most recent alarms.
7	ALM_CLR	06H	Clear the present alarms or alarm history.
8	SYNC_SET	0DH	Change the communication phase (2 → 3).
9	CONNECT	0EH	Establish a MECHATROLINK connection.
10	DISCONNECT	0FH	Release the MECHATROLINK connection.
11	PPRM_RD	1BH	Non-volatile parameter read (This command is not yet installed.)
12	PPRM_WR	1CH	Write multiple parameters to the EEPROM at once.
13	POS_SET	20H	Enable/disable the current value setting and soft limit monitoring function.
14	BRK_ON	21H	Brake actuation request (This command is not yet installed.)
15	BRK_OFF	22H	Brake release request (This command is not yet installed.)
16	SENS_ON	23H	Sensor-ON command
17	SENS_OFF	24H	Sensor OFF command
18	HOLD	25H	Motion stop Stop the actuator currently operating.
19	SMON	30H	Monitor the servo status.
20	SV_ON	31H	Turn ON the servo.
21	SV_OFF	32H	Turn OFF the servo.
22	INTERPOLATE	34H	Interpolated feed (Receive the displacement by every transmission cycle)
23	POSING	35H	Execute this command by specifying the displacement.
24	FEED	36H	Continuous operation at specified speed
25	LATCH	38H	Latch the position via an external input during interpolated feed.
26	EX_POSIN	39H	Positioning where the displacement can be changed via an external input
27	ZRET	3AH	Originating

## Details of main commands

- For details on each command, refer to [4-6 Command data field] (P4-34).
  - For details on ALARM, refer to [Alarm list] (P4-10) and [Warning list] (P4-10).
- (1) Disable command (NOP: 00H)

Byte	Command	Response	Explanation			
1	NOP(00H)	NOP(00H)	Processing category	Network command		
2		ALARM			Synchronization category	Asynchronous command
3		STATUS				
4					Subcommand	Permitted
5					Processing time	Within communication cycle
6					Usable phase	All OK
7						
8						
9						
10						
11						
12						
13						
14						
15						
16	WDT	REDT				
17	Bytes 17 to 29 conform to a subcommand.	Bytes 17 to 29 conform to a subcommand.				
18						
20						
21						
22						
23						
24						
25						
26						
27						
28						
29						

- For details on each command, refer to [4-6 Command data field] (P4-34).
- For details on ALARM, refer to [Alarm list] (P4-10) and [Warning list] (P4-10).

## (2) Parameter read command (PRM\_RD: 01H)

Byte	Command	Response	Explanation										
1	PRM_RD(01H)	PRM_RD(01H)	<table border="1"> <tr> <td>Processing category</td> <td>Data communication command</td> </tr> <tr> <td>Synchronization category</td> <td>Asynchronous command</td> </tr> <tr> <td>Subcommand</td> <td>Not permitted</td> </tr> <tr> <td>Processing time</td> <td>Within communication cycle</td> </tr> <tr> <td>Usable phase</td> <td>2, 3</td> </tr> </table>	Processing category	Data communication command	Synchronization category	Asynchronous command	Subcommand	Not permitted	Processing time	Within communication cycle	Usable phase	2, 3
Processing category	Data communication command												
Synchronization category	Asynchronous command												
Subcommand	Not permitted												
Processing time	Within communication cycle												
Usable phase	2, 3												
2	No.	ALARM											
3		STATUS											
4													
5													
6		No.											
7	SIZE	SIZE	<ul style="list-style-type: none"> <li>● Read the enabled parameters. For the contents of parameters of the set value of No., refer to the next page.</li> <li>● In the following conditions, a warning occurs and the command is ignored. In this case, PARAMETER in the response becomes indeterminable: <ul style="list-style-type: none"> <li>- An out-of-range number is set in No. Code 94</li> <li>- The SIZE does not match Code 94</li> <li>- The command is sent in a phase other than 2 or 3 Code 95</li> </ul> </li> </ul>										
8	PARAMETER	PARAMETER											
9													
10													
11													
12													
13													
14													
15													
16	WDT	REDT											

## (3) Parameter write command (PRM\_WR: 02H)

Byte	Command	Response	Explanation										
1	PRM_RD(02H)	PRM_RD(02H)	<table border="1"> <tr> <td>Processing category</td> <td>Data communication command</td> </tr> <tr> <td>Synchronization category</td> <td>Asynchronous command</td> </tr> <tr> <td>Subcommand</td> <td>Not permitted</td> </tr> <tr> <td>Processing time</td> <td>Within communication cycle</td> </tr> <tr> <td>Usable phase</td> <td>2, 3</td> </tr> </table>	Processing category	Data communication command	Synchronization category	Asynchronous command	Subcommand	Not permitted	Processing time	Within communication cycle	Usable phase	2, 3
Processing category	Data communication command												
Synchronization category	Asynchronous command												
Subcommand	Not permitted												
Processing time	Within communication cycle												
Usable phase	2, 3												
2	No.	ALARM											
3		STATUS											
4													
5													
6		No.											
7	SIZE	SIZE	<ul style="list-style-type: none"> <li>● Tentatively write a user parameter (the E2PROM is not written). After setting, offline user parameters will become enabled when a CONFIG command (04H) is executed.</li> <li>● In the following conditions, a warning occurs and the command is ignored: <ul style="list-style-type: none"> <li>- The command is sent in a phase other than 2 or 3 Code 95</li> <li>- An out-of-range number is set in No. Code 94</li> <li>- The parameter is out of range Code 94</li> <li>- The parameter is sent at a size other than the specified size Code 94</li> </ul> </li> </ul> <p>For the parameter No. and size, refer to the next page.</p>										
8	PARAMETER	PARAMETER											
9													
10													
11													
12													
13													
14													
15													
16	WDT	REDT											

Since the HA-680ML is recognized as a wildcard servo within the MECHATROLINK system, parameter read/write commands are not issued from the MP2300. To change parameters, use the PC monitor software PSF-520. Note that if your system is used in the servo-driver transparent command mode, parameter read/write commands can be used.

- For details on each command, refer to [4-6 Command data field] (P4-34).
- For details on ALARM, refer to [Alarm list] (P4-10) and [Warning list] (P4-10).

Parameter size and No.

No.	Parameter name	Data size		No.	Parameter name	Data size	
0	Position loop gain	4 byte		25	System reservation	4 byte	
1	Speed loop gain	4 byte		26	System reservation	4 byte	
2	Speed loop integral gain	4 byte		27	Deviation clear upon servo-ON	4 byte	
3	Speed loop derivative gain	4 byte		28	Angle compensation	4 byte	*1
4	Speed feed-forward factor	4 byte		29	Automatic gain setting for positioning	4 byte	
5	Acceleration feed-forward factor	4 byte		30	System reservation	4 byte	
6	Torque command filter	4 byte		31	System reservation	4 byte	
7	Speed step correction	4 byte		32	System reservation	4 byte	
8	Torque step correction	4 byte		33	Acceleration time constant	4 byte	
9	Step correction switch range	4 byte		34	Deceleration time constant	4 byte	
10	System reservation	4 byte		35	System reservation	4 byte	
11	System reservation	4 byte		36	System reservation	4 byte	
12	System reservation	4 byte		37	System reservation	4 byte	
13	Input pin logical setting	4 byte	*1	38	System reservation	4 byte	
14	Output pin logical setting	4 byte	*1	39	Final external positioning distance	4 byte	
15	Control input filter time constant	4 byte	*1	40	System reservation	4 byte	
16	System reservation	4 byte		41	FWD soft limit	4 byte	
17	FWD current limiting	4 byte		42	System reservation	4 byte	
18	REV current limiting	4 byte		43	REV soft limit	4 byte	
19	Regenerative brake ON/OFF	4 byte		44	System reservation	4 byte	
20	Rotation direction command	4 byte	*1	45	Originating direction	4 byte	
21	Allowable position deviation	4 byte		46	Origin position range	4 byte	
22	In-position range	4 byte		47	Originating approach speed	4 byte	
23	Command pulse input factor-Numerator	4 byte	*1	48	Originating acceleration/deceleration time	4 byte	
24	Command pulse input factor-Denominator	4 byte	*1	49	Virtual origin	4 byte	

\*1 These are offline user parameters.

- For details on each command, refer to [4-6 Command data field] (P4-34).
  - For details on ALARM, refer to [Alarm list] (P4-10) and [Warning list] (P4-10).
- (4) ID read command (ID\_RD: 03H)

Byte	Command	Response	Explanation											
1	ID_RD(03H)	ID_RD(03H)	<table border="1"> <tr> <td>Processing category</td> <td>Data communication command</td> </tr> <tr> <td>Synchronization category</td> <td>Asynchronous command</td> </tr> <tr> <td>Subcommand</td> <td>Not permitted</td> </tr> <tr> <td>Processing time</td> <td>Within communication cycle</td> </tr> <tr> <td>Usable phase</td> <td>2, 3</td> </tr> </table>	Processing category	Data communication command	Synchronization category	Asynchronous command	Subcommand	Not permitted	Processing time	Within communication cycle	Usable phase	2, 3	
Processing category	Data communication command													
Synchronization category	Asynchronous command													
Subcommand	Not permitted													
Processing time	Within communication cycle													
Usable phase	2, 3													
2	ID_RD(03H)	ALARM												
3		STATUS												
4														
5	DEVICE_CODE	DEVICE_CODE												
6	OFFSET	OFFSET												
7	SIZE	SIZE												
8	ID_RD(03H)	ID	● Read the ID. For details on ID, refer to the explanation below.											
9			● In the following conditions, a warning occurs and the command is ignored:											
10			- DEVICE-CODE is out of range Code 94											
11			- OFFSET is out of range Code 94											
12			- Wrong SIZE (a value other than 1 to 8 is set) Code 94											
13														
14														
15														
16	WDT	REDT												

Type/name		OFFSET	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F	10
		DEVICE CODE																	
Driver	Model	00	H	A	-	6	8	0	M	L	0	0	0	0	0	0	0	0	0
	Firmware ver.	02	01h	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

\*1 The model is indicated by ASCII code.

\*2 The firmware version is indicated in HEX.

\*3 In the above example, the firmware version is 1.00.

- For details on each command, refer to [4-6 Command data field] (P4-34).
  - For details on ALARM, refer to [Alarm list] (P4-10) and [Warning list] (P4-10).
- (5) Device setup request command (CONFIG: 04H)

Byte	Command	Response	Explanation										
1	CONFIG(04H)	CONFIG(04H)	<table border="1" style="width: 100%;"> <tr> <td>Processing category</td> <td>Control command</td> </tr> <tr> <td>Synchronization category</td> <td>Asynchronous command</td> </tr> <tr> <td>Subcommand</td> <td>Not permitted</td> </tr> <tr> <td>Processing time</td> <td>Maximum 4 s + <math>\alpha</math></td> </tr> <tr> <td>Usable phase</td> <td>2, 3</td> </tr> </table> <ul style="list-style-type: none"> <li>● Set the currently set parameters to initialize the positions, signals, etc. again.</li> <li>● If this command is received when the servo is ON, the servo turns OFF.</li> <li>● In the following conditions, a warning occurs and the command is ignored:                             <ul style="list-style-type: none"> <li>- The command is sent in a phase other than 2 or 3 Code 95</li> </ul> </li> </ul>	Processing category	Control command	Synchronization category	Asynchronous command	Subcommand	Not permitted	Processing time	Maximum 4 s + $\alpha$	Usable phase	2, 3
Processing category		Control command											
Synchronization category		Asynchronous command											
Subcommand		Not permitted											
Processing time		Maximum 4 s + $\alpha$											
Usable phase		2, 3											
2		ALARM											
3		STATUS											
4													
5													
6													
7													
8													
9													
10													
11													
12													
13													
14													
15													
16	WDT	REDT											

\* The CMDRDY bit of STATUS remains 0 while the CONFIG command is being executed, and turns 1 upon completion of the CONFIG.

- For details on each command, refer to [4-6 Command data field] (P4-34).
- For details on ALARM, refer to [Alarm list] (P4-10) and [Warning list] (P4-10).

## (6) Error/warning read command (ALM\_RD: 05H)

Byte	Command	Response	Explanation
1	ARM_RD(05H)	ARM_RD(05H)	
2		ALARM	Processing category Control command
3		STATUS	Synchronization category Asynchronous command
4			Subcommand Not permitted
5	ALM_RD_MOD	ALM_RD_MOD	Processing time Maximum 2 s
6		ALM_DATA	Usable phase 2, 3
7			<ul style="list-style-type: none"> <li>● Read the list of present errors/warnings and error history. ALM_RD_MOD 0: Present warnings, errors: The processing time is within the communication cycle. ALM_RD_MOD 1: Error history* Up to 8 errors: The processing time is within 2 seconds. (0 is written for the 8th and subsequent errors and in the empty fields of history data.)</li> <li>● In the following conditions, a warning occurs and the command is ignored: - Wrong ALM_RD_MOD setting Code 94 - The command is sent in a phase other than 2 or 3 Code 95 * Warning history is not kept.</li> </ul>
8			
9			
10			
11			
12			
13			
14			
15			
16	WDT	REDT	

## · Alarm list

Alarm code	Alarm name	Description
<b>72H</b>	Overload	The electronic thermal detected an overload status.
<b>B0H</b>	Excessive deviation	The deviation upon servo-ON exceeds the value of parameter No. 21.
<b>CBH</b>	Encoder breakage	The encoder line is broken.
<b>C9H</b>	Encoder communication error 1	Encoder data could not be received for at least 10 times consecutively.
<b>C9H</b>	Encoder communication error 2	The encoder data receiving circuit detected a communication error.
<b>90H</b>	UVW error	The encoder phases UVW have become the same level.
<b>40H</b>	Regenerative failure	The main-circuit voltage exceeded 50V
<b>7AH</b>	Overheat detected	The driver temperature rose and the temperature sensor actuated.
<b>B3H</b>	System error	A CT error was detected.
<b>B0H</b>	Overcurrent	The CT detected an excessive current.
<b>B1H</b>	Load short circuit	An excessive current flowed to the FET.
<b>EAH</b>	Memory failure	Abnormal parameter or memory in the driver
<b>51H</b>	Overspeed	The motor shaft speed exceeded the max. rotational speed by 100 r/min for 0.5 s or more.
<b>05H</b>	Combination error	A motor different from the one for which the driver had been adjusted was connected (wire-saving encoder only).
<b>E6H</b>	WDT error	An error was detected by the WDT check.
<b>E5H</b>	Synchronization error	Data was received off the transfer cycle.

## · Warning list

Alert name	Description	Alarm code
Overload	The operation is inside an overload range and an alarm may occur.	90
Command data error	Command set data is wrong.	94
Command error	The command that was sent is unsupported, or it was sent in an unsupported phase.	95
Communication warning	A MECHATROLINK communication error occurred.	96

- For details on each command, refer to [4-6 Command data field] (P4-34).
  - For details on ALARM, refer to [Alarm list] (P4-10) and [Warning list] (P4-10).
- (7) Error/warning clear command (ALM\_CLR: 06H)

Byte	Command	Response	Explanation	
1	ARM_CL(06H)	ARM_CL(06H)		
2		ALARM	Processing category	Control command
3			Synchronization category	Asynchronous command
4		STATUS	Subcommand	Not permitted
5			ALM_CLR_MOD	ALM_CLR_MOD
6			Usable phase	2, 3
7			<ul style="list-style-type: none"> <li>● Clear the present errors/warnings and error history. ALM_RD_MOD 0: Clear the present warnings/errors: The processing time is within 200 ms. ALM_RD_MOD 1: Clear the error history: The processing time is within 2 s.</li> <li>● In the following conditions, a warning occurs and the command is ignored:                             <ul style="list-style-type: none"> <li>- Wrong ALM_CLR_MOD setting: Data setting warning Code 94</li> <li>- The command is sent in a phase other than 2 or 3 Code 95</li> </ul> </li> </ul>	
8				
9				
10				
11				
12				
13				
14				
15				
16	WDT	REDT		

\* All present warnings can be cleared, but alarms that cannot be cleared with the clear command remain uncleared. To clear alarms that cannot be cleared with the clear command, you must reconnect the driver power.

Alarm code	Alarm name	Clear command enable/disable
72	Overload	Enable
D0	Excessive deviation	Enable
CD	Encoder breakage	Disable
C9	Encoder communication error 1	Disable
C9	Encoder communication error 2	Disable
90	UVW error	Disable
40	Regenerative failure	Disable
7A	Overheat detected	Disable
B3	System error	Disable
B0	Overcurrent	Disable
B1	Load short circuit	Disable
EA	Memory failure	Disable
51	Overspeed	Disable
05	Combination error	Disable
E6	WDT error	Enable
E5	Synchronization error	Enable

- For details on each command, refer to [4-6 Command data field] (P4-34).
  - For details on ALARM, refer to [Alarm list] (P4-10) and [Warning list] (P4-10).
- (8) Synchronization establishment request command (SYNC\_SET: 0DH)

Byte	Command	Response	Explanation	
1	SYNC_SET(0DH)	SYNC_SET(0DH)	Processing category	Network command
2		ALARM	Synchronization category	Asynchronous command
3		STATUS	Subcommand	Not permitted
4			Processing time	Communication cycle or longer
5			Usable phase	2
6				
7				<ul style="list-style-type: none"> <li>● Synchronous communication is started. (Move from phase 2 to phase 3.)</li> </ul>
8				<ul style="list-style-type: none"> <li>● The processing is complete upon change of the WDT edge.</li> </ul>
9				<ul style="list-style-type: none"> <li>● If this command is received in the following conditions, the applicable operations take place: <ul style="list-style-type: none"> <li>- This command is received in phase 1: Command warning Code 95</li> <li>- This command is received in phase 3: Ignored (no warning)</li> <li>- This command is received in phase 2 when the servo is ON: Servo-OFF</li> </ul> </li> </ul>
10				
11				
12				
13				<ul style="list-style-type: none"> <li>● If any of the following alarms occurs, synchronous communication is resumed by this command: <ul style="list-style-type: none"> <li>- MECHATROLINK synchronization error</li> <li>- MECHATROLINK communication error</li> <li>- MECHATROLINK transfer cycle error</li> </ul> </li> </ul>
14				
15				
16	WDT	REDT		

- For details on each command, refer to [4-6 Command data field] (P4-34).
  - For details on ALARM, refer to [Alarm list] (P4-10) and [Warning list] (P4-10).
- (9) Connection establishment request command (CONNECT: 0EH)

Byte	Command	Response	Explanation										
1	CONNECT(0EH)	CONNECT(0EH)	<table border="1"> <tr> <td>Processing category</td> <td>Network command</td> </tr> <tr> <td>Synchronization category</td> <td>Asynchronous command</td> </tr> <tr> <td>Subcommand</td> <td>Not permitted</td> </tr> <tr> <td>Processing time</td> <td>Communication cycle or longer</td> </tr> <tr> <td>Usable phase</td> <td>All OK</td> </tr> </table>	Processing category	Network command	Synchronization category	Asynchronous command	Subcommand	Not permitted	Processing time	Communication cycle or longer	Usable phase	All OK
Processing category	Network command												
Synchronization category	Asynchronous command												
Subcommand	Not permitted												
Processing time	Communication cycle or longer												
Usable phase	All OK												
2		ALARM											
3		STATUS											
4													
5		VER	VER										
6	COM_MOD	COM_MOD	<ul style="list-style-type: none"> <li>● Establish a MECHATROLINK connection. Set the communication mode via COM_MOD. (Refer to the details of CMD_MOD.)</li> <li>● VER: Set the version 21H.</li> <li>● COM_TIM: Fixed to 1.</li> <li>● In the following conditions, a warning occurs and the command is ignored:                             <ul style="list-style-type: none"> <li>- CMD_MOD is outside the setting range Code 94</li> <li>- CMD_TIM is outside the setting range Code 94</li> <li>- VER is not 21H Code 94</li> </ul> </li> </ul>										
7	COM_TIM	COM_TIM											
8													
9													
10													
11													
12													
13													
14													
15													
16	WDT	REDT											

COM\_MODE details

bit7	bit6	bit5	bit4	bit3	bit2	bit1	bit0
SUBCMD	0	0	0	DTMOD		SYNCMOD	0

Bit	Name	Description	Value	Status
bit1	SYNCMOD	Setting of switching phase	0	Switch from phase 1 to phase 2.
			1	Switch from phase 1 to phase 3.
bit2/3	DTMOD	Data transfer method	D2:0or1 D1:0or1	Single send mode
			D2:0 D1:1	Reserved (Do not set.)
bit7	SUBCMD	Selection of subcommand used/not yet used	0	Subcommand not used
			1	Subcommand used

- For details on each command, refer to [4-6 Command data field] (P4-34).
  - For details on ALARM, refer to [Alarm list] (P4-10) and [Warning list] (P4-10).
- (10) Connection release request command (DISCONNECT: 0FH)

Byte	Command	Response	Explanation										
1	DISCONNECT(0FH)	DISCONNECT(0FH)	<table border="1"> <tr> <td>Processing category</td> <td>Network command</td> </tr> <tr> <td>Synchronization category</td> <td>Asynchronous command</td> </tr> <tr> <td>Subcommand</td> <td>Not permitted</td> </tr> <tr> <td>Processing time</td> <td>Communication cycle or longer</td> </tr> <tr> <td>Usable phase</td> <td>All OK</td> </tr> </table> <ul style="list-style-type: none"> <li>● Open the connection.</li> <li>● When this command is executed, the following operations take place: <ul style="list-style-type: none"> <li>- Switch to phase 1.</li> <li>- Turn OFF the servo.</li> <li>- Initialize the position information.</li> <li>- Disable the reference point setting.</li> </ul> </li> </ul>	Processing category	Network command	Synchronization category	Asynchronous command	Subcommand	Not permitted	Processing time	Communication cycle or longer	Usable phase	All OK
Processing category	Network command												
Synchronization category	Asynchronous command												
Subcommand	Not permitted												
Processing time	Communication cycle or longer												
Usable phase	All OK												
2		ALARM											
3		STATUS											
4													
5													
6													
7													
8													
9													
10													
11													
12													
13													
14													
15													
16	WDT	REDT											

(11) Non-volatile parameter read command (PPRM\_RD: 1BH)

Byte	Command	Response	Explanation
1	PPRM_RD(1BH)	PPRM_RD(1BH)	This command is not yet supported. If this command is sent, warning code 95 occurs.
2		ALARM	
3		STATUS	
4			
5			
6			
7			
8			
9			
10			
11			
12			
13			
14			
15			
16	WDT	RWDT	

- For details on each command, refer to [4-6 Command data field] (P4-34).
  - For details on ALARM, refer to [Alarm list] (P4-10) and [Warning list] (P4-10).
- (12) Non-volatile parameter write command (PPRM\_WR: 1CH)

Byte	Command	Response	Explanation	
1	PPRM_WR(1CH)	PPRM_WR(1CH)		
2		ALARM	Processing category	Data communication command
3		STATUS	Synchronization category	Asynchronous command
4			Subcommand	Not permitted
5		No.	No.	Processing time
6	SIZE	SIZE	Usable phase	2, 3
8	PARAMETER	PARAMETER	<ul style="list-style-type: none"> <li>● Change the contents of the RAM and EEPROM areas where the parameter specified by No. is saved, to the value specified by PARAMETER.</li> <li>● In the following conditions, a warning occurs and the command is ignored:                             <ul style="list-style-type: none"> <li>- The command is sent in phase 1 Code 95</li> </ul> </li> <li>● CMDRDY = 0 applies while the parameter is being written. Do not turn off the HA-680ML during this period.</li> </ul>	
9				
10				
11				
12				
13				
14				
15				
16	WDT	RWDT		

(13) Coordinate system setting command (POS\_SET: 20H)

Byte	Command	Response	Explanation	
1	PPRM_WR(20H)	PPRM_WR(20H)		
2		ALARM	Processing category	Data communication command
3		STATUS	Synchronization category	Asynchronous command
4			Subcommand	Not permitted
5		PS_SUBCMD	PS_SUBCMD	Processing time
6	POS_DATA	POS_DATA	Usable phase	2, 3
7			<ul style="list-style-type: none"> <li>● Set the coordinate system. When REFE of PS_SUBCMD is set to 1, the soft limits are enabled.</li> <li>● In the following conditions, a warning occurs and the command is ignored:                             <ul style="list-style-type: none"> <li>- The command is sent in phase 1 Code 95</li> <li>- A value other than 3 is set in POS_SEL Code 94</li> <li>- This command is sent while the motor is operating Code 94</li> <li>- POS_DATA does not meet the condition of [FWD soft limit &gt; POS_DATA &gt; REV soft limit] Code 94</li> <li>- An attempt is made to change REFE of PS_SUBCMD to 1 when the condition of [FWD soft limit &gt; POS_DATA &gt; REV soft limit] is not met Code 94</li> </ul> </li> <li>● Only 03H (feedback position) can be set in POSSUBCMD (lower 4 bits).</li> </ul>	
8				
9				
10				
11				
12				
13				
14				
15				
16	WDT	REDT		

PS\_SUBCMD details

bit7	bit6	bit5	bit4	bit3	bit2	bit1	bit0
REFE	0	0	0	POS_SEL			

- REFE
  - 0 : Disable the soft limits. 1 : Enable the soft limits.
- POS\_SEL
  - Specify 3H. If a value other than 3H is specified, a warning (94) occurs.

- For details on each command, refer to [4-6 Command data field] (P4-34).
  - For details on ALARM, refer to [Alarm list] (P4-10) and [Warning list] (P4-10).
- (14) Brake actuation request command (BRK\_ON: 21H)

Byte	Command	Response	Explanation										
1	BRK_ON(21H)	BRK_ON(21H)	<table border="1"> <tr> <td>Processing category</td> <td>Data communication command</td> </tr> <tr> <td>Synchronization category</td> <td>Asynchronous command</td> </tr> <tr> <td>Subcommand</td> <td>Not permitted</td> </tr> <tr> <td>Processing time</td> <td>Within communication cycle</td> </tr> <tr> <td>Usable phase</td> <td>2, 3</td> </tr> </table> <p>This command is not yet supported. If this command is sent, a warning (code 95) occurs.</p>	Processing category	Data communication command	Synchronization category	Asynchronous command	Subcommand	Not permitted	Processing time	Within communication cycle	Usable phase	2, 3
Processing category	Data communication command												
Synchronization category	Asynchronous command												
Subcommand	Not permitted												
Processing time	Within communication cycle												
Usable phase	2, 3												
2		ALARM											
3		STATUS											
4													
5													
6													
7													
8													
9													
10													
11													
12													
13													
14													
15													
16	WDT	RWDT											

(15) Brake release request command (BRK\_OFF: 22H)

Byte	Command	Response	Explanation										
1	BRK_OFF(22H)	BRK_OFF(22H)	<table border="1"> <tr> <td>Processing category</td> <td>Data communication command</td> </tr> <tr> <td>Synchronization category</td> <td>Asynchronous command</td> </tr> <tr> <td>Subcommand</td> <td>Not permitted</td> </tr> <tr> <td>Processing time</td> <td>Within communication cycle</td> </tr> <tr> <td>Usable phase</td> <td>2, 3</td> </tr> </table> <p>This command is not yet supported. If this command is sent, a warning (code 95) occurs.</p>	Processing category	Data communication command	Synchronization category	Asynchronous command	Subcommand	Not permitted	Processing time	Within communication cycle	Usable phase	2, 3
Processing category	Data communication command												
Synchronization category	Asynchronous command												
Subcommand	Not permitted												
Processing time	Within communication cycle												
Usable phase	2, 3												
2		ALARM											
3		STATUS											
4													
5													
6													
7													
8													
9													
10													
11													
12													
13													
14													
15													
16	WDT	RWDT											

- For details on each command, refer to [4-6 Command data field] (P4-34).
- For details on ALARM, refer to [Alarm list] (P4-10) and [Warning list] (P4-10).

(16) Sensor-ON command (SENS\_ON: 23H)

Byte	Command	Response	Explanation										
1	SENS_ON(23H)	SENS_ON(23H)	<table border="1"> <tr> <td>Processing category</td> <td>Control command</td> </tr> <tr> <td>Synchronization category</td> <td>Asynchronous command</td> </tr> <tr> <td>Subcommand</td> <td>Not permitted</td> </tr> <tr> <td>Processing time</td> <td>Within communication cycle</td> </tr> <tr> <td>Usable phase</td> <td>2, 3</td> </tr> </table> <p>This command is not yet supported, but even if it is received, the operation is not affected and only a response is returned.</p>	Processing category	Control command	Synchronization category	Asynchronous command	Subcommand	Not permitted	Processing time	Within communication cycle	Usable phase	2, 3
Processing category		Control command											
Synchronization category		Asynchronous command											
Subcommand		Not permitted											
Processing time		Within communication cycle											
Usable phase		2, 3											
2		ALARM											
3		STATUS											
4													
5		MONITOR1											
6													
7													
8													
9	MONITOR2												
10													
11													
12													
13	SEL_MON1/2	SEL_MON1/2											
14		IO_MON											
15													
16	WDT	RWDT											

(17) Sensor OFF command (SENS\_OFF: 24H)

Byte	Command	Response	Explanation										
1	SENS_OFF(24H)	SENS_OFF(24H)	<table border="1"> <tr> <td>Processing category</td> <td>Control command</td> </tr> <tr> <td>Synchronization category</td> <td>Asynchronous command</td> </tr> <tr> <td>Subcommand</td> <td>Not permitted</td> </tr> <tr> <td>Processing time</td> <td>Within communication cycle</td> </tr> <tr> <td>Usable phase</td> <td>2, 3</td> </tr> </table> <p>This command is not yet supported, but even if it is received, the operation is not affected and only a response is returned.</p>	Processing category	Control command	Synchronization category	Asynchronous command	Subcommand	Not permitted	Processing time	Within communication cycle	Usable phase	2, 3
Processing category		Control command											
Synchronization category		Asynchronous command											
Subcommand		Not permitted											
Processing time		Within communication cycle											
Usable phase		2, 3											
2		ALARM											
3		STATUS											
4													
5		MONITOR1											
6													
7													
8													
9	MONITOR2												
10													
11													
12													
13	SEL_MON1/2	SEL_MON1/2											
14		IO_MON											
15													
16	WDT	RWDT											

- For details on each command, refer to [4-6 Command data field] (P4-34).
  - For details on ALARM, refer to [Alarm list] (P4-10) and [Warning list] (P4-10).
- (18) Motion stop request command (HOLD: 25H)

Byte	Command	Response	Explanation										
1	HOLD(25H)	HOLD(25H)	<table border="1"> <tr> <td>Processing category</td> <td>Motion command</td> </tr> <tr> <td>Synchronization category</td> <td>Asynchronous command</td> </tr> <tr> <td>Subcommand</td> <td>Permitted</td> </tr> <tr> <td>Processing time</td> <td>Within communication cycle</td> </tr> <tr> <td>Usable phase</td> <td>2, 3</td> </tr> </table>	Processing category	Motion command	Synchronization category	Asynchronous command	Subcommand	Permitted	Processing time	Within communication cycle	Usable phase	2, 3
Processing category	Motion command												
Synchronization category	Asynchronous command												
Subcommand	Permitted												
Processing time	Within communication cycle												
Usable phase	2, 3												
2	OPTION	ALARM											
3		STATUS											
4	HOLD_MODE	MONITOR1											
5													
6													
7													
8													
9		MONITOR2											
10													
11													
12	SEL_MON1/2	SEL_MON1/2											
13													
14	WDT	IO_MON											
15													
16	Bytes 17 to 29 conform to a subcommand.	REDT											
17													
18													
19													
20													
21													
22													
23													
24													
25													
26													
27													
28													
29													

- The motor in a motion status (operating status) decelerates to a stop over the time specified by parameter No. 34 [Deceleration time constant].
- In the following conditions, a warning occurs and the command is ignored:  
- Issued in phase 1: Command warning Code 95
- The set values of HOLD\_MODE and corresponding operations are as follows:  
0: Decelerate according to the deceleration time constant (parameter No. 34)  
1: Rapid stop (command execution is cancelled.)

- For details on each command, refer to [4-6 Command data field] (P4-34).
  - For details on ALARM, refer to [Alarm list] (P4-10) and [Warning list] (P4-10).
- (19) Status monitor command (SMON: 30H)

Byte	Command	Response	Explanation										
1	SMON(30H)	SMON(30H)	<table border="1"> <tr> <td>Processing category</td> <td>Data communication command</td> </tr> <tr> <td>Synchronization category</td> <td>Asynchronous command</td> </tr> <tr> <td>Subcommand</td> <td>Permitted</td> </tr> <tr> <td>Processing time</td> <td>Within communication cycle</td> </tr> <tr> <td>Usable phase</td> <td>2, 3</td> </tr> </table> <ul style="list-style-type: none"> <li>● The servo status is monitored.</li> <li>● If this command is sent in phase 1, a command warning (95) is issued and the command is ignored.</li> </ul>	Processing category	Data communication command	Synchronization category	Asynchronous command	Subcommand	Permitted	Processing time	Within communication cycle	Usable phase	2, 3
Processing category	Data communication command												
Synchronization category	Asynchronous command												
Subcommand	Permitted												
Processing time	Within communication cycle												
Usable phase	2, 3												
2		ALARM											
3		STATUS											
4													
5		MONITOR1											
6													
7													
8		MONITOR2											
9													
10													
11													
12													
13		SEL_MON1/2	SEL_MON1/2										
14		IO_MON											
15													
16	WDT	REDT											
17	Bytes 17 to 29 conform to a subcommand.	Bytes 17 to 29 conform to a subcommand.											
18													
19													
20													
21													
22													
23													
24													
25													
26													
27													
28													
29													

- For details on each command, refer to [4-6 Command data field] (P4-34).
- For details on ALARM, refer to [Alarm list] (P4-10) and [Warning list] (P4-10).

(20) Servo-ON (SV\_ON: 31H)

Byte	Command	Response	Explanation										
1	SV_ON(31H)	SV_ON(31H)	<table border="1"> <tr> <td>Processing category</td> <td>Control command</td> </tr> <tr> <td>Synchronization category</td> <td>Asynchronous command</td> </tr> <tr> <td>Subcommand</td> <td>Permitted</td> </tr> <tr> <td>Processing time</td> <td>Within 50 ms</td> </tr> <tr> <td>Usable phase</td> <td>2, 3</td> </tr> </table> <ul style="list-style-type: none"> <li>● The actuator servo turns ON.</li> <li>● In the following conditions, a warning occurs and the command is ignored: <ul style="list-style-type: none"> <li>- The command is sent in phase 1: Command warning Code 95</li> <li>- The command is sent while an alarm is present: Only the STATUS warning bit turns 1.</li> </ul> (The ALARM display shows the present alarm.) </li> </ul>	Processing category	Control command	Synchronization category	Asynchronous command	Subcommand	Permitted	Processing time	Within 50 ms	Usable phase	2, 3
Processing category	Control command												
Synchronization category	Asynchronous command												
Subcommand	Permitted												
Processing time	Within 50 ms												
Usable phase	2, 3												
2		ALARM											
3	OPTION	STATUS											
4													
5		MONITOR1											
6													
7													
8													
9		MONITOR2											
10													
11													
12													
13	SEL_MON1/2	SEL_MON1/2											
14		IO_MON											
15													
16	WDT	REDT											
17	Bytes 17 to 29 conform to a subcommand.	Bytes 17 to 29 conform to a subcommand.											
18													
19													
20													
21													
22													
23													
24													
25													
26													
27													
28													
29													

- For details on each command, refer to [4-6 Command data field] (P4-34).
  - For details on ALARM, refer to [Alarm list] (P4-10) and [Warning list] (P4-10).
- (21) Servo-OFF (SV\_OFF: 32H)

Byte	Command	Response	Explanation										
1	SV_OFF(32H)	SV_OFF(32H)	<table border="1"> <tr> <td>Processing category</td> <td>Control command</td> </tr> <tr> <td>Synchronization category</td> <td>Asynchronous command</td> </tr> <tr> <td>Subcommand</td> <td>Permitted</td> </tr> <tr> <td>Processing time</td> <td>Within 50 ms</td> </tr> <tr> <td>Usable phase</td> <td>2, 3</td> </tr> </table> <ul style="list-style-type: none"> <li>● The actuator servo turns OFF.</li> <li>● In the following conditions, a warning occurs and the command is ignored:                     <ul style="list-style-type: none"> <li>- The command is sent in phase 1: Command warning Code 95</li> </ul> </li> </ul>	Processing category	Control command	Synchronization category	Asynchronous command	Subcommand	Permitted	Processing time	Within 50 ms	Usable phase	2, 3
Processing category	Control command												
Synchronization category	Asynchronous command												
Subcommand	Permitted												
Processing time	Within 50 ms												
Usable phase	2, 3												
2		ALARM											
3		STATUS											
4													
5		MONITOR1											
6													
7													
8		MONITOR2											
9													
10													
11													
12													
13	SEL_MON1/2	SEL_MON1/2											
14		IO_MON											
15													
16	WDT	REDT											
17	Bytes 17 to 29 conform to a subcommand.	Bytes 17 to 29 conform to a subcommand.											
18													
19													
20													
21													
22													
23													
24													
25													
26													
27													
28													
29													

4

MECHATROLINK communication function

- For details on each command, refer to [4-6 Command data field] (P4-34).
  - For details on ALARM, refer to [Alarm list] (P4-10) and [Warning list] (P4-10).
- (22) Interpolated feed (INTERPOLATE: 34H)

Byte	Command	Response	Explanation										
1	INTERPOLATE(34H)	INTERPOLATE(34H)	<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td>Processing category</td> <td>Motion command</td> </tr> <tr> <td>Synchronization category</td> <td>Synchronous command</td> </tr> <tr> <td>Subcommand</td> <td>Permitted</td> </tr> <tr> <td>Processing time</td> <td>Within communication cycle</td> </tr> <tr> <td>Usable phase</td> <td>3</td> </tr> </table> <ul style="list-style-type: none"> <li>● Interpolated feed is performed.</li> <li>● In the following conditions, a warning occurs and the command is ignored: <ul style="list-style-type: none"> <li>-The command is sent in a phase other than 3: Command warning Code 95</li> <li>-The command is sent in servo-OFF: Command warning Code 95</li> <li>-The difference from the last TPOS command exceeds the limit value: Data setting warning Code 94</li> </ul> </li> <li>● Use DEN of STATUS to check if the position command output has completed. VFF (speed feed-forward gain) may be sent from the MP2300, but it is ignored by the HA-680ML.</li> </ul>	Processing category	Motion command	Synchronization category	Synchronous command	Subcommand	Permitted	Processing time	Within communication cycle	Usable phase	3
Processing category	Motion command												
Synchronization category	Synchronous command												
Subcommand	Permitted												
Processing time	Within communication cycle												
Usable phase	3												
2		ALARM											
3	OPTION	STATUS											
4													
5	TPOS (Interpolated position)	MONITOR1											
6													
7													
8													
9	VFF (Speed feed forward)	MONITOR2											
10													
11													
12													
13	SEL_MON1/2	SEL_MON1/2											
14		IO_MON											
15													
16	WDT	REDT											
17	Bytes 17 to 29 conform to a subcommand.	Bytes 17 to 29 conform to a subcommand.											
18													
19													
20													
21													
22													
23													
24													
25													
26													
27													
28													
29													

- For details on each command, refer to [4-6 Command data field] (P4-34).
- For details on ALARM, refer to [Alarm list] (P4-10) and [Warning list] (P4-10).

(23) Positioning (POSING: 35H)

Byte	Command	Response	Explanation										
1	POSING(35H)	POSING(35H)	<table border="1"> <tr> <td>Processing category</td> <td>Motion command</td> </tr> <tr> <td>Synchronization category</td> <td>Asynchronous command</td> </tr> <tr> <td>Subcommand</td> <td>Permitted</td> </tr> <tr> <td>Processing time</td> <td>Within communication cycle</td> </tr> <tr> <td>Usable phase</td> <td>2, 3</td> </tr> </table>	Processing category	Motion command	Synchronization category	Asynchronous command	Subcommand	Permitted	Processing time	Within communication cycle	Usable phase	2, 3
Processing category	Motion command												
Synchronization category	Asynchronous command												
Subcommand	Permitted												
Processing time	Within communication cycle												
Usable phase	2, 3												
2		ALARM											
3	OPTION	STATUS											
4													
5	TPOS (Positioning target position)	MONITOR1	<ul style="list-style-type: none"> <li>● Perform positioning to the position specified by TPOS (unit: pls) at the speed set by TSPD (unit: p/s). For the acceleration/deceleration time, the time set by parameter No. 33 [Acceleration time constant] or No. 34 [Deceleration time constant] is applied. (OWxx36 [Acceleration time constant] and OWxx38 [Deceleration time constant] of MP2000 series are not applied.)</li> </ul>										
6													
7													
8													
9	TSPD (Positioning speed)	MONITOR2	<ul style="list-style-type: none"> <li>● In the following conditions, a warning occurs and the command is ignored:                             <ul style="list-style-type: none"> <li>- During phase 1: Command warning Code 95</li> <li>- When the servo is OFF: Command warning Code 95</li> <li>- TSPD is 125pps or below or the command exceeds the maximum rotation speed of the applicable actuator: Data setting warning Code 94</li> </ul> </li> </ul>										
10													
11													
12													
13	SEL_MON1/2	SEL_MON1/2	<ul style="list-style-type: none"> <li>● TPOS is a signed 4-byte command (based on absolute position. The setting unit is [pls].)</li> </ul>										
14		IO_MON											
15													
16	WDT	REDT	<ul style="list-style-type: none"> <li>● TSPD is an unsigned 4-byte command. The setting unit is [p/s].</li> <li>● The target position and target speed can be changed during movement.</li> <li>● Use DEN of STATUS to check if the command output has completed.</li> <li>● The maximum permitted positioning distance is 2147493647 (7FFFFFFFH).</li> </ul>										
17	Bytes 17 to 29 conform to a subcommand.	Bytes 17 to 29 conform to a subcommand.											
18													
19													
20													
21													
22													
23													
24													
25													
26													
27													
28													
29													

- For details on each command, refer to [4-6 Command data field] (P4-34).
- For details on ALARM, refer to [Alarm list] (P4-10) and [Warning list] (P4-10).

## (24) Constant-speed feed (FEED: 36H)

Byte	Command	Response	Explanation										
1	FEED(36H)	FEED(36H)	<table border="1"> <tr> <td>Processing category</td> <td>Motion command</td> </tr> <tr> <td>Synchronization category</td> <td>Asynchronous command</td> </tr> <tr> <td>Subcommand</td> <td>Permitted</td> </tr> <tr> <td>Processing time</td> <td>Within communication cycle</td> </tr> <tr> <td>Usable phase</td> <td>2, 3</td> </tr> </table>	Processing category	Motion command	Synchronization category	Asynchronous command	Subcommand	Permitted	Processing time	Within communication cycle	Usable phase	2, 3
Processing category	Motion command												
Synchronization category	Asynchronous command												
Subcommand	Permitted												
Processing time	Within communication cycle												
Usable phase	2, 3												
2		ALARM											
3	OPTION	STATUS											
4													
5		MONITOR1	<ul style="list-style-type: none"> <li>● TSPD constant-speed feed is performed at the speed set by TSPD (unit: p/s). To stop, use HOLD (25H). Also, for the acceleration/deceleration time, the time set by parameter No. 33 [Acceleration time constant] or No. 34 [Deceleration time constant] is applied. (OWxx36 [Acceleration time constant] and OWxx38 [Deceleration time constant] of MP2000 series are not applied.)</li> </ul>										
6													
7													
8													
9	TSPD (Feed speed)	MONITOR2	<ul style="list-style-type: none"> <li>● In the following conditions, a warning occurs and the command is ignored: <ul style="list-style-type: none"> <li>- During phase 1: Command warning Code 95</li> <li>- When the servo is OFF: Command warning Code 95</li> <li>- TSPD is 125pps or below or the command exceeds the maximum rotation speed of the applicable actuator: Data setting warning Code 94</li> </ul> </li> </ul>										
10													
11													
12													
13	SEL_MON1/2	SEL_MON1/2											
14		IO_MON	<ul style="list-style-type: none"> <li>● TSPD is an unsigned 4-byte command. The setting unit is [p/s].</li> </ul>										
15													
16	WDT	REDT											
17	Bytes 17 to 29 conform to a subcommand.	Bytes 17 to 29 conform to a subcommand.	<ul style="list-style-type: none"> <li>● The target speed can be changed during movement.</li> <li>● Use DEN of STATUS to check if the command output has completed.</li> </ul>										
18													
19													
20													
21													
22													
23													
24													
25													
26													
27													
28													
29													

- For details on each command, refer to [4-6 Command data field] (P4-34).
  - For details on ALARM, refer to [Alarm list] (P4-10) and [Warning list] (P4-10).
- (25) Interpolated feed with position detection function (LATCH: 38H)

Byte	Command	Response	Explanation										
1	LATCH(38H)	LATCH(38H)	<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td>Processing category</td> <td>Motion command</td> </tr> <tr> <td>Synchronization category</td> <td>Synchronous command</td> </tr> <tr> <td>Subcommand</td> <td>Permitted</td> </tr> <tr> <td>Processing time</td> <td>Within communication cycle</td> </tr> <tr> <td>Usable phase</td> <td>3</td> </tr> </table> <ul style="list-style-type: none"> <li>● Interpolated feed is performed. If the signal selected by LT_SGN is input during operation, the input position is stored in the latch counter (LPOS). Also, the value of LPOS is forcibly output to MONITOR2 during [1: Communication cycle]. The set value of VFF is ignored.</li> <li>● In the following conditions, a warning occurs and the command is ignored: <ul style="list-style-type: none"> <li>- Other than phase 3: Command warning Code 95</li> <li>- When the servo is OFF: Command warning Code 95</li> <li>- The difference from the last TPOS command exceeds the limit value: Data setting warning Code 94</li> </ul> </li> <li>● Use DEN of STATUS to check if the position command output has completed. LT-SGN: Latch signal selection (external input or encoder phase Z)</li> </ul>	Processing category	Motion command	Synchronization category	Synchronous command	Subcommand	Permitted	Processing time	Within communication cycle	Usable phase	3
Processing category	Motion command												
Synchronization category	Synchronous command												
Subcommand	Permitted												
Processing time	Within communication cycle												
Usable phase	3												
2	LT_SGN	ALARM											
3	OPTION	STATUS											
4													
5	TPOS (Interpolated position)	MONITOR1											
6													
7													
8	VFF	MONITOR2											
9													
10													
11	SEL_MON1/2	SEL_MON1/2											
12													
13	IO_MON												
14													
15	WDT	REDT											
16													
17													
18													
19													
20													
21													
22													
23													
24													
25													
26													
27													
28													
29													

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MECHATROLINK communication function

- For details on each command, refer to [4-6 Command data field] (P4-34).
- For details on ALARM, refer to [Alarm list] (P4-10) and [Warning list] (P4-10).

(26) External positioning input (EX\_POSING: 39H)

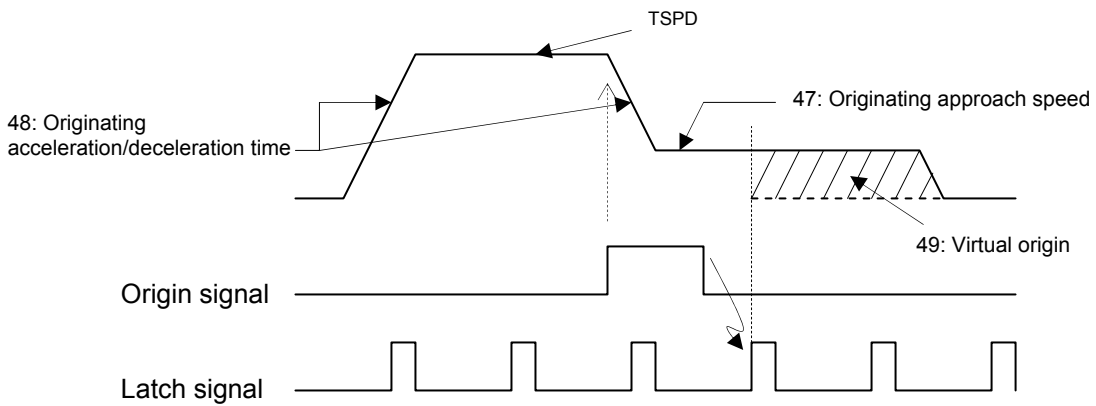
Byte	Command	Response	Explanation										
1	EX_POSING(39H)	EX_POSING(39H)	<table border="1"> <tr> <td>Processing category</td> <td>Motion command</td> </tr> <tr> <td>Synchronization category</td> <td>Asynchronous command</td> </tr> <tr> <td>Subcommand</td> <td>Permitted</td> </tr> <tr> <td>Processing time</td> <td>Within communication cycle</td> </tr> <tr> <td>Usable phase</td> <td>2, 3</td> </tr> </table>	Processing category	Motion command	Synchronization category	Asynchronous command	Subcommand	Permitted	Processing time	Within communication cycle	Usable phase	2, 3
Processing category	Motion command												
Synchronization category	Asynchronous command												
Subcommand	Permitted												
Processing time	Within communication cycle												
Usable phase	2, 3												
2	LT-SGN	ALARM											
3	OPTION	STATUS	<ul style="list-style-type: none"> <li>● Perform positioning to the position specified by TPOS (unit: pls) at the speed set by TSPD (unit: p/s). For the acceleration/deceleration time, the time set by parameter No. 33 [Acceleration time constant] or No. 34 [Deceleration time constant] is applied. (OWxx36 [Acceleration time constant] and OWxx38 [Deceleration time constant] of MP2000 series are not applied.)</li> </ul>										
4													
5	TPOS (Positioning target position)	MONITOR1	<ul style="list-style-type: none"> <li>● If a latch signal (selected by LT-SGN) is input in the middle before the actuator reaches TPOS, the actuator positions to the position set by parameter No. 39 [Final external positioning distance]. (OWxx46 [Final positioning distance] of MP2000 series is not applied.)</li> </ul>										
6													
7													
8													
9	TSPD (Positioning speed)	MONITOR2	<ul style="list-style-type: none"> <li>● In the following conditions, a warning occurs and the command is ignored: <ul style="list-style-type: none"> <li>- During phase 1: Command warning Code 95</li> <li>- When the servo is OFF: Command warning Code 95</li> <li>- TSPD is 125pps or below or the command exceeds the maximum rotation speed of the applicable actuator: Data setting warning Code 94</li> </ul> </li> </ul>										
10													
11													
12													
13	SEL_MON1/2	SEL_MON1/2	<ul style="list-style-type: none"> <li>● TPOS is a signed 4-byte command (based on absolute position. The setting unit is [pls].)</li> </ul>										
14		IO_MON											
15			<ul style="list-style-type: none"> <li>● TSPD is an unsigned 4-byte command. The setting unit is [p/s].</li> </ul>										
16	WDT	REDT											
17	Bytes 17 to 29 conform to a subcommand.	Bytes 17 to 29 conform to a subcommand.	<ul style="list-style-type: none"> <li>● Use DEN of STATUS to check if the position command output has completed. LT-SGN: Latch signal selection (external input or encoder phase Z)</li> </ul>										
18													
19													
20													
21													
22													
23													
24													
25													
26													
27													
28													
29													

- For details on each command, refer to [4-6 Command data field] (P4-34).
  - For details on ALARM, refer to [Alarm list] (P4-10) and [Warning list] (P4-10).
- (27) Originating (ZRET: 3AH)

Byte	Command	Response	Explanation										
1	ZRET(3AH)	ZRET(3AH)	<table border="1"> <tr> <td>Processing category</td> <td>Motion command</td> </tr> <tr> <td>Synchronization category</td> <td>Asynchronous command</td> </tr> <tr> <td>Subcommand</td> <td>Permitted</td> </tr> <tr> <td>Processing time</td> <td>Within communication cycle</td> </tr> <tr> <td>Usable phase</td> <td>2, 3</td> </tr> </table>	Processing category	Motion command	Synchronization category	Asynchronous command	Subcommand	Permitted	Processing time	Within communication cycle	Usable phase	2, 3
Processing category	Motion command												
Synchronization category	Asynchronous command												
Subcommand	Permitted												
Processing time	Within communication cycle												
Usable phase	2, 3												
2	LT-SGN	ALARM											
3	OPTION	STATUS											
4													
5		MONITOR1											
6													
7													
8													
9	TSPD (Feed speed)	MONITOR2	<ul style="list-style-type: none"> <li>● Originating is performed according to the [CN2-3: ORG] signal and [CN2-4, 5: LATCH 1, 2] or encoder phase-Z signal.</li> <li>● In the following conditions, a warning occurs and the command is ignored:                             <ul style="list-style-type: none"> <li>- During phase 1: Command warning Code 95</li> <li>- When the servo is OFF: Command warning Code 95</li> <li>- TSPD is 125pps or below or the command exceeds the maximum rotation speed of the applicable actuator: Data setting warning Code 94</li> <li>- During originating: Command warning Code 95</li> </ul> </li> <li>● TSPD is an unsigned 4-byte command. The setting unit is [p/s].</li> </ul>										
10													
11													
12	SEL_MON1/2	SEL_MON1/2											
13		IO_MON											
14													
15	WDT	REDT											
16	Bytes 17 to 29 conform to a subcommand.	Bytes 17 to 29 conform to a subcommand.											
17													
18													
19													
20													
21													
22													
23													
24													
25													
26													
27													
28													
29													

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## Originating operation when actuator is combined with YASKAWA MP series

If originating (ZRN) is performed when the actuator is combined with MP series by YASKAWA Electric Corporation, the setting registers of parameters, such as the originating speed, are different based on the originating type specified in OWxx3C. Refer to the table below.

OWxx3C set value	Originating method	Method	Set parameter		
			Name	Register No. listed in the MP manual	HA-680ML
0	DEC1 + phase C	Originating by deceleration LS (ORG for HA-680) and phase C (phase Z)	Originating type	OWxx3C	OWxx3C
			Originating direction selection	OBxx093	PRM_WR command No. 45
			Speed command setting	OLxx10	OLxx10
			Override	OLxx18	Not supported
			Approach speed	OLxx3E	PRM_WR command No. 47
			Creep speed	OLxx40	PRM_WR command No. 47
			Originating final positioning distance	OLxx42	PRM_WR command No. 49
1	ZERO signal	ZERO (LATCH1) signal originating	Originating type	OWxx3C	OWxx3C
			Originating direction selection	OBxx093	OBxx093
			Approach speed	OLxx3E	OLxx3E
			Creep speed	OLxx40	OLxx3E
			Originating final positioning distance	OLxx42	PRM_WR command No. 39
2	DEC1+ ZERO signal	Originating by deceleration LS (ORG for HA-680) and ZERO (LATCH1) signal	Originating type	OWxx3C	OWxx3C
			Originating direction selection	OBxx093	PRM_WR command No. 45
			Speed command setting	OLxx10	OLxx10
			Override	OLxx18	Not supported
			Approach speed	OLxx3E	PRM_WR command No. 47
			Creep speed	OLxx40	PRM_WR command No. 47
			Originating final positioning distance	OLxx42	PRM_WR command No. 49
3	Phase C pulse	Phase C (Phase Z) originating	Originating type	OWxx3C	OWxx3C
			Originating direction selection	OBxx093	OBxx093
			Approach speed	OLxx3E	OLxx3E
			Creep speed	OLxx40	OLxx3E
			Originating final positioning distance	OLxx42	PRM_WR command No. 39
11	Phase C pulse	Phase C (phase Z)	Originating type	OWxx3C	OWxx3C
			Speed command setting	OLxx10	OLxx40(OLxx10)
			Creep speed	OLxx40	OLxx40
			Originating final positioning distance	OLxx42	PRM_WR command No. 39
12	POT & phase C pulse	Forward direction OT signal and phase C	Originating type	OWxx3C	OWxx3C
			Speed command setting	OLxx10	OLxx40
			Approach speed	OLxx3E	OLxx3E
			Creep speed	OLxx40	OLxx40
			Originating final positioning distance	OLxx42	PRM_WR command No. 39

OWxx3C set value	Originating method	Method	Set parameter		
			Name	Register No. listed in the MP manual	HA-680ML
13	POT	Forward direction OT signal only	Originating type	OWxx3C	OWxx3C
			Speed command setting	OLxx10	OLxx10(OLxx40)
			Approach speed	OLxx3E	OLxx3E
			Originating final positioning distance	OLxx42	OLxx42
14	HOME LS & phase C pulse	HOME signal (Latch1) and phase C	Originating type	OWxx3C	OWxx3C
			Speed command setting	OLxx10	OLxx40
			Approach speed	OLxx3E	OLxx3E
			Creep speed	OLxx40	OLxx40
15	HOME LS	HOME signal (Latch1)	Originating type	OWxx3C	OWxx3C
			Speed command setting	OLxx10	OLxx40
			Creep speed	OLxx40	OLxx40
			Originating final positioning distance	OLxx42	PRM_WR command No. 39
16	NOT & phase C pulse	Reverse direction OT signal and phase C	Originating type	OWxx3C	OWxx3C
			Speed command setting	OLxx10	OLxx40
			Approach speed	OLxx3E	OLxx3E
			Creep speed	OLxx40	OLxx40
17	NOT	Reverse direction OT signal only	Originating type	OWxx3C	OWxx3C
			Speed command setting	OLxx10	OLxx10(OLxx40)
			Approach speed	OLxx3E	OLxx3E
			Originating final positioning distance	OLxx42	OLxx42
18	INPUT & phase C	Input signal and phase C	Originating type	OWxx3C	OWxx3C
			Speed command setting	OLxx10	OLxx40
			Approach speed	OLxx3E	OLxx3E
			Creep speed	OLxx40	OLxx40
19	INPUT	Input signal	Originating type	OWxx3C	OWxx3C
			Speed command setting	OLxx10	OLxx10
			Creep speed	OLxx40	OLxx40
			Originating final positioning distance	OLxx42	OLxx42
			INPUT signal	OBxx05B	OBxx05B

## 4-5 Subcommand

### Subcommand list

No.	Name	Command	Description
1	NOP	00H	Disable command: Processing is not performed.
2	PRM_RD	01H	Read user parameters.
3	PRM_WR	02H	Write user parameters (change the setting in the RAM).
4	ALM_RD	05H	Read the present alarms or warnings, or up to 8 most recent alarms.
5	PPRM_WR	1CH	Write multiple parameters to the EEPROM at once.
6	SMON	30H	Monitor the servo status.

### Subcommand details

- For details on each command, refer to [4-6 Command data field] (P4-34).

(1) Disable command (NOP: 00H)

Byte	Command	Response	Explanation				
17	NOP(00h)	NOP(00h)	<table border="1"> <tr> <td>By function</td> <td>Network command</td> </tr> <tr> <td>Processing time</td> <td>Within communication cycle</td> </tr> </table>	By function	Network command	Processing time	Within communication cycle
By function		Network command					
Processing time		Within communication cycle					
18		SUBSTATUS					
19							
20							
21							
22							
23							
24							
25							
26							
27							
28							
29							

(2) Parameter read command (PRM\_RD: 01H)

Byte	Command	Response	Explanation				
17	PRM_RD(01H)	PRM_RD(01H)	<table border="1"> <tr> <td>By function</td> <td>Data communication command</td> </tr> <tr> <td>Processing time</td> <td>Within 6 ms</td> </tr> </table>	By function	Data communication command	Processing time	Within 6 ms
By function		Data communication command					
Processing time		Within 6 ms					
18	SUBSTATUS						
19	No.	No.	<ul style="list-style-type: none"> <li>Read the enabled parameters. For the contents of parameters of the set value of No. refer to the next page.</li> <li>In the following conditions, a warning occurs and the command is ignored. In this case, PARAMETER in the response becomes indeterminable: <ul style="list-style-type: none"> <li>- An out-of-range number is set in No. Code 94</li> <li>- The SIZE does not match Code 94</li> </ul> </li> </ul>				
20							
21	SIZE	SIZE					
22		PARAMETER					
23							
24							
25							
26							
27							
28							
29							

● For details on each command, refer to [4-6 Command data field] (P4-34).

(3) Parameter write command (PRM\_WR: 02H)

Byte	Command	Response	Explanation				
17	PRM_WR(02H)	PRM_WR(02H)	<table border="1"> <tr> <td>By function</td> <td>Data communication command</td> </tr> <tr> <td>Processing time</td> <td>Within 6 ms</td> </tr> </table>	By function	Data communication command	Processing time	Within 6 ms
By function	Data communication command						
Processing time	Within 6 ms						
18		SUBSTATUS					
19	No.	No.	<ul style="list-style-type: none"> <li>Tentatively write a user parameter (the E2PROM is not written). After setting, offline user parameters will become enabled when a CONFIG command (04H) is executed.</li> </ul>				
20							
21	SIZE	SIZE	<ul style="list-style-type: none"> <li>In the following conditions, a warning occurs and the command is ignored:                             <ul style="list-style-type: none"> <li>- The command is sent in a phase other than 2 or 3 Code 95</li> <li>- An out-of-range number is set in No. Code 94</li> <li>- The parameter is out of range Code 94</li> </ul> </li> </ul> <p>For the parameter No. and data size, refer to the explanation below.</p>				
22	PARAMETER	PARAMETER					
23							
24							
25							
26							
27							
28							
29							

Parameter number and data size

No.	Parameter name	Data size	No.	Parameter name	Data size
0	Position loop gain	4 byte	25	System reservation	4 byte
1	Speed loop gain	4 byte	26	System reservation	4 byte
2	Speed loop integral gain	4 byte	27	Deviation clear upon servo-ON	4 byte
3	Speed loop derivative gain	4 byte	28	Angle compensation	4 byte *1
4	Speed feed-forward factor	4 byte	29	Automatic gain setting for positioning	4 byte
5	Acceleration feed-forward factor	4 byte	30	System reservation	4 byte
6	Torque command filter	4 byte	31	System reservation	4 byte
7	Speed step correction	4 byte	32	System reservation	4 byte
8	Torque step correction	4 byte	33	Acceleration time constant	4 byte
9	Step correction switch range	4 byte	34	Deceleration time constant	4 byte
10	System reservation	4 byte	35	System reservation	4 byte
11	System reservation	4 byte	36	System reservation	4 byte
12	System reservation	4 byte	37	System reservation	4 byte
13	Input pin logical setting	4 byte *1	38	System reservation	4 byte
14	Output pin logical setting	4 byte *1	39	Final external positioning distance	4 byte
15	Control input filter time constant	4 byte *1	40	System reservation	4 byte
16	System reservation	4 byte	41	FWD soft limit	4 byte
17	FWD current limiting	4 byte	42	System reservation	4 byte
18	REV current limiting	4 byte	43	REV soft limit	4 byte
19	Regenerative brake ON/OFF	4 byte	44	System reservation	4 byte
20	Rotation direction command	4 byte *1	45	Originating direction	4 byte
21	Allowable position deviation	4 byte	46	Origin position range	4 byte
22	In-position range	4 byte	47	Originating approach speed	4 byte
23	Command pulse input factor-Numerator	4 byte *1	48	Originating acceleration/deceleration time	4 byte
24	Command pulse input factor-Denominator	4 byte *1	49	Virtual origin	4 byte

\*1 These are offline user parameters.

- For details on each command, refer to [4-6 Command data field] (P4-34).

## (4) Error/warning read command (ALM\_RD: 05H)

Byte	Command	Response	Explanation				
17	ARM_RD(05H)	ARM_RD(05H)	<table border="1"> <tr> <td>By function</td> <td>Data communication command</td> </tr> <tr> <td>Processing time</td> <td>Maximum 2 s</td> </tr> </table>	By function	Data communication command	Processing time	Maximum 2 s
By function	Data communication command						
Processing time	Maximum 2 s						
18		SUBSTATUS					
19	ALM_RD_MOD	ALM_RD_MOD					
20		ALM_DATA	<ul style="list-style-type: none"> <li>● Read the list of present errors/warnings and error history. ALM_RD_MOD 0: Present warnings, errors: The processing time is within the communication cycle. ALM_RD_MOD 1: Error history* Up to 8 errors: The processing time is within 2 seconds. (0 is written for the 8th and subsequent errors and in the empty fields of history data.)</li> <li>● In the following conditions, a warning occurs and the command is ignored: - Wrong ALM_RD_MOD setting Code 94 * Warning history is not kept.</li> </ul>				
21							
22							
23							
24							
25							
26							
27							
28							
29							

## (5) Non-volatile parameter write command (PPRM\_WR: 1CH)

Byte	Command	Response	Explanation				
17	PRM_WR(1CH)	PRM_WR(1CH)	<table border="1"> <tr> <td>By function</td> <td>Data communication command</td> </tr> <tr> <td>Processing time</td> <td>Maximum 4 s</td> </tr> </table>	By function	Data communication command	Processing time	Maximum 4 s
By function	Data communication command						
Processing time	Maximum 4 s						
18		SUBSTATUS					
19	No.	No.					
20			<ul style="list-style-type: none"> <li>● Change the contents of the RAW and EEPROM areas where the parameter specified by No. is saved, to the value specified by PARAMETER.</li> <li>● In the following conditions, a warning occurs and the command is ignored: - The command is sent in phase 1 Code 95</li> </ul> <p>CMDRDY = 0 applies while the parameter is being written. Do not turn off the HA-680ML during this period.</p>				
21	SIZE	SIZE					
22	PARAMETER	PARAMETER					
23							
24							
25							
26							
27							
28							
29							

- For details on each command, refer to [4-6 Command data field] (P4-34).

(6) Status monitor command (SMON: 30H)

Byte	Command	Response	Explanation	
17	SMON(30H)	SMON(30H)	By function	Data communication command
18		SUBSTATUS		
19	SEL_MON3/4	SEL_MON3/4	Processing time	Within communication cycle
20				
21		MONITOR3	<ul style="list-style-type: none"> <li>● The servo status is monitored.</li> <li>● If this command is sent in phase 1, a command warning (95) is issued and the command is ignored.</li> </ul>	
22				
23				
24		MONITOR4		
25				
26				
27				
28				
29				

## 4-6 Command data field

Data set in main commands and subcommands are explained.

### Latch signal selection: LT-SGN

Select the latch signal (event signal) to be used with the [Interpolated feed with position detection function (LATCH)], [Positioning by external input (EX\_POSING)] and [Originating (ZRET)] commands. The bit assignments are as follows.

bit7	bit6	bit5	bit4	bit3	bit2	bit1	bit0
0	0	0	0	0	0	LT-SGN	

LT-SGN details

bit1	bit0	Latch signal
0	0	Encoder phase Z
0	1	CN2-4: Latch input 1
1	0	CN2-5: Latch input 2

### Option (OPTION)

OPTION can be used with the following commands:

Servo-ON (SV-ON), Motion stop request (HOLD), Interpolated feed (INTERPOLATE), Positioning (POSING), Constant-speed feed (FEED), Interpolated feed with position detection function (LATCH), Positioning by external input (EX\_POSING), Originating (ZRET)

bit7	bit6	bit5	bit4	bit3	bit2	bit1	bit0
0	0	0	0	0	0	0	0

bit15	bit14	bit13	bit12	bit11	bit10	bit9	bit8
N-CL	P-CL	0	0	0	0	0	0

P-CL FWD torque limit

N-CL REV torque limit

0 : Torque not limited

1 : Torque limited

## Status (STATUS)

In the status field, the servo status is monitored using the reserved areas for bytes 3 and 4 of the main command.

The bit assignments are as follows.

Details of byte 3							
bit7	bit6	bit5	bit4	bit3	bit2	bit1	bit0
PSET	ZPOINT	-	PON	SVON	CMDRDY	WARNG	ALARM

Details of byte 4							
bit15	bit14	bit13	bit12	bit11	bit10	bit9	bit8
-	-	N-SOT	P-SOT	NEAR	L_CMP	T_LMT	DEN

Bit	Name	Description	Value	Status
0	ALARM	Occurrence of an alarm	0	None
			1	Occurrence of an alarm
1	WARING	Occurrence of a warning	0	None
			1	Occurrence of a warning
2	CMDRDY	Command ready	0	Command cannot be accepted (busy)
			1	Command can be accepted (ready)
3	SVON	Servo-ON	0	Servo-OFF
			1	Servo-ON
4	PON	Power supply ON	0	OFF
			1	ON
5			0	Always 0
6	ZPOINT	Origin position	0	Out of origin position range (Parameter 46: Origin position range)
			1	Within origin position range (Parameter 46: Origin position range)
7	PSET	In-position complete Deviation after command output completion (DEN = 1)	0	Out of in-position range (Parameter 22: In-position range)
			1	Within in-position range (Parameter 22: In-position range)
8	DEN	Position command execution complete	0	Execution in progress
			1	Execution complete
9	T_LMT	Torque limit	0	Torque not limiting
			1	Torque limiting
10	L_CMP	Latch complete	0	Latch not yet complete
			1	Latch complete (When a latch command is executed, this signal turns 1 upon latching of the feedback position with the latch signal input.)
11	NEAR	Positioning near	0	Deviation outside parameter 22 [In-position range]
			1	Deviation inside parameter 22 [In-position range]
12	P-SOT *1	FWD soft limit	0	Feedback position exceeded the soft limit in forward direction
			1	Not exceeding the soft limit in forward direction
13	N-SOT *1	REV soft limit	0	Feedback position exceeded the soft limit in reverse direction
			1	Not exceeding the soft limit in reverse direction

\*1 Enable only when PS\_SUBCMD REFE of POS\_SET (20H) is 1.

## Monitor selection (SEL\_MON1/2/3/4), monitor information (MONITOR1/2/3/4)

The monitor selection and monitor information signals can be used with the following commands. Servo-ON (SV\_ON), Servo-OFF (SV\_OFF), Interpolated feed (INTERPOLATE), Positioning (POSING), Constant-speed feed (FEED), Interpolated feed with position detection function (LATCH), Positioning by external input (EX\_POSING), Originating (ZRET), Sensor-ON (SENS\_ON), Sensor-OFF (SENS\_OFF)

bit7	bit6	bit5	bit4	bit3	bit2	bit1	bit0
SEL_MON2				SEL_MON1			

bit7	bit6	bit5	bit4	bit3	bit2	bit1	bit0
SEL_MON4				SEL_MON3			

Code	Symbol	Description	Unit
0	POS	Return data equivalent to MPOS	
1	MPOS	Command position (Command Counter)	pulse
2	PERR	Position deviation (Error Counter)	pulse
3	APOS	Feedback position (Feedback Counter)	pulse
4	LPOS	Feedback latch position (latch signal input position)	pulse
5	IPOS	Return data equivalent to MPOS	
6	TPOS	Target position (command-specified target position)	pulse
7			
8	FSPD	Feedback speed	r/min
9	CSPD	Command speed	r/min
A	TSPD	Target speed	r/min
B	TRQ	Torque command	%
C			
D			
E			
F			

## I/O monitor (IO\_MON)

The I/O statuses of the HA-680ML (CN2 (I/O)) are monitored.

bit7	bit6	bit5	bit4	bit3	bit2	bit1	bit0
--	--	--	--	--	SBCMDRDY	SBWARNG	SBALM

This signal can be used with the following commands:

Status monitor (SMON), Servo-ON (SV\_ON), Servo-OFF (SV\_OFF), Motion stop request (HOLD), Interpolated feed (INTERPOLATE), Constant-speed feed (FEED), Positioning (POSING), Interpolated feed with position detection function (LATCH), Positioning by external input (EX\_POSING), Originating (ZRET), Sensor-ON (SENS\_ON), Sensor-OFF (SENS\_OFF)

bit7	bit6	bit5	bit4	bit3	bit2	bit1	bit0
Latch input 2	Latch input 1	0	0	0	Origin signal	REV-IH	FWD-IH

bit15	bit14	bit13	bit12	bit11	bit10	bit9	bit8
0	Ready	Alarm	In-position complete	0	0	0	0

0 : OFF    1 : ON

## Substatus (SUBSTATUS)

In the substatus, the status of a subcommand is monitored using the reserved area for byte 18 of the subcommand.

Bit	Name	Description	Value	Status
0	SBALM	Subcommand alarm occurred	0	None
			1	Occurrence of an alarm
1	SBWARING	Subcommand warning occurred	0	None
			1	Occurrence of a warning
2	SBCMDRDY	Subcommand: Command ready	0	Subcommand: Command cannot be accepted (busy)
			1	Subcommand: Command can be accepted (ready)

# Chapter 5

## Communication software

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How you can use the dedicated personal computer software to check I/O signal statuses, rotation speeds and other servo statuses, perform auto-tuning, set parameters, assign I/O signals and monitor servo operation waveforms are explained in this chapter.

---

5-1	Outlines of PC communication software .....	5-1
-----	---	-----

## 5-1 Outlines of PC communication software

PSF-520 is a PC communication software program with which servo-related parameters setting, waveform monitoring, servo status monitoring and alarm status monitoring can be performed easily. Some of these functions (read parameter settings) can also be performed via MECHATROLINK communication (in the servo-driver transparent command mode). However, monitor operation becomes easy when PSF-520 is used. For details, refer to the [Operation Manual for PSF-520].

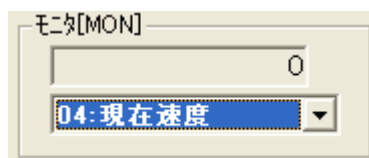
### Outlines of PSF-520

A functional overview of the dedicated communication software PSF-520 that lets you set servo parameters and operate waveform monitoring, servo status monitoring and alarm status monitoring functions is given. For detailed operating methods, refer to the separate volume [Operation Manual for PSF-520].

You can use PSF-520 to change the set value of servo gain even during operation via MECHATROLINK.

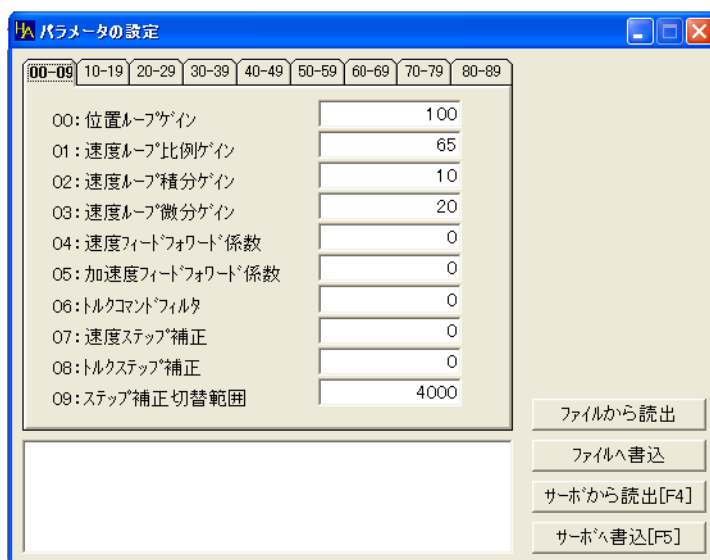
#### Status display

Actuator rotation speed and other information regarding the operating status are displayed.



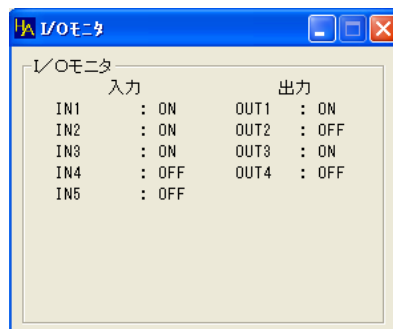
#### Parameter setting

Parameters are set, changed and saved.



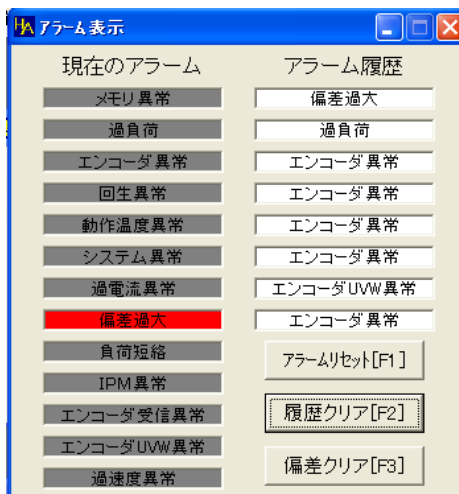
#### I/O signal monitor

I/O signal statuses are displayed.



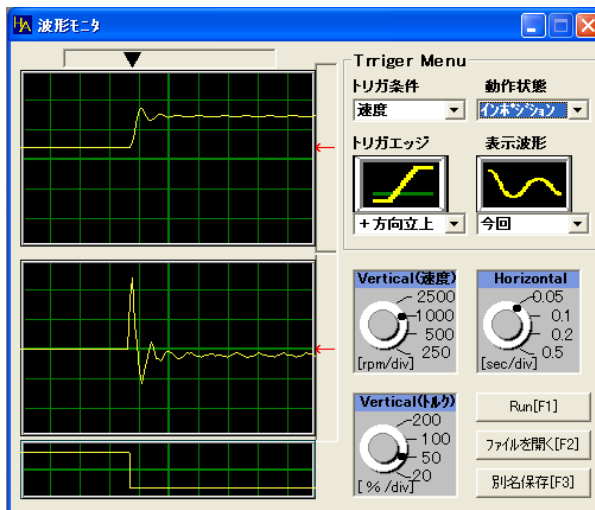
### Alarm display

Present alarms and up to 8 most recent alarms are displayed.



### Waveform monitoring

Speed, torque and other waveforms are measured during operation.





# Chapter 6

## Operation

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Operations and trial run operations are explained in this chapter.

---

6-1	Trial run .....	6-1
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## 6-1 Trial run

When operating the HA-680ML, be sure to follow the precautions below and use the driver safely.



Once the electric power on the plant side is supplied to the system, do not perform any wiring works. Shut off the electric power source on the plant side before any wiring works are carried out. Electric shock may result.

## 6

### Operation



1. Check the wirings again and correct the problems, if any, before turning on the power.
  - (1) Is the cabling correct?
  - (2) Are there temporarily wired lines?
  - (3) Are there any loose terminal connections?
  - (4) Are the wires grounded properly?
2. Clean around the devices. In particular, thoroughly inspect the interior of the system for wire chips, tools and other objects remaining inside the system.
3. When 2 or more persons are working together, discuss the details of work before turning on the power and pay attention to the safety of others.



1. Be sure to perform a trial run before commencing the normal operation.
2. In a trial run, separate the actuator from the machine/system and operate the actuator alone (under no load).

## Operating the actuator alone

First, perform a trial run using the actuator alone.

### Object of trial run

- 1** Check the power wirings
- 2** Check the actuator wirings (actuator cable and encoder cable)
- 3** Check the I/O signal wirings with the host device

## Trial run procedure

### Turn on the HA-680ML control circuit power and MECHATROLINK power supply.

Immediately after the power has been turned on, the HA-680ML driver identifies the actuator automatically. (RSF-3/5 series actuators are not identified automatically.)

Operations which will happen next vary depending on whether or not the actuator code set in the driver matches the connected actuator.

#### **1** Turn on the control circuit power.

If any abnormality is found, the green LED (power ON) on the HA-680ML driver does not come on. This indicates a power connection problem. Cut off the power supply and check the power wirings again.

⇒ The HA-680ML driver identifies the actuator automatically (excluding RSF-3/5).

- **When the actuator code set in the driver matches the actuator physically connected**

⇒ The green LED (power ON) on the HA-680ML driver comes on. The automatic identification process found that the actuator code is a match.

Next, issue a servo-ON (S-ON) input.

- **When the actuator code set in the driver does not match the actuator physically connected**

⇒ The green LED on the HA-680ML driver flickers. The automatic identification process found that the actuator code is not a match.

#### **2** If the code does not match, the control circuit power is cut off. Check the nameplate for the actuator for which the driver has been adjusted, and then replace the current actuator with, and connect the correct actuator. After the correct actuator has been connected, start from (1) again.

### MP2300 setting

- 3** Prepare and set up the MP2300 and connect it to the HA-680ML. (For information on how to prepare the MP2300, refer to the Operation Manual for MP2300.)
- 4** Download the motion program for trial run from our web site and set it in the MP2300.

## Starting trial run

- 5 Operate the MP-2300 and confirm that the actuator operates properly.

## Parameter setting

When the trial run with the actuator alone is complete, start adjusting/setting parameters. Note that the dedicated communication software PSF-520 is required to adjust/set parameters. For details on parameters, refer to Chapter 7 [Parameter setting] and the Operation Manual for the dedicated communication software PSF-520.

### Parameter setting (Changing the settings from PSF-520)

- 6 Open the parameter setting window in the dedicated communication software PSF-520.
- 7 Click the [Read from the servo] button to load all parameters first.
- 8 Select each parameter you want to change, and enter a desired value.
- 9 To cancel the new value and restore the original setting, click the [Read from the file] or [Read from the servo] button.
- 10 To apply the new setting, click the [Write to the servo] button.  
Note: Some parameters require the control circuit power to be reconnected before their new setting becomes effective.
- 11 To save the new settings to the disk, click the [Write to the file] button.

## Ending trial run

This completes the trial run.

- 12 Cut off the power according to the power OFF sequence in 3-10-3.

# Chapter 7

## Parameter setting

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The parameters are explained in this chapter.

---

7-1	Parameter list .....	7-1
7-2	Parameter functions .....	7-3
7-3	Default parameter list .....	7-17

## 7-1 Parameter list

Parameters are set, displayed and adjusted using the dedicated communication software PSF-520 or MECHATROLINK line. (These operations are possible only in the servo-driver transparent command mode.) This chapter explains the details of parameters. When using PSF-520 to perform these operations, refer to the separate volume [Operation Manual for PSF-520].

No	Parameter name	Setting range
00	Position loop gain	10 to 9999
01	Speed loop proportional gain	10 to 9999
02	Speed loop integral gain	10 to 9999
03	Speed loop derivative gain	0 to 9999
04	Speed feed-forward factor	0 to 9999
05	Acceleration feed-forward factor	0 to 9999
06	Torque command filter	0 to 9999
07	Speed step correction	0 to 9999
08	Torque step correction	0 to 9999
09	Step correction switch range	0 to 9999
10	System reservation	*2
11	System reservation	*2
12	System reservation	*2
13	Input pin logical setting	0 to 31 *1
14	Output pin logical setting	0 to 15 *1
15	Control input filter time constant	0 to 99 *1
16	System reservation	*2
17	FWD current limiting	0 ~ *1
18	REV current limiting	0 ~ *1
19	Regenerative brake ON/OFF	0,1
20	Rotation direction command	0,1 *1
21	Allowable position deviation	0 to 32767
22	In-position range	0 to 9999
23	Command pulse input factor-Numerator	1 to 999 *1
24	Command pulse input factor-Denominator	1 to 999 *1
25	System reservation	*2
26	System reservation	*2
27	Deviation clear upon servo-ON	0,1
28	Angle compensation	0,1 *1
29	Automatic gain setting for positioning	0,1
30	System reservation	*2
31	System reservation	*2
32	System reservation	*2
33	Acceleration time constant	1 to 9999
34	Deceleration time constant	1 to 9999
35	System reservation	*2
36	System reservation	*2
37	System reservation	*2
38	System reservation	*2
39	Final external positioning distance	-2147483648 to 2147483647
40	System reservation	0 ~ *2
41	FWD soft limit	-2147483647 to 2147483647
42	System reservation	*2
43	REV soft limit	-2147483648 to 2147483646
44	System reservation	*2
45	Originating direction	0,1

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46	Origin position range	1 to 32768
47	Originating approach speed	10 to 9999
48	Originating acceleration/deceleration time	1 to 9999
49	Virtual origin	-32768 to 32767

- \*1 The new setting will become enabled when the power is reconnected or a device setup request command (CONFIG: 04H) is sent via MECHATROLINK.
- \*2 Do not change or set any of the display parameters reserved for the system.

## 7-2 Parameter functions

### 00: Position loop gain

#### Descriptions of functions

Set the position loop gain. Determine an appropriate value based on the friction torque and rigidity of the machine.

Increasing the set value  $\Rightarrow$  The position deviation decreases and following accuracy relative to the command increases, but setting too high a value makes the servo system unstable and prone to vibration (hunting).

Decreasing the set value  $\Rightarrow$  Setting too low a value leads to poor following accuracy relative to the command.

Set the highest gain within the limits of no vibration (hunting) and minimum overshoot.

#### Set value

Unit	Lower limit value	Upper limit value	Default value
-	10	9999	Note

Note: The specific value varies depending on the actuator model. To change the value, refer to the standard value (reference value) in [7-3 Default parameter list].

### 01: Speed loop proportional gain

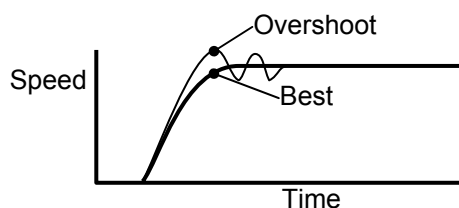
#### Descriptions of functions

Set the proportional gain of the speed loop. Determine an appropriate value based on the inertia moment, friction and rigidity of the machine.

Increasing the set value  $\Rightarrow$  Servo rigidity increases along with response.

However, setting too high a value makes the servo system unstable and prone to vibration (hunting) and overshoot.

Decreasing the set value  $\Rightarrow$  Setting too low a value leads to poor response and following accuracy.



Set the highest gain within the limits of no vibration (hunting) and minimum overshoot.

#### Set value

Unit	Lower limit value	Upper limit value	Default value
-	10	9999	Note

Note: The specific value varies depending on the actuator model. To change the value, refer to the standard value (reference value) in [7-3 Default parameter list].

## 02: Speed loop integral gain

### Descriptions of functions

Set the speed loop integral gain.

Increasing the set value  $\Rightarrow$  Setting too high a value makes the servo system unstable and prone to vibration (hunting) and overshoot.

Decreasing the set value  $\Rightarrow$  Setting too low a value leads to poor response and following accuracy.

### Set value

Unit	Lower limit value	Upper limit value	Default value
-	10	9999	Note

Note: The specific value varies depending on the actuator model. To change the value, refer to the standard value (reference value) in [7-3 Default parameter list].

## 03: Speed loop derivative gain

### Descriptions of functions

Set the derivative gain of the speed loop.

Normally this parameter is set to zero.

Increasing the set value  $\Rightarrow$  Setting too high a value makes the servo system unstable and prone to vibration (hunting) and overshoot.

### Set value

Unit	Lower limit value	Upper limit value	Default value
-	0	9999	Note

Note: The specific value varies depending on the actuator model. To change the value, refer to the standard value (reference value) in [7-3 Default parameter list].

## 04: Speed feed-forward factor

### Descriptions of functions

Set the factor based on which to give the first-order derivative value of the position deviation to the speed command.

Normally this parameter is set to zero.

An appropriate value must be set if immediacy of response is improved.

### Set value

Unit	Lower limit value	Upper limit value	Default value
-	0	9999	0

## 05: Acceleration feed-forward factor

### Descriptions of functions

Set the factor based on which to give the second-order derivative value of the position deviation to the torque command.

Normally this parameter is set to zero.

An appropriate value must be set if immediacy of response is improved.

### Set value

Unit	Lower limit value	Upper limit value	Default value
-	0	9999	0

## 06: Torque command filter

### Descriptions of functions

Set the factor to be applied the low-path filter cutoff frequency for torque commands with the purpose of suppressing self-excited vibration relative to the mechanical system.

Normally this parameter is set to zero.

### Set value

Unit	Lower limit value	Upper limit value	Default value
-	0	9999	0

## 07: Speed step correction

### Descriptions of functions

Set the speed command correction amount to be added to the speed command according to the positive or negative sign of the command.  
Normally this parameter is set to zero. An appropriate value must be set if immediacy of response must be improved.

Increasing the set value  $\Rightarrow$  Setting too high a value makes the servo system unstable and prone to vibration (hunting) and overshoot.

### Set value

Unit	Lower limit value	Upper limit value	Default value
-	0	9999	0

This parameter is related to the value set in [09: Step correction switch range] accessible from [Parameters].

## 08: Torque step correction

### Descriptions of functions

Set the torque command correction amount to be added to the torque command according to the positive or negative sign of the command.  
Normally this parameter is set to zero. An appropriate value must be set if immediacy of response must be improved.

Increasing the set value  $\Rightarrow$  Setting too high a value makes the servo system unstable and prone to vibration (hunting) and overshoot.

### Set value

Unit	Lower limit value	Upper limit value	Default value
-	0	9999	4000

## 09: Step correction switch range

### Descriptions of functions

Set the position deviation amount on the deviation counter at which the values set in [07: Speed step correction] and [08: Torque step correction], both accessible from [Parameters], become effective for the speed step correction and torque step correction, respectively.

If the position deviation amount exceeds this value, the speed step correction value and torque step correction value become effective.

### Set value

Unit	Lower limit value	Upper limit value	Default value
pulse	0	9999	0

Note: In general use, keep the setting of this parameter to 0.

**10: System reservation****11: System reservation****12: System reservation**

This driver supports MECHATROLINK, so the parameter functions corresponding to 10 to 12 are disabled.

**13: Input pin logical setting**

**(The power must be reconnected after changing the setting.)**

**Descriptions of functions**

Set the logic based on which to enable the functions of external input signals.

Refer to the table below and set a value being the total sum of the numbers corresponding to the logics you want to set.

Setting example) To enable input 4 and input 5 based on the normally open logic:

$8 + 16 = 24$ . Accordingly, set 24.

Signal	Normally closed	Normally open
CN2-1 FWD inhibit	0	1
CN2-2 REV inhibit	0	2
CN2-3 Origin signal	0	4
CN2-4 Latch 1	0	8
CN2-5 Latch 2	0	16

**Set value**

Unit	Lower limit value	Upper limit value	Default value
-	0	31	3

Note: The power must be reconnected after setting a new value. Until the power is reconnected, the original value remains effective.

**14: Output pin logical setting**

**(The power must be reconnected after changing the setting.)**

**Descriptions of functions**

Set the logic based on which to determine the operating statuses of the functions of external output signals. Refer to the table below and set a value being the total sum of the numbers corresponding to the logics you want to set.

Setting example) To enable output 3 and output 4 based on the normally open logic:

$4 + 8 = 12$ . Accordingly, set 12.

Signal	Normally closed	Normally open
CN2-7 Operation preparation complete (READY)	0	1
CN2-8 Origin return complete (ORG-END)	0	2
CN2-9 Operation completion (FINISH)	0	4
CN2-10 Alarm (ALARM)	0	8

**Set value**

Unit	Lower limit value	Upper limit value	Default value
-	0	15	8

Note: The power must be reconnected after setting a new value. Until the power is reconnected, the original value remains effective.

## 15: Control input filter time constant

### Descriptions of functions

Set the time constant for soft low-path filter to be applied to control input terminal signals. When using your system in an environment where external high-frequency noise generates, make it more difficult for control input signals to be affected by noise.

### Set value

Unit	Lower limit value	Upper limit value	Default value
ms	0	99	0

## 16: System reservation

This driver supports MECHATROLINK, so the parameter function corresponding to 16 is disabled.

## 17: FWD current limiting (The power must be reconnected after changing the setting.)

## 18: REV current limiting (The power must be reconnected after changing the setting.)

### Descriptions of functions

Set the limit value to be applied when the current limiting function is executed in the option fields of such MECHATROLINK commands as Servo-ON (SV-ON), Motion stop request (HOLD), Interpolated feed (INTERPOLATE), Positioning (POSING), Constant-speed feed (FEED), Interpolated feed with position detection function (LATCH), Positioning by external input (EX\_POSING) and Originating (ZRET).

### Set value

Unit	Lower limit value	Upper limit value	Default value
%	0	Note 1	Upper limit value

Note 1: The specific value varies depending on the actuator model. The upper limit value is calculated by the formula below based on the values stated in the catalog and manual of the AC Servo Actuator.

The rated torque is 100%.

Maximum current / Allowable continuous current x 100 (%) = Upper limit value (%)

Note 2: The power must be reconnected after setting a new value. Until the power is reconnected, the original value remains effective.

## 19: Regenerative brake ON/OFF

### Descriptions of functions

When the regenerative brake is set to ON, turning OFF the servo-ON signal triggers an emergency stop (regenerative braking) by means of driver control. The servo will turn OFF after the actuator stops.

When the regenerative brake is set to OFF, turning OFF the servo-ON signal causes the servo to immediately turn OFF by means of driver control, after which the actuator will become free.

- 0: Do not operate regenerative braking
- 1: Operate regenerative braking

### Set value

Unit	Lower limit value	Upper limit value	Default value
-	0	1	0

## 7

## 20: Rotation direction command (The power must be reconnected after changing the setting.)

### Descriptions of functions

Specify the rotation direction of the actuator relative to the rotation direction specified by the command input signal (forward/reverse).

The relationships are summarized in the table below.

Set value	Forward input	Reverse input
0	Forward	Reverse
1	Reverse	Forward

### Set value

Unit	Lower limit value	Upper limit value	Default value
-	0	1	0

Note: The power must be reconnected after setting a new value. Until the power is reconnected, the original value remains effective.

## 21: Allowable position deviation

### Descriptions of functions

The difference between the position command (unit: pulse) and feedback pulses is calculated as a position deviation by the deviation counter. An excessively large position deviation is considered an error.

If the deviation is equal to or greater than the allowable value set here, an excessive deviation alarm occurs and the servo turns OFF.

The relationships of allowable position deviation, position loop gain, command pulse input factor and pulse command speed conform to the formula below in a steady state. For the maximum pulse command, therefore, set a value appropriate for the speed.

$$\text{Allowable position deviation} = \frac{\text{Pulse command speed[p/s]}}{\text{Position loop gain}} \times \frac{\text{Command pulse input factor - Numerator}}{\text{Command pulse input factor - Denominator}}$$

Also note that an attempt to perform any rotary operation via command pulse input causes the mechanical system of the actuator to fail, thereby disabling the rotary operation. When the deviation pulses subsequently exceed the allowable value, an alarm is output.

### Set value

Unit	Lower limit value	Upper limit value	Default value
pulse	0	32767	30000

## 22: In-position range

### Descriptions of functions

A signal is output to [CN2-9: Operation completion output: FINISH] or bit 7: PSET of the status field in the MECHATROLINK main command to indicate completion of positioning when the difference between the position command (unit: pulse) and feedback pulses, or specifically deviation pulses, becomes equal to or less than the set value of in-position range.

This value simply reflects the monitored result of position deviation status. It has no direct relationship with the rotational control of the servo actuator.

### Set value

Unit	Lower limit value	Upper limit value	Default value
pulse	0	9999	10

**23: Command pulse input factor-Numerator****(The power must be reconnected after changing the setting.)****24: Command pulse input factor-Denominator****(The power must be reconnected after changing the setting.)****Descriptions of functions**

Use each parameter in conjunction with [Command pulse input factor-Numerator] and [Command pulse input factor-Denominator] as the electronic gear function.

The electronic gear function is used to make the displacement of the driven actuator mechanism relative to the command pulses, an integer. The relationship of numerator/denominator is obtained by the formula below:

- **Rotary operation:**

$$\text{Travel angle per command pulse} = \frac{\text{Command pulse input factor - Numerator}}{\text{Command pulse input factor - Denominator}} \times \frac{360}{* \text{ Actuator resolution}} \times \frac{1}{\text{Reduction ratio of load mechanism}}$$

- **Linear operation:**

$$\text{Travel angle per command pulse} = \frac{\text{Command pulse input factor - Numerator}}{\text{Command pulse input factor - Denominator}} \times \frac{\text{Feed pitch of load mechanism}}{* \text{ Actuator resolution}}$$

\* Actuator resolution = Encoder resolution (quadruplicate) x Actuator reduction ratio

Set integers for both the denominator and numerator based on this formula.

**Set value**

	Unit	Lower limit value	Upper limit value	Default value
Numerator	-	1	999	1
Denominator	-	1	999	1

Note 1: The power must be reconnected after setting a new value. Until the power is reconnected, the original value remains effective.

Note 2: With the default setting, internal processing is performed based on a resolution corresponding to quadruplicated encoder pulses. In other words, the actuator moves by a displacement corresponding to quadruplicated encoder pulses relative to the command pulse count.

**25: System reservation****26: System reservation**

This driver supports MECHATROLINK, so the parameter functions corresponding to 25 and 26 are disabled.

**27: Deviation clear upon servo-ON****Descriptions of functions**

The control circuit power is still input even in a non-excitation state and when the stop position of the load mechanism moves due to the effect of gravity, human power, etc., position deviation pulses generate. If the [servo-ON: SV\_ON 31H] command is executed in this status, the actuator operates at the maximum current so that these deviation pulses become [0].

Since such operation can create a dangerous situation, you can keep the deviation amount to [0] when the [servo-ON: SV\_ON 31H] command is executed, to prevent the actuator from operating in this fashion. Note that in this case, the position deviation in non-excitation state is lost and the previous position can no longer be retained.

- 0: Do not clear the deviation counter when the [servo-ON: SV\_ON 31H] command is executed.
- 1: Clear the deviation counter when the [servo-ON: SV\_ON 31H] command is executed.

**Set value**

Unit	Lower limit value	Upper limit value	Default value
-	0	1	0

Note: Once the deviation counter is cleared, the command pulses become the same as the feedback pulses.

**28: Angle compensation****Descriptions of functions**

The HA-680ML driver of 4-wire specification provides an angle compensation function. This function analyzes the angle transmission error of the HarmonicDrive® beforehand and compensates for this erroneous difference to improve uni-directional positioning accuracy. The function improves the uni-directional positioning accuracy by approx. 30% than the value without compensation.

- 0: Compensation function not available
- 1: Compensation function available

**Set value**

Unit	Lower limit value	Upper limit value	Default value
-	0	1	0

Note: The power must be reconnected after setting a new value. Until the power is reconnected, the original value remains effective.

\* RSF supermini series actuators are not supported.

## 29: Automatic gain setting for positioning

### Descriptions of functions

This function automatically increases the speed loop proportional gain when the error pulse is small, to shorten the positioning period.

Accordingly, the speed command value of position loop is proportional to the deviation pulse and thus the positioning speed drops when the deviation pulse is small. In the case, response can be improved by raising the speed loop gain and increasing the current command value.

If the speed loop proportional gain set in [01: Speed loop proportional gain] accessible from [Parameters] is greater than the automatically set value, the value set in [Speed loop proportional gain] becomes effective.

0: Automatic gain setting function disabled

1: Automatic gain setting function enabled

### Set value

Unit	Lower limit value	Upper limit value	Default value
-	0	1	Note

Note: The specific value varies depending on the actuator model. To change the value, refer to the standard value (reference value) in [7-3 Default parameter list].

## 30: System reservation

## 31: System reservation

## 32: System reservation

This driver supports MECHATROLINK, so the parameter functions corresponding to 30 to 32 are disabled.

## 33: Acceleration time constant

## 34: Deceleration time constant

### Descriptions of functions

Set the acceleration/deceleration time to be applied when the [Positioning input (POSING: 35H)], [Low-speed feed (FEED: 36H)] or [External positioning input (EX\_POSING: 39H)] command is executed.

The unit is set value x 10 ms, and the set value represents the time to accelerate from 0 [r/m] to the max. rotational speed of the actuator, or time to decelerate from the max. rotational speed of the applicable actuator to 0 [r/m].

### Set value

Unit	Lower limit value	Upper limit value	Default value
-	1	9999	1

**35: System reservation****36: System reservation****37: System reservation****38: System reservation**

This driver supports MECHATROLINK, so the parameter functions corresponding to 35 to 38 are disabled.

**39: Final external positioning distance****Descriptions of functions**

The actuator moves to the position specified by this parameter upon occurrence of the latch factor specified in the LT\_SGN field while the [External positioning input (EX\_POSING: 39H)] command is being executed.

**Set value**

Unit	Lower limit value	Upper limit value	Default value
pulse	-2147483648	2147483647	0

**40: System reservation**

This driver supports MECHATROLINK, so the parameter function corresponding to 40 is disabled.

**41: FWD soft limit****Descriptions of functions**

If the REFE bit in PS\_SUBCMD is set to 1 for the [Coordinate system setting command (POS\_SET: 20H)], the soft limits are monitored and if the value of the feedback pulse counter exceeds the value set here, the forward command is ignored and the P\_SOT bit in the STATUS field becomes 1.

Although the setting range is from -2147483648 to 2147483647, set an appropriate value that satisfies the conditions [FWD soft limit > REV soft limit] and [Forward limit  $\geq$  Current value].

**Set value**

Unit	Lower limit value	Upper limit value	Default value
pulse	-2147483648	2147483647	2147483647

**42: System reservation**

This driver supports MECHATROLINK, so the parameter function corresponding to 42 is disabled.

## 43: REV soft limit

### Descriptions of functions

If the REFE bit in PS\_SUBCMD is set to 1 for the [Coordinate system setting (POS\_SET: 20H)] command, the soft limits are monitored and if the value of the feedback pulse counter becomes smaller than the value set here, the reverse command is ignored and the N\_SOT bit in the STATUS field becomes 1.

Although the setting range is from -2147483648 to 2147483647, set an appropriate value that satisfies the conditions [FWD soft limit > REV soft limit] and [REV limit  $\leq$  Current value].

### Set value

Unit	Lower limit value	Upper limit value	Default value
pulse	-2147483648	2147483647	-2147483648

## 44: System reservation

This driver supports MECHATROLINK, so the parameter function corresponding to 44 is disabled.

## 45: Originating direction

### Descriptions of functions

Set the originating direction to be applied when the [Originating: ZRET: 3AH] command is executed. The set value is 0 or 1. If 0 is set, originating is performed in forward direction. If 1 is set, originating is performed in reverse direction.

### Set value

Unit	Lower limit value	Upper limit value	Default value
pulse	0	1	0

## 46: Origin position range

### Descriptions of functions

Upon completion of the originating triggered by the [Originating: ZRET: 3AH] command, the ZPOINT bit in the STATUS field becomes 1 if the difference between the origin position and feedback pulse counter is within the range set by this parameter.

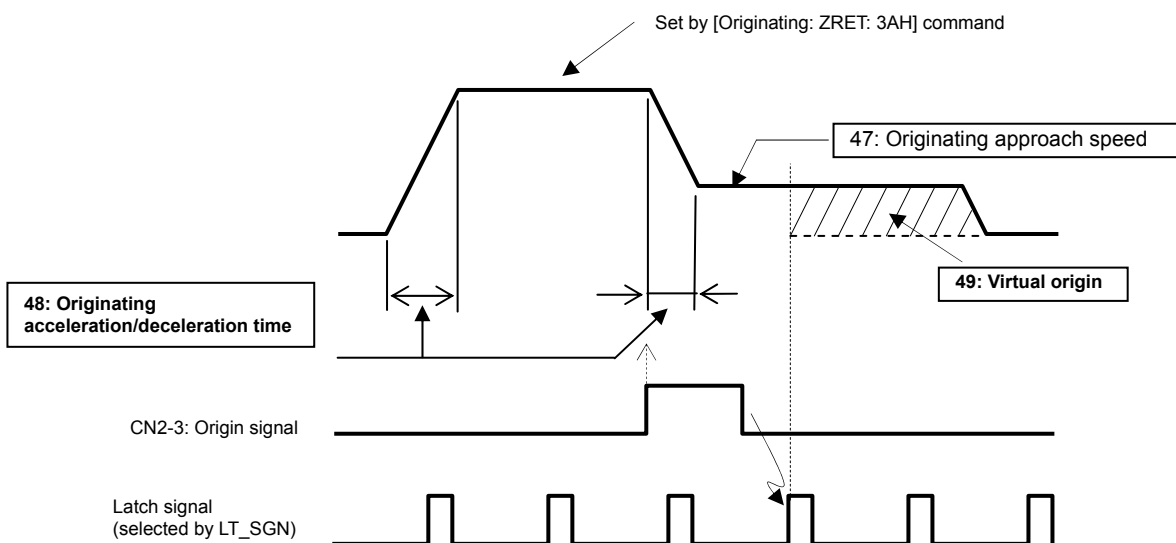
### Set value

Unit	Lower limit value	Upper limit value	Default value
pulse	1	32768	10

**47: Originating approach speed****48: Originating acceleration/deceleration time****49: Virtual origin****Descriptions of functions**

When the [Originating: ZRET: 3AH] command is executed, originating operation is performed as follows.

This parameter sets each aspect of originating.

**Set value**

Originating approach speed

Unit	Lower limit value	Upper limit value	Default value
r/min	10	9999	10

Originating acceleration/deceleration time

Unit	Lower limit value	Upper limit value	Default value
×10ms	1	9999	1

Virtual origin

Unit	Lower limit value	Upper limit value	Default value
pulse	-32768	32767	0

## 7-3 Default parameter list

No.	Description	Unit	FHA-8C -30	FHA-8C -50	FHA-8C -100
00	Position loop gain	-	40	40	40
01	Speed loop proportional gain	-	75	75	75
02	Speed loop integral gain	-	20	20	20
03	Speed loop derivative gain	-	0	0	0
04	Speed feed-forward factor	-	0	0	0
05	Acceleration feed-forward factor	-	0	0	0
06	Torque command filter	-	0	0	0
07	Speed step correction	-	0	0	0
08	Torque step correction	-	0	0	0
09	Step correction switch range	pulse	4000	4000	4000
10		-	-	-	-
11	System reservation Note	-	-	-	-
12		-	-	-	-
13	Input pin logical setting	-	0	0	0
14	Output pin logical setting	-	8	8	8
15	Control input filter time constant	ms	0	0	0
16	System reservation Note	-	-	-	-
17	FWD current limiting	%	188	194	185
18	REV current limiting	%	188	194	185
19	Regenerative brake ON/OFF	-	0	0	0
20	Rotation direction command	-	0	0	0
21	Allowable position deviation	pulse	30000	30000	30000
22	In-position range	pulse	10	10	10
23	Command pulse input factor-Numerator	-	1	1	1
24	Command pulse input factor-Denominator	-	1	1	1
25		-	-	-	-
26	System reservation Note	-	-	-	-
27	Deviation clear upon servo-ON	-	0	0	0
28	Angle compensation	-	-	-	-
29	Automatic gain setting for positioning	-	1	1	1
30		-	-	-	-
31	System reservation Note	-	-	-	-
32		-	-	-	-
33	Acceleration time constant	x 10ms	1	1	1
34	Deceleration time constant	x 10ms	1	1	1
35		-	-	-	-
36		-	-	-	-
37	System reservation Note	-	-	-	-
38		-	-	-	-
39	Final external positioning distance	pulse	0	0	0
40	System reservation Note	-	-	-	-
41	FWD soft limit	pulse	2147483647	2147483647	2147483647
42	System reservation Note	-	-	-	-
43	REV soft limit	pulse	-2147483648	-2147483648	-2147483648
44	System reservation Note	-	-	-	-
45	Originating direction	pulse	0	0	0
46	Origin position range	pulse	10	10	10
47	Originating approach speed	r/min	10	10	10
48	Originating acceleration/deceleration time	x 10ms	1	1	1
49	Virtual origin	pulse	0	0	0

Note: This area is reserved for the system. Do not set anything.

No.	Description	Unit	FHA-11C -30	FHA-11C -50	FHA-11C -100
00	Position loop gain	-	40	40	40
01	Speed loop proportional gain	-	225	225	225
02	Speed loop integral gain	-	20	20	20
03	Speed loop derivative gain	-	0	0	0
04	Speed feed-forward factor	-	0	0	0
05	Acceleration feed-forward factor	-	0	0	0
06	Torque command filter	-	0	0	0
07	Speed step correction	-	0	0	0
08	Torque step correction	-	0	0	0
09	Step correction switch range	pulse	4000	4000	4000
10		-	-	-	-
11	System reservation	Note	-	-	-
12		-	-	-	-
13	Input pin logical setting	-	0	0	0
14	Output pin logical setting	-	8	8	8
15	Control input filter time constant	ms	0	0	0
16	System reservation	Note	-	-	-
17	FWD current limiting	%	211	234	200
18	REV current limiting	%	211	234	200
19	Regenerative brake ON/OFF	-	0	0	0
20	Rotation direction command	-	0	0	0
21	Allowable position deviation	pulse	30000	30000	30000
22	In-position range	pulse	10	10	10
23	Command pulse input factor-Numerator	-	1	1	1
24	Command pulse input factor-Denominator	-	1	1	1
25		-	-	-	-
26	System reservation	Note	-	-	-
27	Deviation clear upon servo-ON	-	0	0	0
28	Angle compensation	-	-	-	-
29	Automatic gain setting for positioning	-	1	1	1
30		-	-	-	-
31	System reservation	Note	-	-	-
32		-	-	-	-
33	Acceleration time constant	x 10ms	1	1	1
34	Deceleration time constant	x 10ms	1	1	1
35		-	-	-	-
36	System reservation	Note	-	-	-
37		-	-	-	-
38		-	-	-	-
39	Final external positioning distance	pulse	0	0	0
40	System reservation	Note	-	-	-
41	FWD soft limit	pulse	2147483647	2147483647	2147483647
42	System reservation	Note	-	-	-
43	REV soft limit	pulse	-2147483648	-2147483648	-2147483648
44	System reservation	Note	-	-	-
45	Originating direction	pulse	0	0	0
46	Origin position range	pulse	10	10	10
47	Originating approach speed	r/min	10	10	10
48	Originating acceleration/deceleration time	x 10ms	1	1	1
49	Virtual origin	pulse	0	0	0

Note: This area is reserved for the system. Do not set anything.

7-3 Default parameter list

No.	Description	Unit	FHA-14C -30	FHA-14C -50	FHA-14C -100
00	Position loop gain	-	40	40	40
01	Speed loop proportional gain	-	250	250	250
02	Speed loop integral gain	-	20	20	20
03	Speed loop derivative gain	-	0	0	0
04	Speed feed-forward factor	-	0	0	0
05	Acceleration feed-forward factor	-	0	0	0
06	Torque command filter	-	0	0	0
07	Speed step correction	-	0	0	0
08	Torque step correction	-	0	0	0
09	Step correction switch range	pulse	4000	4000	4000
10		-	-	-	-
11	System reservation	Note	-	-	-
12		-	-	-	-
13	Input pin logical setting	-	0	0	0
14	Output pin logical setting	-	8	8	8
15	Control input filter time constant	ms	0	0	0
16	System reservation	Note	-	-	-
17	FWD current limiting	%	247	304	280
18	REV current limiting	%	247	304	280
19	Regenerative brake ON/OFF	-	0	0	0
20	Rotation direction command	-	0	0	0
21	Allowable position deviation	pulse	30000	30000	30000
22	In-position range	pulse	10	10	10
23	Command pulse input factor-Numerator	-	1	1	1
24	Command pulse input factor-Denominator	-	1	1	1
25		-	-	-	-
26	System reservation	Note	-	-	-
27	Deviation clear upon servo-ON	-	0	0	0
28	Angle compensation	-	-	-	-
29	Automatic gain setting for positioning	-	1	1	1
30		-	-	-	-
31	System reservation	Note	-	-	-
32		-	-	-	-
33	Acceleration time constant	x 10ms	1	1	1
34	Deceleration time constant	x 10ms	1	1	1
35		-	-	-	-
36	System reservation	Note	-	-	-
37		-	-	-	-
38		-	-	-	-
39	Final external positioning distance	pulse	0	0	0
40	System reservation	Note	-	-	-
41	FWD soft limit	pulse	2147483647	2147483647	2147483647
42	System reservation	Note	-	-	-
43	REV soft limit	pulse	-2147483648	-2147483648	-2147483648
44	System reservation	Note	-	-	-
45	Originating direction	pulse	0	0	0
46	Origin position range	pulse	10	10	10
47	Originating approach speed	r/min	10	10	10
48	Originating acceleration/deceleration time	x 10ms	1	1	1
49	Virtual origin	pulse	0	0	0

Note: This area is reserved for the system. Do not set anything.

No.	Description	Unit	RSF-3B -30	RSF-3B -50	RSF-3B -100
00	Position loop gain	-	100	100	100
01	Speed loop proportional gain	-	120	120	120
02	Speed loop integral gain	-	10	10	10
03	Speed loop derivative gain	-	0	0	0
04	Speed feed-forward factor	-	0	0	0
05	Acceleration feed-forward factor	-	0	0	0
06	Torque command filter	-	0	0	0
07	Speed step correction	-	0	0	0
08	Torque step correction	-	0	0	0
09	Step correction switch range	pulse	4000	4000	4000
10		-	-	-	-
11	System reservation	Note	-	-	-
12		-	-	-	-
13	Input pin logical setting	-	0	0	0
14	Output pin logical setting	-	8	8	8
15	Control input filter time constant	ms	0	0	0
16	System reservation	Note	-	-	-
17	FWD current limiting	%	229	212	201
18	REV current limiting	%	229	212	201
19	Regenerative brake ON/OFF	-	0	0	0
20	Rotation direction command	-	0	0	0
21	Allowable position deviation	pulse	30000	30000	30000
22	In-position range	pulse	10	10	10
23	Command pulse input factor-Numerator	-	1	1	1
24	Command pulse input factor-Denominator	-	1	1	1
25	System reservation	Note	-	-	-
26		-	-	-	-
27	Deviation clear upon servo-ON	-	0	0	0
28	Angle compensation	-	-	-	-
29	Automatic gain setting for positioning	-	0	0	0
30		-	-	-	-
31	System reservation	Note	-	-	-
32		-	-	-	-
33	Acceleration time constant	x 10ms	1	1	1
34	Deceleration time constant	-	-	-	-
35		-	-	-	-
36	System reservation	Note	-	-	-
37		-	-	-	-
38		-	-	-	-
39	Final external positioning distance	pulse	0	0	0
40	System reservation	Note	-	-	-
41	FWD soft limit	pulse	2147483647	2147483647	2147483647
42	System reservation	Note	-	-	-
43	REV soft limit	pulse	-2147483648	-2147483648	-2147483648
44	System reservation	Note	-	-	-
45	Originating direction	pulse	0	0	0
46	Origin position range	pulse	10	10	10
47	Originating approach speed	r/min	10	10	10
48	Originating acceleration/deceleration time	x 10ms	1	1	1
49	Virtual origin	Pulse	0	0	0

Note: This area is reserved for the system. Do not set anything

7-3 Default parameter list

No.	Description	Unit	RSF-5A -30	RSF-5A -50	RSF-5A -100
00	Position loop gain	-	100 (120)	100 (120)	100 (120)
01	Speed loop proportional gain	-	65 (130)	65 (130)	65 (130)
02	Speed loop integral gain	-	10	10	10
03	Speed loop derivative gain	-	20	20	20
04	Speed feed-forward factor	-	0	0	0
05	Acceleration feed-forward factor	-	0	0	0
06	Torque command filter	-	0	0	0
07	Speed step correction	-	0	0	0
08	Torque step correction	-	0	0	0
09	Step correction switch range	pulse	4000	4000	4000
10		-	-	-	-
11	System reservation	Note	-	-	-
12		-	-	-	-
13	Input pin logical setting	-	0	0	0
14	Output pin logical setting	-	8	8	8
15	Control input filter time constant	ms	0	0	0
16	System reservation	Note	-	-	-
17	FWD current limiting	%	211	257	253
18	REV current limiting	%	211	257	253
19	Regenerative brake ON/OFF	-	0	0	0
20	Rotation direction command	-	0	0	0
21	Allowable position deviation	pulse	30000	30000	30000
22	In-position range	pulse	10	10	10
23	Command pulse input factor-Numerator	-	1	1	1
24	Command pulse input factor-Denominator	-	1	1	1
25	System reservation	Note	-	-	-
26		-	-	-	-
27	Deviation clear upon servo-ON	-	0	0	0
28	Angle compensation	-	-	-	-
29	Automatic gain setting for positioning	-	0	0	0
30	System reservation	Note	-	-	-
31		-	-	-	-
32	System reservation	Note	-	-	-
33	Acceleration time constant	x 10ms	1	1	1
34	Deceleration time constant	x 10ms	1	1	1
35		-	-	-	-
36	System reservation	Note	-	-	-
37		-	-	-	-
38		-	-	-	-
39	Final external positioning distance	pulse	0	0	0
40	System reservation	Note	-	-	-
41	FWD soft limit	pulse	2147483647	2147483647	2147483647
42	System reservation	Note	-	-	-
43	REV soft limit	pulse	-2147483648	-2147483648	-2147483648
44	System reservation	Note	-	-	-
45	Originating direction	pulse	0	0	0
46	Origin position range	pulse	10	10	10
47	Originating approach speed	r/min	10	10	10
48	Originating acceleration/deceleration time	x 10ms	1	1	1
49	Virtual origin	pulse	0	0	0

Note: This area is reserved for the system. Do not set anything.

\*: The values of an actuator with brake are shown in parentheses.

No.	Description	Unit	RSF-8B -30-B	RSF-8B-50-B	RSF-8B -100-B
00	Position loop gain		40	40	40
01	Speed loop proportional gain		120	120	120
02	Speed loop integral gain	-	20	20	20
03	Speed loop derivative gain	-	0	0	0
04	Speed feed-forward factor	-	0	0	0
05	Acceleration feed-forward factor	-	0	0	0
06	Torque command filter	-	0	0	0
07	Speed step correction	-	0	0	0
08	Torque step correction	-	0	0	0
09	Step correction switch range	pulse	4000	4000	4000
10	Control mode	-	-	-	-
11	Input function assignment	-	-	-	-
12	Output function assignment	-	-	-	-
13	Input pin logical setting	-	0	0	0
14	Output pin logical setting	-	8	8	8
15	Control input filter time constant	ms	0	0	0
16	Speed limit	r/min	-	-	-
17	FWD current limiting	%	190	195	193
18	REV current limiting	%	190	195	193
19	Regenerative brake ON/OFF	-	0	0	0
20	Rotation direction command	-	0	0	0
21	Allowable position deviation	pulse	30000	30000	30000
22	In-position range	pulse	10	10	10
23	Command pulse input factor-Numerator	-	1	1	1
24	Command pulse input factor-Denominator	-	1	1	1
25	Command pulse input form	-	-	-	-
26	Multiplication of 2-phase input	-	-	-	-
27	Deviation clear upon servo-ON	-	0	0	0
28	Angle compensation	-	-	-	-
29	Automatic gain setting for positioning	-	1	1	1
30	Speed command input factor	r/min	-	-	-
31	Attained speed judgment value	r/min	-	-	-
32	Internal speed command value	r/min	-	-	-
33	Acceleration time constant	ms	1	1	1
34	Deceleration time constant	ms	1	1	1
35	Analog command A/D value (Mid)	-	-	-	-
36	Analog command A/D value (Max)	-	-	-	-
37	Analog command A/D value (Min)	-	-	-	-
38	Zero clamp	-	-	-	-
39	System reservation Note	-	0	0	0
40	Internal torque command value	%	-	-	-
41	Torque command input factor	-	2147483647	2147483647	2147483647
42	System reservation Note	-	-	-	-
43	JOG operation acceleration/deceleration time constant	ms	-2147483648	-2147483648	-2147483648
44	JOG operation feed pulses	pulse	-	-	-
45	JOG operation S-shape selection	-	0	0	0
46	JOG operation speed	r/min	10	10	10
47	Communication setting	-	10	10	10
48	CAN ID Note	-	1	1	1
49	CAN communication speed Note	-	0	0	0

Note: This area is reserved for the system. Do not set anything.

7-3 Default parameter list

No.	Description	Unit	RSF-8B -30-B	RSF-8B-50-B	RSF-8B -100-B
00	Position loop gain	-	40	40	40
01	Speed loop proportional gain	-	140	140	140
02	Speed loop integral gain	-	20	20	20
03	Speed loop derivative gain	-	0	0	0
04	Speed feed-forward factor	-	0	0	0
05	Acceleration feed-forward factor	-	0	0	0
06	Torque command filter	-	0	0	0
07	Speed step correction	-	0	0	0
08	Torque step correction	-	0	0	0
09	Step correction switch range	pulse	4000	4000	4000
10	Control mode	-	-	-	-
11	Input function assignment	-	-	-	-
12	Output function assignment	-	-	-	-
13	Input pin logical setting	-	0	0	0
14	Output pin logical setting	-	8	8	8
15	Control input filter time constant	ms	0	0	0
16	Speed limit	r/min	-	-	-
17	FWD current limiting	%	288	322	191
18	REV current limiting	%	288	322	191
19	Regenerative brake ON/OFF	-	0	0	0
20	Rotation direction command	-	0	0	0
21	Allowable position deviation	pulse	30000	30000	30000
22	In-position range	pulse	10	10	10
23	Command pulse input factor-Numerator	-	1	1	1
24	Command pulse input factor-Denominator	-	1	1	1
25	Command pulse input form	-	-	-	-
26	Multiplication of 2-phase input	-	-	-	-
27	CLEAR signal function selection	-	0	0	0
28	Angle compensation	-	-	-	-
29	Automatic gain setting for positioning	-	1	1	1
30	Speed command input factor	r/min	-	-	-
31	Attained speed judgment value	r/min	-	-	-
32	Internal speed command value	r/min	-	-	-
33	Acceleration time constant	ms	1	1	1
34	Deceleration time constant	ms	1	1	1
35	Analog command A/D value (Mid)	-	-	-	-
36	Analog command A/D value (Max)	-	-	-	-
37	Analog command A/D value (Min)	-	-	-	-
38	Zero clamp	-	-	-	-
39	System reservation Note	-	0	0	0
40	Internal torque command value	%	-	-	-
41	Torque command input factor	-	2147483647	2147483647	2147483647
42	System reservation Note	-	-	-	-
43	JOG Operation acceleration/deceleration time constant	ms	-2147483648	-2147483648	-2147483648
44	JOG operation feed pulses	pulse	-	-	-
45	JOG operation S-shape selection	-	0	0	0
46	JOG operation speed	r/min	10	10	10
47	Communication setting	-	10	10	10
48	CAN ID Note	-	1	1	1
49	CAN communication speed Note	-	0	0	0

Note: This area is reserved for the system. Do not set anything.

No.	Description	Unit	RSF-14B -30	RSF-14B -50	RSF-14B -100
00	Position loop gain	-	40	40	40
01	Speed loop proportional gain	-	120	120	120
02	Speed loop integral gain	-	20	20	20
03	Speed loop derivative gain	-	0	0	0
04	Speed feed-forward factor	-	0	0	0
05	Acceleration feed-forward factor	-	0	0	0
06	Torque command filter	-	0	0	0
07	Speed step correction	-	0	0	0
08	Torque step correction	-	0	0	0
09	Step correction switch range	pulse	4000	4000	4000
10	Control mode	-	-	-	-
11	Input function assignment	-	-	-	-
12	Output function assignment	-	-	-	-
13	Input pin logical setting	-	0	0	0
14	Output pin logical setting	-	8	8	8
15	Control input filter time constant	ms	0	0	0
16	Speed limit	r/min	-	-	-
17	FWD current limiting	%	293	365	261
18	REV current limiting	%	293	365	261
19	Regenerative brake ON/OFF	-	0	0	0
20	Rotation direction command	-	0	0	0
21	Allowable position deviation	pulse	30000	30000	30000
22	In-position range	pulse	10	10	10
23	Command pulse input factor-Numerator	-	1	1	1
24	Command pulse input factor-Denominator	-	1	1	1
25	Command pulse input form	-	-	-	-
26	Multiplication of 2-phase input	-	-	-	-
27	CLEAR signal function selection	-	0	0	0
28	Angle compensation	-	-	-	-
29	Automatic gain setting for positioning	-	1	1	1
30	Speed command input factor	r/min	-	-	-
31	Attained speed judgment value	r/min	-	-	-
32	Internal speed command value	r/min	-	-	-
33	Acceleration time constant	ms	1	1	1
34	Deceleration time constant	ms	1	1	1
35	Analog command A/D value (Mid)	-	-	-	-
36	Analog command A/D value (Max)	-	-	-	-
37	Analog command A/D value (Min)	-	-	-	-
38	Zero clamp	-	-	-	-
39	System reservation Note	-	0	0	0
40	Internal torque command value	%	-	-	-
41	Torque command input factor	-	2147483647	2147483647	2147483647
42	System reservation Note	-	-	-	-
43	JOG Operation acceleration/deceleration time constant	ms	-2147483648	-2147483648	-2147483648
44	JOG operation feed pulses	pulse	-	-	-
45	JOG operation S-shape selection	-	0	0	0
46	JOG operation speed	r/min	10	10	10
47	Communication setting	-	10	10	10
48	CAN ID Note	-	1	1	1
49	CAN communication speed Note	-	0	0	0

Note: This area is reserved for the system. Do not set anything.



# Chapter 8

## Troubleshooting and remedial actions

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The remedial actions to be taken when alarms generate are explained in this chapter.

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8-1	Alarms and remedial actions .....	8-1
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## 8-1 Alarms and remedial actions

The HA-680ML driver has various incorporated functions designed to protect the actuator and driver against abnormal situations. If any of these protective functions actuates, the actuator drive is stopped (motor servo turns OFF) and the indicator LED flickers at 0.5-second intervals. (Steady green, flickering red: The number of flickers varies depending on the content of the alarm. See below.)

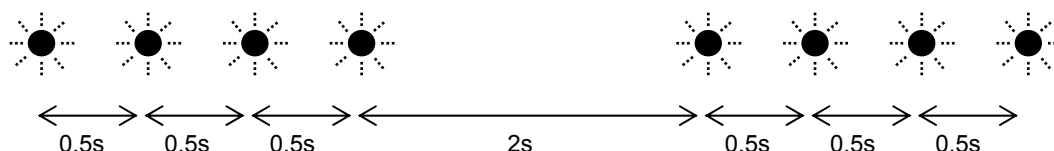
If multiple alarms occur, only the latest alarm is displayed. Up to 8 most recent alarms are stored. The stored alarms can be checked using [Alarm history] in the dedicated communication software PSF-520 or by the [Error/warning read command (ALM\_RD: 05H)] executed via MECHATROLINK.

Alarm name	Description	Number of LED flickers	Alarm clear
Overload	The electronic thermal detected an overload status.	1	Permitted *1
Excessive deviation	The value of the deviation counter exceeded the value set in the parameter.	2	Permitted *1
Encoder break detection	The encoder line is broken.	3	Not permitted *2
Encoder receiving error	Serial encoder data could not be received 10 times consecutively.	4	Not permitted *2
	Serial encoder data could not be received consecutively, and it can no longer be output normally to encoder monitor.	5	
UVW error	All encoder UVW signals have become the same level.	6	Not permitted *2
Regenerative failure	The main-circuit voltage detection circuit detected an overvoltage.	7	Not permitted *2
Operating temperature error	The HA-680ML temperature rose and the temperature sensor actuated.	8	Not permitted *2
System error	An error was detected in the current detection circuit.	9	Not permitted *2
Overcurrent	The current detection circuit detected an excessive current.	10	Not permitted *2
Load short circuit	An excessive current flowed to the FET.	11	Not permitted *2
Memory failure	An attempt to read/write the EEPROM failed.	12	Not permitted *2
Overspeed	The motor shaft speed exceeded the max. rotational speed by 100 rpm for 0.5 s or more.	13	Not permitted *2

\*1 The alarm can be reset by clearing the alarm using the main MECHATROLINK command [Error/warning clear command (ALM\_CLR: 06H)] or cutting off the main power supply and power supply for control power circuit, and then turning on the power again.

\*2 After resetting the alarm, cut off the power. Then, turn it back on according to the power ON sequence. (This alarm cannot be reset via MECHATROLINK.)

Given below is an example of how the LED flickers when an alarm occurs.



In the above example, the LED flickers 4 times at 0.5-second intervals, which indicates [Encoder receiving error].

**WARNING**

**Once the electric power on the plant side is supplied to the system during troubleshooting, do not perform any wiring works.**

If wiring works are performed while the power is supplied, electric shock may result. Shut off the electric power source on the plant side before any wiring works are carried out.

**CAUTION**

- (1) **Clean around the devices. In particular, thoroughly inspect the interior of the system for wire chips, tools and other objects remaining inside the system.**
- (2) **When 2 or more persons are working together, discuss the details of work before turning on the power and pay attention to the safety of others.**

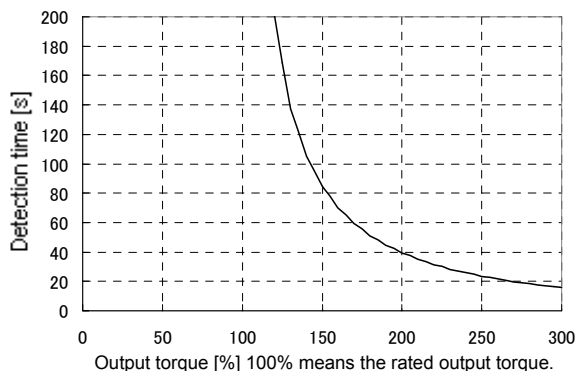
## Overload (Alarm clear: Permitted)

### Description

It always monitors the actuator current, and if the current and its discharge time exceed the curve shown below, an overload alarm occurs.

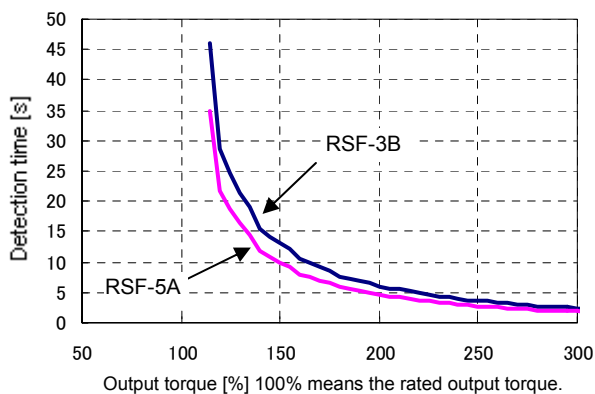
Overload alarm occurrence time

24-VAC FHA-C mini type



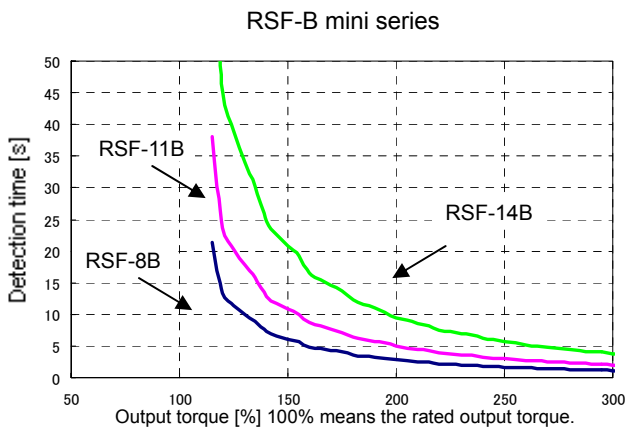
24-VAC FHA-C mini type
(1) An alarm occurs if 1.25 times the allowable continuous current of the actuator flows for approx. 170 seconds.
(2) An alarm occurs if 3 times the allowable continuous current of the actuator flows for approx. 16 seconds.

RSF supermini series



RSF supermini series (RSF-5A)
(1) An alarm occurs if 1.2 times the allowable continuous current of the actuator flows for approx. 35 (45) seconds.
(2) An alarm occurs if twice the allowable continuous current of the actuator flows for approx. 5 (6) seconds.

The value for the RSF-3B is shown in parentheses.

**RSF-8B**

- (1) An alarm occurs if at least 1.2 times the allowable continuous current of the actuator flows for approx. 13 seconds.
- (2) An alarm occurs if 1.5 times the allowable continuous current of the actuator flows for approx. 6 seconds.

**RSF-11B**

- (1) An alarm occurs if at least 1.2 times the allowable continuous current of the actuator flows for approx. 23 seconds.
- (2) An alarm occurs if 1.5 times the allowable continuous current of the actuator flows for approx. 10 seconds.

**RSF-14B**

- (1) An alarm occurs if at least 1.2 times the allowable continuous current of the actuator flows for approx. 45 seconds.
- (2) An alarm occurs if 2.5 times the allowable continuous current of the actuator flows for approx. 5 seconds.

The alarm can be reset by clearing the alarm using the main MECHATROLINK command [Error/warning clear command (ALM\_CLR: 06H)] or cutting off the main power supply and power supply for control power circuit, and then turning on the power again.

**Condition at occurrence**

- (1) **The alarm occurs when the control circuit power is turned on:**
  - **Cause 1: Error in the HA-680ML driver's control circuit**  
⇒Action: Contact our sales office. (Replace the HA-680ML driver.)
- (2) **The alarm occurs during operation (operation can be resumed after cutting off the power and then turning it back on):**
  - **Cause 1: Operation in overload status**  
⇒Action: Review the effective load rate of the actuator and lower the load rate.
- (3) **The alarm occurs after the actuator exhibits hunting:**
  - **Cause 1: Hunting due to inappropriate gain adjustment**  
⇒Action: Adjust [00: Position loop gain], [01: Speed loop proportional gain], [02: Speed loop integral gain] or [03: Speed loop derivative gain], accessible from [Parameters], in a manner matching the load status.
- (4) **The alarm does not occur when only the actuator is operated (no-load), but it occurs once a load is applied:**
  - **Cause 1: Wrong motor or encoder connection**  
⇒Action: Connect the motor/encoder correctly by referring to Chapter 3 [Installation of HA-680ML driver] of this manual.
- (5) **The alarm also occurs when only the actuator is operated (no-load):**
  - **Cause 1: Wrong motor or encoder connection**  
⇒Action: Connect the motor/encoder correctly by referring to Chapter 3 [Installation of HA-680ML driver] of this manual.

## Excessive deviation (Alarm clear: Permitted)

### Description

An alarm occurs when the content of the deviation counter becomes equal to or greater than the pulses set in the applicable parameter (PSF-520 No. 21, Allowable position deviation). This alarm can be reset by inputting the ON signal to [CN2 Clear: CLEAR] or [CN2 Deviation clear: DEV-CLR] and then inputting the ON signal to [CN2 Alarm clear: ALM-CLR].

### Condition at occurrence

#### (1) The alarm occurs when the control circuit power is turned on:

- **Cause 1: Error in the HA-680ML driver's control circuit**  
⇒Action: Contact our sales office. (Replace the HA-680ML driver.)

#### (2) The alarm occurs during acceleration or deceleration:

- **Cause 1: Too low a gain**  
⇒Action: Adjust [00: Position loop gain], [01: Speed loop proportional gain], [02: Speed loop integral gain] or [03: Speed loop derivative gain], accessible from [Parameters], according to the load.
- **Cause 2: Wrong command pulse input factor setting**  
⇒Action: Correctly set [23: Electronic gear factor - Numerator] and [24: Electronic gear factor - Denominator] accessible from [Parameters] again.
- **Cause 3: Excessive load inertia moment (inertia)**  
⇒Action 1: Lower the load inertia moment.  
⇒Action 2: Slowly increase/decrease the command pulse frequency on the host device.

#### (3) The speed does not rise with the command, and the alarm occurs sometime after that:

- **Cause 1: Turning OFF of input signal [CN2-1: FWD inhibit] or [CN2-2: REV inhibit]**  
⇒Action: Check the CN2 connector cable for breakage.

#### (4) The actuator does not rotate and the alarm occurs:

- **Cause 1: Motor cable connection failure or wrong phase order**  
⇒Action 1: Connect the motor cable wires and terminals securely.
- **Cause 2: No input from the main circuit power**  
⇒Action 2: Input the main circuit power.

## Encoder break detection (Alarm clear: Not permitted)

### Description

An alarm occurs when signals from the encoder are cut off (mainly upon detection of encoder line breakage).

This alarm cannot be reset unless you investigate the cause of the alarm, cut off the power and then turn it back on.

### Condition at occurrence

#### (1) The alarm occurs when the control circuit power is turned on:

- **Cause 1: Non-connection or poor connection of the encoder connector (CN1), or encoder line breakage**  
⇒Action: Securely connect the CN1 connector again.
- **Cause 2: Internal damage of the encoder**  
⇒Action: Contact our sales office. (Replace the actuator.)
- **Cause 3: Error in the HA-680ML driver's control circuit**  
⇒Action: Contact our sales office. (Replace the HA-680ML driver.)

#### (2) The alarm occurs during operation (a normal condition is restored when the actuator cools down):

- **Cause 1: Malfunction of the encoder due to rise in actuator temperature**  
⇒Action: Review the installation location and cooling system of the actuator.

## Encoder receiving error (Alarm clear: Not permitted)

### Description

An alarm occurs when data cannot be received normally from the encoder. This alarm also occurs when encoder signals are no longer output. This alarm cannot be reset unless you investigate the cause of the alarm, cut off the power and then turn it back on.

### Condition at occurrence

#### (1) The alarm occurs when the control circuit power is turned on:

- **Cause 1: Non-connection or poor connection of the encoder connector (CN1)**  
⇒Action: Securely connect the CN1 connector again.
- **Cause 2: Internal damage of the encoder**  
⇒Action: Contact our sales office. (Replace the actuator.)
- **Cause 3: Error in the HA-680ML driver's control circuit**  
⇒Action: Contact our sales office. (Replace the HA-680ML driver.)

#### (2) The alarm sometimes occurs during operation:

- **Cause 1: Malfunction due to external noise**  
⇒Action: Suppress noise according to [3-4 Suppressing noise] in this manual.

## UVW error (Alarm clear: Not permitted)

### Description

An alarm occurs if encoder phase UVW signals become abnormal. This alarm cannot be reset unless you investigate the cause of the alarm, cut off the power and then turn it back on.

### Condition at occurrence

#### (1) The alarm occurs when the control circuit power is turned on:

- **Cause 1: Non-connection or poor connection of the encoder connector (CN1)**  
⇒Action: Securely connect the CN1 connector again.
- **Cause 2: Internal damage of the encoder**  
⇒Action: Contact our sales office. (Replace the actuator.)
- **Cause 3: Error in the HA-680ML driver's control circuit**  
⇒Action: Contact our sales office. (Replace the HA-680ML driver.)

#### (2) The alarm sometimes occurs during operation:

- **Cause 1: Malfunction due to external noise**  
⇒Action: Suppress noise according to [3-4 Suppressing noise] in this manual.

## Regenerative failure (Alarm clear: Not permitted)

### Description

An alarm occurs if the main circuit voltage exceeds 50V. If the inertia moment of the load is high, the main circuit voltage rises due to energy generated by actuator deceleration. The alarm can be reset by cutting off the control circuit power and then turning on the power again. Note, however, that this alarm will occur every time if the load condition remains the same.

Connect a regenerative resistor to the terminals for connecting external regenerative resistor or extend the acceleration/deceleration time. If a regenerative resistor is connected, be sure to switch the regenerative resistor switching jumper to the external side.

Also note that the regenerative resistor in the regenerative absorption circuit has a built-in fuse. If the regenerative resistor temperature rises as a result of excessive regeneration and the fuse blows, the regenerative circuit will no longer operate and the main circuit voltage will rise. Cut off the control circuit power and turn on the power again. If a regenerative failure occurs again immediately after the start of subsequent operation, the fuse may have blown. In this case, connect an external regenerative resistor and switch the jumper setting.

### Condition at occurrence

#### (1) The alarm occurs during operation:

- **Cause 1: Load inertia moment which is too high**  
⇒Action 1: Connect an external resistor or capacitor according to [3-8 Connection of the regenerative absorption resistor/capacitor] in this manual.  
⇒Action 2: Increase the deceleration time.  
⇒Action 3: Lower the maximum speed.  
⇒Action 4: Lower the load inertia moment.
- **Cause 2: Overvoltage detection circuit error**  
⇒Action: Contact our sales office. (Replace the HA-680ML driver.)

## Operating temperature error (Alarm clear: Not permitted)

### Description

An alarm occurs when the HA-680ML temperature rises and the temperature sensor actuates. This alarm cannot be reset unless you investigate the cause of the alarm, cut off the power and then turn it back on.

### Condition at occurrence

#### (1) The alarm occurs when the control circuit power is turned on:

- **Cause 1: Temperature sensor error of the HA-680ML driver**  
⇒Action: Contact our sales office. (Replace the HA-680ML driver.)

#### (2) The alarm occurs during operation:

- **Cause 1: Operation in overload status**  
⇒Action: Review the effective load rate of the actuator and lower the load rate.
- **Cause 2: 50°C or above of ambient temperature of the HA-680ML driver**  
⇒Action: Review the installation location and cooling system of the HA-680ML driver.

## System error (Alarm clear: Not permitted)

### Description

An alarm occurs when an error is detected in the current detection circuit. This alarm cannot be reset unless you investigate the cause of the alarm, cut off the power and then turn it back on.

### Condition at occurrence

#### (1) The alarm occurs when the control circuit power is turned on:

- **Cause 1: Error in the HA-680ML driver's current detection circuit**  
⇒Action: Contact our sales office. (Replace the HA-680ML driver.)

#### (2) The alarm sometimes occurs during operation:

- **Cause 1: Malfunction due to external noise**  
⇒Action: Suppress noise according to [3-4 Suppressing noise] in this manual.
- **Cause 2: Error in the HA-680ML driver's current detection circuit**  
⇒Action: If the alarm occurs again after the power is connected, contact our sales office. (Replace the HA-680ML driver.)

## Overcurrent (Alarm clear: Not permitted)

### Description

An alarm occurs when the current detection circuit detects an overcurrent. This alarm cannot be reset unless you investigate the cause of the alarm, cut off the power and then turn it back on.

### Condition at occurrence

#### (1) The alarm occurs when the control circuit power is turned on:

- **Cause 1: Error in the HA-680ML driver's control circuit**  
⇒Action: Contact our sales office. (Replace the HA-680ML driver.)

#### (2) The alarm occurs after excitation with the MECHATROLINK command [SV\_ON (31h): Servo-ON]:

- **Cause 1: Error in the HA-680ML driver's main circuit or control circuit**  
⇒Action: Contact our sales office. (Replace the HA-680ML driver.)

#### (3) The alarm occurs after excitation with the MECHATROLINK command [SV\_ON (31h): Servo-ON], but a normal condition is restored when the command is input (ON) with the motor cable (U, V, W) disconnected:

- **Cause 1: Short-circuited motor cable**  
⇒Action: Check the motor cable connection point again, reconnect the motor cable, or replace/repair the cable.
- **Cause 2: Short-circuited motor coil**  
⇒Action: Contact our sales office. (Replace the actuator.)

#### (4) The alarm occurs during acceleration or deceleration:

- **Cause 1: Excessive load inertia moment (inertia) and too short an acceleration/deceleration time**  
⇒Action 1: Lower the load inertia moment.  
⇒Action 2: Increase the time set in [33: Acceleration time constant] or [34: Deceleration time constant] accessible from [Parameters].
- **Cause 2: Gain which is too high or too low**  
⇒Action 1: Adjust [00: Position loop gain], [01: Speed loop proportional gain], [02: Speed loop integral gain] or [03: Speed loop derivative gain], accessible from [Parameters], according to the load.

#### (5) The alarm occurs during operation (operation can be resumed after 4 to 5 minutes):

- **Cause 1: Operation in overload status**  
⇒Action: Review the effective load rate of the actuator and lower the load rate.
- **Cause 2: 50°C or above of ambient temperature of the HA-680ML driver**  
⇒Action: Review the installation location and cooling system of the HA-680ML driver.

## Load short circuit (Alarm clear: Not permitted)

### Description

An alarm occurs when an excessive current flows to the FET. This alarm cannot be reset unless you investigate the cause of the alarm, cut off the power and then turn it back on.

### Condition at occurrence

#### (1) The alarm occurs when the control circuit power is turned on:

- **Cause 1: Error in the HA-680ML driver's control circuit**  
⇒Action: Contact our sales office. (Replace the HA-680ML driver.)

#### (2) The alarm occurs after excitation with the MECHATROLINK command [SV\_ON (31h): Servo-ON]:

- **Cause 1: Error in the HA-680ML driver's main circuit or control circuit**  
⇒Action: Contact our sales office. (Replace the HA-680ML driver.)

#### (3) The alarm occurs after excitation with the MECHATROLINK command [SV\_ON (31h): Servo-ON], but a normal condition is restored when the command is input (ON) with the motor cable (U, V, W) disconnected:

- **Cause 1: Short-circuited motor cable**  
⇒Action: Check the motor cable connection point again, reconnect the motor cable, or replace/repair the cable.
- **Cause 2: Short-circuited motor coil**  
⇒Action: Contact our sales office. (Replace the actuator.)

#### (4) The alarm occurs during acceleration or deceleration:

- **Cause 1: Excessive load inertia moment (inertia) and too short an acceleration/deceleration time**  
⇒Action 1: Lower the load inertia moment.  
⇒Action 2: Increase the time set in [33: Acceleration time constant] or [34: Deceleration time constant] accessible from [Parameters].
- **Cause 2: Gain which is too high or too low**  
⇒Action 1: Adjust [00: Position loop gain], [01: Speed loop proportional gain], [02: Speed loop integral gain] or [03: Speed loop derivative gain], accessible from [Parameters], according to the load.

#### (5) The alarm occurs during operation (operation can be resumed after 4 to 5 minutes):

- **Cause 1: Operation in overload status**  
⇒Action: Review the effective load rate of the actuator and lower the load rate.
- **Cause 2: 50°C or above of ambient temperature of the HA-680ML driver**  
⇒Action: Review the installation location and cooling system of the HA-680ML driver.

## Memory failure (EEPROM) (Alarm clear: Not permitted)

### Description

An alarm occurs due to an error in the driver's EEPROM memory. This alarm cannot be reset unless you investigate the cause of the alarm, cut off the power and then turn it back on.

### Condition at occurrence

#### (1) The alarm occurs when the control circuit power is turned on:

- **Cause 1: Error in the HA-680ML driver's control circuit**  
⇒Action: Contact our sales office. (Replace the HA-680ML driver.)

#### (2) The alarm occurs during operation:

- **Cause 1: Malfunction of the HA-680ML driver's control circuit element**  
⇒Action: Contact our sales office. (Replace the HA-680ML driver.)

## Overspeed (Alarm clear: Not permitted)

### Description

An alarm occurs when the motor shaft rotation speed exceeds the max. rotational speed by 100 r/min for 0.5 second or more. The alarm can be reset by cutting off the control circuit power and then turning on the power again.

### Condition at occurrence

#### (1) The alarm occurs when the control circuit power is turned on:

- **Cause 1: Error in the HA-680ML driver's control circuit**  
⇒Action: Contact our sales office. (Replace the HA-680ML driver.)

#### (2) The alarm occurs due to high-speed actuator rotation when a rotation command is input:

- **Cause 1: Large overshoot due to inappropriate gain adjustment**  
⇒Action: Adjust [01: Speed loop proportional gain], [02: Speed loop integral gain] or [03: Speed loop derivative gain], all accessible from [Parameters], in a manner matching the load status.
- **Cause 2: Wrong motor or encoder connection**  
⇒Action: Connect the motor/encoder correctly by referring to Chapter 3 [Installation of HA-680ML driver] of this manual.

# Chapter 9

## Options

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Options you can purchase as necessary are explained in this chapter.

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9-1	Extension cables .....	9-1
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# 9-1 Extension cables

## Extension cable 1: 24-VDC FHA-C mini type

This extension cable is used to connect a 24-VDC FHA-C mini type actuator to the HA-680ML driver. Three types of extension cables --for motor, encoder and EIA-232-- are available.

- **Extension cable model (\*\* indicates the cable length of 3m, 5m or 10m.)**

(1) For motors:

EWC-MB\*\*-A06-TN2

Cable length

Symbol	Length
03	3m
05	5m
10	10m

ここも修正しました

(2) For encoders:

EWC-E\*\*-M06-3M14

Cable length

Symbol	Length
03	3m
05	5m
10	10m

# 9

Options

## Extension cable 2: RSF supermini series

This extension cable is used to connect an RSF supermini series actuator to the HA-680ML driver. Three types of extension cables --for motor, encoder and EIA-232-- are available.

- **Extension cable model (\*\* indicates the cable length of 3m, 5m or 10m.)**

(1) For motors:

EWA-M\*\*-JST04-TN2

Cable length

Symbol	Length
03	3m
05	5m
10	10m

(2) For encoders:

EWA-E\*\*-M09-3M14

Cable length

Symbol	Length
03	3m
05	5m
10	10m

If you are using an actuator with brake, you need a brake extension cable in addition to the above extension cable. You also need a separate power supply to release the brake. For details, refer to [AC Servo Actuator RSF Supermini Series Manual].

## Extension cable 3: RSF-B mini series (RSF-8B, 11B, 14B)

- **Extension cable model (\*\* indicates the cable length of 3m, 5m or 10m.)**

(1) For motors:

EWC-MB\*\*-A06-TN2

└── Cable length

Symbol	Length
03	3m
05	5m
10	10m

(2) For incremental encoder + pole sensor:

EWB-F\*\*-M0809-3M14

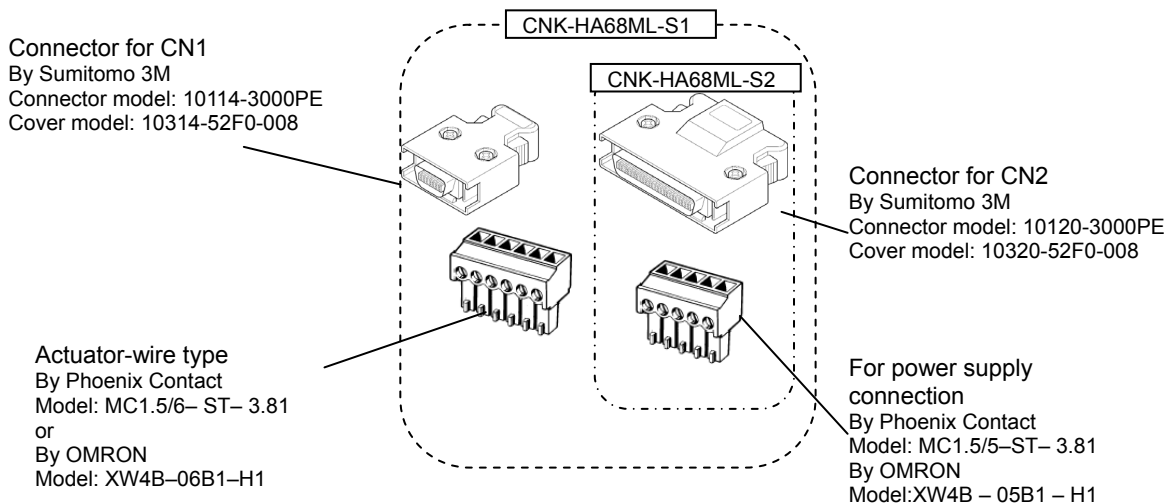
└── Cable length

Symbol	Length
03	3m
05	5m
10	10m

# 9-2 Connectors

These are used to connect the HA-680ML driver's CN1 and CN2 connectors, motor wires, and power supply connectors.

- **Connector model:CNK-HA68ML-S1**  
CN1 type/CN2 type/motor-wire type/power-supply type --- 4 types
- **Connector model:CNK-HA68ML-S2**  
CN2 type/power-supply type --- 2 types



## **9-3** Communication cable

A communication cable is used to connect a personal computer and the servo driver.

For EIA-232:HDM-RS232C Cable length 1.5m

## 9-4 Dedicated communication software PSF-520

This software is used to set/change various parameters in the HA-680ML driver from a PC. Use an EIA-232 crossing cable (dedicated cable HDM-RS232C: cable length 1.5m) to connect [CN3] on the HA-680ML driver to a PC in which the dedicated communication software PSF-520 has been installed, and you can change various servo parameters in the driver.

For details on the dedicated communication software PSF-520, refer to the separate volume [Operation Manual for PSF-520].

You can download the dedicated communication software PSF-520 from our web site [<http://www.hds.co.jp/>].

If you do not have the necessary environment to download the software, contact our sales office.

Model code: PSF-520

Supported OS: Windows/Me/NT/2000/XP \* Windows is a registered trademark of Microsoft Corporation.

What you need: EIA-232 crossing cable (HDM-RS232C, cable length 1.5m)

HA-680ML driver end: Socket terminal: DF11-2428-SCF (by Hirose)

Socket: DF11-8DS-2C (by Hirose)

\* Operation check has not been performed with Windows Vista.

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## Warranty Period and Terms

The HA-680ML series servo drivers are warranted as follows:

### ■ Warranty period

Under the condition that the actuator are handled, used and maintained properly followed each item of the documents and the manuals, all the HA-680ML series drivers are warranted against defects in workmanship and materials for the shorter period of either one year after delivery or 2,000 hours of operation time.

### ■ Warranty terms

All the HA-680ML series drivers are warranted against defects in workmanship and materials for the warranted period. This limited warranty does not apply to any product that has been subject to:

- (1) User's misapplication, improper installation, inadequate maintenance, or misuse.
- (2) Disassembling, modification or repair by others than Harmonic Drive Systems, Inc.
- (3) Imperfection caused by the other than the FHA-C series actuator and the HA-680ML servo driver.
- (4) Disaster or others that does not belong to the responsibility of Harmonic Drive Systems, Inc.

Our liability shall be limited exclusively to repairing or replacing the product only found by Harmonic Drive Systems, Inc. to be defective. Harmonic Drive Systems, Inc. shall not be liable for consequential damages of other equipment caused by the defective products, and shall not be liable for the incidental and consequential expenses and the labor costs for detaching and installing to the driven equipment.



Certified to ISO14001 (HOTAKA Plant)/ISO9001 (TÜV Management Service GmbH)  
 All specifications and dimensions in this manual subject to change without notice.  
 This manual is correct as of June 2011.

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