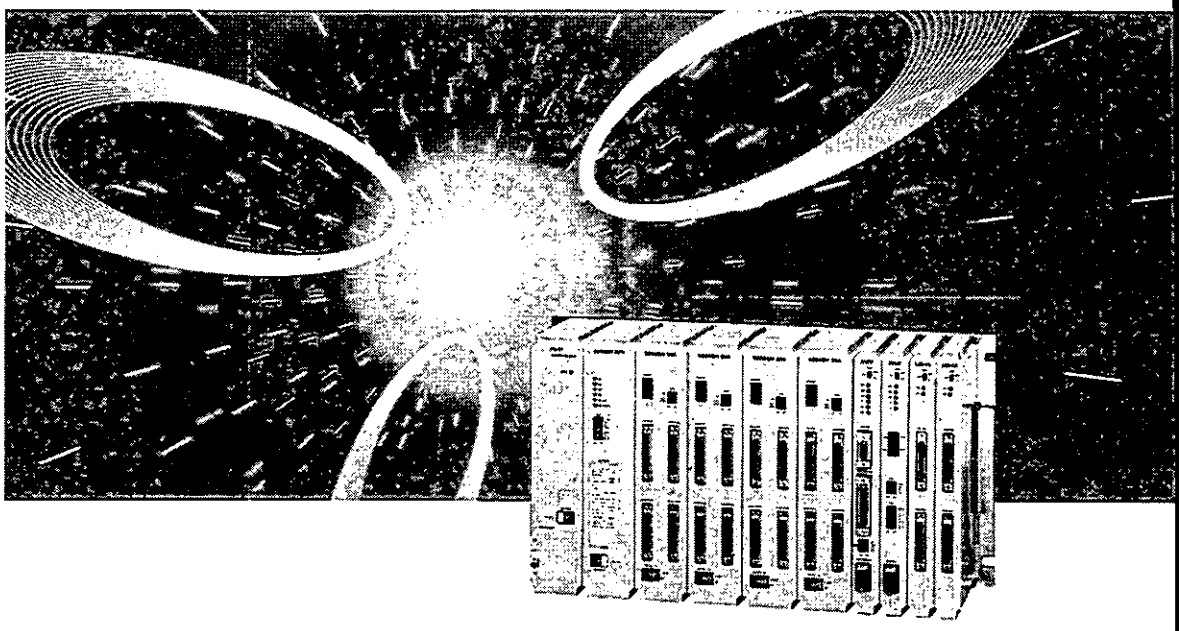
MACHINE CONTROLLER CP-9200SH
SERVO CONTROLLER USER'S MANUAL



YASKAWA

MANUAL NO. SIE-C879-40.2C

This servo controller user's manual contains an explanation of the Servo control module (SVA module) which is part of the Machine Controller CP-9200SH (referred hereinafter as the CP-9200SH) module.

Up to eleven SVA modules can be mounted with speed, torque, position, and differential control on a maximum of 44 axes with each axis able to be operated independently.

This manual explains the software for the SVA module (basic specifications, functions, user programming examples, Servo parameters).
Refer to the Machine Controller CP-9200SH User's Manual (SIE-C879-40.1) for an explanation of the hardware (exterior drawings, display lamps, setting switches, connectors, examples of connections with Servo drives) of the SVA module.

In this document, "CP-717" refers to the Control Pack CP-717 (refered hereinafter as the CP-717). These are peripheral devices of the CP-9200SH.

The following is a list of manuals for the CP-9200SH. Refer to them along with this manual.

■ Related Manuals

Manual No.	Manual Name
SIE-C873-16.4	FDS System Installation Manual
SIE-C877-17.4	Control Pack CP-717 Operation Manual (Vol.1)
SIE-C877-17.5	Control Pack CP-717 Operation Manual (Vol.2)
TOE-C877-17.7	Control Pack CP-717 Instructions
CHE-C879-40	Ultra-high Speed Machine Controller CP-9200SH
KAE-C879-40	Super High-speed Machine Controller CP-9200SH
SIE-C879-40.1	Machine Contorller CP-9200SH User's Manual
SIE-C879-40.3	Machine Contorller CP-9200SH Programming Manual
SIE-C879-40.4	Machine Controller CP-9200SH/PO-01 Motion Controller User's Manual

SAFETY PRECAUTIONS

- For correct use, be sure to read the Instruction and Maintenance Manual, this supplementary manu and other attached documents thoroughly before use (installation, operation, maintenance, inspecti etc.). Also, be sure to use the equipment upon acquiring a thorough knowledge of the equipment, t safety information, and all of the precautions.
  Be sure to keep the documents at a place where they may be readily available for anyone using the devi

- **Safety Symbols Used in this Manual**
  In this manual, the following symbols are used according to the descriptions on safety.

⚠ DANGER	○ **Danger** Indicates cases where erroneous handling may lead to a dangerous situatio that accompanies the possibility of death or serious injury.
⚠ CAUTION	○ **Caution** Indicates cases where erroneous handling may lead to a dangerous situatio that accompanies the possibility of medium or light injury or only materi damage.
PROHIBITED	○ **Prohibited** Strong indication of a prohibited matter which may otherwise lead to seriou results depending on the circumstances.
MANDATORY	○ **Mandatory** Indicates that grounding must be provided.

- In this manual, matters, that do not correspond to being a DANGER or a CAUTION but should be adhe to by the user, are indicated next to the relevant items.

MOUNTING

⚠ DANGER

- **Be sure to perform mounting and dismounting work after turning OFF the power.**
  There is danger of electric shock, death, or serious injury if work is performed with the power ON.

⚠ CAUTION

- **Operate the CP-9200SH in the environment described in the CP-9200SH User's Manual.**
  Operating the machine in surroundings with high temperature, high humidity, dust, corrosive gases, vibration, or shock may cause fires, or incorrect operation.

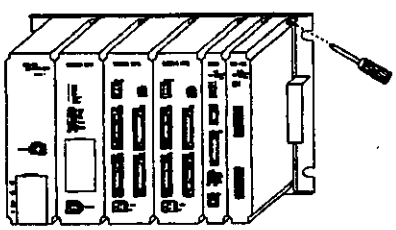
Avoid use in the following environments.

- Places exposed to direct sunlight or places where the ambient temperature falls outside the range, 0 to 55℃.
- Places where the relative humidity falls outside the range, 5 to 95%, and places where dew condensation may occur due to sudden changes in humidity.
- Places with corrosive gas or flammable gas.
- Places where vibration or shock may be transmitted directly to CP-9200SH.
- Places where the product may get splashed with water, oil, chemicals, etc.

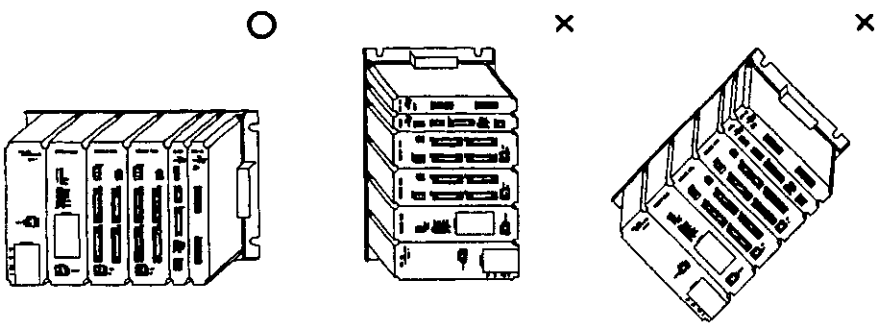
- **Mount the product in accordance with the manual.**
  Falling, failure, or malfunction may occur if there are any inadequacies in mounting.

① **Tighten the mounting screws securely!**

Tighten the CP-9200SH mounting screws and terminal block fixing screws securely so that they will not become loose.
CP-9200SH may malfunction if a screw becomes loose.



② **Mount in the proper direction!**
If the device is not installed correctly, abnormal heat generation may result.



- **Do not let wire scraps or other foreign matter enter inside the unit.**
  This may lead to fire, failure, or malfunction.

2 WIRING

⚠ CAUTION

- **Connect to a power supply that matches the rating.**
  A fires may occur if the product is connected to a power supply that differs from the rated pow supply.

CP-9200SH Power Supply Voltage

When PS-01 is used 85 to 135 VAC or 90 to 140 VDC
When PS-02 is used 170 to 230 VAC
When PS-03 is used 19.2 to 28.8 VDC

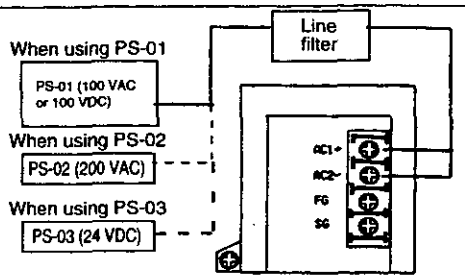
- **Wiring work must be performed by qualified specialists.**
  Electric shock, fire, or failure may be caused by erroneous wiring.

CONNECT THE INTERFACE SECURELY!

- Insert and fix the connectors of the various interface cables to be connected to CP-9200SH secure

IN THE CASE OF POOR POWER SUPPLY CONDITIONS?

- If power supply conditions are poor, place a line filter in the power line. This will prevent malfunction of CP-9200SH due to noise.

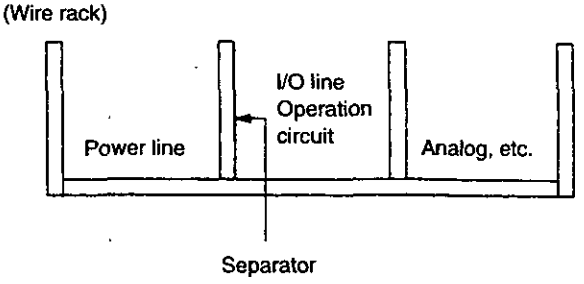


LAY THE EXTERNAL WIRING CORRECTLY

- Select the I/O lines (external wiring) for connecting CP-9200SH with external equipment in consideration of the following.

  · Mechanical strength
  · Influence of noise
  · Wiring distance
  · Signal voltage, etc.

  Lay and wire I/O lines apart from the power lines at the interior and exterior of the control panel. This will reduce the influence of noise.



PRECAUTIONS UPON USE

⚠ DANGER

- **Do not touch the terminals while the power supply is ON.**
  There is danger of electric shock.

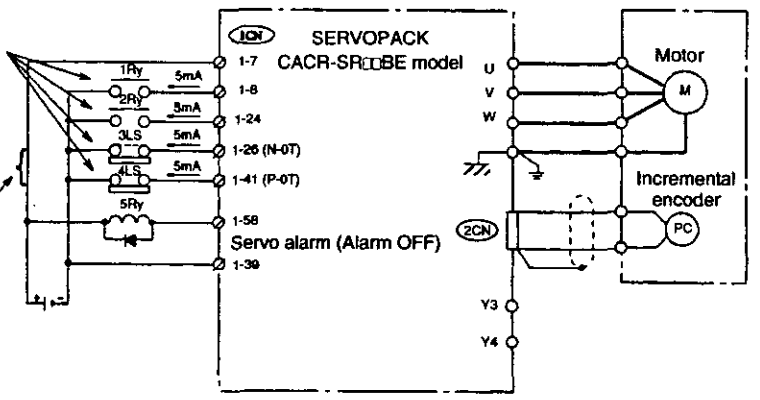
- **Provide an emergency stop circuit, interlock circuit, etc. at the exterior of CP-9200SH.**
  Otherwise, the failure of CP-9200SH may cause breakage of the machine and other accidents.

① **Provide an interlock at the exterior of CP-9200SH!**

Provide an interlock circuit at the exterior of CP-9200SH in cases where malfunction of the CP-9200SH may lead to accidents resulting in injury, death or breakage of products and auxiliary facilities.

(Example)
Please use highly reliable relays.
Make a two point grounded parallel connection using YASKAWA Bestact Relays or equivalent or low level relays.

Install a limit switch at the nearest right/left end within the control limit range of the machine.



⚠ CAUTION

- **Changing the program, performing forced output, and performing operations such as RUN, STOP, etc. while CP-9200SH is running may cause program errors and operation errors which may lead to damage of the machine or to accidents.**
  Perform these upon adequate verification and with the utmost care.

⚠ CAUTION

- **Turn the power on in the methodical order.**
  If a mistake is made in this order, it could result in an accident or damage to the machine.

① **Always turn the SERVOPACK power ON first!**

Turn the power to the SERVOPACK ON before other devices.
If the CP-9200SH are turned ON first, the I/O signal of the SERVOPACK will be delayed, which may cause malfunction or damage to the device.
SERVOPACK power should be turned ON at the same time as, or before the CP-9200SH.

4 MAINTENANCE AND DISPOSAL

⚠ DANGER

- **Connect the ⊕ and ⊖ sides of the battery correctly. Do not recharge, disassemble, short-circuit, or throw away the battery in fire.**
  There is danger of explosion or inflammation.

⚠ CAUTION

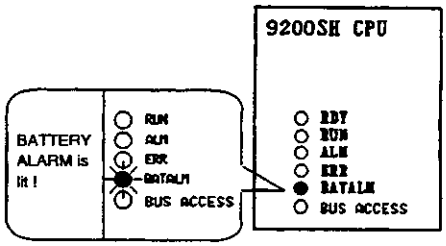
- **Treat the worn-out parts or devices as industrial wastes.**

⃠ PROHIBITED

- **Do not disassemble or modify.**
  There is danger of fire, failure, or malfunction.

BE CAREFUL OF THE LIFETIME OF THE BATTERY!

- **Be careful of the lifetime of the battery.**
  The battery is consumed when the BATTERY ALARM indicator lamp lights up. Replace with a new battery according to the procedures for battery replacement.



5 GENERAL PRECAUTIONS

PRECAUTIONS ON APPLICATION

- **The CP-9200SH is not designated or manufactured for use in devices or systems that may cause harm or risk lives.**
  User who intend to use the product described in this manual for special purposes such as devices or systems relating to transportation, medical, space aviation, atomic power control, or underwater use must contact YASKAWA Electric Corporation beforehand.
- **This product has been manufactured under strict quality control guidelines. However, if this product is to be installed in any location in which a failure of the CP-9200SH involves a life and death situation or in a facility where failure may cause a serious accident, safety device MUST be installed to minimize the likelihood of any accident.**

TABLE OF CONTENTS

APPENDIX

1 OVERVIEW

This chapter explains the system structural diagrams, operating methods and overview of the device. Always observe these items for using the SVA module.

1.1 System Structure

The CP-9200SH is an integrated controller fully equipped with all functions generally necessary for machine control.
A suitable machine sequence or motion control can be freely designed through user programming.
The CP-9200SH is composed of the following modules. Refer to the Machine Controller CP-9200SH Use's Manual (SIE-C879-40.1) for the details of each module.

Structure of the CP-9200SH

- Power module has setting for use with 24 V, 100 V, and 200 V.
- Mounting bases
  There are short mounting bases and long mounting bases.
  A maximum of four mounting bases can be connected.
- CPU modules
  A maximum of two can be installed. Each independently executes user programs.
- Motion modules
  Three kinds of motion modules are available: analog output type SVA module (described in this manual), pulse train output type PO-01 module, and the digital output type SVB module for MECHATROLINK. Up to total (SVA modules and/or PO-01 modules) of 16 motion modules can be mounted.
  SVA modules have position control, speed control, torque control, and phase control functions. A servo driver with a maximum of four axes may be connected. In addition, it is equipped with a reversible counter, an interval counter, and frequency measurement functions, so can be used as a general-purpose counter module. A maximum of 11 SVA modules can be mounted, so up to 44 axes can be controlled.
  PO-01 modules have position control functions such as positioning, zero point return, interpolation, constant-speed feeding, and constant-step feeding. A pulse motor driver with a maximum of four axes may be connected. Maximum 16 PO-01 modules can be mounted, so up to 64 axes can be controlled.
  SVB modules have position control functions such as positioning, zero point return, interpolation, constant-speed feeding, and constant-step feeding. Both a servo driver and an I/O module for MECHATROLINK with a maximum of 14 axes may be connected. A maximum of 16 SVB modules can be mounted, so up to 224 axes can be controlled.
  With CP-216 transmission, the SVB modules can be connected to the inverter used for CP-216 transmission (VS-616G5, VS-676H5).
- Communications modules
  Various types of interface modules are provided, including a CP-215 interface module, a CP-216 interface module, and a RS-232C interface module. The CP-717 is connected to a RS-232C interface module or a CP-215 interface module.
- I/O modules
  Local I/O, and 2000 series I/O modules can be connected.
- Other
  There are modules which connect between mounting bases.

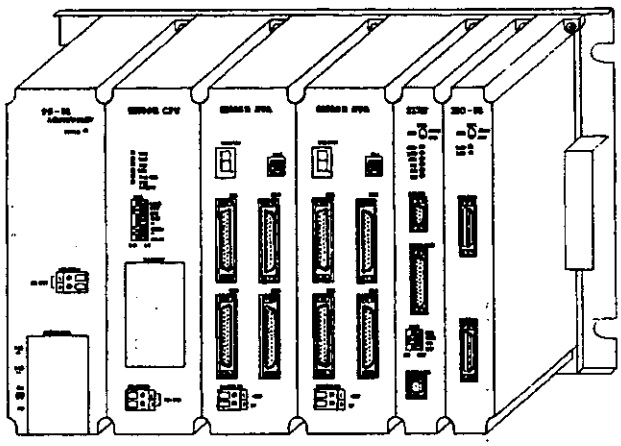


Fig. 1.1 Appearance of CP-9200SH (Short Mounting Base)

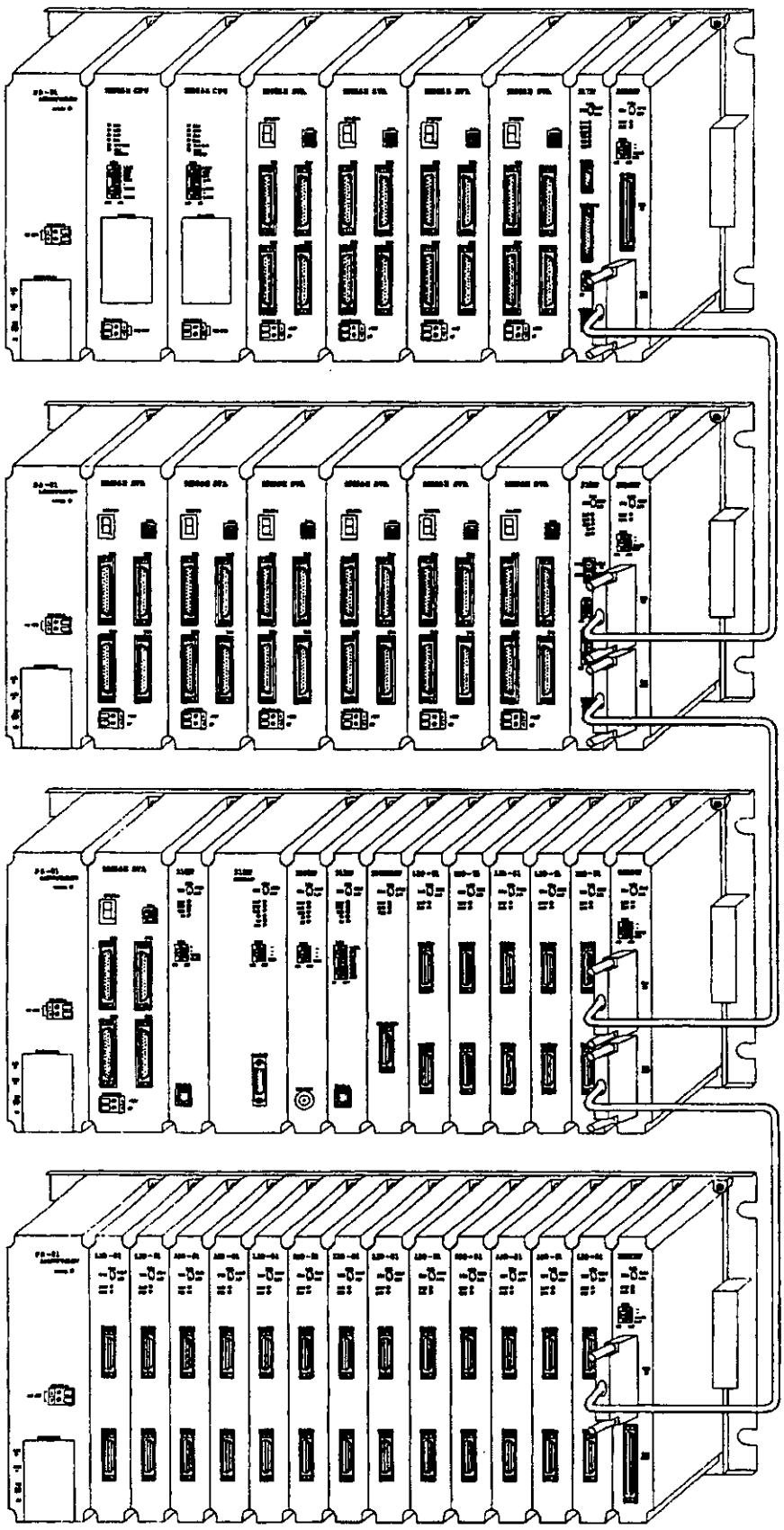


Fig. 1.2 Appearance of CP-9200SH (Long Mounting Base)

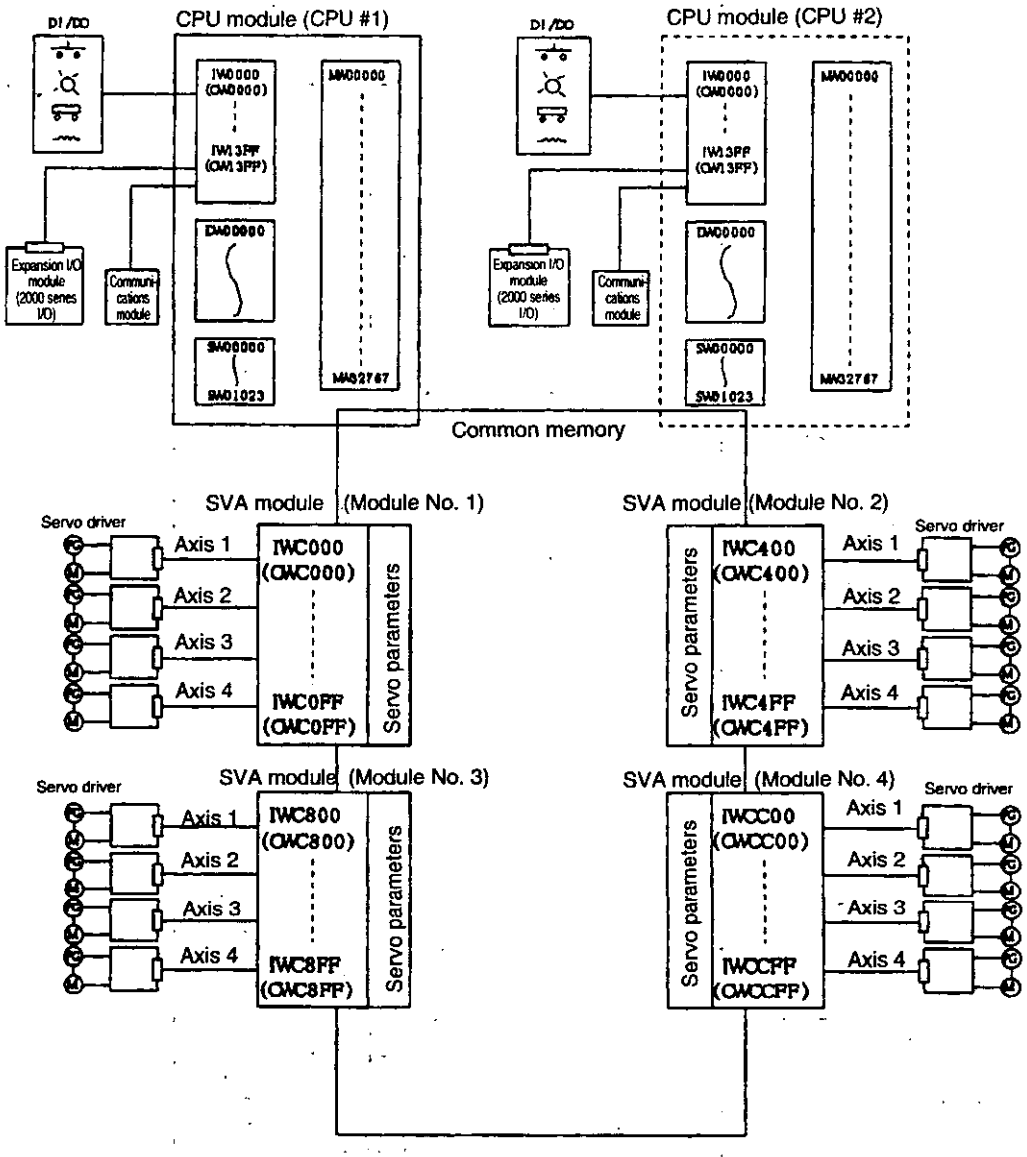


Fig. 1.3 Connections between the CP-9200SH and Peripheral Equipment (Software)

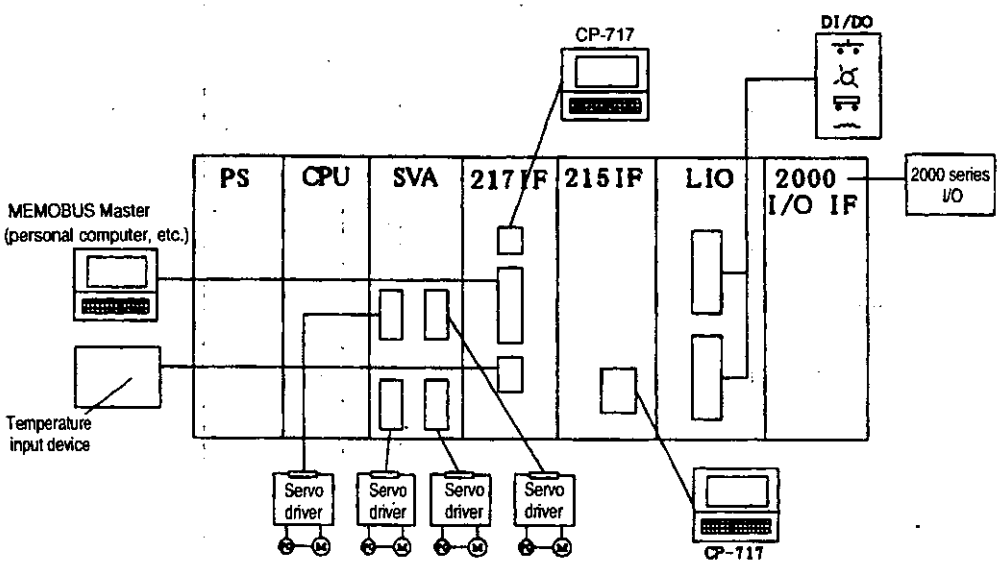


Fig. 1.4 Connections between the CP-9200SH and Peripheral Equipment (Hardware)

Register type	Meanings
SW (system register)	Register to store system operating status and error messages.
IW (input register) OW (output register)	These I/O registers are directly linked to hardware that can be accessed from the CPU module, including DI/DO, and 2000 series I/O. Also, these I/O registers access the CP-215 and CP-217 through a transmission line. Assignment of hardware and I/O registers takes place through the CP-717 screen settings. IW (OW) C000 to IW (OW) E8FF are used for transferring Servo parameters. They may be accessed from either CPU#1 or CPU#2.
MW (DWG common register)	A common general-purpose register for each DWG. It is used in transferring data between DWGs. Data transfer with the CPU takes place by defining part of this register with the CP-717. Refer to the "Common memory allocation screen" of the CP-717 for details.
DW (DWG individual registers)	Individual general-purpose registers for each DWG. Thus, the D registers of other drawings cannot be referenced. Use of these registers simplifies software packaging.

1.2 Operating SVA Module

First a module number is allocated to the SVA module. Then, by simply setting the servo parameters, motion control can be implemented. These servo parameters can be set freely with the user program of the CPU module, to achieve motion control appropriate to the machine.
The SVA module, in addition to motion control, also has the functions of a general-purpose counter module such a reversible counter, an interval counter and frequency measurement.

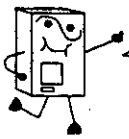
- **Allocating a module number**
  This action takes place in the "Module configuration definition screen" of the CP-717.

- **Transferring data between the CPU module and the SVA module.**
  This takes place through the servo parameters. There are the following three types of servo parameters.

  (1) Servo fixed parameters
  These are parameters that normally set one time and then left unchanged unless device configuration or specifications are modified. These are set through the "Fixed parameter screen" of the CP-717.

  (2) Servo parameters for settings
  These are used for sending instructions from the CPU module to the SVA module. These are transferred to the SVA module in a batch at the head of a high-speed scan. By simply setting these servo parameters, motion control can be implemented.

  (3) Servo parameters for monitoring
  These are used for sending reports from the SVA module to the CPU module. These are transferred to the CPU module in a batch at the head of a high-speed scan. These are used in improving application control and in debugging user programs.

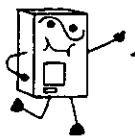


Try running the servo motor without creating a user program by using the "parameter setting" function on the CP-717.

Make and connect a cable to connect the servo driver and the SVA module.	<Reference manual> Machine Controller CP-9200SH User's Manual (SIE-C879-40.1)
↓	
Connect the CP-717 and the CP-9200SH.	<Reference manual> Control Pack CP-717 Operation Manual (SIE-C877-17.4, -17.5)
↓	
Turn the power ON to the servo driver, the CP-9200SH, and the CP-717.[Note 1]	<Reference manual> Machine Controller CP-9200SH User's Manual (SIE-C879-40.1)
↓	
Register the SVA module and allocate a module number on the "Module configuration definition screen" of the CP-717.	Refer to 1.2.1 "Setting the module number"
↓	
Using the "Parameter setting" function of the CP-717, set the servo parameters with the following procedure. ① Set the servo fixed parameters on the "Fixed parameter setting screen." ② Set the necessary parameters on the "Parameter setting screen" to operate the relevant control mode. ③ Turn the control mode selection bit "ON" in the "Parameter setting screen." ④ Turn the "RUN" signal of the Servo Drive Operation Command "ON" in the "Parameter setting screen." ⑤ Set a motion command code on "Parameter setting screen".[Note 2]	Refer to 1.2.2 "Setting the servo fixed parameters" and 1.2.3 "Setting initial values of the servo parameters for setting"

Fig. 1.5 Servomotor Running Procedure

(Note)
1: Always turn the power to the CP-9200SH ON after or at the same time as the servo driver. This is because when the CP-9200SH is powered ON, the absolute position data are read from the absolute value encoder made by Yaskawa.
2. When Bit7 "Selection to use motion command" of the selection of additional functions of servo fixed parameters is set to "OFF", or Bit8 "Motion command enabled" of operation mode of servo parameters for setting is set to "OFF", it is not necessary to set a motion command code.



Next, try creating a simple user program. We will discuss performing a servo motor confirmation test, taking the simple speed control mode as an example.

Set in the program, the servo parameter set with "parameter setting" function in the Servomotor Running Procedure in Fig. 1.5.
The speed pattern example in Fig. 1.6 and the operating conditions are shown below.

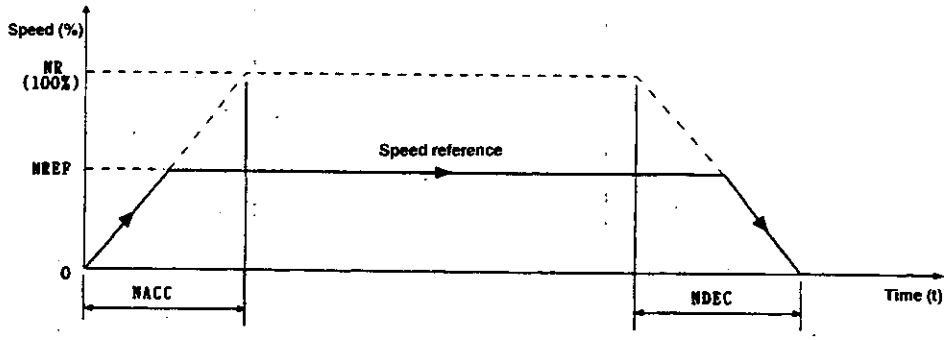


Fig. 1.6 Speed Pattern

<Assumed conditions>

Motor rated speed	: NR = 3000 r/min
Feedback pulse resolution	: FBppr = 2048 ppr
D/A output value at 100% of speed	: 6 V
D/A output value at 100% of torque limit	: 3 V

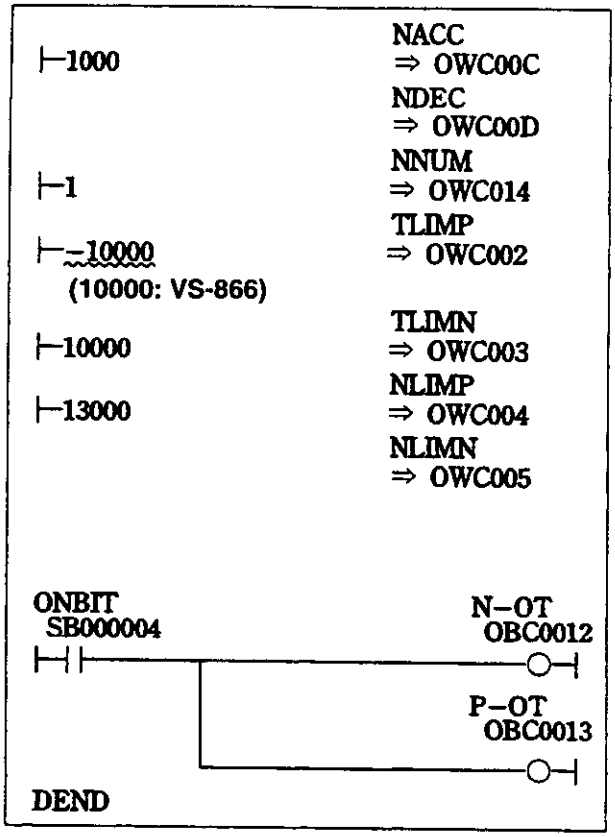
The above servo parameters are set through the "Fixed parameter screen" of the CP-717.

<Operating conditions>

Speed reference	: NREF = 50%
Linear acceleration time	: NACC = 1 sec
Linear deceleration time	: NDEC = 1 sec
Positive torque limit	: TLIMP = −100% (100% for VS-866)
Negative torque limit	: TLIMN = 100%
Positive speed limiter	: NLIMP = 130%
Negative speed limiter	: NLIMN = 130%

In the above conditions, the SERVOPACK at the 1st axis of the module number 1 is used.

Figs. 1.7 and 1.8 are examples of using a programming language to show speed pattern in Fig. 1.6. Refer to Chapter 5 "SERVO PARAMETERS" for the register used (OW□□□□).



Linear acceleration time (NACC)

Linear deceleration time (NDEC)

Average number of rotations (NNUM)

Positive torque limit (TLIMP)

Negative torque limit (TLIMN)

Positive speed limiter (NLIMP)

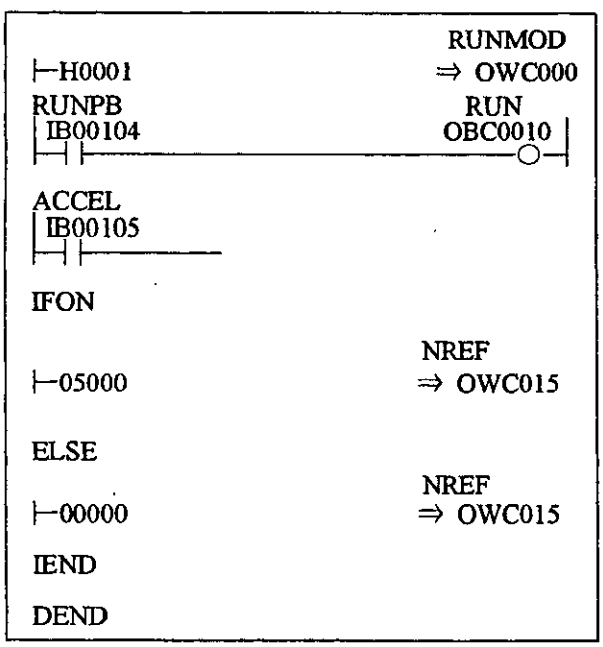
Negative speed limiter (NLIMN)

SB00004: Normally ON contact

Negative overtravel (N-OT), positive overtravel (P-OT) and other references for the driver

Fig. 1.7 Initial Settings (DWG A01)

In the example of Fig. 1.7, the user program is created in DWG.A and initial settings are made, but after setting initial values in the "Fixed parameter screen" of the CP-717, by pressing the "Save" key, the initial values of the servo parameters can be saved. Initial values saved are automatically set in the servo parameters when the CP-9200SH is turned ON. Thus, this is the same as the method of creating a user program in DWG.A and initializing settings. The method of setting initial values in the servo parameter setting screen and saving them is recommended.



Turns speed control ON.

Run command to the driver (RUN)

When IB00104 is turned ON, speed control is starts.

When the acceleration reference (IB00105) is turned ON, speed is controlled at 50% of the speed reference in the acceleration time (ACC) . When IB00105 is turned OFF, the speed is decelerated to stop (speed reference 0%) in the deceleration time (DEC).

Fig. 1.8 Speed Reference (DWG H01)

The example of Fig. 1.8 is extremely simplified, but actually each register type can be freely controlled with a user program.

1.2.1 Setting Module Number

The module number can be set on the Module Configuration Definition screen of the CP-717. The procedures for setting are as follows. Refer to the Control Pack CP-717 Operation Manual (SIE C877-17.4, -17.5) for details .

① Register SVA at the slot where SVA module is mounted.
② The motion start and end register numbers are automatically displayed in each column.
③ Set the module number in the "CIR#" column.
④ The motion start and end register numbers set in 2 are changed.
⑤ Press the SAVE key.

Elements of the Module Configuration Definition Screen

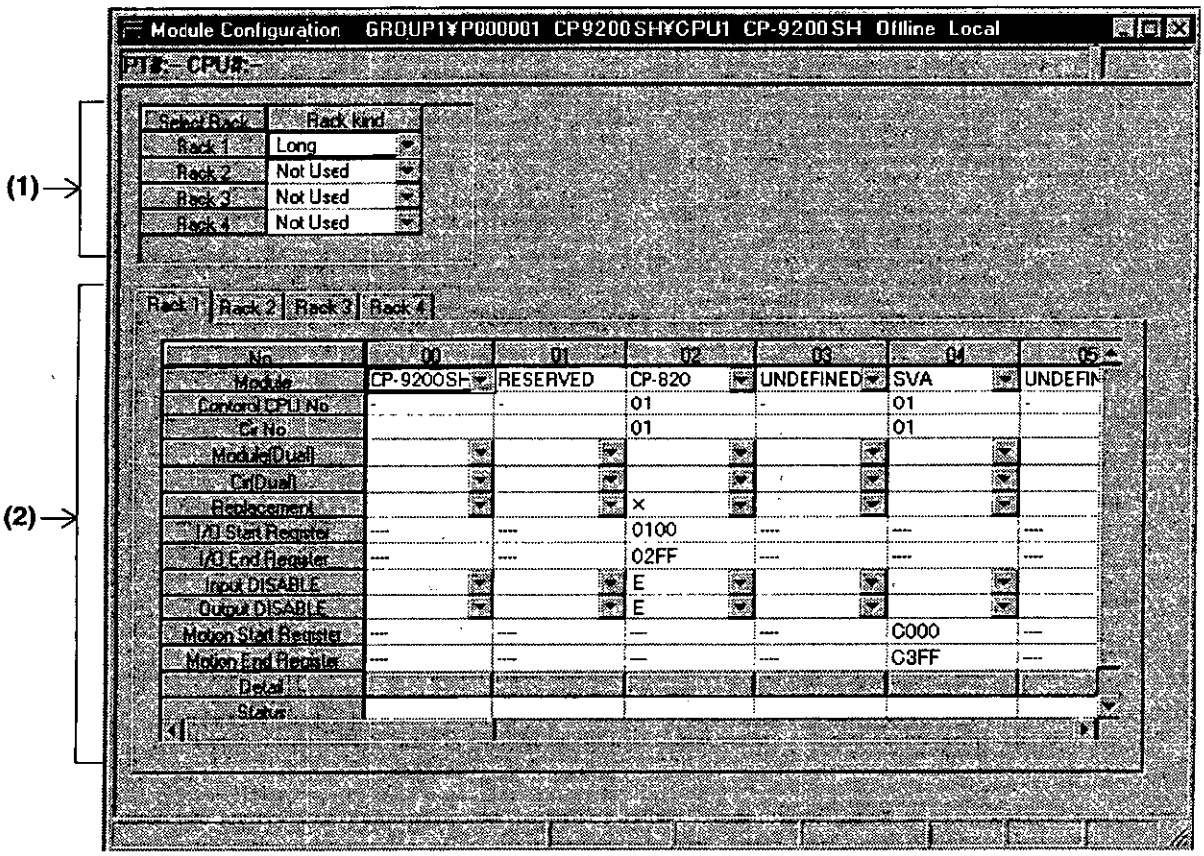


Fig. 1.9 Module Configuration Definition Screen

(1) Rack configuration information
Select the type of rack for connecting modules.

(2) Module configuration information
Information on the configuration of module are displayed.

1.2.2 Setting Servo Fixed Parameters

Set the fixed parameters needed for servo adjustment on the Fixed Parameter Setting screen of the CP-717. Refer to the Control pack CP-717 Operation Manual (SIE-C877-17.4, -17.5) for the method of setting these parameters.

Elements of the Fixed Parameter Setting Screen

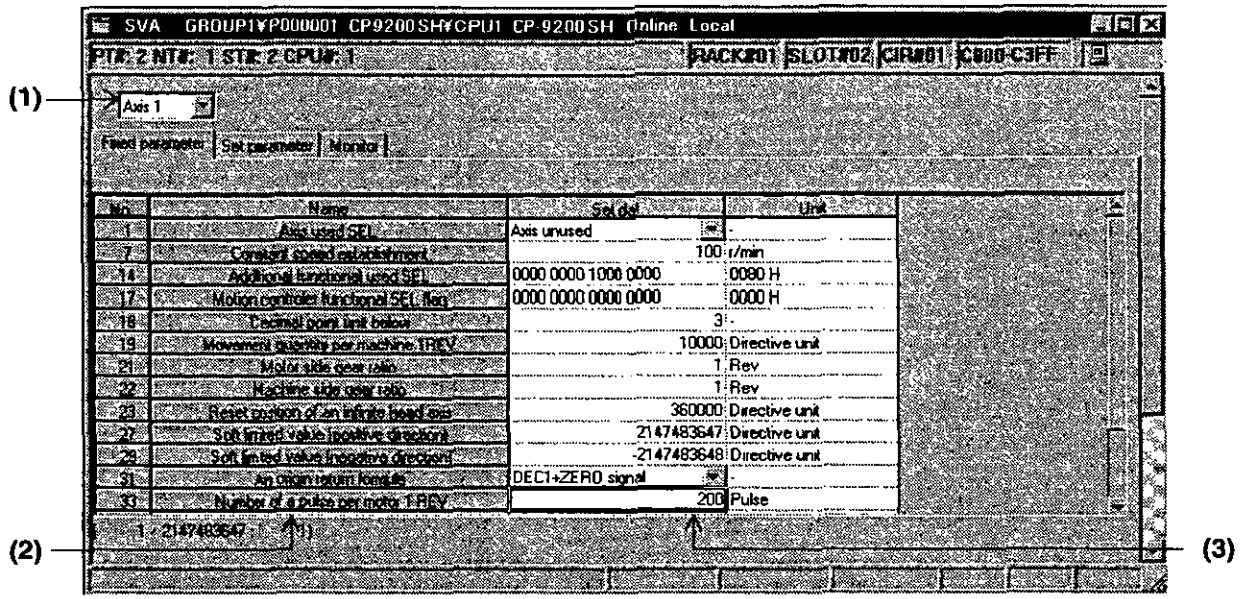


Fig. 1.10 Fixed Parameter Setting Screen

(1) Axis No.
The axis number is displayed.

(2) Name
The parameter name is displayed.

(3) Set dat
Sets the values of the parameters.

(Note)
The settings for servo fixed parameter cannot be saved if the current value of Bit0 in the servo parameter setting No.2 "Servo Operation Command" is ON.

1.2.3 Setting Initial Values of Servo Parameters for Setting

Set the parameters on the Parameter Setting screen of the CP-717 needed for servo adjustment. The data set here are automatically set as initial values of the servo parameters when the CP-9200SH is powered ON. Refer to the Control Pack CP-717 Operation Manual (SIE-C877-17.4, -17.5) for detailes.

Elements of the Parameter setting screen

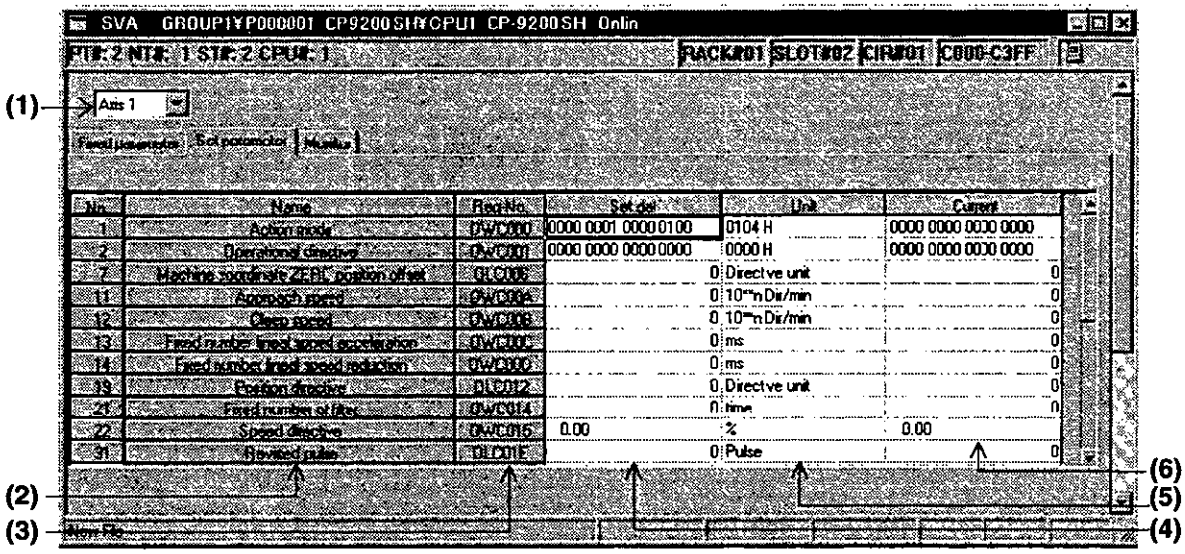


Fig. 1.11 Parameter Setting Screen

(1) Axis No.
The axis number is displayed.

(2) Name
The parameter name is displayed.

(3) Reg. No.
The register number corresponding to the parameter name is displayed.

(4) Set dat
Sets the values of the parameters.

(5) Unit
The units of the set data and the current value are displayed.

(6) Current
The current value of parameter is displayed. When the set value of parameter has been changed in user program, the value different from that in Set dat (4) is displayed.

(Note)
The settings for servo parameter for setting cannnot be saved if the current value of Bit0 in the servo parameter for setting No.2 "Servo Drive Operation Command" is ON.

1.2.4 Monitoring Operating Conditions (Control Data)

Monitor data are displayed on the Parameter Monitor screen of the CP-717. It can be used in debugging user programs or tuning motion control. On this screen, only the current values of the servo adjustment parameters are displayed. None of the set values can be changed.

Elements of the Parameter Monitor Screen

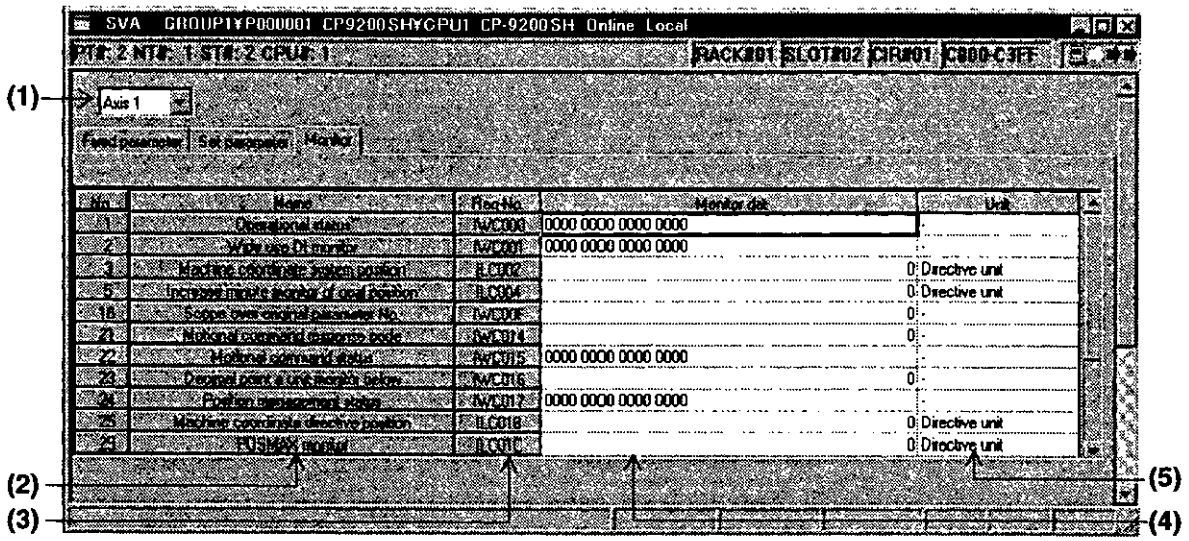


Fig. 1.12 Parameter Monitor Screen

(1) Axis No.
The axis number is displayed.

(2) Name
The parameter name is displayed.

(3) Reg. No.
The register number corresponding to the parameter name is displayed.

(4) Monitor dat
The current value of parameter is displayed.

(5) Unit
The unit of the current value is displayed.

1.3 Module Number and Servo Parameter Register Number

The servo parameter register numbers (input or output register number) will vary with the module number and axis (1st to 4th axes).
The servo parameter register number is given with the following equation.

Servo register number (IW□□□□ and OW□□□□) = Module number offset + Axis offset

The module number offset for each module number is as follows.

Module No. 1 = C000, Module No. 2 = C400, Module No. 3 = C800, Module No. 4 = CC00,
Module No. 5 = D000, Module No. 6 = D400, Module No. 7 = D800, Module No. 8 = DC00,
Module No. 9 = E000, Module No. 10 = E400, Module No. 11 = E800

The axis offset for each module number is as follows.

Axis offset = (Axis number − 1)×40H (64 words)

The above relation is shown in Table 1.1.

Table 1.1 Servo Parameter Register Number

Module No.	1st axis IW (OW)	2nd axis IW (OW)	3rd axis IW (OW)	4th axis IW (OW)
1	C000 to C03F	C040 to C07F	C080 to C0BF	C0C0 to C0FF
2	C400 to C43F	C440 to C47F	C480 to C4BF	C4C0 to C4FF
3	C800 to C83F	C840 to C87F	C880 to C8BF	C8C0 to C8FF
4	CC00 to CC3F	CC40 to CC7F	CC80 to CCBF	CCC0 to CCFF
5	D000 to D03F	D040 to D07F	D080 to D0BF	D0C0 to D0FF
6	D400 to D43F	D440 to D47F	D480 to D4BF	D4C0 to D4FF
7	D800 to D83F	D840 to D87F	D880 to D8BF	D8C0 to D8FF
8	DC00 to DC3F	DC40 to DC7F	DC80 to DCBF	DCC0 to DCFF
9	E000 to E03F	E040 to E07F	E080 to E0BF	E0C0 to E0FF
10	E400 to E43F	E440 to E47F	E480 to E4BF	E4C0 to E4FF
11	E800 to E83F	E840 to E87F	E880 to E8BF	E8C0 to E8FF

(Note)
Registers of different module numbers are not continuous.
If the module number is the same, the registers between the axes are continuous. Use subscripts (i, j) in user programs with care.
(Example)
With ⊢IW(OW)C000i, where i = 0 to 255, the register number can be correctly read out.
With IW(OW)C000i, the register number can be correctly read and written within the register range of module No. 1; IW(OW)C000 to IW(OW)C0FF. Where i ≧ 256, it can not be correctly read out.

1.4 Pulse Counting Method and Pulse Multiplication Function

There are three types of input pulses, pulse A, pulse B, and pulse C. Pulses A and B are used in counting, pulse C in counting control. A choice may be made for pulses A, B, and C between 5 V differential input and 12 V pull up collector input.
There are three methods of counting with pulses A and B: sign type, Up/Down type, and A/B type. The method can be selected independently for each axis.

- **Sign type**
  (With 12 V pull up collector input)
  Pulse A is an adding and subtracting pulse.
  Pulse B is a sign.
  If Pulse B is "Low", the forward rotation (positive in frequency). If it is "High", the reversed rotation (negative in frequency)
  (With 5 V differential input)
  Pulse A is an adding and subtracting pulse.
  Pulse B is a sign.
  If Pulse B is "High", the forward rotation (positive in frequency). If it is "Low", the reversed rotation (negative in frequency).

- **Up/Down type**
  Pulse A input is the addition pulse. (Positive frequency)
  Pulse B input is the subtraction pulse. (Negative frequency)

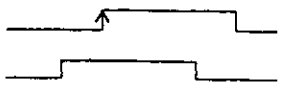
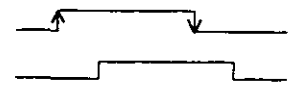
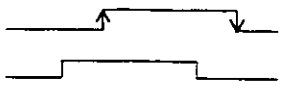
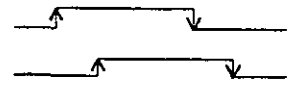
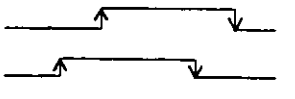
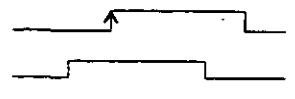
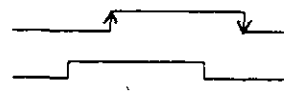
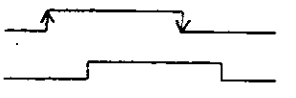
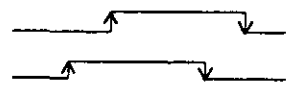
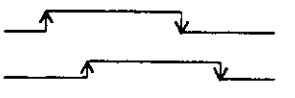
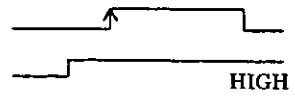
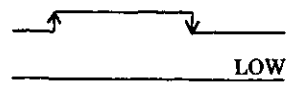
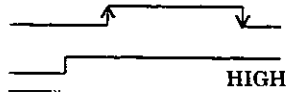
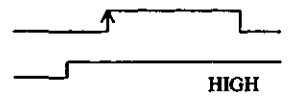
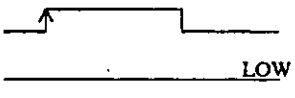
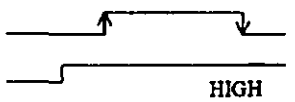
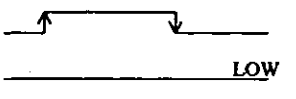
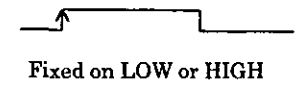
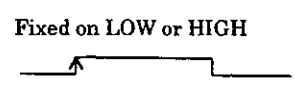
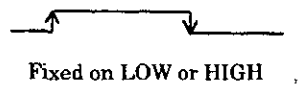
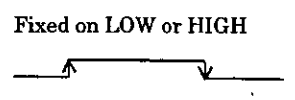
- **A/B type**
  (During 12 V pull up collector input)
  The count is upped if the phase of pulse A input leads pulse B. (Positive frequency)
  The count is downed if the phase of pulse A input lags pulse B. (Negative frequency)
  (During 5 V differential input)
  The count is upped if the phase of pulse A input lags pulse B. (Positive frequency)
  The count is downed if the phase of pulse A input leads pulse B. (Negative frequency)
  Please note that the lead and lag of the phases are opposite between 12 V pull up collector input and 5 V differential input.

There is an multiplication function for rising and falling. Single multiplication (×1), double multiplication (×2), or quadruple multiplication (×4) may be selected.

Single multiplication (×1)	: Count at rising pulse A.
Double multiplication (×2)	: Count at rising and falling of pulse A.
Quadruple multiplication (×4)	: Count at rising and falling of both pulses A and B.

Up/Down counter and pulse counting methods and the relation with the multiplication function are shown in Table 1.2.

Table 1.2 Counter Up/Down and Pulse Counting Methods

Pulse counting method		Up counter (forward rotation)	Down counter (reverse rotation)
A/B type (During 12 V pull up collector input)	×1		
	×2		
	×4		
A/B type (During 5 V differential input)	×1		
	×2		
	×4		
Sign type (During 12 V pull up collector input)	×1		
	×2		
Sign type (During 5 V differential input)	×1		
	×2		
Up/Down type	×1		
	×2		

(Note) In the Up/Down type, if pulses A and B reach simultaneously, the result is ±0.

For selecting pulse input method and pulse counting method, refer to 1.2.2 "Setting Servo Fixed parameters," 5.1.1 "List of Servo Fixed Parameters," and 5.2.1 "Details of Servo Fixed Parameters".

1.5 Overview of Functions

1.5.1 Overview

The SVA module has four functions, reversible counter, interval counter, frequency measurement, and basic counter, which can be selected independently for each axis.

Function	Overview	Motion control Note 1	DI latch Note 2	Coincident output Note 3
Reversible counter	Counts pulses with the input of pulses A and B. While pulse C is input, the count stops.Note 4 Preset of count value, disabling counting possible	Not possible	Not possible	Possible
Interval counter	Counts pulses with the input of pulses A and B. When pulse C rises, the count value is latched, and the counter is reset. Disabling counting possible	Not possible	Not possible	Possible
Frequency measurement	Counts pulses based on the input of pulses A and B. Counts frequency of the input pulse. Preset of count value preset, disabling counting impossible.	Not possible	Not possible	Possible
Basic counter	Counts pulses with the input of pulses A and B. Input of pulse C uses zero point return mode. Disabling counting impossible.	Possible	Possible	Possible

(Notes) 1. In motion control, there are modes for zero point return, speed control, torque control, position control, and phase control, set by servo parameters.
2. The DI latch is the function of latching (reading out) the pulse count value (current position) through an external signal. The DI input signal and pulse C are used as external signals.
3. Coincident output is the function which outputs a coincident output signal (D05) when the preset coincident detection value and the counter value (current value) coincide.
4. For the version No. 87921-9000□-S0200 and later, whether the counting is stopped or not during C-pulse input with reversible counter, can be selected by the servo fixed parameter.

Table 1.3 gives the relations between each function and pulse counting method.

Table 1.3 Counter Functions and Pulse Counting Methods

Pulse counting method / Function	Up/Down method		Sign method		A/B method		
	×1	×2	×1	×2	×1	×2	×4
Reversible counter	Possible	Possible	Possible	Possible	Possible	Possible	Possible
Interval counter	Possible	Possible	Possible	Possible	Possible	Possible	Possible
Frequency measurement	Possible	Possible	Possible	Possible	Possible	Possible	Possible
Basic counter	Possible	Possible	Possible	Possible	Possible	Possible	Possible

For selecting counter mode, refer to 1.2.2 "Setting Servo Fixed Parameters", 5.1.1 "List of Servo Fixed Parameters", and 5.2.1 "Details of Servo Fixed Parameters".

1.5.2 Motion Commands

For CP-9200SH version No. 87921-9000□ -0200 and later, the motion command is available.
To use motion command, the following settings are required.

- Set Bit7 (selection to use motion command) of the servo fixed parameter No. 14 "Selection of Additional function" to "USE (=1)".
- Set Bit8 of the servo parameter for setting "Operation mode (OW□□ 00)" to "1 (use OW□□ 20)".
- Set Bit2 of the servo parameter for setting "Operation mode (OW□□00)" to "1 (position control mode)".

The motion commands include positioning (POSING), zero point return (ZRET), interpolation (INTERPOLATE), constant-speed feeding (FEED), and constant-step feeding (STEP) and they can be selected independently for each axis.

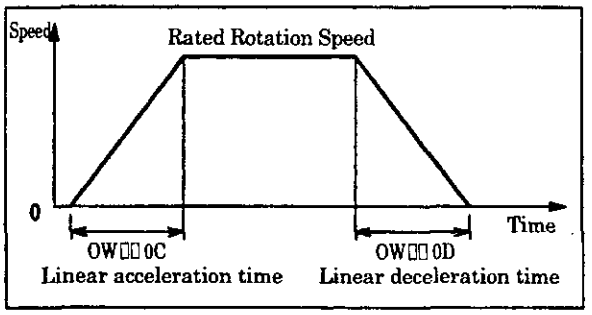
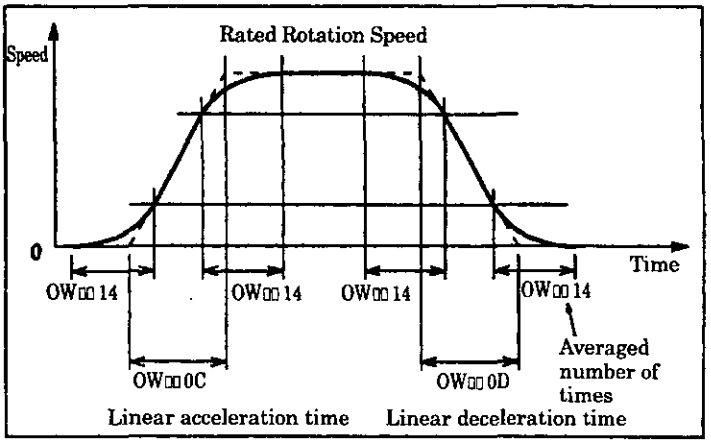
Table 1.4 Function of Motion Command

Function	Explanation
Positioning (POSING)	Moves an axis to a pre-determined position at a specified feed speed with a specified acceleration/deceleration time constant.
External positioning (EX_POSING)	When a latch signal (external positioning signal) is input during positioning, the current position counter is latched by the latch signal and moves the axis to the position moved by the external positioning travel distance.
Zero point return (ZRET)	Performs positioning by moving the axis for the zero point return travel distance from the zero point signal. Four zero point return methods are available.
Interpolation (INTERPOLATION)	Interpolation is performed by the position data at each high-speed scan processed from CPU.
Interpolation with position detection function (LATCH)	During the same interpolation as INTERPOLATION, the current position counter is latched by a latch signal and the latch position calculated in reference units is reported.
Constant-speed feeding (FEED)	Rapid feeding in infinite distance to a specified direction at a specified speed with a specified acceleration/deceleration time constant. By NOP command, the feeding is decelerated to stop.
Constant-step feeding (STEP)	Positioning to a specified direction for a specified travel distance (STEP travel distance) at a rapid feeding speed by a specified acceleration/deceleration time constant.

1.5.3 Types of Acceleration/Deceleration

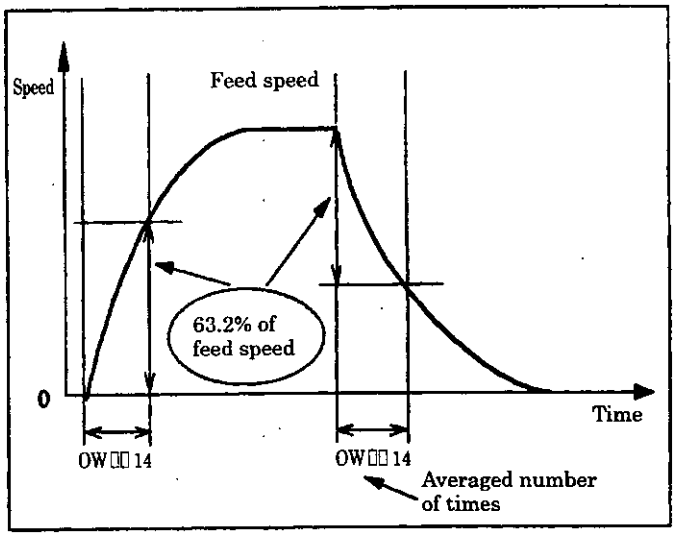
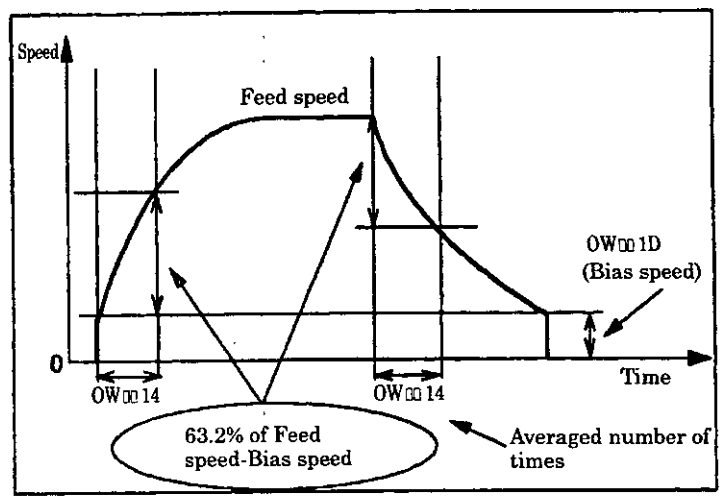
Acceleration/deceleration can be basically classified into linear acceleration/deceleration, S-curve acceleration/deceleration, and exponential acceleration/deceleration.
For exponential acceleration/deceleration, setting of bias speed is possible.
Exponential acceleration/deceleration is possible only when the motion commands are available.

Table 1.5 Types of Acceleration/Deceleration

Type of acceleration/ deceleration	Concerned motion parameters	Contents
Linear acceleration/ deceleration	OW□□ 0C (servo parameter for setting "Linear acceleration") OW□□ 0D (servo parameter for setting "Linear deceleration")	 Set the time to reach the rated motor speed for acceleration/deceleration time.
S-curve acceleration/ deceleration (travel average)	OW□□ 0C (servo parameter for setting "Linear acceleration") OW□□ 0D (servo parameter for setting "Linear deceleration") OW□□ 14 (servo parameter for setting "Averaged number of times" OB□□ 214 to OB□□ 217 (servo parameter for setting "Filter type selection")	 Set "2" (travel averaging filter) for "Filter type selection".

(Continued)

(Continued)

Type of acceleration/ deceleration	Concerned motion parameters	Contents
Exponential acceleration/ deceleration	OW□□ 0C (servo parameter for setting "Linear acceleration") OW□□ 0D (servo parameter for setting "Linear deceleration") OW□□ 14 (servo parameter for setting "Averaged number of times") OB□□ 214 to OB□□ 217 (servo parameter for setting "Filter type selection") OW□□ 1D (servo parameter for setting "Bias speed for exponential acceleration/ deceleration filter")	 · Set "0" for "Linear acceleration/deceleration time (OW□□ 0C, OW□□ 0D)". · Set "1" (exponential acceleration/deceleration) to "Filter type selection". · Set "0" for "Bias speed for exponential acceleration/ deceleration filter".
Exponential acceleration/ deceleration with bias	OW□□ 0C (servo parameter for setting "Linear acceleration") OW□□ 0D (servo parameter for setting "Linear deceleration") OW□□ 14 (servo parameter for setting "Averaged number of times" OB□□ 214 to OB□□ 217 (servo parameter for setting "Filter type selection") OW□□ 1D (servo parameter for setting "Bias speed for exponential acceleration/ deceleration filter")	 · Set "0" for "Linear acceleration/deceleration time (OW□□ 0C, OW□□ 0D)". · Set "1" (exponential acceleration/deceleration) to "Filter type selection".

(Continued)

1.6 Module Hot Swapping

SVA modules should not be hot swapped, since a synchronous error will occur and CPU will goes down. When the modules other than CPU and SVA modules, such as LIO modules, communication modules, are hot swapped, the following states will be resulted. Special care should be taken.
In any case, we recommended to insert or remove modules after power turns OFF.

(Note)
Not only in CP-9200SH but also in CP-317 dual system, when a SVA module is used, the following states and operations are occurred only during the data copy between CPUs with CPU module hot swapping switch OFF.

The reference value of servo parameter before module was inserted or removed remains. And the operation continues with this reference value as follows.

- During speed and torque controlling, operation is performed with the reference speed and torque commanded.

- During zero point returning, the following will occur.
  - During operation at approach speed, that operation will continue.
  - During operation at creep speed, that operation will continue.
  - If after detection of the zero point pulse, zero point return operation will be executed. At the zero point, a servo lock state will result.

- During position control execution, the following will occur.
  - When positioning point-to-point, that positioning operation is executed. When it arrives at the position reference value, a servo lock state will result.
  - If positioning control is implemented when the position reference value is being given step by step with each high-speed scan, immediately a servo lock state will result, with the position reference value at that time.

- During phase control execution, the following will occur.
  - If operating by the electronic shaft, that operation will continue.
  - During operation by the electronic cam, a servo lock state will immediately result around the phase correction value at that point.

1.7 Application Precautions

Head the following precautions when using a SVA module.

(1) The minimum values of high-speed scan set time are as follows.
Set a value more than the minimum value.

(A) When "Selection to use motion command" (Bit7 of fixed parameter No. 14 "Selection of additional function") is set to "NOT USE" ("0")

① When used in speed control mode (Bit0 of OW□□ 00 = "ON")
The minimum value of high-speed scan set value
= 250 μ s + (100 μ s × number of axes in use)

② When used in torque control mode (Bit1 of OW□□ 00 = "ON")
The minimum value of high-speed scan set value
= 250 μ s + (60 μ s × number of axes in use)

③ When used in position control mode (Bit2 of OW□□ 00 = "ON")
The minimum value of high-speed scan set value
= 250 μ s + (150 μ s × number of axes in use)

④ When used in phase control mode (Bit3 of OW□□ 00 = "ON")
The minimum value of high-speed scan set value
= 250 μ s + (100 μ s × number of axes in use)

⑤ When used in zero point return mode (Bit4 of OW□□ 00 = "ON")
The minimum value of high-speed scan set value
= 250 μ s + (150 μ s × number of axes in use)

⑥ When used with RUN "OFF" (Bit0 of OW□□ 01 = "OFF")
The minimum value of high-speed scan set value
= 250 μ s + (70 μ s × number of axes in use)

(Examples)

1) When all of 4 axes are set in speed control mode
The minimum value of high-speed scan set value = 250 μ s + (100 μ s × 4 axes)
= 650 μ s

2) When all of 4 axes are set in torque control mode
The minimum value of high-speed scan set value = 250 μ s + (60 μ s × 4 axes)
= 490 μ s

3) When all of 4 axes are set in position control mode
The minimum value of high-speed scan set value = 250 μ s + (150 μ s × 4 axes)
= 850 μ s

4) When all of 4 axes are set in phase control mode
The minimum value of high-speed scan set value = 250 μ s + (100 μ s × 4 axes)
= 650 μ s

5) When all of 4 axes are set in zero point return control mode
The minimum value of high-speed scan set value = 250 μ s + (150 μ s × 4 axes)
= 850 μ s

(B) When "Selection to use motion command" (Bit7 of fixed parameter No. 14 "Selection of additional function") is set to "USE" ("1")

(i) When "Motion command code" (Bit8 of parameter for setting OW□□ 00) is set to "INVALID" ("0")

① When used in speed control mode (Bit0 of OW□□ 00 = "ON")
The minimum value of high-speed scan set value
= 250 μ s + (170 μ s × number of axes in use)

② When used in torque control mode (Bit1 of OW□□ 00 = "ON")
The minimum value of high-speed scan set value
= 250 μ s + (170 μ s × number of axes in use)

③ When used in position control mode (Bit2 of OW□□ 00 = "ON")
The minimum value of high-speed scan set value
= 250 μ s + (250 μ s × number of axes in use)

④ When used in phase control mode (Bit3 of OW□□ 00 = "ON")
The minimum value of high-speed scan set value
= 250 μ s + (180 μ s × number of axes in use)

⑤ When used in zero point return mode (Bit4 of OW□□ 00 = "ON")
The minimum value of high-speed scan set value
= 250 μ s + (220 μ s × number of axes in use)

⑥ When used with RUN "OFF" (Bit0 of OW□□ 01 = "OFF")
The minimum value of high-speed scan set value
= 250 μ s + (200 μ s × number of axes in use)

(Examples)

1) When all of 4 axes are set in speed control mode
The minimum value of high-speed scan set value = 250 μ s + (170 μ s × 4 axes)
= 930 μ s

2) When all of 4 axes are set in torque control mode
The minimum value of high-speed scan set value = 250 μ s + (170 μ s × 4 axes)
= 930 μ s

3) When all of 4 axes are set in position control mode
The minimum value of high-speed scan set value = 250 μ s + (250 μ s × 4 axes)
= 1250 μ s

4) When all of 4 axes are set in phase control mode
The minimum value of high-speed scan set value = 250 μ s + (180 μ s × 4 axes)
= 970 μ s

5) When all of 4 axes are set in zero point return control mode
The minimum value of high-speed scan set value = 250 μ s + (220 μ s × 4 axes)
= 1130 μ s

(ii) When "Motion command code" (Bit8 of parameter for setting OW□□ 00) is set to "VALID" ("1")

① When used in speed control mode (Bit0 of OW□□ 00 = "ON")
The minimum value of high-speed scan set value
= 250 μ s+ (180 μ s × number of axes in use)

② When used in torque control mode (Bit1 of OW□□ 00 = "ON")
The minimum value of high-speed scan set value
= 250 μ s + (170 μ s × number of axes in use)

③ When used in position control mode (Bit2 of OW□□ 00 = "ON")

a) When "Axis selection" (Bit5 of fixed parameter No. 17 "Motion controller function selection flag" is set to "Finite length axis" ("0")
The minimum value of high-speed scan set value
= 250 μ s + (280 μ s × number of axes in use)

b) When "Axis selection" (Bit5 of fixed parameter No. 17 "Motion controller function selection flag" is set to "Infinite length axis" ("1")
The minimum value of high-speed scan set value
= 250 μ s + (350 μ s × number of axes in use)

④ When used in phase control mode (Bit3 of OW□□ 00 = "ON")
The minimum value of high-speed scan set value
= 250 μ s + (200 μ s × number of axes in use)

⑤ When used in zero point return mode (Bit4 of OW□□ 00 = "ON")
The minimum value of high-speed scan set value
= 250 μ s + (250 μ s × number of axes in use)

⑥ When used with RUN "OFF" (Bit0 of OW□□ 01 = "ON")

a) When "Axis selection" (Bit5 of fixed parameter No. 17 "Motion controller function selection flag" is set to "Finite length axis" ("0")
The minimum value of high-speed scan set value
= 250 μ s + (220 μ s × number of axes in use)

b) When "Axis selection" (Bit5 of fixed parameter No. 17 "Motion controller function selection flag" is set to "Infinite length axis" ("1")
The minimum value of high-speed scan set value
= 250 μ s+ (300 μ s × number of axes in use)

(Examples)

1) When all of 4 axes are set in speed control mode
   The minimum value of high-speed scan set value = 250 μ s + (180 μ s × 4 axes)
   = 970 μ s
2) When all of 4 axes are set in torque control mode
   The minimum value of high-speed scan set value = 250 μ s + (170 μ s × 4 axes)
   = 930 μ s
3) When all of 4 axes are set in position control mode
   a) When all of 4 axes are set to finite length axis
      The minimum value of high-speed scan set value = 250 μ s + (280 μ s × 4 axes)
      = 1370 μ s
   b) When all of 4 axes are set to infinite length axis
      The minimum value of high-speed scan set value = 250 μ s + (300 μ s × 4 axes)
      = 1450 μ s
4) When all of 4 axes are set in phase control mode
   The minimum value of high-speed scan set value = 250 μ s + (200 μ s × 4 axes)
   = 1050 μ s
5) When all of 4 axes are set in zero point return control mode
   The minimum value of high-speed scan set value = 250 μ s + (250 μ s × 4 axes)
   = 1250 μ s

(2) Do not change the high-speed scan set value of CPU module during travelling.
(3) Whenever the module configuration definition of CPU module has been changed (also at loading in batch), be sure to turn OFF the power and ON again.
(4) The units are different depending on the control mode.
Table 1.6 shows the units for the position and speed references in each control mode.

Table 1.6 Units for the position and speed references in each control mode

Control Mode		Speed reference	Torque reference	Position reference
Speed control		%	—	—
Torque control		—	%	—
Zero point return		%	—	—
Phase control		%	—	pulse
Position control	When using a motion command	%	—	pulse
	When not using a motion command	%, mm/min, inch/min, deg/min, or pulse/min	—	mm, inch, deg, or pulse

(Note) Use 1=1 reference unit for the zero position offset setting (OL□□ 06) when selecting to use the motion command to "USE (=1)" and the motion command code valid/invalid (OB□□ 008) to "1" (=valid).
Use 1=1 pulse when using a control mode other than those in Table 1.6.

2 BASIC SPECIFICATIONS

This chapter, explains basic specifications for the SVA module classified in hardware and software.

SVA module performs counter functions or motion functions for up to four axes. Counter functions include a reversible counter, and interval counter, and frequency measurement, which can be independently selected for each axis. Further, motion functions include speed control, torque control, position control, and phase control, which can be independently selected for each axis. Counter functions and motion functions can be independently selected for each axis, and there is absolutely no restriction based on axis number.
A maximum of 11 SVA modules can be mounted on the single CP-9200SH. Thus, a maximum of 44 axes can be independently controlled.
However, when other motion modules such as the PO-01 module are used, a maximum of 16 modules can be mounted.
Primary features of the SVA module are shown in Table 2.1, basic specifications in Table 2.2.

Table 2.1 Primary Features of the SVA Module

Category	Specifications
Motion function	Position control, speed control, torque control, and phase control on four axes Reference: Analog Position detection method: Absolute encoder or incremental encoder made by Yaskawa Hardware pulse latch function: 1 point/1 axis
Counter function	Reversible counter, and interval counter, and frequency measurement on four axes Reversible counter: Count disabling, preset count value are possible Interval counter: Count disabling possible Frequency measurement: Setting detection units for frequencies possible
Pulse counting methods	A/B method, Up/Down method, or sign method Multipulication function is provided (single, double, or quadruple is available)

Table 2.2 Basic Hardware Specifications for SVA Module

Category	Specifications
References (D/A 12 points) Speed reference Positive torque limit reference Negative torque limit reference ×4 axes	Analog reference (Can also be used as a general D/A converter.) · Speed reference: sign + 15 bits · Positive torque limit reference: sign + 15 bits · Negative torque limit reference: sign + 15 bits (Note) The analog output full range is 0 to ±11 V
Monitor input (A/D 8 points) Speed monitor Torque monitor ×4 axes	Each sign + 15 bits (Can also be used as a general A/D converter.) · Speed monitor : 0 to ±10 V · Torque monitor : 0 to ±10 V
Run command/Run status Run command Run status ×4 axes	(Can also be used as a general DI.) · Run command (DO) : 7 points · Run status (DI) : 4 points
Pulse input	A/B/C phase Can choose between 5 V differential input and 12V pull up type collector input Can select a signal polarity, positive logic, or negative logic (valid only for CP-9200SH version 87921-9000□-S0200 and later)
Position detection method	Absolute encoder or incremental encoder made by Yaskawa.
Maximum pulse counting speed	4 Mpps (during quadruple multiplication)

(Continued)

(Continued)

Category	Specifications
Motion functions Reference Position reference for axis 1 Position reference for axis 2 Position reference for axis 3 Position reference for axis 4	 Position reference: 0 to ±2147483647 pulses (at 0.01 mm/1pulse: 0 to ±21474836 mm) Infinite length positioning also possible
Speed reference for axis 1 Speed reference for axis 2 Speed reference for axis 3 Speed reference for axis 4	Speed reference Analog: 0 to ±327.67% (Note) It is possible to designate D/A output voltage at 100%. (Default: 6 V)
Positive torque limit reference for axis 1 Negative torque limit reference for axis 1 Positive torque limit reference for axis 2 Negative torque limit reference for axis 2 Positive torque limit reference for axis 3 Negative torque limit reference for axis 3 Positive torque limit reference for axis 4 Negative torque limit reference for axis 4	Positive/Negative torque limit reference Analog: 0 to ±327.67% (Note) It is possible to designate D/A output voltage at 100%. (Default: 3 V)
Position loop gain (Kp) Linear acceleration/ deceleration setting Auxiliary functions	1 to 999.9 Acceleration time: 0 to 32.767 s Deceleration time: 0 to 32.767 s Equipped with zero point return (for incremental encoder) Equipped with hardware position latch function (DI input signal or Pulse C input signal) Can change control mode during online operation Can change each servo parameter individually during on line operation
Monitor input (A/D 8 points) Speed monitor for axis 1 Speed monitor for axis 2 Speed monitor for axis 3 Speed monitor for axis 4	 Speed monitor: 0 to ±327.67% (Note) It is possible to designate A/D input voltage at 100%. (Default: 6 V)
Torque monitor for axis 1 Torque monitor for axis 2 Torque monitor for axis 3 Torque monitor for axis 4	Torque monitor: 0 to ±327.67% (Note) It is possible to designate A/D input voltage at 100%. (Default: 3 V)
Counter function Reversible counter Interval counter Frequency measurement	 Equipped with pulse count disabling selection Equipped with count value preset function Equipped with pulse count disabling selection Setting detection units for frequencies possible (1 Hz, 0.1 Hz, 0.01 Hz or 0.001 Hz)
Pulse counting method	Can select between sign method, Up/Down method, or A/B method Sign method (Single or double multiplication) Up/Down method (Single or double multiplication) A/B method (Single, double, or quadruple multipulication is available)
Coincident output	Comparison of 32-bit up/down counter (Set value: 32 bit counter value) DO output (DO5) upon coincident detection.

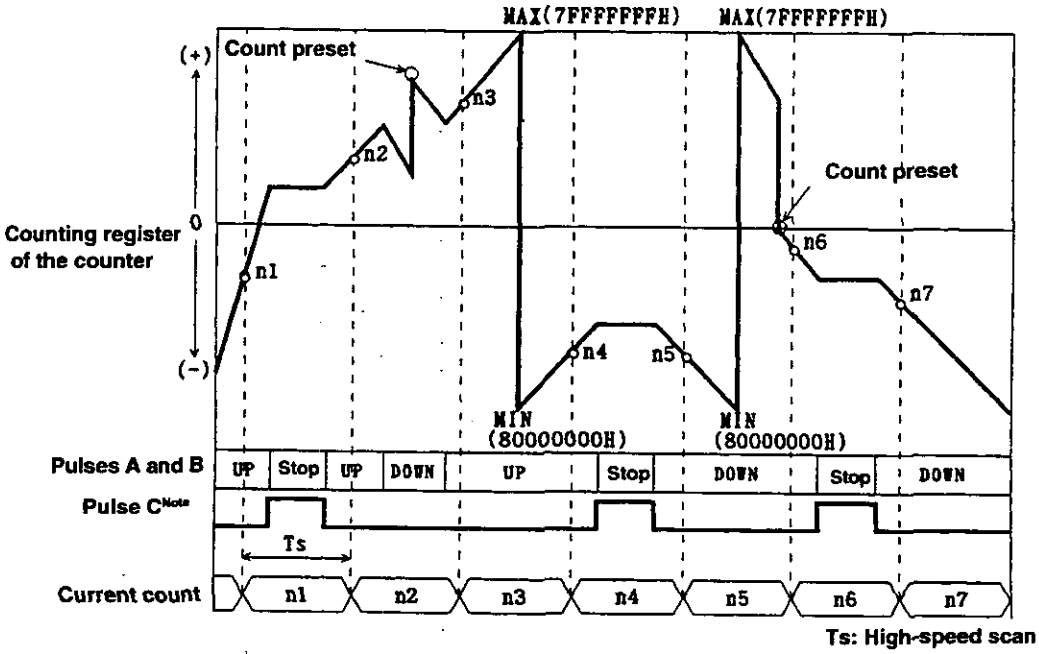
3 EXPLANATION OF FUNCTIONS AND USER PROGRAMMING EXAMPLES

This chapter explains the primary functions and operating methods of the SVA module.
In addition, simplified examples of user programs are included. Refer to these examples to create user programs and use freely the SVA module.

3.1 Reversible Counter

The count goes UP or DOWN by the input of pulse A or B. During the input of pulse C, the counting is stopped.

- The count value can be preset by the servo parameter setting (BitC of OW□□00 + axis ofs).
- The counting can be prohibited by the servo parameter setting (Bit B of OW□□00 + axis ofs).
- The current count value is stored in the hardware counter current value (IL□□08 + axis ofs) with each high speed scan.
- Digital input (DI) and output (DO) can be used as general-purpose DI and DO. Analog input (A/D converter) and output (D/A converter) is used as general-purpose A/D and D/A.



(Note) For CP-9200SH version No. 87921-9000□-S0200 and later, whether the counting is stopped or not by input of pulse C can be selected. Setting of Bit8 of the servo fixed parameter No. 14 "Additional function selection" can make this selection:
When Bit8 = "OFF", the counting is stopped during input of pulse C.
When Bit8 = "ON", the counting is not stopped even during input of pulse C.

Fig. 3.1 Reversible Counter Operation

- The register number is for the 1st axis of the module number 1.
- If the module number and the axis number are different, change the register number referring to 1.3 "Module Number and the Servo Parameter Register Number".
- For the servo parameters used with a reversible counter, "○" is marked in the column "Reversible counter" of "Modes for which data is valid" in 5.1.2 "List of Servo Parameters for Settings" and 5.1.3 "List of Servo Parameters for Monitor".

When using as a reversible counter, refer to the following;

① Set the servo fixed parameters. Switch the counter mode selector to "Reversible counter (=0)". Set other servo fixed parameters appropriately for your machine.

② Digital output (DO) can be used as a general-purpose DO by setting it to servo drive run command (OWC001).

③ Digital input (DI) is informed to servo drive status (IWC001) as general-purpose DI.

④ The analog output (D/A converter) can be used as a general-purpose D/A converter by setting the positive torque limit setting (OWC002), the negative torque limit setting (OWC003), and the speed reference setting (OWC015).

⑤ The analog input (A/D converter) is informed to the speed monitor (IWC00D) and the torque monitor (IWC00E) as general-purpose A/D converter.

⑥ To prevent counting, turn count disable (Bit B of OWC000) "ON."
To allow counting, turn count disable (Bit B of OWC000) "OFF."

⑦ To preset the count value, set as follows.
(i) Set the preset data to count preset data (OLC006).
(ii) Turn the request for count preset (Bit C of OWC000) "ON."
(iii) When count preset is completed, the count preset completion (Bit 6 of IWC000) turns "ON."
(iv) When the count preset completion (Bit 6 of IWC000) turns "ON", turn the request for count preset (Bit C of OWC000) "OFF."
(v) The count preset completion (Bit 6 of IWC000) turns "OFF."

(Note) Please note these functions are invalid when count disable (Bit B of OWC000) is "ON."

3.2 Interval counter

The count goes UP or DOWN by the input of pulse A or B. At the rising of pulse C, the count value is latched, and the counter is reset.

- This latched data (interval count value) are stored in the hardware counter latch data (IL□□06 + axis ofs) at each high-speed scan.
- The current count is stored in the hardware counter current value (IL□□08 + axis ofs).
- Count disabling is possible by setting the servo parameter (OW□□00 + Bit B of axis ofs).
- Digital input and output can be used as general-purpose DI, DO. Analog input and output (A/D, D/A converter) is used as general-purpose A/D, D/A.

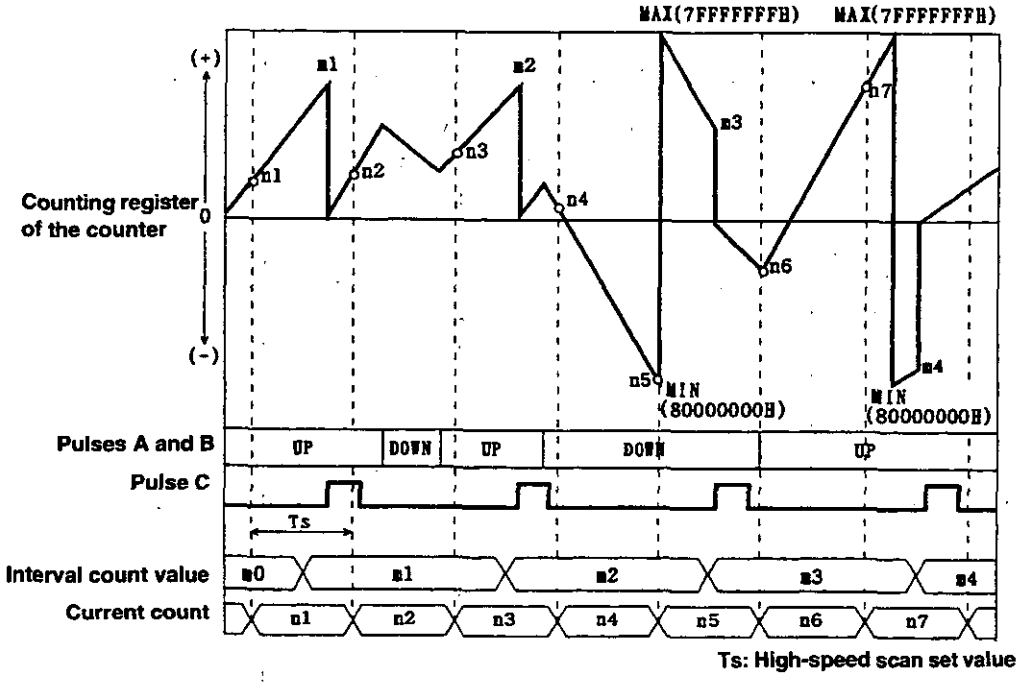


Fig. 3.2 Interval Counter Operation

- The register number is for the 1st axis of the module number 1.
- If the module number and the axis number are different, change the register number referring to 1.3 "Module Number and Servo Parameter Register Number".
- For the servo parameters used with the interval counter, "○" is marked in the column "Interval counter" of "Modes for which data is valid" in 5.1.2 "List of Servo Parameters for Settings" and 5.1.3 "List of Servo Parameters for Monitor".

When using as an interval counter, refer to the following;

① Set the servo fixed parameters. Switch the counter mode selector to "Interval counter (=1)." Set other servo fixed parameters appropriately for your machine.

② Digital output (DO) can be used as a general-purpose DO by setting it to servo drive run command (OWC001).

③ Digital input (DI) is informed to servo drive status (IWC001) as general-purpose DI.

④ The analog output (D/A converter) can be used as a general-purpose D/A converter by setting the positive torque limit setting (OWC002), the negative torque limit setting (OWC003), and the speed reference setting (OWC015).

⑤ The analog input (A/D converter) is informed to the speed monitor (IWC00D) and the torque monitor (IWC00E) as general-purpose A/D converter.

⑥ To prevent counting, turn count disable (Bit B of OWC000) "ON."
To allow counting, turn count disable (Bit B of OWC000) "OFF."

3.3 Frequency Measurement

The frequency is computed based on the sequence of pulses A and B.

- The frequency is stored in the detected frequency (IL□□06 + axis ofs) at each high-speed scan.
- The current count value is stored in the hardware counter current value (IL□□08 + axis ofs).
- Digital input (DI) and output (DO) can be used as general-purpose DI and DO. Analog input (A/D converter) and output (D/A converter) is used as general-purpose A/D and D/A.

[Frequency measurement principle]

The frequency is computed as follows.

$$f = \frac{N_n - N_{n-1}}{(M+1)Ts + (T_{n-1} - T_n)} \times MULT$$

Ts : High-speed scan set value
N_{n-1}, N_n : Current count value of the input pulse at each high-speed scan.
T_{n-1}, T_n : Time from the input pulse to the head of the measuring period (count unit: 8 MHz=0.125 μ s)
M : Number of measurement periods without input pulses
MULT : Frequency count (set by the servo fixed parameter)

(Note) Frequency measurement accuracy $= \pm \frac{1}{8\,\text{MHz} \times Ts}$

For 10 ms high-speed scan, $\pm \frac{1}{8\,\text{MHz} \times 10\,\text{ms}} = \pm \frac{1}{80000} = \pm 0.00125\%$

If more than one pulse is input during the measurement period, computation follows the above formula. If there is no pulse, a value estimated from the previous cycle becomes the computed result. The true value is computed for measurement cycles when a pulse is input.

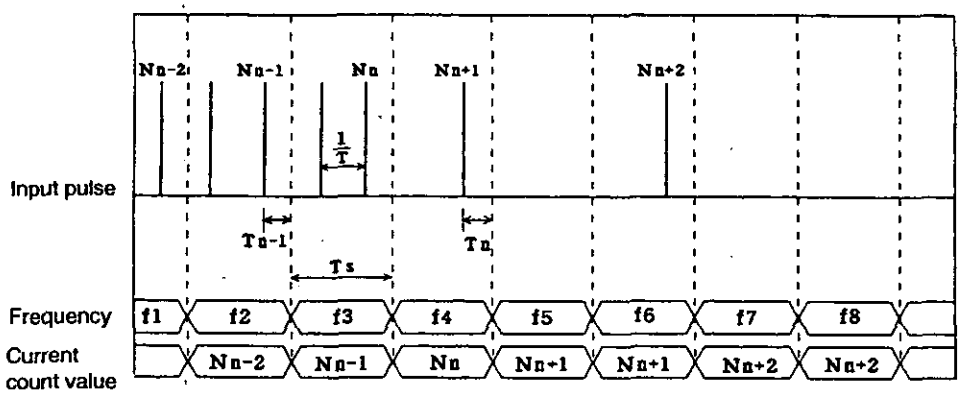


Fig. 3.3 Frequency Measurement

- The register number is for the 1st axis of the module number 1.
- If the module number and the axis number are different, change the register number referring to 1.3 "Module Number and Servo Parameter Register Number".
- For the servo parameters used with the frequency measurement, "○" is marked in the column "Frequency measurement" of "Modes for which data is valid" in 5.1.2 "List of Servo Parameters for Settings" and 5.1.3 "List of Servo Parameters for Monitor".

When using as a frequency measurement, refer to the following;

① Set the servo fixed parameters. Switch the counter mode selector to "Frequency measurement (=2)". Set other servo fixed parameters appropriately for your machine.

② Digital output (DO) can be used as a general-purpose DO by setting it to servo drive run command (OWC001).

③ Digital input (DI) is informed to servo drive status (IWC001) as general-purpose DI.

④ The analog output (D/A converter) can be used as a general D/A converter by setting the positive torque limit setting (OWC002), the negative torque limit setting (OWC003), and the speed reference setting (OWC015).

⑤ The analog input (A/D converter) is informed to the speed monitor (IWC00D) and the torque monitor (IWC00E) as general-purpose A/D converter.

⑥ As necessary, set the average revolutions (OWC014) when the stability (average) of the detected frequency is required rather than the response. Specifically, when the pulse counter mode is set to quadruple multiplication ("A/B method ×4") of the A/B pulse method, detected frequencies at the low-speed area are not stable because of the duty error of the encoder used. In these cases, the detected frequency can be greatly stabilized by setting average revolutions (ordinarily 2 or 4). However, when average revolutions are set, it is almost equivalent to cases where the detection period of the frequency is lengthened (high speed scan set time × average revolutions set value). Therefore, the response speed of detected frequencies lags.

3.4 Basic Counters

Speed control, torque control, position control, phase control, and zero point return can be performed for each axis independently.

3.4.1 Speed Control

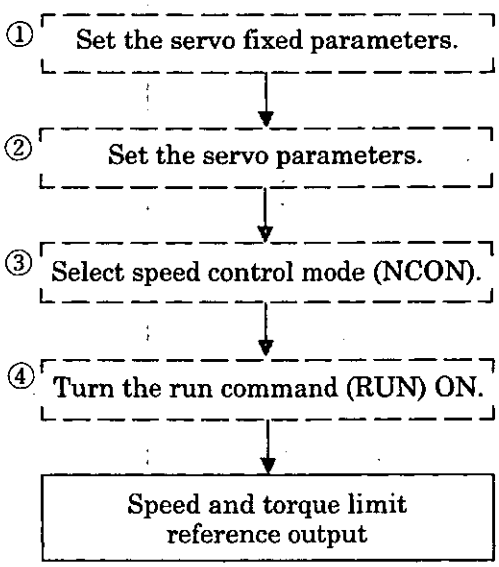
This function is used for rotating the motor at a desired speed. Acceleration and deceleration times can also be set freely. S-curve acceleration and deceleration can be easily obtained with a user program (a single instruction). When speed control is selected, the speed reference is output to the servo driver following the designated linear acceleration and deceleration time. When using as a general-purpose D/A converter, set the linear acceleration and deceleration time and the average revolutions to "0."
Fig. 3.4 shows a speed control block diagram. The register number targets the 1st axis of the module number 1. If the module number and the axis number are different, refer to 1.3 "Module Number and the Servo Parameter Register Number" and change the register number. The servo parameters used with speed control have a circle in the "Speed control" column of the "Modes for which data is valid" in 5.1.2 "List of Servo Parameters for Settings" and 5.1.3 "List of Servo Parameters for Monitor".
Speed control for each axis is performed with the following procedure.

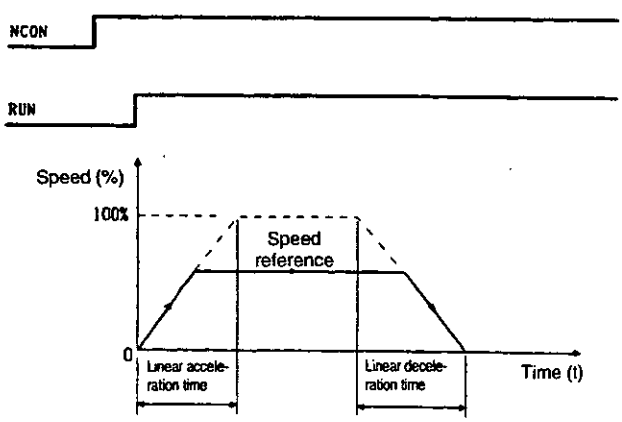
① Set the servo fixed parameters. Switch the counter mode selector to "Basic counter (=3)." Set other servo fixed parameters appropriately for your machine.

② Set the servo parameters for speed control, such as the speed reference setting (OWC015), and the linear acceleration and deceleration time (OWC00C, OWC00D).

③ Select the speed control mode (NCON). (Bit 0 of OWC000)

④ Turn the run command (RUN) ON. (Bit 0 of OWC001)
When the run command (RUN) is turned ON, the axis outputs the speed and the torque limit reference using the designated servo parameters.
Even in the speed control mode, the set values of a servo parameter can be changed.
To stop speed control, turn the run command (RUN) and the speed control mode (NCON) OFF.





The boxes with solid lines are actions the system performs.
The boxes with dotted lines are settings the user makes.

Fig. 3.4 Speed Control Block Diagram

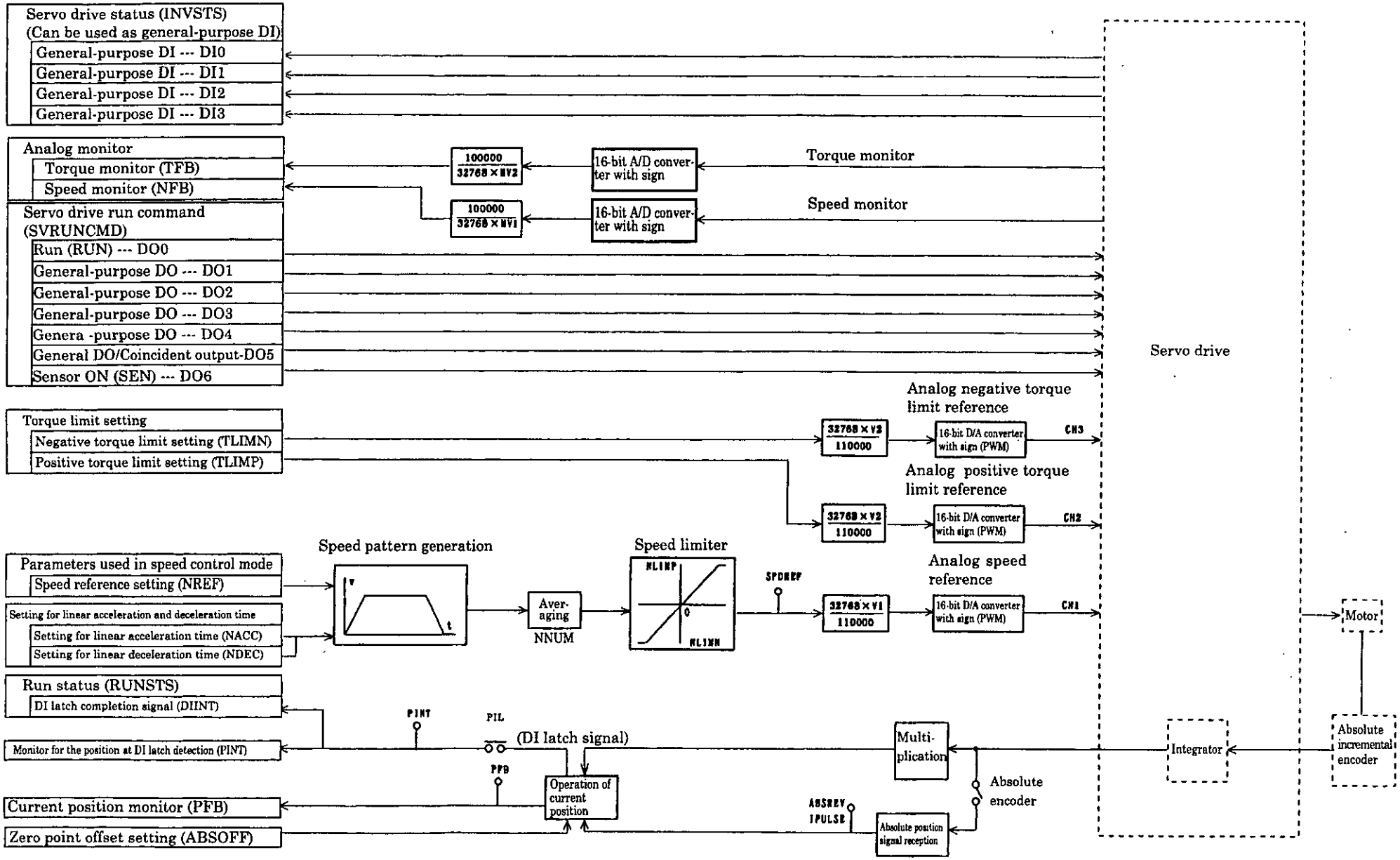


Fig. 3.5 CP-9200SH Speed Control Mode Block Diagram

■ Example of a user program

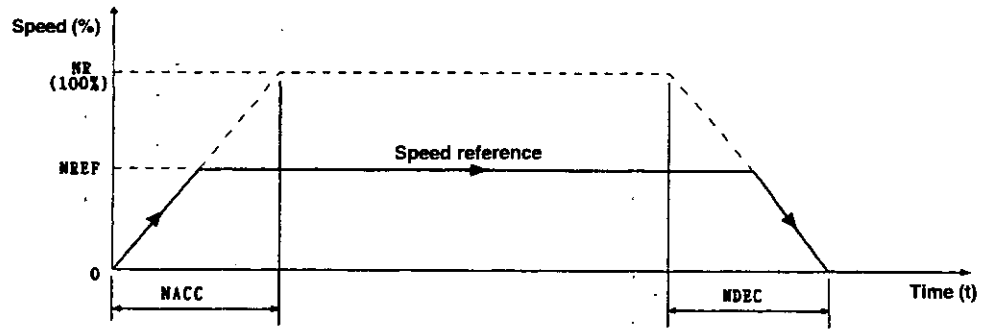


Fig. 3.6 Speed Pattern

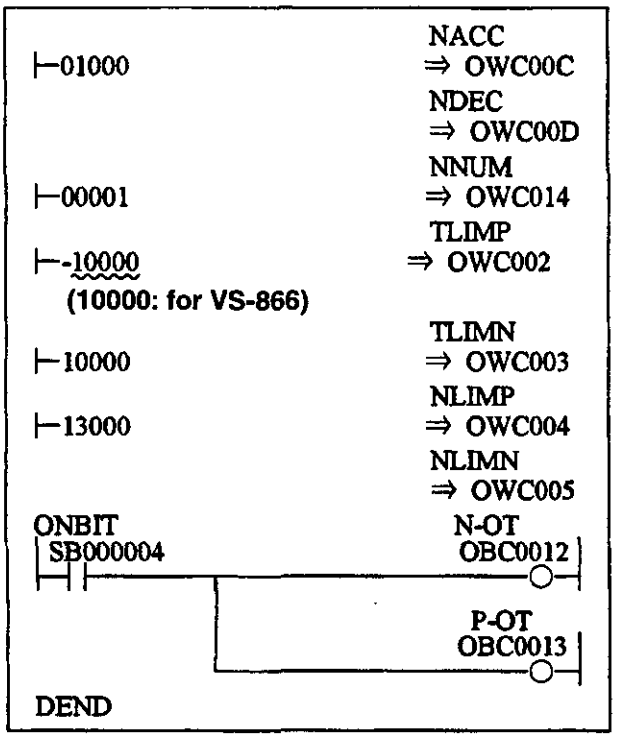
<Assumed conditions>

Motor rated speed : NR = 3000 r/min
Feedback pulse resolution : FBppr = 2048 ppr
D/A output value at 100% of speed : 6 V
D/A output value at 100% of torque limit : 3 V
The above servo parameters are set through the "Fixed parameter screen" of the CP-717.

In Fig. 3.6
Speed reference : NREF = 50%
Linear acceleration time : NACC = 1 sec
Linear deceleration time : NDEC = 1 sec
Positive torque limit : TLIMP = −100% (100% for VS-866)
Negative torque limit : TLIMN = 100%
Positive speed limiter : NLIMP = 130%
Negative speed limiter : NLIMN = 130%

In the example of Fig. 3.6, the SERVOPACK at the number 1 axis of the module number 1 is used. If the module number and the axis number are different, refer to 1.3 "Module Number and Servo Parameter Register Number" and change the register number.
For details of the register (OW□□□□), refer to Chapter 5 "Servo Parameters".

Figs. 3.7 and Fig. 3.8 are examples of using a programming language to show speed pattern in Fig. 3.6.



Linear acceleration time (NACC)

Linear deceleration time (NDEC)

Average number of rotations (NNUM)

Positive torque limit (TLIMP)

Negative torque limit (TLIMN)

Positive speed limiter (NLIMP)

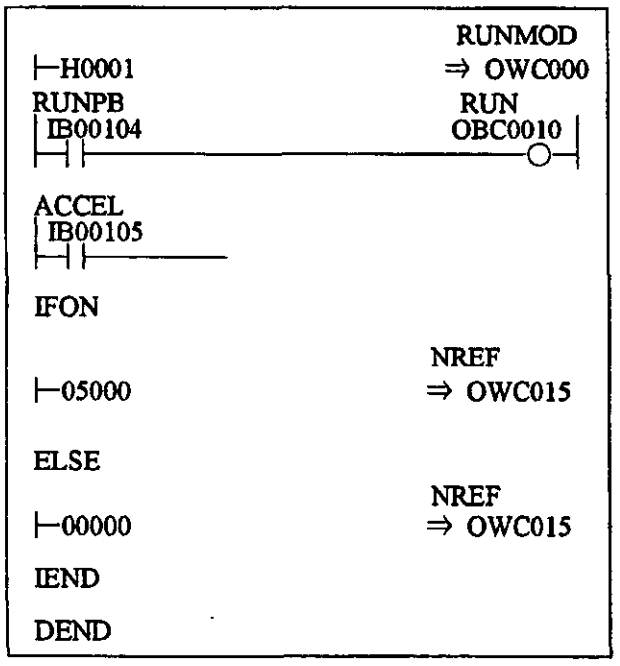
Negative speed limiter (NLIMN)

SB00004: Normally ON contact

Negative overtravel (N-OT), positive overtravel (P-OT) and other reference for the driver

Fig. 3.7 Initial Settings (DWG A01)

In the example of Fig. 3.7, the user program is created in DWG.A and settings are initialized, but after setting initial values in the Fixed Parameter screen of the CP-717, by pressing the "Save" key, the initial values of the servo parameters can be stored. Stored value are automatically set in the servo parameters when the CP-9200SH is turned ON. Thus, this is the same as the method of creating a user program in DWG.A and initializing settings. The method of setting initial values in the servo parameter setting screen and saving them is recommended.



Turn speed control "ON".

Run command to the driver (RUN)

When IB00104 is turned ON, speed control is begun.

When the acceleration reference (IB00105) is turned ON, speed is controlled at 50% of the speed reference in the acceleration time (ACC) . When IB00105 is turned OFF, the speed is decelerated to stop (speed reference 0%) in the deceleration time (DEC).

Fig. 3.8 Run command (DWG H01)

The example of Fig. 3.8 is extremely simplified, but actually each register can be freely controlled with a user program.

3.4.2 Torque Control

This function is used for generating a specified torque unrelated to speed. Select this mode when fastening a metal mold for plastic molding with a specified pressure such as for an injection molding device . When torque control is selected, the specified torque reference and the speed control reference are output to the servo driver. Fig. 3.9 shows a torque control block diagram. The register number targets the 1st axis of the module number 1. If the module number and the axis number are different, refer to 1.3 "Module Number and Servo Parameter Register Number" and change the register number. The Servo parameters used with torque control have a circle in the "Torque control" column of the "Modes for which data is valid" in 5.1.2 "List of Servo Parameters for Settings" and 5.1.3 "List of Servo Parameters for Monitor". Torque control for each axis is performed with the following procedure.

① Set the servo fixed parameters. Switch the counter mode selector to "Basic counter (=3)". Set other servo fixed parameters appropriately for your machine.

② Set the servo parameters for torque control, such as the torque reference setting (OWC01B), the speed control setting (OWC01C).

③ Select the torque control mode (TCON). (Bit 1 of OWC000)

④ Turn the run command (RUN) ON. (Bit 0 of OWC001)
When the run command (RUN) is turned ON, the axis outputs the torque and the torque limit reference using the designated servo parameters.
Even in the torque control mode, the set values of servo parameter can be changed. When the torque control is required for stopping, turn the run command (RUN) and the torque control mode (TCON) OFF.

Note) Negative torque limit setting (OWC003) can be used as a general-purpose D/A converter. It cannot be used as a torque limit.

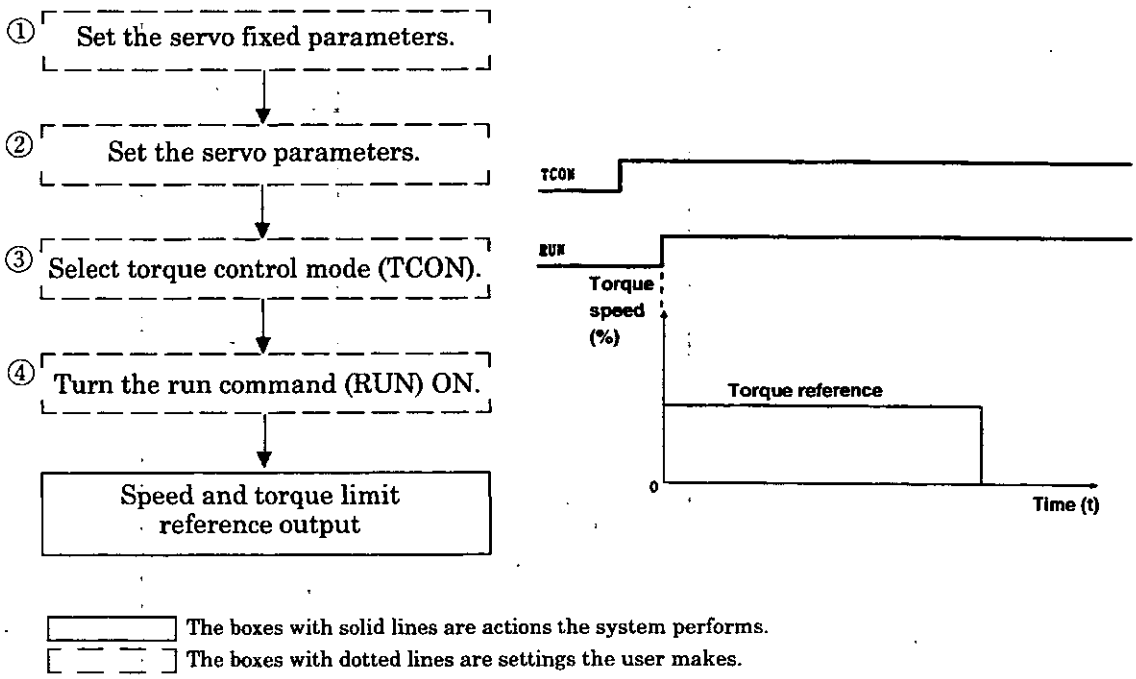


Fig. 3.9 Torque Control Block Diagram

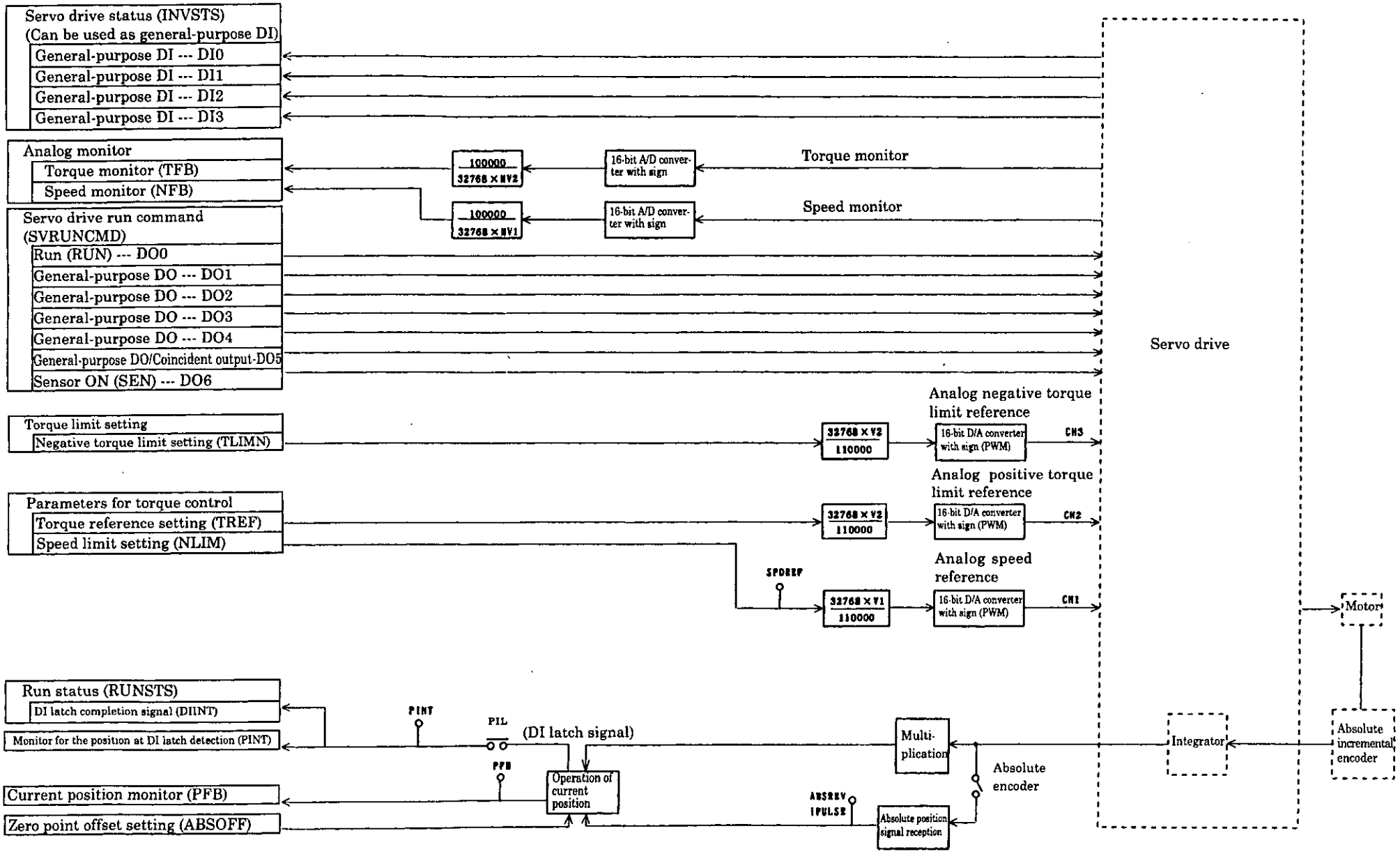


Fig. 3.10 CP-9200SH Torque Control Block Diagram

■ Example of a user program

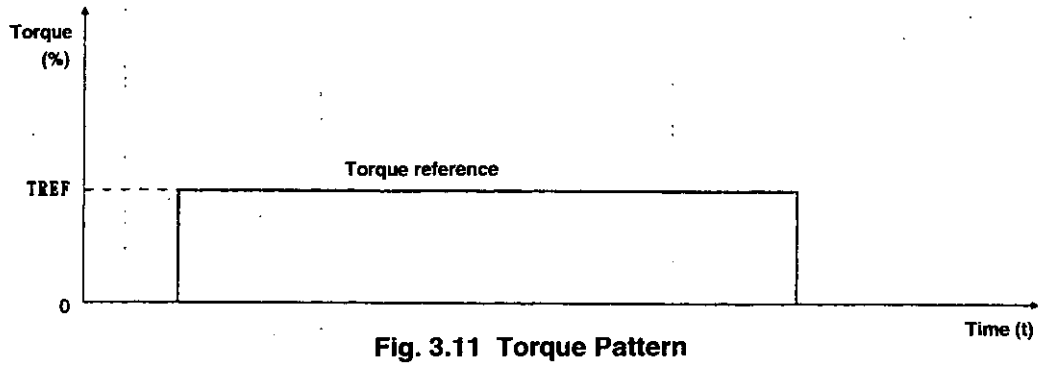


Fig. 3.11 Torque Pattern

<Assumed conditions>

Motor rated speed	: NR = 3000 r/min
Feedback pulse resolution	: FBppr = 2048 ppr
D/A output value at 100% of speed	: 6 V
D/A output value at 100% of torque limit	: 3 V

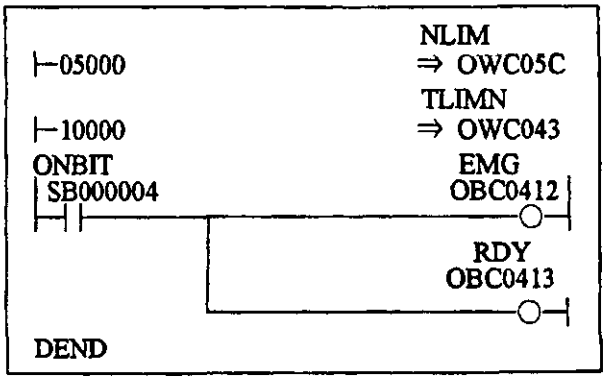
The above servo parameters are set through the Fixed Parameter screen of the CP-717.

In Fig. 3.11

Torque reference	: TREF = 50%
Speed limit	: NLIM = 50%
Negative torque limit	: TLIMN = 100%

In the example of Fig. 3.11, the VS-866 at the 2nd axis of the module number 1 is used.
If the module number and the axis number are different, refer to 1.3 "Module number and Servo Parameter Register Number" and change the register number.
For details of the register (OW□□□□), refer to Chapter 5 "Servo Parameters".

Figs. 3.12 and 3.13 are examples of using a programming language to show torque patterns in Fig. 3.11.



Speed limit (NLIM)

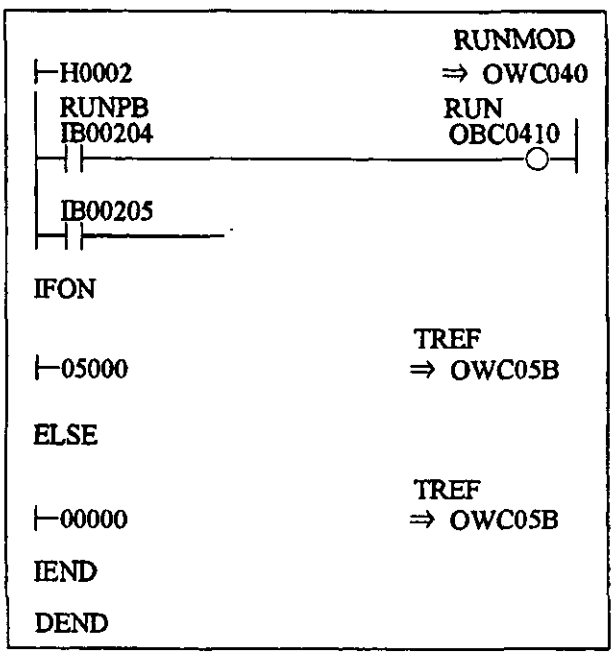
Negative torque limit (TLIMN)

SB00004: Normally ON contact

Emergency stop (EMG), ready to operate (RDY) and other reference to the driver

Fig. 3.12 Initial Settings (DWG A02)

In Fig. 3.12, the user program is created in DWG.A, and settings are initialized. Save the initial values of the servo parameters by pressing the "Save" key after setting the initial values in the Fixed Parameter screen of the CP-717. Initial values saved are automatically set in the servo parameters when the CP-9200SH is turned ON. Thus, this is the same as the method of creating a user program in DWG.A and initializing settings. The method of setting initial values in the servo parameter setting screen and saving them is recommended.



Turn torque control ON.

Run command to the driver (RUN)

When IB00204 is turned ON, torque control is begun.

When IB00205 is turned ON, 50% is output as torque reference.
When IB00205 is turned OFF, 0% is output as torque reference.

Fig. 3.13 Run command (DWG H02)

The example of Fig. 3.13 is simplified, but actually each register can be controlled with a user program.

3.4.3 Position Control

Position control is used when an axis is to be moved to the target position and stop (servo lock).
For a position detector, an incremental encoder or Yaskawa made absolute encoder is used.
When a Yaskawa made absolute encoder is used, even if the power to a positioning device is turned OFF, the absolute position is stored so that the zero point return operation is not necessary after the power is turned ON again.
For position control, there are two methods; the method not using motion command and the method using motion command (OW□□ 20) (Note)
Select whether the motion command (OW□□ 20) is used or not by setting of the servo parameter.

(Note) Position control using motion command is available for CP-9200SH version No. 87921-9000□-S0200 and later.

Servo parameter	When not using motion command (OW□□ 20)	When not using motion command (OW□□ 20)
Bit7 (selection to use motion command) of servo fixed parameter No. 14 "Additional function selection"	Not Use (= 0)	Not Use (= 1)
Bit8 (motion command code valid/invalid) of servo parameter for setting "Operation mode (OW□□ 00)	0 (= valid)	1 (= invalid)

(Note) When Bit7 (selection to use motion command) of servo fixed parameter No. 14 "Additional function selection" is set to Not Use and Bit8 (motion command code valid/invalid) of servo parameter for setting "Operation mode (OW□□ 00)" is set to "1" (=valid), the operation is performed without using motion command.

The differences in the operations when motion command is used and not used are shown in Table 3.1.

Table. 3.1 Differences in Operations when Motion Command is Used and Not Used

Items	When motion command (OW□□ 20) is not used	When motion command (OW□□ 20) is used
Reference unit	Pulse	Select either pulse, mm, inch, or deg.
Electric gear function	Not available	Available
Finite length position control	Possible	Possible
Infinite length position control with rotation to a single direction without resetting after one rotation	Possible	Possible
Infinite length position control, resetting after one rotation	Not possible	Possible
Position reference	Absolute position method	Select either absolute position method or incremental value addition method.
Position buffer	Not available	Available
Position monitor	Pulse unit	Specified unit
Speed reference	% reference	Select either % reference or specified unit.

(Note) Refer to 3.4.3(1) to (6) for details.

(1) Reference unit

The reference unit input to SVA module is determined by settings of the following servo fixed parameters.

- Select the reference unit among pulse, mm, degree (deg), and inch.
- Select the reference unit by Bit0 to Bit3 of the servo fixed parameter No. 17 "Motion controller function selection flag".
- Set "Minimum reference unit" allowed for SVA module is set by the above explained refernce unit and the servo fixed parameter No. 18 "Number of digits below decimal point".
- When motion command (OW□□ 20) is not used, the reference unit is pulse.

Table 3.2 Minimum Reference Unit (1 reference unit)

Units / No. of digits below decimal point	Bit0 to 3 of Servo fixed parameter No. 17 "Motion controller function selection flag"			
	Pulse (= 0)	mm (= 1)	deg (= 2)	inch (= 3)
0	1 pulse	1 mm	1 deg	1 inch
1	1 pulse	0.1 mm	0.1 deg	0.1 inch
2	1 pulse	0.01 mm	0.01 deg	0.01 inch
3	1 pulse	0.001 mm	0.001 deg	0.001 inch
4	1 pulse	0.0001 mm	0.0001 deg	0.0001 inch
5	1 pulse	0.00001 mm	0.00001 deg	0.00001 inch

(Notes) 1. Specify the "No. of digits below decimal point" by the servo fixed parameter No. 18 "Number of digits below decimal point".
2. The above parameters are available for CP-9200SH version No. 87921-9000□-S0200 and later. For the version Nos. older than 87921-9000□-S0200, the reference unit is always pulse.

(2) Electric gear

The reference unit is for the input to SVA module, and the travel unit for machine system is called "output unit".
The electric gear is the function to convert the units of position or speed from the reference unit (mm, deg, inch) to the output unit.
In the machine configuration where the load axis rotates n times when the motor axis rotates m times, using this electric gear function can converts the reference unit to the output unit; "Reference unit" = "Output unit".

Set the function of electric gear by the servo fixed parameters shown in Table. 3.3.
When the unit is selected to pulse and when the motion command is not to be used, the electric gear function is invalid.

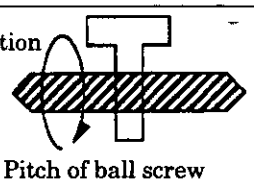
Table 3.3 Parameters for Electric Gear

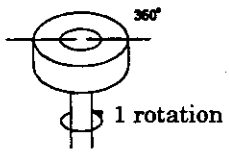
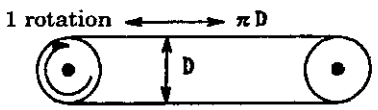
Servo fixed parameter	Name and Meanings
Bit4 of No. 17 "Motion controller function selection flag"	Electric gear valid/invalid (0: valid, 1: invalid) * When the reference unit is set to pulse, the electric gear is invalid. Set to "0" (invalid)
No. 19 "Travel amount per 1 machine rotation"	Travel amount per 1 machine rotation * When the electric gear is set to invalid (="0"), the setting of this parameter is disabled.
No. 20 "Motor side gear ratio"	Motor side gear ratio * When the electric gear is set to invalid (="0"), the setting of this parameter is disabled.
No. 21 "Machine side gear ratio"	Machine side gear ratio * When the electric gear is set to invalid (="0"), the setting of this parameter is disabled.

(Note) The above parameters are available for CP-9200SH version No. 87921-9000□-S0200 and later. For the version Nos. older than 87921-9000□-S0200, the electric gear function is invalid.

Table 3.4 shows the contents and setting examples of the parameters in Table 3.3.

Table 3.4 Contents and Setting Examples of Parameters for Electric Gear

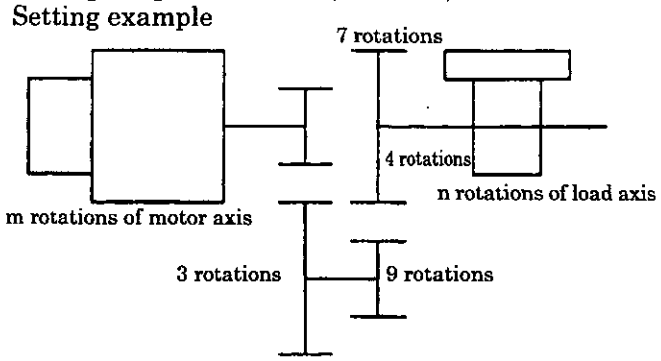
<table>
<tr><th>Servo fixed parameter No.</th><th>Name</th><th>Contents</th><th>Initial value</th></tr>
<tr><td>No. 19</td><td>Travel amount per 1 machine rotation</td><td>
· Indicates the load travel amount per one load axis rotation.
· Set the value of the load travel amount divided by the reference unit.
$$\text{No.19} = \frac{\text{Load travel amount per one load axis rotation}}{\text{Reference unit}}$$
· Examples of load travel amount are shown below.
<table>
<tr><th>Travel amount per one machine rotation</th><th colspan="2">Load configuration examples</th></tr>
<tr><td>P [mm]</td><td>Ball screw</td><td> 

P = Pitch of ball screw</td></tr>
<tr><td>360 [°]</td><td>Round table</td><td> 
</td></tr>
<tr><td>π D [mm]</td><td>Belt</td><td> 
</td></tr>
</table>
· Setting range of No.19: 1 to $2^{31} - 1$ [1 = 1 reference unit]

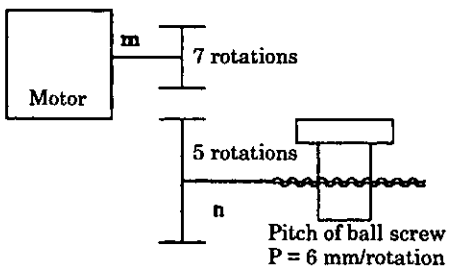
● Setting example
Where
· Travel amount per 1 load axis rotation = 12 mm
· Reference unit = 0.001 mm, set as
$$\text{No. 19} = \frac{12\ \text{mm}}{0.001\ \text{mm}} = 12000.$$
</td><td>10000</td></tr>
</table>

(Continuted)

(Continuted)

Servo fixed parameter No.	Name	Contents	Initial value
No. 20	Motor side gear ratio	· Sets a gear ratio between motor and load. In the configuration where the load axis rotates n times when motor axis rotates m times, set as No. 20 = m rotations and No. 21 = n rotations · Setting range: 1 to 65535 (rotations) ● Setting example  In the above configuration by the following axle ratio; Axle ratio = $\frac{n}{m} = \frac{3}{7} = \frac{4}{9} = \frac{4}{21}$ Accordingly, set as No.20 = 21, No.21 = 4.	1
No. 21	Machine side gear ratio		1

● Setting example of parameter for electric (A) where a ball screw is installed



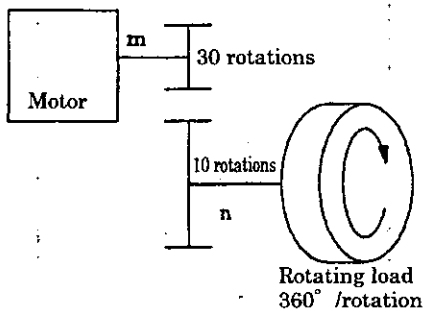
In the above machine system, to get "reference unit" = "output unit" = 0.001 mm, the set value of each parameter should be as follows:

· No.19= $\frac{6\text{ mm}}{0.001\text{ mm}}$ = 6000

· Axle ratio= $\frac{n}{m} = \frac{5}{7}$

· No.20= 7
· No.21= 5

● Setting example of parameter for electric gear (B) where a rotating load is installed



In the above machine system, to get "reference unit" = "output unit" = 0.1° , the set value of each parameter should be as follows:

$$\cdot \text{No.19} = \frac{360^\circ}{0.1^\circ} = \boxed{3600}$$

$$\cdot \text{Axle ratio} = \frac{n}{m} = \frac{10}{30} = \frac{1}{3}$$

· No.20=3
· No.21=1

(3) Axis selection

There are two types of position control; finite length position control where control is made only in the section between specified positions such as for a reciprocating motion, and infinite length position control where the rotation is made only in a single direction. For infinite length position control, there are two methods; a method where the count is reset to 0 every one rotation such as for belt conveyor and the other method where the rotation is made simply in a single direction without resetting the count after one rotation.

The axis selection is to select which position control to be used. Set the axis selection by Bit5 of the servo fixed parameter No.17 "Motion controller function selection flag".

However, when motion command (OW□□20) is not used, the axis selection is invalid. Set to "Finite length axis" (= 0).

Table 3.5 Setting for Axis Selection

Type of Position Control	Setting for Axis Selection
Finite length position control	Finite length axis (= 0)
Infinite length position control where rotation is made simply in a single direction without resetting each rotation	Finite length axis (= 0)
Infinite length position control with resetting every rotation (set the reset position by the motion fixed parameter No.22 "Reset position of infinite length axis").	Infinite length axis (= 1)

(Note) The above parameters are available for CP-9200SH version No. 87921-9000□□-S0200 and later. For the version Nos. older than 87921-9000□ -S0200, it is fixed to infinite length axis (= 0).

(4) Position reference

There are two types of position reference setting method; direct designation to set a position reference directly to OL□□ 12 and indirect designation to set the position buffer No. where a position reference is stored to OL□□ 12.

For direct designation, there are the absolute position reference method to set an absolute position to OL□□12 and the adding incremental value method to set the value of the present travel value added to the previous position reference value (the previous value of OL□□ 12) to OL□□ 12.
For indirect designation to set the position buffer No., treat the position that is stored in the position buffer as an absolute position.

When motion command (OW□□20) is not used, treat the position reference value set to OL□□12 as an absolute position.
Table 3.6 shows the parameters concerned with position control.

Table 3.6 Parameters for Position Reference

Type of parameter	Parameter No. (Register No.)	Name	Contents	Initial value
Servo parameter for setting	Bit12 of OW□□ 01	Position reference value selection	Sets a designation method of position reference. 0: Direct designation Set directly a position data to OL□□ 12. Specify whether the position data is calculated by the absolute position method or by the adding incremental value method at Bit14 of OW□□ 01 1: Indirect designation Sets a position buffer No. to OL□□ 12. In the specified position buffer, store an absolute position beforehand.	0 (Note)
	Bit14 of OW□□ 01	Position reference type	Specifies a position data type. 0: Absolute position method Set an absolute position to OL□□ 12. 1: Adding incremental value method Set the value of the present travel value added to the OL□□ 12 previous value to OL□□ 12. (Note) When the position buffer (indirect designation) is selected, it is invalid.	0 (Note)
	OL□□ 12	Position reference setting	Sets a position data. (Note) The data to be set differs depending on the settings of position reference value selection (Bit12 of OW□□ 01) and position reference type (Bit14 of OW□□ 01)	0

(Note) The above parameters are available for CP-9200SH version No. 87921-9000□□-S0200 and later. For the version Nos. older than 87921-9000□-S0200, it is fixed to infinite length axis (= 0).

Table 3.7 Position Reference Value Selection

Position reference value selection (Bit12 of OW□□01)	Position reference type (Bit14 of OW□□01)	Position reference (OL□□ 12)
0 (Direct designation)	0 (Absolute position method)	Sets an absolute position. (Ex.) OL□□ 12 ← 1000 OL□□ 12 ← 2000
	1 (Adding incremental value method)	Sets the value of the present travel amount (incremental value) added to the previous value of OL□□ 12. OL□□ 12 ← Previous OL□□ 12 + Incremental travel amount (Ex.) When the previous OL□□ 12 = 1000 and the present travel amount = 500, OL□□ 12 ← 1000 + 500 = 1500
1 (In direct designation)	0 (Note)	Sets a position buffer No. In the specified position buffer No., store an absolute position beforehand.

(Note) If it is set to "1" (adding incremental value method), a setting parameter error occurs.
Set "1" to the position reference type for infinite length axis. Calculate the position reference value by adding the present travel amount (incremental travel amount) to the previous position reference value (OL□□ 12) and set newly this value to the position reference (OL□□ 12).
For example, in order to move continuously to one direction, the position reference (OL□□ 12) shall be simply incremented.

What is Position Buffer?
The position data group by each axis can be stored in a buffer (position buffer) inside SVA module.
By specifying a "buffer No." for a position data (OL□□12), the position buffer can perform the operation *equivalent to the operation when a command with absolute position is entered in program.*
The position buffer has a capacity for data of maximum 256 points × 4 axes.
This function is available only for CP-9200SH version No. 87921-9000□-S0200 and later.

(Note)
The data in the position buffer are lost by turning the power OFF or master-reset of CPU module. Therefore, be sure to set data at turning the power ON and before using the position buffer.

■ Preparation of position buffer

Prepare the position buffer by using the servo parameters in Table 3.8.

Table 3.8 Parameters for Preparation of Position Buffer

Name	Register No.	Setting Range	Meanings
Position buffer access No.	OL□□ 38	1 to 256	For setting of position buffer Nos.
Position buffer written-in data	OL□□ 3A	-2^{31} to $2^{31}-1$	For setting of data to write-in position buffer
Motion command control flag (MCMDCTRL)	OB□□ 21E (Bit14 of OW□□ 21)	0 or 1	For writing-in position buffer 0: No processing 1: Write

■ Read-out of position buffer data

By the servo parameters in Table 3.9, the data in position buffer can be read-out to the servo parameter for monitor. Use the parameter to confirm the data.
It takes 2 high-speed scans to set the data to the servo parameter for monitor (IL□□28) after issuing a read-out command.

Table 3.9 Parameters for Reading-out Data of Position Buffer

Name	Register No.	Setting Range	Meanings
Position buffer access No.	OL□□ 38	1 to 256	For setting of position buffer Nos.
Motion command control flag (MCMDCTRL)	OB□□ 21F (Bit15 of OW□□ 21)	0 or 1	For reading-out position buffer 0: No processing 1: Read-out
Position buffer read-out data	IL□□ 28	-2^{31} to $2^{31}-1$	Read-out data of position buffer

■ Using data of position buffer for position reference

By setting the servo parameters in Table 3.10, the data of position buffer can be used as a position reference value.

Table 3.10 Parameters for Using Data of Position Buffer as Position Reference

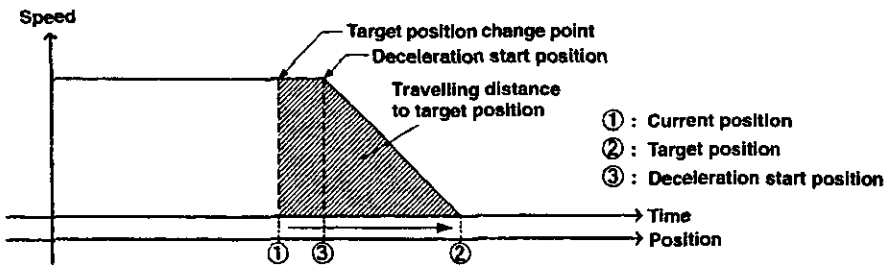
Name	Register No.	Setting Range	Meanings
Position reference setting (XREF)	OL□□ 12	1 to 256	Set a position buffer No. for a position reference.
RUN command setting (SVRUNCMD)	OB□□ 01C (Bit12 of OW□□ 01)	1	Selection to use position buffer 0: Use position reference value for XREF (OL□□ 12) data 1: Use position buffer No. for XREF (OL□□ 12) data

■ Position control without motion commands

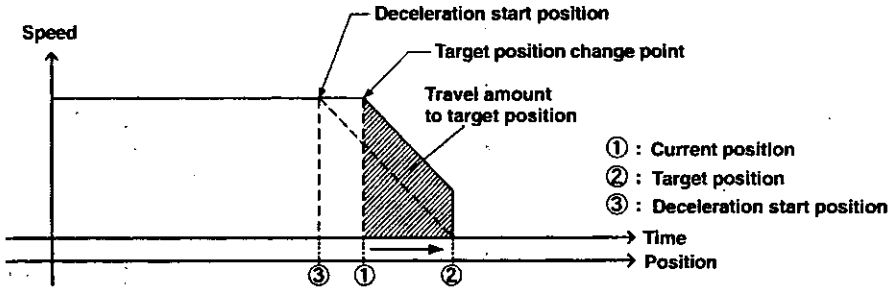
The manipulator moves in the following three motion patterns according to the relation of the current position, the target position, and the deceleration start position when changing the control mode or after having changed the position reference in the position control mode (at the target position change point).

The deceleration start position is the position where deceleration is started so that the positioning to the target position is executed according to the deceleration time set value.

- **Where Current position < Target position AND Current position ≦ Deceleration start position**
  Deceleration is started according to the deceleration time set value.

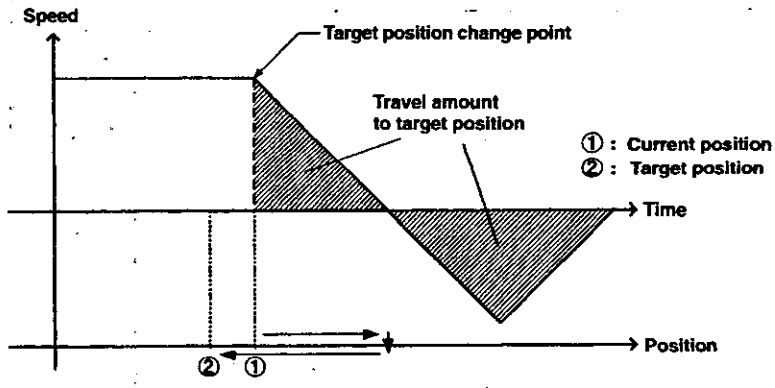


- **Where Current position < Target position AND Current position > Deceleration start position**
  Deceleration is started according to the deceleration time set value and is completed when the manipulator reaches the target position.



In the above case, deceleration should have started at point ③. Because the manipulator passed over the deceleration start point, deceleration is started from the target position change point and is completed when the manipulator reaches the target position.

- **Where Current position ≧ Target position**
  The manipulator decelerates to a stop according to the deceleration time set value. Then it moves in reverse to the target position according to the acceleration/deceleration time set value.



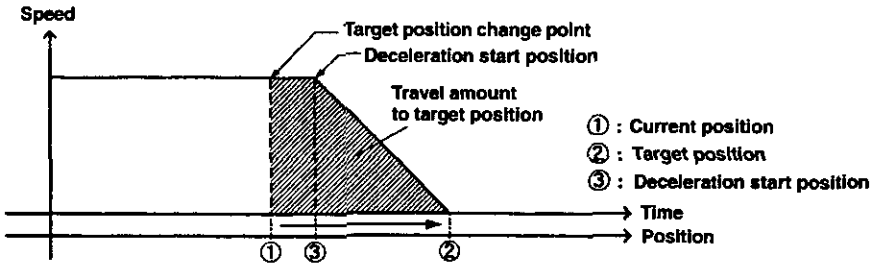
Because the target position is behind the current position, the manipulator decelerates to a stop, and then moves to the target position.

■ Position control with motion commands

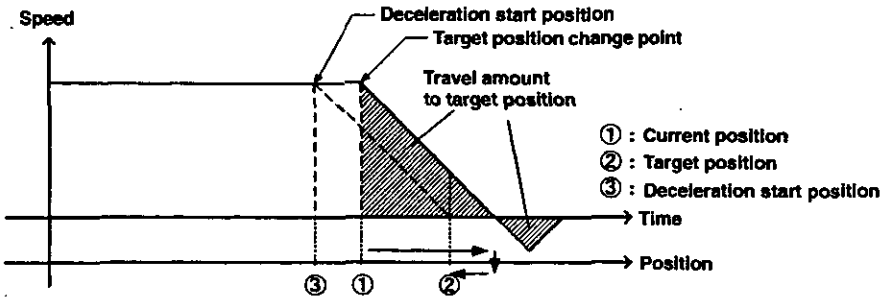
The manipulator moves in the following two motion patterns according to the relation of the current position, the target position, and the deceleration start position when changing the control mode or after having changed the position command in the position control mode (at the target position change point).

The deceleration start position is the position where deceleration is started so that the positioning to the target position is executed according to the deceleration time set value.

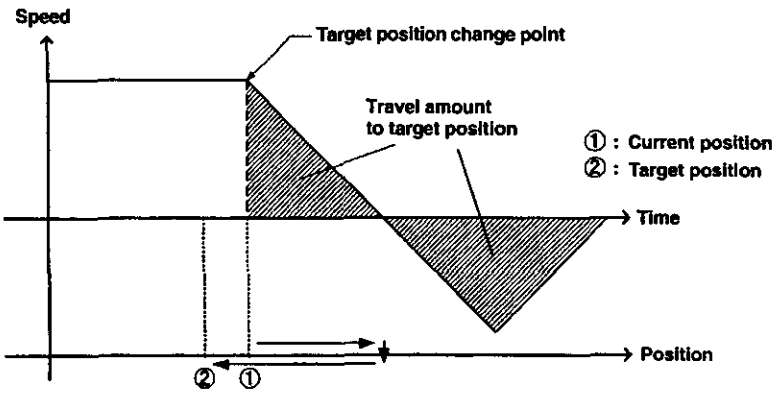
- **Where Current position < Target Position AND Current position ≦ Deceleration start position**
  The deceleration is started according to the deceleration time set value.



- **Where Current position < Target position AND Current position > Deceleration start position, or Where Current position ≧ Target position**
  The manipulator decelerates to a stop according to the deceleration time set value. Then it moves in reverse to the target position according to the acceleration/deceleration time set value.



In the above case, deceleration should have started at point ③. Because the manipulator passed over the deceleration start point, the manipulator decelerates to a stop from the target position change point, and then moves to the target position.



Because the target position is behind the current position, the manipulator decelerates to a stop, and then moves to the target position.

(5) Position monitor

The parameters shown in Table 3.11 are used for position monitor.

Table 3.11 Parameters for Position Monitor

Servo Parameter No. for Monitor (Register No.)	Name	Contents
IL□□ 02	Target position monitor (PTG)	The calculated positions of machine coordinate system monitored by SVA module are reported. Normally, the position data reported to this parameter becomes the target position every scan. Note: When the axis selection is set to "infinite length axis", the range from 0 to (Infinite length axis reset position - 1) is reported. For position reference when "infinite length axis" is set, add the present travel amount (incremental travel amount) to the previous position reference (OL□□ 12) and newly set this value to OL□□ 12 (position reference). Note that the position reference (OL□□12) is not always set in the range 0 to (reset value of infinite length axis - 1).
IL□□ 08	Position monitor (PFG)	The feedback position of machine coordinate system is reported. Note: When the axis selection is set to "infinite length axis", the range from 0 to (Infinite length axis reset position - 1) is reported.
IL□□ 18	Machine coordinate system reference position (MPOS) Note	The position that SVA module outputs externally and reference position of machine coordinate system are reported. In the machine lock status, this data is not updated (in the machine lock status, no data is output externally). When the machine lock function is not used, it is the same as IL□□ 02.
IL□□ 2E	Reference coordinate system calculated position (POS) Note	This parameter takes effect when the axis selection is set to "Infinite length axis". When "Infinite length axis" is selected, the target position of each scan for the position reference is reported to this parameter. Note: When "Finite length axis" is selected, it is the same as IL□□ 02.

(Note) These parameters are valid for CP-9200SH version No. 87921-9000□ -S0200 and later.

■ What is the machine coordinate system?

The machine coordinate is a coordinate system that is set by execution of zero point return mode, execution of "zero point return (ZRET)" of motion command or "zero point setting (ZSET)" operation of motion command.

The SVA module controls positions on the machine coordinate system.

(6) Speed reference

The speed reference such as rapid feed speed, approach speed, and creep speed can be set either in reference unit or in the ratio to the rated motor speed.
The parameters concerned with speed reference are shown in Table 3.12.

Table 3.12 Parameters for Speed Reference

Type of Parameter	Parameter No. (Register No.)	Name	Contents
Servo fixed parameter	No.5	Pulse counting method	Set the pulse counting method and the multiplication factor. 0: Sign method (Single multiplication) 1: Sign method (Double multiplication) 2: UP/DOWN method (Single multiplication) 3: UP/DOWN method (Double multiplication) 4: A/B method (Single multiplication) 5: A/B method (Double multiplication) 6: A/B method (Quadruple multiplication)
	No.7	Rated motor speed setting	Set the number of rotations when the motor runs at the rated speed (100% speed).
	No.8	Number of feedback pulses per motor 1 rotation	Set the number of pulses per motor 1 rotation (the value before multiplication).
Servo parameter for setting	Bit3 of OW□□01	Speed reference value selection Note1	Specify the setting unit for rapid feed speed, approach speed, and creep speed and the register No. for rapid feed speed. 0: Use OL□□22 (unit: 10^n reference unit/min.) for the rapid feed speed. And the unit for approach speed (OW□□0A) and creep speed (OW□□0B) is 1 = 10^n reference unit/min. 1: Use OW□□15 (unit = % to the rated motor speed (1 = 0,001%)) for the rapid feed speed. And the unit for approach speed (OW□□01) and creep speed (OW□□0B) is % to the rated motor speed (1 = 0.01%).
	OW□□0A	Approach speed setting	The unit differs depending on the setting for "speed reference value selection" (Bit13 of OW□□01). (1) When "speed reference value selection" = 0, set in reference unit. 1 = 10^n reference unit/min (n: number of digits below decimal point) In units of pulse: 1 = 1000 pulses/min In units of mm: 1 = 1 mm/min In units of deg: 1 = 1 deg/min In units of inch: 1 = 1 inch/min (2) When "speed reference value selection" = 1, set in % to the rated motor speed. 1 = 0.01%
	OW□□0B	Creep speed setting	
	OW□□15	Speed reference setting	This parameter is valid when "speed reference value selection " (Bit13 of OW□□01) is set to 1. Set a ratio to the rated motor speed (1 = 0.01 %) for the rapid feed speed. Note: This parameter is invalid when "speed reference value selection" is set to 0.
	OL□□22	Rapid feed speed Note 2	This parameter is valid when "speed reference value selection " (Bit13 of OW□□01) is set to 0. Set a reference unit for the rapid feed speed. 1 = 10^n reference unit/min (n: number of digits below decimal point) According to the unit, the reference unit are as follows: In units of pulse: 1 = 1000 pulses/min In units of mm: 1 = 1 mm/min In units of deg: 1 = 1 deg/min In units of inch: 1 = 1 inch/min
	OW□□2C	Override Note 2	The set value for rapid feed speed can be changed to use. Note: OVERRIDE means originally to neutralize the action. However, this OVERRIDE indicates to change the set value to use. By setting Bit9 "override valid/invalid" of servo fixed parameter No. 17 "motion controller function selection flag", the override can be switched valid and invalid. When it is set to invalid, the rapid feed speed is 100 % of the set value.

(Notes) 1. This parameter is invalid when motion command is not used.
Set a ratio to the rated motor speed (1 = 0.01%) to OW□□0A, OW□□0B, and OW□□15.
This parameter is available for CP-9200SH version No. 87921-9000□-S0200 and later. For the version Nos. older than 87921-9000□-S0200, it is fixed to "1".
2. This parameter is invalid when motion command is not used.
This parameter is available for CP-9200SH version No. 87921-9000□-S0200 and later.

Table 3.13 shows the parameter setting examples.

Table 3.13 Parameter Setting Examples

Type of Parameter	Parameter No. (Register No.)	Name	Contents	Initial value
Servo fixed parameter	No.5	Pulse counting method	No. 5 = A/B method (quadruple multiplication) No. 7 = 3000 rpm No. 8 = 2048 ppr Therefore, the rated motor speed = 3000 rpm = 3000 × 2048 × 4 (multiplication) = 24576000 ppm (1) When "speed reference value selection" is set to "0". ① When "pulse" is selected for the unit, with the above fixed parameter setting, to operate at rapid feed speed 1500 rpm, approach speed 300 rpm and creep speed 150 rpm, · OW□0A = 300 (rpm) × 2048 × 4 (ppr) ÷ 1000 = 2457 · OW□0B = 150 (rpm) × 2048 × 4 (ppr) ÷ 1000 = 1228 · OW□15 = — (invalid) · OL□22 = 1500 (rpm) × 2048 × 4 (ppr) ÷ 1000 = 12288 · OW□2C=10000 (100%) ② When "mm" is selected for the unit, with the above fixed parameter setting, to operate at rapid feed speed 900 mm/min, approach speed 180 mm/min, and creep speed 90 mm/min in the machine configuration that travels 10 mm per motor 1 rotation, · OW□0A=180 · OW□0B=90 · OW□15= — (invalid) · OL□22= 900 · OW□2C=10000 (100%) (2) When "speed reference value selection" is set to "1" with the above fixed parameter setting, to operate at rapid speed 1500 rpm, approach speed 300 rpm, and creep speed 150 rpm, · $OW□0A = \frac{300\ (rpm)}{3000(rpm)} \times 10000$ = 1000 (10.00%) · $OW□0B = \frac{150\ (rpm)}{3000\ (rpm)} \times 10000$ = 500 (5.00%) · $OW□15 = \frac{1500\ (rpm)}{3000\ (rpm)} \times 10000$ = 5000 (50.00%) · OL□22 = — (invalid) · OW□2C = 10000 (100%) (3) To reduce the operation speed by half with the same settings for speed reference, approach speed, creep speed, · OLx□2C= 5000 (50.00%) Set 1 (= valid) for Bit 9 "Override valid" of servo fixed parameter No. 17.	A/B method (Quadruple multiplication)
	No.7	Rated motor speed setting		3000
	No.8	Number of feedback pulses per motor 1 rotation		2048
Servo parameter for setting	Bit13 of OW□01	Speed reference value selection		0
	OW□0A	Approach speed		0
	OW□0B	Creep speed		0
	OW□15	Speed reference setting		0
	OL□22	Rapid feed speed		0
	OW□2C	Override		100%

(7) Not using motion command

The position control block diagram is shown in Fig. 3.14. The register number is for the 1st axis of the module number 1. If the module number and the axis number are different, change the register number referring to 1.3 "Module Number and Servo Parameter Register Number". The servo parameters used with position control, "○" is marked in the column "Position control" of "Modes for which data is valid" in 5.1.2 "List of Servo Parameters for Settings" and 5.1.3 "List of Servo Parameters for Monitor".
Position control for each axis is performed with the following procedure.

① Set the servo fixed parameters. Switch the counter mode selector to "Basic counter (=3)". Set other servo fixed parameters appropriately for your machine.

② Set the position reference pulse setting (OLC012) and the constant movement speed to the speed reference setting (OWC015). In addition, set the servo parameter for positioning control, such as the linear acceleration and deceleration times (OWC00C, OWC00D), the position loop gain (OWC010), the positioning completion range (OWC00E).

③ Select the positioning control mode (PCON) (Bit 2 of OWC000).

④ Turn the run command (RUN) ON. (Bit 0 of OWC001)
When the run command (RUN) is turned ON, the axis performs the positioning by the designated servo parameters. Even during positioning, the set values of a servo parameter can be changed.

⑤ When the axis enters the positioning completion range, the positioning completion signal POSCOMP (Bit D of IWC000) is turned ON. Even when entering the positioning completion range, control continues (Servo lock state is entered). When the positioning control is required for stopping, turn the run command (RUN) and the position control mode (PCON) OFF.

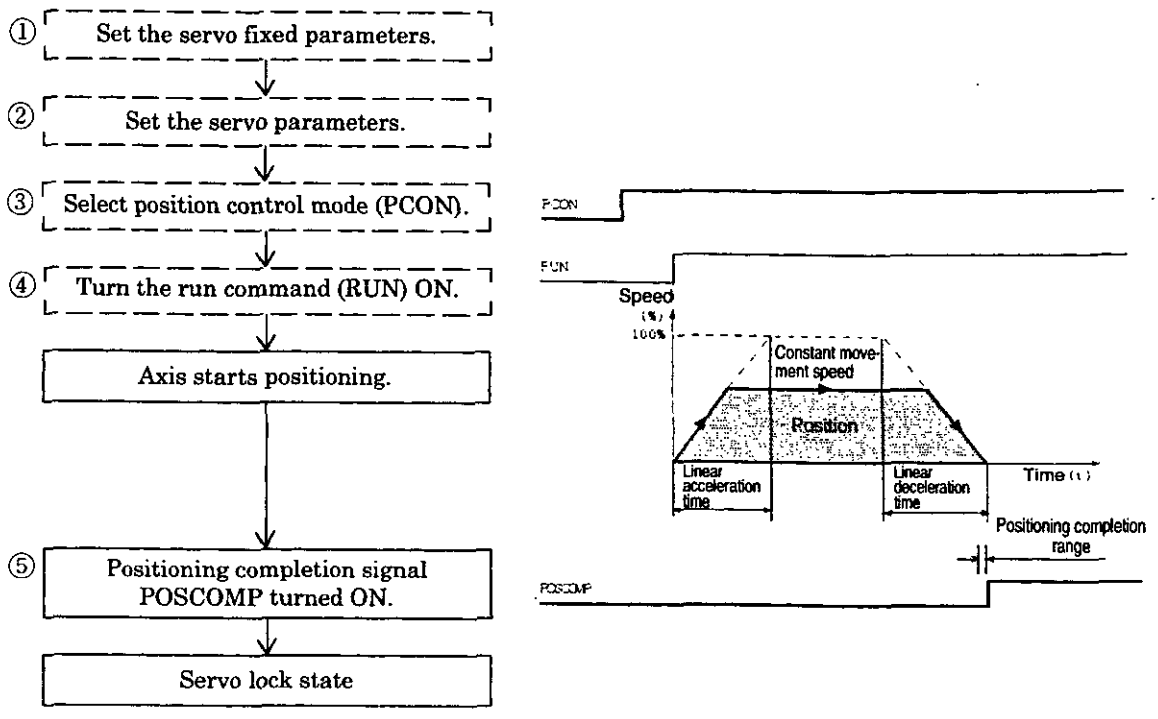
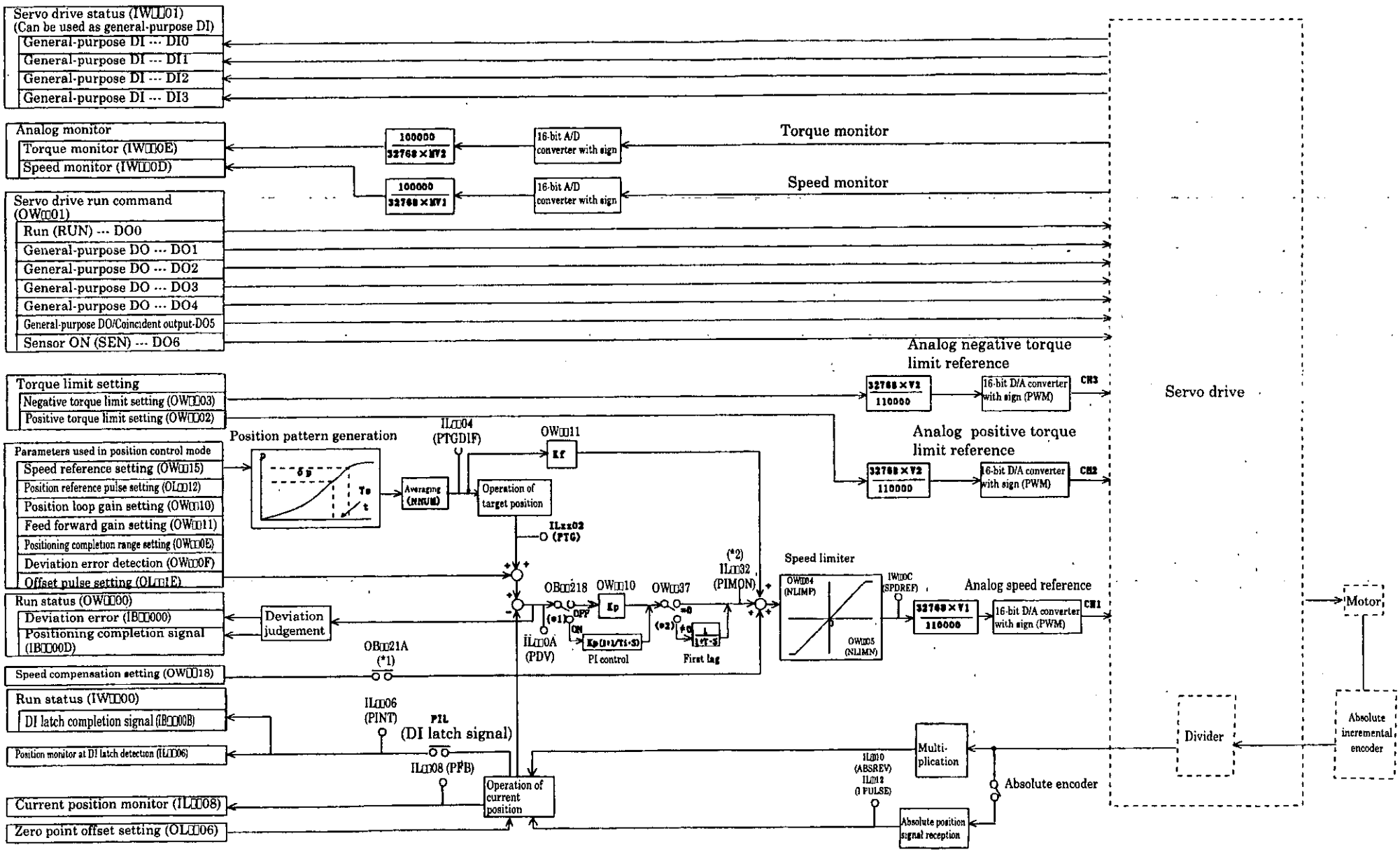


Fig. 3.14 Position Control Block Diagram



*1 :Available for CP-9200SH version No. 87921-9000□-S0110 and later
*2 :Available for CP-9200SH version No. 87921-9000□-S0120 and later

Fig. 3.15 CP-9200SH Positioning Control Mode Block Diagram without Using Motion Command

■ Example of a user program (Point-to-point positioning)

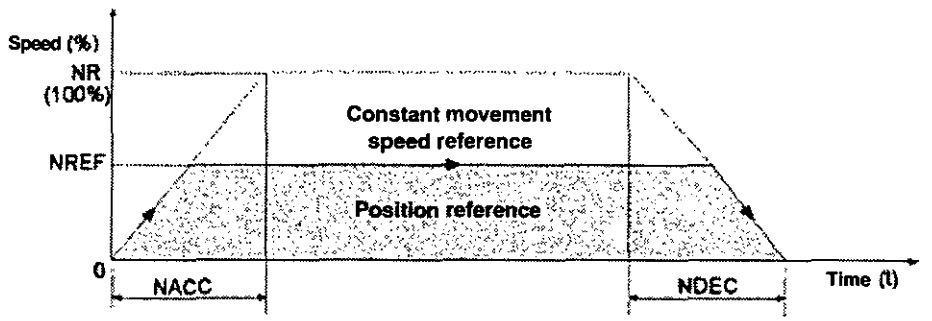


Fig. 3.16 Position Pattern

<Assumed conditions>

Motor rated speed	: NR = 3000 r/min
Feedback pulse resolution	: FBppr = 2048 ppr
D/A output value at 100% of speed	: 6 V
D/A output value at 100% of torque limit	: 3 V

The above servo parameters are set through the Fixed Parameter screen of the CP-717.

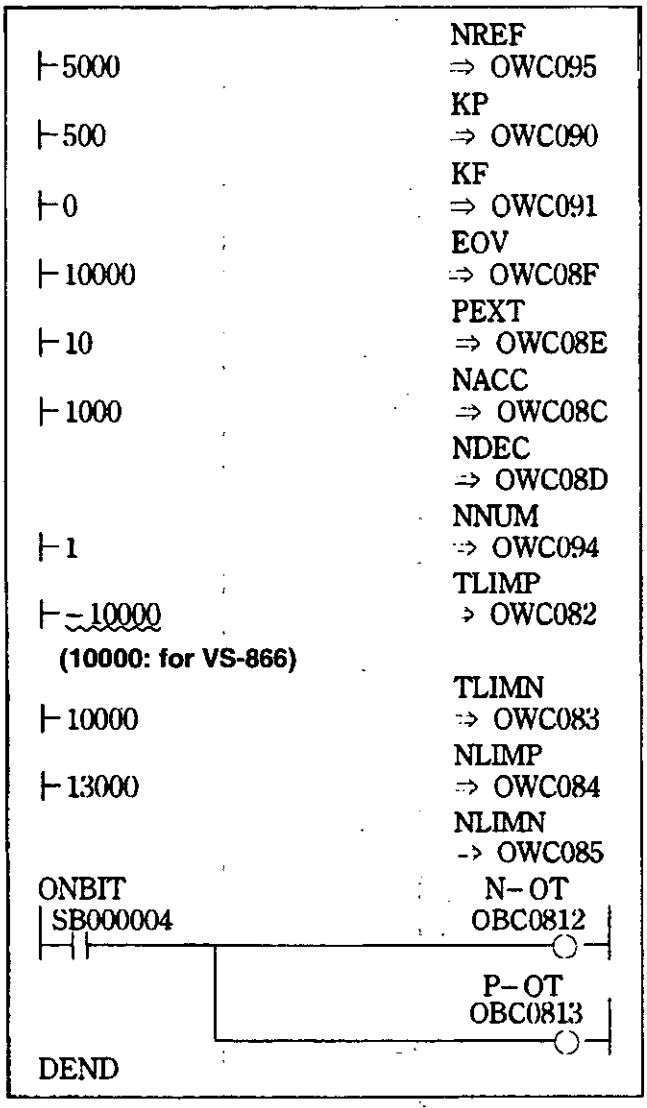
In Fig. 3.16

Constant movement speed	: NREF = 50%
Linear acceleration time	: NACC = 1 sec
Linear deceleration time	: NDEC = 1 sec
Positive torque limit	: TLIMP = − 100% (100% for VS-866)
Negative torque limit	: TLIMN = 100%
Positive speed limiter	: NLIMP = 130%
Negative speed limiter	: NLIMN = 130%
Position loop gain	: Kp = 50

<Operating conditions>

The pattern shown in Fig. 3.16 stops at an absolute position of 10000 pulses.
Position reference: XREF = 10000 pulses
In this example, the SERVOPACK at the 3rd axis of module number 1 is used.
If the module and axis number are different, refer to 1.3 "Module Number and Servo Parameter Register Number" and select the register number.
For the details of the register (OW□□□□), refer to Chapter 5 "Servo Parameters".

Figs. 3.17 and 3.18 are examples of using a programming language to show the position pattern in Fig. 3.16.



Constant movement speed (NREF)

Position loop gain (Kp)

Feed forward gain (Kf)

Deviation error detection value (EOV)

Positioning completion range (PEXT)

Linear acceleration time (NACC)

Linear deceleration time (NDEC)

Average number of rotations (NNUM)

Positive torque limit (TLIMP)

Negative torque limit (TLIMN)

Positive speed limit (NLIMP)

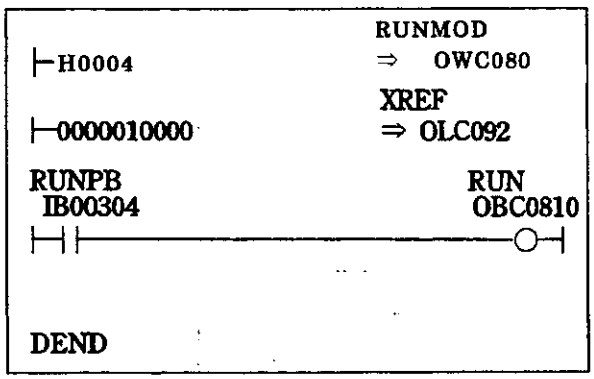
Negative speed limit (NLIMN)

SB00004: Normally ON contact

Negative overtravel (N-OT), positive overtravel (P-OT) and other reference for the driver

Fig. 3.17 Initial Settings (DWG A03)

In Fig. 3.17, the user program is created in DWG.A, and settings are initialized. Save the initial values of the servo parameters by pressing the "Save" key after the setting initial values in the Fixed Parameter screen of the CP-717. Stored value are automatically set in the servo parameters when the CP-9200SH is turned ON. Thus, this is the same as the method of creating a user program in DWG.A and initializing settings. The method of setting initial values in the servo parameter setting screen and saving them is recommended.



Turns the position control mode without using motion command ON.

Position reference pulse (XREF)
(Absolute position: 10000)

Run command to the driver (RUN)

When IB00304 is turned ON, position control is begun, and the device moves to absolute position 10000. When absolute position 10000 is reached, the positioning completion signal IBC080D is turned ON.

Fig. 3.18 Run Command (DWG H03)

The example of Fig. 3.18 is simplified, but actually each register type can be freely controlled with a user program.

(8) Using motion command

(1) Positioning (POSING)

This command is to move an axis to the position reference position with a specified acceleration/deceleration time constant at a commanded rapid feed speed.
The rapid feed speed and the position reference value can be changed during operation.
However, if the position reference value is too small to take the deceleration distance or for reversed direction, decelerate an axis to stop once and moves for the position reference value.

Fig. 3.19 shows the block diagram for positioning.
The positioning of each axis is performed as follows.
The register number is for the 1st axis of module number 1. If the module number and the axis number are different, refer to 1.3 "Module Number and Servo Parameter Register Number" and change the register number.
The servo parameters used for positioning are marked with " ○ " in the column "Position Control Mode/ Positioning" of "Mode for which data is valid" in 5.1.2 "List of Servo Parameters for Setting" and 5.1.3 "List of Servo Parameters for Monitor".

① Set the servo fixed parameters and the initial values of servo parameters for setting. Make proper settings according to your machine. Set the counter mode selection to "Basic counter" (= 3).
(Note) Be sure to set Bit7 (selection to use motion command) of servo fixed parameter No.14 "Additional function selection" to "USE" (=1) and Bit8 (motion command code valid/ invalid) of servo parameter for setting "Operation mode selection" to "1" (= valid).

② Select the position control mode (PCON) at Bit2 of OWC000.

③ Set the position reference setting (OLC012) and the rapid feed speed (OLC022 or OWC015). If necessary, set the servo parameters for setting such as the linear acceleration/deceleration time (OWC00C, OWC00D) and the averaged number of times (OWC014) to be used at positioning (POSING)

④ Turn the servo ON (RUN) to "ON". (Bit0 of OWC001).

⑤ Set a positioning (POSING=1) to the motion command code (OWC020).

⑥ When a positioning (POSING) is set in the motion command code, the axis performs a positioning by the specified servo parameter. During positioning, the set value of servo parameter can be changed.
To momentary stop the positioning, turn HOLD (Bit0 of OWC021) to "ON".
When the momentary stop is completed, HOLDL (Bit1 of IWC015) is turned "ON".
To cancel the momentary stop, turn HOLD (Bit0 of OWC021) to "OFF".

To abort the positioning, turn ABORT (Bit1 of OWC021) to "ON" or set NOP (= 0) to the motion command code.
During the process of abort, BUSY (Bit0 of IWC015) is turned "ON", and turned "OFF" at completion of abort.

(Note) When the abort is cancelled (turning ABORT to "OFF") at completion of abort, the axis makes the following movements.
- When the position reference type (Bit14 of OWC001) is set to the absolute position method (= 0), the axis restarts moving to the position reference (OLC012).
- When the position reference type (Bit14 of OWC001) is set to the adding incremental value method (=1), the axis remains stopped until a new position command (OLC012) enters.

⑦ After the pulse output completion (Bit2 of IWC015 is turned "ON"), when the axis enters in the positioning completion range (OWC00E), the positioning completion signal POSCOMP (BitD of IWC000) is turned "ON".

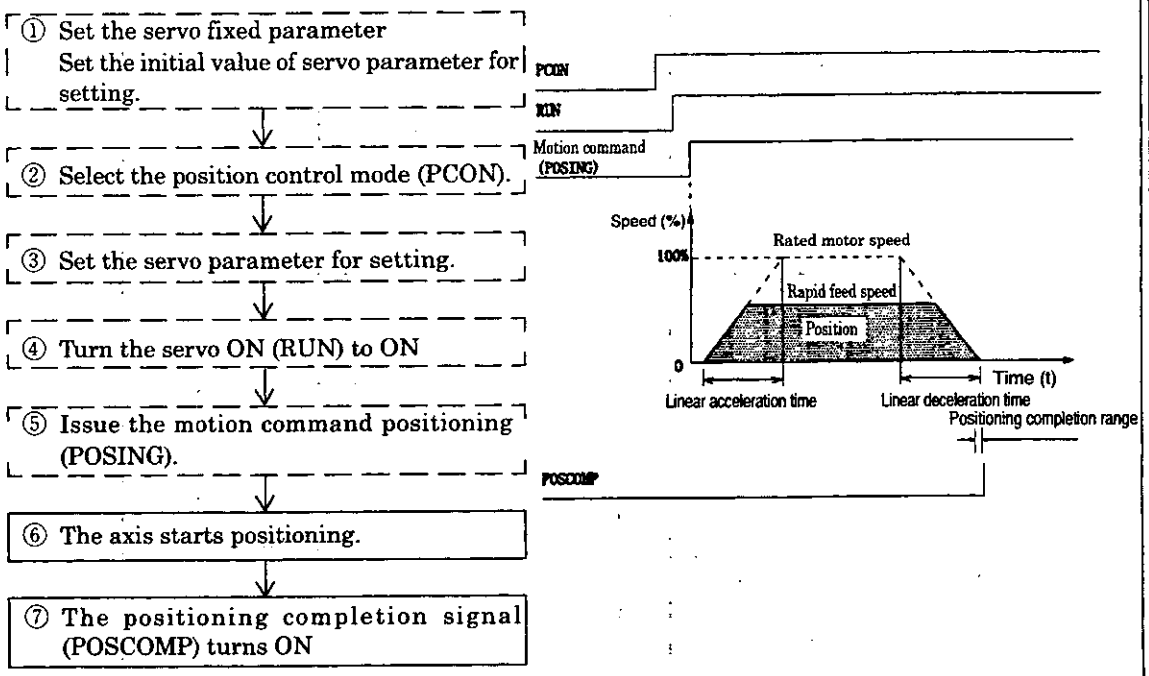
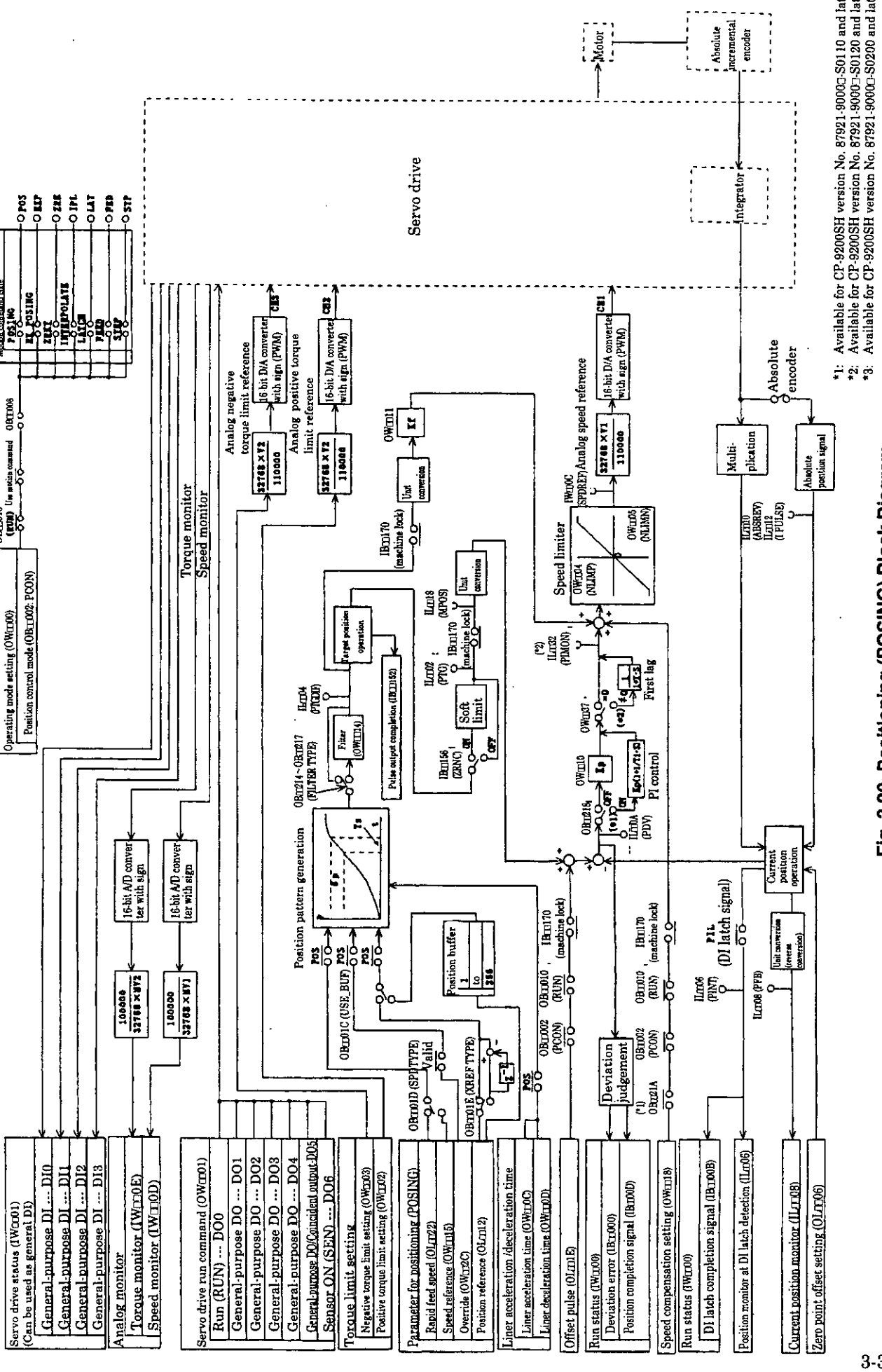


Fig. 3.19 Positioning Block Diagram



*1: Available for CP-9200SH version No. 87921-9000□-S0110 and later
*2: Available for CP-9200SH version No. 87921-9000□-S0120 and later
*3: Available for CP-9200SH version No. 87921-9000□-S0200 and later

Fig. 3.20 Positioning (POSING) Block Diagram

■ Example of a user program (Point to point positioning)

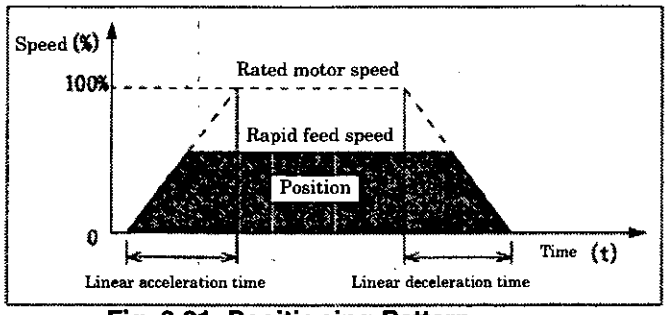


Fig. 3.21 Positioning Pattern

<Assumed conditions>

Set the initial values of servo fixed parameter and servo parameter for setting as described in 5.3 "Example of Servo Parameter Setting".

<Operation conditions>

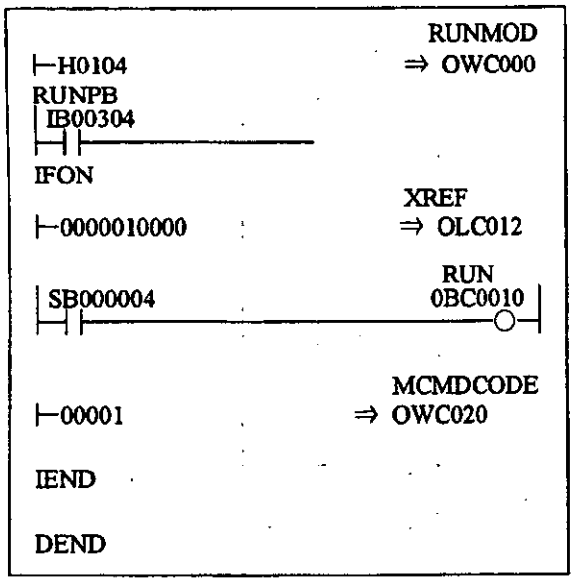
In the pattern shown in Fig. 3.21, the axis stops at the absolute position 10000 pulses.

Position reference: OLC012 = 10000 pulses

In this example, the 1st axis of module number 1 is used.

When the module number and the axis number are different, change the register number referring 1.3 "Module Number and Servo Parameter Register Number".

For details of the registers (OW□□□□) to be used, refer to Chapter 5 "Servo Parameter".



Turns position control mode with using the motion command "ON"

Position reference pulse (XREF)
(Absolute position: 10000)

RUN command (RUN) to driver

Issue POSING (positioning) for the motion command

When IB00304 is turned ON, position control starts and the axis moves to the absolute position 10000.
When the axis reaches the absolute position 10000, the positioning completion signal IBC000D is tuned "ON".

Fig. 3.22 Example of Positioning Program (DWG H03)

The example in Fig. 3.22 is simplified. Actually, each register can be freely controlled in the user program.

(2) External Positioning (EX_POSING)

Same as positioning (POSING), move an axis to the position reference position with a specified acceleration /deceleration time constant at a commanded rapid feed speed.

During moving at the feed speed, when a latch signal (external positioning signal) is input, the current position count is latched by the latch signal, and the axis moves from the current position for the external positioning travel distance set by the parameter.

The rapid feed speed and the position reference value can be changed during operation.
If the set external positioning travel distance is too short for deceleration, the axis is decelerated to stop once and moves again to the target position.

The external positioning travel distance can be changed before a latch signal (external positioning signal) is input. An exclusive discrete input (DI input) is used as a latch signal (external positioning signal).

Refer to the block diagram of "Positioning (POSING)" in Fig. 3.20. The external positioning for each axis is performed as follows.
The register number is for the 1st axis of module number 1. If the module number and the axis number are different, refer to 1.3 "Module Number and Servo Parameter Register Number" and change the register number.
The servo parameters used for external positioning are marked with " ○ " in the column "Position Control Mode/External Positioning" of "Mode for which data is valid" in 5.1.2 "List of Servo Parameters for Setting" and 5.1.3 "List of Servo Parameters for Monitor".

① Set the servo fixed parameters and the initial values of servo parameters for setting. Make proper settings according to your machine. Set the counter mode selection to "Basic counter" (= 3).
(Note) Be sure to set Bit7 (selection to use motion command) of servo fixed parameter No.14 "Additional function selection" to "USE" (=1) and Bit8 (motion command code valid/ invalid) of servo parameter for setting "Operation mode selection" to "1" (= valid).

② Select the position control mode (PCON) at Bit2 of OWC000.

③ Set the position reference setting (OLC012) , the rapid feed speed (OLC022 or OWC015) and the external positioning travel distance (OLC024).
If necessary, set the servo parameters for setting such as linear acceleration/deceleration time (OWC00C, OWC00D) and averaged number of times (OWC014) to be used at external positioning (EX_POSING)

④ Turn the servo ON (RUN) to "ON". (Bit0 of OWC001)

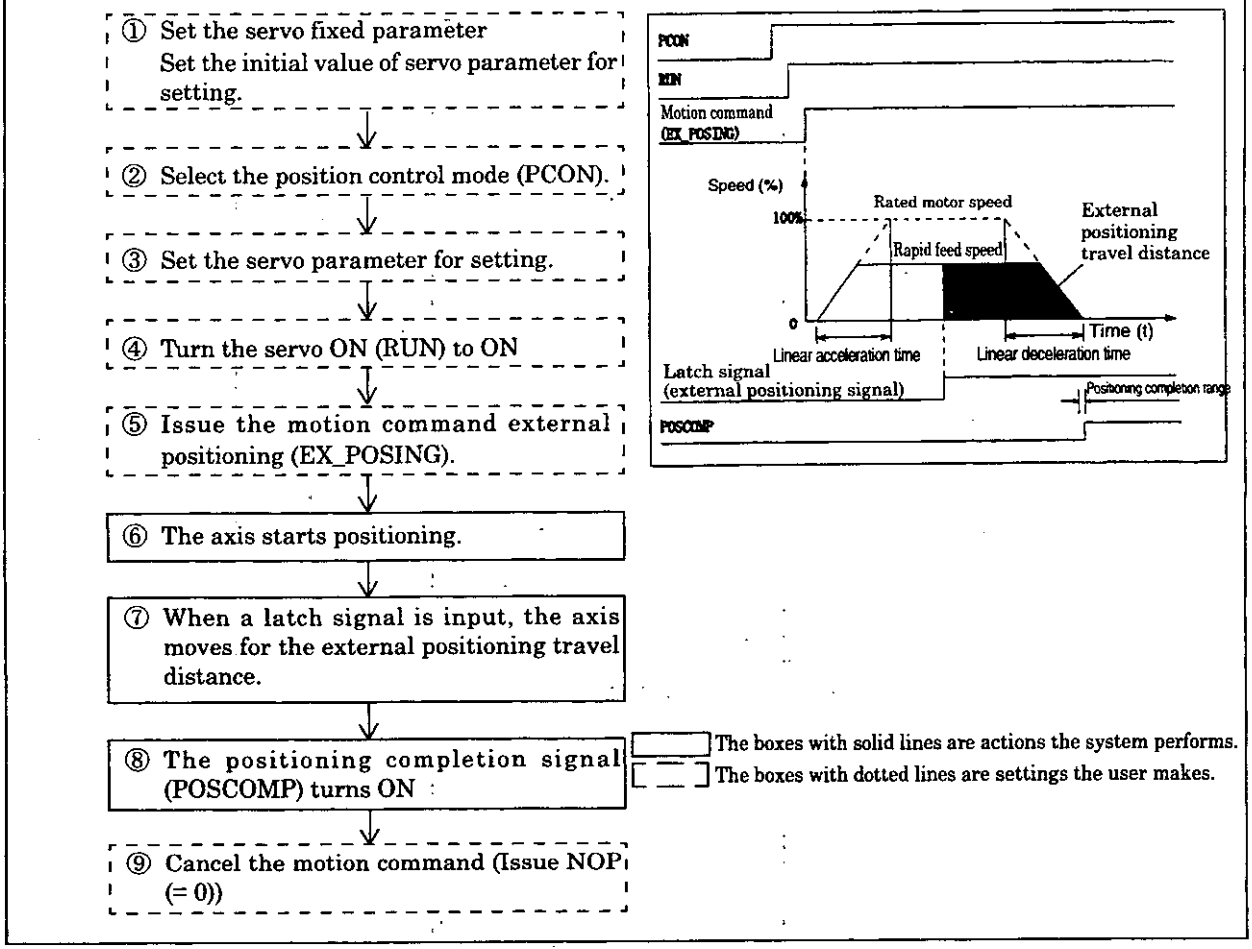
⑤ Set external positioning (EX_POSING=2) for the motion command code (OWC020).

⑥ When external positioning (POSING) is set in the motion command code, the axis performs the positioning by the specified servo parameters. During positioning, the set values of servo parameters can be changed.
To momentary stop the external positioning, turn HOLD (Bit0 of OWC021) to "ON".
When the momentary stop is completed, HOLDL (Bit1 of IWC015) is turned "ON".
To cancel the interruption, turn HOLD (Bit0 of OWC021) to "OFF".
To abort the positioning, turn ABORT (Bit1 of OWC021) to "ON" or set NOP (= 0) to the motion command code.
During process of abort, BUSY (Bit0 of IWC015) is turned "ON", and turned "OFF" at completion of abort.

(Note) When the abort is cancelled (turning ABORT to "OFF") at completion of abort, the axis remains stopped no matter if the position reference type (Bit14 of OWC001) is set to absolute position method (= 0) or adding incremental value method (= 1).

⑦ After the pulse output completion (Bit2 of IWC015 is turned "ON"), when the axis enters in the positioning completion range (OWC00E), the positioning completion signal POSCOMP (BitD of IWC000) is turned "ON".

⑧ When the positioning is completed, cancel the external positioning in the motion command code.
(Note) The external positioning is detected at rising edge. Accordingly, after an external positioning is executed, it is necessary to set NOP for the motion command code for more than 1 scan and set again another external positioning in the motion command code.



■ Example of user program (external positioning)

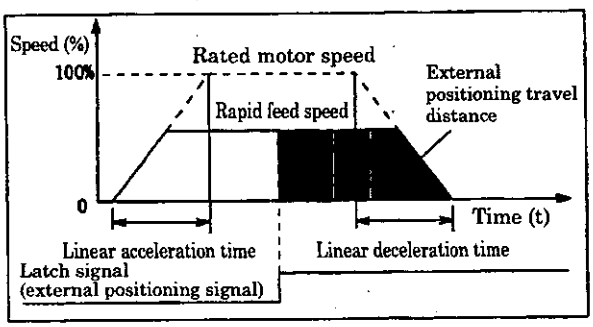


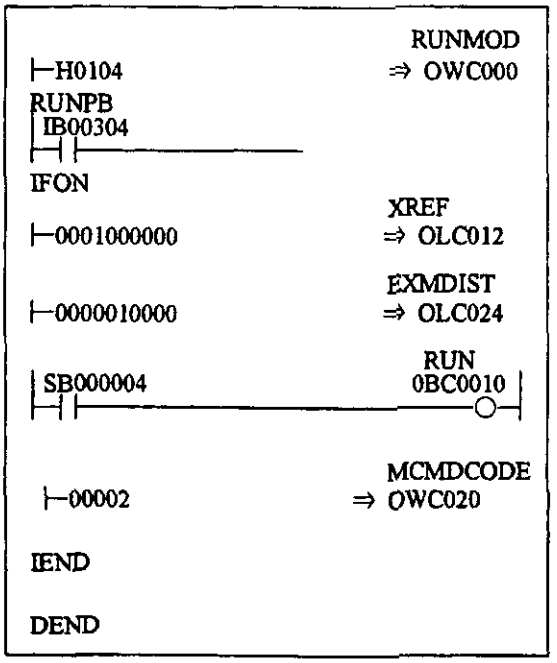
Fig.3.23 External Positioning Pattern Example

<Assumed conditions>
Set the initial values of servo fixed parameter and servo parameter for setting as described in 5.3 "Example of Servo Parameter Setting".

<Operation conditions>
In the pattern shown in Fig. 3.23, the axis stops at the external positioning travel distance 10000 pulses.

Position reference: OLC024 = 10000 pulses

In this example, the 1st axis of module number 1 is used.
When the module number and the axis number are different, change the register number referring to 1.3 "Module Number and Servo Parameter Register Number".
For details of the registers (OW□□□□) to be used, refer to Chapter 5 "Servo Parameter".



Turns position control mode with using the motion command "ON"

Position reference pulse (XREF)
(Absolute position: 1000000)

External positioning travel distance (EXMDIST)

RUN command to driver (RUN)

Issue an external positioning (EX_POSING) as a motion command

When IB00304 is turned "ON", the position control starts and the axis moves to the absolute position 1000000.
When a latch signal (external positioning signal) is input during feeding operation, the axis moves for the external positioning travel distance (10000 pulses).
When the movement is completed, the positioning completion signal IBC000D is turned "ON".
In case that a latch signal is not input, when the axis reaches the absolute position 1000000, the positioning completion signal IBC000D is turned ON.

Fig. 3.24 External Positioning Program Example (DWG H03)

The example in Fig. 3.24 is simplified. Actually, each register can be freely controlled in the user program.

(3) Zero point return (ZRET)

The zero point return is an operation to return an axis to the origin of machine coordinate system.
Since the position data are lost once the power is OFF, it is necessary to set again the origin of machine coordinate system after the power is ON.
Generally, use the limit switch that indicates the zero point pulse (C-phase pulse) and the zero point area to determine the origin.

For the zero point return, the motion command using method (available for CP-9200SH version No. 87921-9000□-S0200 and later) and the zero point control mode using method are available.
The zero point return motion differs depending on the method to be applied.
In this section, the zero point return by using the motion command is explained.
Fig. 3.25 shows the block diagram for zero point return. There are the following 4 types in the method.

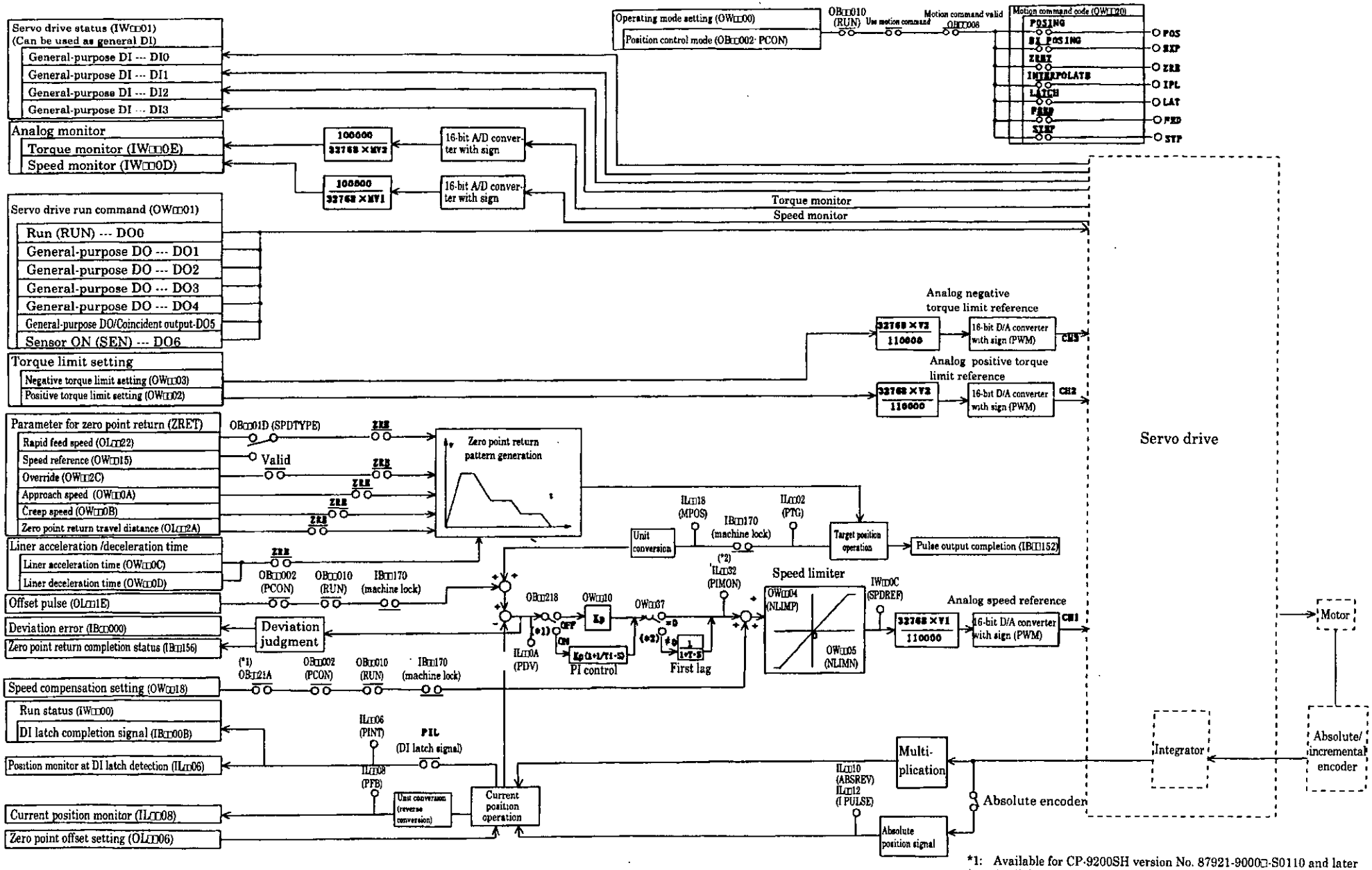
① DEC1 (Limit switch (with width)) + C-phase pulse (Zero point signal)

② DEC2 (Limit switch (without width)) + C-phase pulse (Zero point signal)

③ DEC1 (Limit switch (with width)) + LMT (Limit signal for zero point return)
+ C-phase pulse (Zero point signal)

④ C-phase pulse (Zero point signal)

(Notes)
1. For the limit switch and limit signal for zero point return, prepare a user program to connect external DI signals such as LIO-01 to the following servo parameters for setting:
   Limit switch signal: OB□□01F
   Reversed rotation side limit signal for zero point return: OB□□21C
   Forward rotation side limit signal for zero point return: OB□□21D
2. For the zero point return control mode, refer to 3.4.5 "Zero Point Return Control Mode".

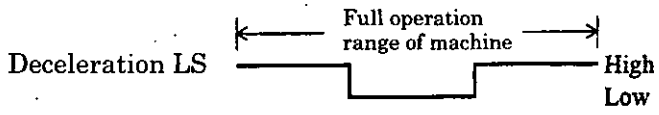


*1: Available for CP-9200SH version No. 87921-9000□-S0110 and later
*2: Available for CP-9200SH version No. 87921-9000□-S0120 and later
*3: Available for CP-9200SH version No. 87921-9000□-S0200 and later

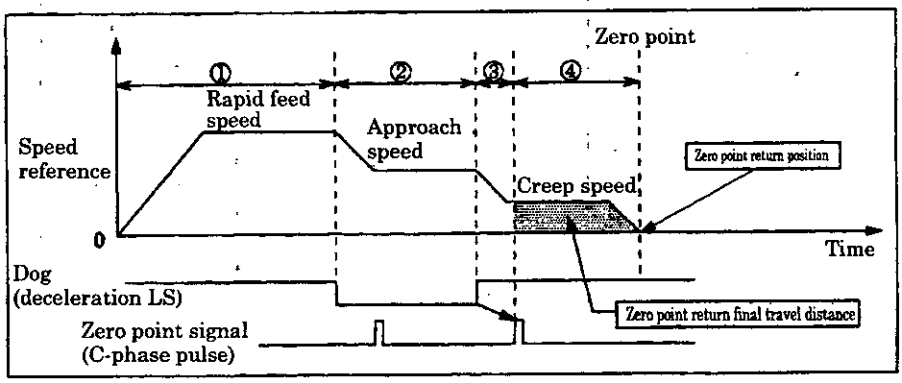
Fig. 3.25 Zero Point Return (ZRET) Block Diagram

(1) DEC1 + C-phase pulse

After rapid feeding with linear acceleration/deceleration, the axis returns to the zero point using the limit switch (deceleration LS) and the zero point signal (C-phase pulse). Apply this method when the limit switch has the following mechanical configuration.



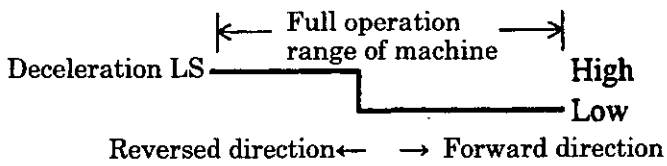
① Moves an axis to the direction specified by the servo parameter for setting (OB□□ 009) at the rapid feed speed.
② At falling edge of dog (deceleration LS) signal, decelerates to the approach speed.
③ At rising edge of dog (deceleration LS) signal, decelerates to the creep speed.
④ When the dog becomes HIGH, the axis moves from the first zero point signal (C-phase pulse) for the zero point return final travel distance (OL□□ 2A) and stops. Take this position as the origin of machine coordinate system.



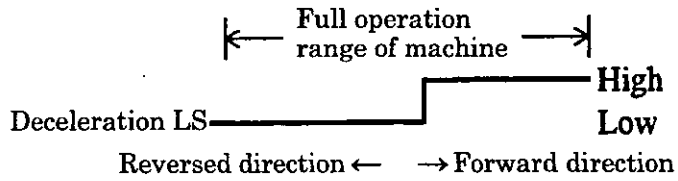
(2) DEC2 + C-phase pulse

After rapid feeding with linear acceleration/deceleration, the axis returns to the zero point using the limit switch (deceleration LS) and the zero point signal (C-phase pulse). Apply this method when the limit switch has the following mechanical configuration.

Pattern A



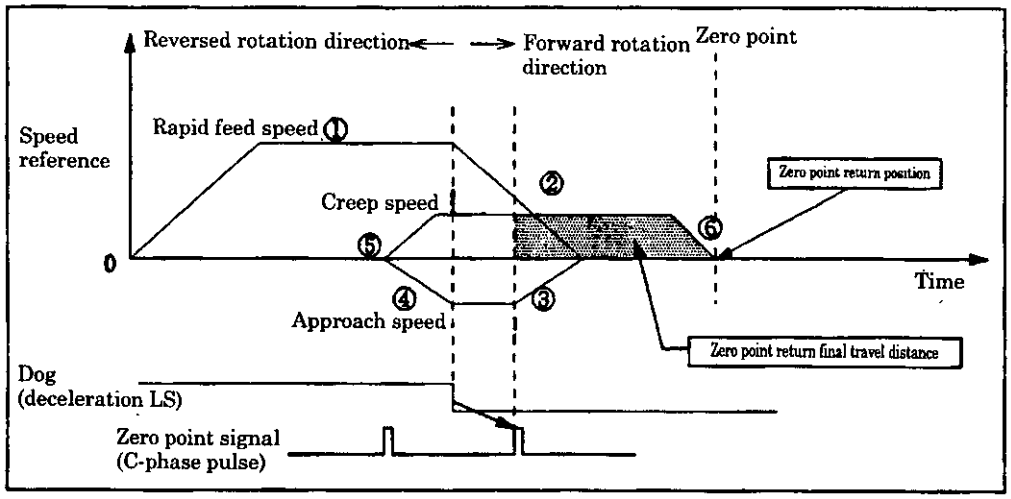
Pattern B



(Note) For Pattern B, set "deceleration LS reversed rotation selection (Bit10)" of servo fixed parameter No.17 to "ON".

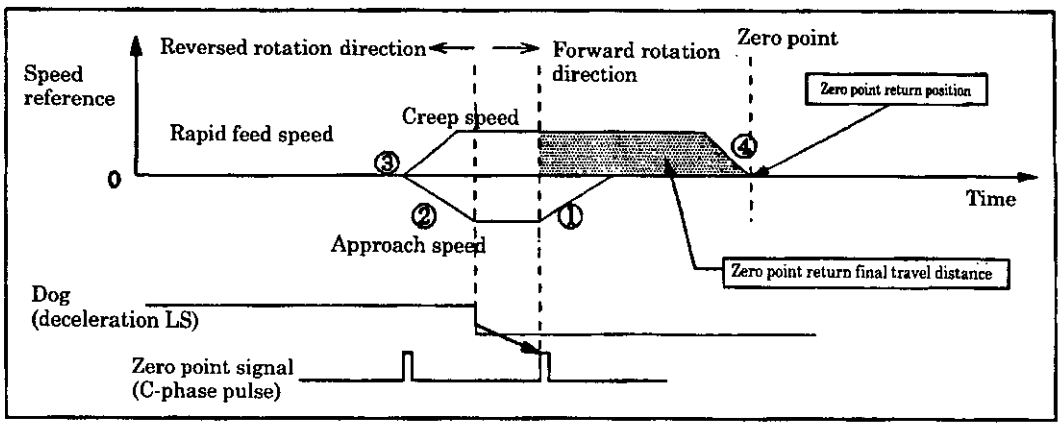
■ Movement when the dog (deceleration LS) signal is in High range at the start of zero point return operation

① Moves at the rapid feed speed to the forward rotation direction.
② Decelerates at falling edge of dog (deceleration LS) signal.
③ Moves at the approach speed to the reversed rotation direction.
④ Decelerates at rising edge of dog (deceleration LS) signal.
⑤ Moves at the creep speed to the forward rotation direction.
⑥ After the falling edge of dog (deceleration LS) is detected, the axis moves from the first zero point signal for the zero point return final travel distance (OL□□2A) and stops. Take this position as the origin of machine coordinate system.



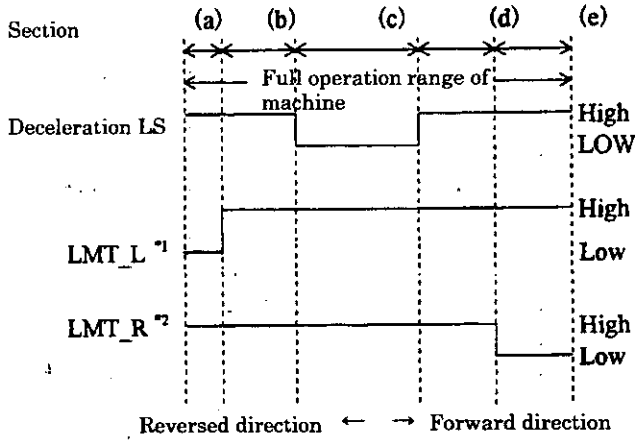
■ Movement when the dog (deceleration LS) signal is in Low range at the start of zero point return operation

① Moves at the approach speed to the reversed rotation direction.
② Decelerates at rising edge of dog (deceleration LS) signal.
③ Moves at the creep speed to the forward rotation direction.
④ After the falling edge of dog (deceleration LS) signal is detected, the axis moves from the first zero point signal for the zero point return final travel distance (OL□ □2A) and stops. Take this position as the origin of machine coordinate system.



(3) DEC1 + LMT + C-phase pulse

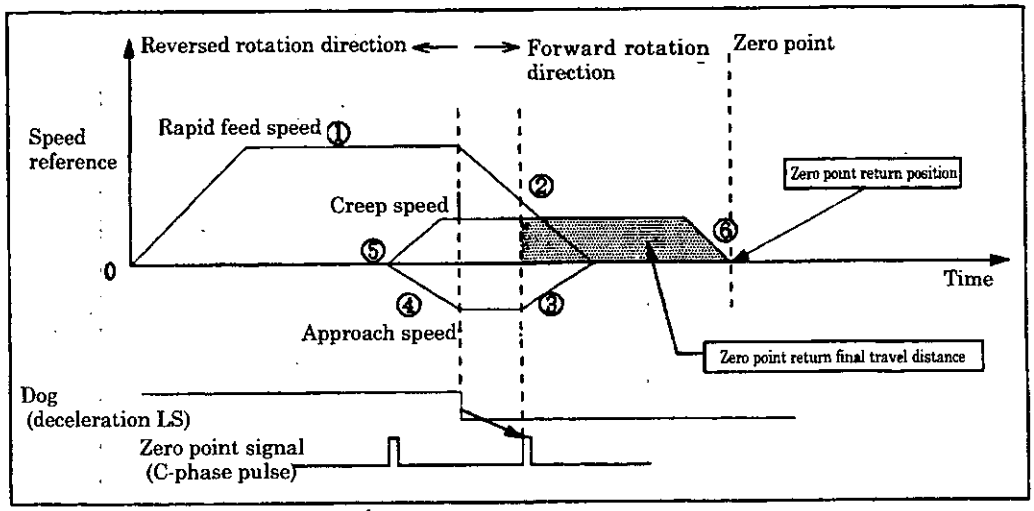
After rapid feeding with linear acceleration/deceleration, the axis returns to the zero point using the limit switch (deceleration LS), the limit signal for zero point return and the zero point signal (C-phase pulse).
Apply this method when the limit switch and the limit signal for zero point return have the following mechanical configuration.



*1: Reversed rotation side limit signal for zero point return
*2: Forward rotation side limit signal for zero point return

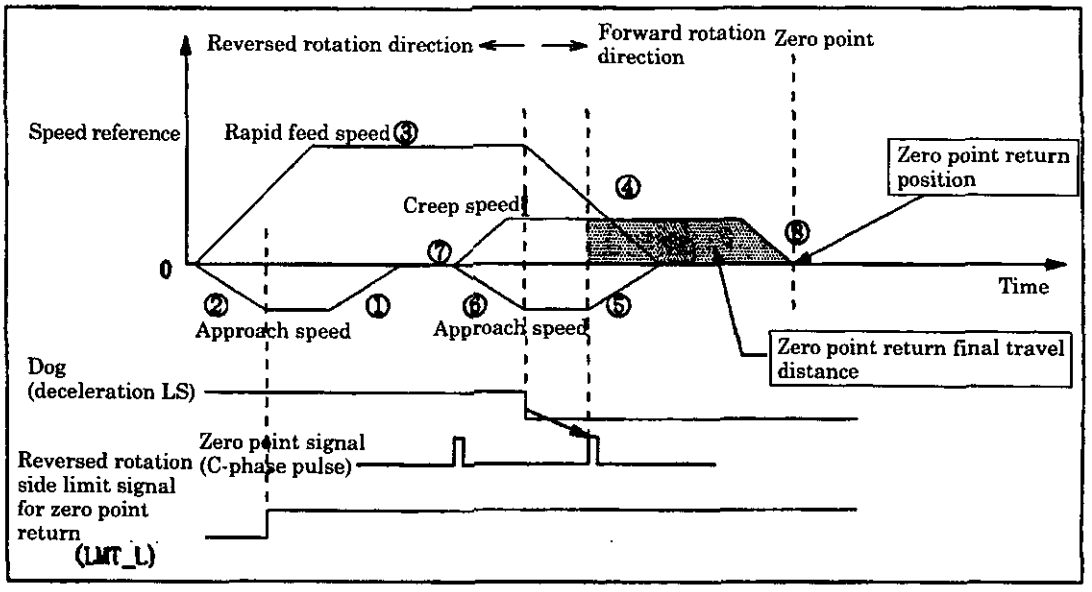
■ Movement when the axis is in Section (a) at the start of zero point return operation

① Moves at the rapid feed speed to the forward rotation direction.
② Decelerates at falling edge of dog (deceleration LS) signal.
③ Moves at the approach speed to the reversed rotation direction.
④ Decelerates at rising edge of dog (deceleration LS) signal.
⑤ Moves at the creep speed to the forward rotation direction.
⑥ After falling edge of dog (deceleration LS) signal is detected, the axis moves from the first zero point signal for the zero point return final travel distance (OL□□ 2A) and stops. Take this position as the origin of machine coordinate system.



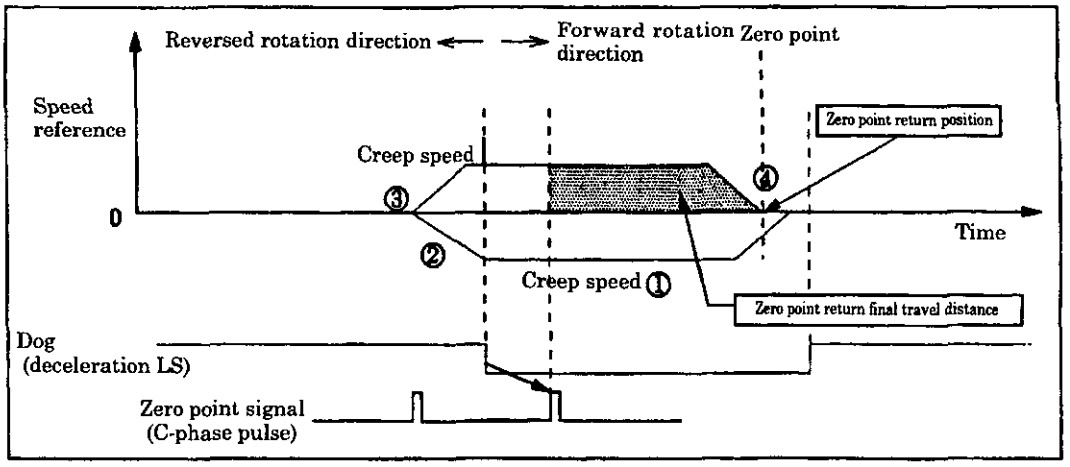
■ Movement when the axis is in Section (b) at the start of zero point return operation

① Moves at the approach speed to the reversed rotation direction.
② Decelerates at falling edge of reversed rotation side limit signal for zero point return (LMT_L).
③ Moves at the rapid feed speed to the forward rotation direction.
④ Decelerates at falling edge of dog (deceleration LS) signal.
⑤ Moves at the approach speed to the reversed rotation direction.
⑥ Decelerates at rising edge of dog (deceleration LS) signal.
⑦ Moves at the creep speed to the forward rotation direction.
⑧ After falling edge of dog (deceleration LS) is detected, the axis moves from the first zero point signal for the zero point return final travel distance (OL□□2A) and stops. Take this position as the origin of machine coordinate system.



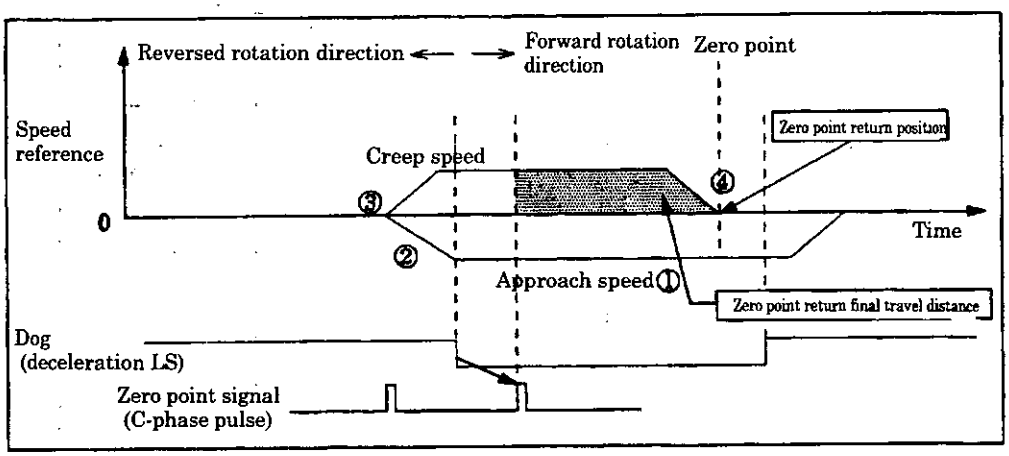
■ Movement when the axis is in Section (c) at the start of zero point return operation

① Moves at the creep speed to the reversed rotation direction
② Decelerates at rising edge of dog (deceleration LS) signal.
③ Moves at the creep speed to the forward rotation direction.
④ After falling edge of dog (deceleration LS) signal is detected, the axis moves from the first zero point signal for the zero point return final travel distance (OL□□2A) and stops. Take this position as the origin of machine coordinate system.



■ **Movement when the axis is in Section (d) and (e) at the start of zero point return operation**

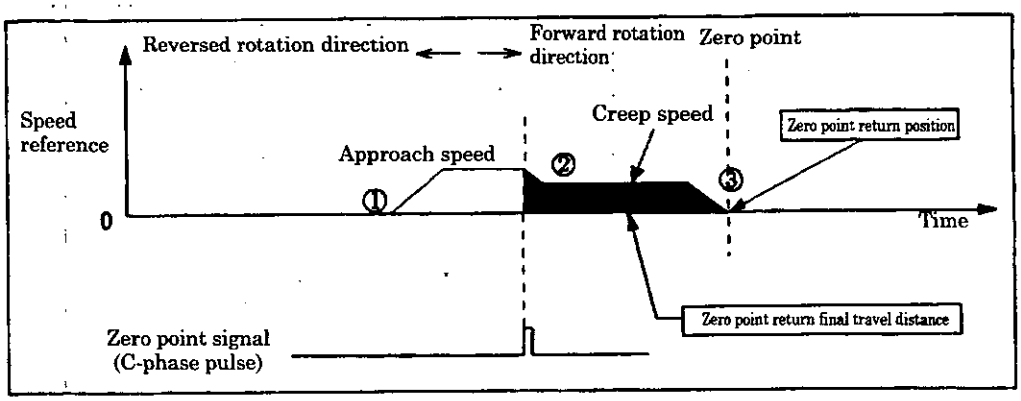
① Moves at the approach speed to the reversed rotation direction.
② Decelerates at rising edge of dog (deceleration LS) signal.
③ Moves at the creep speed to the forward rotation direction.
④ After falling edge of dog (deceleration LS) is detected, the axis moves from the first zero point signal for the zero point return travel distance and stops. Take this position as the origin of machine coordinate system.



(4) C-phase pulse

After feeding with linear acceleration/deceleration, the axis returns to zero point using only the zero point signal (C-phase pulse)

① Moves at the approach speed to the direction specified by the servo parameter for setting (OB□□009).
② When the first zero point signal is detected, decelerates to the creep speed.
③ The axis moves from the first zero point signal for the zero point return travel distance and stops. Take this position as the origin of machine coordinate system.



(5) Operation Example for Zero Point Return

Perform the zero point return for each axis in the following manner.
The zero point return method is explained using the DEC1+C-phase pulse signal method.
The register number is for the 1st axis of module number 1.
If the module number and the axis number are different, refer to 1.3 "Module Number and Servo Parameter Register Number" and change the register number.
The servo parameters used for zero point return are marked with " ○ " in the column "Position Control Mode/Zero Point Return" of "Mode for which data is valid" in 5.1.2 "List of Servo Parameters for Setting" and 5.1.3 "List of Servo Parameters for Monitor".

① Set the servo fixed parameters and the initial values of servo parameters for setting. Make proper settings according to your machine. Set the counter mode selection to "Basic counter" (= 3).
Note: Be sure to set Bit7 (selection to use motion command) of servo fixed parameter No.14 "Additional function selection" to "USE" (=1) and Bit8 (motion command code valid/invalid) of servo parameter for setting "Operation mode selection" to "1" (= valid).

② Select the position control mode (PCON) at Bit2 of OWC000.

③ Set the approach speed (OWC00A), the creep speed (OWC00B), and the rapid feed speed (OLC022 or OWC015).
Set the servo parameters for setting to be used at zero point return such as linear acceleration/deceleration time (OWC00C, OWC00D) and zero point return final travel distance (OLC02A).

④ Turn the servo ON (RUN) to "ON". (Bit0 of OWC001)

⑤ Set zero point return (ZRET=3) in the motion command code (OWC020).

⑥ When the zero point return is set for the motion command code, the axis moves to the direction specified by the zero point return direction selection (Bit9 of OWC000) at the rapid feed speed. During the zero point return operation, the set values of servo parameters can not be changed. The momentary stop at the zero point return is not possible.
To abort the zero point return, turn ABORT (Bit1 of OWC021) ON or set the motion command to NOP (= 0).
During process of abort, BUSY (Bit0 of IWC015) is ON and turns OFF at completion of abort.

Note: When the abort is cancelled (turning ABORT to "OFF") at completion of abort, the axis remains stopped.

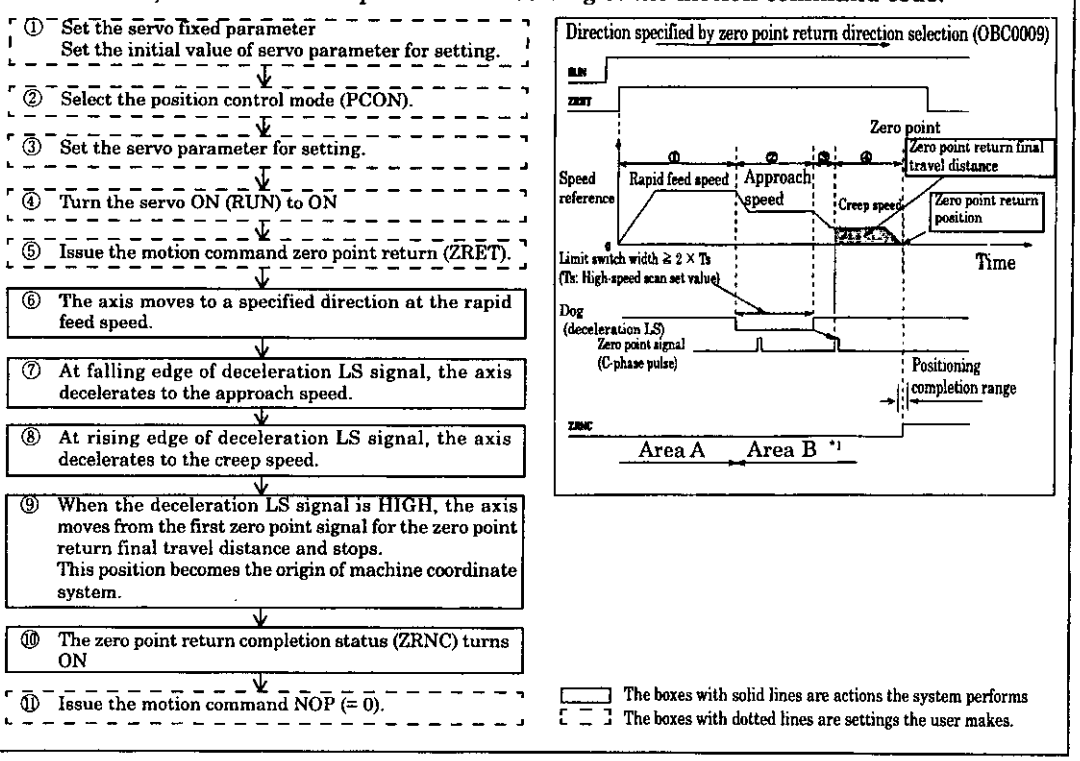
⑦ The axis decelerates to the approach speed at rising edge of Dog (deceleration LS) signal.

⑧ The axis decelerates to the creep speed at falling edge of Dog (deceleration LS) signal.

⑨ When the dog is HIGH, the axis moves from the first zero point signal (C-phase pulse) for the zero point return final travel distance (OLC02A) and stops. Take this position as the origin of machine coordinate system.
A zero point position offset value can be also set (if the zero point position offset value is set to 100, the position data is 100).
A zero point position offset value can be set by the servo parameter for setting (OLC006).

⑩ After the pulse output completion (Bit2 of IWC015 "ON"), when the axis enters the position completion range, the zero point return operation is completed. At completion of zero point return operation, the zero point return completion status ZRNC (Bit6 of IWC015) turns "ON".

⑪ After confirming that the zero point return completion status ZRNC (Bit6 of IBX015) turns "ON", cancels the zero point return setting of the motion command code.



*1. When the machine is in the area B after the power ON, a correct zero point return can not be performed. Be sure to return the machine to the area A and perform the zero point return.

*2. The deceleration LS width must be two times of the high-speed scan set value or more. A standard deceleration LS width (L) can be obtained by the following formula.

TS (s) = High-speed scan set value (ms) / 1000
f (m/s) = k × {NR × n × FBppr} / 60

k	:	Weight of 1 pulse (m/pulse)
NR	:	Rated motor speed (r/min)
FBppr	:	Feedback pulse resolution (ppr)
f	:	100 % speed (m/s)
n	:	Pulse multiplication factor (1, 2 or 4)

Where t (s) = Linear acceleration/deceleration time (s) and
α (m/s^2) = f/t,
α : Acceleration/deceleration time constant (m/s^2)
the following can be obtained:
$L = 1/2 \cdot \alpha (2 \times Ts)^2 = 2 \alpha Ts^2$

Calculate a standard of rapid feed speed with the following formula.
Where Va = Rapid feed speed (%),
Set the value so that va = f × Va/100 and $L \geqq 1/2 \cdot \{va^2/\alpha\}$.

(Note) When "zero point return final travel distance" is too short, the axis goes over the zero point, then comes back to the zero point.

Caluculate a standard of zero point final travel distance (x) by the following formula.
Where, Vc = Creep speed (%)
vc = f × Vc/100
Then,
$x = 1/2 \cdot \{vc^2/\alpha\}$

■ Example of user program (zero point return)

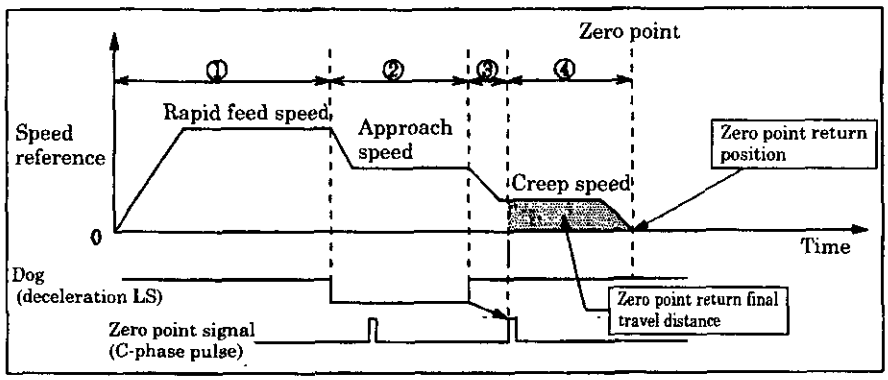


Fig. 3.26 Example of Zero Point Return Pattern (DEC1+C-phase pulse signal method)

<Assumed conditions>
Set the initial values of servo fixed parameter and servo parameter for setting as described in 5.3 "Example of Servo Parameter Setting".

<Operation conditions>
Perform the zero point return in the pattern shown in Fig. 3.26.
Zero point return method: DEC1 + C-phase pulse signal
In this example, the 1st axis of module number 1 is used.
When the module number and the axis number are different, change the register number referring to 1.3 "Module Number and Servo Parameter Register Number".
For details of the register (OW□□□□) to be used, refer to Chapter 5 "Servo Parameter".

```
                                    RUNMOD
 ├─H0104                        ⇒ OWC000
 RUNPB
 │ IB00304
 ├─┤ ├──────────────────────────
 IFON
                                    RV
   ├─0000005000                 ⇒ OLC022

                                    RUN
 │ SB000004                        0BC0010 │
 ├─┤ ├──────────────────────────────(○)──┤
                                    LSDEC
 │ IB00310                          0BC001F │
 ├─┤ ├──────────────────────────────(○)──┤

                                    MCMDCODE
   ├─00003                      ⇒ OWC020

 IEND

 MCMDRCODE                          DB000000 │
 ├─IWC014      =00003             ──────(○)──┤
                ZRNC
 │ DB000000     IBC0156
 ├─┤ ├──────────┤ ├──────────────
 IFON

                                    MCMDCODE
 ├─00000                        ⇒ OWC020
 IEND
 DEND
```

Turns the position control mode with using a motion command "ON"

Rapid feed speed (RV)
(5000000 pulses/min)

RUN command to driver (RUN)

IB00310: Limit switch signal

Issue zero point return (ZRET) as motion command

When IB00304 is turned "ON", the zero point return starts.
When the zero point return is completed, "zero point completion status" (IBC0156) is turned "ON".

When "zero point completion status "(IBC0156) is turned "ON", set the motion command to NOP (= 0).

Fig. 3.27 Example of Zero Point Return (ZRET) Program (DWG H03)

The example in Fig. 3.27 is simplified. Actually, each register can be freely controlled in the user program.

(4) Interpolation (INTERPOLATE)

Performs interpolation according to the position data timely sent from CPU module. Fig. 3.28 shows the block diagram.

The interpolation of each axis is performed as follows. The register number is for 1st axis of module number 1.
If the module number and the axis number are different, refer to 1.3 "Module Number and Servo Parameter Register Number" and change the register number.
The servo parameters used for interpolation are marked with "○" in the column "Position Control Mode/Interpolation" of "Mode for which data is valid" in 5.1.2 "List of Servo Parameters for Setting" and 5.1.3 "List of Servo Parameters for Monitor".

① Set the servo fixed parameters and the initial values of servo parameters for setting. Make proper settings according to you machine. Set the counter mode selection to "Basic counter" (= 3).
Note: Be sure to set Bit7 (selection to use motion command) of servo fixed parameter No.14 "Additional function selection" to "USE" (=1) and Bit8 (motion command code valid/ invalid) of servo parameter for setting "Operation mode selection (OW□□00)" to "1" (= valid).

② Select the position control mode (PCON) at Bit2 of OWC000.

③ Set the position reference setting (OLC12).
If necessary, set the servo parameters for setting such as averaged number of times (OWC014) to be used at interpolation (INTERPOLATE)

④ Turn the servo ON (RUN) to "ON" at Bit0 of OWC001.

⑤ Set the interpolation (INTERPOLATE=4) for the motion command code (OWC020).

⑥ When the interpolation (INTERPOLATE) is set for the motion command code, the axis moves in interpolation by a specified parameter.

⑦ Stop updating the position reference (OLC012).

⑧ After the pulse output completion (Bit2 of IWC015 is turned "ON"), when the axis enters in the positioning completion range (OWC00E), the positioning completion signal POSCOMP (BitD of IWC000) is turned "ON".

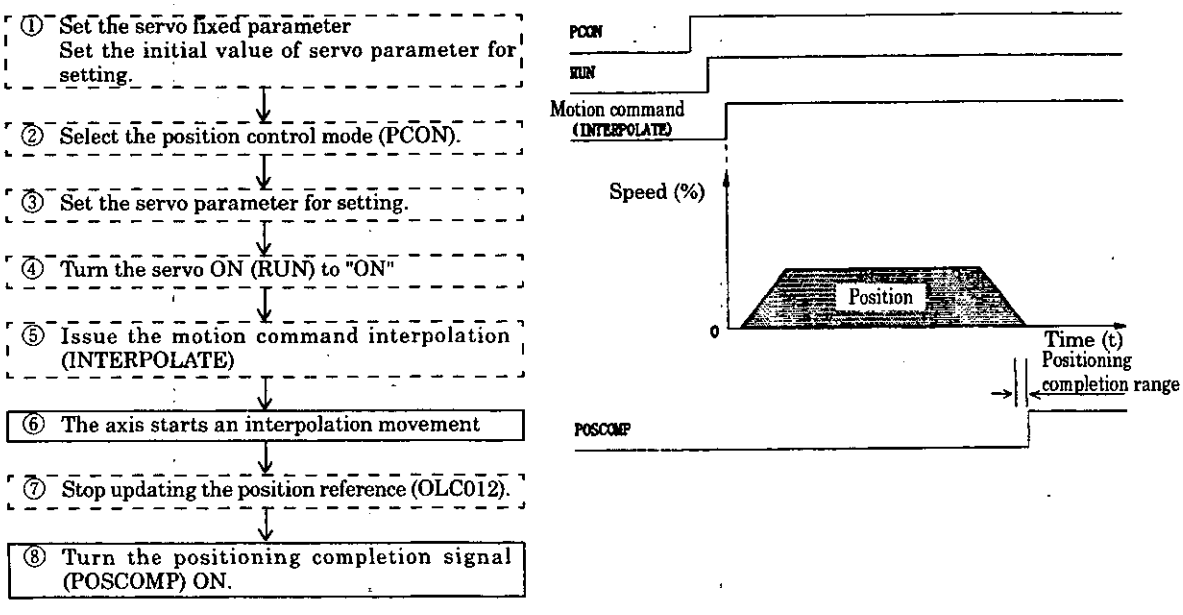


Fig. 3.28 Interpolation Block Diagram

■ Example of user program (interpolation)

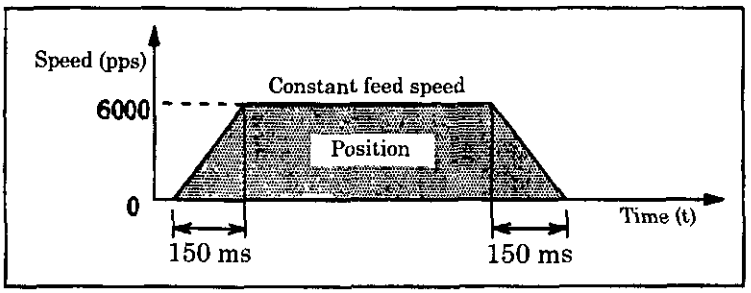


Fig. 3.29 Interpolation Pattern Example

<Assumed conditions>

Set the initial values of servo fixed parameter and servo parameter for setting as described in 5.3 "Example of Servo Parameter Setting".

<Operation conditions>

The axis stops in the pattern shown in Fig. 3.29.

High-speed scan set value = 5.0 ms

Constant feed speed = 6000 pulses/sec (30 pulses per scan)

Acceleration/deceleration time constant to reach the constant feed speed = 150 ms

In this example, the 1st axis of module number 1 is used in this example.

When the module number and the axis number are different, change the register number referring to 1.3 "Module Number and Servo Parameter Register Number".

For details of the register (OW□□□□) to be used, refer to Chapter 5 "Servo Parameter".

```
                                        RUNMOD
 ├─H0104                             ⇒ OWC000
 RUNPB
 │IB00304
 ├─┤ ├──────────────────────────────
 IFON

 START
 │IB00305
 ├─┤ ├──────────────────────────────
 IFON

 START          Rising detection
 │IB00305       DB000000
 ├─┤ ├──────────────↑──────────────
 IFON


   PTG                               XREF
 ├─ILC002                          ⇒ OLC012

                                     INC_PUL
 ├─00000                           ⇒ DL00002

                                       RUN
 │SB000004                            0BC0010 │
 ├─┤ ├──────────────────────────────────○─┤

                                     MCMDCODE
 ├─00004                           ⇒ OWC020

 ELSE

   INC_PUL                           INC_PUL
 ├─DL00002      ++00001            ⇒ DL00002
```

(Continued)

Turns the position control mode with using the motion command "ON".
When IB00304 is turned "ON", the interpolation is executed.

When IB00305 is turned #ON", the interpolation (acceleration) starts.

(1) At rising edge of IB00305

When the rising edge of IB00305 is detected, the position reference (OLC012) is initialized at the current position (ILC002). And, the number of pulses for acceleration/ deceleration (DL00002) is also initialized (= 0).

RUN command to driver (RUN)

Issue the interpolation (INTERPOLATE) for motion command.

(2) When IB00305 is "ON".

The number of pulses for acceleration/ deceleration (DL00002) is incriminated (+1) by each scan.

(Continued)

```
  INC_PUL
├─DL00002    ≧00030

IFON

                                INC_PUL
├─00030                         ⇒ DL00002

IEND

  XREF          INC_PUL         XREF
├─OLC012     ++DL00002          ⇒ OLC012

IEND

ELSE

  INC_PUL                         INC_PUL
├─DL00002    −00001             ⇒ DL00002

  INC_PUL
├─DL00002    ≦0

IFON

                                INC_PUL
├─00000                         ⇒ DL00002

IEND

  XREF          INC_PUL         XREF
├─OLC012     ++DL00002          ⇒ OLC012

IEND

ELSE

                                MCMDCODE
├─00000                         ⇒ OWC020

IEND

DEND
```

When number of pulses for acceleration/ deceleration (DL00002) exceeds the constant feed speed (= 30 pulses), it is limited to 30 pulses.

The position reference is updated (accelerated) by each scan.

(3) When IB00305 is "OFF"

When IB00305 is turned "OFF", the axis is decelerated to stop.
The number of pulses for acceleration/ deceleration (DL00002) is decremented (−1) by each scan and when it comes to "0", the decrement is stopped.

The position reference is updated (decelerated) by each scan.

(4) When IB00304 is "OFF"

When IB00304 is turned "OFF", the interpolation is cancelled.

Fig. 3.30 Example of Interpolation Program (DWG H03)

The example in Fig. 3.30 is simplified. Actually, each register can be freely controlled in the user program.

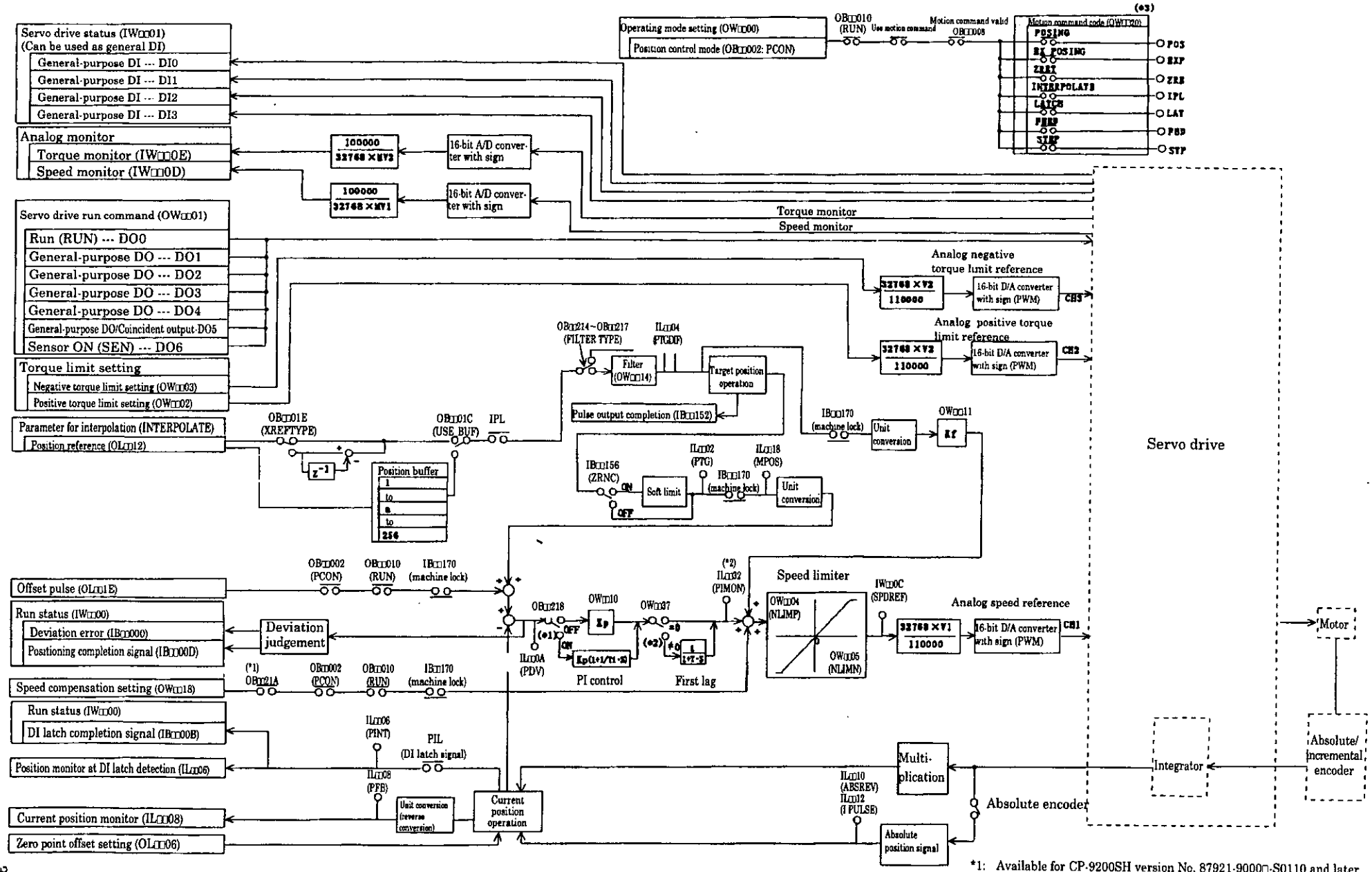


Fig. 3.31 Interpolation (INTERPOLATE) Block Diagram

*1: Available for CP-9200SH version No. 87921-9000□-S0110 and later
*2: Available for CP-9200SH version No. 87921-9000□-S0120 and later
*3: Available for CP-9200SH version No. 87921-9000□-S0200 and later

(5) Interpolation with Position Detecting Function (LATCH)

During normal interpolation, the current position count is latched by a latch signal and the latched position converted in reference unit system is reported.
Use dedicated discrete input (DI input) for the latch signal.

For details of interpolation, refer to the item (4) of 3.4.3 (8) "Interpolation (INTERPOLATE)".

(Note) To execute a latch again after the current position count is latched by a latch signal, set the motion command code to NOP for more than 1 scan, then issue a LATCH command.

(6) Constant Speed Feed (FEED)

Performs a rapid feed with a specified acceleration/deceleration time constant at a specified rapid feed speed in infinite distance
The rapid feed speed can be changed during operation.
When setting the motion command code (OW□□ 20) to NOP (=0), the axis is decelerated to stop.
Fig. 3.32 shows the block diagram.

The constant speed feed for each axis is performed as follows.
The register number is for the 1st axis of module number 1.
If the module number and the axis number are different, refer to 1.3 "Module Number and Servo Parameter Register Number" and change the register number.
The servo parameters used for zero point return are marked with "○" in the column "Position Control Mode/Constant Speed Feed" of "Mode for which data is valid" in 5.1.2 "List of Servo Parameters for Setting" and 5.1.3 "List of Servo Parameters for Monitor"

① Set the servo fixed parameters and the initial values of servo parameters for setting. Make proper settings according to your machine. Set the counter mode selection to "Basic counter" (= 3).
Note: Be sure to set Bit7 (selection to use motion command) of servo fixed parameter No.14 "Additional function selection" to "USE" (=1) and Bit8 (motion command code valid/ invalid) of servo parameter for setting "Operation mode selection (OW□□ 00)" to "1" (= valid).

② Select the position control mode (PCON) at Bit2 of OWC000.

③ Set the rapid feed speed (OLC022 or OWC015).
If necessary, set the servo parameters for setting such as linear acceleration/deceleration time (OWC00C, OWC00D) and averaged number of times (OWC014) to be used at constant speed feed (FEED).

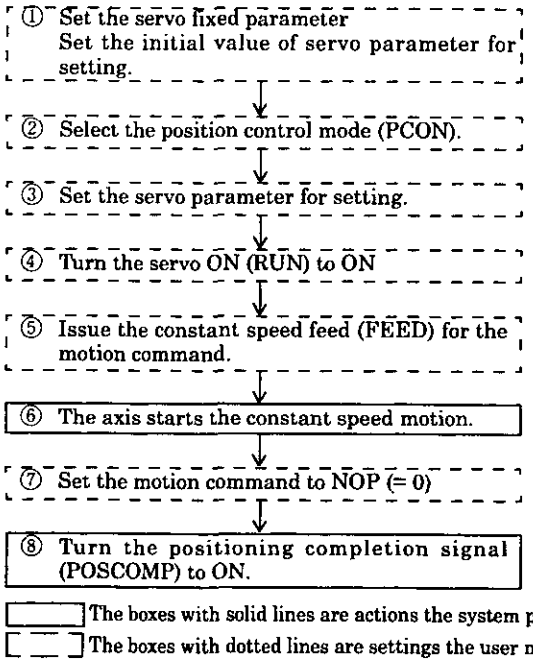
④ Turn the servo ON (RUN) to "ON" at Bit0 of OWC001.

⑤ Set the constant speed feed (FEED=7) for the motion command code (OWC020).

⑥ When the constant speed feed (FEED) is set for the motion command code, the axis performs a rapid feed motion by a specified servo parameter.
This rapid feed motion can not be interrupted.

⑦ To abort the rapid feed motion, set the motion command code to NOP (=0).

⑧ After the pulse output completion (Bit2 of IWC015 is "ON"), when the axis enters in the positioning completion range (OWC00E), the positioning completion signal POSCOMP (BitD of IWC000) is turned "ON".



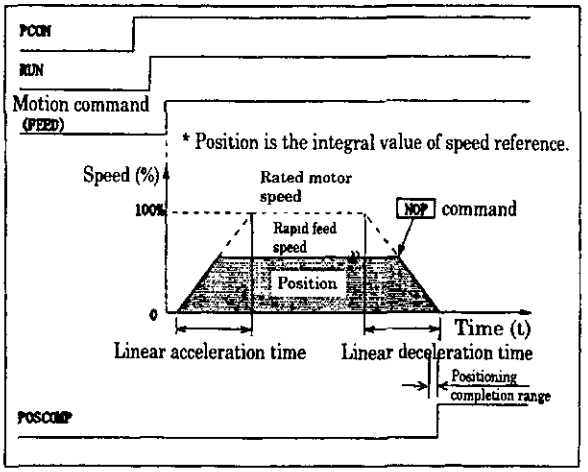


Fig. 3.32 Constant Speed Feed Block Diagram

■ Example of user program (constant speed feed)

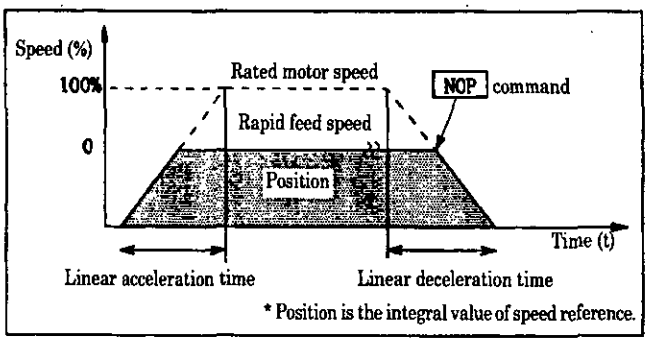


Fig. 3.33 Constant Speed Feed Pattern Example

<Assumed conditions>
Set the initial values of servo fixed parameter and servo parameter for setting as described in 5.3 "Example of Servo Parameter Setting".

<Operation conditions>
In the pattern shown in Fig. 3.33, the rapid feed speed = 5000000 pulses/min.
Rapid feed Speed: OLC022 = 5000 (1 = 1000 pulses/min)
In this example, the 1st axis of module number 1 is used.
When the module number and the axis number are different, change the register number referring to 1.3 "Module Number and Servo Parameter Register Number".
For details of the register (OW□□□□) to be used, refer to Chapter 5 "Servo Parameter"

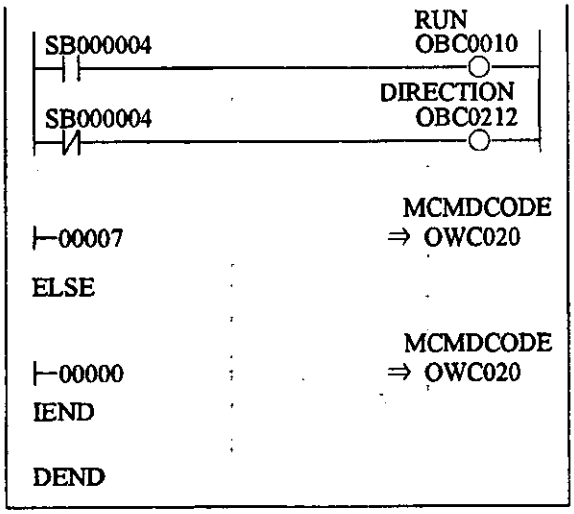
```
                                  RUNMOD
├─H0104                          ⇒ OWC000
RUNPB
 IB00304
├─┤├─
IFON

                                  RV
├─0000005000                     ⇒ OLC022
```

Turns the position control mode with using the motion command "ON"

Rapid feed speed (RV)
(5000000 pulses/min)

(continued)

(continued)



RUN command (RUN) to driver
Issue the constant speed feed (FEED) for the motion command

When IB00304 is turned "ON", the axis performs the rapid feed to the forward (positive) direction.

When IB00304 is turned "OFF", the axis is decelerated to stop and the positioning completion signal (IBC000D) is turned "ON".

Fig. 3.34 Example of Constant Speed Feed Program (DWG H03)

The example in Fig. 3.34 is simplified. Actually, each register can be freely controlled in the user program.

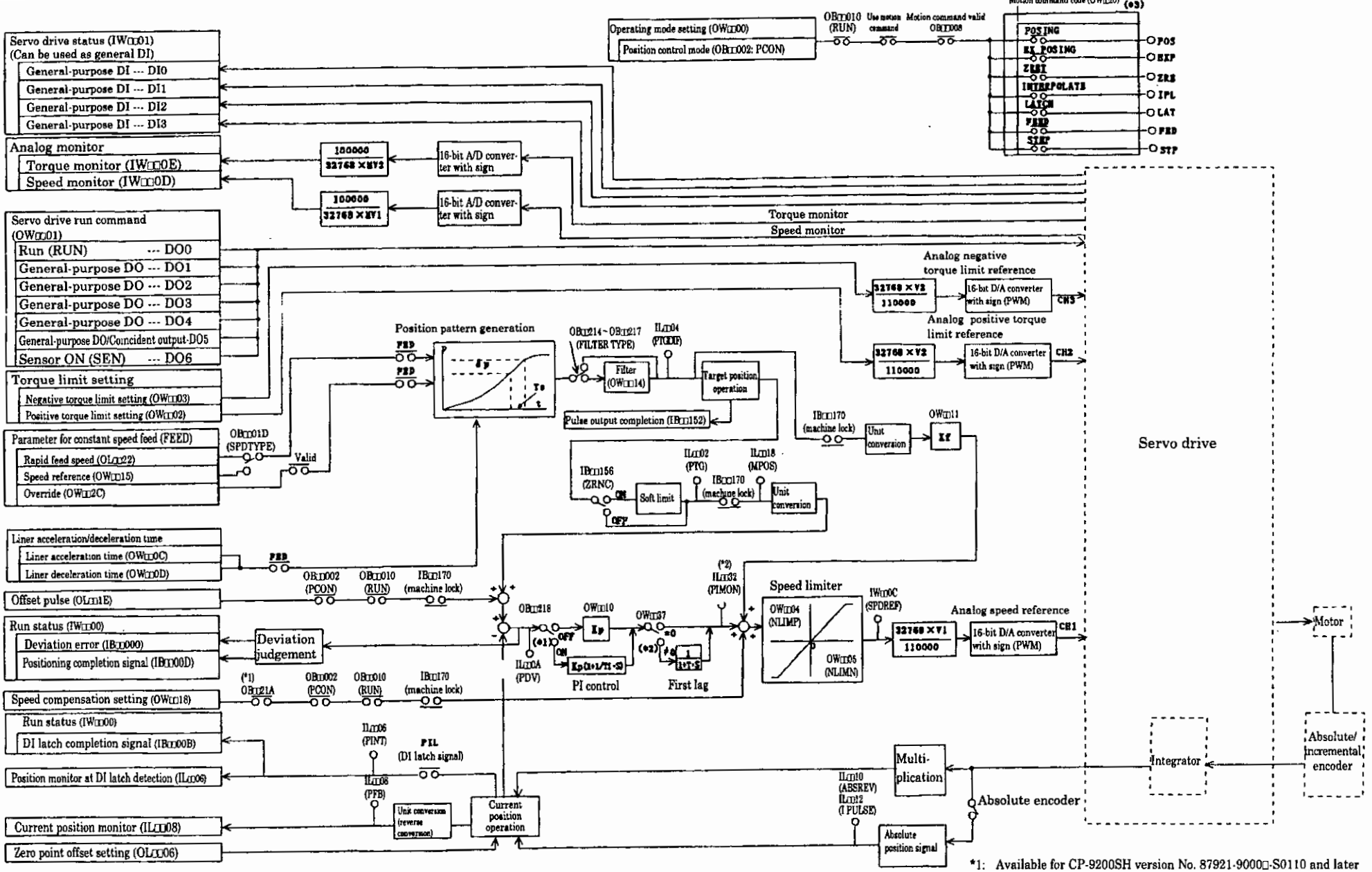


Fig. 3.35 Constant Speed Feed (FEED) Block Diagram

*1: Available for CP-9200SH version No. 87921-9000□-S0110 and later
*2: Available for CP-9200SH version No. 87921-9000□-S0120 and later
*3: Available for CP-9200SH version No. 87921-9000□-S0200 and later

(7) Constant Step Feed (STEP)

The axis moves to a specified direction for a specified travel distance (STEP travel amount) with a specified acceleration/deceleration time constant at the rapid feed speed.
The rapid feed speed can be changed during operation.
When the travel distance is changed during operation, this new value is reflected at the next execution of the constant step feed (FEED).
Fig. 3.36 shows the block diagram.

The constant step feed for each axis is performed as follows. The register number is for the 1st axis of module number 1. If the module number and the axis number are different, refer to 1.3 "Module Number and Servo Parameter Register Number" and change the register number.
The servo parameters used for zero point return are marked with "○" *in the column "Position* Control Mode/Constant Step Feed" of "Mode for which data is valid" in 5.1.2 "List of Servo Parameters for Setting" and 5.1.3 "List of Servo Parameters for Monitor".

① Set the servo fixed parameters and the initial values of servo parameters for setting. Make proper settings according to your machine. Set the counter mode selection to "Basic counter" (= 3).
(Note) Be sure to set Bit7 (selection to use motion command) of servo fixed parameter No.14 "Additional function selection" to "USE" (=1) and Bit8 (motion command code valid/ invalid) of servo parameter for setting "Operation mode selection (OW□□ 00)" to "1" (= valid)

② Select the position control mode (PCON) at Bit2 of OWC000.

③ Set the STEP travel amount (OLC028) and the rapid feed speed (OLC022 or OWC015).
If necessary, set the servo parameters for setting such as linear acceleration/deceleration time (OWC00C, OWC00D) and averaged number of times (OWC014) to be used at constant step feed (STEP).

④ Turn the servo ON (RUN) to "ON". (Bit0 of OWC001)

⑤ Set the constant step feed (STEP=8) for the motion command code (OWC020).

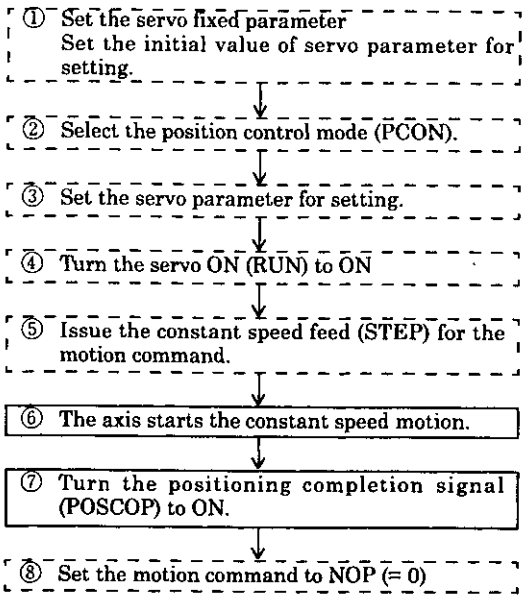
⑥ When the constant step feed (STEP) is set for the motion command code, the axis performs a positioning by a specified servo parameter.
To stop momentarily the positioning, turn HOLD (Bit0 of OWC021) to "ON".
When the momentary stop is completed, HOLDL (Bit1 of IWC015) is turned "ON".
To cancel the momentary stop, turn HOLD (Bit0 of OWC021) to "ON".
To abort the positioning, turn ABORT (Bit1 of OWC021) to "ON" or set the motion command code to NOP (=0).
During the process of abort, BUSY (Bit0 of IWC015) is turned "ON" and turned "OFF" at completion of abort.

(Note) When the abort is cancelled (turning ABORT to "OFF") at completion of abort, the axis remains stopped.

⑦ After the pulse output completion (Bit2 of IWC015 is turned "ON"), when the axis enters in the positioning completion range (OWC00E), the positioning completion signal POSCOMP (BitD of IWC000) is turned "ON".

⑧ When the positioning is completed, cancel the constant step feed of motion command code.

(Note) The constant step feed is detected at the signal rising edge. Accordingly, once the constant step feed is executed, set the motion command code to NOP for more than 1 scan and set again the constant step feed for the motion command code.



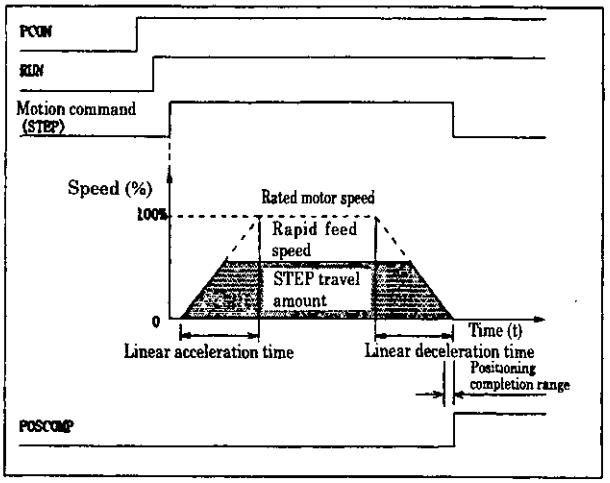


Fig. 3.36 Constant Speed Block Diagram

■ Example of user program (constant step feed)

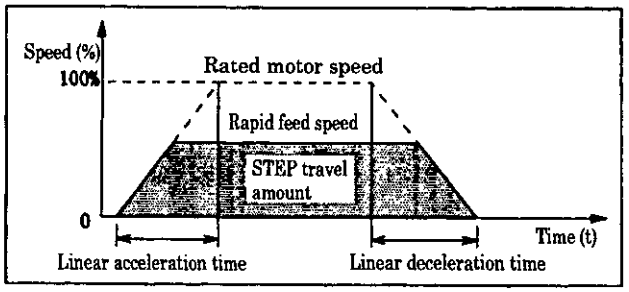


Fig. 3.37 Constant Step Feed Pattern Example

<Assumed conditions>

Set the initial values of servo fixed parameter and servo parameter for setting as described in 5.3 "Example of Servo Parameter Setting".

<Operation conditions>

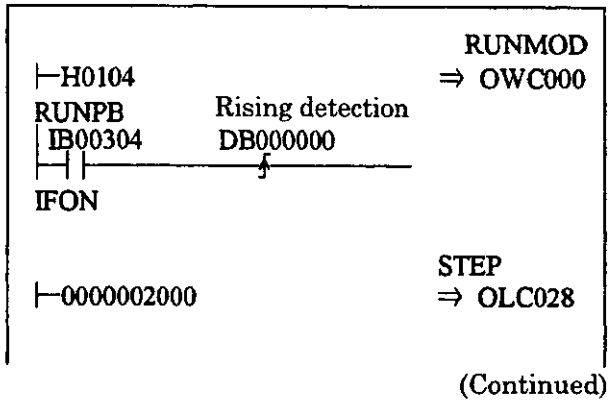
In the pattern shown in Fig. 3.37, the axis stops after the STEP travel amount 2000 pulses.

STEP travel amount: OLC028= 2000 pulses

In this example, the 1st axis of module number 1 is used.

When the module number and the axis number are different, change the register number referring to 1.3 "Module Number and Servo Parameter Register Number".

For details of the register (OW□□□□) to be used, refer to Chapter 5 "Servo Parameter".

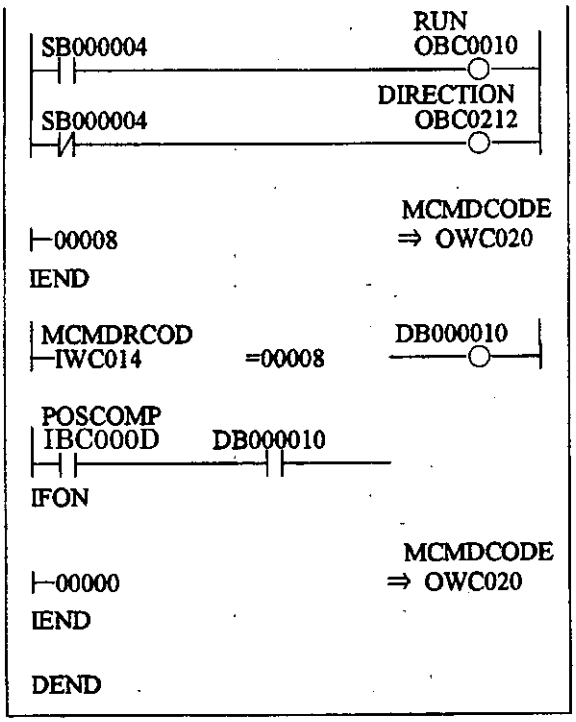


Turn the position control mode with using the motion command to "ON".

STEP travel amount (STEP) (2000 pulses)

(Continued)

(Continued)



RUN command (RUN) to driver
Issue the constant step feed (STEP) for the motion command
When IB00304 is turned "ON", the constant step feed starts and the axis moves to forward (positive) direction for the STEP travel amount.
When the axis has moved for the STEP travel amount, the positioning completion signal IBC000D us turned "ON".

After the movement is completed, clear the motion command (issue NOP command) for the next operation.

Fig. 3.38 Example of Constant Step Feed Program (DWG H03)

The example in Fig. 3.38 is simplified. Actually, each register can be freely controlled in the user program.

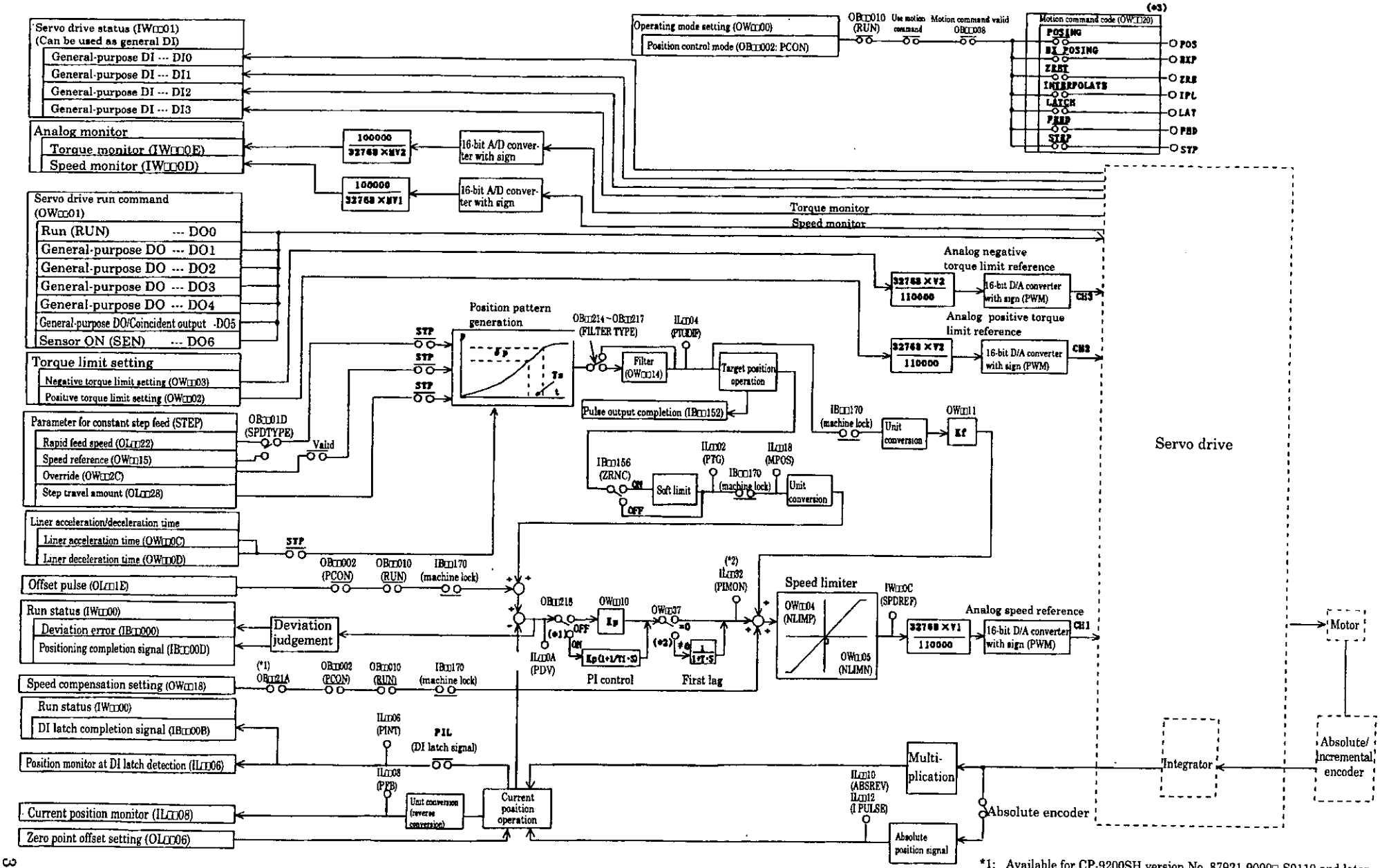


Fig.3.39 Constant Step Feed (STEP) Block Diagram

*1: Available for CP-9200SH version No. 87921-9000□-S0110 and later
*2: Available for CP-9200SH version No. 87921-9000□-S0120 and later
*3: Available for CP-9200SH version No. 87921-9000□-S0200 and later

When the soft limit check is used, it is necessary to execute the zero point return operation or "zero point setting"..
Perform "zero point setting" as follows.

① Move the axis by the constant speed feed or the constant step feed to the zero point, or manually move the machine to zero point.

② Select the position control mode (PCON) at Bit2 of OWC000.
Note: Be sure to set Bit7 (selection to use motion command) of servo fixed parameter No.14 "Additional function selection" to "USE" (=1) and Bit8 (motion command code valid/ invalid) of servo parameter for setting "Operation mode selection (OW□□00)" to "1" (= valid).

③ Set the zero point setting (=9) for the motion command.
Note: The servo ON (Bit0 of OW□□01) can be either "ON" or "OFF". However, if the servo fixed parameter No. 3 "Encoder selection" is set to the absolute encoder (=1) and Bit 5 (Axis selection) of the servo fixed parameter No. 17 "Motion controller function selection flag" is set to "Infinite length axis" (=1), the zero point setting (ZSET) is enabled during the axis movement.

④ When the zero point setting is completed, The zero point setting completion (Bit3 of IW□□15) and the zero point return completion status (Bit6 of IW□□15) are turned "ON".

⑤ After confirming that the zero point setting completion turns ON, set the motion command code to NOP (= 0) for releasing the zero point setting.

⚠ CAUTION

"Zero point setting (ZSET)" is the command to set the "zero point of machine coordinate system". Therefore, if the set position for "zero point setting" is not correct, the axis moves on the different positions from the actual for the proceeding operations. Before the operation, make sure that the "zero point of machine coordinate system" is set correctly.
Otherwise, damage to tools due to interference and an injury may be caused.

3.4.4 Phase Control

This function is used to rotate at the device at a specified speed reference, and at the same time to control the rotation amount. By using this control on multiple axes, the shift of the rotating angle (phase) of related motors can be avoided and control of endless operation of printers and other devices becomes possible. In addition, by utilizing this control, electronic shafts and electronic cams can be realized. By using electronic shafts and electronic cams, complicated machine structures are replaced with servomotors. Phase adjustment, synchronizing operation, proportional operation, and variable speed operation of cams are all moved to the software.

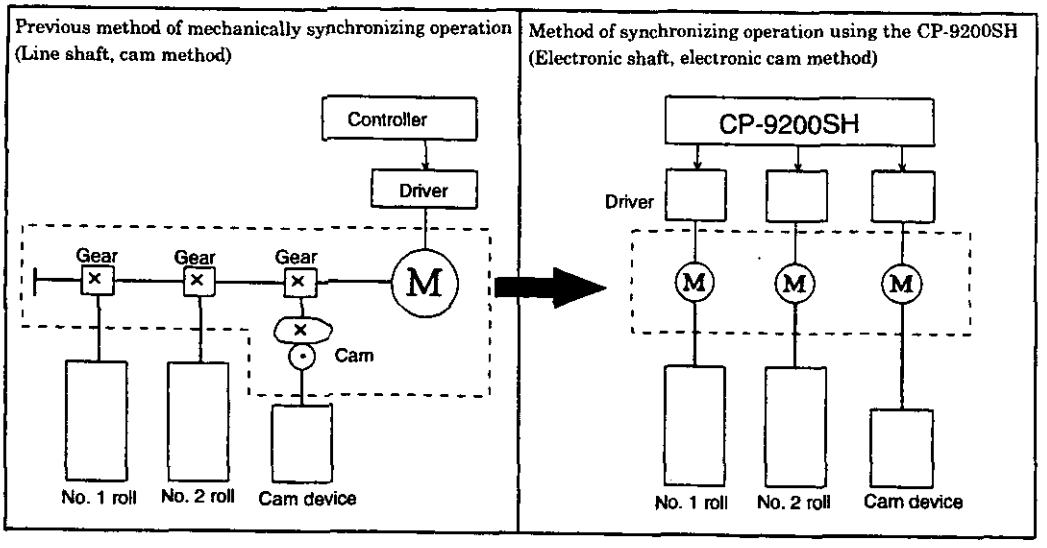


Fig. 3.40 Electronic Shaft, Electronic Cam Conceptual Drawing

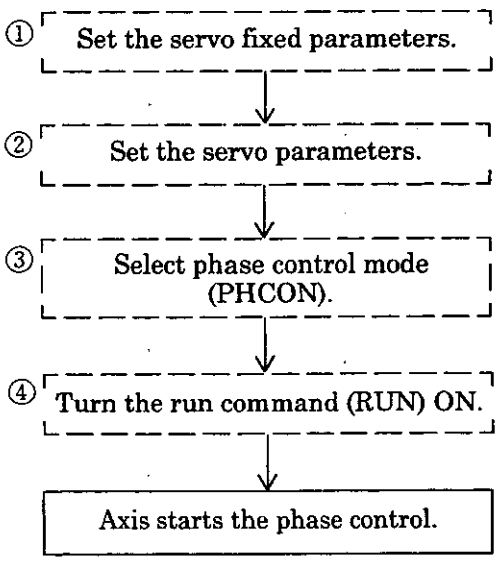
Fig. 3.41 shows a phase control block diagram. The register number is for the 1st axis of the module number 1. If the module number and the axis number are different, refer to 1.3 "Module Number and Servo Parameter Register Number" and change the register number. The servo parameters used with phase control are marked with "○" in the "Phase control mode" column of the "Modes for which data is valid" in 5.1.2 "List of Servo Parameters for Setting" and 5.1.3 "List of Servo Parameters for Monitor." Phase control for each axis is performed with the following procedure.

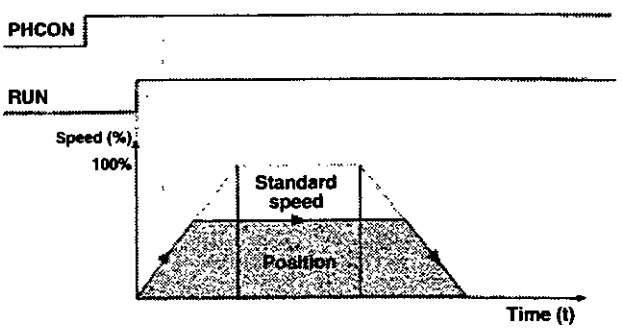
① Set the servo fixed parameters. Switch the counter mode selection to "Basic counter (=3)". Set other servo fixed parameters appropriately for your machine.

② Set the speed compensation setting (OWC018) and the standard speed to the speed reference setting (OWC015). In addition, set the phase correction setting (OLC016), proportional gain (OWC019), integration time (OWC01A), and other servo parameters used during phase control. Standard speed is controlled by the user program so that shock does not occur.

③ Select the phase control mode (PHCON). (Bit 3 of OWC000)
At this time, also set the disabling of the phase reference generation operation (PHREFOFF: Bit7 of OWC000). Normally, set PHREFOFF to "OFF" for using an axis as an electronic shaft, and to "ON" as an electronic cam.

④ Turn the run command (RUN) ON. (Bit 0 of OWC001)
When the run command (RUN) is turned ON, the axis performs phase control using the designated servo parameters. Even the operation of phase control, you can change the set values of servo parameters as desired.





The boxes with solid lines are actions the system performs.
The boxes with dotted lines are settings the user makes.

Fig. 3.41 Phase Control Block Diagram

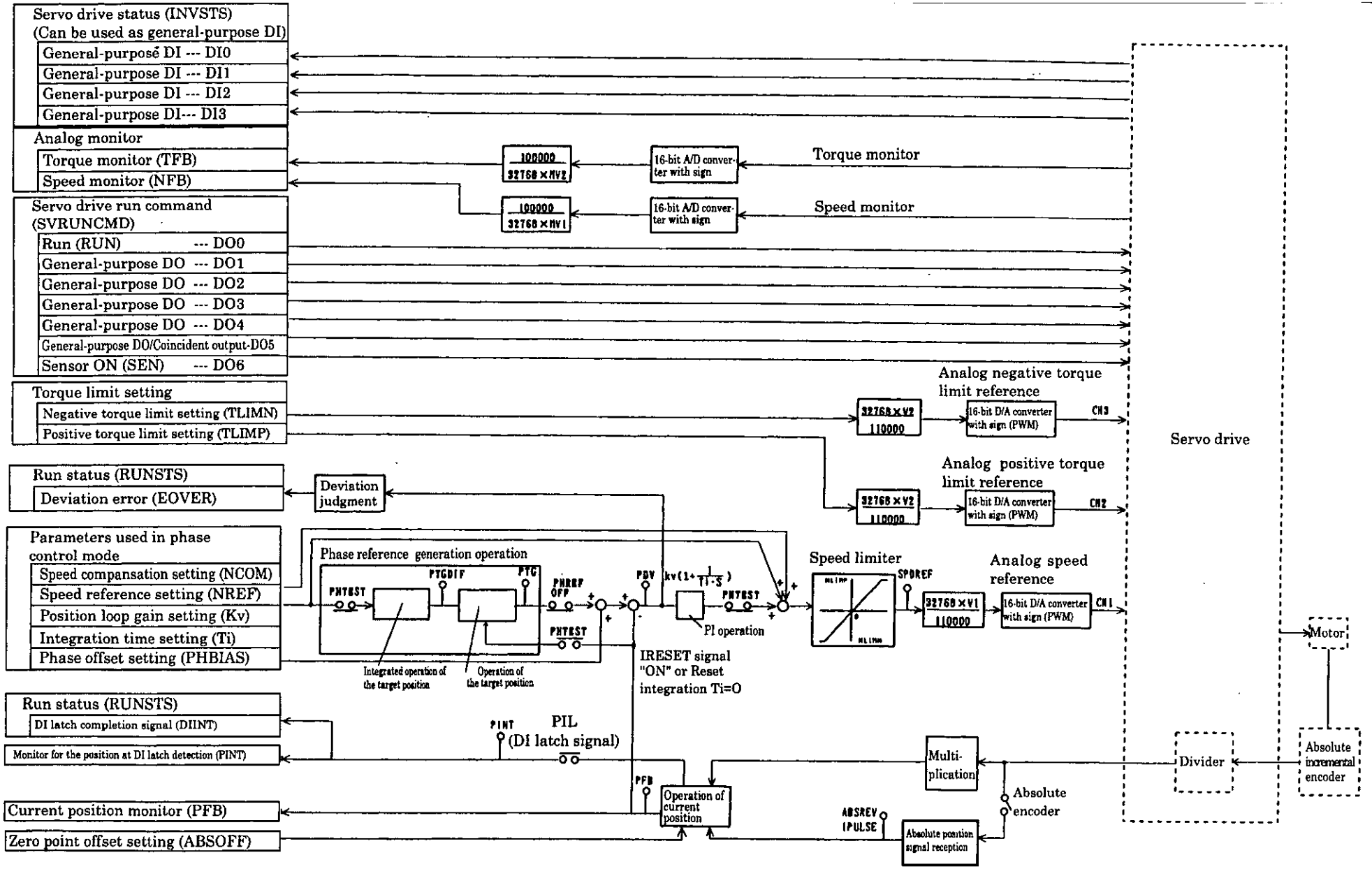


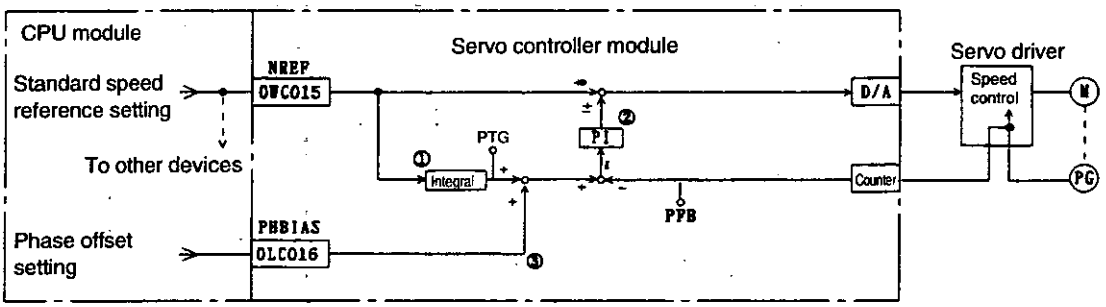
Fig. 3.42 CP-9200SH Phase Control Mode Block Diagram

■ Example of a user program 1 (Electronic shaft)

Phase control can be called "speed control with position correction" or "position control with 100% c speed feed forward." This "position" means the angle of rotation of the motor, so it is called "phas control." Applying this phase control, an electronic shaft can be constructed.

In this example, the 1st axis of module number 1 is used.
If the module number and the axis number are different, refer to 1.3 "Module Number and Serv Parameter Register Number" and change the register number.
For details of the register (OW□□□□), refer to Chapter 5 "Servo Parameters."

Fig. 3.43 shows a phase control loop block diagram.



①: The standard speed reference is integrated, and the corresponding position (pulse) is computed.
②: The speed reference is generated from the deviation ε between the target position (TPOS) and th current position (PFB). This result is the position (phase) offset.
③: If you want to shift the phase, add the amount you want to shift (converting the rotation angle of th motor axis to pulse amount) to the phase offset setting.

Fig. 3.43 Phase Control Loop Block Diagram

The motor rotation phase can be managed (controlled) through the above procedure.
Since these control loops are handled inside the SVA module, the electronic shaft control can b realized simply by selecting the phase control mode on the CPU module side, and setting the necessary parameters to the SVA module.

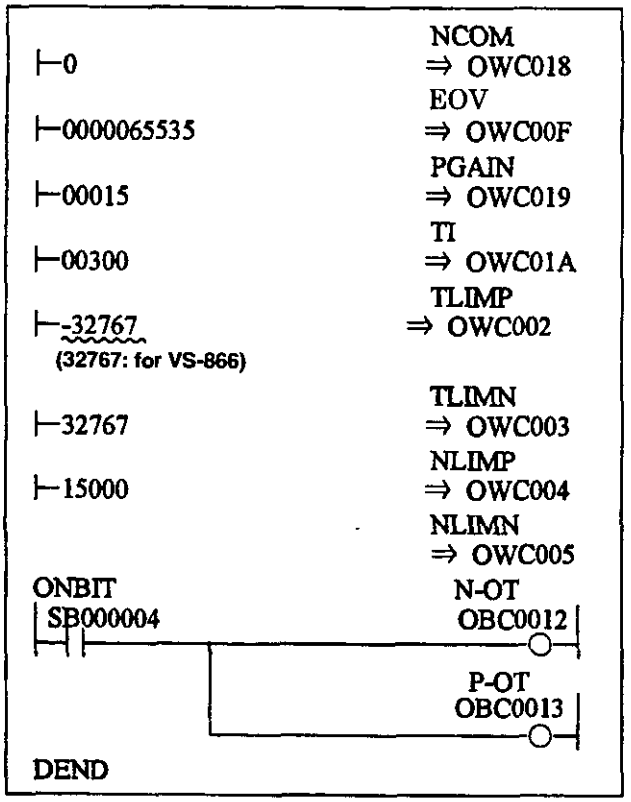
<Assumed conditions>

Motor rated speed	: NR = 1500 r/min
Feedback pulse resolution	: FBppr = 8192 ppr
D/A output value at 100% of speed	: 6 V
D/A output value at 100% of torque limit	: 3 V

The above servo fixed parameters are set on the Fixed Parameter Setting screen of the CP-717.

In Fig. 3.43	
Deviation error detection value	: 65535 pulses
Speed offset value	: 0%
Proportional gain	: 1.5
Integral time	: 300 ms

Figs. 3.44 and 3.45 are examples of using a programming language to show the phase control loop block diagram in Fig. 3.43.



Speed offset value (NCOM)

Deviation error detection value (EOV)

Proportional gain (PGAIN)

Integral time (Ti)

Positive torque limit (TLIMP)

Negative torque limit (TLIMN)

Positive speed limiter (NLIMP)

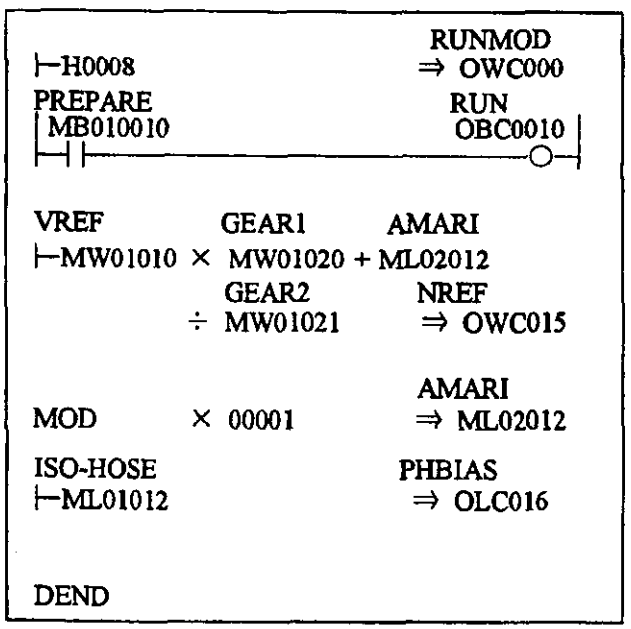
Negative speed limiter (NLIMN)

SB00004: Normally ON contact

Negative overtravel (N-OT), positive overtravel (P-OT), and other reference for the driver

Fig. 3.44 Initial Settings (DWG A04)

In the example of Fig. 3.44 the user program is created in DWG.A and initial settings are made, but after setting initial values in the Fixed Parameter Setting screen of the CP-717, by pressing the "Save" key, the initial values of the servo parameters can be stored. The stored value are automatically set in the servo parameters when the CP-9200SH is turned on. Thus, this is the same as the method of creating a user program in DWG.A and initializing settings. The method of setting initial values in the servo parameter setting screen and saving them is recommended.



Turn the phase control mode ON
Turn the phase reference generation operation disabled OFF.

Run command to the driver (RUN)
When MB010010 is turned ON, phase control is begun.

The standard speed reference (NREF) is set.
The speed reference is stored in MW01010. Gear ratio are stored in MW01020 and MW01021. If gear ratio is not needed, a "1" is stored.

Set the phase offset (OLC016) to shift the phase.
The amount of shift desired (with the rotation angle of the motor axis converted to pulse amount) is stored in ML01012.

Fig. 3.45 Phase Reference (DWG H04)

The example of Fig. 3.45 is simplified, but actually each register type can be freely controlled with a user program.

■ Example of a user program 2 (Electronic cam)

Originally a cam is a device to convert rotational motion to liner motion. It is used to obtain desired movement curves (displacement diagram) in a cycle. A mechanical cam is formed into the shape which corresponds to this displacement diagram. A follower was placed in contact with the circumference, so that by rotating the cam, the desired linear motion can be achieved. An electronic cam already has the displacement diagram data itself as a position pattern in the controller. By transferring the phase, the position can be controlled step by step, a so-called CP (continuous path) control.

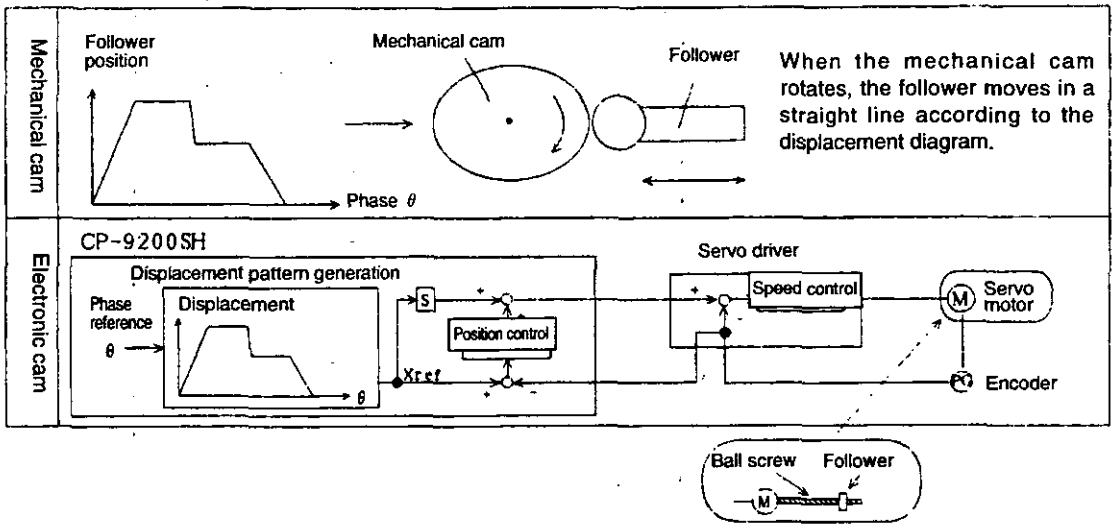


Fig. 3.46 Mechanical Cam and Electronic Cam

In the example of Fig. 3.46, the 1st axis of Servo number 1 is used. If the module number and the axis number are different, refer to 1.3 "Servo Number and Servo Parameter Register Number" and change the register number.
For details of the register (OW□□□□), refer to Chapter 5 "Servo Parameters."

Applying phase control, an electronic cam control loop can be constructed. Regular phase control generates position references based on integrating the standard speed references in the SVA module (refer to Fig. 3.47). On the other hand, the electronic cam control loop cuts the integrated line of standard speed references, and provides position references from the phase offset setting value (refer to Fig. 3.48).

Figs. 3.47 and 3.48 show block diagrams for the phase control loop and the electronic cam control loop.

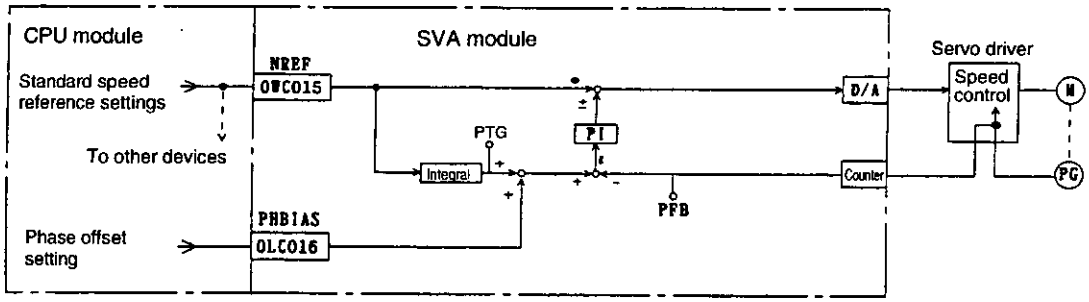


Fig. 3.47 Phase Control Loop Block Diagram

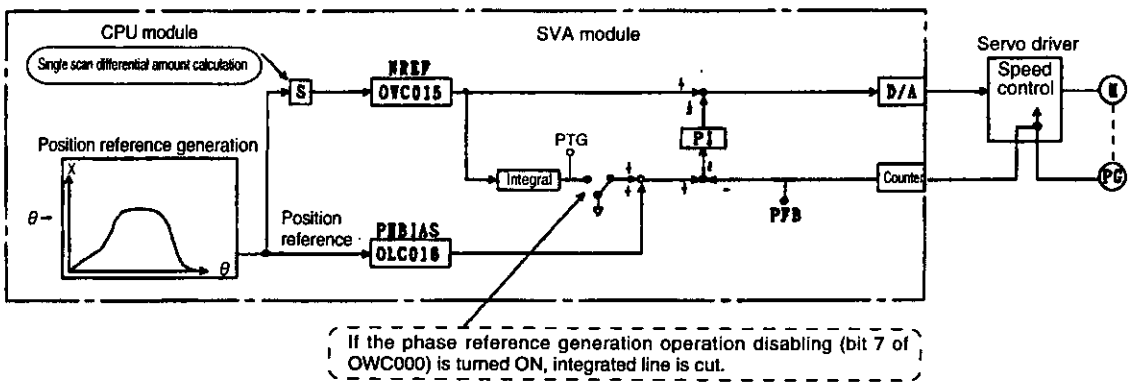


Fig. 3.48 Electronic Cam Control Loop Block Diagram

Since electronic cam control loops are handled inside the SVA module, you can control electronic cam by selecting the phase control mode on the CPU module side, and setting required parameters to the SVA module.

<Assumed conditions>

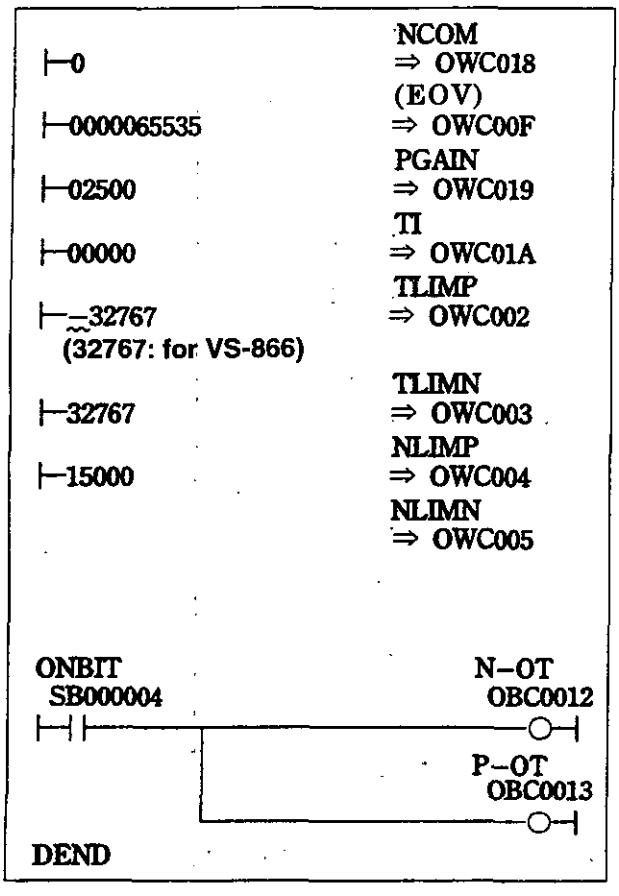
Motor rated speed	: NR = 1500 r/min
Feedback pulse resolution	: FBppr = 8192 ppr
D/A output value at 100% of speed	: 6 V
D/A output value at 100% of torque limit	: 3 V

The above servo parameters are set on the Fixed Parameter Setting screen of the CP-717.

In Figs. 3.47 and 3.48

Deviation error detection value	: 65535 pulses
Speed offset value	: 0%
Proportional gain	: 250.0
Integral time	: 0.0 s

Figs. 3.49 and 3.50 are examples of using a programming language to show the control loop bloc diagrams in Figs. 3.47 and 3.48.



Speed offset value (NCOM)

Deviation error detection value (EOV)

Proportional gain (PGAIN)

Integral time (Ti)

Positive torque limit (TLIMP)

Negative torque limit (TLIMN)

Positive speed limiter (NLIMP)

Negative speed limiter (NLIMN)

SB000004: Normally ON contact

Negative overtravel (N-OT), positive overtrave (P-OT) and other references for the driver

Fig. 3.49 Initial Settings (DWG A04)

In the example of Fig. 3.49 the user program is created in DWG.A and initial settings are made, bu after setting initial values in the Fixed Parameter Setting screen of the CP-717, by pressing the "Save key, the initial values of the servo parameters can be stored.
The stored values are automatically set in the servo parameters when the CP-9200SH is turned ON This is the same as the method of creating a user program in DWG.A and initializing settings. The method of setting initial values in the servo parameter setting screen and saving them is recommended

```
                                    RUNMOD
 ├─H0088                            ⇒ OWC000
 K1              TsH
 ├─MW00040  ×    SW00004
                 K2                 KS
              ÷  MW00041            ⇒ ML03010

                                    FFGAIN
 ├─10000                            ⇒ MW03012

 PREPARE                                RUN
 │MB010010                             OBC0010 │
 ├─┤├──────────────────────────────────────○─┤
 Phase reference
 ├─ML03030
                 Displacement pattern   Displacement X
 FGN             MA03050                ⇒ ML03020

 Displacement X  Previous value         Amount of change
 ├─ML03020   - ML03024                  ⇒ ML03022

 ├─00000

 │Run command
  MB010020
 ├─┤├──
 Amount of change FFGAIN
 [├─ML03022 ]  ×  MW03012
                 KS                     NREF
              ÷  ML03010                ⇒ OWC015

 Position BIAS   Displacement X         PHBIAS
 [├─ML03032 ]    [+ML03020 ]            [⇒ OLC016]
 Displacement X                         Previous value
 ├─ML03020                              ⇒ ML03024

 DEND
```

Turn the phase control mode ON
Turn the phase reference generation operation disabled ON.

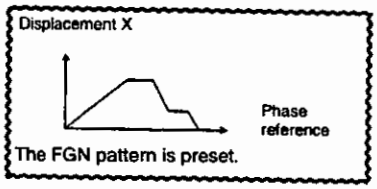
Compute the speed scaling constant (KS). The set value of the high-speed scan: SW00004

$$\frac{NR \times FBppr \times n}{60 \times 10^4} \rightarrow \begin{matrix} \text{Denominator*} : \text{MW00040} \\ \text{Numerator*} : \text{MW00041} \end{matrix}$$

* Reduce a fraction so that the result is within 1 word.
NR = Rated motor speed
FBppr = Number of feedback pulses
n = Pulse multiplication factor (1, 2, or 4).
Feed forward gain [10000/100%]

Run command to the driver (RUN)
When MB010010 is turned ON, phase control is begun.

The displacement (pulse) for the phase reference is read from the FGN function.



Amount of change [pulse] per scan.

When the run command MB010020 is turned ON, the axis moves at the standard speed NREF. When it is OFF, the standard speed NREF stays at "0."

Standard speed reference setting [0.01%]

Phase offset setting [pulse]

Displacement (pulse) for the phase reference
Previous value [pulse]

Fig. 3.50 Phase References (DWG H04)

The example of Fig. 3.50 is simplified, but actually each register type can be freely controlled with a user program.

3.4.5 Zero Point Return

Zero point return is the action of returning the axis to its mechanical zero point.
When the incremental encoder is used, if the power is turned OFF, the position data for the system zero point is lost. Therefore, after turning the power ON, the system zero point must be determined again. A pulse generator with an zero point pulse (PG) and a limit switch which shows the zero point area are used to determine the zero point.
For zero point return, the method using the motion command (available for CP-9200SH version 87921 9000□-S0200 and later) and the method using the zero point return control mode are available.
Note that the axis motion for zero point return differs depending on the method applied.
In this section, the zero point return using the zero point return control mode is explained.

When zero point return is selected while using the absolute encoder, position control with the zero point offset (OL□□06) as the position reference is the result.

Zero point return is executed by turning the run signal (RUN) ON with the zero point return mode (ZRN) selected. The movement direction for zero point return is specified with the zero point return direction selection (ZRNDIR).

When zero point return has completed, the axis stops, and the position data becomes the zero point offset value. At the same time, the zero point return completion signal (ZRNC) is output. The zero point offset value is set in the servo parameters.

(Notes) 1. For the zero point return using the motion command, refer to (3) of 3.4.3 (8) "Zero Point Return (ZRET)".
2. Change to the position control mode for position control of position reference 0.

Fig. 3.51 shows a zero point return block diagram. The 1st axis of the module number 1 is used. If the module number and the axis number are different, refer to 1.3 "Module Number and Servo Parameter Register Number" and change the register number. The servo parameters used with zero point return have a circle in the "Zero point return mode" column of the "Modes for which data is valid" in 5.1.2 "List of Servo Parameters for Setting" and 5.1.3 "List of Servo Parameters for Monitor."
Zero point return for each axis is performed with the following procedure.

① Set the servo fixed parameters. Switch the counter mode selector to "Basic counter (=3)." Set other servo fixed parameters appropriately for your machine.

② Set the approach speed (OWC00A), the creep speed (OWC00B), the linear acceleration and deceleration times (OWC00C, OWC00D), the position loop gain (OWC010), the positioning completion range (OWC00E), and other servo parameters used for the zero point return operation.

③ Select the zero point return mode (ZRN). (Bit 4 of OWC000)

④ Turn the run command (RUN) ON at Bit 0 of OWC001. The axis will move to the direction specified by the zero point return direction selection at Bit 9 of OWC000.

⑤ When the zero point return deceleration point limit switch LSDEC (Bit F of OWC001) turns ON, the axis will decelerate to the creep speed.

(Note) It is necessary to create a user program to connect the limit switch signal $\overline{\text{DECLS}}$ (DI signal input through LIO-01 module, etc.) to the zero point deceleration point limit switch LSDEC (BitF of OWC001).

⑥ The point at which the zero point pulse (C-phase pulse) is detected after the LSDEC is turned from ON to OFF becomes the position of the zero point. The axis, after the first zero point pulse is detected, will decelerate to stop.

⑦ The axis will move by only the distance it overran the zero point at creep speed in the direction to the zero point, and then stop at the zero point. You can also set the zero point offset value. (If the offset value of the zero point is set to 100, the position data becomes 100.) The zero point offset value can be set with the servo parameter (OLC006).

⑧ When the axis enters the positioning completion range, the zero point returning completes. After completing the zero point return, the zero point return completion signal ZRNC (Bit F of IWC000) is turned "ON." After confirming that the zero point return completion signal ZRNC is ON, turn the run command (RUN) and the zero point return mode (ZRN) OFF.

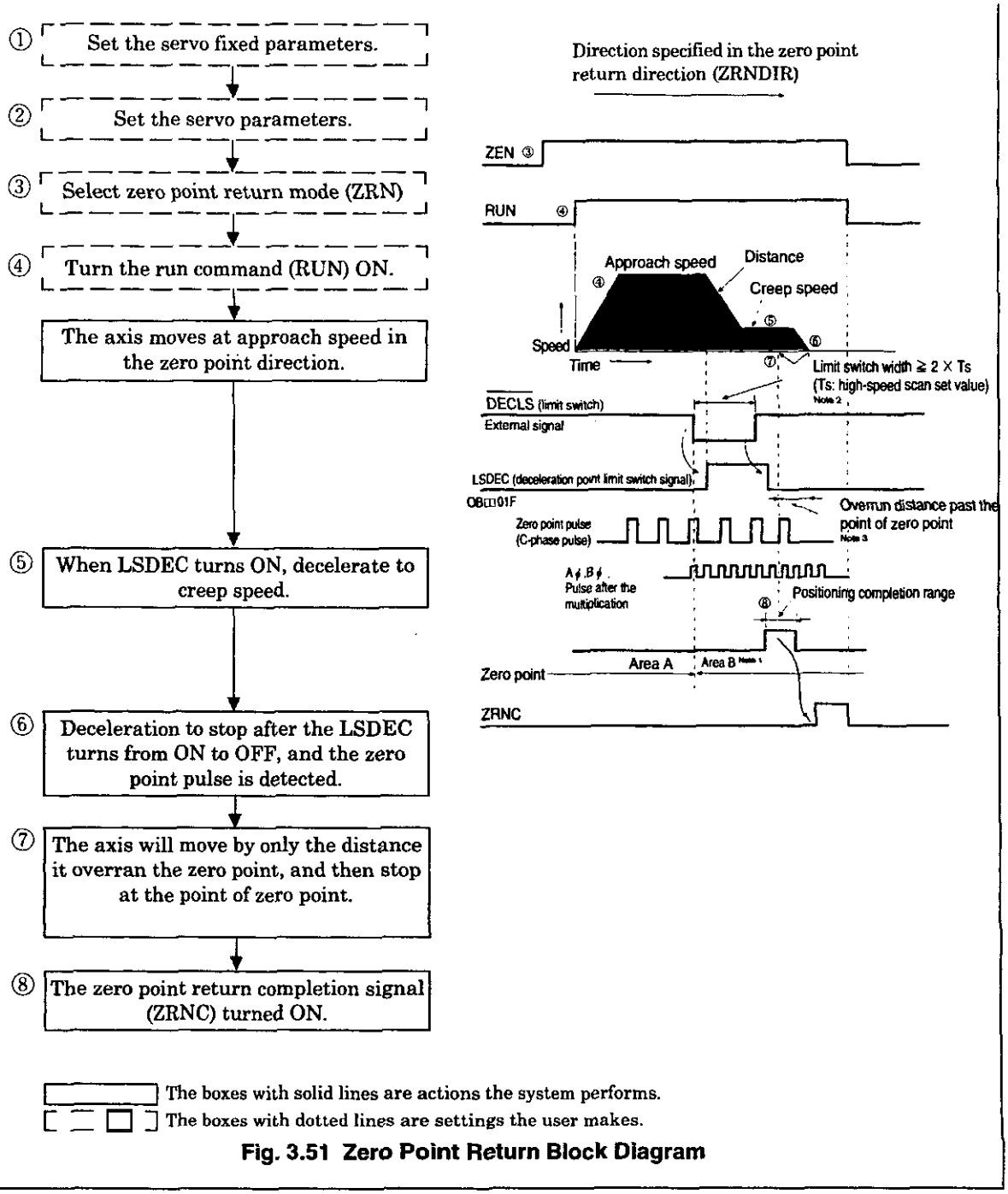


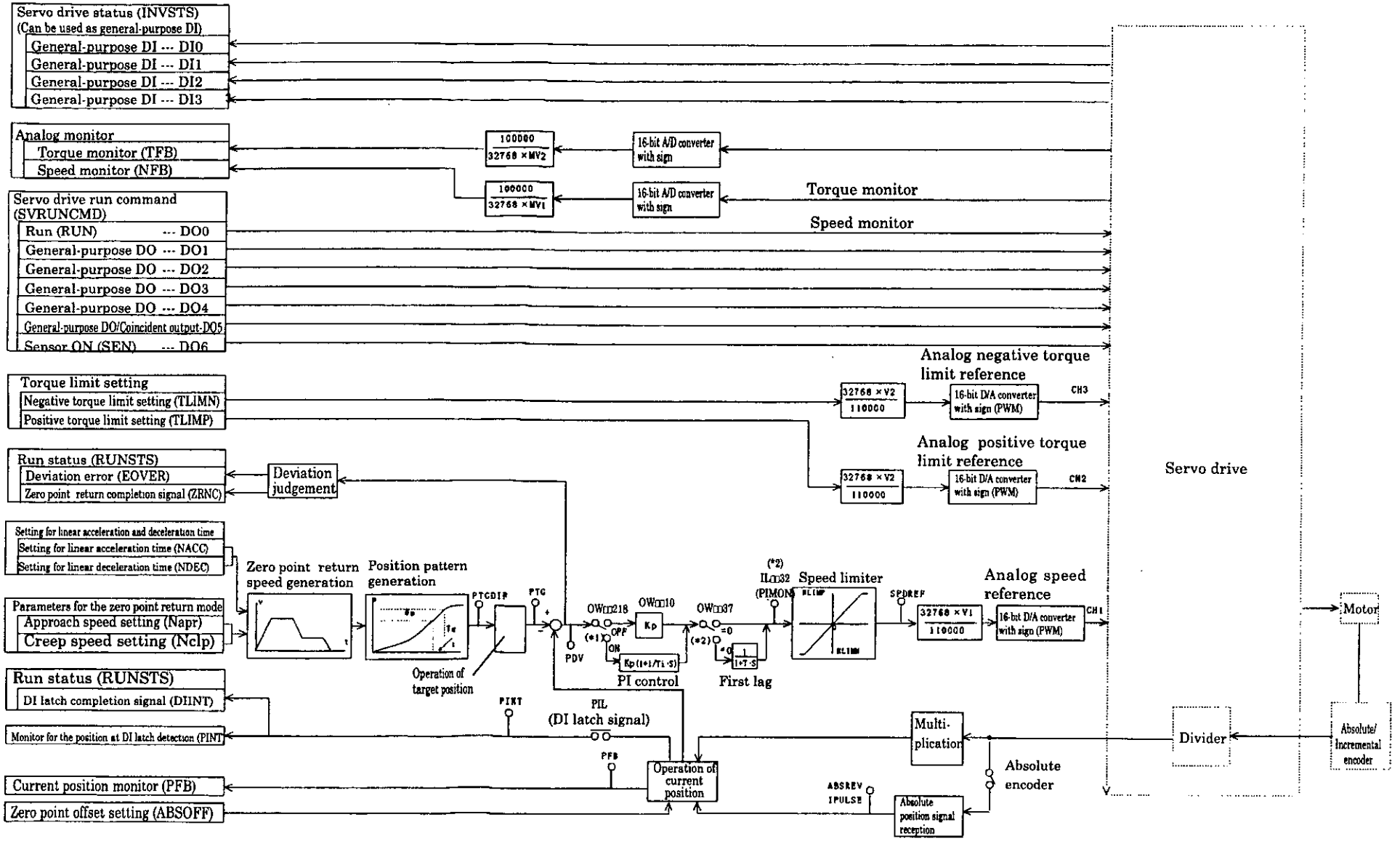
Fig. 3.51 Zero Point Return Block Diagram

(Notes) 1. After turning the power ON, in some cases in area B, the machine will not be able to return correctly. Always return the machine to area A, and perform zero point return.
2. The limit switch width ($\overline{\text{DECLS}}$) should be at least twice the high-speed scan set value. The criteria for the width of the limit switch (L) can be calculated with the following formula.
3. After detecting the zero point, an zero point overrun distance is needed (the width until deceleration to stop).

Ts (s) = high-speed scan set value (ms)/1000
f (m/s) = k × {NR × n × FBppr}/60
K : Weight of one pulse (m/pulse)
NR : Motor rated speed (r/min)
FBppr : Feedback pulse resolution (ppr)
f : 100% of speed (m/s)
n : Pulse multiplication factor (1, 2, or 4)
t (s) = linear acceleration and deceleration time (s)
α (m/s^2) = f/t
α : acceleration and deceleration time constant (m/s^2)
If we make the above substitutions, the following is derived:
$L = 1/2 \cdot \alpha (2 \times Ts)^2 = 2 \alpha Ts^2$

The criteria for the approach speed can be calculated with the following formula.
If we take Va = approach speed (%), then the following settings follow.
$va = f \times Va/100$
$L \geqq 1/2 \cdot \{va^2/\alpha\}$

The criteria for the zero point overrun distance (x) can be computed with the following formula.
If we take Vc = creep speed (%), then the following can be derived.
$vc = f \times Vc/100$
$x = 1/2 \cdot \{vc^2/\alpha\}$



*1 :Available for CP-9200SH version No. 87921-9000□-S0110 and later
*2 :Available for CP-9200SH version No. 87921-9000□-S0120 and later

Fig. 3.52 CP-9200SH Zero Point Return Block Diagram

■ Example of a user program

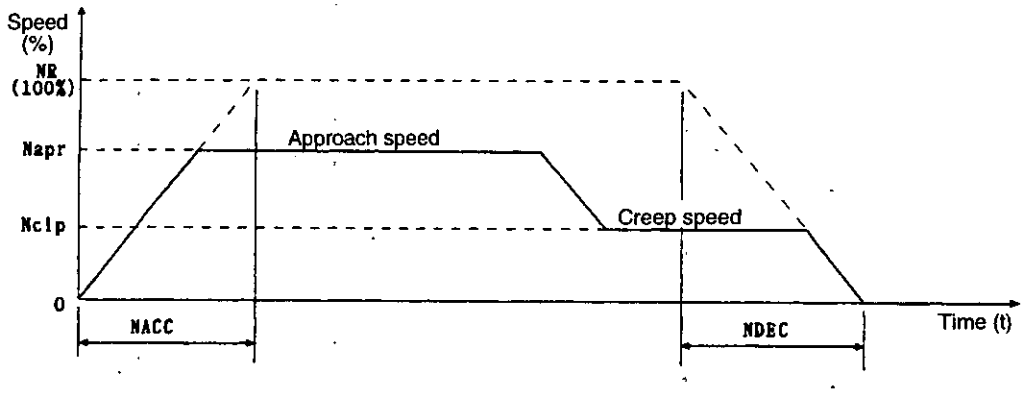


Fig. 3.53 Example of Zero Point Return Pattern

<Assumed conditions>

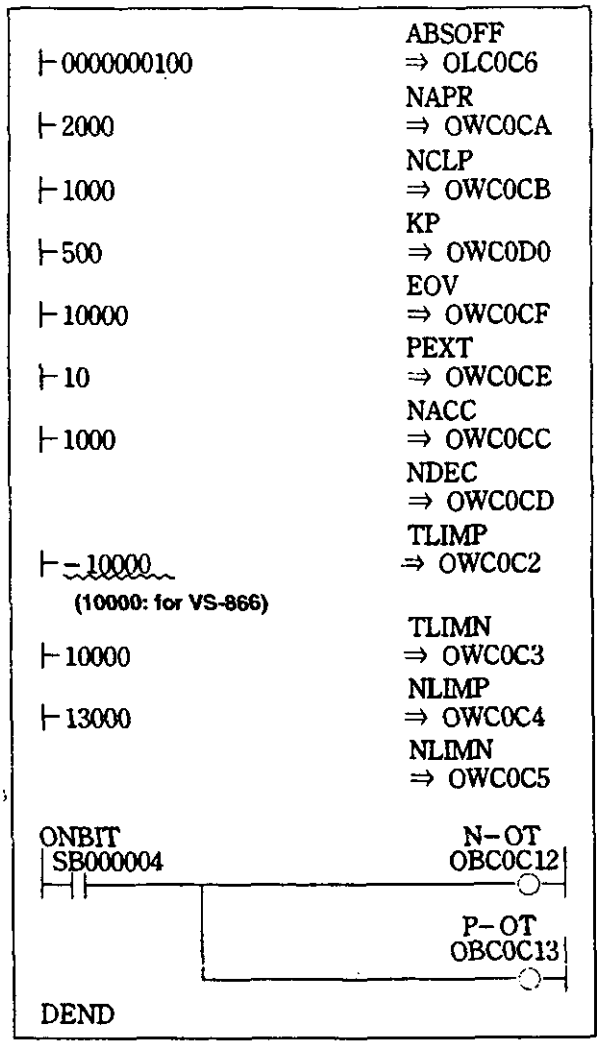
Motor rated speed : NR = 3000 r/min
Feedback pulse resolution : FBppr = 2048 ppr
D/A output value at 100% of speed : 6 V
D/A output value at 100% of torque limit : 3 V
The above servo fixed parameters are set on the Fixed Parameter Setting screen of the CP-717.

In Fig. 3.53
Approach speed : Napr = 20%
Creep speed : Nclp = 10%
Linear acceleration time : NACC = 1 sec
Linear deceleration time : NDEC = 1 sec
Zero point offset : ABSOFF = 100 pulses
Positive torque limit : TLIMP = 100% (100% for VS-866)
Negative torque limit : TLIMN = 100%
Positive speed limiter : NLIMP = 130%
Negative speed limiter : NLIMN = 130%
Position loop gain : Kp = 50

<Operation conditions>

The limit switch signal width inputs two times or more of the high-speed scan set value.
In this example, the SERVOPACK at the 4th axis of module number 1 is used.
If the module number and the axis number are different, refer to 1.3 "Servo Number and Servo Parameter Register Number" and change the register number.
For details of the register (OW□□□□), refer to Chapter 5 "Servo Parameters."

Figs. 3.54 and 3.55 are examples of using a programming language to show the zero point return pattern in Fig. 3.53.



Zero point offset (ABSOFF)

Approach speed (Napr)

Creep speed (Napr)

Position loop gain (Kp)

Deviation error detection value (EOV)

Positioning completion range (PEXT)

Linear acceleration time (NACC)

Linear deceleration time (NDEC)

Positive torque limit (TLIMP)

Negative torque limit (TLIMN)

Positive speed limiter (NLIMP)

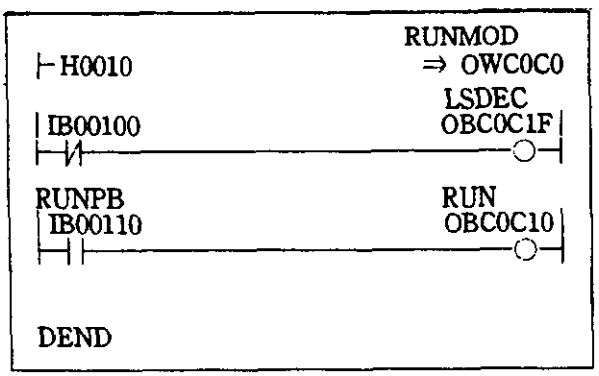
Negative speed limiter (NLIMN)

SB00004: Normally ON contact

Negative overtravel (N-OT), positive overtravel (P-OT), and other contact instructions to the driver

Fig. 3.54 Initial Settings (DWG A05)

In the example of Fig. 3.54 the user program is created in DWG.A and initial settings are made, but after setting initial values in the Fixed Parameter Setting screen of the CP-717, by pressing the "Save" key, the initial values of the servo parameters can be stored. The stored values are automatically set in the servo parameters when the CP-9200SH is turned on. Thus, this is the same as the method of creating a user program in DWG.A and initializing settings. The method of setting initial values in the servo parameter setting screen and saving them is recommended.



Turn the zero point return mode "ON"

IB00100: limit switch signal (DECLS)

Run commands to the driver (RUN)
When IB00110 is turned ON, zero point return starts. When zero point return action is completed, the zero point return completion signal IBC0C0F (ZRNC) is turned ON.

Fig. 3.55 Zero Point Return (DWG H01)

The example of Fig. 3.55 is simplified, but actually each register type can be freely controlled with a user program.

3.4.6 Absolute Position Data Read Out from Absolute Position Encoder

When the absolute position encoder is used, the SVA module reads the absolute position (current position) from the absolute encoder when the power is turned on. Motion control is executed with this current position as the initial value. However, there are cases you want to change only the servo driver without turning off power to the CP-9200SH, such as when the servo driver fails. In these cases, after changing the servo driver, it is necessary to read the absolute position from the absolute encoder. The SVA module can read the absolute position from the Yaskawa absolute encoder without turning the power of CP-9200SH off to on again.

This is performed with the run command (RUN: Bit0 of OW□□01) in an OFF status, by turning ON the absolute position read request (ABSRD: Bit A of the OW□□ 00).
When reading the absolute position from the absolute position encoder is completed, the absolute position read completion signal (ABSRDC: Bit A of the IW□□ 00) is turned ON.
This function is called "absolute position data read during operation."

This absolute position data read during operation can be executed for any one of the first axis to the fourth axis, but cannot be executed simultaneously. If there are simultaneous requests for absolute position data read on two to four axes (more than two at the same time), they are executed in order from the smallest axis number.

The register number is for the 1st axis of the module number 1. If the module number and the axis number are different, refer to 1.3 "Module Number and Servo Parameter Register Number" and change the register number.
Absolute position data during operation are read with the following procedure.

① Turn the run command (RUN) (Bit 0 of OWC001) OFF.
(Note) When the run command (RUN) is ON, even if you turn ON the request command for absolute position data read out ABSRD, it will be invalid.

② With the run command (RUN) OFF, if you turn ON the request command for absolute position data read out ABSRD (Bit A of OW□□ 00), absolute position data read out from the absolute position encoder begins.
(Note) Keep the request command for absolute position data read out ABSRD "ON" until the absolute position read completion signal ABSRDC turns ON (for each axis about 350 ms to 5.0 s). If this is not done, the cumulative rotations reception error PGER will turn ON.

③ When reading the absolute position from the absolute encoder is completed, the absolute position read completion signal ABSRDC (Bit A of IW□□ 00) is turned ON.
- If it completes normally, cumulative rotations reception error PGER (Bit 4 of IWC000) will turn OFF, and the position monitor (ILC008) will be reset. In addition, the cumulative number of rotations received from the absolute value encoder is informed to ILC010, and the initial incremental number of pulses to ILC012.
- If an error is detected, four retries are attempted. If it still does not recover, the cumulative rotations reception error PGER will turn ON, and control of that axis will be cut off. [This results in the same state as the case where the not used selection (=0) was made for the axis selection in the servo fixed parameters.]

After removing the cause, reread the absolute position data.

④ After confirming that the absolute position read completion signal ABSRDC is ON, turn the absolute position data read completion command ABSRD OFF. At the same time, the absolute position read completion signal ABSRDC turns OFF.

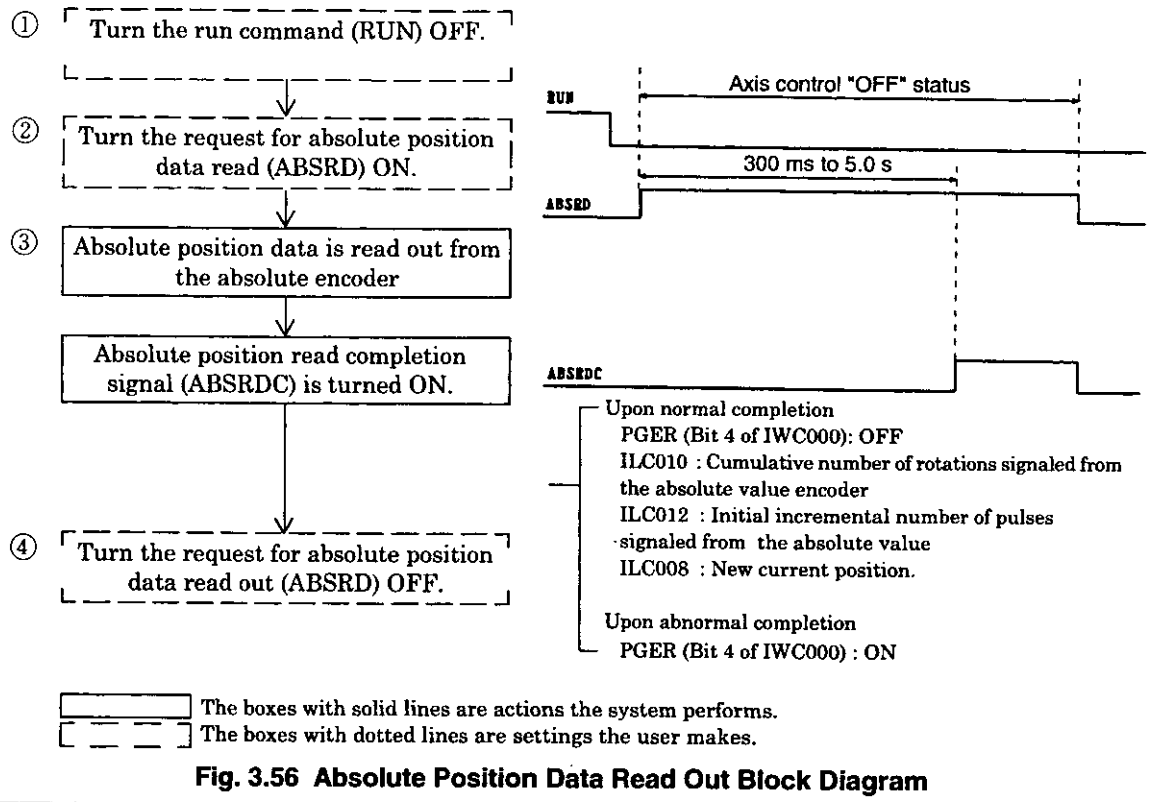


Fig. 3.56 Absolute Position Data Read Out Block Diagram

■ Example of a user program

Fig. 3.57 shows an example of a program flowchart.

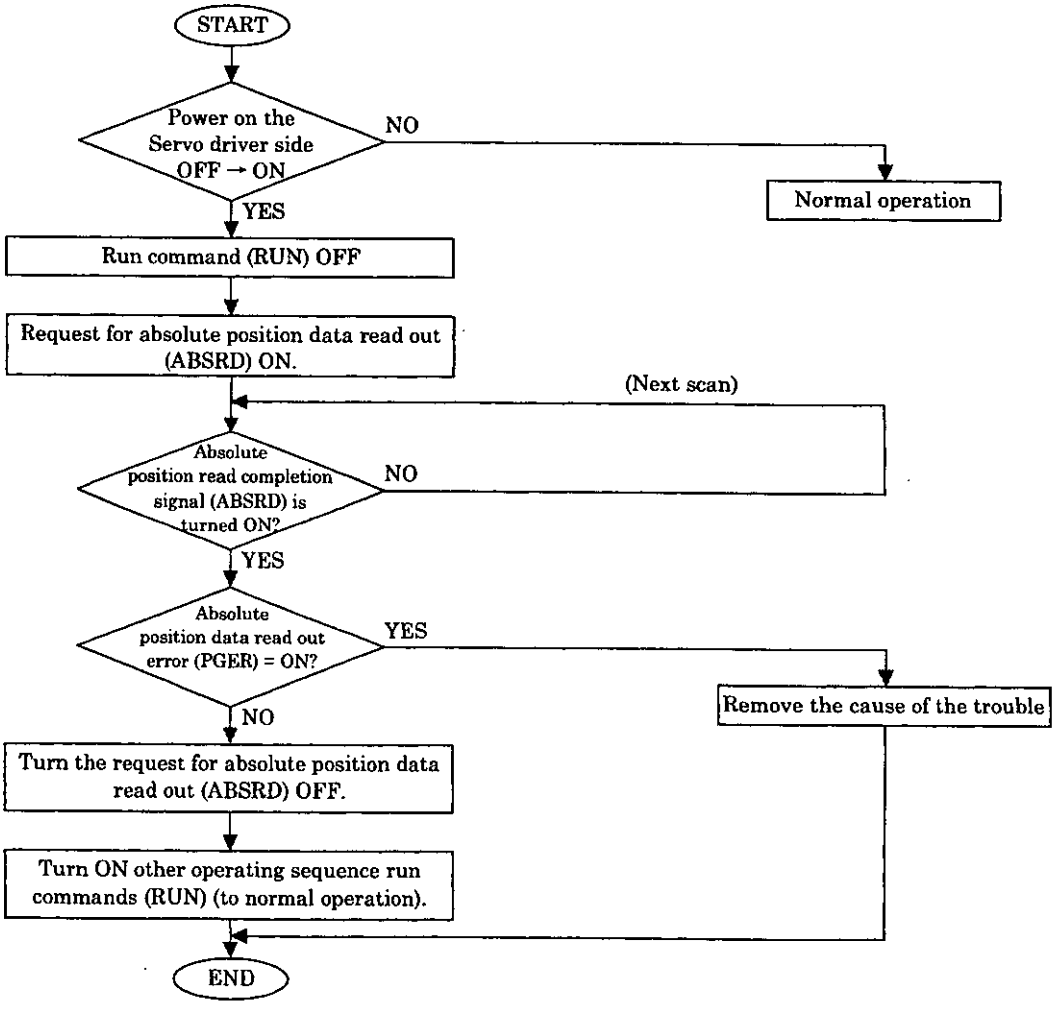
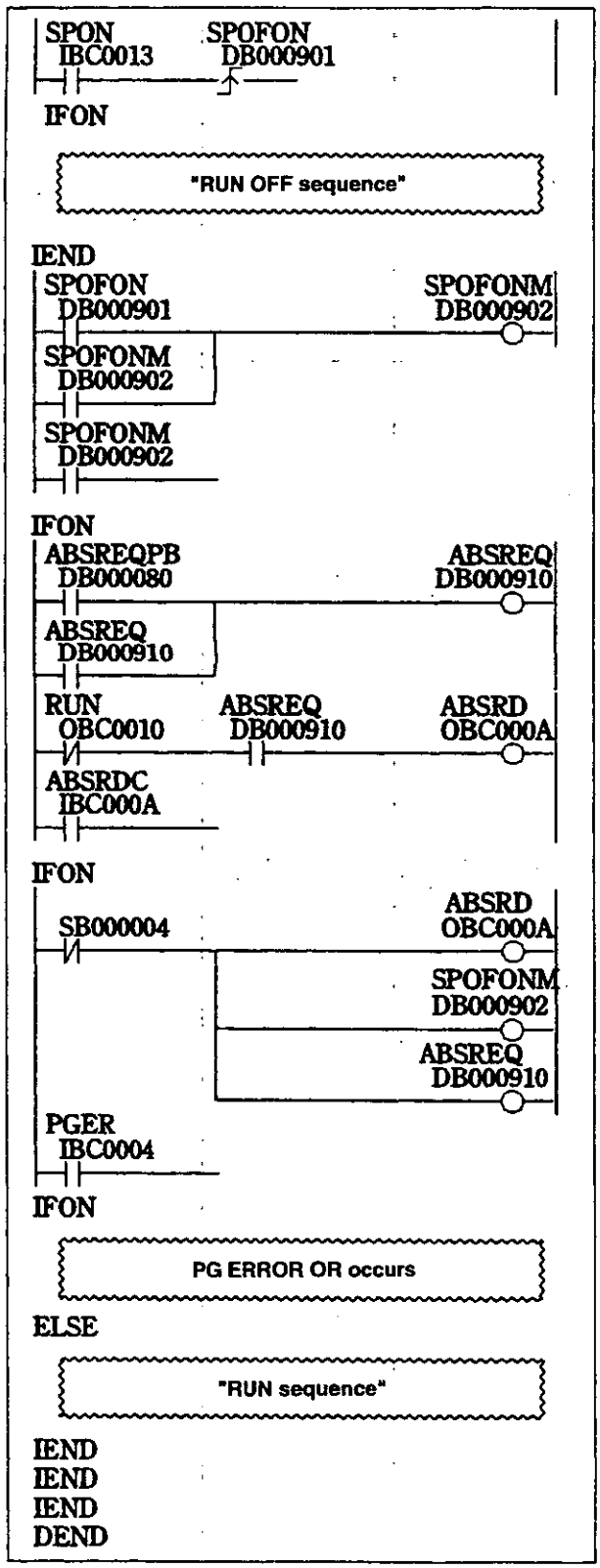


Fig. 3.57 Example of Flowchart for Reading out Absolute Position Data

In Fig. 3.57, the SERVOPACK at the 1st axis of module number 1 is used.
In addition, detection of a power cut off on the SERVOPACK side will be informed with an ALARM signal.
For details of the register (OW□□□□), refer to Chapter 5 "Servo Parameters."

Fig. 3.58 is an example of using a programming language to show the flowchart for reading out absolute position data in Fig. 3.57.



IBC0013: SERVOPACK ALARM signal (DI3)

Here the SERVOPACK ALARM signal is connected for detection of SERVOPACK power cut off.

DB000080: Absolute position request signal
This uses a push button.

When the SERVOPACK power is turned "ON" from "OFF" and the RUN command (OBC0010) is "OFF", pressing the push button (DB000080) turns the absolute position read-out request (OBC00A) "ON".

When the absolute position read out is completed (IBC000A is "ON"), the absolute position read out request (OBC000A) and other signals are reset.

If while reading out absolute position data, an error (IBC0004 is "ON") occurs, perform PG error occurrence process, and investigate the cause of the problem.

If absolute position data read out concludes normally, perform "RUN" sequence process, and restart operations.

Fig. 3.58 Example of Flowchart for Reading out Absolute Position Data (DWG L03)

The example of Fig. 3.58 is simplified, but actually each register type can be freely controlled with a user program.

3.4.7 Latch (DI Latch Detection) with External Signal of Pulse Count Value (Current Position)

The DI latch detection is the function for storing (latching) the current position in the memory register when an external signal enters (rising detection). Specific discrete input (DI input) or C-pulse input may be used as external signals. External signals are defined on the Fixed Parameter Setting screen of the CP-717 by designating the "DI latch detection signal selection." The DI latch detection function can only be used when the counter selection mode is set to basic counter.

(Note)
The DI latch detection is invalid during the operations using the motion commands of external positioning, zero point return, interpolation with position detecting function.

DI latch detection occurs as follows (refer to Fig. 3.59).

① Select the external input signal for the "DI latch detection signal selection" on the Fixed Parameter Setting screen of the CP-717.
② Turn the DI latch detection request DIINTREQ (Bit D of OWC000) "ON".
③ When an external signal is input, the current position at the rising edge of the external signal is informed to the DI detection position monitor PINT (ILC006). In addition, the DI latch completion signal DIINT (Bit B of IWC000) turns "ON".
④ Turn the DI latch detection request DIINTREQ (Bit D of OWC000) OFF.

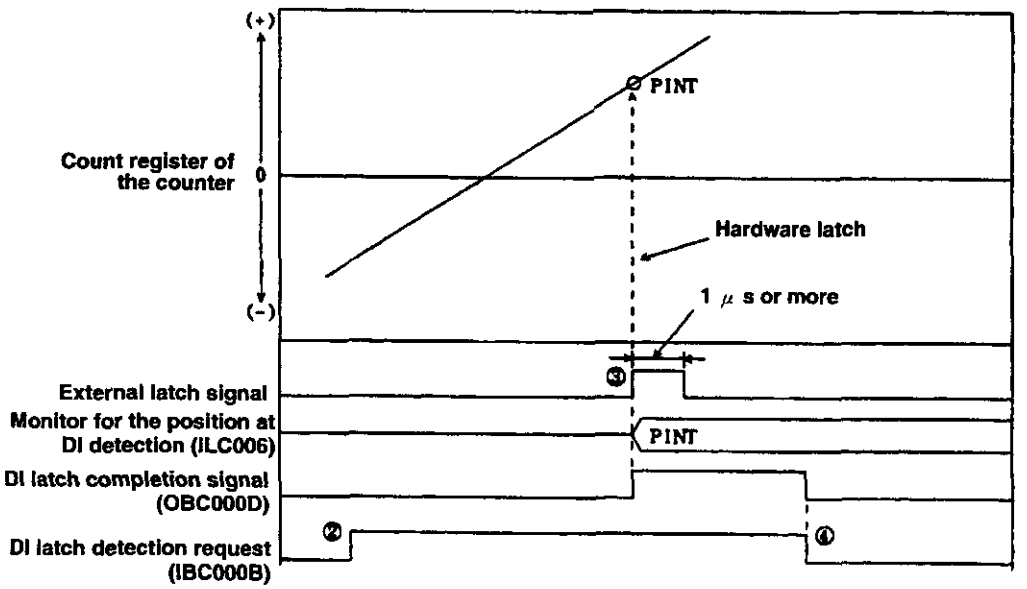


Fig. 3.59 DI Latch Detection

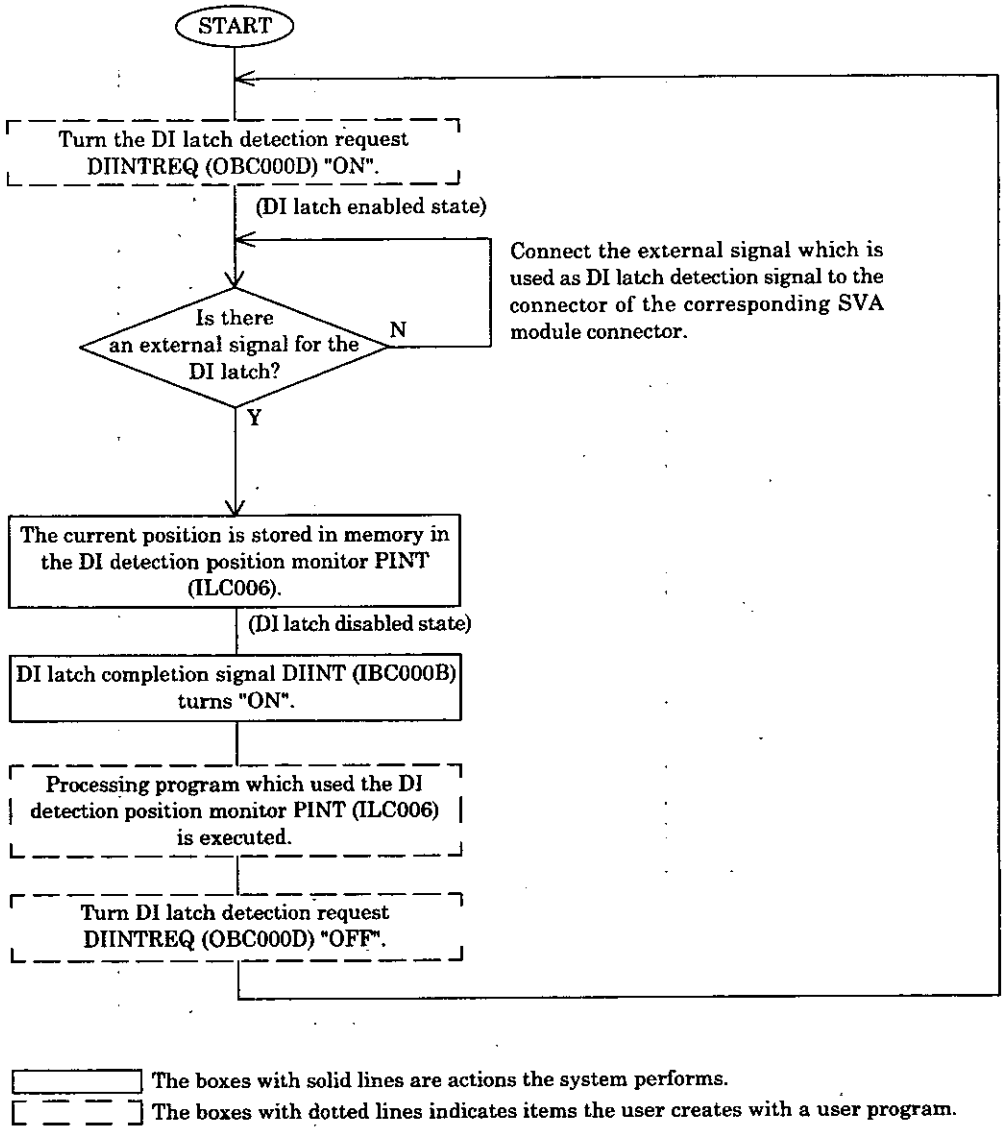
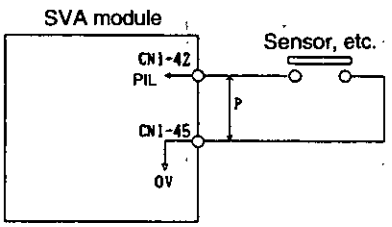
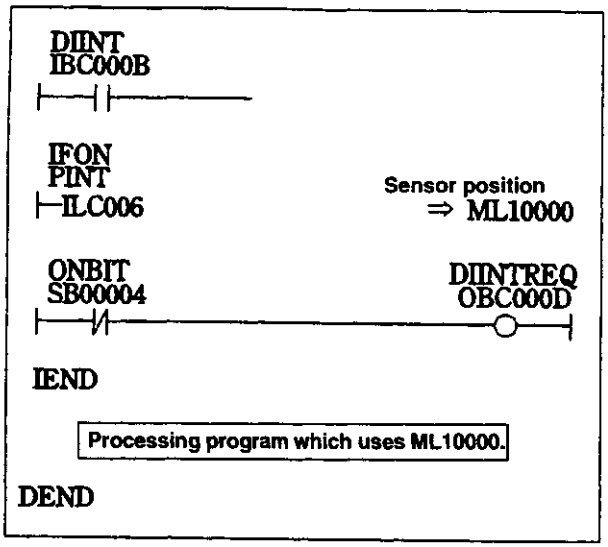


Fig. 3.60 DI Latch Detection Process

■ Example of a user program



PIL hardware lag time: approximately 40 μ s
Minimum pulse width for PIL: approximately 1 μ s
DI latch software detection lag time: none
(NOTE) Since each axis may be independently latched, even if all four axes are latched at the same time, it is the same as if only 1st axis was latched.



DI latch detection confirmation
[The sensor signal closes, and the current position is stored in memory at ILC006.]

ILC006 is stored in the register (ML10000) for internal processing.
The DI latch detection request resets.

Fig. 3.61 DI latch Detection User Program Example (DWG H01)

The example of Fig. 3.61 is simplified, but actually each register type can be freely controlled with a user program.

3.5 Coincident Output

Coincident output is the function of outputting a coincident output signal when the predetermined coincident detection setting and the current value of the counter coincide.
The coincidence output function can be used in the reversible counter, the interval counter, frequency measurement, or the basic counter.

(Note)
The coincident output function is enabled only when "pulse" is selected for the reference unit selection (Bit0 to 3 of servo fixed parameter No.17).

The coincidence output function performs as follows.

① Set the "Coincidence detection function use selection" to "Use (=1)" on the Fixed Parameter Setting screen of the CP-717.
② Set the coincident detection set value (OLC008).
③ Turn the coincident detection request (Bit E of OWC000) "ON".
④ At the point where the coincident detection set value and the current value of the counter coincide, the coincident output signal turns "ON," and is output (DO5). The coincident detection signal (BitE of IWC000) is turned "ON".
⑤ The coincident detection request (Bit E of OWC000) is turned "OFF."
When the coincident detection request is turned "OFF", the coincident output signal (DO5) and the coincident detection signal (Bit E of IWC000) are turned "OFF".

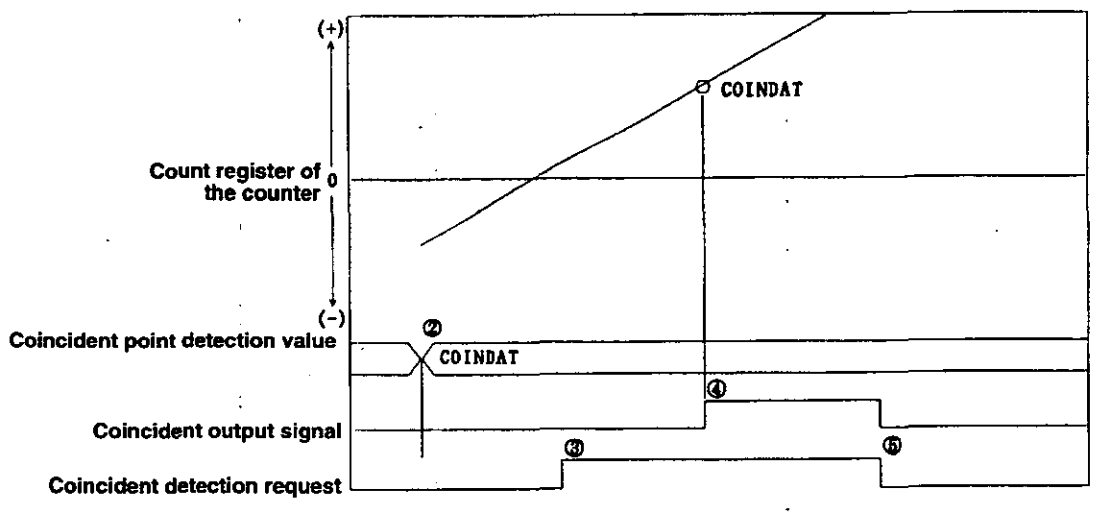


Fig. 3.62 Coincident Output

3.6 Monitoring Run Status (Control Data)

The run status, the position monitor, and the position deviation monitor for each axis are monitored. These monitored data are synchronized with the high-speed scan of the CPU module and informed to the I register. In addition, the SVA module is equipped with a general-purpose DI and general-purpose A/D converter. By connecting these to a Servo driver, Servo driver status, speed monitor, and torque monitor can be taken in. Since these are general-purpose DI and general-purpose A/D converters, they can be used in other applications. Refer to 5.1.3 "List of Servo Parameters for Monitor" and 5.2.3 "Details of Servo Parameters for Monitor."

3.6.1 Pressure Control Using A/D Converter

Here we would like to introduce an example of how torque monitoring informed to as monitored data can be used as a general-purpose A/D converter for pressure control.
Using this torque monitor as input, by creating a control loop with a user program, pressure control can be implemented.

■ Example of user program
With the torque monitor (A/D input) and the target value as inputs, a pressure control loop such as PID control is configured and a user program is created so that the output (control data) is set for the servo parameter of SVA module.
With SVA module referencing and outputting the servo parameter, a pressure control can be performed.

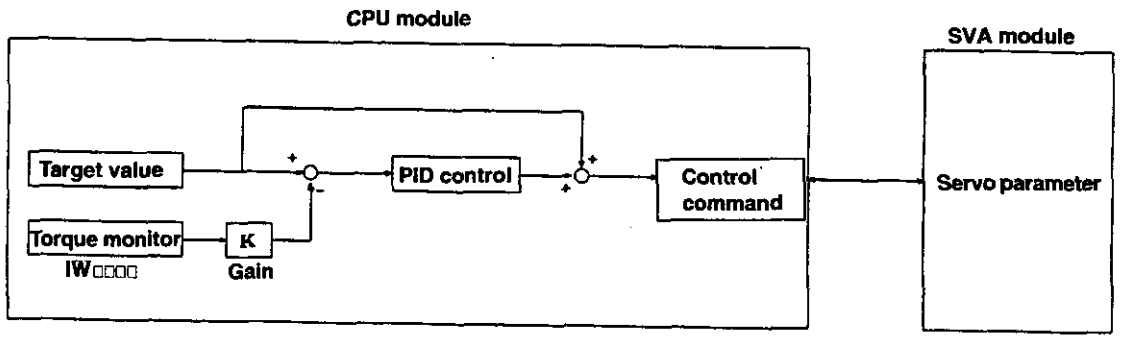


Fig. 3.63 Example of Controlling Pressure

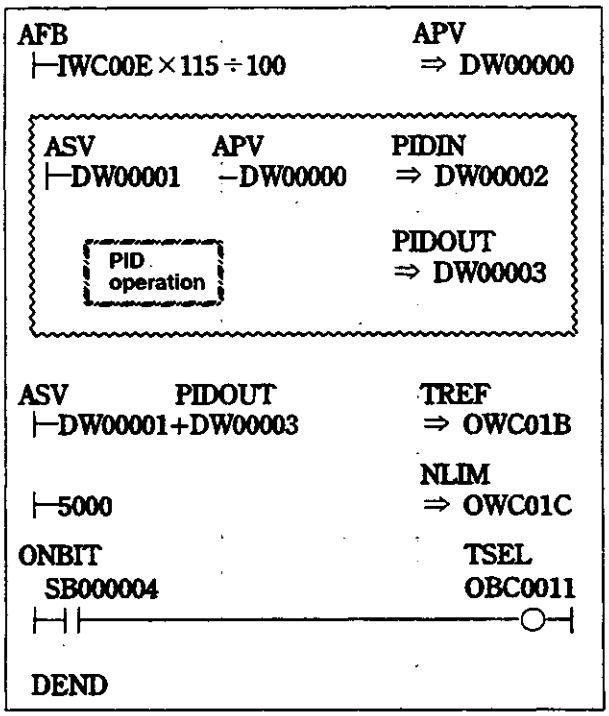
<Assumption>

Servo driver	: VS-866
Control mode	: Torque control
Input of voltage	: Torque monitor input (A/D input: 10 V/100%)

In the example of Fig. 3.63, the 1st axis of module number 1 is used.
Further, in order to use the torque monitor as general-purpose A/D converter for pressure monitor input, set the input voltage at the torque monitor (A/D) 100% to 10V on the Fixed Parameter Setting screen of CP-717.

Fig. 3.64 is an example of using a programming language to show the controlling pressure in Fig. 3.63. The registers used have the following meanings.

DW00000 :Pressure (pressure monitor input × gain)
DW00001 :Target value
DW00002 :PID input value
DW00003 :PID output value



Gain (K) = 1.15

The PID operation uses the PID command in programming.
Refer to the CP-9200SH Programming Manual (SIE-C879-40.3) for information on PID commands.

Setting torque references

Speed limit setting (NLIM) = 50%

OBC0011: DO1 is connected as the torque control mode reference (TSEL).

Fig. 3.64 Position Reference (DWG H03)

The example of Fig. 3.64 is simplified, but actually each register type can be freely controlled with a user program.

3.6.2 Position Indexing at less than One Revolution for Unidirectional Revolving Motors

We will explain the method of indexing the position (angle) of the mechanical (motor) axis which are continuously revolving in a single direction infinitely using the current position monitor (IL□□08). In general for the case of indexing mechanical position from the feedback pulse (current position: IL□□ 08) of the motor, this can be found from equation ①.

The remainder of :

$$\frac{\text{Feedback pulse - zero point position}}{\text{Number of pulse per mechanical axis 1 cycle}}$$ is the mechanical axis current position pulse ... ①

If the axis is rotating indefinitely in a single direction, to express the feedback pulse (current position) as a finite number, if the point where the feedback pulse sign is changed is passed, according to equation ① the operation is not realized. In the CP-9200SH since the feedback pulse (current position) is expressed in 32 bits, equation ① is no longer realized at the point of changing from $+2^{31}-1 \rightarrow -2^{31}$ (Refer to Fig. 3.65).

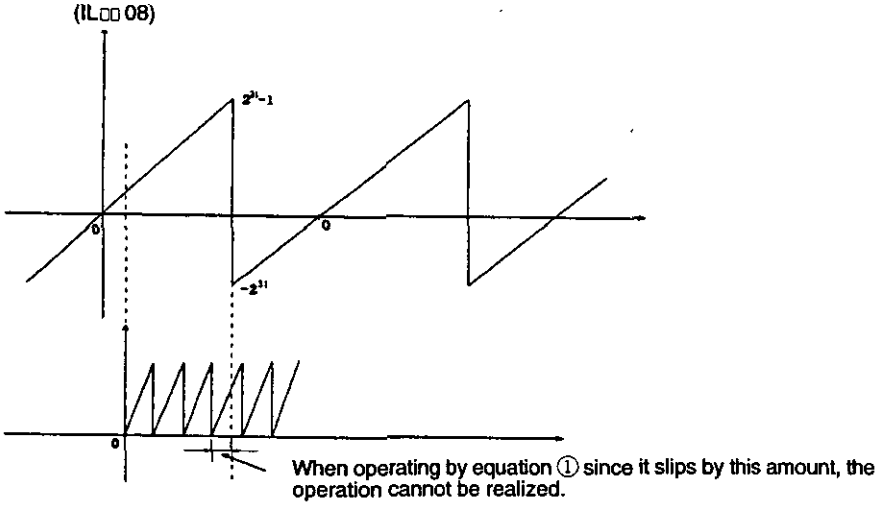


Fig. 3.65 Feedback Pulse

To cancel this, use not division but subtraction.
These are summarized in user functions so they can be used on any axis. By doing this, it becomes even more generic, and easier to use. Fig. 3.66 shows function definitions.

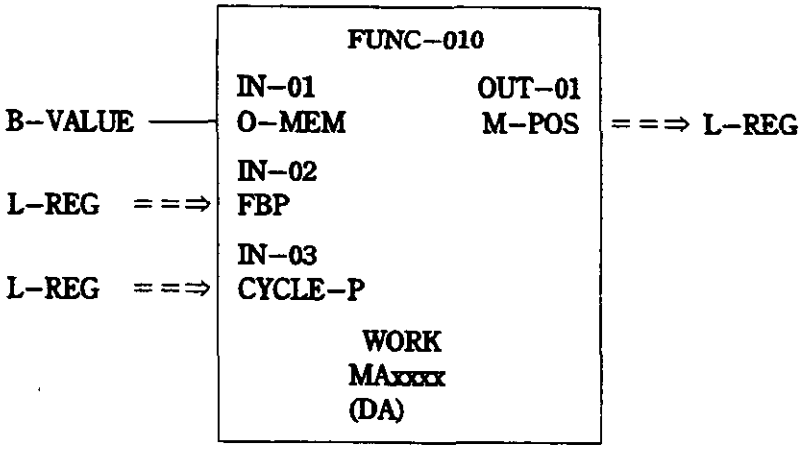


Fig. 3.66 User Function Definitions

Table 3.14 gives the input and output I/F, and Table 3.15 the work register contents of MA□□□ used by the user functions.

Table 3.14 Input and Output I/F

	Register No.	Contents	Data format	Contents
Input	MB000000	Zero point memory	B-VALUE	Set "ON" to store the zero point in memory
	XL00001	Feedback pulse	L-REG	Motor feedback pulse (current position) usually IL□□08 is input.
	XL00003	Machine one cycle pulse	L-REG	Set number of pulses per mechanical axis 1 cycle. (For example, the number of pulses between 0° and 360° on the mechanical axis.)
Output	YL00001	Mechanical axis position	L-REG	The mechanical axis position is output by number of motor axis pulses.

Table 3.15 Work register

	Register No.	Contents	Data format	Contents
Work	AW00000	Bit information	Bit data	
	AL00001	Zero point memory	Double-length integer	When the zero point storing operation is performed (XB000000 is "ON"), the feedback pulse (XL00001) is stored.
	AL00003	Zero point for operation	Double-length integer	

An example of a user function program is shown in Fig. 3.67.

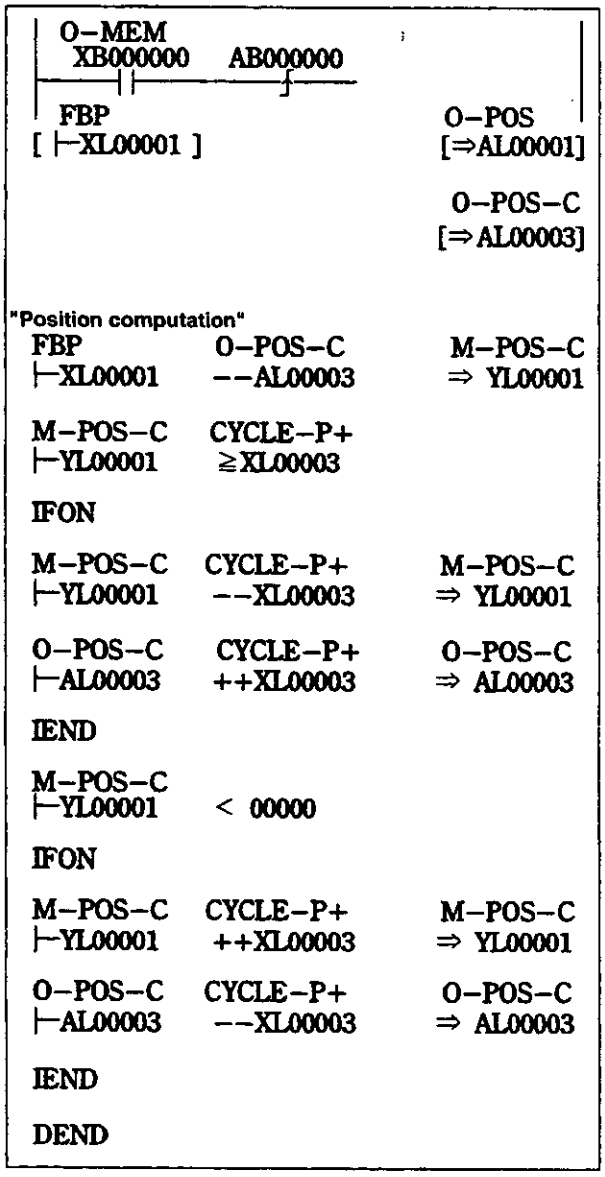
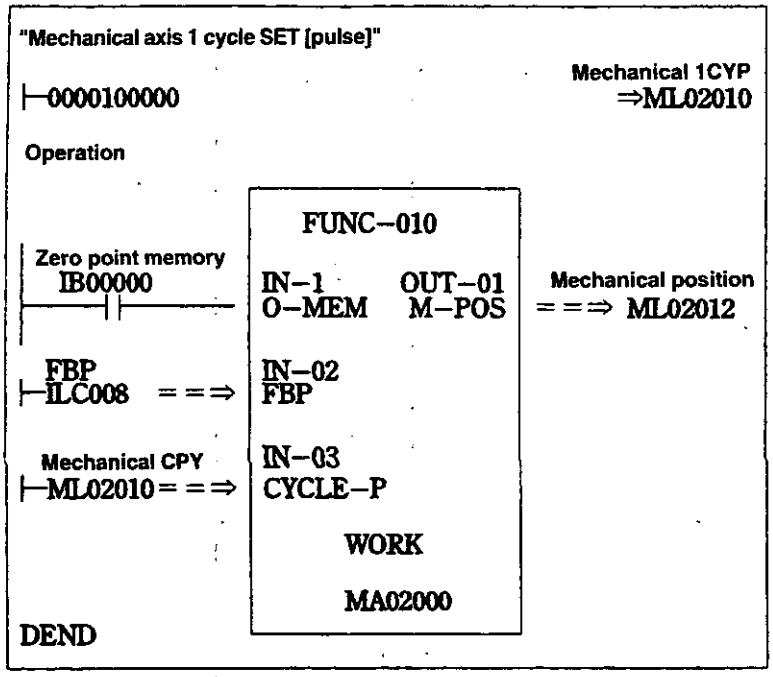


Fig. 3.67 User Function Program (FUNC-010)

Fig. 3.68 shows a DWG program which calls a user function program.



Number of pulses for the machine 1 cycle [pulses].

Mechanical axis position detection

Mechanical axis position [pulse]

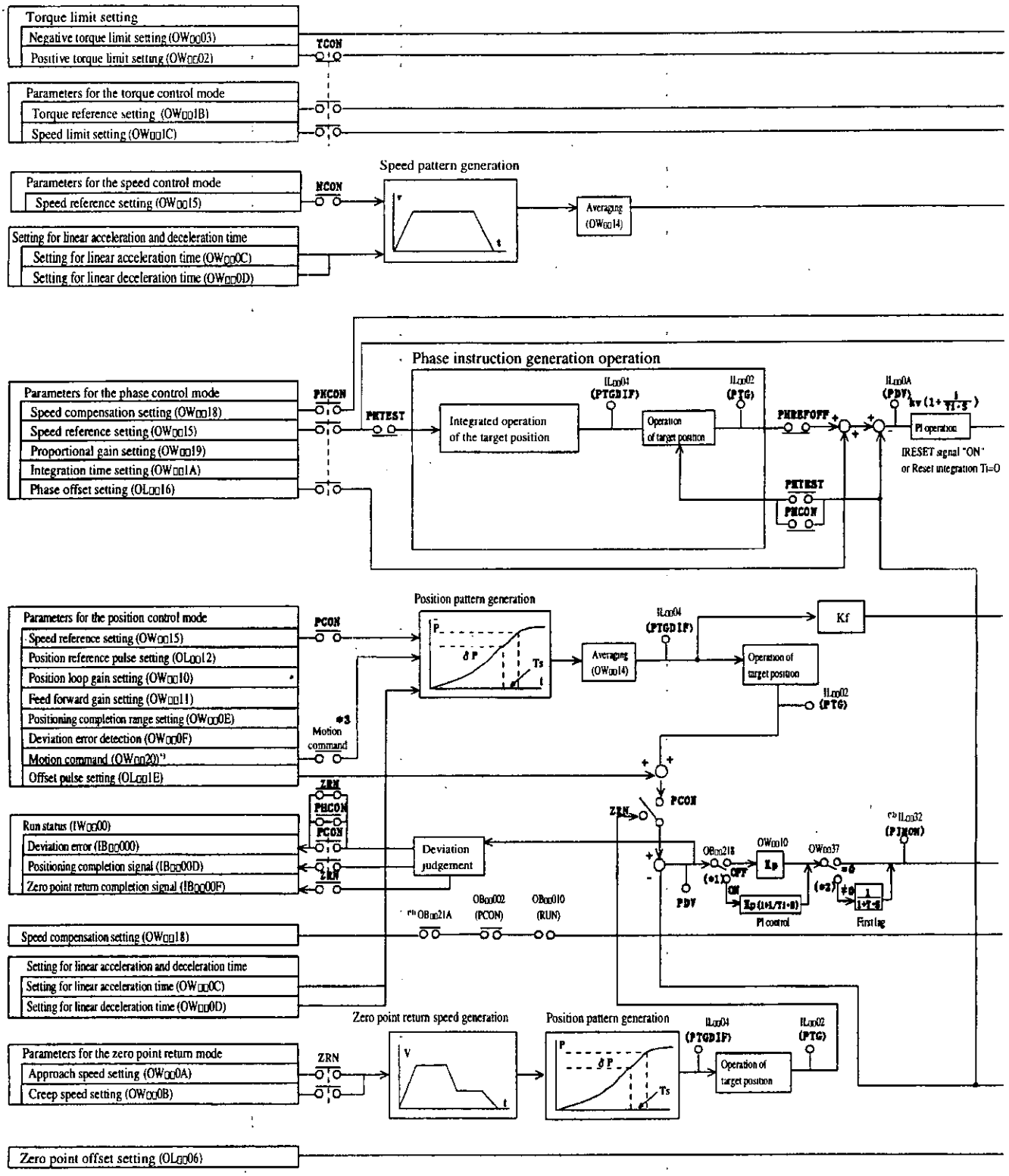
ILC008: Feedback pulse for the first axis of module number 1 (current position).

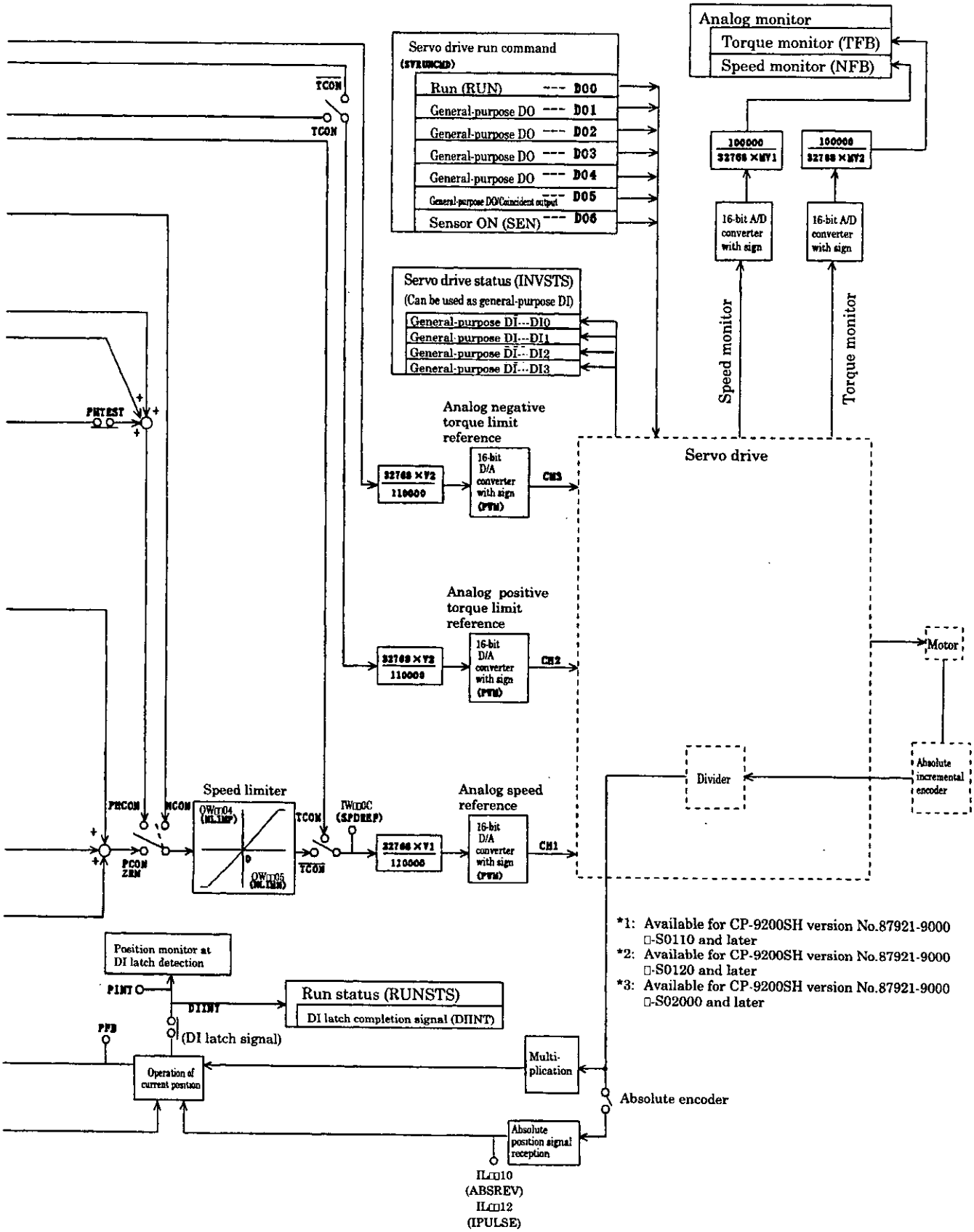
Fig. 3.68 DWG Program (DWG.L10)

4 CONTROL BLOCK DIAGRAM

This chapter contains full control block diagrams. Use them in creating and debugging application programs.

CP-9200SH SVA module block diagram





*1: Available for CP-9200SH version No.87921-9000 □-S0110 and later
*2: Available for CP-9200SH version No.87921-9000 □-S0120 and later
*3: Available for CP-9200SH version No.87921-9000 □-S02000 and later

5 SERVO PARAMETERS

This chapter contains classification and functions of servo parameters. Use these lists when setting servo parameters.

5.1 Servo parameter list

The parameter specifications are the same for each axis. Each axis (1 to 4) register number is th
register number from the table with the offset number added to it. The offset (axis ofs) of each axis i
(axis number − 1) × 40H (64 words). Also, the register number "□□" differs depending on the modul
number. For details, refer to 1.3 "Module number and servo parameter register numbers".
All the set values are automatically set to the default values when the power is turned ON. For eac
setting item, if data outside of the setting range is set, operation is performed with the value limited t
within the setting range.

(Note)
Registers of different module numbers are not continuous.
If the module number is the same, the registers between the axes are continuous. Use subscript
(i, j) in user programs with care.

(Example)
With ⊦IW(OW)C000i, where i = 0 to 255, the register number can be correctly read out.
With IW(OW)C000, the register number can be correctly read and written within the registe
range of module No. 1; IW(OW)C000 to IW(OW)C0FF. Where i ≧ 256, it can not be correctly rea
out.

5.1.1 Servo fixed parameter list

These are parameters which, so long as the machine configuration and specifications are not changed
are not normally changed once they are set. They are set on the Fixed Parameter Setting screen in th
CP-717.

(Note)
The servo fixed parameters can not be changed when the current value of Bit 0 of "Servo drive ru
command (OW□□01)" is "ON". Note that changing the servo fixed parameter initializes items suc
as the current information.

Table 5.1 Servo fixed parameter list

No	Name	Setting	Meanings	Mode for which data is valid														
								Position control mode										
								Selection to use motion command code (OB□□008) *2										
									Motion command code (OW□□20) valid *2									
				Zero point return mode	Speed control mode	Torque control mode	Phase control mode	Invalid	Positioning	External positioning	Zero point return	Interpolation	Latch	Constant speed feed	Constant step feed	Reversible counter	Interval counter	Frequency measurement
1	Axis use selection (USESEL)	0 or 1 (Default = 0)	0: Unused 1: Used	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
2	PG input signal form selection (PGSEL)	Bit 0 to 3: ABPGSEL (Default = 0)	Pulse input signal form selection 0: +5 V differential input 1: +12 V pull-up type collector input	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
		4 to 7: Not used (Default = 0)	—															
		8: ABPISEL (Default = 0)	A/B pulse input signal polarity selection *2 0: Positive logic 1: Negative logic	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
		9: CPISEL (Default = 0)	C pulse input signal polarity selection *2 0: Positive logic 1: Negative logic	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
		10 to 15: Not used (Default = 0)	—															
3	Encoder selection (ENCSEL)	0 to 2 (Default = 0)	0: Incremental encoder 1: Absolute value encoder 2: Absolute value encoder (Used as incremental type)	○	○	○	○	○	○	○	○	○	○	○	○			
4	Selection of rotation direction for when absolute value encoder is used (DIRINV)	0 or 1 (Default = 0)	0: Forward 1: Reverse	○	○	○	○	○	○	○	○	○	○	○	○			
5	Pulse calculation method selection (PULMODE)	0 to 6 (Default = 6)	0: Sign method (Single) 1: Sign method (Double) 2: Up/Down method (Single) 3: Up/Down method (Double) 4: A/B method (Single) 5: A/B method (Double) 6: A/B method (Quadruple)	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
6	Counter mode selection (CNTMODE)	0 to 3 (Default = 3)	0: Reversible counter 1: Interval counter 2: Frequency measurement 3: Basic counter	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
7	Rated speed setting (NR)	1 to 32000 (Default = 3000)	1=1 r/min	○	○	○	○	○	○	○	○	○	○	○	○			
8	Feedback pulses per revolution setting (FBppr)	4 to 65532 in multiples of 4 (Default = 2048)	1=1 pulse/rev Note: Set the value before multiplication.	○	○	○	○	○	○	○	○	○	○	○	○			
9	D/A output voltage setting for when speed is 100% (V1)	1 to 10 (Default = 6)	1=1 V	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
10	D/A output voltage setting for when torque limit is 100% (V2)	1 to 10 (Default = 3)	1=1 V	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
11	Input voltage setting for when speed monitor (A/D) is 100% (MV1)	1 to 10 (Default = 6)	1=1 V	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○

(continued)

Table 5.1 Servo fixed parameter list (Cont'd)

No	Name	Setting	Meanings	Mode for which data is valid																
								Position control mode												
								Selection to use motion command code (OB□□008) *2												
									Motion command code (OW□□20) valid *2											
				Zero point return mode	Speed control mode	Torque control mode	Phase control mode	Invalid	Positioning	External positioning	Zero point return	Interpolation	Latch	Constant speed feed	Constant step feed	Reversible counter	Interval counter	Frequency measurement
12	Input voltage setting for when torque monitor (A/D) is 100% (MV2)	1 to 10 (Default = 3)	1=1 V	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
13	DI latch detection signal selection (DIINTSEL)	0 or 1 (Default = 0)	0: DIINT input signal 1: C pulse input signal	○	○	○	○	○	○			○		○	○			
14	Additional function selection (AFUNCSEL)	Bit 0: COINSEL (Default = 0)	Selection to use coincident detection function 0: NOT USE 1: USE	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
		1 to 5: Not used (Default = 0)	Absolute position data read-out at power ON *2 0: Execute 1: Not execute															
		6: ABSRDSEL (Default = 0)	—	○	○	○	○	○	○	○	○	○	○	○	○			
		7: MCMDSEL (Default = 0)	Selection to use motion command code *2 0: NOT USE 1: USE	○	○	○	○	○	○	○	○	○	○	○	○			
		8: CCNTSEL (Default = 0)	C-pulse input counting disabled *3 0: C-pulse input counting disabled 1: C-pulse input counting enabled													○		
		9: (Default = 0)	Σ II series SERVOPACK selection *4	○	○	○	○	○	○	○	○	○	○	○	○			
		10 to 15: Not used (Default = 0)	—															
15	Frequency coefficient (HZSEL)	0 to 3 (Default = 2)	0: ×1 (1=1 Hz) 1: ×10 (1=0.1 Hz) 2: ×100 (1=0.01 Hz) 3: ×1000 (1=0.001 Hz)															○
16	Simulation mode selection (SIMULATE)	0 to 2 (Default = 0)	0: Normal operation mode 1: Simulation mode (O output) 2: Output adjustment mode (with output) *1	○	○	○	○	○	○	○	○	○	○	○	○			
17	Motion controller function selection flag (SVFUNCSEL)*2	Bit 0 to 3: CMD_UNIT (Default = 0)	Reference unit selection 0: pulse (electric gear invalid) 1: mm 2: deg 3: inch	Set 0 (pulse) when the motion command (OW□□20) is not used.					○	○	○	○	○	○	○			
		4: USE_GEAR (Default = 0)	Electric gear selection 0: Invalid 1: Valid						○	○	○	○	○	○	○			
		5: PMOD_SEL (Default = 0)	Axis selection 0: Finite length axis 1: Infinite length axis	Set 0 (finite length axis) when the motion command (OW□□20) is not used.					○	○	○	○	○	○	○			
		6: USE_BKRSH (Default = 0)	Backlash compensation selection 0: Invalid 1:Valid						○	○	○	○	○	○	○			
		7: USE_SLIMP (Default = 0)	Soft limit (positive direction) selection 0: Invalid 1: Valid						○	○	○	○	○	○	○			
		8: USE_SLIMN (Default = 0)	Soft limit (negative direction) selection 0: Invalid 1: Valid						○	○	○	○	○	○	○			

(continued

Table 5.1 Servo fixed parameter list (Cont'd)

No	Name	Setting	Meanings	Mode for which data is valid														
									Position control mode									
									Selection to use motion command code (OB□□ 008) *2									
										Motion command code (OW□□ 20) valid *2									
				Zero point return mode	Speed control mode	Torque control mode	Phase control mode	Invalid	Positioning	External positioning	Zero point return	Interpolation	Latch	Constant speed feed	Constant step feed	Reversible counter	Interval counter	Frequency measurement
17	Motion controller function selection flag (SVFUNCSEL)*2	Bit 9: USE_OV (Default = 0)	Override selection 0: Invalid 1: Valid						○	○	○	○	○	○	○			
		10:INV_DEC (Default = 0)	Deceleration LS reversing rotation selection 0: Not reverse rotation 1: Reverse rotation	○							○							
		11 to 15: Not used (Default = 0)	—															
18	Number of digits below decimal point (DECNUM) *2	0 to 5 (Default = 3)	Set the number of digits below decimal point for reference (eg.) When the number of digits below decimal point is 3, mm: 1 reference unit = 0.001 mm deg: 1 reference unit = 0.001 deg inch: 1 reference unit = 0.001 inch By the settings of this parameter and "reference unit selection (refer to the servo fixed parameter No.17)", the minimum reference unit is determined. However, the minimum reference unit for pulse is not influenced by this parameter.						○	○	○	○	○	○	○			
19	Travel amount per machine 1 rotation (PITCH) *2	1 to $2^{31} - 1$ (Default = 10000)	1 = 1 reference unit						○	○	○	○	○	○	○			
20	Motor side gear ratio (GEAR_MOTOR) *2	1 to 65535 (Default = 1)	1 = 1 rotation						○	○	○	○	○	○	○			
21	Machine side gear ratio (GEAR MACHINE) *2	1 to 65535 (Default = 1)	1 = 1 rotation						○	○	○	○	○	○	○			
22	Infinite length axis reset position (POSMAX) *2	1 to $2^{31} - 1$ (Default = 360000)	1 = 1 reference unit						○	○	○	○	○	○	○			
23	Maximum rotating amount of absolute encoder (MAXTURN) *2	1 to $2^{31} - 1$ (Default = 99999)	1 = 1 rotation						○	○	○	○	○	○	○			
24	Soft limit value (positive direction) (SLIMP) *2	-2^{31} to $2^{31} - 1$ (Default = $2^{31} - 1$)	1 = 1 reference unit						○	○	○	○	○	○	○			
25	Soft limit value (negative direction) (SLIMN) *2	-2^{31} to $2^{31} - 1$ (Default = -2^{31})	1 = 1 reference unit						○	○	○	○	○	○	○			

(continued)

Table 5.1 Servo fixed parameter list (Cont'd)

No	Name	Setting	Meanings	Mode for which data is valid														
								Position control mode										
								Selection to use motion command code (OB□□008) *2										
									Motion command code (OW□□20) valid *2									
				Zero point return mode	Speed control mode	Torque control mode	Phase control mode	Invalid	Positioning	External positioning	Zero point return	Interpolation	Latch	Constant speed feed	Constant step feed	Reversible counter	Interval counter	Frequency measurement
26	Zero point return method (ZRETSEL) *2	0 to 7 (Default = 0)	0: DEC1 signal (with switch width) + C pulse 1: Not used 2: Not used 3: C pulse 4: Not used 5: Not used 6: DEC2 signal (without switch width) + C pulse 7: DEC1 signal (with switch width) + LMT (limit for zero point return) signal + C pulse This is valid only when the motion command (OW□□20) is used for the zero point return (ZRET).								○							
27	Backlash compensation value (BKLSH) *3	0 to 32767 (Default = 0)	1 = 1 reference unit						○	○	○	○	○	○	○			

*1: Available for CP-9200SH version No. 87921-9000□-S0110 and later
*2: Available for CP-9200SH version No. 87921-9000□-S0200 and later
*3: Available for CP-9200SH version No. 87921-9000□-S0206 and later

5.1.2 List of Servo Parameters for Settings

These parameters are used for the commands to SVA module.
They are sent in batch to SVA module at the head of high-speed scan. Only setting the parameters in this register range allows the motion control.

(Note)
Registers of different module numbers are not continuous.
If the module number is the same, the registers between the axes are continuous. Use subscripts (i, j) in user programs with care.

(Example)
With ⊢IW(OW)C000i, where i = 0 to 255, the register number can be correctly read out.
With IW(OW)C000, the register number can be correctly read and written within the register range of module No. 1; IW(OW)C000 to IW(OW)C0FF. Where i ≧ 256, it can not be correctly read out.

Table 5.2 List of Servo Parameters for Settings

No	Name	Register No.		Setting Range	Meanings	Mode for which data is valid														
										Position control mode									
										Selection to use motion command code (OB□□008) *3									
											Motion command code (OW□□20) valid *3									
						Zero point return mode	Speed control mode	Torque control mode	Phase control mode	Invalid	Positioning	External positioning	Zero point return	Interpolation	Latch	Constant speed feed	Constant step feed	Reverisible counter	Interval counter	Frequency measurement
1	Run mode setting (RUNMOD)	OW□□00																		
		Bit	0	NCON (Default = 0)	Speed control mode		○													
			1	TCON (Default = 0)	Torque control mode			○												
			2	PCON (Default = 0)	Position control mode					○	○	○	○	○	○	○	○			
			3	PHCON (Default = 0)	Phase control mode				○											
			4	ZRN (Default = 0)	Zero point return mode	○														
			5	PHTEST (Default = 0)	Phase control test signal				○											
			6	ACR (Default = 0)	Alarm clear 1: Alarm clear request	Always valid														
			7	PHREFOF (Default = 0)	Phase reference generating operation invalid				○											
			8	MCDSEL (Default = 0) *3	0: Motion command code (OW□□20) invalid 1: Motion command code (OW□□20) valid	Valid when Bit7 (selection to use motion command code) of servo fixed parameter No. 14 "Additional function selection" is set to "USE" and in the position control mode (OB□□002 is "ON")														
			9	ZRNDIR (Default = 0)	Zero point return direction selection 0: Negative (decrement) direction 1: Positive (increment) direction	○							○							
			10	ABSRD (Default = 0)	Absolute position read-out request	Valid when Run (OB□□010 is "OFF")														
			11	CNTDIS (Default = 0)	Counting disabled													○	○	
					Feedforward compensation for control mode change *13					○	○	○	○	○	○	○	○			
			12	PRSREQ (Default = 0)	Count value preset request *4													○		
			13	DIINTREQ (Default = 0)	DI latch detection request *5	○	○	○	○	○	○			○		○	○			

(continued)

Table 5.2 List of Servo Parameters for Settings (Cont'd)

No	Name	Register No.		Setting Range	Meanings	Mode for which data is valid														
										Position control mode										
										Selection to use motion command code (OB□□008) *3										
											Motion command code (OW□□20) valid *3									
						Zero point return mode	Speed control mode	Torque control mode	Phase control mode	Invalid	Positioning	External positioning	Zero point return	Interpolation	Latch	Constant speed feed	Constant step feed	Reversible counter	Interval counter	Frequency measurement
1	Run mode setting (RUNMOD)	Bit	14	COINREQ (Default = 0)	Coincident detection request *6	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
			15	RESET (Default = 0)	Phase control integration reset				○											
2	Servo drive run command setting (SVRUNCMD)	OW□□01																		
		Bit	0	RUN (DO0) (Default = 0)	Servo "ON"	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
			1	DO1 (Default = 0)	General-purpose DO	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
			2	DO2 (Default = 0)	General-purpose DO	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
			3	DO3 (Default = 0)	General-purpose DO	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
			4	DO4 (Default = 0)	General-purpose DO	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
			5	CNTCOIN/ DO5 (Default = 0)	Coincident detection signal or general-purpose DO	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
			6 to 11	Not used (Default = 0)	Always set to "0".															
			12	USE_BUF (Default = 0)	Position reference value selection *3 0: OL□□12 1: Position buffer						○	○		○	○					
			13	SPDTYPE (Default = 0)	Speed reference value selection *3 0: For rapid feed speed, OL□□22 is valid. The unit of approach speed (OW□□0A) and creep speed (OW□□0B) is 1 = 10n reference unit/min. 1: For rapid feed speed, OW□□15 is valid. The unit of approach speed (OW□□0A) and creep speed (OW□□0B) is 1 = 0.01 %						○	○	○			○	○			
			14	XREFTYPE (Default = 0)	Position reference type *3 0: Position reference (OL□□12) by absolute position type 1: Position reference (OL□□12) by adding incremental value type						○	○		○	○					
			15	LSDEC (Default = 0)	Zero point return deceleration point limit switch signal	○							○							
3	Positive side torque limit setting (TLIMP)	OW□□02		− 32768 to 32767 (Default = − 30000)	1 = 0.01% (− 30000 = − 300.00%)	○	○		○	○	○	○	○	○	○	○	○	○	○	○
4	Negative side torque limit setting (TLIMN)	OW□□03		− 32768 to 32767 (Default = 30000)	1 = 0.01% (30000= 300.00%)	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○

(continued)

Table 5.2 List of Servo Parameters for Settings (Cont'd)

No	Name	Register No.	Setting Range	Meanings	Mode for which data is valid														
									Position control mode										
									Selection to use motion command code (OB□□008) *3										
										Motion command code (OW□□20) valid *3										
					Zero point return mode	Speed control mode	Torque control mode	Phase control mode	Invalid	Positioning	External positioning	Zero point return	Interpolation	Latch	Constant speed feed	Constant step feed	Reversible counter	Interval counter	Frequency measurement
5	Positive side speed limiter (NLIMP) *7	OW□□04	0 to 32767 (Default = 15000)	1 = 0.01% (15000 = 150.00%)	○	○		○	○	○	○	○	○	○	○	○			
6	Negative side speed limiter (NLINMN) *7	OW□□05	0 to 32767 (Default = 15000)	1 = 0.01% (15000 = 150.00%)	○	○		○	○	○	○	○	○	○	○	○			
7	Zero point offset *8 or counter preset data (ABSOFF)	OL□□06	-2^{31} to $2^{31}-1$ (Default = 0)	1 = 1 reference unit In units of pulse, 1 = 1 pulse.	○	○	○	○	○	○	○	○	○	○	○	○	○		
8	Coincident detection set value (COINDAT)	OL□□08	-2^{31} to $2^{31}-1$ (Default = 0)	1 = 1 pulse	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
9	Approach speed setting (Napr)	OW□□0A	0 to 32767 (Default = 0)	The unit differs depending on the speed reference value selection (OB□□01D). *5	○							○							
10	Creep speed setting (Nclp)	OW□□0B	0 to 32767 (Default = 0)	When the speed reference value selection = "0", 1 = 10^n reference unit/min (n = number of digits below decimal point) In units of pulse: 1 = 1000 pulses/min. In units of mm: 1 = 1 mm/min In units of deg: 1 = 1 deg/min In units of inch: 1 = 1 inch/min When the speed reference value selection = 1, 1 = 0.01 % (1000 = 10.00 %) In zero point return mode, 1 = 0.0 %	○							○							
11	Linear acceleration time (NACC)	OW□□0C	0 to 32767 (Default = 0)	1 = 1 ms (300 = 0.300s)	○	○			○	○	○	○			○	○			
12	Linear deceleration time (NDEC) *9	OW□□0D	0 to 32767 (Default = 0)	1 = 1 ms (300 = 0.300s)	○	○		○	○	○	○	○			○	○			
13	Positioning completion range (PEXT)	OW□□0E	0 to 65535 (absolute value) (Default = 10)	1 = 1 reference unit In units of pulse, 1 = 1 pulse	○				○	○	○	○	○	○	○	○			
14	Deviation error detection value (EOV)	OW□□0F	0 to 65535 (absolute value) (Default = 65535)	1 = 1 pulse (0 = Without deviation error detection *2)	○			○	○	○	○	○		○	○	○			

(continued)

Table 5.2 List of Servo Parameters for Settings (Cont'd)

No	Name	Register No.	Setting Range	Meanings	Mode for which data is valid															
									Position control mode											
									Selection to use motion command code (OB□□008) *3											
										Motion command code (OW□□20) valid *3											
					Zero point return mode	Speed control mode	Torque control mode	Phase control mode	Invalid	Positioning	External positioning	Zero point return	Interpolation	Latch	Constant speed feed	Constant step feed	Reversible counter	Interval counter	Frequency measurement
15	Position loop gain (kp)	OW□□10	0 to 32767 (Default = 300)	1 = 0.1/s (300=30.0)	○				○	○	○	○	○	○	○	○			
16	Feed forward gain (kf)	OW□□11	0 to 200 (Default = 0)	1 = 1 % (10 = 10 %)					○	○	○	○	○	○	○	○			
17	Position reference setting (XREF) or Position buffer number	OL□□12	-2^{31} to $2^{31}-1$ (Default = 0)	1 = 1 reference unit In units of pulse, 1 = 1 pulse When position reference value selection (OB□□01C) = 1, position buffer number (1 to 256) *3					○	○ ○	○ ○		○ ○	○ ○					
18	Averaged number of times (NUM)	OW□□14	(1) In position control mode when speed control mode and motion command are invalid, S-curve (averaging travel) time constant 0 to 255 (1 = 1 time) (0 = 1 = No averaging)			○			○										
			(2) When Bit4 to 7 of OW□□21 are "2", S-curve (averaging travel) time constant *3 0 to 255 (1 = 1 time) (0 = 1 = No averaging)							○	○		○	○	○	○			
			(3) When Bit4 to 7 of OW□□21 are "1", exponential acceleration/deceleration time constant *3 0 to 32767 (1 = 1 ms)										○	○					
19	Speed reference (NREF) *11	OW□□15	− 32768 to 32767 (Default = 0)	1 = 0.01 % (5000 = 50.00%)		○		○	○	Valid when OB□□01D is "ON".										
										○	○	○			○	○			
20	Phase offset (PHBIAS)	OL□□16	-2^{31} to $2^{31}-1$ (Default = 0)	1=1 pulse				○											
21	Speed offset (NCOM)	OW□□18	− 32768 to 32767 (Default = 0)	1 = 0.01 % (100 = 1.00 %)				○	○	○	○	○	○	○	○	○			
22	Proportional gain (Pv)	OW□□19	0 to 32767 (Default = 0)	1 = 0.1/s (300 = 30.0)				○											
23	Integration time (Ti)	OW□□1A	0 to 32767 (Default = 0)	1 = 1 ms (0 = No integration) (300 = 0.300 s)				○											
24	Torque reference (TREF)	OW□□1B	− 32768 to 32767 (Default = 0)	1 = 0.01 % (10000 = 100.00 %)			○												
25	Speed limit (NLIM)	OW□□1C	− 32768 to 32767 (Default = 15000)	1 = 0.01 % (15000 = 150.00 %)			○												

(continued)

Table 5.2 List of Servo Parameters for Settings (Cont'd)

No	Name	Register No.	Setting Range	Meanings	Mode for which data is valid: Zero point return mode	Speed control mode	Torque control mode	Phase control mode	Position control mode: Invalid	Selection to use motion command code (OB□□008) *3: Invalid	Motion command code (OW□□20) valid *3: Positioning	External positioning	Zero point return	Interpolation	Latch	Constant speed feed	Constant step feed	Reversible counter	Interval counter	Frequency measurement
26	Bias speed for exponential acceleration/ deceleration filter (EXBIAS) *3	OW□□1D	0 to 32767 (Default = 0)	1 = 10^n reference unit/min (n = number of digits below decimal point) In units of pulse: 1 = 1000 pulses/min In units of mm: 1 = 1 mm/min In units of deg: 1 = 1 deg/min In units of inch: 1 = 1 inch/min							○	○		○	○	○	○			
27	Offset pulse (PULBIAS)	OL□□1E	-2^{31} to $2^{31}-1$ (Default = 0)	1 = 1 pulse				○	○	Valid when SVCRUN (IB□□008) is "ON" and "In machine lock (IB□□170)" is "OFF".	○	○	○	○	○	○	○			
28	Motion command code (MCMDCODE) *3	OW□□20	0 to 65535 (Default = 0)	0: NOP (No command) 1: Positioning (POSING) 2: External positioning (EX_POSING) 3: Zero point return (ZRET) 4: Interpolation (INTERPOLATE) 5: Interpolation end segment (ENDOF_INTERPOLATE) 6: Interpolation with position detection function (LATCH) 7: Constant speed feed (FEED) 8: Constant step feed (STEP) 9: Zero point setting (ZSET) 10 to 65535: Not used	Valid when Bit7 (selection to use motion command code) of servo fixed parameter No. 14 "Additional function selection" is set to "USE" and in the position control mode (OB□□002 is "ON") and with the motion command valid (OB□□008 is "ON") (Note) The interpolation end segment is for system use. Normally it is not used.													
29	Motion command control flag (MCMDCTRL)	OW□□21																		
		Bit 0	HOLD (Default = 0)	Momentary stop of command *3						○	○					○			
		1	ABORT (Default = 0)	Abort the execution of command *3						○	○	○				○			
		2	DIRECTION (Default = 0)	Traveling direction (for JOG/STEP) *3 0: Forward rotation 1: Reversed rotation											○	○			
		3	LAGRST (Default = 0)	Without first lag (same as the first lag time constant = 0)	○			○	○	○	○	○	○	○	○	○	○			
		4 to 7	FILTERTYPE (Default = 0)	Filter type selection *3 0: Without filter 1: Exponential filter (Exponential acceleration/deceleration) 2: Travel averaging filter (Simplified S-curve acceleration/deceleration)						○ ○ ○	○ ○ ○	○	○ ○ ○	○ ○ ○	○ ○ ○	○ ○ ○			

(continued)

Table 5.2 List of Servo Parameters for Settings (Cont'd)

No	Name	Register No.		Setting Range	Meanings	Mode for which data is valid														
						Zero point return mode	Speed control mode	Torque control mode	Phase control mode	Position control mode								Reversible counter	Interval counter	Frequency measurement
										Selection to use motion command code (OB□□008) *3										
										Invalid	Motion command code (OW□□20) valid *3									
											Positioning	External positioning	Zero point return	Interpolation	Latch	Constant speed feed	Constant step feed			
29	Motion command control flag (MCMDCTRL)	Bit	8	POS_PPI (Default = 0)	Position loop P/PI switching *1 0: P 1: PI	○				○	○	○	○	○	○	○	○			
			9	POS_IRST (Default = 0)	Integration reset for position control *1	○				○	○	○	○	○	○	○	○			
			10	NCOMSEL (Default = 0)	Speed compensation at position control (OW□□18) valid *1					○	○	○	○	○	○	○	○			
			11	Not used (Default = 0)	–															
			12	LMT_L (Default = 0)	Reversed rotation side limit signal for zero point return *3								○							
			13	LMT_R (Default = 0)	Forward rotation side limit signal for zero point return *3								○							
			14	BUF_W (Default = 0)	Write in position buffer *3 0: No processing 1: Write						○	○	○	○	○	○	○			
			15	BUF_R (Default = 0)	Read out position buffer *3 0: No processing 1: Read						○	○	○	○	○	○	○			
30	Rapid feed speed (RV) *3	OL□□22		0 to $2^{31}-1$ (Default = 0)	1 = 10^n reference unit /min (n = number of digits below decimal point) In units of pulse: 1 = 1000 pulses/min In units of mm: 1 = 1 mm/min In units of deg: 1 = 1 deg/min In units of inch: 1 = 1 inch/min						Valid when OB□□01D is "OFF".					○	○			
											○	○	○			○	○			
31	External positioning travel distance (EXMDIST) *3	OL□□24		-2^{31} to $2^{31}-1$ (Default = 0)	1 = 1 reference unit In units of pulse, 1 = 1 pulse							○								
32	Distance to stop (STOPDIST) *3	OL□□26		-2^{31} to $2^{31}-1$ (Default = 0)	1 = 1 reference unit * This is for system use. Normally set to "0".									○	○					
33	STEP travel amount (STEP) *3	OL□□28		0 to $2^{31}-1$ (Default = 0)	1 = 1 reference unit												○			
34	Zero point return final travel distance (ZRNDIST)*3	OL□□2A		-2^{31} to $2^{31}-1$ (Default = 0)	1 = 1 reference unit								○							
35	Override (OV)*3	OW□□2C		0 to 32767 (Default = 10000)	1 = 0.01 % (10000 = 100.00%)						○	○	○ *12			○	○			

(continued)

Table 5.2 List of Servo Parameters for Settings (Cont'd)

No	Name	Register No.		Setting Range	Meanings	Mode for which data is valid: Zero point return mode	Speed control mode	Torque control mode	Phase control mode	Position control mode: Invalid	Selection to use motion command code (OB□□008) *3: Motion command code (OW□□20) valid *3: Positioning	External positioning	Zero point return	Interpolation	Latch	Constant speed feed	Constant step feed	Reversible counter	Interval counter	Frequency measurement
36	Position monitor control flag (POSCTRL) *3	OW□□2D																		
		Bit	0	MLK (Default = 0)	Machine lock mode setting 0: "OFF" 1: "ON" (in machine lock mode)						○	○	○	○	○	○	○			
			1	TPRSREQ (Default = 0)	POSMAX number of turns of preset request 1: Request "ON"						○	○	○	○	○	○	○			
			2	ABSLDREQ (Default = 0)	Request to load ABS system infinite length position monitor information 1: Request "ON"						Valid when the motion command code (OW□□20 is NOP(=0)									
			3	PUNITSEL (Default = 0)	Unit selection for position monitor 2 (IL□□34) display 0: reference unit 1: pulse unit	When the motion command code is set valid (OB□□008 is "ON") ○	○	○	○		○	○	○	○	○	○	○			
			4 to 15	Not used (Default = 0)	–															
37	Work coordinate system offset (OFFSET) *3	OL□□2E		-2^{31} to $2^{31}-1$ (Default = 0)	1 = 1 reference unit In units of pulse, 1 = 1 pulse *Normally, set to "0".						○	○	○	○	○	○	○			
38	POSMAX number of turns preset data (TURNPRS) *3	OL□□30		-2^{31} to $2^{31}-1$ (Default = 0)	1 = 1 rotation						Valid when the number of POSMAX turns preset request is "ON"									
39	2nd in-position width (INPWIDTH) *3	OW□□32		0 to 65535 (Default = 0)	1 = 1 reference unit In units of pulse, 1 = 1 pulse						○	○	○	○	○	○	○			
40	Zero point position output width (PSETWIDTH) *3	OW□□33		0 to 65535 (Default = 10)	1 = 1 reference unit						Always valid after zero point return completion or zero point setting									
41	Positioning completion check time (PSETTIME) *3	OW□□34		0 to 65535 (Default = 0)	1 = 1ms (0 = Without positioning completion time over check)						○	○	○	○	○	○	○			
42	Integral time for position control (PTi) *1	OW□□35		0 to 32767 (Default = 300)	1 = 1ms (0 = No integration) (300 = 0.300 s)	○				○	○	○	○	○	○	○	○			
43	Integral upper and lower limits for position control (ILIMIT) *1	OW□□36		0 to 32767 (Default = 32767)		○				○	○	○	○	○	○	○	○			
44	Constant at first lag (LAGTi) *2	OW□□37		0 to 32767 (Default = 0)	1 = 1ms (0 = No first lag)	○			○	○	○	○	○	○	○	○	○			

(continued)

Table 5.2 List of Servo Parameters for Settings (Cont'd)

No	Name	Register No.	Setting Range	Meanings	Mode for which data is valid														
					Zero point return mode	Speed control mode	Torque control mode	Phase control mode	Position control mode								Reversible counter	Interval counter	Frequency measurement
									Selection to use motion command code (OB□□008) *3										
									Invalid	Motion command code (OW□□20) valid *3									
										Positioning	External positioning	Zero point return	Interpolation	Latch	Constant speed feed	Constant step feed			
45	Encoder position lowest 2 words at power off or position buffer access No. (eposL) *3	OL□□38	-2^{31} to $2^{31}-1$ (Default = 0)	· When the ABS system infinite length position managing information LOAD request (OB□□2D2) is "ON", the encoder position lowest 2 words at power off. (1=1 pulse) · When the motion command control flag BUF_W (OB□□21E) =1 or BUF_R (OB□□21F) = 1, the position buffer access No. (1 to 256) (0 = Invalid)						Refer to the Meaning in the column on the left.									
46	Encoder position highest 2 words at power off or position buffer write-in data (eposH) *3	OL□□3A	-2^{31} to $2^{31}-1$ (Default = 0)	· When the ABS system infinite length position managing information LOAD request (OB□□2D2) is "ON", the encoder position highest 2 words at power off. (1=1 pulse) · When the motion command control flag BUF_W (OB□□21E) =1 ,the position buffer write-in data						Refer to the Meaning in the column on the left.									
47	Pulse position lowest 2 words at power off (aposL) *3	OL□□3C	-2^{31} to $2^{31}-1$ (Default = 0)	When the ABS system infinite length position managing information LOAD request (OB□□2D2) is "ON", the pulse position lowest 2 words at power off. (1=1 pulse)						Refer to the Meaning in the column on the left.									
48	Pulse position highest 2 words at power off (aposH) *3	OL□□3E	-2^{31} to $2^{31}-1$ (Default = 0)	When the ABS system infinite length position managing information LOAD request (OB□2D2) is "ON", the pulse position highest 2 words at power off. (1=1 pulse)						Refer to the Meaning in the column on the left.									

*1 Available for CP-9200SH version No. 87921-9000□-S0110 and later.
*2 Available for CP-9200SH version No. 87921-9000□-S0120 and later.
*3 Available for CP-9200SH version No. 87921-9000□-S0200 and later.
*4 After a detection is made when this Bit turns ON, another detection will not be made even if a signal is input (for prevention of chattering).
Accordingly, to perform another detection, turn this Bit "OFF" for more than 1 scan.
The count value preset request is valid only when the counting disabled (CNTDIS) is "OFF" in the reversible counter mode.
*5 After a detection is made when this Bit turns ON, another detection will not be made even if a signal is input (for prevention of chattering).
Accordingly, to perform another detection, turn this Bit "OFF" for more than 1 scan.
The DI latch detection request is valid only in the basic counter mode. The motion command can be used only when "pulse" is selected for the reference unit selection (Bit0 to 3 of servo fixed parameter No. 17).
*6 After a detection is made when this Bit turns ON, another detection will not be made even if a signal is input (for prevention of chattering).
Accordingly, to perform another detection, turn this Bit "OFF" for more than 1 scan.
The motion command can be used only when "pulse" is selected for the reference unit selection (Bit0 to 3 of servo fixed parameter No. 17).

*7 The speed limiter value in position control mode should be set bigger than the speed reference set value for 10 % or more.
*8 In the reversible counter mode, this becomes the counter preset data.
*9 Also when RUN signal turns "OFF" during operation in the modes other than the torque control mode, the linear deceleration time is used to decelerate the current speed reference to stop. When RUN signal turns "OFF" during operation in the torque control mode, the axis stops immediately. In the phase control mode, this is used only when RUN signal turns "OFF" during operation (this is not used during operation).
*10 Set the position reference so that the incremental value (difference from the previous reference value) is as follows.

$$|\text{Present reference value} - \text{Previous reference value}| \leqq 2^{31} - 1$$

*11 This has different meanings depending on the control mode.
In speed control mode: Speed reference
In position control mode: Steady travel speed reference
In phase control mode: Standard speed reference
In position control mode, the setting range is 0 to 32767. When a negative value is set, the axis moves with the absolute value.
*12 In the zero point return (ZRET) with motion command, this is valid only for the rapid feed speed. (Invalid for approach speed and creep speed).
*13 Available for CP-9200SH version No. 87921-9000□-S0206 and later.

5.1.3 List of Servo Parameters for Monitor

These are parameters informed by the SVA module. These are reported in a batch at the head of a high-speed scan. They are used for practical control of applications and debugging of user programs.

(Note)
Registers of different module numbers are not continuous.
If the module number is the same, the registers between the axes are continuous. Use subscripts (i, j) in user programs with care.
(Example)
With ⊢ IW(OW)C000i, where i = 0 to 255, the register number can be correctly read out.
With IW(OW)C000, the register number can be correctly read and written within the register range of module No. 1; IW(OW)C000 to IW(OW)C0FF. Where i ≧ 256, it can not be correctly read out.

Table 5.3 List of Servo Parameters for Monitor

No	Name	Register No.		Setting Range	Meanings	Mode for which data is valid														
										Position control mode									
										Selection to use motion command code (OB□□008) *3									
											Motion command code (OW□□20) valid *3									
						Zero point return mode	Speed control mode	Torque control mode	Phase control mode	Invalid	Positioning	External positioning	Zero point return	Interpolation	Latch	Constant speed feed	Constant step feed	Reversible counter	Interval counter	Frequency measurement
1	Run status (RUNSTS)	IW□□00																		
		Bit	0	EOVER	Deviation error	○			○	○	○	○	○	○	○	○	○			
			1	PRMERR	Servo parameter setting error	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
			2	FPRMERR	Servo fixed parameter setting error	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
			3	ADER	A/D conversion error	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
			4	PGER	Cumulative number of rotations reception error	○	○	○	○	○	○	○	○	○	○	○	○			
			5	Not used	–															
			6	PRESET	Count value preset completion													○		
			7	SVCRDY	Servo controller operation ready	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
			8	SVCRUN	Servo controller in running	○	○	○	○	○	○	○	○	○	○	○	○			
			9	DIRINV	Report of rotating direction when the absolute encoder is used	○	○	○	○	○	○	○	○	○	○	○	○			
			10	ABCRDC	Absolute position read-out completion signal	○	○	○	○	○	○	○	○	○	○	○	○			
			11	DIINT	DI latch completion signal	○	○	○	○	○	○			○		○	○			
			12	FBP0	Feedback pulse 0	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
			13	POSCOMP	Positioning completion signal					○	○	○		○	○	○	○			
			14	CNTCOIN	Coincident detection signal (DO5) "ON"	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
			15	ZRNC	Zero point return completion	○														
2	Servo drive status (SVSTS)	IW□□01																		
		Bit	0	DI0	General-purpose DI	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
			1	DI1	General-purpose DI	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
			2	DI2	General-purpose DI	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
			3	DI3	General-purpose DI	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
			4 to 15	Not used	–															
3	Target position monitor (PTG)	IL□□02		-2^{31} to $2^{31}-1$	1 = 1 pulse or 1 = 1 reference unit In units of pulse, 1 = 1 pulse Updated also in machine lock status	○			○	○	○	○	○	○	○	○	○			

Table 5.3 List of Servo Parameters for Monitor (Cont'd)

No	Name	Register No.	Setting Range	Meanings	Mode for which data is valid														
									Position control mode										
									Selection to use motion command code (OB□□008) *3										
										Motion command code (OW□□20) valid *3										
					Zero point return mode	Speed control mode	Torque control mode	Phase control mode	Invalid	Positioning	External positioning	Zero point return	Interpolation	Latch	Constant speed feed	Constant step feed	Reversible counter	Interval counter	Frequency measurement
5	Target position monitor (PTGDIF)	IL□□04	-2^{31} to $2^{31}-1$	1 = 1 pulse or 1 = 1 reference unit In units of pulse, 1 = 1 pulse	○			○	○	○	○	○	○	○	○	○			
7	Position monitor at DI latch detection or hardware counter latch data or detected frequency (PINT)	IL□□06	-2^{31} to $2^{31}-1$	Basic counter: Position monitor at DI latch detection	○	○	○	○	○	○	○		○	○	○	○			
				Interval counter: Hardware counter latch data														○	
				Reversible counter: Invalid															
				Frequency measurement: Detected frequency															○
9	Position monitor or Hardware counter current value (PFB)	IL□□08	-2^{31} to $2^{31}-1$	Basic counter: position monitor 1 = 1 pulse or 1 = 1 reference unit Other than basic counter: Hardware counter current value	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
11	Position deviation monitor or incremental number of pulses per scan (PDV)	IL□□0A	-2^{31} to $2^{31}-1$	Basic counter: position deviation monitor 1 = 1 pulse Not updated in machine lock status Other than basic counter: Incremental number of pulses per scan	○			○	○	○	○	○	○	○	○	○	○		○
13	Speed reference output value monitor (SRDREF)	IW□□0C	−32768 to 32767	1 = 0.01 %	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
14	Speed monitor (NFB)	IW□□0D	−32768 to 32767	1 = 0.01 %	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
15	Torque monitor (TFB)	IW□□0E	−32768 to 32767	1 = 0.01 %	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
16	Parameter No. for the range overrun occurrence (ERNO) Cumulative	IW□□0F	1 to 48 101 to 127	Error No. of servo parameter for setting Error No. of servo fixed parameter	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
17	number of rotations received from the absolute encoder (ABSREV) Initial	IL□□10	0 to ± 99999	1 = 1 rotation	○	○	○	○	○	○	○	○	○	○	○	○			
19	incremental number of pulses received from the absolute encoder Motion command	IL□□12	-2^{31} to $2^{31}-1$	1 = 1 pulse	○	○	○	○	○	○	○	○	○	○	○	○			
21	response code (MCMDRCODE)*3	IW□□14	0 to 65535	The motion command in execution (For details, refer to the servo parameter for setting No. 28)						○	○	○	○	○	○	○			

Table 5.3 List of Servo Parameters for Monitor (Cont'd)

No	Name	Register No.	Setting Range	Meanings	Mode for which data is valid: Zero point return mode	Speed control mode	Torque control mode	Phase control mode	Position control mode: Invalid	Position control mode: Selection to use motion command code (OB□□008) *3: Motion command code (OW□□20) valid *3: Positioning	External positioning	Zero point return	Interpolation	Latch	Constant speed feed	Constant step feed	Reversible counter	Interval counter	Frequency measurement
22	Motion command status (MCMDSTS) *3	IW□□15																	
		Bit 0	BUSY	Command in execution flag						○	○	○	○	○	○	○			
		1	HOLDL	Command momentary stop completed						○	○					○			
		2	DEN	Pulse output completion						○	○	○	○	○	○	○			
		3	ZSET	Zero point setting completed						○	○	○	○	○	○	○			
		4	EX_LATCH	External positioning signal latch completion							○			○					
		5	FAIL	Command error end status						○	○	○	○	○	○	○			
		6	ZRNC	Zero point return completion status								○							
		7 to 15	Not used	–															
23	Number of digits below decimal point monitor (DECNUMM) *3	IW□□16	0 to 5	Servo fixed parameter No. 18 Copy of "number of digits below decimal point"	○	○	*4 ○	○	○	○	○	○	○	○	○	○	*4 ○	○	○
24	Position monitoring status (POSSTS) *3	IW□□17																	
		Bit 0	MLKL	In machine lock status						○	○	○	○	○	○	○			
		1	ZERO	Zero point position						○	○	○	○	○	○	○			
		2	PSET2	2nd in-position completion						○	○	○	○	○	○	○			
		3	ABSLDE	ABS system infinite length position managing information LOAD completion						Valid when the ABS system infinite length position managing information LOAD request (OB□□2D2) is "ON".									
		4	TPRSE	Number of POSMAX turns reset completion						Valid when the number of POSMAX turns reset request (OB□□2D1) is "ON".									
		5	GEARM	Fixed parameter Electric gear selection 0: Invalid 1: Valid	○	○	*4 ○	○	○	○	○	○	○	○	○	○	*4 ○	○	○
		6	MODSELM	Fixed parameter Axis selection 0: Finite length axis 1: Infinite length axis	○	○	*4 ○	○	○	○	○	○	○	○	○	○	*4 ○	○	○
		7 to 15	Not used	–															
25	Machine coordinate system reference position (MPOS) *3	IL□□18	-2^{31} to $2^{31}-1$	1 = 1 reference unit In units of pulse, 1 = 1 pulse Not updated in machine lock status.						○	○	○	○	○	○	○			
27	Not used	IL□□1A	–	–															
29	POSMAX monitor (PMAXMON) *3	IL□□1C	-2^{31} to $2^{31}-1$	1 = 1 reference unit Servo fixed parameter No. 22 Copy of "POSMAX"	○	○	*4 ○	○	○	○	○	○	○	○	○	○	*4 ○	○	○
31	POSMAX number of turns (PMAXTURN)*3	IL□□1E	-2^{31} to $2^{31}-1$	1 = 1 rotation Counted UP/DOWN each time the number exceeds POSMAX						Valid when "Infinite length axis" is selected for servo fixed parameter "Motion controller function selection flag"									
33	Not used	IL□□20	–	–															

(continued)

Table 5.3 List of Servo Parameters for Monitor (Cont'd)

No	Name	Register No.		Setting Range	Meanings	Mode for which data is valid: Zero point return mode	Speed control mode	Torque control mode	Phase control mode	Position control mode: Invalid	Selection to use motion command code (OB□□008) *3: Motion command code (OW□□20) valid *3: Positioning	External positioning	Zero point return	Interpolation	Latch	Constant speed feed	Constant step feed	Reversible counter	Interval counter	Frequency measurement
35	Alarm (ALARM) *3	IL□□22																		
		Bit	0 to 2	Not used	–															
			3	SOTF	Positive direction soft limit						○	○	○	○	○	○	○			
			4	SOTR	Negative direction soft limit						○	○	○	○	○	○	○			
			5	Not used	–															
			6	TIMEOVER	Positioning time over						○	○	○	○	○	○	○			
			7	DISTOVER	Speed over *5						○	○	○	○	○	○	○			
			8 to 9	Not used	–															
			10	MODERR	Control mode error						○	○	○	○	○	○	○			
			11	ZSET_NRDY	Zero point not set						Valid when "Absolute encoder" is used and when "Infinite length axis" is selected									
			12 to 16	Not used	–															
			17	ABSOVER	ABS encoder rotation amount over						○	○	○	○	○	○	○			
			18 to 31	Not used	–															
37	Servo driver ALARM code (SVALARM) *3	IW□□24		–32768 to 32767	Error code at the absolute position read-out error	Valid at the absolute position read-out error														
38	Not used	IW□□25		–	–															
39	Speed reference output value monitor (RVMON) *3	IL□□26		-2^{31} to $2^{31}-1$	1 = 1 reference unit/H scan (for system use)						○	○	○	○	○	○	○			
41	Position buffer read-out data (CNMON) *3	IL□□28		-2^{31} to $2^{31}-1$	Position buffer data						Valid when the position buffer read out (OB□□21F) is "ON"									
43	Not used	IL□□2A		–	–															
45	Integral output value monitor (YIMON) *1	IL□□2C		-2^{31} to $2^{31}-1$	–	○			○	○	○	○	○	○	○	○	○			
47	Reference coordinate system counting position (POS) *3	IL□□2E		-2^{31} to $2^{31}-1$	1 = 1 reference unit						○	○	○	○	○	○	○			
49	First lag monitor (LAGMON) *2	IL□□30		-2^{31} to $2^{31}-1$	(PI output value – First lag output value)	○			○	○	○	○	○	○	○	○	○			
51	Position loop output value monitor *2	IL□□32		-2^{31} to $2^{31}-1$	Position loop output value (the value without adding the feed forward operation value)	○			○	○	○	○	○	○	○	○	○			

Table 5.3 List of Servo Parameters for Monitor (Cont'd)

No	Name	Register No.	Setting Range	Meanings	Mode for which data is valid														
					Zero point return mode	Speed control mode	Torque control mode	Phase control mode	Position control mode: Selection to use motion command code (OB□□008) *3: Invalid	Position control mode: Selection to use motion command code (OB□□008) *3: Motion command code (OW□□20) valid *3: Positioning	External positioning	Zero point return	Interpolation	Latch	Constant speed feed	Constant step feed	Reversible counter	Interval counter	Frequency measurement
53	Position monitor 2 (APOS2) *3	IL□□34	-2^{31} to $2^{31}-1$	Differs depending on the position monitor 2 unit selection (OB□□2D3) (1) OB□□2D3 = 0 (Reference unit is selected) 1 = 1 reference unit (2) OB□□2D3 = 1 (Pulse is selected) 1 = 1 pulse	When the motion command code is selected valid (OB□□008 is "ON") ○	○	○	○		○	○	○	○	○	○	○			
55	Not used	IW□□36	–	–															
56	Not used	IW□□37	–	–															
57	Encoder position lowest 2 words at power off (eposmL) *3	IL□□38	-2^{31} to $2^{31}-1$	1 = 1 pulse (* For ABS system infinite length position management)						Valid when "absolute encoder" is selected for servo fixed parameter "Encoder selection" and when "infinite length axis" is selected for servo fixed parameter "Motion controller function selection flag" and when the zero point setting completion (IB□□153) is "ON"									
59	Encoder position highest 2 words at power off (eposmH) *3	IL□□3A	-2^{31} to $2^{31}-1$	1 = 1 pulse (* For ABS system infinite length position management)															
61	Pulse position lowest 2 words at power off (aposmL) *3	IL□□3C	-2^{31} to $2^{31}-1$	1 = 1 pulse (* For ABS system infinite length position management)															
63	Pulse position highest 2 words at power off (aposmH) *3	IL□□3E	-2^{31} to $2^{31}-1$	1 = 1 pulse (* For ABS system infinite length position management)															

*1 Available for CP-9200SH version No. 87921-9000□-S0110 and later
*2 Available for CP-9200SH version No. 87921-9000□-S0120 and later
*3 Available for CP-9200SH version No. 87921-9000□-S0200 and later
*4 Valid when Bit7 (selection to use motion command) of the servo fixed parameter No.14 "Additional function selection" is set to "USE".
*5 Available for CP-9200SH version No. 87921-9000□-S0206 and later

5.2 Servo Parameter Details

5.2.1 Details of Servo Fixed Parameters

(Note)
The servo fixed parameters can not be changed when the current value of Bit0 of "servo parameter for setting "RUN command (OW□□01)" is set to "ON". Note that the position information are initialized when the servo fixed parameter(s) is changed.

Table 5.4 Details of Servo Fixed Parameters

Parameter No.	Name		Contents		Default
1	Axis use selection (USESEL)		Designates use (=1) or non-use (=0) of specified axis. If non-use is selected, that axis is not controlled at all. Neither are monitor parameters for monitoring (IW□□00 to IL□□3F) updated. However, in run status (IW□□00), "0" is stored. Select "non-use" when the axis is not in use to shorten the processing time. The default value is "non-use" (=0).		0 (Not used)
2	PG signal form selection (PGSEL)			Select the signal form and polarity of PG input signal.	
	Bit	0 to 3	Pulse input signal form selection (ABPGSEL)	Designate the pulse input signal form from encoder, +5 V differential input (=0) or +12 V collector input (=1).	(+5 V differential input
		4 to 7	Not used	–	
		8	A/B pulse input signal polarity selection (ABPISEL)	Set the polarity (0: Positive logic, 1: Negative logic) of A/B pulse input signal. The default value is 0 (positive logic). This parameter is available from CP-9200SH version No. 87921-9000□-S0200 and later.	0 (Positive logic)
		9	C-pulse input signal polarity selection (CPISEL)	Set the polarity (0: Positive logic, 1: Negative logic) of C-pulse input signal. The default value is 0 (positive logic). This parameter is available from CP-9200SH version No. 87921-9000□-S0200 and later.	0 (Positive logic)
		10 to 15	Not used		–
3	Encoder selection (ENCSEL)		Designates the type of pulse encoder; incremental encoder (=0), absolute encoder (=1), or absolute encoder used as an incremental encoder (=2). The default value is for incremental encoder (=0).		0 (For incremental encoder)
4	Rotating direction selection (DIRINV)		In the following cases, designate reverse rotation (=1). · When using the SERVOPACK for absolute encoder, the DIR terminal of the SERVOPACK is connected to the 0V, and reverse rotation connection is selected. Refer to the SERVOPACK operation manual for regarding reverse rotation connection of the SERVOPACK. · When using the VS-866 for absolute encoder, the "reverse rotation selection (Bit 8 of Cn30)" is set ON. In this case, the PB0 connection should also be reversed so the phase relation will be the same as the SERVOPACK. For details, refer to the VS-866 technical sheet. The default value is forward rotation selection (=0).		0 (Forward rotation selection)
5	Pulse counting method selection (PULMODE)		Designates the pulse counting method. There are the following seven types of pulse counting methods. Select the type to match the machine (pulse receiving type). For the pulse counting method and the multiplication function, refer to 1.4 "Pulse Counting Mode and Pulse Amplification Function". · Sign type single multiplication (=0) · Sign type double multiplication (=1) · Up/Down type single multiplication (=2) · Up/Down type double multiplication (=3) · A/B pulse type single multiplication (=4) · A/B pulse type double multiplication (=5) · A/B pulse type quadruple multiplication (=6) The default value is A/B pulse type quadruple multiplication (=6).		6 (A/B×4)

Table 5.4 Details of Servo Fixed Parameters (Cont'd)

Parameter No.	Name	Contents	Default
6	Counter mode selection (CNTMODE)	Designates the counter mode (function). There are following four types of counter modes. Select the type to match the machine (machine control method). For the counter mode, refer to 1.5 "Overview of Functions" and Chapter 3 "Explanation of Functions and User Programming Examples". · Reversible counter (=0) · Interval counter (=1) · Frequency measurement (=2) · Basic counter (=3) The default value is basic counter (=3). When motion control, such as speed control, torque control, position control, phase control, or zero point return is required, select the basic counter.	3 (Basic counter)
7	Motor rated speed (NR)	Sets the number of rotations in units of 1 r/min at 100% of the speed reference. Select the number to match the machine (motor specifications). The default value is 3000 r/min.	3000
8	Number of FB pulses for one revolution (FBppr)	Sets the number of feedback pulses for each revolution of the motor in multiples of 4. The range for settings is 4 to 65532 (P/R), and they must be multiples of 4. Select the number to match the machine (encoder specifications). The default value is 2048 P/R (=2048).	2048
9	D/A output voltage when speed is 100% (V1)	Sets the D/A output voltage in units of 1 V at 100% (10000) of the speed reference. The range for settings is 1 to 10 (V). Ordinarily this sets the rated rotational input voltage of the Servodrive. Select voltage to match the machine (Servodrive specifications). · D/A output value =(Speed reference value×D/A output voltage setting when speed is 100%) /10000 For example, taking the set value of the D/A output voltage when the speed reference is 100% to be 6 V, and the speed instruction value to be 100% (=10000, 1=0.01%), a voltage of (10000×6 V)/10000=6.0 V is output from CN1- to CN4-7 (1 to 4 axes). The default value is 6 V (=6).	6
10	D/A output voltage when torque limit is 100% (V2)	Sets the D/A output voltage in units of 1 V at 100% of the torque limit reference. The range of setting is 1 to 10V, in common for both positive and negative. Ordinarily, when using the SERVOPACK, set the voltage limit value, and when using the VS-866, set the torque limit value. Select voltage to match the machine (Servodrive specifications). · D/A output value =(Positive (negative) torque limit set value×D/A output voltage setting when torque limit is 100%)/10000 For example, taking the set value of the D/A output voltage when the torque limit is 100% to be 3 V, and the positive torque limit set value to be 200% (=20000, 1=0.01%), a voltage of (20000×3 V)/10000=6.0V is output from CN1- to CN4-7 (1 to 4 axes). Further, taking the negative torque limit set value to be -150% (=-15000, 1=0.01%), a voltage of (-15000×3 V)/10000=-4.5 volts is output from CN1- to CN4-5 (1 to 4 axes). The default value is 3 V (=3).	3
11	Input voltage when speed monitor (A/D) is 100% (MV1)	The scaling value (100% (=10000) of voltage values) of the voltages (A/D converter) input to CN1- to CN4-30 (1 to 4 axes) is set in units of 1 V. The range for settings is 1 to 10 (V). The speed monitor value is computed from the data set here and the A/D input voltage, and reported to the speed monitor (IW□□0D). · Speed monitor value =(A/D input voltage×10000)/Set value for input voltage when the speed monitor is at 100% For example, taking the set value for input voltage when the speed monitor (A/D) is at 100% to be 6 V, and the actual A/D input voltage to be 3 V, (3 ×10000)/6 V = 5000 is reported to IW□□0D. The default value is 6 V (=6).	6

Table 5.4 Details of Servo fixed Parameters (Cont'd)

Parameter No.	Name		Contents		Default
12	Input voltage when torque monitor (A/D) is 100% (MV2)		The scaling value (100% (=10000) of voltage values) of the voltages (A/D converter) input to CN1- to CN4-28 (1 to 4 axes) is set in units of 1 V. The range for settings is 1 to 10 (V). The torque monitor value is computed from the data set here and the A/D input voltage, and informed to the torque monitor (1W□□0E + axis ofs). Torque monitor value =(A/D input voltage×10000)/Set value for input voltage when the torque monitor is at 100% For example, taking the set value for input voltage when the torque monitor (A/D) is at 100% to be 3 V, and the actual A/D input voltage to be −9 V, (−9 ×10000)/3 V or −30000 is informed to IW□□0E. The default value is 3 V (=3).		3
13	DI latch detection signal selection (DIINTSEL)		Sets the external signal which performs DI latch detection. When "0" is selected, the signal (PI latch input) input to CN1- to CN4-42 (1 to 4 axes) is used as a DI latch detection signal. When "1" is selected, pulse C of the applicable axis is used as a DI latch detection signal. The default value is the DIINT input signal (=0).		0
14	Additional function selection (AFUNCSEL)			Select an additional function such as the signal type, the function of signal.	
	Bit	0	Selection to use coincident detection function (COINSEL)	Designate "NOT USE (=0)" or "USE (=1)" of the coincident detection function. When the coincident detection function is used, DO5 (CN1- to CN4-49 (1 to 4 axis)) is used as DO for coincident output. It cannot be used for general-purpose DO using the coincident detection function. Therefore, set DO5 (Bit 5 of OW□□01) of the servo drive RUN command to "0". The default value is "NOT USE (=0)".	0 (NOT USE)
		1 to 5	Not used	-	
		6	Absolute position data read-out at power on (ABSRDSEL)	Select whether read out or not read out the absolute position data from the absolute encoder at CP-9200SH power on when "absolute encoder (=1) is selected for the servo fixed parameter "Encoder selection" in the basic counter mode. Normally, select "EXECUTE (=0)" to read out the absolute position data. This parameter is available for CP-9200SH version No. 87921-9000□-S0200 and later.	0 (EXECUTE)
		7	Selection to use motion command (MCMDSEL)	Set whether use or not use the motion command code (OW□□ 20) when the position control mode is selected in the basic counter mode. This parameter is available for CP-9200SH version No. 87921-9000□-S0200 and later.	0 (NOT USE)
		8	Counting by C-pulse input (CCNTSEL)	Select whether enable or disable the counting by C-pulse input (0: Counting disabled, 1: Counting enabled) when the reversible counter mode is selected. The default value is "Counting disabled (=0)". This parameter is available for CP-9200SH version No. 87921-9000□-S0200 and later.	0 (Counting disabled)
		9	Selection of Σ II series SERVOPACK (SIGMA2)	Select it when using a Σ II series SERVOPACK. This parameter is available for CP-9200SH version No. 87921-9000□-S0206 and later.	0
		10 to 15	Not used		0
15	Frequency coefficient selection (HZSEL)		When the counter mode is set to frequency measurement, sets the number of digits of the frequency detected. The result of multiplying the actual frequency by the value set here is informed to (IL□□06). If this is used in the measurement of pulses with long cycles (low frequency), the number of valid digits may be increased, enabling more precise measurements. For example, taking the actual frequency to be 12.345 Hz, the frequency detected depends on the factor selected as follows. 0 (×1) : Frequency detected (IL□□06)=12.345×1=12 1 (×10) : Frequency detected (IL□□06)=12.345×10=123 2 (×100) : Frequency detected (IL□□06)=12.345×100=1234 3 (×1000): Frequency detected (IL□□06)=12.345×1000=12345 The default value is 2 (×100).		2 (× 100)

Table 5.4 Details of Servo fixed Parameters (Cont'd)

Parameter No.	Name			Contents	Default
16	Simulation mode selection (SIMULATE)			Sets operation mode. When the simulation mode is selected, even if there is actually no connection with a Servodrive device, the machine can be operated in position, phase, speed, and torque control modes. The simulation values are informed to servo parameters for monitoring (position monitor, etc.). These can be used for debugging application programs. However, note that the following functions cannot be simulated. (1) Coincident output (2) DI latch detection (3) Zero point return mode (4) Absolute position readout (5) Reversible counter (6) Interval counter (7) Frequency measurement (8) A/D input When the simulation mode is selected, a "0" is output to the DO (CN1- to CN4-22, 23, 47, 48, 49 (1 to 4 axes)) of the applicable axis. "0 V" is also output to D/A (CN1- to CN4-35, -7 (1 to 4 axes)). The shipment adjustment mode is used for our test berore shipping. Do not select this mode. The default value is normal run mode (=0).	0 (Normal run)
17	Motion controller function selection flag (SVFUNCSEL)			Set a function valid or invalid.	
	Bit	0 to 3	Reference unit selection (CMD_UNIT)	Select the unit of reference to input. For the unit of reference, pulse, mm, deg, and inch are available. The setting of this parameter and the servo fixed parameter No. 18, "Number of digits decimal point" determine the minimum reference unit that can be commanded to the SVA module. Refer to 3.4.3 (1) "Reference unit". This parameter is available for CP-9200SH version No. 87921-9000□-S0200 and later.	0 (Pulse)
		4	Selection to use electric gear (USE_GEAR)	Select whether use or not use the electric gear function. For electric gear, refer to 3.4.3 (2) "Electric gear". When "pulse" is selected for the reference unit selection, this parameter is invalid. Set to "invalid (=0)". This parameter is available for CP-9200SH version No. 87921-9000□-S0200 and later.	0 (Invalid)
		5	Axis selection (PMOD_SEL)	Select the finite length axis (=0) or the infinite length axis (=1). For finite length axis and infinite length axis, refer to 3.4.3 (3) "Axis selection". This parameter is available for CP-9200SH version No. 87921-9000□-S0200 and later.	0 (Finite length axis)
		6	Backlash compensation selection (USE_BKRSH)	Select whether use or not use the backlash compensation. This parameter is available for CP-9200SH version No. 87921-9000□-S0200 and later.	0 (Invalid)
		7	Soft limit (positive direction) selection (USE_SLIMP)	Select whether use or not use the soft limit (positive direction) function. Setting to "0" disables the soft limit (positive direction) function. When this bit is set to "valid (=1)", the soft limit function is enabled at completion of zero point return (zero point return completion status of servo parameter for monitoring: IB□□156 is "ON"). When the axis selection (Bit5 of motion controller function selection flag) is set to "infinite length axis (=1)", the function is invalid. Set to "invalid (=0)". This parameter is available for CP-9200SH version No. 87921-9000□-S0200 and later.	0 (Invalid)

Table 5.4 Details of Servo fixed Parameters (Cont'd)

Parameter No.	Name		Contents		Default
17	Bit	8	Soft limit (negative direction) selection (USE_SLIMN)	Select whether use or not use the soft limit (negative direction) function. Setting to "invalid (=0)" disables the soft limit (negative direction) function. When this bit is set to "valid (=1)", the soft limit function is enabled at completion of zero point return (zero point return completion status of servo parameter for monitoring: IB□□156 is "ON"). When the axis selection (Bit5 of motion controller function selection flag) is set to "infinite length axis (=1), the function is invalid. Set to "invalid (=0)". This parameter is available for CP-9200SH version No. 87921-9000□-S0200 and later.	0 (Invalid)
		9	Selection to use override (USE_OV)	Select whether use or not use the override function. Setting to "invalid (=0)" disables the override function. Refer to 3.4.3 (6) "Speed reference". This parameter is available for CP-9200SH version No. 87921-9000□-S0200 and later. Note: "Override" represents the function to change the feed speed set value to use.	0 (Invalid)
		10	Deceleration LS inversion selection (INV_DEC)	Select whether inverse or not inverse the limit switch signal (deceleration LS) at the zero point return. Refer to 3.4.3 (8) "Zero point return (ZRET)". This parameter is available for CP-9200SH version No. 87921-9000□-S0200 and later.	0 (Not inverse)
		11 to 15	Not used		0
18	Number of digits below decimal point (DECNUM)		Set a number of digits below decimal point for the reference unit to be input. The minimum reference unit that can be commanded to the SVA module is determined according to the settings of this parameter and the reference unit selection (Bit0 to 3 of motion controller function selection flag). Refer to 3.4.3 (1) "Reference unit". This parameter is available for CP-9200SH version No. 87921-9000□-S0200 and later.		3
19	Travel amount per machine 1 rotation (PITCH)		Indicates the load travel amount per load axis 1 rotation. Set the value of the load travel amount divided by the reference unit. For details, refer to 3.4.3 (2) "Electric gear". This parameter is invalid when the electric gear selection (Bit4 of motion controller function selection flag) is set to "invalid". Set to the default value. This parameter is available for CP-9200SH version No. 87921-9000□-S0200 and later.		10000
20	Motor side gear ratio (GEAR_MOTOR)		Sets the gear ratio between motor and load. Set the motor side gear ratio in units of one rotation to this parameter. This parameter is invalid when the electric gear selection (Bit4 of motion controller function selection flag) is set to "invalid". Set to the default value This parameter is available for CP-9200SH version No. 87921-9000□-S0200 and later.		1
21	Machine side gear ratio (GEAR_MACHINE)		Sets the gear ratio between motor and load. Set the load side gear ratio in units of one rotation to this parameter. This parameter is invalid when the electric gear selection (Bit4 of motion controller function selection flag) is set to "invalid". Set to the default value This parameter is available for CP-9200SH version No. 87921-9000□-S0200 and later.		1
22	Infinite length axis reset position (POSMAX)		When the infinite length axis is selected for the axis selection (Bit5 of motion controller function selection flag), set the reset position at one rotation. When the finite length axis is selected, this parameter is invalid. Set to the default value. Refer to 3.4.3 (3) "Axis selection". This parameter is available for CP-9200SH version No. 87921-9000□-S0200 and later.		360000
23	Absolute encoder maximum rotation amount (MAXTURN)		When an absolute encoder is used, set the maximum rotation amount of absolute encoder. Refer to the manual for the SERVOPACK used with the servo controller. This parameter is available for CP-9200SH version No. 87921-9000□-S0200 and later.		99999

Table 5.4 Details of Servo fixed Parameters (Cont'd)

Parameter No.	Name	Contents	Default
24	Soft limit value (positive direction) (SLIMP)	When the soft limit (positive direction) selection (Bit7 of motion controller function selection flag) is set to "valid", set a soft limit value (positive direction). When it is set to "invalid", this is invalid. Set to the default value. When this bit is set to "valid (=1)", the soft limit function is enabled at completion of zero point return (zero point return completion status of servo parameter for monitoring: IB□□ 156 is "ON"). When the axis selection (Bit5 of motion controller function selection flag) is set to "infinite length axis (=1)", this is invalid. Set to the default value. This parameter is available for CP-9200SH version No. 87921-9000□-S0200 and later.	2^{31}-1
25	Soft limit value (negative direction) (SLIMN)	When the soft limit (negative direction) selection (Bit8 of motion controller function selection flag) is set to "valid", set a soft limit value (negative direction). When it is set to "invalid", this is invalid. Set to the default value. When this bit is set to "valid (=1)", the soft limit function is enabled at completion of zero point return (zero point return completion status of servo parameter for monitoring: IB□□ 156 is "ON"). When the axis selection (Bit5 of motion controller function selection flag) is set to "infinite length axis (=1)", this is invalid. Set to the default value. This parameter is available for CP-9200SH version No. 87921-9000□-S0200 and later.	-2^{31}
26	Zero point return method selection (ZRETSEL)	When the motion command (OW□□ 20) is used, set a zero point return method for zero point return (ZRET) operation. For details, refer to the item (3) of 3.4.3 (8) "Zero point return (ZRET)". This parameter is available for CP-9200SH version No. 87921-9000□-S0200 and later.	0 (DEC1 + C-pulse)
27	Backlash compensation value (BKLSH)	When the backlash compensation selection (Bit 6 of motion controller function selection flag) is set to "valid", set a backlash compensation value. This parameter is available for CP-9200SH version No. 87921-9000□-S0200 and later.	0

5.2.2 Details of Servo Parameters for Setting

(Note)
Registers of different module numbers are not continuous.
If the module number is the same, the registers between the axes are continuous. Use subscripts (i, j) in user programs with care.
(Example)
With ⊢IW(OW)C000i, where i = 0 to 255, the register number can be correctly read out.
With IW(OW)C000i, the register number can be correctly read and written within the register range of module No. 1; IW(OW)C000 to IW(OW)C0FF. Where i ≧ 256, it can not be correctly read out.

Table 5.5 Details of Servo Parameters for Setting

No.	Name	Register No.		Setting range	Contents	Default value
1	Run mode setting (RUNMOD)	OW□□00		Set the operation mode such as control mode, alarm reset. These are bit configured. The table below indicates that bit configuration.		
		Bit	0	Speed control mode (NCON)	Valid when the counter mode selection (servo fixed parameter setting) is set to basic counter. Select the speed control mode. Refer to the supplementary explanation 1.	0
			1	Torque control mode (TCON)	Valid when the counter mode selection (servo fixed parameter setting) is set to basic counter. Select the torque control mode. Refer to the supplementary explanation 1.	0
			2	Position control mode (PCON)	Valid when the counter mode selection (servo fixed parameter setting) is set to basic counter. Select the position control mode. Refer to the supplementary explanation 1.	0
			3	Phase control mode (PHCON)	Valid when the counter mode selection (servo fixed parameter setting) is set to basic counter. Select the phase control mode. Refer to the supplementary explanation 1.	0
			4	Zero point return mode (ZRN)	Valid when the counter mode selection (servo fixed parameter setting) is set to basic counter. Select the zero point return mode. Position control mode, which takes the zero point as its position reference, results at the moment the zero point is detected. Thus, it is necessary in advance to set at least the following parameters for the position control mode: linear acceleration time setting (OW□□0C), linear deceleration time setting (OW□□0D), position loop gain setting (OW□□10), deviation error detection value setting (OW□□0F), and positioning completion range setting (OW□□0E). Refer to the supplementary explanation 1.	0
			5	Phase control test signal (PHTEST)	Used when the counter mode selection (servo fixed parameter setting) is set to basic counter and in the phase control mode. If this bit is set ON, the phase reference generation operation and the PI control operation result both become invalid (=0). Operation in this state is the same as the speed control mode with the averaged and the settings for the acceleration and deceleration times are "0."	0
			6	Alarm clear (ACR)	When this bit turns ON, the error status (Bit 0) of the run status (IW□□00), servo parameter setting error (Bit 1), the A/D conversion error (Bit 3), and alarm (IL□□22) are all cleared.	0
			7	Phase reference generation operation invalid (PHREF OFF)	Used when the counter mode selection (servo fixed parameter setting) is set to basic counter, and in the phase control mode. If this bit is set ON, the operation result of the phase reference generation operation becomes invalid (=0). The current position is substituted as the target position. The operation result of PI control is valid. Ordinarily, set this Bit OFF to use it as an electronic shaft, and ON to use it as an electronic cam.	0
			8	Selection to use motion command (MCDSEL)	Set whether use or not use the motion command (OW□□20). Valid when the selection to use motion command (servo fixed parameter) is set to "USE (=1)". This parameter is available for CP-9200SH version No. 87921-9000 □-S0200 and later.	0

Table 5.5 Details of Servo Parameters for Setting (Cont'd)

No.	Name	Register No.		Setting range	Contents	Default value
1	Run mode setting (RUNMOD)	Bit	9	Zero point return direction selection (ZRNDIR)	Specifies the direction for zero point return when zero point return mode or motion command zero point return (ZRET) (DEC 1+C-pulse or C-pulse) is selected. 0: Zero point return in a negative direction (direction of decreasing position pulses). 1: Zero point return in a positive direction (direction of increasing position pulses). Refer to 3.4.5 "Zero Point Return Control Mode" and the item (3) of 3.4.3 (8) "Zero point return (ZRET)".	0
			10	Request for absolute position readout (ABSRD)	If this bit is set ON, the absolute position data is read out from the absolute value encoder. When the read out is completed, the absolute position read out completion signal (Bit 10 of IW□□00) turns ON. Used when turning ON or OFF the servo drive power source while CP-9200SH is running.	0
			11	Count disabled (CNTDIS)	The function differs depending on the counter mode selection (servo fixed parameter setting). < Reversible counter / Interval counter > Stops counting. When this bit is ON, counting of the counter is stopped. Thus, in this state even if pulses A and B are input, the counter current position (IL□□ 08) will not be updated. < Basic counters > Compensates for feedforward when switching the control mode. Use to change control modes such as the speed control mode to position control. When the feedforward gain (OW□□11) is not "0", select to the parameter to change the control mode smoothly. This function is available for CP-9200SH version No. 87920-9000□-S0206 and later.	0
			12	Request for count value preset (PRSREQ)	Valid only when the counter mode selection (servo fixed parameter setting) is set to reversible counter. When this bit is set ON, the count preset data (IL□□06) is preset to the counter. When presetting is completed, count value preset completion (Bit 6 of IW□□00) turns ON. This can be used to set a desired value into the counter current position (IL□□08). If this bit is "ON" when presetting is once completed, even if counting preset data (OL□□06) is set in data again, preset will not be executed. Thus, when the next preset is performed, after setting this bit to "OFF" for more than one scan, once again set it back "ON". (Note) This bit is invalid when count disabled (Bit 11 of OW□□00) is ON.	0
			13	DI latch detection request (DIINTREQ)	Valid only when the counter mode selection (servo fixed parameter setting) is set to basic counter. When this bit is set ON, the current position when the DI latch signal turns ON, is informed to DI latch detection position monitor (IL□□06). When the DI latch detection is completed, the DI latch completion signal (Bit 11 of IW□□00) turns ON. If this bit is ON, when DI latch detection is once completed, even if DI latch signal is input again, it will not be received. Thus, for receiving the next latch, after setting this bit to "OFF" for more than one scan, once again set it back "ON".	0
			14	Request for coincidence detection (COINREQ)	When the coincident detection selection is set to "USE" and the reference unit selection (Bit0 to 3 of servo fixed parameter No.17) is set to "pulse" in the control using the motion command, setting this Bit to "ON" turns the coincident detection signal (Bit14 of IW□□ 00) when the coincident detection set value (OL□□ 08) coincides with the counter counting value. The counter count value can be learned from the position monitor or the current value of the hardware counter (IL□□08). If this bit is ON when coincidence detection is once completed, even if coincidence detection set values (OL□□08) is set in data again, coincidence detection will not be executed. Thus, for performing the next coincidence detection, after setting this bit to "OFF" for more than one scan, once again set it back "ON".	0
			15	Phase control integral reset (IRESET)	Used when the counter mode selection (servo fixed parameter setting) is on basic counter and in phase control mode. When this bit is set ON, the PI control integral will reset.	0

Table 5.5 Details of Servo Parameters for Setting (Cont'd)

No.	Name	Register No.		Setting range	Contents	Default value
2	Servo drive run command setting (SVRUNCMD)	OW□□01		Sets the necessary run modes for the motion control and the output signals from the SVA module to the Servo driver. This is bit configuration. The table below indicates that bit configuration.		
		Bit	0	Servo ON (RUN) (DO0)	This is used as a servo ON signal for the driver when the counter mode selection is set to "basic counter". "1" is output from DO0 when SVCRDY (IB□□007) is "ON" and this bit is "1". Used as a general-purpose DO when the counter mode selection (servo fixed parameter setting) is set to a reversible counter, an interval counter, or frequency measurement. Refer to the supplementary explanation 1, 2, and 3.	0
			1	DO1	This is used as a general-purpose DO. Use DO01 for connection to the machine. The data set to this Bit is output from DO01. Refer to the supplementary explanation 3.	0
			2	DO2	This is used as a general-purpose DO. Use DO02 for connection to the machine. The data set to this Bit is output from DO02. Refer to the supplementary explanation 3.	0
			3	DO3	This is used as a general-purpose DO. Use DO03 for connection to the machine. The data set to this Bit is output from DO03. Refer to the supplementary explanation 3.	0
			4	DO4	This is used as a general-purpose DO. Use DO04 for connection to the machine. The data set to this Bit is output from DO04. Refer to the supplementary explanation 3.	0
			5	DO5	When "Use" is selected on the coincidence detection function use selection, this is used as a coincidence output DO. Set to "0" for this case. When "non-use" is selected on the coincidence detection function use selection, it is used as general-purpose DO. The coincidence detection function use selection is set in the Servo Fixed Parameter Setting screen.	0
			6 to 11	Not used		0
			12	Position reference value selection (USE_BUF)	Select a location to set the position reference data in the position control mode using the motion command (OW□□20). 0: The position reference data is the data in OL□□12. Set position data for OL□□12. 1: The position reference data is in a position buffer. Set a position buffer number for OL□□12. The position data must be stored in the specified position buffer beforehand. Refer to 3.4.3 (4) "Position reference" for details. This parameter is available for CP-9200SH version No. 87921-9000□-S0200 and later.	0
			13	Speed reference value selection (SPDTYPE)	Select a register number and unit of speed reference value such as feed speed, approach speed, creep speed in the position control mode using the motion command (OW□□20). 0: Set the rapid feed speed to OL□□20. The setting unit of approach speed (OW□□0A), and creep speed (OW□□0B) is 1 = 10^n reference unit/min. 1: Set the rapid feed speed to OW□□15. The setting unit of approach speed (OW□□0A), and creep speed (OW□□0B) is 1 = 0.01 %. Refer to 3.4.3 (6) "Speed reference" for details. This parameter is available for CP-9200SH version No. 87921-9000□-S0200 and later.	0
			14	Position reference type (XREFTYPE)	Select a data type for feed speed and position reference data in the position control mode using the motion command ((OW□□20). 0: The position reference (OL□□12) is absolute position method. 1: The position reference (OL□□12) is adding incremental value method. Refer to 3.4.3 (4) "Position reference" for details. This parameter is available for CP-9200SH version No. 87921-9000□-S0200 and later.	0

Table 5.5 Details of Servo Parameters for Setting (Cont'd)

No.	Name	Register No.	Setting range	Contents	Default value
2	Servo drive run command setting (SVRUNCMD)	Bit 15	Zero point return deceleration point limit switch signal (LSDEC)	Functions as a limit switch signal for zero point return in the zero point return control mode and for zero point return of the motion command zero point return (ZRET). An external signal (DI signal captured by LIO-01 module) must be connected (programming) to OB□□01F in the user program. For zero point return, refer to 3.4.5 "Zero point return control mode" and (3) of 3.4.3 (8) "Zero point return (ZRET)."	0
3	Positive torque control setting (TLIMP)	OW□□02	−32768 to 32767	The meaning varies depending on the counter mode selection (servo fixed parameter setting). When the basic counter is selected, this setting is used with the speed, position, phase control, or zero point return mode. For the VS-866, positive torque limit value is set with a positive value (in units of 0.01%). For the SERVOPACK, the positive rotation current limit value is set with a negative value (in units of 0.01%). When the reversible counter, interval counter, or frequency measurement is selected, this setting can be used as a general-purpose D/A. The data set in this register are scaled by set value for the D/A output voltage when the torque limit is 100%, and output from CN1- to CN4-7 (1 to 4 axes). The D/A output voltage when the torque monitor is 100% is set on the Servo fixed Parameter Setting screen. · D/A output value =(Positive torque limit set value×D/A output voltage when the torque limit is 100%)/10000 For example, taking the set value for D/A output voltage when the torque limit is 100% to be 3 V, and the positive torque limit setting to be 200% (=20000, 1=0.01%), (20000×3V)/10000 = 6V is output.	-30000 (-300.00%)
4	Negative torque control setting (TLIMN)	OW□□03	−32768 to 32767	The meaning varies depending on the counter mode selection (servo fixed parameter setting). When the basic counter is selected, this setting is used with the speed, position, phase control, or zero point return mode. For the VS-866, negative torque limit value is set with a positive value (in units of 0.01%). For the SERVOPACK, the negative rotation current limit value is set with a positive value (in units of 0.01%). In the torque control mode, this setting can be used a general-purpose D/A converter, but is not used as a torque limit value. When the reversible counter, interval counter, or frequency measurement is selected, this setting can be used as a general-purpose D/A. The data set in this register is scaled by set value for the D/A output voltage when the torque limit is 100%, and output from CN1, CN2, CN3, and CN4-5 (1 to 4 axes). The D/A output voltage when the torque monitor is 100% is set on the Servo fixed Parameter Setting screen. · D/A output value =(Negative torque limit set value×D/A output voltage when the torque monitor is 100%)/10000 For example, taking the set value for D/A output voltage when the torque monitor is at 100% to be 3 V, and the negative torque limit setting to be −150% (=−15000, 1=0.01%), (−15000×3V)/10000=−4.5 V is output.	30000 (300.00%)
5	Positive speed limit value setting (NLIMP)	OW□□04	0 to 32767	Valid only when the counter mode selection (servo fixed parameter setting) is set to basic counter. Sets the positive speed limit value in the speed, position, and phase control, or zero point return mode. Set the positive speed limit value in the position control mode at more than 110% of the speed reference setting (OW□□15 or OL□□22).	15000 (150.00%)
6	Negative speed limit value setting (NLIMN)	OW□□05	0 to 32767	Valid only when the counter mode selection (servo fixed parameter setting) is set to basic counter. Sets the negative speed limit value in the speed, position, phase control, or zero point return mode. Set the negative speed limit value in the position control mode at more than 110% of the speed reference setting (OW□□15 or OL□□22).	15000 (150.00%)

Table 5.5 Details of Servo Parameters for Setting (Cont'd)

No.	Name	Register No.	Setting range	Contents	Default value
7	Zero point return offset (ABSOFF)	OL□□06	-2^{31} to $2^{31}-1$	Used when the counter mode selection (servo fixed parameter setting) is set to basic counter or reversible counter. When on basic counter, only values set in this register can shift the position information. Refer to the supplementary explanation 5. Even though these are valid during a RUN, use them with "OFF". This register stores the data to configure the position control monitored by the SVA module. Special care should be taken since any mistake in settings of this register influences the proceeding movements. Check if the data are correctly set before operation. Otherwise, damage to tools resulted from interference, and injury may be caused. Refer to the supplementary explanation 4. When on reversible counter, when the request for count value preset. Bit 12 of OW□□00) is "ON", the value set in this register is preset as the count value of the counter. When preset is completed, the count value preset completion (Bit 6 of IW□□00) turns "ON".	0
8	Coincidence detection set value (COINDAT)	OL□□08	-2^{31} to $2^{31}-1$	When the coincidence detection function selection (servo fixed parameter setting) is "use," request for coincidence detection (Bit 14 of OW□□00) is "ON", and the value of this register and the count value of the counter coincide, D05 (CN1 to CN4-49: 1 to 4 axes) and the coincidence detection signal (Bit 14 of IW □□00) turn "ON". The counter count value can be monitored from the position monitor, or the current value of the hardware counter (IL□□08).	0
9	Approach speed setting (Napr)	OW□□0A	0 to 32767	Used when the basic counter is selected for the counter mode selection (servo fixed parameter) in zero point return mode or "zero point return (ZRET)" of motion command.	0
10	Creep speed setting (Nclp)	OW□□0B	0 to 32767	The setting unit differs depending on the speed reference value selection (OB□□ 01D). (1) When OB□□ 01D=0 in "zero point return (ZRET)" of the motion command, 1 = 10^{n} reference unit/min (n = number of digits below decimal point) In units of pulse: 1 = 1000 pulses/min In units of mm: 1 = 1 mm/min In units of deg: 1 = 1 deg/min In units of inch: 1 = 1 inch/min (2) When OB□□ 01D=1 in "zero point return (ZRET)" of the motion command, 1 = 0.01 % (ratio to the rated motor speed) (3) In zero point return mode, 1 = 0.01 % (ratio to the rated motor speed) Refer to 3.4.3 (6) "Speed reference", 3.4.5 "Zero Point Return Mode", and the item (3) of 3.4.3 (8) "Zero point return (ZRET)".	0
11	Liner acceleration time setting (NACC)	OW□□0C	0 to 32767	Sets the linear acceleration time when the counter mode selection (servo fixed parameter setting) is set to basic counter, and in the speed, position control, or zero point return mode. Set the acceleration time to reach from 0 % to 100% (rated motor speed). Refer to 1.5.3 "Types of Acceleration/Deceleration".	0
12	Liner deceleration time setting (NDEC)	OW□□0D	0 to 32767	Sets the linear deceleration time when the counter mode selection (servo fixed parameter setting) is set to basic counter, and in the speed, position control, or zero point return mode. Set the deceleration time to decelerate from 100 % (rated motor speed) to 0% (rated motor speed). Refer to 1.5.3 "Types of Acceleration/Deceleration" and the supplementary explanation 2.	0
13	Positioning range setting (PEXT)	OW□□0E	0 to 65535	Used when the counter mode selection (servo fixed parameter setting) is set to basic counter, and in the speed, position control, or zero point return mode. Set a range where the positioning completion signal (Bit 13 of IW□□00) and zero point return completion signal (bit 15 of IW□□00) are ON. Refer to the explanation of IW□□00.	10
14	Deviation error detection value setting (EOV)	OW□□0F	0 to 65535	Used when the counter mode selection (servo fixed parameter setting) is set to basic counter, and in the speed, position control, or zero point return mode. Sets the limit which outputs the deviation error (Bit 0 of IW□□00). If this range is exceeded, the deviation error turns "ON". Position control is activated with this value as deviation. In CP-9200SH version No. 87921-9000□-S0120 and later, when this parameter is set to "0", a deviation error is not detected.	65535

Table 5.5 Details of Servo Parameters for Setting (Cont'd)

No.	Name	Register No.	Setting range	Contents	Default value
15	Positioning loop gain setting (Kp)	OW□□10	0 to 32767	Used when the counter mode selection (servo fixed parameter setting) is set to basic counter, and in the position or zero point return mode. Position loop gain determines the optimum value based on the rigidity of the machine. (The bigger the machine is, the faster the response is. But if too big, overshooting increases, and the machine vibrates.) If the rigidity is high, Kp = 50 to 80, but if low Kp = 20 to 50. Make settings using these as guidelines and then adjust while observing the motion of the machine. For example, for setting 50 as Kp, enter 500 (1 = 0.1) in this register.	300 (30.0)
16	Feed forward gain setting (Kf)	OW□□11	0 to 200	Used when the counter mode selection (servo fixed parameter setting) is set to basic counter, and in position control mode. If a certain level of feed forward gain is input, position control follow-up is improved. Moreover, it also functions to prevent slackness in positioning. Usually there are no problems at Kf = 0, but set the value in the range Kf = 0 to 1.0 as required. For example, for setting Kf to 0.5, enter 50 (1 = 0.01) in this register.	0
17	Position reference setting (XREF) or position	OL□□12	-2^{31} to $2^{31}-1$	Sets the position reference value when the counter mode selection (servo fixed parameter setting) is on basic counter, and in the position control mode. In the position control using the motion command (OB□□20), the meanings of set data differs depending on the position reference value selection (OB□□00C) and the position reference type (OB□□00E). Refer to 3.4.3 (4) "Position reference".	0
18	Averaged number of cycles setting (NNUM)	OW□□14	(1) Travel averaging filter 0 to 255 (0 = 1 = no filter) (2) Exponential acceleration/ deceleration 0 to 32767	Used when the counter mode selection (servo fixed parameter setting) is set to basic counter, or frequency measurement. Set for simple S-curve acceleration and deceleration in the speed control and position control modes, when the basic counter is selected. However, it will lag by Ts×N minute(s) until it reaches linear acceleration and deceleration. N=0 will be considered as N=1 (not averaged) (Ts: High-speed scan setting time) <In the speed control mode> Calculates the transition average of speed reference values (Vr): Speed reference value= $\frac{\Sigma Vr}{N}$ <In the position control mode> Calculates the transition average of the pulses output with each scan (δ p) and makes the position reference value. Position reference value with each scan= $\frac{\Sigma \delta p}{N}$ Note that during operation (a non-zero speed reference is being output), if control is switched to speed or position control from another control mode, the averaging operation is not performed. Moreover, during operation (a non-zero speed reference is being output), even if the number of times of averaging is changed, the averaging operation is not performed. <In the position control mode using the motion command (OW□□20)> Set a filter time constant using a travel averaging filter or an exponential acceleration/deceleration filter. Note that the setting range differs depending on the filter type. Set the filter type at the filter type selection (Bit4 to 7 of OW□□21). Note that any change of filter time constant takes effect at the pulse output completion (IB□□152 is "ON"). Refer to 1.5.3 "Type of Acceleration/Deceleration". <In the frequency measurement> Used in the transition averaging operation of detected frequencies when frequency measurement is selected. This is about the same as when the detection cycle of frequencies is lengthened (Time set for high-speed scan × Value set for number of times of averaging). Realize that the response speed of detected frequencies will lag by that amount of time. When the number of times of averaging is modified, setting data is reflected at that point in time. Use the setting for the average number of rotations in the frequency measurement when the stability (average) of detected frequencies is emphasized over response. For example, when the pulse counting method selector is set to quadruple multiplication of A/B pulse type ("A/B type× 4"), depending on the duty error of the encoder which is being used, there is often instability for frequencies detected in low-speed area. In some of these cases, by setting the average number of rotations (normally, double or quadruple), the detected frequencies can be greatly stabilized.	0

Table 5.5 Details of Servo Parameters for Setting (Cont'd)

No.	Name	Register No.	Setting range	Contents	Default value
19	Speed reference setting (NREF)	OW□□15	–32768 to 32767	The meaning varies depending on the counter mode selection (servo fixed parameter setting). When the basic counter is selected, this setting is used with the speed, position, or phase control mode. <In the speed control> Set the speed reference value in units of 0.01%. <In the position control> Set the steady state speed instruction value in units 0.01%. <In the position control mode using the motion command (OW□□20)> When the speed reference value selection (OB□□01D) is set to "1", the rapid feed speed is set in units of 0.01 % (ratio to the rated motor speed). Refer to 3.4.3 (6) "Speed reference". <In the phase control> Set the standard speed reference value in units of 0.01%. <In the reversible counter, interval counter, or frequency measurement> Used as a general-purpose D/A. The data set in this register are scaled by set value for the D/A output voltage when the speed is 100%, and output from CN1- to CN4-3 (1 to 4 axes). The D/A output voltage when the speed is 100% is set on the Servo Fixed Parameter Setting screen. · D/A output value =(Speed reference value×D/A output voltage when the speed is 100%)/10000 For example, taking the set value for D/A output voltage when the speed is at 100% to be 6 V, and the speed limit reference value to be 100% (=10000, 1=0.01%), (10000×6 V)/10000=6.0 V is output.	0
20	Phase offset setting (PHBIAS)	OL□□16	-2^{31} to $2^{31}-1$	Sets the offset pulse numbers in units of 1 pulse when the counter mode selection (servo fixed parameter setting) is set to basic counter, and in the phase control mode. For example, for setting 100 pulses for offset pulses, set 100 in this register. Used for control systems with no rigidity and no gain can be received to offset the reference pulse.	0
21	Speed compensation setting (NCOM)	OW□□18	–32768 to 32767	Sets the speed compensation value in units of 0.01% when the counter mode selection (servo fixed parameter setting) is set to basic counter, and in the phase control mode. For example, to set a 5% speed compensation, enter 500 (1=0.01) in this register.	0
22	Proportional gain setting (PGAIN)	OW□□19	0 to 32767	Sets the proportional gain of the PI control in units of 0.1 when the counter mode selection (servo fixed parameter setting) is set to basic counter, and in the phase control mode. For example, to set the proportional gain to 50, enter 500 (1=0.1) in this register.	300 (30.0)
23	Integral time setting (Ti)	OW□□1A	0 to 32767	Sets the integral time of the PI control in units of 1 ms when the counter mode selection (servo fixed parameter setting) is set to basic counter, and in the phase control mode. For example, enter 300 (1=1ms) in this register to set the integral time to 300 ms. If 0 is set as the integral time, an integral reset occurs.	300 (300ms)
24	Torque reference setting (TREF)	OW□□1B	–32768 to 32767	Sets the torque reference value in units of 0.01% when the counter mode selection (servo fixed parameter setting) is set to basic counter, and in the phase control mode. The data set in this register are scaled by set value for the D/A output voltage when the torque limit is 100%, and output from CN1- to CN4-7 (1 to 4 axes). The D/A output voltage when the torque limit is 100% is set on the Servo fixed Parameter Setting screen. · D/A output value =(Torque reference value×D/A output voltage when the torque limit is 100%)/10000 For example, taking the set value for D/A output voltage when the torque limit is at 100% to be 3 V, and the reference value to be 50% (=5000, 1=0.01%), (5000×3 V)/10000=1.5 V is output.	0

Table 5.5 Details of Servo Parameters for Setting (Cont'd)

No.	Name	Register No.	Setting range	Contents	Default value
25	Speed limit setting (NLIM)	OW□□1C	−32768 to 32767	Sets the speed limit value in units of 0.01% when the counter mode selection (servo fixed parameter setting) is set to basic counter, and in the phase control mode. The data set in this register are scaled by set value for the D/A output voltage when the speed is 100%, and output from CN1- to CN4-3 (1 to 4 axes). The "D/A output voltage when the speed is 100%" is set on the Servo Fixed Parameter Setting screen. · D/A output value =(Speed reference value×D/A output voltage when the speed is 100%)/10000 For example, taking the set value for D/A output voltage when the speed is at 100% to be 6 V, and the speed limit value to be 150% (=15000. 1≈0.01%),	1500 (150.00%)
26	Bias speed for exponential acceleration/ deceleration (EXPBIAS)	OW□□1D	0 to 32767	(15000×6 V)/10000=9.0 V is output. Set a bias speed at exponential acceleration/deceleration with bias in the position control mode using the motion command (OW□□20). However, the data changed with the RUN "ON" will not be reflected. To change the data, set the RUN to "OFF". When an exponential acceleration/deceleration without bias, set to "0". Refer to 1.5.3 "Type of Acceleration/Deceleration" for details. This parameter is available for CP-9200SH version No. 87921-9000□-S0200 and later.	0
27	Offset pulse setting (PULBIAS)	OL□□1E	-2^{31} to $2^{31}-1$	Used when the counter mode selection (servo fixed parameter setting) is set to *basic counter, and in the phase control mode.* <In the position control mode> Set the number of offset pulses in units of 1 pulse. <In the position control mode using the motion command (OW□□20)> When SVCRUN (IB□□008) is "ON" and "in machine lock" (IB□□170) is "OFF", the pulse amount (1 = 1 pulse) set in this register is output as an offset pulse. The pulse amount set in this register is output regardless of the position information monitored by the SVA module. It is used in the case that the reference pulse should be corrected such as for backlash compensation amount. For example set 100 in this register to set 100 pulses for offset pulses. The pulse amount (1=1 pulse) set in this register is output with each scan after adding it to the reference pulse. The large pulse amount set in the register may cause power swings, set it with care.	0
28	Motion command code (MCMDCODE)	OW□□20	0 to 65535	Used when the counter mode selection (servo fixed parameter) is set to "basic counter", and in the position control mode. This parameter is valid only when Bit 7 (selection to use motion command) of servo fixed parameter No.14 "Additional function selection" is set to "USE (= 1)" and Bit 8 of servo parameter for setting "operation mode (OW□□00) is set to "1 (Use OW□□20)". *Set a motion function such as a move instruction to be used.* For move instruction, there are positioning (POSING), zero point return (ZRET), interpolation (INTERPOLATE), constant speed feed (FEED) and constant step feed (STEP), etc. The interpolation end segment (END OF_INTERPOLATE) is for system use. Therefore, it will not be used on customer's side. Refer to the item (1) "Positioning" to (8) "Zero point setting" of 3.4.3 (8) for details. This parameter is available for CP-9200SH version No. 87921-9000□-S0200 and later.	0

Table 5.5 Details of Servo Parameters for Setting (Cont'd)

No.	Name	Register No.		Setting range	Contents	Default value
29	Motion command control flag (MCMDCTRL)	OW□21		Set an auxiliary function of motion command.		
		Bit	0	Momentary stop of command (HOLD)	Used when the counter mode selection (servo fixed parameter) is set to "basic counter" in the position control mode using the motion command (OW□□20). Valid when the positioning or the constant step feed is selected for motion command (OW□□20). When this Bit is turned "ON" while the axis is moving, the axis is decelerated to stop. When the momentary stop is completed, the momentary stop completion (IB□□151) is turned "ON". Returning this Bit to "OFF" status at this stage cancels the momentary stop to restart the positioning operation. Refer to the corresponding item of each motion function for momentary stop. This parameter is available for CP-9200SH version No. 87921-9000 □-S0200 and later.	0
			1	Abort command (ABORT)	Used when the counter mode selection (servo fixed parameter) is set to "basic counter" in the position control mode using the motion command (OW□□20). Valid when the positioning, the zero point return or the constant step feed is selected for motion command (OW□□20). When this Bit is turned "ON" while the axis is moving, the axis is decelerated to stop. During aborting process, BUSY (IB□□150) is turned "ON" and turned "OFF" when it is completed. Refer to the corresponding item of each motion function for details. To abort the constant speed feed, setting NOP for the motion command performs the same function. This parameter is available for CP-9200SH version No. 87921-9000 □-S0200 and later.	0
			2	Direction of movement (DIRECTION)	Used when the counter mode selection (servo fixed parameter) is set to "basic counter" in the position control mode using the motion command (OW□□20). Valid when the constant speed feed or the constant step feed is selected for motion command (OW□□20). Specify the direction to move. 0: forward rotation 1: reversed rotation This parameter is available for CP-9200SH version No. 87921-9000 □-S0200 and later.	0 (forward rotation)
			3	Reset first lag (LAGRST)	Used when the counter mode selection (servo fixed parameter) is set to "basic counter" in the position control mode or zero point return mode. In position loop, turning this Bit to "ON" resets the first lag. This performs the same operation as when the first lag time constant (OW□□37) is set to "0". This parameter is available for CP-9200SH version No. 87921-9000 □-S0120 and later.	0
			4 to 7	Filter type selection (FILTERTYPE)	Used when the counter mode selection (servo fixed parameter) is set to "basic counter" in the position control mode using the motion command (OW□□20). Select a type of acceleration/deceleration filter. 0: No filter 1: Exponential acceleration/deceleration filter 2: Travel averaging filter When it is set to either "1" or "2", the filter time constant (OW□□14) is valid. Refer to 1.5.3 "Type of Acceleration/Deceleration" This parameter is available for CP-9200SH version No. 87921-9000 □-S0200 and later.	0 (No filter)

Table 5.5 Details of ServoParameters for Setting (Cont'd)

No.	Name	Register No.		Setting range	Contents	Default value
29	Motion command control flag (MCMDCTRL)	Bit	8	Position loop P/PI switching (POS_PPI)	Used when the counter mode selection (servo fixed parameter) is set to "basic counter" in the position control mode or zero point return mode. Set whether P control or PI control is used for position control. 0: P control 1: PI control. Normally, set to "0 (P control)". This parameter is available for CP-9200SH version No. 87921-9000 □-S0110 and later.	0 (P control)
			9	Integral reset for position control (POS_IRST)	Used when the counter mode selection (servo fixed parameter) is set to "basic counter" in the position control mode or zero point return mode. When position loop is used for PI control (refer to Bit8 of OW□□21), turning this Bit "ON" resets PI control integration. This parameter is available for CP-9200SH version No. 87921-9000 □-S0110 and later.	0
			10	Speed offset for position control (OW□□18) valid (NCOMSEL)	Used when the counter mode selection (servo fixed parameter) is set to "basic counter" in the position control mode or zero point return mode. When this Bit is turned "ON", the data set at the Speed compensation setting (OW□□18) is added to the position loop operation value as the speed compensation amount (1 = 0.01 %). Refer to Chapter 4 "Control Block Diagram". This parameter is available for CP-9200SH version No. 87921-9000 □-S0110 and later.	0
			11	Not used	Set to "0".	0
			12	Reversed rotation side limit signal for zero point return (LMT_L)	Used when the counter mode selection (servo fixed parameter) is set to "basic counter" in the position control mode using the motion command (OW□□20). In "zero point return (ZRET)", it functions as reversed rotation side limit signal. Accordingly, it is necessary to connect (program) an external signal (DI signal received through LIO-01 module, etc.) to OB□□21C in the user program. Refer to the item (3) "Zero point return (ZRET)"of 3.4.3 (8) for "zero point return (ZRET)". This parameter is available for CP-9200SH version No. 87921-9000 □-S0200 and later.	0
			13	Forward rotation side limit signal for zero point return (LMT_R)	Used when the counter mode selection (servo fixed parameter) is set to "basic counter" in the position control mode using the motion command (OW□□20). In "zero point return (ZRET)", it functions as forward rotation side limit signal. Accordingly, it is necessary to connect (program) an external signal (DI signal received through LIO-01 module, etc.) to OB□□21D in the user program. Refer to the item (3) "Zero point return (ZRET)"of 3.4.3 (8) for "zero point return (ZRET)". This parameter is available for CP-9200SH version No. 87921-9000 □-S0200 and later.	0
			14	Position buffer write in (BUFF_W)	Used when the counter mode selection (servo fixed parameter) is set to "basic counter" in the position control mode using the motion command (OW□□20). When this Bit is turned "ON", the data set in the position buffer write-in data (OL□□3A) is stored in the position buffer set in the position buffer access No. (OL□□38) as an absolute position data. Refer to 3.1.3 "Position Reference". This parameter is available for CP-9200SH version No. 87921-9000 □-S0200 and later.	0
			15	Position buffer read out (BUF_R)	Used when the counter mode selection (servo fixed parameter) is set to "basic counter" in the position control mode using the motion command (OW□□20). When this Bit is turned "ON", the data is read from the position buffer specified by the position buffer access No. (OL□□38) and stored in the position buffer read-out data (IL□□28). Note that it takes 2 scans from issuing the read-out command (turning this Bit "ON") to storing the data in the position buffer read-out data (IL□□28). Refer to 3.1.3 "Position Reference". This parameter is available for CP-9200SH version No. 87921-9000 □-S0200 and later.	0

Table 5.5 Details of ServoParameters for Setting (Cont'd)

No.	Name	Register No.	Setting range	Contents	Default value
30	Rapid feed speed (RV)	OL□□22	0 to $2^{31}-1$	Used when the counter mode selection (servo fixed parameter) is set to "basic counter" in the position control mode using the motion command (OW□□20). When the speed reference value selection (OB□□01D) is set to "0", set a rapid feed speed in 10^n reference unit/min (n: number of digits below decimal point). In units of pulse: 1 = 1000 pulses/min In units of mm: 1 = 1 mm/min In units of deg: 1 = 1 deg/min In units of inch: 1 = 1 inch/min This parameter is available for CP-9200SH version No. 87921-9000□-S0200 and later.	0
31	External positioning travel distance (EXMDIST)	OL□□24	-2^{31} to $2^{31}-1$	Used when the counter mode selection (servo fixed parameter) is set to "basic counter" in the position control mode using the motion command (OW□□20). Set a distance from the input of latch signal (external positioning signal) until the axis stops at the external positioning (EX_POSING). This parameter is available for CP-9200SH version No. 87921-9000□-S0200 and later.	0
32	Distance to stop (STOPDIST)	OL□□26	-2^{31} to $2^{31}-1$	Used when the counter mode selection (servo fixed parameter) is set to "basic counter" in the position control mode using the motion command (OW□□20). Valid when the interpolation is set for the motion command (OW□□20). This parameter is for system use. Normally, set to "0". This parameter is available for CP-9200SH version No. 87921-9000□-S0200 and later.	0
33	STEP travel amount (STEP)	OL□□28	0 to $2^{31}-1$	Used when the counter mode selection (servo fixed parameter) is set to "basic counter" in the position control mode using the motion command (OW□□20). Valid when the constant step feed is set for the motion command (OW□□20). Set a travel amount in 1 reference unit. Refer to 3.4.3 (1) "Reference unit" for more information about refernce units. This parameter is available for CP-9200SH version No. 87921-9000□-S0200 and later.	0
34	Zero point return final travel distance (ZRNDIST)	OL□□2A	-2^{31} to $2^{31}-1$	Used when the counter mode selection (servo fixed parameter) is set to "basic counter" in the position control mode using the motion command (OW□□20). Valid when "zero point return (ZRET)" is set for the motion command (OW□□20). After a valid zero point pulse has been detected, the axis moves for the distance set in this register and stops. The position the axis stops becomes the origin of machine coordinate system. Refer the item (3) "Zero point return (ZRET)" of 3.4.3 (8) for "zero point return (ZRET)". This parameter is available for CP-9200SH version No. 87921-9000□-S0200 and later.	0
35	Override (OV)	OW□□2C	0 to 32767	Used when the counter mode selection (servo fixed parameter) is set to "basic counter" in the position control mode using the motion command (OW□□20). Set an override value when the override selection (Bit9 of motion controller function selection flag) of motion fixed parameter is set valid. "Override" represents the function that changes a feed speed set value to use. Actually, the result of a multiplication (100% = 1) of the speed reference set value by the set value in this register is taken as the speed reference. However, this is invalid for approach speed and creep speed. This parameter is available for CP-9200SH version No. 87921-9000□-S0200 and later.	0
36	Position monitoring control flag (POSCTRL)	OW□□2D	0 to 65535	Select a function for the position information monitored by the SVA module. Bit configuration. The bit configuration is described below.	
		Bit 0	Machine lock mode setting (MLK)	Used when the counter mode selection (servo fixed parameter) is set to "basic counter" in the position control mode using the motion command (OW□□20). In this mode, the motion command is normally executed and the position information such as IL□□02 are updated, however, the actual control axis is locked and does not move. Any change in this Bit becomes valid at the pulse output completion (IB□□152 is "ON"). This parameter is available for CP-9200SH version No. 87921-9000□-S0200 and later.	0

Table 5.5 Details of ServoParameters for Setting (Cont'd)

No.	Name	Register No.		Setting range	Contents	Default value
36	Position monitoring control flag (POSCTRL)	Bit	1	Number of POSMAX turns preset request (TPRSREQ)	Used when the counter mode selection (servo fixed parameter) is set to "basic counter" in the position control mode using the motion command (OW□□20). Valid when the axis selection (Bit5 of motion controller function selection flag) of servo fixed parameter is set to "infinite length axis (=1)". When this Bit is turned "ON", the data set by POSMAX number of turns (IL□□1E) can be preset according to POSMAX number of turns preset data (OL□□30). Used to reset to "0". This parameter is available for CP-9200SH version No. 87921-9000□-S0200 and later.	0
			2	Request to load ABS system infinite length position monitor information (ABSLDREQ)	Used when the counter mode selection (servo fixed parameter) is set to "basic counter" in the position control mode using the motion command (OW□□20). Valid when the encoder selection of servo fixed parameter is set to "absolute encoder (=1) and the axis selection (Bit 5 of motion controller function selection flag) is set to "infinite length axis (=1). When this Bit is turned "ON", the position information monitored by the SVA module is updated according to the data set in the encoder position at power off (OL□□38, OL□□3A) and the pulse absolute position at power off (OL□□3C, OL□□3E). This parameter is available for CP-9200SH version No. 87921-9000□-S0200 and later.	0
			3	Position monitor 2 (IL□□34) unit selection	Used when the counter mode selection (servo fixed parameter) is set to "basic counter" in the position control mode using the motion command (OW□□20). Select the unit for the data reported to the position monitor (IL□□34). 0: Reference unit Reported in 1 = 1 reference unit 1: Pulse unit Reported in 1 = 1 pulse. This parameter is available for CP-9200SH version No. 87921-9000□-S0200 and later.	0
			4 to 15	Not used	Set to "0".	0
37	Work coordinate system offset (OFFSET)	OL□□2E		-2^{31} to $2^{31}-1$	Used when the counter mode selection (servo fixed parameter) is set to "basic counter" in the position control mode using the motion command (OW□□20). Normally, set to "0". It is not used directly in SVA module. This parameter is available for CP-9200SH version No. 87921-9000□-S0200 and later.	0
38	POSMAX number of turns preset data (TURNPRS)	OL□□30		-2^{31} to $2^{31}-1$	Used when the counter mode selection (servo fixed parameter) is set to "basic counter" in the position control mode using the motion command (OW□□20). When the request to preset POSMAX number of turns (OB□□2D1) is turned "ON", the POSMAX number of turns (IL□□1E) can be preset according to the data set in this register. This parameter is available for CP-9200SH version No. 87921-9000□-S0200 and later.	0
39	2nd in-position width (INPWIDTH)	OW□□32		0 to 65535	Used when the counter mode selection (servo fixed parameter) is set to "basic counter" in the position control mode using the motion command (OW□□20). Set the range where the 2nd in-position completion (Bit2 of IW□□17) is turned "ON". The 2nd in-position completion (IB□□172) is turned "ON" when the pulse output is completed (IB□□152 is "ON") and 0 ≤ (Current position (IL□□08) - Machine coordinate system reference position (IL□□18)) ≤ 2nd in-position width (OW□□32). This parameter is available for CP-9200SH version No. 87921-9000□-S0200 and later.	0

Table 5.5 Details of ServoParameters for Setting (Cont'd)

No.	Name	Register No.	Setting range	Contents	Default value
40	Zero point position output width (PSETWIDTH)	OW□□33	0 to 65535	Used when the counter mode selection (servo fixed parameter) is set to "basic counter" in the position control mode using the motion command (OW□□20). Set the range of zero point position. The zero point position (IB□□171) is turned "ON" when 0 ≦ (Machine coordinate system reference position (IL□□18)) ≦ Zero point position output width and in zero point return completion status (IB□□156 is "ON"). This parameter is available for CP-9200SH version No. 87921-9000□-S0200 and later.	0
41	Positioning completion check time (PSETTIME)	OW□□34	0 to 65535	Used when the counter mode selection (servo fixed parameter) is set to "basic counter" in the position control mode using the motion command (OW□□20). Set the limit value (1 = 1ms) to detect the positioning time over (Bit6 of IL□□22). If the positioning completion signal (Bit13 of IW□□00) is not turned "ON" when the time exceeds this range after the pulse output completion (Bit2 of IW□□15 is turned "ON"), a positioning time over occurs. When it is set to "0", this check is not performed. When a positioning time over is not to be detected, set to "0". This parameter is available for CP-9200SH version No. 87921-9000□-S0200 and later.	0
42	Integral time for position control (PTi)	OW□□35	0 to 32767	Used when the counter mode selection (servo fixed parameter) is set to "basic counter" in the position control mode or zero point return mode. Set an integral time (1 = 1ms) when position loop is used in PI control (refer to Bit8 of OW□□21). When it is set to "0", integral operation is not performed. This parameter is available for CP-9200SH version No. 87921-9000□-S0110 and later.	0
43	Integral upper and lower limits for position control (ILMIT)	OW□□36	0 to 32767	Used when the counter mode selection (servo fixed parameter) is set to "basic counter" in the position control mode or zero point return mode. Set integral upper and lower limits when position loop is used in PI control (refer to Bit8 of OW□□21). The integral output value that exceeds the range, is limited to these values. This parameter is available for CP-9200SH version No. 87921-9000□-S0110 and later.	0
44	First lag time constant (LAGTI)	OW□□37	0 to 32767	Used when the counter mode selection (servo fixed parameter) is set to "basic counter" in the position control mode or zero point return mode. In position loop, set the first lag time constant (1 = 1ms). When it is set to "0", the first lag operation is not performed. This parameter is available for CP-9200SH version No. 87921-9000□-S0120 and later.	0
45	Encoder position lowest 2 words at power off (eposL) or Position buffer access No.	OW□□38	-2^{31} to $2^{31}-1$	Used when the counter mode selection (servo fixed parameter) is set to "basic counter" in the position control mode using the motion command (OW□□20). This parameter is used for the following two methods. (1) Encoder position lowest 2 words at power off Valid when the encoder selection of servo fixed parameter is set to "absolute encoder (=1)" and the axis selection (Bit5 of motion controller function selection flag) of servo fixed parameter is set to "infinite length axis (=1). When the request to LOAD ABS system infinite length position monitor information (Bit2 of OW□□2D) is turned "ON", the data set in this parameter is taken as the encoder position lowest 2 words at power off. (2) Position buffer access No. When the position buffer write-in (Bit14 of OW□□21) or the position buffer read-out (Bit15 of OW□□21) is turned "ON", the data set in this parameter is taken as the position buffer access No. In this case, the setting range is 1 to 256. Invalid when it is set to "0". This parameter is available for CP-9200SH version No. 87921-9000□-S0200 and later.	0

Table 5.5 Details of ServoParameters for Setting (Cont'd)

No.	Name	Register No.	Setting range	Contents	Default value
46	Encoder position highest 2 words at power off (eposH) or Position buffer write-in data	OL□□3A	-2^{31} to $2^{31}-1$	Used when the counter mode selection (servo fixed parameter) is set to "basic counter" in the position control mode using the motion command (OW□□20). This parameter is used for the following two methods. (1) Encoder position highest 2 words at power off Valid when the encoder selection of servo fixed parameter is set to "absolute encoder (=1)" and the axis selection (Bit5 of motion controller function selection flag) of servo fixed parameter is set to "infinite length axis (=1). When the request to LOAD ABS system infinite length position monitor information (Bit2 of OW□□2D) is turned "ON", the data set in this parameter is taken as the encoder position highest 2 words at power off. (2) Position buffer write-in data When the position buffer write-in (Bit14 of OW□□21) is turned "ON", the data set in this parameter is written into the position buffer specified by OL □□38 as the absolute position data. This parameter is available for CP-9200SH version No. 87921-9000□-S0200 and later.	0
47	Pulse position lowest 2 words at power off (aposL)	OL□□3C	-2^{31} to $2^{31}-1$	Used when the counter mode selection (servo fixed parameter) is set to "basic counter" in the position control mode using the motion command (OW□□20). Valid when the encoder selection of servo fixed parameter is set to "absolute encoder" and the axis selection (Bit5 of motion controller function selection flag) of servo fixed parameter is set to "infinite length axis (=1)". When the request to LOAD ABS system infinite length position monitor information (Bit2 of OW□□2D) is "ON", the data set in this parameter is taken as the pulse position lowest 2 words at power off. This parameter is available for CP-9200SH version No. 87921-9000□-S0200 and later.	0
48	Pulse position highest 2 words at power off (aposH)	OL□□3E	-2^{31} to $2^{31}-1$	Used when the counter mode selection (servo fixed parameter) is set to "basic counter" in the position control mode using the motion command (OW□□20). Valid when the encoder selection of servo fixed parameter is set to "absolute encoder" and the axis selection (Bit5 of motion controller function selection flag) of servo fixed parameter is set to "infinite length axis (=1)". When the request to LOAD ABS system infinite length position monitor information (Bit2 of OW□□2D) is "ON", the data set in this parameter is taken as the pulse position highest 2 words at power off. This parameter is available for CP-9200SH version No. 87921-9000□-S0200 and later.	0

[Supplementary explanations]

1. When the counter mode selection (servo fixed parameter setting) is set on the basic counter, for run mode settings (OW□□00), and the Servo drive run command (OW□□01), the priority order is as follows. Thus, if all are turned ON at the same time, the control mode with the highest priority order is activated.

(High)	Priority order	(Low)
RUN>ZRN>NCON>TCON>PCON>PHCON		

2. When the counter mode selection (servo servo fixed parameter setting) is set on the basic counter, if the RUN signal (Bit 0 of OW□□01) turns OFF during operation, the operation of machine is different depending on the control mode.
   - If position, speed, phase control, or zero point return mode is currently selected, the machine will decelerate according to the linear deceleration time (OW□□0D) set from the current speed reference. During that time the RUN signal stays ON. When deceleration stop is completed (a 0 is output as deceleration reference), to the Servo driver, the VS-866 outputs a RUN signal, while the SERVOPACK outputs OFF as a Servo ON signal from terminals CN1- to CN4-22. In other words, even if the RUN signal is turned OFF, the machine will decelerate following the linear deceleration time and the VS-866 will output a RUN signal while the SERVOPACK will output ON as a Servo ON signal until 0 is output for the speed reference.
   - In the torque control mode, if the RUN signal turns OFF, a 0 is output immediately as speed reference. The VS-866 then outputs a RUN signal, while the SERVOPACK outputs OFF as a Servo ON signal.
     Parameters (OW□□02, OW□□03) related to torque control settings and the torque reference setting (OW□□1B) will continue to output setting data regardless of whether the RUN signal is ON or OFF.

3. An example of a general-purpose DO used as an output to servo driver is shown below.
Since it is a general-purpose DO, it can be used in different applications depending on the system.
Note that DO5 can be used as a general-purpose DO only when the coincident detection function is not used.
Use the sensor ON signal (SEN) to connect the other specific signal (DO6).

Name	Connection to VS-866	Connection to SERVOPACLK
DO0	Run (RUN)	Servo ON (SV-ON)
DO1	Torque control selection (TSEL)	Proportional control (P-CON)
DO2	Emergency stop (EMG*)	Reversed rotation over travel (N-OT*)
DO3	Run ready (RDY)	Forward rotation over travel (P-OT*)
DO4	Failure reset (RST)	Alarm reset (ALM-RST)
DO5	ASR integral reset (IRST)	Not used

* Logical value; set "OFF" when such a phenomenon is to be occurred.

4. How to use the reference point zero position offset when the counter mode selection (servo fixed parameter setting) is set on the basic counter is explained below.
   ① When used with applications to rotate the absolute encoder in a single direction.
   We have prepared user functions which manage absolute position using reference point zero position offset settings (OL□□ 06) of the servo parameters.
   ② When initializing the absolute value encoder.
   Simply by short-circuit between R-S, the pulse cannot be reset within a single revolution. For example, if the device stops after 95.5 revolutions, even if the absolute value encoder resets (R-S is short-circuited), and a initial incremental pulse appropriate for 0.5 revolutions is transmitted. Thus the position monitor (IL□□ 08) does not register "0" but position data appropriate for 0.5 revolutions is reported. At that point, since the position monitor registers 0, make the following settings.

<Assumptions>
After initializing the absolute encoder (R-S is short-circuited), and activating the CP-9200SH, transmit a 120-pulse initial incremental pulse. The position monitor displays 120.

<Counter measures>
Adjust with the zero point position offset. When -120 is set as the zero point position offset, the position monitor registers 0. However, when the power of the CP-9200SH is interrupted, the number which was set in the zero point position offset will be reset to "0". We recommend setting using the method shown in Drawing A (Startup processing drawing).

(Example 1) In DWG.A

⊢ OLC006 − 0000000120 ⇒ OLC006

(Example 2) In DWG.A

⊢ OLC006 − DL00022 ⇒ OLC006

Here using the CP-9200SH programming panel, open the register list screen, and set DL00022 to 120. Since DL00022 (D register of DWG.A) has a battery backup, once it has been set, this program will automatically be executed whenever the CP-9200SH is turned ON, and -120 will be set into OLC006.
In this example, we used DL00022, other D registers (DL□□□□□) or M registers (ML□□□□□) may be used.
Each time the absolute encoder is initialized (R-S short-circuited), the initial incremental pulse of less than one revolution changes, so the −120 figure must be changed each time. In example 1, there is no need to change the user program, we simply changed the register data on the programming panel. For repeating machine, the example of number 2 is much more convenient.

5. When "Use" is selected for the motion command code usage selection (servo fixed parameter) and "1 (=valid)" is selected for the motion command code valid (OB□□ 008).
For other than the above, use pulse as a unit.

5.2.3 Details of Servo Parameters for Monitoring

(Note)
Registers of different module numbers are not continuous.
If the module number is the same, the registers between the axes are continuous. Use subscripts (i, j) in user programs with care.
(Example)
With ⊢IW(OW)C000i, where i = 0 to 255, the register number can be correctly read out.
With IW(OW)C000i, the register number can be correctly read and written within the register range of module No. 1; IW(OW)C000 to IW(OW)C0FF. Where i ≧ 256, it can not be correctly read out.

Table 5.6 Details of Servo Parameters for Monitoring

No.	Name	Register No.		Setting Range	Contents
1	Run status (RUNSTS)	IW□□00		Informs of the run status of the SVA module. Is in bit configuration. The table below shows that bit configuration.	
		Bit	0	Deviation error (EOVER)	In the position control mode, the zero point return control mode, or the phase control mode, when the position deviation (IL□□0A) exceeds the deviation error detection value setting (OW□□0F), this Bit turns ON. Since the control continues as it is, when processing for an application such as emergency stop is necessary, monitor this Bit and create a user program that executes another process. The possible causes that this Bit turns ON: (1) The value set for the deviation error detection (OW□□0F) is too small. (2) The motor is not rotating. (3) The load of machine system is too heavy to perform the motion as commanded. When this Bit turns ON, the LED of SVA module displays "⌟" (1st axis), "⌞"(2nd axis), "⌜"(3rd axis) and "⌞"(4th axis). Clear the "deviation error" and when the alarm clear (Bit6 of OW□□00) is ON, the display will be turned "OFF".
			1	Servo parameter setting error (PRMERR)	When a value that exceeds the setting range is set for the servo parameter for setting (OW□□00 to OW□□3F), this Bit turns ON. In this case, the last servo parameter number that causes the setting range error is informed to the range exceeding parameter No. (IW□□0F).
			2	Servo fixed parameter setting error (FPRMERR)	When a value that exceeds the setting range is set for the servo fixed parameter, this Bit turns ON. In this case, 100 added to the last servo fixed parameter that causes the setting range error is informed to the range exceeding parameter No. (IW□□0F). This Bit turns "OFF" automatically when a correct servo fixed parameter is set through CP-717.
			3	A/D conversion error (ADER)	This Bit turns ON when the A/D converter does not operate normally. Clear the A/D conversion error status, and when the alarm clear (Bit6 of OW□□00) is turned "ON", this Bit turns "OFF". Even if this Bit is "ON", the control will be executed, but the analog monitor value will not be updated. The LED display is the same as the "Deviation error" (Bit0 of IW□□00). Since a hardware failure can be suspected, replace the SVA module.
			4	Cumulated number of rotations reception error (When absolute encoder is used) (PGER)	When the counter mode selection (servo fixed parameter) is set to the basic counter and an absolute encoder is used, at power up with the request for absolute position readout (Bit10 of OW□□00) "ON", the absolute position is received by serial transmission. In this case, if a reception error occurs, the transmission is retried four times. If a normal reception is not succeeded after all, this Bit turns ON. When this Bit turns ON, the control for this axis is cut off. (This results in the same state as when the axis use selection of servo fixed parameter is set to "NOT USE" (=0).) The LED display is the same as the "Deviation error" (Bit0 of IW□□00). The possible causes that this Bit becomes "1": (1) The absolute encoder has not been initialized. (2) Cable failure (3) Hardware failure in Servo driver, absolute encoder, or SVA module.
			5	Not used	
			6	Count value preset completion (PRESET)	Valid only when the counter mode selection (servo fixed parameter) is set to the reversible counter. When the request for count value preset (Bit12 of OW□□00) is "ON", the count value completion turns "ON".

Table 5.6 Details of Servo Parameters for Monitoring (Cont'd)

No.	Name	Register No.		Setting Range	Contents
1	Run status (RUNSTS)	Bit	7	Servo controller ready (SVCRDY)	This Bit turns "ON" when the SVA module is ready to run. The possible causes that this Bit turns "OFF": (1) A critical error occurs. (2) The axis use selection (servo fixed parameter) is set to "NOT USE". (3) Servo fixed parameter setting error (4) Cumulative number of rotations reception error (5) While changing a servo fixed parameter (6) While reading out the absolute position from the absolute encoder
			8	Servo controller running (SVCRUN)	Valid only when the counter mode selection (servo fixed parameter) is set to "Basic counter". This Bit turns "ON" when SVCRDY (IB□□007) is "ON", and one of speed control mode (OB□□000), torque control mode (OB□□001), position control mode (OB□□002), phase control mode (OB□□003) and zero point return mode (OB□□004) is "ON", and the servo ON (OB□□010) is "ON". In position control mode using the motion command (OW□□20), when an alarm occurs even if this Bit is "ON", issuing a motion command does not move the axis. Clear the alarm and set the motion command to "NOP" for more than 1 scan, then set the motion command again.
			9	Information of rotating direction selection when using absolute encoder (DIRINV)	Valid only when the counter mode selection (servo fixed parameter) is set to "Basic counter" and an absolute encoder is used. Turns "ON" when the rotation direction selection of servo fixed parameter is set to "Positive", and turns "OFF" when set to "Negative".
			10	Absolute position readout completion signal (ABSRDC)	Turns "ON" when the counter mode selection (servo fixed parameter) is se to "Basic counter" and the absolute position readout request (Bit1 of OW□□00) is "ON" and the absolute position data readout from the absolute encoder is completed. If an error occurs, the cumulative number of rotations reception error (Bit4 of IW□□00) turns "ON".
			11	DI latch completion signal (DIINT)	Turns "ON" when the counter mode selection (servo fixed parameter) is set to "Basic counter" and the DI latch detection request (Bit13 of OW□□00) is "ON" and the DI signal is being input. Further, the current position at that time is informed to the position monitor at DI latch detection (IL□□06).
			12	Feedback pulse 0 (FBP0)	Indicates that there is not feedback pulse. Thus, this Bit normally turns "ON" when the motor is not rotating. If this Bit stays "ON" even though a reference is output, it can be that the feedback signal line from PG is disconnected.
			13	Positioning completion signal (POSCOMP)	Turns "ON" when positioning is completed in the position control mode. (1) When the motion command is not used This Bit turns "ON" when | Current value (IL□□8) – Position reference value (OL□□12) | ≤ Positioning completion range (OW□□0E) (2) When the motion command is used This Bit turns "ON" when the pulse output completion (Bit2 of IW□□15) is "ON" and | Current value (IL□□08) – Machine coordinate system reference position (IL□□18) | ≤ Positioning completion range (OW□□0E)
			14	Coincidence detection signal (CNTCOIN)	Turns "ON" when the coincidence detection function (servo parameter for setting) is selected to "USE" and the coincidence detection request (Bit14 of OW□□00) is "ON" and the coincidence detection set value (IL□□08) and the count value coincide. The count value can be known from the position monitor or the hardware counter
			15	Zero point return completion signal (ZRNC)	current value (IL□□08). Turns "ON" when zero point return is completed in the zero point return mode. Actually, this Bit turns "ON" when | Current value (IL□□08) – Zero point position | ≤ Positioning completion range (OW□□0E).
2	Servo drive status (SVSTS)	IW□□01			Informs the status of input signal and general-purpose DI signal from the servo driver. These input signals are not used to control inside the SVA module. Use them for control in user program if required. The bit configuration is as follows.
		Bit	0	General-purpose DI (DI0)	Informs the status of DI00 signal. Refer to the supplementary explanation 1.
			1	General-purpose DI (DI1)	Informs the status of DI01 signal. Refer to the supplementary explanation 1.
			2	General-purpose DI (DI2)	Informs the status of DI02 signal. Refer to the supplementary explanation 1.

Table 5.6 Details of Servo Parameters for Monitoring (Cont'd)

No.	Name	Register No.		Setting Range	Contents
2	Servo drive status (SVSTS)	Bit	3	General-purpose DI (DI3)	Informs the status of DI03 signal. Refer to the supplementary explanation 1.
			4 to 15	Not used	
3	Target position monitor (PTG)	IL□□02		-2^{31} to $2^{31}-1$	Informs the calculated position of machine coordinate system monitored by SVA module. Generally, the position data informed to this register becomes the target position at each scan. Refer to 3.4.3 (5) "Position monitor" and the supplementary explanation 2.
5	Target position increment monitor (PTGDIF)	IL□□04		-2^{31} to $2^{31}-1$	Informs the pulse output amount at each scan.
7	Position monitor at DI latch detection, or latch data from hardware counter, or detected frequency (PINT)	IL□□06		-2^{31} to $2^{31}-1$	The meaning is different depending on the selected counter mode (servo fixed parameter). When the basic counter is selected, position monitor at DI latch detection is informed. Refer to the supplementary explanation 2. The position monitor at DI latch detection means the current position when the DI latch signal turns "ON". Refer to the explanation on DI latch completion signal of run status (IW□□00). When the interval counter is selected, latch data from the hardware counter are informed. The latch data from the hardware counter means the current count value of the counter when the C-pulse input signal turns "ON". When the frequency measurement is selected, detected frequency is informed. The detected frequency means the computed frequency at each scan immediately before execution of "high-speed scan processing drawing (H-drawing)" from A and B-pulse train. Note that a detected frequency is a value multiplied by a frequency coefficient (servo fixed parameter). Refer to the item "frequency coefficient" of the Details of Servo Fixed Parameters for details. Invalid when the reversible counter is selected.
9	Position monitor, or current value of hardware counter (PFB)	IL□□08		-2^{31} to $2^{31}-1$	The meaning is different depending on the counter mode selection (servo fixed parameter). When the basic counter is selected, the current position monitor value is informed. Refer to the supplementary explanation 2. Note: Invalid at execution of A-drawing. Valid from the execution of H-drawing or L-drawing. When the reversible counter, the interval counter, or the frequency measurement is selected, the current count value of the counter is informed.
11	Position deviation monitor, or Number of incremental pulses at each scan (PDV)	IL□□0A		-2^{31} to $2^{31}-1$	For system analysis. The meaning is different depending on the counter mode selection (servo fixed parameter). When the basic counter is selected, the position deviation (lag pulse) is informed. This is valid in the zero point return mode, the position control mode, and the phase control mode (*Position deviation = Target position at each scan - Current position*) When the reversible counter or frequency measurement is selected, the number of incremental pulses is informed. This is invalid when the interval counter is selected.
13	Speed reference output value monitor (SPDREF)	IW□□0C		−32768 to 32767	For system analysis. The value output to the servo drive is informed as a speed reference output value. This is the latter part of the speed limiter (OW□□04, OW□□05)
14	Speed monitor (NFB)	IW□□0D		−32768 to 32767	The A/D conversion result input to CN1- to CN4-30 (1st to 4th axis) is scaled by the set value for the "input voltage at the speed monitor (A/D) 100%" and informed. The "input voltage at the speed monitor (A/D) 100%" is set on the Servo Fixed Parameter Setting screen. · Speed monitor value = (A/D input voltage × 10000)/Set value for input voltage at the speed monitor 100% For example, when the set value for input voltage at the speed monitor (A/D) 100 % is 6 V and the actual A/D input voltage is 3V, (3 V × 10000)/6 V = 5000 is informed.
15	Torque monitor (TFB)	IW□□0E		−32768 to 32767	The A/D conversion result input to CN1- to CN4-28 (1st to 4th axis) is scaled by the set value for the "input voltage at the torque monitor (A/D) 100 %" and informed. The "input voltage at the torque monitor (A/D) 100%" is set on the Servo Fixed Parameter Setting screen. · Torque monitor value = (A/D input voltage × 10000)/Set value for input voltage at the torque monitor 100% For example, when the set value for input voltage at the torque monitor (A/D) 100 % is 3 V and the actual A/D input voltage is -9 V, (-9 V × 10000)/3 V = −30000 is informed.

Table 5.6 Details of Servo Parameters for Monitoring (Cont'd)

No.	Name	Register No.	Setting Range	Contents
16	Range exceeding parameter No. (ERNO)	IW□□0F	(1) For servo parameter for setting, 1 to 48 (2) For servo fixed parameter, 101 to 127	In setting of the servo parameter for setting (OW□□00 to OW□□3F) or the servo fixed parameter, the last parameter number whose setting exceeds the setting range is informed. In setting the servo parameter for setting (OW□□00 to OW□□3F), when a setting range error is detected, a parameter number from 1 to 48 is informed. In setting the servo fixed parameter, when a setting range error is detected, a parameter number added 100 (101 to 127) is informed. For example, when a setting range error is detected at the linear acceleration time setting (OW□□0C), 00011 is informed. When a setting range error is detected at the rated motor speed (servo fixed parameter), 00107 is informed. Note: Valid when the setting error of servo parameter for setting (IB□□001) or the servo fixed parameter setting error (IB□□002) is "ON".
17	Cumulative number of rotations received from absolute encoder (ABSREV)	IL□□10	-2^{31} to $2^{31}-1$	For system analysis. Valid only when the counter mode selection (servo fixed parameter) is set to "Basic counter" and the absolute encoder is used. The cumulative number of rotations received from the absolute encoder is informed.
19	Number of initial incremental pulses received from absolute encoder (IPLUSE)	IL□□12	-2^{31} to $2^{31}-1$	For system analysis. Valid only when the counter mode selection (servo fixed parameter) is set to "Basic counter" and the absolute encoder is used. The number of initial incremental pulses received from the absolute encoder is informed.
21	Motion command response code (MCMDRCODE)	IW□□14	0 to 65535	Valid when the counter mode selection (servo fixed parameter) is set to "Basic counter" in the position control mode using the motion command (OW□□20). The motion command (OW□□20) in execution is informed. For the motion command, refer to OW□□20. This parameter is available for CP-9200SH version No. 87921-9000□-S0200 and later.
22	Motion command status (MCMDSTS)	IW□□15	Valid when the counter mode selection (servo fixed parameter) is set to "Basic counter" in the position control mode using the motion command (OW□□20). The status of the motion command (OW□□20) in execution is informed. Bit configuration. The bit configuration is as shown below.	
		Bit 0	Flag for motion command in execution (BUSY)	Informs the status of motion command. 0: Ready 1: Busy (in process) This Bit is specially used for the status at abort. This parameter is available for CP-9200SH version No. 87921-9000□-S0200 and onward.
		1	Motion command momentary stop completion flag (HOLDL)	Turns "ON" when a momentary stop is completed. For momentary stop function, refer to each motion function. This parameter is available for CP-9200SH version No. 87921-9000□-S0200 and onward.
		2	Output completion (DEN)	Turns "ON" when the output of travel amount is completed. This parameter is available for CP-9200SH version No. 87921-9000□-S0200 and onward.
		3	Zero point setting completed (ZSET)	When the zero point setting (ZSET) is set for the motion command (OW□□20), this Bit turns "ON" at completion of zero point setting. This parameter is available for CP-9200SH version No. 87921-9000□-S0200 and onward.
		4	External positioning signal latch completion (EX_LATCH)	Turns "ON" at the external positioning signal input in execution of the external positioning (EX_POSING). This parameter is available for CP-9200SH version No. 87921-9000□-S0200 and onward.
		5	Command faulty completion status (FAIL)	Turns "ON" when an alarm occurs during execution of move instruction (positioning, constant-speed feed, etc.). When this Bit is "ON", run is disabled. When this Bit turns "ON", set the motion command (OW□□20) to NOP for more than 1 scan. When this Bit turns "ON", the LED of SVA module displays "⌟"(1st axis), "⌞"(2nd axis), "⌜"(3rd axis) or "⌞⌟"(4th axis). This parameter is available for CP-9200SH version No. 87921-9000□-S0200 and later.

Table 5.6 Details of Servo Parameters for Monitoring (Cont'd)

No.	Name	Register No.		Setting Range	Contents
22	Motion command status (MCMDSTS)	Bit	6	Zero point return completion status (ZRNC)	Turns "ON" at zero point return completion or zero point setting completion. Turns "OFF" at starting zero point return. This parameter is available for CP-9200SH version No. 87921-9000□-S0200 and later.
			7 to 15	Not used	
23	Monitor for number of digits below decimal point (DECNUMM)	IW□□16		0 to 5	Valid when the counter mode selection (servo fixed parameter) is set to "Basic counter" in the position control mode using the motion command (OW□□20). "Number of digits below decimal point" of motion fixed parameter No.18 is informed. This parameter is available for CP-9200SH version No. 87921-9000□-S0200 and later.
24	Position monitor status (POSSTS)	IW□□17		Valid when the counter mode selection (servo fixed parameter) is set to "Basic counter" in the position control mode using the motion command (OW□□20). The statuses of positions monitored by the SVA module are informed. Bit configuration. The bit configuration is as shown below.	
		Bit	0	In machine lock (MLKL)	Turns "ON" in machine lock status. When this Bit is "ON", an actual control axis is locked and remains stopped. This parameter is available for CP-9200SH version No. 87921-9000□-S0200 and later.
			1	Zero point position (ZERO)	Turns "ON" in zero point return completion status (IB□□156 is "ON") and 0 ≦ Machine coordinate system reference position (IL□□18) ≦ Zero point position output width (OW□□33). This parameter is available for CP-9200SH version No. 87921-9000□-S0200 and later.
			2	2nd INP completion (PSET2)	Turns "ON" when the pulse output completion (Bit2 of IW□□15) is "ON" and (Current position (IL□□08) – Machine coordinate system reference position (IL□□18), ≦ 2nd in-position width (OW□□32). This parameter is available for CP-9200SH version No. 87921-9000□-S0200 and later.
			3	LOAD completion of ABS system infinite length position monitor (ABSLDE)	Valid when the encoder selection of servo fixed parameter is set to "Absolute encoder (=1)" and the axis selection of servo fixed parameter (Bit5 of motion controller function selection flag) is set to "Infinite length axis (=1)". Turns "ON" at LOAD completion when the request to LOAD ABS system infinite length monitor information (OB□□2D2) is "ON". Turning the request to LOAD ABS system infinite length monitor information (OB□□2D2) "OFF" turns this Bit "OFF". This parameter is available for CP-9200SH version No. 87921-9000□-S0200 and later.
			4	POSMAX number of turns preset completion (TPRSE)	Valid when the axis selection (Bit5 of motion controller function selection flag) of servo fixed parameter is set to "Infinite length axis (=1)". This Bit turns "ON" at preset completion when POSMAX number of turns preset request (OB□□2D1) is "ON". Turning "OFF" the POSMAX number of turns preset request (OB□□2D1) turns "OFF" this Bit. This parameter is available for CP-9200SH version No. 87921-9000□-S0200 and later.
			5	Electric gear valid selection monitor (GEARM)	"Elecatric gear valid/invalid selection" Bit4 of Servo fixed parameter No.17 is informed. This parameter is available for CP-9200SH version No. 87921-9000□-S0200 and later.
			6	Axis selection monitor (MODSELM)	"Axis selection" Bit5 of Servo fixed parameter No.17 is informed. This parameter is available for CP-9200SH version No. 87921-9000□-S0200 and later.
			7 to 15	Not used	
25	Machine coordinate system reference position (MPOS)	IL□□18		-2^{31} to $2^{31}-1$	Valid when the counter mode selection(servo fixed parameter) is set to "Basic counter" in the position control mode using the motion command (OW□□20). The position that SVA module externally outputs, that is the reference position of machine coordinate system is informed. In machine lock status (IB□□170 is "ON"), this position data is not updated. Refer to 3.4.3 (5) "Position monitor". This parameter is available for CP-9200SH version No. 87921-9000□-S0200 and later.

Table 5.6 Details of Servo Parameters for Monitoring (Cont'd)

No.	Name	Register No.	Setting Range	Contents
27	Not used	IL□□1A	–	–
29	POSMAX monitor (PMAXTURN)	IL□□1C	1 to $2^{31}-1$	Valid when the counter mode selection(servo fixed parameter) is set to "Basic counter" in the position control mode using the motion command (OW□□20). "Infinite length axis reset position (POSMAX)" of servo fixed parameter No. 22 is informed. This parameter is available for CP-9200SH version No. 87921-9000□-S0200 and later.
31	POSMAX number of turns (PMAXTURN)	IL□□1E	-2^{31} to $2^{31}-1$	Valid when the counter mode selection(servo fixed parameter) is set to "Basic counter" in the position control mode using the motion command (OW□□20). The count is up/down every time it exceeds "Infinite length axis reset position (POSMAX)" of servo fixed parameter No. 22. The count can be preset by the POSMAX number of turns preset data (OL□□30) and POSMAX number of turns preset request (OB□□2D1). This parameter is available for CP-9200SH version No. 87921-9000□-S0200 and later.
33	Not used	IL□□20	–	–
35	Alarm (ALARM)	IL□□22	Valid when the counter mode selection(servo fixed parameter) is set to "Basic counter" in the position control mode using the motion command (OW□□20). Alarm information is informed. When this register value is other than "0", run is disabled. This register is cleared to "0" at rising edge of the alarm clear (OB□□006). When this register value is other than "0", the LED of the SVA module displays "⌟"(1st axis), "⌞"(2nd axis), "⌜" (3rd axis), or "⌞" (4th axis). Bit configuration. The bit configuration is as follows.	
		Bit 0 to 2	Not used	
		3	Positive direction soft limit (SOTF)	When the axis selection of servo fixed parameter is set to "Finite length axis" and the soft limit (positive direction) of servo fixed parameter is set to "Valid" and in zero point return completion status (IB□□156 is "ON") (1) When the motion command (OW□□20) is set for interpolation When Machine coordinate system reference position (IL□□18) + Distance to stop (OL□□26) ≧ Soft limit value (positive direction)(servo fixed parameter No. 24), this Bit turns "ON". (2) When the motion command (OW□□20) is set for positioning, constant-speed feed or constant-step feed When Machine coordinate system reference position (IL□□18) ≧ Soft limit value (positive direction) (servo fixed parameter No.24), this Bit turns "ON". This parameter is available for CP-9200SH version No. 87921-9000□-S0200 and later.
		4	Negative direction soft limit (SOTR)	When the axis selection of servo fixed parameter is set to "Finite length axis" and the soft limit (negative direction) of servo fixed parameter is set to "Valid" and in zero point return completion status (IB□□156 is "ON"), (1) When the motion command (OW□□20) is set for interpolation When Machine coordinate system reference position (IL□□18) + Distance to stop (OL□□26) ≦ Soft limit value (negative direction)(servo fixed parameter No. 25), this Bit turns "ON". (2) When the motion command (OW□□20) is set for positioning, constant-speed feed or constant-step feed When Machine coordinate system reference position (IL□□18) ≦ Soft limit value (negative direction (servo fixed parameter No.25), this Bit turns "ON". This parameter is available for CP-9200SH version No. 87921-9000□-S0200 and later.
		5	Not used	
		6	TIMEOVER	Turns "ON" when the positioning completion signal (Bit13 of IW□□00) does not turn "ON" even if the positioning completion check time (OW□□34) is exceeded after the pulse output completion (Bit2 of IW□□15 is "ON"). This parameter is available for CP-9200SH version No. 87921-9000□-S0200 and later.
		7	Speed over (DLSTOVER)	When using the electric gear, turns "ON" when the traveling distance exceeds the limit. This parameter is available for CP-9200SH version No. 87921-9000□-S0206 and later.
		8, 9	Not used	
		10	Control mode error (MODERR)	Turns "ON" when control mode other than position control mode (OB□□002) is set and a move instruction (positioning, constant-speed feed, etc.) is set for the motion command (OW□□20). This parameter is available for CP-9200SH version No. 87921-9000□-S0200 and later.

Table 5.6 Details of Servo Parameters for Monitoring (Cont'd)

No.	Name	Register No.		Setting Range	Contents
35	Alarm (ALARM)	Bit	11	Zero point not set (ZSET_NRDT)	Valid when the encoder selection of servo fixed parameter is set to "Absolute encoder (=1)" and the axis selection of servo fixed parameter (Bit5 of motion controller function selection flag) is set to "Infinite length axis (=1)". This Bits turns "ON" when the zero setting completion signal (Bit3 or IW□□ 15) is "OFF" and POSING/EX_POSING/INTERPOLATE/ ENDOF_INTERPOLATE/LATCH of motion command has been executed. This parameter is available for CP-9200SH version No. 87921-9000□-S0200 and later.
			12 to 16	Not used	
			17	ABS encoder rotation amount exceeded	Turns "ON" when the rotation amount of absolute encoder exceeds the allowable range of SVA module where an absolute encoder is used and the axis selection (Bit5 of motion controller function selection flag) is set to "Infinite length axis (=1)".
			18 to 31	Not used	
37	Not used	IW□□24		–	–
38	Not used	IW□□25		–	–
39	Speed reference output value monitor (RVMON)	IL□□26		-2^{31} to $2^{31}-1$	Valid when the counter mode selection (servo fixed parameter) is set to "Basic counter" in the position control mode using the motion command (OW□□20). The travel amount at each scan is informed. In machine lock status (IB□□170 is "ON"), it turns "0". This parameter is available for CP-9200SH version No. 87921-9000□-S0200 and later.
41	Position buffer readout data (CNMON)	IL□□28		-2^{31} to $2^{31}-1$	Valid when the counter mode selection (servo fixed parameter) is set to "Basic counter" in the position control mode using the motion command (OW□□20). When the position buffer readout (OB□□21F) of servo parameter for setting is "ON", the position data is read out from the position buffer specified by a position buffer access number (OL□□38) and informed. It takes 2 scans until the data is stored in this register from the moment that the position buffer readout command (OB□□21F) is turned "ON". This parameter is available for CP-9200SH version No. 87921-9000□S0200 and later.
43	Not used	IL□□2A		–	–
45	Integral output value monitor (YIMON)	IL□□2C		-2^{31} to $2^{31}-1$	Valid when the counter mode selection (servo fixed parameter) is set to "Basic counter" in the position control mode or zero point return mode. When position loop is used in PI control (refer to Bit8 of OW□□21), an integral output value is informed. This parameter is available for CP-9200SH version No. 87921-9000□-S0110 and later.
47	Machine coordinate system count position (POS)	IL□□2E		-2^{31} to $2^{31}-1$	Valid when the counter mode selection (servo fixed parameter) is set to "Basic counter" in the position control mode using the motion command (OW□□20). This is applied when the axis selection of servo fixed parameter (Bit5 of motion controller function selection flag) is set to "Infinite length axis (=1)". The target position of infinite length axis at each scan is informed. Refer to 3.4.3 (5) "Position monitor". This parameter is available for CP-9200SH version No. 87921-9000□-S0200 and later.
49	First lag monitor (LAGMON)	IL□□30		-2^{31} to $2^{31}-1$	Valid when the counter mode selection (servo fixed parameter) is set to "Basic counter" in the position control mode or zero point return mode. (PI output value – First lag output value) is informed. This parameter is available for CP-9200SH version No. 87921-9000□-S0120 and later.
51	Position loop output value monitor (PIMON)	IL□□32		-2^{31} to $2^{31}-1$	Valid when the counter mode selection (servo fixed parameter) is set to "Basic counter" in the position control mode or zero point return mode. The position loop output value (before adding the feed forward operation value) is informed. This parameter is available for CP-9200SH version No. 87921-9000□-S0120 and later.

Table 5.6 Details of Servo Parameters for Monitoring (Cont'd)

No.	Name	Register No.	Setting Range	Contents
53	Position monitor 2 (APOS2)	IL□□34	-2^{31} to $2^{31}-1$	Valid when the counter mode selection (servo fixed parameter) is set to "Basic counter" in the position control mode using the motion command (OW□□20). Informs the position value before adding the zero point position offset (OL□□02) value. When using this parameter, add the zero point position offset value converted to the currently used unit (reference unit or pulse). The informed contents differ depending on the position monitor 2 unit selection (OB□□2D3). (1) When OB□□2D3 = 0 The current position monitor is informed in 1 = 1 reference unit. This parameter is disabled, however, when the axis selection (fixed parameter) is set to "Infinite length axis" and the zero point position offset (OL□□06) ≠ 0. (2) When OB□□2D3 = 1 The position monitor (IL□□08) converted into a pulse unit is informed. This parameter is available for CP-9200SH version No. 87921-9000□-S0200 and later.
55	Not used	IW□□36	–	–
56	Not used	IW□□37	–	–
57	Encoder position lowest 2 words at power off (eposmL)	IL□□38	-2^{31} to $2^{31}-1$	Valid when the encoder selection of servo fixed parameter is set to "Absolute encoder (=1)" and the axis selection of servo fixed parameter (Bit5 of motion controller function selection flag) is set to "Infinite length axis (=1)". The lowest 2 words of encoder position are informed. This parameter is available for CP-9200SH version No. 87921-9000□-S0200 and later.
59	Encoder position highest 2 words at power off (eposmH)	IL□□3A	-2^{31} to $2^{31}-1$	Valid when the encoder selection of servo fixed parameter is set to "Absolute encoder (=1)" and the axis selection of servo fixed parameter (Bit5 of motion controller function selection flag) is set to "Infinite length axis (=1)". The highest 2 words of encoder position are informed. This parameter is available for CP-9200SH version No. 87921-9000□-S0200 and later.
61	Pulse position lowest 2 words at power off (aposmL)	IL□□3C	-2^{31} to $2^{31}-1$	Valid when the encoder selection of servo fixed parameter is set to "Absolute encoder (=1)" and the axis selection of servo fixed parameter (Bit5 of motion controller function selection flag) is set to "Infinite length axis (=1)". The lowest 2 words of pulse position are informed. This parameter is available for CP-9200SH version No. 87921-9000□-S0200 and later.
63	Pulse position highest 2 words at power off (aposmH)	IL□□3E	-2^{31} to $2^{31}-1$	Valid when the encoder selection of servo fixed parameter is set to "Absolute encoder (=1)" and the axis selection of servo fixed parameter (Bit5 of motion controller function selection flag) is set to "Infinite length axis (=1)". The lowest 2 words of pulse position are informed. This parameter is available for CP-9200SH version No. 87921-9000□-S0200 and later.

<Supplementary explanation>

1. An example of a general-purpose DI used for servo drive status is shown below.
   Since it is a general-purpose DI, it can be used in different applications depending on the system.

Name	Connection to VS-866	Connection to SERVOPACK
DI0	Ready (RDYX)	Servo ready (S-RDY)
DI1	Running (RUNX)	In limiting current (CLT)
DI2	Zero speed (ZSPD)	TGON (TGON)
DI3	Warning (ALM)	Servo alarm (ALM*)

   * Logical value: Turns "OFF" when such a phenomenon occurs.

2. When "Use" is selected for the motion command code usage selection (servo fixed parameter) and "1 (=valid)" is selected for the motion command code valid (OB□□008).
   For other than the above, use pulse as a unit.

5.3 Setting Examples of Servo Parameters

5.3.1 Setting Examples of Servo Fixed Parameters

Table 5.7 Setting Example of Servo Fixed Parameters

	Name The number indicates parameter No.	Setting range	Meaning	Basic counter					Reversible counter	Interval counter	Frequency measurement
				Zero point return	Speed	Torque	Position	Phase			
							Position 1 / Position 2				
1	Axis use selection (USESEL)	0 or 1 (Default = 0)	0: Non-use 1: Use	1	1	1	1	1	1	1	1
2	PG signal form selection (PGSEL)	Set for each bit. (Default = 0000H)	Refer to Table 5.1 "List of Servo Fixed Parameters"	0000H (Set a suitable value.)							
3	Encoder selection (ENCSEL)	0 to 2 (Default = 0)	0: Incremental encoder 1: Absolute value encoder 2: Absolute value encode (use as incremental type)	0: Incremental encoder (Set a suitable value.)							
4	Selection of rotating direction for use with absolute value encoders (DIRINV)	0 or 1 (Default = 0)	0: Forward rotation 1: Reverse rotation	0: Forward rotation (Set a suitable value.)							
5	Pulse counting method selection (PULMODE)	0 to 6 (Default = 6)	0: Sign type (single multiplication) 1: Sign type (double multiplication) 2: Up/down type (single multiplication) 3: Up/down type (double multiplication) 4: A/B pulse type (single multiplication) 5: A/B pulse type (double multiplication) 6: A/B pulse type (quadruple multiplication)	6 : A/B × 4 (Set a suitable value.)							
6	Counter mode selection (CNTMODE)	0 to 3 (Default = 3)	0: Reversible counter 1: Interval counter 2: Frequency measurement 3: Basic counter	3	3	3	3	3	0	1	2
7	Motor rated speed setting (NR)	1 to 32000 (Default = 3000)	1 = 1 rpm	3000 (Set a suitable value.)							
8	Setting for the number of feedback pulses in one revolution (FBppr)	Multiples of 4 between 4 and 65532 (Default = 2048)	1 = 1 pulse/rev	2048 (Set a suitable value.)							
9	D/A output voltage when the speed is at 100% (V1)	1 to 10 (Default = 6)	1 = 1 V	6	6	6	6	6	6	6	6
10	D/A output voltage when the torque is at 100% (V2)	1 to 10 (Default = 3)	1 = 1 V	3	3	3	3	3	3	3	3
11	Input voltage when the speed monitor A/D is at 100% (MV1)	1 to 10 (Default = 6)	1 = 1 V	6	6	6	6	6	6	6	6

Table 5.7 Setting Example of Servo Fixed Parameters (Cont'd)

Name The number indicates parameter No.		Setting range	Meaning	Basic counter					Reversible counter	Interval counter	Frequency measurement
				Zero point return	Speed	Torque	Position	Phase			
							Position 1 / Position 2				
12	Input voltage when the torque monitor A/D is at 100% (MV2)	1 to 10 (Default = 3)	1 = 1 V	3	3	3	3	3	3	3	3
13	DI latch detection signal selection (DIINTSEL)	0 or 1 (Default = 0)	0: DI latch input signal 1: Pulse C input signal	0: DI latch input signal Set a suitable value.							
14	Additional function selection (AFUNCSEL)	Set for each bit (Default = 0000H)	Refer to Table 5.1 "List of Servo Fixed Parameters"	0000H	0000H	0000H	0000H	0000H	0000H	0000H	0000H
				Set a suitable value.							
15	Frequency coefficients (HZSEL)	0 to 3 (Default = 2)	0: ×1 (1 = 1 Hz) 1: ×10 (1 = 0.1 Hz) 2: ×100 (1 = 0.01 Hz) 3: ×1000 (= 0.001 Hz)								2 (×100)
16	Simulation mode selection (SIMULATE)	0 to 2 (Default = 2)	0: Normal run mode 1: Simulation mode 2: Final adjustment mode Note 3	0	0	0	0	0	0	0	0
17	Motion controller function selection flag (SVFUNCSEL) Note 3	Set for each bit (Default = 0000H)	Refer to Table 5.1 "List of Servo Fixed Parameters"	0000H (Set a suitable value.)							
18	Number of digits below decimal point (DECNUM) Note 3	0 to 5 (Default = 3)	Set the number of digits below decimal point of the reference	3							
19	Travel amount per machine one rotation (PITCH) Note 3	1 to $2^{31}-1$ (Default = 10000)	1 = 1 reference unit	10000							
20	Motor side gear ratio (GEAR_MOTOR) Note 3	1 to 65535 (Default = 1)	1 = 1 rotation	1							
21	Machine side gear ratio (GEAR_MACHINE) Note 3	1 to 65535 (Default = 1)	1 = 1 rotation	1							
22	Infinite length axis reset position (POSMAX) Note 3	1 to $2^{31}-1$ (Default = 360000)	1 = 1 reference unit	360000							
23	Absolute encoder maximum rotation amount (MAXTURN) Note 3	1 to $2^{31}-1$ (Default = 99999)	1 = 1 rotation	99999							
24	Soft limit value (positive direction) (SLIMP) Note 3	-2^{31} to $2^{31}-1$ (Default = $2^{31}-1$)	1 = 1 reference unit	$2^{31}-1$							
25	Soft limit value (negative direction) (SLIMN) Note 3	-2^{31} to $2^{31}-1$ (Default = -2^{31})	1 = 1 reference unit	-2^{31}							

Table 5.7 Setting Example of Servo Fixed Parameters (Cont'd)

Name (The number indicates parameter No.)		Setting range	Meaning	Basic counter					Reversible counter	Interval counter	Frequency measurement
				Zero point return	Speed	Torque	Position	Phase			
							Position 1 / Position 2				
26	Zero point return method (ZRETSEL) Note 3	0 to 7 (Default = 0)	0: DEC1 + C-pulse 1: Not used 2: Not used 3: C-pulse 4: Not used 5: Not used 6: DEC2 + C-pulse 7: DEC1 + LMT + C-pulse	0 (DEC1 + C pulse)							
27	Backlash compensation amount (BKLSH) Note 3	0 to 32767 (Default = 0)	1 = 1 reference unit	0							

(Notes) 1. Slanted lines indicate the modes in which the parameter is not used. Use the default setting.
2. In the column "Basic counter", the position 1 indicates the position control mode in which the motion command (OW□□ 20) is not used while the position 2 indicates the position control mode in which the motion command (OW□□ 20) is used.
3. Available for CP9200SH version No. 87921-9000□-S0200 and later

5.3.2 Setting Example of Servo Parameters for Setting

Table 5.8 Setting Example of Servo Parameters for Setting

	Name (The number indicates parameter No.)	Register No.	Setting range	Meaning	Basic counter						Reversible counter	Interval counter	Frequency measurement
					Zero point return	Speed	Torque	Position		Phase			
								Position 1	Position 2				
1	Run mode setting (RUNMOD)	OW□□00	Set for each bit. (Default = 0)	Refer to Table 5.2 "List of Servo Parameters for Setting".	0010H	0001H	0002H	0004H	0104H	0008H	0	0	0
2	Servo drive run command setting (SVRUNCMD)	OW□□01	Set for each bit (Default = 0)	Refer to Table 5.2 "List of Servo Parameters for Setting".	000DH	000DH	000FH	000DH		000DH	0000H (Can be used as general-purpose DO.)		
3	Positive torque limit setting (TLIMP)	OW□□02	-32768 to 32767 (Default = -30000)	1 = 0.01%	When using VS-866: 20000 (200%) When using SERVOPACK: -20000 (-200%)			When using VS-866: 20000 (200%) When using SERVOPACK: -20000 (-200%)			0 (Can be used as general-purpose DA.)		
4	Negative torque limit setting (TLIMP)	OW□□03	-32768 to 32767 (Default = 30000)	1 = 0.01%	20000 (200%)	20000 (200%)	20000 (200%)	20000 (200%)		20000 (200%)	0 (Can be used as general-purpose DA.)		
5	Positive speed limiter setting (NLIMN)	OW□□04	0 to 32767 (Default = 15000)	1 = 0.01%	15000 (150%)	15000 (150%)		15000 (150%)		15000 (150%)			
6	Negative speed limiter setting (NLIMN)	OW□□05	0 to 32767 (Default = 15000)	1 = 0.01%	15000 (150%)	15000 (150%)		15000 (150%)		15000 (150%)			
7	Zero point position offset setting, or count value preset data (ABSOFF)	OL□□06	-2^{31} to $2^{31}-1$ (Default = 0)	1 = 1 pulse or 1 = 1 reference unit	0 (Enter a suitable setting only when using the function.)								
8	Coincidence detection setting (COINDAT)	OL□□08	-2^{31} to $2^{31}-1$ (Default = 0)	1 = 1 pulse	0 (Enter a suitable setting only when using the coincidence detection function.)								
9	Approach speed setting (Napr)	OW□□0A	0 to 32767 (Default = 0)	1 = 0.01% or 1 = 10^n reference unit	2000 (20%)				2000 (2000k pulse/min)				
10	Creep speed setting (Nclp)	OW□□0B	0 to 32767 (Default = 0)	1=0.01% or 1 = 10^n reference unit	1000 (10%)				1000 (1000k pulse/min)				
11	Linear acceleration time settin (NACC)	OW□□0C	0 to 32767 (Default = 0)	1 = 1 ms	300 (0.3s)	300 (0.3s)		300 (0.3s)					
12	Linear deceleration time setting (NDEC)	OW□□0D	0 to 32767 (Default = 0)	1 = 1 ms	300 (0.3s)	300 (0.3s)		300 (0.3s)					
13	Positioning completion range setting (PEXT)	OW□□0E	0 to 65535 (Default = 10)	1 = 1 pulse or 1 = 1 reference unit	100			10					
14	Deviation error detection value setting (EOV)	OW□□0F	0 to 65535 (Default = 65535)	1 = 1 pulse	65535			65535					
15	Position loop gain setting (Kp)	OW□□10	1 to 32767 (Default = 300)	1 = 0.1 (300 = 30.0)	500 (50.0)			Enter a suitable setting.					
16	Feed forward gain setting (Kf)	OW□□11	0 to 200 (Default = 0)	1 = 0.01 (10 = 0.10)									
17	Position reference pulse setting (XREF)	OL□□12	-2^{31} to $2^{31}-1$ (Default = 0)	1 = 1 pulse or 1 = 1 reference unit									
18	Averaged number of times setting (NNUM)	OW□□14	0 to 255 or 0 to 32767 (Default = 0)	1 = 1 time or 1 = 1 ms (0 = 1 = not averaged)		0		0					0
19	Speed reference setting (NREF)	OW□□15	-32768 to 32767 (Default = 0)	1 = 0.01		10000 (100%)		10000 (100%)		10000 (100%)	0 (Can be used as general-purpose DA.)		
20	Phase offset setting (PHBIAS)	OL□□16	-2^{31} to $2^{31}-1$ (Default = 0)	1 = 1 pulse									
21	Speed compensation setting (NCOM)	OW□□18	-32768 to 32767 (Default = 0)	1 = 0.01%						Enter a suitable setting.			
22	Proportional gain setting (Kv)	OW□□19	0 to 32767 (Default = 300)	1 = 0.1									

Table 5.8 Setting Example of Servo Parameters for Setting (Cont'd)

Name (The number indicates parameter No.)		Register No.	Setting range	Meaning	Basic counter					Reversible counter	Interval counter	Frequency measurement
					Zero point return	Speed	Torque	Position	Phase			
								Position 1 / Position 2				
23	Integrated time setting (Ti)	OW□□1A	0 to 32767 (Default = 300)	1=1 ms (0=No integration)					300 (300 ms)			
24	Torque reference setting (TREF)	OW□□1B	0 to 32767 (Default = 0)	1=0.01%			10000 (100%)					
25	Speed limit setting (NLIM)	OW□□1C	-32768 to 32767 (Default = 15000)	1=0.01%			15000 (150%)					
26	Bias speed for exponential acceleration/ deceleration filter (EXBIAS) Note 3	OW□□1D	0 to 32767 (Default = 0)	1=10^n reference unit/min				0				
27	Offset pulse setting (PULBIAS)	OW□□1E	-2^{31} to $2^{31}-1$ (Default = 0)	1=1 pulse				0				
28	Motion command code (MCMDCOD) Note 5	OW□□20	0 to 65535 (Default = 0)	0: No command (NOP) 1: Positioning (POSING) 2: External positioning (EX_POSING) 3: Zero point return (ZRET) 4: Interpolation (INTERPOLATE) 5. Interpolation end segment (ENDOF_INTERPOLATE) 6: Interpolation with position detection function (LATCH) 7: Constant speed feed (FEED) 8: Constant step feed (STEP) 9: Zero point setting (ZSET)				Set a suitable value.				
29	Motion command control flag (MCMDCTRL) Note 5	OW□□21	Set for each bit. (Default = 0)	Refer to Table 5.2 "List of Servo Parameter for Setting"	0			0	0			
30	Rapid feed speed (RV) Note 5	OL□□22	0 to $2^{31}-1$ (Default = 0)	1=10^n reference unit/min					5000 (5000k pulses/min)			
31	External positioning travel distance (EXMDIST) Note 5	OL□□24	-2^{31} to $2^{31}-1$ (Default = 0)	1 = 1 reference unit					0			
32	Distance to stop (STOPDIST) Note 5	OL□□26	-2^{31} to $2^{31}-1$ (Default = 0)	1 = 1 reference unit					0			
33	STEP travel amount (STEP) Note 5	OL□□28	0 to $2^{31}-1$ (Default = 0)	1 = 1 reference unit					0			
34	Zero point return final travel distance (ZRNDIST) Note 5	OL□□2A	-2^{31} to $2^{31}-1$ (Default = 0)	1 = 1 reference unit					0			
35	Override (OV) Note 5	OW□□2C	0 to 32767 (Default = 10000)	1 = 0.01 %					10000 (100.00%)			

Table 5.8 Setting Example of Servo Parameters for Setting (Cont'd)

	Name (The number indicates parameter No.)	Register No.	Setting range	Meaning	Basic counter						Reversible counter	Interval counter	Frequency measurement
					Zero point return	Speed	Torque	Position		Phase			
								Position 1	Position 2				
36	Position monitoring control flag (POSCTRL) Note 5	OW□□2D	Set for each bit (Default = 0)	Refer to Table 5.2 "List of Servo Parameters for Setting"					0				
37	Work coordinate system offset (OFFSET) Note 5	OL□□2E	-2^{31} to $2^{31}-1$ (Default = 0)	1 = 1 reference unit (In units of pulse, 1 = 1 pulse)					0				
38	POSMAX number of turns preset data (TURNPRS) Note 5	OL□□30	-2^{31} to $2^{31}-1$ (Default = 0)	1 = 1 turn					0				
39	2nd in-position width (INPWIDTH) Note 5	OW□□32	0 to 65535 (Default = 0)	1 = 1 reference unit					0				
40	Zero point position output width (PSETWIDTH) Note 5	OW□□33	0 to 65535 (Default = 10)	1 = 1 reference unit					10				
41	Positioning completion check time (PSETTIME) Note 5	OW□□34	0 to 65535 (Default = 0)	1 = 1 ms					0				
42	Integral time for position control (PTi) Note 3	OW□□35	0 to 32767 (Default = 300)	1 = 1 ms	300 (300 ms)			300 (300 ms)					
43	Integral upper and lower limits for position control (ILIMIT) Note 2	OW□□36	0 to 32767 (Default = 32767)		32767			32767					
44	First lag time constant (LAGTi) Note 4	OW□□37	0 to 32767 (Default = 0)	1 = 1 ms	0			0					
45	Encoder position lowest 2 words at power off (eposL) Note 5 or Position buffer access No.	OL□□38	-2^{31} to $2^{31}-1$ (Default = 0)	Refer to Table 5.2 "List of Servo Parameters for Setting)					0				
46	Encoder position highest 2 words at power off (eposH) Note 5 or Position buffer write-in data	OL□□3A	-2^{31} to $2^{31}-1$ (Default = 0)	Refer to Table 5.2 "List of Servo Parameters for Setting)					0				
47	Pulse position lowest 2 words at power off (aposL) Note 5	OL□□3C	-2^{31} to $2^{31}-1$ (Default = 0)	Refer to Table 5.2 "List of Servo Parameters for Setting)					0				
48	Pulse position highest 2 words at power off (aposH) Note 5	OL□□3E	-2^{31} to $2^{31}-1$ (Default = 0)	Refer to Table 5.2 "List of Servo Parameters for Setting)					0				

(Notes) 1. Slanted lines indicate the modes in which the parameter is not used. Use the default setting.
2. In the column "Basic counter", the position 1 indicates the position control mode in which the motion command (OW□□20) is not used while the position 2 indicates the position control mode in which the motion command (OW□□20) is used.
3. Available for CP9200SH version No. 87921-9000□-S0110 and later
4. Available for CP9200SH version No. 87921-9000□-S0120 and later
5. Available for CP9200SH version No. 87921-9000□-S0200 and later

APPENDIX

This chapter contains initialization methods for the absolute encoder and the differences between the CP-9200SH (SVA) and the CP-9200H (HSC). This list of differences will serve as reference for using application programs on the CP-9200SH that were created with the CP-9200H.

Appendix A. Initialization of Absolute Encoder

Initialize the encoder in the following cases:

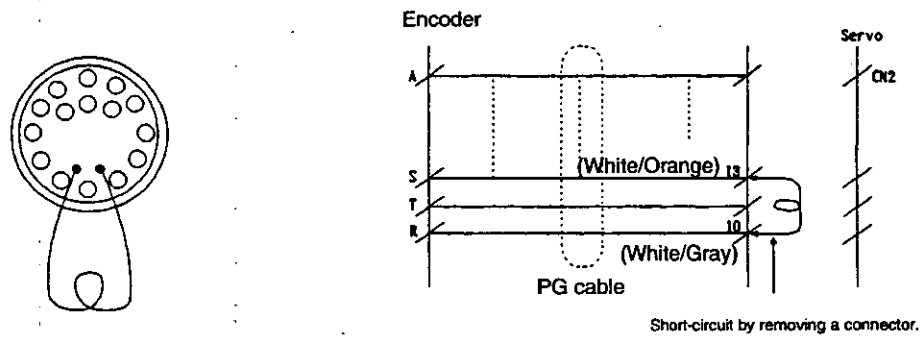
- When initializing the rotation speed from the absolute standard position of the absolute encoder to "0."
- When a battery is not connected to the absolute encoder, and the motor is left unused for four or more days
- When an alarm "absolute encoder error" in the Servo driver (SERVOPACK or VS-866)

A.1 Initialization Procedures for Absolute Encoder (15-bit Type)

① Turn the system power of the Servo driver and the CP-9200SH OFF.
② Discharge the "super capacitor" inside of the encoder by either method (A) or method (B).
(A) Using the encoder side connecter.
- Remove the connector from the encoder.
- Short circuit connector pins of the encoder between (R) and (S). (See Fig. 1)
- Remain in a short-circuited state for at least two minutes.
- Remove the shorted lead, and reconnect the connector to their original positions.

(B) Using the Servo driver side connector
- Remove the connector from the Servo driver.
- Short circuit between pins (10) and (13) with a PG cable as shown in Fig. 2.
- Remain in a short-circuited state for at least two minutes.
- Remove the shorted lead, and reconnect the connectors to their original position.

③ Rewire the cable properly, and connect the battery for the encoder.
④ Turn the system power of the Servo driver and the CP-9200SH ON.
If an alarm occurs, perform the procedure from step ① again.
If the alarm does not occur, initialization is complete.



(a) Initialization of Absolute Encoder on the Encoder Side

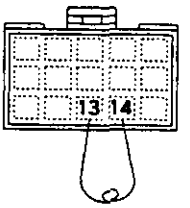
(b) Initialization of Absolute Encoder with PG Cable

Fig. A.1 Initialization of Absolute Encoder

A.2 Initialization Procedures for Absolute Encoder (12-bit Type)

① Turn ON the power to the servo driver.
Make normal connection of the servo driver, motor, and encoder.
Connect the battery, and turn ON the power to the servo driver.

② Bring the SEN signal to High level.
When the SEN signal is in High level, the +5 V power is supplied to the encoder. (Note)
Supply the power for 3 minutes and more to sufficiently charge the backup condenser.
During this process, the encoder is in alarm status.
(Note) To set the SEN signal to High for 3 minutes in CP-9200SH, the servo fixed parameter of CP-9200SH must be set to "absolute encoder".



(Procedures)
(a) Select "absolute encoder" for CP-9200SH servo fixed parameter.
(b) Turn OFF the power to CP-9200SH
(c) Turn ON the power to CP-9200SH (at this stage, the SEN signal becomes High. For 3 minutes)
(d) Turn OFF the power to CP-9200SH
(e) End.

③ Reset the data.
- Turn OFF the power to the servo driver, and remove the encoder connector.
- Short-circuit across the pin (13) and (14) for 1 or 2 seconds.

④ Restore the normal wiring.

⑤ Turn ON the power.
Turn ON the power to the servo driver and CP-9200SH to bring the SEN signal to High level. When no abnormality is found, the setup is completed. If alarm "⌞⌟" (1st axis), "⌞⌞"(2nd axis), "⌜⌝"(3rd axis) or "⌞⌟"(4th axis) is displayed on the LED of the SVA module, repeat the procedures from step ①.

Appendix B. Differences between CP-9200SH (SVA) and CP-9200SH (HSC)

Table B.1 Differences between CP-9200SH (SVA) and CP-9200SH (HSC)

Category \ Product			CP-9200SH (SVA)	CP-9200H (HSC)	Remarks
1	Number of controllable axes		44 axes (4 axes per module, 11 modules maximum)	8 axes (4 axes per module, 2 modules maximum)	
2	Servo parameters	Domain	Fixed I/O registers (128 words/axis) (IWC000 to IWFFFF, OWC000 to OWFFFF)	Common use with M registers (50 words per axis) (MW00000 to MW00399)	
		Number of servo parameters	Monitor: 16 Setting: 25	Monitor: 10 Setting: 32	
		Servo Fixed parameter	Setting on CP-717 screen (Separate from the servo parameters)	M register setting (Included in servo parameters)	
3	Addition of parameters for pulse offset during position control		○	×	
4	Control method improvement during position control		○	—	
5	Counter functions	Basic counter (Servo control)	○	○	
		Frequency measurement	○	×	
		Interval counter	○	×	
		Reversible counter	○	×	
6	Coincidence detection		○	×	
7	DI latch detection		1 point per axis (C pulse also possible)	1 point per axis or 1 point per board (C pulse also possible)	DI latch only valid during basic counter mode
8	User program for absolute position monitoring		User functions for the CP-9200H changed for use with CP-9200SH.	—	

B.1 Equivalence Tables for Servo Fixed Parameters and CP-9200SH Servo Controller

Table B.2 Equivalence Tables for Servo Fixed Parameters and CP-9200SH Servo Controller

Type of Servo controller / Name of servo fixed parameter	CP-9200H Servo controller (87920-2500X-S0YZW) Register No. (+axis ofs)	Remarks
Axis selection (USESEL)	Dip switch	
PG signal form selection (PGSEL)	Dip switch	
Encoder selection (ENCSEL)	Dip switch	
Revolution direction selection when absolute encoder is used (DIRINV)	MB000208	
Pulse counting method selection (PULMODE)	(Not available)	
Counter mode selection (CNTMODE)	(Not available)	
Motor rated speed (NR)	(Not available)	
Number of feedback pulses for one revolution (FBppr)	MW00018	
D/A output voltage when speed is 100% (V1)	MW00048 or similar product	
D/A output voltage when torque limit is 100% (V2)	MW00049 or similar product	
Input voltage when speed monitor (A/D) is 100% (MV1)	(Not available)	On the CP-9200H Servo controller ±100%/±6 V fixed
Input voltage when torque monitor (A/D) is 100% (MV2)	(Not available)	On the CP-9200H Servo controller ±100%/±3 V fixed
DI latch detection signal selection (DIINTSEL)	Plug selection	
Selection to use the coincidence detection function (COINSEL)	(Not available)	
Frequency coefficient (HZSEL)	(Not available)	
Simulation mode selection (SIMULATE)	(Not available)	

(Note) The register number for each axis of the CP-9200H Servo controller is the register number in the table with an axis offset added. Refer to the Control Pack CP-9200/9200H Designer's Manual for Servo Controller (SIE-C879-30.7) for axis offset.

B.2 List of Differences for Servo Parameters for Settings

Table B.3 List of Differences for Servo Parameters for Settings

Type of Servo controller / Name of Servo parameter	CP-9200H Servo controller (87920-2500X-S0YZW) register No. (+axis ofs)	CP-9200SH SVA module register No. (+axis ofs)	Remarks
Speed offset setting (NCOM)	MW00015	OW□□18	–
Zero point position offset setting (ABSOFF)	ML00016 (Can only be used when RUN is "OFF")	OL□□06 (Can also be used when RUN is "ON")	Function newly added with the CP-9200SH (SVA)
Feedback pulse resolution (FBppr)	MW00018	CP-717 screen setting	–
Normal move speed coefficient setting (CVREF)	MW00019	(Not available)	–
Run mode setting (RUNMOD)	MW00020	OW□□00	–
Servo drive run command setting (SVRUNCMD)	MW00021	OW□□01	–
Approach speed setting (Napr)	MW00022	OW□□0A	–
Creep speed setting (Nclp)	MW00023	OW□□0B	–
Position reference pulse setting (XREF)	ML00024	OL□□12	–
Normal move speed setting (VREF)	MW00026	OW□□15	On the CP-9200SH (SVA), used in common during speed, position, phase control modes
Position loop software gain setting (Ksp)	MW00027	OW□□10	On the CP-9200SH (SVA), this becomes position loop gain, which is different from the position loop software gain
Feed forward software gain setting (Ksf)	MW00028	OW□□11	On the CP-9200SH (SVA), this becomes feed forward gain, which is different from the feed forward software gain
Servo error domain setting (EOV)	MW00029	OW□□0F	–
Positioning range setting (PEXT)	MW00030	OW□□0E	–
Speed reference setting (NREF)	MW00031	OW□□15	On the CP-9200SH (SVA), used in common during speed, position, phase control modes
Linear acceleration time setting (NACC)	MW00032	OW□□0C	–
Linear deceleration time setting (NDEC)	MW00033	OW□□0D	–
Averaged number of times (NNUM)	MW00034	OW□□14	–
Torque reference setting (TREF)	MW00035	OW□□1B	–
Speed limit reference (NLIM)	MW00036	OW□□1C	–
Standard speed reference setting (PHREF)	MW00037	OW□□15	On the CP-9200SH (SVA), used in common during speed, position, phase control modes
Phase correction setting (PHBIAS)	ML00038	OL□□16	–
Numerator of the operation coefficient for phase reference generation (k1)	MW00040	(Not available)	–
Denominator of the operation coefficient for phase reference generation (k2)	MW00041	(Not available)	–
Proportional gain setting (Kv)	MW00042	OW□□19	The meaning on the CP-9200SH (SVA) is different from the CP-9200H
Integral time setting (Ti)	MW00043	OW□□1A	–
Positive torque limit setting (TLIMP)	MW00044	OW□□02	–

Table B.4 List of Differences for the Servo Parameters for Settings

Type of Servo controller / Name of Servo parameter	CP-9200H Servo controller (87920-2500X-S0YZW) register No. (+axis ofs)	CP-9200SH SVA module register No. (+axis ofs)	Remarks
Negative torque limit setting (TLIMN)	MW00045	OW□□03	–
Positive speed limit setting (NLIMP)	MW00046	OW□□04	–
Negative speed limit setting (NLIMN)	MW00047	OW□□05	–
D/A output coefficient setting when speed is 100% (C1)	MW00048	CP-717 screen setting	–
D/A output coefficient setting when torque is 100% (C2)	MW00049	CP-717 screen setting	–
Coincidence detection setting (COINDAT)	(Not availavle)	OL□□08	Parameter newly added on the CP-9200SH (SVA)
Offset pulse setting (PULBIAS)	(Not available)	OL□□1E	Parameter newly added on the CP-9200SH (SVA)

(Note) The register number for each axis is the register number in the table with an axis offset added. Note that the axis offsets on the CP-9200H Servo controller and the CP-9200SH SVA module are different.
Refer to the Control Pack CP-9200/9200H Designer's Manual for Servo Controller (SIE-C879-30.7) for axis offset.

Table B.5 List of Differences in Run Mode (RUNMOD)

Type of Servo controller / Name of Servo parameter	CP-9200H Servo controller (87920-2500X-S0YZW) register No. (+axis ofs)	CP-9200SH SVA module register No. (+axis ofs)	Remarks
Speed control mode (NCON)	MB000200	OB□□000	–
Torque control mode (TCON)	MB000201	OB□□001	–
Position control mode (PCON)	MB000202	OB□□002	–
Alarm clear (ACR)	MB000203	OB□□006	–
Phase control mode (PHCON)	MB000204	OB□□003	–
Phase control test signal (PHTEST)	MB000205	OB□□005	–
Zero point return mode (ZRN)	MB000206	OB□□004	–
Phase reference generation operation invalid (PHREFOFF)	MB000207	OB□□007	–
Revolution direction selection when absolute encoder is used (DIRINV)	MB000208	*CP-717 screen setting*	–
Zero point return direction selection (ZRNDIR)	MB000209	OB□□009	–
Request for absolute position readout (ABSRD)	MB00020A	OB□□00A	–
DIINT signal selection (DIINTSEL)	MB00020E	(Not available)	–
Phase control integral reset (IRESET)	MB00020F	OB□□00F	–
Count disabled (CNTDIS)	(Not available)	OB□□00B	Parameter newly added on the CP-9200SH (SVA)
Request for count value preset (PRSREQ)	(Not available)	OB□□00C	Parameter newly added on the CP-9200SH (SVA)
DI latch detection request (DIINTREQ)	(Not available)	OB□□00D	Parameter newly added on the CP-9200SH (SVA)
Request for coincidence detection (COINREQ)	(Not available)	OB□□00E	Parameter newly added on the CP-9200SH (SVA)

(Note) The register number for each axis is the register number in the table with an axis offset added. Note that the axis offsets on the CP-9200H Servo controller and the CP-9200SH SVA module are different.
Refer to the Control Pack CP-9200/9200H Designer's Manual for Servo Controller (SIE-C879-30.7) for axis offset.

Table B.6 List of Differences in Servo Driver Run Commands (SVRUNCMD)

Type of Servo controller / Name of Servo parameter	CP-9200H Servo controller (87920-2500X-S0YZW) register No. (+axis ofs)	CP-9200SH SVA module register No. (+axis ofs)	Remarks
Run (DO0) (RUN)	MB000210 (General-purpose DO)	OB□□010	–
General-purpose DO (DO1) (General-purpose DO)	MB000211 (General-purpose DO)	OB□□011	–
General-purpose DO (DO2) (General-purpose DO)	MB000212 (General-purpose DO)	OB□□012	–
General-purpose DO (DO3) (General-purpose DO)	MB000213 (General-purpose DO)	OB□□013	–
General-purpose DO (DO4) (General-purpose DO)	MB000214 (General-purpose DO)	OB□□014	–
General-purpose DO (DO5) (General-purpose DO)	MB000215 (General-purpose DO)	OB□□015 (General-purpose DO or coincidence detection signal)	–
Sensor on (DO6) (SEN)	MB00021B (system use)	(Not available)	On the CP-9200SH (SVA) also, sensor on (SEN) is DO6
Zero point return deceleration point limit switch signal (LSDEC)	MB00021F	OB□□01F	–

(Note) The register number for each axis is the register number in the table with an axis offset added. Note that the axis offsets on the CP-9200H Servo controller and the CP-9200SH SVA module are different.
Refer to the Control Pack CP-9200/9200H Designer's Manual for Servo Controller (SIE-C879-30.7) for axis offset.

B.3 List of Differences for Servo Parameters for Monitoring

Table B.7 List of Differences for Servo Parameter for Monitoring

Type of Servo controller / Name of Servo parameter	CP-9200H Servo controller (87920-2500X-S0YZW) register No. (+axis ofs)	CP-9200SH SVA module register No. (+axis ofs)	Remarks
Run status (RUNSTS)	MW00000	IW□□00	–
Servo drive status (INVSTS)	MW00001	IW□□01	–
Target position monitor (PTG)	ML00002	IL□□02	–
Target position increment monitor (PTGDIF)	ML00004	IL□□04	–
Interruption time position monitor (PINT)	ML00006	IL□□06	On the CP-9200SH, this becomes the position monitor during DI latch detection
Position monitor (PFB)	ML00008	IL□□08	–
Position deviation monitor (PDV)	ML00010	IL□□0A	–
Speed reference output monitor (SPDREF)	MW00012	IW□□0C	–
Speed monitor (NFB)	MW00013	IW□□0D	–
Torque monitor (TFB)	MW00014	IW□□0E	–
Range exceeding parameter No. (ERNO)	(Not available)	IW□□0F	Parameter newly added on the CP-9200SH (SVA)
Number of accumulated revolutions received from the absolute encoder (ABSREV)	ML00002 (Valid during execution of A Drawing and absolute position data read out)	IL□□10	Parameter newly added on the CP-9200SH (SVA)
Number of initial incremental pulses received from the absolute encoder (IPULSE)	ML00004 (Valid during execution of A Drawing and absolute position data read out)	IL□□12	Parameter newly added on the CP-9200SH (SVA)
Current value of the hardware counter (NCNT)	(Not available)	IL□□08	Function newly added on the CP-9200SH (SVA) (Serves also for the position monitor (IL□□08))
Latch data/Frequency count of the hardware counter (TCNT)	(Not available)	IL□□06	Function newly added on the CP-9200SH (SVA) (Serves also for the interruption time position monitor (IL□□06))
Number of pulses incremented with each scan (dN)	(Not available)	IL□□0A	Function newly added on the CP-9200SH (SVA) (Serves also for the position deviation monitor (IL□□0A))

(Note) The register number for each axis is the register number in the table with an axis offset added. Note that the axis offsets on the CP-9200H Servo controller and the CP-9200SH SVA module are different.
Refer to the Control Pack CP-9200/9200H Designer's Manual for Servo Controller (SIE-C879-30.7) for axis offset.

Table B.8 List of Differences in Run Status (RUNSTS)

Type of Servo controller / Name of Servo parameter	CP-9200H Servo controller (87920-2500X-S0YZW) register No. (+axis ofs)	CP-9200SH SVA module register No. (+axis ofs)	Remarks
Deviation error (EOVER)	MB000000	IB□□000	–
Accumulated cycles signal reception error (PGER)	MB000004	IB□□004	–
A/D conversion error (ADER)	MB000006	IB□□003	–
Absolute position readout completion signal (ABSRDC)	M000000A	IB□□00A	–
DI latch completion signal (DIINT)	MB00000B	IB□□00B	On the CP-9200SH (SVA) and CP-9200H Servo controllers, the method of preventing chattering is different.
Feedback pulse 0 (FBP0)	MB00000C	IB□□00C	–
Positioning completion signal (POSCOMP)	MB00000D	IB□□00D	–
Zero point return completion signal (ZRNC)	MB00000F	IB□□00F	–
Servo parameter setting error (PRMERR)	(Not available)	IB□□001	Parameter newly added on the CP-9200SH (SVA)
Servo fixed parameter setting error (FPRMERR)	(Not available)	IB□□002	Parameter newly added on the CP-9200SH (SVA)
Count value reset completion (PRESET)	(Not available)	IB□□006	Parameter newly added on the CP-9200SH (SVA)
Servo controller ready (SVCRDY)	(Not available)	IB□□007	Parameter newly added on the CP-9200SH (SVA)
Servo controller running (SVCRUN)	(Not available)	IB□□008	Parameter newly added on the CP-9200SH (SVA)
Information of rotation direction when using absolute encoder (DIRINV)	(Not available)	IB□□009	Parameter newly added on the CP-9200SH (SVA)
Coincidence detection signal (CNTCOIN)	(Not available)	IB□□00E	Parameter newly added on the CP-9200SH (SVA)

(Note) The register number for each axis is the register number in the table with an axis offset added. Note that the axis offsets on the CP-9200H Servo controller and the CP-9200SH SVA module are different.
Refer to the Control Pack CP-9200/9200H Designer's Manual for Servo Controller (SIE-C879-30.7) for axis offset.

Table B.9 List of Differences in Servo Drive Status (INVSTS)

Type of Servo controller / Name of Servo parameter	CP-9200H Servo controller (87920-2500X-S0YZW) register No. (+axis ofs)	CP-9200SH SVA module register No. (+axis ofs)	Remarks
General-purpose DI (DI0)	MB000010	IB□□010	–
General-purpose DI (DI1)	MB000011	IB□□011	–
General-purpose DI (DI2)	MB000012	IB□□012	–
General-purpose DI (DI3)	MB000013	IB□□013	–

(Note) The register number for each axis is the register number in the table with an axis offset added. Note that the axis offsets on the CP-9200H Servo controller and the CP-9200SH SVA module are different.
Refer to the Control Pack CP-9200/9200H Designer's Manual for Servo Controller (SIE-C879-30.7) for axis offset.

B.4 List of Differences for Servo Parameters for Each Control Mode

Table B.10 Servo Parameter Settings for Speed Control Mode

Type of Servo controller / Name of Servo parameter	CP-9200H Servo controller (87920-2500X-S0YZW) register No. (+axis ofs)	CP-9200SH SVA module register No. (+axis ofs)	Remarks
Feedback pulse resolution (FBppr)	MW00018	CP-717 screen setting	–
Normal move speed coefficient setting (CVREF)	MW00019	(Not available)	–
Operation mode setting (RUNMOD)	MW00020	OW□□00	–
Servo driver run command setting (SVRUNCMD)	MW00021	OW□□01	–
Position loop software gain setting (Ksp)	MW00027	OW□□10 (Not used in this control mode)	–
Speed reference setting (NREF)	MW00031	OW□□15	On the CP-9200SH (SVA), can also be used during speed and phase control modes
Linear acceleration time setting (NACC)	MW00032	OW□□0C	–
Linear deceleration time setting (NDEC)	MW00033	OW□□0D	–
Averaged number of times (NNUM)	MW00034	OW□□14	–
Positive torque limit setting (TLIMP)	MW00044	OW□□02	–
Negative torque limit setting (TLIMN)	MW00045	OW□□03	–
Positive speed limitter setting (NLIMP)	MW00046	OW□□04	–
Negative speed limitter setting (NLIMN)	MW00047	OW□□05	–
D/A output coefficient setting when speed is 100% (C1)	MW00048	CP-717 screen setting	–
D/A output coefficient setting when torque is 100% (C2)	MW00049	CP-717 screen setting	–
Zero point offset setting (ABSOFF)	ML00016 (Can only be used when RUN is "OFF")	OL□□06 (Can also be used when RUN is "ON")	Function newly added on the CP-9200SH (SVA)
Coincidence detection setting (COINDAT)	(Not available)	OL□□08	Parameter newly added on the CP-9200SH (SVA)

(Note) The register number for each axis is the register number in the table with an axis offset added. Note that the axis offsets on the CP-9200H Servo controller and the CP-9200SH SVA module are different.
Refer to the Control Pack CP-9200/9200H Designer's Manual for Servo Controller (SIE-C879-30.7) for axis offset.

Table B.11 Servo Parameter Settings for Torque Control Mode

Type of Servo controller / Name of Servo parameter	CP-9200H Servo controller (87920-2500X-S0YZW) register No. (+axis ofs)	CP-9200SH SVA module register No. (+axis ofs)	Remarks
Feedback pulse resolution (FBppr)	MW00018	CP-717 screen setting	–
Normal move speed coefficient setting (CVREF)	MW00019	(Does not have this parameter)	–
Operation mode setting (RUNMOD)	MW00020	OW□□00	–
Servo drive run command setting (SVRUNCMD)	MW00021	OW□□01	–
Position loop software gain setting (Ksp)	MW00027	OW□□10 (Not used in this control mode)	–
Torque reference setting (TREF)	MW00035	OW□□1B	–
Speed limit reference (NLIM)	MW00036	OW□□1C	–
Negative torque limit setting (TLIMN)	MW00045	OW□□03	–
D/A output coefficient setting when speed is 100% (C1)	MW00048	CP-717 screen setting	–
D/A output coefficient setting when torque is 100% (C2)	MW00049	CP-717 screen setting	–
Zero point offset setting (ABSOFF)	ML00016 (Can only be used when RUN is "OFF")	OL□□06 (Can also be used when RUN is "ON")	Function newly added on the CP-9200SH (SVA)
Coincidence detection setting (COINDAT)	(Not available)	OL□□08	Parameter newly added on the CP-9200SH (SVA)

(Note) The register number for each axis is the register number in the table with an axis offset added. Note that the axis offsets on the CP-9200H Servo controller and the CP-9200SH SVA module are different.
Refer to the Control Pack CP-9200/9200H Designer's Manual for Servo Controller (SIE-C879-30.7) for axis offset.

Table B.12 Servo Parameter Settings for Position Control Mode

Type of Servo controller / Name of Servo parameter	CP-9200H Servo controller (87920-2500X-S0YZW) register No. (+axis ofs)	CP-9200SH SVA module register No. (+axis ofs)	Remarks
Feedback pulse resolution (FBppr)	MW00018	CP-717 screen setting	–
Normal move speed coefficient setting (CVREF)	MW00019	(Not available)	–
Operation mode setting (RUNMOD)	MW00020	OW□□00	–
Servo driverun command setting (SVRUNCMD)	MW00021	OW□□01	–
Position reference pulse setting (XREF)	ML00024	OL□□12	–
Normal move speed setting (VREF)	MW00026	OW□□15	On the CP-9200SH (SVA), can also be used during speed and phase control modes
Position loop software gain setting (Ksp)	MW00027	OW□□10	On the CP-9200SH (SVA), this becomes position loop gain, which is different from the position loop software gain
Feed forward software gain setting (Ksf)	MW00028	OW□□11	On the CP-9200SH (SVA), this becomes feed forward gain, which is different from the feed forward software gain
Servo error domain setting (EOV)	MW00029	OW□□0F	–
Positioning range setting (PEXT)	MW00030	OW□□0E	–
Linear acceleration time setting (NACC)	MW00032	OW□□0C	–
Linear deceleration time setting (NDEC)	MW00033	OW□□0D	–
Averaged number of times (NNUM)	MW00034	OW□□14	–
Positive torque limit setting (TLIMP)	MW00044	OW□□02	–
Negative torque limit setting (TLIMN)	MW00045	OW□□03	–
Positive speed limiter setting (NLIMP)	MW00046	OW□□04	–
Negative speed limiter setting (NLIMN)	MW00047	OW□□05	–
D/A output coefficient setting when speed is 100% (C1)	MW00048	CP-717 screen setting	–
D/A output coefficient setting when torque is 100% (C2)	MW00049	CP-717 screen setting	–
Zero point offset setting (ABSOFF)	ML00016 (Can only be used when RUN is "OFF")	OL□□06 (Can also be used when RUN is "ON")	Function newly added on the CP-9200SH (SVA)
Coincidence detection setting (COINDAT)	(Not available)	OL□□08	Parameter newly added on the CP-9200SH (SVA)
Offset pulse setting (PULBIAS)	(Not available)	OL□□1E	Parameter newly added on the CP-9200SH (SVA)

(Note) The register number for each axis is the register number in the table with an axis offset added. Note that the axis offsets on the CP-9200H Servo controller and the CP-9200SH SVA module are different.
Refer to the Control Pack CP-9200/9200H Designer's Manual for Servo Controller (SIE-C879-30.7) for axis offset.

Table B.13 Servo Parameter Settings for Zero Point Return Mode

Type of Servo controller / Name of Servo parameter	CP-9200H Servo controller (87920-2500X-S0YZW) Register No. (+axis ofs)	CP-9200SH SVA module register No. (+axis ofs)	Remarks
Zero point offset setting (ABSOFF)	ML00016	OL□□06	Function newly added on the CP-9200SH (SVA).
Feedback pulse resolution (FBppr)	MW00018	CP-717 screen setting	–
Normal move speed coefficient setting (CVREF)	MW00019	(Does not have this parameter)	–
Operation mode setting (RUNMOD)	MW00020	OW□□00	–
Servo driver run command setting (SVRUNCMD)	MW00021	OW□□01	–
Approach speed setting (Napr)	ML00022	OW□□0A	–
Creep speed setting (Nclp)	MW00023	OW□□0B	–
Position loop software gain setting (Ksp)	MW00027	OW□□10	On the CP-9200SH (SVA), this becomes position loop gain, which is different from the position loop software gain
Servo error domain setting (EOV)	MW00029	OW□□0F	–
Positioning range setting (PEXT)	MW00030	OW□□0E	–
Linear acceleration time setting (NACC)	MW00032	OW□□0C	–
Linear deceleration time setting (NDEC)	MW00033	OW□□0D	–
Positive torque limit setting (TLIMP)	MW00044	OW□□02	–
Negative torque limit setting (TLIMN)	MW00045	OW□□03	–
Positive speed limiter setting (NLIMP)	MW00046	OW□□04	–
Negative speed limiter setting (NLIMN)	MW00047	OW□□05	–
D/A output coefficient setting when speed is 100% (C1)	MW00048	CP-717 screen setting	–
D/A output coefficient setting when torque is 100% (C2)	MW00049	CP-717 screen setting	–
Coincidence detection setting (COINDAT)	(Does not have this parameter)	OL□□08	Parameter newly added on the CP-9200SH (SVA)

(Note) The register number for each axis is the register number in the table with an axis offset added. Note that the axis offsets on the CP-9200H Servo controller and the CP-9200SH SVA module are different.
Refer to the Control Pack CP-9200/9200H Designer's Manual for Servo Controller (SIE-C879-30.7) for axis offset.

Table B.14 Servo Parameters Settings for Phase Control Mode

Type of Servo controller / Name of Servo parameter	CP-9200H Servo controller (87920-2500X-S0YZW) register No. (+axis ofs)	CP-9200SH SVA module register No. (+axis ofs)	Remarks
Speed offset setting (NCOM)	MW00015	OW□□18	–
Feedback pulse resolution (FBppr)	MW00018	CP-717 screen setting	–
Normal movement speed coefficient setting (CVREF)	MW00019	(Not available)	–
Operation mode setting (RUNMOD)	MW00020	OW□□00	–
Servo drive run command setting (SVRUNCMD)	MW00021	OW□□01	–
Position loop software gain setting (Ksp)	MW00027	OW□□10 (Not used in this control mode)	–
Servo error domain setting (EOV)	MW00029	OW□□0F	–
Standard speed reference setting (PHREF)	MW00037	OW□□15	On the CP-9200SH (SVA), can also be used during speed and phase control modes
Phase offset setting (PHBIAS)	ML00038	OL□□16	–
Numerator of the operation coefficient for phase reference generation (k1)	MW00040	(Does not have this parameter)	–
Denominator of the operation coefficient for phase reference generation (k2)	MW00041	(Does not have this parameter)	–
Proportional gain setting (Kv)	MW00042	OW□□19	The meaning on the CP-9200SH (SVA) is different from the CP-9200H
Integral time setting (Ti)	MW00043	OW□□1A	–
Positive torque limit setting (TLIMP)	MW00044	OW□□02	–
Negative torque limit setting (TLIMN)	MW00045	OW□□03	–
Positive speed limiter setting (NLIMP)	MW00046	OW□□04	–
Negative speed limiter setting (NLIMN)	MW00047	OW□□05	–
D/A output coefficient setting when speed is 100% (C1)	MW00048	CP-717 screen setting	–
D/A output coefficient setting when torque is 100% (C2)	MW00049	CP-717 screen setting	–
Zero point offset setting (ABSOFF)	ML00016 (Can only be used when RUN is "OFF")	OL□□06 (Can also be used when RUN is "ON")	Function newly added on the CP-9200SH (SVA)
Coincidence detection setting (COINDAT)	(Not available)	OL□□08	Parameter newly added on the CP-9200SH (SVA)

(Note) The register number for each axis is the register number in the table with an axis offset added. Note that the axis offsets on the CP-9200H Servo controller and the CP-9200SH SVA module are different.
Refer to the Control Pack CP-9200/9200H Designer's Manual for Servo Controller (SIE-C879-30.7) for axis offset.

Appendix C. Switching between Torque Control and Speed Control

This section will explain the best way to use the SERVOPACK and the CP-9200SH when using the Servomotor switching between torque and speed control. We will also discuss the mutual interface at that time. For details of the Σ series SERVOPACKs, refer to the respective operation manuals.

C1. When using SERVOPACK Σ Series SGD

C.1.1 Settings for Torque Control Mode

(1) SERVOPACK Σ series SGD

① Set the control mode to "Torque control mode II."

Sets Cn-01 { bitA···1 / bitB···1

Now, switching between torque control and speed control modes is possible with $\overline{\text{P-CON}}$ signal input. The relation between $\overline{\text{P-CON}}$ and each of the signals is as shown in Table C.1.

Table C.1 P-CON and Signal Relationships

Status / P-CON	Control mode	Signal input	
		V-REF	T-REF
OFF	Torque control	Speed limit	Torque reference
ON	Speed control	Speed reference	Invalid

② Set the mode switch to "No function"

Sets Cn-01 { bitC···1 / bitD···1

(2) CP-9200SH SVA module

① Set the operation mode selection of the SVA module to "Torque control (TCON)."

For the first axis, set it to OBC0001···ON.

② To switch the SERVOPACK SGD to torque control mode, turn DO1 OFF.

For the first axis, set it to OBC0011···OFF.

Now, the SERVOPACK has been set to "Torque control mode II" so it is possible on the SVA module side to switch between torque control and speed control modes. The relation of the various signals is as shown in Table C.2.

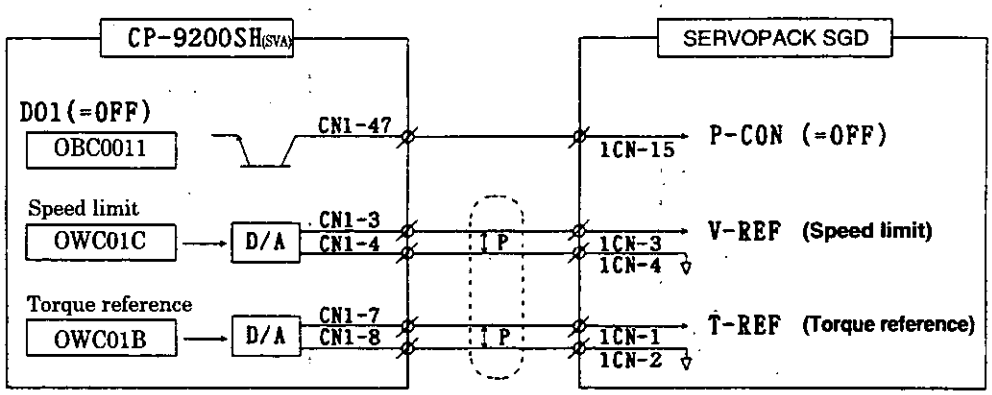
Table C.2 Control Mode and Signal Relation

Signal / Control mode	Control mode setting (CP-9200SH (SVA))			Reference output	
	NCON (OBC0000)	TCON (OBC0001)	DO1 (OBC0011)	To the V-REF of the SERVOPACK	To the T-REF of the SERVOPACK
Torque control	OFF	ON	OFF	Speed limit (OWC01C)	Torque reference (OWC01B)
Speed control	ON	OFF	ON	Speed reference (OWC015)	Positive torque limit (OWC002)

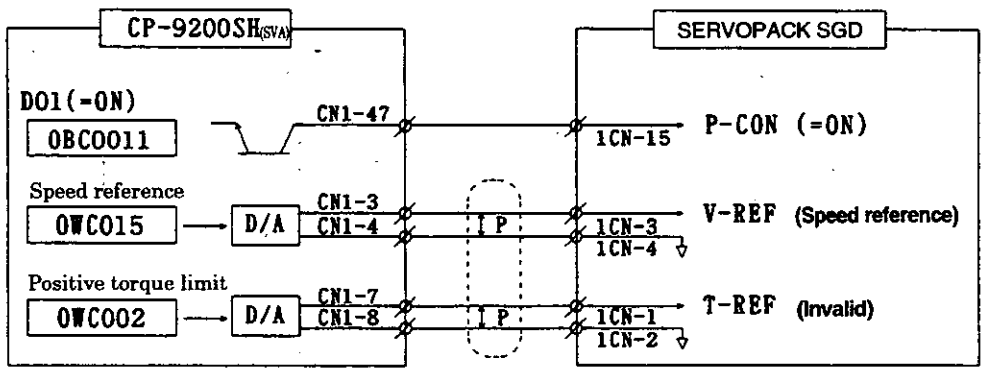
C.1.2 Interface

Here are the main signal interfaces used during the various control modes.

(1) Torque control mode



(2) Speed control mode



(3) Other control modes

If P-CON is turned ON, the SERVOPACK will move in normal speed control form. Thus, in the case the CP-9200SH (SVA) operates under position control, or phase control modes, P-CON must always be ON.

C.2 When using SERVOPACK Σ Series DR1

C.2.1 Settings for the Torque Control Mode

(1) SERVOPACK Σ series DR1

① Set the control mode to "Torque control mode II."

Sets Cn-01 { bitA···1 / bitB···1

Now, switching between torque control and speed control modes is possible with $\overline{\text{P-CON}}$ signal input. The relation between $\overline{\text{P-CON}}$ and each of the signals is as shown in Table C.3.

Table C.3 P-CON and Signal Relation

Status / P-CON	Control mode	Signal input	
		IN-A	IN-B
OFF	Torque control	Speed limit	Torque reference
ON	Speed control	Speed reference	Cannot be used*

* : In this case, since IN-B input is added to IN-A, it must be 0 V.

② Set the mode switch to "No function"

Sets Cn-01 { bitC···1 / bitD···1

(2) CP-9200SH SVA module

① Set the operation mode of the SVA module to "Torque control (TCON)."

For the first axis, set it to OBC0001···ON.

② To switch the SERVOPACK DR1 to torque control mode, turn DO1 OFF.

For the first axis, set it to OBC0011···OFF.

Now, the SERVOPACK has been set to "Torque control mode II" so it is possible on the SVA module side to switch between torque control and speed control modes. The relation of the various signals is as shown in Table C.4.

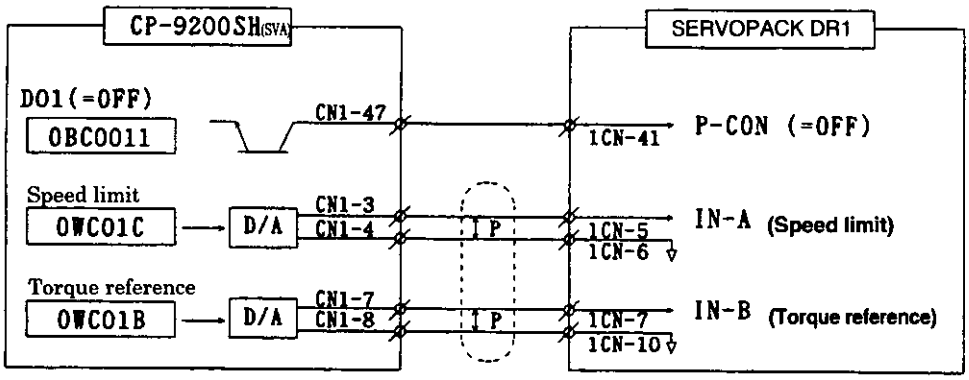
Table C.4 Control Mode and Signal Relation

Signal / Control mode	Control mode setting (CP-9200SH)			Instruction output	
	NCON (OBC0000)	TCON (OBC0001)	DO1 (OBC0011)	To the IN-A of the SERVOPACK	To the IN-B of the SERVOPACK
Torque control	OFF	ON	OFF	Speed limit (OWC01C)	Torque reference (OWC01B)
Speed control	ON	OFF	ON	Speed reference (OWC015)	Positive torque limit (OWC002)

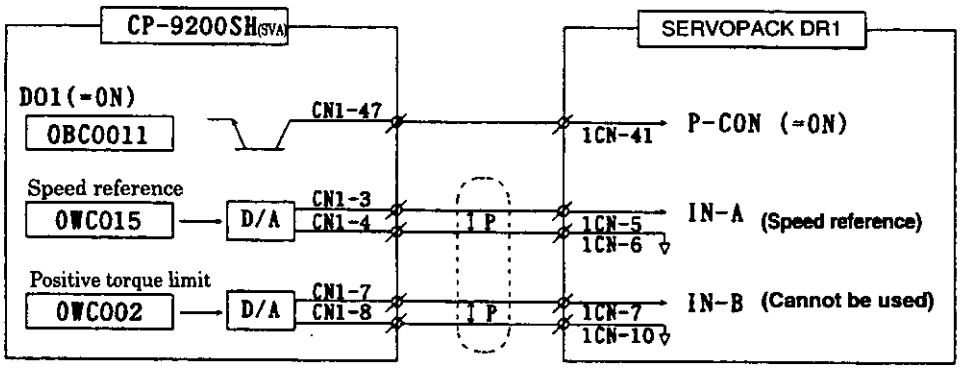
C.2.2 Interface

Here are the main signal interfaces used during the various control modes.

(1) Torque control mode



(2) Speed control mode



(3) Other control modes

If P-CON is turned ON, the SERVOPACK will move in normal speed control form. Thus, in the case when the CP-9200SH operates under position control, or phase control modes, P-CON must always be ON.

MACHINE CONTROLLER CP-9200SH
SERVO CONTROLLER USER'S MANUAL

IRUMA BUSINESS CENTER
480, Kamifujisawa, Iruma, Saitama 358-8555, Japan
Phone 81-42-962-5696 Fax 81-42-962-6138

YASKAWA ELECTRIC AMERICA, INC.
2121 Norman Drive South, Waukegan, IL 60085, U.S.A.
Phone 1-847-887-7000 Fax 1-847-887-7370

MOTOMAN INC. HEADQUARTERS
805 Liberty Lane West Carrollton, OH 45449, U.S.A.
Phone 1-937-847-6200 Fax 1-937-847-6277

YASKAWA ELÉTRICO DO BRASIL COMÉRCIO LTD.A.
Avenida Fagundes Filho, 620 Bairro Saude-Sao Paulo-SP, Brazil CEP: 04304-000
Phone 55-11-5071-2552 Fax 55-11-5581-8795

YASKAWA ELECTRIC EUROPE GmbH
Am Kronberger Hang 2, 65824 Schwalbach, Germany
Phone 49-6196-569-300 Fax 49-6196-569-398

Motoman Robotics Europe AB
Box 504 S38525 Torsås, Sweden
Phone 46-486-48800 Fax 46-486-41410

Motoman Robotec GmbH
Kammerfeldstraβe1, 85391 Allershausen, Germany
Phone 49-8166-90-100 Fax 49-8166-90-103

YASKAWA ELECTRIC UK LTD.
1 Hunt Hill Orchardton Woods Cumbernauld, G68 9LF, United Kingdom
Phone 44-1236-735000 Fax 44-1236-458182

YASKAWA ELECTRIC KOREA CORPORATION
Kfpa Bldg #1201, 35-4 Youido-dong, Yeongdungpo-Ku, Seoul 150-010, Korea
Phone 82-2-784-7844 Fax 82-2-784-8495

YASKAWA ELECTRIC (SINGAPORE) PTE. LTD.
151 Lorong Chuan, #04-01, New Tech Park Singapore 556741, Singapore
Phone 65-6282-3003 Fax 65-6289-3003

YASKAWA ELECTRIC (SHANGHAI) CO., LTD.
4F No.18 Aona Road, Waigaoqiao Free Trade Zone, Pudong New Area, Shanghai 200131, China
Phone 86-21-5866-3470 Fax 86-21-5866-3869

YATEC ENGINEERING CORPORATION
4F., No.49 Wu Kong 6 Rd, Wu-Ku Industrial Park, Taipei, Taiwan
Phone 886-2-2298-3676 Fax 886-2-2298-3677

YASKAWA ELECTRIC (HK) COMPANY LIMITED
Rm. 2909-10, Hong Kong Plaza, 186-191 Connaught Road West, Hong Kong
Phone 852-2803-2385 Fax 852-2547-5773

BEIJING OFFICE
Room No. 301 Office Building of Beijing International Club, 21
Jianguomenwai Avenue, Beijing 100020, China
Phone 86-10-6532-1850 Fax 86-10-6532-1851

TAIPEI OFFICE
9F, 16, Nanking E. Rd., Sec. 3, Taipei, Taiwan
Phone 886-2-2502-5003 Fax 886-2-2505-1280

SHANGHAI YASKAWA-TONGJI M & E CO., LTD.
27 Hui He Road Shanghai China 200437
Phone 86-21-6553-6060 Fax 86-21-5588-1190

BEIJING YASKAWA BEIKE AUTOMATION ENGINEERING CO., LTD.
30 Xue Yuan Road, Haidian, Beijing P.R. China Post Code: 100083
Phone 86-10-6233-2782 Fax 86-10-6232-1536

SHOUGANG MOTOMAN ROBOT CO., LTD.
7, Yongchang-North Street, Beijing Economic Technological Investment & Development Area,
Beijing 100076, P.R. China
Phone 86-10-6788-0551 Fax 86-10-6788-2878

YASKAWA ELECTRIC CORPORATION

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