Communication software for HA-520/HA-680 Series

PSF-520 Instruction Manual

● Thank you for implementing our AC servo driver HA-520, HA-680 series. The PSF-520 software sets various parameters and checks JOG operation and the operating conditions.

● You can download the dedicated communication software PSF-520 from our home page [http://www.hds.co.jp/].

● Incorrect handling and use of this product can cause unexpected accidents and shorten the life of the product. Before using this document, read it carefully to ensure correct and safe use of the product over a long period of time.

● Product specifications are subject to change without prior 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.

HarmonicDrive®

TÜV
SÜD
ISO 14001
ISO 9001
ISO 14001
（HOTAKA Plant）
ISO 9001

Contents

Memo

Chapter 1　　Outline of PSF-520

The PSF-520 software sets various parameters for the AC servo driver HA-520 and HA-680 series (HA-680, HA680CL, HA-680ML) and checks JOG operation and operating conditions.
This tool is required to use HA-680 series.
Prepare the operating environment shown in Section 1-1 below in advance.

1-1　　Operating environment

The environment required for PSF-520 operation is shown below.

	Operating environment
Computer	A personal computer running Windows® XP, Windows Vista®*1 or Windows® 7*1 with a built-in RS-232C communication port
OS	Windows® Xp, Windows Vista® *1 and Windows® 7*1
Memory	More memory space than is required by respective OS
Hard disk	5MB or more available space (Additional space is required to save parameters.)
Display	256 or more colors
	Microsoft® Mouse, Microsoft® intelliMouse® or compatible pointing device

*1: Successful operation has been verified on Windows Vista®, and Windows® 7, but it is not guaranteed.

● **Optional items**

Connect PSF—520 to HA-520 and HA-680 series with the dedicated communication cable.
Communication cable number: "HDM-RS232C" (cable length: **1.5m**)

Chapter 2　　Setup of PSF-520

This chapter describes how to install, delete and start PSF-520.

2-1　Installation

2-2-1　Pre-installation check

(1)　Start Windows.
You need to start Windows to start the installation program. If you have started your PC with other OS, start Windows.

(2)　To set up the software on Windows NT/2000/Xp
You need to log in with a user name belonging to the administrators' group.
Check the details with the system administrator who controls the network.

(3)　Exit from all active applications.
The setup may not be successfully completed if an active application is operating during PSF-650 setup.

2-1-2　Installation start

(1)　Download the installation file from our homepage.
Download the installation file (PSF-520.msi) from our homepage **(**http://www.hds.co.jp). If you don't have an environment to connect to the Internet, request it from our business office.

(2)　Double-click the downloaded file.
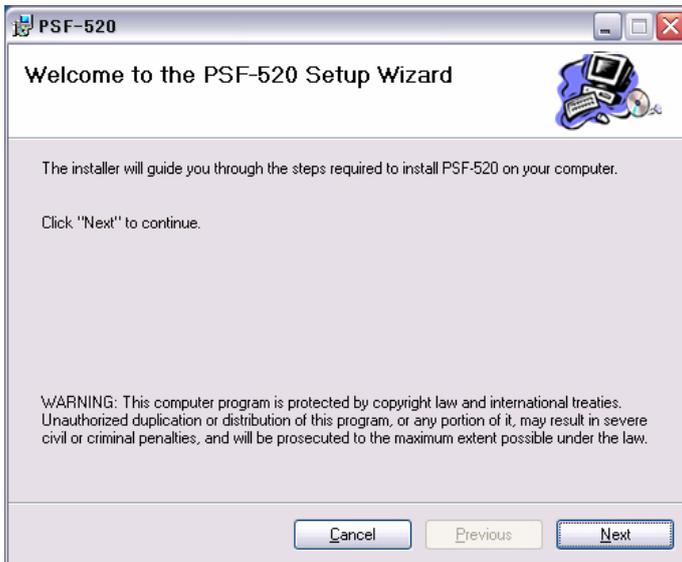
Double-clicking the file starts the setup wizard.
Check out and click Next.

(3) Select an installation folder.
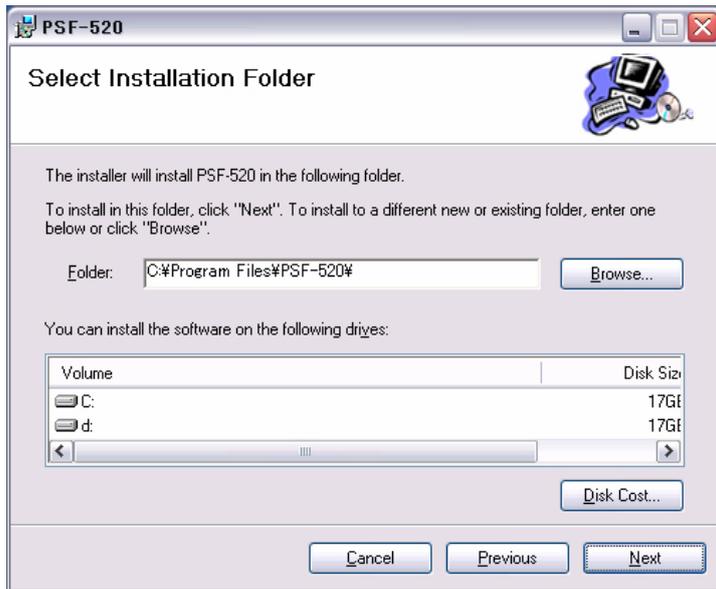
Select an installing destination folder. The default is "C:\Program Files\PSF-520\".

(4) Confirmation of installation start
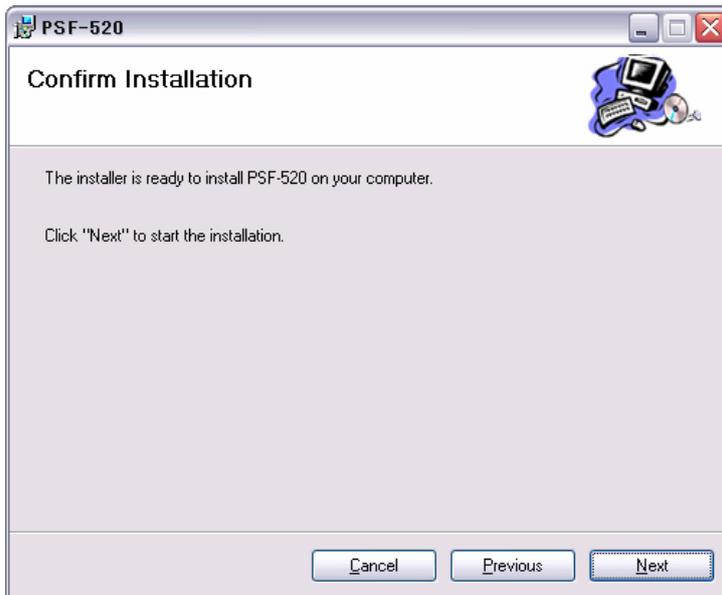
Click Next to start installation.
Click Previous to redo setting.
Click Cancel to abort installation.

(5) Start installation.
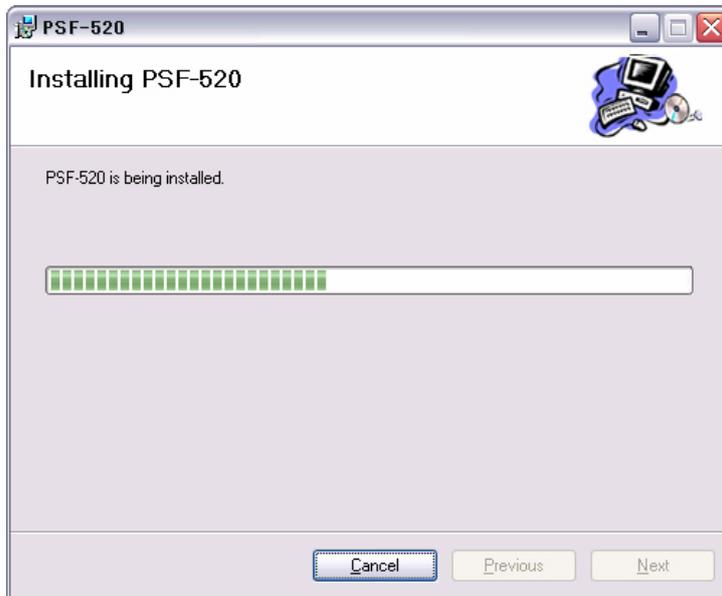
Click Cancel to abort installation.

(6) Completion of installation
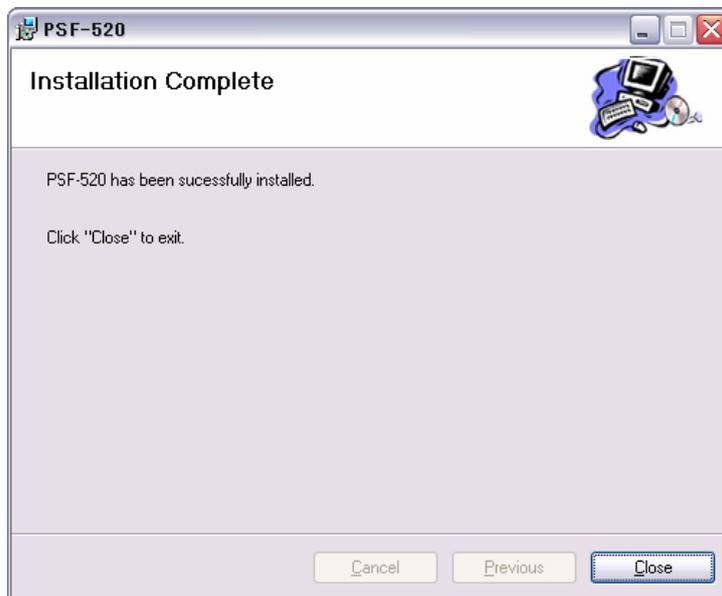
Installation successfully ends when the left screen appears. Click Close.

2-1-3 Deleting the installed file

To delete the installed file, run the "Add/delete application" from the Windows control panel to delete PSF-520.
See the Windows Help file or the manual for details.

2-2 Starting PSF-520

Start PSF-520 in the following order.

① Connect HA-520 or HA-680 to PSF-520 using the dedicated communication cable ("HDM-232C").
② Start the program by pressing the Start button of Windows. (See the Windows Help file or the manual for details.)
③ When the program is successfully started, the following start screen appears.

5
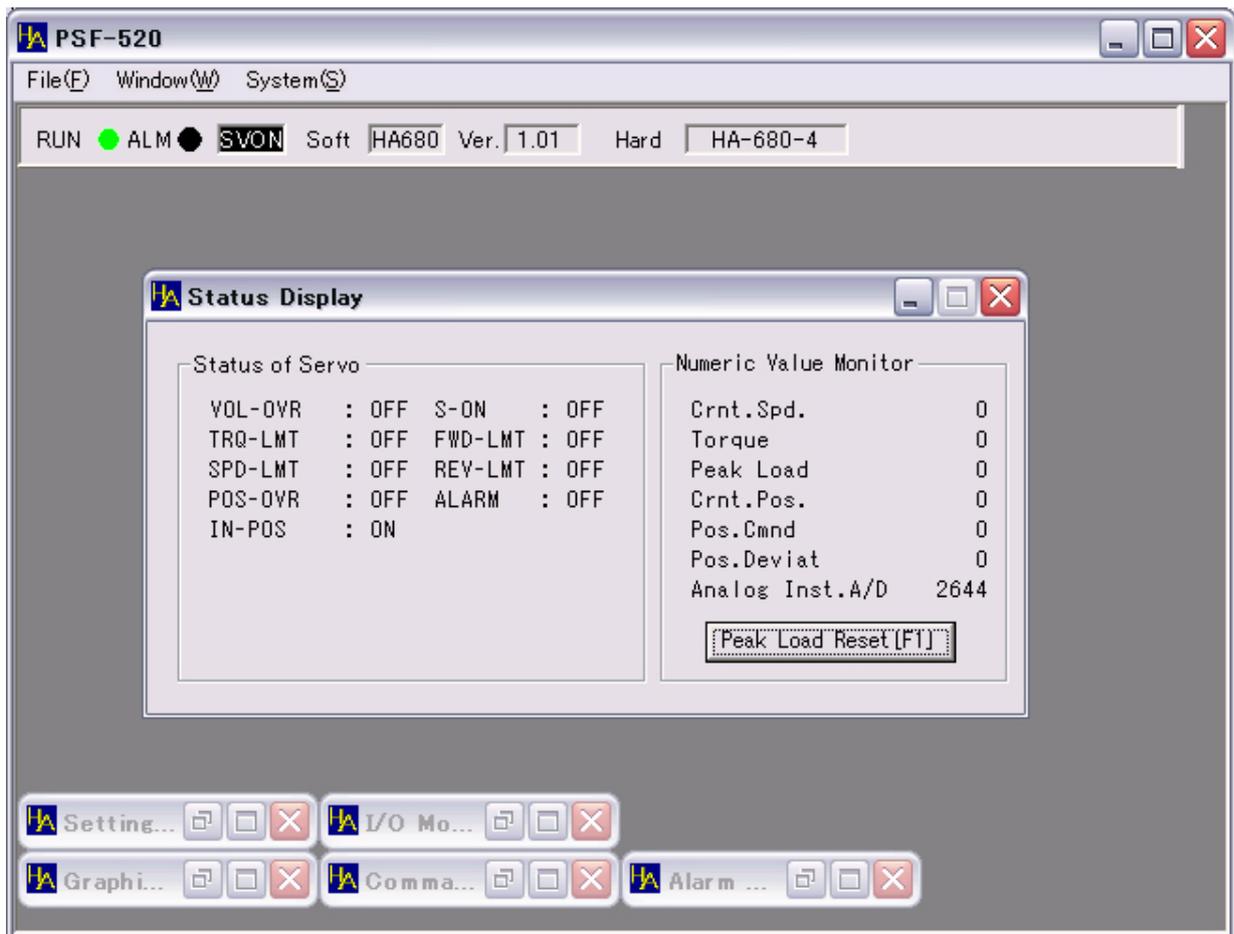
Chapter 3   Start screen

This section describes the PSF-650 start screen.

Menu

Status monitor

Windows

Status display
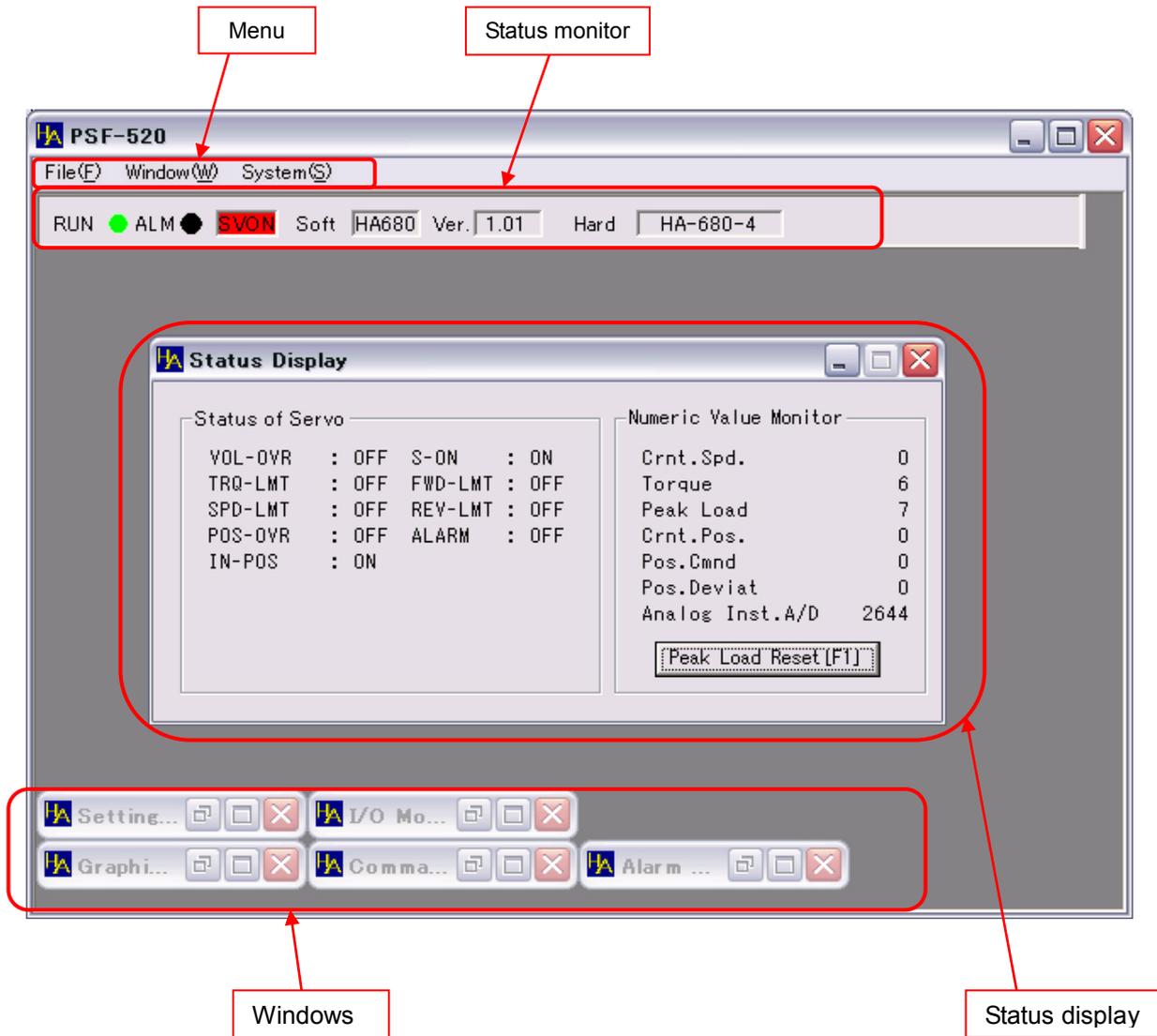
When the PSF-520 is started online (connected with the driver), it communicates with the driver it is connected to, but if the power for the driver goes off while the PSF-520 is connected, it may take about 10 seconds from the next time that the driver power comes on until communication with the driver resumes, depending on the timing for the power going off.

3-1 Description of the start screen

3-1-1 Menu

PSF-520 consists of three menus: File (F), Window (W) and System (S). These menus are tree-structured to allow various operations.

```
HA PSF-520
File(F)  Window(W)  System(S)
```

File (F)	End (E)	End the program.

Window (W)	1 Waveform monitor	Monitor the motor speed/current.
	2 Command transmission	JOG operation
	3 Status display	Display operating status of AC servo driver HA-520 and HA-680.
	4 Alarm display	Display alarms for the last 8 times.
	5 Parameter setting	Set parameters.
	6 I/O monitor	Display I/O status of CN2.

System (S)	Driver (D)	Select the driver. When the PSF-520 starts, it automatically determines which driver is connected and starts in the mode for that driver, but if it starts offline, it starts in HA-520 mode. To edit a parameter other than an HA-520 parameter offline, select the driver from this menu.
	Communication port change	Set communication port number.
	Communication setting （C）	Set communication condition.
	Version information (V)	Display the version of PSF-520.

3-1-2 Status display
Display basic information of the connected AC servo driver HA-520 and HA-680.

① ② ③
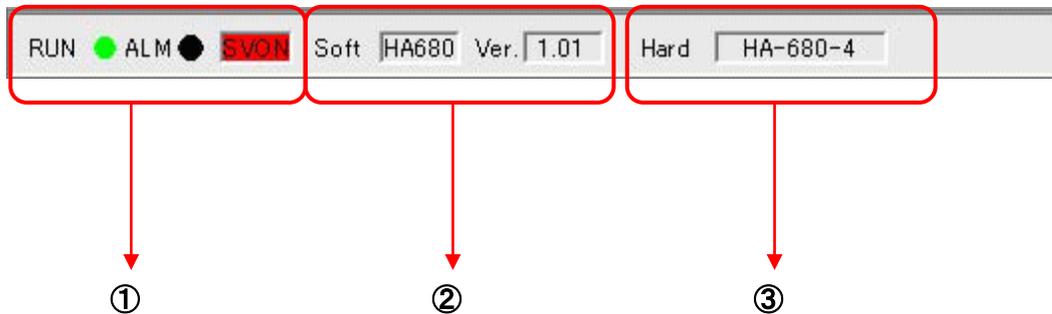
①

This indicates that the control power of the AC servo driver HA-520 and HA-680 is turned on.

This indicates that the S-On signal has been inputted to the AC servo driver HA-520 and HA-680 and the motor is excited. (SVON: Red light on）

This indicates that an alarm has been generated. (Abnormal: red light)

②

This displays the software version of the connected AC servo driver HA-520 and HA-680.

③

This displays the capacity of the connected AC servo driver HA-520 and HA-680.

3-1-3 State display

● **Operation display**

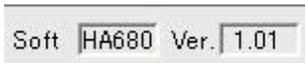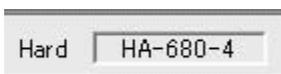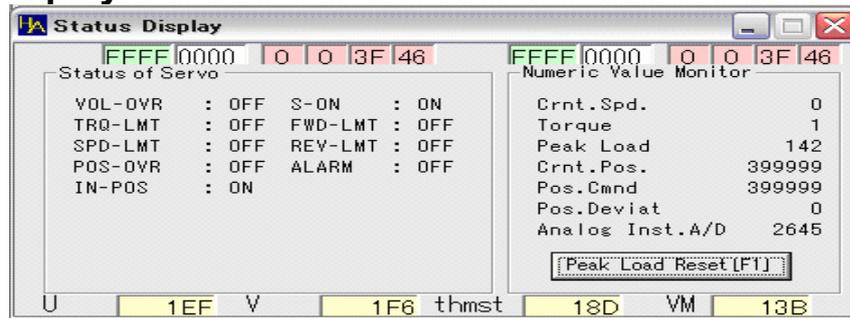|	
VOL-OVER :	This item is always OFF.
TRQ-LMT :	This turns on when the current of the connected actuator exceeds the maximum current or when the AC servo driver HA-520 and HA-680 are limited to the maximum current.
SPD-LMT :	This turns on when the connected actuator operates over the maximum speed or when the AC servo driver HA-520 and HA-680 are limited to the maximum speed.
POS-OVR :	This turns on when the position control operates or when the deviation counter value exceeds the allowable position deviation set value (parameter set number 22).
IN-POS :	This turns on when the position control operates or when the deviation counter value is in the range from the plus (parameter set number 22) to the minus positioning completion setting.
S - O N :	This turns on when a signal is inputted into the S-ON input of CN2. Note that this stays off while an alarm is on.
FWD-LMT :	This turns on when the input function allocation (parameter set number 11) is set to 0-2 by the position control and the reverse rotation limit function is operating. It turns off for other cases.
REV-LMT :	This turns on when the input function allocation (parameter set number 11) is set to 0-2 by the position control and the forward rotation limit function is operating. It turns off for other cases.
A L A R M :	This turns on when an alarm is raised on the AC servo driver HA-520 and HA-680.

● **Numeric monitor**

Rotating speed:	This indicates the rotating speed of the motor in r/min.
Torque %:	This indicates the output torque of the motor in percentage. The allowable continuous torque of the motor is regarded as 100%.
Peak torque %:	This indicates the peak value of the output torque of the motor in percentage. The allowable continuous torque of the motor is regarded as 100%.
Feedback pulse:	This indicates the accumulated value of the feedback pulse of the encoder.
Instruction pulse:	This indicates the accumulated value of the instruction pulse during position control.
Deviation pulse:	This indicates the difference between the instruction pulse and the feedback pulse.
Analog instruction A/D value:	The value displayed here is set for the analog instruction A/D value (Mid) voltage offset (parameter number 35), analog instruction A/D value (Max), analog instruction A/D value (Min), analog instruction voltage maximum value (parameter number 36) and analog instruction voltage maximum value (parameter number 37). See parameter setting for details.
Torque peak reset:	Click this button to reset "Peak torque%" indication.

3-1-4 Windows

Open each window for each operation. See "Chapter 4 Window operation" for details.

Chapter 4 Window operation

4-1   Parameter setting

4-1-1 Description of screens

Parameter selection

Parameters indicated with an asterisk will be available once the power of HA-680 is turned on again.
Shut down the power at least one second after writing to the servo. (*)

Setting Parameters

| 00-09 | 10-19 | 20-29 | **30-39** | 40-49 | 50-59 | 60-69 | 70-79 | 80-89 |

30 Speed Instruction Input Coefficient	*	10000
31 Speed Attainment Judging Value		2000
32 Internal Speed Instructions		1
33 Acceleration Damping Time Const		1
34 Slowdown Damping Time Const		1
35 Analog Voltage Instruction Offset		4096
36 Analog Instruction Voltage Max	*	8192
37 Analog Instruction Voltage Min	*	0
38 Zero Clamp		0
39		0

Open File
Save File
Import Data[F4]
Export Data[F5]

Brief description

Operations

Operations

Read file: Read the parameter file saved on the disk.

Write file: Save the preset parameters on the disk.

Read servo: Read parameters set on the connected HA-680 to display them.

Write servo: Write preset parameters on the servo in block letters. You can't perform this operation unless you have read the parameters from the servo.

EEPROM writing is indicated during writing. Never shut down the power of HA-680 during display. Also, to prevent an accident in which the data cannot be written normally because power to the HA-680 is cut off during the transmission, for example by a power failure, it is recommended to write to a file before writing.

EEPROM Writting ...
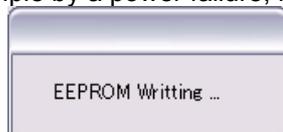
Brief description
　　Brief description of the parameter to be set is displayed.

4-1-2　Parameter List

The following explains the HA-680 parameters as an example. The number of parameters and their details depend on the driver connected. For details, refer to the manual for the driver.
The contents of the parameters are decided by automatically determining which driver is connected, but if the status is offline, select the driver by choosing System (S) -> Driver (D).

	No.	Parameter name	Setting range
Gain-related	00	Position loop gain	10~9999
	01	Speed loop proportional gain	10~9999
	02	Speed loop integral gain	10~9999
	03	Speed loop derivative gain	0~9999
	04	Speed feed-forward factor	0~9999
	05	Acceleration feed-forward factor	0~9999
	06	Torque command filter	0~9999
	07	Speed step correction	0~9999
	08	Torque step correction	0~9999
	09	Step correction switch range	0~9999
Operation setting general	10	Control mode	0~5
	11	Input function assignment	0~20
	12	Output function assignement	0~20
	13	Input pin logical setting	0~31
	14	Output pin logical setting	0~15
	15	Control input filter time costant	0~99
	16	Speed limiting	0~*1
	17	FWD current limiting	0~*2
	18	REV current limiting	0~*2
	19	Regenerative brake ON/OFF	0,1
	20	Rotary direction	0,1
Position control-related	21	Allowable position deviation	0~32767
	22	In-position ready range	0~9999
	23	Command pulse input factor-numerator	1~999
	24	Command pulse input factor-denominator	1~999
	25	Command pulse input form	0~2
	26	Multiplication at 2-phase input	1,2,4
	27	Servo-on deviation clear	0,1
	28	Angle correction	0,1
	29	Auto gain setting at positioning	0,1
Speed control-related	30	Speed command input factor	1~*1
	31	Attained speed determination value	1~*1
	32	Internal speed command value	0~*1
	33	Acceleration time constant	1~9999
	34	Deceleration time constant	1~9999
	35	Analog command A/D value (Mid)	0~8192
	36	Analog command A/D value (Max)	0~8192
	37	Analog command A/D value (Min)	0~8192
	38	Zero clamp	0,1
	39	Reserved for the system	*3
Torque control-related	40	Internal command input factor	0~*2
	41	Torque command input factor	0~*2
	42	Reserved for the system	*3
JOG-related	43	JOG operation acceleration/deceleration time constant	1~9999
	44	JOG operation feed pulse count	0~9999
	45	JOG operation S-shape selection	0,1
	46	JOG operation speed	0~*1
Communication-related	47	Communication setting	0,1
	48	CAN ID	*3
	49	CAN communication speed	*3

*1: This is the maximum rotation speed of the applicable actuator x reduction ratio.

*2: The setting varies depending on the applicable actuator.

*3: This area is reserved for the system. Do not perform any setting.

4-1-3 Function of the parameters
00: Position loop gain   (position / speed)

● Function

This parameter specifies the gain of the position loop. Determine the value based on the frictional torque and rigidity of the machine.

High setting ⇒ The position error is small, and high tracking performance to commands is obtained. If the setting is too high, the servo system will be unstable and hunting may easily occur; it should be decreased so that no hunting can occur.

Low setting ⇒ If the setting is too low, a problem may occur; for example, the tracking performance to commands may be poor, or position precision may not be obtained.

When no hunting occurs and neither overshoot nor undershoot occurs, set the maximum gain.

For speed control, it is effective only when zero clamp is set ("Parameter" ⇒ "38: Zero clamp").

● Setting

unit	Lower limit	Upper limit	Default
-	10	9999	note

Note: The actual setting varies with the AC servo actuator model. When changing the value, consider the defaults shown in Section 6-3, "Default parameters" as the standard (guide setting).

01: Speed loop proportional gain   (position / speed)

● Function

This parameter specifies the proportional gain of the speed loop. Determine the value based on the moment of inertia, the frictional torque, and the rigidity of the machine.

High setting ⇒ If the setting is too high, the servo system will be unstable, and hunting and overshoot will easily occur.

Low setting ⇒ If the setting is too low, the responsiveness and tracking performance will be poor.

When no hunting occurs and neither overshoot nor undershoot occurs, set the maximum gain.

● Setting

unit	Lower limit	Upper limit	Default
-	10	9999	note

Note: The actual setting varies with the AC servo actuator model. When changing the value, consider the defaults shown in Section 6-3, "Default parameters" as the standard (guide setting).
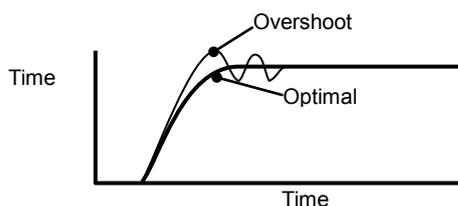
02: Speed loop integral gain (position / speed)

● Function

This parameter specifies the speed loop integral gain.

High setting $\Rightarrow$ If the setting is too high, the servo system will be unstable, and hunting and overshoot will easily occur.

Low setting $\Rightarrow$ If the setting is too low, the responsiveness and tracking performance will be poor.

● Setting

unit	Lower limit	Upper limit	Default
-	10	9999	note

Note: The actual setting varies with the AC servo actuator model. When changing the value, consider the defaults shown in Section 6-3, "Default parameters" as the standard (guide setting).

03: Speed loop derivative gain (position / speed)

● Function

This parameter specifies the speed loop derivative gain.

Usually set this factor to 0.

High setting $\Rightarrow$ If the setting is too high, the servo system will be unstable, and hunting and overshoot will easily occur.

● Setting

unit	Lower limit	Upper limit	Default
-	0	9999	note

Note: The actual setting varies with the AC servo actuator model. When changing the value, consider the defaults shown in Section 6-3, "Default parameters" as the standard (guide setting).

04: Speed feed-forward factor (position)

● Function

This parameter specifies the factor used to give the first-order derivative value to a speed command. Usually set this factor to 0.

This setting is usually required to improve the speed.

● Setting

unit	Lower limit	Upper limit	Default
-	0	9999	0

05: Acceleration feed-forwad factor (position)

● Function

This parameter specifies the factor used to give the second-order derivative value to a torque command. Usually set this factor to 0.

This setting is usually required to improve the speed.

● Setting

unit	Lower limit	Upper limit	Default
-	0	9999	0

06: Torque command filter (position / speed / torque)

● Function

For the purpose of suppressing the self-excited oscillation with the mechanical system, this parameter specifies the factor for the cutoff frequency of the low pass filter of a torque command.

Usually set this factor to 0.

● Setting

unit	Lower limit	Upper limit	Default
-	0	9999	0

07: Speed step correction (position)

● Function

This parameter specifies the speed command correction amount that is to be added to the speed command, depending on the positive or negative amount in the command.

Usually set this parameter to 0. It should be set when the speed is to be improved.

High setting ⇒ If the setting is too high, the servo system will be unstable, and hunting and overshoot will easily occur.

● Setting

unit	Lower limit	Upper limit	Setting
—	0	9999	0

The setting relates to the one in [09: Step correction switching range] of [Parameter].

08: Torque step correction (position)

● Function

This parameter specifies the torque command correction amount that is to be added to the torque command, depending on the positive or negative amount in the command.

Usually set this parameter to 0. It should be set when the speed is to be improved.

High setting ⇒ If the setting is too high, the servo system will be unstable, and hunting and overshoot will easily occur.

● Setting

unit	Lower limit	Upper limit	Setting
—	0	9999	0

The setting relates to the one in [09: Step correction switching range] of [Parameter].

09: Step correction switch range (position)

● Function

This parameter specifies the amount of position deviation for the deviation counter where the following will take effect: speed step correction ([Parameter] $\Rightarrow$ [07: Speed step correction]) and torque step correction ([Parameter] $\Rightarrow$ [08: Torque step correction]).

The values of "Speed step correction" and "Torque step correction" become effective when the amount of position deviation becomes bigger than those set values.

● Setting

unit	Lower limit	Upper limit	Default
Pulse	0	9999	4000

Note: For ordinary use, leave this parameter unchanged from 0.

10: Control mode (The power must be turned on again after setting a change.)
(position / speed / torque)

● Function

The HA-680 driver can control the actuator in either the [position control], [speed control] or [torque control]. This function selects an operating mode.

In the position control a command signal is composed of pulse trains, while in the speed mode or torque mode it is composed of an analog voltage.

[0]: position control (factory default) [1]: speed control [2]: torque control

● Setting

unit	Lower limit	Upper limit	Default
-	0	5	0

Note 1: The power must be turned on again after setting a change. The previous value is effective until you turn on the power again.

Note 2: The upper limit value is 5. However, do not use setting values 3, 4, and 5 because these are reserved for the system.

11: Input function assignment

(The power must be turned on again after setting a change.)

(position / speed / torque)

● **Function**

This function selects the function of the input signal. The relations between the setting value and function selection are as follows.

・**Position control, input signal assignment parameter**

Setting	CN2 pin no.							
	Servo-ON	FWD inhibit	REV inhibit	Clear	Alarm clear	Deviation clear	Speed limit	Current limit
0	7	8	9	—	10	11	—	—
1	7	8	9	10	—	—	11	—
2	7	8	9	10	—	—	—	11
3	7	—	—	—	8	9	10	11

・**Speed control, input signal assignment parameter**

Setting	CN2 pin no.						
	Servo-ON	FWD enable	REV enable	Clear	Internal/ external command	Speed limit	Current limit
0	7	8	9	10	—	11	—
1	7	8	9	10	—		11
2	7	8	9	—	—	10	11
3	7	8	9	10	11	—	—
4	7	8	9	—	10	11	—
5	7	8	9	—	10	—	11

・**Torque control, input signal assignment parameter**

Setting	CN2 pin no.					
	Servo-ON	FWD enable	REV enable	clear	Internal/ external command	Current limit
0	7	8	9	10	—	11
1	7	8	9	10	11	—
2	7	8	9	—	10	11

● **Setting**

unit	Lower limit	Upper limit	Default
-	0	20	0

Note 1: The upper limit value is 20. However, the actual setting range is as shown above depending on the control mode. Do not set any values outside the range because these are reserved for the system.

Note 2: The power must be turned on again after setting a change. The previous value is effective until you turn on the power again.

12: Output function assignment

(The power must be turned on again after setting a change.)

(position / speed / torque)

● **Function**

This function selects the function of the output signal. The relations between the setting value and function selection are as follows.

・**Position control, output signal assignment parameter**

Setting	CN2 pin no.					
	In-position ready	Alarm	Ready	Limiting speed	Limiting current	Phaze-Z OC output
0	1	2	3	4	—	5
1	1	2	3	—	4	5
2	1	2	—	3	4	5

・**Speed control, output signal assignment parameter**

Setting	CN2 pin no.					
	Attained speed	Alarm	Ready	Limiting speed	Limiting current	Phaze-Z OC output
0	1	2	3	4	—	5
1	1	2	3	—	4	5
2	1	2	—	3	4	5

・**Torque control, output signal assignment parameter**

Setting	CN2 pin no.				
	Attained speed	Alarm	Ready	Limiting current	Phaze-Z OC output
0	1	2	3	4	5

● **Setting**

unit	Lower limit	Upper limit	Default
-	0	20	0

Note 1: The upper limit value is 20. However, the actual setting range is as shown above depending on the control mode. Do not set any values outside the range because these are reserved for the system.

Note 2: The power must be turned on again after setting a change. The previous value is effective until you turn on the power again.

13: Input pin logical setting
(The power must be turned on again after setting a change.)

(position / speed / torque)

● Function

This function sets the logic to enable the functions of the external input signals.
Set the sum of the desired logic values in the following table.

Example: To enable Input 4 and Input 5 as normal open: 8+16=24

Therefore, set the value as 24.

Signal	Normal close	Normal open
CN2-7 Input 1(Servo-ON: S-ON)	0	1
CN2-8 Input 2	0	2
CN2-9 Input 3	0	4
CN2-10 Input 4	0	8
CN2-11 Input 5	0	16

● Setting

unit	Lower limit	Upper limit	Default
—	0	31	0

Note: The power must be turned on again after setting a change. The previous value is effective until you turn on the power again.

14: Output pin logical setting
(The power must be turned on again after setting a change.)

(position / speed / torque)

● Function

This function sets the logic to determine the function operation state of the external output signals.
Set the sum of the desired logic values in the following table.

Example: To enable Output 3 and Output 4 as normal open: 4+8=12

Therefore, set the value as 12.

Signal	Normal close	Normal open
CN2-1 Output 1	0	1
CN2-2 Output 2	0	2
CN2-3 Output 3	0	4
CN2-4 Output 4	0	8
CN2-5 Output 5 (Phaze-Z OC output: Z)	0	—

● Setting

unit	Lower limit	Upper limit	Default
—	0	15	2

Note: The power must be turned on again after setting a change. The previous value is effective until you turn on the power again.

Note: Logical setting of Output 5 (Phase-Z OC output) cannot be performed.

15: Control input filter time constant
(position / speed / torque)

● **Function**

This function sets the time constant of the soft low-pass filter applied to the signals at the control input terminal other than forward rotation/reverse rotation command pulses.

If it is used in an environment where there is external high-frequency noise, set the value so that the control input signal is not easily affected by the noise.

● **Setting**

unit	Lower limit	Upper limit	Default
ms	0	99	0

16: Speed limiting
(position / speed)

● **Function**

This function sets the motor rotation speed at which the speed limit becomes effective when the speed limit function is assigned to the signal input in the parameter "13: Input pin logical setting."

A value from [1] to [Motor maximum rotation speed] can be entered.

● **Setting**

unit	Lower limit	Upper limit	Default
r/min	0	Motor maximum rotation speed	Motor maximum rotation speed

Note 1: Motor rotation speed = Actuator rotation speed x reduction ratio

Note 2: When operation continues with the motor rotation speed limited during position control, an error counter overflow alarm occurs.

> ⚠ **WARNING**
>
> **This parameter cannot be set for torque control. The upper limit value of the parameter is the "motor maximum rotation speed." When the load of the actuator is small (including no load), it may rotate at the maximum rotation speed instantaneously.**

17: FWD current limiting (The power must be turned on again after setting a change.)
18: REV current limiting (The power must be turned on again after setting a change.)
(position / speed / torque)

● **Function**

This function sets the current limit value at the forward rotation and reverse rotation sides in the current limit state when the current limit function is assigned to the signal input in the parameter "13: Input pin logical setting."

Set the maximum current values at the forward rotation and reverse rotation sides in percentages of the allowable continuous current.

● **Setting**

unit	Lower limit	Upper limit	Default
%	0	note1	note2

Note 1: The setting value varies depending on the model of the actuator. The upper limit value is calculated using the following formula based on the values listed in the catalogue and manual of the AC servo actuator.
The rated torque is 100%.

Maximum current ÷ Allowable continuous current × 100 (%) = Upper limit value (%)

Note 2: The setting value varies depending on the model of the actuator. When you change the value, use the "6-3 Default parameter list" as the standard values.

Note 3: The power must be turned on again after setting a change. The previous value is effective until you turn on the power again.

19: Regenerative brake ON/OFF   (position / speed / torque)

● **Function**

If this parameter is set on, input of a servo-on signal causes an emergency stop according to the driver control (regenerative brake), and the servo is turned off after it stops.

If this parameter is set off, input of a servo-on signal causes the servo to be turned off according to the driver control, and the motor is left free.

0: Does not operate the regenerative brake.
1: Operates the regenerative brake.

● **Setting**

unit	Lower limit	Upper limit	Lower limit
−	0	1	0

20: Rotary diection (The power must be turned on again after setting a change.)

(position / speed / torque)

● Function

This function specifies the rotary direction of the actuator when responding to rotary direction commands (FWD or REV) of "Command input signal".

The relation among them is as follows:

Setting	FWD command	REV command
0	FWD rotation	REV rotation
1	REV rotation	FWD rotation

● Setting

unit	Lower limit	Upper limit	Default
-	0	1	0

Note: The power must be turned on again after setting a change. The previous value is effective until you turn on the power again.

21: Allowable position deviation (position)

● Function

The [deviation counter] calculates [deviation count] subtracting the [feedback count] from the [position command]. A large position deviation may result in an abnormality.

When the position error exceeds the [Allowable position deviation], a [max. deviation alarm] occurs and the servo power shuts off.

The relation among the allowable position deviation, position loop gain, command pulse input factor, and pulse command speed is determined by the following formula in a stationary state. Set an appropriate maximum pulse command value according to the speed.

$$\text{Allowable position deviation} = \frac{\text{Pulse command speed [p/s]}}{\text{Position loop gain}} \times \frac{\text{Command pulse input factor (numerator)}}{\text{Command pulse input factor (denominator)}}$$

For the actuator that tries rotation by command pulse input, an alarm is outputted when the deviation pulse exceeds the allowable value when rotation is not possible due to failure of the mechanism.

● Setting

unit	Lower limit	Upper limit	Default
Pulse	0	32767	30000

22: In-position ready range   (position)

● Function

When the difference between "command pulse count" and "returned pulse count," which is "deviation pulse count," decreases below the setting value of "in-position ready range," the signal is outputted to "CN2 In-position ready output: IN-POS" as completion of positioning.

This value only monitors the state of position deviation and does not directly affect the rotation control of the servo actuator.

● Setting

unit	Lower limit	Upper limit	Default
Pulse	0	9999	10

23: Command pulse input factor-numerator
(The power must be turned on again after setting a change.)
24: Command pulse input factor-denominator

(The power must be turned on again after setting a change.)   **(position)**

● Function

This parameter is used with "Command pluse input factor - denominator" as electronic gear function. It is used to have integral number for the relationship of the input pulse number and the amount of moment of the machine that the actuator drives.

The formula of the relationship of "numerator and denominator" as follows:

◆ For rotary operation:

$$\text{Angle of movement per input pulse} = \frac{\text{command pulse input factor -numerator}}{\text{command pulse input factor -denominator}} \times \frac{360}{\text{*Actuator resolution}} \times \frac{1}{\text{Reduction ratio of load mechanism}}$$

◆ For linear operation:

$$\text{Amount of feed per input pulse} = \frac{\text{command pulse input factor -numerator}}{\text{command pulse input factor -denominator}} \times \frac{\text{Load mechanism feed pitch}}{\text{*Actuator resolution}}$$

* Actuator resolution = Encoder resolution (4 times) x Actuator duty factor

On the basis of this formula, set the parameter value so that both the numerator and denominator will be integers.

● Setting

	unit	Lower limit	Upper limit	Default
Numerator	—	1	999	1
Denominator	—	1	999	1

Note 1: The power must be turned on again after setting a change. The previous value is effective until you turn on the power again.

Note2: By default, the internal pulse is performed with the encoder resolution (4 times). The amount of movement of the actuator will thus be the one corresponding to the encoder resolution (4 times).
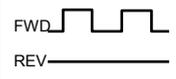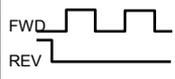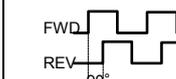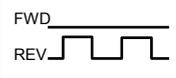
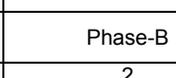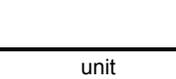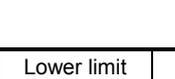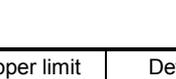# 25: Command pulse input form

(The power must be turned on again after setting a change.)   **(position)**

● Function

Three types of command signals can be inputted to the HA-680 driver as follows:

Type	2-pulse train	1-pulse train	2-phase pulse train
Command pulse input form	Forward / Reverse	Forward / Reverse	Forward / Reverse
FWD CN2-14,15	Forward	Pulse input	Phase-A
REV CN2-16,17	Reverse	Polarity	Phase-B
Setting	0	1	2
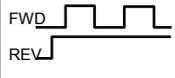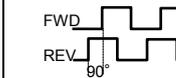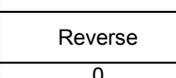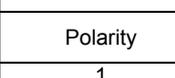
● Setting

unit	Lower limit	Upper limit	Default
-	0	2	0

Note: The power must be turned on again after setting a change. The previous value is effective until you turn on the power again.

26: Multiplication at 4-phase input

(The power must be turned on again after setting a change.)   **(position)**

● Function

When [command pulse input form] is set at [2-phase pulse], it is possible to make the motion command pulse count two or four times greater than the command pulse count.

1: Same as the command count
2: Two times the command count
4: Four times the command count

● Setting

unit	Lower limit	Upper limit	Default
-	1	4	4

Note: The power must be turned on again after setting a change. The previous value is effective until you turn on the power again.

27: Servo-on deviation clear   (position)

● Function

Even when the servo power is OFF, the control power is still ON. If the position of the load mechanism shifts due to gravity or manual force while the servo power is OFF, the deviation count changes. If the servo power is turned ON, the actuator rotates rapidly to make the deviation count return to [0].

This rapid motion may be dangerous. The Servo-ON function allows the deviation count to be reset to [0] when the servo power is turned on. Thus, the actuator will not move when the servo power is restored. However, the position deviation data is lost and the actuator will not return to its original position.

Select the input signal at which the deviation counter is cleared.

0: The deviation counter is not cleared when the servo on signal is inputted.
1: The deviation counter is cleared when the servo on signal is inputted.

● Setting

unit	Lower limit	Upper limit	Default
—	0	1	0

Note: When the deviation counter is cleared, the command pulse count becomes the same value as the returned pulse count.

28: Angle correction

(The power must be turned on again after setting a change.)   **(position)**

● Function

The HA-680 drivers with 4-line specifications provide [angle correction] function, which improves one-way positioning accuracy compensating it with a pre-analyzed error of the HarmonicDrive® component. The function improves the accuracy about 30%.

0: without angle correction
1: with angle correction

● Setting

unit	Lower limit	Upper limit	Default
-	0	1	0

Note 1: The power must be turned on again after setting a change. The previous value is effective until you turn on the power again.

Note 2: If no correction data are recorded in the connected actuator, this parameter cannot be set to 1. (0 is read even if it is set to 1.)

* This is not supported by the RSF supermini series actuators.

29: Auto gain setting at positioning (position)

● Function

To get short period for positioning, the function automatically makes speed loop gain higher when a deviation pulse number becomes small.

For the reason that the speed loop gain is proportionate to deviation pulse number, a positioning speed at small error pulse number becomes comparatively low. In the case, the responsibility for the positioning may be improved by the higher speed loop gain.

If the speed loop gain registered in [parameter] →[01: Speed loop proportional gain] is higher than the automatic gain, the registered gain has priority.

0: without auto gain setting at positioning
1: with auto gain setting at positioning

● Setting

unit	Lower limit	Upper limit	Default
-	0	1	1

30: Speed command input factor

(The power must be turned on again after setting a change.) **(speed)**

● Function

This function sets the motor's rotation speed when the input command voltage is 10 V.

The relation between the input voltage and motor rotation speed is determined by the speed command input factor in the following formula.

Motor rotation speed = Input command voltage $\times \dfrac{\text{Torque command input factor}}{10.0V}$

● Setting

unit	Lower limit	Upper limit	Default
r/min	1	Motor maximum rotation speed	*

Note: The power must be turned on again after setting a change. The previous value is effective until you turn on the power again.

Note: Motor rotation speed = Actuator rotation speed × reduction ratio

* The setting value varies depending on the model of the actuator.

31: Attained speed determination value (speed / torque)

● Function

This parameter is set at [speed control] or [torque control]. The [CN2 attained speed: HI-SPD] signal is outputted when the actuator speed is more than the value of [attained speed].

● Setting

unit	Lower limit	Upper limit	Default
r/min	1	Motor maximum rotation speed	2000

Note: Motor rotation speed = Actuator rotation speed $\times$ reduction ratio

32: Internal speed command (speed)

● Function

The function can operate the actuator without an input signal. This is convenient for test operations without hosts and for system diagnosis.

Actuator motion at the interion speed starts with the input to [CN2 external/internal command: CMD -CHG] and stops when input is OFF.

To reverse an actuator with an [internal speed command], turn ON [CN2 REV enable: REV-EN].

● Setting

unit	Lower limit	Upper limit	Default
r/min	0	Motor maximum rotation speed	1

Note: Motor rotation speed = Actuator rotation speed $\times$ reduction ratio

33: Acceleration time constant (speed)

● Function

This function sets the time in which the motor is accelerated from 0 r/min to the maximum rotation speed during speed control.

For external speed commands, when a speed command faster than the setting value is entered, the setting value has higher priority; when a speed command slower than the setting value is entered, the speed command has higher priority.

For internal speed commands, acceleration is performed based on the setting value.

● Setting

unit	Lower limit	Upper limit	Default
ms	1	9999	1

34: Deceleration time constant (speed)

● Function

This function sets the time in which the motor is decelerated from the motor maximum rotation speed to 0 r/min during speed control.

For external speed commands, when a speed command faster than the setting value is entered, the setting value has higher priority; when a speed command slower than the setting value is entered, the speed command has higher priority.

For internal speed commands, deceleration is performed based on the setting value.

● Setting

unit	Lower limit	Upper limit	Default
ms	1	9999	1

35: Analog command A/D value (Mid)
(Speed / torque)

● Function

This function sets the offset value when the analog command is 0V (a command value to stop the motor). Enter 0V to the analog command, and set the analog input voltage value in the value monitor of the state display window of communication software PSF-520. For details, refer to a separate document, "PSF-520 User's Manual."

● Setting

unit	Lower limit	Upper limit	Default
-	0	8192	4096

36: Analog command A/D value (Max)

(Speed / torque)

● Function

This function sets the offset value when the analog command is -10V. Enter -10V to the analog command, and set the "analog command A/D value" in the value monitor of the state display window of communication software PSF-520. For details, refer to a separate document, "PSF-520 User's Manual."

● Setting

unit	Lower limit	Upper limit	Default
-	0	8192	8192

37: Analog command A/D value (Min)

(Speed / torque)

● Function

This function sets the offset value when the analog command is +10V. Enter +10V to the analog command, and set the "analog command A/D value" in the value monitor of the state display window of communication software PSF-520. For details, refer to a separate document, "PSF-520 User's Manual."

● Setting

unit	Lower limit	Upper limit	Default
-	0	8192	0

38: Zero clamp   (speed)

● Function

During speed control, the motor stops when both FWD enable (FWD-EN) and REV enable (REV-EN) are on or off. When the motor moves due to external force, it stops where it comes to rest because no position control is performed. If zero clamp is enabled, position control is provided so that the motor retains the position before moving due to external force.

● Setting

unit	Lower limit	Upper limit	Default
-	0	1	0

0 indicates that it is disabled, and 1 indicates that it is enabled.

39: Reserved for the system

This parameter is reserved for the system. Do not change the setting.

40: Internal command input factor   (torque)

● Function

"Internal torque command value" allows you to operate the actuator without an input signal. It is useful for a test run of the actuator alone and for system diagnosis. The command value can be set here.

For operation of the actuator using "internal command," internal commands are selected when a signal is entered (on) to "CN2 Internal/external command: CMD-CHG." External commands are selected when a signal is turned off.

To rotate the actuator in the reverse direction with this "internal speed command value," turn on "CN2 REV enable: REV-EN."

● Setting

unit	Lower limit	Upper limit	Default
%	0	note	1

Note: The setting value varies depending on the model of the actuator. The upper limit value is calculated using the following formula based on the values listed in the catalogue and manual of the AC servo actuator.

The allowable continuous torque is 100%.

Maximum current ÷ Allowable continuous current × 100 (%) = upper limit (%)

41: Torque command input factor   (torque)

● Function

This function sets the output torque when the input command voltage is 10 V.

● Setting

unit	Lower limit	Upper limit	Default
%	0	note	note

Note: The setting value varies depending on the model of the actuator. The upper limit value is calculated using the following formula based on the values listed in the catalogue and manual of the AC servo actuator.

The rated torque is 100%.

Maximum current ÷ Allowable continuous current × 100 (%) = upper limit (%)

$$\text{Output current} = \text{Allowable continuous current} \times \frac{\text{Torque command input factor}}{100} \times \frac{\text{Command voltage factor}}{100}$$

42: Reserved for the system

This parameter is reserved for the system. Do not change the setting.

43: JOG operation acceleration/ deceleration time constant　　　(position / speed / torque)

● Function

This function sets the time in which the motor is accelerated from 0 r/min to the maximum rotation speed and the time in which the motor is decelerated from the motor maximum rotation speed to 0 r/min during JOG operation.

● Setting

unit	Lower limit	Upper limit	Default
ms	1	9999	500

44: JOG operation feed pulse count　　　(position)

● Function

When position control is set, it can be moved for the amount of movement set in this parameter.

● Setting

unit	Lower limit	Upper limit	Default
Pulse	0	9999	100

45: JOG operation S-shape selection　　　(position)

● Function

This function allows you to select S-shape acceleration/deceleration during JOG operation.

0: S-shape OFF (linear acceleration/deceleration)
1: S-shape ON (S-shape acceleration/deceleration)

● Setting

unit	Lower limit	Upper limit	Default
—	0	1	0

Note: In other control modes, this parameter is not effective even if it is set.

46: JOG operation speed

(position / speed / torque)

● Function

This function sets the motor maximum rotation speed for operation by JOG commands.

● Setting

unit	Lower limit	Upper limit	Default
r/min	0	Motor maximum rotation speed	500

Remark: Motor rotation speed = Actuator rotation speed × ratio

47: Communication setting

● Function

This function selects whether the end code of the communication data is in uppercase or lowercase.

0: Lowercase
1: Uppercase

● Setting

unit	Lower limit	Upper limit	Default
—	0	1	0

This setting does not affect PSF-520 and HA-680. Use the default value without changing it.

48: CAN ID
49: CAN Communication speed

This parameter is reserved for the system. Do not change the setting.

4-2 I/O monitor

You can monitor the status of the signal input (CN2:7~11pin) and the signal output (CN2:1~5pin) of CN2.

●Input

Signal input status	Monitor display
Input (sequencer output ON)	ON
No input (sequencer output OFF)	OFF

●Output

Signal input status	Monitor display
Output (internal output circuit ON)	ON
No output (internal output circuit OFF)	OFF
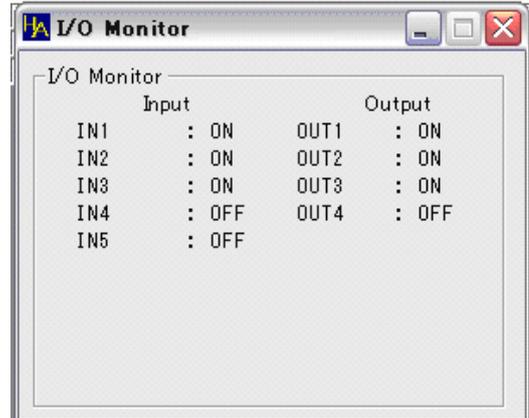
4-3 Alarm display

You can display and clear the alarm history for the last 8 occurrences and reset alarms.

Current alarm display

Alarm history display
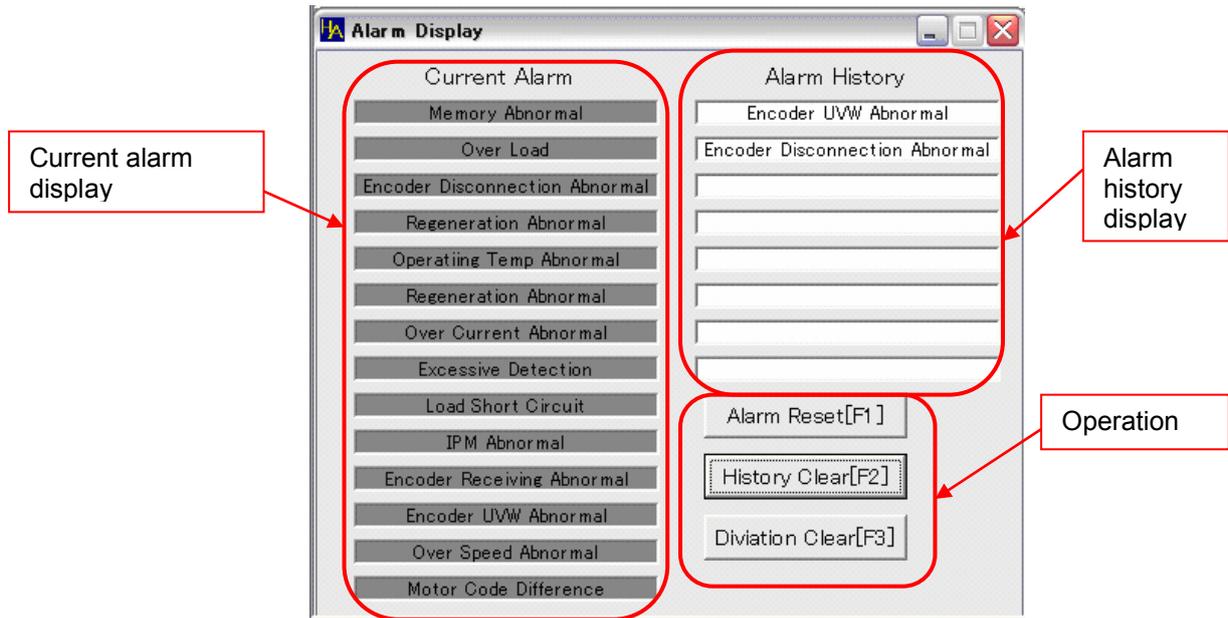
Operation

Current alarm display: The alarm raised on HA-680 is displayed in red.
Alarm history display: The alarm history for the last 8 occurrences is displayed. The top
                            alarm is the latest alarm.
Operation alarm reset: Clear alarms that cannot be cleared by turning on the power.
Operation history clear: Clear the alarm history. Perform clear operation to ship devices.
Operation deviation clear: Clear the deviation counter. Clear the deviation and reset the alarm to
                            clear the excessive deviation alarm.

4-4 Waveform monitor

You can easily monitor the status of the speed and torque in waveform.

4-4-1 Description of the screen
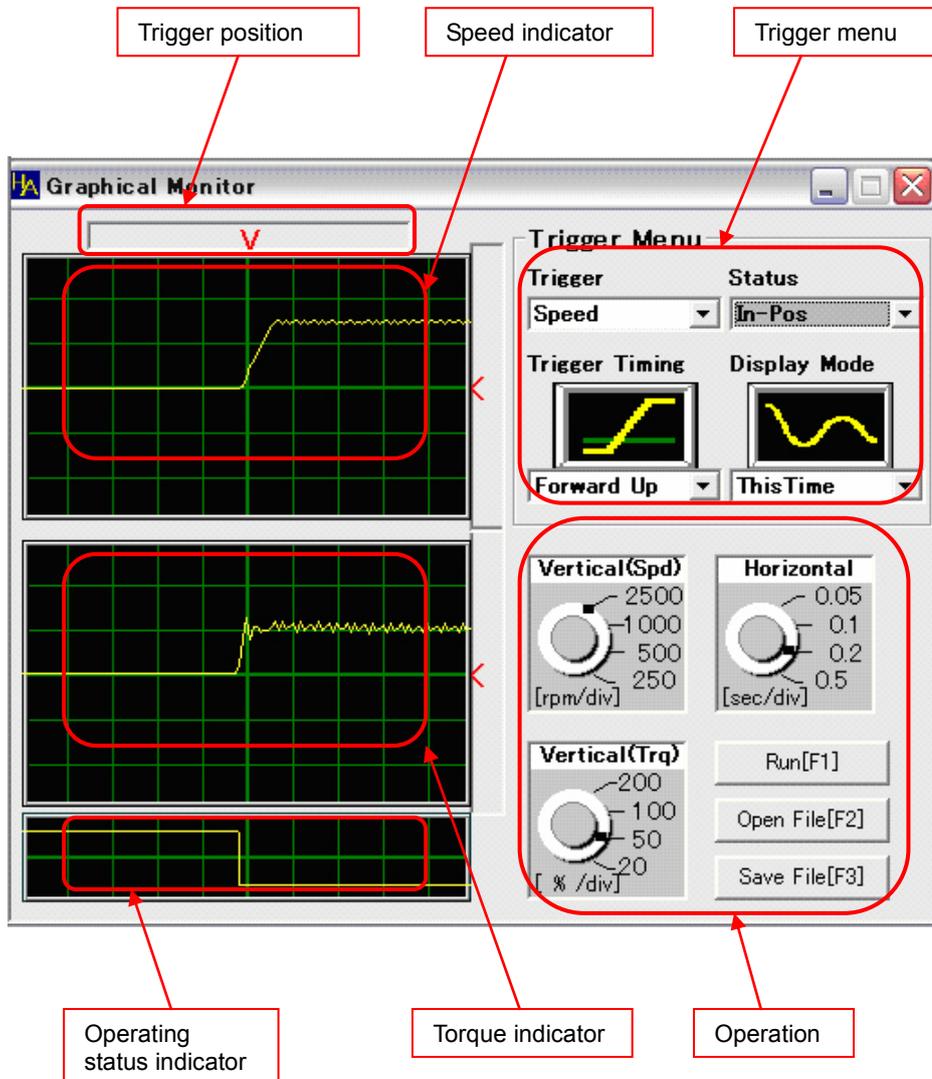
4-4-2　Operation description

●**Trigger position**

Specify the start position to display the operation waveform imported by the trigger menu. Move the sliding mark ("▼") to the right and left to specify the position.
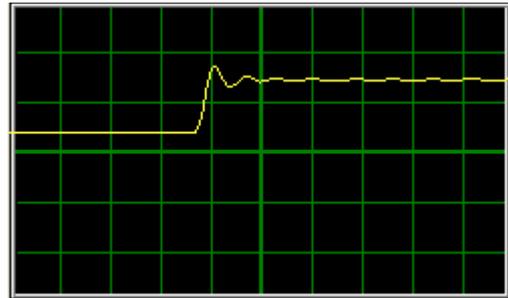
●**Speed indicator**

Display the motor speed waveform calculated from the feedback pulse of the encoder.
The horizontal axis indicates time while the vertical axis indicates speed.
Set each resolution in each operation part.

●**Torque indicator**

Display the motor output torque detected by the current detector.
The horizontal axis indicates time while the vertical axis indicates output torque.
Set each resolution in each operation part.
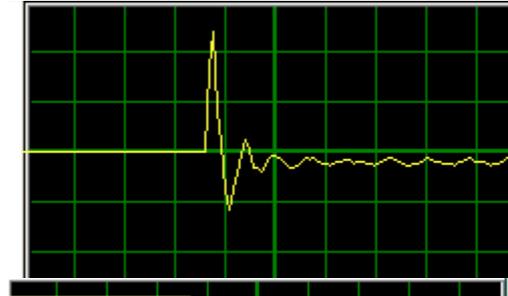
●**Operation status indicator**

The description selected in the operating status of the trigger menu is displayed.
Braking operation: Braking operation is not displayed.
Torque limiter: Display whether or not the output torque is limited to the maximum torque of the applicable actuator.
Speed limiter: Display whether or not the motor speed is limited to the maximum speed of the applicable actuator.
Excessive deviation: Display whether the deviation counter is within the allowable position deviation or exceeds it.
In-position: Display whether or not the deviation counter is within the positioning complete range.

●**Trigger menu**

Set the trigger condition by setting "Trigger condition",
"Operating status" and "Trigger edge".
See the following table for the details.
As displayed waveforms are stored in the buffer up to the
previous waveform data, the previous waveform and the
current waveform can be displayed at the same time by
setting the display waveform. This allows you to easily
adjust the servo gain.
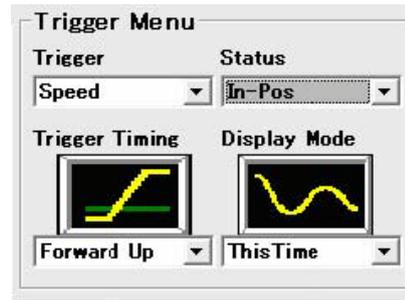
Display waveform setting

Current:	Only the waveform imported by the trigger setting is displayed.
Current +previous:	The waveform imported by the trigger setting and the previous waveform are displayed at the same time.

Trigger setting

Trigger condition	Operating status	Trigger edge	Trigger point
Speed		Forward activation	When the forward rotation is instructed and the motor has started operation
		Forward deactivation	When the forward rotation is instructed and the motor has started slowing down after starting operation
		Backward activation	When the backward rotation is instructed and the motor has started operation
		Backward deactivation	When the backward rotation is instructed and the motor has started slowing down after starting operation
Torque		Forward activation	When the forward rotation is instructed and the motor has started to produce torque
		Forward deactivation	When the forward rotation is instructed and the motor has started to produce a reduction of torque
		Backward activation	When the backward rotation is instructed and the motor has started to produce torque
		Backward deactivation	When the backward rotation is instructed and the motor has started to produce a reduction of torque
Status	Braking operation		A trigger is not available in this setting.
	Torque limiter	Forward activation	When the torque limiter (maximum torque) is operated
		Forward deactivation	When the torque limiter (maximum torque) is operated and has been released
		Backward activation	When the torque limiter (maximum torque) is operated and has been released
		Backward deactivation	When the torque limiter (maximum torque) is operated
	Speed limiter	Forward activation	When the speed limiter (maximum speed) is operated
		Forward deactivation	When the speed limiter (maximum speed) is operated and has been released
		Backward activation	When the speed limiter (maximum speed) is operated and has been released
		Backward deactivation	When the speed limiter (maximum speed) is operated
	Excessive deviation	Forward activation	When the deviation is in excessive status
		Forward deactivation	When the deviation is in excessive status and less than the allowable position
		Backward activation	When the deviation is in excessive status and less than the allowable position
		Backward deactivation	When the device is in excessive deviation status
	In-position	Forward activation	When the deviation counter exceeds the positioning complete range
		Forward deactivation	When the deviation counter is within the positioning complete range
		Backward activation	When the deviation counter is within the positioning complete range
		Backward deactivation	When the deviation counter exceeds the positioning complete range
Manual			When you click the RUN[F1] button in each operation part

4-5 Command transmission

JOG operation is available in the command transmission window.
JOG operation includes three types: constant speed continuous operation, simplified positioning operation, positioning and continuous operation.
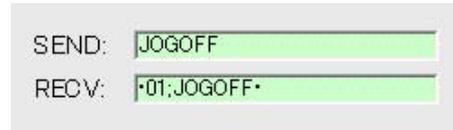
4-5-1 Description of the screen

Transmitting and receiving status

Status monitor

Operation button
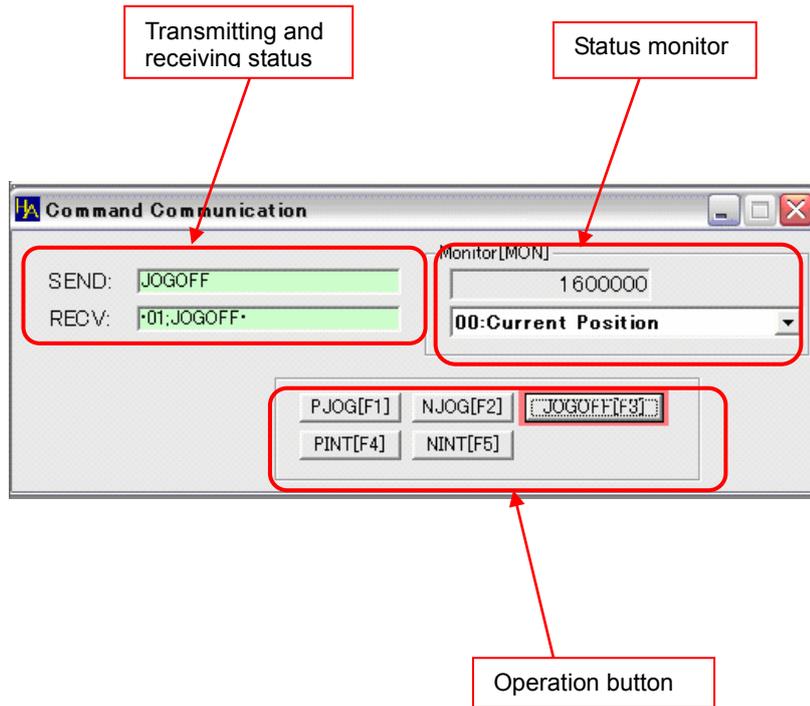
4-5-2 Operation description

● **Transmitting and receiving status**
This monitors the transmitting and receiving status of the RS-232C communication line. This doesn't have any effect on the actual operation.

● **Status monitor**
Display the content selected from the pulldown menu.

Current position: Display the value of the feedback pulse counter.
Instruction position: Display the value of the instruction pulse counter.
Current speed: Display the motor revolution speed calculated from the feedback pulse of the encoder.
Instruction speed: Display the output of the position loop.
Torque instruction: Display the output of the speed loop.
Effective load factor: Display the value detected by the current detection circuit.
Torque peak: Display the peak value of the output torque.
Servo status:
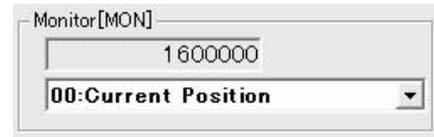
● **Operation button**
Perform JOG operation of the motor with the operation button. Set the parameters required for JOG operation from the parameter setting window.
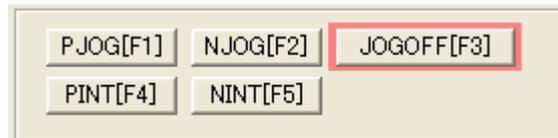
You can perform JOG operation by turning on the "CN2-7 Servo on: S-ON" signal and pressing the desired operation button.

Constant speed continuous operation
This is a general JOG operation. Operation varies depending on the setting of parameters "10: Control mode".

Control mode	Click PJOG[F1]	Click NJOG[F2]	Click JOGOFF[F3]
Position control [*1]	It accelerates to the JOG operation speed according to the acceleration time set for the JOG operation constant for acceleration and continues to operate in the forward direction at a constant speed.	It accelerates to the JOG operation speed according to the acceleration time set for the JOG operation constant for acceleration and continues to operate in the backward direction at a constant speed.	It decelerates and stops according to the deceleration time set for the JOG operation constant for acceleration.
Speed control	It accelerates to the JOG operation speed according to the acceleration time set for the JOG operation constant for acceleration and continues to operate in the forward direction at a constant speed.	It accelerates to the JOG operation speed according to the acceleration time set for the JOG operation constant for acceleration and continues to operate in the backward direction at a constant speed.	It decelerates and stops according to the deceleration time set for the JOG operation constant for acceleration.
Torque control	It continues to operate in the forward direction by the torque instruction set with the internal torque instruction value.	It continues to operate in the backward direction by the torque instruction set with the internal torque instruction value	The motor stops. The setting of the JOG operation constant for acceleration is not reflected while it is at a stop.

*1: To perform "Constant speed continuous operation", set the parameter "No.44: JOG operation feed pulse count" to 0. If a value other than 0 is set, "Positioning and continuous operation" is performed.

Simplified positioning operation
This is effective when the position control is set through "10: Control mode".

Control mode	Click PINT[F4]	Click NINT[F5]	Click JOGOFF[F3]
Position control	It operates in the forward direction by the value set through "44: JOG operation feed pulse number".	It operates in the backward direction by the value set through "44: JOG operation feed pulse number".	No effect on operation
Speed control	No operation	No operation	No effect on operation
Torque control	No operation	No operation	No effect on operation

Positioning and continuous operation
This is effective when "10: Control mode" is set to position control and "44: JOG operation feed pulse number" is set to 1 or more.

Control mode	Click PJOG[F1]	Click NJOG[F2]	Click JOGOFF[F3]
Position control[*1]	It operates in the forward direction by the value set through "44: JOG operation pulse number" and accelerates to the JOG operation speed according to the acceleration time set for the JOG operation constant for acceleration and continues to operate in the forward direction at a constant speed.	It operates in the backward direction by the value set through "44: JOG operation pulse number" and accelerates to the JOG operation speed according to the acceleration time set for the JOG operation constant for acceleration and continues to operate in the backward direction at a constant speed.	It decelerates and stops according to the deceleration time set for the JOG operation constant for acceleration.
Speed control	No operation	No operation	No operation
Torque control	No operation	No operation	No operation

*1: To perform "Positioning and continuous operation", set the parameter "No.44: JOG operation feed pulse count" to 1 - 9999. If 0 is set, "Constant speed continuous operation" is performed.

HARMONIC DRIVE SYSTEMS INC

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