FX_{3U}-20SSC-H Quick Start

A Basic Guide for Beginning Positioning Applications with the FX_{3U}-20SSC-H and FX Configurator-FP Software

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FX_{3U}-20SSC-H Quick Start
(FX Configurator-FP)

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(FX Configurator-FP)

1. Introduction

Based on customer demand, the FX_{3U}-20SSC-H was developed and then introduced in January 2006 as a high performance, cost effective solution for positioning applications in the Micro PLC range of factory automation. The unit's features and capabilities are very similar to the QD75MH2 positioning module, which was developed for the Q Series automation platform CPUs. With high speed fiber optic communication via Mitsubishi Electric's Servo System Control Network III (SSCNET III), the FX_{3U}-20SSC-H provides several advantages for positioning control when used with an $FX_{3U(C)}$ Series PLC. Along with direct communication with servo parameters, optical wiring allows for processes to be controlled with higher speeds, longer distances and an improved resistance to noise interference.

To setup and program the FX_{3U}-20SSC-H for basic positioning operations, FX Configurator-FP and GX Developer can be used with a personal computer along with an optional human machine interface (HMI). This quick start guide provides an overview of the hardware and software involved and describes how to set up a system and understand the device communication. FX Configurator-FP is used for initializing hardware parameters, setting up positioning tables, and for testing and monitoring the FX_{3U}-20SSC-H. Please refer to the FX Configurator-FP Operation Manual (JY997D21801B) for further help.

Related Documents
FX Configurator-FP Operation Manual (JY997D21801B)
FX_{3U}-20SSC-H User's Manual (JY997D21301E)

2. Components Required for Setup

2.1 Hardware Requirements

2.1.1 Components

$FX_{3U(C)}$ Series Main PLC
FX_{3U}-20SSC-H (v1.10 or later)
MR-J3-_B servo amplifier(s)
HF-MP/HF-KP or HF-SP servo motor(s)
MR-J3BUS_M fiber optic cables
Programming cables (SC-09, USB)
MELSEC FGOT or GOT11[*1]

*1: This component is optional.

2.1.2 Setup

With an FX_{3U} Base Unit attached to the FX_{3U}-20SSC-H, up to eight FX_{3U}-20SSC-H modules can be connected via extension cables to the FX_{3U}. With an FX_{3UC} Base Unit attached to the FX_{3U}-20SSC-H, up to seven FX_{3U}-20SSC-H modules can be connected. The FX_{3U}-20SSC-H requires DC power and SSCNET III communication for operation. Manual pulse generator dial(s) are optional. For connection to MR-J3-B type servo amplifiers, please refer to the MELSERVO-J3 Series MR-J3-□B Servo Amplifier Instruction Manual (SH(NA)-030051). A basic wiring overview is explained in the following section.

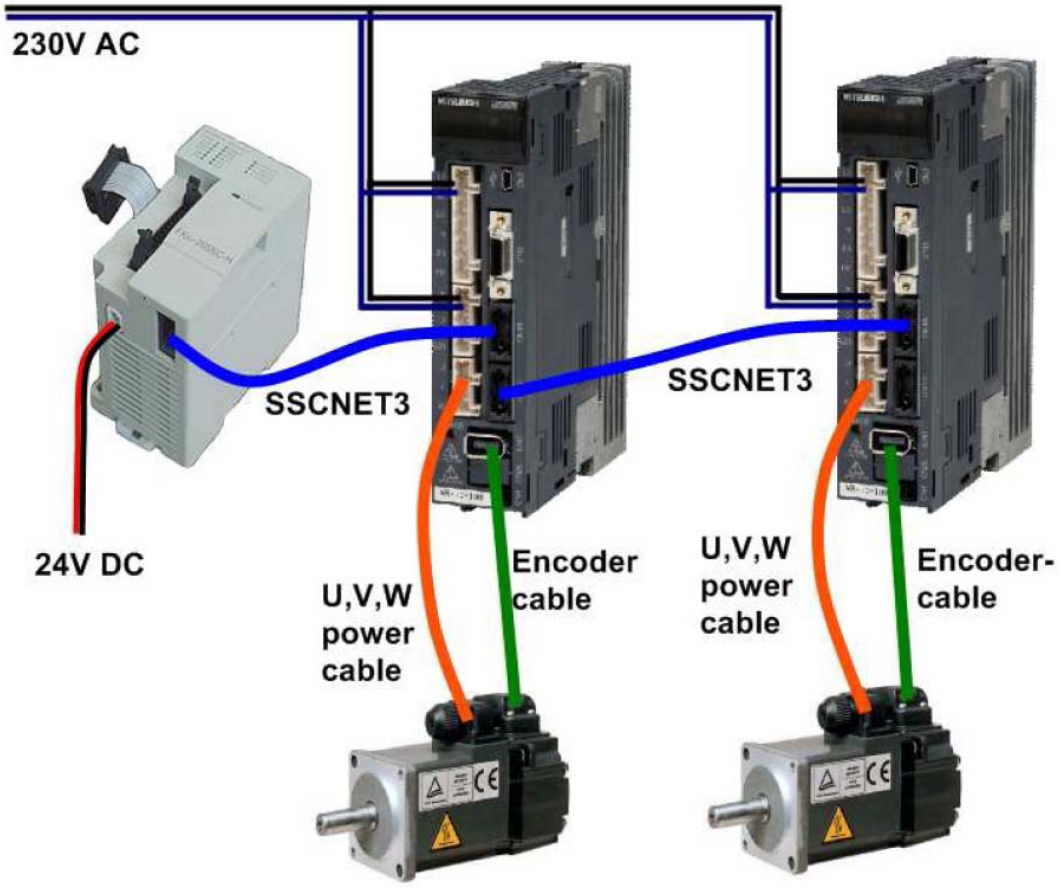
2.1.3 Wiring

Wiring requirements for MR-J3-B:

- 200 - 230V AC to L1, L2, L3 for power circuit
- 200 - 230V AC to L11, L21 for control circuit
- Power cable between motor and amplifier (U, V, W terminal)
- Encoder cable between motor and amplifier (CN2)
- Fiber optic cable SSCNET III at CN1A and CN1B
- 24V DC optional power to CN3 for digital I/O signals and servo stop

Wiring requirements for FX_{3U}-20SSC-H:

- 24V DC to power connector
- Fiber optic cable at SSCNET III connector
- Extension cable to $FX_{3U(C)}$ (module takes 100mA from the 5V DC Bus)



2.2 Software Requirements

2.2.1 Components

FX Configurator-FP version 1.10 or later[*1]
GX Developer version 8.23Z or later

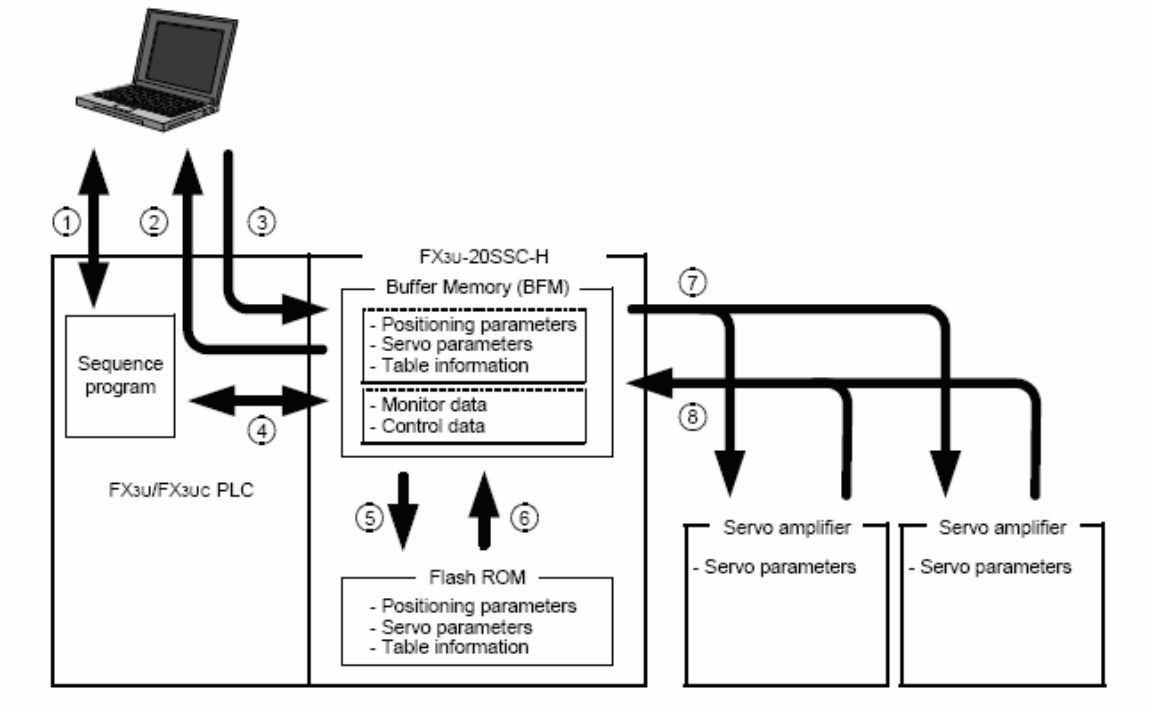
*1: This component is optional, but needed for using this document.

3. Explanation of System Configuration and Communication

3.1 Memory Configuration and Role

The FX_{3U}-20SSC-H has two types of memory for initial data transfer processes and continuous communication with servo equipment and programming devices. The module's flash memory retains parameter information and table data for initializing servo equipment at power-ON while the buffer memory (BFM) constantly communicates with servo equipment and PLC sequence programs during operation. To set up positioning parameters, servo parameters and table information for the FX_{3U}-20SSC-H, it is necessary to send data to the module from a PLC sequence program or from FX Configurator-FP. Due to the convenience and reduced complexity of program coding, FX Configurator-FP should be used whenever possible to program table data. Below is a diagram of how the FX_{3U}-20SSC-H memory communicates with servo amplifiers, PLCs and other equipment.

FX_{3U}-20SSC-H System Components and their Communication



FX_{3U}-20SSC-H System Communication

No.	Description
①	Read/Write/Monitor/Test the sequence programs with GX Developer.
②	Read out the following data from the FX_{3U}-20SSC-H BFM to Configurator-FP. • Positioning parameters • Servo parameters • Table information • Monitor data (Operation status, motion status, input signal status, etc.)
③	Write the following data from Configurator-FP to the FX_{3U}-20SSC-H BFM. • Positioning parameters • Servo parameters • Table information • Control data (The present value change, speed change and operation test command, etc.)
④	Read/Write the following data in BFM with sequence program. • Positioning parameters • Servo parameters • Table information • Monitor data (Operation status, motion status, input signal status, etc.) • Control data (The present value change, speed change and operation test command, etc.)
⑤	Store the following BFM data to the Flash ROM by the store command from a sequence program or from Configurator-FP. • Positioning parameters • Servo parameters • Table information
⑥	Positioning/servo parameters and table information transfer from the Flash ROM to the BFM at power ON. Simultaneously, servo parameters transfer to the servo amplifiers.
⑦	Servo parameters in the BFM transfer to the servo amplifiers at power ON.
⑧	FX_{3U}-20SSC-H retrieves the servo parameters changed by the servo amplifiers and updates the servo parameters in its BFM.

In this document, sections of the FX_{3U}-20SSC-H BFM are referred to as:

Monitor data
Control data
Table information
Positioning parameters
Servo parameters

The positioning parameters, servo parameters and table information can be read and written with several devices such as FX Configurator-FP, GX Developer and HMIs. The monitor data can only be read from the BFM (except for the current address, which has write access), while the control data can be read and written to the BFM. Control data is written to the BFM very frequently, while positioning parameters, table information and servo parameters are usually set less frequently. Refer to the following table for a list of read/write access to the FX_{3U}-20SSC-H buffer memory.

Read/Write Properties for the FX_{3U}-20SSC-H Buffer Memory

BFM Name	BFM #	Description	R/W
Monitor data	0 – 99	X-axis Monitor data	R*1
	100 – 199	Y-axis Monitor data	R*1
	200 – 499	Undefined	R
Control data	500 – 599	X-axis Control data	R/W
	600 – 699	Y-axis Control data	R/W
	700 – 999	Undefined	R
Table Information	1000 – 3999	X-axis Table Information	R/W
	4000 – 6999	Y-axis Table Information	R/W
	7000 – 12999	XY-axis Table Information	R/W
	13000 – 13999	Undefined	R
Positioning parameters	14000 – 14199	X-axis Positioning parameters	R/W
	14200 – 14399	Y-axis Positioning parameters	R/W
	14400 – 14999	Undefined	R
Servo parameters	15000 – 15199	X-axis Servo parameters	R/W
	15200 – 15399	Y-axis Servo parameters	R/W
	15400 – 15999	Undefined	R
	16000 – 16255	System use only	R

*1: R/W is possible for the Current address (user) in [BFM# 1, 0] and [BFM# 101, 100].

4. Begin to Use FX_{3U}-20SSC-H with FX Configurator-FP

4.1 Initialization Process

When setting up the FX_{3U}-20SSC-H for the first time or when beginning a new project, it is recommended to clear the servo parameters, positioning parameters and table information, and then write the desired settings (as needed by the user application) to the controller. The purpose of this section is to define basic settings for the initial testing of the FX_{3U}-20SSC-H using the FX Configurator-FP software.

1) Turn on the power
Confirm that the hardware is set up correctly (as described in *Section 2.1: Hardware Requirements*) and the PLC is in STOP mode. Turn the power ON. (Both of the servos should display 'Ab' when the power is turned ON for the very first time.)

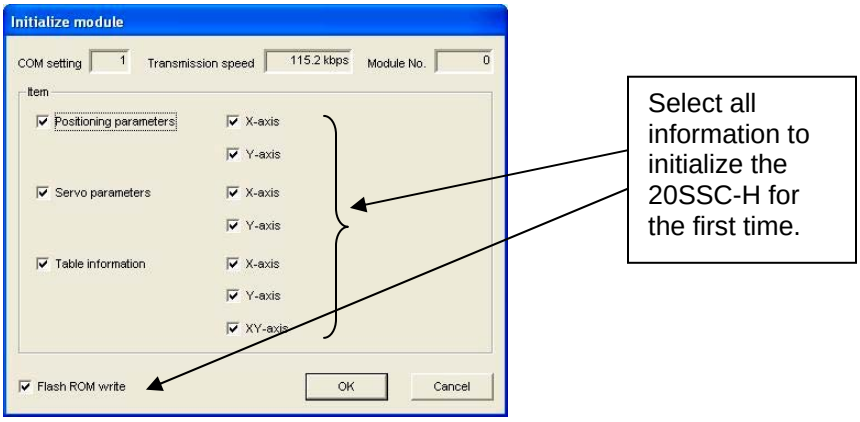
2) Load the software
Open FX Configurator-FP from the Start menu [Start] → [MELSOFT Application] → [FX Configurator-FP] or from the Tools menu of GX Developer [Tools] → [FX special function utility] → [FX Configurator-FP] and create a New file by clicking on  in the Toolbar.

3) Expand the menus
Expand the tree of folders in the [File data list] panel on the left-hand side by double clicking on [Unset file], [Edit], and [Monitor].

4) Verify communication
Go to [Online] → [Connection setup] → [Comm. Test]. Verify that the devices are communicating properly.

5) Initialize the module

Go to [Online] → [Initialize module]. Select all servo parameters, positioning parameters and table information and place a check mark in [Flash ROM write]. Click the OK button and proceed with selecting 'Yes' and then 'OK'. This overwrites all data in the FX_{3U}-20SSC-H buffer memory and Flash ROM with the default settings.



6) Set the positioning parameters

Double click on **[Positioning parameters]** in the [File data list] panel on the left-hand side to modify the positioning parameters.

Change the following items from the [Item] column:

Positioning parameters
• [Maximum speed] →
"26214400 Hz" for X- and Y-axes.

Positioning parameters
• [OPR mode] →
"1: Data set" for X- and Y-axes.
(Note: This setting is used specifically for a system without a DOG or mechanical zero-point.)

Positioning parameters
• [OPR interlock setting] →
"0: Invalid" for X- and Y-axes.
(Note: This is used to ensure that the START command functions regardless of the zero return complete flag's status (BFM# 28, 128: b3).)

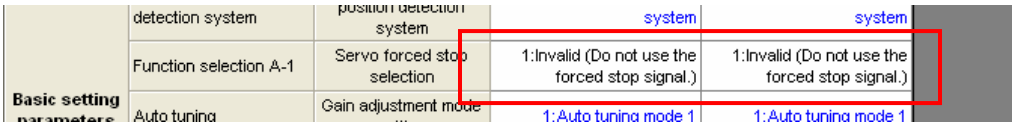
7) Set the servo parameters

Assuming a forced stop switch is not used with the MR-J3-B servos, double click on **[Servo parameters]** in the [File data list] panel on the left-hand side to modify the servo parameters.

Set the following items from the [Kind] column for both the X- and Y- axes:

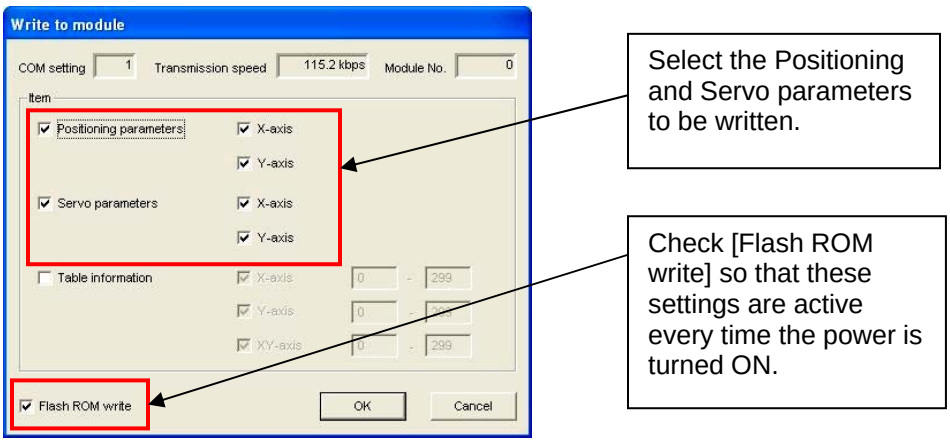
Servo parameters
• [Servo amplifier series] → [Servo amplifier series] →
"1: MR-J3-B" for X- and Y axes.

Servo parameters
• [Basic setting parameters] → [Function selection A-1] → [Servo forced stop Selection] →
"1: Invalid (Do not use the forced stop signal.)" for X- and Y-axes.



8) Write the servo and positioning parameters

Write  the servo parameters and positioning parameters to the FX_{3U}-20SSC-H by pressing the 'Write to module' button or by using [Online] → [Write to module (Ctrl+T)]. Select only the servo and positioning parameters and put a check mark in the [Flash ROM write] box as shown below. Click the OK button and proceed with selecting 'Yes' and then 'OK'. The servos may lose communication since a power reset is needed.



9) Reset the power

Reboot the power to the system to enable communication to the MR-J3 servos. This can be done with a hard boot, or by pressing the 'System reset' 

button. Once communication is established, the servos will read 'd01' and 'd02'. If communication is not established, check the servo hardware and servo parameters again.

4.2 Using TEST MODE

Verify that the PLC is in STOP mode before proceeding with this section.

To enter TEST MODE, press the 'Test On/Off' button  in the Test toolbar or go to [Online] → [Test] → [Test On/Off]. Select 'Yes,' and then 'OK'.

Open up the X- and Y- axis Operation test windows by clicking on the two buttons:  and  .

4.2.1 JOG Operation, X-axis

In the [X-axis Operation test] window, click on the [JOG/MPG] tab. Click and hold down the FWD JOG button. Try changing the JOG speed and JOG instruction evaluation time.

(For more information on the JOG instruction evaluation time, refer to Chapter 8.2.1 in the FX_{3U}-20SSC-H User's Manual (JY997D21301E).)

If positioning does not begin, verify that Positioning and Servo parameters are set for the X- and Y-axes as described in (6) and (7) of *Section 4.1: Initialization Process.*

4.2.2 Setting the Zero Point

When the zero-point is set, the current address data gets set to the zero-point value. This is accomplished by directly changing the current address to 0 (or some other address), or by activating the zero return command in the data-set type OPR mode.

Method 1: Click on the X-axis and Y-axis [OPR] tabs and then click the [REQ. OPR] button and select 'Yes' and 'OK'.

Since the mechanical zero return mode has been set to the data-set type from *Section 4.1: Initialization Process*, the value in BFM# 14028, 14029 (initially zero) is directly written to the current address. In the stopper type and DOG type mechanical zero return modes, this method will cause the motor to turn in the direction of the zero point and will not write zero until the motor comes to a complete stop after detecting an external DOG signal or stopper device. If the [REQ. OPR] button causes the motor to rotate continuously, verify that the Data-set OPR mode has been set in the Positioning Parameters as described in *Section 4.1: Initialization Process.*

WARNING: In OPR modes other than Data-set type, the motor will not stop without an external DOG signal or stopper device.

X-axis Y-axis

Method 2: Directly overwrite the X- and Y-axis current address with a value of zero. Click on the [Feed present value CHG] tab and set the PLS count to 0. Click the [Present value change] button and then 'Yes' and 'OK'.

4.2.3 Positioning patterns, X-axis

By default, the FX_{3U}-20SSC-H is set in Absolute positioning mode. If Incremental positioning (Relative positioning) is desired, a table operation or PLC sequence program must be used to specify the [Incremental mode]. The following procedure uses the default Absolute positioning mode and is meant to be followed as written, step-by-step.

4.2.3.1 Positioning at 1-step speed

Set the zero-point according to *Section 4.2.2: Setting the Zero Point* above if you haven't already done so.
Click on the [Position start] tab and select [Positioning at 1-step speed] in the X-axis Pattern drop-down menu. Set the following X-axis information:

Target address 1:	50,000,000 PLS
Operation speed 1:	10,000,000 Hz

Click on the [Start] button and observe the motor. Click 'Yes' and 'OK'.

If positioning does not begin, verify that Positioning and Servo parameters are set for the X and Y axes as described in (6) and (7) of *Section 4.1: Initialization Process.*

4.2.3.2 Positioning at 2-step speed

Select [Positioning at 2-step speed] in the X-axis Pattern drop-down menu of the [Position start] tab. Set the following X-axis information:

Target address 1:	-20,000,000 PLS
Operation speed 1:	20,000,000 Hz
Target address 2:	0 PLS
Operation speed 2:	5,000,000 Hz

Click on the [Start] button and observe the motor. Click 'Yes' and 'OK'.

4.2.3.3 Variable speed operation

Select [Variable speed operation] in the X-axis Pattern drop-down menu of the [Position start] tab. Set the following X-axis information:

Operation speed 1:	5,000,000 Hz

Click on the [Start] button and then 'Yes' and 'OK'.
Now click on the [Speed CHG] tab to adjust the speed during operation. Try adjusting the [Speed override] setting by entering the following values into the [Speed override] box and pressing the [REQ. speed override] button.

3,000 (x0.1%)
500 (x0.1%)
10 (x0.1%)

Notice the speed changes that occur with each setting.
Finally, click the [Stop] button, 'Yes,' and 'OK'.

4.2.3.4 Linear interpolation

Return the X- and Y- addresses to '0' by setting the zero-point according to *Section 4.2.2: Setting the Zero Point*.

Select [Linear interpolation] in the X-axis Pattern drop-down menu of the [Position start] tab. Set the following X-axis information:

X-axis

Target address 1:	10,000,000 PLS
Operation speed 1:	10,000,000 Hz

Y-axis

Target address 1:	50,000,000 PLS

Click on the [Start] button and observe the motors. Click 'Yes' and 'OK'.

If positioning does not begin, verify that Positioning and Servo parameters are set for the X and Y axes as described in (6) and (7) of *Section 4.1: Initialization Process.*

Now, bring the X- and Y- axes back to 0 PLS by setting the following:

X-axis

Target address 1:	0 PLS
Operation speed 1:	10,000,000 Hz

Y-axis

Target address 1:	0 PLS

Click on the [Start] button and observe the motors. Click 'Yes' and 'OK'.

If positioning does not begin, verify that Positioning and Servo parameters are set for the X and Y axes as described in (6) and (7) of *Section 4.1: Initialization Process.*

4.2.3.5 XY-axis table operation

To perform an XY-axis table operation, it is necessary to input data into the XY-axis Table information screen. Follow the procedure in *Section 4.3: Using Table Data* to create an XY-axis Table and write it to the FX_{3U}-20SSC-H for testing.

In order to use the other positioning patterns, external switches need to be attached to the FX_{3U}-20SSC-H to provide interrupt signals, DOG signals, and pulses from a manual pulsar dial for manual operation.

4.3 Using Table Data

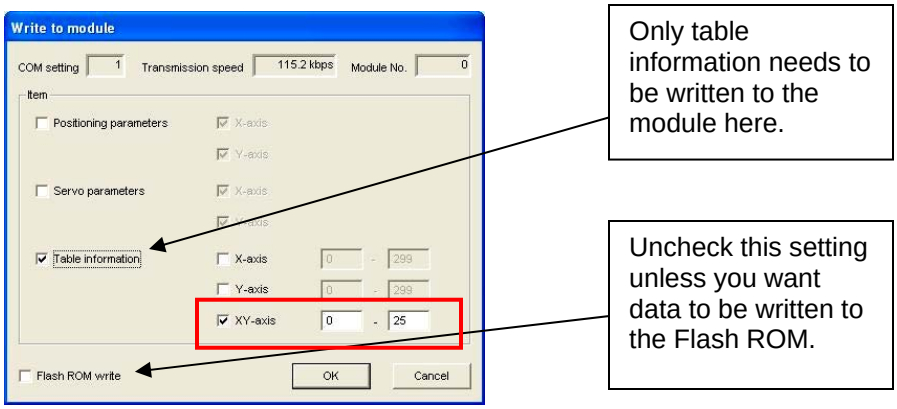
4.3.1 Entering XY-axis Table Data

If you are in TEST MODE, press the 'Test On/Off' button  in the Test toolbar and click 'Yes' to disengage TEST MODE. Double-click on **[XY-axis Table information]** in the [File data list] panel on the left-hand side and maximize the window.
Enter the following data in the XY-axis Table information.

No.	Command Code	Address x:[PLS] y:[PLS]	Speed fx:[Hz] fy:[Hz]	Arc center i:[PLS] j:[PLS]	Time [10ms]	Jump No.	m code
0	Incremental address specification						-1
1	X-axis positioning at 1-step speed	20,000,000	10,000,000				-1
2	Y-axis positioning at 1-step speed	20,000,000	10,000,000				-1
3	XY-axis positioning at 1-step speed	5,000,000 -5,000,000	2,000,000 2,000,000				-1
4	Circular interpolation(CNT,CW)	0 0	15,000,000	5,000,000 5,000,000			-1
5	Dwell				30		-1
6	XY-axis positioning at 2-step speed	10,000,000 -10,000,000	10,000,000 10,000,000				-1
7	XY-axis positioning at 2-step speed	-10,000,000 10,000,000	10,000,000 10,000,000				
8	Dwell				30		-1
9	XY-axis positioning at 2-step speed	10,000,000 -10,000,000	10,000,000 10,000,000				-1
10	XY-axis positioning at 2-step speed	-10,000,000 10,000,000	10,000,000 10,000,000				
11	Dwell				30		-1
12	Circular interpolation(CNT,CCW)	0 0	7,000,000	5,000,000 5,000,000			-1
13	Dwell				30		-1
14	XY-axis positioning at 2-step speed	10,000,000 5,000,000	15,000,000 7,500,000				-1
15	XY-axis positioning at 2-step speed	-5,000,000 -10,000,000	7,500,000 15,000,000				
16	Dwell				30		-1
17	Linear interpolation	20,000,000 -20,000,000	26,214,400				-1
18	Dwell				150		-1
19	Jump					0	
20	End						

With PLS addresses, the numbers can be very large. To reduce the number size, the Position data magnification item can be changed to "3:×1000 times" in the **[Positioning parameters].** If this is changed with data already entered in a table information window, the fields with addresses that lay outside the range –2,147,483,648 to 2,147,483,647 will be highlighted in RED, indicating they must be changed.

After entering the above table, click on the button or use [Online] → [Write to module (Ctrl+T)]. Remove checkmarks from [Positioning parameters] and [Servo parameters] and put a checkmark in [Table information]. Unselect the [X-axis] and [Y-axis], put a checkmark in [XY-axis], and modify the table number range (table rows) to 0 – 25. This will decrease the download time to the FX_{3U}-20SSC-H. Unselect the [Flash ROM write] checkbox, click 'OK' and then 'OK' again.



Save the project.

4.3.2 Performing the XY-axis Table Operation

Select [XY-axis table operation] in the X-axis Pattern drop-down menu of the [Position start] tab. Set the [Table operation start No.] as desired (0 in this example) and begin positioning by pressing the [Start] button, 'Yes,' and 'OK'.

If positioning does not begin, verify that Positioning and Servo parameters are set for the X and Y axes as described in (6) and (7) of *Section 4.1: Initialization Process.*

4.4 Using Monitor Mode

4.4.1 Table Monitor

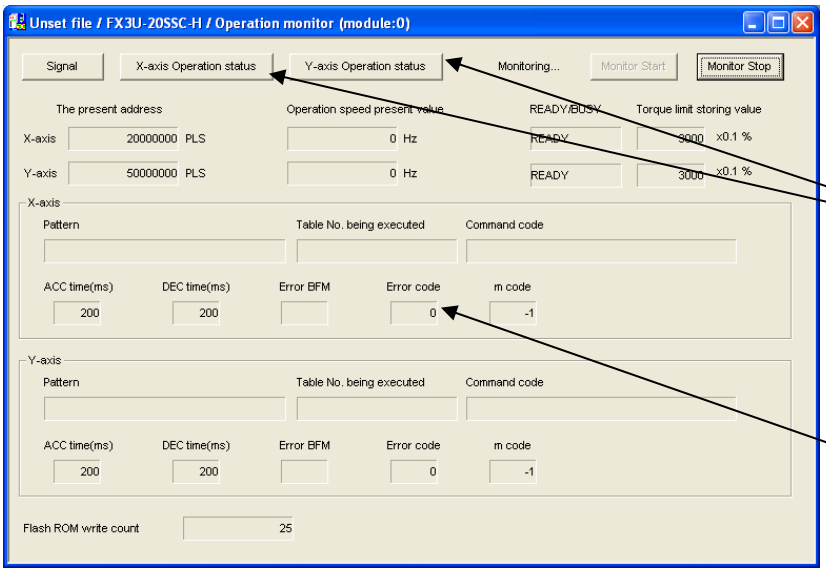
To use the table monitor during positioning, first enable the XY-operation Table pattern in TEST MODE and begin its operation by following *Section 4.2.3.5: XY-axis table operation* above. Do not stop the operation. Ensure that the **[XY-axis Table information]** window is open and click on the Monitor button in the Test toolbar or go to [Online] → [Monitor] → [Monitor On/Off].

Notice how the positioning commands are highlighted as they execute.
To close the Table monitor, click on the Monitor button again.

4.4.2 Operation Monitor

To use operation monitor during positioning, first enable the XY-operation Table pattern in TEST MODE and begin its operation by following *Section 4.2.3.5: XY-axis table operation* above. Do not stop the operation. Instead, click on the Close button to exit the X-axis Operation test window.

Press the 'Test On/Off' button in the Test toolbar and click 'Yes' to turn TEST MODE off. Double-click on **[Operation monitor]** in the [File data list] panel on the left-hand side. Click on the [Monitor Start] button and experiment with the [X-axis Operation status] and [Y-axis Operation status] buttons to monitor axis control data such as target addresses and operation speeds and servo status. By clicking on the [Signal] button, the FX_{3U}-20SSC-H monitor data can be displayed for useful feedback. The Operation Monitor is also helpful for determining positioning errors.



These buttons provide detailed information on the operation speeds and addresses. They also allow monitoring of servo speeds in RPM.

The Error code number allows you to diagnose the cause of the problem with the FX_{3U}-20SSC-H User's Manual.

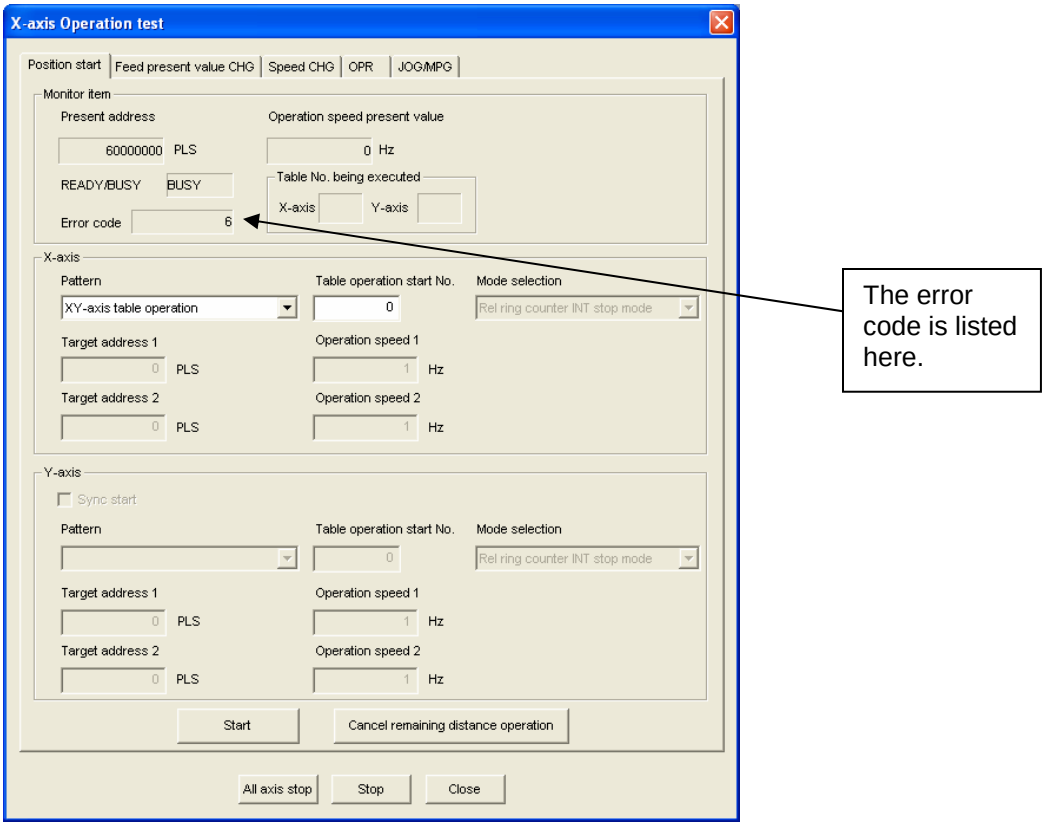
4.5 Resetting an Error

When an error occurs on the X- or Y- axis, the 'X-ERROR' or 'Y-ERROR' light on the 20SSC-H begins blinking and positioning operations are halted until the error-reset bit in the operation data is set via GX Developer or FX Configurator-FP.

4.5.1 Resetting an Error

When an error occurs on the X-axis, the  icon in FX Configurator-FP turns on while in TEST MODE, or while using the Table monitor, or during the **[Operation monitor]** Monitor Start mode. The Error code is listed in the [X-axis Operation test] or [Y-axis Operation test] window as shown below and may be seen in the Operation monitor as well. For information on the error code, refer to Chapter 13.2 in the FX_{3U}-20SSC-H User's Manual (JY997D21301E).

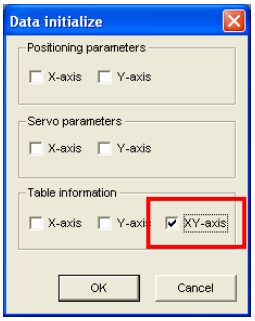
To remove the error, click on the  button or select [Online] → [Test] → [Error reset] → [Error reset X-axis] and press 'Yes' and 'OK'.



4.5.2 Creating and Resetting an Error for Testing

To produce an error for testing purposes, input the erroneous data table listed below into the **[XY-axis Table information]**.

1) Clear XY-axis data (S/W only)
First, it is necessary to initialize (clear) the XY-axis Table information from the software. Go to [Tool] → [Initialize Data] and select the XY-axis Table information. Click on 'OK,' select 'Yes,' and then 'OK.'



2) Enter erroneous table data
Enter the following table for the XY-axis and write it to the FX_{3U}-20SSC-H BFM. Use *Section 4.3: Using Table Data* to input the table and don't forget to write the Table information to the FX_{3U}-20SSC-H buffer memory.

Erroneous Positioning Table Data for XY-axis

No.	Command Code	Address x:[PLS] y:[PLS]	Speed fx:[Hz] fy:[Hz]	Arc center i:[PLS] j:[PLS]	Arc radius r:[PLS]	Jump No.	m code
0	Incremental address specification						-1
1	Circular interpolation(RAD,CW)	10,000,000 0	4,000,000		4,000,000		-1
2	End						

3) Begin the table operation

Enter TEST MODE by pressing the 'Test On/Off' button  in the Test toolbar or go to [Online] → [Test] → [Test On/Off]. Select 'Yes,' and then 'OK'.

Open up the X-axis Operation test window by clicking on the  button.

Select [XY-axis table operation] in the X-axis Pattern drop-down menu of the [Position start] tab.

Set the [Table operation start No.] to '0'.

Begin positioning by pressing the [Start] button, 'Yes,' and 'OK'.

4) Notice the error

Notice how the X-ERROR LED on the FX_{3U}-20SSC-H begins blinking and nothing happens since the radius is too small. The error code, 6, is listed as "Center coordinate setting error" in the FX_{3U}-20SSC-H User's Manual (JY997D21301E) in Chapter 13.2.3. In the Test toolbar, you can see that the error button for the X-axis turns red:  .

5) Correct the error

To correct the error, reset the error according to *Section 4.5.1: Resetting an Error* and then specify an appropriate radius as shown in the table below.
Use *Section 4.3: Using Table Data* to input the table and don't forget to write the Table information to the FX_{3U}-20SSC-H buffer memory.

Non-Erroneous Positioning Table Data for XY-axis

No.	Command Code	Address x:[PLS] y:[PLS]	Speed fx:[Hz] fy:[Hz]	Arc center i:[PLS] j:[PLS]	Arc radius r:[PLS]	Jump No.	m code
0	Incremental address specification						-1
1	Circular interpolation(RAD,CW)	10,000,000 0	4,000,000		5,000,000		-1
2	End						

Follow Step (3) above to execute positioning without an error.
For more information on the Circular Interpolation Operation, refer to Chapter 9.11 in the FX_{3U}-20SSC-H User's Manual (JY997D21301E).

4.6 Absolute Position Detection System

The absolute position detection system is a feature available from the MR-J3-B servo amplifiers to remember the current position of the workpiece at all times. According to Chapter 7.8.4 in the FX_{3U}-20SSC-H User's Manual (JY997D21301E), the current position is stored in the servo amplifiers' battery backed memory, and even if the workpiece moves at power failure, the moving distance is added to the current position with the absolute encoder and servo amplifier absolute position system.

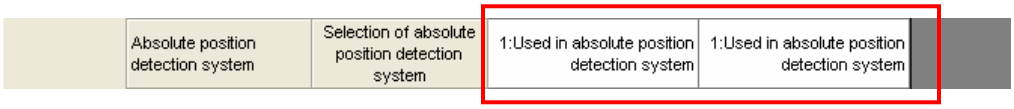
To set the absolute position detection system, it is necessary to write information to the servo parameters and then perform a mechanical zero return operation AT LEAST ONCE to define the coordinate system. After the coordinate system is defined, the zero return operation does not need to be executed again, even when the power is turned on. If the absolute position detection

system is disabled and then enabled again, however, the mechanical zero return operation will need to be executed again.
Follow the steps below to activate the absolute position detection system.

1) Set the servo parameters
Double click on **[Servo parameters]** in the [File data list] panel on the left-hand side to modify the servo parameters.

Set items from the [Kind] column for both the X- and Y- axes as shown:

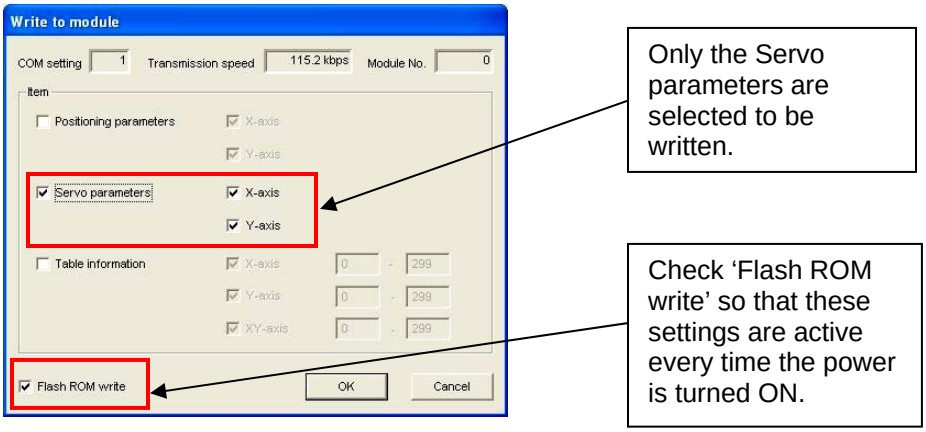
• [Basic setting parameters] → [Absolute position detection system] → [Selection of absolute position detection system] →
"1: Used in absolute position detection system" for X- and Y-axes.



Set all other servo parameters as necessary.

2) Write the servo parameters

Write the servo parameters to the FX_{3U}-20SSC-H BFM and Flash ROM by pressing the 'Write to module' button or by using [Online] → [Write to module (Ctrl+T)]. Select only the servo parameters and put a check mark in the [Flash ROM write] box as shown below. Click the 'OK' button and proceed with selecting 'Yes' and then 'OK'.



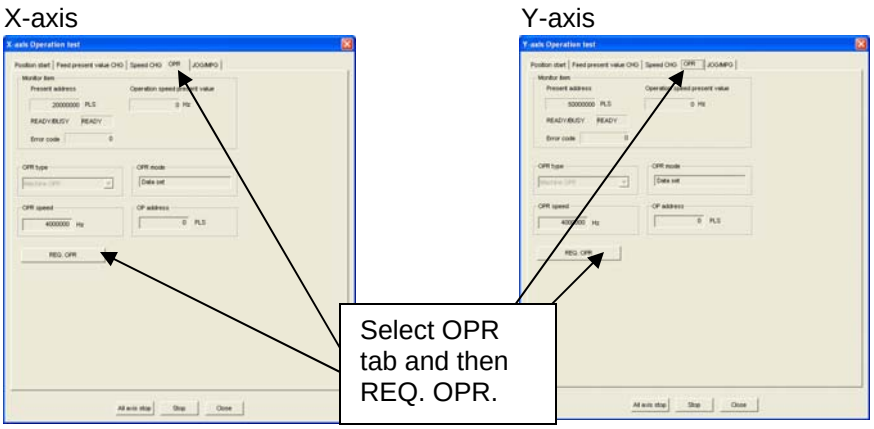
3) Activate zero return for both axes
Using FX Configurator-FP:

Enter TEST MODE by pressing the 'Test On/Off' button in the Test toolbar or go to [Online] → [Test] → [Test On/Off]. Select 'Yes,' and then 'OK'.

Open up the X- and Y- axis Operation test windows by clicking on the two buttons:
and .

Click on the [OPR] tab for each window.

Click on the [REQ. OPR] button and select ‘Yes’ and ‘OK’.



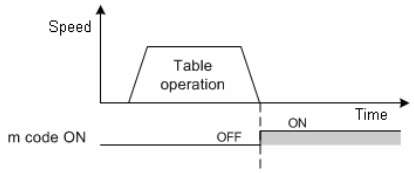
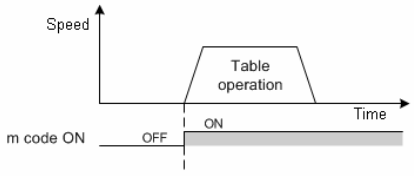
Since the mechanical zero return mode has been set to the data-set type from *Section 4.1: Initialization Process*, the value in BFM# 14028, 14029 (initially zero) is directly written to the current address.

WARNING: In OPR modes other than Data-set type, the motor will not stop without an external DOG signal or stopper device.

4.7 Understanding m code

For an application using table operation data that requires extra control, m code is useful to pause or trigger various events. An m code is a value that causes a bit to turn on at the beginning (with mode) or end (after mode) of a table operation. The m code value (set by the user) determines the timing with which the bit turns on. All positioning operations following the current operation are halted until the m code bit turns off.

The following table explains the difference between the two types of m code.

m code type	m code No.	Description	Illustration
After mode	0 to 9,999	The m code bit turns ON after the table operation completes.	
With mode	10,000 to 32,767	The m code bit turns ON when the table operation begins.	

4.7.1 After mode

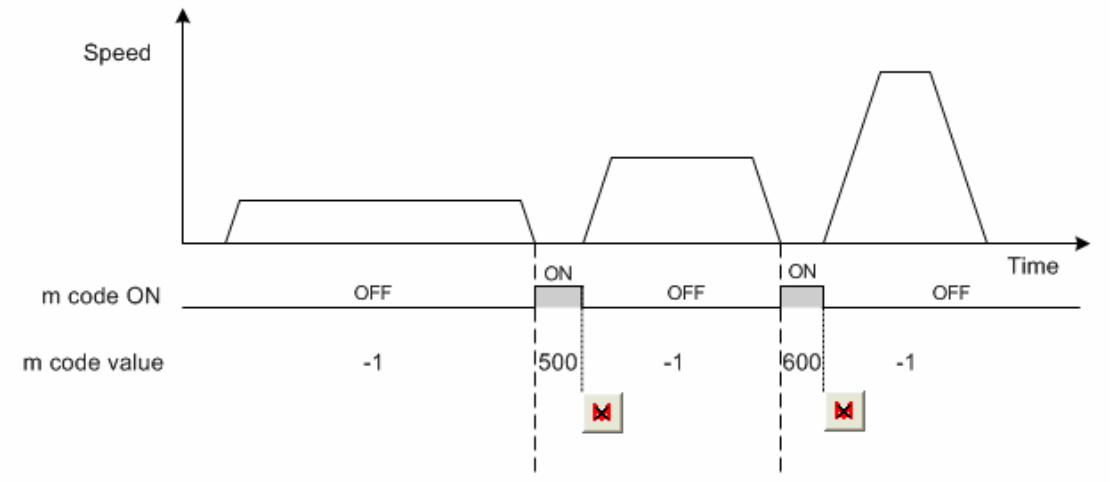
The m code functionality for 'After mode' can be tested by entering m code values between 0 and 9,999 into a table. The following exercise uses FX Configurator-FP to turn the m code bit off for each table operation that uses a value other than '-1' so that positioning operations can be continued. A value of '-1' represents normal operation.

1) Enter X-axis table data

Enter the following table for the X-axis and write it to the FX_{3U}-20SSC-H BFM. Use *Section 4.3: Using Table Data* to input the table and don't forget to write the Table information to the FX_{3U}-20SSC-H buffer memory.

X-axis Table Data with m code (After mode)

No.	Command Code	Address [PLS]	Speed [Hz]	Time [10ms]	Jump No.	m code
0	Incremental address specification					-1
1	Positioning at 1-step speed	10,000,000	2,000,000			500
2	Positioning at 1-step speed	10,000,000	4,000,000			600
3	Positioning at 1-step speed	20,000,000	17,500,000			-1
4	End					



2) Begin the table operation

Enter TEST MODE by pressing the Test On/Off button  in the Test toolbar or go to [Online] → [Test] → [Test On/Off]. Select 'Yes,' and then 'OK'.

Open up the X-axis Operation test window by clicking on the  button.

Select [X-axis table operation] in the X-axis Pattern drop-down menu of the [Position start] tab and set the [Table operation start No.] to '0'.

Begin positioning by pressing the [Start] button, 'Yes,' and 'OK'.

3) Observe the m code

After the Table No. 1 row operation completes, the m code '500' is written and the table operation is paused. To continue the operation, click on the 'm code Off X-axis' button  , select 'Yes,' and then 'OK'.

Table No. 2 operates and the m code '600' is written after its completion, preventing Table No. 3 from being consecutively performed. Again, turn the m code bit off by pressing the 'm code Off X-axis' button  .

4.7.2 With mode

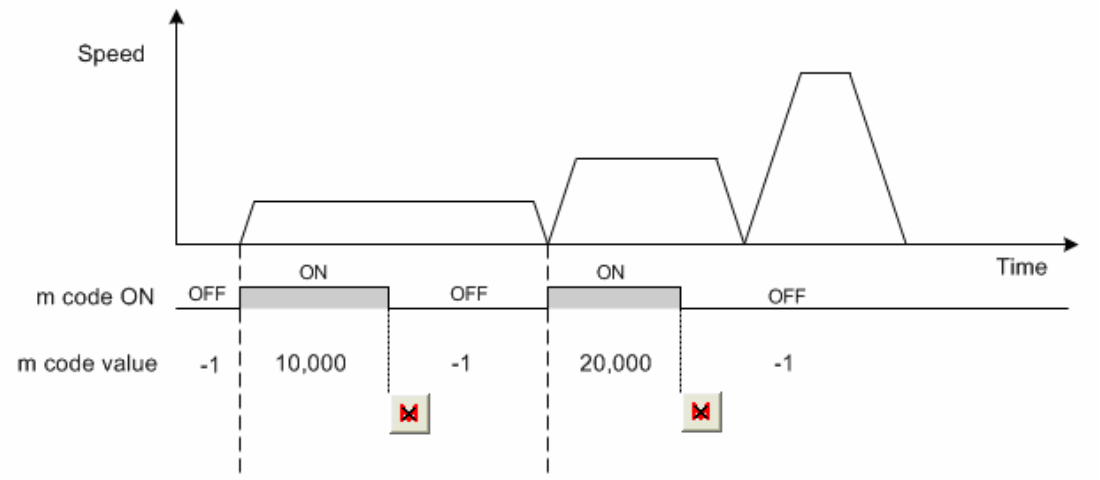
The m code functionality for 'With mode' can be tested by entering m code values between 10,000 and 32,767 into a table. The following exercise uses FX Configurator-FP to turn the m code bit off for each table operation that uses a value other than '-1' so that positioning operations can be continued. A value of '-1' represents normal operation.

1) Enter X-axis table data

Enter the following table for the X-axis and write it to the FX_{3U}-20SSC-H BFM. Use *Section 4.3: Using Table Data* to input the table and don't forget to write the Table information to the FX_{3U}-20SSC-H buffer memory.

X-axis Table Data with m code (With mode)

No.	Command Code	Address [PLS]	Speed [Hz]	Time [10ms]	Jump No.	m code
0	Incremental address specification					-1
1	Positioning at 1-step speed	10,000,000	2,000,000			10,000
2	Positioning at 1-step speed	10,000,000	4,000,000			20,000
3	Positioning at 1-step speed	20,000,000	17,500,000			-1
4	End					



2) Begin the table operation

Enter TEST MODE by pressing the Test On/Off button  in the Test toolbar or go to [Online] → [Test] → [Test On/Off]. Select 'Yes,' and then 'OK'.

Open up the X-axis Operation test window by clicking on the  button.

Select [X-axis table operation] in the X-axis Pattern drop-down menu of the [Position start] tab and set the [Table operation start No.] to '0'.

Begin positioning by pressing the [Start] button, 'Yes,' and 'OK'.

4) Observe the m code

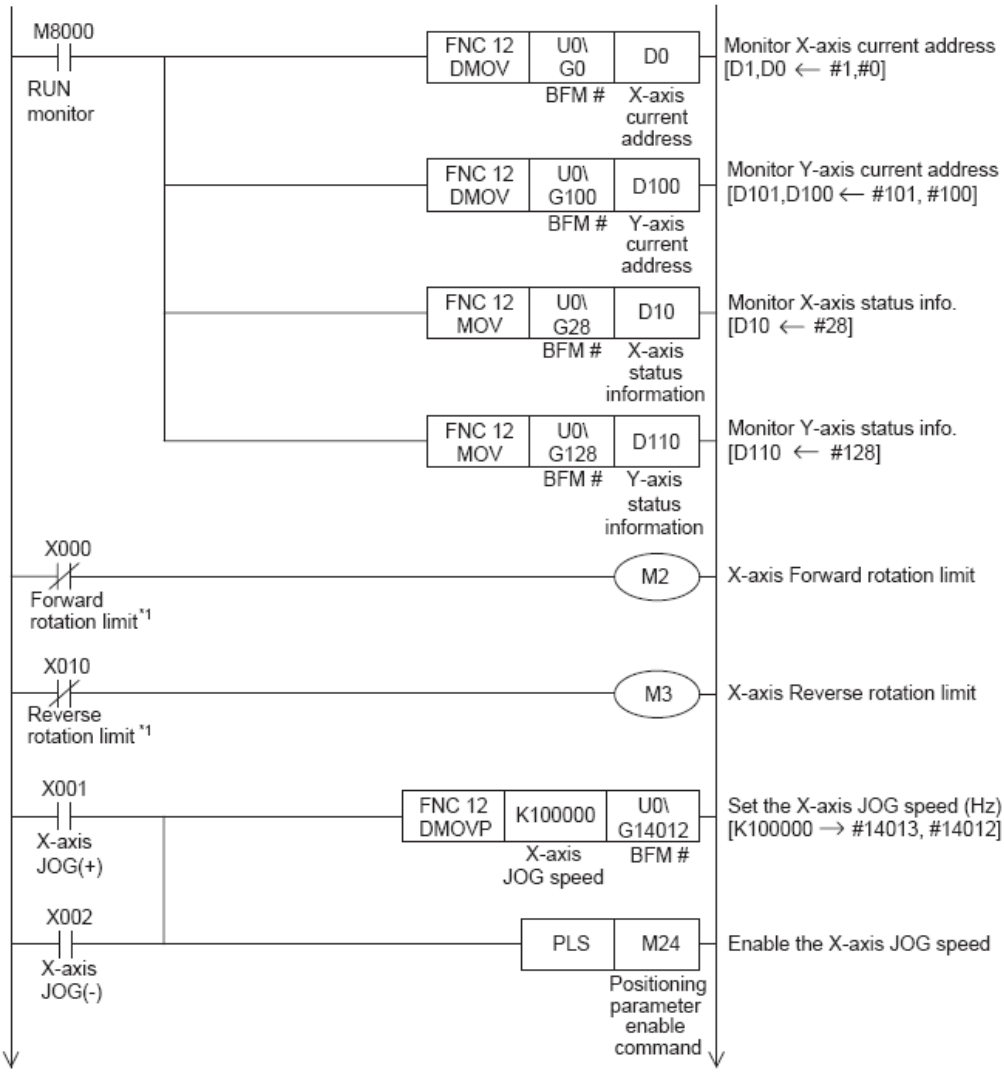
When the Table No. 1 row operation begins, the m code '10,000' is written. To turn off the m code bit, click on the 'm code Off X-axis' button  , select 'Yes,' and then 'OK'. Since the m code is OFF (m code value = -1) before the next operation, Table No. 2

begins after Table No. 1 completes, and a value of '20,000' is written. The rest of the table can only be completed when the m code bit turns off again by pressing the 'm code Off X-axis' button  .

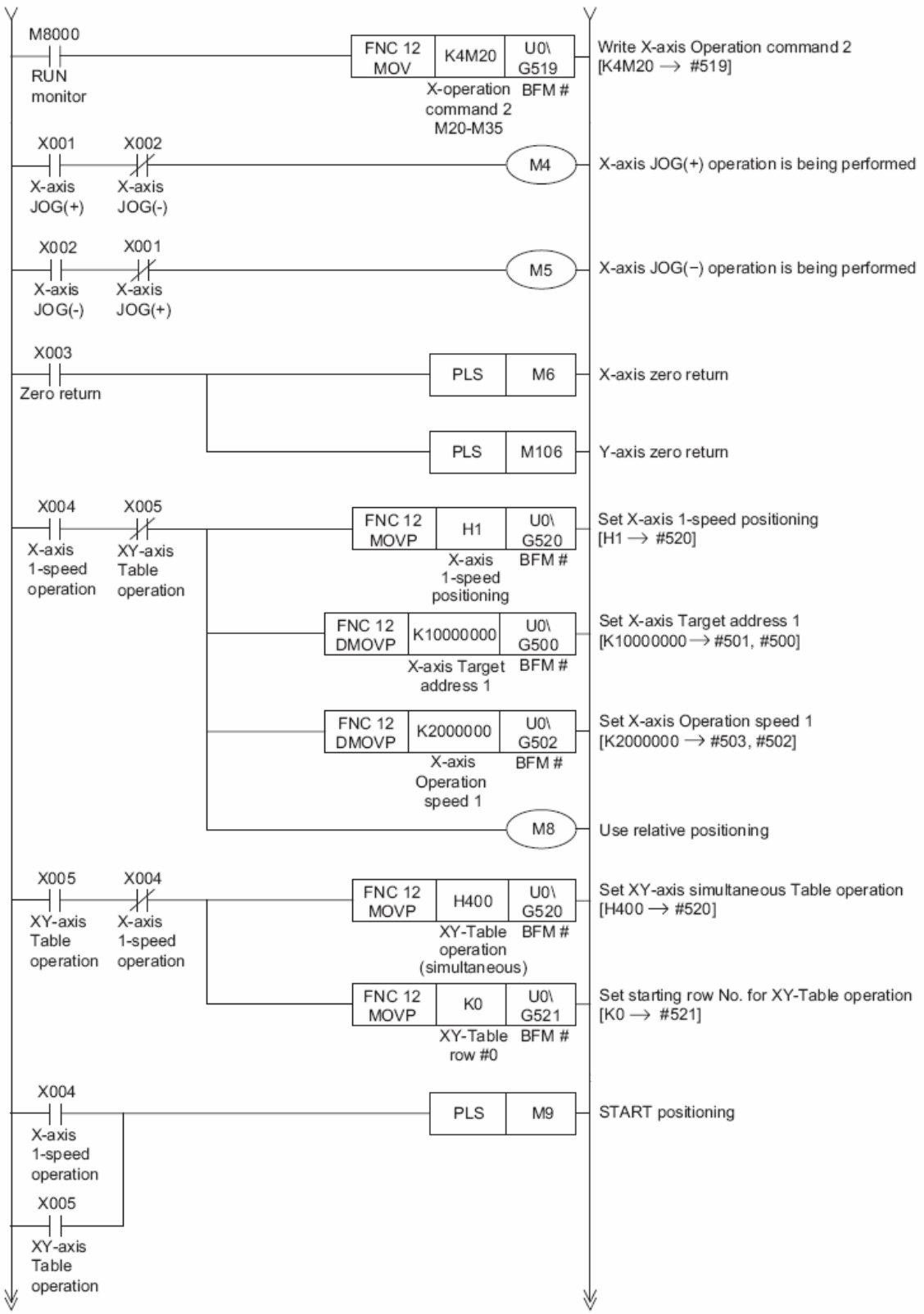
5. Begin to Use FX_{3U}-20SSC-H with GX Developer

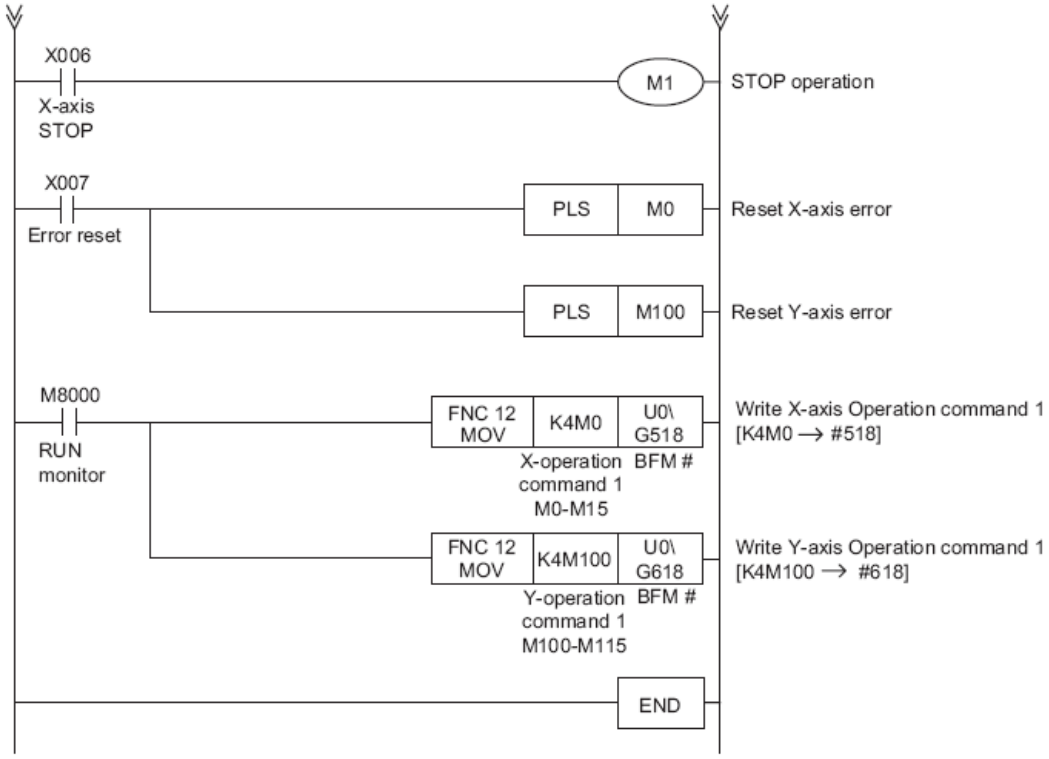
The following program uses buffer memory communication to perform JOG positioning, 1-speed positioning, and table operation control. The XY-table from *Section 4.3: Using Table Data* can be used to perform the table operation. In this example, FX Configurator-FP should be used to specify the servos, change the maximum speed, and to set the zero return mode through the parameter settings as described in *Section 4.1: Initialization Process.*

The following ladder program is to be used with an $FX_{3U(C)}$ PLC and MR-J3-B servo system. Without these components, the program cannot be tested.



*1. The forward and reverse rotation limit switches must be wired so that they are turned ON by default. When these limit switches turn OFF (due to the workpiece going out-of-bounds), M2 or M3 will turn ON and cause the pulse operation to stop.


M8000
RUN monitor
FNC 12 MOV
K4M20
U0\ G519
X-operation command 2 M20-M35
BFM #
Write X-axis Operation command 2 [K4M20 → #519]
X001
X-axis JOG(+)
X002
X-axis JOG(-)
M4
X-axis JOG(+) operation is being performed
X002
X-axis JOG(-)
X001
X-axis JOG(+)
M5
X-axis JOG(−) operation is being performed
X003
Zero return
PLS
M6
X-axis zero return
PLS
M106
Y-axis zero return
X004
X-axis 1-speed operation
X005
XY-axis Table operation
FNC 12 MOVP
H1
U0\ G520
X-axis 1-speed positioning
Set X-axis 1-speed positioning [H1 → #520]
FNC 12 DMOVP
K10000000
U0\ G500
X-axis Target address 1
Set X-axis Target address 1 [K10000000 → #501, #500]
FNC 12 DMOVP
K2000000
U0\ G502
X-axis Operation speed 1
Set X-axis Operation speed 1 [K2000000 → #503, #502]
M8
Use relative positioning
X005
XY-axis Table operation
X004
X-axis 1-speed operation
FNC 12 MOVP
H400
U0\ G520
XY-Table operation (simultaneous)
Set XY-axis simultaneous Table operation [H400 → #520]
FNC 12 MOVP
K0
U0\ G521
XY-Table row #0
Set starting row No. for XY-Table operation [K0 → #521]
X004
X-axis 1-speed operation
X005
XY-axis Table operation
PLS
M9
START positioning


X006
X-axis STOP
M1
STOP operation
X007
Error reset
PLS
M0
Reset X-axis error
PLS
M100
Reset Y-axis error
M8000
RUN monitor
FNC 12 MOV
K4M0
U0\ G518
Write X-axis Operation command 1 [K4M0 → #518]
X-operation command 1 M0-M15
BFM #
FNC 12 MOV
K4M100
U0\ G618
Write Y-axis Operation command 1 [K4M100 → #618]
Y-operation command 1 M100-M115
BFM #
END

Revision Details:

January 1st, 2008

- Updated version information
  - -FX_{3U}-20SSC-H v1.10 or later
  - -FX Configurator-FP v1.10 or later
- Edited Section 4.1 Initialization Process
  - -Deleted servo forced stop information
  - -Modified parameter write sequence
  - -FX Configurator-FP reset button
- Explanation of m code (Section 4.7)
- Addition of ladder program (Section 5)
- Edited general text
- Revised graphics
- Updated manual versions
- Added references for FX_{3UC}
- Removed GOT information