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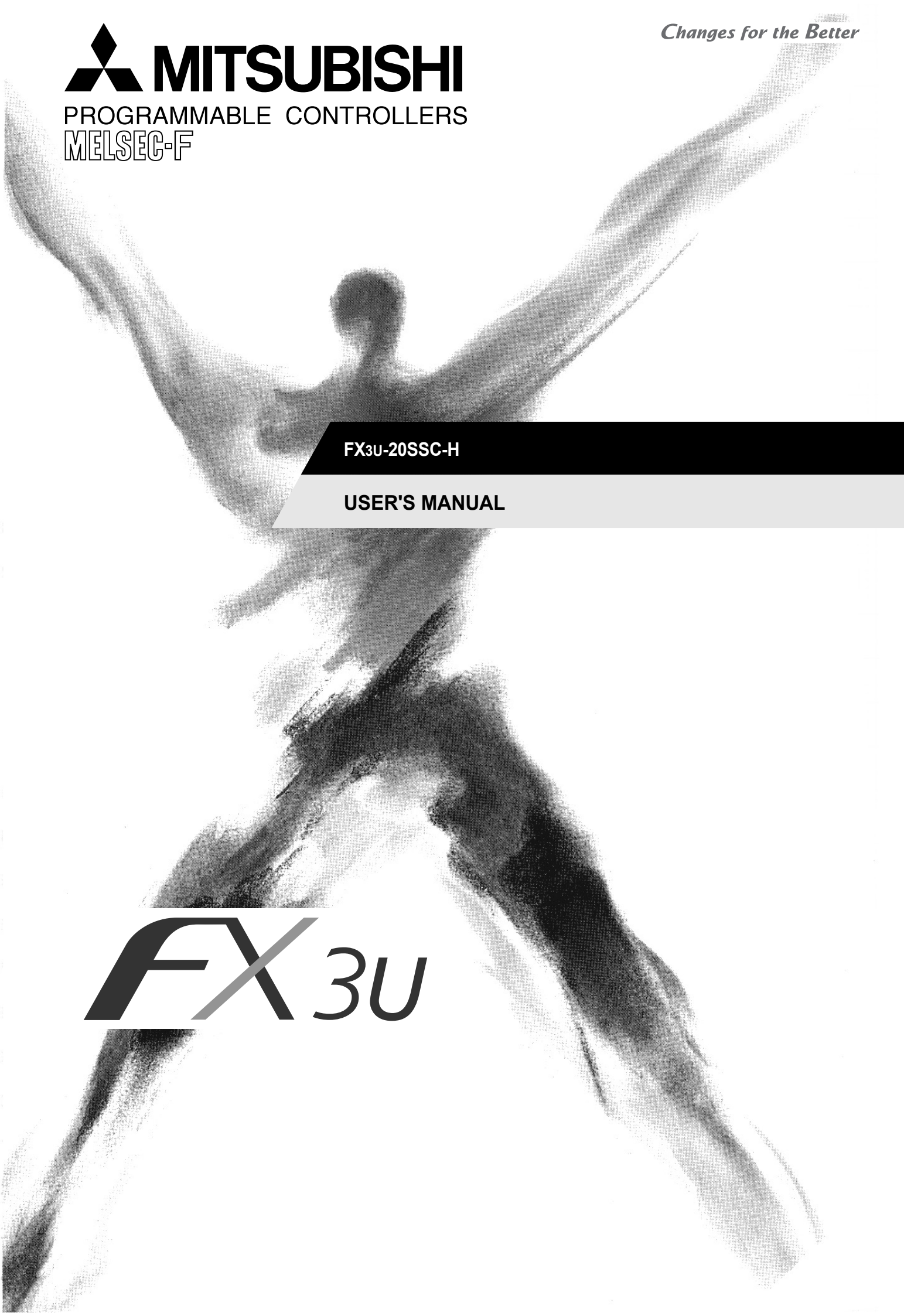
MITSUBISHI

PROGRAMMABLE CONTROLLERS

MELSEC-F



FX3U-20SSC-H

USER'S MANUAL

FX 3U

Safety Precautions

(Read these precautions before using.)

Before installing, operating, maintenance or inspecting this product, thoroughly read and understand this manual and the associated manuals. Also pay careful attention to handle the module properly and safety.

This manual classifies the safety precautions into two categories: DANGER and CAUTION.

DANGER	Indicates that incorrect handling may cause hazardous conditions, resulting in death or severe injury.
CAUTION	Indicates that incorrect handling may cause hazardous conditions, resulting in medium or slight personal injury or physical damage.

Depending on circumstances, procedures indicated by CAUTION may also be linked to serious results.
In any case, it is important to follow the directions for usage.
Store this manual in a safe place so that you can take it out and read it whenever necessary. Always forward it to the end user.

1. DESIGN PRECAUTIONS

DANGER	Reference
• Provide a safety circuit on the outside of the PLC so that the whole system operates to ensure the safety even when external power supply trouble or PLC failure occurs. Otherwise, malfunctions or output failures may result in an accident. 1) An emergency stop circuit, a protection circuit, an interlock circuit for opposite movements, such as normal and reverse rotations, and an interlock circuit for preventing damage to the machine at the upper and lower positioning limits should be configured on the outside of the PLC. 2) When the PLC CPU detects an error, such as a watch dog timer error, during self-diagnosis, all outputs are turned off. When an error that cannot be detected by the PLC CPU occurs in an input/output control block, output control may be disabled. Design external circuits and mechanisms to ensure safe operations of the machine in such a case. 3) When some sort of error occurs in a relay, triac or transistor of the output unit, output may be kept on or off. For output signals that may lead to serious accidents, design external circuits and mechanisms to ensure safe operations of the machine in such cases. • At forward/reverse rotation limits wiring, make sure to wire in negative logic and use NC contact. Setting in positive logic and using NC-contact can cause serious accidents.	19 38

CAUTION	Reference
• Observe the following items. Failure to do so may cause incorrect data-writing by noise to PLCs and result the PLC failure, machine damage or an accident. 1) Do not lay close or bundle with the main circuit line, high-voltage line, or load line. Noise and Surge induction interfere with the system operation. Keep a safe distance of least 100 mm (3.94") from the above lines during wiring. 2) Ground the shield wire or shield of a shielded cable at one point on the PLC. However, do not ground at the same point as high voltage lines. • Install in a manner which prevents excessive force from being applied to the built-in connectors dedicated to programming, power connectors and I/O connectors. Failure to do so may result in wire breakage or failure of the PLC.	19 25 32 38

2. INSTALLATION PRECAUTIONS

DANGER	Reference
• Make sure to cut off all phases of the power supply externally before starting the installation or wiring work. Failure to do so may cause electric shock.	23

⚠CAUTION	Reference
• Fit the extension cables, peripheral device connecting cables, input/output cables and battery connecting cable securely to the designated connectors. Contact failures may cause malfunctions. • Use the product in the environment within the generic specifications described in section 3.1 of this manual. Never use the product in areas with dust, oily smoke, conductive dusts, corrosive gas (salt air, Cl_2, H_2S, SO_2 or NO_2), flammable gas, vibration or impacts, or expose it to high temperature, condensation, or wind and rain. If the product is used in such a place described, electrical shock, fire, malfunctions, damage, or deterioration may be caused. • Do not touch the conductive parts of the product directly, thus avoiding failure or malfunctions. • Install the product securely using a DIN rail or mounting screws. • Install the product on a flat surface. If the mounting surface is rough, undue force will be applied to the PC board, thereby causing nonconformities. • When drilling screw holes or wiring, cutting chips or wire chips should not enter ventilation slits. such an accident may cause fire, failures or malfunctions. • Be sure to remove the dust proof sheet from the PLC's ventilation port when the installation work is completed. Failure to do so could cause fires, equipment failures, and malfunctions. • Make sure to attach the terminal cover offered as an accessory to the product before turning on the power or starting the operation after installation or wiring work. Failure to do so may cause electric shock.	23

3. WIRING PRECAUTIONS

⚠DANGER	Reference
• Make sure to cut off all phases of the power supply externally before starting the installation or wiring work. Failure to do so may cause electric shock.	25

⚠CAUTION	Reference
• Connect the DC power supply wiring to the dedicated terminals described in this manual. If an AC power supply is connected to a DC input/output terminal or DC power supply terminal, the PLC will be burnt out. • Perform class D grounding (grounding resistance: 100. or less) to the grounding terminal in the 20SSC-H with a wire as thick as possible. Do not connect the grounding terminal at the same point as a heavy electrical system (refer to subsection 5.2.2). • Make sure to attach the terminal cover offered as an accessory to the product before turning on the power or starting the operation after installation or wiring work. Failure to do so may cause electric shock. • Cables and wires for input to the 20SSC-H must be connected to their corresponding dedicated connectors as described in this manual. For example, if you connect an AC power cable to a DC input connector, they will burn out. • Do not wire vacant terminals externally. Doing so may damage the product. • When drilling screw holes or wiring, cutting chips or wire chips should not enter ventilation slits. such an accident may cause fire, failures or malfunctions. • Properly perform wiring to the FX Series terminal blocks following the precautions below in order to prevent electrical shock, short-circuit, breakage of wire, or damage to the product: - The disposal size of the cable end should follow the dimensions described in this manual. - Tightening torque should be between 0.5 to 0.8 N•m. • Do not wire or bundle the SSCNET III cable with the main circuit cable, power cable and/or other such load carrying cables other than those for the PLC. Separate these cables at least 100mm (3.94") from each other. Noise and Surge induction interfere with the system operation. • When pulling out SSCNET III cable from the connector, be sure to put the cap on SSCNET III connector. If the SSCNET III end face is dirty, optical transmission is interrupted and it may cause malfunctions. • Do not see directly the light generated from SSCNET III connector of servo amplifier or 20SSC-H. When the light gets into the eyes, it causes discomformity in the eyes. (The light source of SSCNET III corresponds to class1 defined in JISC6802 or IEC60825-1.) • If SSCNET III cable is added a power such as a major shock, lateral pressure, haul, sudden bending or twist, its inside distorts or breaks, and optical transmission will not be available. SSCNET III cable should be given loose slack to avoid from becoming smaller than the minimum bend radius, and it should not be twisted. • Make sure to use SSCNET III cable within the range of operating temperature (refer to subsection 5.1.1) described in this manual. The optical cable and code part melts down if being left near the fire or high temperature. Therefore, do not make it touched the part which becomes high temperature, such as radiator or regenerative brake option of servo amplifier, or servomotor.	25

⚠CAUTION	Reference
• Make sure to lay SSCNET III cable with greater radius than the minimum bend radius. (Refer to the Section 5.4.1 Precautions for SSCNET III cable wiring.) • Fix the optical cable at the closest part to the connector with bundle material in order to prevent SSCNET III cable from putting its own weight on SSCNET III connector. • Never use vinyl tape for optical cord. Plasticizing material in vinyl tape goes into optical fiber and lowers the optical characteristic. At worst, it may cause wire breakage. If using adhesive tape for the optical cable laying, the fire resistant acetate cloth adhesive tape 570F (Teraoka Seisakusho Co., Ltd) is recommended. If laying with other wires, do not make the optical cable touched wires or cables made from soft polyvinyl chloride (PVC), polyethylene resin (PE), teflon (Fluorocarbon resin) or nylon which contains plasticizing material. • If the adhesion of solvent and oil to the code part of SSCNET III cable may lower the optical characteristic and machine characteristic. If it is used such an environment, be sure to do the protection measures to the optical cord. • When storing, put a cap on the connector part for preventing the connector edge of SSCNET III from getting dirt, dust and so on. • SSCNET III connector is put a cap to protect light device inside connector from dust. For this reason, do not remove a cap until just before mounting SSCNET III cable. Then, when removing SSCNET III cable, make sure to put a cap. • Keep the cap for SSCNET III connector and the tube for protecting light code end of SSCNET cable in a plastic bag with a zipper of SSCNET III cable to prevent them from becoming dirty. • When changing the servo amplifier or 20SSC-H, make sure to put cap on SSCNET III connector. When asking repair of servo amplifier for some troubles, make sure to put a cap on SSCNET III connector. When the connector is not put a cap, the light device may be damaged at the transit. In this case, exchange and repair of light device is required.	25 26

4. STARTUP AND MAINTENANCE PRECAUTIONS

⚠DANGER	Reference
• Do not touch any terminal while the PLC's power is on. Doing so may cause electrical shock or malfunctions. • Before cleaning or retightening terminals, externally cut off all phases of the power supply. Failure to do so may expose you to shock hazard. • Before modifying the program under operation or performing operation for forcible output, running or stopping, carefully read the manual, and sufficiently ensure the safety. An operation error may damage the machine or cause accidents. • To test Zero-return, JOG operation and Positioning data, throughly read this manual, ensure the safe system operation An operation error may damage the machine or cause accidents.	32 138 153

⚠CAUTION	Reference
• Do not disassemble or modify the PLC. Doing so may cause failures, malfunctions or fire. For repair, contact your local Mitsubishi Electric distributor. • Before connecting or disconnecting any extension cable, turn off power. Failure to do so may cause unit failure or malfunctions. • Before attaching or detaching the following devices, turn off power. Failure to do so may cause device failure or malfunctions. - Peripheral devices, expansion boards and special adapters - I/O extension blocks/units and terminal blocks	32 138 153

5. DISPOSAL PRECAUTIONS

⚠CAUTION	Reference
• Please contact a company certified in the disposal of electronic waste for environmentally safe recycling and disposal of your device.	19

6. TRANSPORTATION PRECAUTIONS

⚠CAUTION	Reference
• The PLC is precision equipment. During transportation, avoid impacts larger than that is specified in the manual of the PLC main unit. Failure to do so may cause failures in the PLC. After transportation, check the operations of the PLC.	19

FX3U-20SSC-H

User's Manual

Manual number	JY997D21301
Manual revision	B
Date	1/2006

Foreword

This manual describes FX3U-20SSC-H Positioning Block and should be read and understood before attempting to install or operation of software.
Store this manual in a safe place so that you can take it out and read it whenever necessary. Always forward it to the end user.

Outline Precautions

- This manual provides information for the use of the FX3U Series Programmable Controllers. The manual has been written to be used by trained and competent personnel. The definition of such a person or persons is as follows;

1) Any engineer who is responsible for the planning, design and construction of automatic equipment using the product associated with this manual should be of a competent nature, trained and qualified to the local and national standards required to fulfill that role. These engineers should be fully aware of all aspects of safety with regards to automated equipment.

2) Any commissioning or service engineer must be of a competent nature, trained and qualified to the local and national standards required to fulfill that job. These engineers should also be trained in the use and maintenance of the completed product. This includes being completely familiar with all associated documentation for the said product. All maintenance should be carried out in accordance with established safety practices.

3) All operators of the completed equipment should be trained to use that product in a safe and coordinated manner in compliance to established safety practices. The operators should also be familiar with documentation which is connected with the actual operation of the completed equipment.

Note: the term 'completed equipment' refers to a third party constructed device which contains or uses the product associated with this manual

- This product has been manufactured as a general-purpose part for general industries, and has not been designed or manufactured to be incorporated in a device or system used in purposes related to human life.
- Before using the product for special purposes such as nuclear power, electric power, aerospace, medicine or passenger movement vehicles, consult with Mitsubishi Electric.
- This product has been manufactured under strict quality control. However when installing the product where major accidents or losses could occur if the product fails, install appropriate backup or failsafe functions in the system.
- When combining this product with other products, please confirm the standard and the code, or regulations with which the user should follow. Moreover, please confirm the compatibility of this product to the system, machine, and apparatus with which a user is using.
- If in doubt at any stage during the installation of the product, always consult a professional electrical engineer who is qualified and trained to the local and national standards. If in doubt about the operation or use, please consult the nearest Mitsubishi Electric distributor.
- Since the examples indicated by this manual, technical bulletin, catalog, etc. are used as a reference, please use it after confirming the function and safety of the equipment and system. Mitsubishi Electric will accept no responsibility for actual use of the product based on these illustrative examples.
- This manual content, specification etc. may be changed without a notice for improvement.
- The information in this manual has been carefully checked and is believed to be accurate; however, if you have noticed a doubtful point, a doubtful error, etc., please contact the nearest Mitsubishi Electric distributor.

Registration

- Microsoft® and Windows® are either registered trademarks or trademarks of Microsoft Corporation in the United States and/or other countries.
- The company name and the product name to be described in this manual are the registered trademarks or trademarks of each company.

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Compliance with EC directive (CE Marking)

This note does not guarantee that an entire mechanical module produced in accordance with the contents of this note will comply with the following standards.
Compliance to EMC directive and LVD directive for the entire mechanical module should be checked by the user / manufacturer. For more details please contact the local Mitsubishi Electric sales site.

Requirement for Compliance with EMC directive

The following products have shown compliance through direct testing (of the identified standards below) and design analysis (through the creation of a technical construction file) to the European Directive for Electromagnetic Compatibility (89/336/EEC) when used as directed by the appropriate documentation.

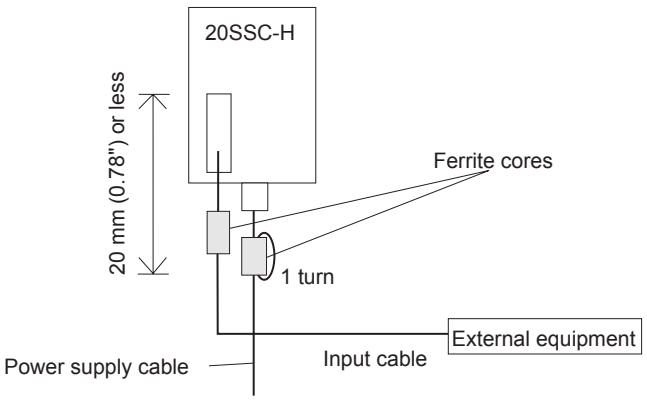
Type: Programmable Controller (Open Type Equipment)
Models: MELSEC FX3U series manufactured

from December 1st, 2005 FX3U-20SSC-H

Standard	Remark
EN61131-2:2003 Programmable controllers - Equipment requirements and tests	Compliance with all relevant aspects of the standard. • Radiated Emissions • Mains Terminal Voltage Emissions • RF immunity • Fast Transients • ESD • Conducted • Power magnetic fields

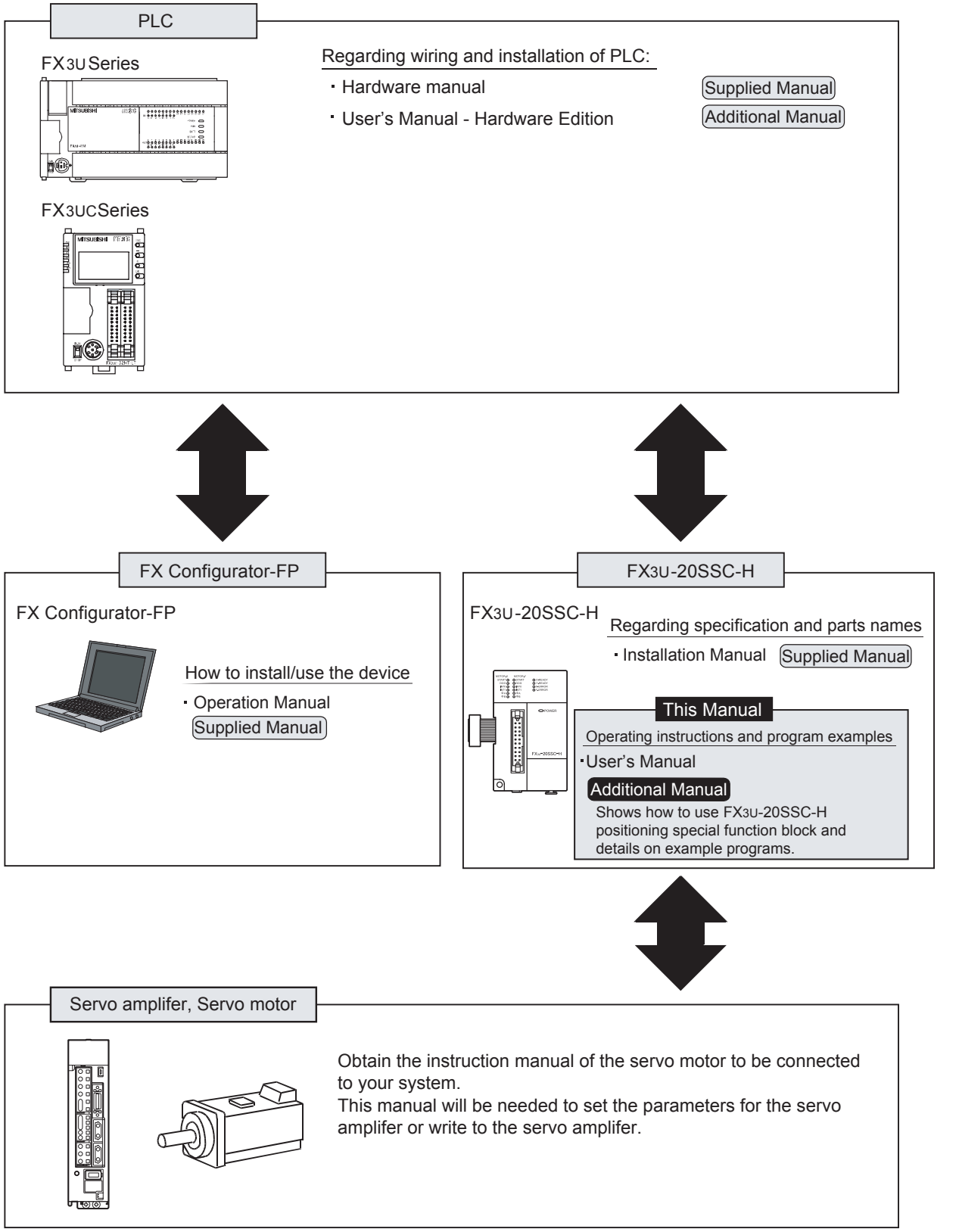
Caution to conform with EC Directives

Attach the ferrite cores to the power supply and the input cables (20SSC-H side).
Attach the ferrite core approximately 200 mm or less from connector on the 20SSC-H side.



- The ferrite core should use the following equivalent product:
  - Power supply cable (needs at least 1 turn)
    Model name: ZCAT2035-0930
    (Manufactureed by TDK co., Ltd.)
  - Input cable
    Model name: ZCAT3035-1330
    (Manufactureed by TDK co., Ltd.)

Functions and Use of This Manual



Associated Manuals

For a detailed explanation of the FX3U-20SSC-H positioning block, refer to this manual.
For the operation of FX Configurator-FP, or hardware information and instructions of the PLC main unit, refer to the respective manuals.

⊙ Refer to these manuals
○ Refer to the appropriate equipment manual
For a detailed explanation, refer to an additional manual

		Title of manual	Document number	Description	Model code
Manual for the Main Module					
FX3U Series PLCs Main Unit					
△	Supplied Manual	FX3U Series Hardware Manual	JY997D18801	Describes FX3U Series PLC specification for I/O, wiring and installation extracted from the FX3U User's Manual - Hardware Edition. For details, refer to FX3U Series User's Manual - Hardware Edition.	-
⊙	Additional Manual	FX3U Series User's Manual - Hardware Edition	JY997D16501	Describes FX3U Series PLC specification details for I/O, wiring, installation and maintenance.	09R516
FX3UC Series PLCs Main Unit					
△	Supplied Manual	FX3UC Series Hardware Manual (Only Japanese document)	JY997D12701	Describes FX3UC Series PLC specification for I/O, wiring and installation extracted from the FX3UC User's Manual - Hardware Edition. For details, refer to FX3UC Series User's Manual - Hardware Edition (Only Japanese document).	-
⊙	Additional Manual	FX3UC Series User's Manual - Hardware Edition (Only Japanese document)	JY997D11601	Describes FX3UC Series PLC specification details for I/O, wiring, installation and maintenance. (Only Japanese document)	09R513
Programming for FX3U/FX3UC Series					
⊙	Additional Manual	FX3U / FX3UC Series Programming Manual - Basic & Applied Instruction Edition	JY997D16601	Describes FX3U / FX3UC Series PLC programming for basic/ applied instructions and devices.	09R517
Manuals for FX3U-20SSC-H Positioning Block					
△	Supplied Manual	FX3U-20SSC-H Installation Manual	JY997D21101	Describes FX3U-20SSC-H positioning block specification for I/O, power supply extracted from the FX3U-20SSC-H User's Manual. For details, refer to FX3U-20SSC-H User's Manual.	-
⊙	Additional Manual	FX3U-20SSC-H User's Manual	JY997D21301	Describes FX3U-20SSC-H Positioning block details.	09R622
⊙	Supplied Manual	FX Configurator-FP Operation Manual	JY997D21801	Describes operation details of FX Configurator-FP Configuration Software.	09R916
AC Servo Related Manual					
○	Additional Manual	MR-J3-□B Instruction Manual	SH-030051	Explains parameters and the detailed specifications for MR-J3-□B servo amplifier.	-
○	Additional Manual	EMC Installation Guidelines	IB67339	Explains installation procedures to conform with EMC Directives and fabrication method of control board.	-

Generic Names and Abbreviations Used in Manual

Generic name or abbreviation	Description
PLC	
FX3U series	Generic name for FX3U Series PLC
FX3U PLC or main unit	Generic name for FX3U Series PLC main unit
FX3UC series	Generic name for FX3UC Series PLC
FX3UC PLC or main unit	Generic name for FX3UC Series PLC main unit Only manuals in Japanese are available for these products.
FX2N Series	Generic name for FX2N Series PLC
FX2NC Series	Generic name for FX2NC Series PLC
Expansion board	
Expansion board	Generic name for expansion board The number of connectable units, however, depends on the type of main unit. To check the number of connectable units, refer to the User's Manual - Hardware Editon of main unit to be used for your system.
Special adapter	
Special adapter	Generic name for high-speed input/output special adapter, communication special adapter, and analog special adapter The number of connectable units, however, depends on the type of main unit. To check the number of connectable units, refer to the User's Manual - Hardware Editon of main unit to be used for your system.
Special function unit/block	
Special function unit/block or Special extension unit	Generic name for special function unit and special function block The number of connectable units, however, depends on the type of main unit. To check the number of connectable units, refer to the User's Manual - Hardware Edition of main unit to be used for your system.
Special function unit	Generic name for special function unit
Special function block	Generic name for special function block The number of connectable units, however, depends on the type of main unit. To check the number of connectable units, refer to the User's Manual - Hardware Edition of main unit to be used for your system.
Positioning special function block or 20SSC-H	Abbreviated name of FX3U-20SSC-H
Optional unit	
Memory cassette	FX3U-FLROM-16, FX3U-FLROM-64, FX3U-FLROM-64L
Battery	FX3U-32BL
FX Series terminal block	FX-16E-TB, FX-32E-TB
Input/output cable or Input cable	FX-16E-500CAB-S, FX-16E- □ □ □CAB, FX-16E- □ □ □CAB-R □ □ □ represents 150, 300, or 500.
Input/output connector	FX2C-I/O-CON, FX2C-I/O-CON-S, FX2C-I/O-CON-SA
Power cable	FX2NC-100MPCB, FX2NC-100BPCB, FX2NC-10BPCB1
Peripheral unit	
Peripheral unit	Generic name for programming software, handy programming panel, and indicator
Programming tool	
Programming tool	Generic name for programming software and handy programming panel
Programming software	Generic name for programming software
GX Developer	Generic name for SW □D5C-GPPW-J/SW □D5C-GPPW-E programming software package
FX-PCS/WIN(-E)	Generic name for FX-PCS/WIN or FX-PCS/WIN-E programming software package
Handy programming panel (HPP)	Generic name for FX-20P(-E) and FX-10P(-E)
Configuration software	
Configuration software or FX Configurator-FP	Abbreviated name of FX Configurator-FP Configuration software

Generic name or abbreviation	Description
Indicator	
GOT1000 series	Generic name for GT15 and GT11
GOT-900 series	Generic name for GOT-A900 series and GOT-F900 series
GOT-A900 series	Generic name for GOT-A900 series
GOT-F900 series	Generic name for GOT-F900 series
ET-940 series	Generic name for ET-940 series Only manuals in Japanese are available for there products
Servo motor/servo amplifier	
Servo motor	Generic name for servo motor or stepping motor Including servo amplifier corresponding to SSCNET III.
Servo amplifier	Generic name for servo amplifier corresponding to SSCNET III
MELSERVO series	Generic name for MELSERVO-J3 series
Other unit	
Manual pulse generator	Generic name for manual pulse generator (prepared by user)
Manual	
FX3U hardware Edition	FX3U Series User's Manual - Hardware Edition
FX3UC hardware Edition	This manual is available only in Japanese.
Programming manual	FX3U/FX3UC Series Programming Manual - Basic and Applied Instructions Edition
Communication control Edition	FX Series User's Manual - Data Communication Edition
Analog control Edition	FX3U/FX3UC Series User's Manual - Analog Control Edition
Positioning control Edition	FX3U/FX3UC Series User's Manual - Positioning Control Edition

Reading of the Manual

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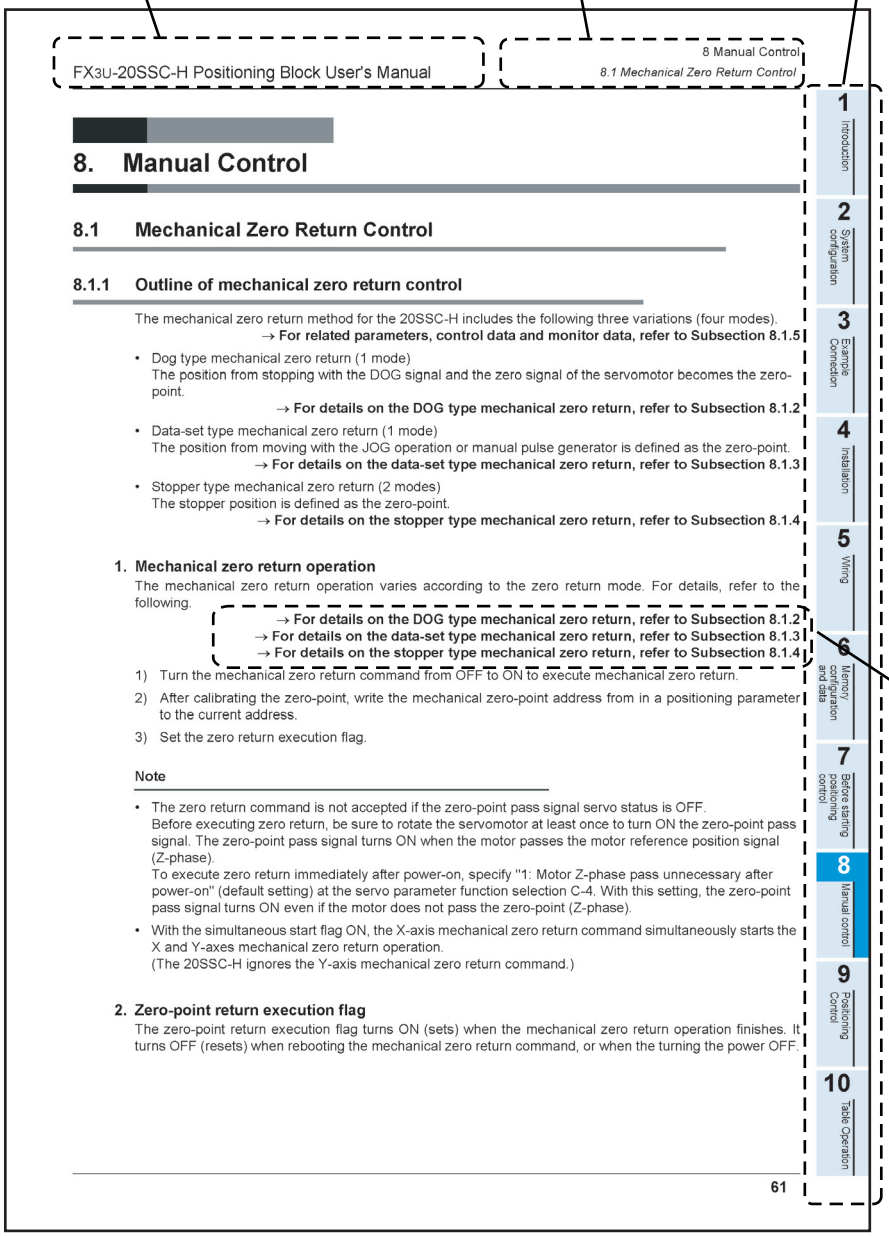

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1. Introduction

1.1 Outline

FX3U-20SSC-H type positioning block (hereinafter referred to as 20SSC-H) is a special function block applicable to SSCNET III.
20SSC-H can perform positioning control by servo motor via SSCNET III applied servo amplifier.

1. 2-axis control is possible

One 20SSC-H controls 2 axes.
20SSC-H applies the 1-speed positioning and interrupt 1-speed constant quantity feed operations for constant quantity feed control, and also the linear interpolation and circular interpolation operations.

→ **For positioning control, refer to Chapter 9.**

2. Connection to servo amplifier by SSCNET III is possible

20SSC-H connects directly to the MELSERVO (our company's servo amplifier: MR-J3-B) via SSCNETIII.

- Connection using the SSCNET III cable between the 20SSC-H and the servo amplifier and between servo amplifiers reduces wiring. (Maximum length is 50m.)
- Using the SSCNET III cable (optical communication) makes connections less susceptible to electromagnetic noise, etc. from the servo amplifier.
- Setting the servo parameters on the 20SSC-H side and writing/reading the servo parameters to/from the servo amplifier using SSCNET III is possible.
- Actual current values and error descriptions the servo amplifier can be checked by the buffer memories of the 20SSC-H.

3. Easy application of absolute position detection system

- The servo amplifier with absolute position detection enables the absolute positioning detection system.
- Once the zero position is established, the zero return operation at power startup is not necessary.
- The absolute position system allows the establishment of zero position by the data set type zero return. In this case, wiring for near-point DOG, etc. is not required.

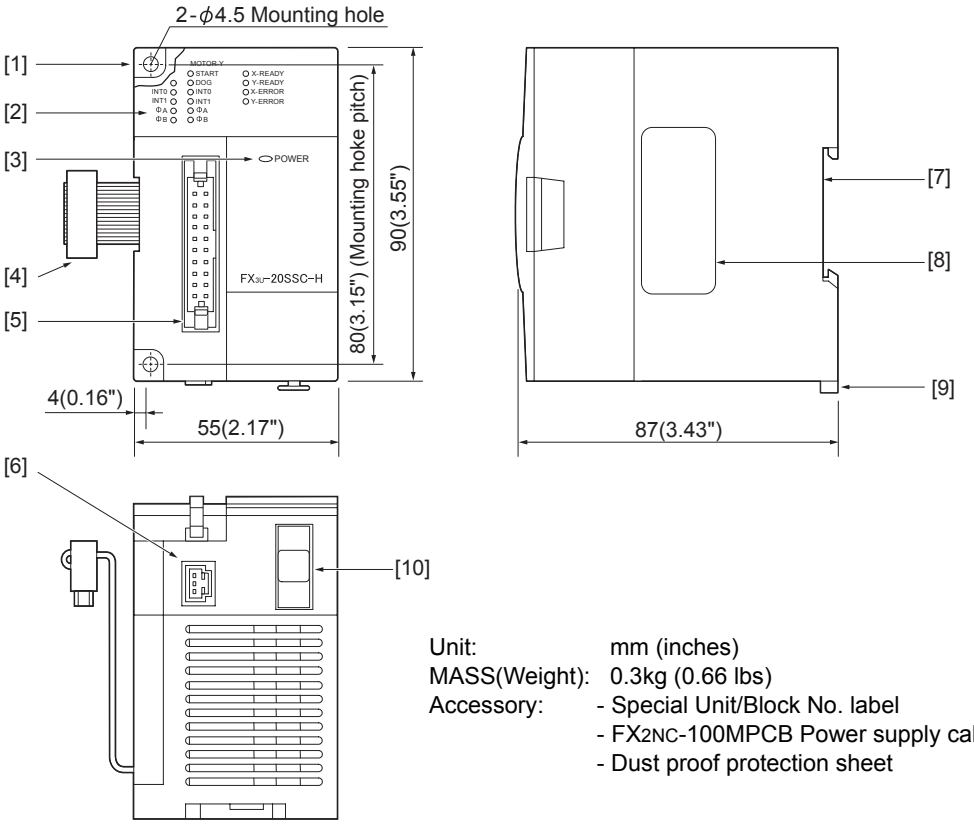
4. Easy maintenance

Various data such as positioning data, parameters, etc. can be saved to the flash memory (ROM) in the 20SSC-H.
This allows the data to be saved without battery.

5. Connectable PLC

- The connected FX3U or FX3UC PLC reads/writes the positioning data from/to the 20SSC-H.
- For connection to the FX3UC PLC, the FX2NC-CNV-IF or FX3UC-1PS-5V is needed.

1.2 External Dimensions and Part Names



Unit: mm (inches)
MASS(Weight): 0.3kg (0.66 lbs)
Accessory: - Special Unit/Block No. label
- FX2NC-100MPCB Power supply cable [1m (3'3")]
- Dust proof protection sheet

[1] Direct mounting hole:2 holes of ϕ 4.5 (0.18") (mounting screw: M4 screw)
[2] Status LEDs

→ **Refer to Section 1.3**

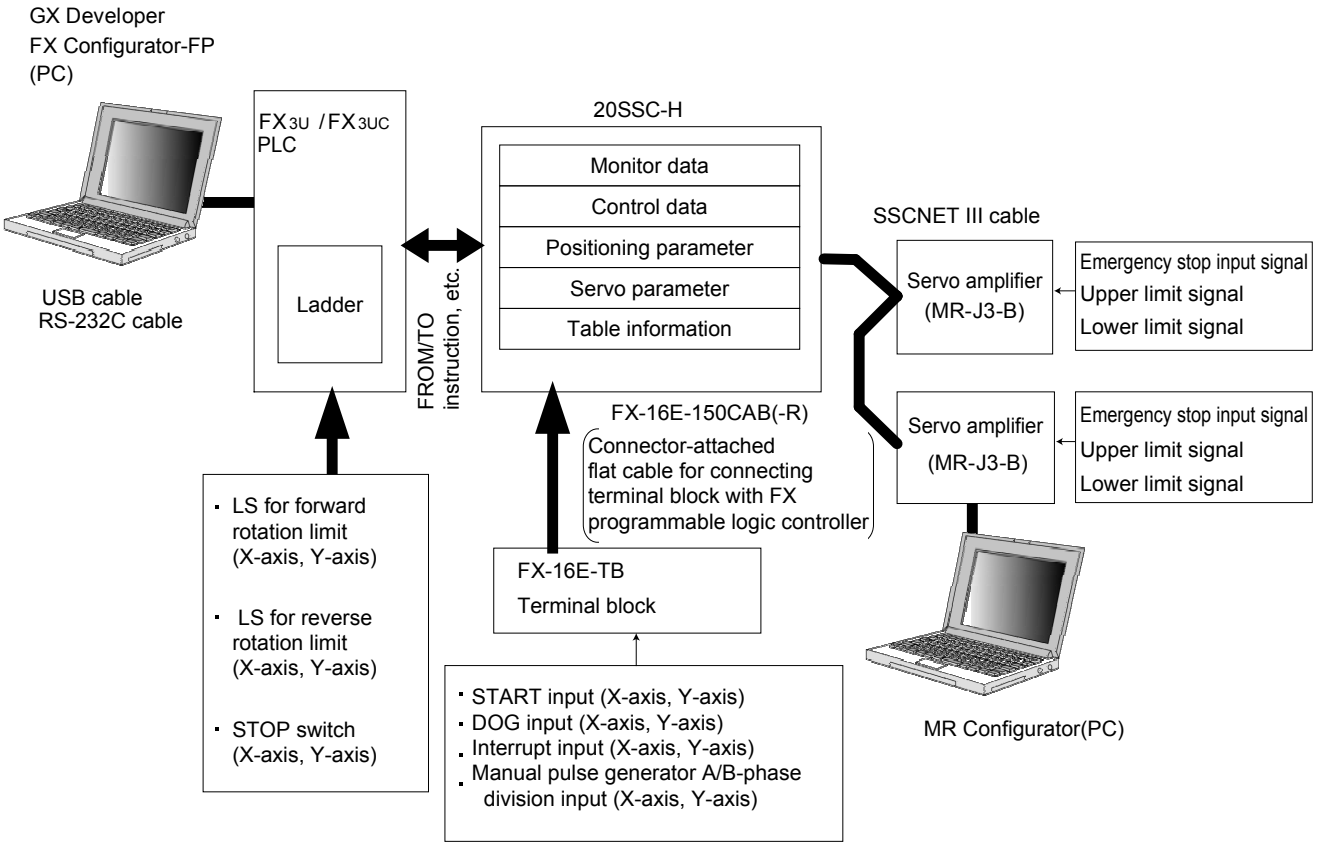
[3] POWER LED (green)
[4] Extension cable
[5] Input connector
[6] Power supply connector
[7] DIN rail mounting groove (DIN rail: DIN46277)
[8] Name plate
[9] DIN rail mounting hook
[10] SSCNET III connector

1.3 Power and Status LED

LED display	Color	Status	Description
POWER	Green	OFF	Power is not being supplied from the external power supply or the PLC
		ON	Power is being supplied from the external power supply or the PLC
X-READY Y-READY	Green	OFF	Error is occurring or positioning is being executed on the X/Y axis
		ON	Various operation commands are acceptable on the X/Y axis
X-ERROR Y-ERROR	Red	OFF	X/Y axis is operating normally
		Flicker	Error is occurring on the X/Y axis
		ON	CPU error is occurring on the X/Y axis
X-START Y-START	Red	OFF	Start input OFF
		ON	Start input ON
X-DOG Y-DOG	Red	OFF	DOG input OFF
		ON	DOG input ON
X-INT0 Y-INT0 X-INT1 Y-INT1	Red	OFF	Interrupt input OFF
		ON	Interrupt input ON
X- ϕ A Y- ϕ A	Red	OFF	Manual pulse generator A-phase input OFF
		ON	Manual pulse generator A-phase input ON
X- ϕ B X- ϕ B	Red	OFF	Manual pulse generator B-phase input OFF
		ON	Manual pulse generator B-phase input ON

2. System Configuration

2.1 General Configuration



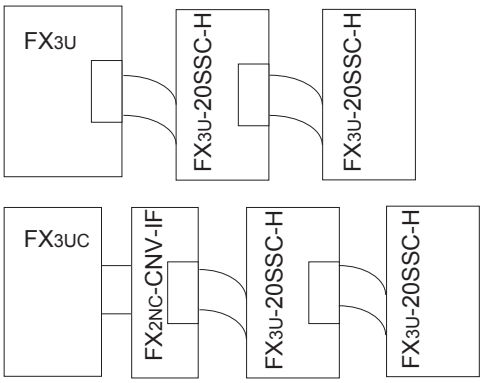
Component list

Part name	Model name	Remarks
Positioning block	FX3U-20SSC-H	-
PLC	FX3U/FX3UC PLC	-
PC software	GX Developer	PLC programming software
	FX Configurator-FP	Setting/Monitoring software for entering or monitoring of the servo parameters, positioning parameters and table information
	MR Configurator	Servo amplifier set-up software
PC	DOS/V	-
USB cable	FX-USB-AW	Connection cable between FX PLC and PC
RS-232C cable	F2-232CAB-1	PC connection cable and interface
	FX-232AWC-H	
	FX-422CAB0	
Servo amplifier	MR-J3- B	-
SSCNET III cable	Inside panel standard cable : MR-J3BUS □M	□ : 0.15/0.3/0.5/1/3(Cable length: in meters)
	Outside panel standard cable : MR-J3BUS □ M-A	□ : 5/10/20(Cable length:in meters)
	Inside panel standard cable : MR-J3BUS □M-B	□ : 30/40/50(Cable length:in meters)
Terminal block	FX-16E-TB	-
I/O cable	FX-16E- CAB	□ : 150/300/500 Cable length 150:1.5m, 300:3m, 500:5m
	FX-16E- CAB-R	

2.2 Connection with PLC

20SSC-H connects with PLC via extension cable.
The 20SSC-H is handled as a special extension block of the PLC. The unit number of the 20SSC-H is automatically assigned No.0 to No.7 starting from the special function unit/block closest to the PLC main unit. (This unit number is used for the designation of a FROM/TO instruction.) For details on assignment of the I/O number and unit number of the PLC, refer to the following manual corresponding to the connected PLC.

→ **FX3U Hardware Edition**
→ **FX3UC Hardware Edition (Japanese document only)**



- A maximum of 8 units/blocks can be connected with the FX3U PLC. With the FX3UC PLC, a maximum of 7 units/blocks can be connected.
- An FX2NC-CNV-IF or FX3UC-1PS-5V is necessary to connect the 20SSC-H with the FX3UC PLC.
- The optional FX0N-65EC (FX0N-30EC) and FX2N-CNV -BC are necessary to lengthen the extension cable.
- The number of I/O points occupied by the 20SSC-H is eight. Be sure that the total of the number of I/O points (occupied I/O points) of the main unit, power extension unit and extension block and the number of points occupied by the special function block does not exceed the maximum number of I/O points of the PLC.
  For the maximum number of I/O points of the PLC, refer to the following manual.

  → **FX3U Hardware Edition**
  → **FX3UC Hardware Edition (Japanese document only)**

2.3 Applicable PLC

Model name	Applicability
FX3U Series PLC	Ver. 2.20 (from the first product) and later Up to 8 blocks can be extended
FX3UC Series PLC	Ver. 2.20 (from products manufactured in May, 2005 with SER No. 55****) and later Up to 7 blocks can be extended

The version number can be checked by monitoring the last three digits of D8001.

3. Specifications

DESIGN PRECAUTIONS DANGER

- Provide a safety circuit on the outside of the PLC so that the whole system operates to ensure the safety even when external power supply trouble or PLC failure occurs.
  Otherwise, malfunctions or output failures may result in an accident.
  1) An emergency stop circuit, a protection circuit, an interlock circuit for opposite movements, such as normal and reverse rotations, and an interlock circuit for preventing damage to the machine at the upper and lower positioning limits should be configured on the outside of the PLC.
  2) When the PLC CPU detects an error, such as a watch dog timer error, during self-diagnosis, all outputs are turned off. When an error that cannot be detected by the PLC CPU occurs in an input/output control block, output control may be disabled.
  Design external circuits and mechanisms to ensure safe operations of the machine in such a case.
  3) When some sort of error occurs in a relay, triac or transistor of the output unit, output may be kept on or off.
  For output signals that may lead to serious accidents, design external circuits and mechanisms to ensure safe operations of the machine in such cases.
- At forward/reverse rotation limits wiring, make sure to wire in negative logic and use NC contact. Setting in positive logic and using NC-contact can cause serious accidents.

DESIGN PRECAUTIONS CAUTION

- Observe the following items. Failure to do so may cause incorrect data-writing by noise to PLCs and result the PLC failure, machine damage or an accident.
  1) Do not lay close or bundle with the main circuit line, high-voltage line, or load line.
  Noise and Surge induction interfere with the system operation.
  Keep a safe distance of least 100 mm (3.94") from the above lines during wiring.
  2) Ground the shield wire or shield of a shielded cable at one point on the PLC. However, do not ground at the same point as high voltage lines.
- Install in a manner which prevents excessive force from being applied to the built-in connectors dedicated to programming, power connectors and I/O connectors.
  Failure to do so may result in wire breakage or failure of the PLC.

DISPOSAL PRECAUTIONS CAUTION

- Please contact a company certified in the disposal of electronic waste for environmentally safe recycling and disposal of your device.

TRANSPORTATION PRECAUTIONS CAUTION

- The PLC is precision equipment. During transportation, avoid impacts larger than that is specified in the manual of the PLC main unit.
  Failure to do so may cause failures in the PLC.
  After transportation, check the operations of the PLC.

3.1 General Specifications

The items other than the following are equivalent to those of the PLC main unit.
For general specifications, refer to the manual of the PLC main unit.

→ **Refer to FX3U Hardware Edition**
→ **Refer to FX3UC Hardware Edition (Japanese document only)**

Item	Specification	
Dielectric withstand voltage	500V AC for one minute	Conforming to JEM-1021 Between all terminals and ground terminal
Insulation resistance	5MΩ or more by 500V DC Megger	

3.2 Power Supply Specification

Item		Specification
External power supply	Power supply voltage	24V DC +20% -15% Ripple (p-p) within 5%
	Permitted instantaneous power failure time	Operation continues when the instantaneous power failure is shorter than 5ms.
	Powerconsumption	5W
	Power fuse	1A
Internal power supply	PLC power supply	100mA /5V DC

3.3 Performance Specification

Item		Specification
Number of control axes		2 axes
Backup		Positioning parameters, servo parameters, and table information can be saved to flash memory Write count: Maximum 100,000 times
No. of occupied I/O points		8 points (input or output, whichever may be counted)
Connectable servo amplifier		MELSERVO MR-J3-☐B Maximum 2 amplifiers can be connected Standard cord length: Station to station maximum 20m (65'7") Long distance cord length: Station to station maximum 50m (164')
Servo bus		SSCNET III
Scan cycle		1.77ms
Control input		Interrupt input: 2 inputs (INT0 and INT1) per axis DOG: 1 input per input axis START input: 1 input per axis Manual pulse generator: 1 input per axis (A/B-phase)
Parameter		Positioning parameter: 21 types Servo parameter: 50 types
Control data		17 types
Monitor data		26 types
Positioning program		Created by sequence programs (using FROM/TO instruction, etc.) Direct operation (1 for X and Y axes respectively) Table operation (300 tables for X, Y, and XY axes respectively)
Positioning	Method	Increment/Absolute
	Unit	PLS,μm, 10^{-4}inch, mdeg
	Unit magnification	1, 10, 100, and 1000-fold
	Positioning range	-2,147,483,648 to 2,147,483,647 PLS
	Speed command	Hz, cm/min, 10deg/min, inch/min
	Acceleration/ deceleration process	Trapezoidal acceleration/deceleration, S-pattern acceleration/deceleration: 1 to 5,000ms Only trapezoidal acceleration/deceleration is available for interpolation
	Starting time	1.6ms or less
	Interpolation function	2-axes linear interpolation, 2-axes circular interpolation

3.4 Input Specifications

3.4.1 Input specifications

Item		Specification
Input signal name	Group 1	X axis interrupt input: X-INT0, X-INT1 Used for interrupt operation
		Y axis interrupt input: Y-INT0, Y-INT1 Used for interrupt operation
		X axis near-point DOG input: X-DOG Used for zero return
		Y axis near-point DOG input: Y-DOG Used for zero return
		START command for X axis positioning operation: X-START
		START command for Y axis positioning operation: Y-START
	Group 2	Manual pulse generator input for X axis: X- ϕ A+/X- ϕ A-, X- ϕ B+/X- ϕ B- 1 edge count at 2-phase 2-count
		Manual pulse generator input for Y axis: Y- ϕ A+/Y- ϕ A-, Y- ϕ B+/Y- ϕ B- 1 edge count at 2-phase 2-count
	Group 3	External power supply for signals: S/S Connected to power supply for INT0, INT1, DOG and START
Group 1	Operation display	LED ON at input ON
	Signal voltage	24VDC+20% -15% (Power is supplied from S/S terminal)
	Input current	7.0mA ± 1mA /24V DC
	ON current	4.5mA or more
	OFF current	1.5mA or less
	Signal form	No-voltage contact input Sink input: NPN open collector transistor Source input: PNP open collector transistor
	Response time	Hardware filter 1ms or less
	Circuit insulation	Photo-coupler insulation
Group 2	Operation display	LED ON at input ON
	Signal voltage	3 to 5.25V DC
	Input current	3.0 to 8.5mA
	ON current	3.0mA or more
	OFF current	0.5mA or less
	Signal form	Differential line driver (corresponding to AM26LS31)
	Response frequency	2-phases pulse 100KHz or less (Duty 50%)
	Circuit insulation	Photo-coupler insulation
Group 3	Power supply voltage	24V DC +20% -15%
	Consumption current	64mA or less

3.4.2 Internal input circuit

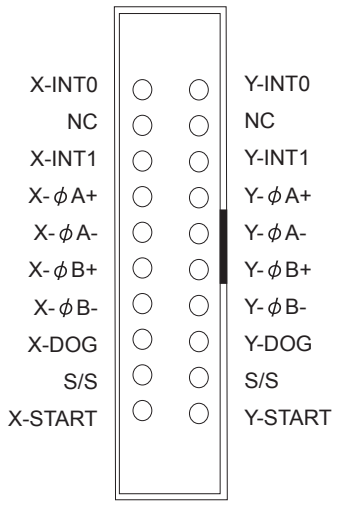
For the internal input circuit diagram, refer to the following.

→ **For the internal input circuit diagram, refer to section 5.3**

3.5 Pin Configuration

3.5.1 Input connector

Connector pin array (aperture side)

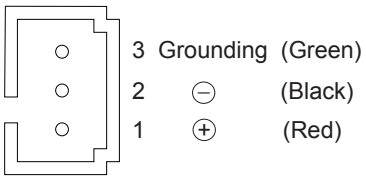


Terminal name	Description	Terminal name	Description
X-INT0	Interrupt input (for X axis)	Y-INT0	Interrupt input (for Y axis)
NC	Not used	NC	Not used
X-INT1	Interrupt input (for X axis)	Y-INT1	Interrupt input (for Y axis)
X- ϕ A+	Input terminal for A-phase input of 2-phase pulse (for X axis)	Y- ϕ A+	Input terminal for A-phase input of 2-phase pulse (for Y axis)
X- ϕ A-	Common terminal for A-phase input of 2-phase pulse (for X axis)	Y- ϕ A-	Common terminal for A-phase input of 2-phase pulse (for Y axis)
X- ϕ B+	Input terminal for B-phase input of 2-phase pulse (for X axis)	Y- ϕ B+	Input terminal for B-phase input of 2-phase pulse (for Y axis)
X- ϕ B-	Common terminal for B-phase input of 2-phase pulse (for X axis)	Y- ϕ B-	Common terminal for B-phase input of 2-phase pulse (for Y axis)
X-DOG	Near-point DOG input terminal (for X axis)	Y-DOG	Near-point DOG input terminal (for Y axis)
S/S	Power input terminal (START, DOG, INT0 and INT1) 24VDC Pins that have the same name (S/S) are shorted inside.	S/S	Power input terminal (START, DOG, INT0 and INT1) 24VDC Pins that have the same name (S/S) are shorted inside.
X-START	START input terminal (for X axis)	Y-START	START input terminal (for Y axis)

Caution

The pin array is seen from the connection side (aperture side) of the input connectors of the 20SSC-H.
The pin numbers and the position of ▲ vary depending on the connectors for user cables.
Perform wiring properly while paying attention to the position of notches and the direction of connectors.
Otherwise, the product may be damaged due to wiring mistakes.

3.5.2 Power supply connector



4. Installation

INSTALLATION PRECAUTIONS DANGER

- Make sure to cut off all phases of the power supply externally before starting the installation or wiring work.
  Failure to do so may cause electric shock.

INSTALLATION PRECAUTIONS CAUTION

- Fit the extension cables, peripheral device connecting cables, input/output cables and battery connecting cable securely to the designated connectors.
  Contact failures may cause malfunctions.
- Use the product in the environment within the generic specifications described in section 4.1 of this manual.
  Never use the product in areas with dust, oily smoke, conductive dusts, corrosive gas (salt air, Cl2, H2S, SO2 or NO2), flammable gas, vibration or impacts, or expose it to high temperature, condensation, or wind and rain.
  If the product is used in such a place described, electrical shock, fire, malfunctions, damage, or deterioration may be caused.
- Do not touch the conductive parts of the product directly, thus avoiding failure or malfunctions.
- Install the product securely using a DIN rail or mounting screws.
- Install the product on a flat surface.
  If the mounting surface is rough, undue force will be applied to the PC board, thereby causing nonconformities.
- When drilling screw holes or wiring, cutting chips or wire chips should not enter ventilation slits. such an accident may cause fire, failures or malfunctions.
- Be sure to remove the dust proof sheet from the PLC's ventilation port when the installation work is completed. Failure to do so could cause fires, equipment failures, and malfunctions.
- Make sure to attach the terminal cover offered as an accessory to the product before turning on the power or starting the operation after installation or wiring work.
  Failure to do so may cause electric shock.

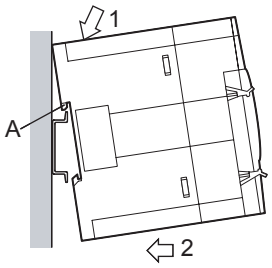
The product can be connected on the right side of the main unit or extension unit/block. To connect to the FX3UC PLC or FX2NC PLC extension block, the FX2NC-CNV-IF or FX3UC-1PS-5V is necessary. For the installation environment, refer to the following respective manual.

→ **Refer to the FX3U Hardware Edition**
→ **Refer to the FX3UC Hardware Edition (Japanese document only)**

20SSC-H is installable into a control cabinet by 35 mm wide DIN46277 DIN rail mounting or M4 screw direct mounting.

4.1 DIN rail Mounting

The product can be mounted on a 35mm wide DIN46277 (DIN rail.



1 Fit the upper edge (A in the figure to the right) of the DIN rail mounting groove onto the DIN rail.

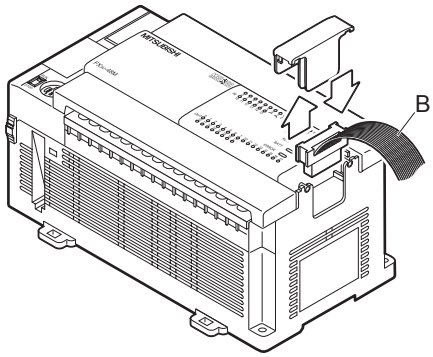
2 Push the product onto the DIN rail.

- An interval space between each unit of 1 to 2 mm (0.04" to 0.08") is necessary.

3 Connect the extension cable.

Connect the extension cable (B in the figure to the right) to the main unit, I/O extension unit/block or special function unit/block to the left side of the product.
For extension cable connection procedure, refer to the following respective PLC manual.

→ **Refer to the FX3U Hardware Edition**
→ **Refer to the FX3UC Hardware Edition (Japanese document only)**



4.2 Direct Mounting

The product can be installed directly with screws.
An interval space between each unit of 1 to 2 mm (0.04" to 0.08") is necessary.
For installation, refer to the following respective PLC manual.

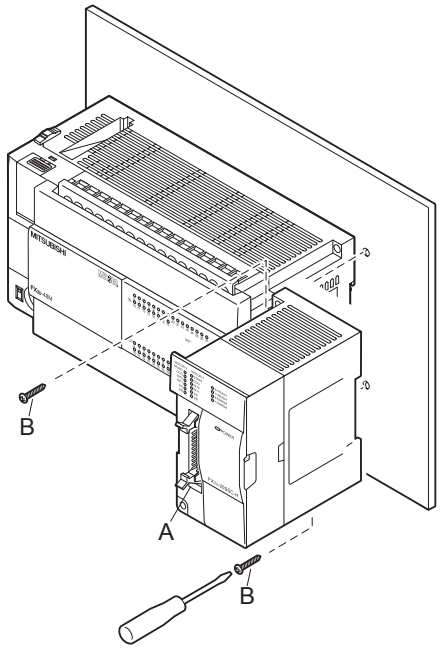
→ **For the mounting hole pitches, refer to Section 1.2.**
→ **Refer to the FX3U Hardware Edition**
→ **Refer to the FX3UC Hardware Edition (Japanese document only)**

1 Make mounting holes in the mounting surface according to the external dimensions diagram.

2 Fit 20SSC-H (A in the figure to the right) to holes and tighten M4 screws (B in the figure to the right).

For the screw position and quantity, refer to the dimensioned drawing specified below.

→ **For dimensions, refer to Section 1.2.**



3 Connect the extension cable.

Connect the extension cable (C in the figure to the right) to the main unit, I/O extension unit/block or special function unit/block to the left side of the product. (Refer to Step 3 in Section 4.1.)
For extension cable connection procedure, refer to the following respective PLC manual.

→ **Refer to the FX3U Hardware Edition**
→ **Refer to the FX3UC Hardware Edition (Japanese document only)**

5. Wiring

DESIGN PRECAUTIONS ⚠ CAUTION

- Observe the following items. Failure to do so may cause incorrect data-writing by noise to PLCs and result the PLC failure, machine damage or an accident.
  1) Do not lay close or bundle with the main circuit line, high-voltage line, or load line.
     Noise and Surge induction interfere with the system operation.
     Keep a safe distance of least 100 mm (3.94") from the above lines during wiring.
  2) Ground the shield wire or shield of a shielded cable at one point on the PLC. However, do not ground at the same point as high voltage lines.
- Install in a manner which prevents excessive force from being applied to the built-in connectors dedicated to programming, power connectors and I/O connectors.
  Failure to do so may result in wire breakage or failure of the PLC.

WIRING PRECAUTIONS ⚠ DANGER

- Make sure to cut off all phases of the power supply externally before starting the installation or wiring work.
  Failure to do so may cause electric shock.

WIRING PRECAUTIONS ⚠ CAUTION

- Connect the DC power supply wiring to the dedicated terminals described in this manual.
  If an AC power supply is connected to a DC input/output terminal or DC power supply terminal, the PLC will be burnt out.
- Perform class D grounding (grounding resistance: 100. or less) to the grounding terminal in the 20SSC-H with a wire as thick as possible. Do not connect the grounding terminal at the same point as a heavy electrical system (refer to subsection 5.2.2).
- Make sure to attach the terminal cover offered as an accessory to the product before turning on the power or starting the operation after installation or wiring work.
  Failure to do so may cause electric shock.
- Cables and wires for input to the 20SSC-H must be connected to their corresponding dedicated connectors as described in this manual. For example, if you connect an AC power cable to a DC input connector, they will burn out.
- Do not wire vacant terminals externally.
  Doing so may damage the product.
- When drilling screw holes or wiring, cutting chips or wire chips should not enter ventilation slits. such an accident may cause fire, failures or malfunctions.
- Properly perform wiring to the FX Series terminal blocks following the precautions below in order to prevent electrical shock, short-circuit, breakage of wire, or damage to the product:
  - The disposal size of the cable end should follow the dimensions described in this manual.
  - Tightening torque should be between 0.5 to 0.8 N•m.
- Do not wire or bundle the SSCNET III cable with the main circuit cable, power cable and/or other such load carrying cables other than those for the PLC. Separate these cables at least 100mm (3.94") from each other.
  Noise and Surge induction interfere with the system operation.
- When pulling out SSCNET III cable from the connector, be sure to put the cap on SSCNET III connector.
  If the SSCNET III end face is dirty, optical transmission is interrupted and it may cause malfunctions.
- Do not see directly the light generated from SSCNET III connector of servo amplifier or 20SSC-H.
  When the light gets into the eyes, it causes discomformity in the eyes.
  (The light source of SSCNET III corresponds to class1 defined in JISC6802 or IEC60825-1.)
- If SSCNET III cable is added a power such as a major shock, lateral pressure, haul, sudden bending or twist, its inside distorts or breaks, and optical transmission will not be available.
  SSCNET III cable should be given loose slack to avoid from becoming smaller than the minimum bend radius, and it should not be twisted.
- Make sure to use SSCNET III cable within the range of operating temperature (refer to subsection 5.1.1) described in this manual.
  The optical cable and code part melts down if being left near the fire or high temperature. Therefore, do not make it touched the part which becomes high temperature, such as radiator or regenerative brake option of servo amplifier, or servomotor.
- Make sure to lay SSCNET III cable with greater radius than the minimum bend radius. (Refer to the Section 5.4.1 Precautions for SSCNET III cable wiring.)
- Fix the optical cable at the closest part to the connector with bundle material in order to prevent SSCNET III cable from putting its own weight on SSCNET III connector.
- Never use vinyl tape for optical cord. Plasticizing material in vinyl tape goes into optical fiber and lowers the optical characteristic. At worst, it may cause wire breakage. If using adhesive tape for the optical cable laying, the fire resistant acetate cloth adhesive tape 570F (Teraoka Seisakusho Co., Ltd) is recommended.
  If laying with other wires, do not make the optical cable touched wires or cables made from soft polyvinyl chloride (PVC), polyethylene resin (PE), teflon (Fluorocarbon resin) or nylon which contains plasticizing material.

WIRING PRECAUTIONS ⚠ CAUTION

- If the adhesion of solvent and oil to the code part of SSCNET III cable may lower the optical characteristic and machine characteristic. If it is used such an environment, be sure to do the protection measures to the optical cord.
- When storing, put a cap on the connector part for preventing the connector edge of SSCNET III from getting dirt, dust and so on.
- SSCNET III connector is put a cap to protect light device inside connector from dust. For this reason, do not remove a cap until just before mounting SSCNET III cable. Then, when removing SSCNET III cable, make sure to put a cap.
- Keep the cap for SSCNET III connector and the tube for protecting light code end of SSCNET cable in a plastic bag with a zipper of SSCNET III cable to prevent them from becoming dirty.
- When changing the servo amplifier or 20SSC-H, make sure to put cap on SSCNET III connector. When asking repair of servo amplifier for some troubles, make sure to put a cap on SSCNET III connector. When the connector is not put a cap, the light device may be damaged at the transit. In this case, exchange and repair of light device is required.

5.1 Cable to Be Used, Applicable Connector and Wire Size

5.1.1 SSCNET III cable

The SSCNET III cable for connecting 20SSC-H with the servo amplifier is described.

Model	Cable length	Flex Lif	Operating temperature range	Application and remarks
MR-J3BUS□*1M	0.15, 0.3, 0.5, 1, 3m	Standard	-40 to 85 °C (-40 to 185 °F)	For standard in-panel cable
MR-J3BUS□*1M-A	5, 10, 20m	Standard		For standard external cable
MR-J3BUS□*1M-B	30, 40, 50m	Long flex	-20 to 70 °C (-4 to 158 °F)	For long distance cable

*1. □ indicates the cable length.
015 : 0.15m, 03 : 0.3m, 05 : 0.5m, 1 : 1m, 3 : 3m, 5 : 5m, 10 : 10m, 20 : 20m, 30 : 30m, 40 : 40m, 50 : 50m

5.1.2 Power supply cable

The cable for connecting the 20SSC-H power supply connector with the power supply is described.

Model name	Length	Remarks
FX2NC-100MPCB	1m	Accessory of 20SSC-H

Preparing the power cable by yourself

To prepare the power cable by yourself, use the following wiring material and connector.

		Specifications/model name
Wire size		AWG 24(0.2mm2)
Crimp terminal		50083-8014 (Manufactured by Molex Incorporated)
Housing	For main unit, 20SSC-H	51030-0330 (Manufactured by Molex Incorporated)
	For input extension block	51030-023 (Manufactured by Molex Incorporated)

5.1.3 Input cable and terminal block

The cable for connecting the 20SSC-H input connector with external devices is described.

1. Input connector

The input connector of 20SSC-H complies with MIL-C83503.
Procure the input cable while referring to the following.

1) Applicable connector (commercially available connectors)
Use the 20-pin (1-key) socket complying with MIL-C-83503.
Check in advance for interference with peripheral parts such as the connector cover.

2) Input cable (by Mitsubishi Electric)

Model name	Cable length	Remarks
FX-16E-☐*1CAB	1.5, 3, 5m	Flat cable (with tube) provided with a 20-pin connector at both ends
FX-16E-☐*1CAB-R		Round multi-conductor cable provided with a 20-pin connector at both ends
FX-16E-500CAB-S	5m	Bulk cable with 20-pin connector provided on a single end (cable color: red)

*1. ☐ indicates the cable length.
150 : 1.5m, 300 : 3m, 500 : 5m

3) Applicable connector for user cable (by Mitsubishi Electric)
The users should prepare the electric wires and pressure crimp tool.

Model name and configuration of I/O connector				Applicable cable (UL-161 recommended) and tool	
Our model name			Description of part (Made by DDK Ltd.)	Wire size	Crimp tool (Made by DDK Ltd.)
For flat cable	FX2C-I/O-CON	Set of 10 pieces	Crimp connector FRC2-A020-30S	AWG28 (0.1mm^2) 1.27 pitch 20 conductors	357J-46740: Main body 357J-4664N: Attachment
For united cable	FX2C-I/O-CON-S	Set of 5	Housing HU-200S2-001 Crimp contact HU-411S	AWG22 (0.3mm^2)	357J-5538
	FX2C-I/O-CON-SA	Set of 5	Housing HU-200S2-001 Crimp contact HU-411SA	AWG20 (0.5mm^2)	357J-13963

4) Applicable connectors (commercially available connectors)
DDK Ltd. connector specified in Item (3) above and Matsushita Electric Works connector specified in the table below.

Model name of connector		Applicable cable (UL-1061 recommended)	Crimp tool
Housing	AXW1204A	AWG22(0.3mm^2) AWG24(0.2mm^2)	AXY52000
Contact	AXW7221		
Cover	AXW62001A		

2. Terminal block

1) Terminal block (our option)
For the specification and internal circuit of the terminal block, refer to the following respective PLC manual.

→ **Refer to the FX3U Hardware Edition**
→ **Refer to the FX3UC Hardware Edition (Japanese document only)**

Model name	Application and remarks
FX-16E-TB	Converts input connector to terminal block

2) Terminal layout of FX-16E-TB connected to input connector

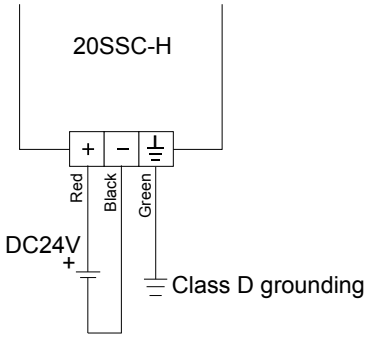
→ **For the pin array of the input connector, refer to Subsection 3.5.1**

	Y-START	·	X-ϕA+	S/S*1	X-ϕB+	X-DOG	S/S*1	·	Y-ϕA+	S/S*1	Y-ϕB+	Y-DOG	S/S*1
X-START	X-INT0	X-INT1	S/S*1	X-ϕA-	X-ϕB-	S/S*1	Y-INT0	Y-INT1	S/S*1	Y-ϕA-	Y-ϕB-	S/S*1	

*1. The S/S terminal is connected inside FX-16E-TB.

5.2 Power Supply Wiring

5.2.1 Power supply wiring



Power-on timing

The 20SSC-H power supply should be turn ON simultaneously or before the PLC main unit. Before turning the power OFF, ensure the safety of the system and then simultaneously turn the main unit, 20SSC-H, and other extension equipment (the special extension equipment is included) OFF.
For details, refer to the following PLC manual.

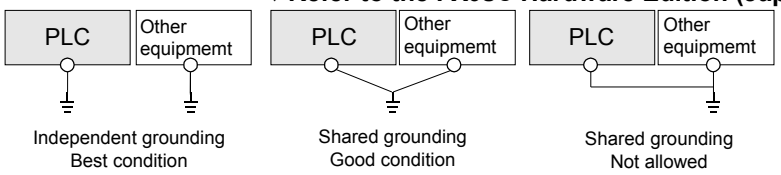
→ **Refer to the FX3U Hardware Edition**
→ **Refer to the FX3UC Hardware Edition (Japanese document only)**

5.2.2 Grounding

Ground the cables as follows

- The grounding resistance should be 100Ω or less.
- Grounding should perform independent grounding as far as possible.
  Independent grounding should be performed for best results.
  When independent grounding is not performed, perform "shared grounding" as shown in the following figure.
  For details, refer to the following respective PLC manual.

→ **Refer to the FX3U Hardware Edition**
→ **Refer to the FX3UC Hardware Edition (Japanese document only)**

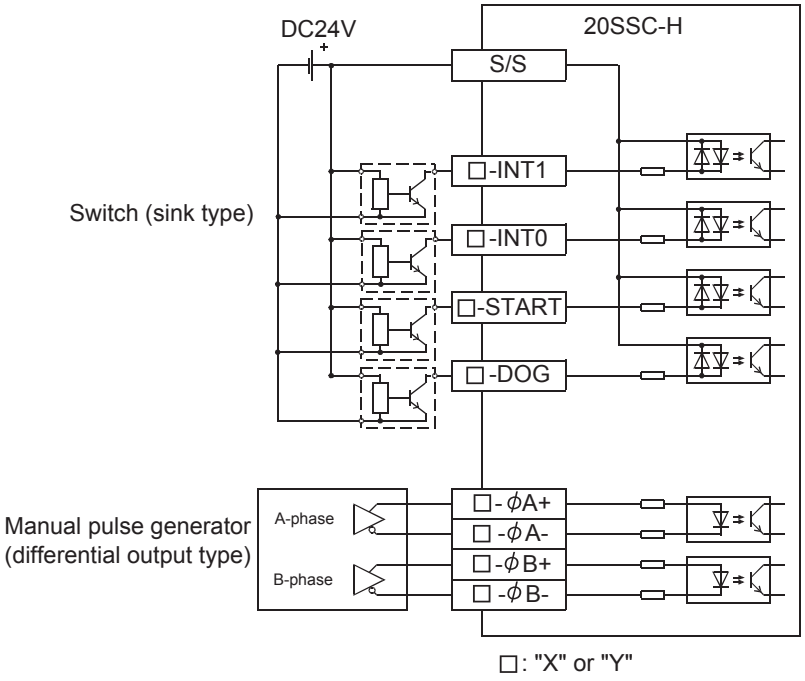


- The grounding wire size should be AWG22-20 (0.3 to 0.5 mm^2).
- The grounding point should be close to the PLC, and all grounding wires should be as short as possible.

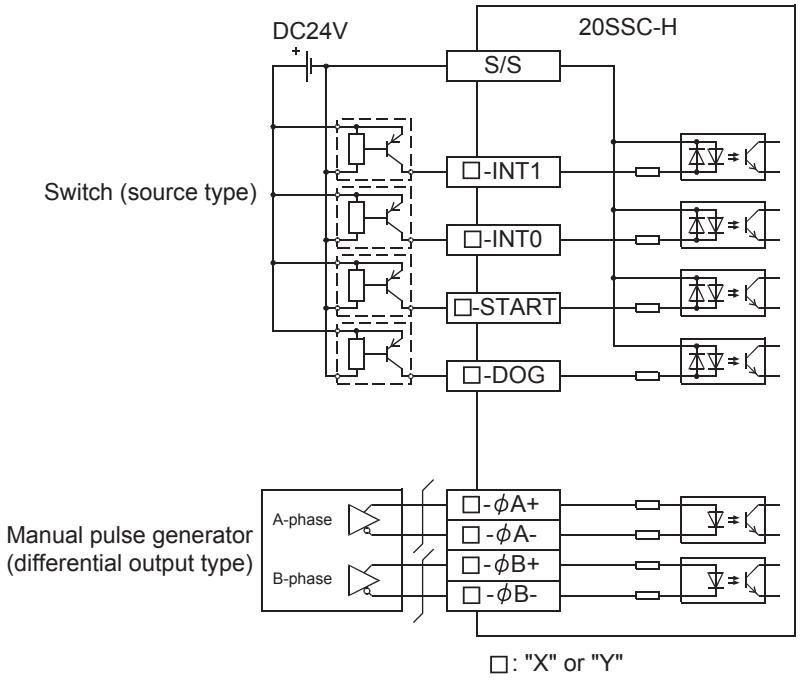
5.3 Input Wiring

An external power supply (24VDC) is necessary for the START, DOG, INT0 , INT1 and S/S terminals.

5.3.1 Sink input wiring



5.3.2 Source input wiring



5.4 Connecting the SSCNET III Cable

5.4.1 Cautions for installation the SSCNET III cable

SSCNET III cable is made from optical fiber.
If a force is applied to the optical fiber such as a major shock, lateral pressure, haul, sudden bending or twist, its inside distorts or breaks, and optical transmission will not be available.
Carefully read the precautions in this manual when handling the SSCNET III cable.
For detailed specifications of the SSCNET III cable or details on the assembling procedure, refer to the following manual.

→ **Refer to the MR-J3-□B Servo Amplifier Instruction Manual**

1) Minimum bend radius
Make sure to lay SSCNET III cable with bending radius greater than the minimum bend radius.
If the SSCNET III cable is less than the minimum bend radius, optical transmission is interrupted and it may cause malfunctions.

SSCNET III cable	Minimum bend radius [mm (inches)]
MR-J3BUS□M	25 (0.98")
MR-J3BUS□M-A	Reinforced film cable : 50 (1.97") Code part : 25 (0.98")
MR-J3BUS□M-B	Reinforced film cable : 50 (1.97") Code part : 30 (1.18")

2) Tension
If tension is applied to the SSCNET III cable, increase of transmission loss occurs due to external forces which concentrate on the fixing part of SSCNET III cable or the connecting part of SSCNET connector. In the worst case, the SSCNET III cable may break or be damaged. When laying SSCNET III cable, handle without applying forced tension.

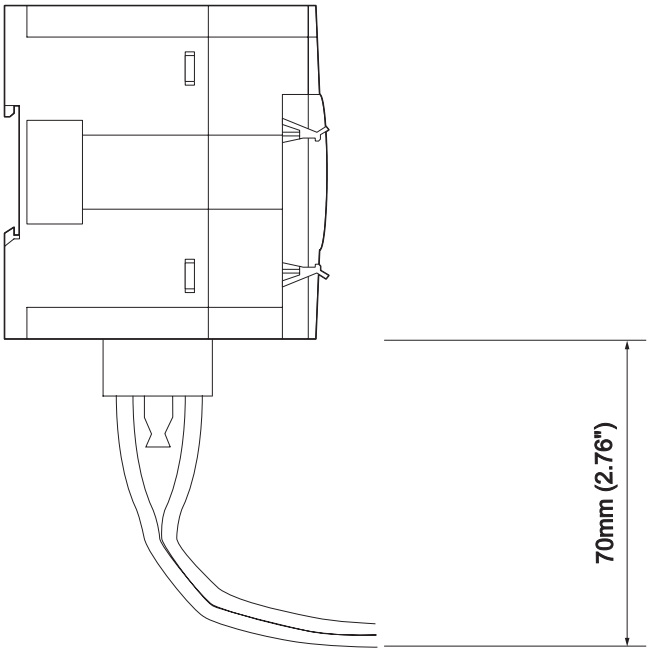
3) Lateral pressure
If lateral pressure is applied to the optical cable, the SSCNET III cable itself distorts, the internal optical fiber gets stressed, and transmission loss will increase. In the worst case, the SSCNET III cable may break. To avoid lateral pressure while laying cable, do not bind the SSCNET III cable with things nylon bands (TY-RAP).

4) Twisting
If the SSCNET III cable is twisted, it is the same as when local lateral pressure or bending stress is applied. Consequently, transmission loss increases, and in the worst case, the SSCNET III cable may break.

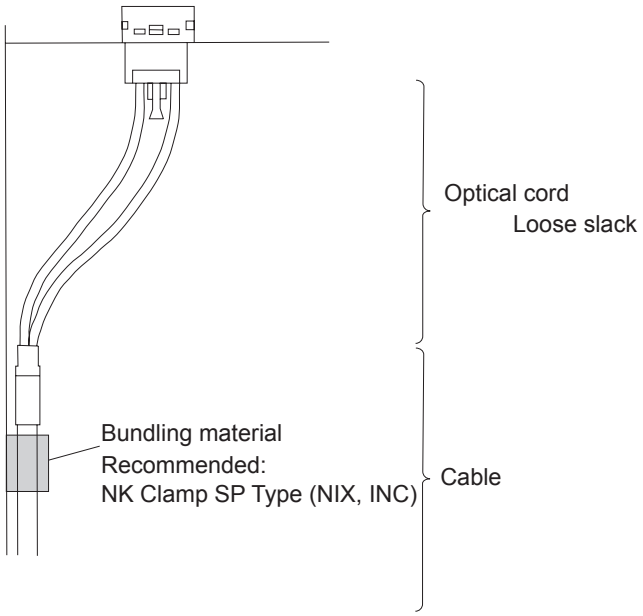
5.4.2 Cautions for SSCNET III cable wiring

Secure the cable at close to the connector with bundle material in order to prevent the SSCNET III cable from applying its own weight to the connector.
Reserve the following distance when wiring.

1) Wiring duct
If the duct is below the bottom of the 20SSC-H, leave sufficient clearance to eliminate effects on the SSCNET III cable. The space height should be 70 mm (2.76") minimum.



2) Bundling



6. Memory Configuration and Data Operation

DESIGN PRECAUTIONS ⚠ CAUTION

- Observe the following items. Failure to do so may cause incorrect data-writing by noise to PLCs and result the PLC failure, machine damage or an accident.
  1) Do not lay close or bundle with the main circuit line, high-voltage line, or load line.
     Noise and Surge induction interfere with the system operation.
     Keep a safe distance of least 100 mm (3.94") from the above lines during wiring.
  2) Ground the shield wire or shield of a shielded cable at one point on the PLC. However, do not ground at the same point as high voltage lines.
- Install in a manner which prevents excessive force from being applied to the built-in connectors dedicated to programming, power connectors and I/O connectors.
  Failure to do so may result in wire breakage or failure of the PLC.

STARTUP AND MAINTENANCE PRECAUTIONS ⚠ DANGER

- Do not touch any terminal while the PLC's power is on.
  Doing so may cause electrical shock or malfunctions.
- Before cleaning or retightening terminals, externally cut off all phases of the power supply.
  Failure to do so may expose you to shock hazard.
- Before modifying the program under operation or performing operation for forcible output, running or stopping, carefully read the manual, and sufficiently ensure the safety.
  An operation error may damage the machine or cause accidents.
- To test Zero-return, JOG operation and Positioning data, throughly read this manual, ensure the safe system operation
  An operation error may damage the machine or cause accidents.

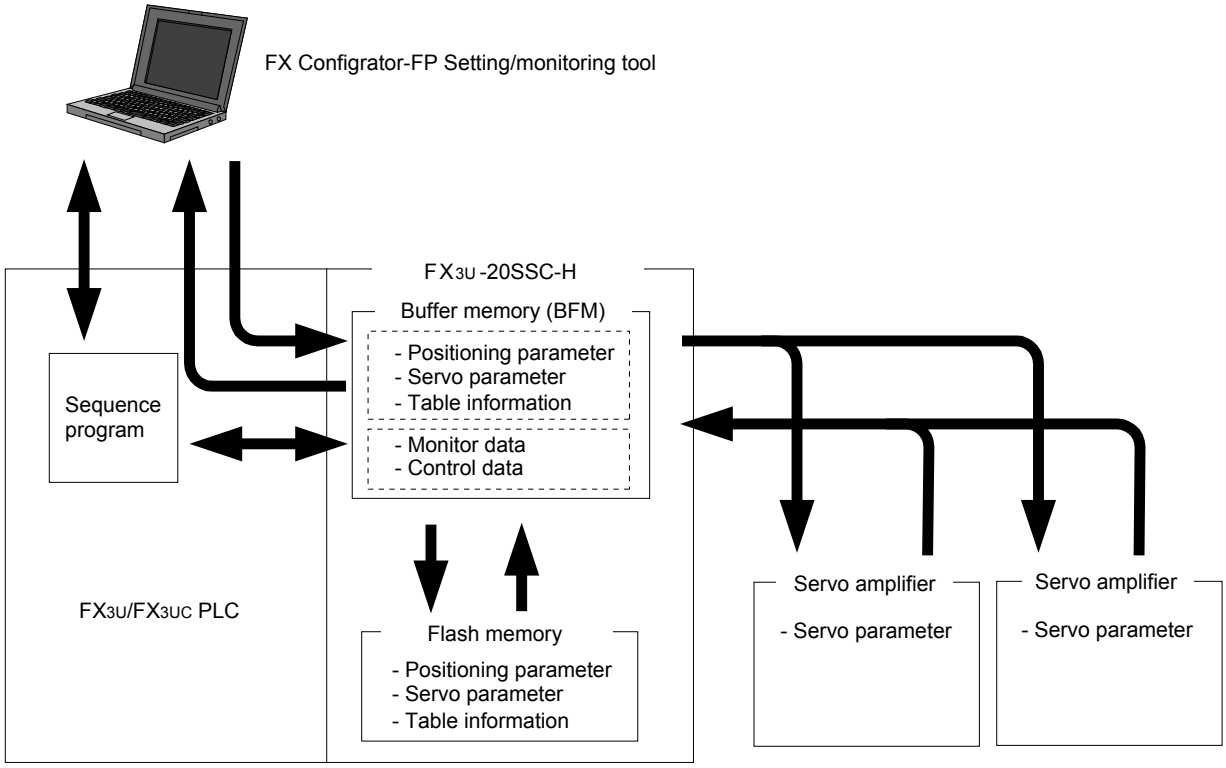
STARTUP AND MAINTENANCE PRECAUTIONS ⚠ CAUTION

- Do not disassemble or modify the PLC.
  Doing so may cause failures, malfunctions or fire.
  * For repair, contact your local Mitsubishi Electric distributor.
- Before connecting or disconnecting any extension cable, turn off power.
  Failure to do so may cause unit failure or malfunctions.
- Before attaching or detaching the following devices, turn off power.
  Failure to do so may cause device failure or malfunctions.
  - Peripheral devices, expansion boards and special adapters
  - I/O extension blocks/units and terminal blocks

6.1 Memory Configuration and Role

6.1.1 Memory configuration

Store parameters and data necessary for control in the buffer memory (BFM) and flash memory inside 20SSC-H, using the sequence program or FX Configurator-FP.



1) Buffer memory (BFM)
The PLC can access the buffer memory (BFM) directly, using sequence programs.
20SSC-H uses parameters and data in this area to execute positioning control.

2) Flash memory
The flash memory saves parameters and table information necessary for positioning control.
Store necessary data in advance for the mechanical equipment and applications.

6.1.2 Data type and role

Data type	Application	BFM number		
		X-axis	Y-axis	X-/Y-axis
Monitor data	Data indicating the control state. The monitor data is stored in the buffer memory. Monitor the data when necessary. → **For details, refer to Section 11.3**	BFM #0 to #99	BFM #100 to #179	-
Control data	The user controls the positioning control system, using the control data. The control data is related to operation-related settings, speed change command during positioning operation, stop operation, restart, etc. → **For details, refer to Section 11.4**	BFM #500 to #599	BFM #600 to #699	-
Positioning parameter	The positioning parameter specifies the unit, speed and other features of the positioning control. Enter data according to the mechanical equipment and applicable motor. → **For details, refer to Section 11.1**	BFM #14000 to #14199	BFM #14200 to #14399	-
Servo parameter	The servo parameter depends on the servo amplifier to be used, and it is used to control the servomotor. Enter data according to the specifications to be used. → **For details, refer to Section 11.2**	BFM #15000 to #15199	BFM #15200 to #15399	-
Table information	The table information is used for table type positioning control. Positioning control is based on the data specified in each table (operation information, position information, speed information, m code information). Up to 300 positioning tables can be defined. → **For details, refer to Section 11.5**	BFM #1000 to #3999	BFM #4000 to #6999	BFM #7000 to #12999

Note

- Positioning and servo parameters are automatically created and set for each of the X- and Y- axes according to the factory default settings. (Leave default parameters for unused axes.)
- The table information is created for each of the X-, Y- and XY-axes.
- The positioning parameters, servo parameters and table information can be initialized, using FX Configurator-FP or sequence program.

6.2 Parameter setting method

Use one of the following methods to set parameters to 20SSC-H.

1. **FX Configurator-FP**
   Positioning parameters, servo parameters and table information may be set using FX Configurator-FP.
   For operation details on using FX Configurator-FP, refer to the following manual.
   → **Refer to the FX Configurator-FP Operation Manual**

   Note

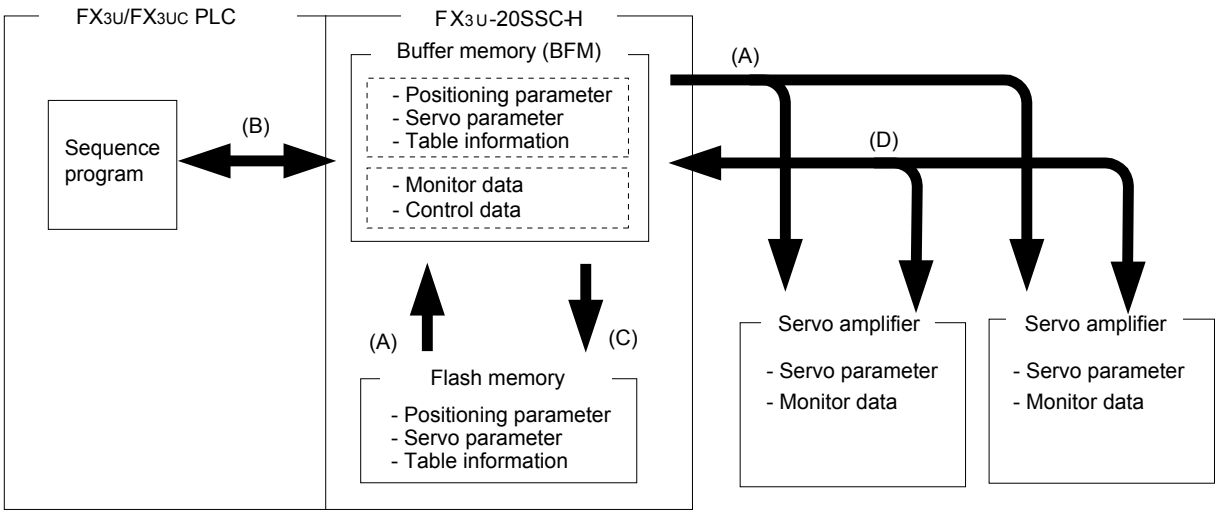
   Use FX Configurator-FP whenever possible to set positioning parameters, servo parameters and table information, and save the setting data in the flash memory.
   The use of the sequence program for this purpose requires many steps and devices, resulting in a complex program and increased scan time.

2. **Sequence program**
   Using a sequence program, may be set using applied instructions such as the FROM/TO instructions to read/write parameters from/to the buffer memory of 20SSC-H, and to save the setting data in the flash memory.
   For details on using the FROM/TO instructions and direct specification of buffer memory for applied instructions, refer to the following manual.
   → **Refer to the Programming Manual**

6.3 Data Transfer Process

6.3.1 PLC, 20SSC-H and servo amplifier

The data transfer between PLC, 20SSC-H, and servo amplifier is as follows.



1. Power-on data transfer process [A in the figure above]

The following data transfer process occurs.

1) The data in the flash memory of 20SSC-H is transferred to the buffer memory (BFM).

2) The servo parameters are transferred to the servo amplifier.
To transfer the servo parameters automatically to the servo amplifier at PLC power-on, set the following parameter in flash memory and turn the power ON in order from the servo amplifier to 20SSC-H (including the PLC).

→ **For details, refer to Subsection 6.3.3**

- Save servo parameters that relate to the servo amplifier with the servo series (BFM #15000, #15200), to the flash memory.

2. Data transfer between PLC and buffer memory (BFM) of 20SSC-H [B in the figure above]

Applied instructions such as the MOV instruction, or the FROM/TO instruction are used to read/write parameters and data between the PLC and buffer memory.

Note

Use FX Configurator-FP, whenever possible to set positioning parameters, servo parameters and table information, and save the setting data in the flash memory.
The use of the sequence program for this purpose requires many steps and devices, resulting in a complex program and increased scan time.

3. Writing data to the flash memory in 20SSC-H [C in the figure above]

To change data in the flash memory, use a sequence program or FX Configurator-FP to modify the buffer memory data, then activate a save command (BFM #523 b0 to 6) to save positioning parameters, servo parameters and table information from the buffer memory to the flash memory.

→ **For the operation of FX Configurator-FP, refer to the FX Configurator-FP Operation Manual.**
→ **For the flash memory save command, refer to Section 11.4.15**

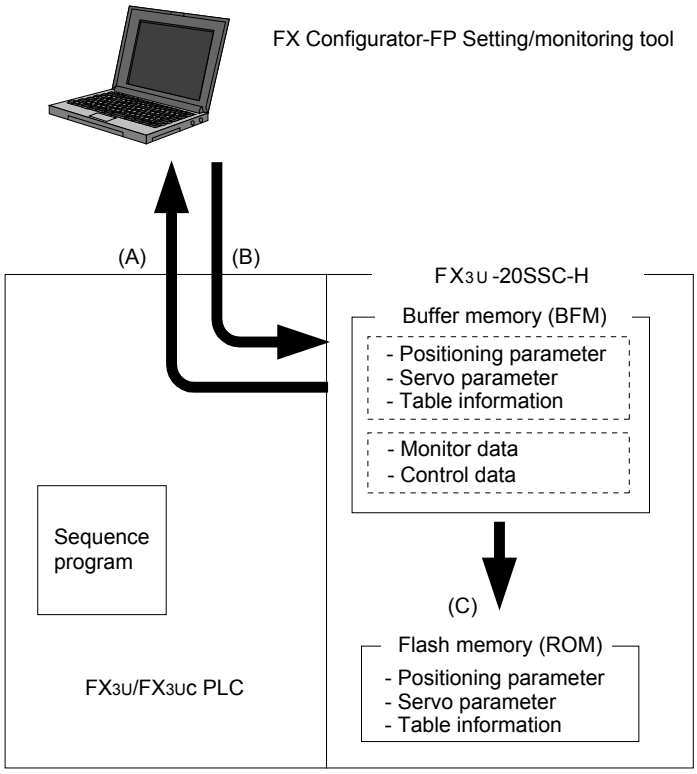
4. Data transfer process between 20SSC-H and servo amplifier [D in the figure above]

When servo parameters or monitor data on the servo amplifier side are modified, the buffer memory of 20SSC-H is automatically updated.
For the initial servo parameter transfer method, refer to the following.

→ **For the initial servo parameter transfer method, refer to Section 6.3.3**

6.3.2 FX Configurator-FP and 20SSC-H

The data transfer between FX Configurator-FP and 20SSC-H via the PLC is as follows.



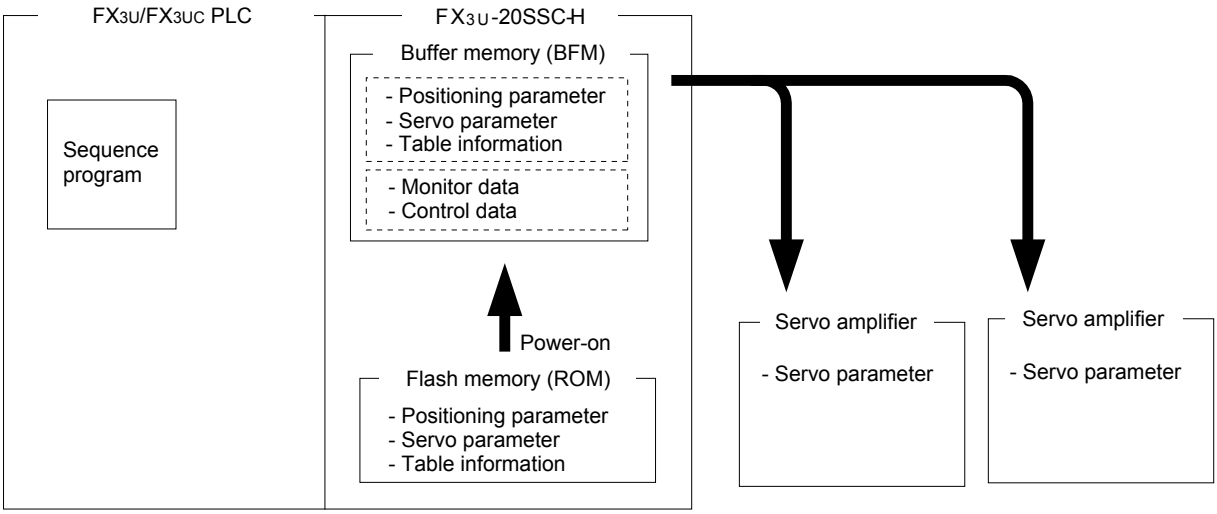
1. **From 20SSC-H to FX Configurator-FP [A in the figure above]**
   The following data is read from the buffer memory in 20SSC-H to FX Configurator-FP.
   - Positioning parameters
   - Servo parameters
   - Table information
   - Monitor data (operation status, action status, input signal status, etc.)

2. **From FX Configurator-FP to 20SSC-H (buffer memory) [B in the figure above]**
   The following data is written from FX Configurator-FP to the buffer memory in 20SSC-H.
   - Positioning parameters
   - Servo parameters
   - Table information
   - Control data (new current values, speed change, operation test command, etc.)

3. **From FX Configurator-FP (buffer memory in 20SSC-H) to 20SSC-H (flash memory) [C in the figure above]**
   The following data is saved from the buffer memory in 20SSC-H to the flash memory according to the save command sent from FX-Configurator-FP.
   - Positioning parameters
   - Servo parameters
   - Table information

6.3.3 Transfer (writing) servo parameter to servo amplifier

At power-ON, servo parameters in the flash memory are transferred to the servo amplifier.



1) Save servo parameters that relate to the servo amplifier with the servo series (BFM #15000, #15200), to the flash memory.
2) Turn the power ON in order from the servo amplifier to 20SSC-H (including the PLC).

Note

To transfer the following parameters from the buffer memory (BFM) to the servo amplifier, turn the servo parameter transfer command (b9) of operation command 2 [BFM #519 (X-axis) and #619 (Y-axis)] to ON.

→ **For the operation command, refer to Section 11.4.11**

1) Transferred servo parameters
   - Auto tuning mode
   - Auto tuning response
   - Feed forward gain
   - Ratio of load inertia moment to servo motor inertia moment
   - Model control gain
   - Position control gain
   - Speed control gain
   - Speed integral compensation
   - Speed differential compensation
2) Conditions for executing servo parameter transfer command
   The servo parameter transfer command is ignored during the positioning operation.
3) Status information
   The servo parameter transfer flag in the status information is set during servo parameter transfer.

→ **For the status information, refer to Section 11.3.1.3**

7. Before Starting Positioning Operation

DESIGN PRECAUTIONS DANGER

- Provide a safety circuit on the outside of the PLC so that the whole system operates to ensure the safety even when external power supply trouble or PLC failure occurs.
  Otherwise, malfunctions or output failures may result in an accident.
  1) An emergency stop circuit, a protection circuit, an interlock circuit for opposite movements, such as normal and reverse rotations, and an interlock circuit for preventing damage to the machine at the upper and lower positioning limits should be configured on the outside of the PLC.
  2) When the PLC CPU detects an error, such as a watch dog timer error, during self-diagnosis, all outputs are turned off. When an error that cannot be detected by the PLC CPU occurs in an input/output control block, output control may be disabled.
  Design external circuits and mechanisms to ensure safe operations of the machine in such a case.
  3) When some sort of error occurs in a relay, triac or transistor of the output unit, output may be kept on or off.
  For output signals that may lead to serious accidents, design external circuits and mechanisms to ensure safe operations of the machine in such cases.
- At forward/reverse rotation limits wiring, make sure to wire in negative logic and use NC contact. Setting in positive logic and using NC-contact can cause serious accidents.

DESIGN PRECAUTIONS CAUTION

- Observe the following items. Failure to do so may cause incorrect data-writing by noise to PLCs and result the PLC failure, machine damage or an accident.
  1) Do not lay close or bundle with the main circuit line, high-voltage line, or load line.
  Noise and Surge induction interfere with the system operation.
  Keep a safe distance of least 100 mm (3.94") from the above lines during wiring.
  2) Ground the shield wire or shield of a shielded cable at one point on the PLC. However, do not ground at the same point as high voltage lines.
- Install in a manner which prevents excessive force from being applied to the built-in connectors dedicated to programming, power connectors and I/O connectors.
  Failure to do so may result in wire breakage or failure of the PLC.

7.1 Note on Setting Parameters

Set the positioning parameters and servo parameters according to the system.
The following parameters must be set.

1) Servo series [Servo parameters (Basic setting)]
This parameter must be set to transfer information between 20SSC-H and the servo amplifier.
Set the servo series of servo parameters according to servo amplifier.
Servo parameters must be saved to the flash memory in 20SSC-H.
→ **For servo series details, refer to subsection 11.2.1**

2) Function selection C-4 [Servo parameters (Expansion setting)]
Immediately after power ON, this parameter needs to be set to operate other than the JOG or manual pulse generator operation modes.
Set “1: Not needed to pass motor Z-phase after the power supply is switched on” (default setting) here.
In other setting cases, the servo motor should be rotated more than one revolution by the JOG or manual pulse generator immediately after power-ON.
→ **For details, refer to subsection 8.1.1 and 11.2.3**

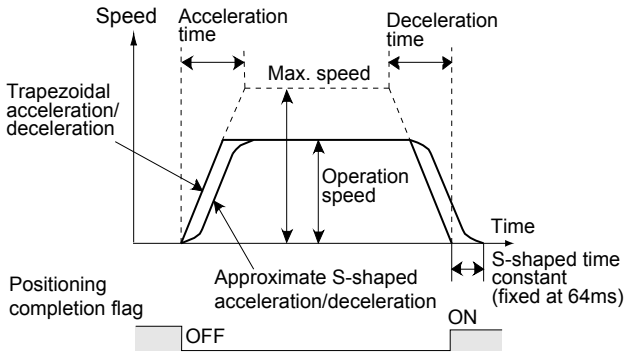
3) Zero return interlock setting [Positioning parameters (Operation parameter 2)]
Immediately after power ON, this parameter needs to be set to operate in modes other than the JOG, manual pulse generator or mechanical return operation modes.
Set "invalid" here.
In other setting cases, operate to be set to the zero return executed flag.
→ **For details, refer to subsection 7.6.9 and 11.1.2**

7.2 Outline of Positioning Operation

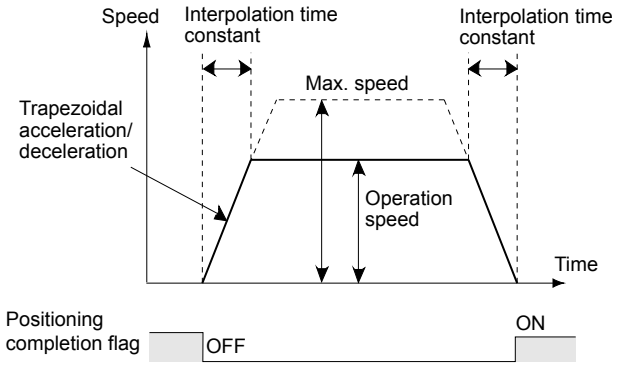
The relationship between the operation speed, acceleration/deceleration and travel distance of the positioning operation is shown below.
For futher details on the positioning operations suppurted by 20SSC-H and a note on positioning cautions, refer to the following.

→ **For a note on positioning cautions, refer to the next page.**
→ **For manual operation, refer to Chapter 8**
→ **For positioning operation except for that of table operation, refer to Chapter 9**
→ **For table operation, refer to Chapter 10**

In individual axis operation



In simultaneous two-axis operation (interpolation operation)



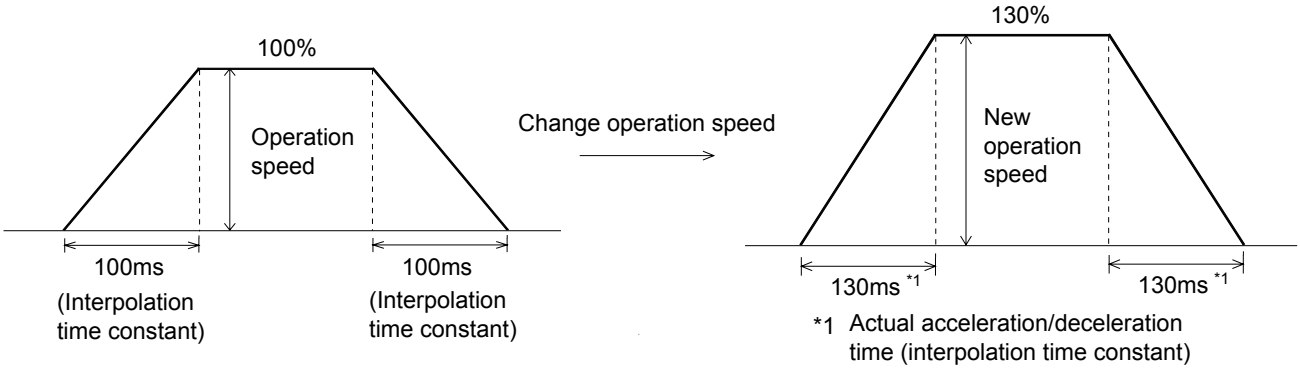
Parameters and control data used for positioning operation

Item		BFM number X-axis	BFM number Y-axis	Description
Maximum speed		BFM #14009,#14008	BFM #14209,#14208	Upper limit of speed in each operation mode
Operation speed	Operation speed 1	BFM #503,#502	BFM #603,#602	Actual operation speed in each operation mode
	Operation speed 2	BFM #507,#506	BFM #607,#606	Actual operation speed for two-speed positioning operation and interrupt two-speed positioning
	JOG speed	BFM #14013,#14012	BFM #14213,#14212	Manual forward/reverse (JOG+/JOG-) operation speed
Acceleration time		BFM #14018	BFM #14218	Time needed to reach from zero speed to the maximum speed
Deceleration time		BFM #14020	BFM #14220	Time needed to reach from the maximum speed to the zero speed
Travel distance	Target address 1	BFM #501,#500	BFM #601,#600	Target position (absolute address) or travel distance (relative address) in each operation mode
	Target address 2	BFM #505,#504	BFM #605,#604	Target position (absolute address) or travel distance (relative address) for two-speed positioning operation
Acceleration/deceleration mode		BFM #14000 b11	BFM #14200 b11	Select the acceleration/deceleration control method (approximate S-shaped acceleration/deceleration or trapezoidal acceleration/deceleration). In interpolation operation, this mode handles trapezoidal acceleration/deceleration only even if the approximate S-shaped acceleration/deceleration is selected.
Interpolation time constant		BFM #14022	BFM #14222	Acceleration/deceleration time for interpolation operation.Time to reach from zero speed to the operation speed (for acceleration) or time to reach from the operation speed to the zero speed (for deceleration)
Positioning completion		BFM #28 b6	BFM #128 b6	The flag is reset at the beginning of each operation or at the error occurrence, and it is set upon normal completion. However, the flag is not set during stop operation or the following operation even if operation is normally finished - JOG operation - Mechanical zero return (data setting type) - Manual pulse generator operation - Variable speed operation

Note

- Trapezoidal acceleration/deceleration and approximate S-shaped acceleration/deceleration
  If trapezoidal acceleration/deceleration and approximate S-shaped acceleration/deceleration are performed under the same conditions (travel distance, operation speed and acceleration/deceleration time), the positioning time of approximate S-shaped acceleration/deceleration becomes longer by 64ms.
- Approximate S-shaped acceleration/deceleration
  Specify 64ms or larger (64 to 5000) acceleration and deceleration time.
- If the operation speed [jog speed, operation speed 1, operation speed 2, zero return speed (high speed) or zero return speed (creep)] is 0Hz, operation is at 1Hz.
- When the operation speed is changed by the override function during interpolation operation, the acceleration/deceleration time (interpolation time constant) changes according to the ratio by which the operation speed changes

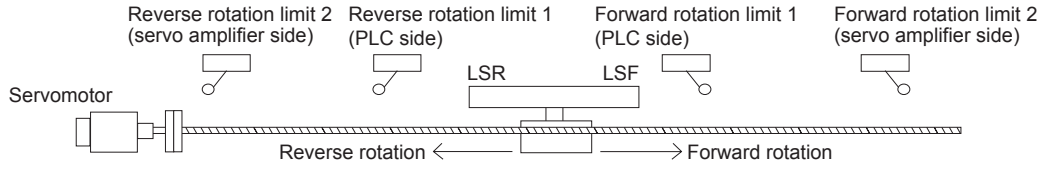
→ **For override function details, refer to Subsection 7.5.1**



*1 Actual acceleration/deceleration time (interpolation time constant) after the operation speed change.

7.3 Handling the Forward Rotation Limit and Reverse Rotation Limit

The concept of the forward rotation limit and that of the reverse rotation limit are described. Suppose that limit switches are located as shown in the figure below.



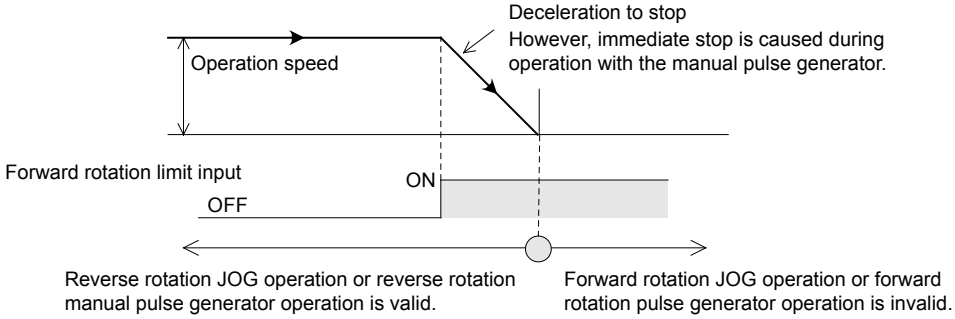
Limit		Stopping action	Description	Reference
Servo amplifier	Forward rotation limit 2, reverse rotation limit 2	Deceleration to stop	Specify the action limit so that no damage is caused to the machine that decelerates after activation of a limit switch until it is stopped. Connect without fail for safety.	Subsection 7.3.1
PLC	Forward rotation limit 1, reverse rotation limit 1	Deceleration to stop	This limit switch is necessary for retraction with the PLC if a DOG search function is used in zero return operation or if the limit switch is activated at the forward or reverse rotation limit modes in other than zero home operation. Provide at positions so that the limit switch is activated before forward rotation limit 2 or reverse rotation limit 2 connected with the servo amplifier.	Subsection 7.3.2
Software forward rotation limit Software reverse rotation limit		Deceleration to stop	Operation limit based on the current address that is effective after mechanical zero return. Specify at addresses that activation is caused before forward rotation limit 1 or reverse rotation limit 1 connected with the PLC.	Subsection 7.3.3

Note

The 20SSC-H does not have a terminal for connecting the forward or reverse rotation limit switch. Connect the forward and reverse rotation limit switches to the PLC and/or servo amplifier.

How to restart after the limit switch is activated

When the limit switch is activated, the work piece decelerates to stop, and a limit error occurs. The work piece cannot move to the activated limit-switch side. Use the JOG operation in opposite direction or the manual pulse generator in the opposite direction to avoid the limit error.



7.3.1 Forward rotation limit 2 (FLS) and reverse rotation limit 2 (RLS) [servo amplifier side]

Connect forward rotation limit 2 (FLS) and reverse rotation limit 2 (RLS) to the upper limit (FLS) and lower limit (RLS) external signal terminals of the servo amplifier, respectively. This limit switch should be provided in a position to avoid causing damage to the machine after activation. Connect for safety.

→ **For the related parameters, control data and monitor data, refer to Section 7.9**

1. Wiring the forward rotation limit 2 (FLS) and reverse rotation limit 2 (RLS)

Connect forward rotation limit 2 (FLS) and reverse rotation limit 2 (RLS) to the upper limit (FLS) and lower limit (RLS) external signal terminals of the servo amplifier, respectively.

→ **For the wiring method, refer to the servo amplifier manual**

2. Servo amplifier external signal setting

Specify the following for the external signal of the servo amplifier.

		Description of setting
External signal selection	Selection of FLS/RLS signal	Use the forward/reverse rotation limit of the servo amplifier and PLC.
	Logic of FLS/RLS signal	NC contact (servo amplifier)

3. Restarting method

Refer to the following.

→ **Refer to Section 7.3 (on the previous page)**

7.3.2 Forward rotation limit (LSF) and reverse rotation limit (LSR) [PLC side]

For retraction with the PLC during use of the DOG search function in zero return or upon activation of a forward or reverse rotation limit switch in modes other than the zero return operation, these limit switches are necessary.

Provide at a position so that activation is caused before forward rotation limit 2 or reverse rotation limit 2 connected to the servo amplifier.

→ **For the related parameters, control data and monitor data, refer to Section 7.9**

1. Wiring the forward rotation limit 1 (LSF) and reverse rotation limit 1 (LSR)

Connect forward rotation limit 1 (LSF) and reverse rotation limit 1 (LSR) at the input terminals of the PLC.
For details of the PLC wiring method, refer to the following respective PLC manual.

→ **Refer to the FX3U Hardware Manual.**
→ **Refer to the FX3UC Hardware Manual.**

2. Specifying forward rotation limit 1 (LSF) and reverse rotation limit 1 (LSR)

Operate the forward rotation limit 1 (LSF) and reverse rotation limit 1 (LSR) connected with the PLC with the forward rotation limit flag and reverse rotation limit flag of 20SSC-H, respectively.

→ **Refer to Chapter 13**

3. Restarting method

Refer to the following.

→ **Refer to Section 7.3 (on the previous page)**

7.3.3 Software limit

This operation limit is based on the 0 address that becomes valid after mechanical zero return.
Specify at addresses so that activation is before forward rotation limit 1 and reverse rotation limit 1 connected with the PLC.

→ **For the related parameters, control data and monitor data, refer to Section 7.9**

1. Conditions for validating the software limit

- Specify the software limit so that the following condition is satisfied.
  Large software limit > small software limit
- State with active zero return execution flag
  (After execution of mechanical zero return and completion of positioning at the zero-point, or in an absolute position detection system where the current value is established)

Note

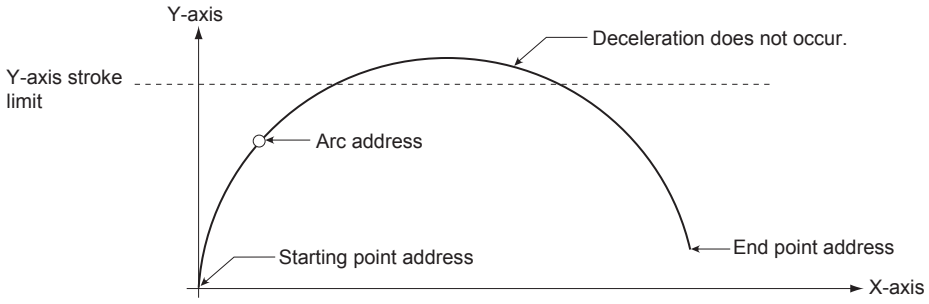
To refrain from using the software limit, specify the software limit settings as shown below.

- Software limit (upper) = Software limit (lower)
- Software limit (upper) < Software limit (lower)

Cautions for use of software limit

1) The software limit is invalid under the following control.
   a) Mechanical zero return control
   b) Current value change

2) The limit error of the software limit is changed at the starting and end points of the operation. Therefore the specified upper or lower software limit may be exceeded in circular interpolation control.
   In this case, deceleration does not occur even if the software limit is exceeded.
   If there is a possibility of overshoot beyond the software limit, install an external limit switch.



7.4 Handling the STOP command

When the STOP command of 20SSC-H turns ON during positioning operation, the servomotor decelerates to stop.
When stopped by the STOP command, the following statuses are shown below.

→ **For the related parameters, control data and monitor data, refer to Section 7.9**

Status	State
Positioning completion	OFF
READY	ON

1. STOP command during JOG operation, manual pulse generator operation or variable speed operation

When a STOP command is turned ON during the JOG operation, manual pulse generator operation or variable speed operation, the servomotor decelerates to stop without regard to the stop mode setting type. Operation is restarted when the STOP command is turned off and the forward or reverse rotation JOG command is ON or the manual pulse generator is being operated.

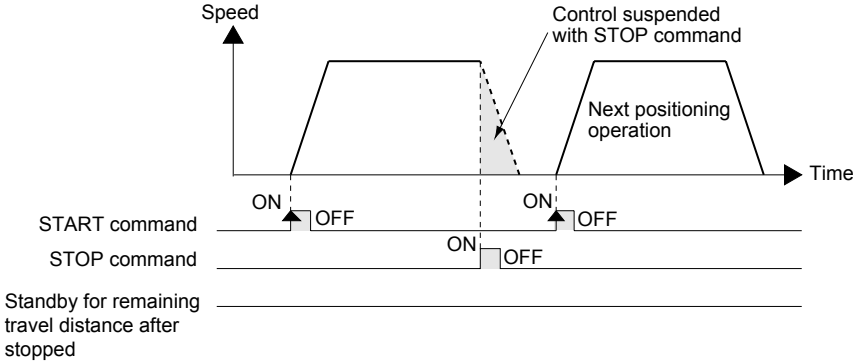
Operation stop for JOG operation, manual pulse generator operation or variable speed operation

To stop the JOG operation, manual pulse generator operation or variable speed operation, turn the operation command to off or stop the manual pulse generator input. (without using the STOP command)

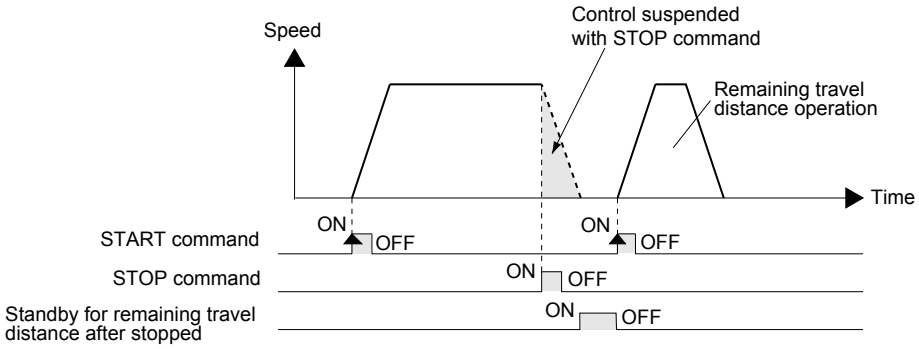
2. STOP command during positioning operation (without the JOG operation, manual pulse generator operation or variable speed operation)

When the STOP command is turned ON during positioning control operation, the operation is as follows according to the stop mode setting. There are two types of stop mode: the positioning control end mode and remaining travel distance operation mode.

1) Positioning control end mode
When the STOP command is turned ON, operation decelerates to a stop and is terminated.
When the STOP command is OFF, positioning operation begins when the START command is turned ON.

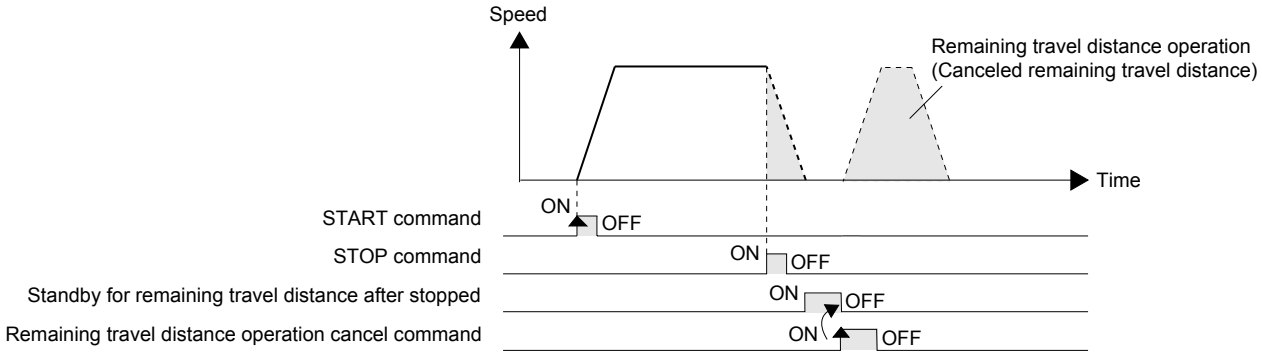


2) Remaining travel distance operation mode
When the STOP command is turned ON, operation decelerates to a stop and the 20SSC-H enters standby state for the remaining travel distance operation. At this time, "standby for remaining travel distance" flag is turned ON. When the STOP command is OFF and the START command is turned ON during standby status, positioning operation continues for the remaining travel distance.



To cancel the remaining travel distance operation in the remaining travel distance operation mode

When "remaining travel distance operation cancel command" is turned ON in standby status, the operation for the remaining travel distance is cancelled and the positioning operation terminates.



3. Wiring the stop switch

Connect the stop switch to the input terminal of the PLC.
For details of the PLC wiring method, refer to the following manual according to the PLC being used.

→ **Refer to the FX3U Hardware Edition**
→ **Refer to the FX3UC Hardware Edition (Japanese document only)**

4. STOP command

Operate the PLC's STOP switch together with the 20SSC-H STOP command.

→ **Refer to Section 7.4**

7.5 Changing During Operation (Operation Speed, Target Address)

7.5.1 Changing the operation speed with override function

This function is possible to change the operation speed at an arbitrary timing through the override setting value (0.1 to 3000.0%).

→ **For the related parameters, control data and monitor data, refer to Section 7.9**

1. To use the override function

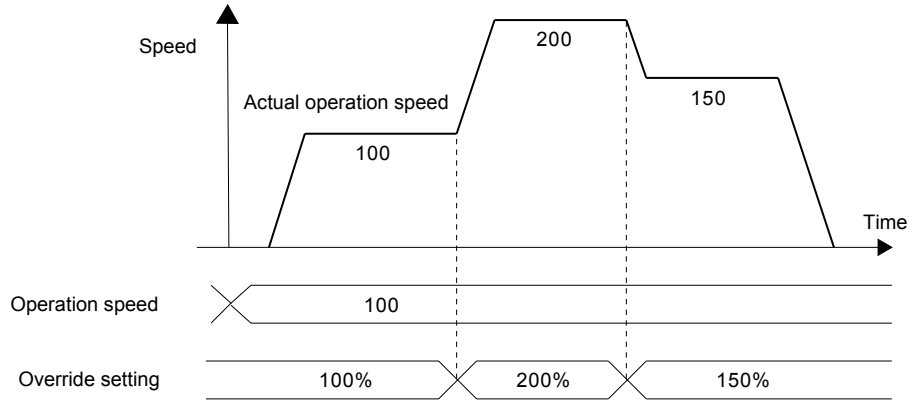
Set the following setting.

Setting item	Description
Override setting	Specify in the range from 1 to 30000 × 0.1% (0.1 to 3000.0%).

2. Applicable positioning operations

- Operations applicable to the override function
  - Mechanical zero return (at high speed)
  - JOG operation
  - 1-speed positioning operation
  - Interrupt 1-speed constant quantity feed
  - 2-speed positioning operation
  - Interrupt 1-speed constant quantity feed
  - Interrupt stop
  - Variable speed operation
  - Multi-speed operation
  - Linear interpolation
  - Linear interpolation (interrupt stop)
  - Circular interpolation
- Operations inapplicable to the override function
  - Mechanical zero return (at creep)
  - Manual pulse generator operation

3. Operation



4. Caution for speed change

- If the overridden (actual) operation speed is smaller than 1, operation speed handles on "1" in the current speed unit.
- If "100 (%)" is specified as an override, the speed does not change.
- The operation speed can be changed during positioning operation.
  The override function is invalid during deceleration after a STOP command or in positioning operation.
- When the operation speed is changed by the override function during interpolation operation, the acceleration/deceleration time (interpolation time constant) changes according to the ratio by which the operation speed changes.

→ **For details, refer to the note in Section 7.2**

7.5.2 Changing the operation speed with the operation speed change function

This function is possible to change to the specified new operation speed at an arbitrary timing.
However, the speed does not change during mechanical zero return after detection of the near point DOG and start of deceleration to the creep speed.

→ **For the related parameters, control data and monitor data, refer to Section 7.9**

1. To make speed change valid

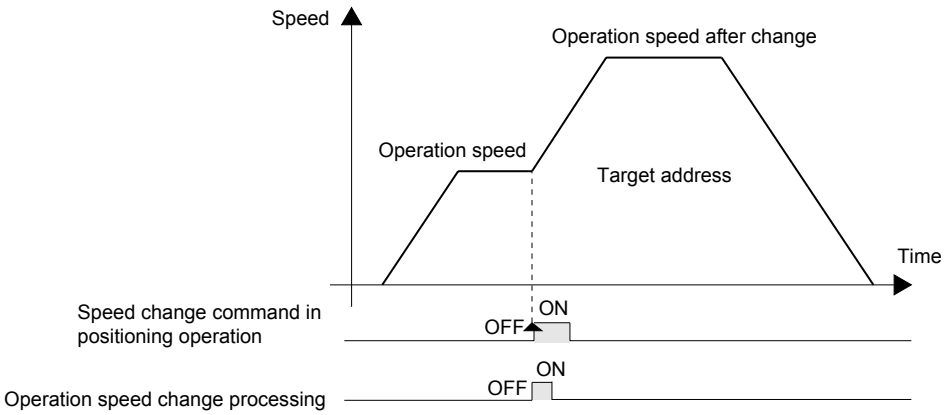
Specify the following settings.

Setting item	Description
Change command in operation disabled	OFF
Speed change value	Setting
Speed change command in positioning operation	ON at speed change

2. Applicable positioning operations

- Operations applicable to the operation speed change function
  - Mechanical zero return (at high speed)
  - JOG operation
  - 1-speed positioning operation
  - Interrupt 1-speed quantity feed
  - 2-speed positioning operation
  - Interrupt 2-speed quantity feed
  - Interrupt stop
  - Multi-speed operation
  - Linear interpolation
  - Linear interpolation (interrupt stop)
  - Circular interpolation
- Operations inapplicable to the operation speed change function
  - Mechanical zero return (at creep)
  - Manual pulse generator operation
  - Variable speed operation

3. Operation



4. Cautions for speed change

- After operation speed change, if STOP command is turned ON during positioning operation, the next operation speed becomes the changed speed.
- The operation speed can not change in the following statuses.
  - During deceleration by STOP command
  - During automatic deceleration in position control
- If an operation speed larger than the maximum speed is specified for the speed change value, a setting error occurs and the operation speed is controlled at the maximum speed.
- To change the speed at interpolation control, the speed change value has to be set in the X-axis setting.
- The operation speed does not change during mechanical zero return (at creep). The speed change command is ignored.

7.5.3 Changing the target address

This function is used to change the target address in positioning control to a new specified address.

1. To make target address change valid

Specify the following settings.

Setting item	Description
Change command in operation disabled	OFF
Target position change value (address)	Set the new target address.
Target position change value (speed)	Set the new operation speed.
Target position change command in positioning operation	ON at target address change

Note

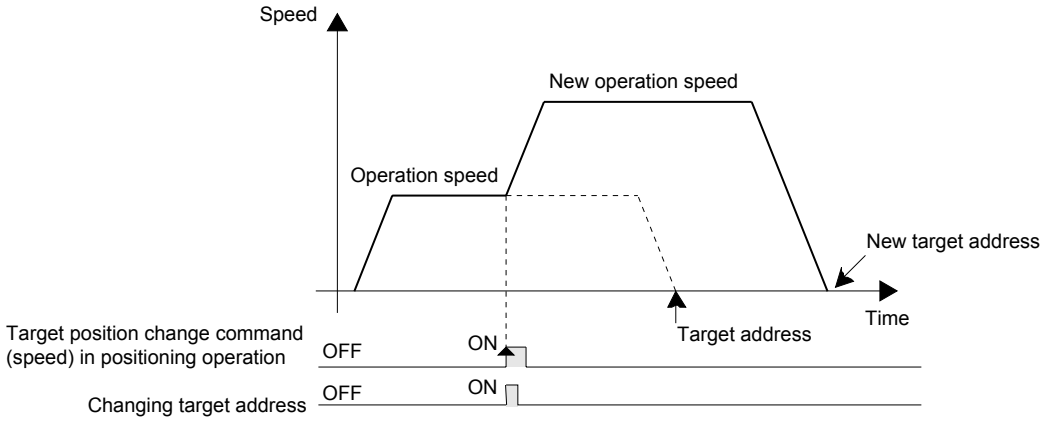
To leave the operation speed unchanged, set the target position change value (speed) to the same speed as the current operation speed.

2. Applicable positioning operations

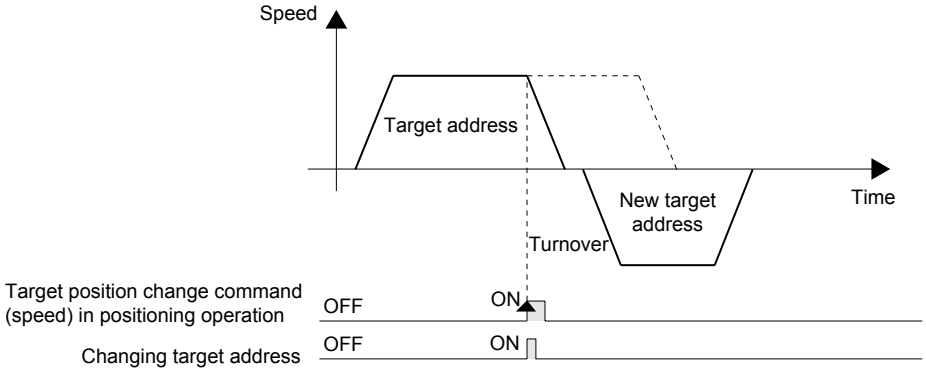
- Operations applicable to the target address change function
  - 1-speed positioning operation
  - Interrupt 1-speed constant quantity feed
  - 2-speed positioning operation
  - Interrupt 2-speed constant quantity feed
  - Interrupt stop
- Operations inapplicable to the target address change function
  - Mechanical zero return
  - Manual pulse generator operation
  - JOG operation
  - Variable speed operation
  - Multi-speed operation
  - Linear interpolation
  - Linear interpolation (interrupt stop)
  - Circular interpolation

3. Operation

1) When changing both the address and speed



2) When the direction of operation changes



4. Cautions

- The operation speed can not change in the following statuses.
  - During deceleration by STOP command
  - During automatic deceleration in position control
- If the target position change value (address) converted in units of pulses is out of the setting range, an error occurs.
- If the target position change value (speed) is out of the setting range, the operation speed is handled to "1" (lower limit) or maximum speed (upper limit).

7.6 Other functions

The 20SSC-H has an absolute position detection system, torque limit function, servo ON/OFF and servo check functions and others.
The parameter setting and sequence program enable each function.

7.6.1 Servo-ready check function

The servomotor ready signal (completion of preparation) is checked during startup of operation or during operation. With no servo ready signal, a servo-ready error occurs, stopping the operation.
For servomotors with no servo-ready signal, disable the servo-ready check function.

→ **For related parameters, control data and monitor data, refer to Section 7.9**

7.6.2 Servo end check function

Use the servo end check function to detect the positioning operation completion by the servo status in-position signal.
When the servo status in-position signal turns ON after operation completion (within the range of servo end check determination time) the 20SSC-H detects that the positioning operation has ended.
When the in-position signal does not turn ON within the specified servo end determination time, an external error occurs, stopping the operation.

→ **For related parameters, control data and monitor data, refer to Section 7.8**

- Zero or smaller settings are handled as "1ms."
- 5001 or larger settings are handled as "5000ms."

1. To use the servo end check function

Specify the following settings.

Setting item	Description
Servo end check	Enable the servo end check.
Servo end determination time	Specify the value within in the range 1 and 5000ms.

2. Applicable positioning operations

- Operations applicable to the servo end check
  - JOG operation
  - 1-speed positioning operation
  - Interrupt 1-speed constant quantity feed
  - 2-speed positioning operation
  - Interrupt 1-speed constant quantity feed
  - Interrupt stop
  - Variable speed operation
  - Multi-speed operation
  - Linear interpolation
  - Linear interpolation (interrupt stop)
  - Circular interpolation
  - Mechanical zero return
- Operations inapplicable to the servo end check
  - During continuous multi-speed operation
  - During continuous pass operation of interpolation operation
  - Manual pulse generator operation

7.6.3 Torque limit function

This torque limit function sets torque limit value of servo amplifier from 20SSC-H.

→ **For related parameters, control data and monitor data, refer to Section 7.8.**

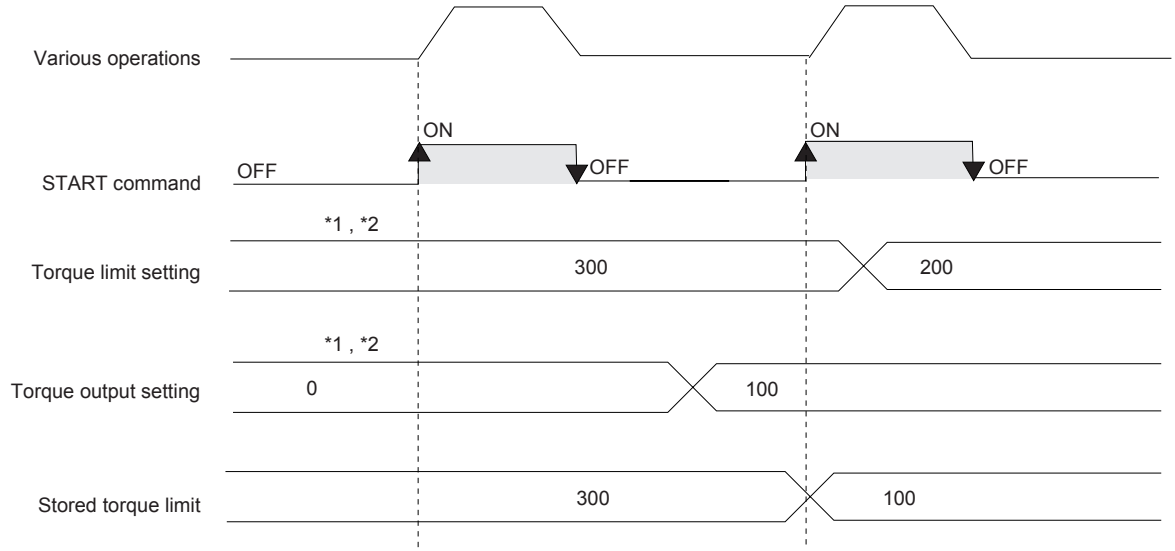
1. Torque limit function setting

Specify the following items to use the torque limit function.

Setting item	Description
Zero return torque limit value	Torque limit value for zero return control (creep)
Torque limit setting	The torque limit during the following operations is the torque limit setting or torque output setting according to the torque output setting value. - If the torque output setting is "0" The torque is limited to the torque limit value or zero return torque limit value. - If the torque output setting is between 1 and 10000 (increment: 0.1%) The torque is limited to the torque output setting. • During mechanical zero return at zero return speed (high speed) • JOG operation • 1-speed positioning operation
Torque output setting	• Interrupt 1-speed constant quantity feed • 2-speed positioning operation • Interrupt 2-speed constant quantity feed • Interrupt stop • Variable speed operation • Multi-speed operation • Linear interpolation • Linear interpolation (interrupt stop) • Circular interpolation • Manual pulse generator operation

2. Details of control

The operation with the torque limit is as follows.



*1 : The torque limit setting or torque output setting becomes valid at the rising edge of the START signal. If the torque output setting is "0," operation is made with the torque limit setting.

*2 : If the positioning parameter setting is changed, issue a positioning control parameter command to validate the new setting.

3. Precautions for control

- If the zero return torque limit value exceeds the torque limit setting, an error occurs.
- If the torque limit function causes the operation to stop, drop pulses remain in the deviation counter. After the load torque is removed, the operation continues according to the remaining pulses.

7.6.4 Absolute position detection system

An absolute position detection system is available with 20SSC-H.

→ **For related parameters, control data and monitor data, refer to Section 7.9**

What is the absolute position detection system?

In the absolute position detection system, the current position is stored in the servo amplifiers battery backed memory, and even if the work piece moves at power failure, the moving distance is added to the current position with the absolute encoder and servo amplifier absolute position system. After power-ON, the absolute position detection system does not require the zero return procedure.

1. Conditions to use the absolute position detection system

- Use servomotors with absolute position encoders.
- Place a backup battery to the servo amplifier.
- Enables the absolute position detection system in servo parameters.

2. Initial zero-point determination

Even with the absolute position detection system, the zero-point must be determined at least once after the equipment is manufactured.
To determine the zero-point for the first time, perform zero return according to one of the following types : data set type, DOG type or stopper type.

→ **For zero return operation, refer to Section 8.1**

3. Absolute position lost

If the absolute position in the encoder becomes indefinite in the absolute position detection system, the absolute position loss signal (ABSV) turns ON. At ABSV signal ON, make sure to operate zero return immediately to establish the zero-point again.
The absolute position becomes indefinite in the three cases below.

- When changed into the absolute position detection system by the parameter setting of the servo amplifier, and the servo amplifier turns ON.
- An absolute position loss alarm (AL-25) is caused.
- An absolute position counter warning (AL-E3) is issued.

Note

While the absolute position loss signal (ABSV) is ON, do not start the automatic operation. Otherwise the system will run away.

7.6.5 Servo ON/OFF

The servo of the servo amplifier connected with 20SSC-H turns ON/OFF.
The servo ON enables the servomotor operations.

→ **For related parameters, control data and monitor data, refer to Section 7.9**

1. Servo ON/OFF

- Turn OFF(0) the servo-OFF command to turn the servo on.
- Turn ON (1) the servo-OFF command to turn the servo off.

Note

- Perform servo-ON/OFF while the servomotor is stopped.
- The servo can be turned OFF with Ready-ON in the status information.
  The servo-OFF command during positioning operation is invalid.
- If the servomotor turns due to an external force during servo-OFF, a follow-up process occurs with the follow-up function.

7.6.6 Follow-up function

With the follow-up function, the motor rpm is monitored when the servo is OFF, and the motor rpm is reflected in the current value.
With this function, even if the servomotor rotates while the servo is OFF, the servomotor always starts positioning at the next servo-ON, ignoring the drop pulse.
The 20SSC-H always executes the follow-up process during servo OFF.

→ **For related parameters, control data and monitor data, refer to Section 7.9**

7.6.7 Simultaneous start function

Operation in the X- and Y-axes start simultaneously with this function.

→ **For related parameters, control data and monitor data, refer to Section 7.9**

1. Applicable positioning operations

- Operations applicable to the simultaneous start function
  - JOG operation
  - Mechanical zero return
  - 1-speed positioning operation
  - Interrupt 1-speed constant quantity feed
  - 2-speed positioning operation
  - Interrupt 2-speed constant quantity feed
  - Interrupt stop
  - Table operation (independent)
- Operations inapplicable to the simultaneous start function
  - Manual pulse generator operation
  - Variable speed operation
  - Multi-speed operation
  - Linear interpolation
  - Linear interpolation (interrupt stop)

2. Operation

1) Enter the X-axis and Y-axis operation patterns.
2) Turn on the X-axis simultaneous start flag.
3) Reboot the X-axis start command.
   In the JOG operation, reboot the X-axis forward/reverse rotation jog command.
4) X-axis and Y-axis operation begins simultaneously.

POINT

- The Y-axis start command and forward/reverse jog command are ignored.

7.6.8 Current address change function

With this function, the current address of a stopped axis changes arbitrarily.
Write the desired value to the current address (user) to change, followed by the current address (pulse) update.

→ **For parameters, control data and monitor data, refer to Section 7.9**

The current address does not change in the following states.

- READY/BUSY in the status information is OFF (0).
- Interruption due to a STOP command occurs and the operation is waiting for the remaining distance.

7.6.9 Zero return interlock setting

This function disables the start command before mechanical return.

→ **For related parameters, control data and monitor data, refer to Section 7.9**

1. Applicable positioning operations

- Operations applicable to the zero return interlock setting
  - 1-speed positioning operation
  - Interrupt 1-speed constant quantity feed
  - 2-speed positioning operation
  - Interrupt 2-speed constant quantity feed
  - Interrupt stop
  - Variable speed operation
  - Multi-speed operation
  - Linear interpolation
  - Linear interpolation (interrupt stop)
  - Table operation (independent)
  - Table operation (simultaneous)
- Operations inapplicable to the zero return interlock setting
  - JOG operation
  - Manual pulse generator operation
  - Mechanical zero return

2. Setting items

The zero return interlock setting is valid in one of the following states.

- The zero return interlock setting of operation parameter I is ON (1).
- The zero return completed status is OFF.

7.7 Precautions for using the user units (mechanical or composite system of units)

1. User units

The user can select the unit setting for positioning.
For the unit setting method, refer to the following section.

→ **For the setting method, refer to Section 11.1.1**

1) System of units
Select the unit to use.
- Motor system of units :The position command and speed command are based on the number of pulses.
- Mechanical system of units :The position command and speed command are based on mm, mdeg, 10^{-4} inches and so on.
- Composite system of units :The position command is based the mechanical system, while the speed command is based on the motor system, or similar composite units are used.

2) Data magnification
You can select the position data magnification (×1, ×10, ×100 or ×1000).

3) Setting value in user units
According to the user unit setting, specify the value as follows.

Position data magnification	Unit setting (position unit)			
	PLS	μm	inch	mdeg
×1	PLS	μm	× 0.0001 inch	mdeg
×10	× 10 PLS	× 10 μm	× 0.001 inch	× 10 mdeg
×100	× 100 PLS	× 100 μm	× 0.01 inch	× 100 mdeg
×1000	× 1000 PLS	mm	× 0.1 inch	deg

2. Converted pulse data

Enter data within the setting range of converted pulse data, when setting ranges overlap. The equation for conversion is as follows.

1) Travel distance
Travel distance in converted pulse data (PLS) =
Travel distance (μm, 10^{-4}inch, mdeg) × position data magnification × (pulse rate / feed rate)

2) Operation speed
Operation speed in converted pulse data (Hz) =
Operation speed (μm/min, inch/min, 10deg/min) × 10^4 × (pulse rate / feed rate) / 60

Servomotor rotation speed and operation speed (converted pulse data)

Do not exceed the maximum rotation speed of the servomotor when specifying the operation speed (including the maximum speed, jog speed and zero return speed). The servomotor rotation speed is calculated from the speed (converted pulse data) as follows.
Servomotor rpm (r/min) =
The converted pulse data of operation speed (Hz) × 60 / the resolution per revolution of servomotor

Servo amplifier	Resolution per revolution or servomotor (PLS/REV)
MR-J3B	262144

3. Error

Supposing that the pulse rate be A, feed rate be B, and relative travel distance be C. C × (A/B) is the number of pulses output from 20SSC-H.
No command error occurs as long as (A/B) is an integer. C × (A/B) does not have to be an integer.
However, if C × (A/B) is not an integer, repetitive operation of relative movement causes an accumulated error in the current address. In absolute address operation, an error within 1 pulse occurs with the calculation result rounded off, but it does not cause an accumulated error.
In addition, an accumulated error does not occur in the motor system of units.

4. Maximum speed restriction

To specify speed data in the mechanical system of units, enter data in the range between 1 and 50,000,000Hz in converted pulse data.

7.8 Cautions for Positioning Operation

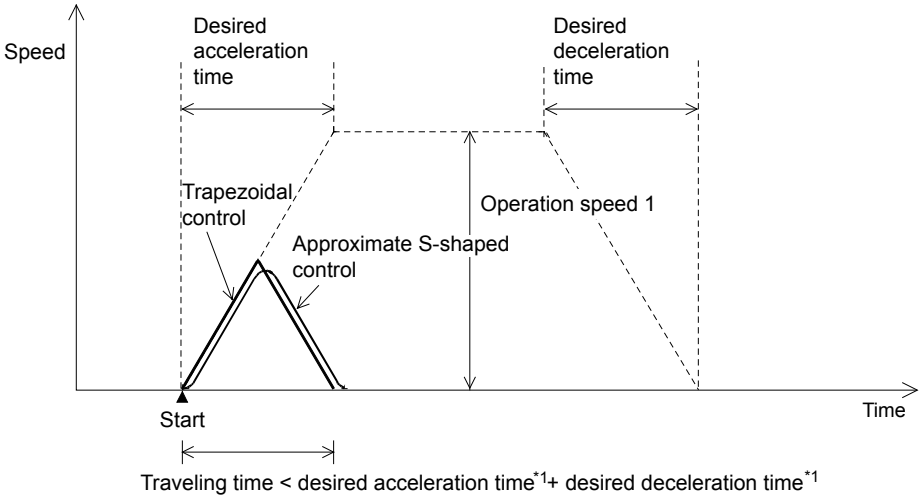
7.8.1 Overlapped specification of operation mode

The positioning operation does not start at START input/command if multiple operation patterns are selected (with multiple bits turned on) in the parameters for operating patterns.
Likewise, the positioning operation does not start if multiple positioning commands (i.e. forward/reverse JOG and mechanical zero return commands of operation command 1) are simultaneously ON.

7.8.2 When the travel distance is small

1. 1-speed positioning operation

If the time needed for the travel distance (target address I) is shorter than the acceleration/deceleration time, the actual operation speed does not reach the command speed (operation speed 1).

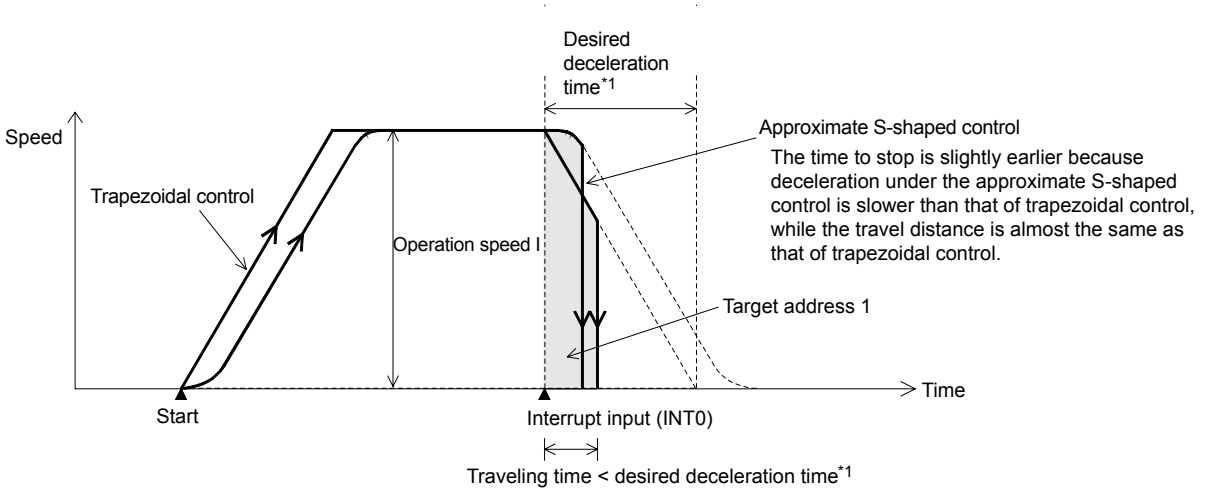


*1. For the relation between the time for the actual acceleration/deceleration and the specified time for desired acceleration/deceleration, refer to the following.

→ **Refer to Section 7.2**

2. Interrupt 1-speed positioning operation

If the time needed for the travel distance (target address 1) is shorter than the deceleration time, the pulse output stops at the target address 1.
If the travel distance is zero, immediate stop occurs when interrupt input INT0 turns ON.



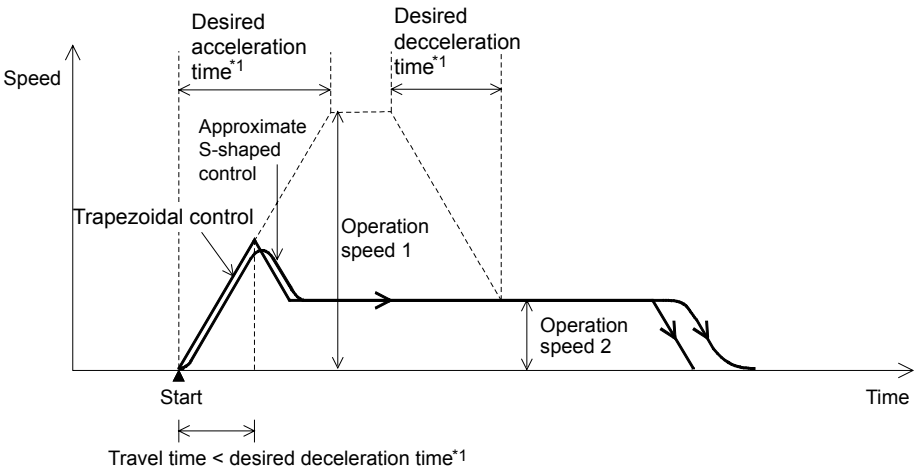
*1. For the relation between the time for the actual deceleration and the specified time for desired deceleration, refer to the following.

→ **Refer to Section 7.2**

3. 2-speed positioning operation

1) If the travel distance at the first speed is small

If the travel time is smaller than the time*1 needed to decelerate to the operation speed 2, the first operation speed does not reach the operation speed 1.
If the travel distance of the first speed is zero, the travel is at the second operation speed and travel distance. (No error is caused.)

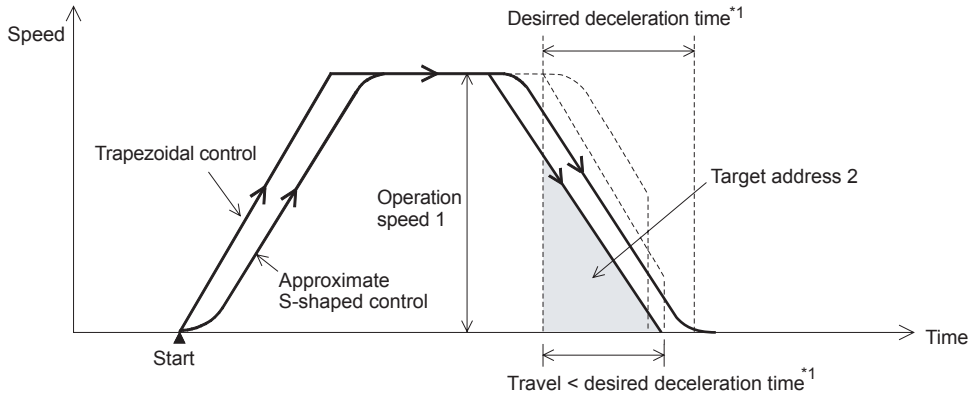


*1. For the relation between the time for the actual deceleration and the specified time for desired deceleration, refer to the following.

→ **Refer to Section 7.2**

2) If the travel distance of the second speed is small

If the travel time at the second speed is smaller than the time*1 needed to decelerate from the operation speed 2, deceleration is started from operation speed 1.
If the travel distance at the second speed is zero, the operation decelerates to stop for the travel distance to be the target address 1 as if it were a 1-speed positioning operation. (No error is caused.)



*1. For the relation between the time for the actual deceleration and the specified time for desired deceleration, refer to the following.

→ **Refer to Section 7.2**

4. Linear interpolation operation

If the time necessary for the travel distance (target address 1) is smaller than the acceleration/deceleration time, the actual operation speed does not reach the command speed.

5. Linear interpolation operation (interrupt stop)

If the time necessary for the travel distance (target address 1) is smaller than the deceleration time, the output pulses stop at the deceleration target address 1 (target address 1).
If the travel distance is zero, the operation immediately stops at the interrupt input (INT0) ON.

6. Interpolation operation (during continuous pass operation)

If the travel distance is small and the travel time from the starting point to the end point is shorter than the interpolation time constant, the operation temporarily stops, and then shifts to the next interpolation operation.

7.9 Related parameter, control data and monitor data

Item		BFM number		Description
		X-axis	Y-axis	
Operation parameter				
Operation parameter 1	STOP mode	BFM #14000 b15	BFM #14200 b15	ON: Operation for remaining distance OFF: End of positioning control (initial setting)
Operation parameter 2	Servo end check	BFM #14002 b0	BFM #14202 b0	ON: Valid OFF: Invalid
	Servo ready check	BFM #14002 b1	BFM #14202 b1	ON: Valid OFF: Invalid
Zero return interlock setting		BFM #14002 b2	BFM #14232 b2	ON: Valid OFF: Invalid
Zero return mode		BFM #14031	BFM #14231	Specify the zero return mode. 0: DOG type (default setting) 1: Data set type 2: Stopper type (1) 3: Stopper type (2)
Servo end judgment time		BFM #14032	BFM #14232	Setting range: 1 to 5000ms
Soft limit, large		BFM #14035,#14034	BFM #14235,#14234	Specify for the software limit (upper/lower). Setting range: -2,147,483,648 to 2,147,483,647(user unit)*1
Soft limit, small		BFM #14037,#14036	BFM #14237,#14236	
Torque limit setting		BFM #14038	BFM #14238	Setting range: 1 to 10000 (×0.1%)
Zero return torque limit		BFM #14040	BFM #14240	Setting range: 1 to 10000 (×0.1%)
External signal selection	FLS/RLS signal selection	BFM #14044 b0	BFM #14244 b0	ON: Use the FLS/RLS signal of the servo amplifier. OFF:Do not use the FLS/RLS signal of the servo amplifier. (Default setting)
	FLS/RLS signal logic	BFM #14044 b8	BFM #14244 b8	ON: The logic of the FLS/RLS signal of the servo amplifier is the NC contact. (Servo amplifier) (Default setting) OFF:The logic of the FLS/RLS signal of the servo amplifier is the NO signal. (Servo amplifier)
Control data				
Override setting		BFM #508	BFM #608	Specify the actual operation speed ratio to the operation speed. Setting range: 1 to 30000 (×0.1%)
Torque output setting		BFM #510	BFM #610	Setting range: 0 to 10000% (×0.1%)
Speed change value		BFM #513,#512	BFM #613,#612	Setting range: -2,147,483,648 to 2,147,483,647 (user unit)*1
New target position (address)		BFM #515,#514	BFM #615,#614	Setting range: -2,147,483,648 to 2,147,483,647(user unit)*1
New target position (speed)		BFM #517,#516	BFM #617,#616	Setting range: -2,147,483,648 to 2,147,483,647(user unit)*1
Operation command 1	STOP command	BFM #518 b1	BFM #618 b1	When this bit turns ON, the positioning operation decelerates to stop. With this bit ON, the stop-state continues.
	Forward rotation limit (LSF)	BFM #518 b2	BFM #618 b32	When this bit turns ON while forward rotation pulses are being output, the operation decelerates to stop.
	Reverse rotation limit (LSR)	BFM #518 b3	BFM #618 b3	When this bit turns ON, while reverse rotation pulses are being output, the operation decelerates to stop.
	Forward rotation jog	BFM #518 b4	BFM #618 b4	When this bit turns ON, forward rotation pulses are output.
	Reverse rotation jog	BFM #518 b5	BFM #618 b5	When this bit turns ON, reverse rotation pulses are output.

Item		BFM number		Description
		X-axis	Y-axis	
Control data				
Operation command 1	Mechanical zero return command	BFM #518 b6	BFM #618 b6	Execute zero return in the zero return mode specified with a positioning parameter.
	Relative/absolute addressing	BFM #518 b8	BFM #618 b8	OFF: Operate in the absolute address mode. ON: The positioning operation selected with an operation pattern begins. At standby for the remaining distance by STOP command, the operation restarts.
	Start command	BFM #518 b9	BFM #618 b9	OFF: Positioning operation does not start. ON: The positioning operation selected with an operation pattern begins. At standby for the remaining distance by STOP command, the operation restarts.
	Simultaneously start flag	BFM #518 b10	BFM #618 b10	Turn on the X-axis start command to simultaneously start X-axis and Y-axis operation.
	In-process speed change prohibition	BFM #518 b12	BFM #618 b12	OFF: The speed and target position change commands are valid during positioning operation. ON: The speed and target position change commands during positioning operation are invalid.
	Speed change during positioning control operation	BFM #518 b13	BFM #618 b13	Changes the current operation speed to the specified speed.
	Target position change during positioning control operation	BFM #518 b14	BFM #618 b14	Changes the current target address to the specified target position.
Operation command 2	Remaining distance operation cancel command	BFM #519 b0	BFM #619 b0	Cancels the remaining distance and finishes the positioning when this bit is truned from OFF to ON.
	positioning parameter valid	BFM #519 b4	BFM #619 b4	Enables the positioning parameter when this bit is truned from OFF to ON.
	Servo-OFF command	BFM #519 b8	BFM #619 b8	OFF: Turns the servo on. ON: Turns the servo off.
Monitor data				
Current address (user unit)		BFM #1,#0	BFM #101,#100	User unit *1
Current address (pulse)		BFM #3,#2	BFM #103,#102	Unit: PLS
Stored torque limit		BFM #5,#4	BFM #105,104	Unit: ×0.1%
Status information	READY/BUSY	BFM #28 b0	BFM #128 b0	ON : READY OFF: BUSY
	Zero return execution	BFM #28 b3	BFM #128 b3	ON: Zero return completed (current value established) OFF: Zero return not completed (current value indefinite)
	Waiting for travel of remaining distance at stop	BFM #28 b7	BFM #128 b7	ON in standby for the remaining distance by a STOP command. OFF with another start command or remaining distance operation cancel command.
	Speed change in progress	BFM #28 b13	BFM #128 b13	ON: Speed change in progress OFF: Speed change finished
	Target address change in progress	BFM #28 b14	BFM #128 b14	ON: Address change in progress OFF: Address change finished
Servo status	In-position	BFM #64 b12	BFM #164 b12	ON if the remaining distance is at or below the in-position range.

Item		BFM number		Description
		X-axis	Y-axis	
Servo parameter				
Basic setting	Absolute position detection system	BFM #15003	BFM #15203	Specify the absolute position detection system. 1:Valid 0:Invalid (Default setting)
	In-position range	BFM #15010	BFM #15210	Specify the in-position range. Setting range: 0 to 50000PLS
Output signal device selection 3 (CN3-15)		BFM #15104	BFM #15304	To assign the absolute position lost signal (ABSV) of the servo amplifier to the CN3-15 pin in the servo amplifier, specify "H11" at output signal device selection 3.

*1. For the user unit, refer to the following section.

→ **Refer to Section 7.7**

8. Manual Control

8.1 Mechanical Zero Return Control

8.1.1 Outline of mechanical zero return control

The mechanical zero return method for the 20SSC-H includes the following three variations (four modes).

→ **For related parameters, control data and monitor data, refer to Subsection 8.1.5**

- Dog type mechanical zero return (1 mode)
  The position from stopping with the DOG signal and the zero signal of the servomotor becomes the zero-point.
  → **For details on the DOG type mechanical zero return, refer to Subsection 8.1.2**
- Data-set type mechanical zero return (1 mode)
  The position from moving with the JOG operation or manual pulse generator is defined as the zero-point.
  → **For details on the data-set type mechanical zero return, refer to Subsection 8.1.3**
- Stopper type mechanical zero return (2 modes)
  The stopper position is defined as the zero-point.
  → **For details on the stopper type mechanical zero return, refer to Subsection 8.1.4**

1. Mechanical zero return operation

The mechanical zero return operation varies according to the zero return mode. For details, refer to the following.

→ **For details on the DOG type mechanical zero return, refer to Subsection 8.1.2**
→ **For details on the data-set type mechanical zero return, refer to Subsection 8.1.3**
→ **For details on the stopper type mechanical zero return, refer to Subsection 8.1.4**

1) Turn the mechanical zero return command from OFF to ON to execute mechanical zero return.
2) After calibrating the zero-point, write the mechanical zero-point address from in a positioning parameter to the current address.
3) Set the zero return execution flag.

Note

- The zero return command is not accepted if the zero-point pass signal servo status is OFF.
  Before executing zero return, be sure to rotate the servomotor at least once to turn ON the zero-point pass signal. The zero-point pass signal turns ON when the motor passes the motor reference position signal (Z-phase).
  To execute zero return immediately after power-on, specify "1: Motor Z-phase pass unnecessary after power-on" (default setting) at the servo parameter function selection C-4. With this setting, the zero-point pass signal turns ON even if the motor does not pass the zero-point (Z-phase).
- With the simultaneous start flag ON, the X-axis mechanical zero return command simultaneously starts the X and Y-axes mechanical zero return operation.
  (The 20SSC-H ignores the Y-axis mechanical zero return command.)

2. Zero-point return execution flag

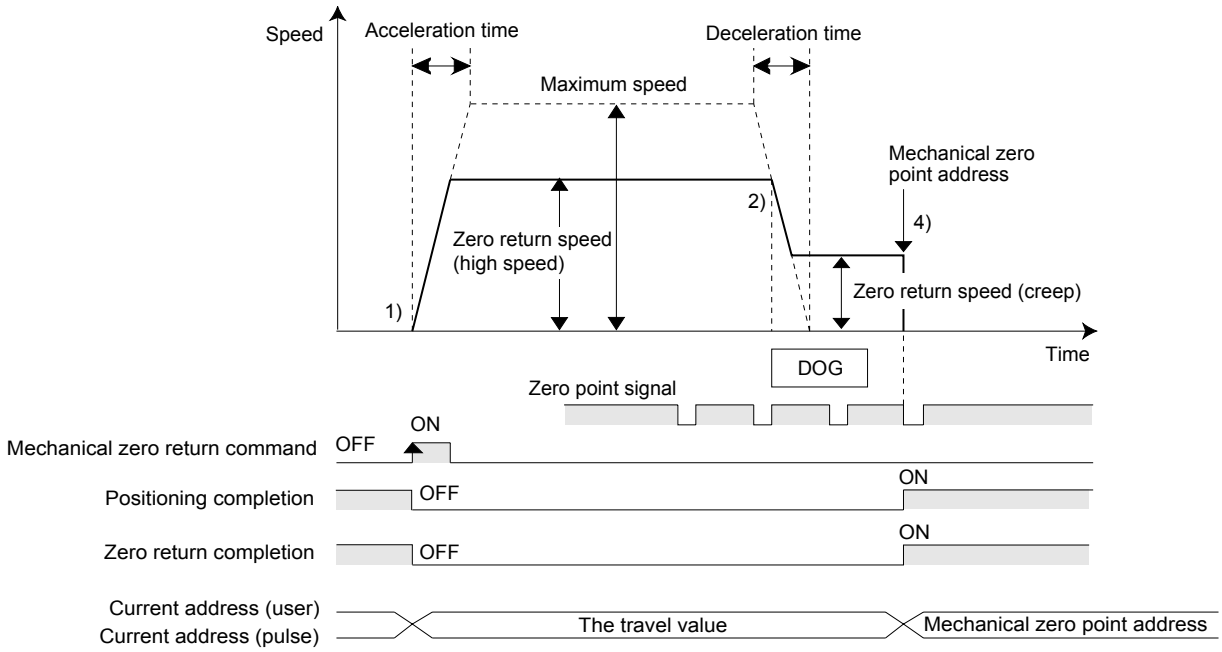
The zero-point return execution flag turns ON (sets) when the mechanical zero return operation finishes. It turns OFF (resets) when rebooting the mechanical zero return command, or when the turning the power OFF.

8.1.2 DOG type zero return

With the DOG type mechanical zero return, the 20SSC-H sets the zero-point, the position as where the module stops with a near-point DOG signal and servo motor zero-point signal. Use the DOG search function to execute the DOG type mechanical zero return arbitrarily.

1. Operation

Zero return starts as follows, at the rising edge (OFF → ON) of the mechanical zero return command.



1) At the rising edge (OFF → ON) of the mechanical zero return command, the work piece moves in the zero return direction at the zero return speed (high speed).
2) At the DOG input, the 20SSC-H decelerates the work piece to the zero return speed (creep).
3) The 20SSC-H counts zero-point signals after passing the zero-point signal count start timing.
4) After counting the specified number (zero-point signal numbers), the 20SSC-H stops the work piece.
5) After the zero-point is reached, the work piece does not travel with a the mechanical zero return command.
6) The 20SSC-H turns the positioning completion flag ON and sets the zero return execution flag.

Note

- The zero return command is not accepted if the zero-point pass signal servo status is OFF.
  Before executing zero return, be sure to rotate the servomotor at least once to turn the zero-point pass signal ON. The zero-point pass signal turns ON when the motor passes the motor reference position signal (Z-phase).
  To execute zero return immediately after power-on, specify "1: Motor Z-phase pass unnecessary after power-on" (default setting) at servo parameter function selection C-4. With this setting, the zero-point pass signal turns ON even if the motor does not pass the zero-point (Z-phase).
- With the simultaneous start flag ON, the X-axis mechanical zero return command simultaneously starts the X and Y-axes mechanical zero return operation.
  (The 20SSC-H ignores the Y-axis mechanical zero return command.)

Precautions when setting the DOG input logic

An incorrect DOG input logic disables the correct operation. Pay close attention when changing the initial setting value.

2. Setting items

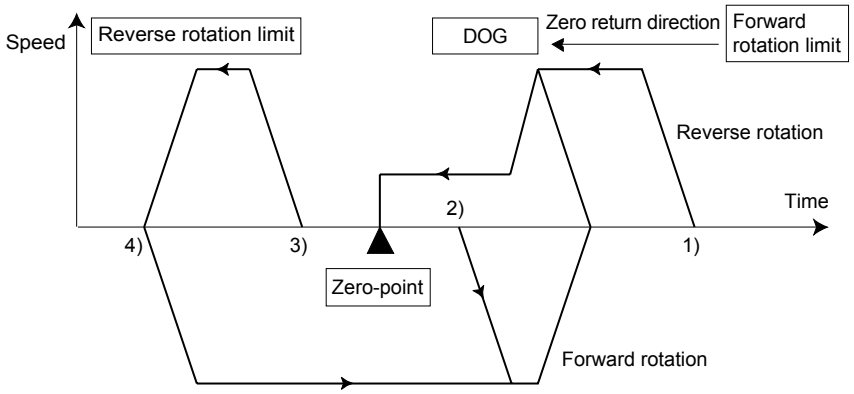
With DOG type mechanical zero return, specify the following settings.

→ **For details on the setting items, refer to Subsection 8.1.5**

Setting item	Description
Zero return mode	Specify the DOG type zero return mode.
Zero return speed (high speed)	Enter the zero return speed (high speed)
Zero return speed (creep)	Specify the post-DOG-input zero return speed (creep).
Zero return direction	Specify the zero return direction (the current value increase/decrease direction).
DOG input selection	Select the DOG input (servo amplifier/20SSC-H) to be used.
DOG input logic	Specify the logic (NO/NC contact) of the DOG input to be used.
Zero-point signal count start timing	Specify the timing (front/rear edge of DOG) to start counting the zero-point signal.
Zero-point signal count	Specify the zero-point signal count.
Mechanical zero-point address	Specify the current address (user unit) written after the mechanical zero return completion.

3. Dog search function

The zero return with DOG search is executable with forward/reverse rotation limit1 on the PLC side. At this time, the zero return action varies in the following way according to the zero return starting position.



1) If the starting position is in the near point signal OFF area (before passing DOG)
   a) Operation is conducted in the zero return direction at the zero return speed (high speed).
   b) After the DOG detection, the deceleration to the zero return speed (creep) begins.
   c) After detecting the zero-point signal count start timing, the zero-point signal is counted.
   d) After counting the specified number of zero-point signals, the travel is stopped.
2) If the starting position is in the near point signal ON area
   a) Operation is conducted at the zero return speed in the direction opposite to the zero return direction.
   b) Upon the DOG detection (escaping from the DOG), the deceleration to stop begins.
   c) Operation is conducted in the zero return direction at the zero return speed (high speed).
   d) After the DOG is detected, deceleration to the zero return speed (creep) begins.
   e) After counting the zero-point signal, the 20SSC-H stops.
3) If the starting position is in the near point signal OFF area (after passing DOG)
   a) Operation is conducted in the zero return direction at the zero return speed (high speed).
   b) Upon the forward/reverse rotation limit, the travel decelerates to stop.
   c) Operation is conducted in the direction opposite to the zero return direction at the zero return speed (high speed).
   d) Upon the DOG detection (escaping from the DOG), the travel decelerates to stop.
   The operation begins again in the zero return direction at the zero return speed (high speed).
   e) After DOG detection, the travel decelerates to the zero return speed (creep speed) and, after counting the zero-point signal, the 20SSC-H stops.

4) When the limit switch (forward or reverse rotation limit) in the zero return direction turns ON
   a) The operation is conducted in the direction opposite to the zero return direction at the zero return speed (high speed).
   b) Upon the DOG detection (escaping from the DOG), the travel decelerates to stop.
   c) The operation is conducted again in the zero return direction at the zero return speed (high speed).
   d) Upon the DOG detection, the travel decelerates to the zero return speed (creep speed) and after counting the zero-point signal, the 20SSC-H stops.

Caution

If the DOG is not detected during the DOG search operations, a limit error occurs.

4. Changing the zero return speed

Use the override function or operation speed change function to change the zero return speed (high speed). However, the speed does not change when the operation speed change disable flag is ON.

→ **For the override function, refer to Subsection 7.5.1**
→ **For the operation speed change function, refer to Subsection 7.5.2**

8.1.3 Data-set type mechanical zero return

Use the data-set type mechanical zero return procedure to set the position moved by JOG or manual pulse generator operation, as a zero-point. Therefore the work piece does not travel at the mechanical zero return command.
This zero return procedure is frequently used for equipment without a DOG, or for transfer lines without a mechanical zero-point.

1. Operation

1) With JOG or manual pulse generator operation, the work piece moves to the desired zero-point.
2) Reboot the mechanical zero return command.
3) Write the mechanical zero-point address, specified in positioning parameters to the current address.
4) Set the zero return execution flag.
   In the data-set type mechanical zero return, the positioning completion flag does not turn ON.

Note

- The zero return command is not accepted if the zero-point pass signal servo status is OFF.
  Before executing zero return, be sure to rotate the servomotor at least once to turn the zero-point pass signal ON. The zero-point pass signal turns ON when the motor passes the motor reference position signal (Z-phase).
  To execute zero return immediately after power-on, specify "1: Motor Z-phase pass unnecessary after power-on" (default setting) at servo parameter function selection C-4. With this setting, the zero-point pass signal turns ON even if the motor does not pass the zero-point (Z-phase).
- With the simultaneous start flag ON, the X-axis mechanical zero return command simultaneously starts the X and Y-axes mechanical zero return operation.
  (The 20SSC-H ignores the Y-axis mechanical zero return command.)

2. Setting items

In the data-set type zero return, specify the following settings.

→ **For details on the setting items, refer to Subsection 8.1.5**

Setting item	Description
Zero return mode	Specify the data-set type zero return mode.
Mechanical zero return address	Specify the current address (user unit) after the mechanical zero return completion.

8.1.4 Stopper type mechanical zero return

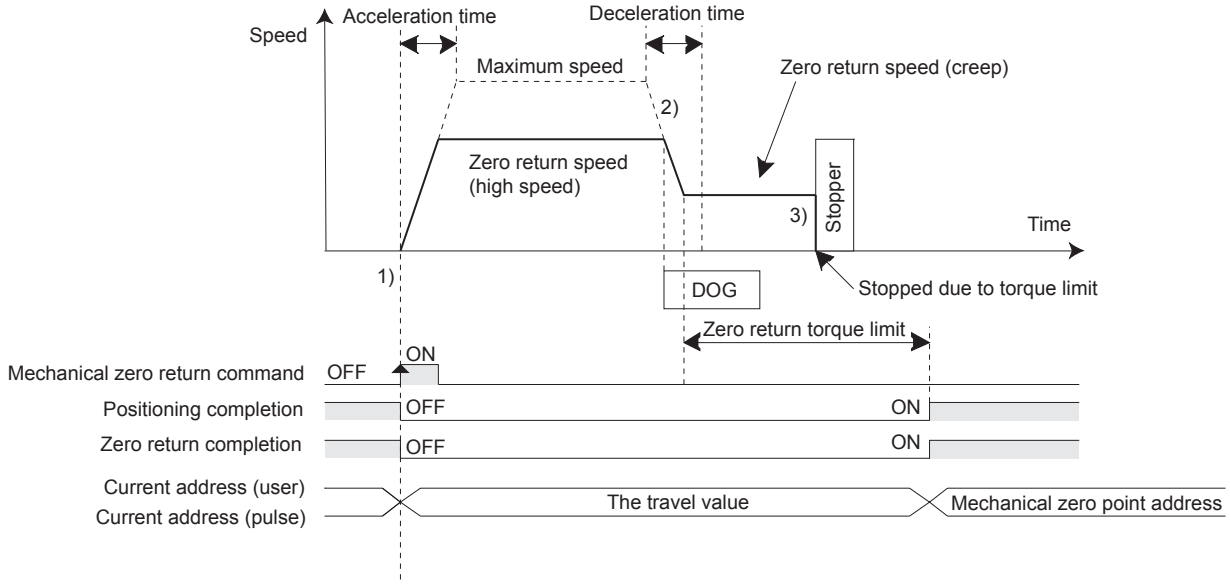
The stopper position is defined as the zero-point. The stopper type mechanical zero return includes the following two types (modes).

- Stopper type (1)
  This mechanical zero return method uses the DOG signal and stopper.
  The high speed travel is possible up to the DOG signal, so this zero return type reduces the time for mechanical return.
- Stopper type (2)
  This mechanical zero return method uses only the stopper.

Note

- The zero return command is not accepted if the zero-point pass signal servo status is OFF.
  Before executing zero return, be sure to rotate the servomotor at least once to turn the zero-point pass signal ON. The zero-point pass signal turns ON when the motor passes the motor reference position signal (Z-phase).
  To execute zero return immediately after power-on, specify "1: Motor Z-phase pass unnecessary after power-on" (default setting) at servo parameter function selection C-4. With this setting, the zero-point pass signal turns ON even if the motor does not pass the zero-point (Z-phase).
- With the simultaneous start flag ON, the X-axis mechanical zero return command simultaneously starts the X and Y-axes mechanical zero return operation.
  (The 20SSC-H ignores the Y-axis mechanical zero return command.)

1. Stopper type (1) operation

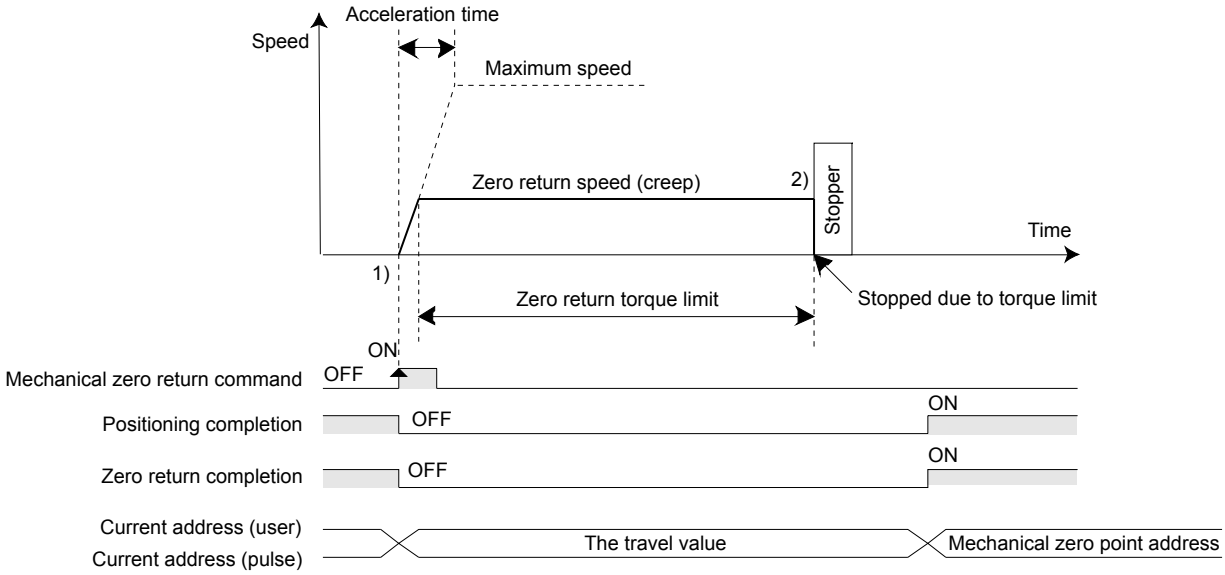


1) At the rising edge (OFF → ON) of the mechanical zero return command, the work piece moves in the zero return direction at the zero return speed (high speed).
2) At the DOG input, the 20SSC-H decelerates the work piece to the zero return speed (creep).
3) The work piece hits the stopper, and the work piece stops when the servomotor torque reaches the zero return torque limit value.
4) After the stop point, the 20SSC-H writes the mechanical zero point address, specified in positioning parameters, to the current address.
5) The 20SSC-H turns the positioning completion flag ON and sets (turns ON) the zero return execution flag.

Dog position

Install the DOG at a position far enough from the stopper for the work piece to decelerate to the zero-point return speed (creep).

2. Stopper type (2)



1) Upon the rising edge (OFF → ON) of the mechanical zero return command, the work piece moves in the zero return direction at the zero return speed (creep).
2) After the work piece hits the stopper, the work piece stops when the servomotor torque reaches the zero return torque limit value.
3) After the stop, the 20SSC-H writes the mechanical zero point address, specified in positioning parameters, to the current address.
4) The 20SSC-H turns the positioning completion flag ON and sets (turns ON) the zero return execution flag.

3. Setting item

In the stopper type mechanical zero return, specify the following settings.

→ **For details on the setting items, refer to Subsection 8.1.5.**

Setting item	Description
Zero return mode	Specify the stopper type 1 (2) zero return mode.
Zero return speed (high speed)	Specify the zero return speed (high speed).
Zero return speed (creep)	Specify the post-DOG-input zero return speed (creep).
Zero return direction	Specify the zero return direction (current value increase/decrease direction).
Selection of DOG input	Select the DOG input (servo amplifier/20SSC-H) to be used.
DOG input logic	Specify the logic (NO/NC contact) of the DOG input to be used.
Mechanical zero-point address	Specify the current address (user unit) written after the mechanical zero return completion.
Zero return torque limit	Specify the torque limit value for zero return speed (creep).

4. Changing the zero return speed

Use the override function or operation speed change function to change the zero return speed (high speed). However, the speed does not change when the operation speed change disable flag is ON.

→ **For the override function, refer to Subsection 7.5.1**
→ **For the operation speed change function, refer to Subsection 7.5.2**

8.1.5 Related parameters, control data and monitor data

Item		BFM number X-axis	BFM number Y-axis	Description
Positioning parameter				
Operation parameter 1	Zero return direction	BFM #14000 b10	BFM #14200 b10	OFF: The current value decreasing direction ON: The current value increasing direction
	DOG input logic	BFM #14000 b12	BFM #14200 b12	OFF: The NO contact for the DOG input logic of 20SSC-H. ON: The NC contact for the DOG input logic of 20SSC-H.
	Zero-point signal count start timing	BFM #14000 b13	BFM #14200 b13	OFF: The rear edge of DOG ON: The front edge of DOG
Maximum speed		BFM #14009,#14008	BFM #14209,#14208	Setting range: 1 to 2,147,483,647(user unit)*1
Acceleration time		BFM #14018	BFM #14218	Setting range: 1 to 5000ms
Deceleration time		BFM #14020	BFM #14220	Setting range: 1 to 5000ms
Mechanical zero-point address		BFM #14029,#14028	BFM #14229,#14228	Setting range:-2,147,483,648 to 2,147,483,647(user unit)*1 Set the value within -2,147,483,648 to 2,147,483,647PLS in the converted pulse data
Zero return mode		BFM #14031	BFM #14231	0: DOG type 1: Data-set type 2: Stopper type (1) 3: Stopper type (2)
Zero return speed (high speed)		BFM #14025,#14024	BFM #14225,#14224	Setting range: 1 to 2,147,483,647(user unit)*1 Set the value within 1 to 50,000,000Hz in converted pulse data to satisfy the following conditions. • Zero return speed (high speed) ≦ maximum speed • The 20SSC-H operates at the maximum speed when the zero return speed (high speed) > maximum speed
Zero return speed (creep)		BFM #14027,#14026	BFM #14227,#14226	Setting range: 1 to 2,147,483,647(user unit)*1 Set the value within 1 to 50,000,000Hz in converted pulse data to satisfy the following conditions. • Zero return speed (creep) ≦ zero return speed (high speed) ≦ maximum speed • The 20SSC-H operates at the maximum speed when the zero return speed (high speed) > maximum speed
Zero-point signal count		BFM #14030	BFM #14230	Setting range: 0 to 32767PLS
Zero return torque limit		BFM #14040	BFM #14240	Setting range: 1 to 10000(×0.1%)
External signal selection	FLS/RLS signal selection	BFM #14044 b0	BFM #14244 b0	OFF: The RLS/RLS signal of the servo amplifier is not used. ON : The FLS/RLS signal of the servo amplifier is used.
	DOG signal selection	BFM #14044 b1	BFM #14244 b1	OFF: The DOG signal of the servo amplifier is not used. ON: The DOG signal of the servo amplifier is used.
	FLS/RLS signal logic	BFM #14044 b8	BFM #14244 b8	OFF: The NO contact for the FLS/RLS signal logic of the servo amplifier. ON: The NC contact for the FLS/RLS signal logic of the servo amplifier.
	Dog signal logic	BFM #14044 b9	BFM #14244 b9	OFF: The NO contact for the DOG input logic of the servo amplifier. ON: The NC contact for the DOG input logic of the servo amplifier.

Item		BFM number		Description
		X-axis	Y-axis	
Control data				
Override setting		BFM #508	BFM #608	Specify the ratio (percent) of the actual operation speed to the operation speed. Setting range: 1 to 30000(×0.1%)
Operation command 1	Forward rotation limit (LSF)	BFM #518 b2	BFM #618 b2	The 20SSC-H decelerates to stop at this parameter ON during forward rotation output
	Reverse rotation limit (LSR)	BFM #518 b3	BFM #618 b3	he 20SSC-H decelerates to stop at this parameter ON during reverse rotation output
	Mechanical zero return command	BFM #518 b6	BFM #618 b6	The 20SSC-H starts the mechanical zero return when rebooting this bit
	Simultaneous start flag	BFM #518 b10	BFM #618 b10	The 20SSC-H simultaneously starts the X and Y-axes operation at the X-axis start command ON.
	In-process speed change prohibition	BFM #518 b12	BFM #618 b12	OFF: The speed and target position change commands during positioning control operation are valid. ON: The speed and target position change commands during positioning control operation are invalid.
Monitor data				
Current address (user)		BFM #1,#0	BFM #101,#100	Setting range:-2,147,483,648 to 2,147,483,647(user unit)*1
Current address (pulse)		BFM #3,#2	BFM #103,#102	Setting range:-2,147,483,648 to 2,147,483,647PLS
Status information	Zero return execution	BFM #28 b3	BFM #128 b3	OFF: Zero return is normally finished. ON: Zero return is started.
	End of positioning	BFM #28 b6	BFM #128 b6	This parameter turns OFF at the start of each operation / at errors, and turns ON at normal operation end, but does not turn ON in STOP operations / in the following operations even at normal operation end - JOG operation - Mechanical zero return (data-set type) - Manual pulse generator operation - Variable speed operation
Servo status	End of positioning	BFM #63 b0	BFM #163 b0	OFF: Motor Z-phase pass after power-on ON: Motor Z-phase no pass after power-on
Servo parameter				
Extended setting	Function selection C-4	BFM #15080	BFM #15280	0:Motor Z-phase pass when power-on is necessary. 1:Motor Z-phase pass when power-on is unnecessary.

*1. For the user units, refer to the following.

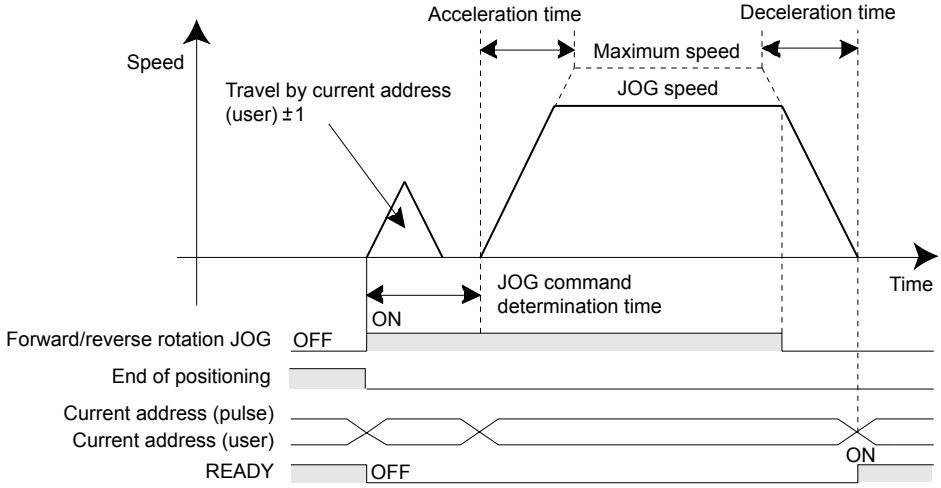
→ **Refer to Section 7.7**

8.2 JOG Operation

8.2.1 Outline of JOG operation

1. JOG operation

Forward pulses are output in the forward JOG mode, while reverse pulses are output in the reverse JOG mode.



- After decelerating to stop at in the opposite direction while the FWD/RVS JOG operates, the 20SSC-H re-starts the JOG operation when the FWD/RVS JOG is rebooted.
- If the FWD/RVS JOG is rebooted while decelerating to FWD/RVS JOG operates, the 20SSC-H re-accelerates to continue the operation.
- If the forward/reverse rotation limit 1 turns ON, a limit error occurs after decelerating to stop.
  In this case, a JOG operation in the opposite direction saves the work piece from the limit switch ON-state.

Note

- Inching operation (JOG determination time)
  To perform inching operation, specify the JOG determination time.
  - If the forward/reverse JOG activation time is within the JOG command determination time, a pulse string equivalent to ±1 (user unit) is output at the current address to operate the inching.
  - If the forward/reverse rotation JOG activation time is equal to or larger than the JOG command determination time, pulse strings are output continuously.
  - If the JOG command determination time is 0ms, the travel equivalent to ±1 at the current address (user) is not executed. Continuous operation is executed from the first point.
- If the simultaneous START flag turns ON, the simultaneous JOG operation in the X- and Y-axes starts at an X-axis JOG command.(The Y-axis JOG command is ignored.)
  At the X-axis JOG command OFF, the 20SSC-H stops the X and Y-axes JOG operation.

2. Related parameters, control data and monitor data

Item		BFM number X-axis	BFM number Y-axis	Description
Positioning parameter				
Maximum speed		BFM #14009,#14008	BFM #14209,#14208	Setting range: 1 to 2,147,483,647(user unit)*1
JOG speed		BFM #14013,#14012	BFM #14213,#14212	Setting range: 1 to 2,147,483,647(user unit)*1
JOG determination time		BFM #14014	BFM #14214	Setting range: 0 to 5000ms
Acceleration time		BFM #14018	BFM #14218	Setting range: 1 to 5000ms
Deceleration time		BFM #14020	BFM #14220	Setting range: 1 to 5000ms
Positioning parameter				
External signal selection	FLS/RLS signal selection	BFM #14044 b0	BFM #14244 b0	OFF: The FLS/RLS signal of the servo amplifier is not used. ON: The FLS/RLS signal of the servo amplifier is used.
	FLS/RLS signal logic	BFM #14044 b8	BFM #14244 b8	OFF: The NO contact for the FLS/RLS signal logic of the servo amplifier. ON: The NC contact for the FLS/RLS signal logic of the servo amplifier.
Control data				
Override setting		BFM #508	BFM #608	Specify the ratio (percent) of the actual operation speed to the operation speed. Setting range: 1 to 30000(×0.1%)
Operation command 1	Forward rotation limit (LSF)	BFM #518 b2	BFM #618 b2	The 20SSC-H decelerates to stop at this parameter ON during forward rotation output
	Reverse rotation limit (LSR)	BFM #518 b3	BFM #618 b3	The 20SSC-H decelerates to stop at this parameter ON during reverse rotation output
	Forward rotation JOG	BFM #518 b4	BFM #618 b4	Forward pulses are output while this parameter remains ON.
	Reverse rotation JOG	BFM #518 b5	BFM #618 b5	Reverse pulses are output while this parameter remains ON.
	Simultaneous start command	BFM #518 b10	BFM #618 b10	The 20SSC-H simultaneously starts the X and Y-axes operation at the X-axis start command ON.
	In-process speed change prohibition	BFM #518 b12	BFM #618 b12	OFF: The speed and target position change commands during positioning control operation are valid. ON: The speed and target position change commands during positioning control operation are invalid.
Monitor data				
Current address (user)		BFM #1,#0	BFM #101,#100	Setting range:-2,147,483,648 to 2,147,483,647(user units)*1
Current address (pulse)		BFM #3,#2	BFM #103,#102	Setting range:-2,147,483,648 to 2,147,483,647PLS

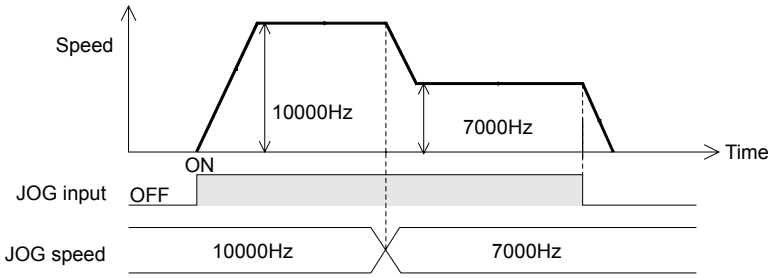
*1. For the user units, refer to the following.

→ **Refer to Section 7.7**

8.2.2 Changing the speed during JOG operation

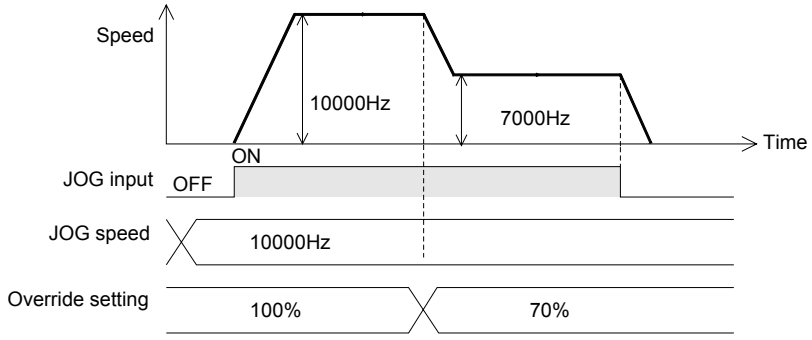
1. Changing the JOG speed

If the in-operation speed change disable turns ON, the JOG speed change is rejected.



2. Changing the override setting

Use the override setting to change the ratio of the actual operation speed to the JOG speed.

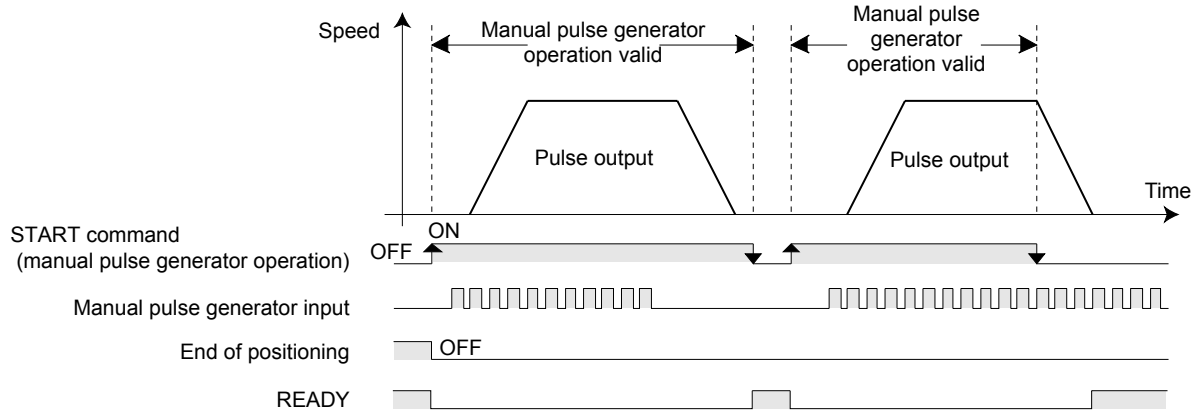


8.3 Manual pulse generator operation

8.3.1 Outline of manual pulse generator operation

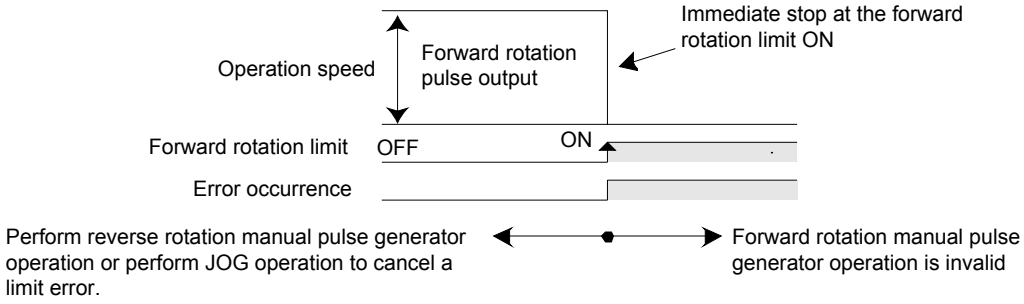
1. Operation

When selecting the MPG (manual pulse generator operation) in the operation patterns, the 20SSC-H operates by the MPG input at the START command ON.

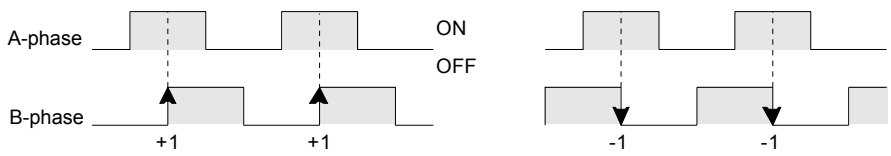


Note

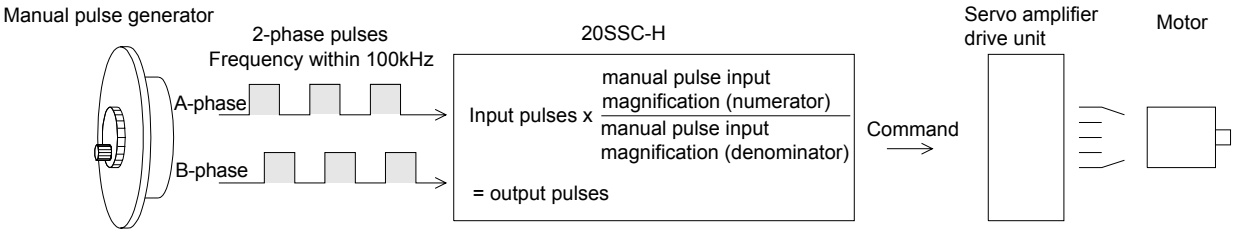
- The manual pulse generator inputs the pulses in two phases (A-/B-phase).
- The positioning completion flag does not turn ON.
- When reaching the forward/reverse rotation limit during forward/reverse rotation, a forward/reverse rotation limit error occurs.
  Perform reverse rotation if the forward rotation limit is ON, or perform forward rotation if the reverse rotation limit is ON to cancel a limit switch ON-state.



- The manual pulse generator inputs two-phase pulses (A-/B-phase) at 1 edge count.
  - Only the differential output type manual pulse generator is connectable.
  - Operation at the manual pulse generator is always counted.
    See the "current MPG (manual pulse generator) input value" to monitor in modes other than the manual pulse generator operation mode.



- The operation speed is proportional to the frequency of pulse strings from the manual pulse generator according to the manual pulse input magnification.
  In addition, the override setting is invalid.



- The following equation provides output pulses to 20SSC-H.

Input pulses (frequency, pulse quantity) from manual pulse generator X manual pulse input magnification $\left(\frac{\text{Manual pulse input magnification (numerator)}}{\text{Manual pulse input magnification (denominator)}}\right)$

- If the pulse generator magnification is smaller than 1/1, one pulse is output for every multiple input pulse.
  Therefore, the frequency of output pulses is low while the pulse quantity is small.
  If the pulse generator input electronic gear ratio is larger than 1/1, multiple pulses are output for each input pulse.
  Therefore, the frequency of output pulses is high while the pulse quantity is large.
  If the pulse generator input electronic gear ratio is larger than 1/1, the motor rpm for each input pulse becomes larger, causing rough positioning accuracy.

8.3.2 Current manual pulse input value

The current number of total input pulses from the manual pulse generator is stored.

8.3.3 Input frequency of manual pulse generator

The frequency of the manual pulse generator inputs is stored.
The sign of an increasing count is positive (+), while the sign of a decreasing count is negative (-).

8.3.4 Related parameters, control data and monitor data

Item		BFM number		Description
		X-axis	Y-axis	
Positioning parameter				
Maximum speed		BFM #14009,#14008	BFM #14209,#14208	Setting range:1 to 2,147,483,647(user units)*1
External signal selection	FLS/RLS signal selection	BFM #14044 b0	BFM #14244 b0	OFF: The FLS/RLS signal of the servo amplifier is not used. ON : The FLS/RLS signal of the servo amplifier is used.
	FLS/RLS signal logic	BFM #14044 b8	BFM #14244 b8	OFF: The NO contact the FLS/RLS signal logic of the servo amplifier. ON: The NC contact for the FLS/RLS signal logic of the servo amplifier.
Control data				
Operation command 1	Forward rotation limit (LSF)	BFM #518 b2	BFM #618 b2	The 20SSC-H decelerates to stop at this parameter ON during forward rotation output
	Reverse rotation limit (LSR)	BFM #518 b3	BFM #618 b3	The 20SSC-H decelerates to stop at this parameter ON during reverse rotation output
Pulse generator magnification (numerator)		BFM #525,#524	BFM #625,#624	Specify the magnification for input pulses. Setting range: 1 to 1,000,000
Pulse generator magnification (denominator)		BFM #527,#526	BFM #627,#626	Specify the dividing rate for input pulses. Setting range: 1 to 1,000,000
Monitor data				
Current address (user)		BFM #1,#0	BFM #101,#100	-2,147,483,648 to 2,147,483,647 (user unit)*1
Current address (pulse)		BFM #3,#2	BFM #103,#102	-2,147,483,648 to 2,147,483,647PLS
Manual pulse generator current input value		BFM #13,#12	BFM #113,#112	-2,147,483,648 to 2,147,483,647PLS
Manual pulse generator input frequency		BFM #15,#14	BFM #115,#114	The sign is positive (+) for an increasing count, while the sign is negative (-) for a decreasing count.

*1. For the user units, refer to the following.

→ **Refer to Section 7.7**

9. Positioning Control

This chapter describes the control of each positioning operation.
For table operation control, refer to the following section.

→ **For details on table operation, refer to Chapter 10**

9.1 Functions Available with Each Positioning Operation

		1-speed positioning	Interrupt 1-speed constant quantity feed	2-speed positioning	Interrupt 2-speed constant quantity feed	Interrupt stop	Variable speed operation	Multi-speed operation	Linear interpolation	Linear interpolation (Interrupt stop)	Circular interpolation	Reference
Approximate S-shaped acceleration/deceleration, trapezoidal acceleration/deceleration		○	○	○	○	○	○	○	○ *1	○ *1	○ *1	Section 7.2
Forward rotation limit, reverse rotation limit		○	○	○	○	○	○	○	○	○	○	Section 7.3
STOP command		○	○	○	○	○	○	○	○	○	○	Section 7.4
Operation speed change	Override function	○	○	○	○	○	○	○	○	○	○	Subection 7.5.1
	Operation speed change function	△	△	△	△	△	-	△	△	△	△	Subection 7.5.2
Target address change		△	△	△	△	△	-	-	-	-	-	Subection 7.5.3
Servo ready check		○	○	○	○	○	○	○	○	○	○	Subection 7.6.1
Servo end check		○	○	○	○	○	○	○ *2	○ *3	○ *3	○ *3	Subection 7.6.1
Torque limit		○	○	○	○	○	○	○	○	○	○	Subection 7.6.3
Simultaneous start function		○	○	○	○	○	-	-	-	-	-	-

○ : Applicable

△ : When the speed change disable during operation signal is ON, operation speed and target address cannot be changed.

- : Not applicable

*1. Operation becomes trapezoidal acceleration/deceleration.
If the approximate S-shaped acceleration/deceleration is set by positioning parameters, operates the trapezoidal acceleration/deceleration.

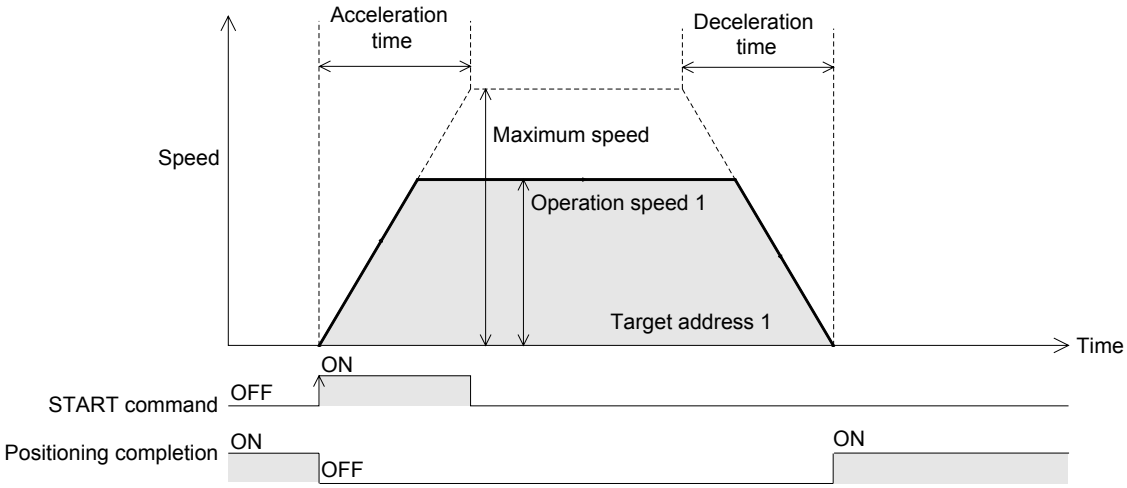
*2. The servo end check is not performed during continuous operation.

*3. The servo end check is not performed during continuous pass operation.

9.2 1-speed Positioning Operation

→ **For details on the operation speed change and target address change, refer to Section 7.5**
→ **For details on torque limit, refer to Subsection 7.6.3**
→ **For details on STOP command, refer to Section 7.4**
→ **For details on the related parameters, control data, and monitor data, refer to Section 9.12**

1. Operation



1) Set the Operation speed 1 and Target address 1.
2) Select the 1-speed positioning operation from the operation patterns and activate the START command to start the 1-speed positioning operation (above figure).
(The positioning completion signal is turned OFF.)
3) The operation stops at the target address 1, and the operation ends, turning the positioning completion signal ON.

POINT

The positioning completion signal turns ON if the travel distance is 0.
If the travel distance is 0 or the travel time is too short, however, it is impossible for the sequence program to detect the positioning completion signal turning OFF.

2. Operation Speed

Actual operation speed is "operation speed 1 × override setting."
Operation speed 1 can be changed using the operation speed change function except for the following conditions.

- During deceleration operation
- When the speed change disable during operation signal is ON.

3. Address Specification

Absolute/Relative address can be specified.
With the specified absolute address: Specifies a target address (position) using address 0 as the base.
With the specified relative address: Specifies a travel distance from the current address.

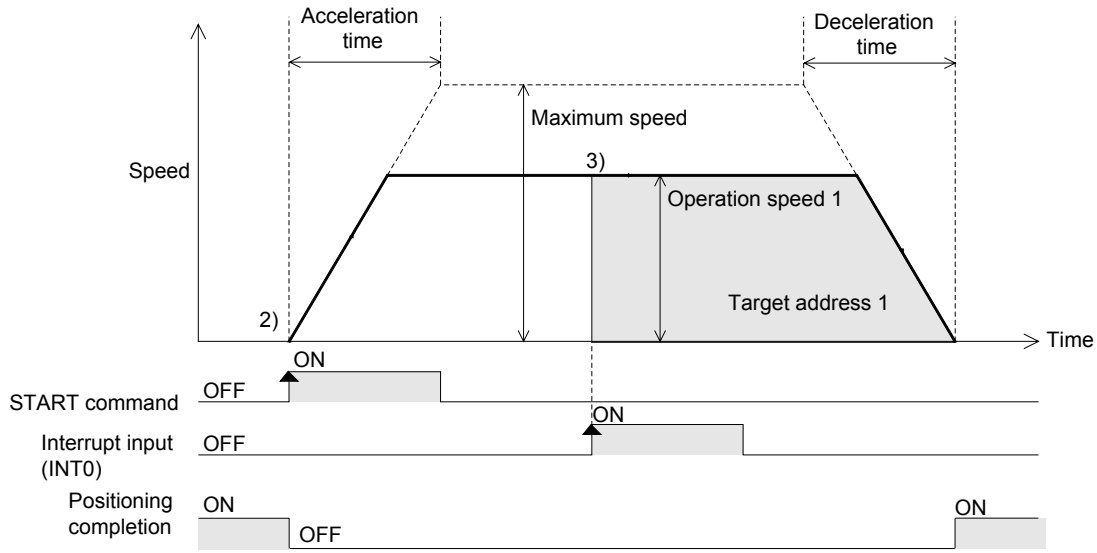
4. Rotation Direction

With the specified absolute address: The rotation direction depends on whether the target address 1 is larger or smaller than the current address.
With the specified relative address: The rotation direction is decided by the sign (positive/negative) of target address 1.

9.3 Interrupt 1-speed Constant Quantity Feed

→ For details on the operation speed change and target address change, refer to Section 7.5
→ For details on torque limit, refer to Subsection 7.6.3
→ For details on STOP command, refer to Section 7.4
→ For details on the related parameters, control data, and monitor data, refer to Subsection 9.12

1. Operation



1) Set the Operation speed 1 and Target address 1 (travel distance after interrupt input).
2) Select the interrupt 1-speed constant quantity feed from the operation patterns and activate the START command to start the interrupt 1-speed constant quantity feed (above figure).
(The positioning completion signal is turned OFF.)
3) At interrupt input (INT0) ON, the work piece moves at the operation speed 1 to the target address 1, where the operation ends and the positioning copletion signal turns ON.

Note

The travel distance for target address 1 must be larger than the deceleration distance to stop.
If the travel distance for target address 1 is smaller, the work piece decelerates as much as possible, and the operation stops.

→ For details, refer to Subsection 7.8.2

2. Operation speed

Actual operation speed is "operation speed 1 x override setting."
Operation speed 1 can be changed using the operation speed change function except for the following conditions.

- During deceleration operation
- When the speed change disable during operation signal is ON.

3. Address specification

Specified addresses are handled as relative addresses (travel distance from the current address).
(Relative/Absolute address specification is ignored.)

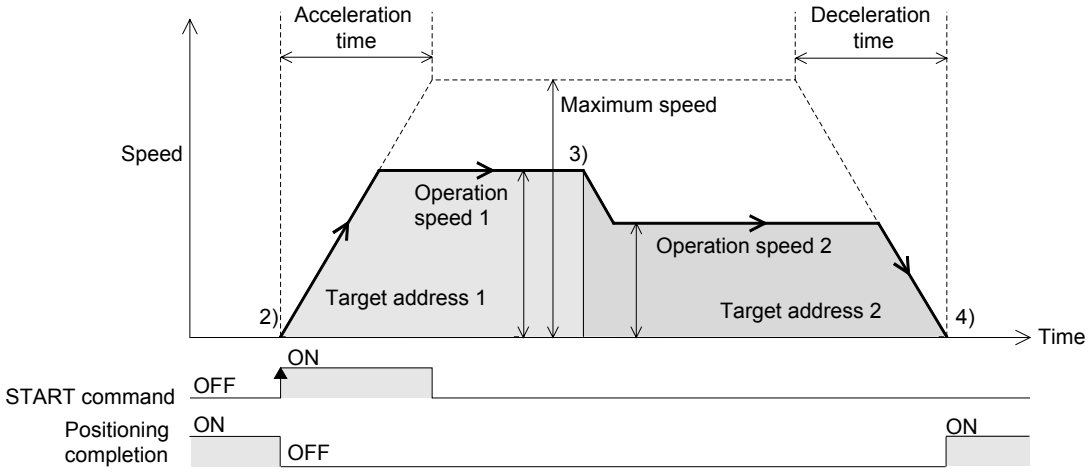
4. Rotation Direction

The sign of the target address decides the operation direction.
+: Operates in the direction that increases the current value. (When the value is 0, it is regarded as 1.)
-: Operates in the direction that decreases the current value.

9.4 2-speed Positioning Operation

→ **For details on the operation speed change and target address change, refer to Section 7.5**
→ **For details on torque limit, refer to Subsection 7.6.3**
→ **For details on STOP command, refer to Section 7.4**
→ **For details on the related parameters, control data, and monitor data, refer to Subsection 9.12**

1. Operation



1) Set the operation speed 1, operation speed 2, target address 1, and target address 2.
2) Select the 2-speed positioning operation from the operation patterns and activate the START command to start the 2-speed positioning operation (above figure).
(The positioning completion signal is turned OFF.)
3) Acceleration or deceleration operation to shift to operation speed 2 is started upon reaching the target address 1.
4) The work piece stops at target address 2 and the operation ends, turning the positioning completion signal ON.

2. Operation speed

The actual operation speed is decided by the following calculation formulas.

- Operation speed 1 × Override setting
- Operation speed 2 × Override setting

Operation speed 1 and operation speed 2 can be changed using the operation speed change function except for the following conditions.

- During deceleration operation from operation speed 2
- When the speed change disable during operation signal is ON.

3. Address Specification

Absolute/Relative address can be specified.
With the specified absolute address: Specifies a target address (position) using address 0 as the base.
With the specified relative address: Specifies a travel distance from the current address.

4. Rotation Direction

With the specified absolute address: The rotation direction depends on whether the target address 1 is larger or smaller than the current address.
With the specified relative address: The rotation direction is decided by the sign (positive/negative) of target address 1.

Note

If the moving directions of target address 1 and target address 2 are not the same as follows, a reverse operation is performed immediately after the deceleration stop at target address 1.
With the specified absolute address: when the sign difference between the current value and target address 1 is different from the sign difference between target address 1 and target address 2.
With the specified relative address : when the sign (positive/negative) of target address 1 differs from that of target address 2.

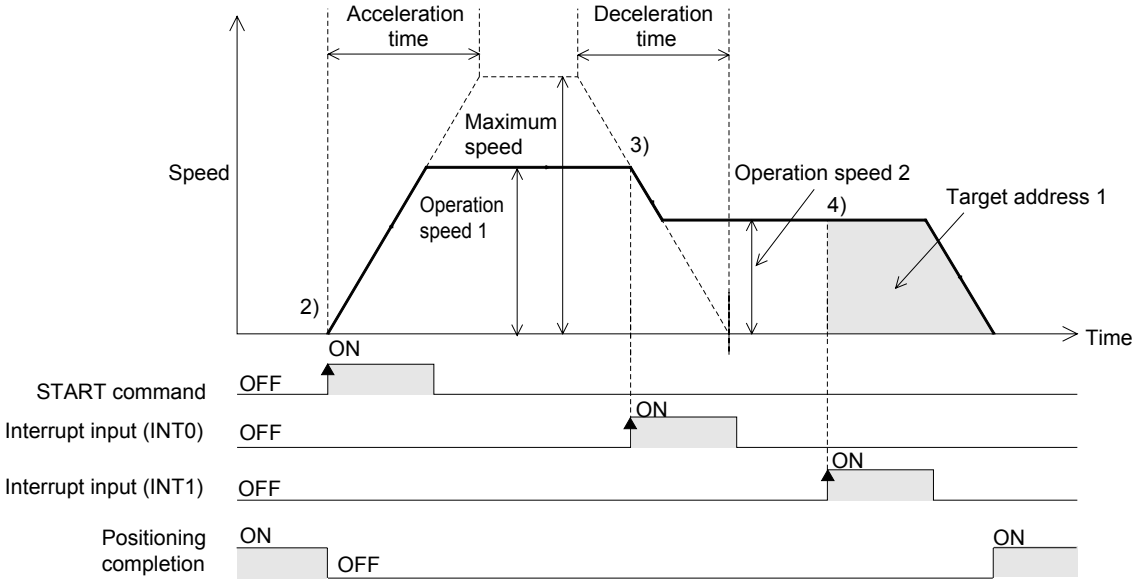
Caution

An abrupt change of the rotation direction may damage the machine. It may also cause an error by motor overload.
If the operation in a different direction requires stop time, use 1-speed positioning operation.

9.5 Interrupt 2-speed Constant Quantity Feed

→ For details on the operation speed change and target address change, refer to Section 7.5
→ For details on torque limit, refer to Subsection 7.6.3
→ For details on STOP command, refer to Section 7.4
→ For details on the related parameters, control data, and monitor data, refer to Subsection 9.12

1. Operation



1) Set the operation speed 1, operation speed 2, and target address 1.
2) Select the Interrupt 2-speed constant quantity feed from the operation patterns and activate the START command to start the Interrupt 2-speed constant quantity feed (above figure).
(The positioning completion signal is turned OFF.)
3) At interrupt input (INT0) ON, the work piece starts accelerating/decelerating to the operation speed 2.
4) At interrupt input (INT1) ON, the work piece moves at the operation speed 2 to the target address 1, and the operation ends, turning ON the positioning completion signal.

Note

- Interrupt input is detected in the order of INT0 and INT1.
- The travel distance for target address 1 must be larger than the deceleration distance to stop.
If the travel distance for target address 1 is smaller, the work piece decelerates as much as possible, and the operation stops.

→ For details, refer to Subsection 7.8.2

2. Operation speed

The actual operation speed is decided by the following calculation formulas.

- Operation speed 1 × Override setting
- Operation speed 2 × Override setting

Operation speed 1 and operation speed 2 can be changed using the operation speed change function except for the following conditions.

- During deceleration operation from operation speed 2
- When the speed change disable during operation signal is ON.

3. Address specification

Specified addresses are handled as relative addresses (travel distance from the current address).
(Relative/Absolute address specification is ignored.)

4. Rotation Direction

The sign of the target address decides the operation direction.

+: Operates in the direction that increases the current value. (When the value is 0, it is regarded as 1.)

-: Operates in the direction that decreases the current value.

9.6 Interrupt Stop Operation

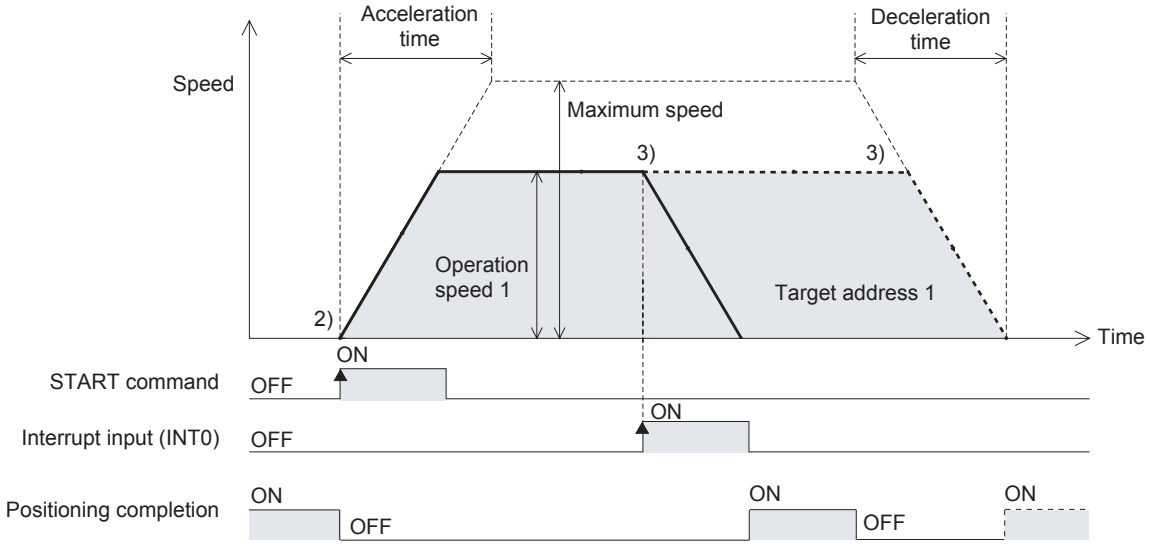
→ **For details on the operation speed change and target address change, refer to Section 7.5**

→ **For details on torque limit, refer to Subsection 7.6.3**

→ **For details on STOP command, refer to Section 7.4**

→ **For details on the related parameters, control data, and monitor data, refer to Section 9.12**

1. Operation



1) Set the operation speed 1 and target address 1 (maximum travel distance).

2) Select the Interrupt stop operation from operation patterns and activate the START command to start the Interrupt stop operation at operation speed 1 (above figure).
(The positioning completion signal is turned OFF.)

3) At interrupt input (INT0) ON, before target address 1, the work piece decelerates to stop, and the operation ends, turning the positioning completion signal ON.
When the interrupt input (INT0) does not turn ON before target address 1, the work piece decelerates to stop at target address 1, and the operation ends, turning the positioning completion signal ON.

2. Operation Speed

Actual operation speed is "operation speed 1 × override setting."
Operation speed 1 can be changed using the operation speed change function except for the following conditions.

- During deceleration operation
- When the speed change disable during operation signal is ON.

3. Address Specification

Absolute/Relative address can be specified.
With the specified absolute address: Specifies a target address (position) using address 0 as the base.
With the specified relative address: Specifies a travel distance from the current address.

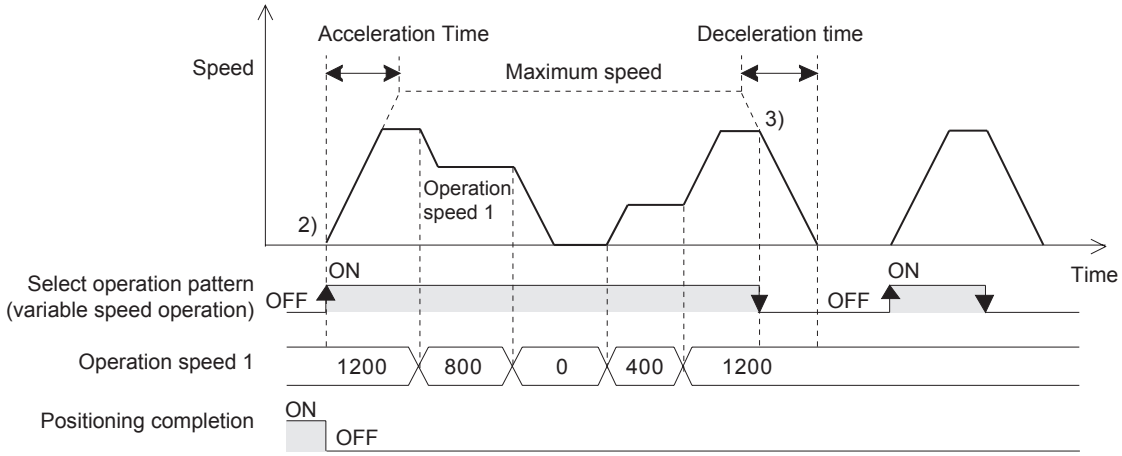
4. Rotation Direction

With the specified absolute address: The rotation direction depends on whether the target address 1 is larger or smaller than the current address.
With the specified relative address: The rotation direction is decided by the sign (positive/negative) of target address 1.

9.7 Variable Speed Operation

→ **For details on the operation speed change, refer to Section 7.5**
→ **For details on torque limit, refer to Subsection 7.6.3**
→ **For details on STOP command, refer to Section 7.4**
→ **For details on the related parameters, control data, and monitor data, refer to Section 9.12**

1. Operation



1) Set the operation speed 1 to a value other than 0.
2) Select the variable speed operation from the patterns to start the variable speed operation (above figure). (The positioning completion signal is turned OFF.)
3) When selecting an operation pattern other than the variable speed operation, the work piece decelerates to stop and the operation ends. (Positioning completion signal remains OFF.)

Note

- When setting the operation speed to 0, the work piece decelerates to stop, but the variable speed operation does not end.
  The operation pattern should be changed to another pattern when terminating the variable speed operation.
- At STOP command ON, the work piece decelerates to stop.
  Note that the operation restarts at STOP command OFF.

2. Operation speed

Actual operation speed is "operation speed 1 x override setting."

3. Rotation Direction

The operation direction is decided by the sign of operation speed 1.
+: Operates in the direction which increases the current value.(Decelerates to stop when the value is 0.)
-: Operates in the direction which decreases the current value.
If the sign of the operation speed value changes, the reverse operation starts after decelerating to stop.

Caution

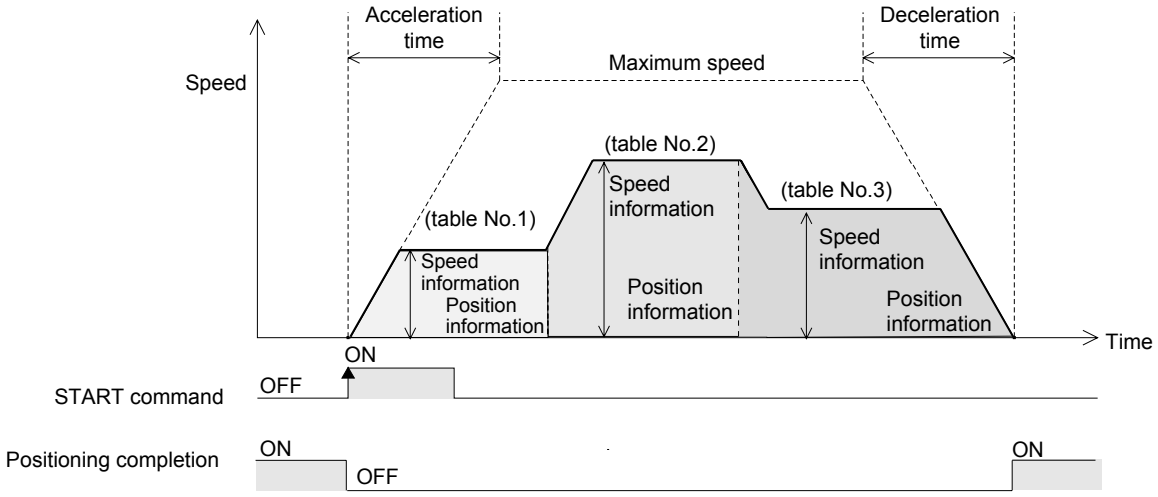
An abrupt change of the rotation direction may damage the machine.
It may also cause an error by motor overload.
To change the rotation direction, set the operation speed 1 value to 0, and wait for the motor to stop completely after decelerating to stop.
If the operation speed 1 value changes from positive to negative (e.g. 100 → -100), the work piece decelerates to stop, and 20SSC-H starts the reverse operation immediately.

9.8 Multi-Speed Operation

The multi-speed operation is positioning procedure, available only in the table operation.
For the details to control by table operation, and to change the operation speed, refer to the following section.

→ **For details on the table operation, refer to Chapter 10**
→ **For details on the operation speed change, refer to Section 7.5**
→ **For details on torque limit, refer to Subsection 7.6.3**
→ **For details on STOP command, refer to Section 7.4**
→ **For details on the related parameters, control data, and monitor data, refer to Section 9.12**

1. Operation



1) Set the operation information, speed information, and position (address) information for each table.
2) When rebooting the START command at the table operation start number with the specified multi-speed operation, 20SSC-H starts the positioning operation from the designated table number.
(The positioning completion signal is turned OFF.)
3) The operation continuously executes the table positioning until the END command. (above figure)
4) The work piece decelerates to stop at the specified position (address) in the table before the END command. When the operation ends, the positioning completion signal turns ON.

POINT

- In multi-speed operation, preparation for the next table number operation is performed simultaneously with the current operation.
If a travel distance to shift the operation speed is less than the pulses to accelerate/decelerate, or if the travel time is too short (at 50 ms or less), the current operation does not continue and temporarily stops.
- When using m code in multi-speed operation, use With mode.
With the m code in After mode, operation does not continue from the table since the 20SSC-H suspends the operation shift to the next table until the m code turns OFF .
- Multi-speed operation ends if another operation information is performed during the multi-speed operation.

2. Operation information

Set multi-speed operation, absolute address specification, relative address specification and end in the operation information.

→ **For details, refer to Chapter 10**

3. Speed information

Actual operation speed is "operation speed 1 × override setting."
Operation speed 1 can be changed using the operation speed change function except for the following conditions.

- During deceleration operation
- When the speed change disable during operation signal is ON.

4. Position (address) information

Absolute address and relative address can be specified in the operation information.

With the specified absolute address: Specifies a target address (position) using address 0 as the base.

With the specified relative address: Specifies a travel amount from the current address.

5. Rotation Direction

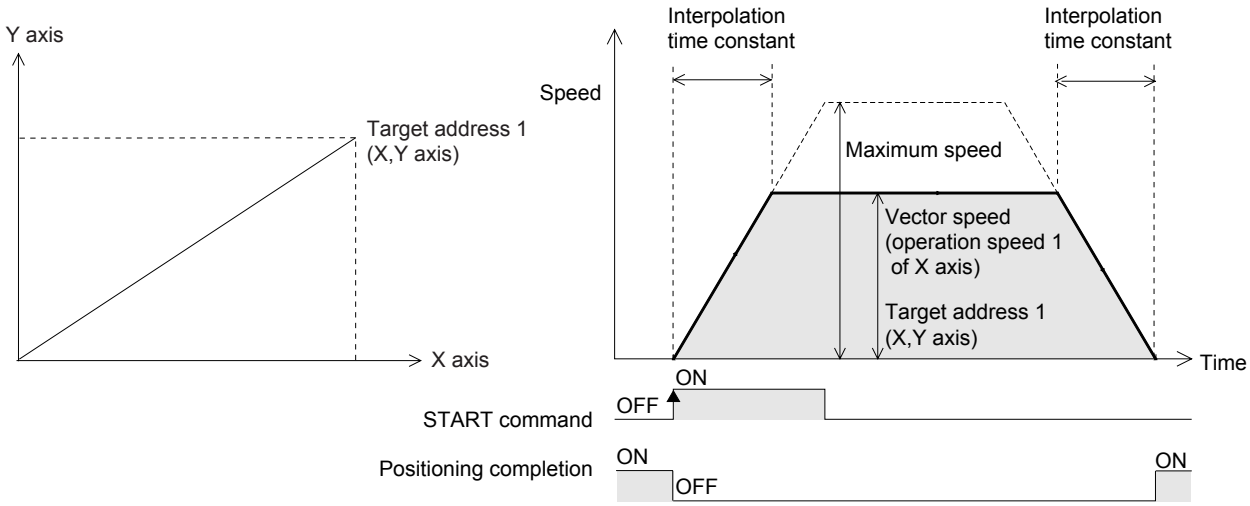
With the specified absolute address: The rotation direction depends on whether the target address 1 is larger or smaller than the current address.

With the specified relative address: The rotation direction is decided by the sign (positive/negative) of target address 1.

9.9 Linear Interpolation Operation

→ For details on the operation speed change, refer to Section 7.5
→ For details on torque limit, refer to Subsection 7.6.3
→ For details on STOP command, refer to Section 7.4
→ For details on the related parameters, control data, and monitor data, refer to Section 9.12

1. Operation



1) Set operation speed 1 of X-axis and target address 1 of X/Y-axis.
2) Select the linear interpolation operation from the operation pattern of X-axis and activate the START command of X-axis. The linear interpolation operation shown above will be started at vector speed (X-axis operation speed 1). (The positioning completion signal is turned OFF.)
The operation pattern and START command of Y-axis are ignored.
3) The work piece stops at the XY coordinate in target address 1, and the operation ends, turning the positioning completion signal ON.

POINT

- The positioning completion signal turns ON if the travel distance is 0.
If the travel distance is 0 or the travel time is too short, however, it is impossible for the sequence program to detect the positioning completion signal turning OFF.
- When interpolation operation is continued in table operation, it is continuous pass operation.

→ For details on the continuous pass operation, refer to Section 10.10

2. Operation speed

Actual operation speed (vector speed) is "X-axis operation speed 1 x X-axis override setting."
Operation speed 1 of X-axis can be changed using the operation speed change function except for operating under the following conditions.

- During deceleration operation
- When the speed change disable during operation signal is ON.

3. Address specification

Absolute/relative address can be specified.
With the specified absolute address: Specifies a target address (position) using address 0 as the base.
With the specified relative address: Specifies a travel amount from the current address.

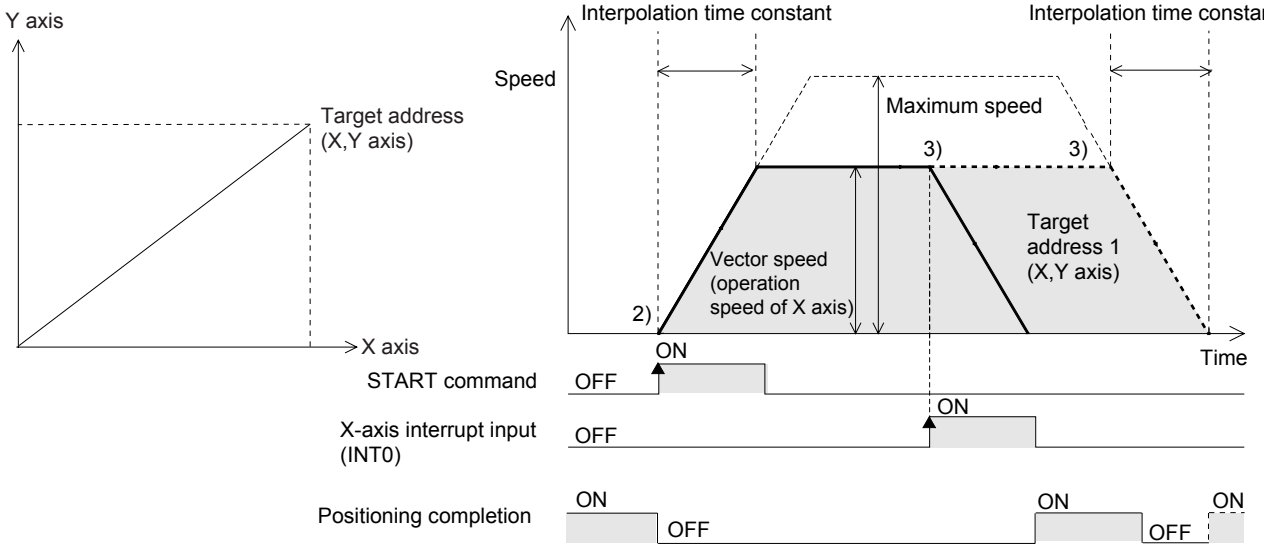
4. Rotation Direction

With the specified absolute address: The rotation direction depends on whether the target address 1 is larger or smaller than the current address.
With the specified relative address: The rotation direction is decided by the sign (positive/negative) of target address 1.

9.10 Linear Interpolation Operation (Interrupt Stop)

→ **For details on the operation speed change, refer to Section 7.5**
→ **For details on torque limit, refer to Subsection 7.6.3**
→ **For details on STOP command, refer to Section 7.4**
→ **For details on the related parameters, control data, and monitor data, refer to Section 9.12**

1. Operation



1) Set operation speed 1 of X-axis and target address 1(maximum travel distance) of X/Y-axis.
2) Select the linear interpolation operation (interrupt stop) from the operation pattern of X-axis and activate the START command. The linear interpolation operation (interrupt stop) shown above will be started at vector speed (X-axis operation speed 1). (The positioning completion signal is turned OFF.)
The operation pattern and START command of Y-axis are ignored.
3) At interrupt input (INT0) ON before the XY coordinate in target address 1, the work piece decelerates to stop, and the operation ends, turning the positioning completion signal ON.
When the interrupt input (INT0) does not turn ON before the XY coordinate in target address 1, the work piece moves to the target address 1, and the operation ends, turning the positioning completion signal ON.

Note

When interpolation operation continues in table operation, it is continuous pass operation.
→ **For details on the continuous pass operation, refer to Section 10.10**

2. Operation speed

Actual operation speed (vector speed) is "X-axis operation speed 1 x X-axis override setting."
Operation speed 1 of X-axis can be changed using the operation speed change function except for operating under the following conditions.

- During deceleration operation
- When the speed change disable during operation signal is ON.

3. Address specification

Absolute/relative address can be specified.
With the specified absolute address: Specifies a target address (position) using address 0 as the base.
With the specified relative address: Specifies a travel amount from the current address.

4. Rotation Direction

With the specified absolute address: The rotation direction depends on whether the target address 1 is larger or smaller than the current address.
With the specified relative address: The rotation direction is decided by the sign (positive/negative) of target address 1.

9.11 Circular Interpolation Operation

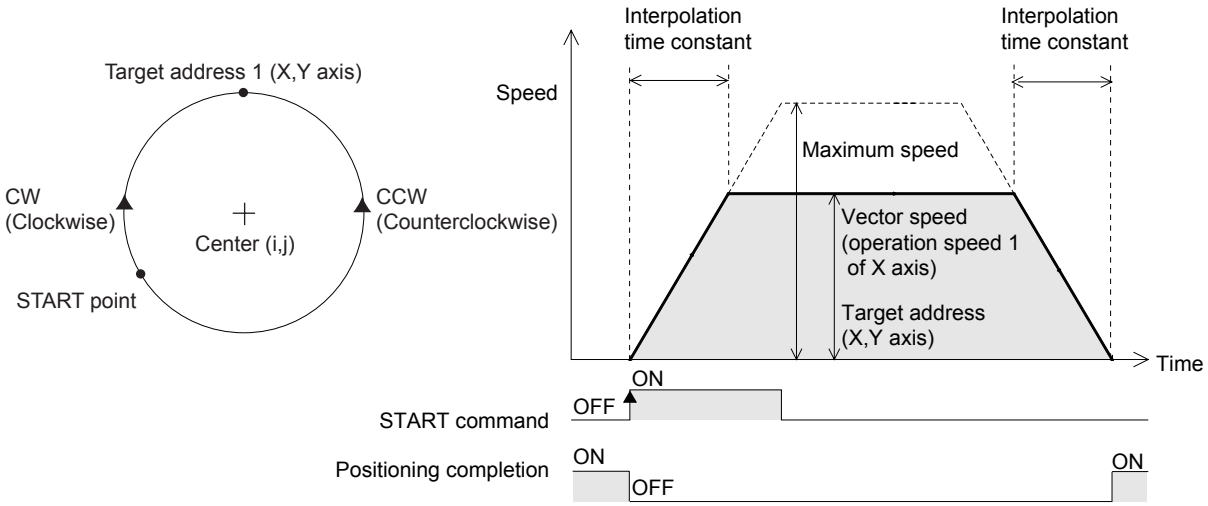
The circular interpolation operation is a positioning procedure, available only in the table operation.
The circular interpolation operation has the center coordinate specification/radius specification format.
For details on controlling by table operation, and changing the operation speed, refer to the following section.

→ **For details on the table operation, refer to Chapter 10**
→ **For details on the operation speed change, refer to Section 7.5**
→ **For details on torque limit, refer to Subsection 7.6.3**
→ **For details on STOP command, refer to Section 7.4**
→ **For details on the related parameters, control data, and monitor data, refer to Subsection 9.12**
→ **For details on the radius specification, refer to Subsection 9.11.2**

9.11.1 Circular interpolation [center coordinate specification]

The work piece moves from the start point to the target address, following the circular arc locus around the specified center coordinate.

1. Operation



1) Set table information, X-axis speed, X/Y axis position (address) information and center coordinate in the XY table information.
2) When turning the X-axis START command ON at the table operation start number with the specified circular interpolation (center, CW direction) / (center, CCW direction), the work piece moves to the target position at the specified speed, following the circle's center coordinate.
3) The work piece stops at the XY coodinate in target address 1, and the operation ends, turning the positioning completion signal ON.

Note

- The center coordinate is always handled as a relative address from the start point.
- When setting the same address for the start and target points, the work piece moves in a perfect circle. The center coordinate specification is available in the perfect circle operation.
- During continuous pass operation
  If the circular path is too short and the travel time from the start point to the target point is shorter than the interpolation time constant, the operation temporarily stops and shifts to the next interpolation operation.
- When interpolation operation is continued in table operation, it becomes a continuous pass operation.

→ **For details on the continuous pass operation, refer to Section 10.10**

2. Operation information

Set a circular interpolation operation ("center, CW direction" or "center, CCW direction") and an absolute/relative address in the operation information.

3. Speed information

Actual operation speed (vector speed) is "X-axis operation speed 1 x X-axis override setting."
Operation speed 1 of X-axis can be changed using the operation speed change function except for operating under the following conditions.

- During deceleration operation
- When the speed change disable during operation signal is ON.

4. Position (address) information

Absolute address and relative address can be specified in the operation information.
With the specified absolute address: Specifies a target address (position) using address 0 as the base.
With the specified relative address: Specifies a travel amount from the current address.

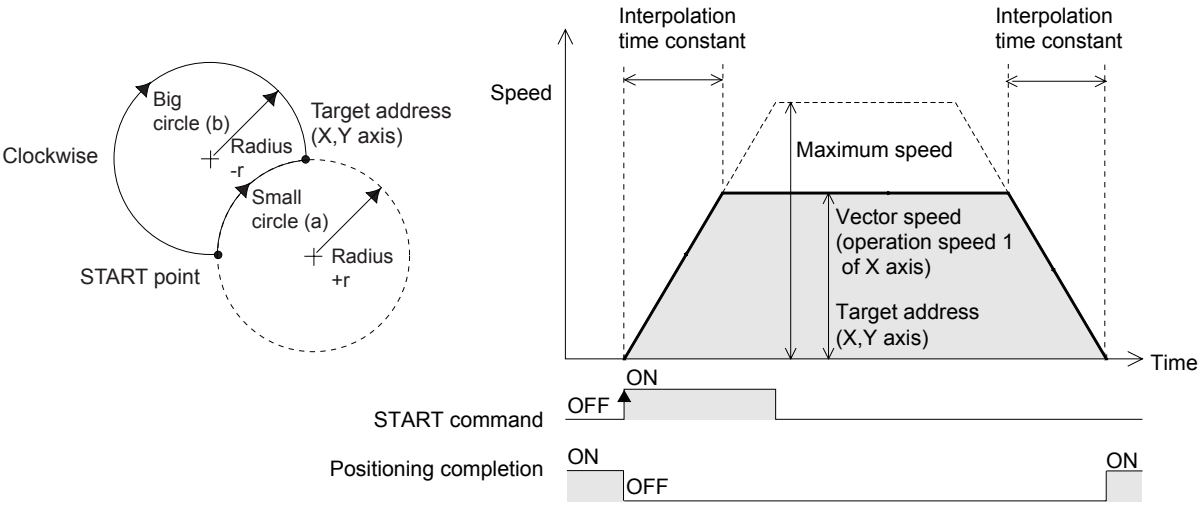
5. Circle information (center coordinate)

Set the center coordinate (i, j) by a relative address from a start point.

9.11.2 Circular interpolation [radius specification]

The work piece moves in a circular arc with a specified radius from the start point to the target address.

1. Operation



1) Set table information, X-axis speed, X/Y axis position (address) and radius in the XY table information.
2) When turning the X-axis START command ON at the table operation start number with the specified circular interpolation (radius, CW direction) / (radius, CCW direction), the work piece moves to the target position at the specified speed, following the circle's center coordinate calculated from the start point, target position and radius.
3) The work piece stops at the XY coodinate in the target address 1, and the operation ends, turning the positioning completion signal ON.

Note

- The radius is specified as r. When r is a positive value, the small circle (a) path is selected and when it is negative, the big circle (b) path is selected.
- Pulse rate and feed rate
  During the circular interpolation operation, the radius value is kept constant and pulses are allocated to the X and Y axes. If the ratio of the pulse rate to the feed rate differs between the X-axis and Y-axis, the circle becomes deformed.
- Use the center coordinate specification in a perfect circle operation.
- During continuous pass operation
  If the circular path is too short and the travel time from the start point to the target point is shorter than the interpolation time constant, the operation temporarily stops, and shifts to the next interpolation operation.
- When interpolation operation is continued in table operation, it becomes a continuous pass operation.

→ **For details on the continuous pass operation, refer to Section 10.10**

2. Operation information

Set a circular interpolation operation ("radius, CW direction" or "radius, CCW direction") and an absolute/ relative address in the operation information.

→ **For details, refer to Chapter 10**

3. Speed information

Actual operation speed (vector speed) is "X-axis operation speed 1 x X-axis override setting."
Operation speed 1 of X-axis can be changed using the operation speed change function except for operating under the following conditions.

- During deceleration operation
- When the speed change disable during operation signal is ON.

4. Position (address) information

Absolute address and relative address can be specified in operation information.
With the specified absolute address: Specifies a target address (position) using address 0 as the base.
With the specified relative address: Specifies a travel amount from the current address.

5. Circle information (radius)

Set the radius of a circular by r.
With specified positive (+) value: Operates the small circle (a) path.
With specified negative (-) value: Operates the big circle (b) path.

9.12 Parameter, Control Data, Monitor Data and Table Information

Item		BFM Number X-axis	BFM Number Y-axis	Description
Positioning Parameters				
Maximum speed		BFM #14009,#14008	BFM #14209,#14208	Setting range: 1 to 2,147,483,647 (user unit) *1
Acceleration time		BFM #14018	BFM #14218	Setting range: 1 to 5000 ms
Deceleration time		BFM #14020	BFM #14220	
Interpolation time constant		BFM #14022	BFM #14222	
Monitor data				
Current address (user)		BFM #1,#0	BFM #101,#100	Unit: user unit *1
Current address (pulse)		BFM #3,#2	BFM #103,#102	Unit: PLS
Control data				
Target address1		BFM #501,#500	BFM #601,#600	Setting range: -2,147,483,648 to 2,147,483,647 (user unit) *1
Operation speed 1		BFM #503,#502	BFM #603,#602	
Target address2		BFM #505,#504	BFM #605,#604	
Operation speed 2		BFM #507,#506	BFM #607,#606	
Override setting		BFM #508	BFM #608	Setting range: 1 to 30000(x 0.1%)
Operation command 1	Relative/Absolute address specification	BFM #518 b8	BFM #618 b8	OFF: Operates absolute address ON : Operates relative address (This parameter is disabled during a table operation.)
	START command	BFM #518 b9	BFM #618 b9	At this command OFF → ON, 20SSC-H starts a positioning operation in a selected motion pattern.
	Simultaneous START flag	BFM #518 b10	BFM #618 b10	At X-axis START command ON while this flag ON, operations at X and Y axis starts simultaneously .
	Speed change disable during operation	BFM #518 b12	BFM #618 b12	OFF: Enables the operation speed and target position change commands. ON: Disables the operation speed and target position change commands.

Item	BFM Number		Description
	X-axis	Y-axis	
Control data			
Operation pattern selection	BFM #520 b0	BFM #620 b0	Select motion patterns. b0 : 1-speed positioning operation b1 : Interrupt 1-speed constant quantity feed b2 : 2-speed positioning operation b3 : Interrupt 2-speed constant quantity feed b4 : Interrupt stop b5 : Variable speed operation b6 : Manual pulse generator operation b7 : Linear interpolation operation b8 : Linear interpolation (interrupt stop) operation b9 : Table operation (individual) b10: Table operation (simultaneous)
Table Information			
For details on the table operation, refer to the following. → **Refer to Chapter 10 and Section 11.5**			
Operation information	Refer to Section 11.5		Set operation information. → **Refer to subsection 10.1.3**
Position (address) data			Set the target address. Setting range: -2,147,483,648 to 2,147,483,647 (user unit) *1
Speed information			Set the operation speed. Setting range: 1 to 50,000,000 (user unit) *1

*1. For details on the units, refer to the following.

→ **Refer to Section 7.7**

10. Table Operation

10.1 Outline of Table Operation

This section describes the table information setting and table operation motions.
For details on positioning in table operation, refer to the following.

→ **For details on each positioning operations, refer to Chapter 9**

About the table operation

"Table operation" executes preset motion patterns of positioning operations from the table information. By table operation, 20SSC-H continues the supported positioning operation while also combining motion patterns. A few positioning operations are available in table operation only.

Positioning operations for table operation only

- Multi-speed operation
- Circular interpolation
- Continuous pass operation

10.1.1 Applicable positioning operations for table operation

- Applicable positioning operations for table operation
  - 1-speed positioning operation
  - Interrupt 1-speed constant quantity feed
  - 2-speed positioning operation
  - Interrupt 2-speed constant quantity feed
  - Interrupt stop
  - Multi-speed operation
  - Linear interpolation*1
  - Linear interpolation (interrupt stop)*1
  - Circular interpolation*1
  - Mechanical zero return
- Inapplicable positioning operations for table operation
  - Variable speed operation
  - Manual pulse generator
  - JOG operation

*1. Continuous pass operation in which interpolation operation is continuously executed is supported.

→ **For details on continuous operation, refer to section 10.10**

10.1.2 Types of table information and number of registered tables

Type of table information	Number of registered tables	Table number
X-axis table information	300 tables	0 to 299
Y-axis table information	300 tables	0 to 299
XY-axis table information	300 tables	0 to 299

10.1.3 Table information setting items

Setting item	Content	Type of table information		
		X-axis	Y-axis	XY-axis
Operation information*1	Sets a positioning operation in table operation along with a current address change, etc. - No processing - m code - End - 1-speed positioning - Interrupt 1-speed constant quantity feed - 2-speed positioning - Interrupt 2-speed constant quantity feed - Interrupt stop - Multi-speed operation (requires multiple tables) - Linear interpolation - Linear interpolation (interrupt stop) - Circular interpolation (center, CW direction) - Circular interpolation (center, CCW direction) - Circular interpolation (radius, CW direction) - Circular interpolation (radius, CCW direction) - Mechanical zero return - Current address change - Absolute address specification - Relative address specification - Dwell - Jump	✓	✓	✓
Position information (x,y)	Sets the following items depending on the settings in operation information. • In positioning operations Set the target address Setting range: -2,147,483,648 to 2,147,483,647 (user unit)*2 Set the value within -2,147,483,648 to 2,147,483,647PLS in converted pulse data. • In current address changes Set the new current address. Setting range: -2,147,483,648 to 2,147,483,647 (user unit)*2 Set the value within -2,147,483,648 to 2,147,483,647PLS in converted pulse data. • In Dwell Set a dwell time. Setting range: 0 to 32767(×10ms) • In Jump Set the jump No. table. Setting range: 0 to 299	✓	✓	✓
Speed information (fx,f,fy)	Set the operation speed. Setting range: 1 to 50,000,000 (user unit)*2 Set the value within 1 to 50,000,000Hz in converted pulse data.	✓	✓	✓
Circle information (i,r,j)	Set the center coordinate and radius of the circle during circular interpolation operation. Setting range: -2,147,483,648 to 2,147,483,647 (user unit)*2 Set the value within -2,147,483,648 to 2,147,483,647PLS in converted pulse data.	-	-	✓
m code information*3	Sets m codes. • No m code .....-1 • After-mode m code .....0 to 9999 • With-mode m code .....10000 to 32767	✓	✓	✓

*1. The operation information in the buffer memory has numerical value settings for instructions (e.g. DRV or DRVZ).

Type		Symbol	Setting value	Position information		Speed information		Circle information		m code information
				x	y	fx/f	fy	i/r	j	
No processing		NOP	-1	-	-	-	-	-	-	-
m code		NOP	-1	-	-	-	-	-	-	✓
End		END	0	-	-	-	-	-	-	-
1-speed positioning operation	X-axis	DRV_X	1	✓		✓	-	-	-	✓
	Y-axis	DRV_Y	2	-	✓	-	✓	-	-	✓
	XY-axis	DRV_XY	3	✓	✓	✓	✓	-	-	✓

Type		Symbol	Setting value	Position information		Speed information		Circle information		m code information
				x	y	fx/f	fy	i/r	j	
Interrupt 1-speed constant quantity feed	X-axis	SINT_X	4	✓	-	✓	-	-	-	✓
	Y-axis	SINT_Y	5		✓	-	✓	-	-	✓
	XY-axis	SINT_XY	6	✓	✓	✓	✓	-	-	✓
2-speed positioning operation (2 tables used)	X-axis	DRV2_X	7	✓	-	✓	-	-	-	✓
				✓	-	✓	-	-	-	-
	Y-axis	DRV2_Y	8	-	✓	-	✓	-	-	✓
				-	✓	-	✓	-	-	-
	XY-axis	DRV2_XY	9	✓	✓	✓	✓	-	-	✓
				✓	✓	✓	✓	-	-	-
Interrupt 2-speed constant quantity feed (2 tables used)	X-axis	DINT_X	10	✓	-	✓	-	-	-	✓
				-	-	✓	-	-	-	-
	Y-axis	DINT_Y	11	-	✓	-	✓	-	-	✓
				-	-	-	✓	-	-	-
	XY-axis	DINT_XY	12	✓	✓	✓	✓	-	-	✓
				-	-	✓	✓	-	-	-
Interrupt stop	X-axis	INT_X	13	✓	-	✓	-	-	-	✓
	Y-axis	INT_Y	14	-	✓	-	✓	-	-	✓
	XY-axis	INT_XY	15	✓	✓	✓	✓	-	-	✓
Multi-speed operation (requires multiple tables used)	X-axis	DRVC_X	16	✓	-	✓	-	-	-	✓
	Y-axis	DRVC_Y	17	-	✓	-	✓	-	-	✓
Linear interpolation		LIN	19	✓	✓	✓	-	-	-	✓
Linear interpolation (interrupt stop)		LIN_INT	20	✓	✓	✓	-	-	-	✓
Circular interpolation (center, CW direction)		CW_i	21	✓	✓	✓	-	✓	✓	✓
Circular interpolation (center, CCW direction)		CCW_i	22	✓	✓	✓	-	✓	✓	✓
Circular interpolation (radius, CW direction)		CW_r	23	✓	✓	✓	-	✓	-	✓
Circular interpolation (radius, CCW direction)		CCW_r	24	✓	✓	✓	-	✓	-	✓
Mechanical zero return	X-axis	DRVZ_X	25	-	-	-	-	-	-	✓
	Y-axis	DRVZ_Y	26	-	-	-	-	-	-	✓
	XY-axis	DRVZ_XY	27	-	-	-	-	-	-	✓
Current address change	X-axis	SET_X	90	✓	-	-	-	-	-	✓
	Y-axis	SET_Y	91	-	✓	-	-	-	-	✓
	XY-axis	SET_XY	92	✓	✓	-	-	-	-	✓
Absolute address specification		ABS	93	-	-	-	-	-	-	✓
Relative address specification		INC	94	-	-	-	-	-	-	✓
Dwell		TIM	95	✓	-	-	-	-	-	✓
				-	✓	-	-	-	-	✓
Jump		JMP	96	✓	-	-	-	-	-	-
				-	✓	-	-	-	-	-

*2. For details on the user unit, refer to the following.

→ **Refer to section 7.7**

*3. The m code is an auxiliary command to support positioning data in execution.
For details on m code, refer to the following.

→ **Refer to section 10.9**

10.1.4 Table operation execution procedure

The following shows the procedure for executing table operation and describes the operation.

1 Set the operation pattern of the control data and the table start No.

Item	BFM number		Content
	X-axis	Y-axis	
Operation pattern selection	BFM #520	BFM #620	b9 : Table operation (individual) Table operation is executed by X-axis table data and Y-axis table data. b10: Table operation (simultaneous) Table operation is executed by XY-axis table data.
Table operation start No.	BFM #521	BFM #621	Specify the table No. of the table operation to be executed. When setting the table operation (simultaneous) in operation patterns, set X-axis table operation start No. only. Setting range : 0 to 299

Writing table operation data

Write table operation data to buffer memory beforehand, following the procedure below:

- Transfer the table information from the 20SSC-H flash memory to buffer memories (only while power ON)
  → **Refer to Chapter 6**
- Write (transfer) table data to buffer memories with FX Configurator-FP.
  → **For details on operation, refer to the FX Configurator-FP Operation Manual**
- Write table information by a sequence program.
  → **For an explanation of applied instructions, refer to the Programming Manual**
- Change (write) table information by the test function in GX Developer's BFM monitor.
  → **For details on operation, refer to the GX Developer Operating Manual**

2 When rebooting the START command, executes the table operation.

When operating XY-axis table information, turn the START command of the X-axis from OFF to ON.

3 20SSC-H executes table operation in numerical order the table operation start No.

20SSC-H executes table operation in numerical order until the table No. with END command in operation information.

4 After executing the table No. in operation information, the table operation ends.

10.2 How to Set Table Information

20SSC-H has 2 procedures to set table information, via FX Configurator-FP or by a sequence program.

Setting table information by sequence program

To set table information by sequence program, write each setting to 20SSC-H buffer memory by TO instruction, or move instructions (MOV, etc.) for direct specification.
For details on buffer memory assignments, refer to the following.

→ **Refer to Sections 10.3 and 11.5**

Note

It is strongly recommended to set and store table information in the flash memory via FX Configurator-FP. When table information is set by sequence program, a considerable amount of the sequence program and devices are used, which makes the program complicated and increases the scan time.

Setting table information on FX Configurator-FP

Set value with the X-axis, Y-axis, XY-axis table information edit windows in FX Configurator-FP.
For details on operation of FX Configurator-FP, refer to the following manual.

→ **FX Configurator-FP Operation Manual**

- Operation method

1) Double-click "File name"→"Edit"→"X-axis table information", "Y-axis table information" or "XY-axis table information" in the file data list.
2) The selected X-axis table information, Y-axis table information or XY-axis table information edit window is displayed.

Note

Note that the procedures to set the table information from FX Configurator-FP and a sequence program are different.

●The position of the operation information is different.

a) Position information
b) Speed information
c) Operation information
d) m code information
e) Circle information

1) X-axis, Y-axis table information

・Buffer memory

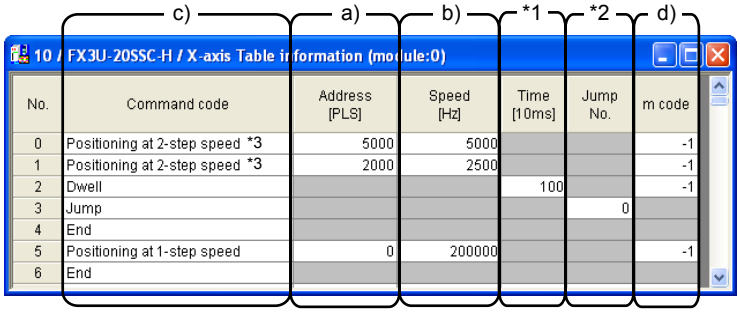
Table No.	a) Position information	b) Speed information	c) Operation information	d) m code information
0	5000	5000	7*3	-1
1	2000	2500	7*3	-1
2	100*1	-	95	-1
3	0*2	-	96	-1
4	-	-	0	-
5	0	200000	1	-1
6	-	-	0	-

*1, *2 The setting method for the following information is different.

・Dwell time
Buffer memory : Set in position information.
FX Configurator-FP : Set in time

・Jump point table No.
Buffer memory : Set in position information.
FX Configurator-FP : Set in jump No.

・FX Configurator-FP



*3 In 2-speed positioning operation and interrupt 2-speed constant quantity feed operation, two setting rows are required.

2) XY-axis table information

・Buffer memory

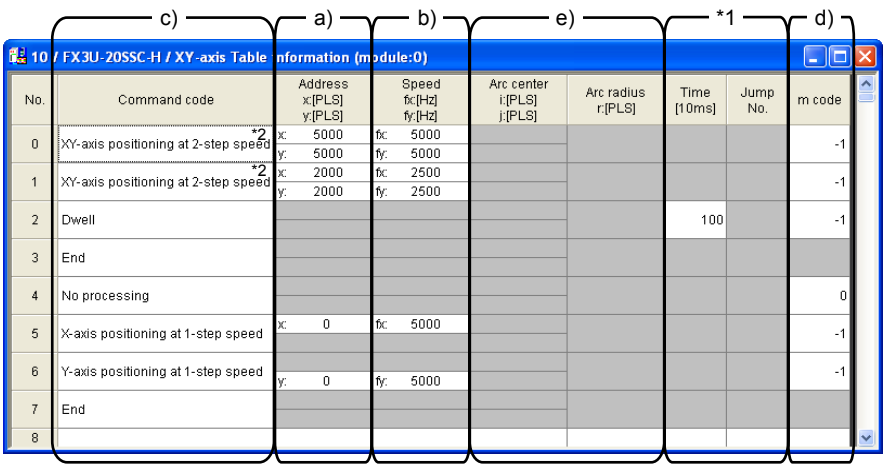
Table No.	a) Position information		b) Speed information		e) Circle information		c) Operation information	d) m code information
	X-axis	Y-axis	X-axis	Y-axis	X-axis	Y-axis		
0	5000	5000	5000	5000	-	-	9*2	-1
1	2000	2000	2500	2500	-	-	9*2	-1
2	100*1	-	-	-	-	-	95	-1
3	-	-	-	-	-	-	0	-
4	-	-	-	-	-	-	-1	-
5	0	-	5000	-	-	-	1	-1
6	-	0	-	5000	-	-	2	-1
7	-	-	-	-	-	-	0	-

*1 The setting method for the following information is different.

・Dwell time
Buffer memory : Set in position information.
FX Configurator-FP : Set in time

・Jump point table No.
Buffer memory : Set in position information.
FX Configurator-FP : Set in Jump No.

・ FX Configurator-FP



*2 In 2-speed positioning operation and interrupt 2-speed constant quantity feed operation, two setting rows are required.

10.3 Tables and BFM No. Allocation

Stores the table operation information to the 20SSC-H buffer memory. There are 2 BFM types, one for operation by individual axis (X/Y axis) and the other for XY-axis simultaneous operation.

Table No.	Items		BFM No.		
			X-axis table information	Y-axis table information	XY-axis table information
0	Position information	Position data x	BFM #1001, #1000	-	BFM #7001, #7000
		Position data y	-	BFM #4000, #4001	BFM #7003, #7002
	Speed information	Speed data f, fx	BFM #1003, #1002	-	BFM #7005, #7004
		Speed data fy	-	BFM #4002, #4003	BFM #7007, #7006
	Circle information	Center coordinate i, radius r	-	-	BFM #7009, #7008
		Center coordinate j	-	-	BFM #7011, #7010
	Operation information		BFM #1004	BFM #4004	BFM #7012
	m code information		BFM #1005	BFM #4005	BFM #7013
:					
299	Position information	Position data x	BFM #3991, #3990	-	BFM #12981, #12980
		Position data y	-	BFM #6991, #6990	BFM #12983, #12982
	Speed information	Speed data f, fx	BFM #3993, #3992	-	BFM #12985, #12984
		Speed data fy	-	BFM #6993, #6992	BFM #12987, #12986
	Circle information	Center coordinate i, radius r	-	-	BFM #12989, #12988
		Center coordinate j	-	-	BFM #12991, #12990
	Operation information		BFM #3994	BFM #6994	BFM #12992
	m code information		BFM #3995	BFM #6995	BFM #12993

Note

- The save command (BFM #523 b2 to b4) writes and stores the BFM table information in the 20SSC-H flash memory.
- The default value for table information is "-1".
- 20SSC-H stores the executing table number in executing table number (BFM #16, #116).

Caution for setting

Selecting the following patterns in the operation information requires two tables.

- 2-speed Positioning operation
- Interrupt 2-speed constant quantity feed

In the case of X-axis, Y-axis table information

Table No.	Position information	Speed information	Operation information	m code information
0	500	500	7	-1
1	3000	300	7	-1
⋮	⋮	⋮	⋮	
10	5000	500	7	-1
11	3000	1000	3	-1

One positioning operation is performed using two tables. (*1)

When only 1 table is set, the next table (table No.11) is judged to be the 2nd speed of table No.10 and operation is performed using that table information. (*2)

In the case of XY-axis table information

Table No.	Position information		Speed information		Circle data		Operation information	m code information
	X-axis	Y-axis	X-axis	Y-axis	X-axis	Y-axis		
0	5800	10000	5000	6000	-	-	9	-1
1	3000	5000	1000	1200	-	-	9	-1
⋮			⋮				⋮	
10	500	1000	500	600	-	-	9	-1
11	800	1500	1000	1200	-	-	3	-1

*1

*2

10.4 Current Position Change

This operation information changes the current address (user/pulse) value to the one specified in the position (address) information.

10.5 Absolute Address Specification

This operation information sets the position data of subsequent table operations to an absolute address based on the (0, 0) point.

Note

- When table operation is started, the position information in handled on the absolute address specification (default). To use position information by relative addresses, the operation information of positioning control must be set beforehand.
- The arc center (i , j), radius r, Interrupt 1-speed constant quantity feed and, Interrupt 2-speed constant quantity feed setting items are handled as relative addresses.

10.6 Relative address specification

This operation information sets the position data of subsequent table operations to a relative address based on the current address.

Point

When table operation is started, the position information in handled on the absolute address specification (default). To use position information by relative addresses, the operation information of positioning control must be set beforehand.

10.7 Jump

When executing this operation information, jumps to the specified table No..
Note that table No. does not jump from X-axis table information to Y-axis table information.
Set the table No. of the jump point to the position information of the table information in buffer memory.
(On FX Configurator-FP, set the table No. of the jump point by the Jump No.)

10.8 Dwell

When executing this operation information, operation waits for the specified time. A dwell is used as a wait to move between operations.
Set the dwell by the position information of the table information in the buffer memory.
(On FX Configurator-FP, set the dwell by the Time.)

10.9 m code

The m code is an auxiliary command to support positioning data in execution.
When an m code turns ON in table operation, 20SSC-H stores the table No. in monitor data as an m code number, while also turning ON the m code ON flag in status information.
There are two modes for m code, after mode and with mode, and each mode has a different ON timing.

Mode	Content	m code No.
after mode	The m code turns ON when the operation of table information is completed.	0 to 9999
with mode	The m code turns ON when the operation information is started.	10000 to 32767

10.9.1 After mode

The specified m code turns ON after the operation.

→ **For details on related setting items, refer to Subsection 10.9.3**

1. Operation

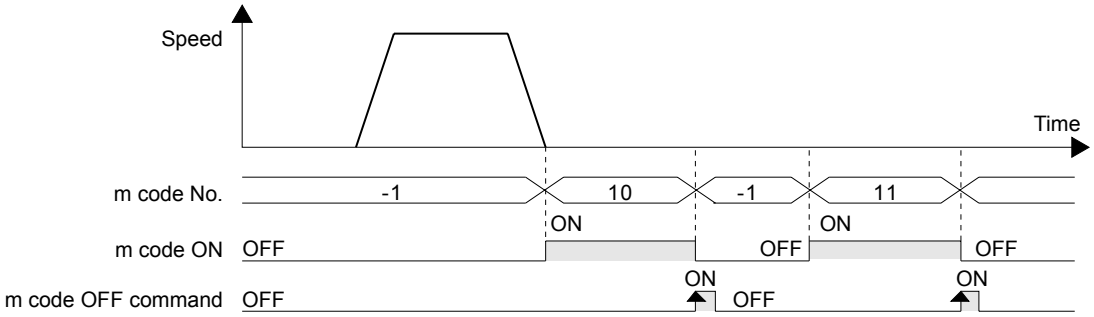


Table No.	Operation information	m code information
0	1 (1-speed positioning)	10 (after mode)
1	-1 (no processing)	11 (after mode)
2	0 (END)	-1

1) When the table No. 0 operation with m code "10" ends, the m code ON flag in the status information turns ON, and the 20SSC-H stores "10" in the m code No. of monitor data.
2) At m code OFF, the m code ON flag and m code itself turns OFF, and 20SSC-H stores "-1" in the m code No. of monitor data.
3) At m code OFF, 20SSC-H executes the next table No..

Note

- With after-mode m codes in multi-speed operations and continuous pass operations, the operation does not continue the table since 20SSC-H suspends the operation until m code OFF.
- With "0" in m code information, 20SSC-H turns to standby mode. With start command or m code OFF command, the m code turns OFF.
- To turn only the m code ON without performing positioning operation, set "m code" to the operation information of the table information, and set the m code information.

2. Available m code Nos.

To use m code in the after mode, set m code in the range 0 to 9999 to the m code information.

10.9.2 With mode

The specified m code turns ON when the operation starts.

→ **For details on related setting items, refer to Subsection 10.9.3**

1. Operation

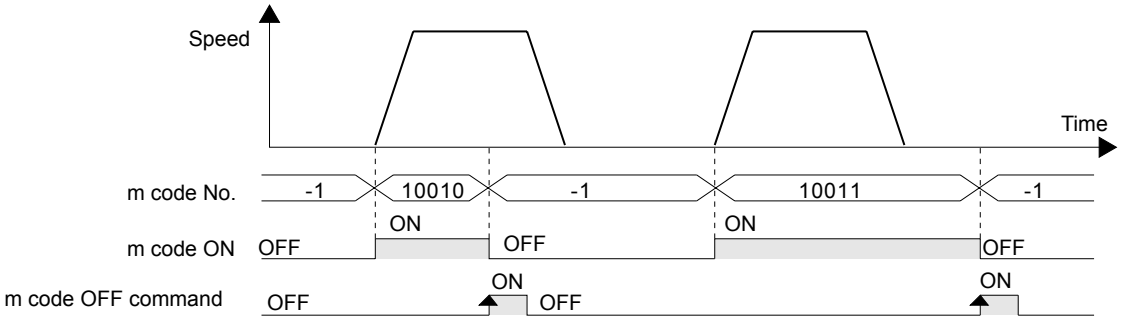
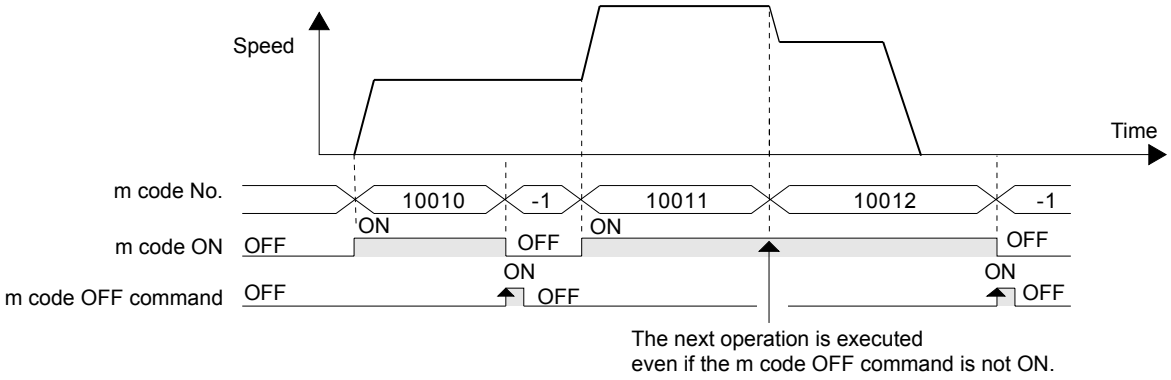


Table No.	Operation information	m code information
0	1 (1-speed positioning)	10010 (with mode)
1	1 (1-speed positioning)	10011 (with mode)
2	0 (END)	-1

1) 20SSC-H stores "10010" in the m code No. of monitor data while also starting table No. 0 with "10010" and turning ON the m code ON flag in the status information.
2) At m code OFF, the m code ON flag and m code itself turns OFF, and 20SSC-H stores "-1" in the m code No. of monitor data.
3) When operation of the operation information is completed, the next table No. is executed even if the m code OFF command does not turn ON.

Note

- With "0" in m code information, 20SSC-H turns to standby mode. With start command or m code OFF command, the m code turns OFF.
- 20SSC-H continues operating while multi-speed operation and continuous pass operation without m code OFF commands. The specified m codes also turn ON in numerical order.



2. Available m code Nos.

To use the m code in the with mode, set the m code in the range from 10000 to 32767.

10.9.3 Related buffer memory

Item		BFM number		Content
		X-axis	Y-axis	
Control data				
Operation command 1	m code OFF command	BFM #518 b11	BFM #618 b11	When this command is ON, the m code is turned OFF and -1 is stored to the m code No.
Monitor data				
m code No.		BFM #9	BFM #109	Stores the m code number in ON state. Stores -1 when the m code is OFF.
Status information	m code ON	BFM #28 b8	BFM #128 b8	This flag turns ON when an m code turns ON.

10.10 Continuous Pass Operation

Continuously executing interpolation operation (linear interpolation, circular interpolation) results in a continuous pass operation.

1. Operations valid for continuous pass operation

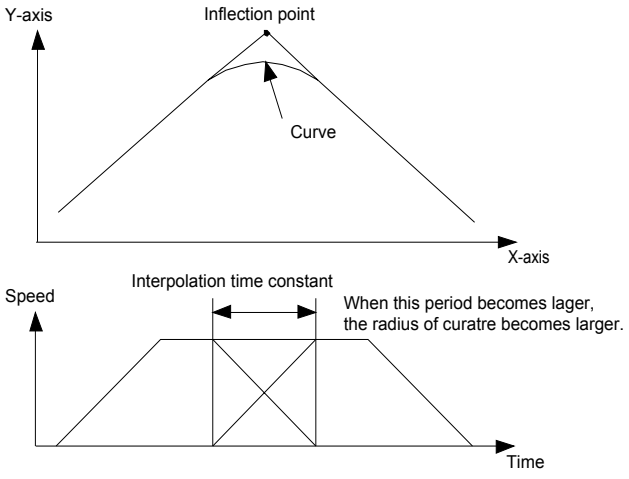
- Operations that result in continuous pass operation
  - Linear interpolation
  - Circular interpolation
- Operations that do not result in continuous pass operation
  - Variable speed operation
  - Manual pulse generator
  - JOG operation
  - 1-speed positioning operation
  - Interrupt 1-speed constant quantity feed
  - 2-speed positioning operation
  - Interrupt 2-speed constant quantity feed
  - Interrupt stop
  - Variable speed operation
  - Multi-speed operation
  - Linear interpolation (interrupt stop)
  - Mechanical zero return
  - Dwell
  - End

Note

- The number of continuous passes is not limited.
- Continuous pass operation does not continue if interpolation operations include the following:
  - No processing
  - Jump
- Continuous pass operation is not executed if the program contains the following typea of instructed interpolation operation:
  - When after mode m code are set
  - When the travel time of the operation is 50 ms or less
  - When the travel time of the operation is “interpolation time constant × 2” or less
  - When the preparation for the next operation (information pre-reading) is not in time

2. Content of continuous pass operation

- Consecutive interpolation instructions do not stop, and inflection points become smooth curves.
  The radius of curvature varies depending on the interpolation time constant.
  A larger interpolation time constant makes a larger radius of curvature.
- To draw a precise locus, apply circular interpolation operations.
- When the speeds between each interpolation operation differ, the velocity becomes the composite speed with the one at the next step.



11. Buffer Memory (Parameters & Monitored Data)

11.1 Positioning Parameters

The positioning parameters to set speed and units of measurement.
The BFMs in positioning parameters are readable/writable.
For X-axis: BFM #14000 to #14199
For Y-axis: BFM #14200 to #14399

Caution

Do not use unlisted BFMs for changing values not described in this section.

11.1.1 Operation parameters 1 [BFM #14000, BFM #14200]

BFM Number		Bit Number	Description	Default
X-axis	Y-axis			
BFM #14000	BFM #14200	b0 b1	System of units (user unit)*1 (b1,b0)=00: motor system (b1,b0)=01: mechanical system (b1,b0)=10: composite system (b1,b0)=11: composite system	H0000
		b2 b3	User unit setting*1 (b1,b0)=00: μm, cm/min (b1,b0)=01: 10^{-4}inch, inch/min (b1,b0)=10: mdeg, 10deg/min (b1,b0)=11: not available	
		b4 b5	Position data magnification*2 Position data can be multiplied by 1, 10, 100, and 1000 times. (b5,b4)=00: 1 time (b5,b4)=01: 10 times (b5,b4)=10: 100 times (b5,b4)=11: 1000 times	
		b6 to b9	Not available	
		b10	Zero return direction 1: In zero return, starts operation toward the direction increasing current value. 0: In zero return, starts operation toward the direction decreasing current value. →**For details on the zero return operation, refer to Section 8.1**	
		b11	Acceleration/deceleration mode 1: Operates in approximate S-shaped acceleration/deceleration. (Trapezoidal ACC/DEC in interpolations) 0: Operates in trapezoidal acceleration/deceleration. →**For details on the acceleration/deceleration mode, refer to Section 7.2**	
		b12	DOG switch input logic Sets DOG switch input logic for 20SSC-H. 1: NC-contact (operates at input OFF) 0: NO-contact (operates at input ON) →**For details on the DOG mechanical zero return operation, refer to Subsection 8.1.2**	
		b13	Count start timing for zero-phase signal 1: DOG forward end (at off-to-on transition of DOG input) A front end of DOG triggers the zero-phase signal count. 0: DOG backward end (at on-to-off transition of DOG input) A back end of DOG triggers the zero-point signal count. →**For details on the DOG mechanical zero return operation, refer to Subsection 8.1.2**	
		b14	Not available	

BFM Number		Bit Number	Description	Default
X-axis	Y-axis			
BFM #14000	BFM #14200	b15	STOP mode 1: Suspends the operation, and the START command starts the operation for the remaining travel distance. 0: Ends the operation, canceling the remaining distance. In table operations, operation is terminated. →**For details on the stop command, refer to Section 7.4**	H0000

*1. User unit setting
Positioning and speed units are customizable as user units.
The combination of system of units (b1,b0) and unit setting bit (b3,b2) gives the following settings.
→ **For details on the user unit, refer to Section 7.7**

Unit Setting Bit Status		System of units Bit Status		System of units	Unit	
b3	b2	b1	b0		Positioning Unit	Speed Unit
-	-	0	0	Motor system units	PLS	Hz
0	0	0	1	Mechanical system units	μm	cm/min
0	1	0	1		10^{-4}inch	inch/min
1	0	0	1		mdeg	10deg/min
0	0	1	0/1	Composite system units	μm	Hz
0	1	1	0/1		10^{-4}inch	
1	0	1	0/1		mdeg	

Note

Motor system units and mechanical system units require the pulse/feed rate settings.

*2. The positioning data with position data magnification are as follows:

- Mechanical origin address
- Software limit (upper)
- Software limit (lower)
- Target address1
- Target address2
- Target position change value (address)
- Current address (user)
- Current address (pulse)
- Table information (position data)
- Table information (circular data)

Example:

The actual address (or travel distance) with target address 1 "123" and position data magnification "1000" are as follows:

Motor system units: $123 \times 1000 = 123000$ (pulse)

Mechanical system units, composite system units: $123 \times 1000 = 123000$ (μm, mdeg, 10^{-4}inch)
$= 123$(mm, deg, 10^{-1}inch)

11.1.2 Operation parameters 2 [BFM #14002, BFM #14202]

BFM Number		Bit Number	Description	Default
X-axis	Y-axis			
BFM #14002	BFM #14202	b0	Enables or disables the servo end check function. →For details on the servo end check, refer to Subsection 7.5.2. 1: Enable At an in-position signal, determinates the positioning operation completion 0: Disable	H0007
		b1	Enables or disables the servo ready check function. →For details on the servo ready check, refer to Subsection 7.5.1. 1: Enable Checks the ready signal ON/OFF at operation start / while operation 0: Disable	
		b2	Enables or disables the OPR interlock function. 1: Enable Disables the START command without zero return completion Enables the START command with zero return completion (zero return completed: ON) 0: Disable	
		b3 to b15	Not available	

11.1.3 Pulse rate [BFM #14005, #14004, BFM #14205, #14204]

This parameter sets the number of pulses to rotate servo motors once. "Mechanical system units" and "Composite system units" require this setting, "Motor system units" ignores it.

→ **For details on the system of units, refer to Section 7.7**

BFM Number		Description	Default
X-axis	Y-axis		
BFM #14005, #14004	BFM #14205, #14204	Setting range: 1 to 200,000,000 PLS/REV	K262,144

11.1.4 Feed rate [BFM #14007, #14006, BFM #14207, #14206]

This parameter sets the travel distance per revolution of the motor. "Mechanical system units" and "Composite system units" require this setting, "Motor system units" ignores it.

→ **For details on the system of units, refer to Section 7.7**

BFM Number		Description	Default
X-axis	Y-axis		
BFM #14007, #14006	BFM #14207, #14206	Setting range: 1 to 200,000,000 (μm/REV, 10^{-4}inch/REV, mdeg/REV)	K52,428,800

11.1.5 Maximum speed [BFM #14009, #14008, BFM #14209, #14208]

This parameter sets the maximum speed for each operation.

→ **For details on the maximum speed, refer to Section 7.2**

BFM Number		Description	Default
X-axis	Y-axis		
BFM #14009, #14008	BFM #14209, #14208	Setting range: 1 to 2,147,483,647(user unit)*1 The value must be within the range from 1 to 50,000,000 Hz when converted to pulse data*1.	K4,000,000

*1. Refer to the section shown below for details on the user units and converted pulse data.

→ **Refer to Section 7.7**

Note

Set JOG speed, zero return speed (high speed), zero return speed (creep), operation speed 1 and operation speed 2 at or below the maximum speed. If the operation speed exceeds the maximum speed, 20SSC-H operates at the maximum speed.

Cautions in setting

Set the maximum speed at or below the maximum rotation speed of the servo motor.
The formula to calculate the rotation speed of the servo motor from the pulse (Converted pulse data) is as follows.

→ **For details on the converted pulse data, refer to Section 7.7**

Servo motor rotational speed (r/min) =
Operation speed converted into pulse (Hz) × 60 ÷ resolution per revolution of servo motor

Servo Amplifier	Resolution per Revolution of Servo Motor (PLS/REV)
MR-J3B	262144

11.1.6 JOG speed [BFM #14013, #14012, BFM #14213, #14212]

This parameter sets the speed for Forward JOG and Reverse JOG operations.

→ **For details on the JOG operations, refer to Section 8.2**

BFM Number		Description	Default
X-axis	Y-axis		
BFM #14013, #14012	BFM #14213, #14212	Setting range: 1 to 2,147,483,647 (user unit)*1 Set the value within 1 to 50,000,000Hz in converted pulse data*1.	K2,000,000

*1. Refer to the section shown below for details on the user units and converted pulse data.

→ **Refer to Section 7.7**

Note

- Set the JOG speed at or below the maximum speed.
  When the JOG speed exceeds the maximum speed, 20SSC-H operates at the maximum speed.
- Speed change commands in positioning operation change the JOG speed into a preset value.

11.1.7 JOG Instruction evaluation time [BFM #14014, BFM #14214]

This parameter sets the evaluation time for the forward/reverse JOG command to determine whether the control is inching or continuous.
For forward/reverse commands that are ON for longer than the JOG evaluation time, 20SSC-H executes continuous operation. For forward/reverse commands that are ON for shorter than the JOG evaluation time, the 20SSC-H executes inching operation.

→ **For details on the JOG operations, refer to Section 8.2**

BFM Number		Description	Default
X-axis	Y-axis		
BFM #14014	BFM #14214	Setting range: 0 to 5000 ms	K300

POINT

The JOG instruction evaluation time “0 ms” gives continuous operation only.

11.1.8 Acceleration time [BFM #14018, BFM #14218]

This parameter sets a time for the operation speed to reach the maximum speed from zero.

→ **For details on the acceleration time, refer to Section 7.2**

BFM Number		Description	Default
X-axis	Y-axis		
BFM #14018	BFM #14218	Setting range: 1 to 5000 ms	K200

Note

- The acceleration time becomes 1 ms when set at 0 ms or lower, and becomes 5000 ms when set at 5001 ms or higher.
- Set the time within the range from 64 (greater than 64) to 5000 ms in the approximate S-shaped acceleration/deceleration.

11.1.9 Deceleration time [BFM #14020, BFM #14220]

This parameter sets the time for the operation speed to reach to zero from the maximum.

→ **For details on the deceleration time, refer to Section 7.2**

BFM Number		Description	Default
X-axis	Y-axis		
BFM #14020	BFM #14220	Setting range: 1 to 5000 ms	K200

Note

- The acceleration time becomes 1 ms when set at 0 ms or lower, and becomes 5000 ms when set at 5001 ms or higher.
- Set the time within the range from 64 (greater than 64) to 5000 ms in the approximate S-shaped acceleration/deceleration.

11.1.10 Interpolation time constant [BFM #14022, BFM #14222]

This parameter sets the time for the interpolation operation speed to reach the maximum speed from zero (acceleration) or to reach zero from the maximum speed (deceleration).

→ **For details on the interpolation time constant, refer to Section 7.2**

BFM Number		Description	Default
X-axis	Y-axis		
BFM #14022	BFM #14222	Setting range: 1 to 5000 ms	K100

Note

The acceleration time becomes 1 ms when set at 0 ms or lower, and becomes 5000 ms when set at 5001 ms or higher.

11.1.11 Zero return speed (High Speed) [BFM #14025, #14024, BFM #14225, #1424]

This parameter sets the mechanical zero return operation speed (high speed) [DOG, Stopper #1].

→ **For details on the mechanical zero return, refer to Section 8.1**

BFM Number		Description	Default
X-axis	Y-axis		
BFM #14025, #14024	BFM #14225, #14224	Setting range: 1 to 2,147,483,647 (user unit)*1 Set the value within 1 to 50,000,000Hz in converted pulse data*1.	K4,000,000

*1. Refer to the section shown below for details on the user units and converted pulse data.

→ **Refer to Section 7.7**

Note

- Set the zero return speed (high speed) at or below the maximum speed.
  When the zero return speed (high speed) exceeds the maximum speed, 20SSC-H operates at the maximum speed.
- Speed change commands in positioning operation change the zero return speed (high speed) into a preset value.

11.1.12 Zero return speed (Creep) [BFM #14027, #14026, BFM #14227, #14226]

This parameter sets the mechanical zero return operation speed (creep) [DOG, Stopper #1, #2].

→ **For details on the mechanical zero return, refer to Section 8.1**

BFM Number		Description	Default
X-axis	Y-axis		
BFM #14027, #14026	BFM #14227, #14226	Setting range: 1 to 2,147,483,647 (user unit)*1 Set the value within 1 to 50,000,000Hz in converted pulse data*1.	K100,000

*1. Refer to the section shown below for details on the user units and converted pulse data.

→ **Refer to Section 7.7**

Note

- Set the zero return speed (creep) at or below the maximum speed and zero return speed (high speed). When the zero return speed (creep) exceeds the maximum speed, 20SSC-H operates at the maximum speed.
- Set the speed as slow as possible to achieve the best stop position accuracy.

11.1.13 Mechanical origin address [BFM #14029, #14028, BFM #14229, #14228]

This parameter sets the current value address at zero return operation completion.
After mechanical zero return completion, the 20SSC-H writes the current address to this parameter.

→ **For details on the mechanical zero return, refer to Section 8.1**

BFM Number		Description	Default
X-axis	Y-axis		
BFM #14029, #14028	BFM #14229, #14228	Setting range: -2,147,483,648 to 2,147,483,647 (user unit)*1 Set the value within -2,147,483,648 to 2,147,483,647PLS in converted pulse data*1.	K0

*1. Refer to the section shown below for details on the user units and converted pulse data.

→ **Refer to Section 7.7**

11.1.14 Zero-phase signal count [BFM #14030, BFM #14230]

This parameter sets the number of zero-phase signal counts in the mechanical zero return operation [DOG, Stopper #1].
The mechanical zero return ends at the specified number of zero-phase signal count.

→ **For details on the mechanical zero return, refer to Section 8.1**

BFM Number		Description	Default
X-axis	Y-axis		
BFM #14030	BFM #14230	Setting range: 0 to 32767 PLS	K1

Note

- With the value "0" set in mechanical zero return operation [DOG], the 20SSC-H immediately stops when the zero-phase signal count starts. In this case, the operation abruptly stops from the zero return speed (creep/high speed). Observe the following items to protect peripheral devices from damage.
  - Set the zero return speed (creep) as slow as possible for safety.
  - Change the trigger of the zero-point signal count at the DOG backward end.
  - Design the DOG to allow the machine to gently decelerate to the zero return speed (creep) before the zero-phase signal count.

11.1.15 Zero return mode [BFM #14031, BFM #14231]

This parameter selects mechanical zero return operations.

→ **For details on the zero return operation, refer to Section 8.1**

BFM Number		Description	Default
X-axis	Y-axis		
BFM #14031	BFM #14231	0: DOG 1: Data set type 2: Stopper #1 3: Stopper #2	K0

11.1.16 Servo end evaluation time [BFM #14032, BFM #14232]

This parameter sets the evaluation time for the servo end check.

→ **For details on the servo end check, refer to Section 7.6.2**

BFM Number		Description	Default
X-axis	Y-axis		
BFM #14032	BFM #14232	Setting range: 1 to 5000 ms	K5000

Note

- To apply this function, set b0 in operation parameter 2 to ON.

→ **For details on the operation parameters 2, refer to Subsection 11.1.2**

- For a servo end evaluation time setting outside of the range, see the following:
  - Becomes 1 ms when set at 0 ms or less.
  - Becomes 5000 ms when set at 5001 ms or more.

11.1.17 Software limit (upper) [BFM #14035, #14034, BFM #14235, #14234] Software limit (lower) [BFM #14037, #14036, BFM #14237, #14236]

This parameter sets each address value for the software limit.
The software limit is an operating limit from the current address after zero return operation completion, which becomes enabled upon completion of the zero return operation.

→ **For details on the software limit, refer to Subsection 7.3.3**

BFM Number		Description	Default
X-axis	Y-axis		
BFM #14035, #14034	BFM #14235, #14234	Sets the software limit (upper) Setting range: -2,147,483,648 to 2,147,483,647 [User unit]*1 Set the value within -2,147,483,648 to 2,147,483,647PLS in the converted pulse data*1.	K0
BFM #14037, #14036	BFM #14237, #14236	Sets the software limit (lower) Setting range: -2,147,483,648 to 2,147,483,647 [User unit]*1 Set the value within -2,147,483,648 to 2,147,483,647PLS in the converted pulse data*1.	K0

*1. Refer to the section shown below for details on the user units and converted pulse data.

→ **Refer to Section 7.7**

POINT

The relationship between the upper and lower software limits must be as follows:

- When enabling the software limit
  Software limit (upper) is larger than Software limit (lower)
- When disabling the software limit
  Software limit (upper) is equal to Software limit (lower)
  Software limit (upper) is smaller than Software limit (lower)

11.1.18 Torque limit [BFM #14038, BFM #14238]

This parameter sets the torque limit for the servo motor and magnifies the servo motor torque in the range from 0.1 to 1000.0%. For a target move with a torque limit, refer to the section shown below.

→ **For details on the torque limit, refer to Subsection 7.6.3**

BFM Number		Description	Default
X-axis	Y-axis		
BFM #14038	BFM #14238	Setting range: 1 to 10000 (× 0.1%)	K3000

11.1.19 Zero return torque limit [BFM #14040, BFM #14240]

This parameter sets the torque limit for the mechanical zero return operation (creep speed) and magnifies the servo motor torque during the zero return operation (creep speed) in the range from 0.1 to 1000.0%.

→ **For details on the torque limit, refer to Subsection 7.6.3**

BFM Number		Description	Default
X-axis	Y-axis		
BFM #14040	BFM #14240	Setting range: 1 to 10000 (× 0.1%)	K3000

11.1.20 External input selection [BFM #14044, BFM #14244]

BFM Number		Bit Number	Description	Default
X-axis	Y-axis			
BFM #14044	BFM #14244	b0	Sets the FLS, RLS signals from the servo amplifier to be used/not used →**For instructions on how to use forward/reverse rotation limit, refer to Section 7.3** 1: Use Use forward/reverse rotation limits from the servo amplifier and those from the PLC. 0: Not use Use only forward/reverse rotation limits from the PLC.	H0100
		b1	Sets the DOG signals from the servo amplifier to be used/not used →**For details on the mechanical zero return, refer to Section 8.1** 1: Use Use DOG signals from the servo amplifier. 0: Not use Use DOG signals from the 20SSC-H. The "b12" in command parameter1 sets the 20SSC-H DOG signal. →**For details on the operation parameters 1, refer to Subsection 11.1.1**	
		b2 to b7	Not available	
		b8	Sets the FLS/RLS signal logic of the servo motor 1: NC-contact (servo amplifier) 0: NO-contact (servo amplifier)	
		b9	Sets the DOG signal logic of the servo motor 1: NC-contact (servo amplifier) 0: NO-contact (servo amplifier)	
		b10 to b15	Not available	

11.2 Servo Parameters

Various parameters for the servo amplifier can be set. The following buffer memories in servo parameters are readable and writable.
For details on the servo amplifier parameters in the table below with their parameter numbers, refer to the manual of the servo amplifier.

→ **Refer to the manual of the servo amplifier**

For X-axis: BFM #15000 to #15199
For Y-axis: BFM #15200 to #15399

CAUTION

Do not use unlisted BFMs for changing values not described in this section.

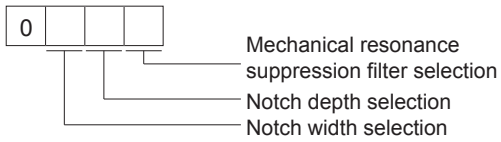
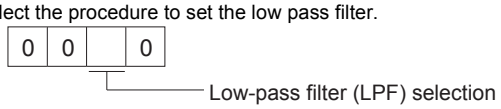
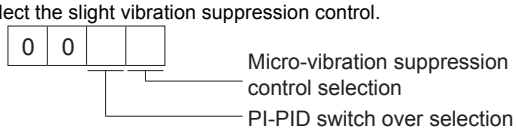
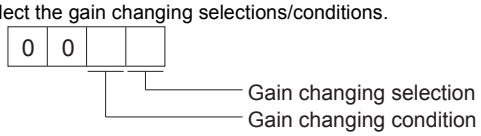
11.2.1 Servo parameters (Basic settings)

BFM Number		Servo Amplifier Parameter No.	Name	Description	Default
X-axis	Y-axis				
BFM #15000	BFM #15200	-	Servo series	Specify the series name of the servo amplifier connected to the 20SSC-H. 0: None 1: MR-J3B **CAUTION** The servo series name must be specified. 20SSC-H at factory default value "0" does not communicate with servo amplifiers.	K0
BFM #15002	BFM #15202	PA02	Regenerative brake option	Select which regenerative brake option to use, or not use the option. 0 0 □ □ Revival option selection 00: Not use regenerative brake resistor 01: FR-BU / FR-RC 02: MR-RB032 03: MR-RB12 04: MR-RB32 05: MR-RB30 06: MR-RB50 07: MR-RB31 08: MR-RB51 09: FMR-RB51	H0000
BFM #15003	BFM #15203	PA03	Absolute position detection system	Select whether or not to use the absolute position detection system. 0 0 0 □ Absolute position detection system setting 0: Disable (use in incremental system) 1: Enable (use in absolute position detection system) **CAUTION** A parameter error occurs if you select "1: Enable (use in absolute position detection system)" when using the increment synchronous encoder.	H0000
BFM #15004	BFM #15204	PA04	Function selection A-1	Select whether to use or not use the servo forced stop function (EM1). 0 □ 0 0 Servo forced stop input setting 0: Enable (use the forced stop (EM1)) 1: Disable (not use the forced stop (EM1))	H0000
BFM #15008	BFM #15208	PA08	Auto tuning mode	Select the gain adjustment mode. 0 0 0 □ Gain adjustment mode setting 0: Interpolation mode 1: Auto tuning mode 1 2: Auto tuning mode 2 3: Manual mode	H0001

BFM Number		Servo Amplifier Parameter No.	Name	Description	Default
X-axis	Y-axis				
BFM #15009	BFM #15209	PA09	Auto tuning response	Set this if you want to improve the servo amplifier response. Low responsivity 1:(10.0Hz) ~ High responsivity 32:(400.0Hz) →	K12
BFM #15010	BFM #15210	PA10	In-position range	Set the range to output a positioning completion signal in units of command pulse. Setting range: 0 to 50000 PLS	K100
BFM #15014	BFM #15214	PA14	Rotation direction selection	Select the servo motor rotation direction when viewed from the servo amplifier's load side. 0: Forward rotation (CCW) when the current value is increased 1: Reverse rotation (CW) when the current value is increased	K0
BFM #15015	BFM #15215	PA15	Encoder output pulse	Set the number of pulses per revolution or output division ratio for encoder pulses (A-phase, B-phase) output by the servo amplifier Setting range: 1 to 65535 PLS/REV	K4000

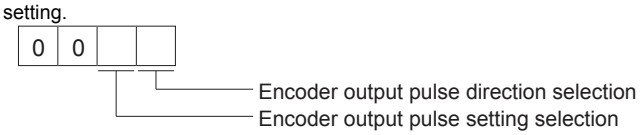
11.2.2 Servo parameters (Gain/Filter settings)

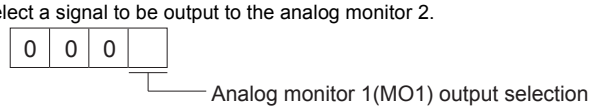
BFM Number		Servo Amplifier Parameter No.	Name	Description	Default
X-axis	Y-axis				
BFM #15019	BFM #15219	PB01	Adaptive tuning mode (Adaptive filter 2)	Select the adaptive filter tuning mode. 0: Filter OFF 1: Filter tuning mode (adaptive filter) 2: Manual mode	K0
BFM #15020	BFM #15220	PB02	Vibration suppression control tuning mode (advanced vibration suppression control)	Select the vibration suppression control tuning mode. 0: Vibration suppression control OFF 1: Vibration suppression control tuning mode 2: Manual mode	K0
BFM #15022	BFM #15022	PB04	Feed forward gain	Set the feed forward gain coefficient to be used for positioning control. Setting range: 0 to 100%	K0
BFM #15024	BFM #15224	PB06	Ratio of load inertia moment to servo motor inertia moment	Set the ratio of load inertia moment to servo motor inertia moment. Setting range: 0 to 3000 (×0.1 times)	K70
BFM #15025	BFM #15225	PB07	Model loop gain	Set the response gain up to the target position. Setting range: 1 to 2000 rad/s	K24
BFM #15026	BFM #15226	PB08	Position loop gain	Set the gain of the position loop. Setting range: 1 to 1000 rad/s	K37
BFM #15027	BFM #15227	PB09	Speed loop gain	Set the gain of the speed loop. Setting range: 20 to 50000 rad/s	K823
BFM #15028	BFM #15228	PB10	Speed integral compensation	Set the integral time constant of the speed loop. Setting range: 1 to 10000 (× 0.1 ms)	K337
BFM #15029	BFM #15229	PB11	Speed differential compensation	Set the differential compensation. Setting range: 0 to 1000	K980
BFM #15031	BFM #15231	PB13	Machine resonance suppression filter 1	Set the notch frequency of the machine resonance suppression filter 1. (Set the frequency in accordance with the mechanical resonance frequency.) Setting range: 100 to 4500 Hz	K4500
BFM #15032	BFM #15232	PB14	Notch shape selection 1	Specify the notch shape used for the machine resonance suppression filter 1 (Notch shape selection 1). 0 _ _ 0 Notch depth selection Notch width selection • Notch Depth: 0: Deep (-40db), 1: ↑ (-14db), 2: ↓ (-8db), 3: Shallow (-4db) Notch Width: 0: Standard (α=2), 1:↑ (α=3), 2:↓ (α=4), 3: Wide (α=5)	H0000
BFM #15033	BFM #15233	PB15	Machine resonance suppression filter 2	Set the notch frequency of the machine resonance suppression filter 2. (Set the frequency in accordance with the mechanical resonance frequency.) Setting range: 100 to 4500 Hz	K4500

BFM Number		Servo Amplifier Parameter No.	Name	Description	Default
X-axis	Y-axis				
BFM #15034	BFM #15234	PB16	Notch shape selection 2	Specify the notch shape used for the machine resonance suppression filter 2 (Notch shape selection 2).  • Select the machine resonance suppression filter 2 0: Disable 1: Enable • Notch Depth 0: Deep (-40db) 1: ↑(-14db) 2: ↓(-8db) 3: Shallow (-4db) Notch Width 0: Standard (α=2) 1: ↑(α=3) 2: ↓(α=4) 3: Wide (α=5)	H0000
BFM #15036	BFM #15236	PB18	Low pass filter setting	Set the low pass filter. Setting range: 100 to 18000 rad/s	K3141
BFM #15037	BFM #15237	PB19	Vibration suppression control vibration frequency setting	Set the vibration frequency for vibration suppression control to suppress low-frequency machine vibration, such as enclosure vibration. Setting range: 1 to 1000 (×0.1 Hz)	K1000
BFM #15038	BFM #15238	PB20	Vibration suppression control resonance frequency setting	Set the resonance frequency for vibration suppression control to suppress low-frequency machine vibration, such as enclosure vibration. Setting range: 1 to 1000 (× 0.1 Hz)	K1000
BFM #15041	BFM #15241	PB23	Low pass filter selection	Select the procedure to set the low pass filter.  0: Automatic setting 1: Manual setting (specify a number for the low pass filter setting)	H0000
BFM #15042	BFM #15242	PB24	Slight vibration suppression control selection	Select the slight vibration suppression control.  • Slight vibration suppression control selection 0: Disable 1: Enable • PI-PID switch over selection 0: Enables PI control 3: Enables PID control all the time	H0000
BFM #15044	BFM #15244	PB26	Gain changing selection	Select the gain changing selections/conditions.  • Gain changing selection 0: Disable 1: Settings designated by a gain change command take effect 2: Set command frequency as a trigger to change gain 3: Set droop pulses as a trigger to change gain 4: Set servo motor speed as a trigger to change gain • Gain changing condition 0: Valid when a value is bigger than the set value 1: Valid when a value is smaller than the set value	H0000
BFM #15045	BFM #15245	PB27	Gain changing condition	Set the value for gain changing condition. Setting range: 0 to 9999 (kpps, PLS, r/min)	K10
BFM #15046	BFM #15246	PB28	Gain changing time constant	Set the time constant for changing gain. Setting range: 0 to 100 ms	K1
BFM #15047	BFM #15247	PB29	Gain changing Ratio of load inertia moment to servo motor inertia moment	Set the ratio of load inertia moment to servo motor inertia moment when gain changing is valid. Setting range: 0 to 3000 (×0.1 times)	K70

BFM Number		Servo Amplifier Parameter No.	Name	Description	Default
X-axis	Y-axis				
BFM #15048	BFM #15248	PB30	Gain changing Position loop gain	Set the position loop gain when the gain changing is valid. Setting range: 1 to 2000 rad/s	K37
BFM #15049	BFM #15249	PB31	Gain changing Speed loop gain	Set the speed loop gain when the gain changing is valid. Setting range: 20 to 50000 rad/s	K823
BFM #15050	BFM #15250	PB32	Gain changing Speed integral compensation	Set the speed integral compensation when the gain changing is valid. Setting range: 1 to 50000 (× 0.1 ms)	K337
BFM #15051	BFM #15251	PB33	Gain changing Vibration suppression control vibration frequency setting	Set the vibration frequency for vibration suppression control when the gain changing is valid. Setting range: 1 to 1000 (× 0.1 Hz)	K1000
BFM #15052	BFM #15252	PB34	Gain changing Vibration suppression control resonance frequency setting	Set the resonance frequency for vibration suppression control when the gain changing is valid. Setting range: 1 to 1000 (× 0.1 Hz)	K1000

11.2.3 Servo parameters (Advanced setting)

BFM Number		Servo Amplifier Parameter No.	Name	Description	Default
X-axis	Y-axis				
BFM #15064	BFM #15264	PC01	Error excessive alarm level	Set error excessive alarm level with rotation amount of servo motor. Setting range: 1 to 200 REV	K3
BFM #15065	BFM #1565	PC02	Electromagnetic brake sequence output	Set the delay time from when the electronic brake interlock (MBR) turns off until the base drive circuit is shut-off. Setting range: 0 to 1000 ms	K0
BFM #15066	BFM #15266	PC03	Encoder output pulse selection	Select the encoder output pulse direction and encoder pulse output setting.  Encoder output pulse direction 0: 90 degrees in CCW direction (A-phase) 1: 90 degrees in CW direction (A-phase) Encoder output pulse setting 0: With output pulses 1: With output division ratio	H0000
BFM #15067	BFM #15267	PC04	Function selection C-1	Select the serial encoder cable type to be used. 0: Two-wire type 1: Four-wire type	K0
BFM #15068	BFM #15268	PC05	Function selection C-2	Enable or disable the motor-less operation. 0: Disable 1: Enable	K0
BFM #15070	BFM #15270	PC07	Zero speed	Set the output range of the zero speed signal (ZSP). Setting range: 0 to 10000 r/min	K50

BFM Number		Servo Amplifier Parameter No.	Name	Description	Default
X-axis	Y-axis				
BFM #15072	BFM #15272	PC09	Analog monitor 1 output	Select a signal to be output to the analog monitor 1.  0: Servo motor speed (±8V at the maximum) 1: Torque (±8 V at the maximum)*B 2: Servo motor speed (+8V at the maximum) 3: Torque (+8 V at the maximum)*B 4: Current command (±8 V at the maximum) 5: Speed command (±8V at the maximum) 6: Droop pulses (±10 V/1 × 10^2 PLS)*A 7: Droop pulses (±10 V/1 × 10^3 PLS)*A 8: Droop pulses (±10 V/1 × 10^4 PLS)*A 9: Droop pulses (±10 V/1 × 10^5 PLS)*A A: Feedback position (±10 V/1 × 10^6 PLS)*A*C B: Feedback position (±10 V/1 × 10^7 PLS)*A*C C: Feedback position (±10 V/1 × 10^8 PLS)*A*C D: Bus voltage (+8 V / 400 V) *A: Encoder pulse unit *B: Outputs 8 V as the maximum torque *C: Can be used for the absolute position detection system	H0000
BFM #15073	BFM #15273	PC10	Analog monitor 2 output	Select a signal to be output to the analog monitor 2.  0: Servo motor speed (±8V at the maximum) 1: Torque (±8 V at the maximum)*B 2: Servo motor speed (+8V at the maximum) 3: Torque (+8 V at the maximum)*B 4: Current command (±8 V at the maximum) 5: Speed command (±8V at the maximum) 6: Droop pulses (±10 V/1 × 10^2 PLS)*A 7: Droop pulses (±10 V/1 × 10^3 PLS)*A 8: Droop pulses (±10 V/1 × 10^4 PLS)*A 9: Droop pulses (±10 V/1 × 10^5 PLS)*A A: Feedback position (±10 V/1 × 10^6 PLS)*A*C B: Feedback position (±10 V/1 × 10^7 PLS)*A*C C: Feedback position (±10 V/1 × 10^8 PLS)*A*C D: Bus voltage (+8 V / 400 V) *A: Encoder pulse unit *B: Outputs 8 V as the maximum torque *C: Can be used for the absolute position detection system	H0001
BFM #15074	BFM #15274	PC11	Analog monitor 1 offset	Set the offset voltage of the analog monitor 1 (MO1) output. Setting range: -999 to 999 mV	K0
BFM #15075	BFM #15275	PC12	Analog monitor 2 offset	Set the offset voltage of the analog monitor 2 (MO2) output. Setting range: -999 to 999 mV	K0
BFM #15080	BFM #15280	PC17	Function selection C-4	Select the home position setting condition in the absolute position detection system. 0: Need to pass motor Z-phase after power on 1: Not need to pass motor Z-phase after power on	K1

11.2.4 Servo parameters (I/O setting)

BFM Number		Servo Amplifier Parameter No.	Name	Description	Default
X-axis	Y-axis				
BFM #15102	BFM #15302	PD07	Output signal device selection 1 (CN3-13)	Specify a signal assigned (output) to the CN3-13 connector of the servo amplifier. 0 0 [ ] [ ] Select CN3-13 pin output device 00: Always OFF 01: RDY (ready ON) 02: RD (servo ON) 03: ALM (error) 04: INP (In-position) *A 05: MBR (electronic brake interlock) 06: DB (external dynamic brake) 07: TLC (torque is limited) 08: WNG (warning) 09: BWNG (battery warning) 0A: Always OFF*B 0B: For manufacturer setting*C 0C: ZSP (zero speed) 0D: For manufacturer setting*C 0E: For manufacturer setting*C 0F: CDPS (selecting a variable gain) 10: For manufacturer setting*C 11: ABSV (losing the absolute position) *A 12 to 3F: For manufacturer setting*C *A: Always OFF in speed control mode *B: Becomes SA (speed achieved) in speed control mode *C: Never specify the values for the manufacturer setting.	H0005
BFM #15103	BFM #15303	PD08	Output signal device selection 2 (CN3-9)	Specify a signal assigned (output) to the CN3-9 connector of the servo amplifier. 0 0 0 [ ] Select CN3-9 pin output device 00: Always OFF 01: RDY (ready ON) 02: RD (servo ON) 03: ALM (error) 04: INP (In-position) *A 05: MBR (electronic brake interlock) 06: DB (external dynamic brake) 07: TLC (torque is limited) 08: WNG (warning) 09: BWNG (battery warning) 0A: Always OFF*B 0B: For manufacturer setting*C 0C: ZSP (zero speed) 0D: For manufacturer setting*C 0E: For manufacturer setting*C 0F: CDPS (selecting a variable gain) 10: For manufacturer setting*C 11: ABSV (losing the absolute position) *A 12 to 3F: For manufacturer setting*C *A: Always OFF in speed control mode *B: Becomes SA (speed achieved) in speed control mode *C: Never specify the values for the manufacturer setting.	H0004

BFM Number		Servo Amplifier Parameter No.	Name	Description	Default
X-axis	Y-axis				
BFM #15104	BFM #15304	PD09	Output signal device selection 3 (CN3-15)	Specify a signal assigned (output) to the CN3-15 connector of the servo amplifier. 0 0 [ ] [ ] Select CN3-15 pin output device 00: Always OFF 01: RDY (ready ON) 02: RD (servo ON) 03: ALM (error) 04: INP (In-position) *A 05: MBR (electronic brake interlock) 06: DB (external dynamic brake) 07: TLC (torque is limited) 08: WNG (warning) 09: BWNG (battery warning) 0A: Always OFF*B 0B: For manufacturer setting*C 0C: ZSP (zero speed) 0D: For manufacturer setting*C 0E: For manufacturer setting*C 0F: CDPS (selecting a variable gain) 10: For manufacturer setting*C 11: ABSV (losing the absolute position) *A 12 to 3F: For manufacturer setting*C *A: Always OFF in speed control mode *B: Becomes SA (speed achieved) in speed control mode *C: Never specify the values for the manufacturer setting.	H0003

11.3 Monitor Data

Operating conditions for the positioning system are stored as monitor data. The following buffer memories for monitor data are read-only memories except for the current address (user) [BFM #1, #0 (X-axis), BFM #101, #100 (Y-axis)].

For X-axis: BFM #0 to #99
For Y-axis: BFM #100 to #199

Caution

Do not use unlisted BFMs for changing values not described in this section.

11.3.1 Current address (User) [BFM #0, BFM #100]

The current address data is stored in units specified by the user*1.

BFM Number		Description	Value Format	Default
X-axis	Y-axis			
BFM #1,#0	BFM #101,#100	-2,147,483,648 to 2,147,483,647 (user unit) *1	Decimal	-

*1. Refer to the section shown below for details on the user units.

→ **Refer to Section 7.7**

POINT

- The stored address data is always handled as an absolute address.
- The unit of the value is a user-specified one and includes a magnification setting for position data. The unit and magnification setting can be specified by the operation parameters 1.

→ **For details on the operation parameters 1, refer to Subsection 11.1.1**

- It is possible to change the current address of a stopped axis to any address. Overwrite the current address (user) with a new address. The current address will be changed and its pulse data will be updated.

→ **For details on the current address change function, refer to Subsection 7.6.8**

11.3.2 Current address (Pulse) [BFM #3, #2, BFM #103, #102]

The current address is converted into pulses and stored.

BFM Number		Description	Value Format	Default
X-axis	Y-axis			
BFM #3,#2	BFM #103,#102	-2,147,483,648 to 2,147,483,647 PLS	Decimal	-

POINT

- The stored address data is always handled as an absolute address (converted pulse data).

→ **For details on the converted pulse data, refer to Section 7.7**

- It is possible to change the current address of a stopped axis to any address. Overwrite the current address (user) with a new address. The current address will be changed and its pulse data will be updated.

→ **For details on the current address change function, refer to Subsection 7.5.8**

11.3.3 Torque limit storing value [BFM #5, #4, BFM #104, #105]

Torque limit value used for the torque limit function is stored.
The torque limit value is a torque limit setting value, torque output setting value or zero return torque limit value.

→ **For details on the torque limit function, refer to Section 7.6.3**

BFM Number		Description	Value Format	Default
X-axis	Y-axis			
BFM #5,#4	BFM #105,#104	1 to 10,000(× 0.1%)	Decimal	-

11.3.4 Error BFM numbers [BFM #6, BFM #106]

If an error arises, BFM numbers in which the error occurred are stored.

BFM Number		Description	Value Format	Default
X-axis	Y-axis			
BFM #6	BFM #106	-1: No error Others: BFM number in which an error occurred	Decimal	-

11.3.5 Terminal Information [BFM #7, BFM #107]

Each input terminal status of the 20SSC-H is allocated to a bit status corresponding to each input terminals.

BFM Number		Bit Number	Description	Value Format	Default
X-axis	Y-axis				
BFM #7	BFM #107	b0	Becomes ON while the START terminal is used.	Bit	-
		b1	Becomes ON while the DOG terminal is used.		
		b2	Becomes ON while the INTO terminal is used.		
		b3	Becomes ON while the INT1 terminal is used.		
		b4	Becomes ON while the ϕA terminal is used.		
		b5	Becomes ON while the ϕB terminal is used.		
		b6 to b15	Not available		

11.3.6 Servo terminal information [BFM #8, BFM #108]

Each input terminal status of the servo amplifier is allocated with a bit status.

BFM Number		Bit Number	Description	Value Format	Default
X-axis	Y-axis				
BFM #8	BFM #108	b0	Becomes ON while the FLS terminal is used.	Bit	-
		b1	Becomes ON while the RLS terminal is used.		
		b2	Becomes ON while the DOG terminal is used.		
		b6 to b15	Not available		

11.3.7 m code [BFM #9, BFM #109]

At m code ON, the m code number is stored.
At no m code ON, "-1" is stored.

→ **For details on the m code, refer to Section 10.9.**

BFM Number		Description	Value Format	Default
X-axis	Y-axis			
BFM #9	BFM #109	-1 :m code is OFF 0 to 32767 :Stores the activated m code number	Decimal	-

11.3.8 Current value of operation speed [BFM #11, #10, BFM #111, #110]

The current value of operation speed is stored.
The value becomes zero under suspension, or in operation with a manual pulse input.

BFM Number		Description	Value Format	Default
X-axis	Y-axis			
BFM #11,#10	BFM #111,#110	0 to 2,147,483,647 (user unit)*1	Decimal	-

*1. Refer to the section shown below for details on the user unit.

→ **Refer to Section 7.7**

11.3.9 Current pulses input by manual pulse generator [BFM #13, #12, BFM #113, #112]

The number of input pulses from the manual pulse generator is stored.
Forward rotation increments the current number of pulses, and reverse rotation decrements it.
Magnification settings for the manual input pulses are not reflected on the stored value.

BFM Number		Description	Value Format	Default
X-axis	Y-axis			
BFM #13,#12	BFM #113,#112	-2,147,483,648 to 2,147,483,647 PLS	Decimal	-

11.3.10 Frequency of pulses input by manual pulse generator [BFM #15, 14, BFM #115, 114]

Manual pulse generator input frequency is stored.

BFM Number		Description	Value Format	Default
X-axis	Y-axis			
BFM #15,#14	BFM #115,#114	-100,000 to 100,000 Hz	Decimal	-

POINT

Magnification settings for the manual input pulses are not reflected on the stored value.

11.3.11 Table numbers in execution [BFM #16, BFM #116]

While performing a table operation, table numbers in execution are stored.

BFM Number		Description	Value Format	Default
X-axis	Y-axis			
BFM #16	BFM #116	-1 : Not in execution 0-299 : Stores table numbers in execution	Decimal	-

11.3.12 Version information [BFM #17]

The version of 20SSC-H is stored.

BFM Number		Description	Value Format	Default
X-axis	Y-axis			
BFM #17	-	Ver.1.00 is stored as K100.	Decimal	-

11.3.13 Status information [BFM #28, BFM #128]

Status of the 20SSC-H can be checked by ON/OFF statuses of each bit.

BFM Number		Bit Number	Description	Value Format	Default
X-axis	Y-axis				
BFM #28	BFM #128	b0	READY/BUSY Turns ON when the 20SSC-H is ready for a START command after normal completion of positioning, or when recovering from an error.	Bit	-
		b1	Outputting pulses for forward rotation. Turns ON while pulses for forward rotation are output.		
		b2	Outputting pulses for reverse rotation. Turns ON while pulses for reverse rotation are output.		
		b3	Completion of zero return operation. Turns ON upon completion of mechanical zero return operation, or when the current position is established by the absolute position detection system. Turns OFF at off-to-on transition of a mechanical zero return command, at power-off (reset), or when an absolute position is lost during the absolute position detection system.		
		b4	Current value overflow. • This bit is set when the current address value falls outside the range of 32-bit data (-2,147,483,648 to 2,147,483,647). • Cleared by power-off or when a zero return command becomes active.		
		b5	Occurrence of an error. • This bit is set upon occurrence of an error from the 20SSC-H or the servo amplifier. • Cleared when an error reset command becomes active. **→For details on the statuses at occurrence of errors, refer to Subsection 11.3.13**		
		b6	Completion of positioning. This bit is set upon normal completion of positioning.*1 Cleared when a START command becomes active, an error occurs, or an error reset command becomes active. When the 20SSC-H is stopped by a STOP command, the bit is kept in OFF status.		
		b7	Ready and waiting for remaining travel after stopping. This bit is set when the 20SSC-H goes into a standby state for the remaining travel upon a STOP command. Cleared by a START command, or when the remaining travel operation is canceled. **→For details on the stop command, refer to Section 7.4**		
		b8	m code is active. This bit is set when a m code becomes active. When a m code OFF command is received, the bit is cleared. **→For details on the m code, refer to Section 10.9**		
		b9	The unit is ready. This bit is set upon completion of 20SSC-H boot-up after power-on. (It is kept in ON state until the power is turned off.) Each value of buffer memories becomes valid after the bit is set.		
		b10	Transferring servo parameters is in progress. This bit is ON state while transferring servo parameters with a transfer command. It is automatically cleared upon completion of the transfer. **→For details on the servo parameters transfer, refer to Subsection 11.4.11**		
		b11	Saving data into flash-memory is in progress. • This bit is ON while saving buffer memory data into flash-memory. • When finished storing the data, the bit is cleared. **→For details on storing buffer memory into a flash-memory, refer to Subsection 11.4.15**		

BFM Number		Bit Number	Description	Value Format	Default
X-axis	Y-axis				
BFM #28	BFM #128	b12	Initialization of buffer memory is in progress. • This bit is ON while initializing data in buffer memories. • When finished initializing the data, the bit is cleared. →**For details on initializing buffer memory, refer to Subsection 11.4.15**	Bit	-
		b13	Changing speed is in progress. • This bit is set upon receiving a speed change command during positioning operation. • Cleared upon completion of the speed change. →**For details on the operation speed change command, refer to Subsection 7.5.2**		
		b14	Changing a target address is in progress. This bit is set upon receiving a target address change command during positioning operation. Cleared upon completion of the change of target address. →**For details on the target address change command, refer to Subsection 7.5.3**		
		b15	Table operation is in progress. This bit is kept in ON status while performing table operation. (It is set by a START command and cleared when the operation is finished.)		

*1. Completion of positioning

1) Operations turning the "positioning completion" bit ON.

- Operations turning the "positioning completion" bit ON.
  - Mechanical zero return operation (DOG)
  - 1-speed positioning operation
  - Interrupt 1-speed constant quantity feed
  - 2-speed positioning operation
  - Interrupt 2-speed constant quantity feed
  - Interrupt stop
  - Multi-speed operation
  - Linear interpolation
  - Linear interpolation (interrupt stop)
  - Circular interpolation
  - Mechanical zero return operation
- Operations turning the "positioning completion" bit OFF.
  - Mechanical zero return operation (data set type)
  - JOG operation
  - Manual pulse generator operation
  - Variable speed operation

2) When stopped at a STOP command
The "Positioning completion" bit does not turn ON at the target address.

11.3.14 Error code [BFM #29, BFM #129]

If an error occurs, the error code is stored.

1. Buffer memories to store error information

If an error occurs, the buffer memories store error information as shown in the table below.
After removing the cause of the error, the system can recover from the error by an error reset command.

Item	Description
No. of BFM in which an error occurred	Number of buffer memory in which an error occurred is stored.
Status information	Becomes active upon detecting an error.
Error code	The error code is stored.
Servo parameter error number	The servo amplifier error code is stored.
Servo status	Turns ON, when an error of the servo amplifier occurs.

2. Error codes

An error code is stored in decimal format.

→ **For details on the error codes, refer to Subsection 13.2.3**

11.3.15 Model code [BFM #30]

The model code of the 20SSC-H has been stored.

BFM Number		Description	Value Format	Default
X-axis	Y-axis			
BFM #30	-	The model code of the 20SSC-H is K5220.	Decimal	-

11.3.16 Deviation counter value [BFM #51, #50, BFM #151, #150]

The deviation counter value of the servo amplifier is stored.

BFM Number		Description	Value Format	Default
X-axis	Y-axis			
BFM #51,#50	BFM #151,#150	Deviation counter value of the servo amplifier (PLS)	Hexadecimal	-

11.3.17 Motor speed [BFM #52, BFM #152]

The present rotation speed of the servo motor is stored.

BFM Number		Description	Value Format	Default
X-axis	Y-axis			
BFM #52	BFM #152	The present rotation speed of the servo motor (×0.1 r/min)	Hexadecimal	-

11.3.18 Motor current value [BFM #54, BFM #154]

The present value of the servo motor current is stored.

BFM Number		Description	Value Format	Default
X-axis	Y-axis			
BFM #54	BFM #154	The value of the servo motor current (× 0.1%)	Hexadecimal	-

11.3.19 Servo amplifier software number [BFM #53, #52, BFM #153, #152]

The software number of the servo amplifier is stored.
Updated at control power on to the servo amplifier.

BFM Number		Description	Value Format	Default
X-axis	Y-axis			
BFM #56, #61	BFM #156, #161	Servo amplifier software number	ACSII code	-

Note

The servo software number is stored in ASCII code as shown below.

Example: When the number is -B35W200␣A0␣ :

BFM Number	Monitor Value	ASCII Code	Servo amplifier software number
BFM #56	H422D	B -	-B35W200␣A0␣
BFM #57	H3533	5 3	
BFM #58	H3257	2 W	
BFM #59	H3030	0 0	
BFM #60	H4120	A SPACE	
BFM #61	H2030	SPACE 0	

11.3.20 Servo parameter error numbers [BFM #62, BFM #162]

Parameter numbers that has caused servo parameter errors are stored.

BFM Number		Description	Value Format	Default
X-axis	Y-axis			
BFM #62	BFM #162	Servo parameter number	Hexadecimal	-

Monitor Values and Servo Parameter Numbers

Stored value	Parameter No.	Stored value	Parameter No.	Stored value	Parameter No.	Stored value	Parameter No.	Stored value	Parameter No.	Stored value	Parameter No.
001	PA01	018	PA18	035	PB17	052	PB34	069	PC06	102	PD07
002	PA02	019	PB01	036	PB18	053	PB35	070	PC07	103	PD08
003	PA03	020	PB02	037	PB19	054	PB36	071	PC08	104	PD09
004	PA04	021	PB03	038	PB20	055	PB37	072	PC09	⋮	⋮
005	PA05	022	PB04	039	PB21	056	PB38	073	PC10	127	PD32
006	PA06	023	PB05	040	PB22	057	PB39	074	PC11		
007	PA07	024	PB06	041	PB23	058	PB40	075	PC12		
008	PA08	025	PB07	042	PB24	059	PB41	⋮	⋮		
009	PA09	026	PB08	043	PB25	060	PB42	080	PC17		
010	PA10	027	PB09	044	PB26	061	PB43	⋮	⋮		
011	PA11	028	PB10	045	PB27	062	PB44	095	PC32		
012	PA12	029	PB11	046	PB28	063	PB45	096	PD01		
013	PA13	030	PB12	047	PB29	064	PC01	097	PD02		
014	PA14	031	PB13	048	PB30	065	PC02	098	PD03		
015	PA15	032	PB14	049	PB31	066	PC03	099	PD04		
016	PA16	033	PB15	050	PB32	067	PC04	100	PD05		
017	PA17	034	PB16	051	PB33	068	PC05	101	PD06		

11.3.21 Servo status [BFM #64, #63, BFM #164, #163]

BFM Number		Bit Number	Description	Value Format	Default
X-axis	Y-axis				
BFM #63	BFM #163	b0	Zero-phase is passed The bit is set when the zero-phase of the encoder is passed.	Bit	-
		b1,b2	Not available		
		b3	Operating at zero speed This bit is set while the motor is driven at speeds slower than "zero speed".		
		b4 to b15	Not available		
BFM #64	BFM #164	b0	Ready ON This bit is set while the servo ready is ON.		
		b1	Servo ON This bit is set while the servo is ON. Cleared when the servo turns OFF.		
		b2 to b6	Not available		
		b7	An alarm has been raised This bit is set while an alarm is raised.		
		b8 to b11	Not available		
		b12	In-position This bit is set while droop pulses are within a range of "In-position".		
		b13	Torque is limited This bit is set while the servo amplifier is limiting torque.		
		b14	Losing an absolute position This bit is set while the servo amplifier is losing an absolute position.		
		b15	A warning is occurring This bit is set while a warning is occurring at the servo amplifier.		

11.3.22 Regenerative load ratio [BFM #65, BFM #165]

The regenerative load ratio power to the maximum regenerative power is stored in percentage.
With regenerative brake option, the regenerative power ratio of the allowable capacity is stored.

BFM Number		Description	Value Format	Default
X-axis	Y-axis			
BFM #65	BFM #165	Regenerative load ratio (%)	Decimal	-

11.3.23 Effective load torque [BFM #66, BFM #166]

The continuous effective load torque is stored.
This parameter stores the average value of the load ratio to the rated torque (100%) in the past 15 seconds.

BFM Number		Description	Value Format	Default
X-axis	Y-axis			
BFM #66	BFM #166	Effective load torque (%)	Decimal	-

11.3.24 Peak torque ratio [BFM #67, BFM #167]

The maximum torque during operations is stored.
This parameter stores the peak value to the rated torque (100%) in the past 15 seconds.

BFM Number		Description	Value Format	Default
X-axis	Y-axis			
BFM #67	BFM #167	Peak torque ratio (%)	Decimal	-

11.3.25 Servo warning code [BFM #68, BFM #168]

Warnings detected by the servo amplifier are stored.
Clear the cause of warning.

→ **For details on the warnings, refer to the manual of the connected servo amplifier**
→ **For details on the warning codes, refer to Subsection 13.2.4**

11.3.26 Motor feedback position [BFM #71, #70, BFM #171, #170]

Motor feedback positions are stored.

BFM Number		Description	Value Format	Default
X-axis	Y-axis			
BFM #71,#70	BFM #171,#170	Motor feedback position (PLS)	Decimal	-

11.3.27 Servo status 2 [BFM #72, BFM #172]

BFM Number		Bit Number	Description	Value Format	Default
X-axis	Y-axis				
BFM #72	BFM #172	b0	A parameter update completed flag • This bit is set when an automatic update of servo parameters is completed. • Cleared when a servo parameter save command or servo parameter initialization command is finished.	Bit	-
		b15 to b1	Not available		

11.3.28 Flash memory write count [BFM #91, #90]

The number of times data is written to the flash memory is stored.

BFM Number		Description	Value Format	Default
X-axis	Y-axis			
BFM #91,#90	-	The number of writes to the flash memory	Decimal	-

Note

The maximum number of writes to the built-in flash memory is 100,000 times.

11.4 Control Data

The control data is user-specified data for controlling the positioning system.
For X-axis: BFM #500 to #599
For Y-axis: BFM #600 to #699

Caution

Do not use unlisted BFMs for changing values not described in this section.

11.4.1 Target address 1 [BFM #501, #500, BFM #601, #600]

This data item sets a target position or travel for positioning operation distance as the target address 1.

BFM Number		Description	Default
X-axis	Y-axis		
BFM #501,#500	BFM #601,#600	Setting range: -2,147,483,648 to 2,147,483,647 [User unit]*1 Set the value within -2,147,483,648 to 2,147,483,647 PLS in the converted pulse data	K0

*1. Refer to the section shown below for details on the user unit.

→ **Refer to Section 7.7**

Note

- The positioning operation differs as follows depending on the procedure to specify the absolute address or relative address.
  - With absolute address: travels from the current position to the target position.
    The rotation direction depends whether target address 1 is larger or smaller than the current address.
  - With relative address: moves by the specified travel distance from the current position. The rotation direction depends on the target address sign (+/-).
- The units of the value are user-specified and include the position data magnification.

11.4.2 Operation speed 1 [BFM #503, #502, BFM #603, #602]

This data item sets the operation speed 1 for positioning operations.

BFM Number		Description	Default
X-axis	Y-axis		
BFM #503,#502	BFM #603,#602	Setting range: -2,147,483,648 to 2,147,483,647 [User unit]*1 Set the value within 1 to 50,000,000Hz in converted pulse data.	K1

*1. Refer to the section shown below for details on the user unit.

→ **Refer to Section 7.7**

Note

- Set the operation speed 1 slower than the maximum speed.
  If the operation speed 1 exceeds the maximum speed, 20SSC-H operates at the maximum speed.
- You can change the operation speed during positioning operation if changing speed is enabled (when not setting the flag for "speed change disable during operation").

→ **For details on the operation speed change function, refer to Subsection 7.5.2**

11.4.3 Target address 2 [BFM #505, #504, BFM #605, #604]

This data item sets a target position or travel for positioning operation distance as the target address 2.

BFM Number		Description	Default
X-axis	Y-axis		
BFM #505,#504	BFM #605,#604	Setting range: -2,147,483,648 to 2,147,483,647 [User unit]*1 Set the value within -2,147,483,648 to 2,147,483,647 PLS in the converted pulse data	K0

*1. Refer to the section shown below for details on the user units.

→ **Refer to Section 7.7**

Note

- The positioning operation differs as follows depending on the procedure to specify the, absolute address or relative address.
  - With absolute address: travels from the current position to the target position.
    The rotation direction depends on whether target address 2 is larger or smaller than the current address.
  - With relative address: moves by the specified travel distance from the current position. The rotation direction depends on the target address sign (+/-).
- The units of the value are user-specified and include the position data magnification.

11.4.4 Operation speed 2 [BFM #507, #506, BFM #607, #606]

This data item sets the operation speed 2 for positioning operations.

BFM Number		Description	Default
X-axis	Y-axis		
BFM #507,#506	BFM #607,#606	Setting range: -2,147,483,648 to 2,147,483,647 [User unit]*1 Set the value within 1 to 50,000,000 Hz in converted pulse data.	K1

*1. Refer to the section shown below for details on the user units.

→ **Refer to Section 7.7**

Note

- Set the operation speed 1 slower than the maximum speed.
  If the operation speed 1 exceeds the maximum speed, 20SSC-H operates at the maximum speed.
- You can change the operation speed during positioning operation if changing speed is enabled (when not setting the flag for "speed change disable during operation").

→ **For details on the operation speed change function, refer to Subsection 7.5.2**

11.4.5 Override setting [BFM #508, BFM #608]

This data item sets an override value for the override function.

→ **For details on the override function, refer to Subsection 7.5.1**

BFM Number		Description	Default
X-axis	Y-axis		
BFM #508	BFM #608	Setting range: 1 to 30000 (× 0.1%)	K1000

11.4.6 Torque output setting value [BFM #510, BFM #610]

This data item sets an output torque for the torque limit function.

→ **For details on the torque limit function, refer to Subsection 7.6.3**

BFM Number		Description	Default
X-axis	Y-axis		
BFM #510	BFM #610	Setting range: 0 to 10000 (× 0.1%)	K0

11.4.7 Velocity change value [BFM #513, #512, BFM #613, #612]

This data item sets the velocity change value.

→ **For details on the operation speed change function, refer to Subsection 7.5.2**

BFM Number		Description	Default
X-axis	Y-axis		
BFM #513,#512	BFM #613,#612	Setting range: -2,147,483,648 to 2,147,483,647 [User unit]*1 Set the value within 1 to 50,000,000 Hz in converted pulse data.	K1

*1. Refer to the section shown below for details on the user units.

→ **Refer to Section 7.7**

11.4.8 Target position change value (Address) [BFM #515, #514, BFM #615, #614]

This data item sets the target address for the target address change function.

→ **For details on the target address change function, refer to Subsection 7.5.3.**

BFM Number		Description	Default
X-axis	Y-axis		
BFM #515,#514	BFM #615,#614	Setting range: -2,147,483,648 to 2,147,483,647 [User unit]*1 Set the value within -2,147,483,648 to 2,147,483,647 PLS in the converted pulse data	K0

*1. Refer to the section shown below for details on the user units.

→ **Refer to Section 7.7**

11.4.9 Target position change value (Speed) [BFM #517, #516, BFM #617, #616]

This data item sets the operation speed for the target address change function.

→ **For details on the target address change function, refer to Subsection 7.5.3**

BFM Number		Description	Default
X-axis	Y-axis		
BFM #517,#516	BFM #617,#616	Setting range: -2,147,483,648 to 2,147,483,647 [User unit]*1 Set the value within 1 to 50,000,000 Hz in converted pulse data.	K1

*1. Refer to the section shown below for details on the user units.

→ **Refer to Section 7.7**

11.4.10 Operation command 1 [BFM #518, BFM #618]

BFM Number		Bit Number	Setting Item	Description	Detection*1	Default
X-axis	Y-axis					
BFM #518	BFM #618	b0	Error reset	Set this to recover from errors and clear the following information. - Error BFM numbers (BFM #6, BFM #106) - Status information Occurrence of an error (b5) - Error code (BFM #29)	Edge	H0000
		b1	STOP (deceleration stop)	When this bit is ON during positioning operation, decelerate to stop. →**For details on the stop command, refer to Section 7.4**	Level	
		b2	Forward rotation limit (LSF)	Set this to perform a deceleration stop while outputting pulses for forward rotation. →**For details on the forward rotation limit (LSF), refer to Subsection 7.3.2**	Level	
		b3	Reverse rotation limit (LSR)	Set this to perform a deceleration stop while outputting pulses for reverse rotation. →**For details on the reverse rotation limit (LSR), refer to Subsection 7.3.2**	Level	
		b4	Forward rotation JOG	Pulses for forward rotation are output while this is set. →**For details on the JOG operations, refer to Section 8.2**	Level	
		b5	Reverse rotation JOG	Pulses for reverse rotation are output while this is set. →**For details on the JOG operations, refer to Section 8.2**	Level	

BFM Number		Bit Number	Setting Item	Description	Detection*1	Default
X-axis	Y-axis					
BFM #518	BFM #618	b6	Mechanical zero return command	When this is set, mechanical zero return operation is started. →**For details on the mechanical zero return, refer to Section 8.1**	Edge	H0000
		b7	Not available	-	-	
		b8	Relative/Absolute address specification	OFF: An absolute address is used (moves to the specified target address based on the base position). ON: A relative address is used (moves by a specified amount of travel from the current address).	Level	
		b9	START command	Set this to start a positioning operation selected from the operation patterns.	Edge	
		b10*2	Simultaneous START flag	ON: Starts X and Y positioning operations simultaneously when a START command for X-axis becomes active. (includes JOG and zero return operations) OFF: X and Y positioning operations start individually by their respective START commands. (excludes interpolation and XY-table operations)	Level	
		b11	m code OFF	Set this to disable m codes. →**For details on the m code, refer to Section 10.9**	Edge	
		b12	Change commands during operations are disabled	Set this to disable an operation speed change command and target position change command during operations.	Level	
		b13	Speed change command during positioning operation	Changes the operation speed to the speed preset as a velocity change value during operation. →**For details on the operation speed change, refer to Subsection 7.5.2**	Edge	
		b14	Target position change command during positioning operation	Changes the target address to the address preset as a target position change value (address or speed) during operations. →**For details on the target address change, refer to Subsection 7.5.3**	Edge	
		b15	Not available	-	-	

*1. Timing of detection
1) Level detection: activated when the bit is set or cleared.
2) Edge detection: activated at off-to-on transition.

*2. The simultaneous START flag is b10 in the X-axis operation command 1 (BFM #518).
Do not use b10 in the Y-axis operation command 1 (BFM #618).

Note

- Priority of start flag and stop flag
  The STOP command has higher priority over the forward / reverse rotation JOGs and the START command.
- Handling of each flag ON/OFF state
  - The 20SSC-H retains stop and start flag ON/OFF states until power OFF.
  - The commands with level detection executes/stops at writing ON/OFF.
  - For commands with edge detection, create a program so that the bits are always turned OFF upon completion of ON operations.
    (The second and subsequent cycles cannot be performed without turning the bits OFF.)

11.4.11 Operation command 2 [BFM #519, BFM #619]

BFM Number		Bit Number	Setting Item	Description	Detection*1	Default
X-axis	Y-axis					
BFM #519	BFM #619	b0	Remaining travel cancel command	Set this to cancel the standby status for the remaining travel after the STOP command. →**For details on the stop command, refer to Section 7.4**	Edge	H0000
		b1 to b3	Not available	-	-	
		b4	Positioning parameters enable command	Set this to enable positioning parameters in the buffer memories. Whenever you make a change to positioning parameters, this bit must be set before starting operation.	Edge	
		b5 to b7	Not available	-	-	
		b8	Servo OFF command	Set this to turn the servo OFF. →**For details on the servo ON/OFF state, refer to Subsection 7.6.5** 0: servo ON 1: servo OFF	Level	
		b9	Servo parameters transfer command	Set this to transfer servo parameters in the buffer memories to the servo amplifier.	Edge	
		b10	Gain changing command	Changes the gain of the amplifier from the 20SSC-H. For details on changing gain, refer to the manual shown below. →**MR-J3-□B Servo Amplifier Instruction Manual**	Level	
		b11 to b15	Not available	-	-	

*1. Timing of detection
1) Level detection: activated when the bit is set or cleared.
2) Edge detection: activated at off-to-on transition.

POINT

1) Changing positioning parameters
When the 20SSC-H is powered ON, operation starts with the positioning parameters in the flash memory. During operation, when the buffer memory positioning parameters are changed via FX Configurator-FP or a sequence program, it is necessary to reboot the positioning parameters enable command. Without rebooting the command, changes will not be reflected in actual operation.

2) Transferring servo parameters
a) The following servo parameters are transferred to the servo amplifier when rebooting the servo parameter transfer command.
- Auto tuning mode
- Auto tuning response
- Feed forward gain
- Ratio of load inertia moment to servo motor inertia moment
- Model loop gain
- Position loop gain
- Speed loop gain
- Speed integral compensation
- Speed differential compensation

b) During positioning operations, the servo parameter transfer command is ignored.
c) "Transferring servo parameters" in the status information is ON during the transfer.
→ **For details on the status information, refer to Subsection 11.3.13**

11.4.12 Operation pattern selection [BFM #520, BFM #620]

BFM Number		Bit Number	Setting Item	Description	Detection*1	Default
X-axis	Y-axis					
BFM #520	BFM #620	b0	1-speed positioning operation	Set this to perform 1-speed positioning operation. →**For details on the 1-speed positioning operation, refer to Section 9.2**	Level	H0000
		b1	Interrupt 1-speed constant quantity feed	Set this to perform an interrupt 1-speed constant quantity feed. →**For details on the interrupt 1-speed constant quantity feed, refer to Section 9.3**		
		b2	2-speed positioning operation	Set this to perform 2-speed positioning operation. →**For details on the 2-speed positioning operation, refer to Section 9.4**		
		b3	Interrupt 2-speed constant quantity feed	Set this to perform an interrupt 2-speed constant quantity feed. →**For details on the interrupt 2-speed constant quantity feed, refer to Subsection 9.5**		
		b4	Interrupt stop	Set this to perform an interrupt stop. →**For details on the interrupt stop, refer to Section 9.6**		
		b5	Variable speed operation	Set this to perform a variable speed operation. →**For details on the variable speed operation, refer to Section 9.7**		
		b6	Operation using the manual pulse generator	Set this to perform an operation with the manual pulse generator. →**For details on the manual pulse generator operation, refer to Section 8.3**		
		b7	Linear interpolation	Set this to perform a linear interpolation operation. →**For details on the linear interpolation operation, refer to Section 9.9**		
		b8	Linear interpolation (interrupt stop)	Set this to perform a linear interpolation operation (interrupt stop). →**For details on the linear interpolation operation (interrupt stop), refer to Section 9.10**		
		b9	Table operation (individual)	Set this to perform an individual table operation. →**For details on the table operation (individual), refer to Section 10.1**		
		b10	Table operation (simultaneous)	Set this to perform a simultaneous table operation. →**For details on the table operation (samultaneous), refer to Section 10.1**		
		b11 to b15	Not available	-	-	

*1. Timing of the detection
1) Level detection: activated when the bit is set or cleared.
2) Edge detection: activated at off-to-on transition.

Note

- The selected operation is started at a START input or START flag.
- The program must be created so that the operation pattern selection is executed before the START input or the START command.
- A positioning operation cannot be started even by the START input or START command when all bits of the operation patterns are OFF, or multiple bits are ON.
  (An error occurs if multiple bits are set to ON.)

11.4.13 Table operation start number [BFM #521, BFM #621]

This data item sets a table information number for the table operation.

→ **For details on the table operation, refer to Chapter 10**

BFM Number		Description	Default
X-axis	Y-axis		
BFM #521	BFM #621	Setting range: 0 to 299	K0

11.4.14 Control command enable/disable [BFM #522]

This data item enables or disables control commands.
Once the model code is stored, control commands are enabled.

BFM Number		Description	Default
X-axis	Y-axis		
BFM #522		Model code (K5220) :enables control commands Values other than the model code :disables control commands	K0

Note

Write the model code (K5220) to the "control command enable/disable" before executing control commands.
After control commands are executed, "0" is automatically stored in the "control command enable/disable."

11.4.15 Control command [BFM #523]

This data item sets data to the buffer memory/the flash memory, or initializes the data.

BFM Number		Bit Number	Setting Item		Description	Detection*1	Default
X-axis	Y-axis						
BFM #523		b0	Positioning parameters save command	X-axis	Writes X-axis positioning parameters (BFM #14000 to BFM #14199) into the flash memory.	Edge	H0000
		b1		Y-axis	Writes Y-axis positioning parameters (BFM #14200 to BFM #14399) into the flash memory.		
		b2	Table information save command	X-axis	Writes X-axis table information (BFM #1000 to BFM #3999) into the flash memory.		
		b3		Y-axis	Writes Y-axis table information (BFM #4000 to BFM #6999) into the flash memory.		
		b4		XY-axes	Writes XY-axes table information (BFM #7000 to BFM #12999) into the flash memory.		
		b5	Servo parameters save command	X-axis	Writes X-axis servo parameters (BFM #15000 to BFM #15199) into the flash memory.		
		b6		Y-axis	Writes Y-axis servo parameters (BFM #15200 to BFM #15399) into the flash memory.		
		b7	Not available		-	-	
		b8	Positioning parameters initialization command	X-axis	Resets X-axis positioning parameters (BFM #14000 to BFM #14199) to their factory default.	Edge	
		b9		Y-axis	Resets Y-axis positioning parameters (BFM #14200 to BFM #14399) to their factory default.		
		b10	Table information initialization command	X-axis	Resets X-axis table information (BFM #1000 to BFM #3999) to their factory default.		
		b11		Y-axis	Resets Y-axis table information (BFM #4000 to BFM #6999) to their factory default.		
		b12		XY-axes	Resets XY-axes table information (BFM #7000 to BFM #12999) to their factory default.		
		b13	Servo parameters initialization command	X-axis	Resets X-axis servo parameters (BFM #15000 to BFM #15199) to their factory default.		
		b14		Y-axis	Resets Y-axis servo parameters (BFM #15200 to BFM #15399) to their factory default.		
		b15	Not available		-	-	

*1. Timing of the detection
1) Level detection: activated when the bit is set or cleared.
2) Edge detection: activated at off-to-on transition.

Before executing control commands:

Write the model code (K5220) to the "control command enable/disable" before executing control commands.
After control commands are executed, "0" is automatically stored in the "control command enable/disable."

Notes on saving data into flash memory

- The save command is ignored during a positioning operation.
- Be sure to note the following points while saving data into the flash memory (status information: ON).
  - Do not turn the power OFF while saving data into the flash memory.
  - Do not write any data to buffer memories until saving data into flash memory is completed.
- A memory error occurs when failed to save data into the flash memory.
- The maximum number of times data can be written to the flash memory is 100,000 times.
  The number of times data has been written to the flash memory can be checked by the number of writes.
  → **For details on the flash memory maximum number of writes, refer to Section 11.3.28**

Notes on initializing buffer memories

While initialization is in progress, the "initializing" status of the status information is ON and READY/BUSY is OFF (BUSY).

11.4.16 Manual pulse generator input magnification (numerator) [BFM #525, #524, BFM #625, #624]

This data item sets the magnification to be applied to the numerator of a pulse train input by the manual pulse generator.

→ **For details on the manual pulse generator, refer to Section 8.3**

BFM Number		Description	Default
X-axis	Y-axis		
BFM #525,#524	BFM #625,#624	Setting range: 1 to 1,000,000 times	K1

11.4.17 Manual pulse generator input magnification (denominator) [BFM #527, #526, BFM #627, #626]

This data item sets the magnification to the denominator of a pulse train input by the manual pulse generator.

→ **For details on the manual pulse generator, refer to Section 8.3**

BFM Number		Description	Default
X-axis	Y-axis		
BFM #527,#526	BFM #627,#626	Setting range: 1 to 1,000,000 times	K1

11.5 Table Information

This section shows BFMs for positioning in table operation.
Table numbers and BFM numbers are assigned as shown in the table below.
For details on the table operation, refer to the following.

→ **Refer to Chapter 10**

For X-axis :BFM #1000 to #3999
For Y-axis :BFM #4000 to #6999
For XY-axes :BFM #7000 to #12999

Table No.	BFM Number			Name		Description	Default
	X-axis	Y-axis	XY axes				
0	BFM #1001,#1000	-	BFM #7001,#7000	Position information	Position information	Set target addresses or etc. for the table operation.	K-1
	-	BFM #4001,#4000	BFM #7003,#7002		Position information y		K-1
	BFM #1003,#1002	-	BFM #7005,#7004	Speed information	Speed information x	Set the operation speed.	K-1
	-	BFM #4003,#4002	BFM #7007,#7006		Speed information y		K-1
	-	-	BFM #7009,#7008	Circular information	Center coordinate i Radius r	Set center coordinate and radius of a circular line for circular interpolation operation	K-1
	-	-	BFM #7011,#7010		Center coordinate j		K-1
	BFM #1004	BMF# 4004	BFM #7012	Operation information		Set actions by the table operation.	K-1
	BFM #1005	BMF# 4005	BFM #7013	m code information		m code is output each time at positioning operation.	K-1
1	BFM #1011,#1010	-	BFM #7021,#7020	Position information	Position information x	Same as the table 0	K-1
	-	BFM #4011,#4010	BFM #7023,#7022		Position information y		K-1
	BFM #1013,#1012	-	BFM #7025,#7024	Speed information	Speed information x		K-1
	-	BFM #4013,#4012	BFM #7027,#7026		Speed information y		K-1
	-	-	BFM #7029,#7028	Circular information	Center coordinate i Radius r		K-1
	-	-	BFM #7031,#7030		Center coordinate j		K-1
	BFM #1014	BFM #4014	BFM #7032	Operation information			K-1
	BFM #1015	BFM #4015	BFM #7033	m code information			K-1
⋮		⋮		⋮		⋮	⋮
299	BFM #3991,#3990	-	BFM #12981,#12980	Position information	Position information x	Same as the table 0	K-1
	-	BFM #6991,#6990	BFM #12983,#12982		Position information y		K-1
	BFM #3993,#3992	-	BFM #12985,#12984	Speed information	Speed information x		K-1
	-	BFM #6993,#6992	BFM #12987,#12986		Speed information y		K-1
	-	-	BFM #12989,#12988	Circular information	Center coordinate i Radius r		K-1
	-	-	BFM #12991,#12990		Center coordinate j		K-1
	BFM #3994	BFM #6994	BFM #12992	Operation information			K-1
	BFM #3995	BFM #6995	BFM #12993	m code information			K-1

1. Position information

Set the following items according to the table operations set in the operation information.

Table Operation Action	Item	Description
Positioning operation	Set the target address.	Setting range: -2,147,483,648 to 2,147,483,647 [User unit]*1 Set the value within -2,147,483,648 to 2,147,483,647PLS in the converted pulse data
Changes the current address	Specify the current address after changed.	Setting range: -2,147,483,648 to 2,147,483,647 [User unit]*1 Set the value within -2,147,483,648 to 2,147,483,647PLS in the converted pulse data
Dwell	Set wait time to be spent for shifting operations.	Setting range: 0 to 32767 (× 10 ms)
Jump	Sets the table number of the jump address.	Setting range: 0 to 299

*1. Refer to the section shown below for details on the user units.

→ **Refer to Section 7.7**

2. Speed data (fx, f, fy)

Sets the operation speed of the positioning operation to be used for table operation.

Setting range: -2,147,483,648 to 2,147,483,647 [User unit]*1
Set the value within 1 to 50,000,000 Hz in converted pulse data

*1. Refer to the section shown below for details on the user units.

→ **Refer to Section 7.7**

3. Circular information (i, r, j)

Sets center coordinate and radius for a circular line to be used in circular interpolation operation

Setting range: -2,147,483,648 to 2,147,483,647 [User unit]*1
Set the value within -2,147,483,648 to 2,147,483,647PLS in the converted pulse data.

*1. Refer to the section shown below for details on the user units.

→ **Refer to Section 7.7**

4. Operation information

Sets the positioning operation for table operation and changes the current address.
Designate instruction words (such as DRV, DRVZ) in numerical values for operation information.

Type		Abbreviation	Setting value	Meaning	Position information		Speed information		Circular information		m code information
					x	y	fx/f	fy	i/r	j	
No processing		NOP	-1	Does not cause any operation.	-	-	-	-	-	-	-
m code		NOP	-1	Does not cause any operation. Used to activate m code.	-	-	-	-	-	-	✓
End		END	0	Terminates the table operation.	-	-	-	-	-	-	-
1-speed positioning operation	X-axis	DRV_X	1	Performs 1-speed positioning operation.	✓		✓	-	-	-	✓
	Y-axis	DRV_Y	2		-	✓	-	✓	-	-	✓
	XY-axes	DRV_XY	3		✓	✓	✓	✓	-	-	✓
Interrupt 1-speed constant quantity feed	X-axis	SINT_X	4	Performs interrupt 1-speed constant quantity feed.	✓	-	✓	-	-	-	✓
	Y-axis	SINT_Y	5			✓	-	✓	-	-	✓
	XY-axes	SINT_XY	6		✓	✓	✓	✓	-	-	✓
2-speed positioning operation (two tables are used)	X-axis	DRV2_X	7	Performs 2-speed positioning operation.	✓	-	✓	-	-	-	✓
					✓	-	✓	-	-	-	-
	Y-axis	DRV2_Y	8		-	✓	-	✓	-	-	✓
					-	✓	-	✓	-	-	-
	XY-axes	DRV2_XY	9		✓	✓	✓	✓	-	-	✓
					✓	✓	✓	✓	-	-	-

Type		Abbreviation	Setting value	Meaning	Position information x	Position information y	Speed information fx/f	Speed information fy	Circular information i/r	Circular information j	m code information
Interrupt 2-speed constant quantity feed (two tables are used)	X-axis	DINT_X	10	Performs interrupt 2-speed constant quantity feed.	✓	-	✓	-	-	-	✓
					-	-	✓	-	-	-	-
	Y-axis	DINT_Y	11		-	✓	-	✓	-	-	✓
					-	-	-	✓	-	-	-
	XY-axes	DINT_XY	12		✓	✓	✓	✓	-	-	✓
					-	-	✓	✓	-	-	-
Interrupt stop	X-axis	INT_X	13	Performs interrupt stop operation.	✓	-	✓	-	-	-	✓
	Y-axis	INT_Y	14		-	✓	-	✓	-	-	✓
	XY-axes	INT_XY	15		✓	✓	✓	✓	-	-	✓
Multi-speed operation (multiple tables are used)	X-axis	DRVC_X	16	Performs multi-speed operation.	✓	-	✓	-	-	-	✓
	Y-axis	DRVC_Y	17		-	✓	-	✓	-	-	✓
Linear interpolation		LIN	19	Performs linear interpolation operation.	✓	✓	✓	-	-	-	✓
Linear interpolation (interrupt stop)		LIN_INT	20	Performs linear interpolation operation (interrupt stop).	✓	✓	✓	-	-	-	✓
Circular interpolation (center, CW direction)		CW_i	21	Performs circular interpolation operation.	✓	✓	✓	-	✓	✓	✓
Circular interpolation (center, CCW direction)		CCW_i	22		✓	✓	✓	-	✓	✓	✓
Circular interpolation (radius, CW direction)		CW_r	23		✓	✓	✓	-	✓	-	✓
Circular interpolation (radius, CCW direction)		CCW_r	24		✓	✓	✓	-	✓	-	✓
Mechanical zero return operation	X-axis	DRVZ_X	25	Performs mechanical zero return operation.	-	-	-	-	-	-	✓
	Y-axis	DRVZ_Y	26		-	-	-	-	-	-	✓
	XY-axes	DRVZ_XY	27		-	-	-	-	-	-	✓
Changes the current address	X-axis	SET_X	90	The current address is replaced with a specified address (user units) by this command.	✓	-	-	-	-	-	✓
	Y-axis	SET_Y	91		-	✓	-	-	-	-	✓
	XY-axes	SET_XY	92		✓	✓	-	-	-	-	✓
Absolute address		ABS	93	When this command is issued, the position information (x, y) of the table operation becomes an absolute address, which specifies positions from the (0, 0) point. (absolute address is specified by default)	-	-	-	-	-	-	✓
Relative address		INC	94	When this command is issued, the position information (x, y) of the table operation becomes a relative address based on the current address.	-	-	-	-	-	-	✓
Dwell		TIM	95	The 20SSC-H waits for the specified time period. Use this to specify waiting time for shifting operations.	✓	-	-	-	-	-	✓
					-	✓	-	-	-	-	✓
Jump		JMP	96	Jumps to the specified table number. Jumping from X-axis table to Y-axis table is not allowed.	✓	-	-	-	-	-	-
					-	✓	-	-	-	-	-

5. m code information

m code is output each time at positioning operation.
For instructions on how to use the m code, refer to the following.

→ **Refer to Section 10.9**

No code••••••••••••••-1
m code after mode••••••0 to 9999
m code with mode••••••10000 to 32767

12. Program Example

STARTUP AND MAINTENANCE PRECAUTIONS **DANGER**

- Do not touch any terminal while the PLC's power is on.
  Doing so may cause electrical shock or malfunctions.
- Before cleaning or retightening terminals, externally cut off all phases of the power supply.
  Failure to do so may expose you to shock hazard.
- Before modifying the program under operation or performing operation for forcible output, running or stopping, carefully read the manual, and sufficiently ensure the safety.
  An operation error may damage the machine or cause accidents.
- To test Zero-return, JOG operation and Positioning data, throughly read this manual, ensure the safe system operation
  An operation error may damage the machine or cause accidents.

STARTUP AND MAINTENANCE PRECAUTIONS **CAUTION**

- Do not disassemble or modify the PLC.
  Doing so may cause failures, malfunctions or fire.
  For repair, contact your local Mitsubishi Electric distributor.
- Before connecting or disconnecting any extension cable, turn off power.
  Failure to do so may cause unit failure or malfunctions.
- Before attaching or detaching the following devices, turn off power.
  Failure to do so may cause device failure or malfunctions.
  - Peripheral devices, expansion boards and special adapters
  - I/O extension blocks/units and terminal blocks

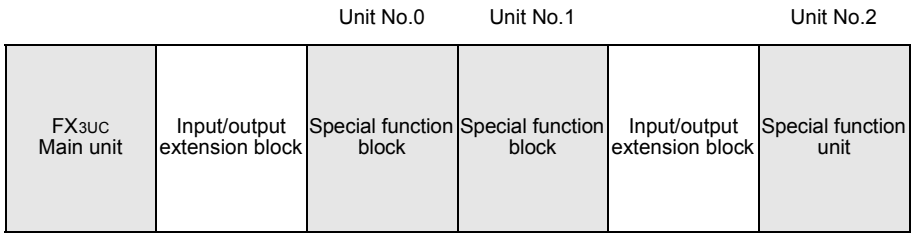
12.1 Reading/Writing Buffer Memory

12.1.1 Assigned unit number

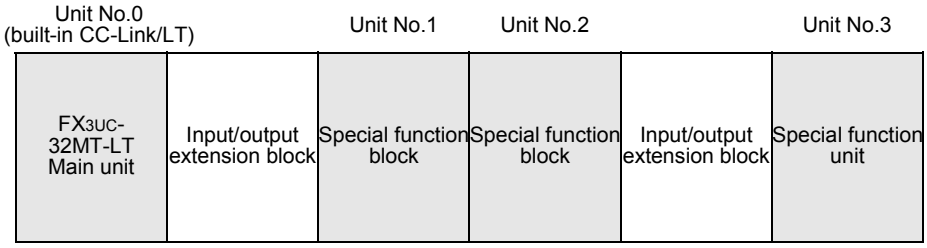
1. Assigned unit number

The unit number for the 20SSC-H is automatically assigned No.0 to No.7 starting from the special function unit/block closest to the PLC main unit.

- In the FX3U series



- In the FX3UC series



12.1.2 How to read/write from/to buffer memory

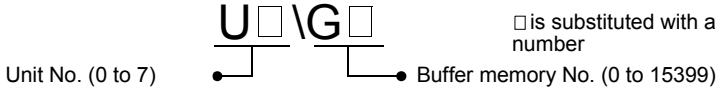
To read/write from/to buffer memory in 20SSC-H, use the FROM/TO instructions or applied instructions that directly specify the buffer memory.
To directly specify the buffer memory, FX3U/FX3UC PLC applicable software (GX Developer) is required.

Note

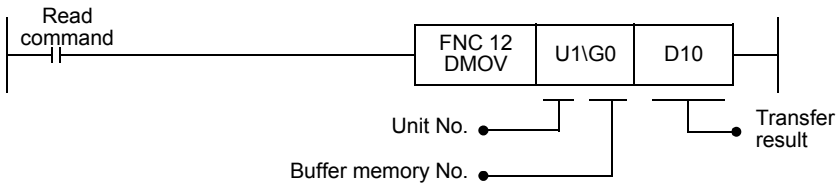
Buffer memory that is assigned in 32 bits must use 32-bit instructions to read/write.
Data cannot be correctly read/written from/to buffer memory assigned in 32 bits if 16-bit read/write instructions are used.

1. Direct specification of buffer memory

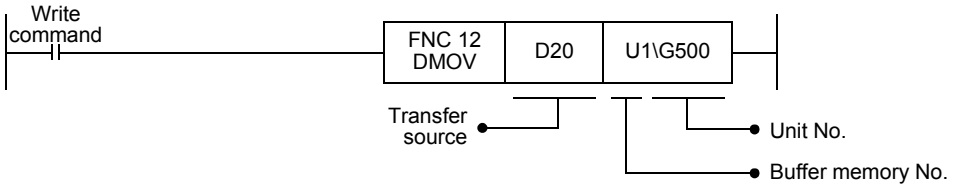
The following setting device is specified for the source or destination of an applied instruction.



1) Example 1
In the following program example, data is read from the buffer memory (BFM #1,#0) in unit No.1 to data registers (D11, D10).

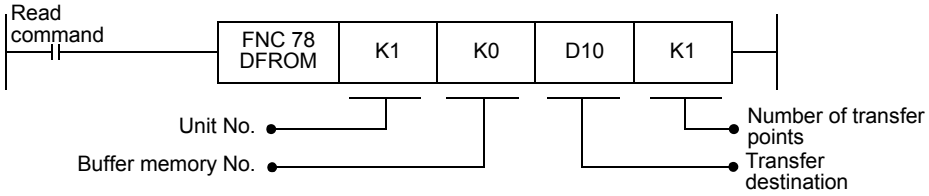


2) Example 2
In the following program example, 32-bit data in data registers (D21,D20) is written to buffer memory (BFM #501,#500) in unit No.1.



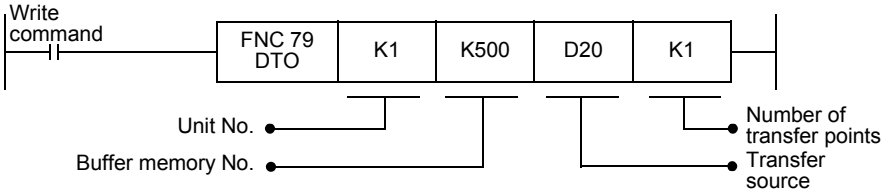
2. FROM/TO instructions (conventional method)

1) FROM instruction (read from BFM to PLC)
The FROM instruction is used to read data from the buffer memory.
The following shows how to use this instruction in a sequence program.



In the above program example, a 32-bit data is read from buffer memory (BFM #1,#0) in unit No.1 to data registers (D11,D10).

2) TO instruction (write from PLC to BFM)
The TO instruction is used to write data to buffer memory.
The following shows how to use this instruction in sequence program.



In the above program example, 32-bit data in data registers (D21,D20) is written to buffer memory (BFM #501,#500) in unit No.1.

12.2 Device Assignments

Name		Device No.		Remark
		X-axis	Y-axis	
Input				
Error reset		X000	X010	
STOP		X001	X011	
Forward rotation limit		X002	X012	Use external wiring with NC contacts.
Reverse rotation limit		X003	X013	
Forward rotation JOG		X004	X014	
Reverse rotation JOG		X005	X015	
Mechanical zero return command		X006	X016	
START command		X007	X017	
Selection of 1-speed positioning operation		X020	X021	
Selection of table operation (individual)		X022	X023	
Selection of table operation (simultaneous)		X024	-	
Control data				
Operation pattern selection	1-speed Positioning operation	M0	M100	
	Interrupt 1-speed constant quantity feed	M1	M101	
	2-speed Positioning operation	M2	M102	
	Interrupt 2-speed constant quantity feed	M3	M103	
	Interrupt stop	M4	M104	
	Variable speed operation	M5	M105	
	Manual pulse generator	M6	M106	
	Linear interpolation operation	M7	M107	
	Linear interpolation (interrupt stop) operation	M8	M108	
	Table operation (individual)	M9	M109	
	Table operation (simultaneous)	M10	M110	
	Not available	M11 to M15	M111 to M115	Always OFF
Operation command 1	Error reset	M20	M120	
	STOP	M21	M121	
	Forward rotation limit	M22	M122	
	Reverse rotation limit	M23	M123	
	Forward rotation JOG	M24	M124	
	Reverse rotation JOG	M25	M125	
	Mechanical zero return command	M26	M126	
	Not available	M27	M127	Always OFF
	Relative/absolute address specification	M28	M128	
	START command	M29	M129	
	Simultaneous start flag	M30	M130	
	m code OFF command	M31	M131	
	Change command in operation disabled	M32	M132	
	Speed change command in positioning control	M33	M133	
	Target position change command in positioning control	M34	M134	
	Not available	M35	M135	Always OFF
Target address 1		D501, D500	D601, D600	
Operation speed 1		D503, D502	D603, D602	
Table operation start No.		D521	D621	

Name		Device No.		Remark
		X-axis	Y-axis	
Monitor data				
Status information	READY	M40	M140	
	During forward rotation pulse output	M41	M141	
	During reverse rotation pulse output	M42	M142	
	Zero return completed	M43	M143	
	Current value overflow	M44	M144	
	Error occurrence	M45	M145	
	Positioning completion	M46	M146	
	Standby for remaining travel distance at STOP	M47	M147	
	m code ON	M48	M148	
	Unit ready	M49	M149	
	During servo parameters transfer	M50	M150	
	Saving to flash memory	M51	M151	
	Initializing buffer memory	M52	M152	
	During operation speed change	M53	M153	
	During target address change	M54	M154	
	During table operation execution	M55	M155	
Current address (user)		D1, D0	D101, D100	
Error BFM No.		D6	D106	
m code No.		D9	D109	
Operation speed present value		D11, D10	D111, D110	
Number of the table in operation		D16	D116	
Error code		D29	D129	
Motor rotation speed		D53, D52	D153, D152	
Servo status		D64	D164	
Servo warning code		D68	D168	
Motor feedback position		D71, D70	D171, D170	

12.3 Explanation of Operation

This section describes operation of the example program.
Positioning control parameters are used with their default settings.

→ **For details on device assignments, refer to section 12.2**
→ **For details on sequence programs, refer to section 12.4**

Note

- ***Set the servo series in the servo parameters according to the servo amplifier to be used.***

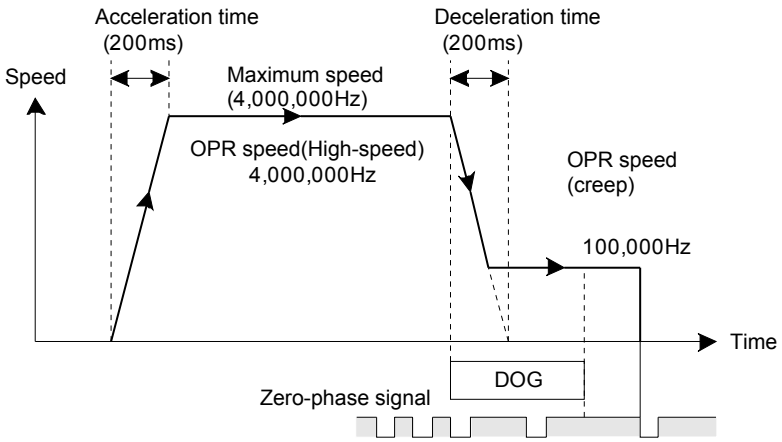
→ **Refer to Section 7.1 and 11.2**

- Set the following parameters if necessary.

→ **For details, refer to Section 7.1 and Chapter 11**

  - Function selection (C-4) for servo parameters
  - Zero return interlock setting in positioning parameters

12.3.1 Mechanical zero return



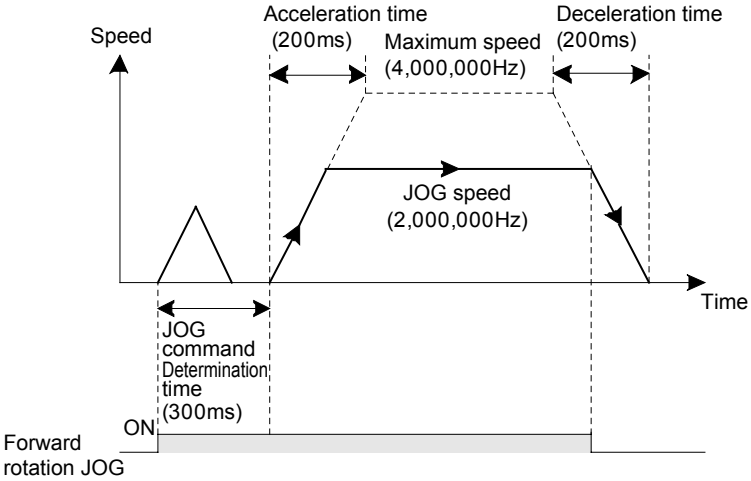
X-axis

1) When turning X006 "X-axis mechanical zero return command" to ON at the PLC main unit, DOG type mechanical zero return operation starts in the current value decrementing direction.
2) When turning the DOG ON, the operation decelerates to the zero return speed (creep).
3) When turning the DOG OFF, the operation stops at the zero-phase signal of the motor, and the mechanical origin address is stored to the current value. (zero-point signal count: 1 time)

Y-axis

1) When turning X016 "Y-axis mechanical zero return command" to ON at the PLC main unit, DOG type mechanical zero return operation starts in the current value decrementing direction.
2) When turning the DOG ON, operation decelerates to the zero return speed (creep).
3) When turning the DOG OFF, the operation stops at the zero-phase signal of the motor, and the mechanical origin address is stored to the current value. (zero-point signal count: 1 time)

12.3.2 JOG operation



X-axis

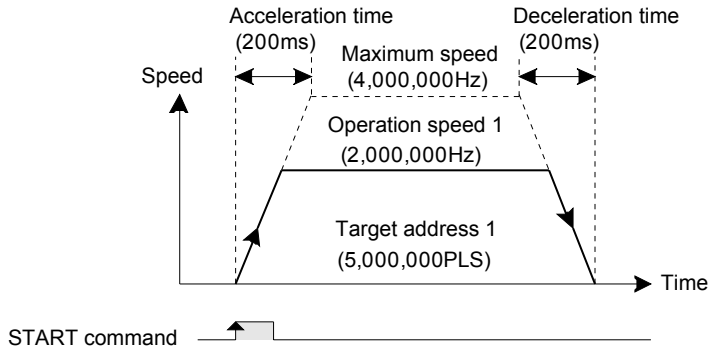
- When turning X004 "X-axis forward rotation JOG" to ON at the PLC main unit, the JOG operation starts in the current value incrementing direction.
- When turning X005 "X-axis reverse rotation JOG" to ON at the PLC main unit, the JOG operation starts in the current value decrementing direction.

Y-axis

- When turning X014 "Y-axis forward rotation JOG" to ON at the PLC main unit, the JOG operation starts in the current value incrementing direction.
- When turning X015 "Y-axis reverse rotation JOG" to ON at the PLC main unit, the JOG operation starts in the current value decrementing direction.

12.3.3 1-speed positioning operation

The 1-speed positioning operation operates by the drive for incrementing. The positioning operates at constant quantity feed.



X-axis

- When turning X007 "X-axis START command" to ON with X020 "X-axis selection of 1-speed positioning operation" turned ON at the PLC main unit, the 1-speed positioning operation starts. After 5,000,000 pulses of travel in the current value incrementing direction, the operation decelerates to stop.
- When X007 is turned ON again, positioning starts with the same travel distance again.
  (The state of X020 "X-axis selection of 1-speed positioning operation" on the PLC main unit changes from OFF to ON).
- When turning X001 "X-axis stop" to ON during positioning, the operation decelerates to stop.

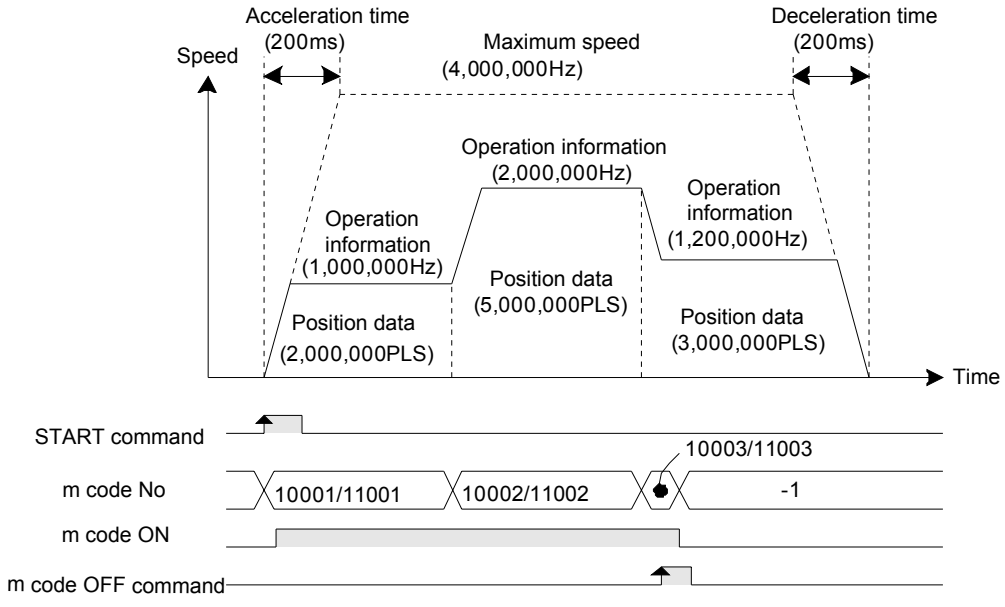
Y-axis

- When turning X017 "X-axis START command" to ON with X021 "X-axis selection of 1-speed positioning operation" turned ON at the PLC main unit, the 1-speed positioning operation starts. After 5,000,000 pulses of travel in the current value incrementing direction, the operation decelerates to stop.
- When X017 is turned ON again, positioning starts with the same travel distance again.
  (The state of X021 "X-axis selection of 1-speed positioning operation" on the PLC main unit changes from OFF to ON).
- When turning X011 "X-axis stop" to ON during positioning, the operation decelerates to stop.

12.3.4 Multi-speed operation [table operation (individual)]

Multi-speed operation works in table operation. In this example, multi-speed operation functions by the drive to increment.

1. Operation details



X-axis

- When turnig X007 "X-axis START command" to ON with X022 "X-axis selection of table operation (individual)" turned ON, multi-speed operation preset to X-axis table information starts. After 10,000,000 pulses of travel in the current value incrementing direction, operation decelerates to stop.
- When turning X007 "X-axis START command" to ON after the table operation ends, the positioning operates by the same travel distance again.
- When turnig X001 "X-axis stop" to ON during positioning, the positioning decelerates to stop.
- m codes are output in the with mode. At the start of each operation, the m code ON flag becomes "1" and the m code number is stored.
  When the m code number of 10003, the m code OFF command turns ON, and the m code turns OFF.

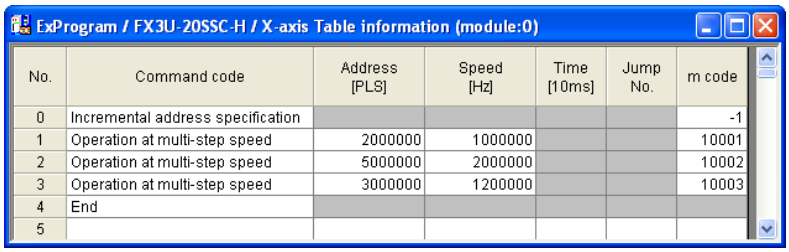
Y-axis

- When turnig X017 "X-axis START command" to ON with X023 "X-axis selection of table operation (individual)" turned ON, multi-speed operation preset to X-axis table information starts. After 10,000,000 pulses of travel in the current value incrementing direction, operation decelerates to stop.
- When turning X017 "X-axis START command" to ON after the table operation ends, the positioning operates by the same travel distance again.
- When turnig X011 "X-axis stop" to ON during positioning, the positioning decelerates to stop.
- m codes are output in the with mode. At the start of each operation, the m code ON flag becomes "1" and the m code number is stored.
  When the m code number of 11003, the m code OFF command turns ON, and the m code turns OFF.

2. Setting table information

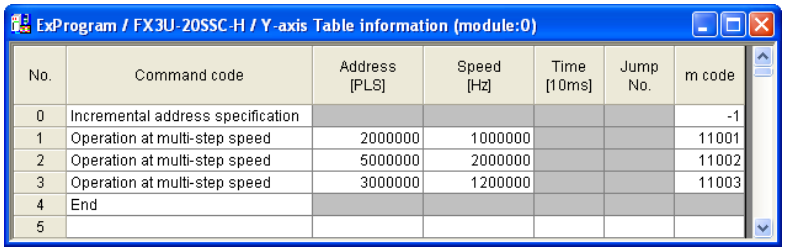
Set the X-axis/Y-axis table information as follows in FX Configurator-FP.

1) X-axis table information



No.	Command code	Address [PLS]	Speed [Hz]	Time [10ms]	Jump No.	m code
0	Incremental address specification					-1
1	Operation at multi-step speed	2000000	1000000			10001
2	Operation at multi-step speed	5000000	2000000			10002
3	Operation at multi-step speed	3000000	1200000			10003
4	End					
5						

2) Y-axis table information

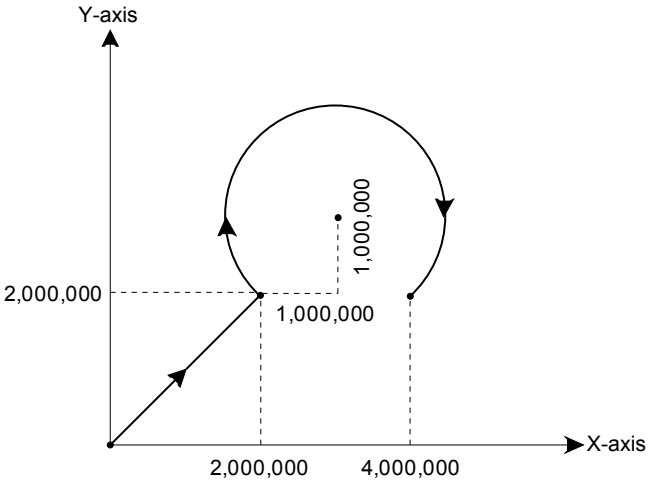


No.	Command code	Address [PLS]	Speed [Hz]	Time [10ms]	Jump No.	m code
0	Incremental address specification					-1
1	Operation at multi-step speed	2000000	1000000			11001
2	Operation at multi-step speed	5000000	2000000			11002
3	Operation at multi-step speed	3000000	1200000			11003
4	End					
5						

12.3.5 Circular interpolation operation [table operation (simultaneous)]

Circular interpolation operation works in table operation. In this example, circular interpolation operation functions by the drive to increment.

1. Operation details



XY-axis

- When turnig X007 "X-axis START command" to ON with X024 "X-axis selection of table operation (simultaneous)" turned ON, operation starts in the order of the XY-table information.
  1) Linear interpolation operation
  2) Dwell
  3) Circular interpolation operation
  4) End
- When turnig X001 "X-axis stop" to ON during positioning, operation decelerates to stop.

2. Setting table information

Set the XY-axis table information as follows on FX Configurator-FP.

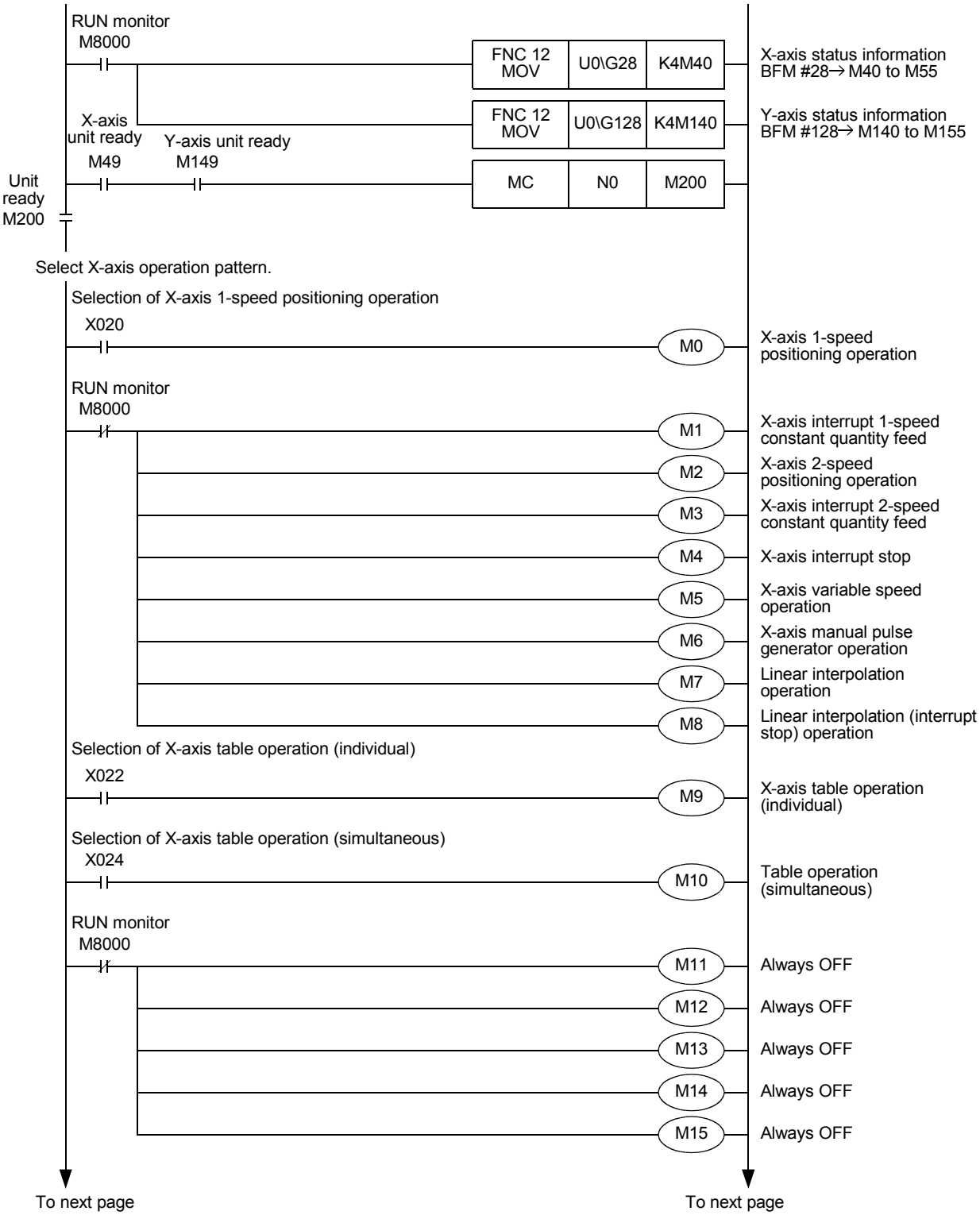
ExProgram / FX3U-20SSC-H / XY-axis Table information (module:0)

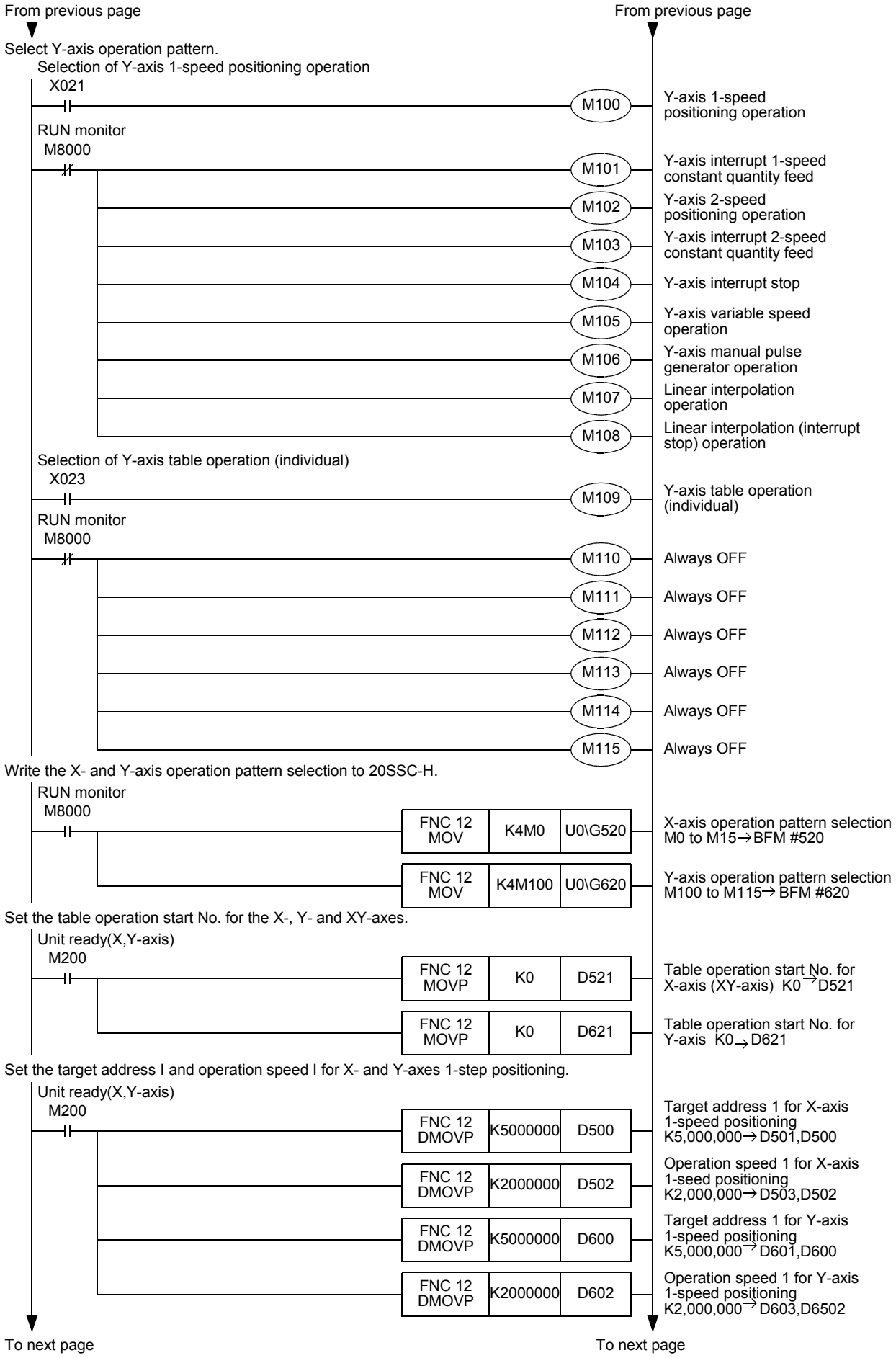
No.	Command code	Address x:[PLS] y:[PLS]	Speed fx:[Hz] fy:[Hz]	Arc center i:[PLS] j:[PLS]	Arc radius r:[PLS]	Time [10ms]	Jump No.	m code
0	Incremental address specification							-1
1	Linear interpolation	x: 2000000 y: 2000000	fx: 1000000					-1
2	Dwell					100		-1
3	Circular interpolation(CNT,CW)	x: 2000000 y: 0	fx: 1000000	i: 1000000 j: 1000000				-1
4	End							
5								

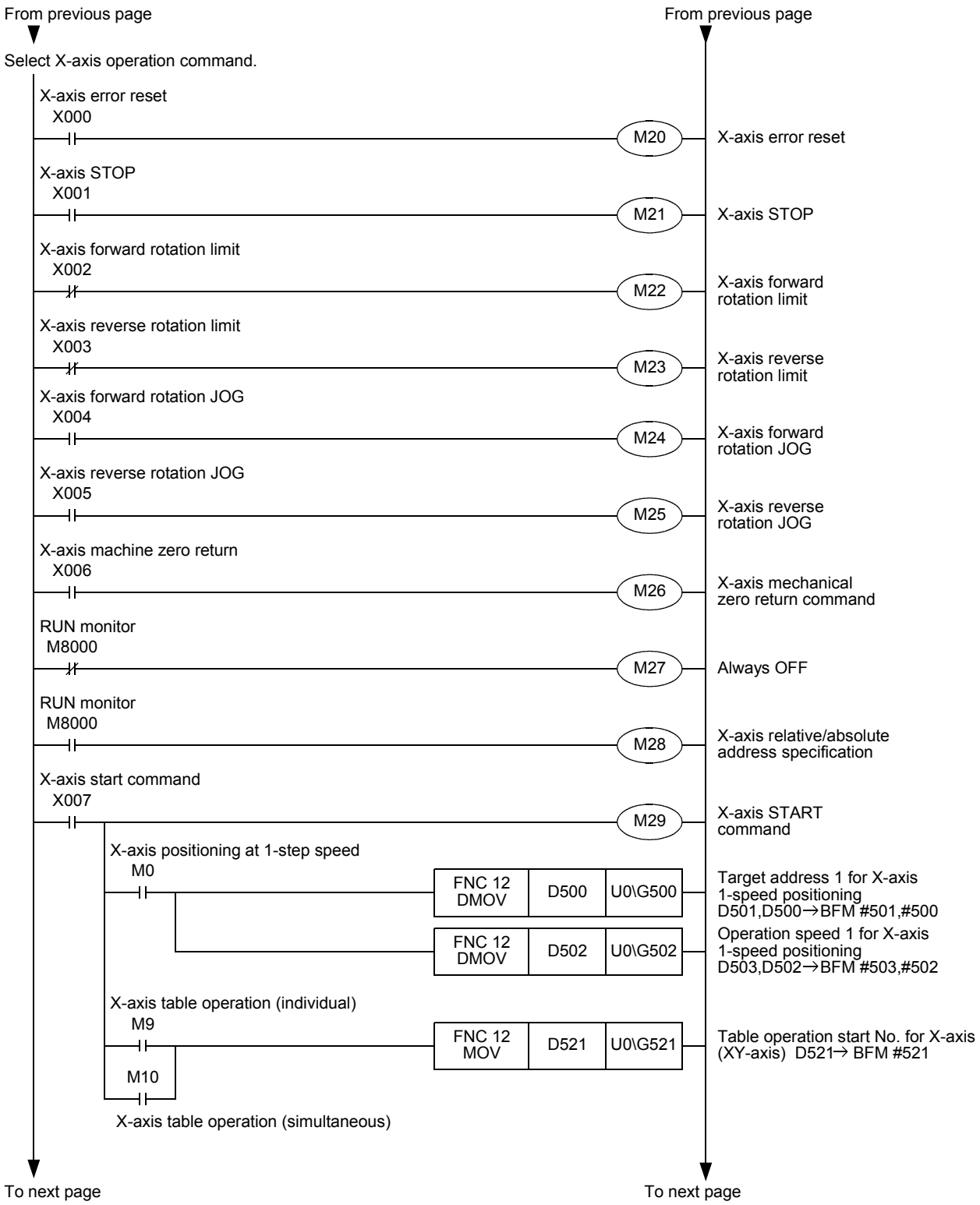
12.4 Sequence Program

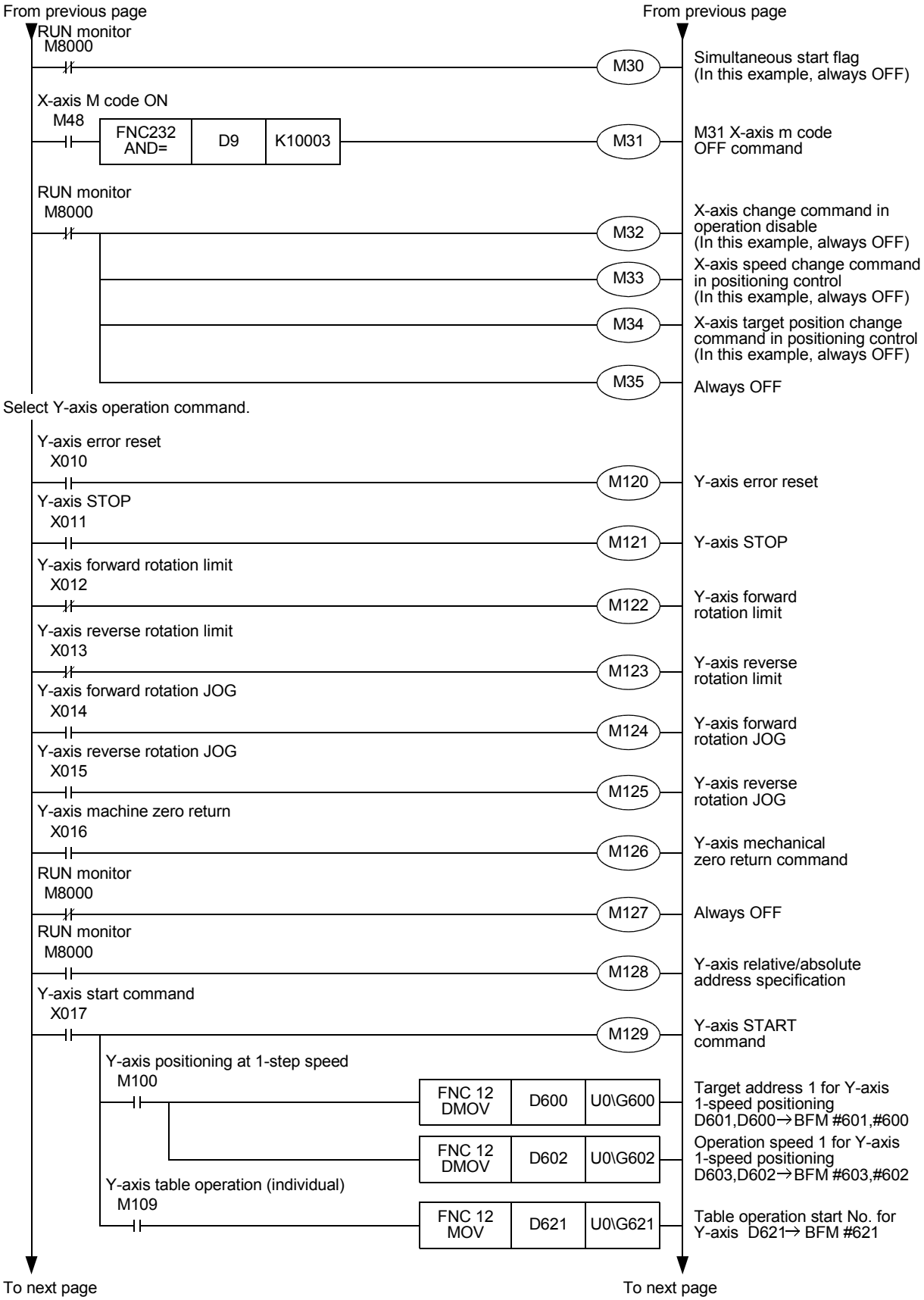
This program example describes the sequence program as unit No.0.
Rewrite the unit No. with the actual system configuration to be used.

→ **For details on the unit No., refer to subsection 12.1.1**
→ **For details on device assignments, refer to section 12.2**
→ **For an explanation of operation, refer to section 12.3**


RUN monitor
M8000
FNC 12 MOV
U0\G28
K4M40
X-axis status information
BFM #28→ M40 to M55
FNC 12 MOV
U0\G128
K4M140
Y-axis status information
BFM #128→ M140 to M155
X-axis unit ready
M49
Y-axis unit ready
M149
Unit ready
M200
MC
N0
M200
Select X-axis operation pattern.
Selection of X-axis 1-speed positioning operation
X020
M0
X-axis 1-speed positioning operation
RUN monitor
M8000
M1
X-axis interrupt 1-speed constant quantity feed
M2
X-axis 2-speed positioning operation
M3
X-axis interrupt 2-speed constant quantity feed
M4
X-axis interrupt stop
M5
X-axis variable speed operation
M6
X-axis manual pulse generator operation
M7
Linear interpolation operation
M8
Linear interpolation (interrupt stop) operation
Selection of X-axis table operation (individual)
X022
M9
X-axis table operation (individual)
Selection of X-axis table operation (simultaneous)
X024
M10
Table operation (simultaneous)
RUN monitor
M8000
M11
Always OFF
M12
Always OFF
M13
Always OFF
M14
Always OFF
M15
Always OFF
To next page
To next page


From previous page
From previous page
Select Y-axis operation pattern.
Selection of Y-axis 1-speed positioning operation
X021
M100
Y-axis 1-speed positioning operation
RUN monitor
M8000
M101
Y-axis interrupt 1-speed constant quantity feed
M102
Y-axis 2-speed positioning operation
M103
Y-axis interrupt 2-speed constant quantity feed
M104
Y-axis interrupt stop
M105
Y-axis variable speed operation
M106
Y-axis manual pulse generator operation
M107
Linear interpolation operation
M108
Linear interpolation (interrupt stop) operation
Selection of Y-axis table operation (individual)
X023
M109
Y-axis table operation (individual)
RUN monitor
M8000
M110
Always OFF
M111
Always OFF
M112
Always OFF
M113
Always OFF
M114
Always OFF
M115
Always OFF
Write the X- and Y-axis operation pattern selection to 20SSC-H.
RUN monitor
M8000
FNC 12 MOV
K4M0
U0\G520
X-axis operation pattern selection M0 to M15→BFM #520
FNC 12 MOV
K4M100
U0\G620
Y-axis operation pattern selection M100 to M115→ BFM #620
Set the table operation start No. for the X-, Y- and XY-axes.
Unit ready(X,Y-axis)
M200
FNC 12 MOVP
K0
D521
Table operation start No. for X-axis (XY-axis) K0→D521
FNC 12 MOVP
K0
D621
Table operation start No. for Y-axis K0→D621
Set the target address I and operation speed I for X- and Y-axes 1-step positioning.
Unit ready(X,Y-axis)
M200
FNC 12 DMOVP
K5000000
D500
Target address 1 for X-axis 1-speed positioning K5,000,000→D501,D500
FNC 12 DMOVP
K2000000
D502
Operation speed 1 for X-axis 1-seed positioning K2,000,000→D503,D502
FNC 12 DMOVP
K5000000
D600
Target address 1 for Y-axis 1-speed positioning K5,000,000→D601,D600
FNC 12 DMOVP
K2000000
D602
Operation speed 1 for Y-axis 1-speed positioning K2,000,000→D603,D6502
To next page
To next page


From previous page
From previous page
Select X-axis operation command.
X-axis error reset
X000
M20
X-axis error reset
X-axis STOP
X001
M21
X-axis STOP
X-axis forward rotation limit
X002
M22
X-axis forward rotation limit
X-axis reverse rotation limit
X003
M23
X-axis reverse rotation limit
X-axis forward rotation JOG
X004
M24
X-axis forward rotation JOG
X-axis reverse rotation JOG
X005
M25
X-axis reverse rotation JOG
X-axis machine zero return
X006
M26
X-axis mechanical zero return command
RUN monitor
M8000
M27
Always OFF
RUN monitor
M8000
M28
X-axis relative/absolute address specification
X-axis start command
X007
M29
X-axis START command
X-axis positioning at 1-step speed
M0
FNC 12 DMOV
D500
U0\G500
Target address 1 for X-axis 1-speed positioning D501,D500→BFM #501,#500
FNC 12 DMOV
D502
U0\G502
Operation speed 1 for X-axis 1-speed positioning D503,D502→BFM #503,#502
X-axis table operation (individual)
M9
FNC 12 MOV
D521
U0\G521
Table operation start No. for X-axis (XY-axis) D521→ BFM #521
M10
X-axis table operation (simultaneous)
To next page
To next page


From previous page
From previous page
RUN monitor
M8000
M30
Simultaneous start flag
(In this example, always OFF)
X-axis M code ON
M48
FNC232
AND=
D9
K10003
M31
M31 X-axis m code
OFF command
RUN monitor
M8000
M32
X-axis change command in
operation disable
(In this example, always OFF)
M33
X-axis speed change command
in positioning control
(In this example, always OFF)
M34
X-axis target position change
command in positioning control
(In this example, always OFF)
M35
Always OFF
Select Y-axis operation command.
Y-axis error reset
X010
M120
Y-axis error reset
Y-axis STOP
X011
M121
Y-axis STOP
Y-axis forward rotation limit
X012
M122
Y-axis forward
rotation limit
Y-axis reverse rotation limit
X013
M123
Y-axis reverse
rotation limit
Y-axis forward rotation JOG
X014
M124
Y-axis forward
rotation JOG
Y-axis reverse rotation JOG
X015
M125
Y-axis reverse
rotation JOG
Y-axis machine zero return
X016
M126
Y-axis mechanical
zero return command
RUN monitor
M8000
M127
Always OFF
RUN monitor
M8000
M128
Y-axis relative/absolute
address specification
Y-axis start command
X017
M129
Y-axis START
command
Y-axis positioning at 1-step speed
M100
FNC 12
DMOV
D600
U0\G600
Target address 1 for Y-axis
1-speed positioning
D601,D600→BFM #601,#600
FNC 12
DMOV
D602
U0\G602
Operation speed 1 for Y-axis
1-speed positioning
D603,D602→BFM #603,#602
Y-axis table operation (individual)
M109
FNC 12
MOV
D621
U0\G621
Table operation start No. for
Y-axis D621→ BFM #621
To next page
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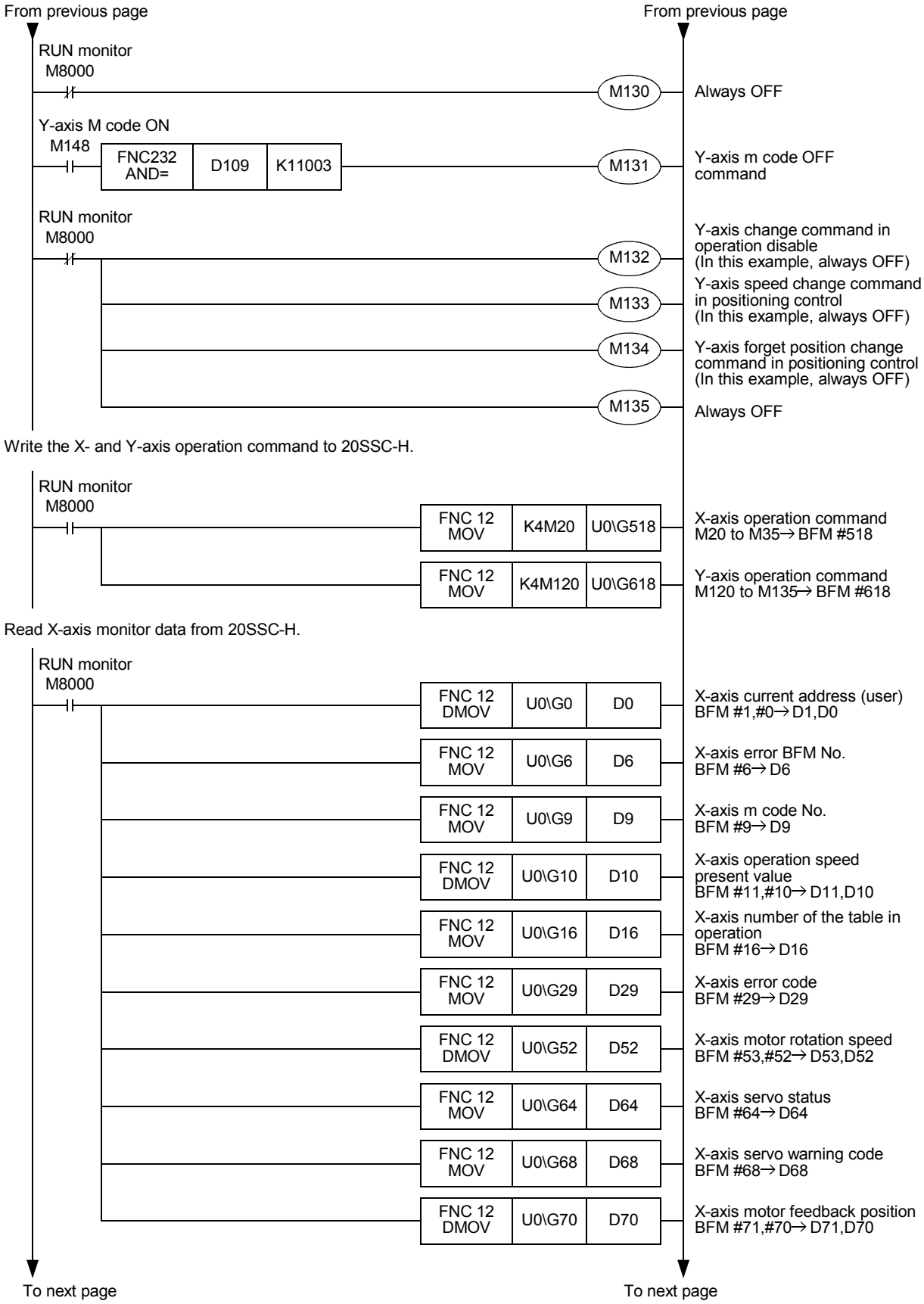
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RUN monitor
M8000
M130
Always OFF
Y-axis M code ON
M148
FNC232 AND=
D109
K11003
M131
Y-axis m code OFF command
RUN monitor
M8000
M132
Y-axis change command in operation disable (In this example, always OFF)
M133
Y-axis speed change command in positioning control (In this example, always OFF)
M134
Y-axis forget position change command in positioning control (In this example, always OFF)
M135
Always OFF
Write the X- and Y-axis operation command to 20SSC-H.
RUN monitor
M8000
FNC 12 MOV
K4M20
U0\G518
X-axis operation command M20 to M35→ BFM #518
FNC 12 MOV
K4M120
U0\G618
Y-axis operation command M120 to M135→ BFM #618
Read X-axis monitor data from 20SSC-H.
RUN monitor
M8000
FNC 12 DMOV
U0\G0
D0
X-axis current address (user) BFM #1,#0→ D1,D0
FNC 12 MOV
U0\G6
D6
X-axis error BFM No. BFM #6→ D6
FNC 12 MOV
U0\G9
D9
X-axis m code No. BFM #9→ D9
FNC 12 DMOV
U0\G10
D10
X-axis operation speed present value BFM #11,#10→ D11,D10
FNC 12 MOV
U0\G16
D16
X-axis number of the table in operation BFM #16→ D16
FNC 12 MOV
U0\G29
D29
X-axis error code BFM #29→ D29
FNC 12 DMOV
U0\G52
D52
X-axis motor rotation speed BFM #53,#52→ D53,D52
FNC 12 MOV
U0\G64
D64
X-axis servo status BFM #64→ D64
FNC 12 MOV
U0\G68
D68
X-axis servo warning code BFM #68→ D68
FNC 12 DMOV
U0\G70
D70
X-axis motor feedback position BFM #71,#70→ D71,D70
To next page
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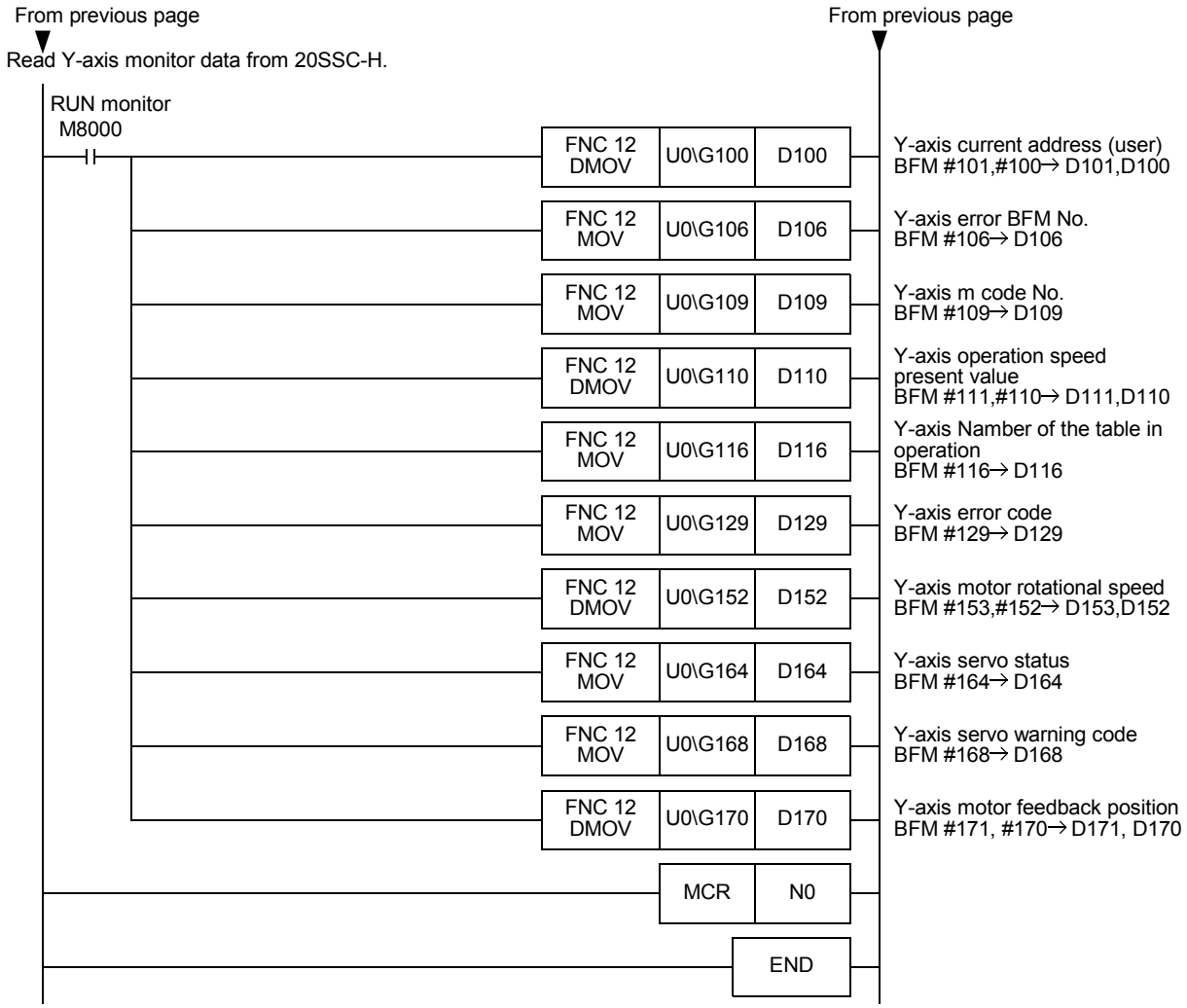
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Read Y-axis monitor data from 20SSC-H.
From previous page
RUN monitor
M8000
FNC 12 DMOV U0\G100 D100
Y-axis current address (user)
BFM #101,#100→ D101,D100
FNC 12 MOV U0\G106 D106
Y-axis error BFM No.
BFM #106→ D106
FNC 12 MOV U0\G109 D109
Y-axis m code No.
BFM #109→ D109
FNC 12 DMOV U0\G110 D110
Y-axis operation speed present value
BFM #111,#110→ D111,D110
FNC 12 MOV U0\G116 D116
Y-axis Namber of the table in operation
BFM #116→ D116
FNC 12 MOV U0\G129 D129
Y-axis error code
BFM #129→ D129
FNC 12 DMOV U0\G152 D152
Y-axis motor rotational speed
BFM #153,#152→ D153,D152
FNC 12 MOV U0\G164 D164
Y-axis servo status
BFM #164→ D164
FNC 12 MOV U0\G168 D168
Y-axis servo warning code
BFM #168→ D168
FNC 12 DMOV U0\G170 D170
Y-axis motor feedback position
BFM #171, #170→ D171, D170
MCR N0
END

13. Diagnostics

When a fault occurs, check the power supply voltage, the PLC main unit and I/O devices for loose terminal screws, and examine the connectors for a defective contact.
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STARTUP AND MAINTENANCE PRECAUTIONS DANGER

- Do not touch any terminal while the PLC's power is on.
  Doing so may cause electrical shock or malfunctions.
- Before cleaning or retightening terminals, externally cut off all phases of the power supply.
  Failure to do so may expose you to shock hazard.
- Before modifying the program under operation or performing operation for forcible output, running or stopping, carefully read the manual, and sufficiently ensure the safety.
  An operation error may damage the machine or cause accidents.
- To test Zero-return, JOG operation and Positioning data, throughly read this manual, ensure the safe system operation
  An operation error may damage the machine or cause accidents.

STARTUP AND MAINTENANCE PRECAUTIONS CAUTION

- Do not disassemble or modify the PLC.
  Doing so may cause failures, malfunctions or fire.
  For repair, contact your local Mitsubishi Electric distributor.
- Before connecting or disconnecting any extension cable, turn off power.
  Failure to do so may cause unit failure or malfunctions.
- Before attaching or detaching the following devices, turn off power.
  Failure to do so may cause device failure or malfunctions.
  - Peripheral devices, expansion boards and special adapters
  - I/O extension blocks/units and terminal blocks

13.1 Check LEDs

13.1.1 Check LEDs

LED Indication	Color Indication	State	Content of Error	Action
POWER	Green	Off	No power supply from the external power supply and PLC main unit.	• Correctly connect the extension cable and power cable. • Correctly connect the wiring to the external power supply. • When the service power supply of the PLC main unit is in use, make sure that the supply capacity is not being exceeded.
		On	Power is supplied from the external power supply and PLC main unit.	The power supply is normal.
X-READY Y-READY	Green	Off	An error has occurred on the X-axis/ Y-axis, or positioning control is being executed.	When the stop command is input, the positioning operation stops, and the LED lights. If the LED does not light even after a stop, an error has occuerd. Check the error and remove the cause.
		On	The X-axis/Y-axis cannot accept operation commands.	-
X-ERROR Y-ERROR	Red	Off	No error	-
		Flashing	An error has occurred.	An error has occurred on the 20SSC-H. Check the error code, and perform the action according to the content of the error. For details on error codes, refer to the following: →**Refer to subsection 13.2.3**
		On	CPU error	If the 20SSC-H does not restore the problem at power ON again, consult a Mitsubishi Electric distributor.

13.1.2 Input LED state indications

LED Indication	Color Indication	State	Content of Error	Action
X-START Y-START	Red	Off	START input OFF	If the LED does not light even if input is ON, check the input wiring. The 20SSC-H inputs START, DOG, INT0, and INT1 require an external power supply (24VDC).
X-DOG Y-DOG	Red	Off	DOG input OFF	
X-INT0 Y-INT0 X-INT1 Y-INT1	Red	Off	INT0, INT1 input OFF	
X-ϕA Y-ϕA	Red	Off	Manual pulse generator A phase input OFF	If the LED does not flash even at pulse input from the manual pulse generator, check the input wiring.
X-ϕB Y-ϕB	Red	Off	Manual pulse generator B phase input OFF	

13.2 Check Error Code

13.2.1 Checking errors

When an error or warning (servo amplifier) occurs, error or warning information is stored to the following buffer memories.
FX Configurator-FP and GX-Developer check the error by monitoring, and so does a sequence program.

Item		BFM number X-axis	BFM number Y-axis	Content
Monitor data				
Error occurrence BFM No.		BFM #6	BFM #106	When an error occurs, the BFM No. with error is stored. -1: No error occurrence Other: BFM No. with error →**Refer to subsection 11.3.4**
Status information	Error occurrence	BFM #28 b5	BFM #128 b5	This is set when a 20SSC-H and servo amplifier error occurs. This can be reset by an error reset. →**Refer to subsection 11.3.13**
Error code		BFM #29	BFM #129	When an error occurs, the error code is stored. →**Refer to subsection 13.2.3**
Servo parameter error No.		BFM #62	BFM #162	When a servo parameter error occurs, the parameter No. of the servo parameter that is in error is stored. →**Refer to subsection 11.3.20**
Servo status	In alarm	BFM #64 b5	BFM #164 b5	This turns ON at a servo alarm. →**Refer to subsection 11.3.21**
	In warming	BFM #164 b15	BFM #164 b15	This turns ON at the servo amplifier warning. →**Refer to subsection 11.3.21**
Servo warning code		BFM #68	BFM #168	The warning detected by the servo amplifier is stored. →**Refer to subsection 13.2.24**

13.2.2 How to reset an error

After detecting and removing the cause of the error, reset the error by performing an error reset.

How to reset an error

1) Turn the following bit from OFF to ON in the sequence programor on GX Developer.

Item	BFM number X-axis	BFM number Y-axis	Content
Control data			
Error reset	BFM #518 b0	BFM #618 b0	When this turns ON at an error, an error reset is performed, and the following information is cleared. - Error occurrence BFM No. (BFM #6, #106) - Status information Error occurrence (b5) - Error code (BFM #29) →**Refer to subsection 11.4.10**

2) Perform an error reset with FX Configurator-FP.

Point

- At a servo parameter error
  Correct the servo parameter, save the correct parameter to 20SSC-H flash memory, and reboot the 20SSC-H and servo amplifier.
- Alarms and warnings detected on the servo amplifier
  The servo amplifier requires rebooting depending on the content of the alarm and warning.
  → **For details on countermeasures, refer to subsection 13.2.3 and 13.2.4**

13.2.3 Error code list [BFM #29 (X-axis), BFM #129 (Y-axis)]

When an error occurs, an error code is stored in decimal to BFM #29 (X-axis) and BFM #129 (Y-axis).

Error category	Error Code (decimal)	Error Content	Action
-	0	No error	-
Setting error	2	Incorrect value range A value outside of the setting range is set to the buffer memory.	Change the setting value in buffer memory so that it is within the setting range.
	3	Value overflow The converted pulse data (e.g. travel distance or operation speed) exceeds 32 bits.	Change the setting value of the corresponding buffer memory so that the converted pulse data is smaller than 32-bit data.
	4	The zero return, STARTand JOG commands are ON at the same time.	Change the program in the PLC main unit so that positioning control start commands do not overlap.
	5	The operation pattern has Multiple operation patterns	Change the program in the PLC main unit so that only one operation pattern is selected.
	6	Center coordinate setting error When one of the following applies: - Start point = center coordinate - End point = center coordinate - Center coordinate is outside of the -2,147,483,648 to 2,147,483,647 PLS range	Check the center coordinate setting and set so that a circle is formed.
Control errors	3000	Table operation start No. error The table No. is executed outside of the range 0 to 299.	Change the table operation start No. to 0 to 299.
	3001	Jump No. fault The jump No. for the table information is set outside the range 0 to 299.	Change the jump No. for the table information to 0 to 299.
	3002	Command format fault The operation information of the table information is set by a non-defined number.	Change the operation information of the table information.
	3004	Current value overflow at absolute value detection system The converted pulse data of the current address exceeds 32 bits.	Turn the power OFF, or perform a mechanical zero return or data set type zero return.
	3005	Manual pulse generator input error	Change the pulse generator input (numerator) and pulse generator input (denominator) settings.
External errors	4002	Servo end error The in-position signal did not turn ON during the servo end determination time.	Increase the servo end determination time setting.
	4003	Servo ready error The servo motor ready signal did not turn ON at operation start or during operation.	Check the servo motor and encoder cable.
	4004	Forward rotation limit, reverse rotation limit error • The forward rotation limit (LSF) and reverse rotation limit (LSR) are ON. • The forward rotation limit 2 (FLS) and reverse rotation 2 (RLS) limit are ON.	• Check the wiring of the forward/reverse rotation limit, limit switches and the program. • Check the external signal selection (positioning parameter) settings. • Retract from the forward/reverse rotation limit by JOG operation or manual pulse generator input operation.
	4005	Software limit error The current address exceeds the software upper and lower limits.	• Correct the target address. • Set the current value to within the software limit range by JOG operation manual pulse generator input operation.
	4006	The servo amplifier emergency switch is ON.	Check the servo motor and encoder cable.
	4007	ABS error The current position could not be established.	• Make sure to use a servo motor with absolute position detection. • Make sure to use the battery for the servo motor to retain the origin position. • Make sure that the absolute position detection system in servo parameters is valid. • Check the servo motor and encoder cable.
	4008	Illegal origin data The backup data for restoring the absolute position is illegal.	Execute a zero return.

Error category	Error Code (decimal)	Error Content	Action
External errors	4009	Encoder error 1 During operation, the variation of the encoder current value changes as follows: "Encoder current value variation/1.7[ms] > motor 180°"	• Check the servo motor and encoder cable. • Adopt the noise suppression measures as described in the manual for the servo amplifier.
	4010	Encoder error 2 During operation, the following condition occurred: "encoder current value (encoder unprocessed data) [PLS] ≠ feedback current value (servo amplifier internal data) [PLS] (number of encoder valid bits)".	• Check the servo motor and encoder cable. • To reduce noise, follow the servo amplifier manual.
	4011	SSNET III communication error SSCNET III cable communication error	• Check the SSCNET cable connection. • Wipe off any dirt from the end surface. • Change the SSCNET cable. • To reduce noise, follow the servo amplifier manual.
Major errors	9000	Memory error	If this error occurs after rebooting and initializing the 20SSC-H, the module needs repair. Consult a Mitsubishi Electric distributor.
	9001	Sum check error	
	9002	Watchdog timer error	
	9003	Hardware error	
Servo amplifier	Parentheses ( ) in the error code column indicate the LED display on the servo amplifier. →**For details on how to check errors and actions, refer to the manual of the servo amplifier to be connected.**		
	2010 (10)	Undervoltage • MR-J3-□B: Power supply voltage dropped to 160VAC or less • MR-J3-□B1: Power supply voltage dropped to 83VAC or less	Review the power supply
	2012 (12)	Memory error 1 (RAM) RAM, memory fault (in servo amplifier)	The servo amplifier must be repaired. Consult a Mitsubishi Electric distributor.
	2013 (13)	Clock error • Faulty board • Clock error transmitted from 20SSC-H	The servo amplifier or 20SSC-H must be repaired. Consult a Mitsubishi Electric distributor.
	2014 (14)	CPU watchdog error • Servo amplifier hardware error	The servo amplifier must be repaired. Consult a Mitsubishi Electric distributor.
	2015 (15)	Memory error 2 (EEPROM) • EEPROM error (in servo amplifier) • The EEPROM write count exceeds 100,000 operations.	
	2016 (16)	Sensor fault 1 (after power-on) • Communication error occurred between sensor and servo amplifier.	• Connect correctly. • Change the servo motor. • Repair or change the cable. • Correct the setting of the 4th digit of parameter No. PC04.
	2017 (17)	Board error • CPU/part fault	The servo amplifier must be repaired. Consult a Mitsubishi Electric distributor.
	2019 (19)	Memory error 3 (Flash ROM) • ROM memory fault	
	2020 (20)	Sensor fault 2 • Communication error occurred between sensor and servo amplifier.	• Connect correctly. • Change the servo motor. • Repair or change the cable.
	2024 (24)	Main circuit error • Ground fault occurred at the servo motor power (U, V and W phases) of the servo amplifier.	• Correct the wiring. • Change the cable. • Change the servo amplifier.
	2025 (25)	Absolute position erase • Absolute position data in error • Power was switched ON for the first time in the absolute position detection system.	• After leaving the alarm occurring for a few minutes, switch power OFF, then ON again. Always create the home position setting again. • Change the battery Always make the home position again.

Error category	Error Code (decimal)	Error Content	Action
Servo amplifier	Parentheses ( ) in the error code column indicate the LED display on the servo amplifier. →**For details on how to check errors and actions, refer to the manual of the servo amplifier to be connected.**		
	2030 (30)	Regenerative alarm • The permissible regenerative power of the built-in regenerative brake resistor or regenerative brake option is exceeded. • Regenerative transistor fault	• Correct the setting of the regenerative brake option (servo parameter). →**Refer to subsection 11.2.1** • Correctly connect the built-in regenerative brake resistor or regenerative brake option. • High-duty operation or continuous regenerating operation to exceed the permissible regenerative power of the regenerative brake option. - Reduce the frequency of positioning. - Change the regenerative brake option to the one with a larger capacity. - Reduce the load. • Review the power supply • Change the servo amplifier or regenerative brake option.
	2031 (31)	Overspeed • The rotation speed has exceeded the instantaneous permissible speed.	• When the acceleration/deceleration overshoots, check the acceleration/deceleration time constant in the fixed parameters. • If the servo gain cannot be set to a proper value: - Reduce the load inertia moment ratio (servo parameter) to the servo motor. →**Refer to subsection 11.2.2** - Review the acceleration/deceleration time constant. • Change the servo motor.
	2032 (32)	Overcurrent • The current flow is higher than the permissible current of the servo amplifier.	• Correct the wiring. • Change the servo amplifier. • Adopt noise suppression measures.
	2033 (33)	Overvoltage • The converter bus voltage exceeded 400VDC.	• Use the regenerative brake option. • Correct the setting of the regenerative brake option (servo parameter). →Refer to subsection 11.2.1. • Change the regenerative brake option leads. • Correctly connect the regenerative brake option leads. • Replace the servo amplifier. • For a wire break of the built-in regenerative brake resistor, change the servo amplifier. • For a wire break of the regenerative brake option, change the regenerative brake option. • Add the regenerative brake option or increase the capacity. • Review the power supply • Correct the wiring.
	2034 (34)	Receive error 1 • SSCNET III communication error (continuous communication error for about 3.5ms)	• Connect after turning the control circuit power supply of the servo amplifier OFF. • Wipe off any dirt from the end surface. • Change the cable. • Adopt noise suppression measures.
	2035 (35)	Command frequency error • The input pulse frequency of the command pulse is too high.	• Review the operation program. • Change the servo system controller. • Adopt noise suppression measures on the I/O signals. • Adopt noise suppression measures on the controller side.
	2036 (36)	Receive error 2 • SSCNET III communication error (intermittent communication error for about 70ms)	• Connect after turning the control circuit power supply of the servo amplifier OFF. • Wipe off any dirt from the end surface. • Change the cable. • Adopt noise suppression measures.
	2037 (37)	Parameter error • Parameter setting is wrong.	• Change the servo amplifier. • Set the parameter value within the setting range. • Change the servo amplifier.

Error category	Error Code (decimal)	Error Content	Action
Servo amplifier	Parentheses ( ) in the error code column indicate the LED display on the servo amplifier. →**For details on how to check errors and actions, refer to the manual of the servo amplifier to be connected.**		
	2045 (45)	Main circuit device overheat • Main circuit device overheat	• Replace the servo amplifier. • Review the drive method. • Review the environment so that the ambient temperature is within the range 0 to 55°C. • Use within the specification range.
	2046 (46)	Servo motor overheat • A servo motor temperature rise actuated the thermal sensor.	• Review the environment so that the ambient temperature is within the range 0 to 40°C. • Reduce the load. • Review the operation pattern. • Use a servo motor that provides larger output. • Replace the servo motor.
	2047 (47)	Cooling fan alarm • The cooling fan of the servo amplifier stopped. • The rotation speed of the fan fell below the alarm level.	• Replace the cooling fan of the servo amplifier. • Remove any debris • Replace the servo amplifier.
	2050 (50)	Overload 1 The load exceeded the overload protection characteristics of the servo amplifier.	• The servo amplifier is exceeding its continuous output current rating. - Reduce the load. - Review the operation pattern. - Use a servo motor that provides larger output. • Machine collision occurred. - Review the operation pattern. - Install limit switches. • Connect the servo motor correctly. • Servo system is unstable due to servo hunting (jittering). - Repeat acceleration/deceleration to execute auto tuning. - Change the auto tuning response setting (servo parameter). →**Refer to subsection 11.2.1** - Set the auto tuning mode (servo parameter) to OFF and manually adjust the the gain. →**Refer to subsection 11.2.1** • Replace the servo motor.
	2051 (51)	Overload 2 • A machine collision or other simiar factor has caused the max. output current to flow continuously for several seconds. Servo motor - Locked :1s or more - During rotation :2.5s or more	• Machine collision occurred. - Review the operation pattern. - Install limit switches. • Connect the servo motor correctly. • Hunting is occurring due to an unstable servo system. - Repeat acceleration/deceleration to execute auto tuning. - Change the auto tuning response setting (servo parameter). →**Refer to subsection 11.2.1** - Set the auto tuning mode (servo parameter) to OFF and manually adjust gain. →**Refer to subsection 11.2.1** • Replace the servo motor.

Error category	Error Code (decimal)	Error Content	Action
Servo amplifier	Parentheses ( ) in the error code column indicate the LED display on the servo amplifier. →**For details on how to check errors and actions, refer to the manual of the servo amplifier to be connected.**		
	2052 (52)	Excessive error The deviation between the model position and the actual servo motor position exceeds the excessive error alarm level (servo parameter) setting value (default: 3 rotations). →**Refer to subsection 11.2.3**	• Increase the acceleration/deceleration time constant. • Increase the torque limit value. • The motor cannot be started due to insufficient torque caused by a power supply voltage drop. - Review the power supply capacity. - Use a servo motor with larger output. • Increase the value of model control gain (servo parameter) and adjust to ensure proper operation. →**Refer to subsection 11.2.2** • The servo motor shaft was rotated by external force. - When the torque is limited, increase the limit value. - Reduce the load. - Use a servo motor with larger output. • Machine collision occurred. - Review the operation pattern. - Install limit switches. • Replace the servo motor. • Connect the servo motor correctly. • Replace the SSCNET III cable.
	2060 (1A)	Motor combination error • Wrong combination of servo amplifier and servo motor	Select the correct combination.
	2088 (888)	Watchdog • CPU/part fault	The servo amplifier must be repaired. Consult a Mitsubishi Electric distributor.

13.2.4 Servo warning list [BFM #68 (X-axis), BFM #168 (Y-axis)]

The warning detected by the servo amplifier is stored.
Remove the cause of the warning.

→ **For details on warnings, refer to the manual of the servo amplifier to be connected.**

1. State when a warning code occurs

Warning code	Servo amplifier LED indication	Name	State when a warning occurs	
			Servo amplifier	20SSC-H
2102	92	Open battery cable warning	Servo ON is continued	Operation is continued
2106	96	Home position setting warning		
2116	9F	Battery warning		
2140	E0	Excessive regenerative warning		
2141	E1	Overload warning 1		
2143	E3	Absolute position counter warning		Operation is continued warning(zero return completed: OFF)
2144	E4	Parameter warning		Open battery cable warning
2146	E6	Servo forced stop warning	Servo OFF	Servo OFF (An error has occurred.)
2147	E7	Controller forced stop warning		
2148	E8	Cooling fan speed reduction warning	Servo ON is continued	Operation is continued
2149	E9	Main circuit OFF warning		
2152	EC	Overload warning 2		
2153	ED	Output watt excess warning		

2. Content of warning and action

20SSC-H error code	Servo amplifier LED indication	Content	Action
2102	92	Open battery cable warning The absolute position detection system battery voltage is low.	Replace the servo amplifier battery.
2106	96	Home position setting warning The zero return could not be set to the accurate position.	• Remove the cause of droop pulses. • Reduce the creep speed.
2116	9F	Battery warning The voltage of the battery for the absolute position detection system is low.	Replace the servo amplifier battery.
2140	E0	Excessive regenerative warning There is a possibility that regenerative power may exceed the permissible regenerative power of the built-in regenerative brake resistor or the regenerative brake option.	• Reduce the frequency of positioning. • Change the regenerative brake option to the one with a larger capacity. • Reduce the load.
2141	E1	Overload warning There is a possibility that overload (error code: 2050) or overload (error code: 2051) may occur.	Refer to the manual of the servo amplifier.
2143	E3	Absolute position counter warning Absolute position encoder pulses are faulty.	• To reduce the noise, follow the servo amplifier manual. • Replace the servo motor.
2144	E4	Parameter warning Parameters are outside the setting range.	Set the servo parameters correctly.
2146	E6	Servo forced stop warning Servo amplifier input signal EM1 is OFF.	Ensure safety and deactivate the forced stop.
2147	E7	The watchdog error occurred on the 20SSC-H.	If this error occurs after rebooting and initializing the 20SSC-H the module needs repair. Consult a Mitsubishi Electric distributor.
2148	E8	Cooling fan speed reduction warning The rotation speed of the servo amplifier's cooling fan fell below the warning level. *1	• Replace the cooling fan of the servo amplifier. • Replace the servo amplifier.
2149	E9	Main circuit OFF warning The servo ON signal turned ON with the main circuit power OFF.	Turn the main circuit power ON.
2152	EC	Overload warning 2 Operation, in which a current exceeding the rating flow intensity in any of the U, V or W phases of the servo motor, was repeated.	• Reduce the positioning frequency at the specific positioning address. • Reduce the load. • Exchange the servo amplifier/servo motor with one of a larger capacity.
2153	ED	Output watt excess warning The status, in which the output wattage (speed × torque) of the servo motor exceeded the rated output, continued steadily.	• Reduce the rotation speed of the servo motor. • Reduce the load.

*1. This warning is not displayed on MR-J3-70B/100B servo amplifiers with cooling fans.

13.3 Diagnostics on the PLC Main Unit

The following describes some of the PLC errors from the LED lights on the PLC.
For details related to the PLC main unit wiring, special auxiliary relays, and special data registers, refer to the following respective manuals.

→ **FX3U Hardware Edition**
→ **FX3UC Hardware Edition (Japanese document only)**

13.3.1 POWER LED [on/flashing/off]

LED state	PLC state	Action
On	Power of the specified voltage is being supplied to the power supply terminal.	The power supply is normal.
Flashing	One of the following causes may have occurred: • Power and current of the specified voltage is not being supplied to the power supply terminal. • Incorrect external wiring. • Internal errors in the PLC.	• Check the supply voltage. • After disconnecting cables other than the power cable, turn the power ON again, and check for changes in the state. If no improvement is obtained, Consult a Mitsubishi Electric distributor.
Off	One of the following causes may have occurred: • The power supply is OFF. • Incorrect external wiring. • Power of the specified voltage is not being supplied to the power supply terminal. • The power cable is broken.	• If the power is not OFF, check the power supply and the power supply route. If power is being supplied correctly, consult a Mitsubishi Electric distributor. • After disconnecting cables other than the power cable, turn the power ON again, and check for changes in the state. If no improvement is obtained, Consult a Mitsubishi Electric distributor.

13.3.2 BATT LED [on/off]

LED state	PLC state	Action
On	The battery voltage is low.	Immediately replace the battery.
Off	The battery voltage is higher than the value with D8006.	Normal

13.3.3 ERROR LED [on/flashing/off]

LED state	PLC state	Action
On	A watchdog timer error may have occurred, or the hardware of the PLC may be damaged.	1) Stop the PLC, and turn the power ON again. If the ERROR LED goes out, a watchdog timer error may have occurred. Adopt any of the following measures: - Review the program. Set the maximum value (D8012) lower than the watchdog timer value. - Check that the input used for input interrupt or pulse catch is not being abnormally turned ON and OFF in one scan. - Check that the frequency of the pulse (duty 50%) input to the high-speed counter is not exceeding the specified range. - Add WDT instructions. Add some WDT instructions to the program, and reset the watchdog timer several times in one scan. - Change the watchdog timer value. Change the watchdog timer setting (D8000) in the program so that the setting is larger than the maximum value of the scan time (D8012). 2) Remove the PLC and supply the power to it from another power source. If the ERROR LED goes out, noise may have affected the PLC. Adopt the following measures: - Check the ground wiring, and re-examine the wiring route and installation location. - Fit a noise filter onto the power supply line. 3) If the ERROR LED does not go out even after measures in 1) and 2) are adopted, consult a Mitsubishi Electric distributor.
Flashing	One of the following errors has occurred on the PLC: • Parameter error • Syntax error • Ladder error	Perform PLC diagnosis and program check with the programming tool.
Off	No errors to stop the PLC have occurred.	If the operations of the PLC are abnormal, perform PLC diagnosis and program check with the programming tool. An I/O error, parallel link/communication error, or operation error may have occurred.

Appendix A: LIST OF PARAMETERS AND DATA

Appendix A-1 Monitor Data List

BFM Number		Item	Description	Value of monitor	Default value	Reference
X axis	Y axis					
BFM #1,#0	BFM #101,#100	Current address (user)	-2,147,483,648 to 2,147,483, 647 (user unit) *1	Decimal	-	subsection 11.3.1
BFM #3,#2	BFM #103,#102	Current address (pulse)	-2,147,483,648 to 2,147,483,647 PLS	Decimal	-	subsection 11.3.2
BFM #5,#4	BFM #105,#104	Torque limit storing value	1 to 10000(×0.1%)	Decimal	-	subsection 11.3.3
BFM #6	BFM #106	Error BFM number	Stores error BMF number	Decimal	-	subsection 11.3.4
BFM #7	BFM #107	Terminal information	b0 START terminal input: ON b1 DOG terminal input: ON b2 INT0 terminal input: ON b3 INT1 terminal input: ON b4 ϕA terminal input: ON b5 ϕB terminal input: ON b15 to b6 Not available	Bit	-	subsection 11.3.5
BFM #8	BFM #108	Servo terminal information	b0 FLS terminal input: ON b1 RLS terminal input: ON b2 DOG terminal input: ON b15 to b3 Not available	Bit	-	subsection 11.3.6
BFM #9	BFM #109	m code number	Stores m code number which is ON.	Decimal	-	subsection 11.3.7
BFM #11,#10	BFM #111,#110	Operation speed present value	0 to 2,147,483,647(user unit) *1	Decimal	-	subsection 11.3.8
BFM #13,#12	BFM #113,#112	Manual pulse generator input current value	-2,147,483,648 to 2,147,483,647 PLS	Decimal	-	subsection 11.3.9
BFM #15,#14	BFM #115,#114	Manual pulse generator input frequency	-100000 to 100000Hz	Decimal	-	subsection 11.3.10
BFM #16	BFM #116	Number of the table in operation	Stores the number of the table in operation	Decimal	-	subsection 11.3.11
BFM #17	-	Version information	Example: In Ver.1.00, K100 is stored.	Decimal	-	subsection 11.3.12
BFM #28	BFM #128	Status information	b0 READY/BUSY b1 During forward rotation pulse output b2 During reverse rotation pulse output b3 Zero return completed b4 Current value overflow b5 Error occurrence b6 Positioning control completion b7 Standby for remaining travel distance at stop b8 m code is ON b9 Unit ready b10 During servo parameter transfer b11 Saving to flash memory b12 Initializing buffer memory b13 During operation speed change b14 During target address change b15 During table operation execution	Bit	-	subsection 11.3.13
BFM #29	BFM #129	Error code	Stores the error code	Decimal	-	subsection 11.3.14
BFM #30	-	Model code	Stores the model code of 20SSC-H	Decimal	K5220	subsection 11.3.15
BFM #51,#50	BFM #151,#150	Deviation counter value	Deviation counter value of servo amplifier (PLS)	Hexadecimal	-	subsection 11.3.16
BFM #52	BFM #152	Motor rotation speed	Rotation speed of servo motor (×0.1 r/min.)	Hexadecimal	-	subsection 11.3.17
BFM #54	BFM #154	Motor current value	Current value of servo motor (×0.1%)	Hexadecimal	-	subsection 11.3.18
BFM #61 to#56	BFM #161 to#156	Software number of servo amplifier	Stores software number of servo amplifier	ASCII code	-	subsection 11.3.19

BFM Number		Item	Description	Value of monitor	Default value	Reference
X axis	Y axis					
BFM #62	BFM #162	Servo parameter error number	Stores parameter number of servo parameter	Hexadecimal	-	subsection 11.3.20
BFM #63	BFM #163	Servo status	b0 Zero phase passed b2,b1 Not available b3 Zero speed b15 to b4 Not available	Bit	-	subsection 11.3.21
BFM #64	BFM #164		b16 Ready ON b17 Servo ON b22 to b18 Not available b23 Servo alarm is arising b27 to b24 Not available b28 In-position b29 Torque is limited b30 Absolute position is lost b31 Warning is arising	Bit	-	subsection 11.3.21
BFM #65	BFM #165	Regenerative load ratio	Regenerative load ratio(%)	Decimal	-	subsection 11.3.22
BFM #66	BFM #166	Effective load torque	Effective load torque (%)	Decimal	-	subsection 11.3.23
BFM #67	BFM #167	Peak torque ratio	Peak torque ratio (%)	Decimal	-	subsection 11.3.24
BFM #68	BFM #68	Servo warning Code	Stores servo warning number	Decimal	-	subsection 11.3.25
BFM #71,#70	BFM #171,#170	Motor feedback position	Motor feedback position (PLS)	Decimal	-	subsection 11.3.26
BFM #72	BFM #172	Servo status 2	b0 Flag indicating parameter update is completed b15 to b1 Not available	Bit	-	subsection 11.3.27
BFM #91,#90	-	Flash memory write count	Number of writing to flash memory (max:100,000 times)	Decimal	-	subsection 11.3.28

*1. For details on the user units, refer to the section given below.

→ **Refer to Section 7.7**

Appendix A-2 Control Data Table

BFM number		Item	Description/Setting range	Default value	Reference
X axis	Y axis				
BFM #501,#500	BFM #601,#600	Target address1	-2,147,483,648 to 2,147,483,647 (user unit) *1	K0	subsection 11.4.1
BFM #503,#502	BFM #603,#602	Operation speed1	-2,147,483,648 to 2,147,483,647 (user unit) *1	K1	subsection 11.4.2
BFM #505,504	BFM #605,#604	Target address2	-2,147,483,648 to 2,147,483,647 (user unit) *1	K0	subsection 11.4.3
BFM #507,#506	BFM #607,#606	Operation speed2	-2,147,483,648 to 2,147,483,647 (user unit) *1	K1	subsection 11.4.4
BFM #508	BFM #608	Override setting	1 to 30000(×0.1%)	K1000	subsection 11.4.5
BFM #510	BFM #610	Torque output setting value	0 to 10000(×0.1%)	K0	subsection 11.4.6
BFM #513,#512	BFM #613,#612	Speed change value	-2,147,483,648 to 2,147,483,647 (user unit) *1	K1	subsection 11.4.7
BFM #515,#514	BFM #615,#614	Target position change value (address)	-2,147,483,648 to 2,147,483,647 (user unit) *1	K0	subsection 11.4.8
BFM #517,#516	BFM #617,#616	Target position change value (speed)	-2,147,483,648 to 2,147,483,647 (user unit) *1	K0	subsection 11.4.9
BFM #518	BFM #618	Operation command 1	b0 Error reset b1 STOP (Deceleration stop) b2 Forward rotation limit (LSF) b3 Reverse rotation limit (LSR) b4 Forward rotation JOG b5 Reverse rotation JOG b6 Mechanical zero return command b7 Not available b8 Relative/absolute address specification b9 START command b10 Simultaneous START flag b11 m code OFF b12 Change command in operation disabled b13 Speed change command in positioning operation b14 Target position change command in positioning operation b15 Not available	H0000	subsection 11.4.10
BFM #519	BFM #619	Operation command 2	b0 Remaining distance operation cancel command b3 to b1 Not available b4 Positioning parameter enable command b7 to 5 Not available b8 Servo OFF command b9 Servo parameter transfer command b10 Gain change command b15 to 11 Not available	H0000	subsection 11.4.11
BFM #520	BFM #620	Operation pattern selection	b0 1-speed positioning b1 Interrupt 1-speed constant quantity feed b2 2-speed positioning b3 Interrupt 2-speed constant quantity feed b4 Interrupt stop b5 Variable speed operation b6 Manual pulse generator operation b7 Linear interpolation b8 Linear interpolation (interrupt stop) b9 Table operation (independent) b10 Table operation (simultaneous) b15 to 11 Not available	H0000	subsection 11.4.12
BFM #521	BFM #621	Table operation start number	0 to 299	K0	subsection 11.4.13
BFM #522		Control command enable/disable	Model code: control command enabled Other than model code: control command disabled	H0000	subsection 11.4.14

BFM number		Item	Description/Setting range	Default value	Reference
X axis	Y axis				
BFM #523		Control command	b0 Stores positioning parameters of X axis (BFM#14000 to BFM #14199) to flash memory b1 Stores positioning parameters of Y axis(BFM#14200 to BFM #14399) to flash memory b2 Stores table information of X axis (BFM #1000 to BFM #3999) to flash memory b3 Stores table information of Y axis (BFM #4000 to BFM #6999) to flash memory b4 Stores table information of XY axes (BFM #7000 to BFM #12999) to flash memory b5 Stores servo parameters of X axis (BFM #15000 to BFM #15199) to flash memory b6 Stores servo parameters of Y axis (BFM #15200 to BFM #15399) to flash memory b7 Not available b8 Initializes positioning parameters of X axis (BFM #14000 to BFM #14199) b9 Initializes positioning parameters of Y axis (BFM #14200 to BFM #14399) b10 Initializes table information of X axis (BFM #1000 to BFM #3999) b11 Initializes table information of Y axis (BFM #4000 to BFM #6999) b12 Initializes table information of XY axes (BFM #7000 to BFM #12999) b13 Initializes servo parameters of X axis (BFM #15000 to BFM #15199) b14 Initializes servo parameters of Y axis (BFM #15200 to BFM #15399) b15 Not available	H0000	subsection 11.4.15
BFM #525,#524	BFM #625,#624	Manual pulse input magnification (numerator)	1 to 1,000,000 times	K1	subsection 11.4.16
BFM #527,#526	BFM #627,#626	Manual pulse input magnification (denominator)	1 to 1,000,000 times	K1	subsection 11.4.17

*1. For details on the user units, refer to the section given below.

→ **Refer to Section 7.7**

Appendix A-3 Table Information List

BFM number			Table number	Item	Description/Setting range	Default value	Refe-rence
X axis	Y axis	XY axis					
BFM #1001,#1000	-	BFM #7001,#7000	0	Position data x	Positioning: 2,147,483,648 to 2,147,483,647 (user unit) *1 Present address changing: -2,147,483,648 to 2,147,483,647 (user unit)*1 Dwell: 0 to 32,767 (×10ms) Jump: 0 to 299	K-1	section 11.5
-	BFM #4001,#4000	BFM #7003,#7002		Position data y		K-1	
BFM #1003,#1002	-	BFM #7005,#7004		Speed data x	1 to 50,000,000 (user unit) *1	K-1	
-	BFM #4003,#4002	BFM #7007,#7006		Speed data y		K-1	
-	-	BFM #7009,#7008		Center coordinate i, radius r	-2,147,483,648 to 2,147,483,647 (user unit) *1	K-1	
-	-	BFM #7011,#7010		Center coordinate j		K-1	
BFM #1004	BFM #4004	BFM #7012		Operation informa-tion	Sets operation/command (-1 to 99) *2	K-1	
BFM #1005	BFM #4005	BFM #7013		m code information	Stores m code in execution	K-1	
BFM #1011,#1010	-	BFM #7021,#7020	1	Position data x	Same as table number 0	K-1	
-	BFM #4011,#4010	BFM #7023,#7022		Position data y		K-1	
BFM #1013,#1012	-	BFM #7025,#7024		Speed data x		K-1	
-	BFM #4013,#4012	BFM #7027,#7026		Speed data y		K-1	
-	-	BFM #7029,#7028		Center coordinate i, radius r		K-1	
-	-	BFM #7031,#7030		Center coordinate j		K-1	
BFM #1014	BFM #4014	BFM #7032		Operation information		K-1	
BFM #1015	BFM #4015	BFM #7033		m code information		K-1	
:	:	:	:	:	:	:	:
BFM #3991,#3990	-	BFM #12981,#12980	299	Position data x	Same as table number 0	K-1	
-	BFM #6991,#6990	BFM #12983,#12982		Position data y		K-1	
BFM #3993,#3992	-	BFM #12985,#12984		Speed data x		K-1	
-	BFM #6993,#6992	BFM #12987,#12986		Speed data y		K-1	
-	-	BFM #12989,#12988		Center coordinate i, radius r		K-1	
-	-	BFM #12991,#12990		Center coordinate j		K-1	
BFM #3994	BFM #6994	BFM #12992		Operation information		K-1	
BFM #3995	BFM #6995	BFM #12993		m code information		K-1	

*1. For details on the user units, refer to the section given below.

→ **Refer to Section 7.7**

*2. The operation information includes the following items.

-1: No processing (NOP)
-1: m code (NOP)
0: End (END)
1: 1-speed positioning (DRV_X)
2: 1-speed positioning (DRV_Y)
2: 1-speed positioning (DRV_XY)
4: Interrupt 1-speed constant quantity feed (SINT_X)
5: Interrupt 1-speed constant quantity feed (SINT_Y)
6: Interrupt 1-speed constant quantity feed (SINT_XY)
7: 2-speed positioning (DRV2_X)
8: 2-speed positioning (DRV2_Y)
9: 2-speed positioning (DRV2_XY)
10: Interrupt 2-speed constant quantity feed (DINT_X)
11: Interrupt 2-speed constant quantity feed (DINT_Y)
12: Interrupt 2-speed constant quantity feed (DINT_XY)
13: Interrupt stop (INT_X)
14: Interrupt stop (INT_Y)
15: Interrupt stop (INT_XY)
16: Multi speed operation (DRVC_X)
17: Multi speed operation (DRVC_Y)
19: Linear interpolation (LIN)
20: Linear interpolation (interrupt stop) (LIN_INT)
21: Circular interpolation (center, CW direction)(CW_i)
22: Circular interpolation (center, CCW direction) (CCW_i)
23: Circular interpolation (radius, CW direction) (CW_r)
24: Circular interpolation (radius, CCW directio) (CCW_r)
25: Mechanical zero return operation (DRVZ_X)
26: Mechanical zero return operation (DRVZ_Y)
27: Mechanical zero return operation (DRVZ_XY)
90: Current address change (SET_X)
91: Current address change (SET_Y)
92: Current address change (SET_XY)
93: Absolute address specification (ABS)
94: Relative address specification (INC)
95: Dwell (TIM)
96: Jump (JMP)

Appendix A-4 Positioning parameter List

BFM number		Item	Description/Setting range	Default value	Reference
X axis	Y axis				
BFM #14000	BFM #14200	Operation parameter 1	b1,b0 System of units (user unit)*1 (motor, mechanical, composite system) b3,b2 Unit of measurement for the user units (μm, Ccm/min, 10^{-4}inch, inch/min, mdeg, 10deg/min) b5,b4 Position data magnification (1 to 1000 times) b9 to b6 Not available b10 Zero return direction b11 Acceleration/deceleration mode b12 DOG input logic b13 Zero-phase signal count start timing b14 Not available b15 STOP mode	H0000	subsection 11.1.1
BFM #14002	BFM #14202	Operation parameter 2	b0 Servo end check enabled/disabled b1 Servo ready check enabled/disabled b2 Zero return interlock setting enabled/disabled b3 to b15 Not available	H0007	subsection 11.1.2
BFM #14005, #14004	BFM #14205, #14204	Pulse rate	1 to 200,000,000 PLS/REV	K262,144	subsection 11.1.3
BFM #14007, #14006	BFM #14207, #14206	Feed rate	1 to 200,000,000 (μm/REV, 10^{-4}inch/REV, mdeg)	K52,428,800	subsection 11.1.4
BFM #14009, #14008	BFM #14209, #14208	Maximum speed	1 to 2,147,483,647 (user unit) *1	K4,000,000	subsection 11.1.5
BFM #14013, #14012	BFM #14213, #14212	JOG speed	1 to 2,147,483,647 (user unit) *1	K2,000,000	subsection 11.1.6
BFM #14014	BFM #14214	JOG command determination time	0 to 5000 ms	K300	subsection 11.1.7
BFM #14018	BFM #14218	Acceleration time	1 to 5000 ms	K200	subsection 11.1.8
BFM #14020	BFM #14220	Deceleration time	1 to 5000 ms	K200	subsection 11.1.9
BFM #14022	BFM #14222	Interpolation time constant	1 to 5000 ms	K100	subsection 11.1.10
BFM #14025, #14024	BFM #14225, #14224	Zero return speed (high speed)	1 to 2,147,483,647 (user unit) *1	K4,000,000	subsection 11.1.11
BFM #14027, #14026	BFM #14227, #14226	Zero return speed (creep)	1 to 2,147,483,647 (user unit) *1	K100	subsection 11.1.12
BFM #14029, #14028	BFM #14229, #14228	Machine zero-point address	-2,147,483,648 to 2,147,483,647 (user unit) *1	K0	subsection 11.1.13
BFM #14030	BFM #14230	Zero signal count	0 to 32767 PLS	K1	subsection 11.1.14
BFM #14031	BFM #14231	Zero return mode	Selects zero return mode (DOG, Data set, Stopper #1, Stopper #2)	K0	subsection 11.1.15
BFM #14032	BFM #14232	Servo end evaluation time	1 to 5000 ms	K5000	subsection 11.1.16
BFM #14035, #14034	BFM #14235, #14234	Software limit (upper)	Sets upper limit of software limit -2,147,483,648 to 2,147,483,647 (user unit) *1	K0	subsection 11.1.17
BFM #14037, #14036	BFM #14237, #14236	Software limit (lower)	Sets lower limit of software limit -2,147,483,648 to 2,147,483,647 (user unit) *1	K0	
BFM #14038	BFM #14238	Torque limit value	1 to 10000(×0.1%)	K3000	subsection 11.1.18
BFM #14040	BFM #14240	Zero return torque limit value	1 to 10000(×0.1%)	K3000	subsection 11.1.19

BFM number		Item	Description/Setting range		Default value	Reference
X axis	Y axis					
BFM #14044	BFM #14244	External input selection	b0 b1 b7 to b2 b8 b9 b15 to b10	Use/ not use FLS, RLS signal servo amplifier Use/ not use DOG signal of servo amplifier Zero return interlock setting enabled/disabled FLS/RLS signal logic of servo amplifier DOG signal logic of servo amplifier Not available	H0100	subsection 11.1.20

*1. For details on the user units, refer to the section given below.

→ **Refer to Section 7.7**

Appendix A-5 Servo Parameter List

BFM number		Item	Settings	Default value	Reference
X axis	Y axis				
BFM #15000	BFM #15200	Servo amplifier series	Setting of servo amplifier series connected to 20SSC-H	K0	subsection 11.2.1
BFM #15002	BFM #15202	Regeneration option	Setting of with/without regeneration option	H0000	
BFM #15003	BFM #15203	Absolute position detection system	Setting of with/without absolute detection system	K0	
BFM #15004	BFM #15204	Selecting functions A-1	Setting of with/without emergency stop input (EMI) to servo amplifier	H0000	
BFM #15008	BFM #15208	Auto tuning mode	Setting of gain adjustment	H0001	
BFM #15009	BFM #15209	Auto tuning response	Setting of auto tuning response (low to high)	K12	
BFM #15010	BFM #15210	In-position range	0 to 50000 PLS	K100	
BFM #15014	BFM #15214	Rotation direction selection	Setting of rotation direction (CCW/CW) when viewed from the servo motor load	K0	
BFM #15015	BFM #15215	Encoder output pulses	1 to 65535 PLS/REV	K4000	
BFM #15019	BFM #15219	Adaptive tuning mode (Adaptive filter 2)	Setting of adaptive filter tuning	K0	subsection 11.2.2
BFM #15020	BFM #15220	Vibration suppression control tuning mode (advanced vibration suppression control)	Setting of vibration suppression control tuning mode	K0	
BFM #15022	BFM #15022	Feed forward Gain	0 to 100%	K0	
BFM #15024	BFM #15224	Ratio of load inertia moment to servo motor inertia moment	0 to 3000 (×0.1 time)	K70	
BFM #15025	BFM #15225	Model loop gain	1 to 2000rad/s	K24	
BFM #15026	BFM #15226	Position loop gain	1 to 1000rad/s	K37	
BFM #15027	BFM #15227	Speed loop gain	20 to 50000rad/s	K823	
BFM #15028	BFM #15228	Speed integral compensation	1 to 10000(×0.1ms)	K337	
BFM #15029	BFM #15229	Speed differential compensation	0 to 1000	K980	
BFM #15031	BFM #15231	Machine resonance suppression filter 1	100 to 4500Hz	K4500	
BFM #15032	BFM #15232	Notch shape selection 1	Setting of notch form (depth, width)	H0000	
BFM #15033	BFM #15233	Machine resonance suppression filter 2	100 to 4500Hz	K4500	
BFM #15034	BFM #15234	Notch shape selection 2	Settings of validity for machine resonance suppression filter 2 and notch shape (depth, width of notch)	H0000	
BFM #15036	BFM #15236	Low-pass filter	100 to 18000rad/s	K3141	
BFM #15037	BFM #15237	Vibration suppression Vibration frequency setting	1 to 1000(×0.1Hz)	K1000	
BFM #15038	BFM #15238	Vibration suppression Resonance frequency setting	1 to 1000(×0.1Hz)	H0000	

BFM number		Item	Settings	Default value	Reference
X axis	Y axis				
BFM #15041	BFM #15241	Low-pass filter selection	Selects setting method (auto/manual) of low-pass filter	H0000	subsection 11.2.2
BFM #15042	BFM #15242	Slight vibration suppression control selection	Selects slight vibration suppression control (validity of the function, PI-PID switching method)	H0000	
BFM #15044	BFM #15244	Gain changing selection	Setting of the selection/condition for gain changing	H0000	
BFM #15045	BFM #15245	Gain changing condition	0 to 9999 (kpps, PLS, r/min)	K10	
BFM #15046	BFM #15246	Gain changing time constant	0 to 100 ms	K1	
BFM #15047	BFM #15247	Gain changing Ratio of load inertia moment to servo motor inertia moment	0 to 3000 (×0.1 time)	K70	
BFM #15048	BFM #15248	Gain changing Position loop gain	1 to 2000 rad/s	K37	
BFM #15049	BFM #15249	Gain changing Speed loop gain	20 to 50000 rad/s	K823	
BFM #15050	BFM #15250	Gain changing Speed integral compensation	1 to 50000 (×0.1ms)	K337	
BFM #15051	BFM #15251	Gain changing Vibration suppression control Vibration frequency setting	1 to 1000 (×0.1Hz)	K1000	
BFM #15052	BFM #15252	Gain changing Vibration suppression control Resonance frequency setting	1 to 1000 (×0.1Hz)	K1000	
BFM #15064	BFM #15264	Error excessive alarm level	1 to 200 rev	K3	subsection 11.2.3
BFM #15065	BFM #15265	Electromagnetic brake sequence output	0 to 1000 ms	K0	
BFM #15066	BFM #15266	Encoder output pulses selection	Selects the direction/setting for encoder pulse output	H0000	
BFM #15067	BFM #15267	Function selection C-1	Selection of serial encoder cable (2-wire or 4-wire type)	K0	
BFM #15068	BFM #15268	Function selection C-2	Selects validity for operations without motor	K0	
BFM #15070	BFM #15270	Zero speed	0 to 10000 r/min.	K50	
BFM #15072	BFM #15272	Analog monitor output 1	Setting of output signal to analog monitor 1	H0000	
BFM #15073	BFM #15273	Analog monitor output 2	Setting of output signal to analog monitor 2	H0000	
BFM #15074	BFM #15274	Analog monitor 1 Offset	-999 to 999 mV	K0	
BFM #15075	BFM #15275	Analog monitor 2 Offset	-999 to 999 mV	K0	
BFM #15080	BFM #15280	Function selection C-4	Select the home position setting condition in the absolute position detection system	K1	
BFM #15102	BFM #15302	Output signal device Selection 1 (CN3-13)	Setting of output signal to the connector (CN3-13 pin) of servo amplifier	H0005	subsection 11.2.4
BFM #15103	BFM #15303	Output signal device Selection 2 (CN3-9)	Setting of output signal to the connector (CN3-9 pin) of servo amplifier	H0004	
BFM #15104	BFM #15304	Output signal device Selection 3 (CN3-15)	Setting of output signal to the connector (CN3-15 pin) of servo amplifier	H0003	

MEMO

Warranty

Please confirm the following product warranty details before using this product.

1. Gratis Warranty Term and Gratis Warranty Range

If any faults or defects (hereinafter "Failure") found to be the responsibility of Mitsubishi occurs during use of the product within the gratis warranty term, the product shall be repaired at no cost via the sales representative or Mitsubishi Service Company. However, if repairs are required onsite at domestic or overseas location, expenses to send an engineer will be solely at the customer's discretion. Mitsubishi shall not be held responsible for any re-commissioning, maintenance, or testing on-site that involves replacement of the failed module.

[Gratis Warranty Term]

The gratis warranty term of the product shall be for one year after the date of purchase or delivery to a designated place. Note that after manufacture and shipment from Mitsubishi, the maximum distribution period shall be six (6) months, and the longest gratis warranty term after manufacturing shall be eighteen (18) months. The gratis warranty term of repair parts shall not exceed the gratis warranty term before repairs.

[Gratis Warranty Range]

1) The range shall be limited to normal use within the usage state, usage methods and usage environment, etc., which follow the conditions and precautions, etc., given in the instruction manual, user's manual and caution labels on the product.
2) Even within the gratis warranty term, repairs shall be charged for in the following cases.
   a) Failure occurring from inappropriate storage or handling, carelessness or negligence by the user. Failure caused by the user's hardware or software design.
   b) Failure caused by unapproved modifications, etc., to the product by the user.
   c) When the Mitsubishi product is assembled into a user's device, Failure that could have been avoided if functions or structures, judged as necessary in the legal safety measures the user's device is subject to or as necessary by industry standards, had been provided.
   d) Failure that could have been avoided if consumable parts (battery, backlight, fuse, etc.) designated in the instruction manual had been correctly serviced or replaced.
   e) Relay failure or output contact failure caused by usage beyond the specified Life of contact (cycles).
   f) Failure caused by external irresistible forces such as fires or abnormal voltages, and failure caused by force majeure such as earthquakes, lightning, wind and water damage.
   g) Failure caused by reasons unpredictable by scientific technology standards at time of shipment from Mitsubishi.
   h) Any other failure found not to be the responsibility of Mitsubishi or that admitted not to be so by the user.

2. Onerous repair term after discontinuation of production

1) Mitsubishi shall accept onerous product repairs for seven (7) years after production of the product is discontinued.
   Discontinuation of production shall be notified with Mitsubishi Technical Bulletins, etc.
2) Product supply (including repair parts) is not available after production is discontinued.

3. Overseas service

Overseas, repairs shall be accepted by Mitsubishi's local overseas FA Center. Note that the repair conditions at each FA Center may differ.

4. Exclusion of loss in opportunity and secondary loss from warranty liability

Regardless of the gratis warranty term, Mitsubishi shall not be liable for compensation of damages caused by any cause found not to be the responsibility of Mitsubishi, loss in opportunity, lost profits incurred to the user or third person by Failures of Mitsubishi products, special damages and secondary damages whether foreseeable or not , compensation for accidents, and compensation for damages to products other than Mitsubishi products, replacement by the user, maintenance of on-site equipment, start-up test run and other tasks.

5. Changes in product specifications

The specifications given in the catalogs, manuals or technical documents are subject to change without prior notice.

6. Product application

1) In using the Mitsubishi MELSEC programmable logic controller, the usage conditions shall be that the application will not lead to a major accident even if any problem or fault should occur in the programmable logic controller device, and that backup and fail-safe functions are systematically provided outside of the device for any problem or fault.
2) The Mitsubishi programmable logic controller has been designed and manufactured for applications in general industries, etc. Thus, applications in which the public could be affected such as in nuclear power plants and other power plants operated by respective power companies, and applications in which a special quality assurance system is required, such as for Railway companies or Public service purposes shall be excluded from the programmable logic controller applications.
   In addition, applications in which human life or property that could be greatly affected, such as in aircraft, medical applications, incineration and fuel devices, manned transportation, equipment for recreation and amusement, and safety devices, shall also be excluded from the programmable logic controller range of applications.
   However, in certain cases, some applications may be possible, providing the user consults their local Mitsubishi representative outlining the special requirements of the project, and providing that all parties concerned agree to the special circumstances, solely at the users discretion.

Revised History

Date	Revision	Discription
12/2005	A	First Edition
1/2006	B	• "Power-on Timing" added. [Subsection 5.2.1] • Clerical Error Correction [Subsection 3.4.1, 8.1.4, 8.1.5, 8.3.1, 8.3.3, 9.2.1, Section 9.9, 12.4, Appendix A-1, Appendix A-3]

FX3U-20SSC-H

USER'S MANUAL

MITSUBISHI ELECTRIC CORPORATION
HEAD OFFICE: TOKYO BUILDING, 2-7-3 MARUNOUCHI, CHIYODA-KU, TOKYO 100-8310, JAPAN
HIMEJI WORKS: 840, CHIYODA CHO, HIMEJI, JAPAN

MODEL	FX3U-20SSC-U-E
MODEL CODE	09R622

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(MEE)
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