HITACHI PROGRAMMABLE CONTROLLER

HIDIC EH-150

1 Axis Pulse Positioning Control Module

EH-POS

APPLICATION MANUAL

NJI-315(x)

WARNING

To ensure that the equipment described by this manual. As well as all equipment connected to and used with it, operate satisfactorily and safety, all applicable local and national codes that apply to installing and operating the equipment must be followed. Since codes can vary geographically and can change with time, it is the user's responsibility to determine which standard and codes apply, and to comply with them.

FAILURE TO COMPLY WITH APPLICABLE CODES AND STANDARDS CAN RESULT IN DAMAGE TO EQUIPMENT AND/OR SERIOUS INJURY TO PERSONNEL.

INSTALL EMARGENCY POWER STOP SWITCH, WHICH OPERATES INDEPENDENTLY OF THE PROGRAMMABLE CONTROLLER TO PROTECT THE EQUIPMENT AND/OR PERSONNEL IN CASE OF THE CONTROLLER MALFUNCTION.

Personnel who are to install and operate the equipment should carefully study this manual and any other referred to by it prior to installation and/or operation of the equipment. Hitachi Industrial Equipment Systems Co., Ltd. constantly strives to improve its products, and the equipment and the manual(s) that describe it may be different from those already in your possession.

If you have any questions regarding the installation and operation of the equipment, or if more information is desired, contact your local Authorized Distributor or Hitachi Industrial Equipment Systems Co., Ltd.

IMPORTANT

THIS EQUIPMENT GENERATES, USES, AND CAN RADIATE RADIO FREQUENCY ENERGY AND, IF NOT INSTALLED AND USED IN ACCORDANCE WITH THE INSTRUCTION MANUAL, MAY CAUSE INTERFERENCE TO RADIO COMMUNICATIONS. AS TEMPORARILY PERMITTED BY REGULATION, IT HAS NOT BEEN TESTED FOR COMPLIANCE WITH THE LIMITS FOR CLASS A COMPUTING DEVICES PURSUANT TO SUBPART J OF PART 15 OF FCC ROULES, WHICH ARE DESIGNED TO PROVIDE PEASONABLE PROTECTION AGAINST SUCH INTERFERENCE.

OPERATION OF THIS EQUIPMENT IN A RESIDENTIAL AREA IS LIKELY TO CAUSE INTERFERENCE IN WHICH CASE THE USER, AT HIS OWN EXPENSE, WILL BE REQUIRED TO TAKE WHATEVER MEASURES MAY BE REQUIRED TO CORRECT THE INTERFERENCE.

LIMITED WARRANTY AND IMITATION OF LIABILITY

Hitachi Industrial Equipment Systems Co., Ltd. (Hitachi) warrants to the original purchaser that the programmable logic controller (PLC) manufactured by Hitachi is free from defects in material and workmanship under normal use and service. The obligation of Hitachi under this warranty shall be limited to the repair or exchange of any part or parts which may prove defective under normal use and service within eighteen (18) months from the date of manufacture or twelve (12) months from the date of installation by the original purchaser which ever occurs first, such defect to be disclosed to the satisfaction of Hitachi after examination by Hitachi of the allegedly defective part or parts. This warranty in expressly in lieu of all other warranties expressed or implied including the warranties of merchantability and fitness for use and of all other obligations or liabilities and Hitachi neither assumes, nor authorizes any other person to assume for Hitachi, any other liability in connection with the sale of this PLC. This warranty shall not apply to this PLC or any part hereof which has been subject to accident, negligence, alternation, abuse, or misuse. Hitachi makes no warranty whatsoever in respect to accessories or parts not supplied by Hitachi. The term “original purchaser”, as used in this warranty, shall be deemed to mean that person for whom the PLC in originally installed.

In no event, whether as a result of breach of contract, warranty, tort (including negligence) or otherwise, shall Hitachi or its suppliers be liable for any special, consequential, incidental or penal damages including but not limited to, loss or profit or revenues, loss of use of the products or any associated equipment, damage to associated equipment, cost of capital, cost of substitute products, facilities, services or replacement power, down time costs, or claims of original purchaser’s customers for such damages.

To obtain warranty service, return the product to your distributor, or send it with a description of the problem, proof of purchase, post paid, insured, and in a suitable package to:

Quality Assurance Dept.
Hitachi Industrial Equipment Systems Co., Ltd.
46-1 Ooaza-Tomioka Nakajo-machi
Kitakanbara-gun, Niigata-ken
959-2608 JAPAN

The Information and/or drawing set forth in this document and all right in and to inventions disclosed herein and patent which might be granted thereon disclosing or employing and the materials, methods, techniques or apparatus described herein are the exclusive property of Hitachi Industrial Equipment Systems Co., Ltd .

No copies of the information or drawings shall be made without the prior constant of Hitachi Industrial Equipment Systems Co., Ltd.

Hitachi Industrial Equipment Systems Co., Ltd. provides customer assistance in varied technical areas. Since Hitachi does not possess full access to data concerning all of the uses and applications of customer's products, responsibility is assumed by Hitachi neither for customer product design nor for any infringement of patents or rights of others, which may result from Hitachi assistance.

The specifications and descriptions contained in this manual were accurate at the time they were approved for printing. Since Hitachi Industrial Equipment Systems Co., Ltd. Incorporated constantly strives to improve all its products, we reserve the right to make changes to equipment and/or manual at any time without notice and without incurring any obligation other than as noted in this manual.

Hitachi Industrial Equipment Systems Co., Ltd. assumes no responsibility for errors that may appear in this manual.

As the product works with user program, and Hitachi Industrial Equipment Systems Co., Ltd. cannot test all combination of user program components, it is assumed that a bug or bugs may happen unintentionally. If it is happened: please inform the fact to Hitachi Industrial Equipment Systems Co., Ltd. or its representative. Hitachi will try to find the reason as much as possible and inform the countermeasure when obtained.

Nevertheless Hitachi Industrial Equipment Systems Co., Ltd. intends to make products with enough reliability, the product has possibility to be damaged at any time. Therefore personnel who are to install and operate the equipment have to prepare with the countermeasure such as power off switch can be operated independently of the controller. Otherwise, it can result in damage to equipment and/or serious injury to personnel.

Safety Precautions

Read this manual and related documents thoroughly before installing, operating, performing preventive maintenance or performing inspection, and be sure to use the unit correctly. Use this product after acquiring adequate knowledge of the unit, all safety information, and all cautionary information. Also, make sure this manual enters the possession of the chief person in charge of safety maintenance.

Safety caution items are classified as "Danger" and "Caution" in this document.

DANGER : Cases where if handled incorrectly a dangerous circumstance may be created, resulting in possible death or severe injury.

CAUTION : Cases where if handled incorrectly a dangerous circumstance may be created, resulting in possible minor to medium injury to the body, or only mechanical damage.

However, depending on the circumstances, items marked with CAUTION may result in major accidents.

In any case, they both contain important information, so please follow them closely.

Icons for prohibited items and required items are shown below:

: Indicates prohibited items (items that may not be performed). For example, when open flames are prohibited, is shown.

: Indicates required items (items that must be performed). For example, when grounding must be performed, is shown.

1. About installation

CAUTION

- Use this product in an environment as described in the catalogue and this document.
  If this product is used in an environment subject to high temperature, high humidity, excessive dust, corrosive gases, vibration or shock, it may result in electric shock, fire or malfunction.
- Perform installation according to this manual.
  If installation is not performed adequately, it may result in dropping, malfunction or an operational error in the unit.
- Do not allow foreign objects such as wire chips to enter the unit.
  They may become the cause of fire, malfunction or failure.

2. About wiring

REQUIRED

- Always perform grounding (FE terminal).
  If grounding is not performed, there is a risk of electric shocks and malfunctions.

CAUTION

- Connect power supply that meets rating.
  If a power supply that does not meet rating is connected, fire may be caused.
- The wiring operation should be performed by a qualified personnel.
  If wiring is performed incorrectly, it may result in fire, damage, or electric shock.

3. Precautions when using the unit

DANGER

- Do not touch the terminals while the power is on.
  There is risk of electric shock.
- Structure the emergency stop circuit, interlock circuit, etc. outside the programmable controller (hereinafter referred to as PC).
  Damage to the equipment or accidents may occur due to failure of the PC.
  However, do not interlock the unit to external load via relay drive power supply of the relay output module.

CAUTION

- When performing program change, forced output, RUN, STOP, etc., while the unit is running, be sure to verify safety.
  Damage to the equipment or accidents may occur due to operation error.
- Supply power according to the power-up order.
  Damage to the equipment or accidents may occur due to malfunctions.

4. About preventive maintenance

DANGER
• Do not connect the ⊕, ⊖ of the battery in reverse. Also, do not charge, disassemble, heat, place in fire, or short circuit the battery. There is a risk of explosion or fire.

PROHIBITED
• Do not disassemble or modify the unit. These actions may result in fire, malfunction, or malfunction.

CAUTION
• Turn off the power supply before removing or attaching module/unit. Electric shock, malfunction or failure may result.

Table of contents

Chapter 1 Introduction

1.1 Before use

This instruction manual describes how properly operate the EH-POS (Positioning Control Module), which is one of the special function module of EH-150 Programmable Logic controller (PLC).
Carefully read this manual to familiarize yourself with the procedures respectively of installation, operation, and maintenance and inspection.
Please be sure to read the related application manual, too.

Table 1.1 Reference Manual list

item	Document name	Manual No.
PLC Main body	EH-150 Application Manual	NJI-281*(x)
Programming Software	Ladder Editor for Windows® V1.25 Instruction Manual (Type:HLW-PC3)	NJI-206C
	Ladder Editor for Windows® V2 Instruction Manual (Type:HLW-PC3)	NJI-299
	Pro-H	

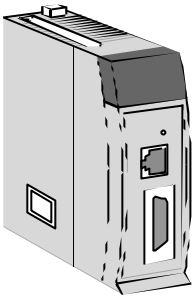
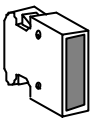
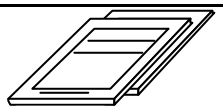
*The last character of the manual number may be modified when the product is revised.

⚠ Cautions

- Use EH-CPU308 or EH-CPU316 for CPU module with EH-POS.
- When EH-CPU104 or EH-CPU208 is used, confirm ROM Version 02 or more. In this case, access to external output area of the slot, on which high function module such as EH-POS is attached, can not be executed by double word (DY), but it is possible by word (WY).ROM Version 01 and less can not be used.(Please show the left side of CPU module)
- EH-POS is different from H-series positioning module POSIT-H, POSIT-2H, POSIT-A2H,POSH in detailed specifications. To transplant an existing user program for EH-POS, read the both manuals carefully and understand the difference. See the Chapter 12 for the difference between POSIT-2H (2 axis pulse positioning module) and EH-POS.
- Read this manual carefully before using EH-POS to operate the module correctly.
- Contents of the manual may be changed without notice.

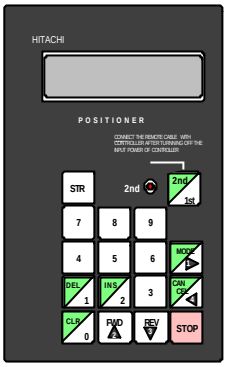
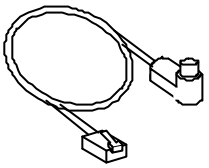
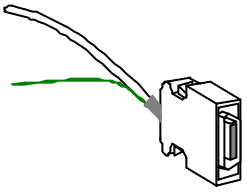
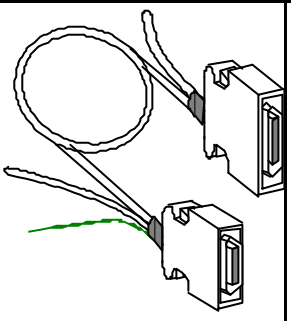
1.2 Accessories

The following accessories are packed in the EH-POS module. Check each item after unpacking the module.

No.	Item name	Model	Appearance	Number of pieces	Remark
1	1-axis positioning module	EH-POS		1	**Caution** • Use EH-CPU308 or EH-CPU316 for CPU module with EH-POS. • When EH-CPU104 or EH-CPU208 is used, check ROM Version to be Version 02 or more. In this case, access to external output area of the slot, can not be executed by double word (DY), but it is possible by word (WY).
2	I/O connector (Cable side)	Case: 10320-52F0-008		1	Supplied by Sumitomo 3M Caution Earth the shielded of connector and cable to solve noise problem.
		Connector (Solder type): 20 poles 10120-3000VE		1	
3	Connector for positioner	TM8DC		1	Supplied by Hirose Electronics
4	Instruction manual	NJI-326:Japanese		1	
		NJI-326(X):English		1	

1.3 Option

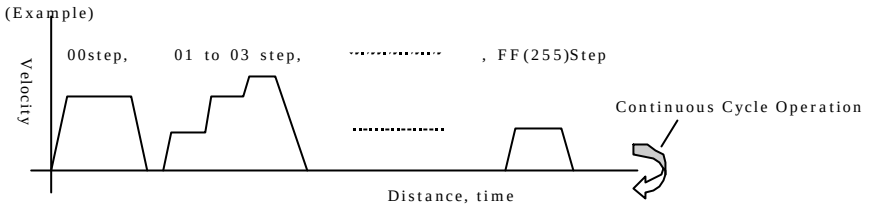
The following options are for the EH-POS module.

No.	Name	Model (Spec.)	Appearance	Number of pieces	Remark
1	Positioner	RPS-3A		1	This needs another cable for Positioner (Item No.2). **Caution** **This is not applied for CE marking and C-TICK.**
2	Cable for positioner	EH-POP10 (1m)		1	Only for EH-POS Caution This is only for EH-POS positioner.
		EH-POP28 (2.8m)		1	
3	Cable for I/O connector	EH-POC10 (1m)		1	Supplied by Sumotomo 3M. Plug:20 pole 10120-6000EL Case: 10320-3210-000
		EH-POC20 (2m)		1	
		EH-POC50 (5m)		1	
4	Cable for servo amp Soon on sale				(1)HITACHI AD series (2)YASUKAWA Σ II series (3)SANYO P series Caution Contact sales office for detailed information.

Chapter 2 Features

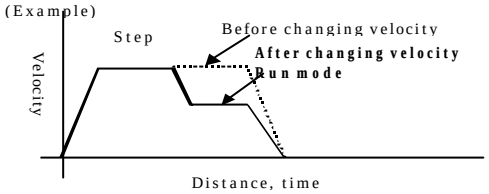
1. Build-in continuous automatic operation function

Maximum 256 steps of Automatic operation, Continuous Automatic operation are installed.
Step operation, cycle operation, Continuous cycle operation are possible.



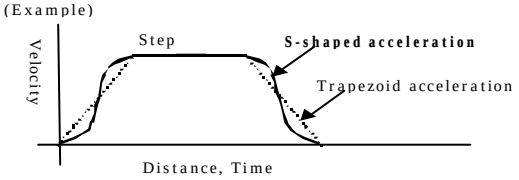
2. "Velocity change in Run mode" function.

EH-POS realized velocity change in RUN mode, by changing velocity data.



3. S-shaped acceleration function

At acceleration method, S-shaped acceleration mode (3 steps acceleration mode) is added.
At setting of acceleration mode in common parameter, "trapezoid acceleration mode" or "S-shaped acceleration mode" can be selected.



4. ABS (absolute value) encoder input

EH-POS applies for ABS (absolute value) encoder input.
At setting of "Homing mode" in common parameter, you can set homing mode of absolute encoder.
(Applied manufacturer/series : Hitachi AD series,YasukawaΣseries/Σ II series, Sanyo Electric P series)

5. Battery-less

EH-POS applies EEPROM as memory and realizes to back-up memory without battery. It is rewritable up to about 100,000 times.
Preparing for frequent rewriting velocity and position data, a dedicated command is prepared.

6. Easy to use by positioner

If you do not have a programming tool, the positioner can allow you to operate "Homing operation", "Manual operation", "Automatic operation" and "Teaching". Common parameter setting or automatic operation data setting is available too.
Positioner can display a position and error code. Positioner is an option.

7. Ease of using position command

EH-POS supports four kinds of position command modes (pulse,μm, inch, degree).

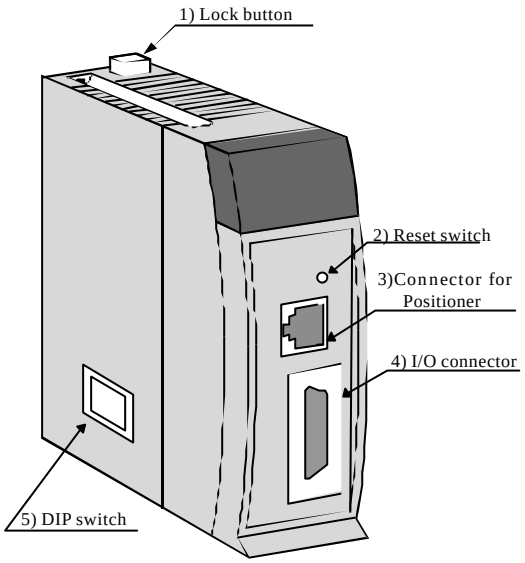
8. Differential Line driver output method

The differential driver output is added in pulse output method. Both open collector and differential driver are available on different output terminals.

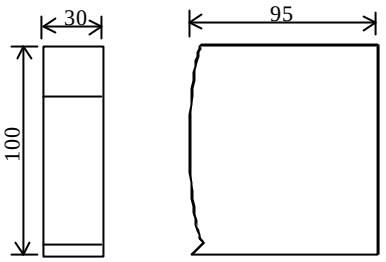
Chapter 3 System configuration

3.1 Structure and Parts name

Name and function



Model	EH-POS
Weight	Approx. 0.18 kg
Dimension(mm)	



No	Name	Function	Remarks
1)	Lock button	This is used when removing the module from the base unit. After it is installed to the base unit, the fixation can be reinforced using screws. In this case, use M4×10-mm screws.	
2)	Reset switch	When module is abnormal, module is to be reset by pushing this switch.	
3)	Connector for Positioner	By connecting a positioner, setting and writing of internal data, manual operation, automatic operation and teaching operations are available.	Positioner is optional.
4)	I/O connector	This is connector for pulse output and external control input.	Connector for cable: SUMITOMO 3M product Solder type:10120-3000VE Case:10320-52F0-008
5)	DIP switch	Setting this switch designates the following operating modes. Even if the switch setting is changed while the module is energizing, the operating mode will not be changed. To switch operating modes, turn the power off, then do the settings correctly.	Caution When switch number 5,6 is turned on, external overrun signal is disable.

Switch No	ON	OFF	Supplementary explanation
	1	2	
1, 2	ON	ON	CW/CCW Pulse Line Output (negative)
	ON	OFF	CW/CCW pulse Line Output (positive)
	OFF	ON	CK/Sign Pulse Line Output (negative)
	OFF	OFF	CK/Sign Pulse Line Output (positive)
3	Not used	Not used	
4	Ext. COIN disable	Ext. COIN enable	External permission Operation (When switch number 4 is turned off, it is valid.)
5	Ext. +O.RUN disable	Ext. +O.RUN enable	External CCW overrun Operation (When switch number 5 is turned off, it is valid.)
6	Ext. –O.RUN disable	Ext. –O.RUN enable	External CW overrun Operation (When switch number 6 is turned off, it is valid.)

3.2 System configuration

The system configuration of the EH-150 is shown below.

The EH-150 is a module-type programmable controller with the configuration shown in Figure 3.1.

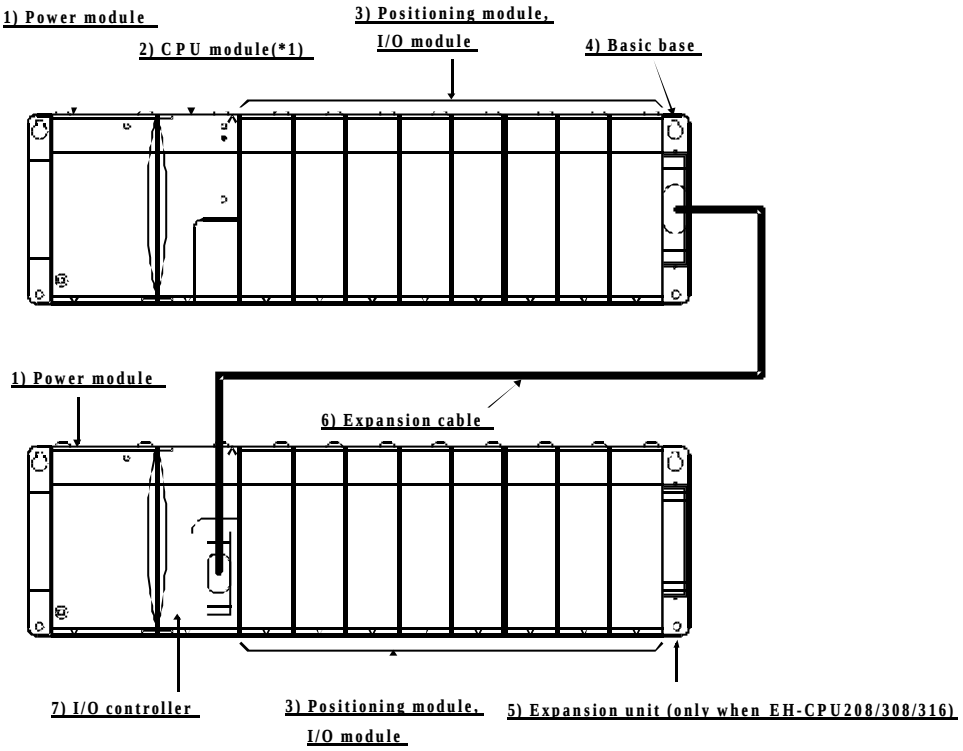


Figure 3.1 EH-150 System configuration diagram

No.	Device name	Description of function
1)	Power module	Converts power supply to the power to be used within the EH-150.
2)	CPU module*1	Performs operations based on the contents of the user program, receives input and controls output.
3)	I/O module*2	Positioning module, Input module, output module, analog module
4)	Basic base unit*2	Base in which the power module, CPU module, I/O module, etc. are loaded.
5)	Expansion base unit	Base in which the power module, I/O controller, I/O module, etc. are loaded.
6)	Expansion cable	Cable that connects the I/O controllers for the basic base and expansion base.
7)	I/O controller	Interface with expansion base and CPU module.

*1 Adopt EH-CPU308 or EH-CPU316 as CPU module with this EH-POS module. If EH-CPU104 or EH-CPU208 is adopted as CPU module, please confirm ROM Version is 02 or more. In this case, access to external output area of the slot, on which high function module such as EH-POS is attached, can not be executed by double word (DY), but it is possible by word (WY). CPU module of ROM Version01 or less cannot be used with this EH-POS module.

*2 The same type unit can be used both for the basic unit and the expansion unit.

Chapter 4 Function and Performance Specifications

4.1 General Specifications

The general specifications of EH-POS are shown in the table below.

Item	Specification
Power requirement	5 V DC, 300 mA, 600 mA (when Positioner connected) , (supplied from the programmable controller)
Operating temperature	0 to 55 °C storing temperature –10 to 75 °C)
Operating humidity	20 to 90 % RH (no condensation), storing humidity 10 to 90 % RH (no condensation)
Operating atmosphere	No presence of corrosive gases or heavy dusts
Cooling method	Natural air cooling
Weight	Approx. 0.18 kg
Dimension	30(W) ×100(H) ×95(D) mm (170(D) with I/O Connector)
External power source	5 V DC ±5% 100 mA (for pulse output) , 24 V DC 10 mA/point (for external control input)

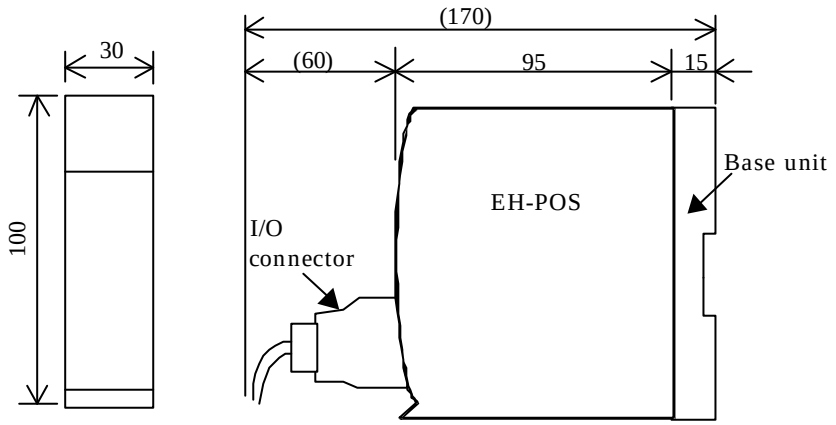


Figure 4.1 Dimensions of EH-POS with I/O connector

4.2 Functional Specifications

The function specifications of EH-POS are shown in the table below.

Item		Specification
Number of controlled axes		1 axis
Maximum Speed		400k Pulse/s
Positioning data	Number of occupied points	256 points
	Setting method	1. Sequence program 2. Positioner (Option)
Positioning system	System	1. Absolute system 2. Absolute + Increment system 3. Increment system
	Positioning command unit	1. Pulse 2. μm 3. inch 4. degree
	Speed command	Automatic, manual, homing 6.25 to 400k Pulse/s specification with μm/s, inch/s, degree/s
	Speed stage	10 stages
	Acceleration and deceleration	Linear acceleration and deceleration S-shaped acceleration and deceleration (3 stage acceleration and Deceleration)
	Acc./dec. time	1 to 65,535 ms
	Backlash correction	0 to 255 pulses
	Range	+2,147,463,647 to –2,147,463,648 pulses
	Pulse Output form	1. Pulse train (CW/CCW) 2. Clock + direction signal (CK/Sign) DIP switch No.1 & No.2 decide (Output form and logic polarity).
	Pulse Output method	1. Open collector Output (Photo coupler isolation) 2. Differential driver Output (Photo coupler isolation)
Function of homing		1. Desirable homing 2. Low speed homing 3. High speed homing (Limit SW OFF edge) 4. High speed homing (Z or C Pulse input)
Absolute encoder		AD series of HITACHI, Σ/Σ II of YASUKAWA and P series of SANYO are available.
Teaching		Available
Manual (JOG) operation		Pulse output by manual input
I/O assignment		Word 4W/4W
Operation of EH-POS in the CPU's stop		Enable by I/O set or a Positioner (Option)

Caution 1.Positioner is not applied for CE marking and C-TICK.
2.When the CPU is stopped in the running, the motor goes slow down and stop.
3.Maximum moving distance is 2,147,463,647 pulses in one operation. In case of the over maximum moving distance, the motion is stopped at the maximum moving value.
4.When a power supply of EH-150 is turned off during a power supply of servo system is on, EH-POS may output some pulses. So, please turn off the power supply of the servo system, before turning off the power supply of EH-150. And make homing operation after power supply is turned on in case of position control mode.

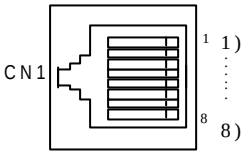
4.3 I/O Interface Specifications

I/O interface specifications of EH-POS are shown in the table below.

Items			Specification
Output	CW/CCW Pulse line Output CK/Sign Pulse line Output		Opto-isolated open collector transistor (max.30 V DC, 30 mA Resistor Load) Opto-isolated line driver output (5 V DC)
	Max. leak current		100 μA or less
	Max. ON drop voltage		0.8 V (at output current = 30mA)
Input	Input voltage		10.8 to 30 V DC
	Input Impedance		Approx. 2.2 kΩ
	Input current		Approx. 10 mA(24 V DC)
	Operating Voltage	Min. ON voltage	9 V
		Max. OFF voltage	3.6 V
	Input delay	ON to OFF	1 ms or less
		OFF to ON	1 ms or less
	Polarity		Only input of encoder signal is Plus common, others none
	Isolation method		By photo-coupler

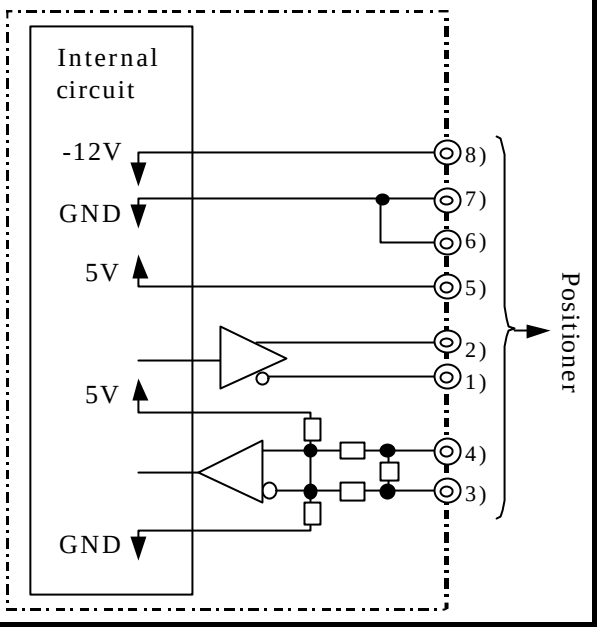
1) Positioner connector (CN1): Base on RS-422

Terminal configuration



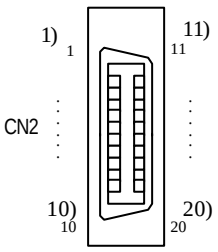
No.	Sign	signal name
1)	Do–	Driver output –
2)	Do+	Driver output +
3)	Ri–	Receiver input –
4)	Ri+	Receiver input +
5)	5 V DC+	+5V
6)	0 V	GND
7)	0 V	GND
8)	12 V DC–	–12V

Diagram of internal circuit



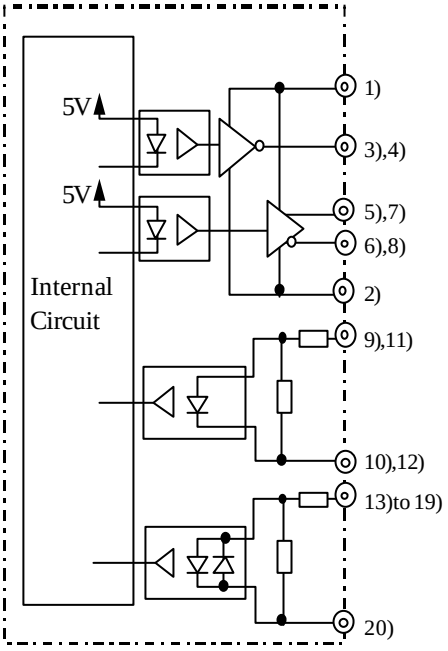
2) I/O connector (CN2)

Terminal configuration



No.	Sign	signal name
1)	5 V DC+	Eternal power
2)	P5G	Source(pulse output)
3)	CW	Open collector
4)	CCW	pulse output
5)	CW+	Differential
6)	CW–	pulse output
7)	CCW+	
8)	CCW–	
9)	C+	Encoder
10)	C–	C-phase
11)	PS–	Encoder
12)	PS+	position signal
13)	COIN	Operation complete
14)	PROG	Home LS
15)	+O.RUN	+Over Run
16)	–O.RUN	–Over Run
17)	MODE-SEL	Control mode Switch
18)	M-CW	Manual CW
19)	M-CCW	Manual CCW
20)	24 V DC+	External power source (control)

Diagram of internal circuit



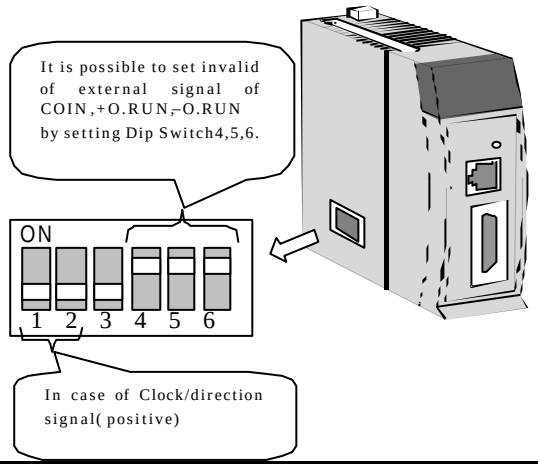
4.4 Input/output Signal

Input /output signals of EH-POS are shown in the table below.

No.	I/O	Symbol	Signal name	Content
1)	Power	P5V	Power for Pulse output	Power supply terminal
2)		P5G		
3)	Output	CW	Signal for Pulse output	Open collector output (Note 1)
4)		CCW		
5)		CW+		Differential driver output(Note 1)
6)		CW–		
7)		CCW+		
8)		CCW–		
9)	Input	C+	C phase of encoder (or Z phase)	High-speed homing 2 (C or Z phase of servo driver)
10)		C–		
11)		PS–	Encoder position	Data input signal when absolute value encoder is used
12)		PS+		
13)		COIN	Operation permission	Read deviation 0 of servo driver(Note 2)
14)		PROG	Home limit switch	Home/datum LS
15)		+O.RUN	CCW overrun (Normally ON)	CCW direction overrun(Note 2)
16)		–O.RUN	CW overrun (Normally ON)	CW direction overrun(Note 2)
17)		MODE-SEL	Control mode select	When the system is in the velocity + positioning control mode, change the mode to positioning mode by turning the switch from ON to OFF.
18)		M-CW	CW Manual operation	Input of CW direction operation in the manual operation mode
19)		M-CCW	CCW Manual operation	Input of CCW direction operation in the manual operation mode
20)	Power	COM(+24V)	External power source	External power source common terminal

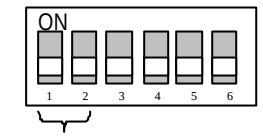
Note 1: The pulse output method (CW/CCW or CK/direction change) and output logic (Positive/negative) are set by DIP switch 1 and 2. DIP switch 3 is not used.

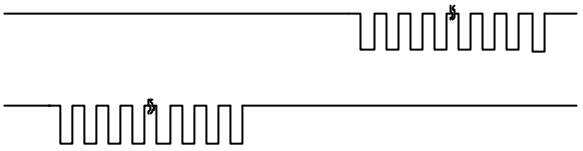
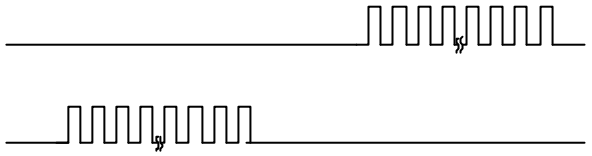
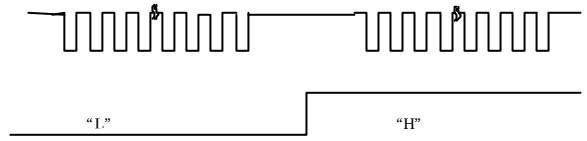
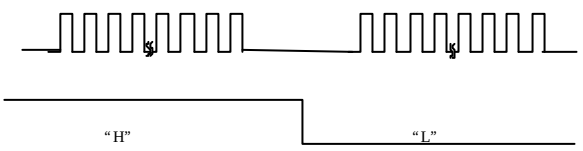
Note 2: When the external inputs (COIN, +O.RUN, –O.RUN) are not used, the output input is made invalid by setting the DIP switch 4,5,6 ON. Please note the module read the setting of DIPswitch when power on. When you wish the external inputs (COIN, +O.RUN, –O.RUN) valid, set DIPswitch 4,5,6 OFF definitely.



4.5 Output Method

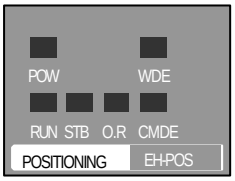
Pulse output method (CW/CCW or, CK/direction change) or, output logic (positive/negative) is set by the DIP switch No.1, 2 at side of module.
Set the same method of the pulse output of EH-POS and that of servo controller.

Apparatus of DIP_SW	DIP_SW No.		Output method
	1	2	
 (4)Clock/direction(positive logic) (Factory setting)	ON	ON	(1) CW/CCW pulse output (negative logic)
	ON	OFF	(2) CW/CCW pulse output (positive logic)
	OFF	ON	(3)Clock/direction signal output(negative logic)
	OFF	OFF	(4)Clock/direction signal output(positive logic)

Output method	Output signal	Forward(CCW direction) Reverse(CW direction)
(1) CW/CCW Pulse output (Negative logic)	CW CCW	
(2) CW/CCW Pulse output (Positive logic)	CW CCW	
(3) Clock/direction (Negative logic)	Clock (CW) Direction signal (CCW)	
(4) Clock/direction (Positive logic)	Clock (CW) Direction signal (CCW)	

4.6 Name of LED

LEDs on the front part of EH-POS module are explained in the table below.

LED part of EH-POS	LED name	Signal name	Content	Color
	POW	Power	Lighted when module is normal	Yellow green
	RUN	Run	Positioning (Pulse are outputting)	Yellow green
	STB	Stand by	Input queuing (Pulses not working)	Yellow green
	O.R	Over run	Lighted at overrun	Red
	CMDE	Command error	Lighted at command error	Red
	WDE	Watch dog timer error	Lighted at Micro computer error	Red

(Note) "WDE" lights a moment, when power is made ON/OFF. This is not abnormal.

Chapter 5 Trial Run (Simple Operation Example)

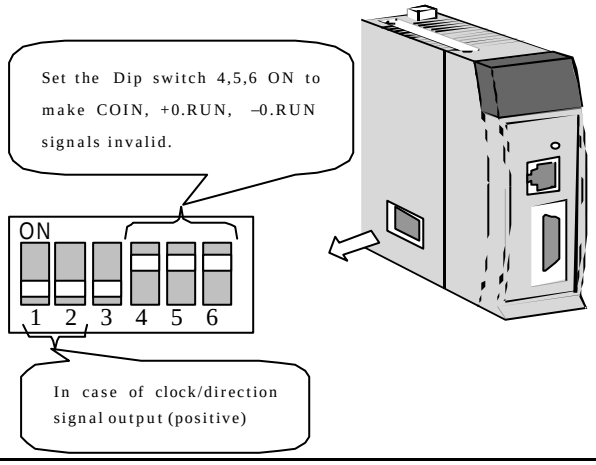
You can confirm the pulse output only using EH-POS by itself without EH-POS being wired to a servo amplifier and a motor. Furthermore, EH-POS can supply the power and signals for pulse output to servo amplifier and can drive a motor without input of positioning completion signal or over run signal.

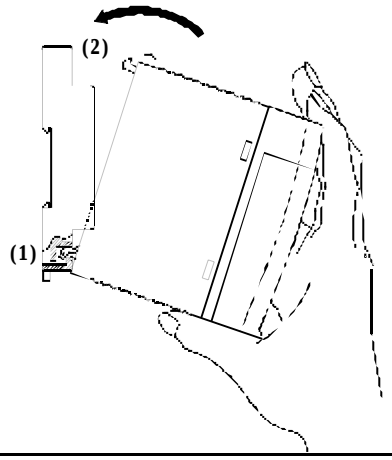
5.1 Items of Trial Run

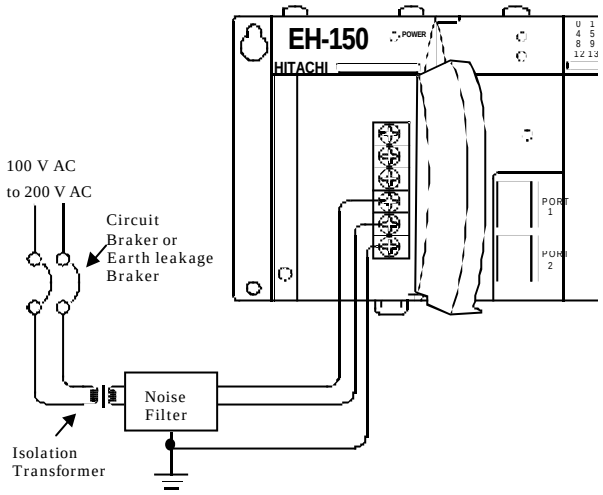
Following is the main items the way of pulse output by EH-POS itself

1. Dip switch Setting
2. Installation
3. Wiring
4. Power on
5. Trial run
   - 5-1. Trial run using ladder program
   - 5-2. Trial run by "Force set"
   - 5-3. Trial run by Positioner (Option)
6. Power off
7. Remove
8. Cancellation of Dip switch setting

5.2 Procedure

<table>
<tr>
<td> 
</td>
<td>1. Setting of dip switch
(1) Set the Dip switch 4,5 and 6 on. Then signals COIN (positioning completion), +O.RUN (Over run to CCW), –O.RUN (Over run to CW) are made invalid.

Note : To make COIN, +O.RUN and –O.RUN signals valid, set the Dip switch 4,5 and 6 to off.</td>
</tr>
<tr>
<td> 
</td>
<td>2. Installation
(1) Insert the hook at the lower section in the base.
(2) Press in the upper side of the module until it clicks.
Note: After loading the module, check that it is firmly attached.
When you install, disconnect the cable from EH-POS for safety, if it is attached.</td>
</tr>
</table>



3. Wiring to power supply module.

(1) Use a power line cable over 2mm square not to drop the voltage.

(2) Use an earth cable (to FE terminal) more than 2 mm square. The impedance should be less than 100 ohms.
The earth cable should be less than 20 m.

(2-1)Common use with instrumentation cabinet or relay cabinet is permitted.

(2-2)Do not share with the earth line of equipment such as high frequency heating furnace, large-scale power cabinet (more than 5kW), thyristor converter, electric welding machine, which may emit noise.

(2-3)Use a noise filter certainly in power supply line.

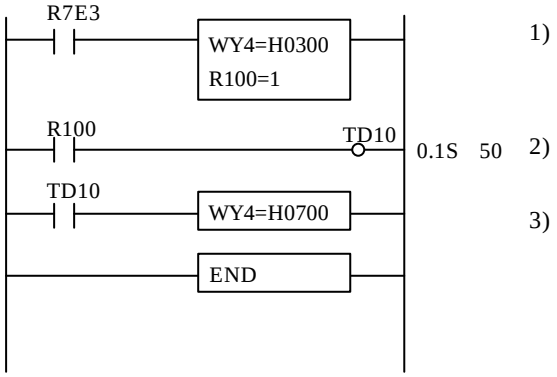
(3) The terminal screw is M3. Tighten a screw with torque of 49 to 78 N·m.

(4) Use a same power supply for both modules in basic and expansion rack.

4. Power on

Switch on the circuit breaker.

Set I/O assignment of EH-POS as "word 4W/4W" at configuration setting on programming tool.
Please refer to the manual of programming software about ladder programming.
Following description is the case that EH-POS is put on slot 0.



5. Trial run

5-1 Trial run using ladder program

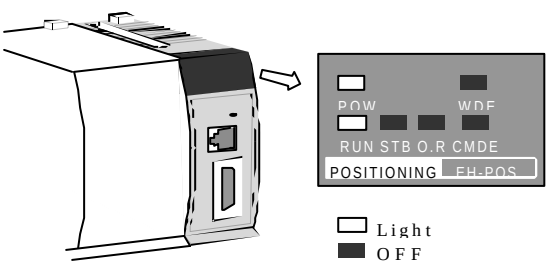
(1) Make the ladder program as left and download to the CPU.

[Program]

1) During the 1st scan after RUN, the "Continuous pulses for forward rotation of manual operation command" is executed. RUN LED (Green) lights up. R100 is set to 1.

2) When R100 is on, the timer TD10 will start, and the current value increases.

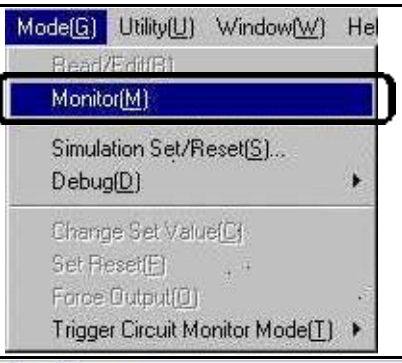
3) After 5 seconds, TD10 turns to on, and H0700 is set in WY4. Then "Slow down and stop command" is executed. The RUN LED (Green) will switch off and STB LED (Green) will light up.



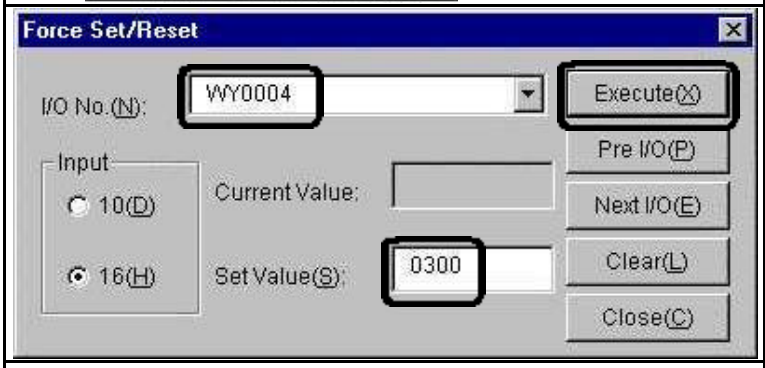
(2) Make the RUN-switch on to run EH-CPU. Then RUN LED on EH-POS will light up for 5 seconds. Pulses are output during the time.
After 5 second, RUN LED turns off and STB LED lights on.

Concerning how to use the ladder editor, please refer to the manual of Ladder Editor.
Following is a description for using Ladder Editor for Windows (Type: HLW-PC3).

5-2 Test operation by Forced Set/Reset
(1) Start Ladder Editor and select Online mode.
Make sure I/O assignment of EH-POS is "Word 4W/4W". For details, refer Ladder Editor manual Type HLW-PC3.

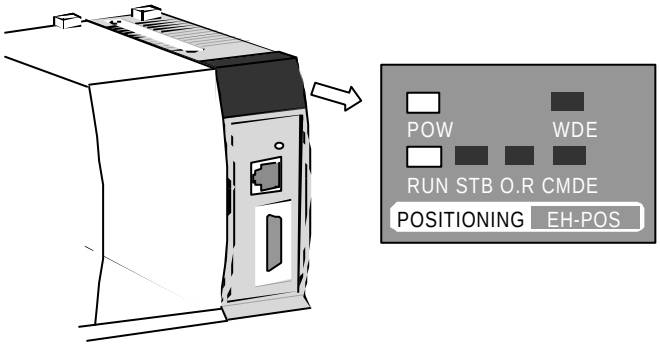


(2)Switch the mode by choosing the from [Edit-Readout] to [Online]-[Mode]-[Monitor] on the Ladder Editor.

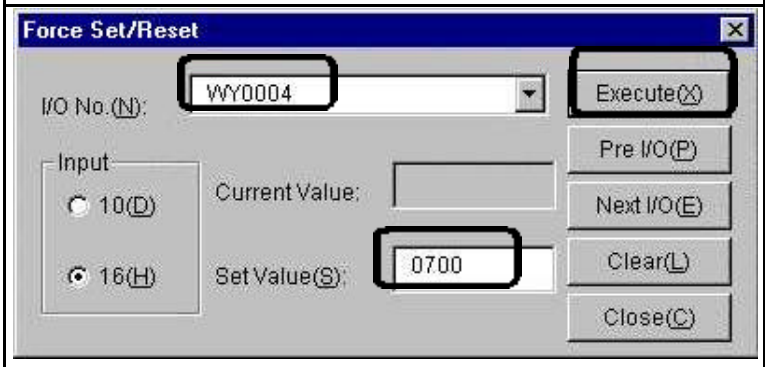


(3) Select [Forced Set/Reset] in the menu bar. Then the dialog box is displayed.

(4) Input "WY0004" at I/O No. ("WY4" is also accepted) and "0300" as hexadecimal set value. Then click the [Execute] button. "Forward rotation of manual operation by continuous pulses command (H300)" is executed.

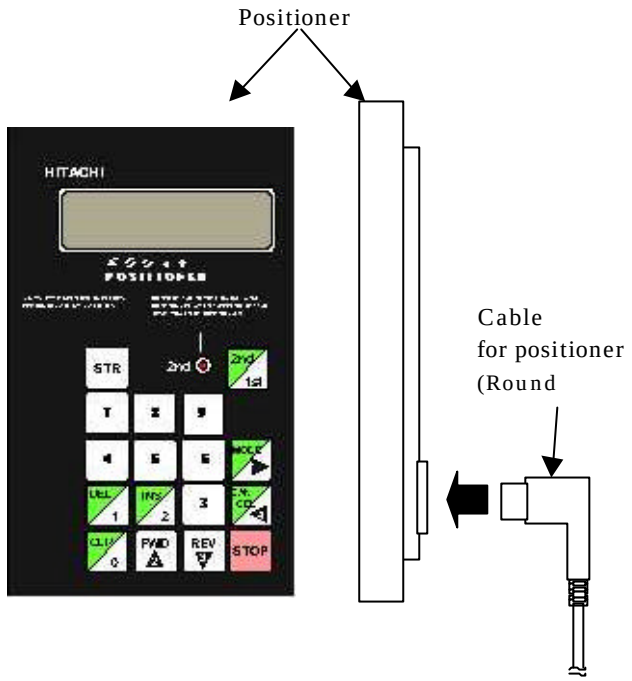


(5) After completion of step 4), the RUN LED (Green) will light up and pulses will be output from EH-POS.



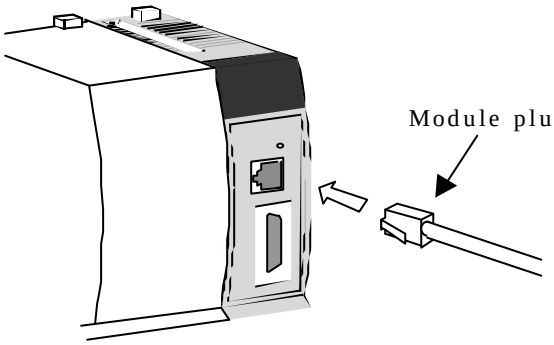
(6) Input "WY0004" ("WY4" is also acceptable) as the I/O No., and "0700" ("700" is also acceptable) as Hexadecimal set value. Then click the [Execute] button. "Stop with slowdown" command is executed.

(7) After completion of step 6), the RUN LED (Green) will turn off and STB LED (Green) will light up.



5-3. Trial run using the positioner (Option)

(1) Connect cable for positioner to the connector behind the positioner.

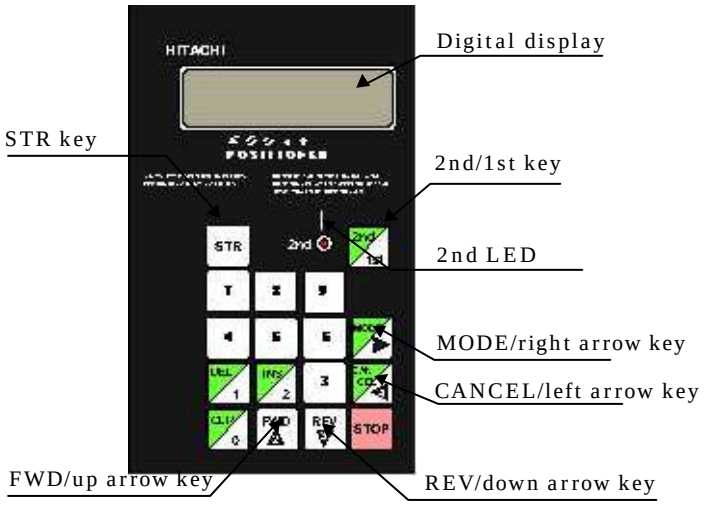


(2) Turn the circuit off.

(3) Connect the module plug to module Connector (CN1) of EH-POS until it clicks.

(4) Turn the circuit on.

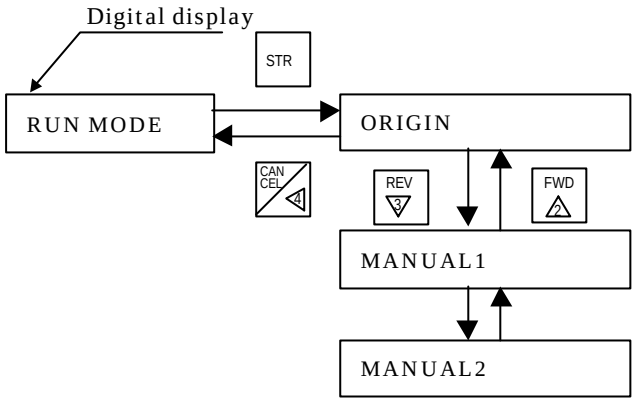
Note: Make sure to connect the plug (cable) before power on.



(5) "MONITOR MODE" is displayed after "POWER ON" signal.

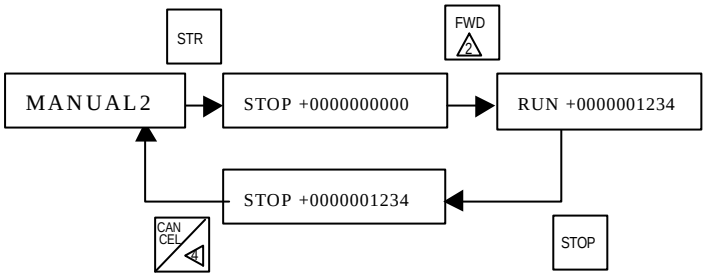
(6) Press the "2nd/1st" key. 2nd LED will light up and 2nd keys are available.

(7) Press the MODE key twice until "RUN MODE" is displayed.



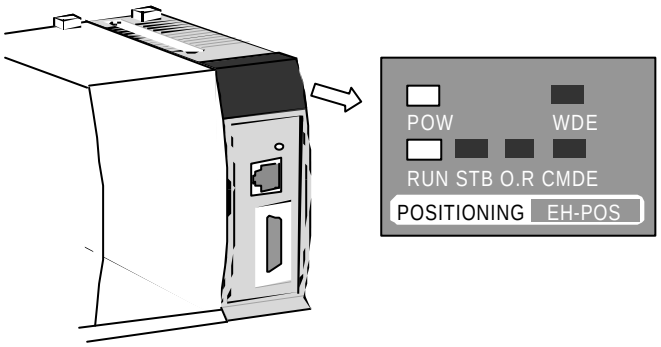
(8) Press the STR key once until "ORIGIN" is displayed.

(9) Press the REV/down arrow key twice. Then "MANUAL2" is displayed.



(10) Press the STR key once until "STOP" is displayed.

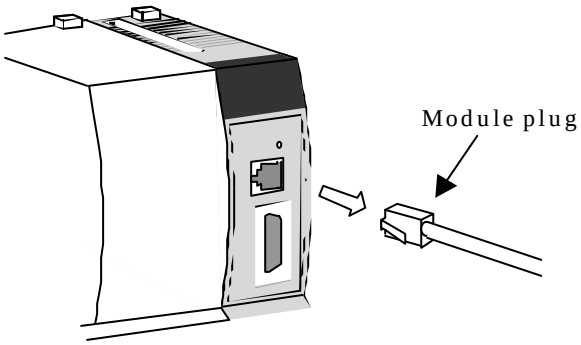
(11) Press the FWD/up arrow key once until "RUN" is displayed. Pulses for forward rotation will be output.(REV/down arrow key is for reverse rotation.)



(12) RUN LED (Green) will light up as shown left.

(13) Press the STOP key. Pulses are stopped and "STOP" is displayed. RUN LED will switch off and STB LED (Green) will light up.

(14) Press the CANCEL key. "MANUAL2" is displayed again.

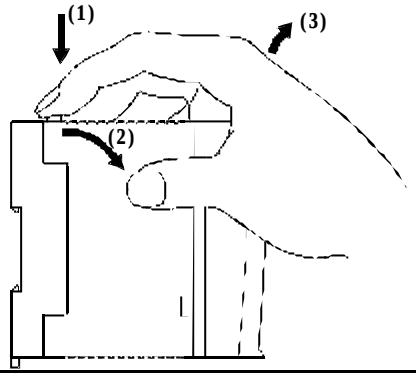


6. Power off

(1) Turn the circuit off.

(2) Disconnect the module plug from module Connector (CN1) on EH-POS.

Note: Make sure to disconnect the plug after power off.

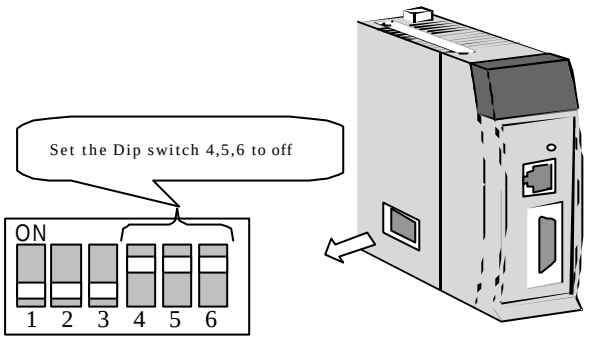


7. Removing

(1) Push in the lock button.

(2) With the lock button pushed in, pull the top of the module toward the front.

(3) Raise it toward the front.



8. Cancellation of the dip switch

(1) Set the DIPswitch 4,5,6 to off.
External signals to COIN (positioning completion), +O.RUN (Over run to CCW), –O.RUN (Over run to CW) are valid.

Chapter 6 Operation Data Setting

6.1 Operation Data

In order to operate the EH-POS, common parameters as well as automatic operation position data for each step are required to be set.
Common parameters and 0 step of automatic operation position data are set with default values.

6.1.1 Common parameter

The common parameter consists of 12 data (15-words) and is needed for all operation modes (homing mode, manual operation, and automatic operation). Set the data correctly before operation.
Default values are set as follows.

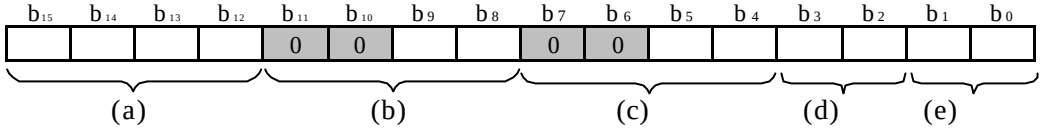
Parameter No.	Communication word No.	Most significant bit ← (MSB) → Least significant bit (LSB) 15 14 13 12 11 10 9 8 7 6 5 4 3 2 1 0	Content	Default value Hexadecimal (Decimal)
1	1	(a)Homing mode | (b)Velocity mode | (c)Acceleration/Deceleration mode | (d) Position specifying unit 1 | (e) Position specifying unit 2	Homing mode Velocity mode, Acceleration/Deceleration mode Position specifying unit	H0000 (0000)
2	2	Pulse number for one rotation ((e)Valid for position control unit is μm, inch, degree)	Pulse number for one rotation of motor 1 to 65535(HFFFF)	H07D0 (2000)
3	3	Work move length for one rotation ((e)Valid for position control unit is μm, inch, degree)	Work move length at one rotation of motor 1 to 65535(HFFFF)	H07D0 (2000)
4	4	Upper limit of speed	Setting the upper limit speed of the velocity control mode 1 to 65535(HFFFF)	H1F40 (8000)
5	5	Initial speed	Setting of initial speed of manual operation/automatic operation 1 to 65535(HFFFF)	H0010 (0016)
6	6	Manual /High-speed homing velocity	Setting the velocity in the manual operation/ High-speed homing 1 to 65535(HFFFF)	H0020 (0032)
7	7	Low-speed homing velocity	Setting the velocity in the low-speed homing 1 to 65535(HFFFF)	H0010 (0016)
8	8	Acceleration/Deceleration time	Setting Acceleration /Deceleration time in the homing/manual operation (unit: ms) 1 to 65535(HFFFF)	H03E8 (1000)
9	9	Backlash	Setting the backlash correcting data 1 to 65535(HFFFF)	H0000
10	10	Upper limit position data (Lower)	Setting the maximum position data for normal rotation direction +2,147,483,647(H7FFFFFFF) to –2,147,483,648(H80000000)	H3FFFFFFF (+1073741823)
	11	Upper limit position data (Upper)		
11	12	Lower limit position data (Lower)	Setting the maximum position data for reverse rotation direction +2,147,483,647(H7FFFFFFF) to –2,147,483,648(H80000000)	HC0000000 (–1073741824)
	13	Lower limit position data (Upper)		
12	14	Home position data (Lower)	Setting the position data of the starting point +2,147,483,647(H7FFFFFFF) to –2,147,483,648(H80000000)	H00000000
	15	Home position data (Higher)		

Note 1 The maximum position value in one operation is 2,147,483,647 (H7FFFFFFF) pulses.
Note 2 In case to return to default value, execute the command (H4D00) to set the default. See the 6.3.2 Communication Command in detail.
Note 3 At homing operation or manual operation including teaching operation, the system can be operated by setting the common parameters only.
Note 4 When data is set over the range of 2,147,483,647 (H7FFFFFFF) to –2,147,483,648(H80000000), H00000000 is set automatically for the position data of parameter No.10, 11 and 12.
Note 5 Because the common parameters and automatic operation position data are stored in EEPROM, data will not be lost at power failure. EEPROM can be rewritten up to about 100,000 times.

Common parameter default values

<table>
<tr><th rowspan="2">Parameter No.</th><th colspan="2">Default value</th><th colspan="4" rowspan="2">Content</th></tr>
<tr><th>Hexadecimal</th><th>Decimal</th></tr>
<tr><td rowspan="2">1</td><td rowspan="2">H0000</td><td rowspan="2">–</td><td>0 (b15~b12)</td><td>0 (b11~b8)</td><td>0 (b7~b4)</td><td>0 (b3~b0)</td></tr>
<tr><td>Desirable homing</td><td>Velocity magnification 6.25</td><td>Trapezoidal Acc./Dec.</td><td>Pulse magnification ×1</td></tr>
<tr><td>2</td><td>H07D0</td><td>2000</td><td colspan="4">Pulse number at one rotation of motor = 2,000 pulse
(Position control setting is pulse in parameter No.1, this data is not valid. When the setting is except for pulse, this value is valid.)</td></tr>
<tr><td>3</td><td>H07D0</td><td>2000</td><td colspan="4">Work move length at one rotation of motor = 2, 000 pulse
(Position control setting is pulse in parameter No.1, therefore this data is not valid. When the setting is except for pulse, this value is valid.)</td></tr>
<tr><td>4</td><td>H1F40</td><td>8000</td><td colspan="4">Upper limit of speed of speed control mode
= 8,000×6.25(speed magnification of parameter No.1) ×1(Magnification of parameter No.1)= 50,000 pulse/s</td></tr>
<tr><td>5</td><td>H0010</td><td>16</td><td colspan="4">Setting of initial speed of manual operation/automatic operation
= 16×6.25(speed magnification of parameter No.1) ×1(Magnification of parameter No.1) = 100 pulse/s</td></tr>
<tr><td>6</td><td>H0020</td><td>32</td><td colspan="4">the velocity in the manual operation/ High-speed homing
= 32×6.25(speed magnification of parameter No.1) ×1(Magnification of parameter No.1) = 200 pulse/s</td></tr>
<tr><td>7</td><td>H0010</td><td>16</td><td colspan="4">the velocity in the low-speed homing
= 16×6.25(speed magnification of parameter No.1) ×1(Magnification of parameter No.1) = 100 pulse/s</td></tr>
<tr><td>8</td><td>H03E8</td><td>1000</td><td colspan="4">Acceleration /Deceleration time in the homing/manual operation (unit: ms) = 1,000 ms.</td></tr>
<tr><td>9</td><td>H0000</td><td>0</td><td colspan="4">Backlash correcting data = 0 pulse</td></tr>
<tr><td>10</td><td>H3FFFFFFF</td><td>+1,073,741,823</td><td colspan="4">The maximum position data for normal rotation direction = +1,073,741,823 (H3FFFFFFF)</td></tr>
<tr><td>11</td><td>HC0000000</td><td>–1,073,741,824</td><td colspan="4">The maximum position data for reverse rotational direction = –1,073,741,824 (HC0000000)</td></tr>
<tr><td>12</td><td>H00000000</td><td>0</td><td colspan="4">Position data of the home position = 0</td></tr>
</table>

(1) Common parameter No.1



(a) Homing mode (b_{15} to b_{12})

Bits in the table below set homing modes.

b_{15}	b_{14}	b_{13}	b_{12}	Homing Mode			Data (Hexadecimal)	
							b_{15}=0(Reverse)	b_5=1(Forward)
0	0	0	0	Desirable homing			H0***	–
*	0	0	1	Low speed homing			H1*** (CW)	H9*** (CCW)
*	0	1	0	High speed homing 1 (off edge)			H2*** (CW)	HA*** (CCW)
*	0	1	1	High speed homing 2 (marker end)			H3*** (CW)	HB***CCW)
0	1	0	0	ABS Encoder Homing	YASUKAWA *1	Σ series 12bit ABS encoder	H4***	–
0	1	0	1			ΣII series 16bit ABS encoder	H5***	–
0	1	1	0			ΣII series 17bit ABS encoder	H6***	–
					HITACHI	AD series17bit ABS encoder		
0	1	1	1		SANYO	P series	H7***	–

*: Optional value *1: Not applied to 15bit ABS Encoder CW/CCW shows rotating direction.

(b) Velocity mode(b_{11} to b_8)

Bits in the table below set velocity range and velocity magnification.

b_{11}	b_{10}	b_9	b_8	Velocity magnification	Velocity range	Data (Hexadecimal)
0	0	0	0	6.25	50k pulse/s	H*0**
0	0	0	1	12.5	100k pulse/s	H*1**
0	0	1	0	25	200k pulse/s	H*2**
0	0	1	1	50	400k pulse/s	H*3**

*: Optional value

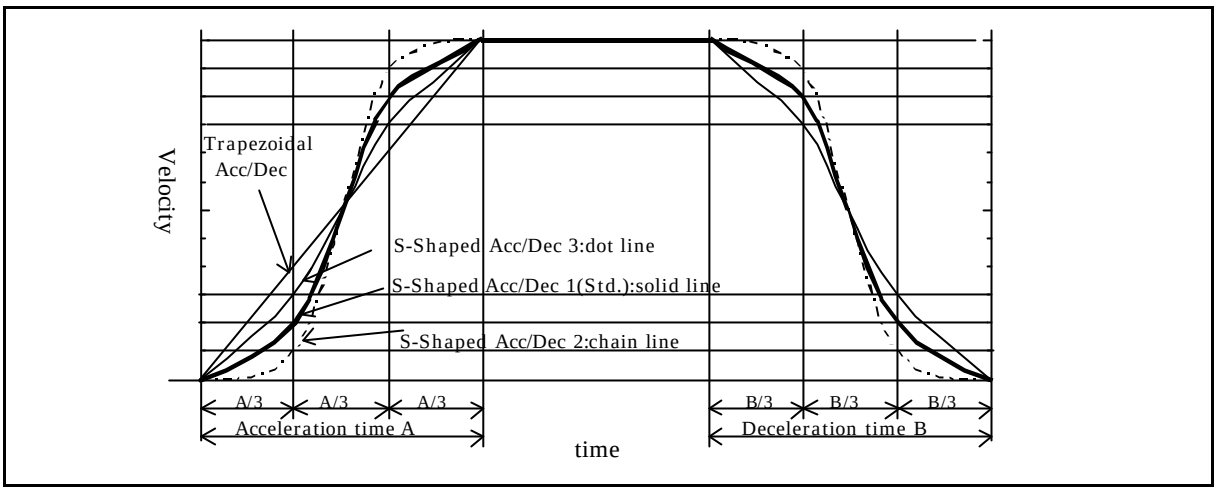
(c) Acceleration/Deceleration mode(b_7 to b_4)

Acceleration/Deceleration mode set by bits in the table below.

b_7	b_6	b_5	b_4	Acc./Dec. mode	Content	Data (Hexadecimal)
0	0	0	0	Trapezoidal Acc./Dec.mode		H**0*
0	0	0	1	S-Shaped Acc./Dec.mode1	S-Shaped Acc./Dec. standard	H**1*
0	0	1	0	S-Shaped Acc./Dec. mode2	Up/down edge is smooth than S-Shaped Acc./Dec. standard	H**2*
0	0	1	1	S-Shaped Acc./Dec. mode3	Close to Trapezoid than S-Shaped Acc./Dec. standard	H**3*

*: Optional value

Explanation of Acceleration/Deceleration mode


Velocity
Trapezoidal
Acc/Dec
S-Shaped Acc/Dec 3:dot line
S-Shaped Acc/Dec 1(Std.):solid line
S-Shaped Acc/Dec 2:chain line
A/3
A/3
A/3
Acceleration time A
B/3
B/3
B/3
Deceleration time B
time

(d) Position control magnification (b_3, b_2)

Position control magnification is to be set.

b_3	b_2	Magnification
0	0	1
0	1	10
1	0	100
1	1	1,000

(Note) In case position control unit is pulse, magnification is always 1.

(e) Position control unit (b_1, b_0)

Position control unit is to be set.

b_1	b_0	Unit	Range	To data 1
0	0	pulse	+2,147,483,647 to –2,147,483,648	1
0	1	μm	+214,748,364.7 to –214,748,364.8μm	0.1 μm
1	0	inch	+21,474.83647 to –21,474.83648 inch	0.00001 inch
1	1	degree	+21,474.83647 to –21,474.83648 degree	0.00001 degree

Control position setting ((d), (e)) *: Optional value

b_3	b_2	b_1	b_0	Magnification	Unit	Data (Hexadecimal)
0	0	0	0	1	pulse	H***0
0	0	0	1		μm	H***1
0	0	1	0		inch	H***2
0	0	1	1		degree	H***3
0	1	0	1	10	μm	H***5
0	1	1	0		inch	H***6
0	1	1	1		degree	H***7
1	0	0	1	100	μm	H***9
1	0	1	0		inch	H***A
1	0	1	1		degree	H***B
1	1	0	1	1,000	μm	H***D
1	1	1	0		inch	H***E
1	1	1	1		degree	H***F

<Position control magnification and unit>

Positioning module controls the position and velocity by number of pulses. Therefore moving distance must be converted to various units (μm, inch, degree) to number of pulses. The converting expression is as follows:

Moving amount for a pulse(Lp)

Lp = moving amount a rotation / pulse number a rotation

Setting of moving distance for a rotation, in case of μm it is 0 to 6553.5μm, in case of inch it is 0 to 0.65535 inch, in case of degree it is 0 to 0.65535 degree, therefore necessary moving distance for a rotation is lacked. In this case, set the proper position control magnification ((d)).

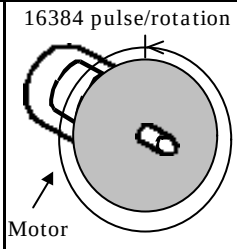
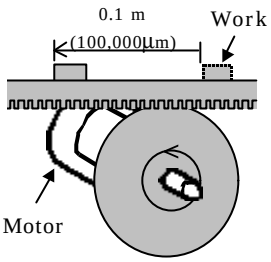
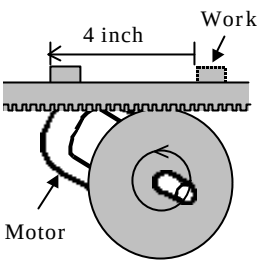
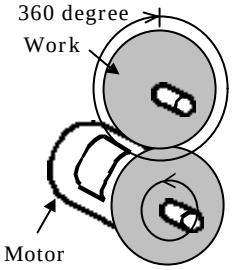
Moving amount a rotation (real moving distance)

= Moving distance a rotation (parameter No.3) × magnification (parameter No.1 (d) position control b_3b_2)

In this case, moving distance for a pulse (Lp)

Lp = moving amount a rotation × magnification / number of pulses a rotation

Examples of Position Specification Unit

Item	Example 1	Example 2	Example 3	Example 4
	Specified by pulse	Specified by μm	Specified by inch	Specified by Degree
Contents	Making a single CCW turn by the motor which moves with 16384 pulse per rotation	Moving a work 0.1m (100,000μm) , by the motor which moves with 16384 pulse per rotation	Moving a work 4inchs , by the motor which moves with 16384 pulse per rotation	Moving a work 360 degree , by the motor which moves with 16384 pulse per rotation
Motor operation				

Common parameter and automatic operation position data in example

Data	No.	item	Example 1	Example 2	Example 3	Example 4
			Specified by pulse	Specified by μm	Specified by inch	Specified by degree
Common Parameter	1	Homing mode Velocity coef. Acc./Dec. mode Position spec.	H0000 Desirable homing Velocity magnification 6.25 Trapezoidal Acc./Dec. Pulse spec, mag.1	H0009 Desirable homing Velocity magnification 6.25 Trapezoidal Acc./Dec. Mm spec mag.100	H0006 Desirable homing Velocity magnification 6.25 Trapezoidal Acc./Dec. inch spec, mag.10	H030F Desirable homing Velocity magnification 50 Trapezoidal Acc./Dec. degree spec, mag.1000
	2	Pulse per rotation	D **** (Note1) If position spec. is pulse, setting data is invalid.	D16384 16384 Pulse per rotation	D16384 16384 Pulse per rotation	D16384 16384 Pulse per rotation
	3	Work movement per Rotation	D**** (Note1) If position spec. is pulse, setting data is invalid.	D10000 10,000×0.1×100 = 100,000μm/rotation	D40000 40,000×0.00001×10 = 4 inch/rotation	D36000 36,000×0.00001×1000 = 360 degree/rotation
	4	Velocity upper limit	D8000 8,000 × 6.25 = 50k pulse/s	D8000 8,000 × 0.1 × 6.25 = 5,000 μm/s	D8000 8,000 × 0.00001 × 6.25 = 0.5 inch/s	D14400 14,400 × 0.00001 × 50 = 7.2 degree/s
	5	Initial velocity	D0016 16 × 6.25 = 100 pulse/s	D1000 1,000 × 0.1 × 6.25 = 625 /μm s	D0400 400 × 0.00001 × 6.25 = 0.025 inch/s	D4000 4,000 × 0.00001 × 50 = 2 degree/s
	6	Manual/High speed homing velocity	D0032 32 × 6.25 = 200 pulse/s	D2000 2,000 × 0.1 × 6.25 = 1,250 /μm s	D0800 800 × 0.00001 × 6.25 = 0.05 inch/s	D8000 8,000 × 0.00001 × 50 = 4 degree/s
	7	Low speed homing velocity	D0016 16 × 6.25 = 100 pulse/s	D1000 1,000 × 0.1 × 6.25 = 625 /μm s	D0400 400 × 0.00001 × 6.25 = 0.025 inch/s	D4000 4,000 × 0.00001 × 50 = 2 degree/s
	8	Acc./Dec. time	D1000 1,000 ms	D1000 1,000 ms	D1000 1,000 ms	D1000 1,000 ms
	9	Backlash	0	0	0	0
	10	Upper position data	H3FFFFFF	H3FFFFFF	H3FFFFFF	H3FFFFFF
	11	Lower position data	HC0000000	HC0000000	HC0000000	HC0000000
	12	Home position data	0	0	0	0

Note1: "*" is an optional value.

Note2: Constant 0.1 and 0.00001 used in calculations are magnification of conversion of one pulse. (Refer to clause e of common parameter No.1.)

Data	No	item	Example1	Example2	Example3	Example4
			Specified by pulse	Specified by μm	Specified by inch	Specified by Degree
Auto. Ope. Pos. Data	1	Operation mode/Dwell	H8000	H8000	H8000	H8000
			Operation valid. No continuous operation. Position control, ABS mode, Dwell 0	Operation valid. No continuous operation. Position control, ABS mode, Dwell 0	Operation valid. No continuous operation. Position control, ABS mode, Dwell 0	Operation valid. No continuous operation. Position control, ABS mode, Dwell 0
	2	Acceleration time	D1000	D1000	D1000	D1000
			1,000 ms	1,000 ms	1,000 ms	1,000 ms
	3	Deceleration time	D1000	D1000	D1000	D1000
			1,000 ms	1,000 ms	1,000 ms	1,000 ms
	4	Velocity	D0052	D3200	D1280	D14400
			52 × 6.25 = 325 pulse/s	3,200 × 0.1 × 6.25 = 2,000 μm/s	1,280 × 0.00001 × 6.25 = 0.08 inch/s	14,400 × 0.00001 × 50 = 7.2 degree/s
	5	Target position data	D16384	D1000000	D400000	D36000000
			16,384 pulse	1000,000 × 0.1 = 100,000 μm	400,000 × 0.00001 = 4 inch	36,000,000 × 0.00001 = 360 degree

(2) Common parameter No.4 to 7

Calculation of Velocity data VD in Common parameter No.4 to7 is explained here. Range of the data is 1 to 65535(HFFFF).

Velocity data (V) is calculated on the product of the velocity data (VD) set in Common parameter No.4 to7 and the Velocity magnification in Common parameter No.1 (b).

V=VD × KV V: Velocity (Output frequency)[pulse/s]
VD: Speed data (Common parameter No.4 to 7)[pulse/s]
KV: Velocity magnification(b11 to b8: H* ** in Common parameter No. 1)

<Example>
When the velocity (V) should be 10,000pulse/s, the setting of speed data (VD) is calculated as follows.

.

1) In case b11 to b8 in Common parameter No. 1 is "0" (H*0**): K_V =6.25
VD = V/ KV = 10,000/6.25 = 1,600 = D1600 (H0640)

2) In case b11 to b8 in Common parameter No. 1 is "1"(H*1**):KV=12.5
VD = V/ KV = 10,000/12.5 = 800 = D0800 (H0320)

3) In case b11 to b8 in Common parameter No. 1 is "2"(H*2**):KV=25
VD = V/ KV = 10,000/25 = 400 = D0400 (H0190)

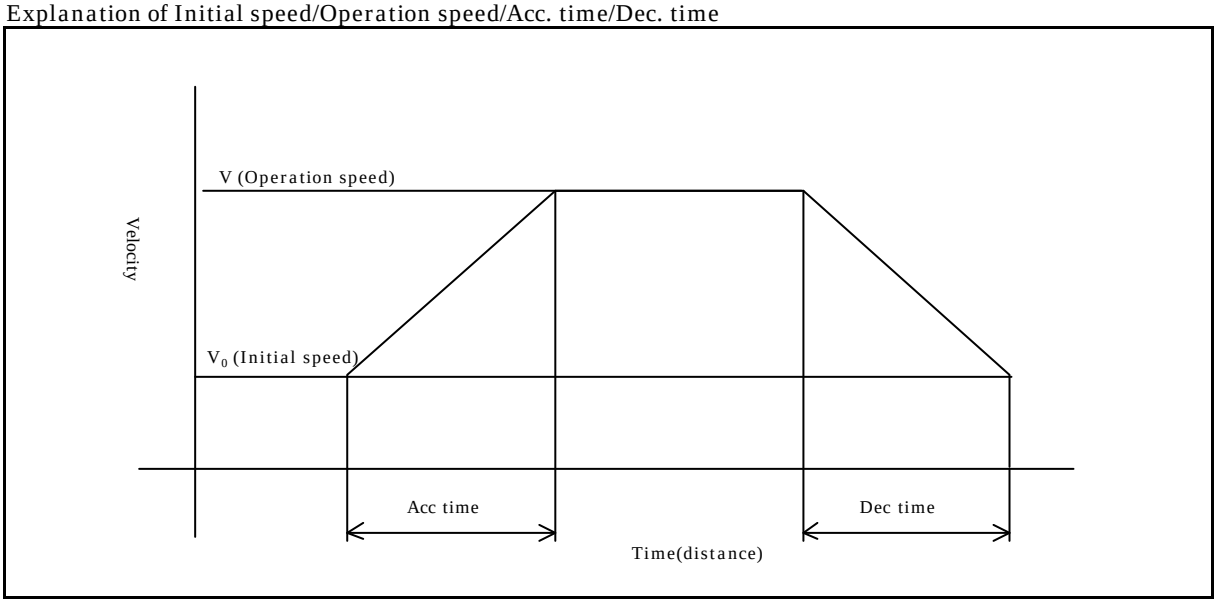
4) In case b11 to b8 in Common parameter No. 1 is "3"(H*3**):KV=50
VD = V/ KV = 10,000/50 = 200 = D0200 (H00C8)

When the velocity (V) should be Maximum speed (400k pulse/s),the setting of speed data (VD) is calculated as follows.
V= V/ KV = 400,000/50 = D8000 (H1F40)

(3) Common parameter No.8

This parameter sets the acceleration or deceleration time data. Time unit is ms and it is set in the range of 1 to 65,535 ms (1 to 65535(HFFFF)).

Explanation of Initial speed/Operation speed/Acc. time/Dec. time



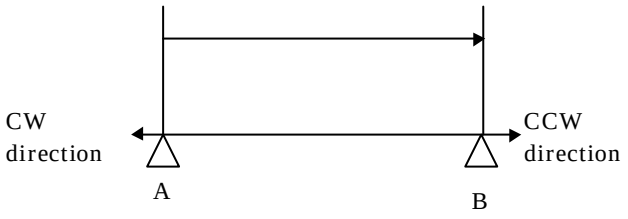
Note: If a difference between initial speed and running speed is big, a controlled motor might not stop within deceleration time. In this case, please adjust the speed by setting the initial speed or velocity mode (velocity coefficient) of common parameter No.1 (b) to rather higher.

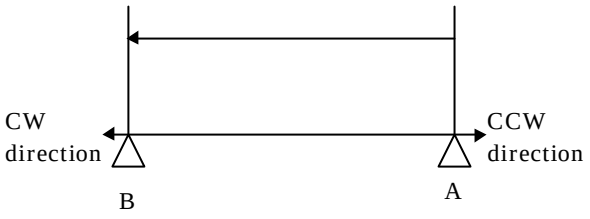
(4) Common parameter No.9

This parameter sets the backlash amount. The setting range is 1 to 65535(HFFFF).

(Backlash correction procedure)
Correction of backlash is performed every time when the direction of rotation of the mother is changed in the manual operation (including teaching operation) and automatic operation modes.
In addition note that the display of the current position changes in the homing mode.

(a) Automatic operation absolute mode
When the object is to be moved from point A to point B, the current position after moving to point B is the data of point b + the backlash amount (low-speed homing, high speed homing2), or the data of point B (high-speed homing 1) if A < B.
To the contrary, if A > B, the current position after moving to point B is the data of point B (low-speed homing, high-speed homing 2) or the data of point B – backlash amount (high-speed homing 1)





Homing mode	Current position display
Low-speed homing	B + Backlash amount
High-speed homing 1 (Note 1)	B
High-speed homing 2	B + Backlash amount

(a) In case of A<B

Homing mode	Current position display
Low-speed homing	B
High-speed homing 1 (Note 1)	B - Backlash amount
High-speed homing 2	B

(b) In case of A>B

The current position of point A displayed is also changed depending on the positional direction.

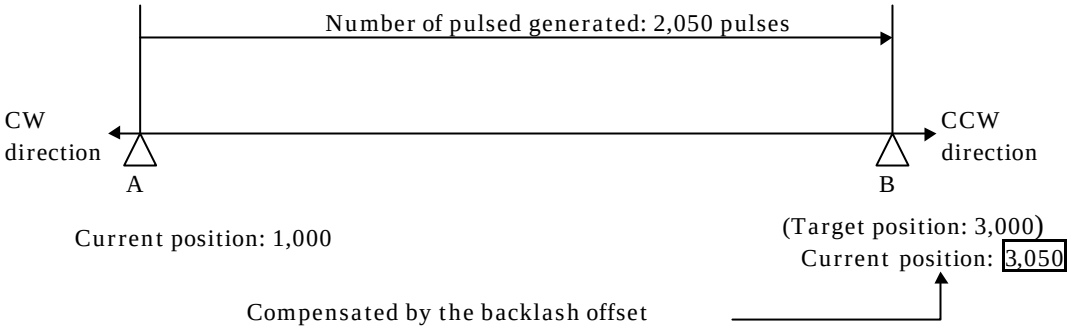
(Note 1) When ON period of the starting point LS is short (refer ⚠ Caution in 8.1.3), the value of (a) and (b) will be reversed.

(Note 2) The backlash correction is not guaranteed when an optional starting point is set.

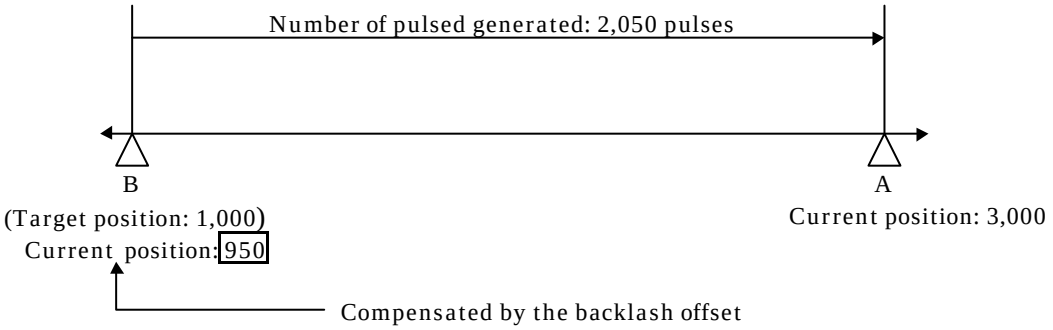
Example (In case of the automatic Operation Absolute Mode)

(1) When the homing mode is set to low-speed homing, and positioning from point A to point B is performed by the automatic operation using the following data,

Point A position : 1,000(Current position display)
Point B position : 3,000(Target position data)
Backlash amount : 50



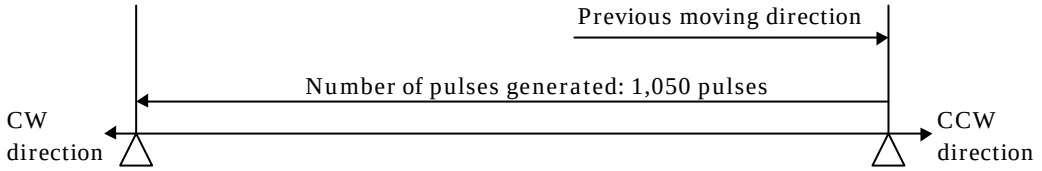
(2) When the homing mode is set to high-speed homing1, and positioning from point A to point B is performed by the automatic operation using the following data,
Point A position : 3,000(current position display)
Point B position : 1,000(Target position data)
Backlash amount : 50



(b) In case of the automatic operation increment mode
The pulses added by the backlash amount is output every time when the positioning direction is changed. Namely, If the previous positioning direction is CW, and the current direction is CCW, the number of pulses increased by the backlash amount is generated in CCW direction.
To the contrary, if the previous moving direction is CCW, and current direction is CW, the number of pulses increased by the backlash amount is generated in CW direction. If the moving directions are the same, no backlash amount is corrected.

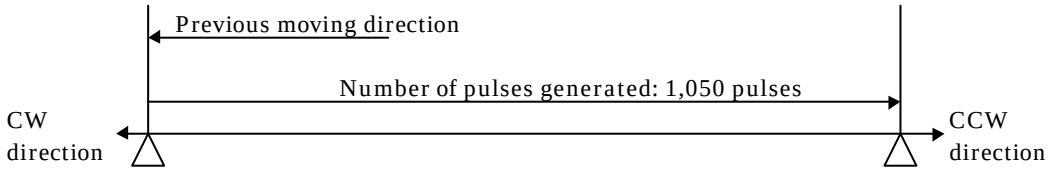
Example (In case of the automatic operation increment mode)

(1) When the moving direction is changed from CCW to CW direction
Target position data: -1,000
Backlash amount: 50



Target position: -1,000(HFFFFFC18)
Current position: -1,050(HFFFFFBE6)

(2) When the moving direction is changed from CW to CCW direction
Target position data: 1,000
Backlash amount: 50

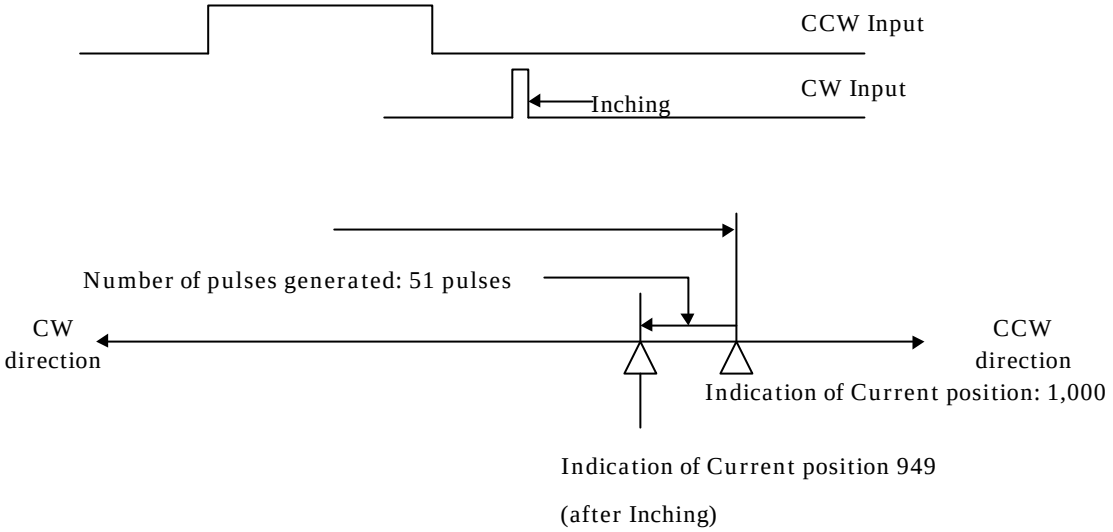


Target position: 1,000
Current position: 1,050

(c) In case of the manual operation
The pulses added with the backlash amount are output when the moving direction is changed. In case of inching operation (moving by one pulse), the backlash amount + one pulse are output.

Example (Manual Operation)

Backlash amount: 50
When the system is stopped at position 1,000 by CCW input and moved by inching operation by CW input.



Cautions required in teaching operation

Make sure to stop in the direction of homing and set the data of the target position at teaching mode using backlash compensation.

Homing mode	Stopping direction
Low-speed homing	CW direction
High-speed homing 1	CCW direction
High-speed homing 2	CW direction

(5) Common parameter No.10

This parameter sets the upper limit of the position data. The default data is 1,073,741,823(H3FFFFFFF).
The available range is between +2,147,483,647(H7FFFFFFF) and –2,147,483,648(H80000000).
If an attempt to move the system in the CCW direction with a target positional data greater than the upper limit in the automatic operation mode, the attempt will result in the maximum position error and the system will not move. However the system moves in the CW direction.
Set the positional data correctly and restart the system to release the error and to operate the system normally.
Even if an attempt is made to move the system in the CCW direction exceeding the upper limit in the manual operation, the system will reduce the speed and stop at this point. Then the maximum position error is caused, though the system moves in the CW direction normally.

(6) Common parameter No.11

This parameter sets the lower limit of position data. The default data is –1,073,741,824(HC0000000).
The available range is between +2,147,483,647(H7FFFFFFF) and –2,147,483,648(H80000000).
If an attempt is made to move the system in the CW direction with a target positional data smaller than the lower limit in the automatic operation mode, the attempt will result in the maximum positron error and the system will not move. However the system moves in the CCW direction.
Set the positional data correctly and restart the system to release the error and to operate the system normally.
Even if an attempt is made to move the system in the CW direction exceeding the lower limit in the manual operation, the system will reduce the speed and stop at this point. Then the maximum position error is caused, though the system moves in the CCW direction normally.

(7) Common parameter No.12

This parameter sets the starting point data. The default data is 0.
The current position data is changed to this data after homing operation. The available range is between +2,147,483,647(H7FFFFFFF) to -2,147,483,648(H80000000).

6.1.2 Automatic Operation Position data

The automatic positional data are consisting of 5-data as explained in the table below.
Maximum 256 steps can be set and they are stored in EEPROM of EH-POS.

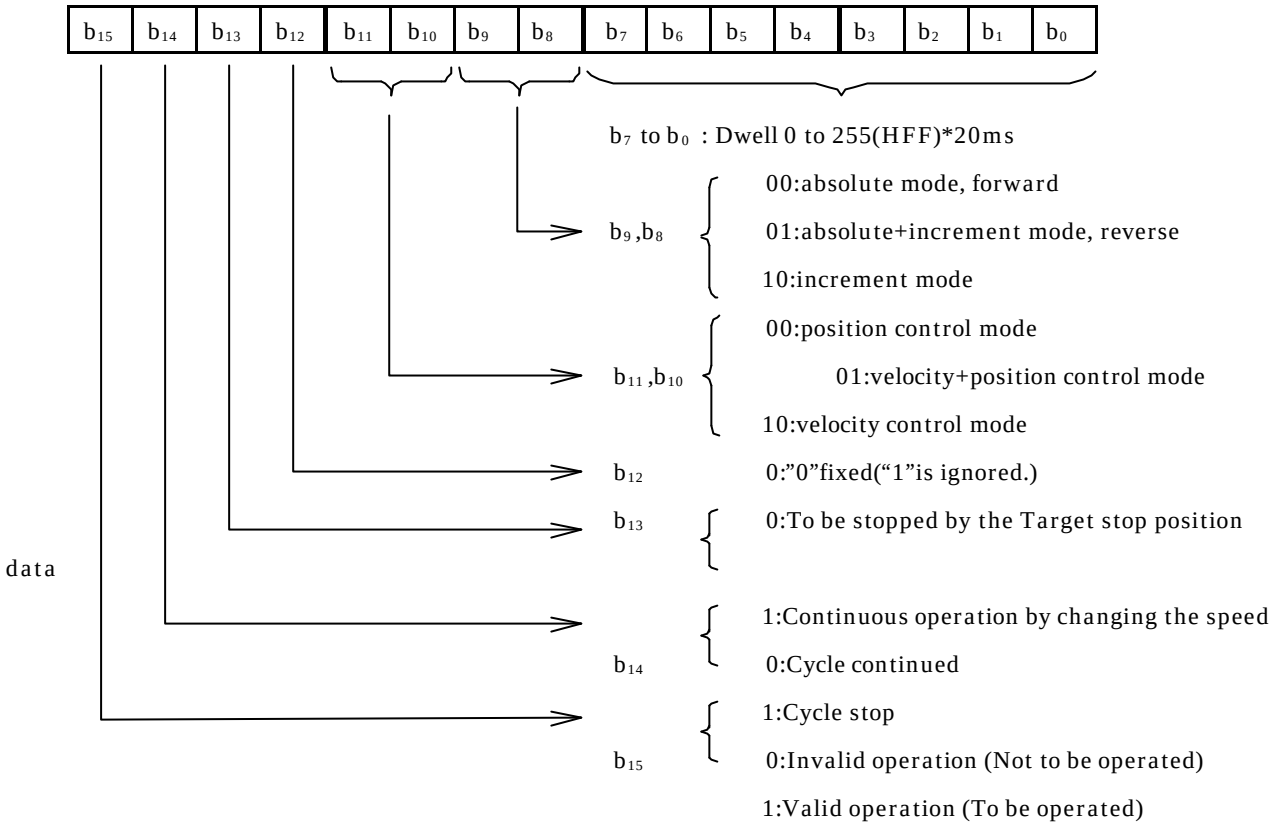
Data No.	Transmission Word No.	MSB 15 to 12	11 to 8	7 to 4	LSB 3 to 0	Contents	Default Data (Hexadecimal)
1	1	Operation mode		Dwell		Operation mode Dwell(×20ms) 0 to 255(HFF)	H8000
2	2	Acceleration time data				Acceleration time(ms) 1 to 65535(HFFFF)	H03E8 (1000)
3	3	Deceleration time data				Deceleration time (ms) 1 to 65535(HFFFF)	H03E8 (1000)
4	4	Velocity data				Velocity data 1 to 8000(H1F40)	H0020 (0032)
5	5	Target position data (Lower)				Target stop position or speed change position in continuous operation +2,147,483,647(H7FFFFFFF) to −2,147,483,648(H80000000)	H00000000
	6	Target position data (Upper)					

Note 1. Maximum moving amount for a rotation is H7FFFFFFF (2,147,483,647).
Note 2: Automatic operation data is stored in EEPROM, data is kept during power off. EEPROM can be rewritten up to about 100,000 times.
Note 3: If the target position data of parameter No.5 is set out of the range (+2,147,483,647 (H7FFFFFFF) to –2,147,483,648 (H80000000)), data will be set as H00000000.
Note 4: In homing operation and manual operation (including teaching mode), operation can be done by only setting common parameter. Automatic operation position data is not necessary to set then.
Note 5: Only 0 step is set to default data at factory setting.
Note 6: There is no command to set automatic operation position data to the default value.

Automatic operation position default data (0 step only at factory setting)

Parameter No.	Default data Hexadecimal	Default data Decimal	Content
1	H8000	–	Operation mode: Valid operation, Cycle continued, to be stopped by the target stop position data, position control mode, absolute mode Dwell (stop period)= 0×20 ms = 0 ms
2	H03E8	1000	Acceleration time(unit: ms) = 1,000 ms
3	H03E8	1000	Decceleration time(unit: ms) = 1,000 ms
4	H0020	32	Automatic operation Velocity data = 32×6.25(parameter No.1 Velocity magnification) = 200 pulse/s
5	H00000000	0	Target position data = 0

(1) Data No.1 Operation mode



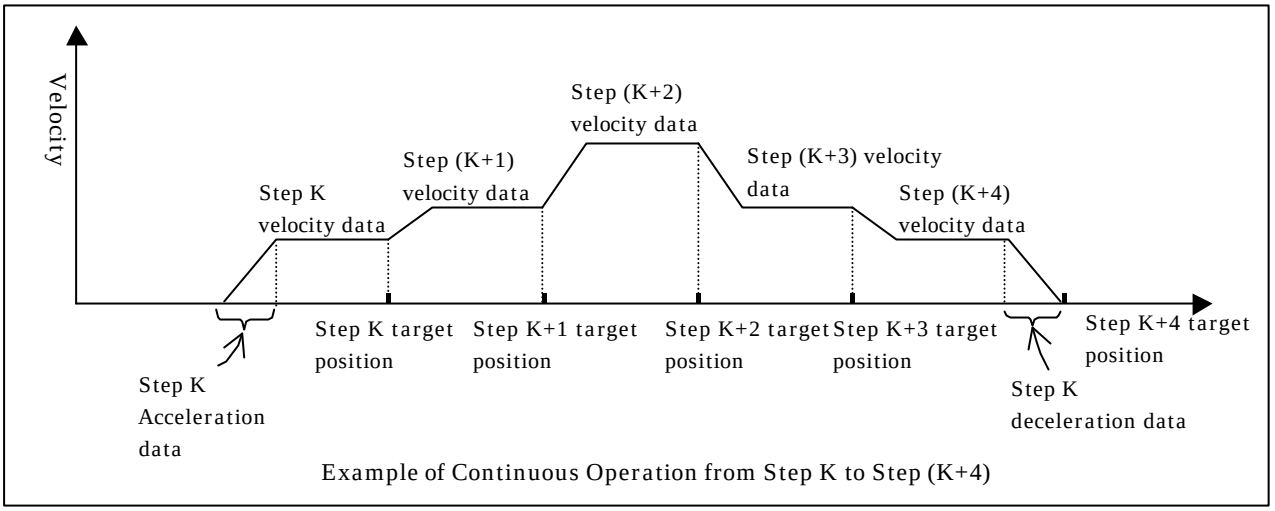
(a) Valid operation (b_{15})
When this bit is "1"(operation valid), the operation is executed. When this bit is "0" (operation invalid), it results in the command error and the system will not start. If any step which b15 is "0" exists in the cycle operation, the step is skipped and the next step is performed.

(b) Cycle stop (b_{14})
In one cycle operation and continuous cycle operation, the operation is done from the step started, and continues for one cycle or until the step which cycle stop bit (b14) is found as "1". (Note 7)

(c) Continuous operation mode (b_{13})

When the bit is set to "1" in the case where speed change is required, the target position data is set to the speed change point, changing to the velocity of the next step. The operation continues while changing its velocity until the step set to "0" is found. (Note 6)

Velocity changes up to 10 steps can be set. The direction is not changed in the continuous operation. The system always toward the final target positional data. (Notes 4 and 5)



Example of Continuous Operation from Step K to Step (K+4)

Note 1 Acceleration and deceleration time are set to those of the start step.

Note 2 If any step whose operation mode is different is found in the steps in the continuous operation, the operation results in the command error and will not be started.

Note 3 Setting more than 11 steps in the automatic continuous operation mode will result in the command error and such an operation will not be started.

Note 4 If the target position data is not found in the moving direction in an intermediate step of the continuous operation, or the target position data is smaller than the previous data while moving in the CCW direction, or the target position data is greater than the previous data while moving in the CW direction, the step is ignored and the next step is executed.

Note 5 If the final target position data in the continuous operation is closer to the start position than the target position of an intermediate step, the intermediate step is ignored and the system stops at the final target position.

Note 6 Velocity changes up to 10 steps can be set. (10 steps including invalid ones)

Note 7 When cycle stop is required in the continuous operation, set all the cycle stop bits of the steps in the continuous operation to "1".

(d) Control mode (b_{11} ,b_{10})

These bits set the control mode of each step.

i) position control mode (b_{11}=0 ,b_{10}=0)

Positioning operation is performed in the positioning mode specified by b_9 and b_8.

ii) velocity + position control mode (b_{11}=0 ,b_{10}=1)

The operation starts in the velocity control mode and positioning operation is started at the point where the control mode switching input (MOD-SEL) is changed from ON to OFF.

The current value is set to "0" in the velocity mode.

The positioning mode is set to increment mode regardless of the mode specified by b_9 and b_8.The direction of rotation is determined by the position data of data No.5 but not No.4, normal or reverse rotation bit. If the data is positive, normal direction is set while reverse rotation is set if the data is negative. Turn the control mode switching input (MOD-SEL) to ON at the start of the operation.

iii) velocity control mode(b_{11}=1 ,b_{10}=0)

The velocity only is controlled regardless of the positioning data.

Rotating direction is defined by b9 and b8. (forward direction (CCW) at b9 = 0 and b8 = 0, reverse direction(CW) at b9 =0 and b8 = 1)

The operation can be stopped by HALT command, stop bit, or +/– O.RUN only. In this case, the current value is set to "0" regardless of the positioning mode.

The step velocity can be changed by speed change command (H8000). See 6.3.1 Control command for detail.

Sample of automatic operation position data at continuous operation

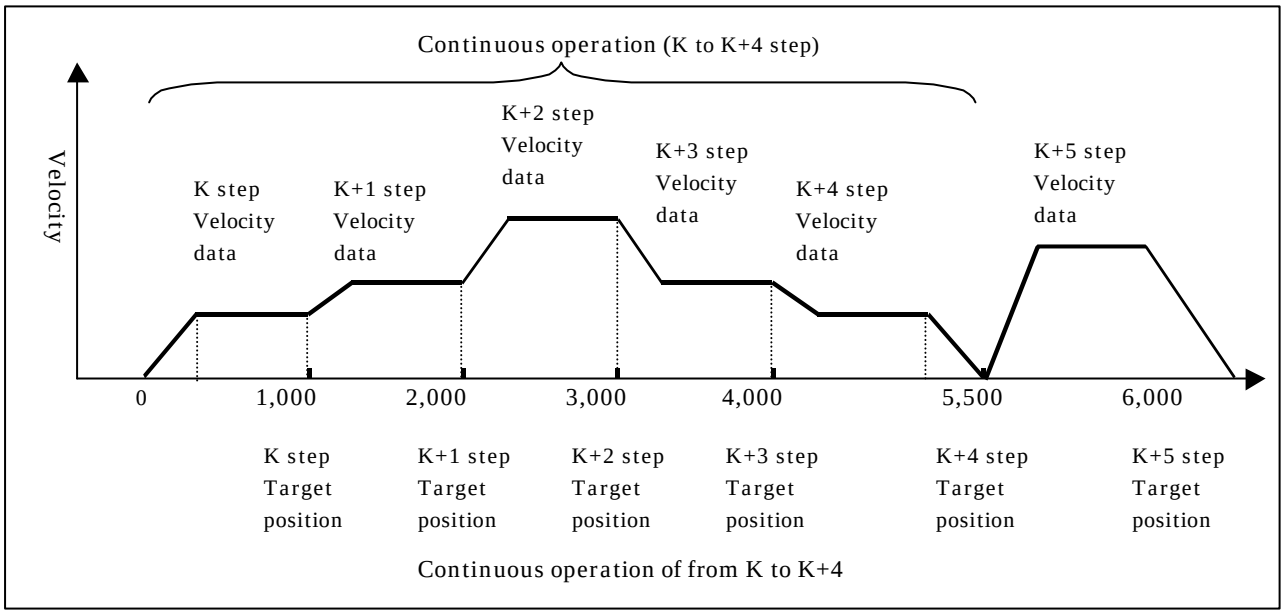


Table6.1 Example of automatic operation position data at continuous operation
(In case of stopping at K+4 step)

	Data No.	content	K step	K+1 step	K+2 step	K+3 step	K+4 step	K+5 step
Data	1	Operation mode/ Dwell	*1 **HE000**	*1 **HE000**	*1 **HE000**	*1 **HE000**	*1 **HC000**	**H8000**
	2	Acc. time	D1000	D1000	D1000	D1000	D1000	D1000
	3	Dec. time	D1000	D1000	D1000	D1000	D1000	D1500
	4	Velocity	D0020	D0030	D0050	D0030	D0020	D0040
	5	Target position	D1000	D2000	D3000	D4000	D5500	D6500

*1: If stopping step is continuous operation, cycle stop bit (b14) of all continuous operation steps should be "1".

Table 6.2 Example of automatic operation position data at continuous operation
(In case of not stopping until last step)

	Data No.	content	K step	K+1 step	K+2 step	K+3 step	K+4 step	K+5 step
Data	1	Operation mode/ Dwell	**HA000**	**HA000**	**HA000**	**HA000**	**H8000**	**HC000**
	2	Acc. time	D1000	D1000	D1000	D1000	D1000	D1000
	3	Dec. time	D1000	D1000	D1000	D1000	D1000	D1500
	4	Velocity	D0020	D0030	D0050	D0030	D0020	D0040
	5	Target position	D1000	D2000	D3000	D4000	D5500	D6500

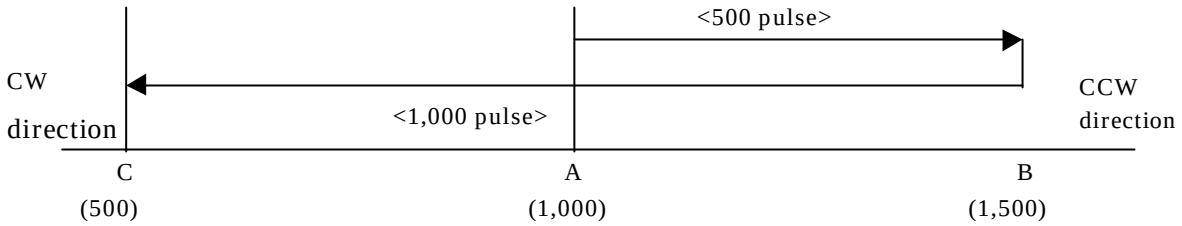
(e) Positioning mode (b_9, b_8)

These bits specify the positioning mode for each step.

i) Absolute mode (b_9=0,b_8=0)

The system is operated in the absolute coordinate mode.

(Ex.)A (position data: 1,000) →B (Position data: 1,500) →C (Position data: 500)
Execute the positioning. (Without backlash)

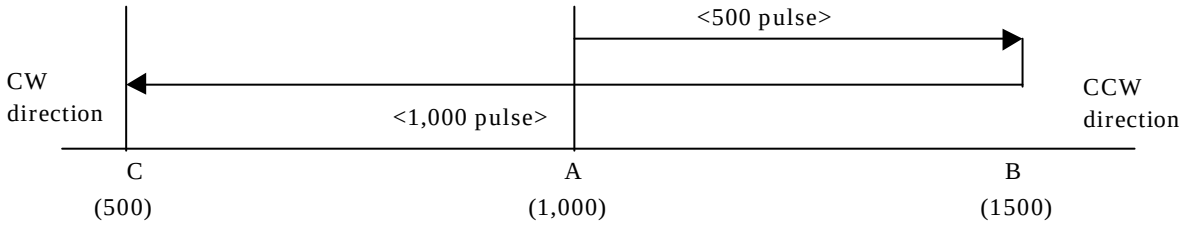


The position data are considered as the absolute coordinates.
The value in ( ) indicates the current value after positioning, while the value in < >is the number of pulses generated.

ii) Absolute + increment mode (b_9=0, b_8=1)

The current value is controlled by the absolute value and the positional data are considered as the moving distance.

(Ex.)A (Position data: 1,000) →B (Position data: 500) →C (Position data: -1,000)
Execute the positioning. (Without Backlash)

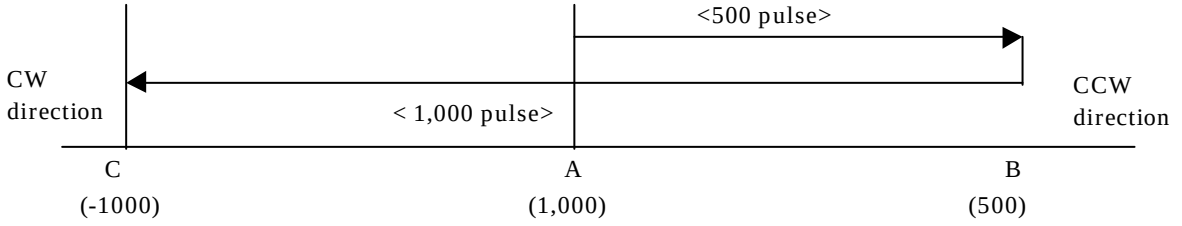


The position data are considered as the absolute coordinates.
The value in ( ) indicates the current value after positioning, while the value in < >is the number of pulses generated.

iii) Increment mode (b_9=1, b_8=0)

At the start of the operation, the current position is set to “0” first. The position data is moving distance. The same applies to re-start of the operation after HALT.

(Ex.)A (Position data: 1,000) →B (Position data: 500) →C (Position data: -1,000)
Execute the positioning. (Without Backlash)



The position data are considered as the absolute coordinates.
The value in ( ) indicates the current value after positioning, while the value in < >is the number of pulses generated.

The operation mode list is shown in table 6.3. Data "a" and "b" indicate operation mode (automatic operation position data No.1 H a b**). ** is dwell.

Table 6.3 Operation Mode List

Data		Operation mode				
		Explanation of a (b_{15}- b_{12})			Explanation of b (b_{11}- b_8)	
a	b	(a) Operation valid/invalid	(b)Cycle continue/stop	(c) At target position stop/continue	(d)Control mode	(e)Positioning mode
8	0	valid	continue	stop	position	ABS
	1	valid	continue	stop	position	ABS +INC
	2	valid	continue	stop	position	INC
	4	valid	continue	stop	velocity + position	INC *2
	8	valid	continue	stop	velocity	Forward *1
	9	valid	continue	stop	velocity	Reverse *1
A	0	valid	continue	continue	position	ABS
	1	valid	continue	continue	position	ABS +INC
	2	valid	continue	continue	position	INC
	4	valid	continue	continue	velocity + position	INC *2
C	0	valid	stop	stop	position	ABS
	1	valid	stop	stop	position	ABS +INC
	2	valid	stop	stop	position	INC
	4	valid	stop	stop	velocity + position	INC *2
E	0	valid	stop	continue	position	ABS
	1	valid	stop	continue	position	ABS +INC
	2	valid	stop	continue	position	INC
	4	valid	stop	continue	velocity + position	

*1: Rotating direction in velocity control mode

*2: In velocity control mode, the current position becomes to "0". In position control mode, the current position is shown by increment mode.

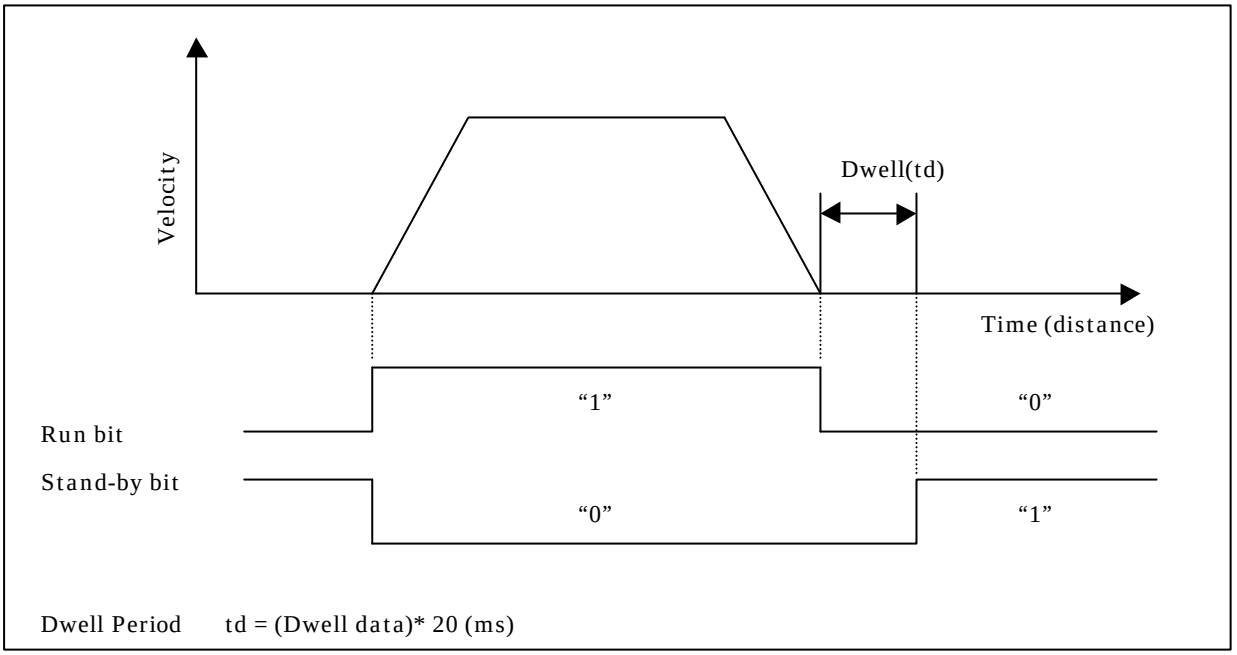
How to use Table 6.3

Example 1. At some step, when you need (a) valid operation, (b) continuous cycle, (c) stopping at target position, (d) position control mode, (e) ABS positioning, then you have to select H80** as automatic operation position data No.1 (here, ** is dwell).

Example 2. At some step, when you need cycle to be stopped, and other conditions are same as sample1, automatic operation position data becomes HC0** (here, ** is dwell).

(2) Data No.1 Dwell (Stop period)

Dwell can be set. The period can be set by the unit of 20 ms and within the range of 0 to 5,100 ms (= 20 ms * 255). The available data range is between 0 and 255(HFF).



(3) Data No.2, No.3 (Acceleration rate and deceleration rate data)

Acceleration and deceleration rate can be set independently. Refer to Parameter No.8 Acceleration and deceleration rate in section 6.1.1(3) Common parameters No.8 for the calculating procedures.
The available range is between 1 and 65535(HFFFF).

(4) Data No.4 (Velocity data)

Refer to parameter No.4 to 7 in section 6.1.1(2) Common parameters for the calculating procedures.
The available range is between 1 to 65535 (HFFFF). Set a value so that the value does not exceed the upper limit of the common parameter No.4.
Set the velocity data greater than the initial velocity of common parameter No.5. If the velocity data is smaller than the initial velocity, the command error (H0004) is issued and the operation will be executed with the velocity data as automatic operation velocity.

(5) Data No.5 (Target position data)

Set the target position data between upper limit position data of common parameter No.10 and lower position data of common parameter No.11. The operation will result in maximum position error if the velocity data is out of the range.
Moreover, note this data is absolute coordinate position or moving distance depend on control mode. Refer to (1)(e) control mode (b_{11} ,b_{10}).

(a) Absolute mode (b_{11}=0 ,b_{10}=0)
Absolute coordinates position
(b) Absolute + increment mode (b_{11}=0 ,b_{10}=1)
Moving distance
(c) Increment mode (b_{11}=1 ,b_{10}=0)
Moving distance

Note 1 Maximum moving distance is 2,147,463,647 (H7FFFFFFF) pulses in one step operation. Also in case of continuous operation, the maximum moving distance is 2,147,483,647 (H7FFFFFFF) pulses from start to end of operation.

Note 2 In case of setting the target position data, if it is set over the maximum moving distance (+2,147,483, 647 (H7FFFFFFF) to –2,147,483,648 (H80000000)), the target position is set as "0".

6.2 Register configuration and operation data setting

6.2.1 I/O Allocation

I/O allocation of EH-POS is word 4W/4W. Refer to EH-150 application manual for Setting of I/O allocation.

6.2.2 I/O register configuration

Setting of data from EH-CPU to EH-POS, start of the operation or display of the EH-POS operation status is performed through word registers connected with the PI/O bus. The function of the word registers (8-word) is shown in the Figure 6.1.

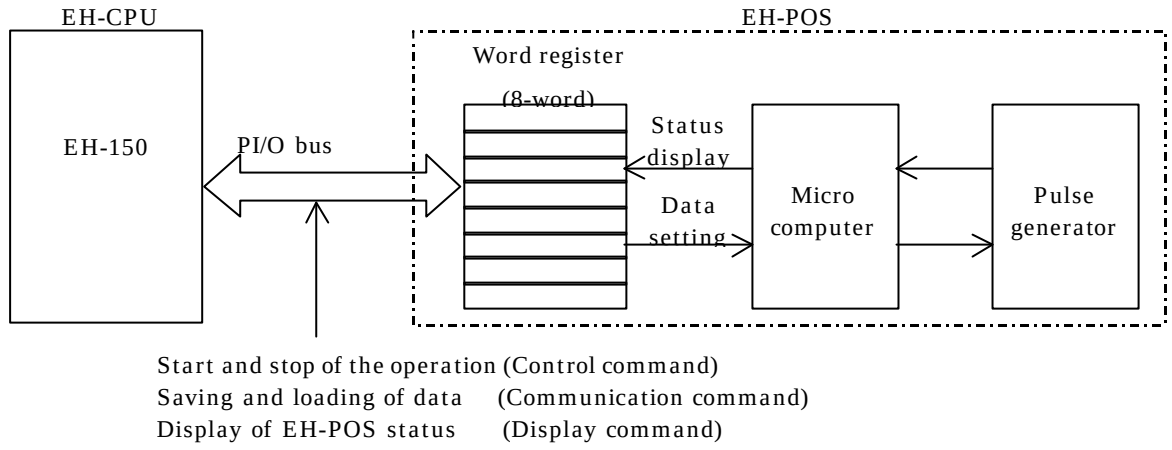


Figure 6.1 Word register function

Figure 6.2 shows the word register structure.
The word registers consist of the 4-word input register (WX***0 to WX***3) and the 4-word output registers (WY***4 to 7).
The input registers consist of 4 words totally. They are the status register (WX***0) consisting mainly of the status display bit, unused register (WX***1), and 2-words of display area (WX***2, WX***3) in which the displayed contents can be switched by display commands. The input register data can only be read from the CPU, but not be written.
The output registers consist of four words: the control register (WY***4) for issuing the various commands from EH-CPU to EH-POS and the 3-word transmission area (WY***5, WY***6, WY***7) for setting the operation data to EH-POS. The output registers can be written data only from the EH-CPU. (However the forced setting can be done through the external programming tools.)

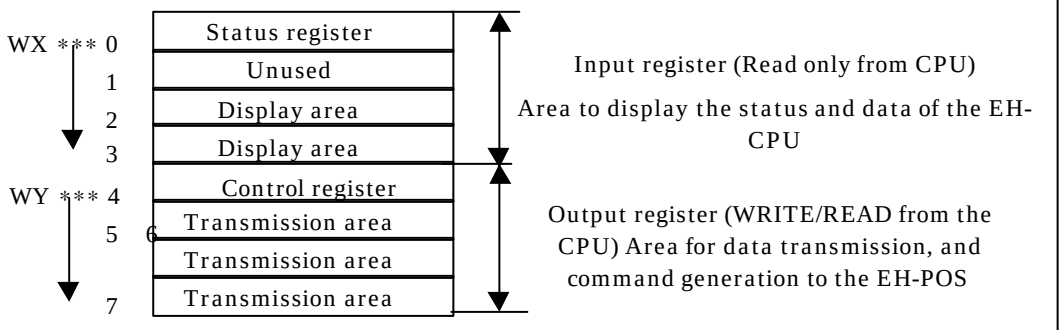


Figure 6.2 Structure of word register

In I/O register, data of status register (WX***0) and control register (WY***4) can be dealt as bit data. In this case, their addresses are X***00 to X***15, Y***64 to Y***79. The other registers can not be dealt as bit data but dealt as word data.

6.2.3 Status register(Input register) Bit Allocation

Bit allocations of status register (WX***0) is shown in bellow.

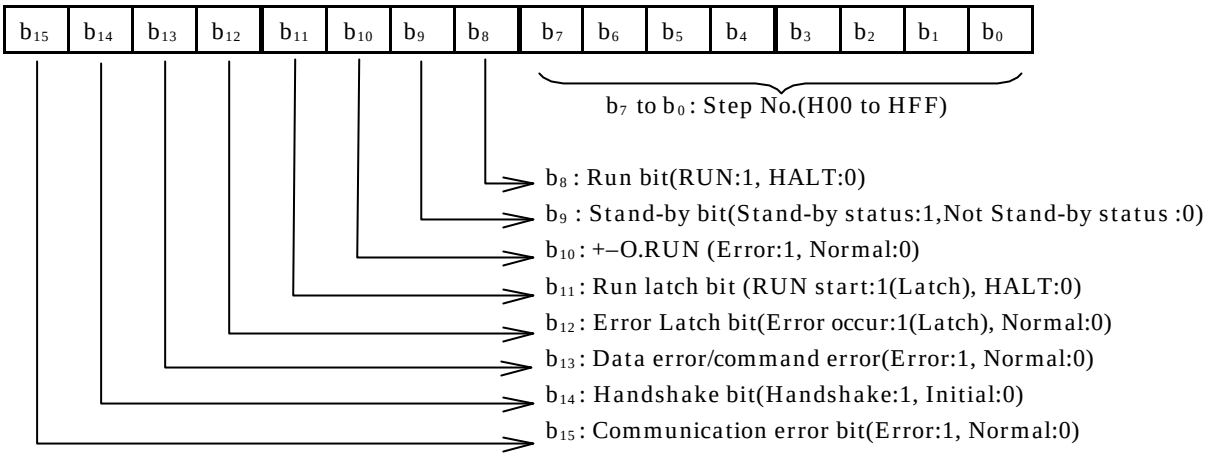


Table 6.4 Status Bit register bit description

Bit No.	Bit Name	Value	Content
b_0 to b_7	Step No.	Step No.	During Run: operating step No., HALT: previous step No.
b_8	Run bit	1	During RUN (pulse generated)
		0	During HALT (pulse stopped)
b_9	Stand-by bit	1	During Stand-by ((a) after returning to the starting point, (b)after termination of automatic operation(after dwell, positioning complete input),(c) after completing pulse output in manual operation)
		0	During not Stand-by ((a)power is reset (b)reset switch ON (c)overrun error (d)during RUN(from RUN start to positioning complete input)
b_{10}	+–O.RUN	1	During overrun error
		0	During normal(overrun error clear)
b_{11}	Run latch bit	1	Start operation(receive control command) (This bit is set to “0” by communication initial command.)
		0	During HALT
b_{12}	Error latch bit	1	When data error or command error occurs, this bit is latched to “1”. (This bit is set to “0” by communication Initial command.)
		0	During normal
b_{13}	Data error / command error	1	Data error or command error (When EH-POS is restarted with correct data, or when another control command is issued, this bit is set to “0”)
		0	During normal
b_{14}	Handshake bit	1	During handshake (This bit is for communication procedure. Refer to communication procedure.)
		0	During communication initial
b_{15}	Communication error bit	1	During communication error (This bit is set to “0”, when communication initial command(H5100) is issued.)
		0	During normal

Note: The initial values (at power on or reset switch on) are all set to “0”.

6.2.4 Control register(Output register) Bit allocation

Bit allocations of Control register (WY***4) is shown in bellow.

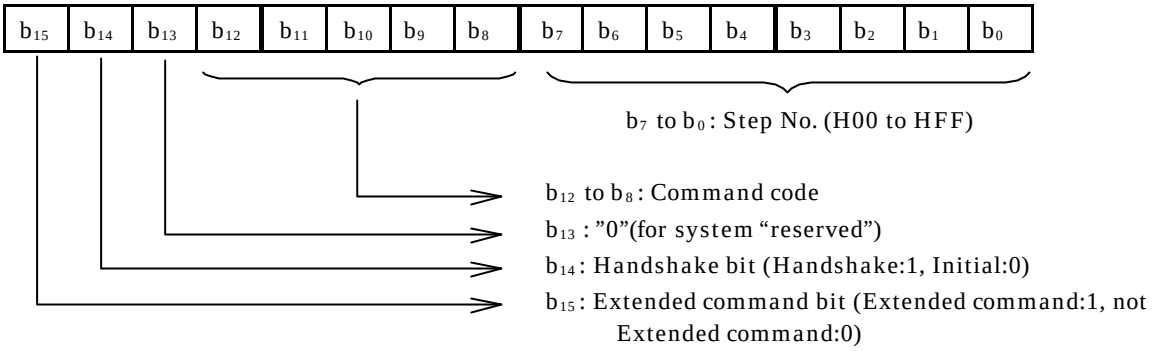


Table 6.5 Control register bit description

Bit No.	Bit Name	Content
b_0 to b_7	Step No. or parameter number. (There is exception)	1) Step No. (H00 to HFF) which Control command executes by. 2) Parameter No. of Communication command (common parameter rewriting) 3) Step No. of communication command (automatic operation position data rewriting). 4) Parameter No. of display command (Common parameter reading) 5) Step No. of display command (automatic operation position data reading)
b_8 to b_{12}	Command code	Code of control command, communication command or display command (Refer command code table for detailed.)
b_{13}	Reserve	To be set to "0"
b_{14}	Handshake bit	Communication procedure bit (Refer to communication procedure for detail.)
b_{15}	Extended command bit	When it is extended command, the bit is set to "1" (Refer to command code table.)

Note: The initial values (Power ON or reset switch ON) are all set to "0".

6.3 Command

Operation, communication, and display can be controlled by writing various commands into the control register (WY***4). There are three kinds of command.

No.	Kind	Function
1	Control command	Executes start and stop control of operation
2	Communication command	Sets common parameter and automatic operation position data
3	Display command	Displays current position, error code and setting data

6.3.1 Control command

Table 6.6 Control command

No	Control register written value	Command name	Positioner display	Content
1	H0100	Homing	STARTING POINT	Starts the homing
2	H0200	Manual operation	MANUAL1	Sets to manual operation mode (By External Input M-CCW/M-CW, forward/reverse pulse is generated.) It Is cancelled by stop command.
3	H03**	Manual operation	MANUAL2	This command generates pulse, and it is stopped by stop command.
	H0300	Forward manual operation		This command generates forward continuous pulse, and it is stopped by stop command.
	H0301	Forward JOG operation		This command generates forward one pulse (JOG).
	H0310	Reverse manual operation		This command generates reverse continuous pulse, and it is stop by stop command.
	H0311	Reverse JOG operation		This command generates reverse one pulse (JOG).
4	H04**	Automatic step operation	RUN STEP	Starts the step H**(2 digits in hexadecimal) of positioning operation.
5	H05**	Automatic cycle operation	RUN CYCL	One cycle positioning operation is performed continuously from step H** to the step whose cycle stop bit is “1”.
6	H06**	Automatic continuous cycle operation	RUN CONT	Cyclic positioning operation from the step H** to step whose cycle stop bit is “1” is performed continuously.
7	H07**	Stop	STOP	
	H0700	Deceleration stop	STOP (single click)	
	H07FF	Emergency stop	STOP (double click)	
8	H8000	Velocity change (Note 1)	None	Changes the velocity in operation to the value of (WY***5). The stored data is not changed.
9	H84**	Velocity and position data specified automatic step operation (Note 2)	None	Automatic step operation is performed by using the control mode, acceleration time and deceleration time which are used in the stored data of ** STEP, and by using the specified data of velocity and position in operation. It is not used for continuous operation. The stored data is not changed

Note 1: Changes the velocity in operation to the value of (WY***5). The stored data is not changed.
It is reflected to homing, manual operation and automatic operation. It is ignored during stop.
(In manual operation mode, it is valid until setting is cleared), but the stored data of common parameter and automatic operation position data is not changed.
In case of S-shaped acceleration/deceleration mode, the mode is changed to trapezoidal mode after the time point the velocity change command is executed.

Note 2: The velocity data is the data in communication area WY***5 when operation command is received.
The position data is data of WY***6(lower) and WY***7(upper).
Because the data is not kept and operation is performed with position data and velocity data, it is very effective to rewrite position data every time.
System does not rewrite EEPROM. EEPROM can be rewritten up to about 100,000 times.

6.3.2 Communication command

Table 6.7 Communication command

Data	No.	Control register written value	Command Name	Content	Word Number
Common parameter	1	H4E01	Starting point/velocity/ Acc./Dec. /position instruction mode set	Updates common parameter No.1 with data in WY***5	1
	2	H4E02	Pulse number for a rotation data set	Updates common parameter No.2 with data in WY***5	1
	3	H4E03	Moving amount a rotation data set	Updates common parameter No.3 with data in WY***5	1
	4	H4E04	Upper limit of velocity data set	Updates common parameter No.4 with data in WY***5	1
	5	H4E05	Initial velocity data set	Updates common parameter No.5 with data in WY***5	1
	6	H4E06	Manual/High-speed homing velocity data set	Updates common parameter No.6 with data in WY***5	1
	7	H4E07	Low-speed homing velocity data set	Updates common parameter No.7 with data in WY***5	1
	8	H4E08	Acc./Dec. time data set	Updates common parameter No.8 with data in WY***5	1
	9	H4E09	Backlash data set	Updates common parameter No.9 with data in WY***5	1
	10	H4E0A	Upper limit of position data set	Updates common parameter No.10 with data in WY***5(lower) and WY***6(Upper)	2
	11	H4E0B	Lower limit of position data set	Updates common parameter No.11 with data in WY***5(lower) and WY***6(Upper)	2
	12	H4E0C	Starting point position data set	Updates common parameter No.12 with data in WY***5(lower) and WY***6(Upper)	2
	13	H4F00	Common parameter all data set	Updates common parameter No.1 to No.12 (total 15 word) with 3 word by 5 times (Note 1)	15
	14	H4D00	Default value setting	Sets the Common parameters to default values	–
Automatic operation position data	15	H49**	Control mode set	Updates automatic operation position data No.1 in **step with data in WY***5	1
	16	H4A**	Acc./Dec. time data set	Updates data of automatic operation position data No.2 in **step with data in WY***5, and data No.3 with data in WY***6.	2
	17	H4B**	Velocity data set	Updates automatic operation position data No4. in **step with data in WY***5	1
	18	H4C**	Target position data set	Updates automatic operation position data No.5 with data in WY***5(lower), WY***6(upper)	2
	19	H48**	One step position data set	Updates automatic operation position data(total 6 word) with 3 word by 2 times (Note 1)	6
Other	20	H4DFF	Current position data set	Updates current position data with data in WY***5(lower) and WY***6(Upper)	2
	21	H5100	Communication Initial command	Initializes communication process (waiting for receipt of data). Releases communication error.	–

Note 1. Refer communication procedure (Handshake procedure).

Note 2. EEPROM can be rewritten up to about 100,000 times.

6.3.3 Display command

Table 6.8 Display command list

No.	Control register writing value	Content of display area		Remark
		WX***3	WX***2	
1	H1800	Current position (upper)	Current position (lower)	Displays by renewing by 10mS
2	H5800	Current position(upper)	Current position (lower)	Displays by holding the position
3	H59**	0	Step ** control mode/dwell	Automatic operation position data No.1
4	H5A**	Step ** deceleration time	Step ** acceleration rate data	Automatic operation position data No.2,3
5	H5B**	0	Step ** velocity data	Automatic operation position data No.4
6	H5C**	Step ** target position (upper)	Step ** target position (lower)	Automatic operation position data No.5
7	H5F01	0	Starting point/velocity/Acc./Dec. /position specification mode	Common parameter No.1
8	H5F02	0	Pulse number for a rotation	Common parameter No.2
9	H5F03	0	Moving amount for a rotation	Common parameter No.3
10	H5F04	0	Upper limit of velocity	Common parameter No.4
11	H5F05	0	Initial velocity	Common parameter No.5
12	H5F06	0	Manual/high-speed return to home velocity	Common parameter No.6
13	H5F07	0	Low-speed return to home velocity	Common parameter No.7
14	H5F08	0	Acceleration/Deceleration time	Common parameter No.8
15	H5F09	0	Backlash	Common parameter No.9
16	H5F0A	Upper limit of position data (upper)	Upper limit of position data (lower)	Common parameter No.10
17	H5F0B	Lower limit of position data (upper)	Lower limit of position data (lower)	Common parameter No.11
18	H5F0C	Home position data (upper)	Home position data (lower)	Common parameter No.12
19	H5000	0	Error code	Error code
20	H5100	0	Software revision	Software revision No. Common with communication initialize command

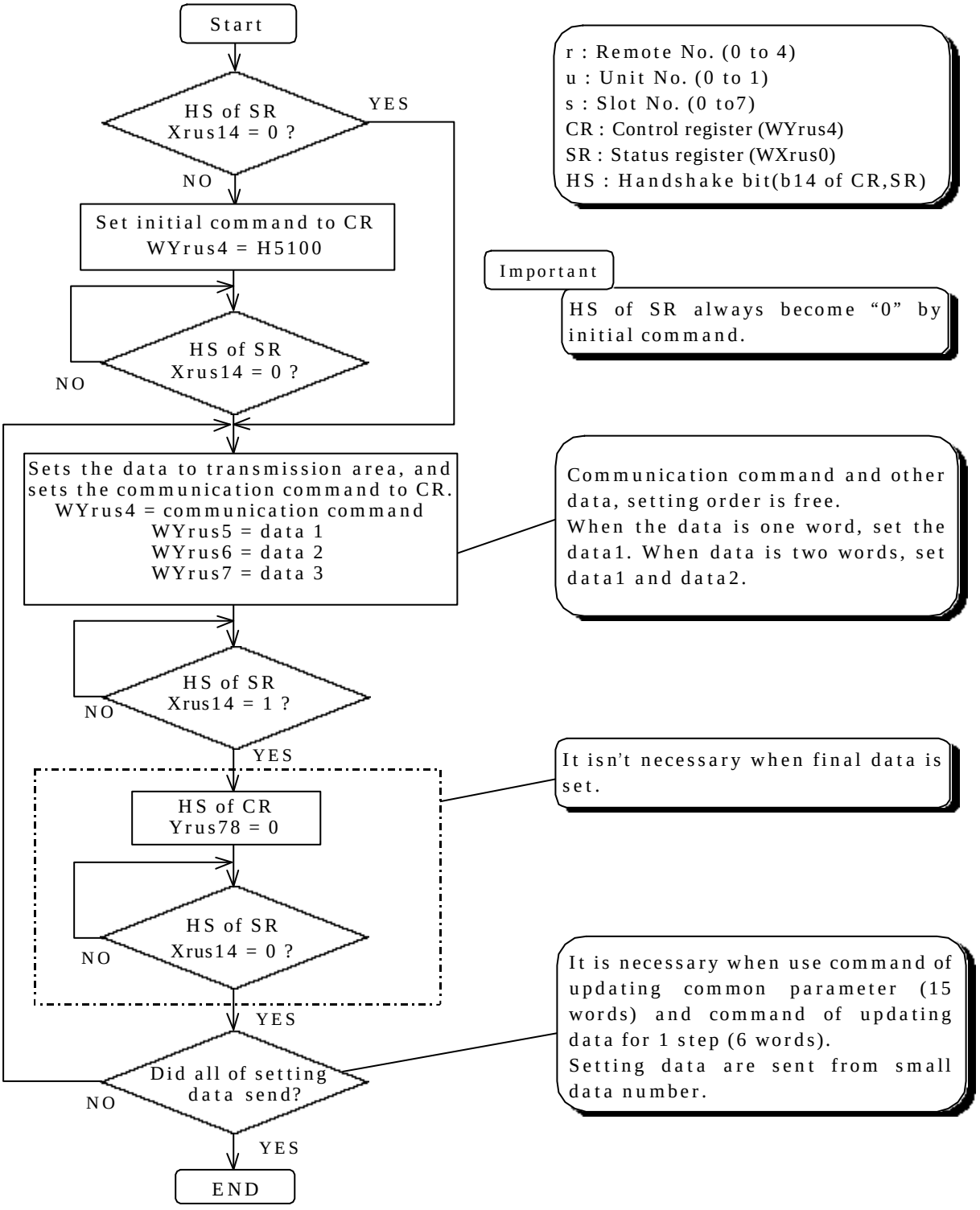
(Note) Display command as well as communication command is controlled by Handshake procedure.
(The handshake bit: “1“ execute, “0“ release)
After starting generating pulse line, current position data (upper data) is indicated in WX***3 and lower data is indicated in WX***2 in every 10 ms.

Chapter 7 Data Setting and Reading

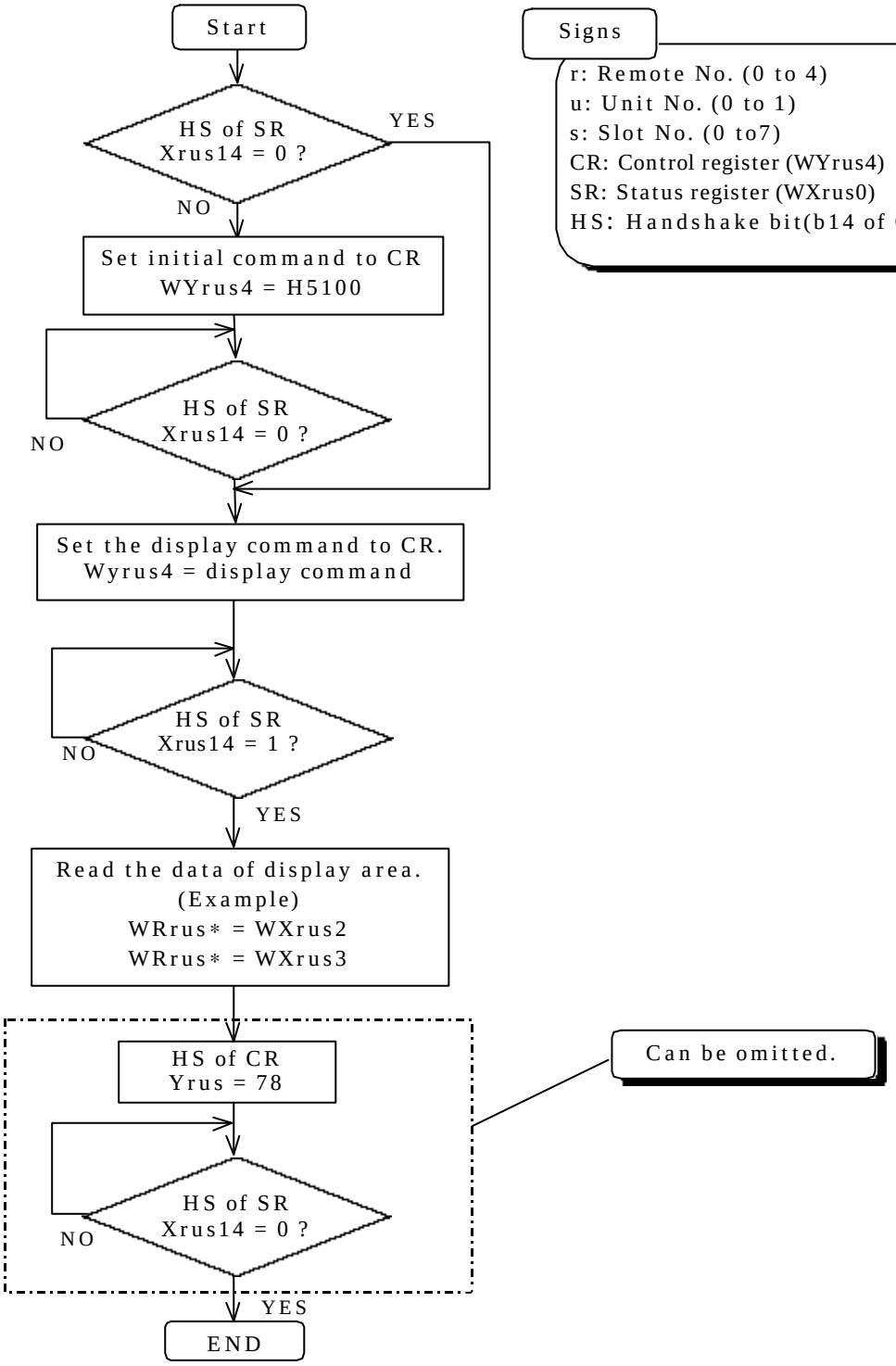
The operation data are set by communication command, and read out by display command. There are two ways to set and read the data. One is by using handshake bit through PI/O bus, and other is by using Positioner (option unit) through serial port of EH-POS. Here the way of using handshake bit is explained.

7.1 Communication sequence

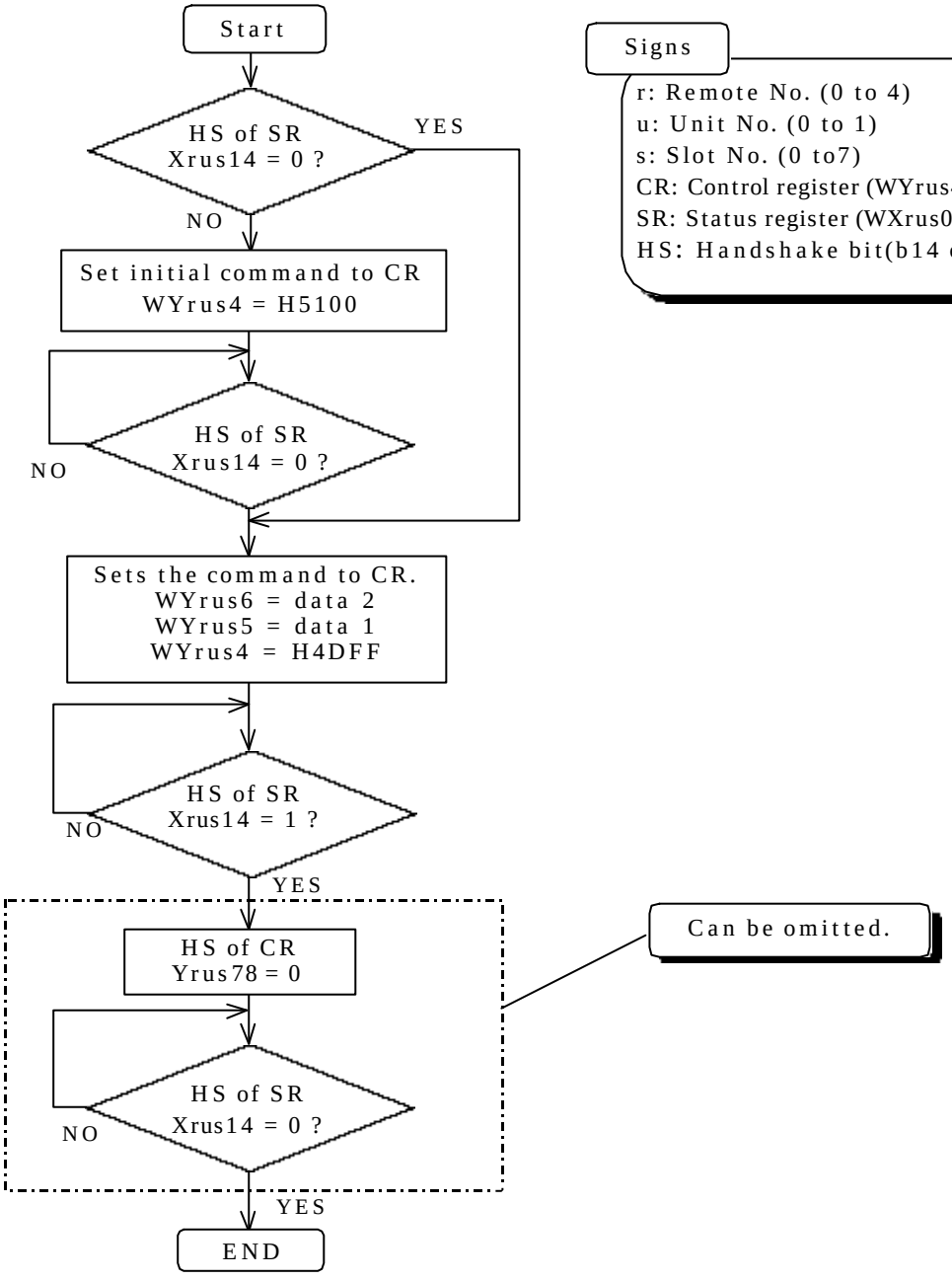
7.1.1 Setting communication flow (communication command)



7.1.2 Reading communication flow (in case of Display command)



7.2 Communication flow to change current data

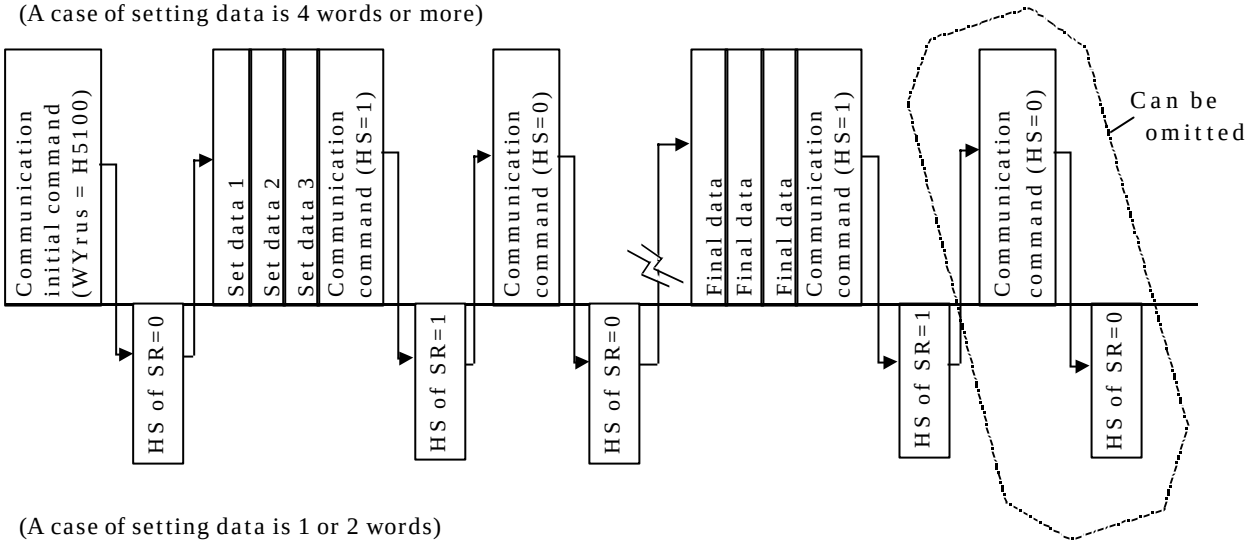


7.3 Handshake sequence

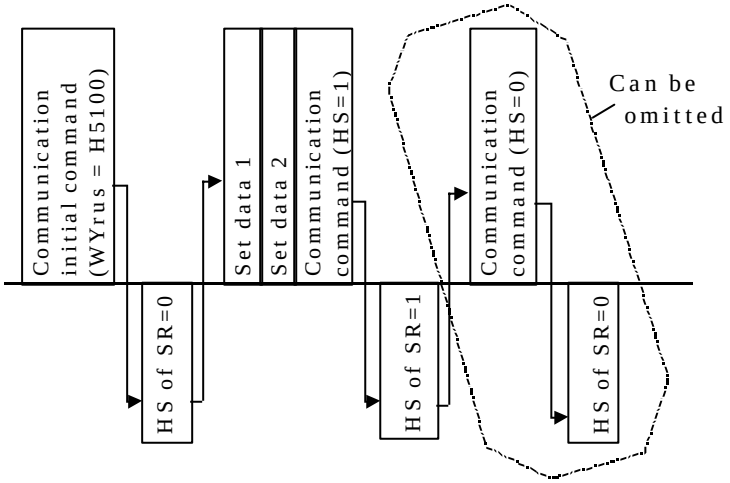
Handshake sequence of communication and display command are as follows.

7.3.1 Communication command

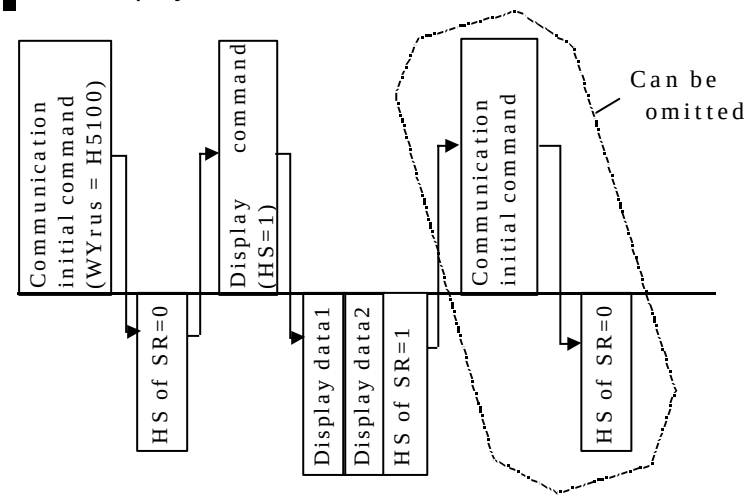
(A case of setting data is 4 words or more)



(A case of setting data is 1 or 2 words)



7.3.2 Display command



7.3.3 Transmission matrix

Table7.1 Transmission matrix of between CPU and EH-POS

				CPU operation (issue of command)					
	No.	state	event code	A	B	C	D	E	F
			Event / status	trs.com YHS = 1	trs.com YHS = 0	dpl.com YHS = 1	dpl.com YHS = 0	trs. initial YHS = 1	trs. initial YHS = 0
EH-POS	1	stop	waiting (YHS = 0)	→2	→3	→2	→3	→1	→3
	2		set finish (YHS = 1)	→3	→1	→3	→1	→1	→1
	3		trs. error	→3	→3	→3	→3	→1	→3
	4	run	waiting (YHS = 0)	→5	→6	→5	→6	→4	→6
	5		set end (YHS = 1)	→6	→4	→6	→4	→4	→4
	6		trs. error	→6	→6	→6	→6	→4	→6
	7		com. error	→7	→4	→7	→7	→4	→7

				CPU operation		Positioner operation		
	No.	state	event code	G	H	J	K	L
			Event / status	ctr.com same as before	ctr.com different to before	data writing	operation start	data display
EH-POS	1	stop	waiting (YHS = 0)	→4	→4	→1	→4	→1
	2		set finish (YHS = 1)	→4	→4	→2	→5	→2
	3		trs. error	→6	→6	→3	→6	→3
	4	run	waiting (YHS = 0)	→4	→7	→4	–	→4
	5		set end (YHS = 1)	–	→7	→5	–	→5
	6		trs. error	–	→7	→6	–	→6
	7		com. error	→7	→1 or 7	→7	–	→7

Abbreviation : trs = transmission, dpl = display, com. = command, ctr = control
XHS: Handshake bit (Xrus14) of Status register (Wxrus0)
YHS: Handshake bit (Yrus78) of control register (Wyrus4)

How to use the Table 7.1
(1) Each No. shows to the state of EH-POS.
(2) Each event shows processing of CPU against EH-POS.
(3) The figure with arrow in the table shows the transition order of EH-POS in each event.

Example
When EH-POS is in the state No.1 (stop and waiting (YHS =0)), if event A (issue of transmission command YHS=1) is done, the state of EH-POS moves to No.2 (stop and set finish (YHS = 1).

Chapter 8 Operation

There are three operation types: Homing Operation, Manual Operation and Automatic (positioning) Operation. Start and stop of the operation are executed by writing a control command onto the control register (WYrus4), or by using a Positioner (option).

8.1 Homing Operation

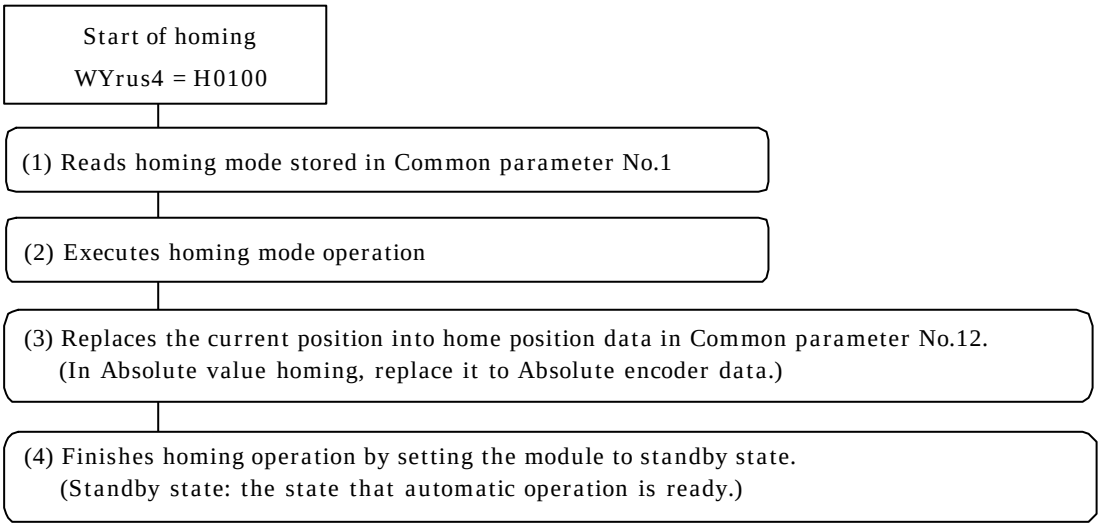
Homing operation (Return to home position operation) is executed by writing the control command H0100 into the control register (WYrus4).

Homing mode is selectable from five kinds shown in the table below, and it can be decided by the word of Common parameter No.1.

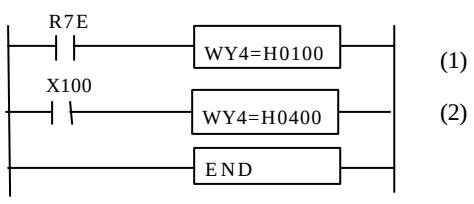
No.	Homing mode			Common parameter No.1	
1	Desirable homing			H0***	–
2	Low speed homing			H1*** (CW)	H9 *** (CCW)
3	High speed homing 1 (off edge)			H2*** (CW)	HA*** (CCW)
4	High speed homing 2 (marker end)			H3*** (CW)	HB*** (CCW)
5	Absolute encoder homing	YASUKAWA	Σseries 12bit absolute value encoder (not applied for 15bit)	H4***	–
			ΣII series 16bit absolute value encoder	H5***	–
			ΣII series 17bit absolute value encoder	H6***	–
		HITACHI	AD series 17bit absolute value encoder		
		SANYO	P series	H7***	–

*: Optional value, CW/CCW: rotating direction

When homing operation is executed, the current position data is changed to home position data which is set at common parameter (No.12), and status of module becomes standby state (the state automatic operation is ready), then homing operation is finished (except for "absolute encoder homing"). Homing operation is explained below.



An example of homing operation is shown by ladder programming below.



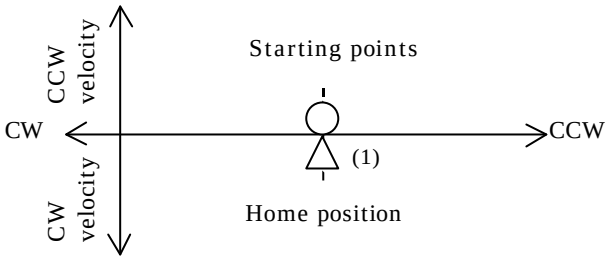
[Explanation of program]

(1) WY4 is set to H0100 at only one scanning time after run, and executes homing command (H0100). At this time, the green STB LED of the front of EH-POS turns on.

(2) By making the external input X100 ON, the one-step operation command of Step1 is started, and pulse-train is outputs. Then STB LED is turned off, and RUN LED is turned on. After finishing pulse-train output, it goes to standby state.

8.1.1 Desirable Homing

Desirable homing mode is got by setting Common parameter No.1 with H0***.



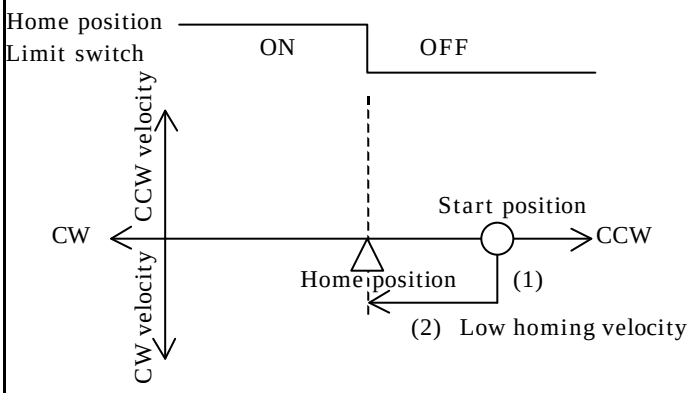
(1) At the state that common parameter No.1 is set with H0***, when homing command H0100 is made ON, the current position data is replaced with the home position data (Common parameter No.12), and homing operation is finished

8.1.2 Low Speed Homing

Low speed homing mode is got by setting Common parameter No.1 with H1***(CW) or H9***(CCW).

(1) In case that Common parameter No.1 is H1***(CW)

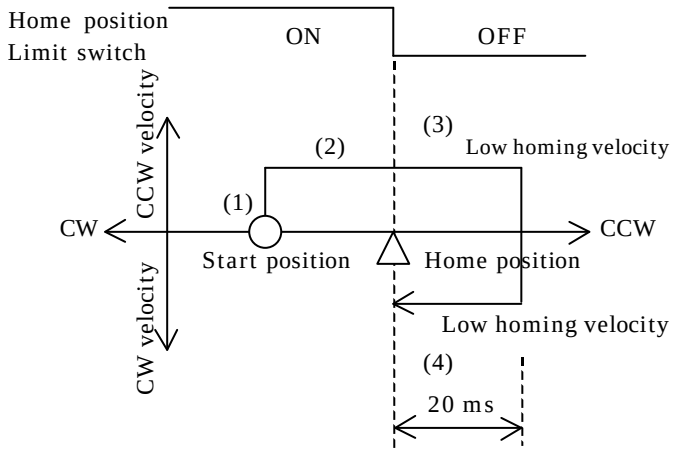
[In case home position limit switch is OFF at starting]



(1) When Common parameter No.1 is set with H1***, homing command H0100 is triggered.

(2) The motor moves to CW with low speed, and stops at the ON edge of home position limit switch, and finishes homing.

[In case home position limit switch is ON at start]



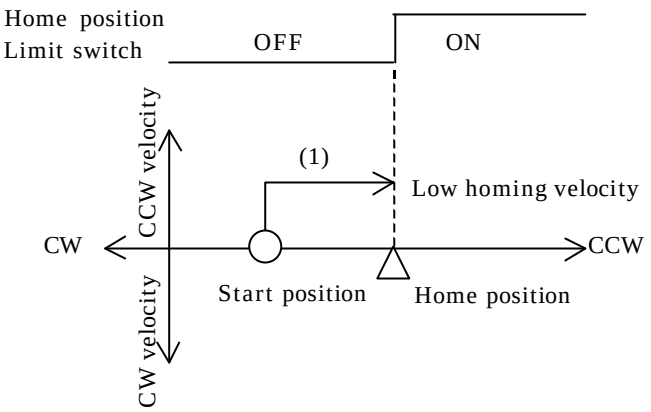
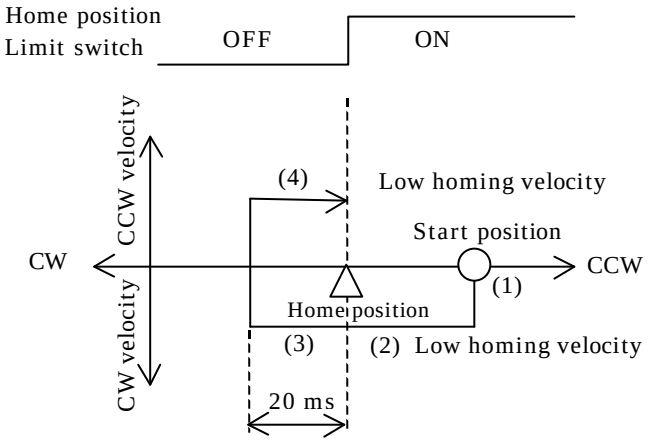
(1)When Common parameter No.1 is set with H1***, homing command H0100 is triggered.

(2) The motor moves to CCW with low speed until the OFF edge of home position limit switch.

(3)EH-POS outputs pulses for 20ms. The motors moves corresponding to pulses.

(4)EH-POS outputs pulses to CW direction for 20ms. Motor moves correspondingly, stops at the ON edge of home position limit switch, and finishes homing operation.

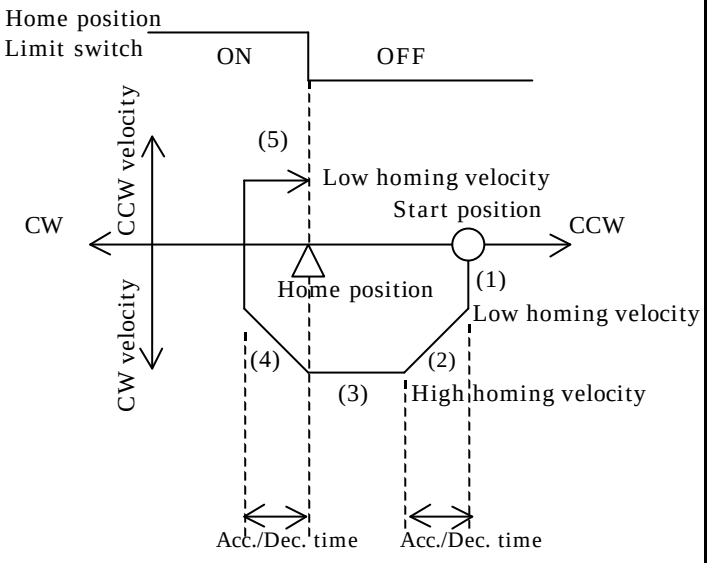
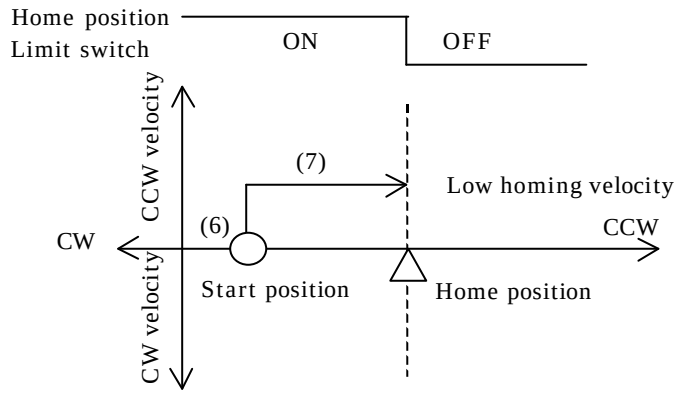
(2) In case that Common parameter No.1 is H9***(CCW)

<table>
<tr>
<td>[In case home position limit switch is OFF at start]
 
</td>
<td>(1) When Common parameter No.1 is set with H9***, homing command H0100 is triggered.
(2) The motor moves to CW with low velocity, and stops at the ON edge of home position limit switch, and finishes homing.</td>
</tr>
<tr>
<td>[In case home position limit switch is ON at start]
 
</td>
<td>(1)When Common parameter No.1 is set with H9***, homing command H0100 is triggered.
(2) The motor moves to CW with low velocity until the OFF edge of home position limit switch.
(3)EH-POS outputs pulses for 20ms. The motors moves corresponding to pulses.
(4)EH-POS outputs pulses to CCW direction for 20ms. Motor moves correspondingly, stops at the ON edge of home position limit switch, and finishes homing operation.</td>
</tr>
</table>

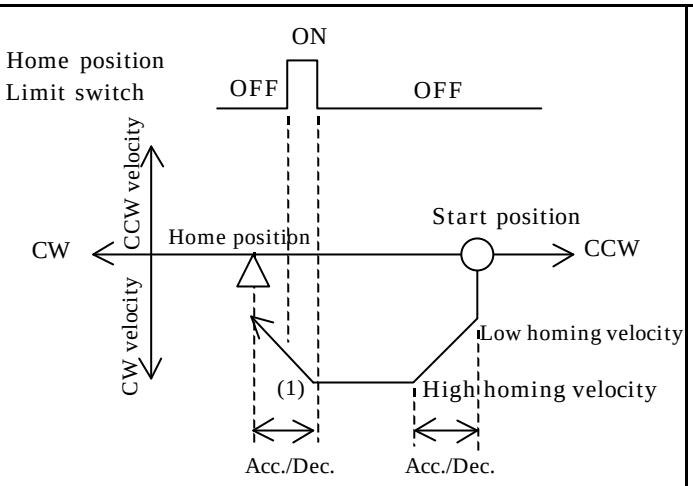
8.1.3 High Seed Homing 1 (Off edge)

High-speed homing (Off Edge) mode is got by setting Common parameter No.1 with H2***(CW) or HA***(CCW).

(1) High speeds homing mode (Off Edge) of CW direction
(In case homing mode (Common parameter No.1) is H2***))

<table>
<tr>
<td>[In case of home position limit switch OFF at start]
 
</td>
<td>(1)When Common parameter No.1 is set with H2***, homing command H0100 is triggered.
(2) The motor starts to CW with low homing velocity as initial velocity, and accelerates until high homing velocity in acc./dec. time.
(3) The motor moves with high homing velocity until the ON edge of home position limit switch.
(4) The motor decelerates to low homing velocity in acc./dec. time.
(5) The motor reverses rotating direction to CCW, and stops at the OFF edge of home position limit switch, and finishes homing operation.
Low homing velocity = Common parameter No.7
High homing velocity = Common parameter No.6
Acc./Dec. time = Common parameter No.8</td>
</tr>
<tr>
<td>[In case home of position limit switch ON at start]
 
</td>
<td>(1)When Common parameter No.1 is set with H2***, homing command H0100 is triggered.
(2)The motor moves to CCW with low speed, and stops at the OFF edge of home position limit switch, and finishes homing.</td>
</tr>
</table>

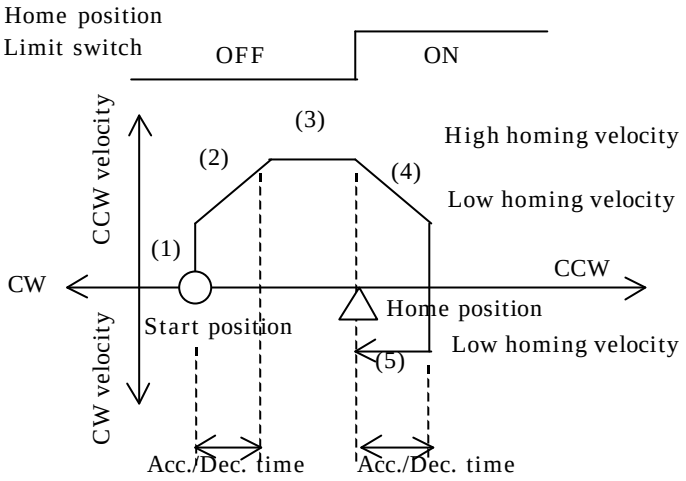
Notice



(1) When homing position limit switch is made off before the motor stop and slow down, the homing operation is finished at the time point of the motor stops.
If there is backlash correction, the motor changes its direction at the final stage.

(2) High-speed homing mode (Off Edge) of CCW direction
(In case homing mode (Common parameter No.1) is HA***))

[In case home of position limit switch OFF at start]



(1)When Common parameter No.1 is set with HA***, homing command H0100 is triggered.

(2)The motor starts to CCW with low homing velocity as initial velocity, and accelerates until high homing velocity in acc./dec. time.

(3)The motor moves with high homing velocity until the ON edge of home position limit switch.

(4)The motor decelerates to low homing velocity in acc./dec. time.

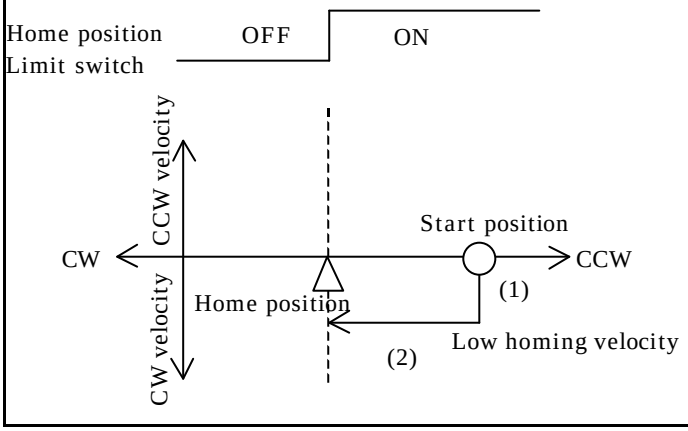
(5)The motor reverses rotating direction to CW, and stops at the OFF edge of home position limtit switch, and finishes homing operation.

Low homing velocity = Common parameter No.7

High homing velocity = Common parameter No.6

Acc./Dec. time = Common parameter No.8

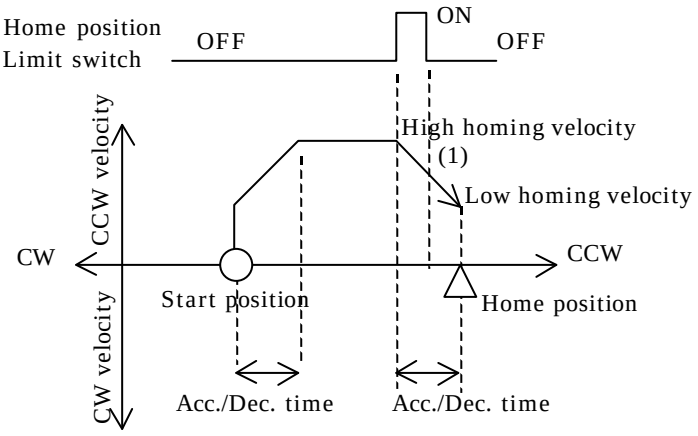
[In case home position limit switch ON at start]



(1) When Common parameter No.1 is set with HA***, homing command H0100 is triggered.

(2) The motor moves to CW with low speed, and stops at the OFF edge of home position limit switch, and finishes homing.

Notice

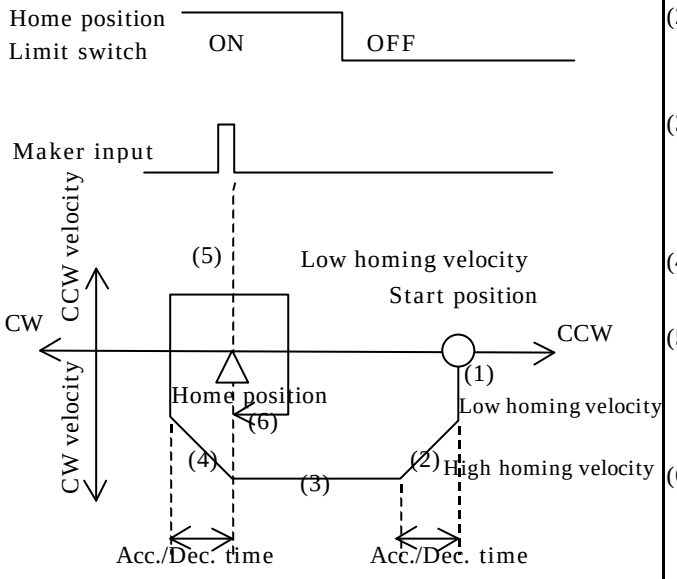


(1)When homing position limit switch is made off before the motor stop and slow down, the homing operation is finished at the time point of the motor stops.
If there is backlash correction, the motor changes its direction at the final stage.

8.1.4 High Seed Homing 2 (Marker stop

High speed homing (Marker stop) mode is got by setting Common parameter No.1 with H3***(CW) or HB***(CCW).

(1) High speed homing mode (Marker stop) of CW direction
(In case of homing mode (Common parameter No.1) is H3***))



(1)When Common parameter No.1 is set with H3***, homing command H0100 is triggered.

(2)The motor starts to CW with low homing velocity as initial velocity, and accelerates until high homing velocity in acc./dec. time.

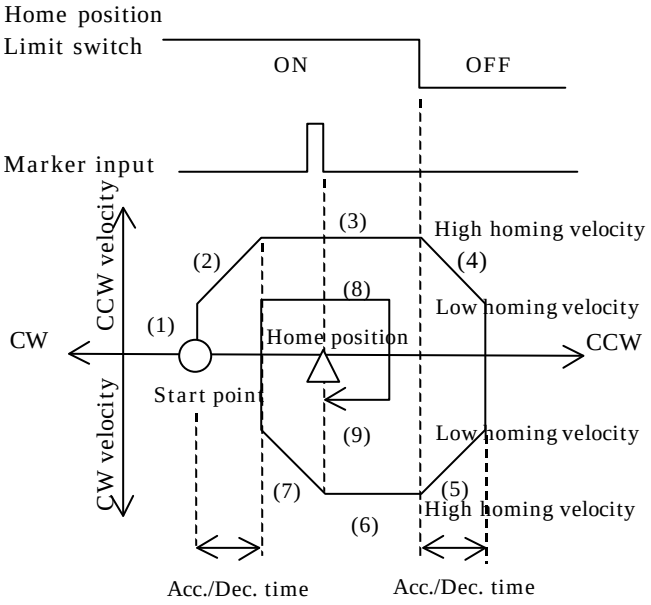
(3)The motor moves with high homing velocity from on edge of homing position limit switch to the first maker position (Encoder C phase or Z phase).

(4)The motor decelerates to low homing velocity in acc./dec. time.

(5)The motor changes the rotation to CCW, and moves with low homing velocity until marker as second time, and stops after five pulses.

(6)The motor changes the rotation to CW, and outputs pulses with interval of 20ms. When reached to maker as third time, the motor stops, and finishes homing operation.

[In case homing position limit switch is ON at start]



(1)When Common parameter No.1 is set with H3***, homing command H0100 is triggered.

(2)The motor starts to CCW with low homing velocity as initial, and accelerates until high homing velocity in acc./dec. time.

(3)The motor moves with high homing velocity until of off edge of homing position limit switch.

(4)The motor decelerates with low homing velocity in acc./dec time and stops.

(5)The motor changes direction to CW, and starts with low homing velocity as initial, and accelerates until high-speed velocity in acc./dec. time.

(6)The motor moves to the marker with high homing velocity.

(7)The motor decelerates in acc./dec. time, and stops.

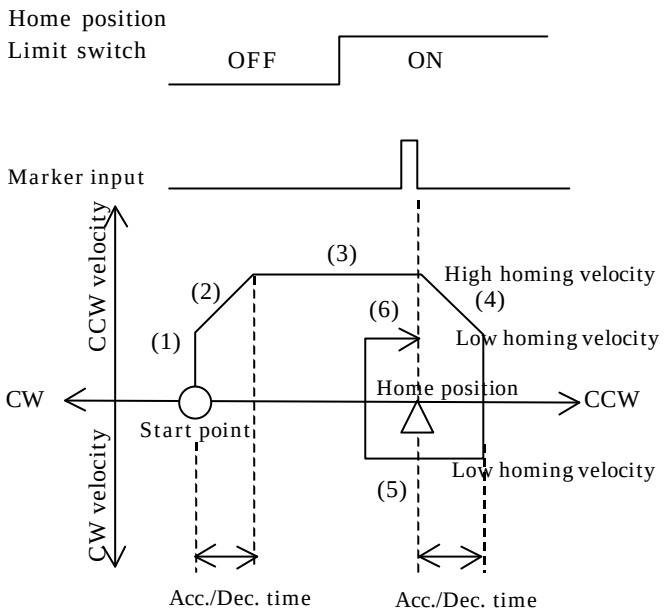
(8)The motor changes the direction to CCW, and moves to marker with low homing velocity, and stops.

The motor changes the direction to CW, outputs pulses by 20mS interval, and stops at the marker.

(2) High speed homing mode (Marker stop) of CCW direction

(In case of homing mode (Common parameter No.1) is HB***))

[In case of home position limit switch OFF at start]



(1)When Common parameter No.1 is set with HB***, homing command H0100 is triggered.

(2)The motor starts to CW with low homing velocity as initial velocity, and accelerates until high homing velocity in acc./dec. time.

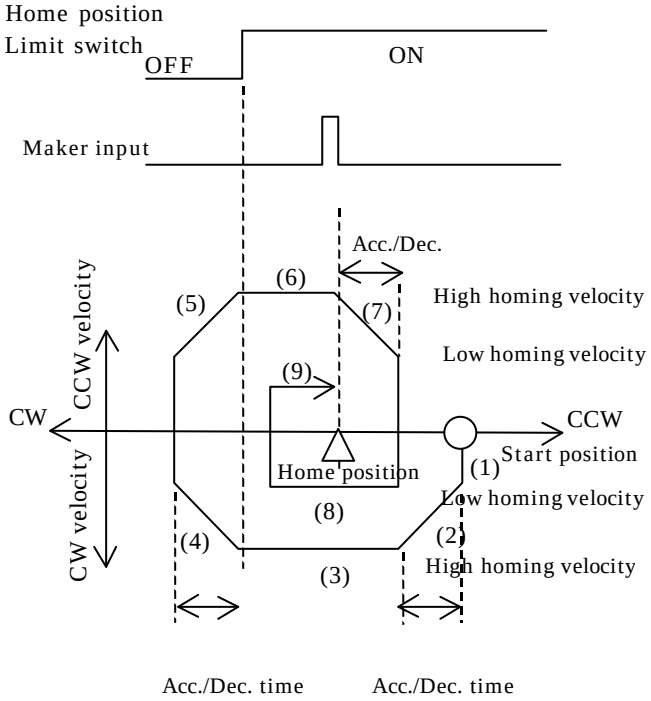
(3)The motor moves with high homing velocity from on edge of homing position limit switch to the first maker position (Encoder C phase or Z phase).

(4)The motor decelerates until low homing velocity in acc./dec. time, and stops.

(5)The motor changes the rotation to CW, and moves with low homing velocity until marker as second time, and stops after five pulses.

(6)The motor changes the rotation to CCW, and outputs pulses with interval of 20ms. When reached to maker as third time, the motor stops, and finishes homing operation.

[In case of home position limit switch ON at start]



(1)When Common parameter No.1 is set with HB***, homing command H0100 is triggered.

(2)The motor starts to CW with low homing velocity as initial, and accelerates until high homing velocity in acc./dec. time.

(3)The motor moves with high homing velocity until of off edge of homing position limit switch.

(4)The motor decelerates until low homing velocity in acc./dec. time and stops.

(5)The motor changes direction to CCW, and starts with low homing velocity as initial, and accelerates until high-speed velocity in acc./dec. time.

(6)The motor moves to the marker with high homing velocity.

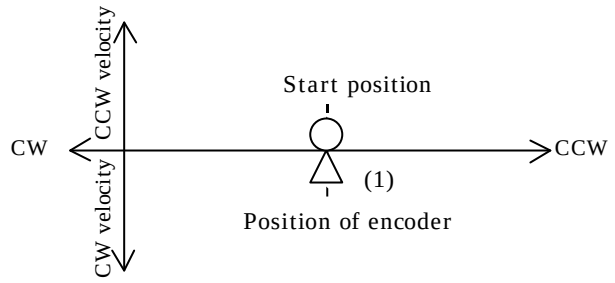
(7)The motor decelerates in acc./dec. time, and stops.

(8)The motor changes the direction to CW, and moves to marker with low homing velocity, and stops after outputting five pulses.

(9)The motor changes the direction to CCW, outputs pulses by 20mS interval, and stops at the marker.

8.1.5 Home position of Absolute Encoder

By executing homing command, EH-POS reads the absolute encoder signal from the servomotor (ex: AD series of HITACHI, Σ/ΣII series of YASUKAWA, or P series of SANYO) and replaces current position data with read data. Then it becomes standby mode and finishes homing operation.
This command can be used to correct the current position data, too.



(1)When one of H4***, H5***, H6***, H7*** is set in the Common parameter No.1, and homing command H0100 is executed, current position data are rewritten with the position data of the encoder, and the homing operation is finished.

Data of Common parameter No.1 is different with the type of the servomotor.
Please set the data according to the table below.

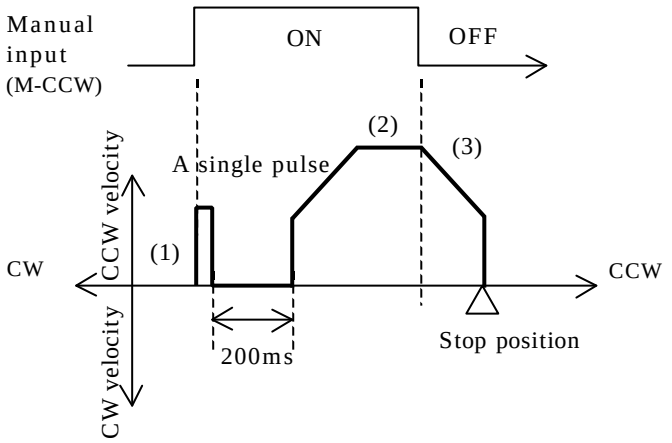
Manufacturer	Content		Common parameter No.1
YASUKAWA	Σ series	12 bit absolute encoder (1024 pulse encoder) (not applied for 15 bit encoder)	H4***
	Σ II series	16 bit absolute encoder (16384 pulse encoder)	H5***
		17 bit absolute encoder (32768 pulse encoder)	H6***
HITACHI	AD series		
SANYO	P series	2048 pulse encoder	H7***

*: Optional value

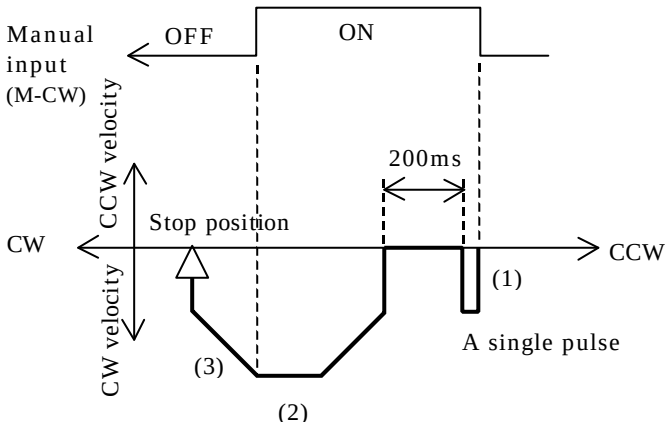
8.2 Manual Operation

8.2.1 Manual Operation1 (Control Mode by External Input)

By writing H0200 into the control register (WY***4), manual operation1 is set. When external input manual CCW (counter clockwise) is ON, forward pulses are output. When manual CW (clockwise) is ON, reverse pulses are output*1. When manual CCW or CW input signal time is fewer than 200ms, the inching operation (generating a single pulse) will be done.
Until writing H07** to the control register (WY***4), manual operation can be continued by ON/ OFF of manual input handling.



(1) Writes H0200 into WY***4, and executes manual operation command ON. Then make M-CCW ON of external input.
(2) After 200ms of a single pulse output, the motor starts with low homing velocity, and accelerates up to manual velocity.
(3) By making M-CCW off, The motor stops with slow down.
(4) Until Stop command (H0700 or H07FF) is written into Control register (WY***4), manual operation is available.



(1) Writes H0200 into WY***4, and executes manual operation command ON. Then make M-CW ON of external input.
(2) After 200ms of a single pulse output, the motor starts with low homing velocity, and accelerates up to manual velocity.
(3) By making M-CW off, The motor stops with slow down.
(4) Until Stop command (H0700 or H07FF) is written into Control register (WY***4), manual operation is available.

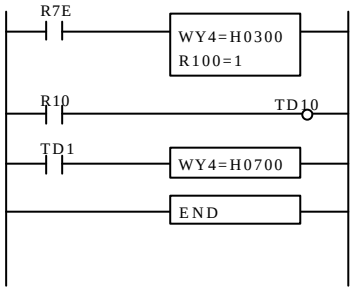
Notes
*1: If both manual inputs M-CW and M-CCW are made ON at same time, the motor stops with slow down.
*2: To finish manual operation, execute the stop command (H0700 or H07FF) without fail. Another command is not accepted.
*3: In the operation, if the command (H0700) is written in, the motor stops with slowdown. If the command (H07FF) is written in, the motor stops without slowdown.

Notice
In manual operation, it is possible to operate even out of standby state. In other words, it is possible to operate at the state that homing operation is not finished. However, without completing homing operation, the current data are inaccurate.

8.2.2 Manual Operation2 (Command Control Mode)

Manual operation command control mode is started by filling control register (WY***) with H03**.
In this mode, start and stop control is done by commands. By this function, start and stop of the motor (output control of pulse(s)) can be controlled by program written in the PLC, without concerning with the automatic operation position data written in EH-POS.

Control Register written data	Command name	Indication on Positioner	Content
H03**	Manual Operation	MANUAL2	Generation of pulse-train is controlled by Start and Stop commands.
H0300	Manual Forward Operation		Generation of forward pulse-train is controlled by Start and Stop commands.
H0301	Manual Forward Jog Operation		Generation of single forward pulse is controlled by Start and Stop commands.
H0310	Manual Reverse Operation		Generation of reverse pulse-train is controlled by Start and Stop commands.
H0311	Manual Reverse Jog Operation		Generation of single reverse pulse is controlled by Start and Stop commands.



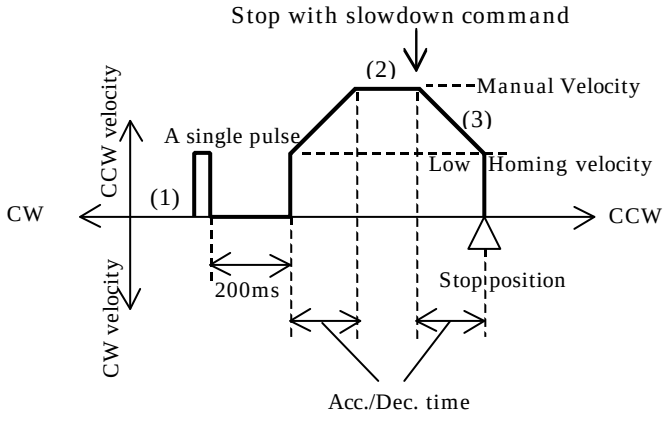
(1) For one scanning after RUN, H0300 is set in WY4, and [the command to generate forward pulse-train in manual operation] is triggered. Then RUN LED (green) at the front of EH-POS module is made ON. R100 is set with 1.

(2) When R100 is made ON (1), TD0 begins to increase.

(3) After 5 seconds, TD0 is made ON, and WY4 is set with H0700 (stop with slow down command). This command is executed immediately. Then, RUN LED at the front of EH-POS is made OFF, and STB LED is made ON.

(1) Manual Forward Operation (Generation of pulse-train)

Continuous forward pulse-train is generated to write H0300 into Control Register WY***4.
Stop of pulse-train generation is done by writing H0700 (stop with slowdown command) or F07FF (stop without slowdown command) into the same Control Register WY***4.



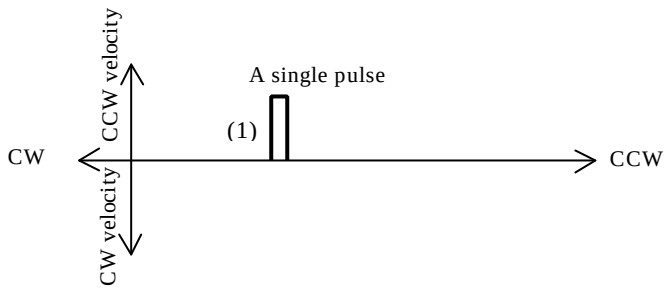
(1) By writing H0300 into WY***4, [Manual Forward Operation] command is executed.

(2) 200ms after single pulse generation, the motor is started with low homing velocity as initial, accelerated to manual velocity in acc./dec. time.

(3) Executing [Stop with slowdown] command by setting H0700 into WY***4,the motor is decelerated in acc./dec. time and stopped.

(2) Manual Forward Jog Operation ((Generation of a single pulse))

Forward single pulse is generated to write H0301 into Control Register WY***4.

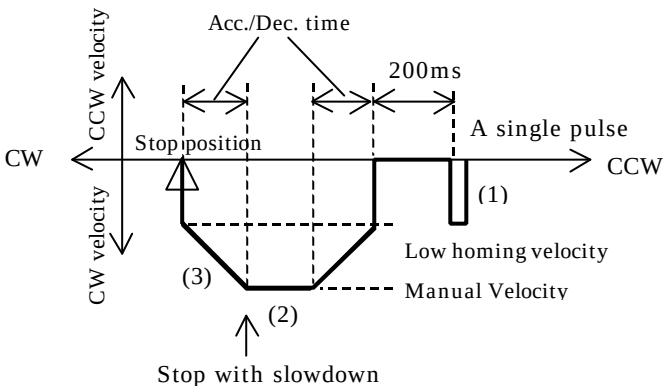


(1)By writing H0301 into WY***4, [Manual Forward Jog Operation] command is executed.

(2)Outputs a single pulse.

(3) Manual Reverse Operation (Generation of pulse-train)

Continuous forward pulse-train is generated to write H0310 into Control Register WY***4.
Stop of pulse-train generation is done by writing H0700 (stop with slowdown command) or F07FF (stop without slowdown command) into the same Control Register WY***4.



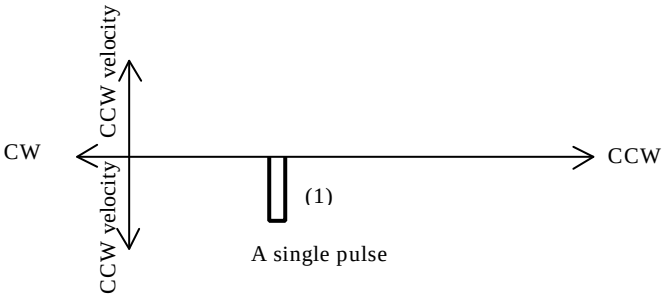
(1) By writing H0310 into WY***4, [Manual Reverse Operation] command is executed.

(2) 200ms after a single pulse generation, the motor is started with low homing velocity as initial, accelerated to manual velocity in acc./dec. time.

(3) Executing [Stop with slowdown] command by setting H0700 into WY***4,the motor is decelerated in acc./dec. time and stopped.

(4) Manual Reverse Jog Operation (Generation of a single pulse)

Reverse single pulse is generated to write H0311 into Control Register WY***4.



(1) By writing H0311 into WY***4, [Manual Reverse Jog Operation] command is executed.

(2) Outputs a single pulse.

8.3 Automatic Operation

In automatic operation, the positioning operation is executed according to the automatic operation Position Data prepared in advance. Three kinds of operation are prepared. They are automatic operation1 (a single step operation), automatic operation2 (a single cycle operation) and automatic operation3 (continuous cycle operation). The operation is specified with the control command. Automatic operation of 256 steps is possible.

In case of starting automatic operation, it needs the standby state (the state operation is ready). The standby state can be obtained by executing homing operation or manual operation.

Control Register written data	Command name	Indication on Positioner	Content
H04**	Automatic operation1 (A single step operation)	RUN STEP	One point positioning operation of the single step specified by ** of data
H05**	Automatic operation2 (A single cycle operation)	RUN CYCL	Continuous single cycle operation from the step specified by ** of data to the step cycle stop bit is 1.
H06**	Automatic operation3 (Continuous cycle operation)	RUN CONT	Continuous cycle operation from the step specified by ** of data to the step cycle stop bit is 1.

Automatic Operation Position Data is consisting of five kinds of data for every step. Data for a single step is shown below. For detail, refer 6.1.2 Automatic operation position data.

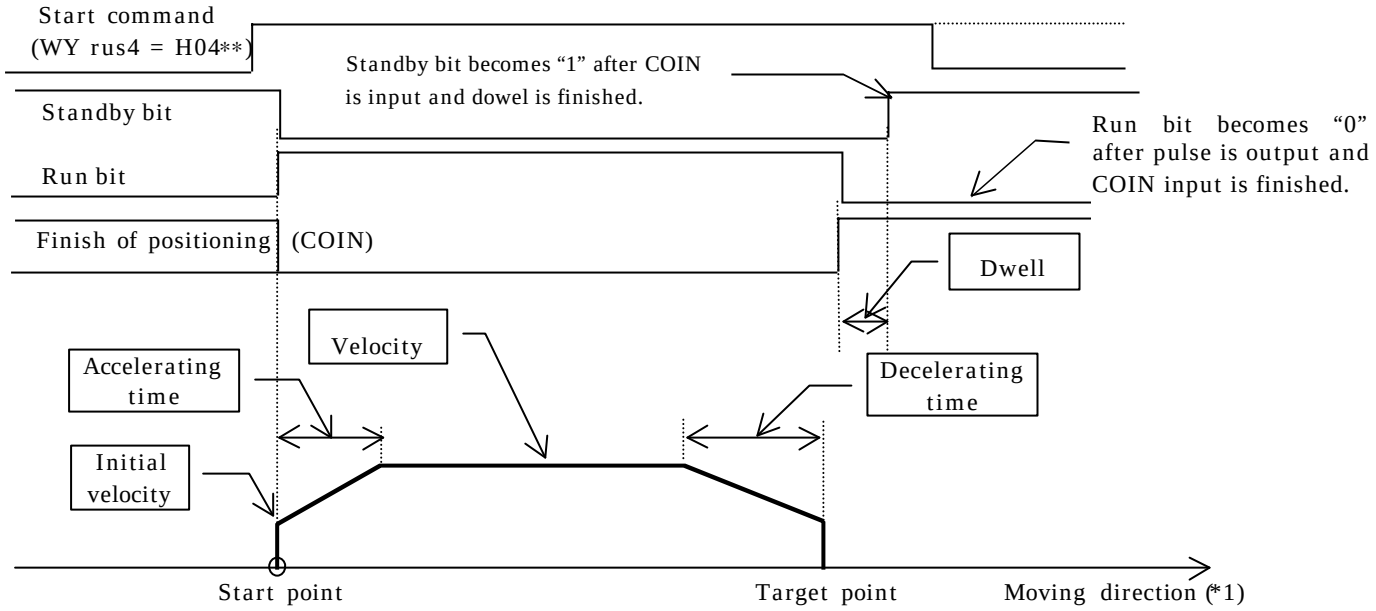
Data No.	Trans-mission Word No.	MSB 15 to 12	11 to 8	7 to 4	LSB 3 to 0	Content	Default Data (Hexadecimal)
1	1	Operation mode		Dwell		Operation mode Dwell(×20ms) 0 to 255 (HFF)	H8000
2	2	Acceleration time data				Acceleration time(ms) 1 to 65535 (HFFFF)	H03E8 (1000)
3	3	Deceleration time data				Deceleration time (ms) 1 to 65535 (HFFFF)	H03E8 (1000)
4	4	Velocity				Velocity data 1 to 8000 (H1F40)	H0020 (0032)
5	5	Target position data (Lower)				Target stop position or speed change position in continuous operation +2,147,483,647 (H7FFFFFFF) to -2,147,483,648 (H80000000)	H00000000
	6	Target position data (Upper)					

(Note) 0 step of automatic operation position data are set with default values

8.3.1 Automatic Operation1 (One Step Operation)

Single Step Operation is started by writing H04** (** indicates step No. by hexadecimal) into control register WYrus4. At starting, standby bit is to be "1" (b9 of status register WX rus4). If standby bit isn't "1", operation isn't executed. After started, pluses corresponding to the target point data come are output, then stops. Timing of each signal is as follows.

(1) Single Step Operation (When b13 of operation mode is "0")



Note

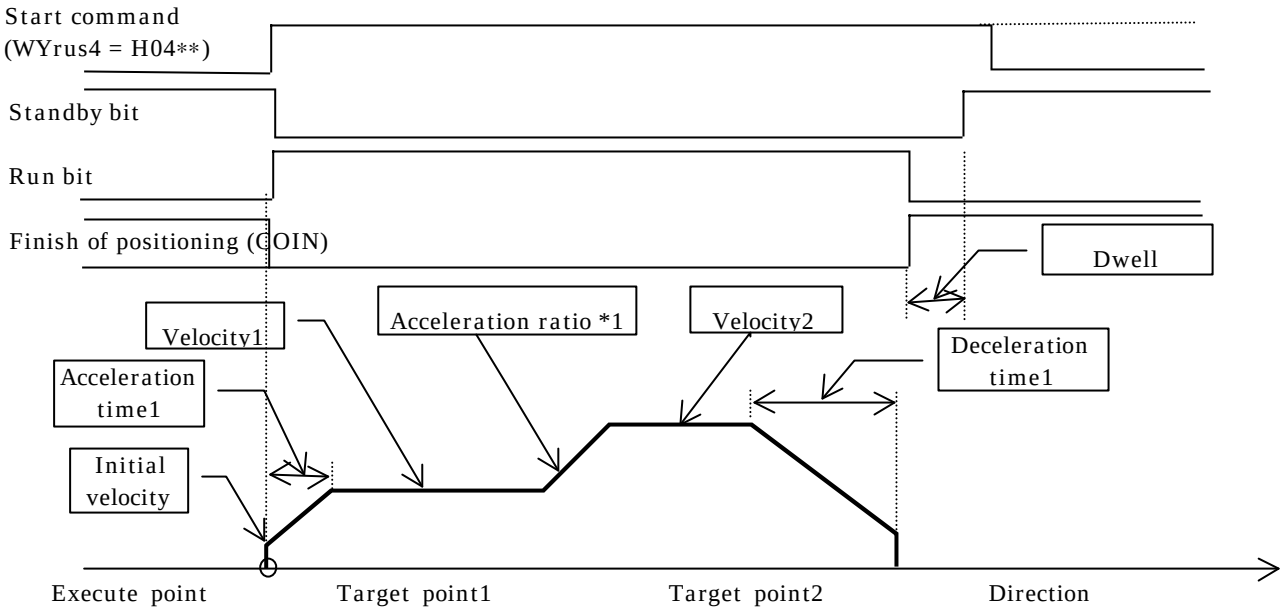
*1: Moving direction is as follows.

Absolute mode: When target position data is bigger than current position data, it is CCW.
When target position data is smaller than current position data, it is CW.

Increment mode: When target position data is plus (H1 to H7FFFFFFF), it is CCW.
When target position data is minus (H80000000 to HFFFFFFFF), it is CW.

(2) A case of continuous operation with velocity change (b13 of operation mode is “1”)

Timing is shown below for the case that operation starts at step (H**), and stops at next step (H** + 1) with changing velocity.



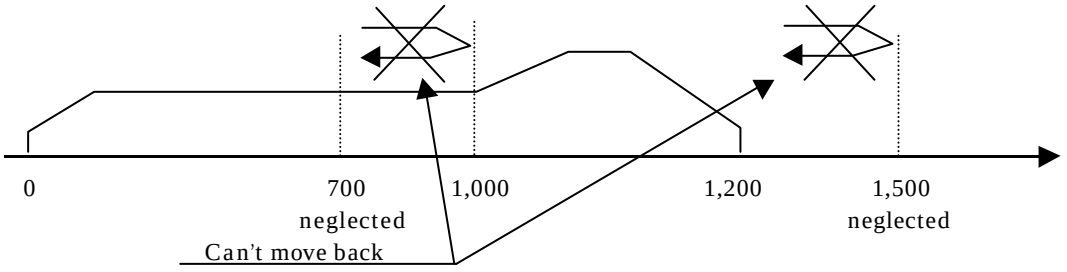
Acceleration time1, Deceleration time1, Velocity1 and Target point1 are set at step **.
Speed2 and Target point2 are set at step **+1. For Acceleration ratio*1, refer Caution below.

⚠ Caution

1. Acceleration ratio for continuing steps is the one of start step.
2. At the point of changing velocity, if direction of continuing step isn't same as start step as the result of velocity change, continuing step is neglected and next step is executed.
3. When target point data of middle step is bigger than final target point data, the step is neglected.

Example

Suppose that start point is “0”, first target point is “1000”, second target point is “700”, third target point is ”1500”, and final target point is “1200”. In this case it don't move to second “700” and third “1500” point.



4. When the mode of continuing operation step is different from the one of former step, it doesn't execute and becomes command error.

Example

A case that there are absolute mode and increment mode. A case that there are speed mode and position mode.

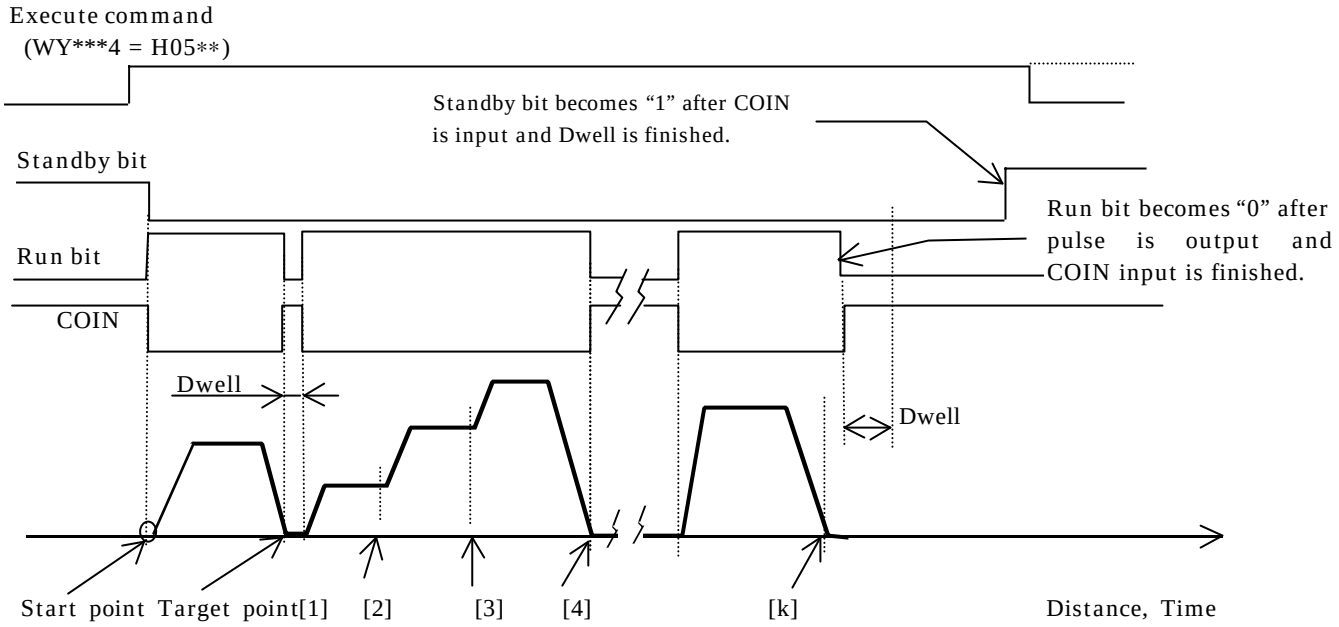
5. When stop step of cycle operation is continuous operation, set “1” to cycle stop bit of all steps of continuous operation.

8.3.2 Automatic Operation2 (Single cycle Operation)

Single Cycle Operation is started by writing H05** (** indicates step No. by hexadecimal) into control register WYrus4. At starting, standby bit (b9 of status register WX rus4) is to be "1". If standby bit isn't "1", operation isn't executed.

After started, every step is executed automatically until the step which cycle stop bit (b14) in operation mode of automatic operation Position Data is set to "1",

Timing of each signal is as follows.



⚠ Caution

1. It is permitted to have increment and absolute step in a cycle operation, but current position data isn't correct. Please use the same mode in a cycle operation.
2. It is permitted to have position and speed mode in a cycle operation, but current position data isn't correct. Please use same mode in a cycle operation.
3. When stop step of cycle operation is continuous operation, set "1" to cycle stop bit of all steps of continuous operation.

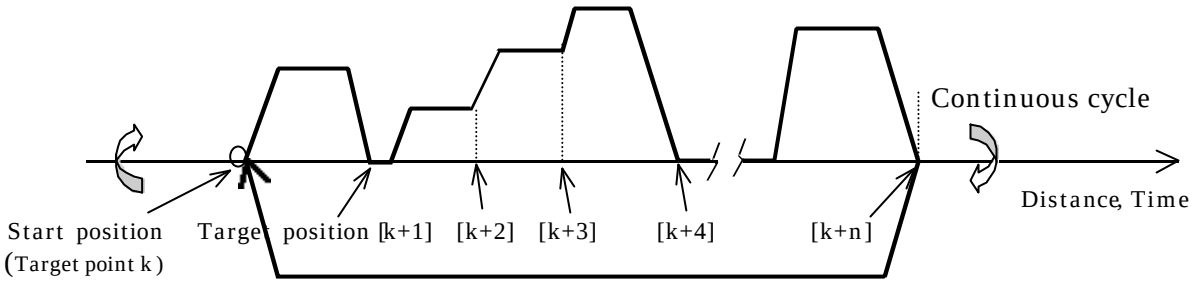
8.3.3 Automatic Operation3 (Continuous Cycle Operation)

Continuous Cycle Operation is started by writing H06** (** indicates step No. by hexadecimal) into control register WYrus4. At starting, standby bit (b9 of status register WX rus4) is to be “1”. If standby bit isn’t “1”, operation isn’t executed.

In this operation, The operation stated in 8.3.2 is executed repetitively, as shown below.

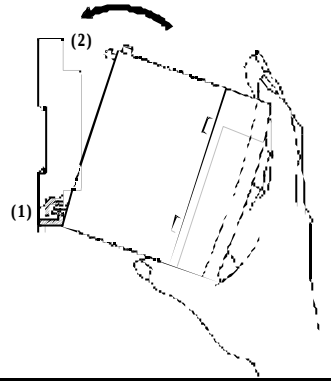
[Start step (Target position k)→Stop step (Target position k+n) → Start step (Target position k)---]

By setting Stop command (Stop with slow down or Emergency Stop), operation is stopped, and finished.



Chapter 9 Positioning Module Installation

9.1 Loading the positioning module

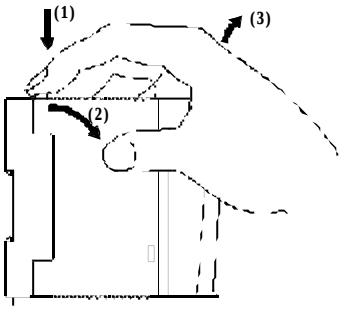


(1) Installing

1) Hook the claw at the lower section of the module to the hole in the base.

2) Press in the upper side of the module until it clicks.

Note 1: After loading the module, check to make sure it does not come out.



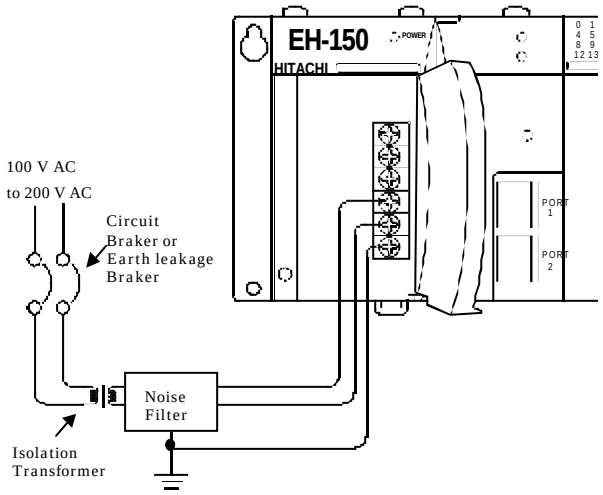
(2) Removing

1) Push in the lock button

2) With the lock button pushed in, pull the top of the module toward the front.

3) Raise it toward the top and pull it out.

9.2 Wiring to the power supply module



(3) Wiring

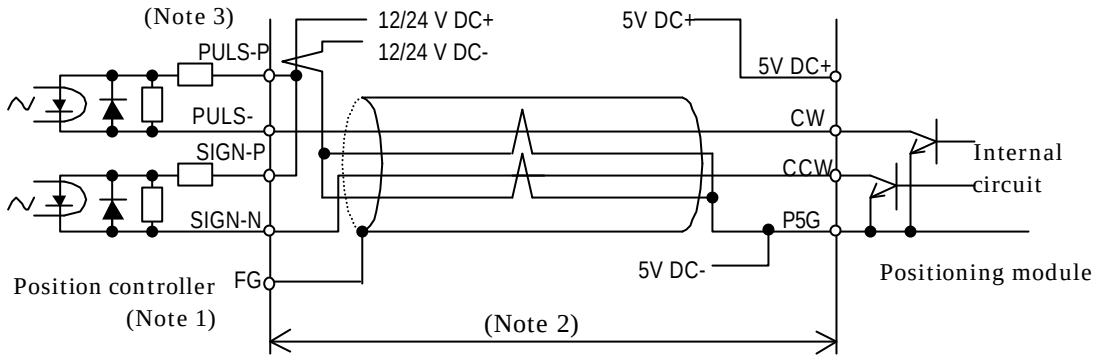
1) For power supply wiring, use a cable of 2 mm^2 (0.0031 in^2.) or more to prevent a voltage drop from occurring.
2) The function ground terminal (FE terminal) should use cable of 2 mm^2 (0.0031 in^2.) or more grounding (100 Ω or less). The appropriate distance for ground cable is within 20 m (65ft.).
   a) The wiring can be shared with instrumentation panel, relay panel grounding
   b) Avoid joint grounding with equipment that can generate noise such as high-frequency heating furnace, large power panel (several kW or more), thyristor exchanger, electric welders, etc.
   c) Be sure to connect a noise filer (NF) to the power cable.
3) The terminal screw is an M3. When wiring, tighten screws within a torque range of 49 to 78 N·m.
4) Use the same power supply system for the connected basic and expansion units.

9.3 Wiring to the Positioning module

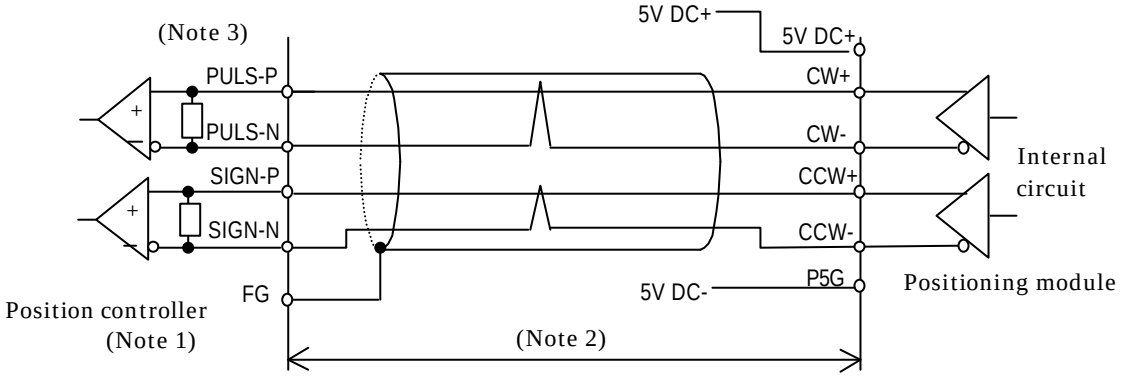
Multi-shielded twisted pair cable, which thickness is more than 0.25 mm or equal, should be used for pulse line output.
Standard maximum cable length is 5 m.

9.3.1. Output wiring

(1) In case interface is 12/24 V level and optical coupler is used



(2) In case interface is line-receiver

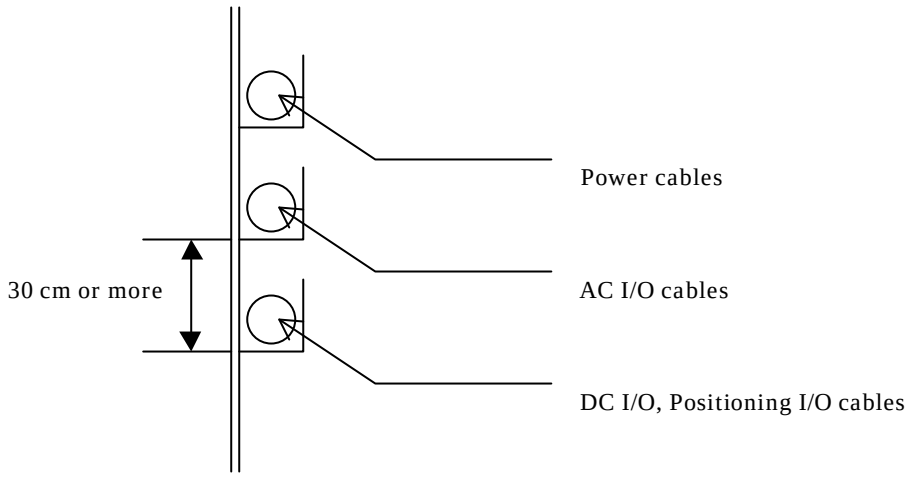


(Note 1) Though shielding of the output cable is recommended to be grounded at a cable end of receiving side (input side) as a rule, according to noise environment and grounding condition, other ways, like no grounding or grounding at transmitting side, are sometimes better. Please select best way in each application.

(Note 2) If cable length is long, then output pulse becomes delayed and when output frequency is high, position controller side might not receive signals correctly. Cable length is recommended to be short as much as possible. Though cable length is influenced by kind of cable and load of position controller, standard cable length is recommended to be max. 5m.

(Note 3) Signals of servo amplifier are different between manufacturers' types. Wiring is to be started after confirming the specifications of the servo amplifier adopted.

9.3.2. Caution of Input / output wiring



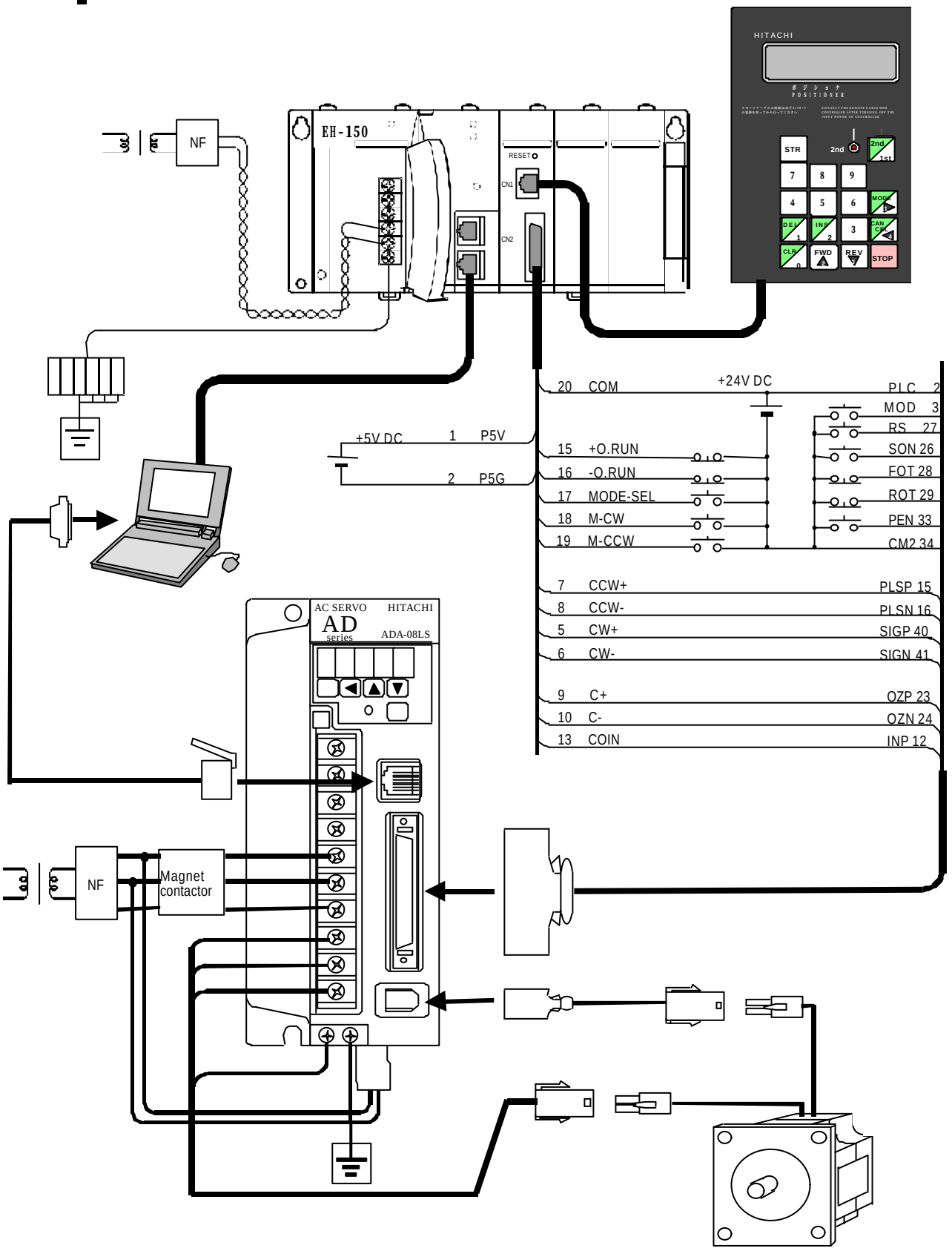
(Note) I/O cables of positioning module are to be wired separately from power cables and AC I/O cables.

⚠ Caution

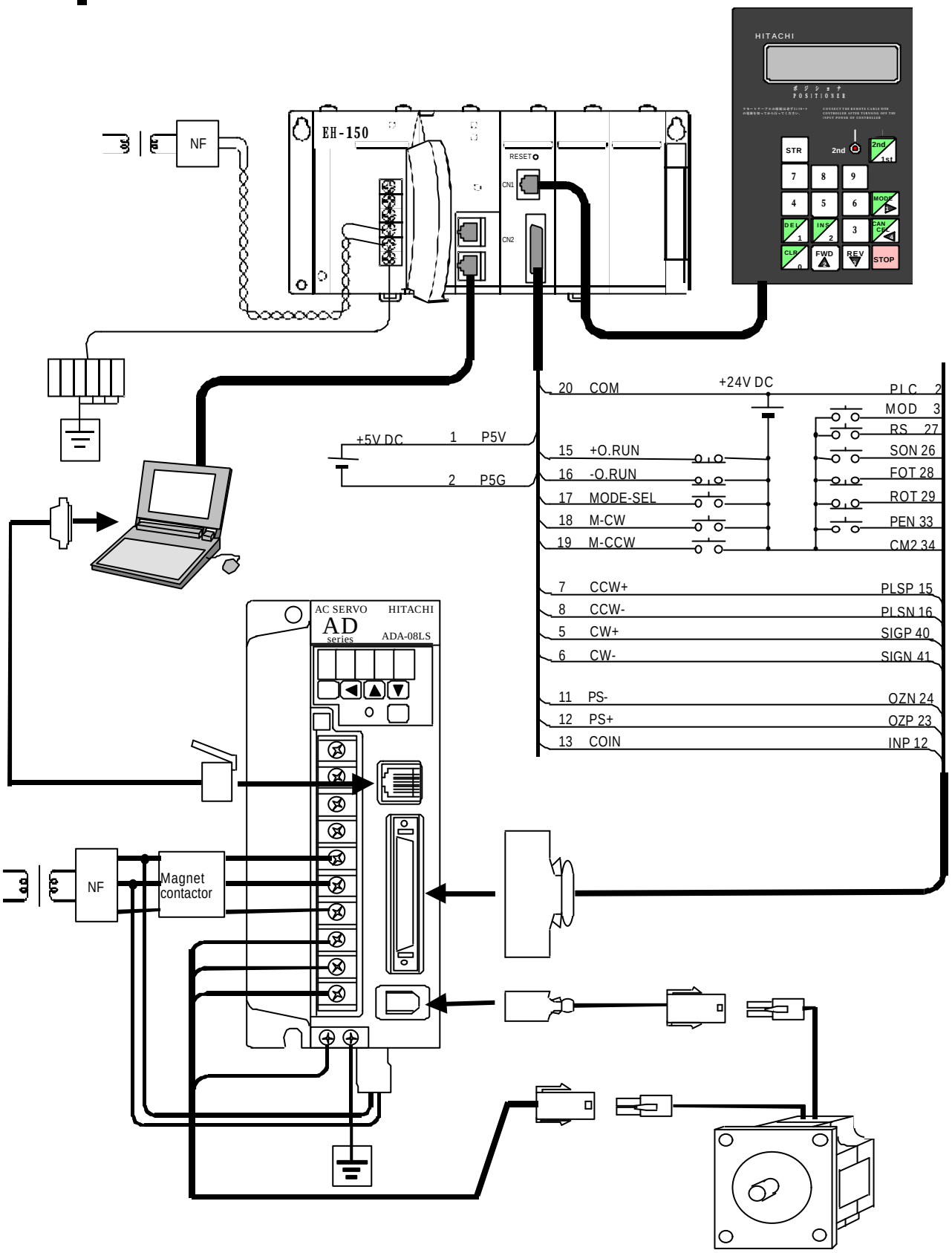
- I/O wiring of EH-POS is to be separated from power lines and wiring of AC input/output modules.
- When I/O wiring is cut by accident, or a component of PLC (including EH-POS) is broken down, the motor in the system may move unexpectedly.
  For failsafe, prepare protection means for operator(s) and machine(s) such as Emergency Stop Circuit, Protection Circuit and Interlock Circuit of PLC system, against unusual operation of the system.

9.4 Example of wiring with a Servo Amplifier

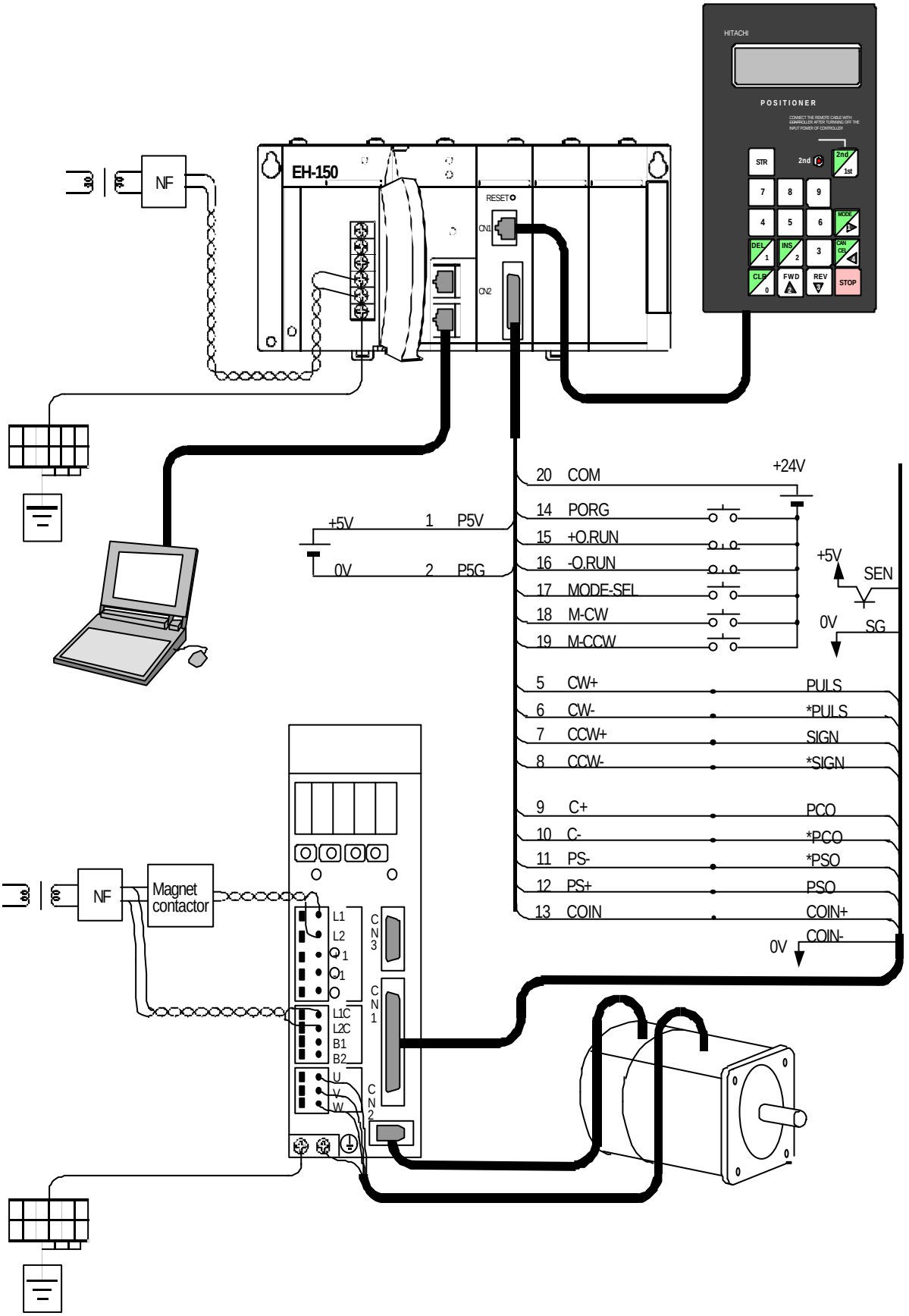
9.4.1 Example of wiring with Hitachi AD series (increment)



9.4.1 Example of wiring with Hitachi AD series (absolute)



9.4.3 Example of wiring with Yasukawa Σ II series (absolute)



Chapter 10 Error code list

There are two kinds of error code indication as below.

(1) Execution error indication command code (H5000) by user program or forced Set/Reset, and store error code into WX***2.

(2) Indicate error code on a display of Positioner (optional operator) by selecting “Error Code Indication Menu” in “Monitor Mode” by the Positioner.

Please take countermeasures against errors based on the error list below.

○: Continue RUN ×: Stop RUN

Group	Error Code	Contents	Beha-vior	Clearing timing
Command error	H0001	A control command other than STOP command was received during RUN. Received command is to be ignored.	○	At executing communication initial command (H5100) or resetting control commands
	H0002	Reserved		
	H0003	Control mode of automatic RUN (data No.1 of position data of automatic RUN.) is set in undefined mode.	×	
	H0004	In case velocity data of automatic RUN (data No.4 of position data of automatic RUN) is smaller than an initial velocity (parameter No.5 of common parameters), EH-POS starts with the velocity data as an initial velocity.	○	
	H0005	In case acceleration time of automatic RUN (data No.2 of position data of automatic RUN) is smaller than min. available acceleration time, EH-POS accelerates with the min. available acceleration time.	○	
	H0006	In case deceleration time of automatic RUN (data No.3 of position data of automatic RUN) is smaller than min. available deceleration time, EH-POS decelerates with the min. available deceleration time.	○	
	H0007	Velocity data of automatic RUN (data No.4 of position data of automatic RUN) is 0.	×	
	H0008	In case initial velocity data (parameter No.5 of common parameters) is 0, EH-POS start with the min. available velocity.	○	
	H0009	There is a step which has a different running mode in a continuous RUN (refer to data No.1of position data of automatic RUN).	×	
	H0010	No. of steps is 11 or bigger(refer to data No.1of position data of automatic RUN).	×	
	H0011	Reserved		
	H0012	Starting step is invalid	×	
	H0013	Reserved		
	H0014	Reserved		
	H0015	Reserved		
	H0016	In case acceleration time of manual RUN and High-speed homing (common parameter No.2) is smaller than min. available acceleration time; EH-POS accelerates with the min. available acceleration time.	○	
	H0017	In case initial manual velocity (parameter No.5 of common parameters) is 0 in manual RUN, EH-POS starts with the min. available velocity.	○	
	H0018	Manual velocity (parameter No.5 of common parameters) is 0 in manual RUN	×	
	H0019	At homing low-speed return velocity (Parameter No.7 of common parameter) is 0.	×	

Group	Error Code	Contents	Beha-vior	Clearing timing
Data error	H0020	At homing high-speed return velocity (parameter No.6 of common parameter) is 0.	×	At executing communication initial command (H5100) or resetting control commands
	H0021	Reserved		
	H0022	Reserved		
	H0023	Velocity data of common parameters (parameter No. 5 to 7 of common parameters) or velocity data of automatic RUN (data No.4 of automatic RUN position data) exceeds available range.	×	
	H0024	Upper limit position data of common parameters (parameter No. 10 of common parameters) or Lower limit position data (parameter No. 11 of common parameters) exceeds available range.	×	
	H0025	Home position data of common parameters (parameter No. 12 of common parameters) exceeds available range.	×	
	H0026	Homing mode of common parameters (parameter No.1 of common parameters) is undefined mode.	×	
	H0027	Velocity mode of common parameters (parameter No.1 of common parameter) is undefined mode.	×	
	H0028	Acceleration and deceleration mode of common parameters (parameter No.1 of common parameters) is undefined mode.	×	
	H0029	Pulse number for one rotation (parameter No.2 of common parameters) or Work move length for one rotation (parameter No.3 of common parameters) is 0.	×	
	H0030	Undefined command was received.	×	
	H0100	In the ABS encoder homing mode (parameter No.1 of common parameter), at starting to homing there was no ABS encoder input.	×	

Group	Error code	Contents	Beha-vior	Clearing timing
Data error	H0401	In the velocity and position mode (refer to data No.1 of automatic RUN position data), if deceleration time (data No.3 of automatic RUN position data) is smaller than min. available deceleration time, EH-POS decelerates with the min. available deceleration time.	○	At executing communication initial command (H5100) or resetting control commands
	H0402	In the velocity and position mode (refer to data No.1 of automatic RUN position data), at accelerating or decelerating control mode setting signal was changed from ON to OFF.	○	
	H0403	Reserved		
	H0404	Reserved		
	H0405	In the velocity and position mode (refer to data No.1 of automatic RUN position data), control mode setting signal was changed from ON to OFF.	×	
	H0407	Reserved		
	H0410	Velocity data of automatic RUN position data (data No.4 of automatic RUN position data) exceeds upper limit (parameter No.4 of common parameters.)	×	
	H0411	Destination data of automatic RUN (data No.5 of automatic RUN position data) is smaller than under limit position data (parameter No.10 of common parameters), or bigger than upper limit position data (parameter No.11 of common parameters). Or EH-POS was tried to operate in manual RUN mode with a bigger or smaller position data than upper or lower position specified by common parameters.	×	
	H0412	Moving quantity exceeded max. number (2,147,483,647).	×	

Group	Error Code	Contents	Beha-vior	Clearing timing
Overrun	H0801	Overrun to + direction (CCW) happened. Take measures according to “Procedure when O.R. lamp turned ON” in chapter 11 “Trouble shooting”.	×	At releasing overrun
	H0802	Overrun to – direction (CW) happened. Take measures according to “Procedure when O.R. lamp turned ON” in chapter 11 “Trouble shooting”.	×	
Communication error	H8001	There is a mistake in a parameter number in common parameter indication command.	○	At releasing communication initial command (H5100) or releasing control command
	H8002	Because next control command was received before completion of a current control command (before outputting pulses), the received next control command is ignored.	○	
	H8003	Parameter number in a communication command of common parameters has a mistake. Received command is ignored.	○	
	H8004	A command other than communication initializing command was received during executing of communication command H4F00 or H48**. The communication is stopped.	○	
	H8005	A communication command was received during handshake bit of a status register was 1. The received command is ignored.	○	
	H8006	Next command was not received more than 1 sec. or equal during executing communication command H4F00 or H48**. The communication is stopped.	○	
	H8010	There was a communication error between a Positioner and an EH-POS.	○	
Memory error	H0910	Data can not be written to EEPROM. Rewriting times may exceed the maximum number (100,000). Reset the module and write data, or exchange the module.	×	At pushing the reset switch or at changing the module
	H0911	Sum check error of EEPROM happened. This error may happen at writing EEPROM. Confirm setting value of Common parameters and automatic operation positions data, and write EEPROM again. Then reset the module.	×	

Chapter 11 Trouble shooting

This chapter describes the errors at operation. There are major five kinds of error indication as follows.

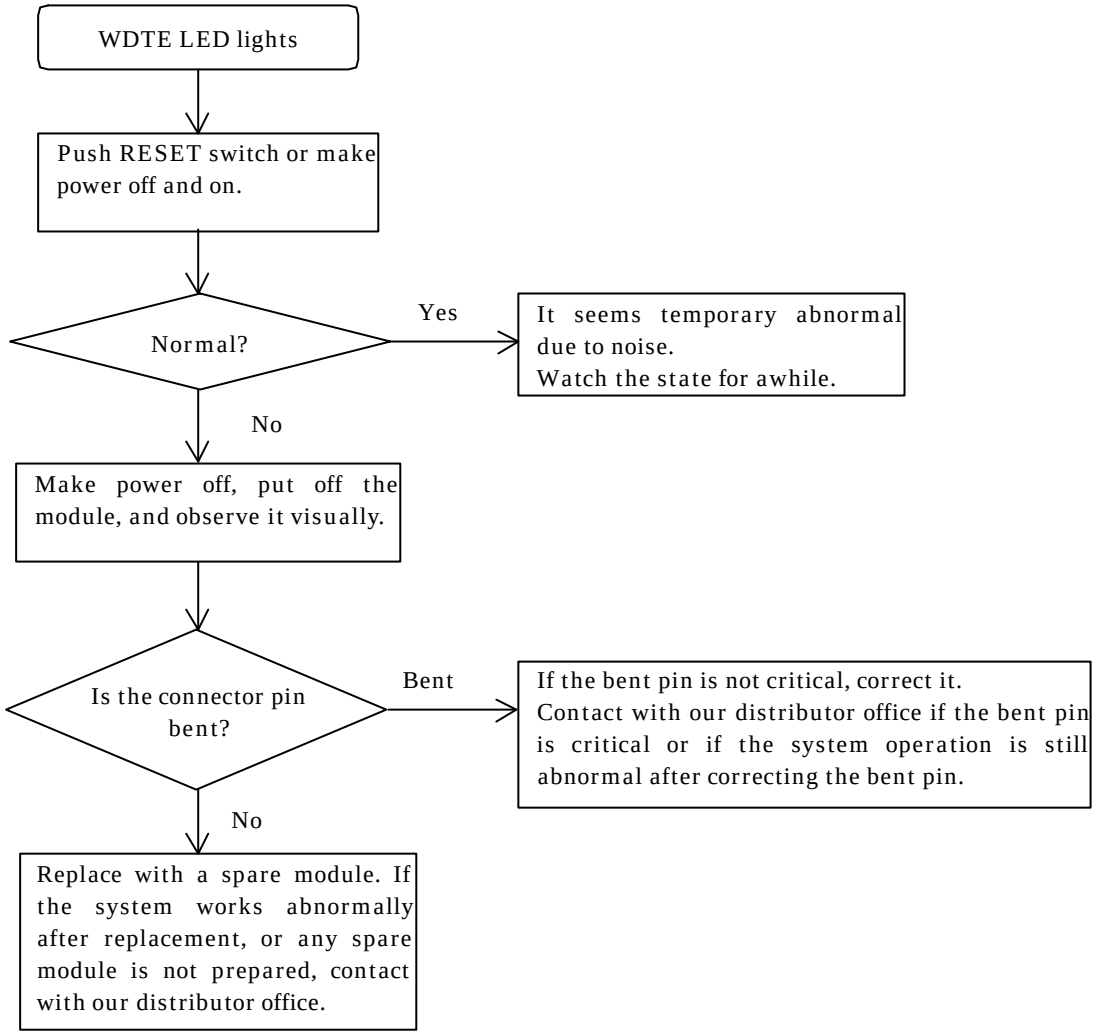
(1) LED Indication in front of EH-POS
(2) Status register (WX***0) Indication
(3) Positioner (option) Indication
(4) EH-CPU Indication
(5) No error indication on EH-POS and EH-CPU but abnormal motor operation

11.1 Error indication of LED

LED	ERROR or Function	Content	Countermeasure	LED at abnormal
POW	Power LED	No power (Power LED of Power module is turned off). The module is not mounted in base correctly.	Check the power supply is added. Check the connection of module and mount module correctly.	off
WDE	Watch dog timer error	MPU in EH-POS has an error.	Push RESET switch. Reset the power supply.	on
O.R	Overrun error	Overrun state occurred. (In case DIP switch No.5 and 6 are OFF, and external input signal of overrun is valid.)	Release the overrun state in manually, and perform return to starting again. In case the external input signal of over RUN is not used, set DIPswitch No.5 and 6 on to be invalid it (Refer 11,12).	on
CMDE	Command error	Command error occurs.	Check the error code in WX***2 by executing error display command (H5000). Perform error recovery procedures according to chapter 10. error code list.	on

Note: At power off, “WDE” LED lights for a moment, but this is not abnormal.

11.1.1 Trouble shooting procedure for WDTE LED on. (Module abnormal)

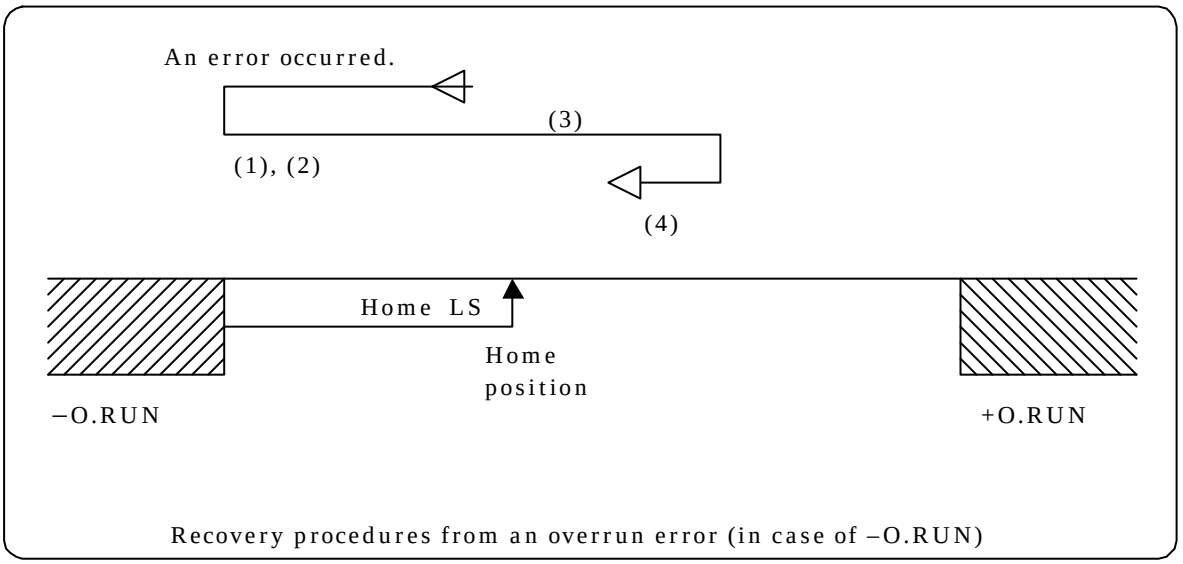


11.1.2 Trouble shooting procedure for O.R lamp on (Overrun error)

Take the following procedures to recover from an overrun error.
The case of –O.RUN is explained below (In case of +O.RUN, the direction is the opposite.)

Abbreviation: –O.RUN = Overrun of clockwise (CW) direction
+O.RUN = Overrun of counterclockwise (CCW) direction
O.RUN = Overrun including –O.RUN and O.RUN

(1) Move the system manually in the direction where O.RUN is released.
(2) Confirm the release of O.RUN. When the O.RUN is released, OR lamp turns off.
(3) Move the system manually toward a positive position of the starting point or a position within the home LS.
(4) Execute return to starting point.
(5) Execute normal operation.



Recovery procedures from an overrun error (in case of –O.RUN)

11.2 Error indication of LED

The error bit of the status register is set to “1” when data error, command error or communication error occur.

Status register display	Name of error	Description	Countermeasure
H*4** H*C**	Overrun error	Overrun occurred.	Refer to Trouble shooting procedure of this chapter (11.1.1).
H3*** H1***	Data error or command error	Data error or command error occurred.(Note1)	Refer to the Error code list in chapter 10.
H8*** HC***	Communication error	Communication error occurred	

Note1: After error is released, if communication initializing command (H5100) is not issued, the display shows H1***.

11.3 Error display at Positoner(Option)

When error code display is selected in monitor mode, error code will be displayed on display part. Refer to chapter 14 for operation of positioner. Refer to chapter 10 for error code in detail.

11.4 Error display on EH-CPU

When watchdog timer error occurs at EH-POS, EH-CPU displays error as module abnormal.
Refer to the application manual of EH-150 in detail.

11.5 Abnormal operation of Motor

No.	item	explanation / countermeasure
1	Is the I/O allocation correct?	Confirm I/O allocation of EH-POS. I/O allocation of EH-POS is “word 4W/4W”. Otherwise, EH-POS operation is abnormal or no operation in wrong I/O allocation.
2	Is the wiring proper?	Check the connection of the output terminal of EH-POS and the input terminal of motor controller. In case of O.RUN error, refer to section 11.1.2
3	Does the setting of DIPswitch No.1 and 2, match with the pulse output method of EH-POS, and the pulse-input method of motor controller?	In case of the mismatch, one of the following abnormal operations is caused. (a) The motor runs only in one direction. (b) An error occurs to the motor controller. (c) The motor running direction changes in a short interval.
4	Is EH-POS in stand-by mode before automatic operation?	When automatic operation is executed, EH-POS must be in stand-by mode. By executing homing or manual operation command, set EH-POS in stand-by mode.
5	Are connectors connected? Is the connector pin bent?	When I/O connectors are not inserted exactly or connector pin is bent, signals are not transferred correctly, the motor may cause miss-operation or may not move.
6	Isn't pulse generated even indication of current position changes in manual operation or automatic operation?	If No.1,2 and 4 above are correct, then module trouble is guessed. In this case please contact with our distributor office.

Chapter 12 Comparison with POSIT-2H

12.1 Comparison with POSIT-2H

EH-POS has additional functions shown below against POSIT-2H and POSH for H-series PLC.

(1) It is possible to select a type of homing (Return to home position).
Type of returning to (arbitrary, low-speed, high-speed) and direction (forward, reverse) can be selected in common parameters.

(2) Acceleration time and deceleration time can be specified individually in automatic operation mode.
Acceleration time and deceleration time are specified individually at each step in automatic operation mode. In return to home point mode and manual operation mode, they are performed at value with acceleration/deceleration time being set in common parameter.

(3) S-shaped acceleration/deceleration function is added.
Trapezoidal or S-shaped (3-kind) acceleration/deceleration can be set in common parameters.

(4) Line driver output of pulse output method is added.
Open collector output and line driver output are available on different terminal at same time.
(CW/CCW, Clock/direction are specified with DIP switch No.1 and 2 at side of EH-POS module.

(5) It is possible to select a valid/invalid of external input signals (COIN, +O.RUN, -O.RUN).
The eternal input signals (COIN, +O.RUN, -O.RUN), which is usually ON in normal operation, can be specified in valid or invalid. This is usable to operate before wiring of COIN,+O.RUN and -O.RUN signals.
The selection of valid/invalid is set with DIPswitch No.4,5 and 6 at side of EH-POS module.

(6) Command code is extended according to the addition or extension of function.
(a) The velocity change in RUN mode (addition of H8000)
This is available in homing mode and automatic operation mode.
(b) Current position data update (addition of H4DFF)
Current position data update command (H4DFF) is supported in communication command.
(c) Restart after stop command
It is possible to restart after deceleration stop (H0700) and Emergency stop (H07FF). (System keeps stand-by.)
(d) Handshake procedure in display command
The handshake procedure is added to ensure the procedure.

(7) ABS encoder
Encoder type is specified in homing mode in common parameters.
(Applied manufacturer and series: HITACHI AD series, Yasukawa Σ series/Σ II series, Sanyo P series)

(8) Content of status register is changed.
Run latch bit and error latch bit are added.

12.2 Command Comparison with POSIT-2H

The table below shows the commands added to EH-POS against POSIT-2H.

Table 12.1 Comparison of Control Command

No.	Control register WY***4 written value	POSIT-2H		EH-POS		Changed/ added
		Command name	Content	Command name	Content	
1	H0000	HALT	Decelerated stop	Undefined	The command is ignored. (Countermeasure of I/O refresh)	Changed
2	H03**	Manual 2	Teaching setting	Manual operation	This command generates pulse, and it is stopped by stop command.	Added
	H0300	Undefined	–	Forward manual operation	This command generates forward continuous pulse.	Added
	H0301	Undefined	–	Forward JOG operation	This command generates forward one pulse (JOG).	Added
	H0310	Undefined	–	Reverse manual operation	This command generates reverse continuous pulse.	Added
	H0311	Undefined	–	Reverse JOG operation	This command generates reverse one pulse (JOG).	Added
3	H07**	Undefined	–	Stop	The system is stopped and is set to stand-by mode.	Added
	H0700	Undefined	–	Slow down and stop	The system is decelerated and stop.	Added
	H07FF	Undefined	–	Emergency stop	The system stops without deceleration.	Added
4	H8000	Stop	Emergency stop	Velocity change	This command changes the velocity in RUN mode. The stored data is not changed.	Changed
5	H84**	Undefined	–	Velocity and position data specified automatic step operation	Automatic step operation is performed by the control mode, acceleration time and deceleration time, which are used in the ** step data and the specified data of velocity and position in operation.	Added

Chapter 13 Programming example

When EH-CPU issues three kinds of command such as communication, operation and display command, and the EH-POS executes these commands. Program to issue above three commands are called as communication program, operation program, data read program individually. In this chapter, these three programs are explained.

13.1 Caution on programming

EH-POS can not recognize the second command or later when it receives the same command twice continuously, because of EH-CPU refresh processing. Therefore when you want to write the same command continuously to the control register, write the communication initial command (H5100) or the other command in the next scan.

13.2 Communication program

Communication program is the program, which writes the communication command in 6.3.2 to control register (WYrus4). EH-POS sets data (common parameter, automatic position data) on EH-POS in transmission are (WYrus5 to 7) according to communication command. Therefore setting data must be write in transmission area before issuing communication command. (Communication command and setting data may be write in the scan, Because of EH-CPU refresh processing.)

⚠ Caution

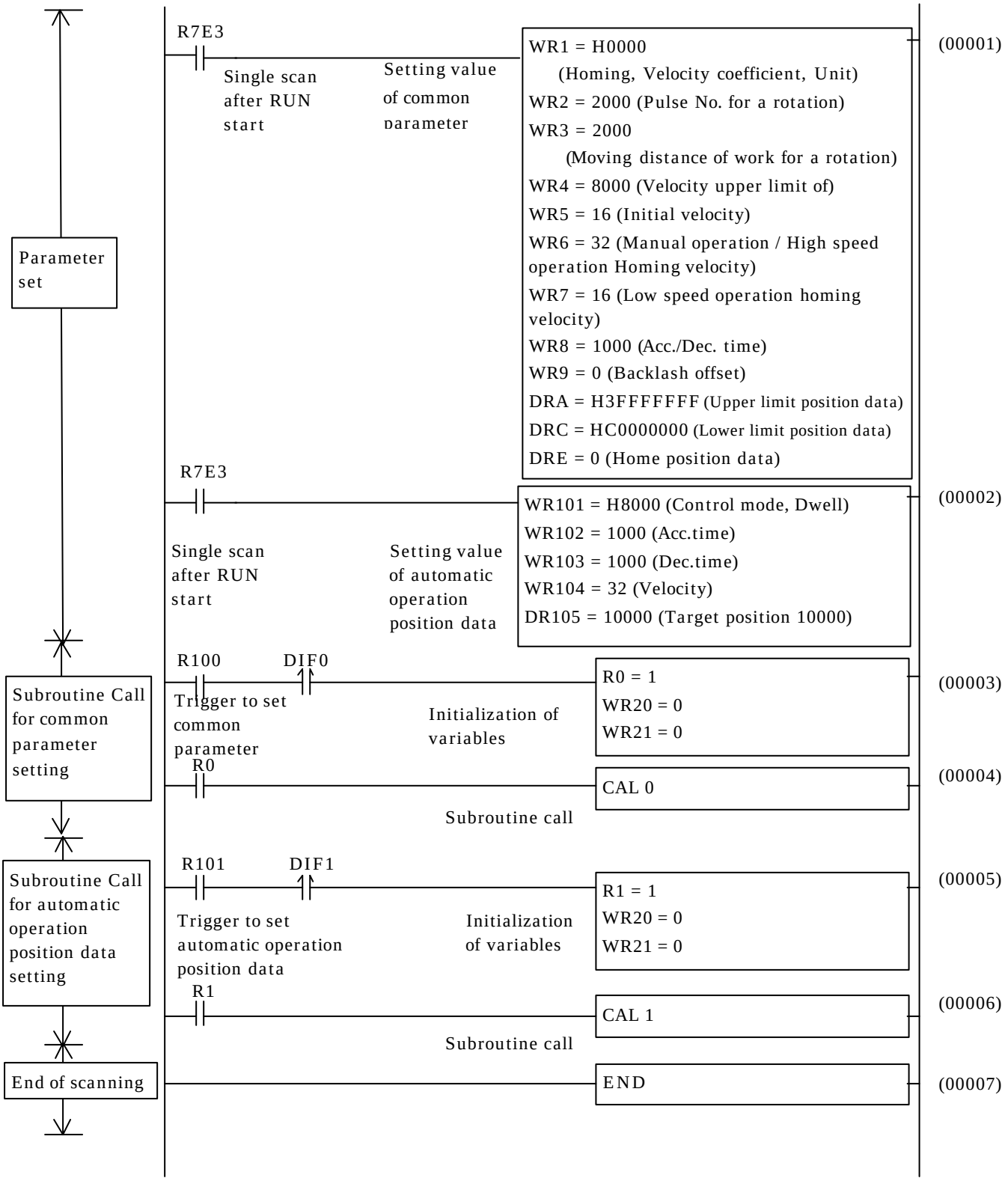
When data are set to EH-POS, they are stored in the internal memory (EEPROM) and such data are retained in case of power failure.

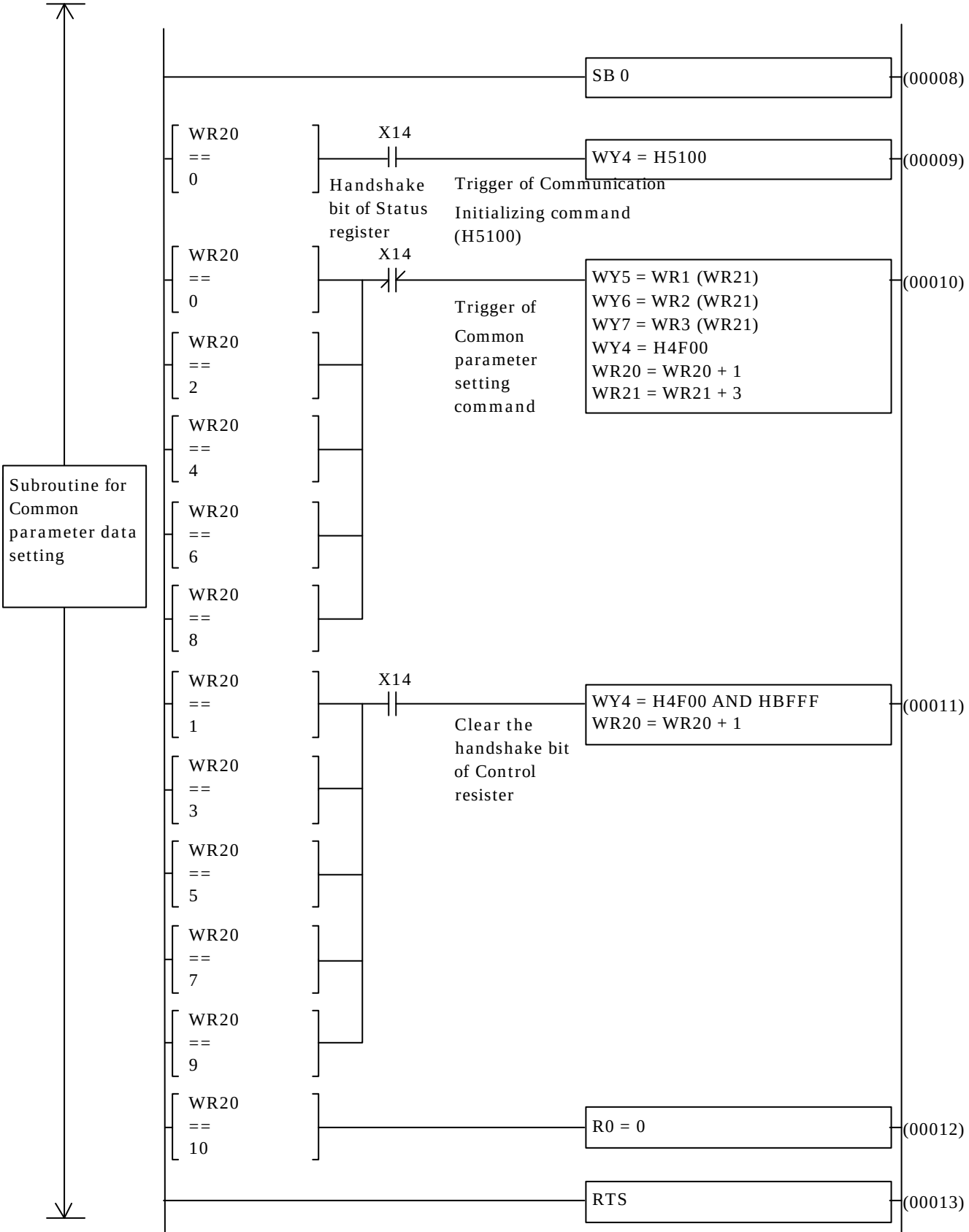
Therefore, once data are set by program, no communication program is required. However store the data set in the memory onto an external storage device such as floppy disk, preparing for the accidental memory damage. If it is not available, record the data on setting sheet attached at the end of the manual, and keep it. It is possible to rewrite data individually by executing the communication command, which is driven by Forced Set/Reset function. (Refer to 6.3.2 Communication command for details.)

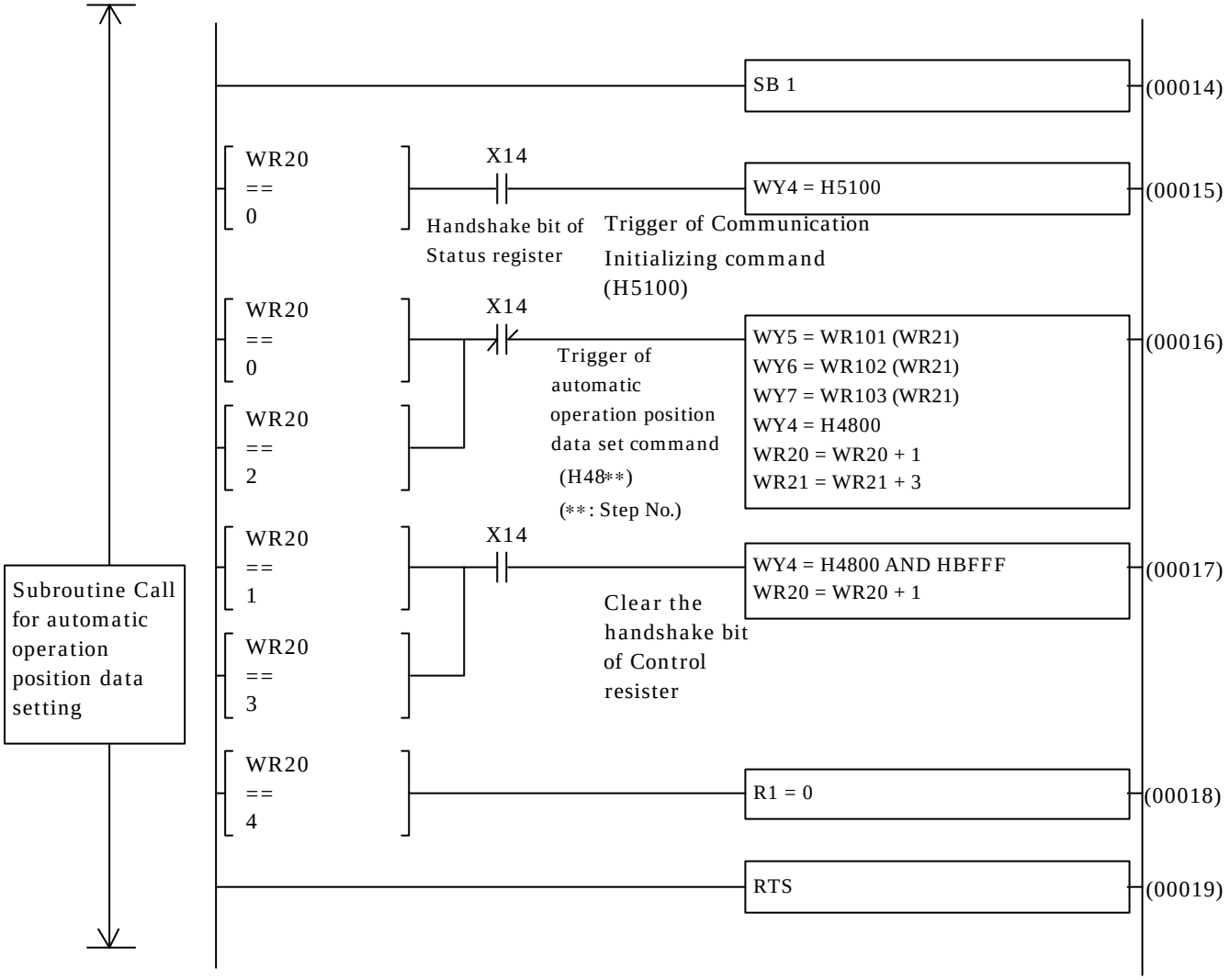
The content of EEPROM can be rewritten up to about 100,000 times. It is not guaranteed to rewrite more than about 100,000 times.

Data are transferred from the EH-CPU to EH-POS using 3-word transmission area (WYrus5 to 7). Therefore repeating 5 times of transmission process is required to update all the 15 words of common parameter (when communication command is H4F00), while two repeating of transmission process is required to update all 6 words of the automatic operation data for one step (when the communication command is H48**. Here **is the step No.). Refer to Chapter 7 for details of communication procedure.

(Example) In case of setting Common parameter all data set (H4F00), and setting of One step position data set (H4800) for Step00. (Following description is the case that EH-POS is put on slot 0.)




Subroutine for Common parameter data setting
SB 0
(00008)
WR20 == 0
X14
WY4 = H5100
(00009)
Handshake bit of Status register
Trigger of Communication Initializing command (H5100)
WR20 == 0
X14
WY5 = WR1 (WR21)
WY6 = WR2 (WR21)
WY7 = WR3 (WR21)
WY4 = H4F00
WR20 = WR20 + 1
WR21 = WR21 + 3
(00010)
Trigger of Common parameter setting command
WR20 == 2
WR20 == 4
WR20 == 6
WR20 == 8
WR20 == 1
X14
WY4 = H4F00 AND HBFFF
WR20 = WR20 + 1
(00011)
Clear the handshake bit of Control resister
WR20 == 3
WR20 == 5
WR20 == 7
WR20 == 9
WR20 == 10
R0 = 0
(00012)
RTS
(00013)



⚠ Notice

In case of rewriting all of common parameter 15 words (in this case, Communication command H4F00 is used), rewrite by three words by five times, within one second. If more than one second elapsed for this setting, the communication error occurred (Error code is H8006 then).
Refer to 7.1.1 Setting Communication Flow)

In case of rewriting all of automatic operation data 6 words for one step (in this case, Communication command H8** is used), rewrite with in one second or less.
(Refer to 7.1.1 Setting Communication Flow)

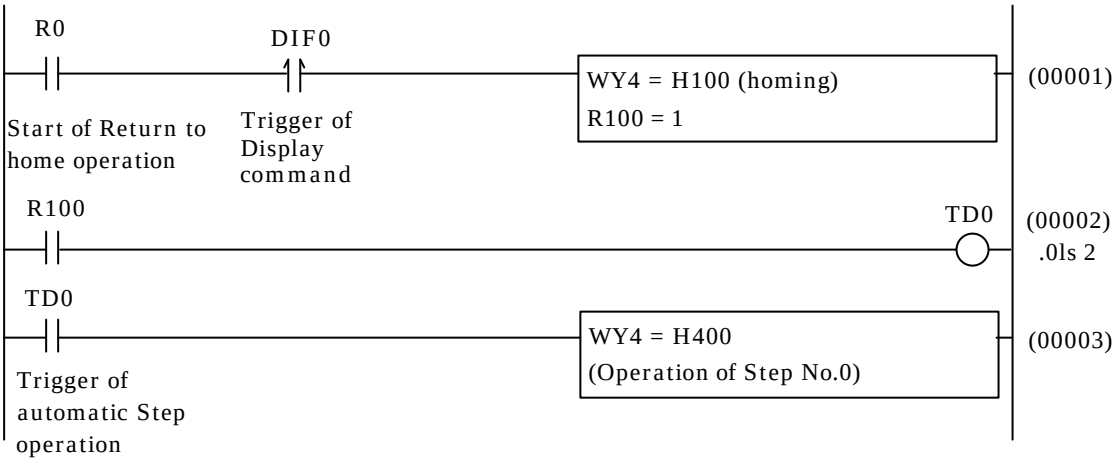
13.3 Operation program

Operation program is program, which writes the control command shown in 6.3.1 into control register (WYrus4). EH-POS will do the operation such as homing, manual operation, automatic operation, stop the operation and so on.

(Example) After homing operation, automatic step operation (Step No. 0) is executed. (Following description is the case that EH-POS is put on slot 0.)

This program will operates as follows.

(1) By setting internal output R0 with 0, homing operation is executed.[Circuit No.1]
(2) On-delay timer TD0 starts to count up. [Circuit No.2]
(3) When the current value of TD0 reached to 20mS, automatic step operation starts. [Circuit No.3]



⚠ Notice

By using Forced Set/Reset function in Monitor mode of programming tool, you can execute the operation command, without using sequence program by ladder diagram. In this case, set the control command into the Control Register (WYrus4).

The current position is displayed on display area of the memory (WXrus2 and WXrus3).

13.4 Data readout program

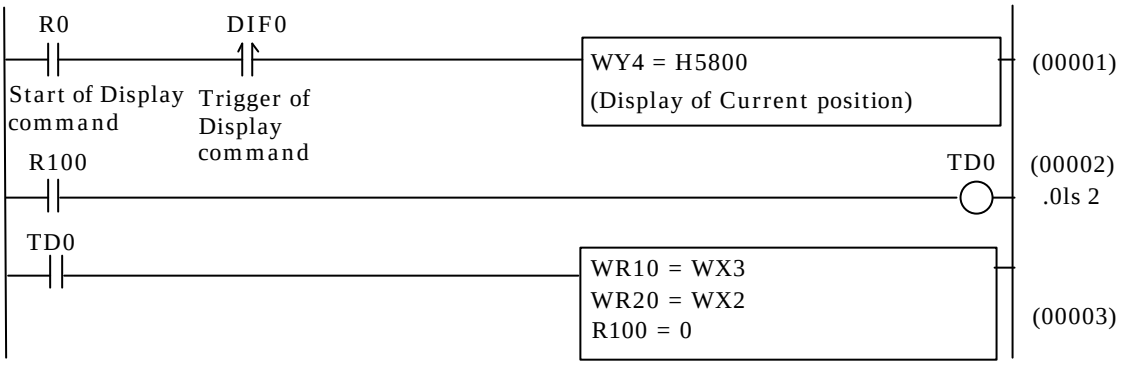
Data readout program is the program to write the Display command shown in 6.3.3 into Control Register (WYrus4). By the command written, EH-POS will read the data (Common Parameter or automatic Operation Position data), Error code and other data, which is set in the EH-POS.

To get data in the display area, at least one scanning time is necessary after writing the Display Code into Control Register (WYrus4). When you make data readout program, make sure to keep the above. Usually, to send data into CPU, one scanning time is necessary.

(Example) After homing operation, automatic step operation (Step0) is executed. (Following description is the case that EH-POS is put on slot 0.)

This program will operates as follows.

(1) By setting internal output R0 with 1, Current Position Data display command is executed.[Circuit No.1]
(2) On-delay timer TD0 starts to count up. [Circuit No.2]
(3) When the current value of TD0 reached to 20mS, current position (upper) is set in WR10, and current position (lower) is set in WR20. [Circuit No.3]



⚠ Notice

Readout of individual data can be done by Forced Set/Reset function in the Monitor mode of the programming tool. In this case, the sequence program of the ladder diagram is not necessary.

Especially, when no data back up is needed, or data (which is used in setting communication program) is backed up by floppy disk, Sequence program is not necessary.

By using Forced Set/Reset, set the communication command into Control Register (WYrus4).

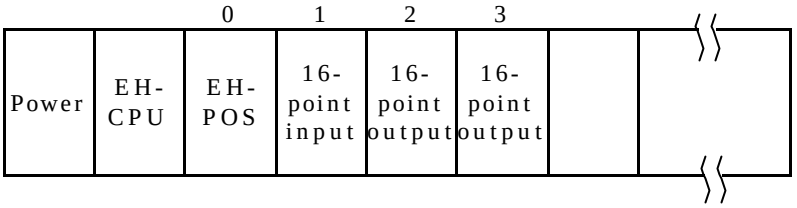
Readout data is displayed on the Display area (WXrus2 and WXrus3).

13.5 Example of simple program and operation

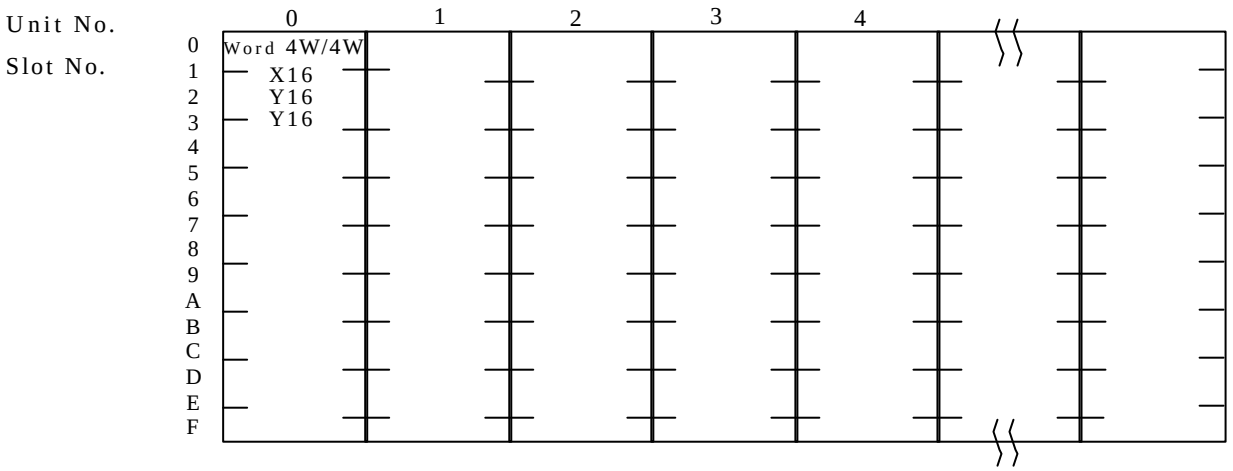
The programs (communication program, operation program and data read program) are usually used in combination. In this section, a simple program combining these three programs and its operation is explained.

13.5.1 Configuration

(1) Installation position is shown below.



(2) I/O allocation is shown below.
CPU setting: EH-150
I/O assignment (Standard I/O assignment)



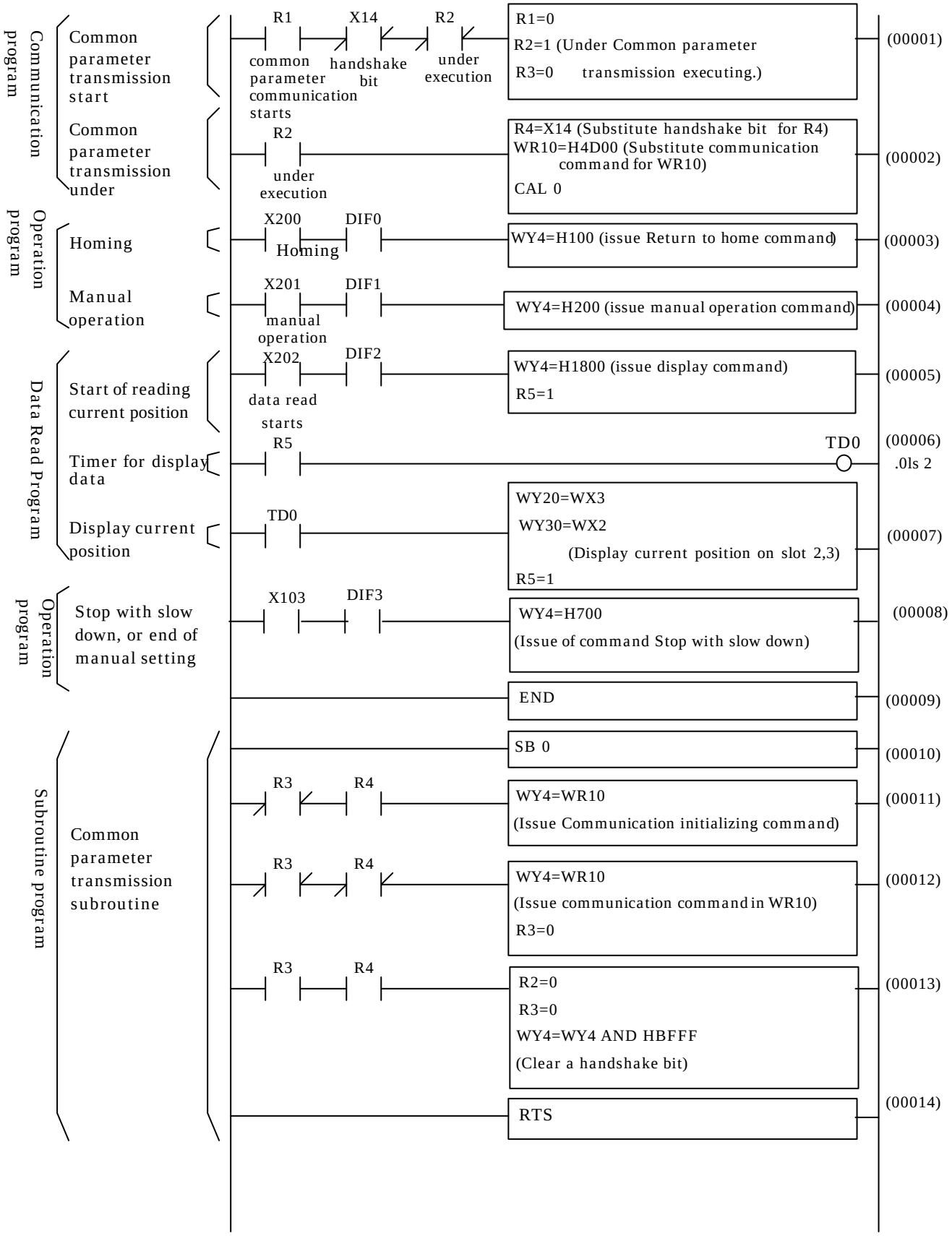
(3) For external wiring, refer to Chapter 9 Positioning module installation.

13.5.2 Explanation of Execution

This program executes operation below.
(1) When R1 is turned on, common parameter is set with the default value.
(2) When X100 is turned on, homing operation is done.
(3) When X101 is turned on, it turns to manual positioning operation mode.
(4) When X102 is turned on, the current position data is shown on slot2 and slot3.
(Lower word is shown on slot3 and upper word is shown on slot2.)
(5) When X103 is turned on, the motor stops after slow down (deceleration).
(When motor is in Stop State, ending procedure of manual operation is done.)

13.5.3 Program

(1) Program list



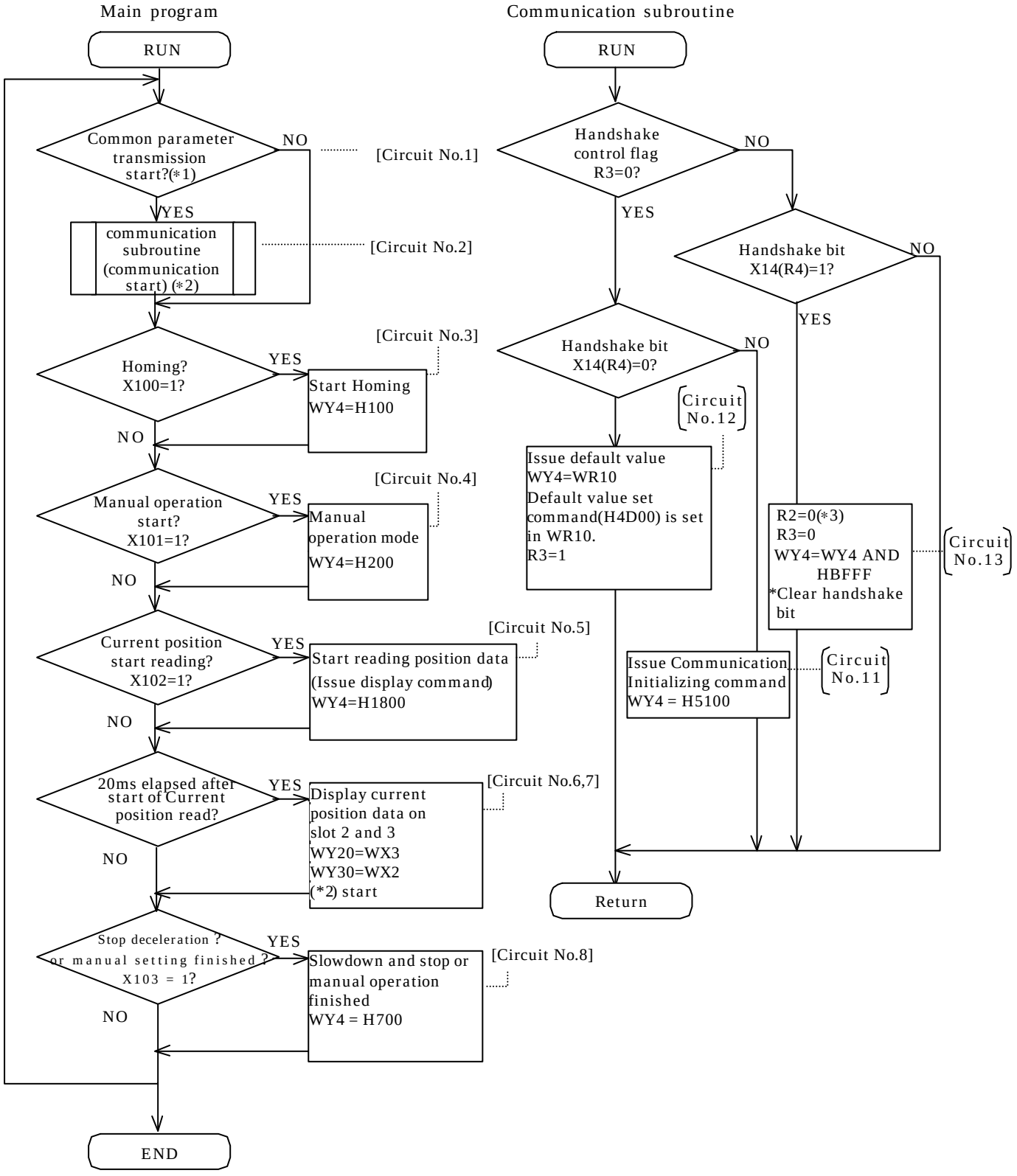
(2) Bit and word allocation

The operation is started by setting the bit marked by * in the table to “1”.

Table 13.5.3 Internal bit and word list

Circuit No. be used	Program to be used	I/O No.	Function and Description
1 to 2 11 to 13	Communication program (include Subroutine)	R1	Common parameter transmission starts *
		R2	Common parameter is under sending
		R3	Handshake control flag (Sets the handshake bit to”1” by communication command issued, and to “0” by communication completes.)
		R4	The value of the handshake bit of status register 1 (set “1” after data setting completes)
		WR10	Communication command Indicates the communication command to be set to the control register in communication
3 to 4,8	Operation program	X100	Input of the return to starting point operation start *
		X101	Input of the manual operation mode start
		X103	Start input of Stop with slow down * Or input to finish manual operation
5 to 7	Data Read Program	R5	Start Timer(TD0) operation
		X102	Start reading current position data *
		WY20	Output current position data (upper) on slot 2.
		WY30	Output current position data (lower) on slot 3.

(3) Flow chart



—Optional explanation —

(*1): Is R1 turned ON?

(*2): When R2 is turned on, communication starts. Communication subroutine is executed every time until R2 is turned OFF.

When R2 is off, the communication subroutine is not executed.

(*3): R2 is set to “0” as transmission is completed. The communication subroutine is terminated.

13.5.4 Operation example

The example of operation is shown in below.

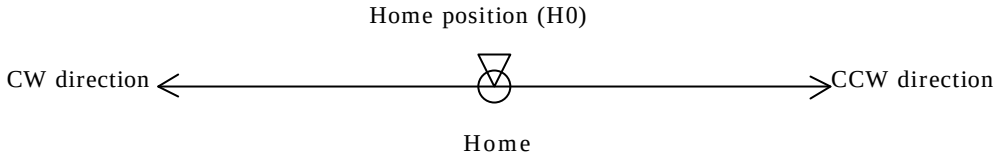
(1) Set default values in common parameter

The default values are set in common parameter by making R1 on using Forcing set/reset function in programming tool.

(2) Homing operation

Homing operation (Return to home point operation) is executed by setting X100 on.

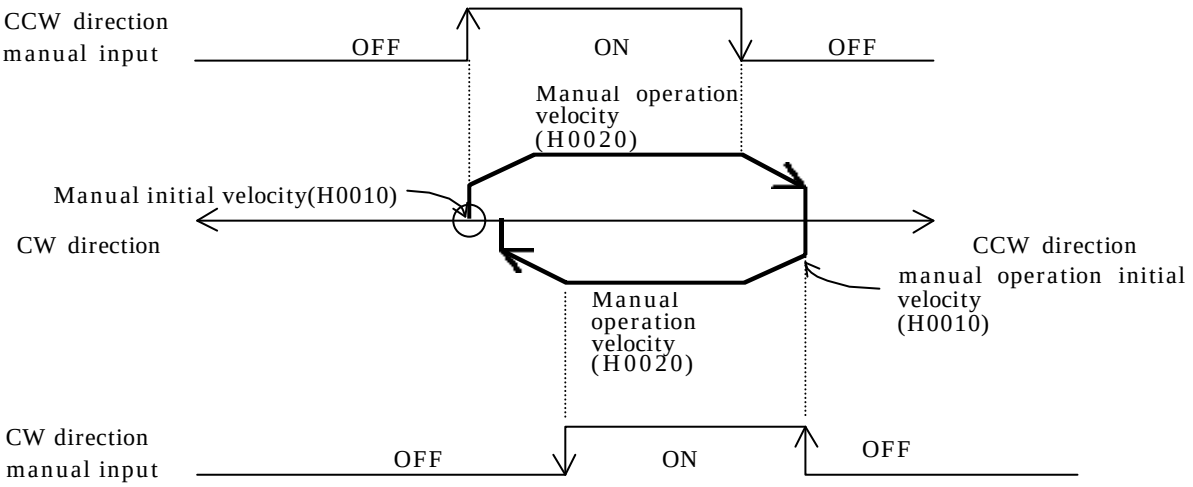
Output pulse is not generated (Motor dosed not move.) and starting point change to the current position data, then homing operation is terminated.



(3) Manual operation

Set the manual operation mode. (Set X101 to ON.)

Start position is assumed as home point.



(Note) Refer to Section 8.2.1 Manual operation1 (External input specification mode) for the operation timings.

(4) Read current position data

Start reading current position data is performed. (Set X102 to ON.)

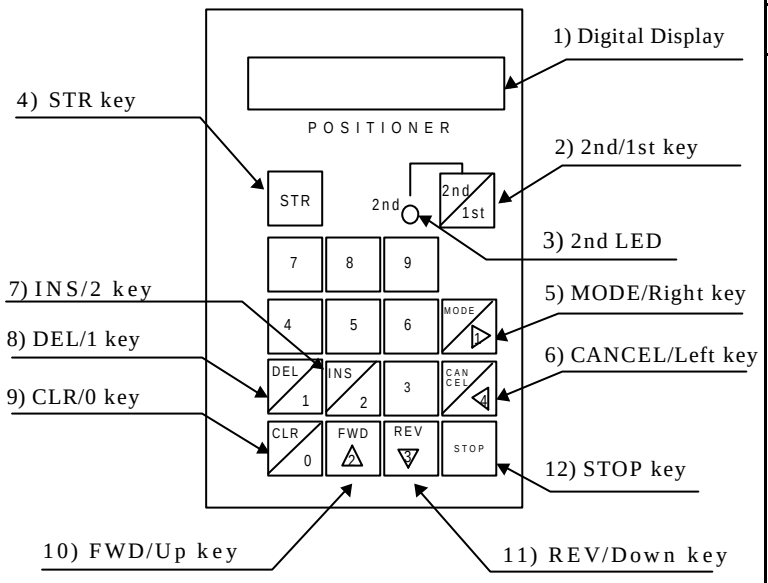
Display the current data (upper) on slot 2. (Hexadecimal)

Display the current data (lower) on slot 3. (Hexadecimal)

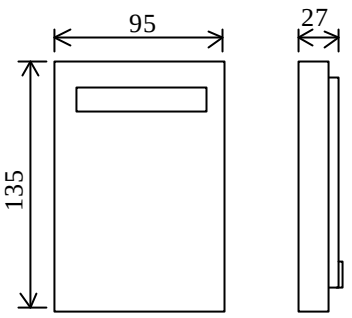
Capture 14 Positioner (option) Operation

14.1 Structure and operation keys

Name and function

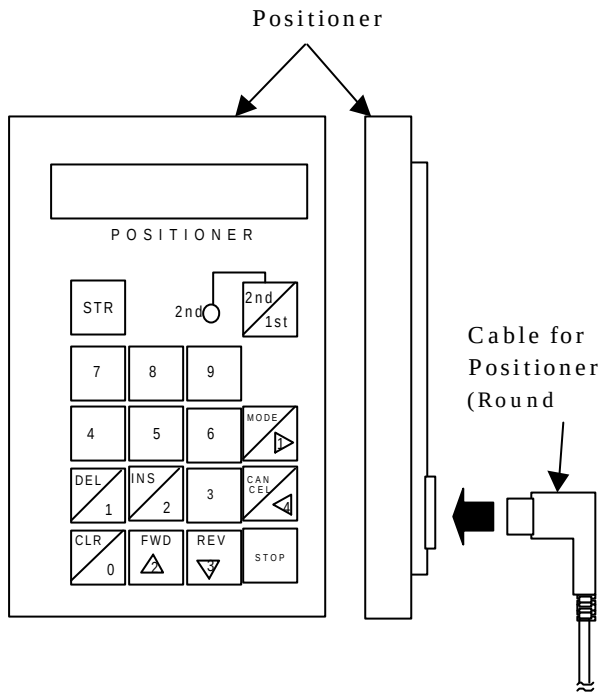


Model	RPS-3A
Weight	Approx. 0.2 kg
Dimension(mm)	



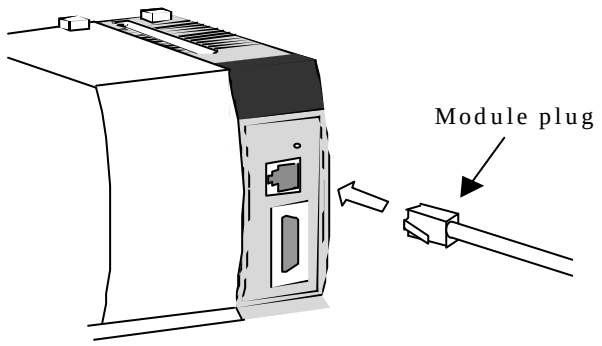
No.	Name		Function	Remark
1)	Digital Display		Displays various data such as common parameter and automatic operation position data, status, position and error code.	
2)	2nd/1st key		Changes 2nd key and 1st key.	
3)	2nd LED		Lights when 2nd key is valid.	
4)	STR key		Changes lower mode or lower menu. Transmits a set data to module.	
5)	MODE /Right key	MODE	Selects a mode. Change display of decimal and hexadecimal when data input.	2nd key selected.
		Right	Moves a cursor to right, when setting data is changed.	1st key selected.
6)	CANCEL /Left key	CANCEL	Changes upper mode or upper menu. Deletes a previous data.	2nd key selected.
		Left	Moves a cursor to left, when setting data is changed.	1st key selected.
7)	INS /2 key	INS	Increments a setting data. Commands a forward one pulse output in manual operation mode. Changes a sign(+ or -)	2nd key selected.
		2	Inputs “2”.	1st key selected.
8)	DEL /1 key	DEL	Decrements a setting data. Commands a reverse one pulse output in manual operation.	2nd key selected.
		1	Inputs “1”.	1st key selected.
9)	CLR /0 key	CLR	Clears displayed data and set to “0”.	2nd key selected.
		0	Inputs “0”.	1st key selected.
10)	FWD /Up key		Changes mode or menu (UP). Commands forward pulse output in manual mode.	
11)	REV /Down key		Changes mode or menu (Down). Commands reverse pulse output in manual mode.	
12)	STOP key		Stops operation. (single click: deceleration stop, double click: emergency stop (stop without slow down))	
	Numerical key		Inputs figures.	

14.2 Installtion of Positioner



(1) Positioner (Option) connection

In Positioner behind, connect a round connector of cable for Positioner.



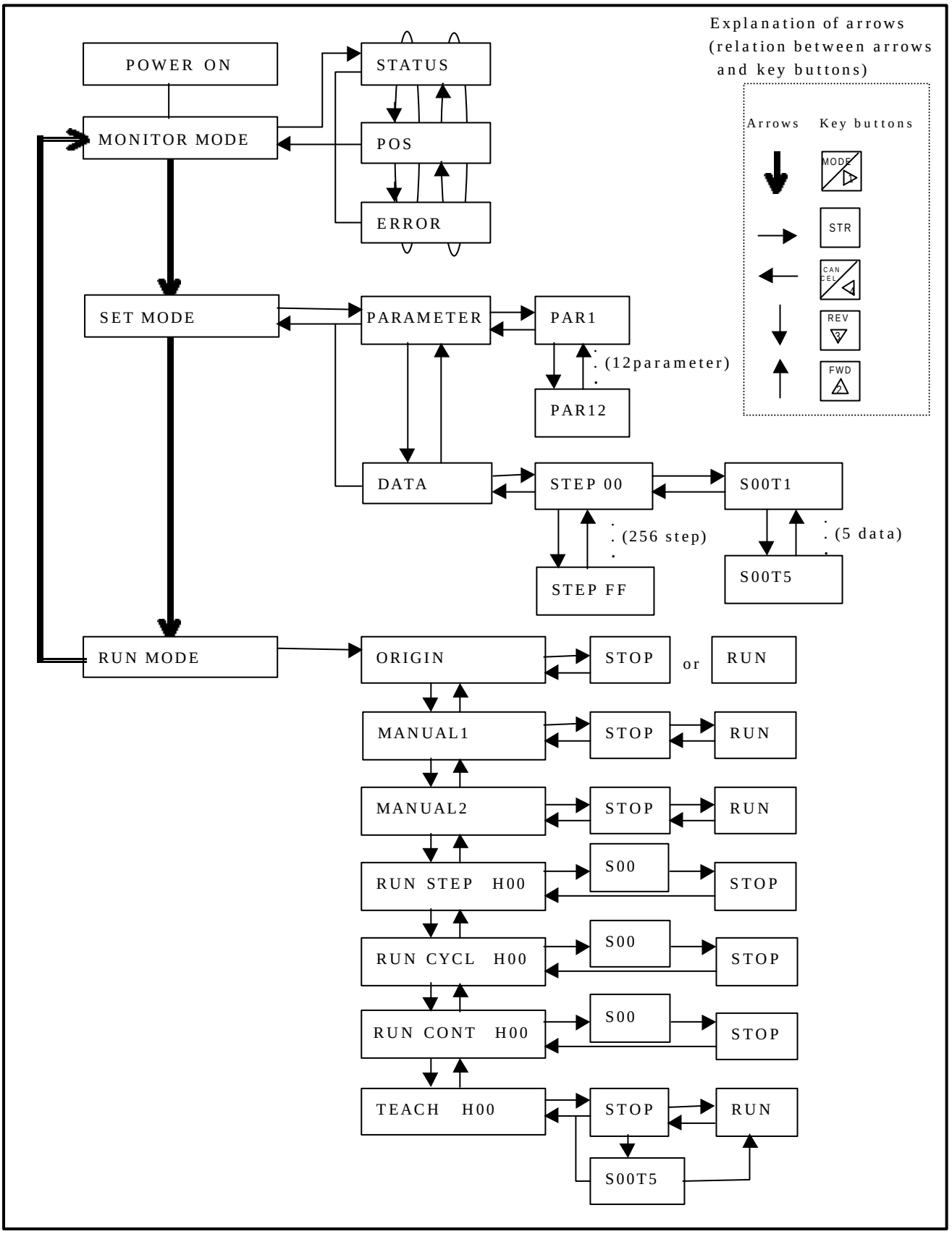
(2) Shut off the power

(3) Connect the module plug to module Connector (CN1) of EH-POS until it clicks.

(4) Turn on the power.

14.3 Function

Even you do not have an external programmer, you can operate homing operation, manual operation, and automatic operation with a Positioner.
Positioner can display the common parameter, automatic operation position data, status, position, and error code. The Flowchart for operating Positioner is shown below.

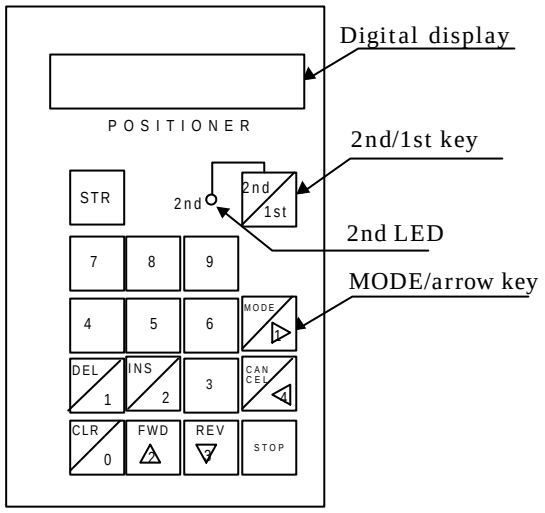


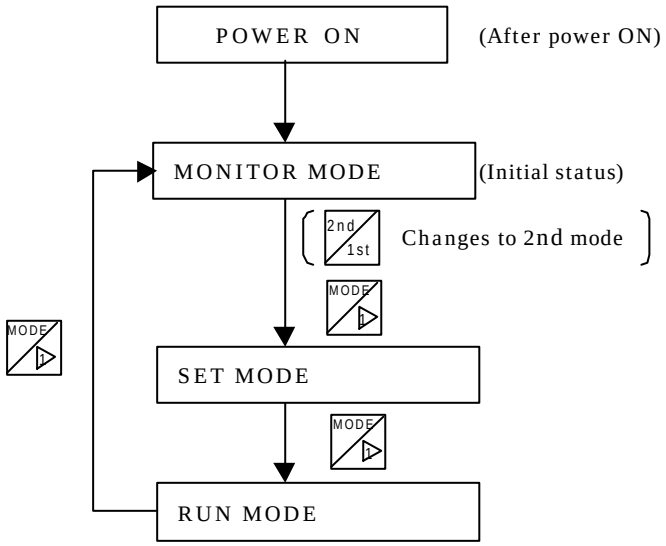
14.3.1 Monitor selection

There are three modes in Positioner as bellow.

No.	Mode	Function
1	Monitor mode	Displays data in status register, current position data, and error code.
2	SET mode	Sets Common parameter, automatic operation position data.
3	RUN mode	Operates to homing, starting manual operation, starting automatic operation, and teaching

How to change menu is shown below.





(1) Connect the Positioner to EH-POS, and Turn on the power.

(2) After displaying "POWER ON" on digital display, "MONITOR MODE" is displayed.

(3) By Poshing 2nd /1st key, 2nd LED lights and it changes to 2nd key mode.

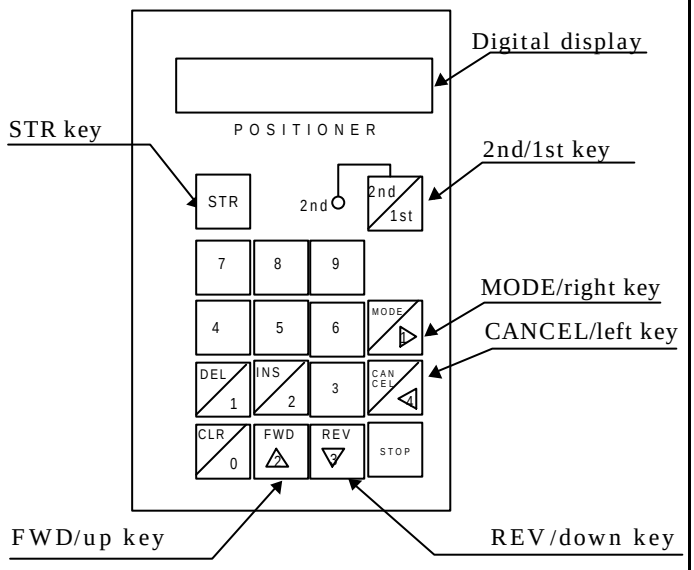
(4)Whenever MODE key is pushed, contents on the digital display is changed.

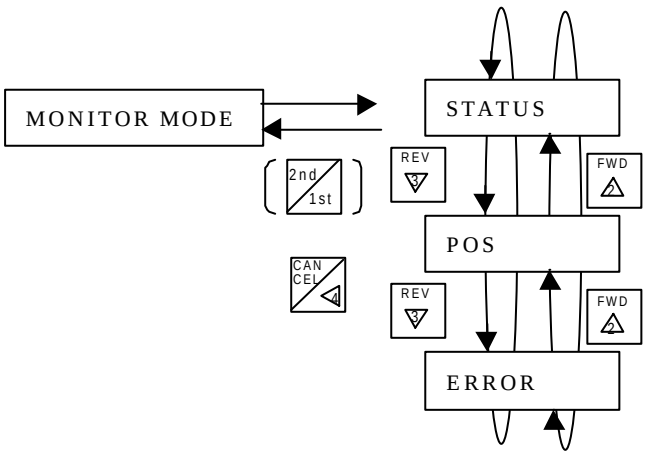
14.3.2 Monitor mode

Three are three menus in the monitor mode.

No.	Menu	Function
1	Status register (STATUS)	Displays the value of status register as hexadecimal.
2	Current position data (POS)	Displays current position data as hexadecimal or decimal.(frequency: approx. 0.2 second)
3	Error code display (ERROR)	Displays error code as hexadecimal. (H0000 is displayed when error is not existing.)

How to change menu at monitor mode is shown below.





To change decimal/hexadecimal display, push MODE key.

(1) Connect a positioner to EH-POS, and turn on the power.

(2) After displaying ”POWER ON” on digital display, ”MONITOR MODE” is displayed.

(3) After pushing STR key, display changes to ”STATUS”.

(4) Whenever REV down arrow key is pushed, display changes to ”STATUS” – ”POS” – ”ERROR” in order.

(5) Whenever FWD up arrow key is pushed, display changes to “STATUS” – ”ERROR” – ”POS” in order.

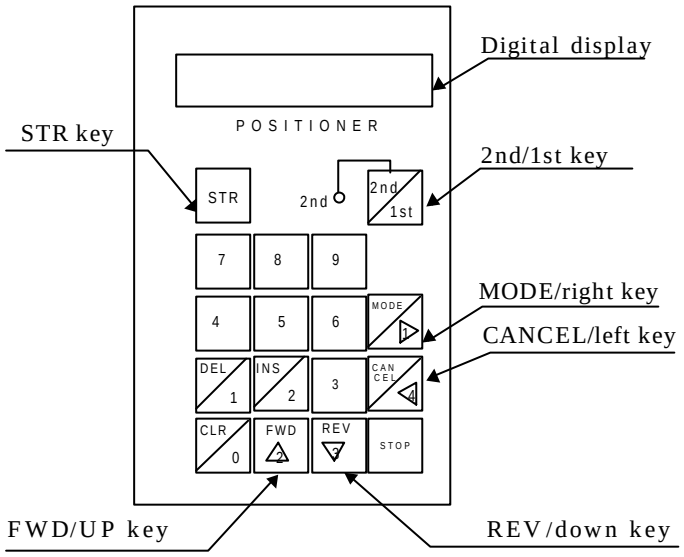
(6) Display returns to ”MONITOR MODE” by pushing CANCEL key, at the 2nd key mode which is get by pushing 2nd/1st key,

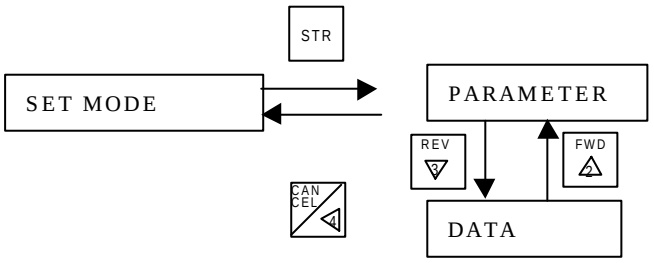
14.3.3 Set mode

There are two menus of SET mode in below.

No.	Menu	Function
1	Set common parameter (PARAMETER)	Set common parameters. (from PAR1 to PAR12)
2	set automatic operation position data (DATA)	Set automatic operation position data. (DAT1 to DAT5)

How to change menu at Set mode is shown below.





To change decimal/hexadecimal display, push the MODE key.

(1) Connect the Positioner to EH-POS, and turn on power.

(2) After displaying "POWER ON" on digital display, "MONITOR MODE" is displayed.

(3) By pushing 2nd/1st key, 2nd LED lights, and it changes to 2nd key mode.

(4) By pushing MODE key, display changes to "SET MODO".

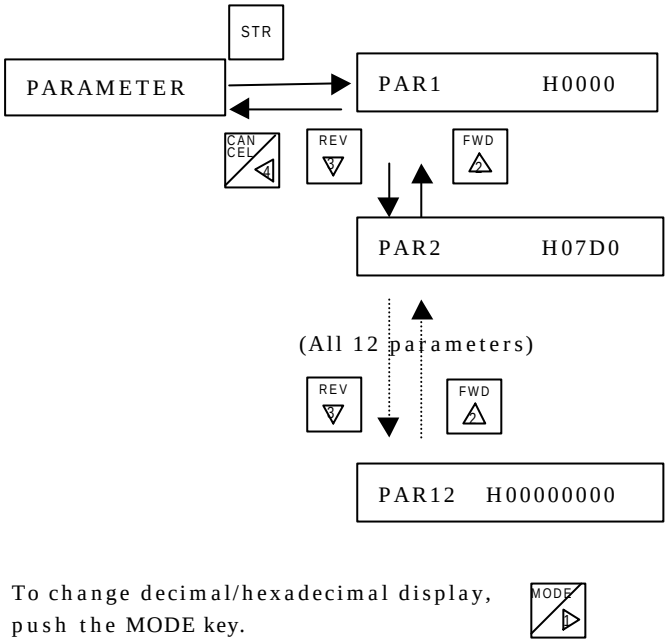
(5) By pushing STR key, display changes to "PARAMETER".

(6) By pushing REV down key, display changes from "PARAMETER" to "DATA".

(7) By pushing FWD up key, display returns from "DATA" to "PARAMETER".

(8) By pushing CANCEL key, display returns to "SET MODE".

Setting procedure of common parameters in PARAMER menu is shown below.



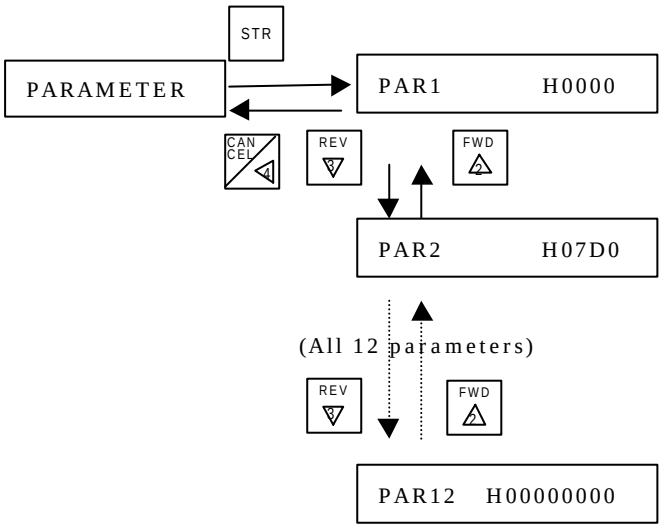
To change decimal/hexadecimal display, push the MODE key.

(1) By pushing STR key, display changes to“ PAR1”.

(2) Whenever REV down key is pushed, display forwards from ” PAR1” to ” PAR2”, ” PAR3”, ····· , ” PAR12”.

(3) Whenever pushing FWD up key, display returns from ” PAR12” to ” PAR11”, ” PAR10”, ····· , ” PAR1”.

(4) By pushing CANCEL key, display returns to ”PARAMETER”.



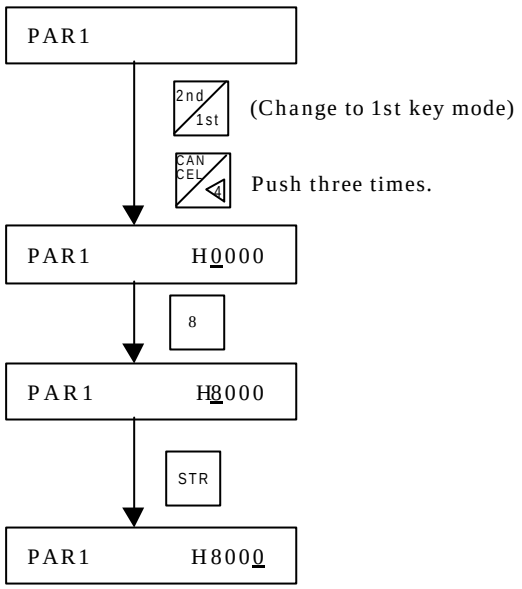
To change decimal/hexadecimal display, push the MODE key.

(5) By pushing STR key, display changes to“ PAR1”.

(6) Whenever REV down key is pushed, display forwards from ” PAR1” to ” PAR2”, ” PAR3”, ····· , ” PAR12”.

(7) Whenever pushing FWD up key, display returns from ” PAR12” to ” PAR11”, ” PAR10”, ····· , ” PAR1”.

(8) By pushing CANCEL key, display returns to ”PARAMETER”.



In case of setting data of PAR1 from H0000 to H8000

(1) By pushing 2nd/1st key, 2nd LED turns off, it changes 1nd key mode.

(2) By pushing Left key three times, the under bar "_" at first figure in foot of Number moves to three figures in left side.

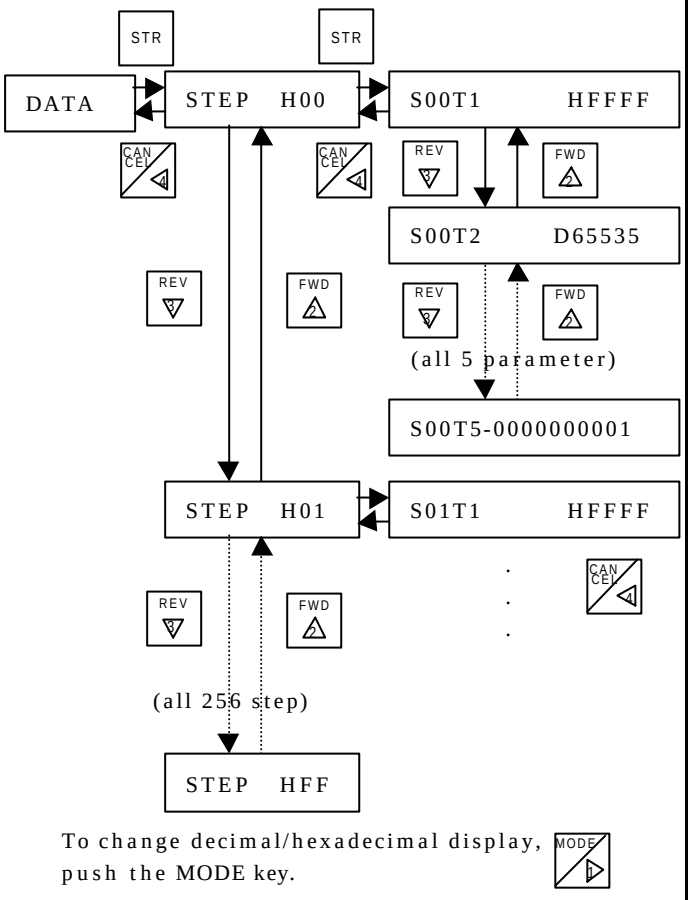
(3) By pushing "8" key, the display changes from " H0000" to " H8000".

(4) By pushing STR key, data is stored in memory, "_"(under bar) moves to fisrt place.

Note

Without pushing STR key, data is not stored in memory.

Setting procedure of automatic operation position data in DATA menu is shown below.



To change decimal/hexadecimal display, push the MODE key.

(1) By pushing STR key, display changes to "STEP H00".

(2) Whenever pushing REV down key, display forwards from "STEP H00" to "STEP H01", ····· ," STEP HFF".

(3) Whenever pushing FWD up key, display returns from "STEP HFF" to "STEP HFE", ·····," STEP H00".

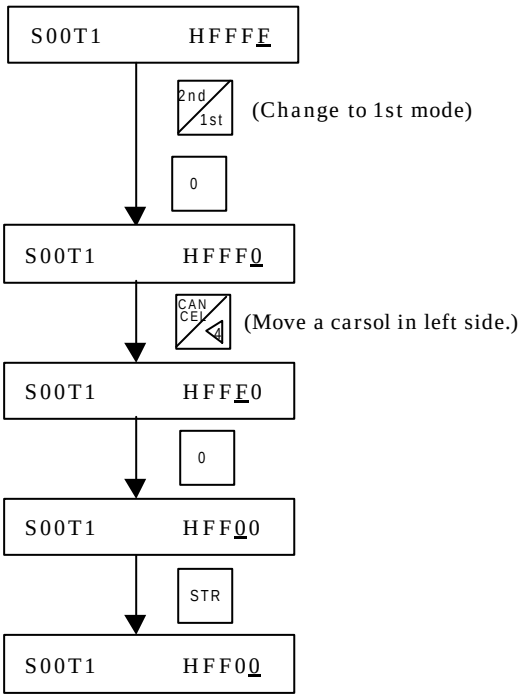
(4) By pushing CANCEL key, screen of digital display returns to "DATA".

(5) By pushing STR key at "STEP H00" status, display changes to " HFFFF".

(6) Whenever REV down key is pushed, display changes from "S00T1 HFFFF" forward to " S00T2 HFFFF", ····· , until "S00T5 HFFFFFFFF".

(7) Whenever FWD up key is pushed, display changes back to "S00T1 HFFFF".

(8) By pushing CANCEL key, display returnes to "STEP H00".



In case of setting data of S00T1 from HFFFF to HFF00

(1) By pushing 2nd/1st key, 2nd LED turns off, it changes 1nd key mode.

(2) By pushing "0" key, the display changes from " HFFFF" to " HFFF0".

(3) By pushing Left key, the under bar "_" at first figure in foot of Number moves in left side.

(4) By pushing "0" key, the display changes from " HFFF0" to " HFF00".

(5) By pushing STR key, data is stored in memory, "_"(under bar) moves to fisrt figure.

Note

Without pushing STR key, data is not stored in memory.

(1) Common parameter (PARAMETER)

Display	No.	MSB 15 to 12	11 to 8	7 to 4	3	2	1	LSB 0	Content	Default value Hexadecimal (decimal)
PAR1	1	Return to home position (Homing)	Velocity mode	Acceleration/deceleration mode	*1		*2		Return to home position Velocity/ acc./dec. mode Position control unit spec.	H0000
PAR2	2	Pulse number at one rotation							Pulse number at one rotation of motor	H07D0 (2000)
PAR3	3	Work move length at one rotation							Work move length at one rotation of motor	H07D0 (2000)
PAR4	4	Upper limit of speed							Sets the upper limit speed of the velocity control mode	H1F40 (8000)
PAR5	5	Initial speed							Sets of initial speed of manual operation/automatic operation	H0010 (0016)
PAR6	6	Manual /High-speed homing velocity							Sets the velocity in the manual operation/ high speed homing	H0020 (0032)
PAR7	7	Low-speed return to homing velocity							Sets the velocity in the low-speed homing	H0010 (0016)
PAR8	8	Acceleration/deceleration time							Sets Acc. /dec. time in homing/manual operation (unit: ms)	H03E8 (1000)
PAR9	9	Backlash							Sets the backlash correcting data	H0000
PAR10	10	Upper limit positional data (Lower)							Sets the maximum position data for normal rotation direction +2,147,483,647(H7FFFFFFF) to -2,147,483,648 (H80000000)	H3FFFFFFF (+1073741823)
		Upper limit positional data (Upper)								
PAR11	11	Lower limit positional data (Lower)							Sets the maximum position data for normal rotation direction +2,147,483,647(H7FFFFFFF) to -2,147,483,648 (H80000000)	HC0000000 (-1073741824)
		Lower limit positional data (Upper)								
PAR12	12	Starting point positional data (Lower)							Sets the position data of the starting point +2,147,483,647(H7FFFFFFF) to -2,147,483,648(H80000000)	H00000000
		Starting point positional data (Higher)								

(Note) The default values are set when EH-POS is delivered.

*1: Position control command unit setting 1 *2: Position control command unit setting 2

(2) Automatic operation position data (DATA)

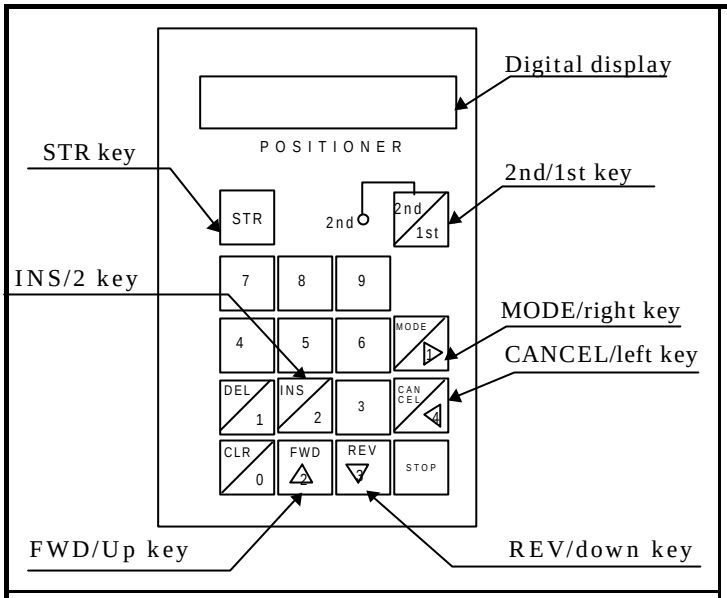
Display	Data No.	MSB 15 to 12	11 to 8	7 to 4	LSB 3 to 0	Content	Default value Hexadecimal (decimal)
DAT1	1	Operation mode		Dwell		Operation mode Dwell(×20ms)	H0000
DAT2	2	Acceleration time data				Acceleration time	H03E8 (1000)
DAT3	3	Deceleration time data				Deceleration time	H03E8 (1000)
DAT4	4	Velocity data				Velocity data	H0020 (0032)
DAT5	5	Target position data (lower)				Target stop position or velocity changing point in continuous operation +2,147,483,647(H7FFFFFFF) to –2,147,483,648(H80000000)	H00000000
		Target position data (upper)					

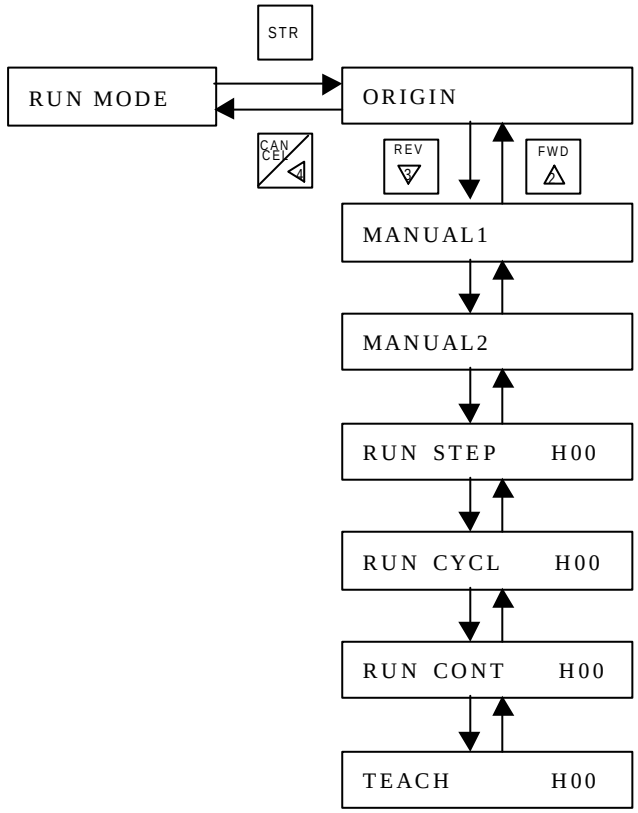
(Note) Only 0 step is set default value when EH-POS is delivered.

14.3.4 Run mode

There are seven operation modes in RUN mode shown below.

No.	RUN mode	Function
1	Return to home position (or homing)	According to homing mode setting in common parameter (PAR1), executes one of five kind homing operation such as arbitrary, low-speed, high-speed 1(OFF edge starting point), high-speed 2(Marker stop), absolute encoder homing.
2	Manual operation 1 (MANUAL1)	Outputs forward pulse(s) or reverse pulse when external manual CCW (forward) or manual CW (reverse) is set to ON.
3	Manual operation 2 (MANUAL2)	Outputs forward pulse or reverse pulse(s) by pulse output command.
4	Automatic operation 1 (step operation) (RUN STEP)	Outputs pulse(s) corresponding to the target position data of automatic operation position data in the specified step, and stops.
5	Automatic operation 2 (Cycle operation) (RUN CYCL)	Operates automatically from the specified step to the step which operation cycle stop bit (b_{14}) in automatic operation data is “1”.
6	Automatic operation 3 (Continuous cycle operation) (RUN CONT)	Continues cycle operation until stop command input.
7	Teaching (TEACH)	Sets the automatic operation position data of the specified step manually.





(1) After connecting Positioner to EH-POS, turn power on of the power supply module,

(2) After displaying ”POWER ON” on display, ”MONITOR MODE” is displayed

(3) By pushing 2nd/1st key, 2nd LED lights it changes to 2nd key mode.

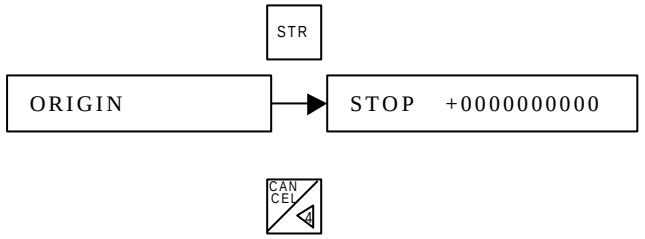
(4) By pushing MODE key twice, display changes to ”RUN MODE”.

(5) By pushing STR key, display changes to ”ORIGIN”.

(6) Whenever REV down key is pushed, display is changed from “ORIGIN” to MANUAL1”, ·····, ” TEACH”.

(7) Whenever FWD up key is pused, display is changed back from ” TEACH” to ”RUN CONT”, ·····, ” ORIGIN”.

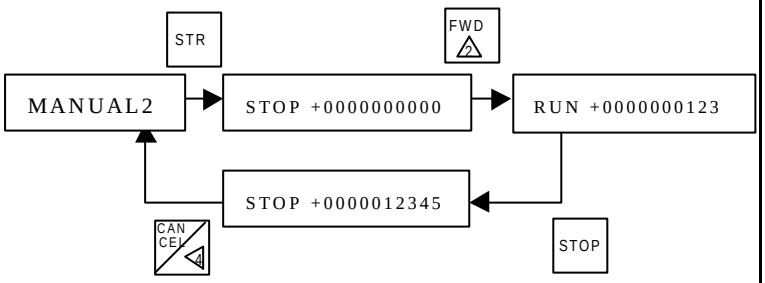
(8) By pushing CANCEL key, display returns to ”RUN MODE”.



In case Homing operation (In this case Desirable homing mode).

(1) When pushing STR key, the current position data is replaced with the home position data (Common parameter No.12), and homing operation is finished

(2) Pushing CANCEL key, the display returns to" ORIGIN".



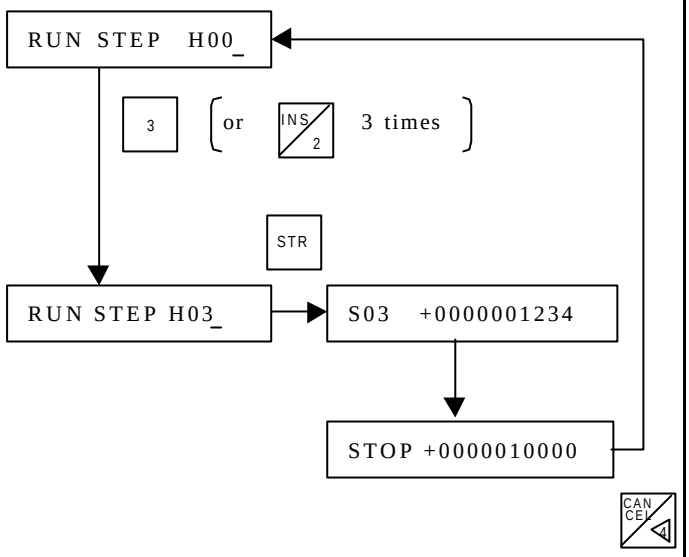
In case manual operation. (Command control mode)

(1) Press the STR key once until "STOP" is displayed. (in this case 0)

(2) Press the FWD/up arrow key once until "RUN" is displayed. Pulses for forward rotation will be output. (REV/down arrow key is for reverse rotation.)

(3) When work comes at the target position, push STOP key.(single click: deceleration stop, double click: emergency stop) (in this case +12345) To fit the target position, push INS key (or DEL key) for fine-tune.

(4) Pushing CANCEL key, the display returns to" MANUAL2".



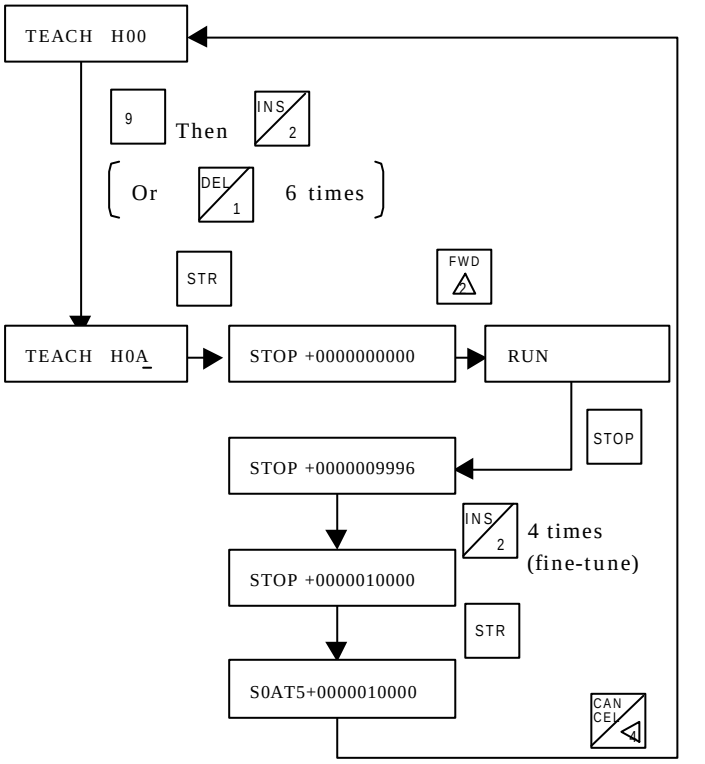
In case step 03 (STEP H03) is executed in step operation.

(1) Pushing "3"(or INS/2 key three times), "H00" changes "H03".

(2) Pushing STR key, step operation is executed.

(3) System outputs number of pulse (in this case 10000) corresponds to target position data in automatic operation position data, and stops.

(4) Pushing CANCEL key, display returns to "STEP MODE".



In case set target position data in step 0A(STEP 0A) in teaching mode.

(1) To push INS key After "9" (or push DEL keyb 6 tiems), "H00" changes to "H0A".

(2) To push STR key, display returns to "STOP +0000000000".

(3) Output forward pulse to push FWD up. Output reverse pulse to push REV down key.

(4) When work comes at the target position, push STOP key.(single click: deceleration stop, double click: emergency stop)

(5) To fit the target position (in this case +1000), push INS key (or DEL key) for fine-tune.

(6) Pushing STR key, display returns to " S0AT5+0000010000".

(7) Pushing CANCEL key, the display returns to"TEACH H00".

Caution

When STR key is pushed, data is stored in memory.