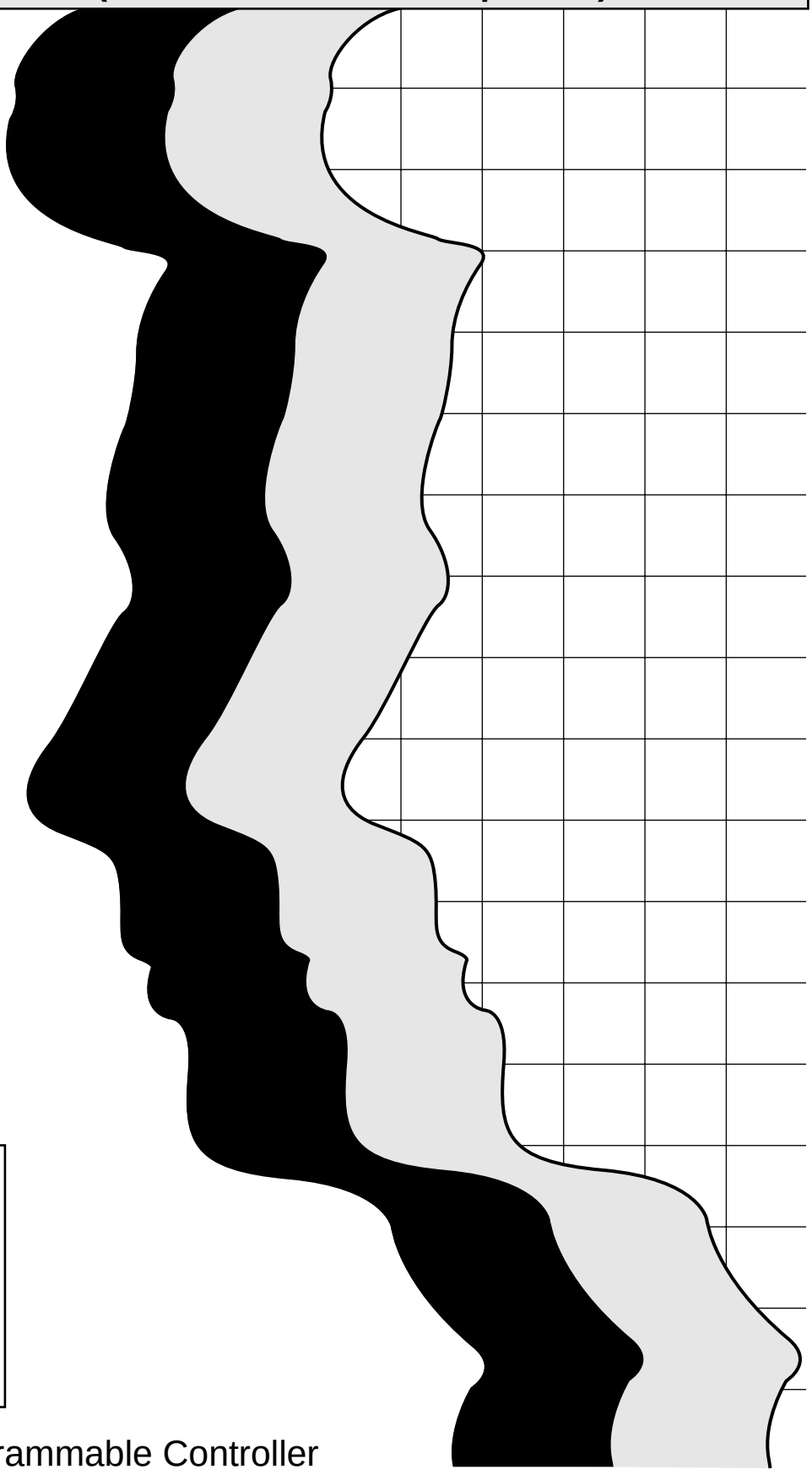
MITSUBISHI

Type A1FXCPU Module

User's Manual (Function description)



MELSEC

Mitsubishi Programmable Controller

• SAFETY INSTRUCTIONS •

(Always read these instructions before using this equipment.)

Before using this product, please read this manual and the relevant manuals introduced in this manual carefully and pay full attention to safety to handle the product correctly.
The instructions given in this manual are concerned with this product. For the safety instructions of the programmable controller system, please read the CPU module user's manual.
In this manual, the safety instructions are ranked as "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.**

Note that the CAUTION level may lead to a serious consequence according to the circumstances. Always follow the instructions of both levels because they are important to personal safety.

Please save this manual to make it accessible when required and always forward it to the end user.

[Designing Instructions]

⚠ DANGER

- Provide safety circuits outside the PLC to ensure that the system operates safely if an external power fault or PLC failure occurs.
  Not doing so may cause misoutput or misoperation.
  (1) Configure up circuits, e.g. an emergency stop circuit, a protective circuit, interlock circuits for forward/reverse rotation and other opposite operations, and interlock circuits for machine damage prevention such as upper and lower positioning limits, outside the PLC.
  For an interlock circuit example, refer to the A1FXCPU User's Manual (Setup).
  (2) When the PLC detects either of the following faulty conditions, it stops operation and switches off all outputs.
  • The overcurrent or overvoltage protector of the power supply module is activated.
  • The self-diagnostic function of the PLC CPU detects a fault such as a watchdog timer error.
  Faults undetectable by the PLC CPU, e.g. a fault at the I/O control section may cause all outputs to switch on. The external circuit and mechanism should be designed to ensure that the machine operates safely at such a time.
  For a failsafe circuit example, refer to the A1FXCPU User's Manual (Setup).
  (3) The output current of the service power supply for sensor differs according to the model and whether there are extension blocks or not. If overload occurs, the voltage drops automatically, PLC inputs become inoperative, and all outputs switch off. The external circuit and mechanism should be designed to ensure that the machine operates safely at such a time.
  (4) Some failures of relays, transistors and other devices of the output module may cause outputs to turn on or off. An external monitoring circuit should be provided to monitor output signals which may lead to a serious accident.

[Designing Instructions]

DANGER

- If a current higher than the rating or an overcurrent due to a load short-circuit, etc. kept on flowing for a long time in the outputs, fuming or combustion may occur. To prevent this, provide an external safety circuit such as a fuse.

- Configure up a circuit so that the external supply power is switched on after the power of the PLC is switched on.
  If the external supply power is switched on first, an accident may occur due to misoutput or misoperation.

- When a communication fault occurs in inter-PLC link, the faulty station retains the data prior to the occurrence of the communication fault.
  Using communication status data, make up an interlock circuit in the sequence program to ensure that the system operates safely.
  Not doing so may cause an accident due to misoutput or misoperation.
  For an interlock circuit example, how to check a faulty station, and operating status at communication fault occurrence, refer to Section 5.2 in this manual.

CAUTION

- Do not bundle control or communication cables with the main circuit, power or other lines or lay them near these lines. As a guideline, separate the cables at least 100mm (3.94 inch).
  A failure to do so can cause misoperation due to noise.
  When controlling items like lamp load, heater or solenoid valve using an output module, large current (approximately ten times greater than that present in normal circumstances) may flow when the output is turned OFF to ON.
  Take measures such as replacing the module with one having sufficient rated current.

[Installation Precautions]

CAUTION

- Use the PLC in an environment that conforms to the general specifications given in this manual.
  Not doing so can cause an electric shock, fire, misoperation or product damage or deterioration.

- Completely turn off the external power supply before loading or unloading the module. Not doing so could result in electric shock or damage to the product.

- Do not touch the conductive areas and electronic parts of the module directly.
  Doing so can cause the module to misoperate or fail.

[Wiring Instructions]

DANGER

- Before starting mounting, wiring or other work, always switch power off externally in all phases.
  Not doing so may cause an electric shock or product damage.

- When switching power on or starting operation after mounting, wiring or other work, always fit the supplied terminal cover to the product.
  Not doing so can cause an electric shock.

CAUTION

- Be sure to ground the FG terminals and LG terminals to the protective ground conductor.
  Not doing so could result in electric shock or erroneous operation.

- Wire the module correctly after confirming the rated voltage and terminal arrangement of the product.
  A fire or failure can occur if the power supply connected is different from the rating or wiring is incorrect.

- Do not connect the A1FXCPU and extension module service power supply outputs in parallel.
  Doing so can cause the power supply module to overheat, leading to a fire or failure.

- Do not supply external power to the +24V/24G terminals of the A1FXCPU and the 24+ terminal of the extension module.
  Also, do not wire the empty terminal (NC) of the A1FXCPU and the empty terminal ▪ of the extension module externally.
  Doing so may cause product damage.

- Tighten the terminal screws to the specified torque.
  Undertightening can cause a short circuit, fire or misoperation.
  Overtightening can cause a drop, short circuit or misoperation due to damaged screws or module.

- Ensure that foreign matters such as chips and wire off-cuts do not enter the module.
  They can cause a fire, failure or misoperation.

- Do not connect multiple power supply modules to one module in parallel.
  The power supply modules may be heated, resulting in a fire or failure.

[Starting and Maintenance Precautions]

DANGER

- Do not touch the terminals while power is on.
  This can cause an electric shock or misoperation.
- Connect the battery correctly. Do not recharge, disassemble, heat, short or solder the battery or throw it into fire.
  Improper handling of the battery may result in injury or fire due to heating, burst, combustion, etc.
- Before starting cleaning or terminal screw retightening, always switch power off externally in all phases.
  Not doing so can cause an electric shock.
  Overtightening can cause a drop, short circuit or misoperation due to damaged screws or module.

CAUTION

- Before starting online operation with the peripheral connected to the running CPU module (especially program modification, forced output, operating status change), carefully read the manual and fully ensure safety.
  Not doing so can cause machine damage or accident due to operational mistakes.
- Use any radio communication device such as a cellular phone or a PHS phone more than 25cm (9.85 inch) away from the PLC. Not doing so can cause a malfunction.
- Do not disassemble or modify each module.
  This can cause a failure, misoperation, injury or fire.
- Completely turn off the external power supply before loading or unloading the module. Not doing so could result in electric shock or damage to the product.
- Do not drop or give an impact to the battery installed in the module.
  Otherwise the battery will be broken, possibly causing internal leakage of electrolyte. Do not use but dispose of the battery if it has fallen or an impact is given to it.
- Always make sure to touch the grounded metal to discharge the electricity charged in the electricity charged in the body, etc., before touching the module.
  Failure to do say cause a failure or malfunctions of the module.

[Disposal Precautions]

CAUTION

- When disposing of this product, treat it as industrial waste.

[Transportation Precautions]

CAUTION

- When transporting lithium batteries, make sure to treat them based on the transport regulations. (Refer to the A1FXCPU User's Manual (Setup) for details of the controlled models.)

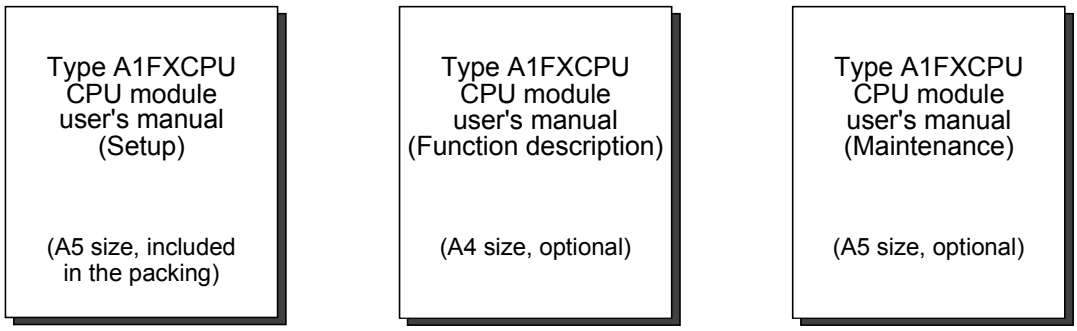
Revisions

*The manual number is noted at the lower left of the back cover.

Print Date	*Manual Number	Revision
Feb., 1998	SH(NA)-4002-A	First edition
Dec., 2005	SH(NA)-4002-B	Partial correction SAFETY PRECAUTIONS, Manual Makeup, Related Manuals, CONTENTS, Section 2.2.1, 2.2.2, 2.3.2, 2.7, 2.8, 3.2.2, 3.3, 5.1, 5.3.5, Appendix 4.1, Appendix 4.2 Addition WARRANTY Deletion Appendix 2.2
Sep., 2006	SH(NA)-4002-C	Partial correction Section2.1.5, 2.1.6, Appendix 4.1, Appendix 4.2
Jul., 2007	SH(NA)-4002-D	Partial correction Section 2.8

[Manual Makeup]

There are three different manuals related to the A1FXCPU: setup, function description and maintenance manuals.



1) A1FXCPU user's manual (Setup)

This manual provides procedures from product and accessory checkup to installation and wiring to be followed after you have purchased the A1FXCPU and unpacked the package.

The setup manual describes the following items.

· A1FXCPU performances (CPU section, power supply section, built-in functions)
· Names of parts
· Settings of parts (hardware settings)
· I/O number assignment
· EMC Directive, Low Voltage Directive
· Installation of A1FXCPU
· External wiring
· Outline dimension drawings

2) A1FXCPU user's manual (Function description)

This manual includes the explanation, data setting and programming of the built-in functions added to the A1FXCPU, I/O number assignment needed for I/O control, methods of communication with special modules/special blocks, error codes and other information.

The function description manual describes the following items.

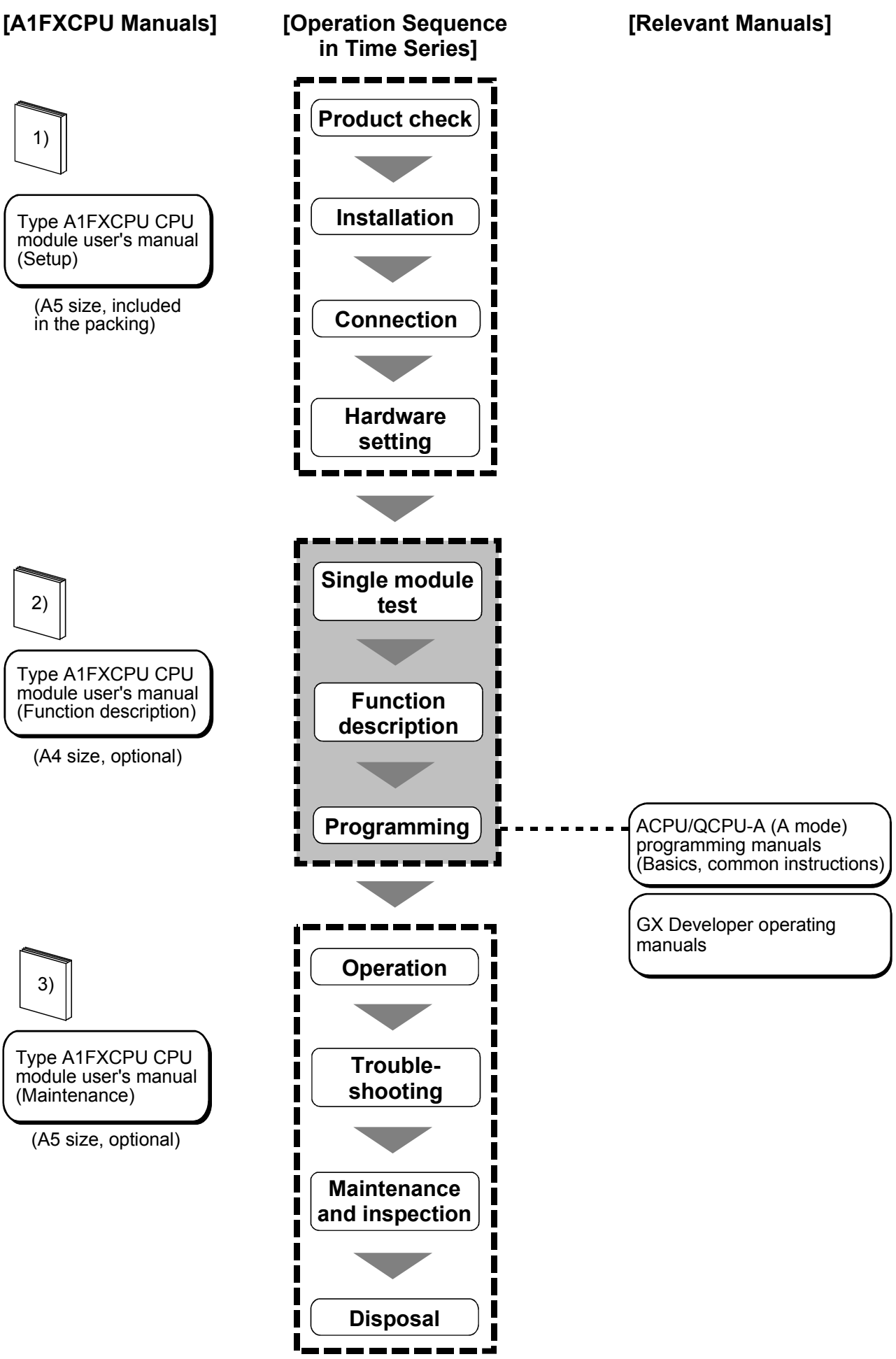
· System configuration
· Performances of A1FXCPU (CPU section, power supply section, built-in functions)
· Built-in functions of A1FXCPU (simple inter-PLC link, simple positioning, high-speed counter, external interrupt)
· I/O number assignment
· Communication with special modules/special blocks
· Error codes
· Special relays, special registers
· Outline dimension drawings

3) A1FXCPU user's manual (Maintenance)

This manual explains the inspection of a system using the A1FXCPU and troubleshooting at error occurrence.

· Names of parts
· Settings of parts
· Maintenance and inspection
· Troubleshooting
· Special relays, special registers

Refer to ACPU/QCPU-A (A mode) programming manuals for the instructions needed for devices and programming of the A1FXCPU, and to GX Developer operating manuals for peripheral operation to be performed for programming.


[A1FXCPU Manuals]
[Operation Sequence in Time Series]
[Relevant Manuals]
1)
Type A1FXCPU CPU module user's manual (Setup)
(A5 size, included in the packing)
Product check
Installation
Connection
Hardware setting
2)
Type A1FXCPU CPU module user's manual (Function description)
(A4 size, optional)
Single module test
Function description
Programming
ACPU/QCPU-A (A mode) programming manuals (Basics, common instructions)
GX Developer operating manuals
3)
Type A1FXCPU CPU module user's manual (Maintenance)
(A5 size, optional)
Operation
Trouble-shooting
Maintenance and inspection
Disposal

About This Manuals

The following product manuals are available. Please use this table as a reference to request the appropriate manual as necessary.

Related Manuals

Manual Name	Manual No. (Model Code)
Type A1FXCPU module user's manual (Setup) Provides the specifications, installation, wiring and other information of the module for use of the A1FXCPU. (Option)	IB-66839 (13JL57)
Type A1FXCPU module user's manual (Maintenance) Provides maintenance/inspection and troubleshooting procedures of the module for use of the A1FXCPU. (Option)	SH-4003 (13JL58)
ACPU/QCPU-A (A mode) Programming Manual (Fundamentals) Offers programming methods, device names, parameters, program types, memory area makeup, etc. needed to write programs. (Option)	IB-66249 (13J740)
ACPU/QCPU-A (A mode) Programming Manual (Common Instruction) Programming ManualGives how to use sequence, basic and application instructions and microcomputer programs. (Option)	IB-66250 (13J741)
Type MELSAP-II Programming Manual Provides specifications, functions, instructions, programming methods, etc. needed when the MELSAP-II is used for programming with SFC programs. (Option)	IB-66361 (13JF40)

POINT
For the FX series, refer to the manual you use.

CONTENTS

1. INTRODUCTION

The A1FXCPU is a CPU module including a CPU, power supply and I/O (input: 14 points, output: 4 points) in one body and capable of control using A series instructions.
The A1FXCPU incorporates the simple inter-PLC link function, simple positioning function, high-speed counter function and interrupt input function.
The FX series extension modules, extension blocks, special modules and special blocks can be connected to the A1FXCPU to control them.

1.1 Features

The A1FXCPU module has the following features.

(1) CPU module having a power supply, CPU and I/O in one body
The A1FXCPU contains the power supply, CPU, I/O (input: 14 points, output: 4 points) and program memories (RAM, E^2PROM).

(2) Special functions incorporated in the CPU module
The CPU modules incorporates the simple inter-PLC link function, simple positioning function, high-speed counter function and interrupt input function in addition to the A2SHCPU functions.

(3) A series instructions available
The A series peripheral can be used to perform programming with the A series instructions.

(4) FX series extension modules, extension blocks, special modules and special blocks available
The FX_{2N} and FX_{0N} series extension modules, extension blocks and special blocks can be used to configure up a compact system.
The FX_1 and FX_2 series extension modules and extension blocks can also be connected to the A1FXCPU to make up a system.

(5) Data link with the FX_{2N} and FX_{0N} series
The simple inter-PLC link function allows bit data and word data to be communicated with the FX_{2N} and FX_{0N} series.

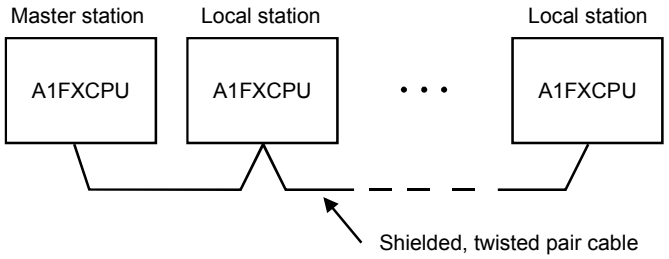
(6) CE Mark compliant product
The A1FXCPU complies with the CE Mark.
For full information, refer to the A1FXCPU User's Manual (Setup).

1.2 Functions Built in the A1FXCPU

The A1FXCPU has the following built-in functions.

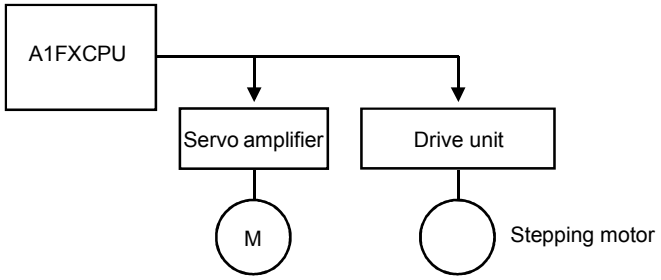
(1) Simple inter-PLC link function

Up to eight A1FXCPU modules and FX_{2N} and FX_{0N} series main modules can be connected by shielded, twisted pair cables to communicate bit and word data.



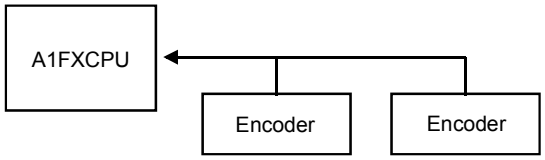
(2) Simple positioning function

One servo amplifier and one stepping motor driver may be connected to the A1FXCPU to do simple positioning with max. 60kpps pulses output.



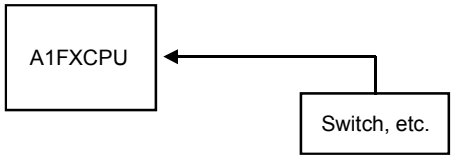
(3) High-speed counter function

Two encoders may be connected to the A1FXCPU to count max. 60kpps pulses input. When the set value matches the count value, an interrupt program (I12, I13) can be run.



(4) Interrupt input function

By switching on the interrupt terminals of the A1FXCPU external connector, interrupt programs (I0 to I5) can be run by the A1FXCPU.



1.3 Instructions for Use of the A1FXCPU

When using the A1FXCPU, follow these instructions.

(1) Switching between RAM and E^2PROM

The A1FXCPU incorporates RAM and E^2PROM and allows ROM operation (E^2PROM) to be performed by setting the DIP switch to the corresponding position. (The DIP switch is factory-set for RAM operation.)

For details, refer to Section 4.2.1.

(2) Assignment of I/O points

(a) The A1FXCPU controls the extension module/extension block inputs and outputs in blocks of 16 points.

If the input extension module used is of 8 points, the number of I/O points is calculated as 16 points.

Use the number of occupied points in Table 3.3 to calculate the number of I/O points used with the A1FXCPU.

(b) One special module or special block occupies 8 I/O points.

Hence, the number of points used for special modules/special blocks is decremented by 8 points per special module/special block.

However, the FX_{0N}-16NT, FX-16NT and FX-16NP do not occupy 8 points.

(3) Assignment of I/O numbers

(a) The I/O numbers of the A1FXCPU are controlled in hexadecimal (X/Y□0 to X/Y□F).

The I/O numbers always begin with "X/Y□0".

(b) One special module or special block occupies the number of I/O points in Table 3.3.

The I/O number assignment of a special module or special block having 8 I/O points in Table 3.3 should be set in the same way as when there are no special modules and special blocks.

Since the FX_{0N}-16NT, FX-16NT and FX-16NP do not occupy 8 points, assign their I/O numbers as in the I/O assignment of I/O blocks.

The FX_{0N}-16NT-S3 and FX-16NT-S3 occupy 8 points and their I/O numbers should be assigned as in the I/O number assignment of I/O blocks.

(c) For details of I/O number assignment, refer to Chapter 6.

(4) Communication with special module/special block

The FROM/TO instructions are used for communication with a special module/ special block. Note that the ways of specifying the FROM/TO instructions are different.

For full information, refer to Chapter 7.

(5) Instructions for use of special modules/special blocks

The following special modules/special blocks continue operating normally when the A1FXCPU is reset or an operation error occurs.

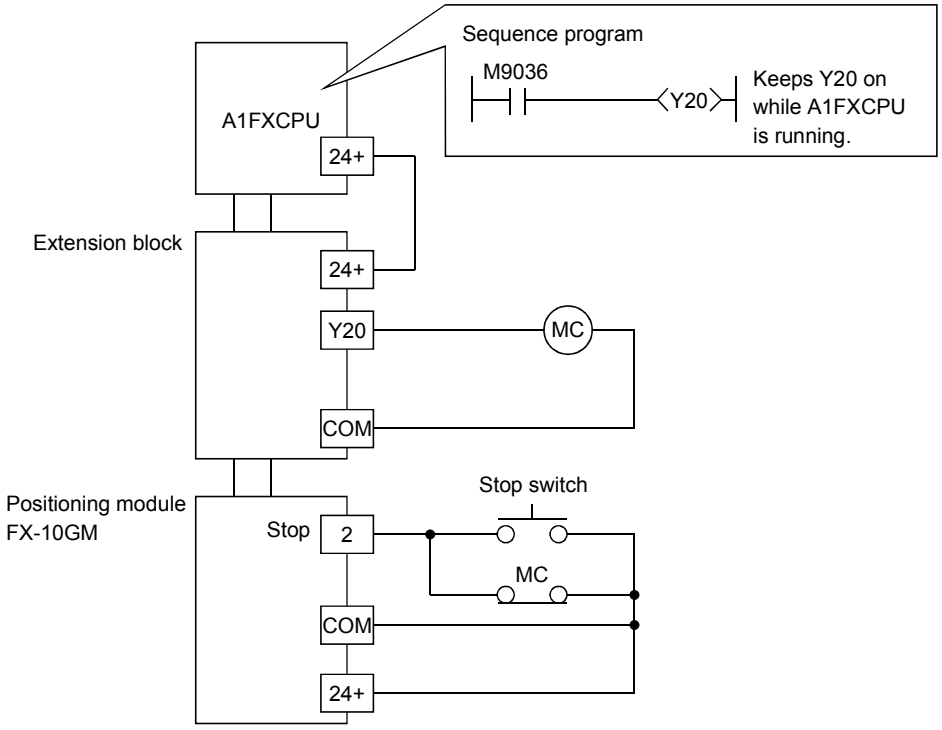
When it is necessary to stop their operations in user's system configuration, make up an interlock circuit outside the PLC.

(a) Special module/special block operations
- FX0N-3A : Analog outputs hold the RUN mode output states.
- FX-1GM : Continues positioning operation.
- FX-10GM : Continues positioning operation.
- FX-20GM : Continues positioning operation.

(b) Interlock circuit

Configure up a circuit to provide an interlock (stop external equipment operation) when the output (Y) used as an interlock turns off.

(The output (Y) turns off when the A1FXCPU is reset or an operation error occurs.)



POINT

The buffer memories of the above special modules and special block cannot be initialized by the RESET switch of the A1FXCPU. Switch power off, then on again or use a sequence program to initialize them.

(6) Type setting at startup of the peripheral

When using a peripheral for the A1FXCPU programming, start up the peripheral with the PLC type "A1FX".

When using the SW3NX/IVD-GPPA or earlier, start up with "A2".

(7) FX series peripheral unavailable

For the A1FXCPU, the A series peripheral is used to perform programming with the A series instructions.

The FX series peripheral cannot be used for programming.

1.4 Packing List

After unpacking, confirm that there are the following products.

Product	Quantity
A1FXCPU module	1
32-pin connector	1
Battery (A6BAT)	1
Terminal resistor (110Ω, 1/2W)	1
I/O label	1
Link station number label	1

2. PERFORMANCE

2.1 Performance of the CPU Section

This section provides the CPU section performance of the A1FXCPU.

2.1.1 CPU section performance list

Table 2.1 gives the CPU section performance list of the A1FXCPU.

Table 2.1 Performance List

Item		Performance		
Control method		Repeated operation (using stored program)		
I/O control method		Refresh system		
Program language		Language dedicated to sequence control Relay symbol words, logic symbolic words, MELSAP-II (SFC)		
Number of instructions (types)		Sequence instruction : 26 Basic instruction : 131 Application instruction : 93		
Processing speed (sequence instruction, μs/step)		0.25		
Number of I/O points	(points)	224 (X/Y20 to 10FF)		
Watchdog timer	(ms)	10 to 2000		
Memory capacity	(k bytes)	Built-in RAM : 64 Built-in E^2PROM : 32 (E^2PROM service life for writing: 100000 times)		
Program capacity	(k steps)	Main sequence : Max. 14 Sub sequence : None		
Internal relay (M)	(points)	1000 (M0 to 999)	A total of 2048 points of M and L are commonly used.	Set in parameters
Latch relay (L)	(points)	1048 (L1000 to 2047)		
Step relay (S)	(points)	0	Must not be set.	
Link relay (B)	(points)	1024 (B0 to 3FF)		
Timer (T)	(points)	256 100ms timer: Set time 0.1 to 3276.7s (T0 to 199) 10ms timer: Set time 0.01 to 327.67s (T200 to 255) 100ms retentive timer: Set time 0.1 to 3276.7s		Set in parameters
Counter (C)	(points)	256 Normal counter: Setting range 1 to 32767 (C0 to 255) Interrupt program counter: Setting range 1 to 32767 (Counter used in interrupt program)		Set in parameters
Data register (D)	(points)	1024 (D0 to 1023)		

Table 2.1 Performance List (Continued)

Item	Performance
Link register (W) (points)	1024 (W0 to 3FF)
Annunciator (F) (points)	256 (F0 to 255)
File register (R) (points)	Max. 4096 (R0 to 4095)
Accumulator (A) (points)	2 (A0, A1)
Index register (V, Z) (points)	2 (V, Z)
Pointer (P) (points)	256 (P0 to 255)
Interrupt pointer (I) (points)	11 (10 to 15, 112, 113, 129 to 131)
Special relay (M) (points)	256 (M9000 to 9255)
Special register (D) (points)	256 (D9000 to 9255)
Number of comment points (in increments of 64 points) (points)	Max. 3648
Self-diagnostic function	Watchdog timer error, memory error, CPU error, I/O error, battery error detection, etc.
Operation mode at error occurrence	Stop or continue selected
Output mode switching at the time of STOP to RUN	Before-STOP operation status re-output or output after operation execution is selected.
Clock function	Year, month, day, hour, minute, second, day of the week (automatic judgment of leap year) Accuracy -3.2 to + 3.5s (TYP. +2.1s) / d at 0 °C -3.4 to + 5.3s (TYP. +2.1s) / d at 25 °C -13.4 to + 3.6s (TYP. -3.2s) / d at 55 °C
Permissible instantaneous power failure period (ms)	10
Outline dimensions (mm)(inch)	130(5.12)(W) × 90(3.55)(H) × 87(3.43)(D)
Weight (kg)(lb)	0.56(1.24)

2.1.2 Overview of operation processing

This section provides the overview of processing from power-on of the A1FXCPU to run of the sequence program.
A1FXCPU processing is roughly divided into the following.

(1) Initial processing
Pre-processing for execution of sequence operation. Performed only once when power is switched on or the CPU is reset by the RESET switch.
(a) When there is a link setting program, the link parameters for simple inter-PLC link are registered. (Refer to Section 5.2.)

(b) The extension module/extension block outputs are reset and initialized.

(c) The unlatched areas of data memory are initialized (bit devices are turned off and word devices set to 0).
Note that file registers are not initialized.

(d) The I/O addresses of the extension modules/extension blocks connected to the A1FXCPU are allocated automatically.

(e) Self-diagnostic check is performed on parameter setting, operation circuit, etc. (Refer to Section 2.1.4.)

(2) Sequence program operation processing
The sequence program written to the A1FXCPU is run from step 0 to the END (FEND) instruction.

(3) END processing
Post-processing performed to terminate single sequence program operation processing and return sequence program run to step 0.
(a) Self-diagnostic check is made for power-off, I/O module verify error, battery low, etc. of the extension modules/extension blocks. (Refer to Section 2.1.4.)

(b) The present values of timers and counters are updated and their contacts switched on/off.
(For more information on the timers and counters, refer to the ACPU Programming Manual (Basics).)

(c) When the sampling trace point is per scan (after execution of the END instruction), the statuses of preset devices are stored into the sampling trace area.

(d) When a refresh request is given during use of simple inter-PLC link, link refresh processing is carried out.

(e) When the simple positioning function is used, pulse output start/stop processing is performed.

(f) The extension modules/extension blocks are I/O refreshed (ON/OFF data updated). (For details of refresh processing, refer to the ACPU Programming Manual (Basics).)

2.1.3 Operation processing in RUN, STOP and PAUSE modes

The A1FXCPU has three different operation modes: "RUN mode", "STOP mode" and "PAUSE mode".
This section describes the operation processing of the PLC CPU performed in each mode.

(1) Operation processing in RUN mode

In the RUN mode, sequence program operation is repeated in sequence of step 0 to END (FEND) instruction to step 0.
When entering the RUN mode, the CPU outputs the output status saved in the STOP mode according to the STOP→RUN output mode setting in the parameter.
Processing time up to the start of sequence program operation, which depends on the system configuration, is as follows:

- When power is switched on or the CPU is reset by RESET switch : 2 to 3s
- When the CPU is switched from STOP to RUN : 1 to 3s

(2) Operation processing in STOP mode

In the STOP mode, sequence program operation is stopped by:

- Moving the RUN/STOP switch to the STOP position.
- Executing the STOP instruction in the sequence program.
- Performing remote STOP from the peripheral.
- Turning on the remote STOP contact. *1

When entering the STOP mode, the A1FXCPU saves the output status internally and turns off all extension module/extension block outputs (Y). *2
Data memories other than the outputs (Y) are latched.

(3) Operation processing in PAUSE mode

In the PAUSE mode, the outputs (Y) and data memories are latched and sequence program operation is stopped by:

- Performing remote PAUSE from the peripheral.
- Turning on the remote PAUSE contact and PAUSE enable contact (M9040). *1

POINT

In any of the RUN, STOP and PAUSE modes, the A1FXCPU is making:

- Communication with the peripheral
- Refresh processing of extension modules/extension blocks
- Link refresh of simple inter-PLC link

Therefore, I/O monitoring and test operation can be performed from the peripheral equipment in the STOP and PAUSE modes.

REMARKS

*1: Set the remote STOP and remote PAUSE contacts in parameters from the peripheral.
*2: When the peripheral is used to monitor the outputs (Y), they all turn off.

2.1.4 Operation processing at occurrence of an instantaneous power failure

The A1FXCPU detects an instantaneous power failure when the input source voltage supplied to the power supply section of the A1FXCPU drops below the specified value.
On detection of an instantaneous power failure, the A1FXCPU performs the following operation processing.

(1) Instantaneous power failure shorter than permissible instantaneous power failure time
   (a) When an instantaneous power failure has occurred, the A1FXCPU holds the output status and suspends operation processing.

   (b) When an instantaneous power failure is cleared, the A1FXCPU resumes operation processing.
   At this time, it adds 1 to the AC down detection storing special register (D9005).

   (c) If operation is being suspended due to the occurrence of an instantaneous power failure, the A1FXCPU continues the timing of the watchdog timer (WDT).
   For example, when the watchdog timer setting is 200ms, a watchdog timer error occurs if an instantaneous power failure of 10ms occurs at the scan time of 195ms.

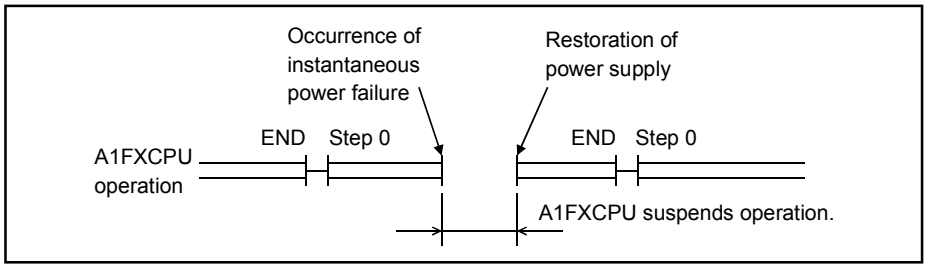


Fig. 2.1 Operation Processing at Occurrence of Instantaneous Power Failure

(2) Instantaneous power failure longer than permissible instantaneous power failure time
   The A1FXCPU makes an initial start.
   When making an initial start, the A1FXCPU performs the same operation processing as when power is switched on or the CPU is reset by the RESET switch.

POINT

When the AC down detection storing special register (D9005) is incremented, check the power supplied to the A1FXCPU.

2.1.5 Self-diagnosis

Self-diagnosis is a function that the A1FXCPU self-checks for a error.
The self-diagnostic function of the A1FXCPU detects an error which occurs at power-on or during run and displays the corresponding error message and stops operation to prevent a PLC malfunction and perform preventive maintenance.
The A1FXCPU has two different operation modes for self-diagnosed errors: operation stop mode and operation continuation mode.
For some errors, the continuation mode may be changed into the stop mode. (Refer to Table 2.2.)
The occurrence and definition of the error detected are stored into the corresponding special relay (M) and special register (D). (Refer to Appendix 4.)
Especially in the continuation mode, use the special relays and special registers in the program to prevent PLC or mechanical system malfunctions.
In the operation stop mode, the A1FXCPU stops operation and switches off all outputs (Y) on detection of an error.
In the operation continuation mode, the A1FXCPU runs the program with the exception of a faulty part.
When an I/O module verify error has occurred, the A1FXCPU continues operation at the I/O addresses prior to the occurrence of the error.
Table 2.2 on the next page indicates self-diagnosed errors.

Tale 2.2 Self-Diagnosis List

Diagnosis		Diagnosis Timing	CPU Status	RUN LED Status	Error Display of Peripheral	Error Code
Memory error	Instruction code check	• When that instruction is executed	Stop	Flicker	INSTRCT CODE ERR.	10
	Parameter setting check	• When power is switched on or CPU is reset • When (STOP/PAUSE) is switched to (RUN)			PARAMETER ERROR	11
	No END instruction	• When (STOP/PAUSE) is switched to (RUN)			MISSING END INS.	12
	Instruction execution disable	• When CJ, SCJ, JMP, CALL(P) or FOR-NEXT instruction is executed • When (STOP/PAUSE) is switched to (RUN)			CAN'T EXECUTE (P)	13
	Format (CHK) check	• When (STOP/PAUSE) is switched to (RUN)			CHK FORMAT ERR.	14
	Instruction execution disable	• When interrupt occurs • When (STOP/PAUSE) is switched to (RUN)			CAN'T EXECUTE (I)	15
CPU error	RAM check	• When power is switched on or CPU is reset • When M9084 is switched on in STOP mode	Stop	Flicker	RAM ERROR	20
	Operation circuit check	• When power is switched on or CPU is reset			OPE CIRCUIT ERR.	21
	Watchdog error monitor	• When END instruction is executed			WDT ERROR	22
	END instruction not executed	• When END instruction is executed			END NOT EXECUTE	24
	Endless loop execution	• Always			WDT ERROR	25
	Main CPU check	• Always			MAIN CPU DOWN	26
I/O error	I/O module verify (Default: Stop)	• When END processing is executed (Not checked when M9084 is on)	Stop / Run	Flicker / On	UNIT VERIFY ERR.	31
	Power off (Default: Continuation)	• When END processing is executed (Not checked when M9084 is on)			FUSE BREAK OFF	32
Special function module error	Control bus check	• When FROM/TO instruction is executed	Stop	Flicker	CONTROL BUS ERR.	40
	Special function module error	• When FROM/TO instruction is executed			SP. UNIT DOWN	41
	I/O interrupt error	• When interrupt occurs			I/O INT. ERROR	43
	Special function module assignment error	• When power is switched on or CPU is reset • When (STOP/PAUSE) is switched to (RUN)			SP. UNIT LAY ERR.	44
	Special function module access error (Default: Stop)	• When FROM/TO instruction is executed	Stop / Run	Flicker / On	SP. UNIT ERR.	46
	Link parameter error	• When power is switched on or CPU is reset • When (STOP/PAUSE) is switched to (RUN)	Run	On	LINK PARA ERROR	47
Battery	Battery error	• Always (Not checked when M9084 is on)	Run	On	BATTERY ERROR	70
Operation error (Default : Continuation)		• When corresponding instruction is executed	Stop / Run	Flicker / On	OPERATION ERROR	50

REMARKS

1) Two modes described in the "CPU Status" and "RUN LED Status" columns in Table 2.2 indicate that they can be changed by parameter setting from the peripheral.
2) The messages given in "Error Message of Peripheral" of Table 2.2 are displayed when the peripheral is used to make PLC diagnosis.
3) *: FUSE BREAK OFF is displayed in the peripheral device.

2.1.6 Parameter setting range list

Parameters are used to assign the A1FXCPU's user memory, set various functions, and specify device ranges.
The set data is stored in the first 3k bytes of the user memory area.
Default (initial) parameter values as indicated in Table 2.3 may be selected or the user may change the setting ranges according to the purposes of use from the peripheral device.

Table 2.3 Parameter Setting Range List

Item		Default Value	Setting Range	Remarks
Main sequence program (k steps)		6	1 to 14	
File register (k bytes)		None	0 to 4	
Comment capacity (points)		None	0 to 3648	
Status latch (k bytes)		None	0/8 to 16	
Sampling trace (k bytes)		None	0/8	
Latch range setting	Link relay (B)	• Only L1000 to L2047 are latched. • None for other devices.	B0 to B3FF (in units of 1 point)	
	Timer (T)		T0 to T255 (in units of 1 point)	
	Counter (C)		C0 to C255 (in units of 1 point)	
	Data register (D)		D0 to D1023 (in units of 1 point)	
	Link register (W)		W0 to W3FF (in units of 1 point)	
Internal relay (M), latch relay (L), step relay (S) setting		M0 to M999 L1000 to L2047 None for S	M/L0 to M/L2047	Step relay (S) must not be set. (If set, parameter error occurs.)
Timer setting		T0 to T199 (100ms) T200 to T255 (10ms)	Total 256 points of 100ms, 10ms and retentive timers	
Interrupt counter setting		None	Total 256 points of counters and interrupt counters (in units of 8 points) These counters are processed in numerical order.	
I/O number assignment		None	None	Setting is invalid.
Remote RUN/STOP, PAUSE contact setting		——	X0 to XFF 1 point each for RUN and STOP contacts. (Setting of PAUSE contact alone is not allowed)	X100 to X1FF must not be set.
Operation mode at time of error	Fuse	Stop	Stop/continuation	
	I/O module verify error			
	Operation error			
	Special function module check error			
STOP→RUN output mode		Operation status prior to stop is re-output.	Output prior to stop or after operation execution.	
Print title registration		None	Up to 128 characters	
Keyword registration		None	Hexadecimal (0 to 9, A to F) Max. 6 digits	
Link range setting		None	None	Setting is invalid.

*:Operation mode setting at error occurrence in the peripheral device parameters is done with FUSE BREAK OFF.

2.1.7 Memory capacity (main program, file register, comment, etc.) setting

The A1FXCPU is standard-equipped with 64k byte RAM and 32k byte E^2PROM.
The DIP switch of the A1FXCPU is used to switch between RAM and E^2PROM.
(For the DIP switch setting, refer to Section 4.2.1.)

The following data are stored in 64k byte RAM.

- Parameters
- T/C set values
- Main program
- Sampling trace data
- Status latch data
- File registers
- Comments

32k byte E^2PROM is used for ROM operation of the A1FXCPU and can store the following data.

- Parameters
- T/C set values
- Main program

(1) Memory capacity calculation

Use RAM/E^2PROM after determining stored data types and memory capacities by parameter setting.
Use Table 2.4 to calculate memory capacities.

Table 2.4 Parameter Setting and Memory Capacity List

Item		Setting Increments	Memory Capacity	Storage into E^2PROM	Remarks
Parameters, T/C set values			4k bytes (fixed)	Allowed	
Main program	Sequence program	1k step	⌈Main sequence program capacity⌉ × 2k bytes		
	Microcomputer program	2k bytes	⌈Main microcomputer program capacity⌉ × 2k bytes		
Sampling trace		No/yes	0/8k bytes	Disallowed	
Status latch	Data memory	No/yes	0/8k bytes	Disallowed	Memory capacity for file register status latch is the file register capacity set in parameter.
	File registers	No/yes	⌈File register memory capacity⌉ k bytes		
File registers		1k points	⌈File register points⌉ × 2k bytes	Disallowed	
Comments		64 points	$\frac{\text{(Comment points)}}{64}$ + 1k byte	Disallowed	Comment capacity setting occupies 1k byte in system.

(2) Sequence of data storage into user memory

(a) Various data set in parameters are stored in the sequence shown in Fig. 2.2.

(b) Before performing write protect, make sure that the sampling trace, file register and other areas where data is written during sequence program execution are not in the write protect range.

(c) If the main program is stored in E^2PROM, the system uses the area where the main program was stored in the RAM operation mode.
Hence, if E^2PROM operation is performed, the sampling trace, status latch, file register and comment capacities cannot be increased.

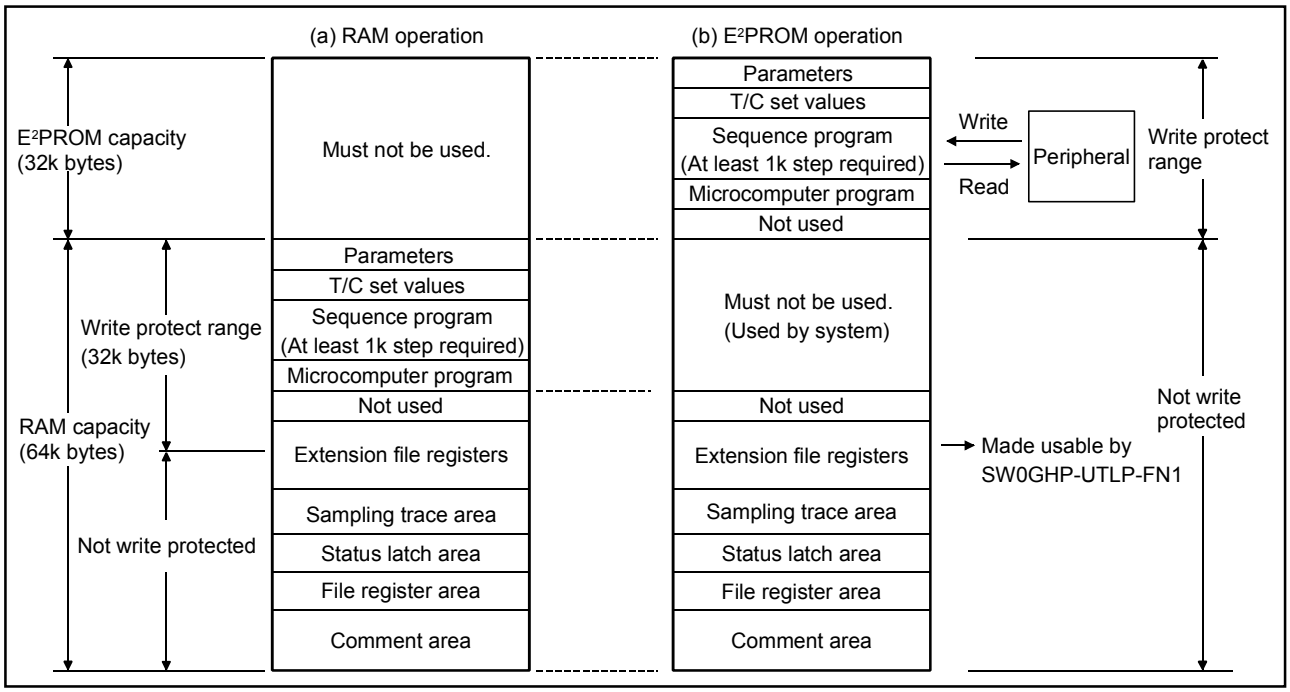


Fig. 2.2 Sequence of Data Storage into User Memory

(3) Procedure for writing parameters, T/C set values and sequence program to E^2PROM

Write parameters, T/C set values and sequence program to E^2PROM in the following procedure.

- On the peripheral, read the parameters, T/C set values and sequence program from RAM.
  (Read from RAM is not required when above data were stored on the programming peripheral in the RAM operation mode.)
- Move the DIP switch to the "ROM" position.
- Switch power on again.
- Write the parameters, T/C set values and sequence program from the peripheral to E^2PROM.

REMARKS

1) In Fig. 2.2, parameters occupy 3k bytes and T/C set values 1k byte.
1 to 14k steps (2 to 28k bytes) can be set to the sequence program.

2.2 Performance of the Power Supply Section

This section provides the power supply section performance of the A1FXCPU.

2.2.1 Power supply section performance list

Table 2.5 gives the power supply section performance list of the A1FXCPU.

Table 2.5 Performance List

Item	Performance
Input voltage	100-240VAC +10% -15% (85-264VAC)
Input frequency	50/60Hz ±3Hz
Input apparent power	100VA
Inrush current	50A 5ms at input of 240VAC *4
Rated output *1	5VDC 1.2A/24VDC 0.41A [MAX] (for CPU, I/O) 24VDC 0.43A (for external service power supply) *2, *3
Overcurrent protection	5VDC 1.5A or more/24VDC 0.65A or more (total for insulation and non-insulation) *5
Overvoltage protection	5.5 to 6.5vDC *6
Efficiency	65% or more
Power indication	POWER LED indication
Terminal screw size	M3×8
Applicable wire size	0.3 to 2mm^2
Applicable solderless terminal	• RAV1.25-3 R1.25-3 (in conformance with JIS C 2805) [Applicable wire size: 0.3 to 1.25mm^2] • V2-MS3 (Japan Solderless Terminal Mfg. Co., Ltd.), RAP2-3SL RAP2-3.5SL (Japan Terminal Co., Ltd.) [Applicable wire size: 1.25 to 2mm^2]
Permissible instantaneous power failure period	Within 10ms *7

*1: For details, refer to Sections 2.2.2 and 2.2.3.

*2: For external service power supply : 0.3A
For built-in functions : 0.13A
} Total 0.43A

*3: 24VDC can be used up to a total of 0.6A for the CPU, I/O and external service power supply.

*4: Inrush current
If the power supply module is re-powered ON right after powered OFF (within 5seconds), the inrush current exceeding the specified value (2ms or less) may be generated. Therefore, make sure to re-power ON the module 5seconds after power off.
When selecting a fuse or breaker for external circuit, consider the above point as well as meltdown and detection characteristics.

*5: Overcurrent protection

The overcurrent proctection device shuts off the 5VDC and/or 24VDC circuit(s) and stops the system if the current exceeding the specified value flows in the circuit(s).

As this results in voltage drop, the power supply module LED turns OFF or is dimly lit.

After that, eliminate the causes of overcurrent, e.g., insufficient current capacity and short circuit, and then start the system.

When the current has reached the normal value, the initial start up of the system will be performed.

*6: Overvoltage protection

The overvoltage protection shuts off the 5VDC circuit and stops the system if the overvoltage of 5.5 to 6.5V is applied to the circuit.

This results in the power supply module LED turning OFF.

When restarting the system, power OFF and ON the input power supply, and the initial start up of the system will be performed.

If the system is not booted and the LED remains off, this means that the power supply module has to be replaced.

*7: Allowable momentary power failure period

The PLC CPU allowable momentary power failure period varies with the power supply module used.

In case of the A1S63P power supply module, the allowable momentary power failure period is defined as the time from when the primary side of the stabilized power supply for supplying 24VDC to the A1S63P is turned OFF until when the voltage (secondary side) has dropped from 24VDC to the specified value (15.6VDC) or less.

REMARKS

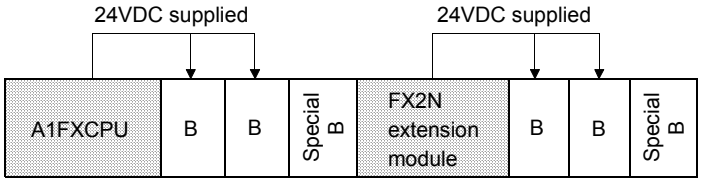
For the power supply specifications of the extension module, refer to the A1FXCPU User's Manual (Setup).

2.2.2 Number of extension points and 24VDC service power supply capacity

The A1FXCPU and extension module supply 24VDC power to extension blocks.
Therefore, the number of extension block points connected must be within the range in which the A1FXCPU and extension module can supply power.
Since 0.13A out of servicing power supply 24VDC is used for the built-in functions, the 24VDC external service power supply capacity is max.
0.3A (0.43A-0.13A=0.3A)

(1) Power supplying range

The A1FXCPU or extension module can supply 24VDC service power in the following range.



B: Extension block Special B: Special block

The A1FXCPU or extension module supplies 24VDC current to extension locks in the extension module connected next.
When the extension block is designed for input, the power supply for input equipment drive requires external wiring. Special blocks are supplied with 5VDC power.

(2) 24VDC capacity calculation

The capacity of the 24VDC service power supply depends on the model.
<24VDC service power supply capacity>

Model	Power Supply Capacity	Remarks
A1FXCPU	300mA	Power supplied to extension blocks
FX2N-32E	250mA	
FX2N-48E	460mA	

Extension blocks designed for input and output differ in current consumption.
Current consumption less than the total capacity indicates that extension blocks can be connected.
Remaining power may be used for sensors, output loads, etc.

Total service power supply capacity 300mA, 250mA or 460mA - (Extension block for FX2N/FX0N input 8 points,50mA × Number of blocks connected) - (Extension block for FX2N/FX0N output 8 points, 75mA for 24 or more points × Number of blocks connected)

≧0 (remaining power for sensors and loads)
If the result is less than 0, the capacity is short.
Use an extension module midway.

Connection example: A1FXCPU, FX0N-8EX, FX2N-16EX, FX0N-8EYR

300mA - 50mA × 1 - 50mA × 2 - 0mA × 1 = 150mA ≧ 0 (may be connected)

Remaining 24VDC service power

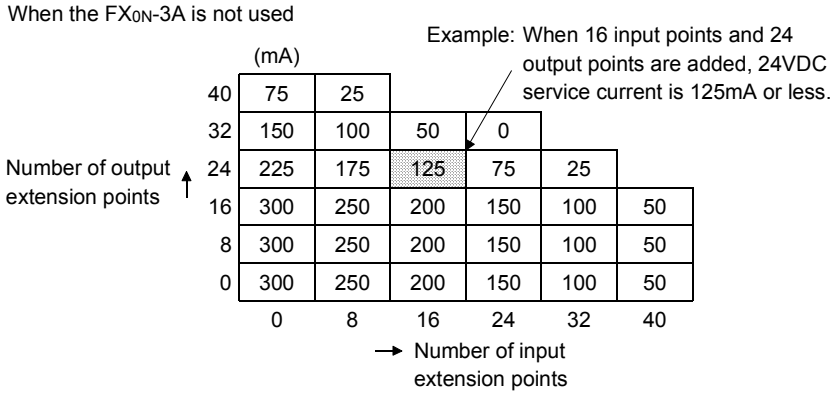
Because of less than 24 output points

(3) Quick calculation table

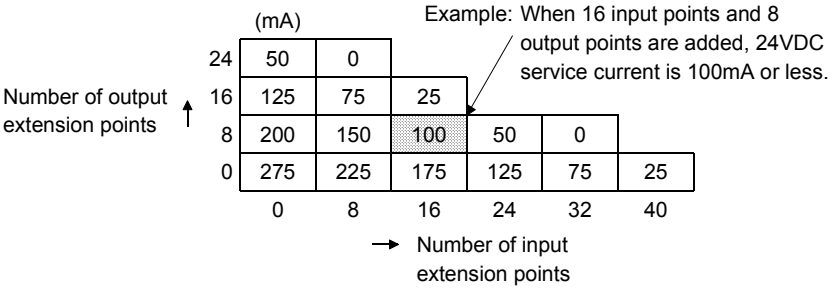
The following tables represent capacity formulas with specific values.
They can be used to determine whether extension blocks may be connected or not and to find the remaining 24VDC service power.

A1FXCPU

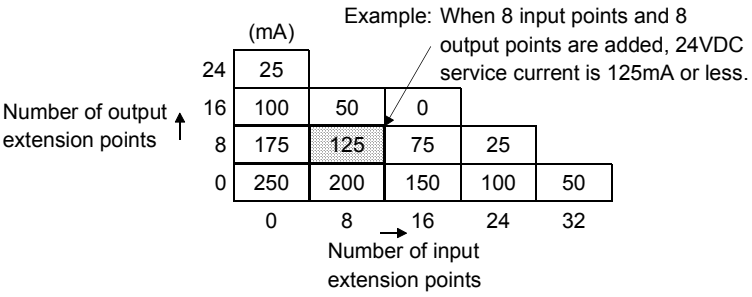
When the FX_{0N}-3A is not used



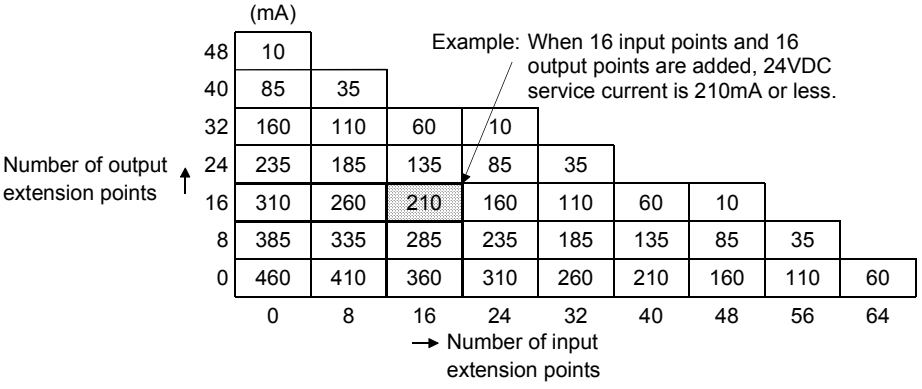
When the FX_{0N}-3A is used (up to 2 FX_{0N}-3A's may be connected)



When FX_{2N}-32E is used



When FX_{2N}-48E is used



2.2.3 Number of special extension modules and blocks and 5VDC power supply capacity

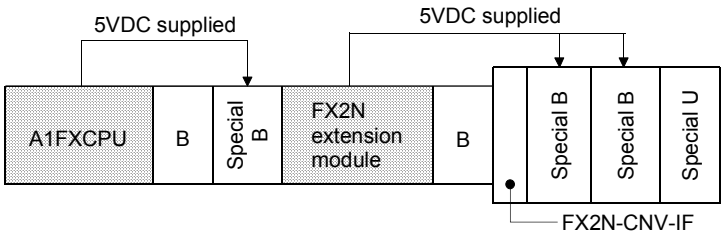
When special modules and special blocks are used, the number of modules and blocks connected and 5VDC current consumption must be taken into consideration.

(1) Number of modules and blocks connected

Up to eight special modules/special blocks may be connected to the A1FXCPU.

(2) Power supply range

Special blocks are supplied with 5VDC in the following range.



B: Extension block Special B: Special block Special U: Special module

The A1FXCPU or extension module supplies 5VDC power to the special blocks in the extension module connected next. (The special module does not include a power supply.)

As 5VDC power is supplied through the extension cable, external wiring is not necessary.

(3) 5VDC capacity calculation

The 5VDC power supply of each module is as follows. Refer to the following table for the current consumption of each special block.

<5VDC power supply capacity>

Model	Power Supply Capacity	Remarks
A1FXCPU	300mA	The 5VDC current to the CPU and the equipment connected to the programming connector has already been subtracted.
FX_{2N} extension module	690mA	

5VDC Total capacity 300mA or 690mA	-	Special block 5VDC Current consumption Refer to Table 2.6.	≧ 0	If the result is less than 0, the capacity is short. Use an extension module midway.

Up to two FX_{0N}-3A's may be connected to the A1FXCPU or FX_{2N}-32E, or up to three FX_{0N}-3A's to the FX_{2N}-48E. If more blocks are connected, use the extension module (FX_{2N}-32E, FX_{2N}-48E) midway.

Connection example: A1FXCPU, FX_{0N}-3A ×2, FX-IHC ×1 , FX-10GM ×1

300mA - (30 ´ 2)mA - 70mA - 0mA (power supply built-in: unnecessary)=170mA≧0 (connectable)

Table 2.6 Special Block and Special Module Current Consumption List

Model	Type	Name	Current Consumption (5VDC)
Special block	FX_{0N}-3A	2-channel analog input, 1-channel analog output	30mA
	FX_{0N}-16NT	For M-NET/MINI (twisted wire)	20mA
	FX_{2N}-4AD	4-channel analog input	30mA
	FX_{2N}-4DA	4-channel analog output	30mA
	FX_{2N}-4AD-PT	4-channel temperature sensor input (PT-100)	30mA
	FX_{2N}-4AD-TC	4-channel temperature sensor input (thermocouple)	30mA
	FX_{2N}-1HC	50kHz 2-phase high-speed counter	90mA
	FX_{2N}-1PG	100kpps pulse output block	55mA
	FX_{2N}-232IF	RS-232C communication interface	40mA
	FX-16NP *	For M-NET/MINI (optical fiber)	80mA
	FX-16NT *	For M-NET/MINI (twisted wire)	80mA
	FX-16NP-S3 *	For M-NET/MINI-S3 (optical fiber)	80mA
	FX-16NT-S3 *	For M-NET/MINI-S3 (twisted wire)	80mA
	FX-2DA *	2-channel analog output	30mA
	FX-4DA *	4-channel analog output	30mA
	FX-4AD *	4-channel analog input	30mA
	FX-2AD-PT *	2-channel temperature sensor input (PT-100)	30mA
	FX-4AD-TC *	4-channel temperature sensor input (thermocouple)	40mA
	FX-1HC *	50kHz 2-phase high-speed counter	70mA
	FX-1PG *	100kpps pulse output block	55mA
	FX-1DIF *	ID interface	130mA
Special module	FX-1GM *	Positioning pulse output module (1 axis)	Self-supply
	FX-10GM *	Positioning pulse output module (1 axis)	Self-supply
	FX-20GM *	Positioning pulse output module (2 axes)	Self-supply

* The FX_{2N}-CNV-IF conversion adaptor is required for use of special modules and special blocks.

2.3 Performance of Simple Inter-PLC Link

This section provides the simple inter-PLC link performance of the A1FXCPU.

2.3.1 Simple inter-PLC link performance list

Table 2.7 gives the simple inter-PLC link performance list of the A1FXCPU.

Table 2.7 Performance List

Item		Performance
Interface		Conformance with RS-485
Communication method		Half duplex communication system
Synchronous method		Asynchronous system
Transmission speed		38400bps
Total transmission distance		Max. 500m
Number of stations		8 stations
Data	Bit data	0, 32 or 64 bits/station
	Word data	4 or 8 words/station
Data communication method		N : N
Link scan time		Max. 200ms

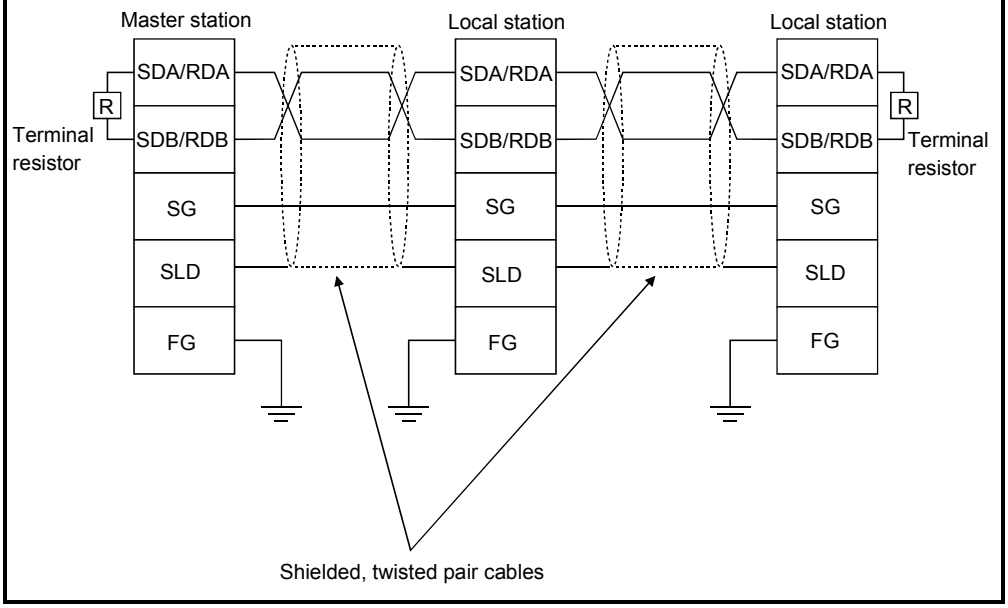
2.3.2 Interface specifications

Table 2.8 gives the RS-485 interface specification list of the A1FXCPU.

Table 2.8 Specification List

Signal Abbreviation	Signal Direction Module↔Module	Description
SDA/RDA	↔	Send/receive data
SDB/RDB	↔	Send/receive data
SG	↔	Signal ground

Wiring method



POINT

Connect both ends of the shield wire of the twisted pair cable to the ground (ground conductor with class D (class-3)) via "SLD" and "FG" of each module.
SLD and FG are connected inside the module.

2.3.3 Specifications of the twisted pair cable

Table 2.9 indicates the specifications of the cable that may be used in simple inter-PLC link of the A1FXCPU.

Table 2.9 Twisted Pair Cable Specifications

Item	Specifications
Cable type	Shielded twisted pair cable
Number of pairs	2 pairs or more
Conductor resistance (20°C)	88.0Ω/km or less
Capacitance (1kHz)	Average 60nF/km or less
Characteristic impedance (100kHz)	110±10Ω

REMARKS

The manufacturers and types of the recommended shielded twisted pair cables are as follows.

Manufacturer	Type	Remarks
Mitsubishi Cable Industries	SPEV (SB) - 0.2 - 2P	0.2mm^2 2-pair cable
	SPEV (SB) - 0.5 - 2P	0.5mm^2 2-pair cable
Showa Electric Wire & Cable	KMPEV-SB CWS-178 0.2SQ×2P	0.2mm^2 2-pair cable
	KMPEV-SB CWS-178 0.5SQ×2P	0.5mm^2 2-pair cable
Sumitomo Electric Industries	DPEV SB 0.3×3P	0.3mm^2 2-pair cable
	DPEV SB 0.5×3P	0.5mm^2 2-pair cable
Furukawa Electric	D-KPEV-SB 0.2×3P	0.2mm^2 2-pair cable
	D-KPEV-SB 0.5×3P	0.5mm^2 2-pair cable
Fujikura	IPEV-SB 0.3mm^2×2P	0.3mm^2 2-pair cable
	IPEV-SB 0.5mm^2×2P	0.5mm^2 2-pair cable

2.4 Performance of Simple Positioning

This section provides the simple positioning performance of the A1FXCPU.

2.4.1 Simple positioning performance list

Table 2.10 gives the simple positioning performance list of the A1FXCPU.

Table 2.10 Performance List

Item		Performance
Number of axes controlled		2 axes
Number of positioning data	Capacity	1
	Setting method	By sequence program
Control unit		pulse
Positioning system		Position control
Acceleration/deceleration processing		Automatic trapezoidal acceleration/deceleration
Acceleration/deceleration time		1 to 32767 (ms)
Output pulse range		0 to 16777215 (pulse)
Output pulse speed		1 to 60000 pps
Starting bias speed		1 to 60000 pps
Error indication*1		Special relay
Positioning data storage destination		Special register

*1: For details, refer to Section 5.3.4.

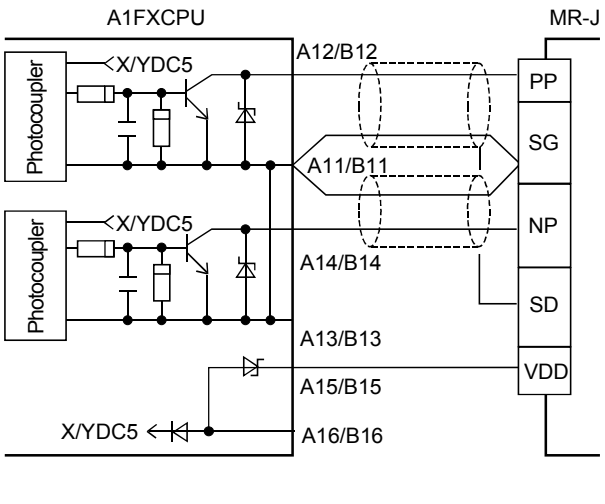
2.4.2 Interface specifications

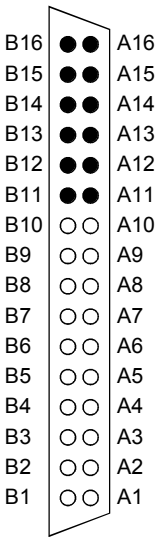
Table 2.11 gives the simple positioning interface specification list of the A1FXCPU.

Table 2.11 Specification List

Item	Specifications
Number of output points	4 points (positioning pulse output 2 axes×2 points, Y10 to 13)
Output form	Transistor (open collector) output
Rated load voltage	5-15/24VDC
Operating load voltage range	4.75 to 16.5VDC (at 5-15VDC)/21.6 to 26.4VDC (at 24VDC)
Max. load current/inrush current	50mA/point, 200mA 10ms or less (at 25°C)
Min. load current	2mA (when it is less than 2mA, a dummy resistor should be added.)
Max. voltage drop at ON	0.5VDC or less
Leakage current at OFF	0.1mA or less
Common method	2 points-1 common (Y10 COM and Y12 COM, and Y11 COM and Y13 COM are connected internally)

External wiring





X axis		Y axis	
Terminal Number	Signal Name	Terminal Number	Signal Name
B16	YDC5	A16	XDC5
B15	TDC24	A15	XDC24
B14	Y13	A14	Y12
B13	Y13 COM	A13	Y12 COM
B12	Y11	A12	Y10
B11	Y11 COM	A11	Y10 COM
B10	—	A10	—
B9	—	A9	—
B8	—	A8	—
B7	—	A7	—
B6	—	A6	—
B5	—	A5	—
B4	—	A4	—
B3	—	A3	—
B2	—	A2	—
B1	—	A1	—

— : Indicates the terminal which is not used with this function.

POINT

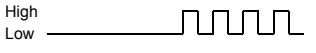
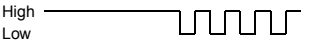
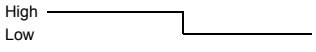
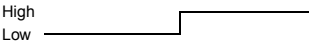
For use of the X axis·····Connect the power supply to XDC5 at 5-15VDC or to XDC24 at 24VDC.

For use of the Y axis·····Connect the power supply to YDC5 at 5-15VDC or to YDC24 at 24VDC.

2.4.3 Output specifications

(1) Pulse output

The following table lists the relationships between pulse output switching and pulse outputs by pulse output logic switching setting. (Refer to Section 5.3.4):

Output Terminals		Pulse Output Method	Positive Logic		Negative Logic	
X axis	Y axis		Forward rotation	Reverse rotation	Forward rotation	Reverse rotation
Y10	Y11	CW				
Y12	Y13	CCW				
Y10	Y11	PULSE				
Y12	Y13	SIGN				

(2) Pulse rise/fall time

The following table lists the pulse rise and fall times at the ordinary ambient temperature.

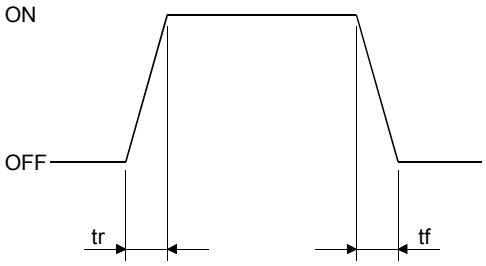
Table 2.12 Pulse Rise/Fall Time at Normal Temperatures

Load voltage (V)		26.4						4.75					
Cable length (m)		1			2			1			2		
Load current (mA)	Pulse speed (kpps)	tf	tr	Duty	tf	tr	Duty	tf	tr	Duty	tf	tr	Duty
2	60	0.1	3.4	41	0.1	5.0	39	0.1	0.8	48	0.1	1.1	49
	10	0.1	4.0	48	0.1	5.7	48	0.1	0.9	50	0.1	1.2	50
10	60	0.1	0.7	48	0.1	1.1	46	0.1	0.3	50	0.1	0.4	50
	10	0.1	0.9	50	0.1	1.3	50	0.1	0.3	50	0.1	0.4	50
50	60	0.1	0.3	48	0.1	0.4	49	0.2	0.3	50	0.2	0.3	50
	10	0.1	0.4	50	0.1	0.4	50	0.2	0.3	50	0.2	0.3	50

(Units = tf, tr : μs, Duty : %)

REMARKS

1) In Table 2.12, tr indicates a pulse rise time and tf its fall time.



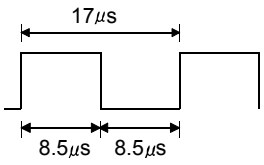
2.5 Performance of the High-Speed Counter

This section provides the high-speed counter performance of the A1FXCPU.

2.5.1 High-speed counter performance list

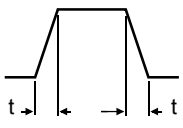
Table 2.13 gives the high-speed counter performance list of the A1FXCPU.

Table 2.13 Performance List

Item			Specifications
Counting speed selection setting			1 phase/2 phase: 60kpps/1 phase: 10kpps, 2 phase: 7kpps
Number of channels			2 channels
Count input	Phase		1-phase input, 2-phase input
	Count input signal		CH.1 ϕA: XA, ϕB: XC CH.2 ϕA: XB, ϕB: XD
Pulse input mode			1-phase input multiplied by 1, 1-phase input multiplied by 2 2-phase input multiplied by 1, 2-phase input multiplied by 2, 2-phase input multiplied by 4
Counter	Counting speed (max.)	1-phase input	60kpps
		2-phase input	60kpps
	Counting range		0 to 16777215
	Type		UP/DOWN preset counter + ring counter function
	Min. count pulse width (duty ratio 50%)		 (1-, 2-phase input)
Comparison output	Comparison range		0 to 16777215
	Comparison result		Set value<count value (M9147/M9167) Set value=count value (M9148/M9168) Set value>count value (M9149/M9169)
External input	Preset		CH.1: X8 CH.2: X9
	Disable/latch trigger		CH.1: X6 CH.2: X7
Interrupt output	Coincidence output		CH.1: I12 CH.2: I13

Countalbe Counting Speed

Counting Speed Selection Setting	60k		10k	
Rise/fall time	1-phase input	2-phase input	1-phase input	2-phase input
t=2.5μs or less	60kpps	60kpps	10kpps	7kpps
t=25μs or less	10kpps	10kpps	1kpps	700pps
t=500μs or less	—	—	500pps	250pps



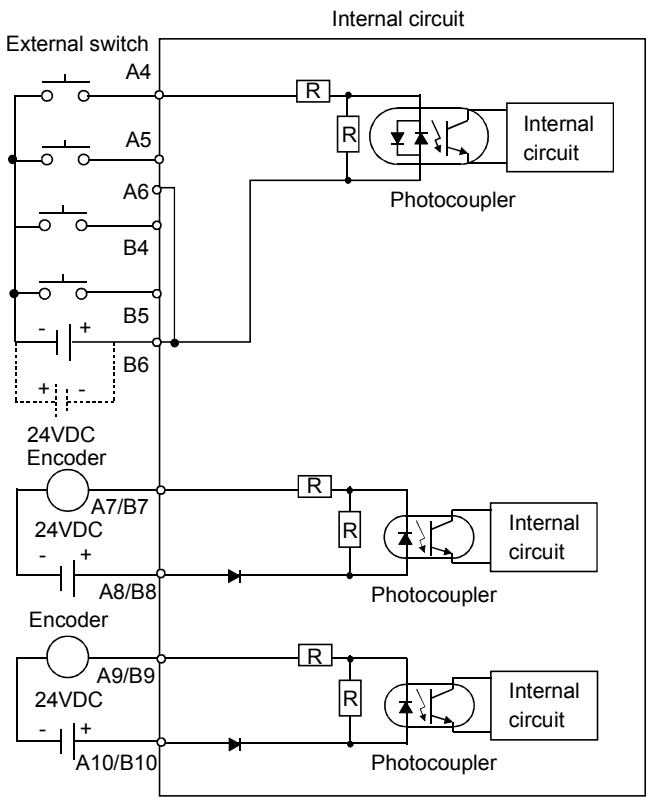
2.5.2 Interface specifications

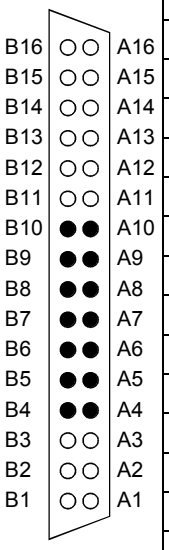
Table 2.13 gives the high-speed counter function interface specification list of the A1FXCPU.

Table 2.13 Specification List

Item		Specifications	
		External input	Counter input
Number of input points		4 points (X6 to 9)	4 points (XA to D)
Built-in function		Preset 2 channels×1 point Disable/latch trigger 2 channels×1 point	Counter input 2 channels×2 points
Isolation method		Photocoupler isolation	
Rated input voltage		24VDC	24VDC
Rated input current		5mA	8mA
Operating voltage range		21.6 to 26.4VDC (ripple ratio within 5%)	
Max. number of simultaneous input points		100% simultaneous ON	
ON voltage/ON current		18V/3.5mA or more	19V/5.5mA or more
OFF voltage/OFF current		3V/0.7mA or less	3V/0.25mA or less
Input resistance		4.7kΩ	2.7kΩ
Response time	OFF→ON	0.5ms or less	60kpps or less
	ON→OFF	0.5ms or less	60kpps or less
Common method		10 points-1 common (2 terminals) (Common to X0 to 9)	All points with independent commons

External wiring





CH1		CH2	
Terminal Number	Signal Name	Terminal Number	Signal Name
A16	—	B16	—
A15	—	B15	—
A14	—	B14	—
A13	—	B13	—
A12	—	B12	—
A11	—	B11	—
A10	XC	B10	XD
A9		B9	
A8	XA	B8	XB
A7		B7	
A6	COM1	B6	COM1
A5	X8	B5	X9
A4	X6	B4	X7
A3	—	B3	—
A2	—	B2	—
A1	—	B1	—

— : Indicates the terminal which is not used with this function.

2.6 Performance of the External Interrupt Function

This section provides the external interrupt function performance of the A1FXCPU.

2.6.1 External interrupt function performance list

Table 2.15 gives the external interrupt function performance list of the A1FXCPU.

Table 2.15 Performance List

Item	Performance
Number of interrupt points	6 points
Interrupt factor	• X0 to X5: External inputs (you can select interrupt execution on leading/trailing edge for each point.) I0: X0, I1: X1, I2: X2, I3: X3, I4: X4, I5: X5

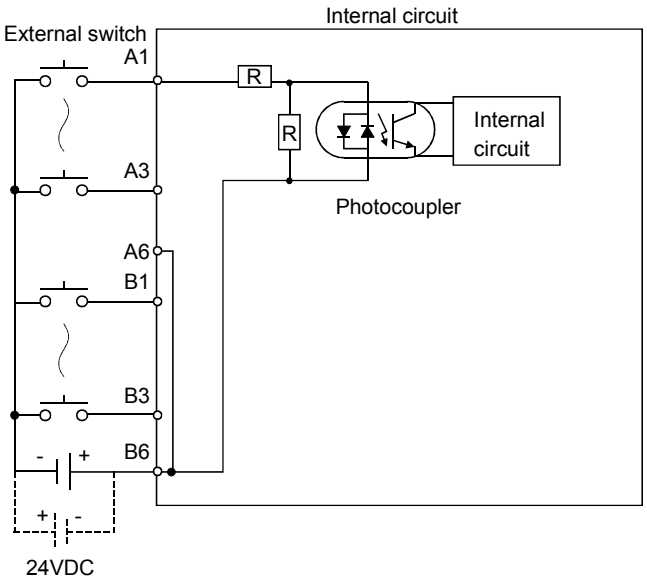
2.6.2 Interface specifications

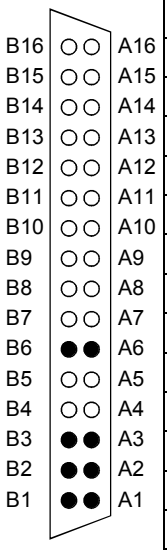
Table 2.16 gives the interrupt function interface specification list of the A1FXCPU.

Table 2.16 Specification List

Item		Specifications
Number of input points		6 points (X0 to 5)
Isolation method		Photocoupler isolation
Rated input voltage		24VDC
Rated input current		5mA
Operating voltage range		21.6 to 26.4VDC (ripple ratio within 5%)
Max. number of simultaneous input points		100% simultaneous ON
ON voltage/ON current		18V/3.5mA or more
OFF voltage/OFF current		3V/0.7mA or less
Input resistance		4.7kΩ
Response time	OFF→ON	0.5ms or less
	ON→OFF	0.5ms or less
Common method		10 points-1 common (2 terminals) (Common to X0 to 9)

External wiring





Terminal Number	Signal Name	Terminal Number	Signal Name
B16	—	A16	—
B15	—	A15	—
B14	—	A14	—
B13	—	A13	—
B12	—	A12	—
B11	—	A11	—
B10	—	A10	—
B9		A9	
B8	—	A8	—
B7		A7	
B6	COM1	A6	COM1
B5	—	A5	—
B4	—	A4	—
B3	X5	A3	X4
B2	X3	A2	X2
B1	X1	A1	X0

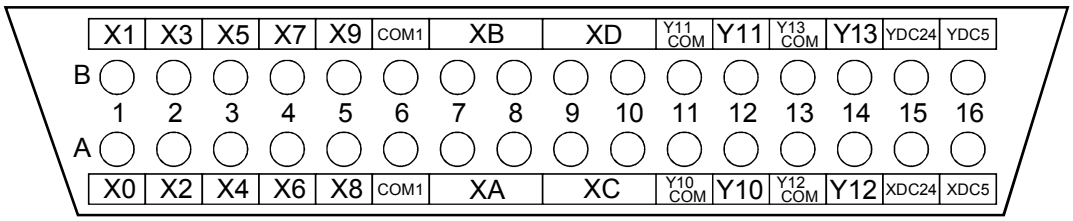
— : Indicates the terminal which is not used with this function.

2.7 Terminal Arrangement of the Built-in Function Connector

Table 2.17 gives the Built-in function connector terminal arrangement list of the A1FXCPU.

Table 2.17 Terminal Arrangement List

Built-in Function Connector Terminal Arrangement (Front View)



Terminal Number	Signal Name	Application	Terminal Number	Signal Name	Application
A1	X0	Interrupt input I0	B1	X1	Interrupt input I1
A2	X2	Interrupt input I2	B2	X3	Interrupt input I3
A3	X4	Interrupt input I4	B3	X5	Interrupt input I5
A4	X6	CH1 count disable/latch counter trigger input	B4	X7	CH2 count disable/latch counter trigger input
A5	X8	CH1 counter preset input	B5	X9	CH2 counter preset input
A6	COM1	Common for input X0 to 9	B6	COM1	Common for input X0 to 9
A7	XA	CH1 A-phase pulse input (high-speed counter)	B7	XB	CH2 A-phase pulse input (high-speed counter)
A8			B8		
A9	XC	CH1 B-phase pulse input (high-speed counter)	B9	XD	CH2 B-phase pulse input (high-speed counter)
A10			B10		
A11	Y10 COM	X axis CW/PULSE common (connected to Y12 common internally)	B11	Y11 COM	Y axis CW/PULSE 0V (connected to Y13 common internally)
A12	Y10	X axis CW/PULSE output	B12	Y11	Y axis CW/PULSE output
A13	Y12 COM	X axis CCW/SIGN common (connected to Y10 common internally)	B13	Y13 COM	Y axis CCW/SIGN common (connected to Y11 common internally)
A14	Y12	X axis CCW/SIGN output	B14	Y13	Y axis CCW/SIGN output
A15	XDC24	External supply for Y10, 12 (X axis) (at 24VDC), 24VDC input	B15	YDC24	External supply for Y11, 13 (Y axis) (at 24VDC), 24VDC input
A16	XDC5	External supply for Y10, 12 (X axis) (at 5-15VDC), 5-15VDC input	B16	YDC5	External supply for Y11, 13 (Y axis) (at 5-15VDC), 5-15VDC input

POINT

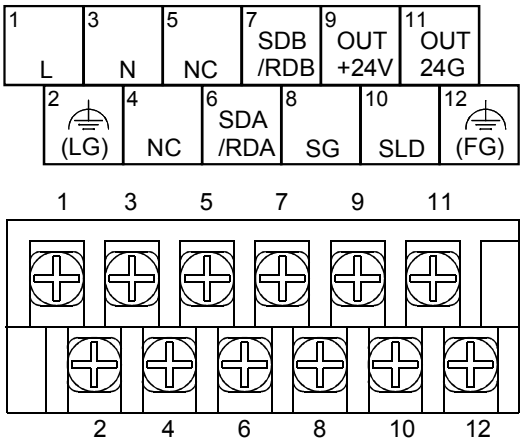
The applicable wire size is 0.3mm^2.

2.8 Performance Specifications of the Terminal Block

Table 2.18 provides the terminal block performance specification list of the A1FXCPU.

Table 2.18 Performance List

Terminal Block Front View



Terminal Number	Signal Name	Application
1	L	AC power input
2	LG	Line ground. Always ground the terminal to the protective ground conductor.
3	N	AC power input
4	NC	Must not be used
5	NC	
6	SDA/RDA	Simple PLC link
7	SDB/RDB	
8	SG	
9	+24V	24VDC output for external service power supply.
10	SLD	Simple PLC link
11	24G	24VDC ground for external service power supply.
12	FG	Grounding terminal. Always ground the terminal to the protective ground conductor.

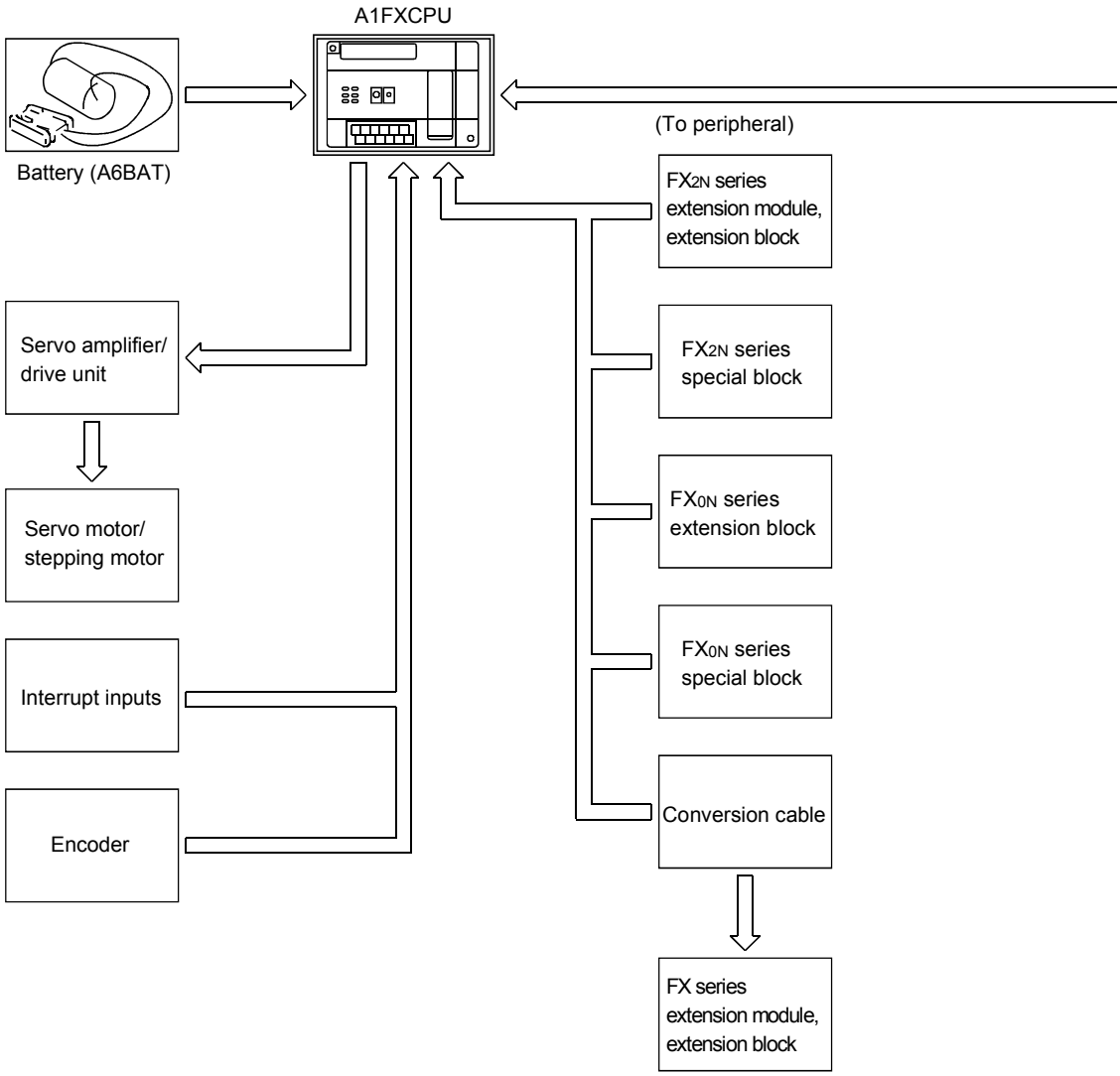
POINT

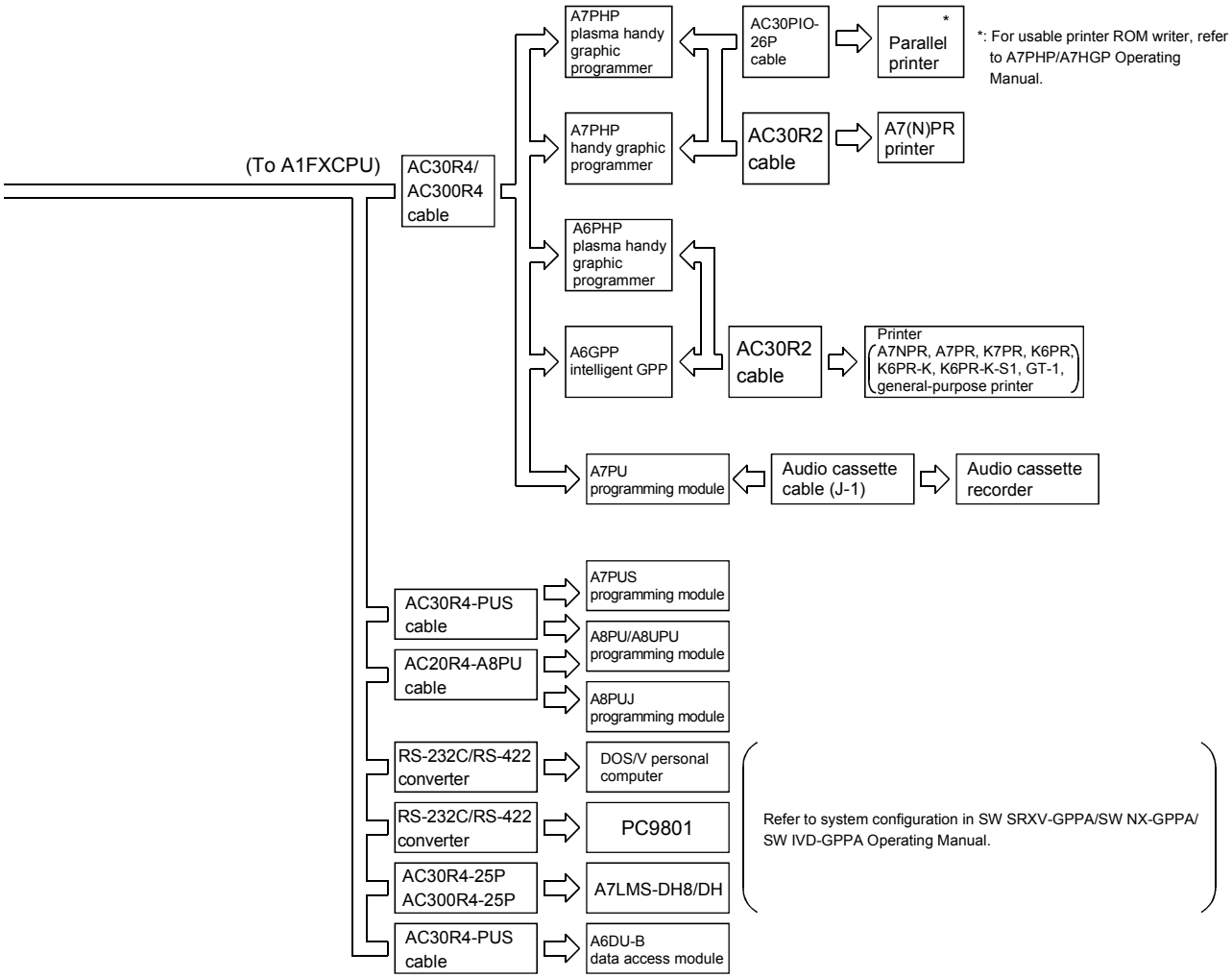
(1) Tighten the terminal screws within the following tightening torque.
Terminal block screw (M3 screw) 39 to 59N·cm
(2) The applicable wire sizes are 0.3 to 2mm^2.

3. SYSTEM CONFIGURATION

This chapter provides the system configuration usable with the A1FXCPU, system configuration instructions and system equipment.

3.1 Overall Configuration




(To A1FXCPU)
AC30R4/
AC300R4
cable
A7PHP
plasma handy
graphic
programmer
AC30PIO-
26P
cable
*
Parallel
printer
*: For usable printer ROM writer, refer to A7PHP/A7HGP Operating Manual.
A7PHP
handy graphic
programmer
AC30R2
cable
A7(N)PR
printer
A6PHP
plasma handy
graphic
programmer
A6GPP
intelligent GPP
AC30R2
cable
Printer
(A7NPR, A7PR, K7PR, K6PR,
K6PR-K, K6PR-K-S1, GT-1,
general-purpose printer)
A7PU
programming module
Audio cassette
cable (J-1)
Audio cassette
recorder
AC30R4-PUS
cable
A7PUS
programming module
A8PU/A8UPU
programming module
AC20R4-A8PU
cable
A8PUJ
programming module
RS-232C/RS-422
converter
DOS/V personal
computer
RS-232C/RS-422
converter
PC9801
AC30R4-25P
AC300R4-25P
A7LMS-DH8/DH
AC30R4-PUS
cable
A6DU-B
data access module
Refer to system configuration in SW SRXV-GPPA/SW NX-GPPA/
SW IVD-GPPA Operating Manual.

3.2 System Configuration Instructions

Observe the following instructions when using the hardware and software packages available for the A1FXCPU.

3.2.1 Hardware

(1) I/O modules

The I/O modules that may be used with the A1FXCPU are the FX series extension modules/extension blocks.

Refer to Section 3.3. for the types of the usable FX series extension modules/ extension blocks.

(2) Special modules

The special modules that may be used with the A1FXCPU are the FX series special modules/special blocks.

Refer to Section 3.3. for the types of the usable FX series special modules/special blocks.

(3) Peripherals

(a) Any of the following programming modules may be used with the A1FXCPU in the hand-held method. (The following peripherals cannot be used with the A1FXCPU in the add-on method.)

Programming Module	CPU Type Indication
A7PU	A2
A7PUS	
A8PU	
A8UPU	
A8PUJ	
A6DU-B*	

* The A6DU-B is a data access module.

(b) EP-ROM cannot be used with the A1FXCPU.

E^2PROM built in the A1FXCPU is used to perform ROM operation.

Use the DIP switch of the A1FXCPU to switch between RAM operation and E^2PROM operation. (Refer to Section 4.2.)

(4) Program write in E^2PROM operation mode

(a) In the E^2PROM operation mode, write during RUN cannot be performed.
If write during RUN is performed, the following error message appears on the peripheral.

Peripheral	Message
A6GPP A6PHP	PC COMMUNICATION ERROR ERROR CODE=17
A7PHP A7HGP A7LMS A75LMS PC9801 DOS/V personal computer	CANNOT COMMUNICATE WITH PC ERROR CODE=17
A7PU A7PUS A8PU A8UPU A8PUJ	PC NOT RESPOND

Change the program in the "PC mode" or "online mode" of the peripheral.

(5) Restrictions on use of peripherals

"Buffer memory batch monitoring" of the special module/special block cannot be performed from the peripheral connected to the A1FXCPU.
If buffer memory monitoring is made, the following error message appears on the peripheral.

Peripheral	Error Message
A6GPP A6PHP	I/O ADDRESS SETTING ERROR
A7PHP A7HGP A7LMS A75LMS PC9801 DOS/V personal computer	WRONG I/O ADDRESS SETTING

On the A1FXCPU, use the FROM/TO instructions to read/write data from/to the special module/special block. (Refer to Chapter 7.)

(6) Restrictions on use of GOT

(a) The GOT may only be connected directly to the A1FXCPU by the RS-422 cable. It cannot be connected by a bus or computer link.

(b) "Buffer memory batch monitoring" of the special module/special block cannot be performed from the GOT connected to the A1FXCPU.
If buffer memory monitoring is made, error message "SPECIFIED DEVICE OUTSIDE RANGE" appears on the GOT.

(c) Special module monitoring cannot be performed from the GOT connected to the A1FXCPU.
If special module monitoring is made, "ALL SLOTS EMPTY" appears.

3.2.2 Software packages

(1) System software package and startup type setting

Any of the A series peripherals and system software packages indicated in Table 3.1 can be used with the A1FXCPU.

When starting up the system with the system software package, set "A2" as the CPU type.

The FX series software packages cannot be used with the A1FXCPU.

Table 3.1 A Series Peripherals and System Software Packages

Peripheral	System Software Package	Startup Type Setting
A6GPP	SW3-GPPA SW□GP-GPPA	A2
A6PHP	SW□GP-GPPA	
A7PHP	SW0RX-GPPA SW0SRX-GPPA SW□SRXV-GPPA	
A7HGP	SW□HX-GPPA	
A7LMS	SW□S-GPPA SW0SRX-GPPA SW□SRXV-GPPA	
A75LMS	SW□SRXV-GPPA	
PC9800	SW0N-GPPA SW□NX-GPPA	
DOS/V personal computer	SW□IVD-GPPA	

(2) Utility packages

Table 3.2 indicates the utility packages usable with the A1FXCPU.

Table 3.2 Utility Packages Usable with A1FXCPU

Utility Package Type	Usability	Remarks
SW0GHP-UTLPC-FN1	Usable	Select "A2" for startup type setting.
SW0GHP-UTLPC-PID		
SW0GHP-UTLPC-FD1		
SW0GHP-UTLPC-FN0		
SW0C-UTLP-FN0		
SW2SRXV-SAPA (MELSAPII)		
SW1GP-AD57P	Unusable	
SW1GP-SAPA (MELSAP)		

3.3 System Equipment List

Table 3.3 indicates the FX_{2N} and FX_{0N} series extension modules, extension blocks, special modules and special blocks that may be connected with the A1FXCPU.

Table 3.3 System Equipment List

Model		Type	Description	Occupied Points
FX2N series	Extension module	FX_{2N}-32ER	24VDC input: 16 points, relay output: 16 points, power supply (100 to 240VAC) built in	32 points
		FX_{2N}-32ES	24VDC input: 16 points, triac output: 16 points, power supply (100 to 240VAC) built in	32 points
		FX_{2N}-32ET	24VDC input: 16 points, transistor output: 16 points, power supply (100 to 240VAC) built in	32 points
		FX_{2N}-48ER	24VDC input: 24 points, relay output: 24 points, power supply (100 to 240VAC) built in	64 points
		FX_{2N}-48ES	24VDC input: 24 points, triac output: 24 points, power supply (100 to 240VAC) built in	64 points
		FX_{2N}-48ET	24VDC input: 24 points, transistor output: 24 points, power supply (100 to 240VAC) built in	64 points
	Extension block	FX_{2N}-16EX	24VDC input: 16 points	16 points
		FX_{2N}-16EYT	Transistor output: 16 points	16 points
		FX_{2N}-16EYR	Relay output: 16 points	16 points
		FX_{2N}-16EYS	Triac output: 16 points	16 points
	Special block	FX_{2N}-4AD	4-channel analog input	8 points
		FX_{2N}-4DA	4-channel analog output	8 points
		FX_{2N}-4AD-PT	4-channel temperature sensor input (PT-100)	8 points
		FX_{2N}-4AD-TC	4-channel temperature sensor input (thermocouple)	8 points
		FX_{2N}-1PG	100kpps pulse output	8 points
		FX_{2N}-1HG	50kHz 2-phase high-speed counter	8 points
		FX_{2N}-232IF	RS-232C computer link interface, communication enabled in no-protocol mode	8 points
FX_{0N} series	Extension block	FX_{0N}-16EX	24VDC input: 16 points	16 points
		FX_{0N}-8ER	24VDC input: 4 points, 2A relay output: 4 points	32 points
		FX_{0N}-8EYR	2A relay output: 8 points	16 points
		FX_{0N}-8YT	0.5A transistor output: 8 points	16 points
		FX_{0N}-16EYR	2A relay output: 16 points	16 points
		FX_{0N}-16YET	0.5A transistor output: 16 points	16 points
	Special block	FX_{0N}-3A	Analog I/O, 8-point bits, input 2 channels, output 1 channel	8 points
		FX_{0N}-16NT	MELSECNET/MINI interface (twisted pair cable)	32 points
	Extra extension cable	FX_{0N}-65EC	Extension cable 65cm for connection between A1FXCPU and FX_{0N}/FX_{2N} series extension module	———
FX series	Special block	FX-4AD	4-channel analog input	8 points
		FX-2DA	2-channel analog output	8 points
		FX-2AD-PT	2-channel temperature sensor input (PT-100)	8 points
		FX-4AD-TC	4-channel temperature sensor input (thermocouple)	8 points
		FX-1PG	100kpps positioning pulse output	8 points
		FX-1HG	50kHz 2-phase high-speed counter	8 points
		FX-16NP	MELSECNET/MINI interface (optical cable)	32 points
		FX-16NT	MELSECNET/MINI interface (twisted pair cable)	32 points
		FX-16NP-S3	MELSECNET/MINI-S3 interface (optical cable)	40 points
		FX-16NT-S3	MELSECNET/MINI-S3 interface (twisted pair cable)	40 points
		FX-IDIF	ID interface	40 points

Table 3.3 System Equipment List (Continued)

Model		Type	Description	Occupied Points
FX series	Special module	FX-1GM	Positioning pulse output (1 axis), max. frequency 100kpps	8 points
		FX-10GM	Positioning pulse output (1 axis), max. frequency 200kpps	8 points
		FX-20GM	Positioning pulse output (2 axes), max. frequency 200kpps	8 points
	Power supply module	FX-10PSU	24VDC 1A power supply (for external service power supply)	——
		FX-20PSU	24VDC 2A power supply (for external service power supply)	——
	Conversion cable	FX2N-CNV-IF	For connection of FX series special extension block to A1FXCPU	——
Data access module		FX-25DU	Data access module (direct PLC connection type)	——
		FX-30DU-B	Blue liquid crystal screen data access module	——
		FX-40DU	Black-and-white liquid crystal screen data access module	——
		FX-40DU-B	Blue liquid crystal screen data access module	——
		FX-40DU-TK	Black-and-white liquid crystal screen data access module (Touch key type)	——
		FX-40DU-TKB	Blue liquid crystal screen data access module (Touch key type)	——
		FX-50DU-TK	Black-and-white liquid crystal screen data access module (Touch key type)	——
		FX-50DU-TKS	Color liquid crystal screen data access module (Touch key type)	——
		FX-40DU-CAB	Cable for connection of data access module and A1FXCPU 3m	——
Graphic operation terminal		A985GOT	Large-sized graphic operation terminal [800×600 dots], TFT color liquid crystal, 256 colors	32[32 special points]
		A975GOT	Large-sized graphic operation terminal [640×480 dots], TFT color liquid crystal, 256 colors/ [640×480 dots], TFT color wide angle view, 256 colors	
		A970GOT	Large-sized graphic operation terminal [640×480 dots], TFT color liquid crystal, 16 colors/ [640×480 dots], TFT color wide angle view, 16 colors/ [640×480 dots], STN color, 8 colors/ [640×480 dots], STN monochrome, 2 colors	
		A960GOT	Large-sized graphic operation terminal [640×400 dots], EL, 2 colors	
		A956GOT	Mid-sized graphic operation terminal [320×240 dots], STN color, 8 colors/ [320×240 dots], STN monochrome/ [320×240 dots], TFT color liquid crystal, 256 colors	
		A956WGOT	Mid-sized graphic operation terminal [320×240 dots], TFT color liquid crystal, 256 colors	
		A953GOT	Mid-sized graphic operation terminal [320×240 dots], STN color, 8 colors/ [320×240 dots], STN monochrome/ [320×240 dots], TFT color liquid crystal, 256 colors With handheld-type	——
		A951GOT	Mid-sized graphic operation terminal [320×240 dots], STN color, 8 colors/ [320×240 dots], STN monochrome/ [320×240 dots], TFT color liquid crystal, 256 colors	32[32 special points]

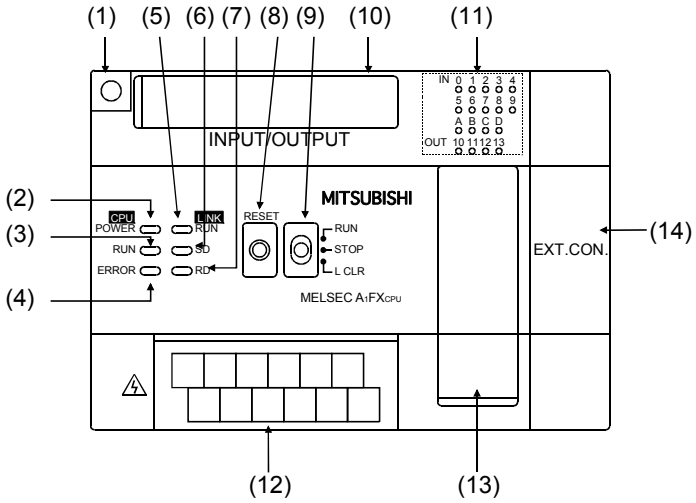
Table 3.3 System Equipment List (Continued)

Model	Type	Description	Occupied Points
Graphic operation terminal	A950GOT	[320×240 dots], STN color, 8 colors/ [320×240 dots], STN monochrome/ [320×240 dots], TFT color liquid crystal, 256 colors With handheld-type	——
	GT1565-VTBA	Large-sized graphic operation terminal 8.4" [640×480 dots], TFT color, 256 colors/65536 colors, (When installing a multi-color display board, 65536 colors can be displayed.)	32[32 special points]
	GT1575-VTBA	Large-sized graphic operation terminal 10.4" [640 × 480 dots], TFT color, 256 colors/65536 colors, (When installing a multi-color display board, 65536 colors can be displayed.)	
Modem interface module	A6TEL	Interface for connection of A1FXCPU and modem May be connected to A1FXCPU in hand-held method.	——
Battery	A6BAT	RAM memory backup (mounted on A1FXCPU)	——

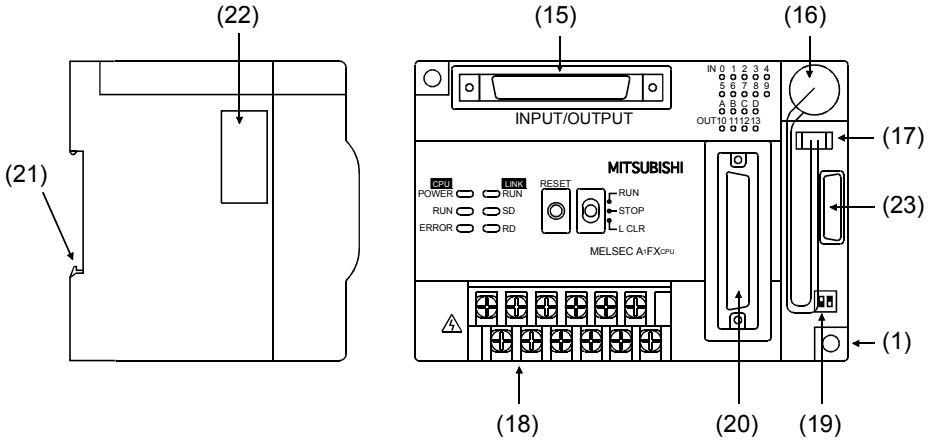
4. NAMES OF PARTS AND THEIR SETTINGS

4.1 Names of Parts

Front view



Left side view and the front view without cover



No.	Name	Application
1	Mounting hole (For M4 screw)	Pear-shaped hole used to mount this module to a panel such as a control box.
2	"POWER" LED	• 5VDC power indicator LED
3	"RUN" LED	• On : Indicates that the RUN/STOP switch is in the "RUN" position and sequence program operation is being executed. (Remains on if an error defined to continue sequence program operation occurs.) • Off : Turns off when : • 100 to 240VAC is not supplied to the A1FXCPU. • The RUN/STOP switch is in the "STOP" position. • Remote STOP is performed. • Remote PAUSE is performed. • Flicker : Flickers when: • The self-diagnostic function detected an error defined to stop sequence program operation. • Latch clear operation is performed.

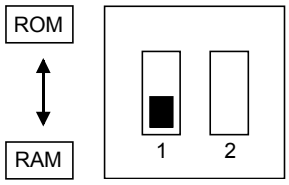
No.	Name	Application
4	"ERROR" LED	• On : Indicates that the self-diagnostic function detected an error. (Remains off when the error detected is the one preset to be turned off in the LED indication priority setting.) • Off : Indicates a normal status or that a failure was detected with the CHK instruction. • Flicker : Indicates that the annunciator (F) was switched on in the sequence program.
5	"LINK RUN" LED	• On : Indicates normal operation of simple inter-PLC link. • Off : Indicates a simple inter-PLC link fault.
6	"SD" LED	• Flicker : Indicates that data is being sent to the other station in simple inter-PLC link. • Off : Indicates that data is not yet sent to the other station in simple inter-PLC link.
7	"RD" LED	• Flicker : Indicates that data is being received from the other station in simple inter-PLC link. • Off : Indicates that data is not yet received from the other station in simple inter-PLC link.
8	RESET switch	• RESET : Hardware reset. Used to make a reset at occurrence of an operation fault and initialize operation.
9	RUN/STOP switch	• RUN/STOP: Used to execute/stop sequence program operation. • LATCH CLEAR (L. CLR) : Used to clear (OFF or 0) latch clear data set in parameters. (LATCH CLEAR also clears data other than the latch clear data.)
10	Built-in function connector cover	Cover for protection of the built-in function connector. When the connector is not used, put this cover on.
11	Indicator LED	I/O indicator LED
12	Terminal block cover	Cover for protection of the terminal block. Put this cover on except when making connections.
13	Peripheral connector cover	Connector cover for connection of a peripheral. When a peripheral is not used, put this cover on.
14	Protective cover	Cover for protection of the battery, connector, etc. of the A1FXCPU. Open the protective cover to perform the following operations. • DIP switch setting • Connection to the battery connector • Battery replacement • Connection/disconnection to/from the extension block connector When the above operations are not performed, put this cover on.
15	Built-in function connector	Connector for the high-speed counter, positioning output and external interrupt input.
16	Battery	Used to back up program, latch range device, file register and other data.
17	Battery connector	For connection of the battery side connector.
18	Terminal block	Terminal block for AC power input, service power output and simple inter-PLC link.
19	DIP switches	Used to set memory protect and select between RAM and E^2PROM.
20	Peripheral connector (D sub-25 pins)	Connector used to perform main program write/read, monitoring and test using a peripheral.
21	DIN rail catch	Catch for mounting this module to a DIN rail.
22	Cover	Do not open this cover.
23	Extension block connector	Connector for connection of the FX_{0N} and FX_{2N} series extension modules, extension blocks, special modules and special blocks.

4.2 Settings

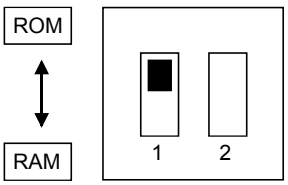
The A1FXCPU settings include RAM/E^{2}PROM operation and write protect settings.

4.2.1 RAM/E^{2}PROM operation setting

The memory operation system includes RAM and E^{2}PROM modes.
Use the DIP switch (SW1) to select the memory operation system.
SW1 is factory-set in the RAM operation (lower) position.



Move SW1 to the lower position
to set RAM operation.



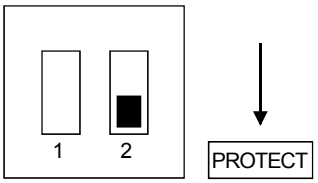
Move SW1 to the upper position
to set ROM operation.

POINT

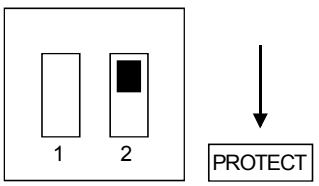
Before choosing the E^{2}PROM mode, read the contents of RAM with a peripheral.

4.2.2 Write protect switch setting

The write protect switch is used to prevent RAM and E^{2}PROM data from being rewritten by operation performed from a peripheral.
Use this switch to prevent a program created from being rewritten or deleted, for example.
When this function is used, RAM is write-protected in the RAM operation mode and E^{2}PROM write-protected in the E^{2}PROM operation mode.
Before making corrections to the RAM memory contents, clear write protect (move the switch to the upper position).
Use the DIP switch (SW2) to select or clear write protect.
SW2 is factory-set in the write protect clear (upper) position.



Move SW2 to the lower position
to select write protect.



Move SW2 to the upper position
to clear write protect.

4.3 Latch Clear Operation

When performing latch clear using the RUN/STOP switch, perform operation in the following procedure. This operation also clears non-latched devices.

(1) Move the RUN/STOP switch from the "STOP" position to the "L CLR" position several times to flicker the "RUN" LED.
When the "RUN" LED flickers, latch clear is ready.

(2) After the "RUN" LED has flickered, move the RUN/STOP switch from the "STOP" position to the L CLR" position again. Latch clear is then completed and the "RUN" LED goes off.
To cancel the latch clear operation at any point, move the RUN/STOP switch to the "RUN" position to place the A1FXCPU in the RUN mode.

REMARKS

Latch clear may also be done by GPP function operation.
For the operation method, refer to the GPP Function Operating Manual.

5. FUNCTIONS

This chapter describes the functions of the A1FXCPU.

5.1 Function List

The functions common to the MELSEC-A series and available for the A1FXCPU are listed in Table 5.1 and the built-in functions added to the A1FXCPU are indicated in Table 5.2. (For full information on the functions common to the MELSEC-A series, refer to the ACPU Programming Manual (Basics).)

Table 5.1 Functions Common to the MELSEC-A Series

Function	Description
Constant scan	• This function executes the sequence program at specified intervals independently of the sequence program scan time. • Constant scan setting: 1 to 200 (10 to 2000ms)
Latch (power failure compensation)	• This function retains device contents when the A1FXCPU is switched off or is reset by the RESET switch or if an instantaneous power failure of longer than 10ms occurs. • Devices that can be latched: L, B, T, C, D, W (default: L only)
Remote RUN/STOP	• This function controls RUN/STOP of the CPU from an external device (e.g. peripheral, external input) when the RUN/STOP switch is in the RUN position.

PAUSE	• This function stops operation while holding the outputs (Y).
	• Either of the following methods may be used to put the CPU in the PAUSE mode.
	  • Remote PAUSE contact set in the parameter
	  • Remote PAUSE from the peripheral

Status latch	• This function stores the contents of all devices into the status latch area of the A1FXCPU when the status latch condition is satisfied (STRA instruction is executed). • This function can be used to check the statuses of all devices of the A1FXCPU if an error occurred in the sequence program. • The contents of the devices stored in the status latch area can be monitored with the peripheral.
Sampling trace	• This function samples the operating statuses of the specified devices at specified intervals and stores them into the sampling trace area. • This function can be used to check the progress of statuses of the error-factor devices at scans/specified time intervals if an error occurs in the sequence program. • Data stored in the sampling trace area can be monitored with the peripheral.
Offline switch	• This function can separate devices (Y, M, L, F, B) used for OUT instructions from the operation processing of the sequence program. • This function can be used to switch on/off the OUT instruction devices when the system is started up.
ERROR LED priority setting	• Setting of whether the ERROR LED is lit or not at error occurrence.
Clock *1	• This function executes clock operation in the A1FXCPU. • This function can be used for time control in the A1FXCPU. • Clock data: Year, month, day, hour, minute, second, day of the week • Clock data can be read to special registers D9025-D9028.

Table 5.2 Built-In Functions Added to the A1FXCPU

Function	Description	Refer To

Simple inter-PLC link	• With this function, data is automatically exchanged between up to eight A1FXCPU, FX_{2N} and FX_{0N} series modules connected.
	• Select the number of link points per station from the following patterns.
	  • Pattern 0: Bit data: 0 points, word data: 4 points
	  • Pattern 1: Bit data: 32 points, word data: 4 points
	  • Pattern 2: Bit data: 64 points, word data: 8 points
	• Transmission distance: 500m overall
		Section 5.2

Simple positioning	• With this function, positioning is performed by max. 60kpps pulse output with servo amplifier/stepping motor driver connected. • Number of controlled axes: 2 axes (2 axes independent/simultaneous start) • Pulse output : CW/CCW, PULSE/SIGN • Positioning range : 0 to 16777215 pulses	Section 5.3
High-speed counter	• This function counts max. 60kpps pulse inputs from an encoder. • Number of channels: 2 channels • Counting range: 0 to 16777215 pulses • An interrupt program (I12, I13) can be run when the coincidence output set value matches the present value of the counter.	Section 5.4
External interrupt	• This function executes a program (I0 to I5) corresponding to an interrupt factor when an external interrupt factor occurs.	Section 5.5

REMARKS

The following functions cannot be used in the A1FXCPU.

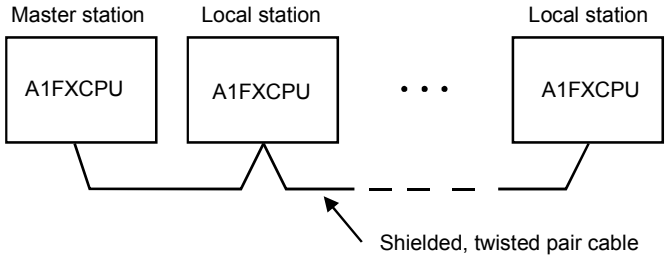
- Step run
- PAUSE by RUN/STOP switch
- I/O module change in online mode

5.2 Simple Inter-PLC Link

(1) Simple inter-PLC link

Simple inter-PLC link is a network which automatically makes data communication between up to eight A1FXCPU, FX_{2N} and FX_{0N} series modules connected.

On this network, the data of the devices set in the refresh range are transferred between the PLCs and those devices can be monitored by all PLCs.



(2) Classification of stations connected to simple inter-PLC link

The A1FXCPU, FX_{2N} and FX_{0N} series modules connected to simple inter-PLC link are classified into master and local stations.

(a) The master station is a controlling module for simple inter-PLC link.

One master station is always required in a simple inter-PLC link system.

Set the following link parameters to the master station in the sequence program (link setting program) (refer to Section 5.2.4).

- Corresponding station number (set 0)
- Number of local stations
- Refresh range (pattern 0 to 2)
- Number of retries
- Monitor time

(b) Local stations are modules which make data communication using the link parameters of the master station.

Set only the corresponding station numbers (station numbers of host stations) to the local stations in the sequence program (link setting program). (Refer to Section 5.2.4.)

5.2.1 Instructions for simple inter-PLC link

In simple inter-PLC link, the FX_{2N} and FX_{0N} series can be connected.
This section provides instructions for connection of the FX_{2N} and FX_{0N} series.

(1) Versions of FX_{2N} and FX_{0N} series [*1]
The FX_{0N}/FX_{2N} series connected to simple inter-PLC link should all be version V.2.00 or later (simple inter-PLC link compatible).

(2) Connect communication adaptors to the FX_{2N} and FX_{0N} series
(a) The FX_{0N} series requires the communication adaptor (FX_{0N}-485ADP) to be connected.

(b) The FX_{2N} series requires the communication adaptor (FX_{0N}-485ADP) or communication board (FX_{2N}-485-BD) to be connected.
- When the communication adaptor is used, overall distance is 500m.
- When the communication board is used, overall distance is 50m.

Use the special adaptor when the FX_{2N} series is used and overall distance of longer than 51m is required.

(3) Serial number of communication adaptor (FX_{0N}-485ADP) [*2]
The FX_{0N}-485ADP having the serial number 79**** or earlier cannot be used in simple inter-PLC link.
In simple inter-PLC link, use the FX_{0N}-485ADP having the serial number 7X**** or later.

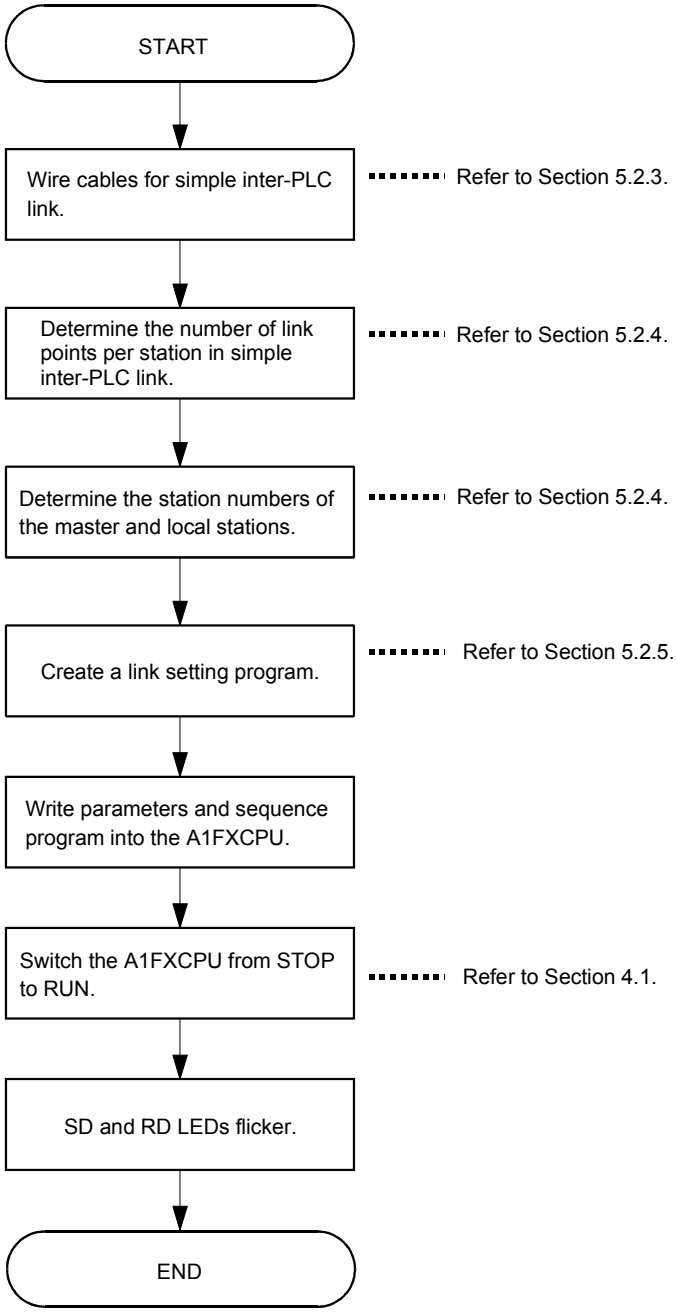
(4) Restrictions on connection of FX_{0N} series
When one or more FX_{0N} series are used, the refresh range may only be set to pattern 0.
When using pattern 1 or 2, use the A1FXCPU or FX_{2N} series modules at all stations.

REMARKS

*1: The versions of the FX_{0N} and FX_{2N} are printed on the side face of the modules.
*2: The serial number of the FX_{0N}-485ADP is printed on the side face of the module.

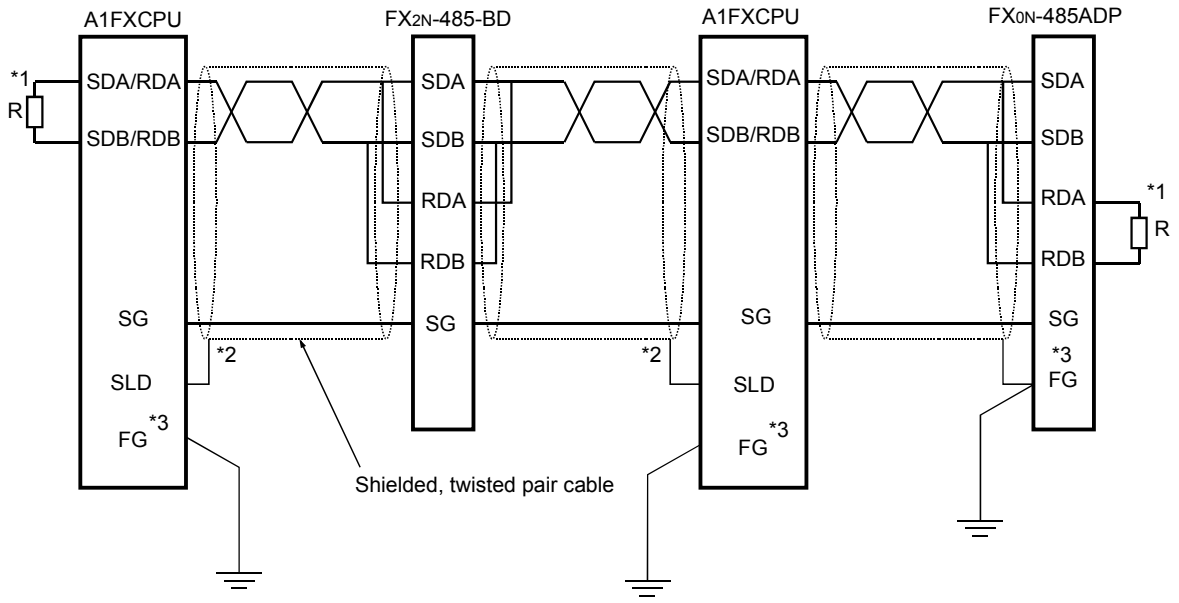
5.2.2 Procedure for simple inter-PLC link

The following is a simple inter-PLC link procedure.



5.2.3 Wiring for simple inter-PLC link

For simple inter-PLC link, connect the A1FXCPU, FX2N and FX0N series modules as shown below.



(1) Connection

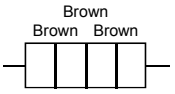
Connect simple inter-PLC link stations as shown above.
(When using the FX2N and FX0N series, refer to the user's manual of the communication adaptor/communication board used.)

(2) Connection cables

Connect simple inter-PLC link stations by shielded, twisted pair cables.
(For the specifications of the shielded, twisted pair cables, refer to Section 2.3.3.)

(3) Connection of terminal resistors (*1)

"R"s connected to the stations at both ends of simple inter-PLC link are terminal resistors (110Ω, 1/2W).
Use the terminal resistors supplied to the A1FXCPU, communication adaptor and communication board (see below).



(4) Grounding

*2: The shielded, twisted pair cables used for connection in simple inter-PLC link must be connected to the SLD terminals.
*3: The FG terminal must be connected to the earth terminal of the PLC which has been earthed to the protective earth conductor.

REMARKS

1) The FX2N-485-BD is the communication board designed for the FX2N series.
2) The FX0N-485ADF is the communication adaptor designed for the FX0N series.

5.2.4 Data to be set for simple inter-PLC link

There are the following link parameter data for simple inter-PLC link.

- Corresponding station number
- Number of local stations
- Refresh range
- Number of retries
- Monitor time

Set the link parameters to the special registers in Table 5.3 in the sequence program.

Table 5.3 Special Registers Used in Link Parameter Setting

Number	Name	Description	Setting Range	Initial Value	Set Station	
					M	L
D9176	Corresponding station number	• Set the station number of the host station.	0 to 7	FFFFH	O	O
D9177	Number of local stations	• Set the number of local stations to communicate with.	1 to 7	7	O	—
D9178	Refresh range	• Set the refresh range pattern.	0 to 2	0	Δ	—
D9179	Number of retries	• Set the number of retries up to error detection.	0 to 10	3	Δ	—
D9180	Monitor time	• Set the local station no-response time (monitor time) to the master station.	5 to 255	5	Δ	—

M : Master station, L: Local station
O : Must be set.
Δ : Set when initial value is changed (operative with initial value)
— : Need not be set.

(1) Corresponding station number setting

(a) Set the station number of the host station to the special register (D9176) with any of 0 to 7.

Station Number	Master Station	Local Station						
		Station 1	Station 2	Station 3	Station 4	Station 5	Station 6	Station 7
Setting	0	1	2	3	4	5	6	7

(b) Station numbers must be set to the master and local stations.
Any station without this setting cannot make data communication in simple inter-PLC link.

(2) Local station count setting

(a) Set the number of local stations connected to simple inter-PLC link to the special register (D9177).

Number of local stations	1 module	2 modules	3 modules	4 modules	5 modules	6 modules	7 modules
Setting	1	2	3	4	5	6	7

(b) The local station count setting is required for the master station only.
It is not need for local stations.

(3) Refresh range setting

(a) Set the number of points per station for data communication in simple inter-PLC link to the special register (D9178) with any of patterns 0 to 2 (0 to 2).

		Refresh Range		
		Pattern 0	Pattern 1	Pattern 2
Link devices	Bit devices	0 points for each station	32 points for each station	64 points for each station
	Word devices	4 points for each station	4 points for each station	8 points for each station
Value set to D9178		0	1	2

(b) Pattern 0 may only be used when the FX0N is used.
When using pattern 1 or 2, use the A1FXCPU or FX2N at all stations.

(c) Refresh range setting is required for the master station only.
It is not needed for local stations.
(Local stations make data communication in the refresh range set in the master station.)

(d) When the refresh range has been set, the A1FXCPU uses the following devices for simple inter-PLC link. (Both the master and local stations occupy the same range.)
When transmitting data to the other station in simple inter-PLC link, write data to the devices specified for the station number of the host station.

[Devices used in pattern 0]

	Devices Used			
	Bit devices: 0 points		Word devices: 4 points	
	A1FXCPU	FX series	A1FXCPU	FX series
Station 0	—		W00 to W03	D0 to D3
Station 1	—		W10 to W13	D10 to D13
Station 2	—		W20 to W23	D20 to D23
Station 3	—		W30 to W33	D30 to D33
Station 4	—		W40 to W43	D40 to D43
Station 5	—		W50 to W53	D50 to D53
Station 6	—		W60 to W63	D60 to D63
Station 7	—		W70 to W73	D70 to D73

[Devices used in pattern 1]

	Device Numbers Used			
	Bit devices: 32 points		Word devices: 4 points	
	A1FXCPU	FX series	A1FXCPU	FX series
Station 0	B000 to B01F	M1000 to M1031	W00 to W03	D0 to D3
Station 1	B040 to B05F	M1064 to M1095	W10 to W13	D10 to D13
Station 2	B080 to B09F	M1128 to M1159	W20 to W23	D20 to D23
Station 3	B0C0 to B0DF	M1192 to M1223	W30 to W33	D30 to D33
Station 4	B100 to B11F	M1256 to M1287	W40 to W43	D40 to D43
Station 5	B140 to B15F	M1320 to M1351	W50 to W53	D50 to D53
Station 6	B180 to B19F	M1384 to M1415	W60 to W63	D60 to D63
Station 7	B1C0 to B1EF	M1448 to M1479	W70 to W73	D70 to D73

[Devices used in pattern 2]

	Device Numbers Used			
	Bit devices: 64 points		Word devices: 8 points	
	A1FXCPU	FX series	A1FXCPU	FX series
Station 0	B000 to B03F	M1000 to M1063	W00 to W07	D0 to D7
Station 1	B040 to B07F	M1064 to M1127	W10 to W17	D10 to D17
Station 2	B080 to B0BF	M1128 to M1191	W20 to W27	D20 to D27
Station 3	B0C0 to B0FF	M1192 to M1255	W30 to W37	D30 to D37
Station 4	B100 to B13F	M1256 to M1319	W40 to W47	D40 to D47
Station 5	B140 to B17F	M1320 to M1383	W50 to W57	D50 to D57
Station 6	B180 to B1BF	M1384 to M1447	W60 to W67	D60 to D67
Station 7	B1C0 to B1FF	M1448 to M1511	W70 to W77	D70 to D77

(4) Retry count setting

(a) Set to the special register (D9179) the number of retries to be made when there is no response in simple inter-PLC link.
When there is no response at the preset count of link scans, the other stations judge that the corresponding station is in data transmission sequence error.

(b) Retry count setting is required for the master station only.
It is not needed for local stations.
(Local stations use the retry count set in the master station.)

(5) Monitor time setting

(a) Set the period of time needed to determine that the master or local station is faulty in data transmission between the master and local stations.
Set any to 5 to 255 (50ms to 2550ms) in 10ms increments.

(b) Monitor time setting is required for the master station only.
It is not needed for local stations.
(Local stations monitor the response time from the master station in a period twice longer than the monitor time set in the master station.)

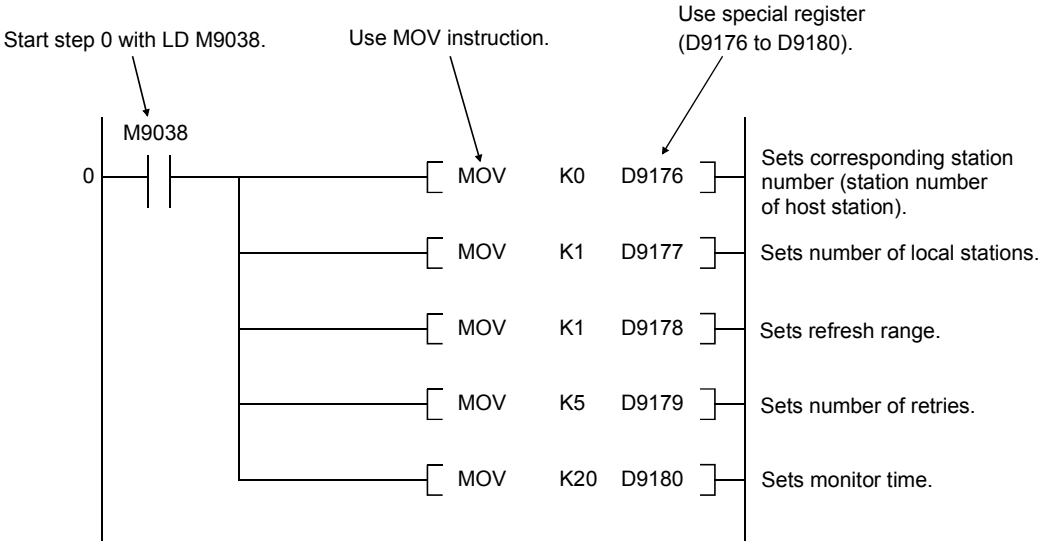
5.2.5 Link parameter setting method

Set the link parameters for simple inter-PLC link in the sequence program (link setting program).

(1) Instructions for link setting program

(a) Write the link setting program under the following conditions.
If any of the following conditions is not satisfied, simple inter-PLC link is not performed.
- Write the link setting program from step 0.
- Write LD M9038 at the beginning (step 0) of the link setting program.
- Use "MOV" instructions to store data into D9176-D9180. (The MOVP instruction must not be used.)

(b) The link parameters end at either of the following steps.
- Step where there is a device other than D9176-D9180.
- Step where there is an instruction other than LD M9038 and MOV instruction in the link setting program.



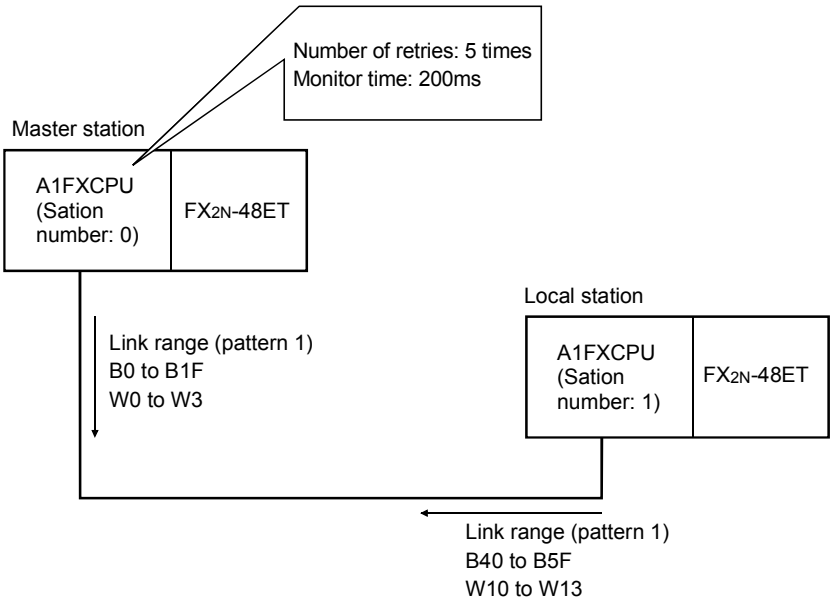
(c) When the link setting program is proper, the values set are stored into D9173-D9175.
- D9173: Corresponding station number setting status
- D9174: Local station count setting status
- D9175: Refresh range setting status

POINT

(1) The values within the specified ranges should be set to D9176-D9180.
If any of the D9176-D9180 values in link parameters is outside the specified range, LINK PARAM ERROR occurs and simple inter-PLC link is not made.
(However, if only the station numbers are proper, simple inter-PLC link is performed with default parameter values even when LINK PARAM ERROR has occurred.)

(2) Link parameter setting program example

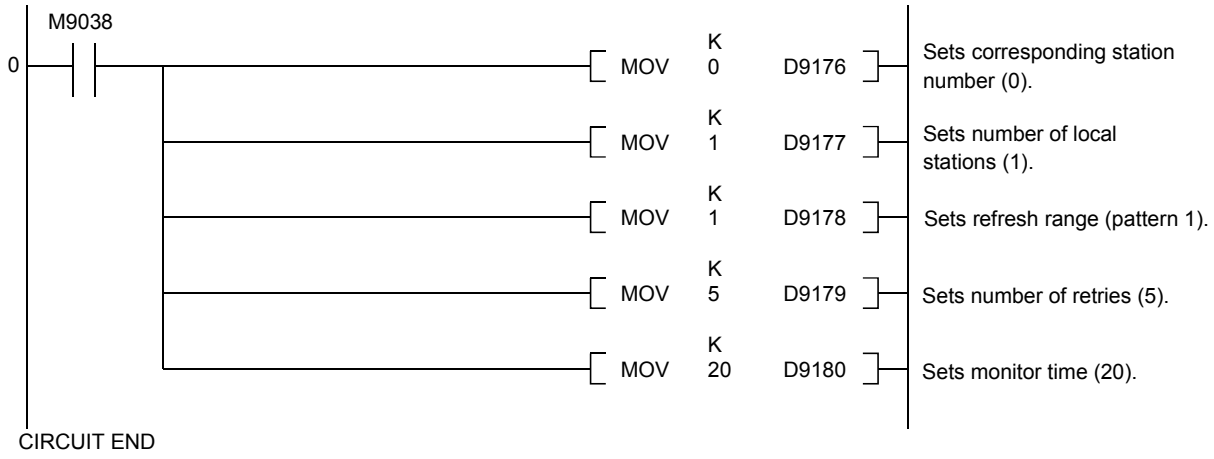
The link setting programs shown below are designed for simple inter-PLC link in the following system.



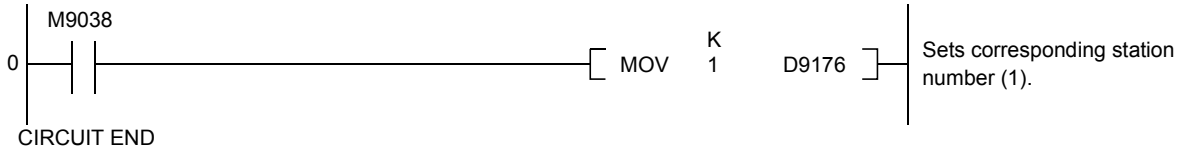
The following table lists the link parameter setting items and set data.

Number	Name	Setting	
		Master station	Local station
D9176	Corresponding station number	0	1
D9177	Number of local stations	1	—
D9178	Refresh range	1	—
D9179	Number of retries	5	—
D9180	Monitor time	20	—

[Master station program example]



[Local station program example]



5.2.6 Checking for errors in simple inter-PLC link

Whether simple inter-PLC link is normal or abnormal can be checked by the special relays and special registers for simple inter-PLC link.

(1) Error checking special relays

Table 5.4 lists the special relays designed to check for errors at other stations in simple inter-PLC link.

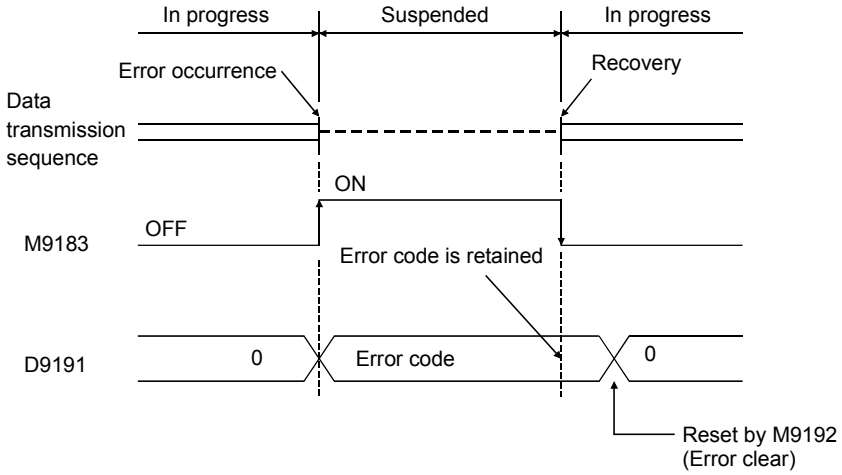
Table 5.4 Special Relays for Simple Inter-PLC Link

Number	Name	Normal/Abnormal Judgment		Usability	
		Normal	Abnormal	Master station	Local station
M9183	Data transmission sequence error (master station)	OFF	ON	—	O
M9184	Data transmission sequence error (local station 1)	OFF	ON	O	O
M9185	Data transmission sequence error (local station 2)				
M9186	Data transmission sequence error (local station 3)				
M9187	Data transmission sequence error (local station 4)				
M9188	Data transmission sequence error (local station 5)				
M9189	Data transmission sequence error (local station 6)				
M9190	Data transmission sequence error (local station 7)				
M9191	Data transmission sequence in progress	ON	OFF	O	O
M9192	Error clear	—	—	O	O

O: Usable, —: Unusable

(a) M9183: Data transmission sequence error (master station)

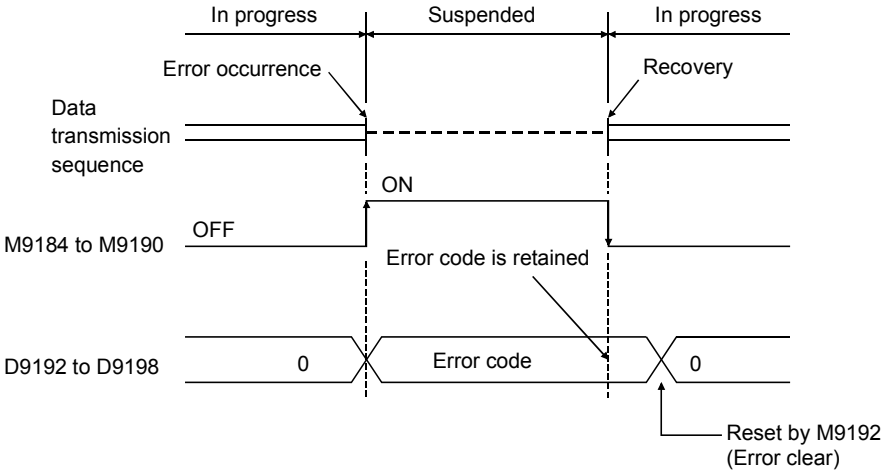
- A flag used by the local station connected to simple inter-PLC link to determine whether the master station is normal or abnormal.
- M9183 turns on when an error occurs in the master station during data transmission sequence execution.
  M9183 turns off when the master station recovers from the error and resumes the data transmission sequence.



- When M9183 has turned on, the error definition can be checked with the error code stored in D9191 (data transmission error No. (master station)).

(b) M9184 to M9190: Data transmission sequence error (local station n)

- A flag used by the master or local station connected to simple inter-PLC link to determine whether there is a faulty local station or not.
- The corresponding special relay turns on when a data transmission sequence error occurs in a local station during data transmission sequence execution.
  It turns off when the local station recovers from the error and resumes the data transmission sequence.



- When any of M9184 to M9190 has turned on, the error definition can be checked with the error code stored in any of D9192 to D9198 (data transmission error No. (local station n)).

(2) Error checking special registers

Table 5.5 lists the special registers designed to check for errors in simple inter-PLC link.

Table 5.5 Special Registers for Simple Inter-PLC Link

Number			Name	Normal/Abnormal Judgment		Usability	
A1FXCPU	FX_{0N}	FX_{2N}		Normal	Abnormal	Master station	Local station
D9183	—	—	Data transmission sequence error count (master station)	0	Other than 0	—	O
D9184	—	—	Data transmission sequence error count (local station 1)	0	Other than 0	O	O
D9185	—	—	Data transmission sequence error count (local station 2)				
D9186	—	—	Data transmission sequence error count (local station 3)				
D9187	—	—	Data transmission sequence error count (local station 4)				
D9188	—	—	Data transmission sequence error count (local station 5)				
D9189	—	—	Data transmission sequence error count (local station 6)				
D9190	—	—	Data transmission sequence error count (local station 7)				
D9191	D211	D8183	Data transmission error number (master station)	0	Other than 0	—	O
D9192	D212	D8184	Data transmission error number (local station 1)	0	Other than 0	O	O
D9193	D213	D8185	Data transmission error number (local station 2)				
D9194	D214	D8186	Data transmission error number (local station 3)				
D9195	D215	D8187	Data transmission error number (local station 4)				
D9196	D216	D8188	Data transmission error number (local station 5)				
D9197	D217	D8189	Data transmission error number (local station 6)				
D9198	D218	D8190	Data transmission error number (local station 7)				

(a) D9183: Data transmission sequence error count (master station)
- The number of times M9183 turned from OFF to ON is stored.

(b) D9184 to D9190: Data transmission sequence error count (local station n)
- The numbers of times M9184 to M9190 turned from OFF to ON are stored in D9184 to D9190.
- The following table indicates relationships between M9184-M9190 and D9184-D9190.

Station Number	A1FXCPU	
	Special relay	Special register
Station 1	M9184	D9184
Station 2	M9185	D9185
Station 3	M9186	D9186
Station 4	M9187	D9187
Station 5	M9188	D9188
Station 6	M9189	D9189
Station 7	M9190	D9190

(c) D9191: Data transmission error number (master station)
- The error code of the master station detected by the local stations connected to simple inter-PLC link is stored.
- For the error codes stored, refer to Section 5.2.6 (3).
- The error code is cleared when M9192 (error clear) is turned from OFF to ON after the corresponding station had recovered from the error and the data transmission sequence has resumed.

(d) D9192 to D9198: Data transmission error number (local station n)
- The error code of the local station detected by the master/local stations connected to simple inter-PLC link is stored.
- For the error codes stored, refer to Section 5.2.6 (3).
- The error code is cleared when M9192 (error clear) is turned from OFF to ON after the corresponding station had recovered from the error and the data transmission sequence has resumed.

(3) Error code list

Table 5.6 lists error codes stored into the data transmission error code storing data registers of the stations which detected errors at occurrence of data transmission sequence errors.

Table 5.6 Error Code List

Error Code	Error Item	Station Where Error Occurred	Station Which Detected Error	Error Definition	Check Items
01H	Monitor time-out	Local station	Master station	Local station does not respond to the send request of the master station after monitor time has elapsed.	Cable wiring Local station power supply
02H	Station number error	Local station	Master station	Another local station responded to the send request of the master station.	Cable wiring
03H	Counter error	Local station	Master station	Counter value in transmission data differs from the counter value returned by the local station.	Cable wiring
04H	Transmission format error	Local station	Master station Local station	Message returned by the local station is incorrect.	Cable wiring Local station power supply Station number setting
11H	Monitor time-out	Master station	Local station	After monitor time has elapsed, the master station does not provide a send request, parameters and master station sending data to the next local station.	Cable wiring Master station power supply
14H	Transmission format error	Master station	Local station	Transmission format error	Cable wiring Master station power supply Station number setting
21H	Local station no-response error	Local station	Local station *1	Local station does not exist.	Cable wiring Local station power supply Station number setting
22H	Station number error	Local station	Local station *1	Another local station responded to the send request of the master station.	Cable wiring
23H	Counter error	Local station	Local station *1	Counter value in transmission data differs from the counter value returned by the local station.	Cable wiring
31H	Parameter unreceived	Local station	Local station *2	With no parameters received, a send request was received from the master station.	Cable wiring Master station power supply
32H	Receive buffer error	All stations	Host station	As the next data was received prior to the end of receive data processing, unprocessed data was accumulated to fill the receive buffer.	Monitor time (Monitor time should be longer than A1FXCPU scan time.)

*1: Local stations other than the one where the error occurred

*2: Local station where the error occurred

5.2.7 Loopback self-check

The A1FXCPU can self-check whether its simple inter-PLC link function operates properly or not (loopback self-check).
This check judges whether data sent from SDA/RDA and SDB/RDB can be received by SDA/RDA and SDB/RDB properly to determine whether the function is normal or abnormal.

(1) Operation procedure

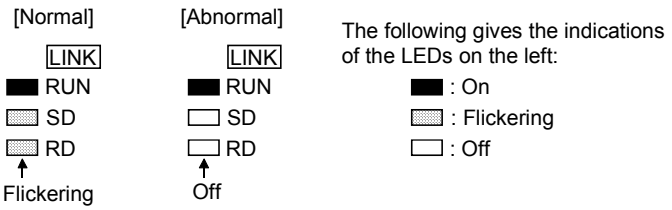
(a) When a cable is connected to SDA/RDA and SDB/RDB for simple inter-PLC link, disconnect the cable from the terminal block after switching off the power of the A1FXCPU.

(b) Move the RUN/STOP switch of the A1FXCPU to the "STOP" position. *1

(c) Switch on the power of the A1FXCPU.

(d) Turn on the special relay M9193 in the test mode of the peripheral. *2

- When the function is normal, the "L RUN" LED is lit and "SD" and "RD" flicker.
  (Since "SD" and "RD" flicker fast, they appear as if they are lit.)
- When the function is abnormal, "SD" and "RD" are extinguished.
  (The "L RUN" LED goes off when M9193 is turned off.)



(e) To end the loopback self-check, turn off the special relay M9193 in the test mode of the peripheral.

(2) Action to be taken after end of loopback self-check

(a) When the function is normal, start simple inter-PLC link in the following procedure.

- Shut off the power of the A1FXCPU in all phases.
- Connect the A1FXCPU, FX_{0N} and FX_{2N} series modules by cables.
- Switch on the power of the A1FXCPU.
- When there is no link setting program written, move the RUN/STOP switch to the STOP position and write the link setting program from the peripheral to the A1FXCPU.
- When the RUN/STOP switch of the A1FXCPU is moved from STOP to RUN, simple inter-PLC link starts.
  (Simple inter-PLC link is also started by switching on the power of the A1FXCPU or by resetting the A1FXCPU by the RESET switch.)

(b) When the function is abnormal, the possible cause is an A1FXCPU hardware fault. Therefore, change the A1FXCPU.

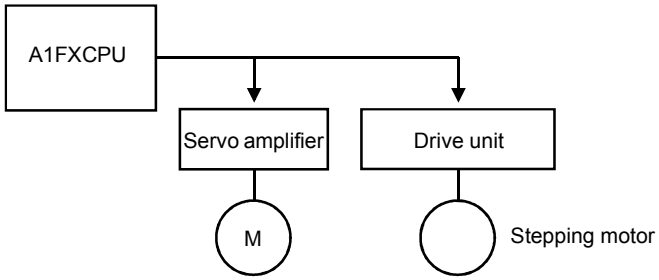
POINT

- *1: The loopback self-check may only be made when the A1FXCPU is in the STOP mode.
  When the A1FXCPU is in the RUN mode, the loopback self-check cannot be made if M9193 is turned on.
- *2: The loopback self-check may be performed if there is no link setting program written.

5.3 Simple positioning control function

(1) Simple positioning control function

One servo amplifier and one stepping motor driver may be connected to the A1FXCPU to exercise simple positioning control with max. 60kpps pulses output.



(2) Positioning data (refer to Section 5.3.4)

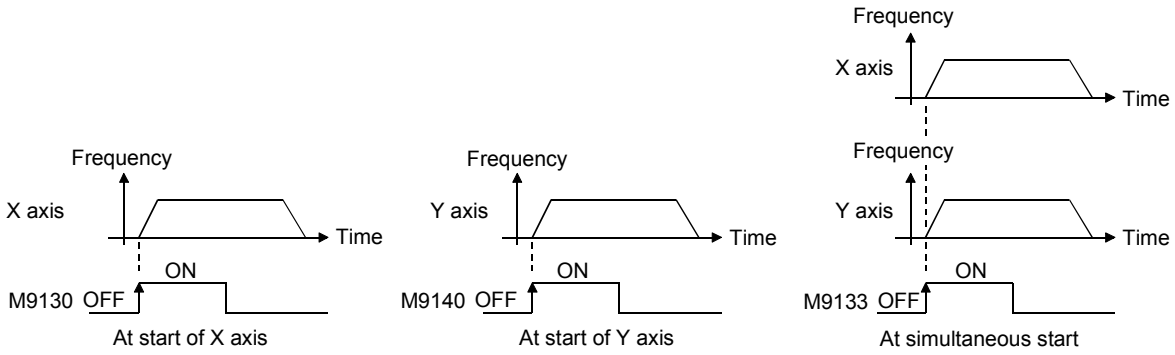
In simple positioning control, set the following positioning data to the special relays and special registers.

- Pulse output logic method (negative logic, positive logic)
- Pulse output method (CW/CCW, PULSE/SIGN)
- Start/stop frequency
- Running frequency
- Acceleration/deceleration time
- Number of output pulses
- Setup time when PULSE/SIGN method is selected

(3) Starting the simple positioning control (pulse output start, refer to Section 5.3.5)

In simple positioning control, the X and Y axes can be started independently or simultaneously.

However, linear interpolation of two axes cannot be made.



(4) Checking the simple positioning control (pulse output) status (refer to Section 5.3.6)

The simple positioning control status can be checked with the special relays.

The numbers of output pulses can also be checked with the special registers.

5.3.1 Instructions for the simple positioning control function

Observe the following instructions for executing simple positioning control.

(1) Use of simple positioning control must be specified

The simple positioning control outputs may be used in two different ways: "simple positioning control" and "general-purpose outputs".

To carry out simple positioning control, the following special relays must be turned on.

- M9128: Turned on when the X axis is used for simple positioning control.
- M9138: Turned on when the Y axis is used for simple positioning control.

When M9128 and M9138 are off, the outputs corresponding to the axes which are off act as general-purpose outputs. (Refer to Section 5.6.)

(2) Importing the positioning data

There are two types of simple positioning data: data which is made valid at the END processing of the preset scan; and data which is made valid at the start of positioning.

(3) Simple positioning control in incremental system

Simple positioning control is exercised in the incremental system where the number of output pulses (travel) is specified. (The number of output pulses can be set between 0 and 16777215 pulses.)

Specify the traveling direction by switching on/off the following special relays. (Refer to Section 5.3.5)

- M9129: For X axis
  OFF for forward rotation direction, ON for reverse rotation direction.
- M9139: For Y axis
  OFF for forward rotation direction, ON for reverse rotation direction.

(4) Address management

Because of the incremental system, simple positioning control manages addresses internally. (The number of output pulses provided after start of pulse output is stored in the present output pulse count storing special registers.)

When making address management as a system, the number of pulses (travel) in the present output pulse count storing special registers should be incremented or decremented in the sequence program to calculate the present value.

(5) Switching from RUN mode to STOP mode during positioning control

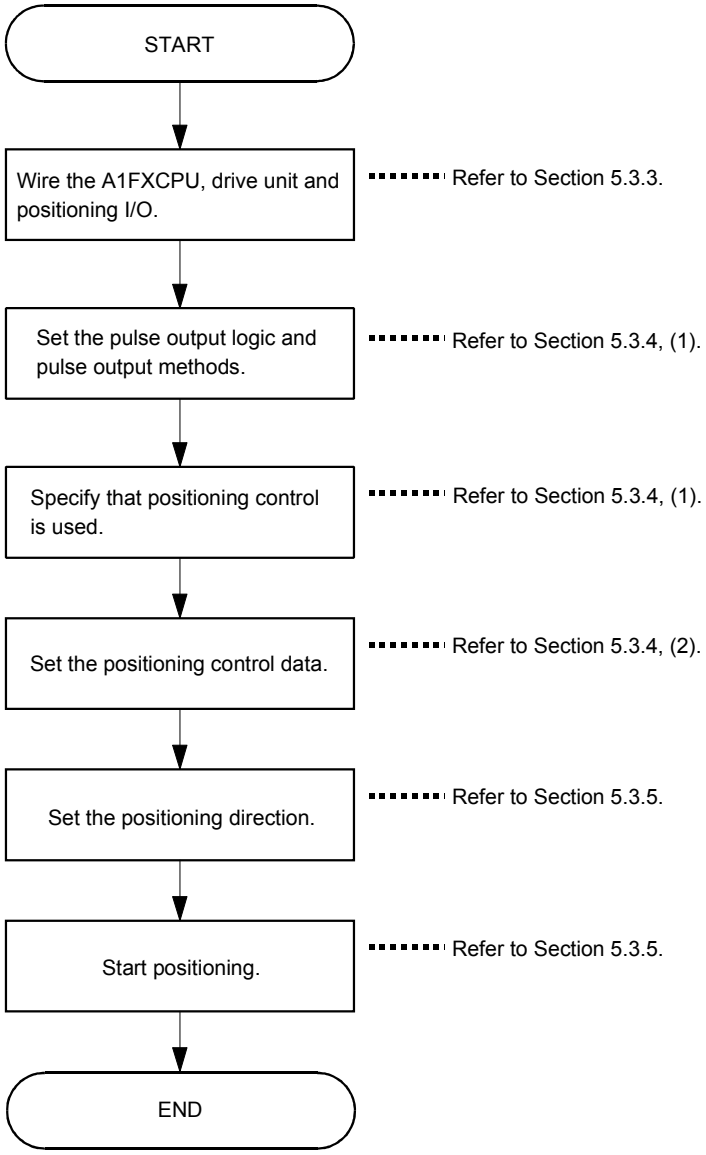
During pulse output, do not move the RUN/STOP switch to the "STOP" position. Doing so will cause the axes to decelerate to a stop.

(6) Zeroing

There is no zeroing function in simple positioning control.

5.3.2 Procedure for simple positioning control

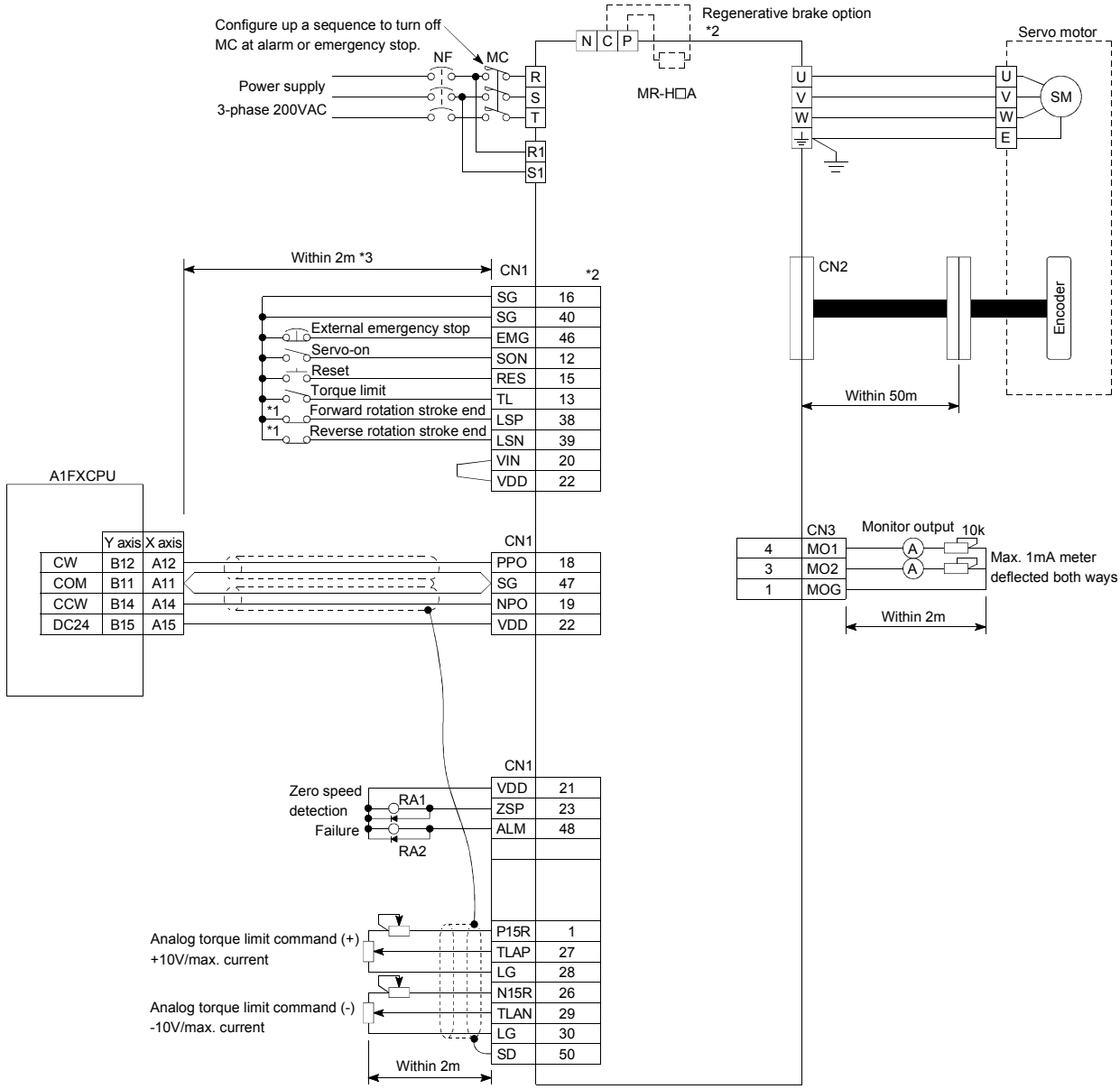
Use the following procedure to exercise simple positioning control.



5.3.3 Wiring for simple positioning control

The following diagrams show connection examples of the A1FXCPU for simple positioning.

(1) Example of connection with the MR-H□A



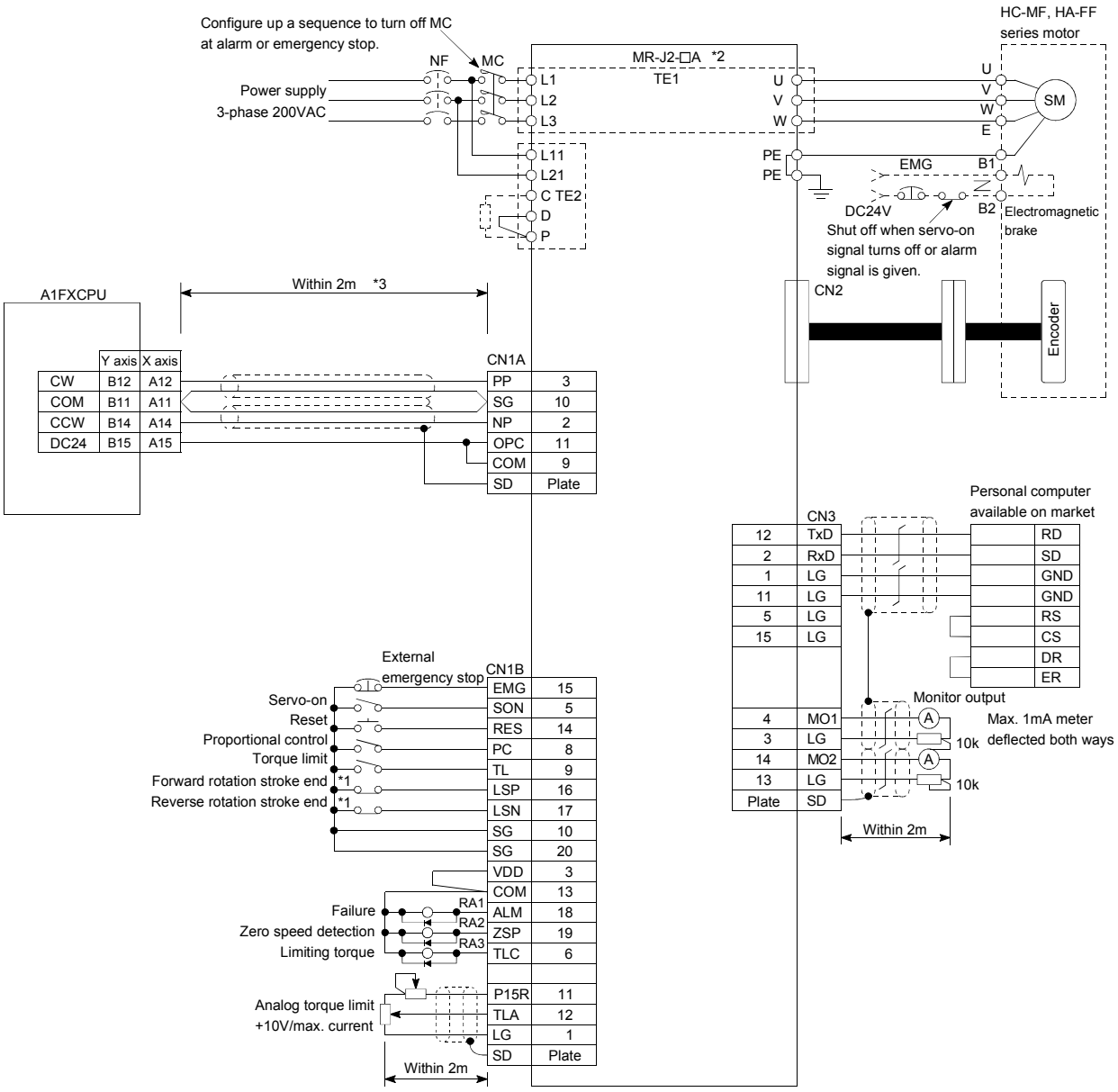
REMARKS

*1: Limit switch for servo (stop).

*2: For connection details, refer to the Specifications and Installation Guide of the MR-H servo amplifier.

*3: Indicates a distance between A1FXCPU and amplifier.

(2) Example of connection with the MR-J2□A



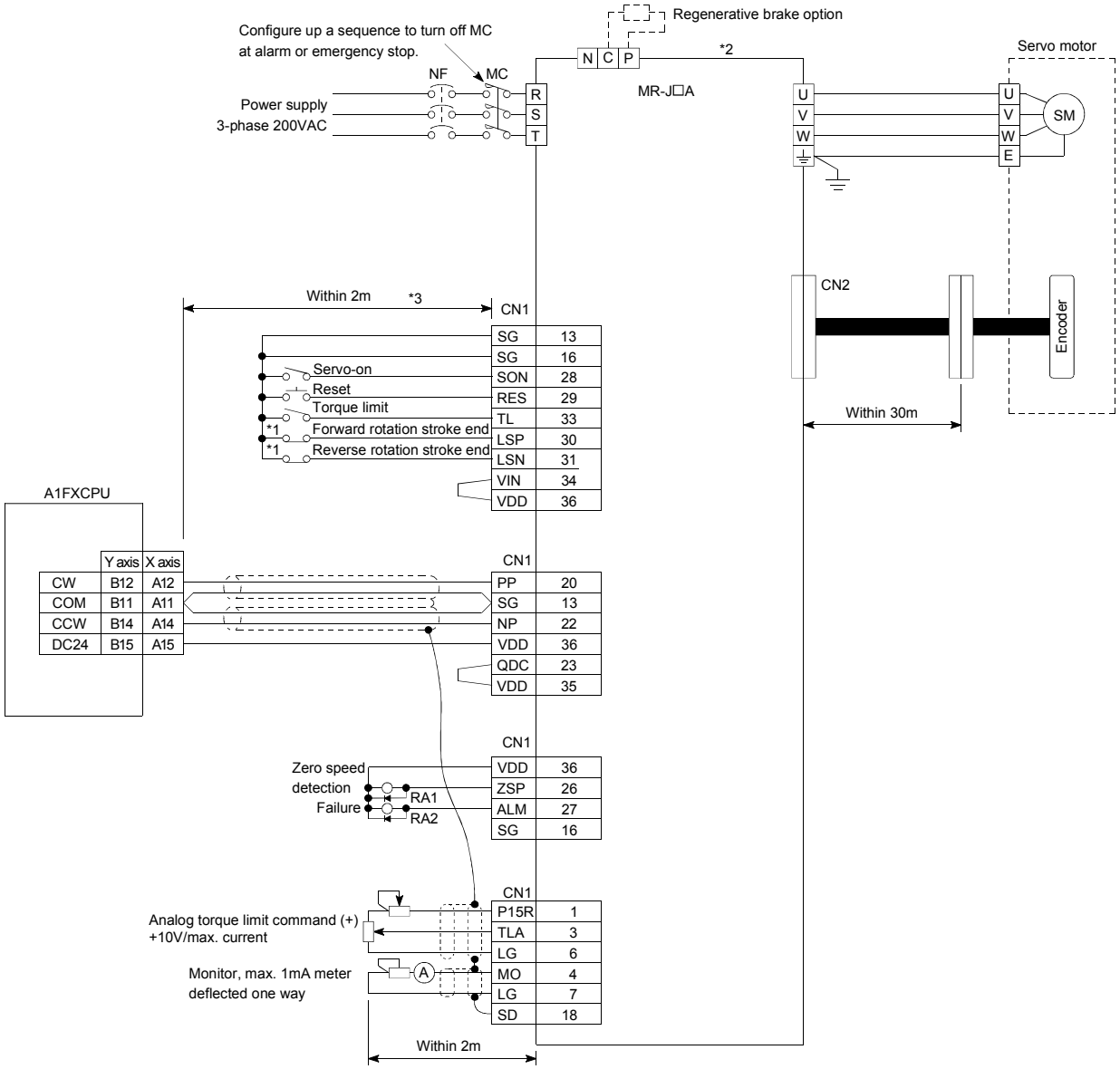
REMARKS

*1: Limit switch for servo (stop).

*2: For connection details, refer to the Specifications and Installation Guide of the MR-J2 servo amplifier.

*3: Indicates a distance between A1FXCPU and amplifier.

(3) Example of connection with the MR-J□A



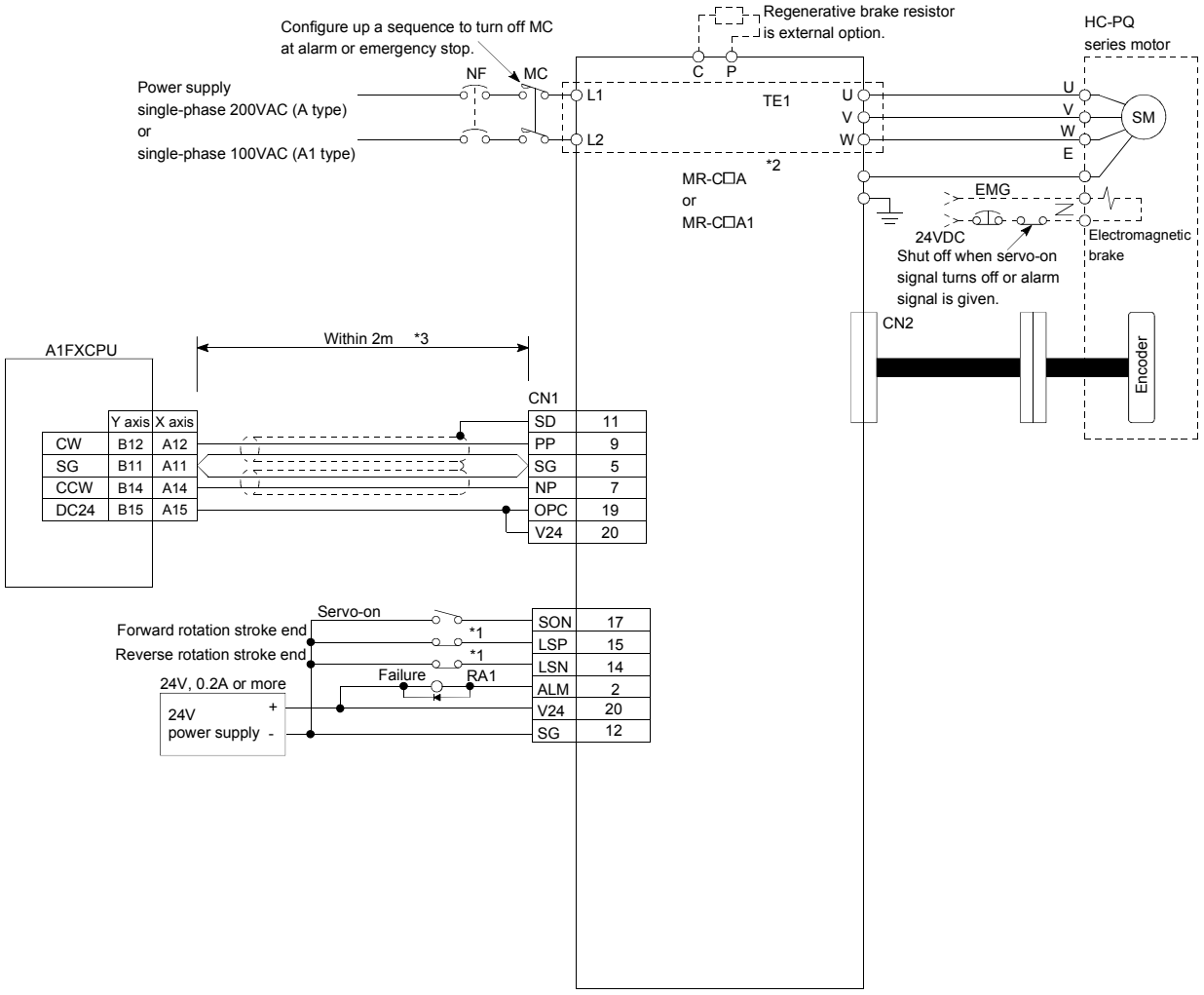
REMARKS

*1: Limit switch for servo (stop).

*2: For connection details, refer to the Specifications and Installation Guide of the MR-J servo amplifier.

*3: Indicates a distance between A1FXCPU and amplifier.

(4) Example of connection with the MR-C□A



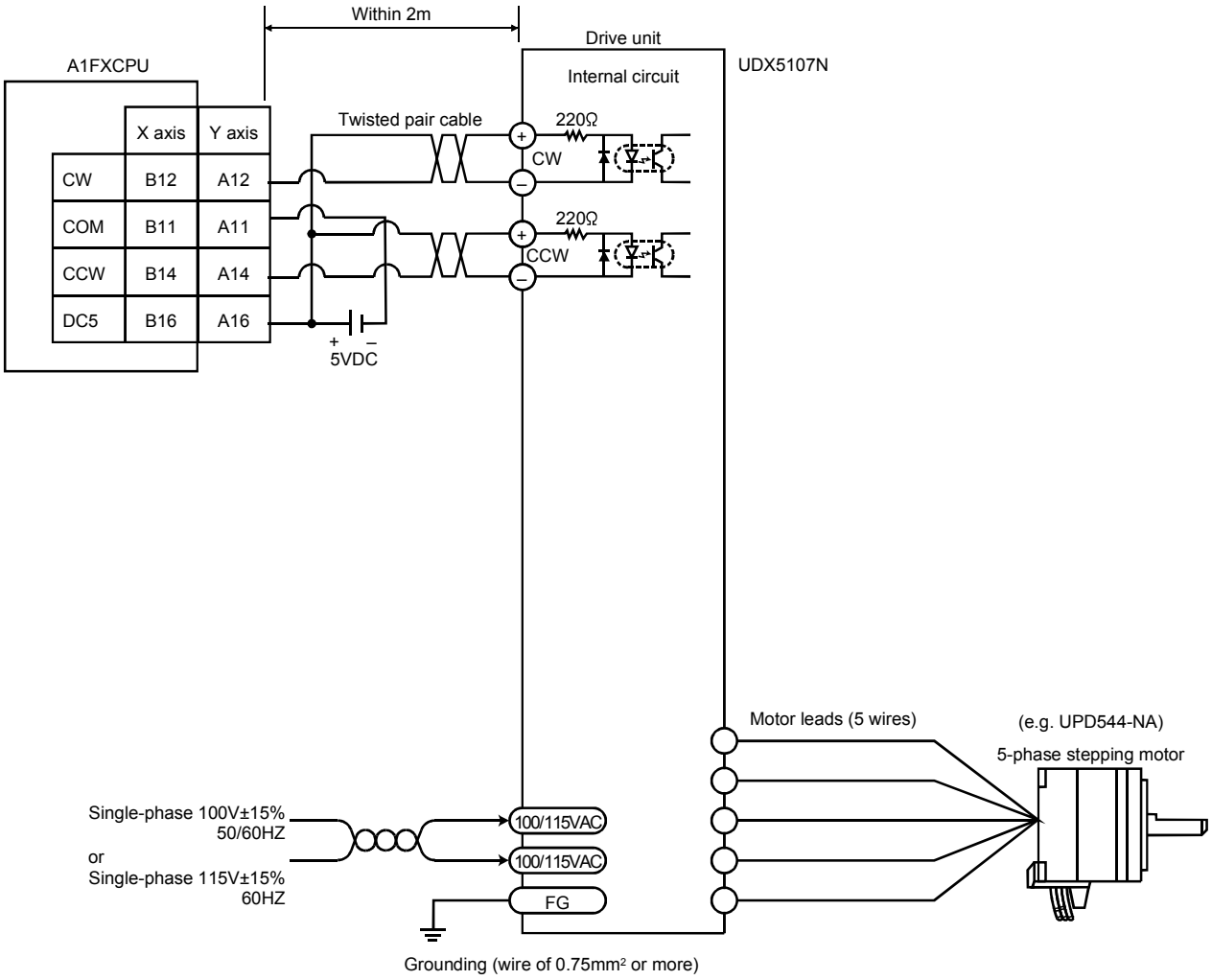
REMARKS

*1: Limit switch for servo (stop).

*2: For connection details, refer to the Specifications and Installation Guide of the MR-C servo amplifier.

*3: Indicates a distance between A1FXCPU and amplifier.

(5) Example of connection with stepping motor driver



5.3.4 Setting for simple positioning control (setting of positioning data)

Use the special relays and special registers to set the positioning data.

(1) Special relays for setting the positioning data

Special relays are used to set the pulse output logic and pulse output methods according to the servo amplifier and stepping driver connected.
They are also used to set whether simple positioning control is used or not.

Once set, these data are not changed during control. Hence, set the special relays at the first scan after power is switched on or the CPU is reset by the RESET switch.

Special relay settings are imported at the END processing of the preset scan.
Positioning cannot be started at the scan where special relays have been set.

Table 5.7 Special Relays for Setting the Positioning Data

Relevant Axis	Number	Name	Operation at ON/OFF		What Are Set		
			OFF	ON	Use of X axis	Use of Y axis	Use of simultaneous start
X axis	M9126	Pulse output logic switching	Negative logic	Positive logic	○	—	○
	M9127	Pulse output method	CW/ CCW	PULSE/ SIGN	○	—	○
	M9128	Whether simple positioning control is used or not	Not used	Used	○	—	○
Y axis	M9136	Pulse output logic switching	Negative logic	Positive logic	—	○	○
	M9137	Pulse output method	CW/ CCW	PULSE/ SIGN	—	○	○
	M9138	Whether simple positioning control is used or not	Not used	Used	—	○	○

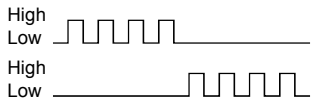
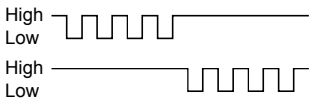
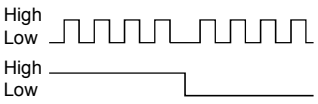
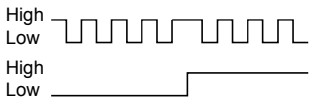
○ : Must be set. — : Need not be set.

(a) Pulse output logic switching (M9126/M9136)

1) Turn on when the drive unit uses positive logic.
2) Turn off when the drive unit uses negative logic.

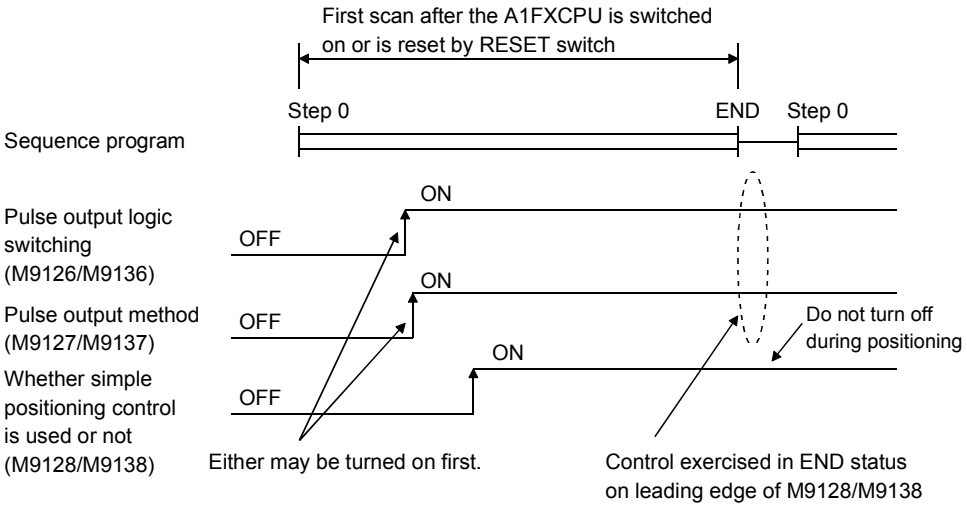
(b) Pulse output method switching (M9127/M9137)

1) Turn on when the drive unit uses PULSE/SIGN.
2) Turn off when the drive unit uses CW/CCW.
3) Relationships between pulse output switching and pulse outputs by pulse output switching setting are shown below.

Pulse Output Method	Positive Logic		Negative Logic	
	Forward rotation	Reverse rotation	Forward rotation	Reverse rotation
CW CCW				
PULSE SIGN				

(c) Whether simple positioning control is used or not (M9128/M9138)

1) Turn on when using the outputs (4 points) of the A1FXCPU for simple positioning since the "pulse output logic" and "pulse output method" when M9128/M9138 is turned from OFF to ON are made valid. When M9128/M9138 is off, the outputs serve as general-purpose outputs (transistor outputs: Y10 to Y13).
2) Set M9128/M9138 at the first scan after power is switched on or the CPU is reset by the RESET switch.
   Before turning on M9128/M9138, set the "pulse output logic" and "pulse output method".
3) When M9128/M9138 has been turned on to choose simple positioning control, do not turn M9128/M9138 off at any point during positioning.



(2) Special registers for setting the positioning data

Special registers are used to set the speeds, travels, etc. for positioning.
Set data to the special registers before outputting pulses by the pulse output start signal (M9130/M9140/M9133).

Table 5.8 indicates the special registers used for setting the positioning data.

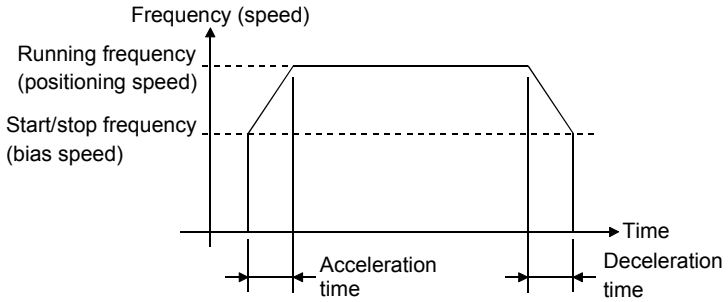
Table 5.8 Special Registers for Setting the Positioning Data

Relevant Axis	Number	Name	Unit	Default Value	Setting Range	What Are Set		
						Use of X axis	Use of Y axis	Use of simultaneous start
X axis	D9140	Start/stop frequency	Hz	0	0 to 60000	○	—	○
	D9141	Running frequency	Hz	1	1 to 60000	○	—	○
	D9142	Acceleration/deceleration time	ms	1	1 to 32767	○	—	○
	D9143 D9144	Number of output pulses	pulse	0	0 to 16777215	○	—	○
	D9150	Setup time when PULSE/SIGN method is selected	μs	1000	0 to 32767	Δ	—	Δ
Y axis	D9145	Start/stop frequency	Hz	0	0 to 60000	—	○	○
	D9146	Running frequency	Hz	1	1 to 60000	—	○	○
	D9147	Acceleration/deceleration time	ms	1	1 to 32767	—	○	○
	D9148 D9149	Number of output pulses	pulse	0	0 to 16777215	—	○	○
	D9151	Setup time when PULSE/SIGN method is selected	μs	1000	0 to 32767	—	Δ	Δ

○: Must be set. —: Need not be set.
Δ: Must be set only when PULSE/SIGN method is chosen

REMARKS

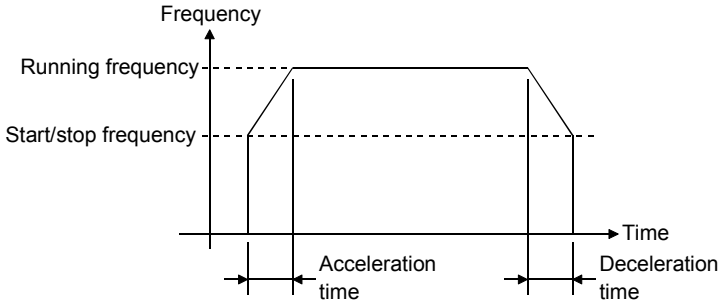
1) The following diagram shows the relationships between start/stop frequency, running frequency and acceleration/deceleration time set in Table 5.8.
The terms within parentheses are used for the A series positioning modules.



2) The number of output pulses in Table 5.8 is the "positioning address/travel" when used for the MELSEC-A series positioning modules.

(a) Start/stop frequency (D9140/D9145)

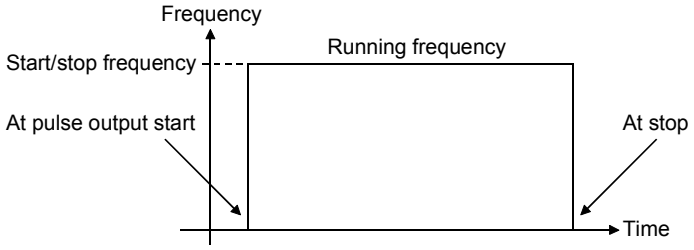
1) Set the frequency used when pulse output is started and stopped.
Speed is increased/decreased from/to the specified start/stop frequency to/from the running frequency.



2) Set the start/stop frequency within the 0 to 60000Hz range to the value with which the following condition is satisfied.

(Start/stop frequency) ≦ (running frequency)

3) When the start/stop frequency and running frequency are the same, the preset acceleration/deceleration time is ignored and the following operation is performed.



4) The preset start/stop frequency is made valid in the END processing of the scan where the pulse output start signal (M9130, M9133, M9140) switches from OFF to ON.

(b) Running frequency (D9141/D9146)

1) Set the frequency used when simple positioning is performed.
2) Set the running frequency within the 1 to 60000Hz range to the value with which the following condition is satisfied.

(Start/stop frequency) ≦ (running frequency)

3) The preset running frequency is made valid in the END processing of the scan where the pulse output start signal (M9130, M9133, M9140) switches from OFF to ON.

REMARKS

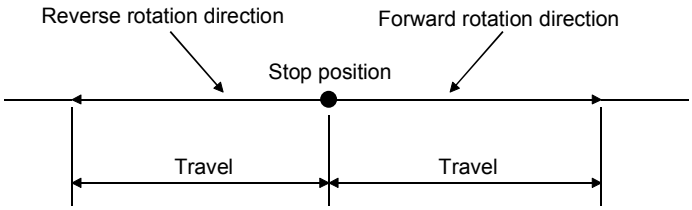
1) The 16-bit data of the MELSEC-A series is signed and represented as -32768 to 32767.
Hence, any value greater than 32768 cannot be set in decimal.
When setting the start/stop frequency and running frequency of 32768Hz or higher from the peripheral, convert 32768 to 60000Hz into hexadecimal numbers before setting.
For example, set 32768 as 8000H and 60000 as EA60H.

(c) Acceleration/deceleration time (D9142/D9147)

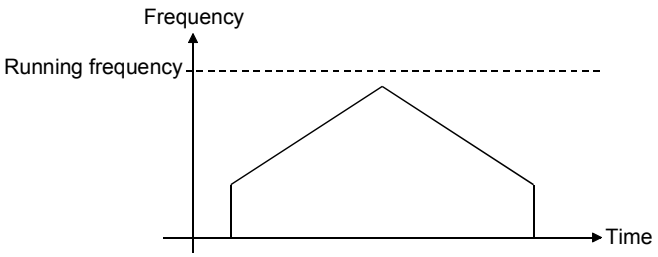
1) Set the time required to reach the running frequency from pulse output start (acceleration time) and the time required to make a stop from the running frequency (deceleration time).
   The acceleration time and deceleration time are the same value.
2) The preset acceleration/deceleration time is made valid in the END processing of the scan where the pulse output start signal (M9130, M9133, M9140) switches from OFF to ON.

(d) Number of output pulses (D9143, D9144/D9148, D9149)

1) Set the travel for simple positioning.
2) Set any of 0 to 16777215 as the number of output pulses.
   Use the rotation direction switching register (M9129/M9139) to change the moving direction.
   Setting of 0 provides no pulse output and resets the present output pulse count storing special registers (D9136, D9137/D9138, D9139) to 0 to terminate simple positioning.



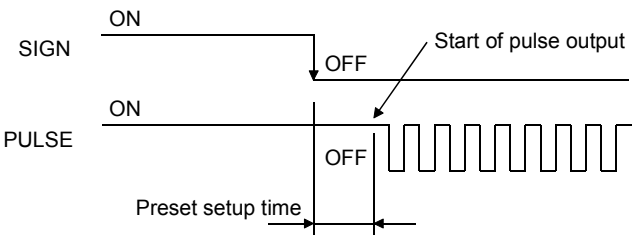
3) If the number of output pulses set is too small to reach the running frequency, the operation as shown below is performed.



4) The output of the preset number of pulses is started in the END processing of the scan where the pulse output start signal (M9130, M9133, M9140) switches from OFF to ON.

(e) Setup time when PULSE/SIGN method is chosen (D9150/D9151)

1) Set the time from when the SIGN signal is switched until pulse output from the A1FXCPU is made valid in the drive unit.
   When the pulse output method is CW/CCW, the setup time setting is invalid.



5.3.5 Pulse output starting (positioning starting) and stopping signals

Use the special relays in Table 5.9 to start and stop pulse outputs.

Table 5.9 Special Relays Used to Start and Stop Pulse Outputs

Relevant Axis	Number	Name	Operation at ON/OFF			Validity of ON/OFF		
			ON	OFF→ON	OFF	Use of X axis	Use of Y axis	Use of simultaneous start
X axis	M9129	Rotation direction switching	Forward rotation	—	Reverse rotation	○	—	○
	M9130	Pulse output start signal	No processing	Pulse output start	No processing	○	—	—
	M9131	Deceleration to stop	No processing	Deceleration to stop	Stop	○	—	○*2
	M9132	Forced stop	No processing	Immediate stop	Stop	○	—	○*2
X, Y axes (Simultaneous)	M9133	Pulse output start signal	No processing	Pulse output start	No processing	—	—	○
	M9134	Deceleration to stop	No processing	Deceleration to stop	Stop	○*1	○*1	○
	M9135	Forced stop	No processing	Immediate stop	Stop	○*1	○*1	○
Y axis	M9139	Rotation direction switching	Forward rotation	—	Reverse rotation	—	○	○
	M9140	Pulse output start signal	No processing	Pulse output start	No processing	—	○	—
	M9141	Deceleration to stop	No processing	Deceleration to stop	Stop	—	○	○*3
	M9142	Forced stop	No processing	Immediate stop	Stop	—	○	○*3

○ : Valid — : Invalid

REMARKS

1) *1: Decelerates the X/Y axis to a stop or forces it to stop.

2) *2: Decelerates the X axis to a stop or forces it to stop.

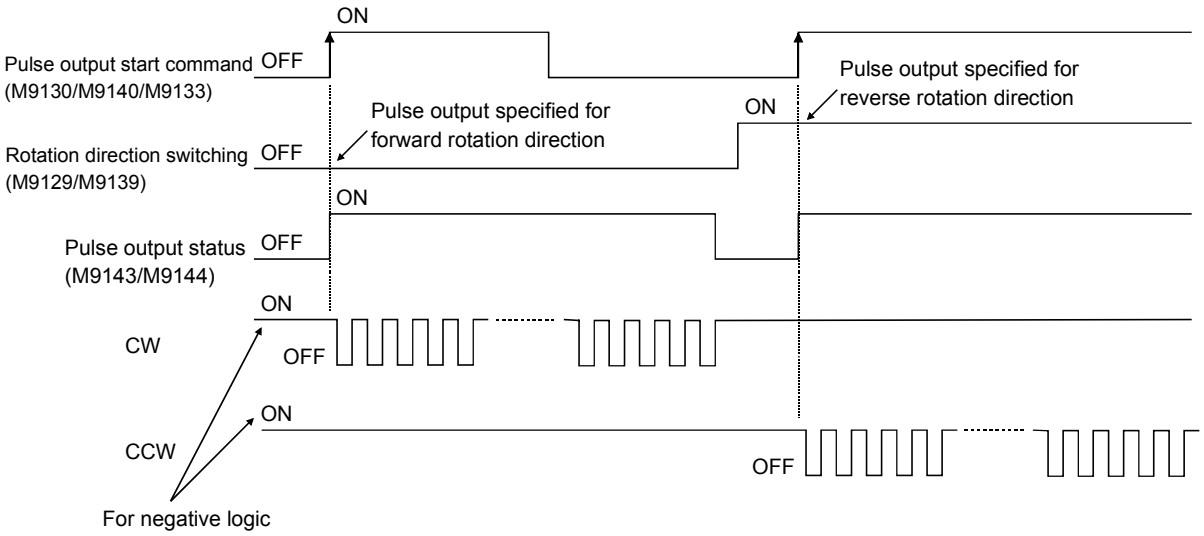
3) *3: Decelerates the Y axis to a stop or forces it to stop.

(1) Rotation direction switching (M9129/M9139)

(a) Turn on when positioning the axis in the reverse rotation direction.
Turn off when positioning the axis in the forward rotation direction.

Rotation Direction Switching	Relevant Axis	Pulse Output Direction	
		Forward rotation direction	Reverse rotation direction
M9129	X axis	OFF	ON
M9139	Y axis	OFF	ON

(b) Since the rotation direction switching command is made valid on the leading edge (OFF to ON) of the pulse output start signal (M9130, M9140, M9133), the rotation direction can be changed per positioning control.



REMARKS

1) For details of the pulse output status (M9143/M9144), refer to Section 5.3.6.

(2) Pulse output start signal (M9130/M9140/M9133)

(a) Turn on when starting positioning.

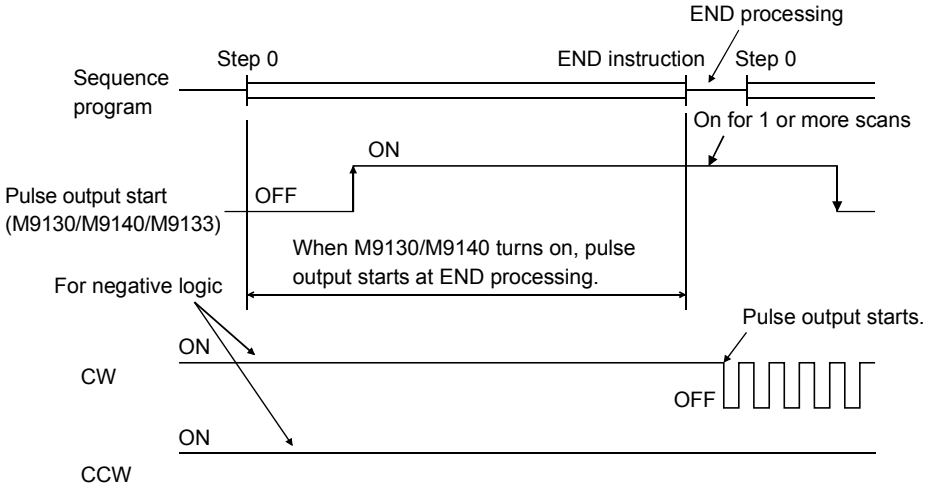
(b) Pulse output is provided in the END processing of the scan where M9130/M9140/M9133 is turned on.
M9130/M9140/M9133 should be switched on for 1 or more scans of the sequence program.
Positioning is not performed when M9130/M9140/M9133 is off in END processing.

POINT

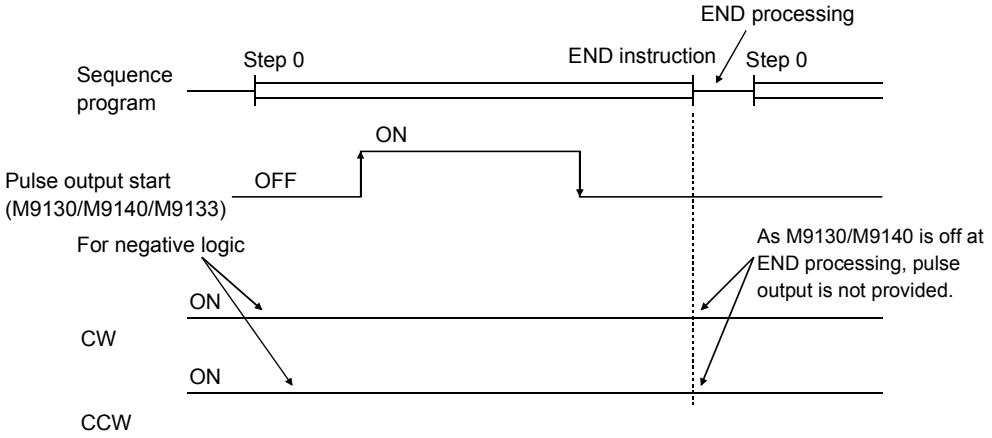
(1) To minimize the influence of the sequence program scan time on the delay time at the start of the pulse output, turn on M9130/M9140/M9133 near the END instruction.

(2) If executing a COM instruction of a link refresh soon after turning the M9130/M9140/M9133 on, a pulse processing is performed by the COM instruction. M9143/M9144 signals, which tell the pulse status (refer to Section 5.3.6), are turned on with the COM instruction execution.

[Processing performed when M9130/M9140/M9133 is turned on]



[Processing performed when M9130/M9140/M9133 is turned off during 1 scan]

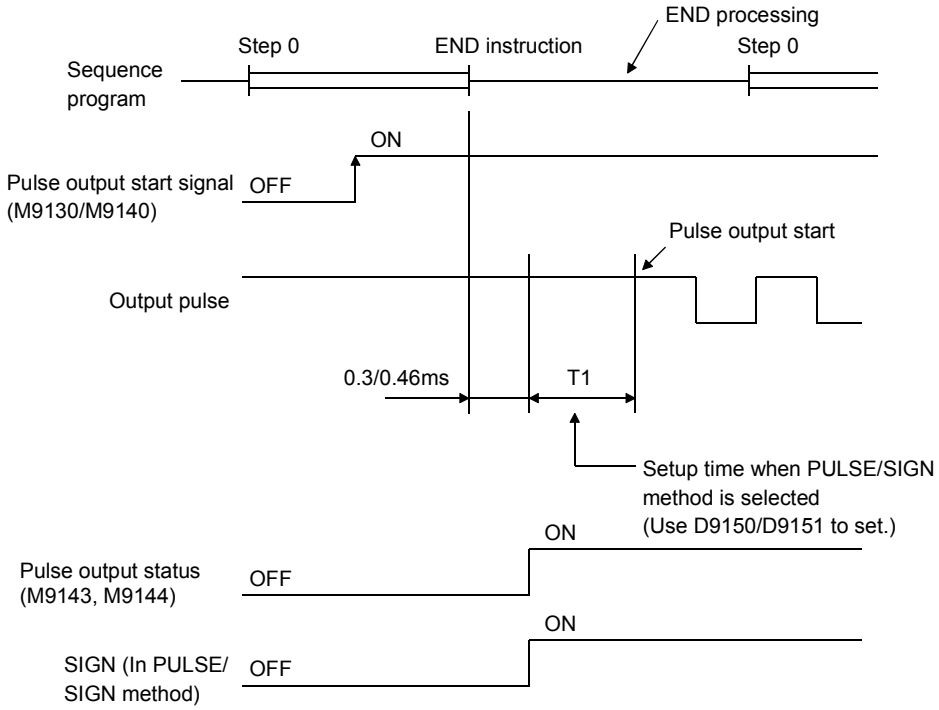


(c) Pulse output is not provided if the pulse output start signal is turned from off to on while the stop signal is on.
No processing is performed when the pulse output start signal is turned from off to on during pulse output.

(d) Start time
The following formulas indicate times required from when the rise of the pulse output start signal (M9130/M9140/M9133) is accepted at END processing until when pulse output is provided.

(X/Y axis start time) = 0.30 + T1 (s)
(Simultaneous X and Y axis start time) = 0.46 + T1 (s)

Operation performed up to pulse output is shown below.

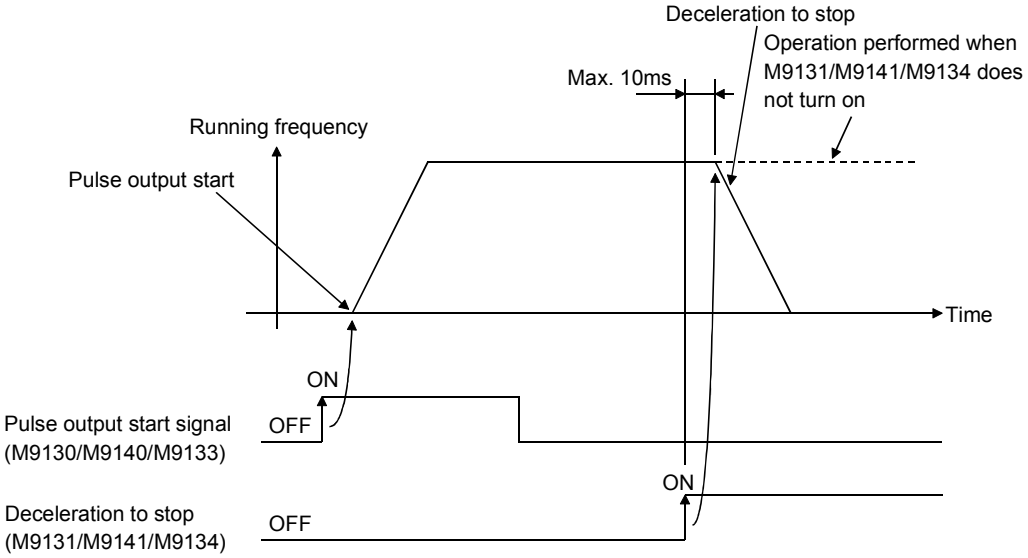


(3) Deceleration to stop (M9131/M9141/M9134)

(a) Turn on when decelerating the axis being positioned to a stop.

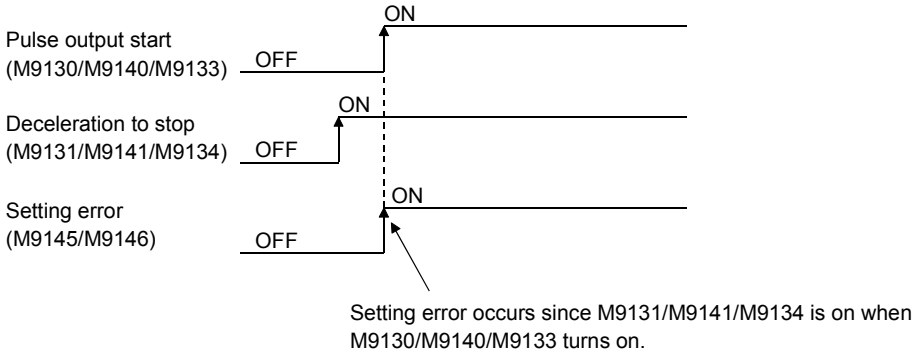
- M9131: Deceleration of the X axis to a stop
- M9141: Deceleration of the Y axis to a stop
- M9134: Simultaneous deceleration of the X and Y axes to a stop

(b) There is a maximum of 10ms delay between when M9131/M9141/M9134 turns on and when the corresponding axis (axes) starts (start) decelerating.



(c) While M9131/M9141/M9134 is on, pulse output is not provided if the pulse output start signal (M9130/M9140/M9133) is turned from off to on.
At this time, a setting error occurs and M9145/M9146 turns on. (Refer to Section 5.3.7.)

- M9145: X axis
- M9146: Y axis

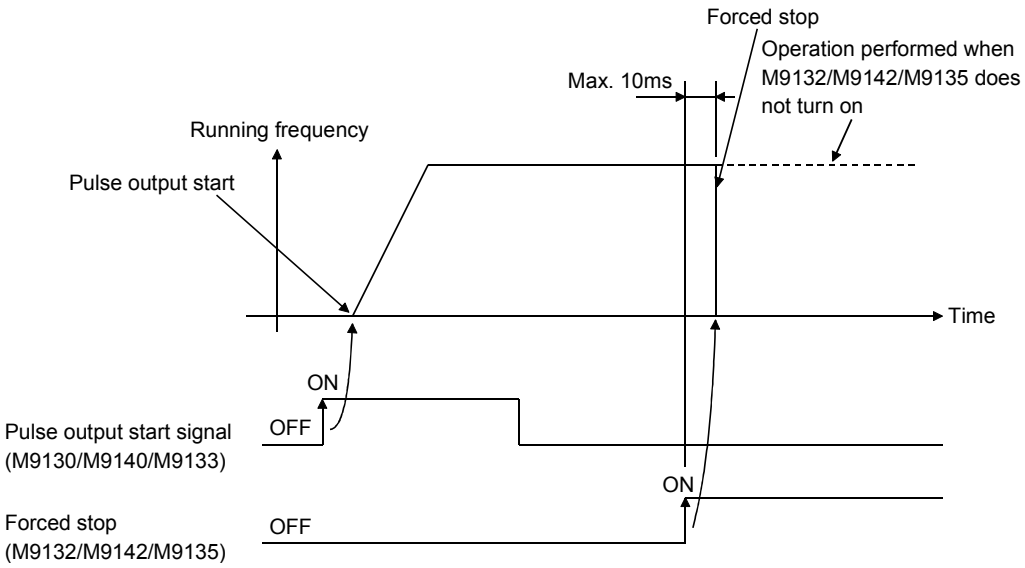


(4) Forced stop (M9132/M9142/M9135)

(a) Turn on when forcing the axis being positioned to stop.

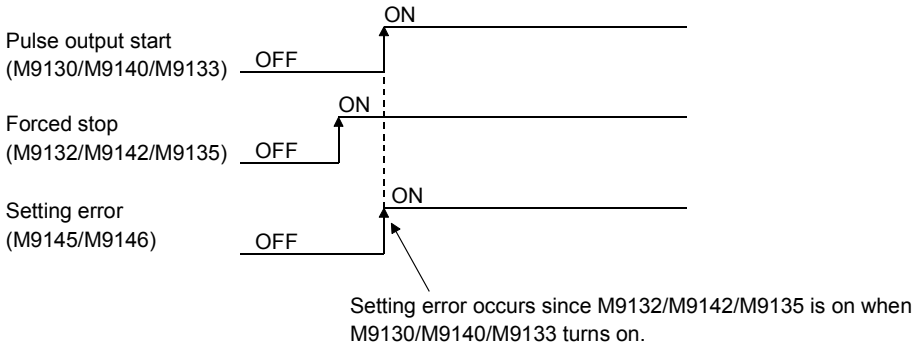
- M9132: Forced stop of the X axis
- M9142: Forced stop of the Y axis
- M9135: Simultaneous forced stop of the X and Y axes

(b) There is a maximum of 10ms delay between when M9132/M9142/M9135 turns on and when the corresponding axis (axes) stops (stop).
When the forced stop is turned on, the axis stops in units of 1 pulse.
For example, when the forced stop is turned from off to on at Low level in negative logic, the axis stops after 1 pulse has fully been output.
When the forced stop is turned from off to on at High level in negative logic, the axis stops immediately.



(c) While M9132/M9142/M9135 is on, pulse output is not provided if the pulse output start signal (M9130/M9140/M9133) is turned on.
At this time, a setting error occurs and M9145/M9146 turns on. (Refer to Section 5.3.7.)

- M9145: X axis
- M9146: Y axis



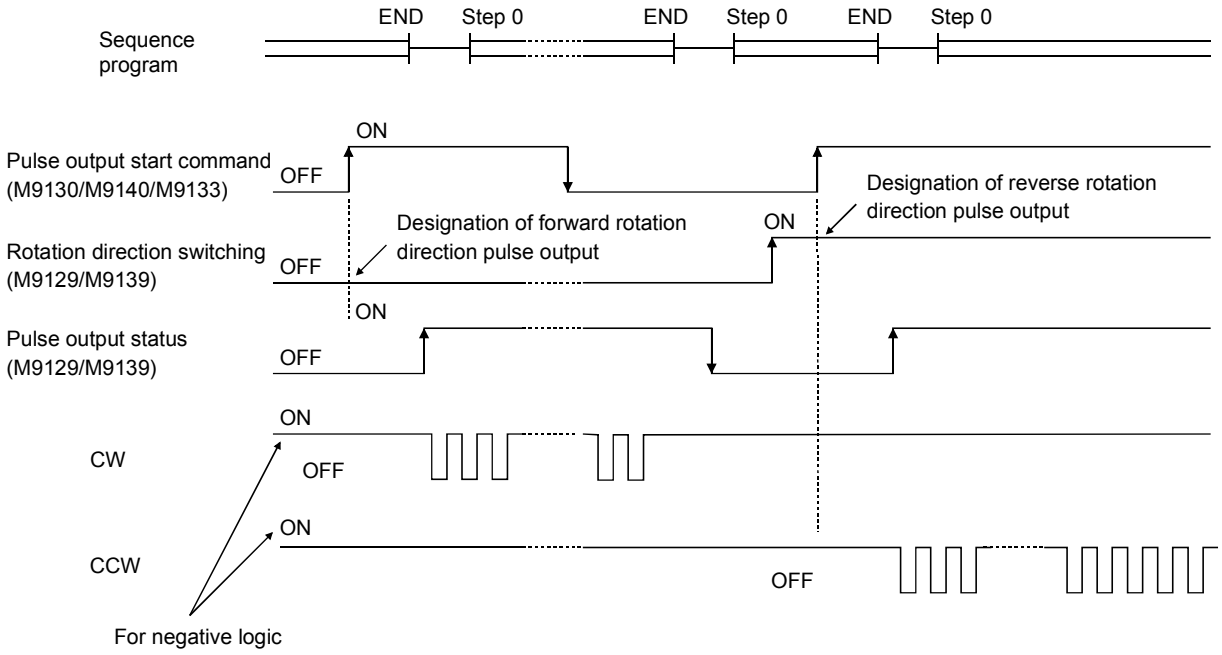
5.3.6 Confirming the positioning statuses

In simple positioning, the "pulse output status" and "number of output pulses" can be confirmed.

(1) Pulse output status

(a) The pulse output status can be confirmed by checking whether the special relay (M9143/M9144) is on or off.

Relevant Axis	Number	Name	Description
X axis	M9143	Pulse output status	OFF : Pulse output stop ON : During pulse output
Y axis	M9144		



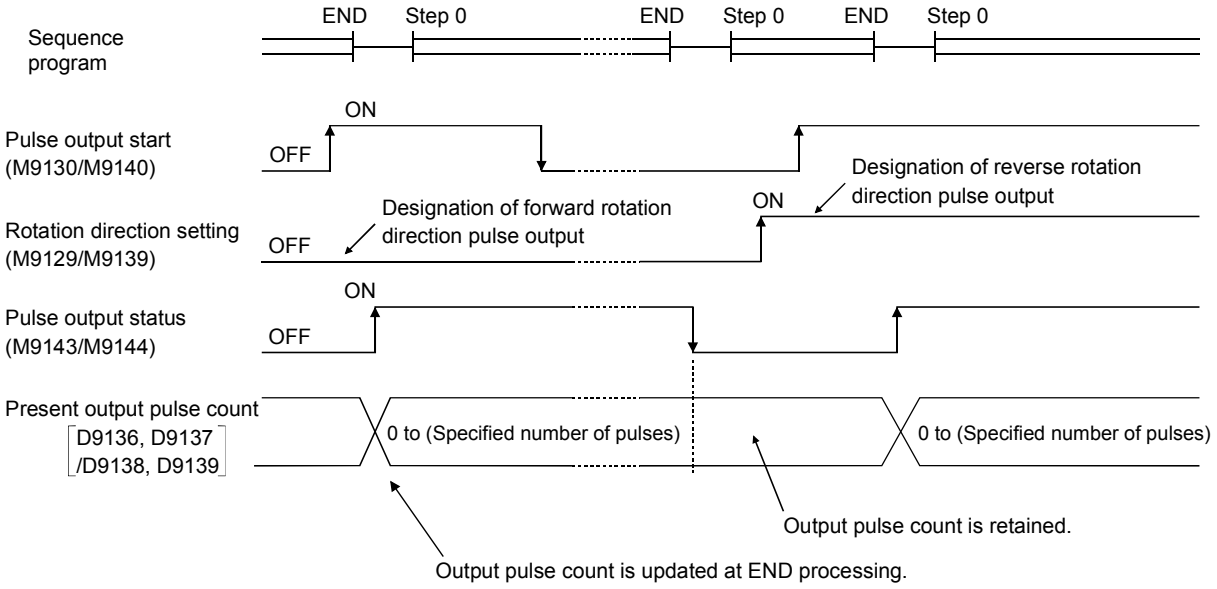
(b) The pulse output start signal (M9130/M9140/M9133) should be turned from off to on when M9143/M9144 is off.

Axis Relevant to Pulse Output	Pulse Output Start Signal	ON Condition of Pulse Start Signal	
		M9143	M9144
X axis	M9130	OFF	OFF/ON
Y axis	M9140	OFF/ON	OFF
X, Y axes (simultaneous start)	M9133	OFF	OFF

(2) Present output pulse count

The number of pulses output after the pulse output start signal has been turned on can be confirmed by checking the special registers (D9136 to D9139).

Relevant Axis	Number	Name		Description
X axis	D9136	Present output pulse count	Lower 16 bits	• Store the number of pulses output after the pulse output start signal has been turned on. • The output pulse count is updated at END processing. • Write by the user is inhibited.
	D9137		Upper 8 bits	
Y axis	D9138	Present output pulse count	Lower 16 bits	
	D9139		Upper 8 bits	



5.3.7 Checking for errors in simple positioning control

This section describes errors which are detected when simple positioning is performed by the A1FXCPU.

(1) Errors

Pulse output is provided when no error is found by an error check made at the END processing of the scan where the simple positioning pulse output start signal (M9130/M9140/M9133) is turned on. Pulse output is not provided when an setting error occurs since.

- The specified positioning data is outside the setting range
- Start/stop frequency > running frequency
- For X axis start
  - M9130 was turned on when M9128 was off
  - M9130 was turned on while any of M9131, M9132, M9134 and M9135 was on
- For Y axis start
  - M9140 was turned on when M9138 was off
  - M9140 was turned on while any of M9141, M9142, M9134 and M9135 was on
- For simultaneous start
  - M9133 was turned on when M9128 and M9138 were not on
- M9133 was turned on while any of M9131, M9132, M9134, M9135, M9141 and M9142 was on

(2) Error check

M9145/M9146 turns on if an error exists when the pulse output start signal is turned on for simple positioning.

- M9145: X axis
- M9146: Y axis

REMARKS

The following special relays are used for error check. For details, refer to Section 5.3.4.

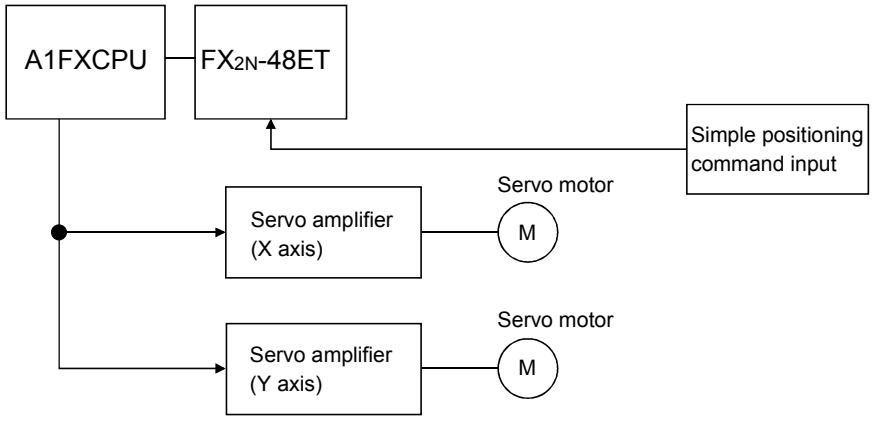
Relevant Axis	Number	Name
X axis	M9128	Simple positioning control use
	M9130	Pulse output start
	M9131	Deceleration to stop
	M9132	Forced stop
X, Y axes	M9133	Pulse output start
	M9134	Deceleration to stop
	M9135	Forced stop
Y axis	M9138	Simple positioning control use
	M9140	Pulse output start
	M9141	Deceleration to stop
	M9142	Forced stop

5.3.8 Program examples

Program examples for simple positioning are given below.

(1) System configuration

(a) The system configuration used for program examples is shown below.

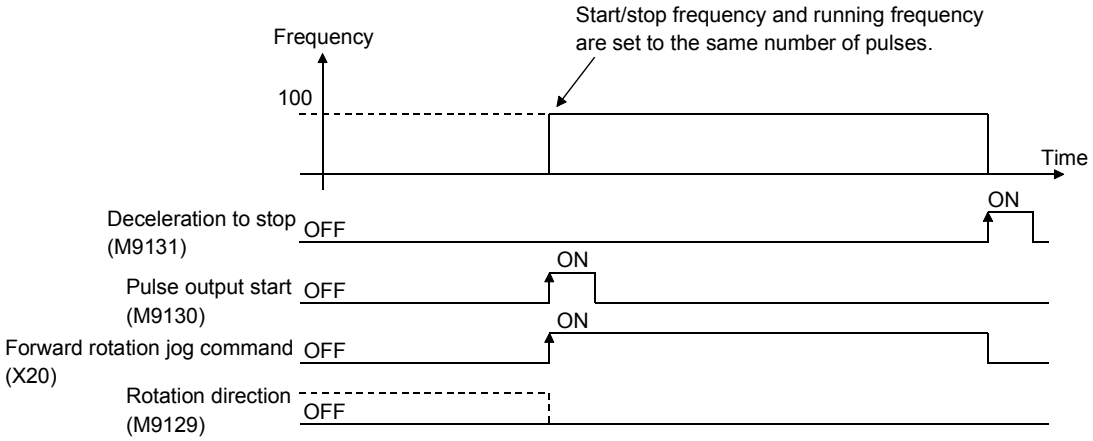


(2) X-axis jog operation program

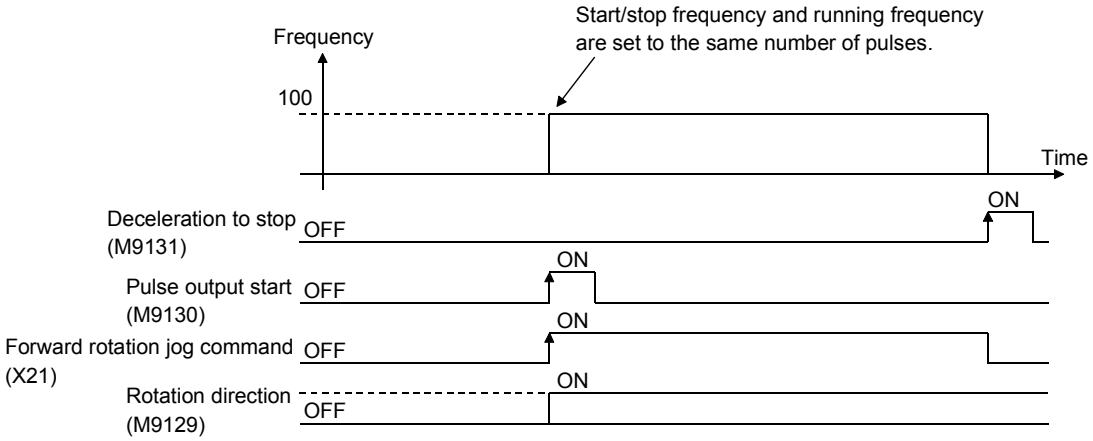
(a) Motions in jog operation

- While the forward rotation jog command (X20) is on, the axis is positioned in the forward direction and stops when the forward rotation jog command switches off.
- While the reverse rotation jog command (X21) is on, the axis is positioned in the reverse direction and stops when the reverse rotation jog command switches off.
- When the forward/reverse rotation jog command does not switch on, the axis stops after 16777215 pulses are output.

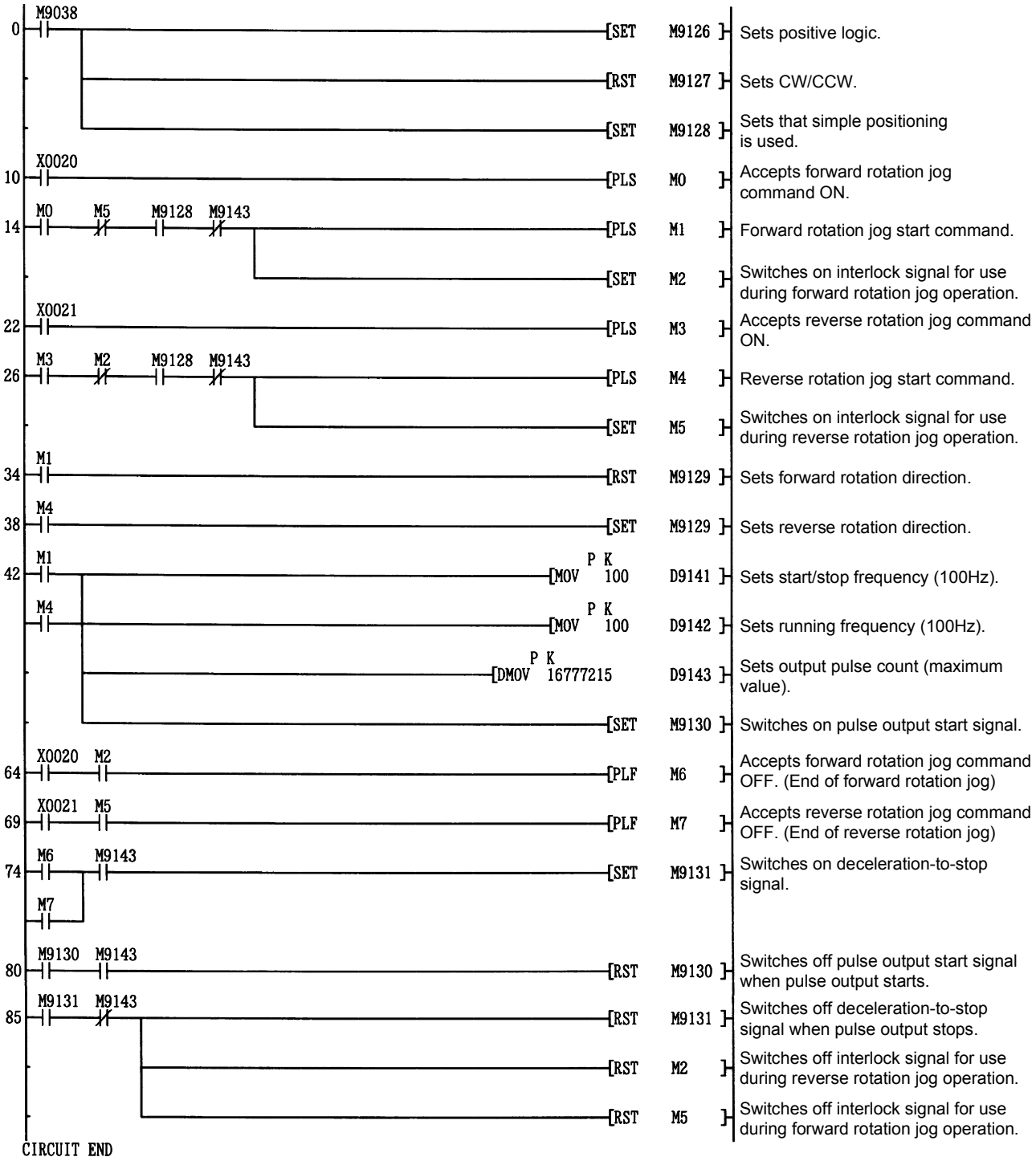
[Forward rotation jog operation]



[Reverse rotation jog operation]



(b) Jog operation program



(3) X-axis simple positioning program

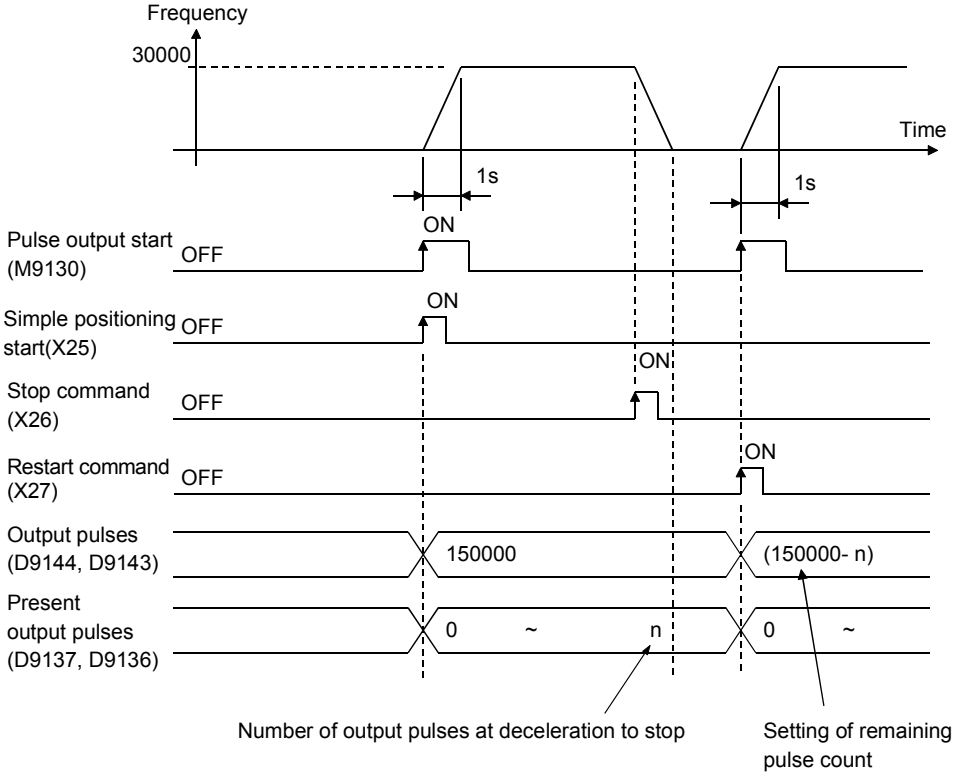
(a) Motions in simple positioning

- Pulse output starts when simple positioning start (X25) is turned on.
  At this time, the rotation direction is set by rotation direction setting (ON/OFF of X24).
  - X24 OFF: Forward rotation direction
  - X24 ON : Reverse rotation direction

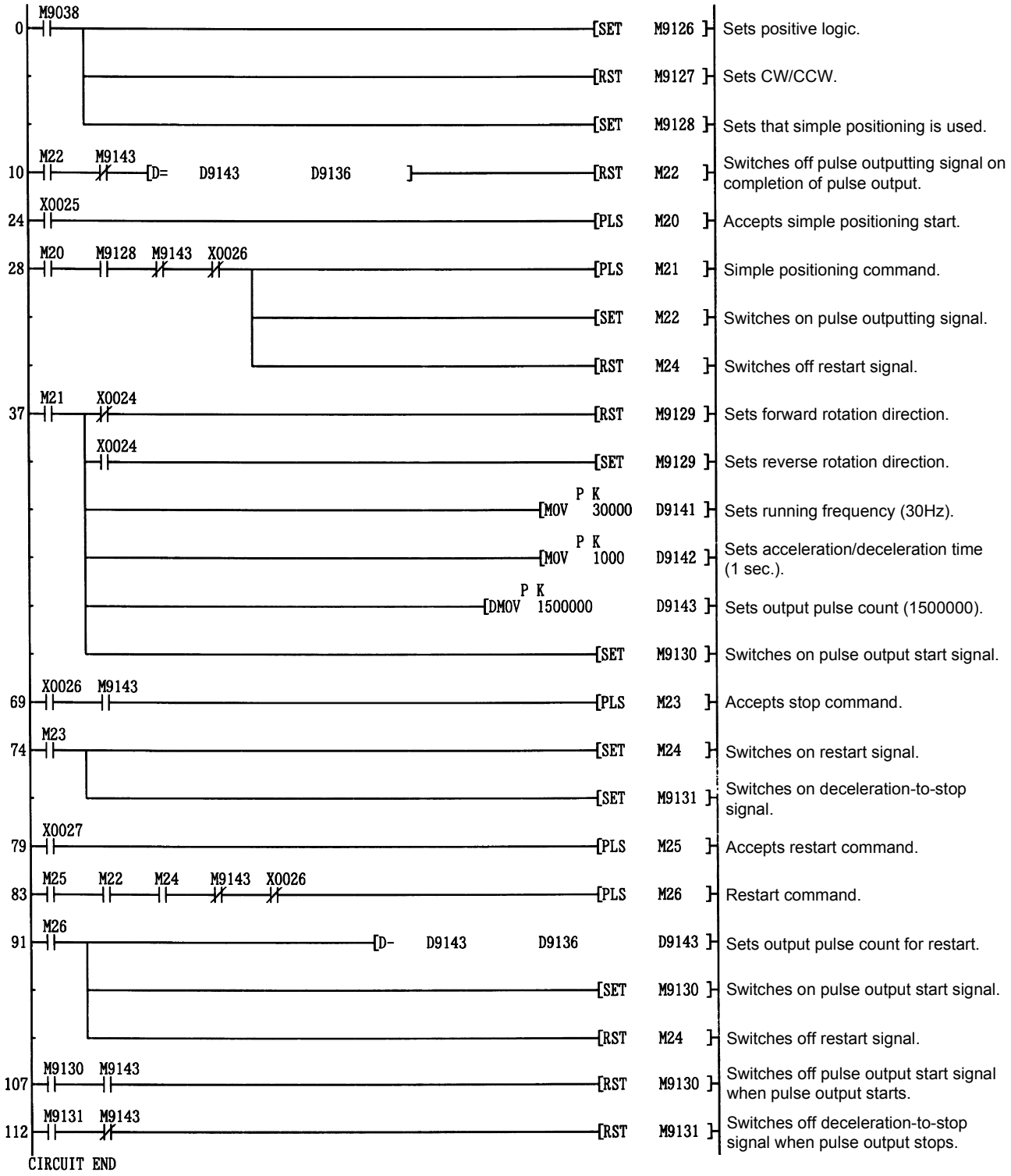
- The axis is decelerated to a stop when the stop command (X26) is turned on during pulse output.

- When the restart command (X27) is turned on after deceleration to stop, the axis is restarted from the stop position (output of remaining pulses).

- When simple positioning start (X25) is turned on after deceleration to stop, the specified number of pulses are output to the axis at the stop position.



(b) Program example



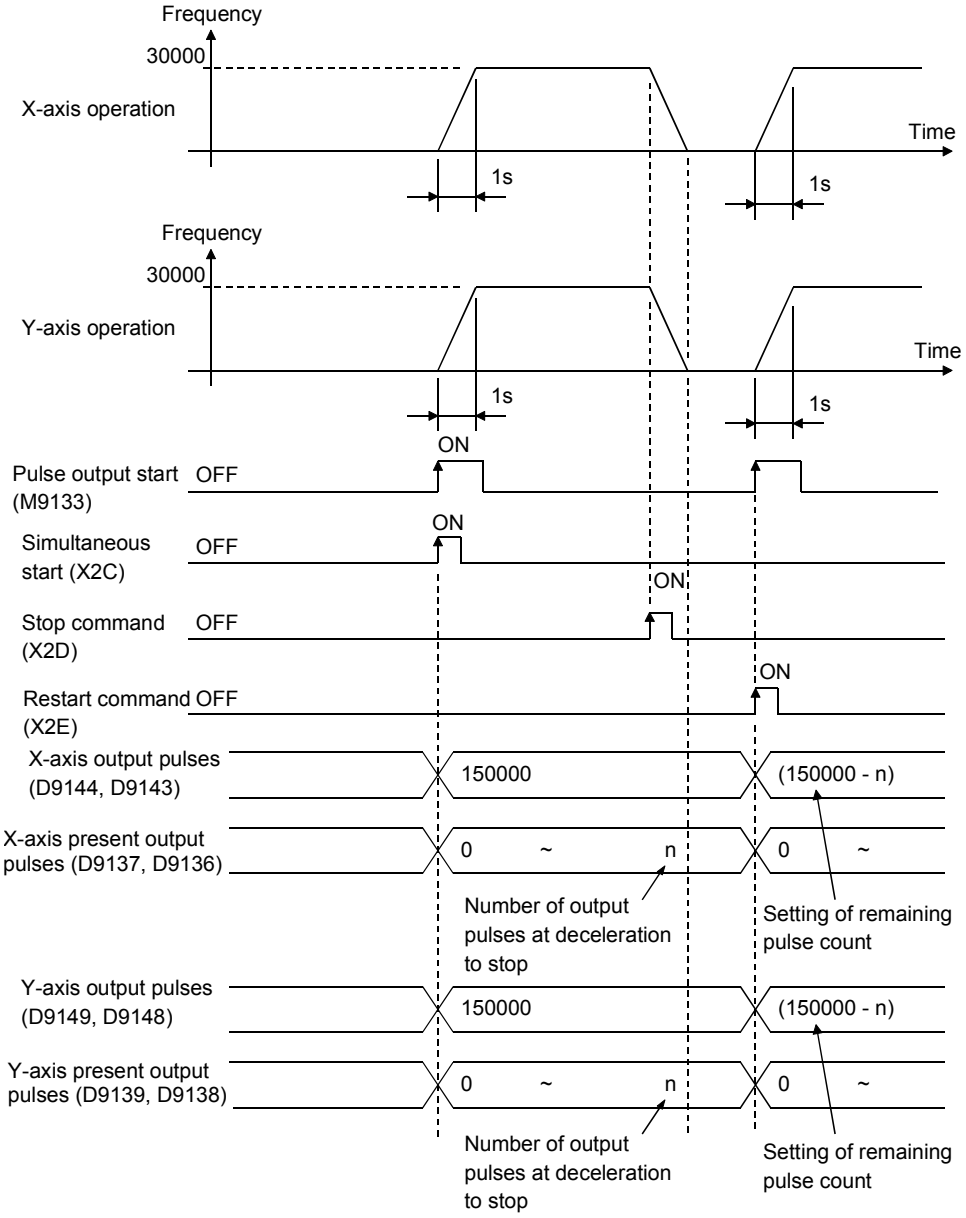
(4) Simultaneous start program

(a) Motions in simultaneous start

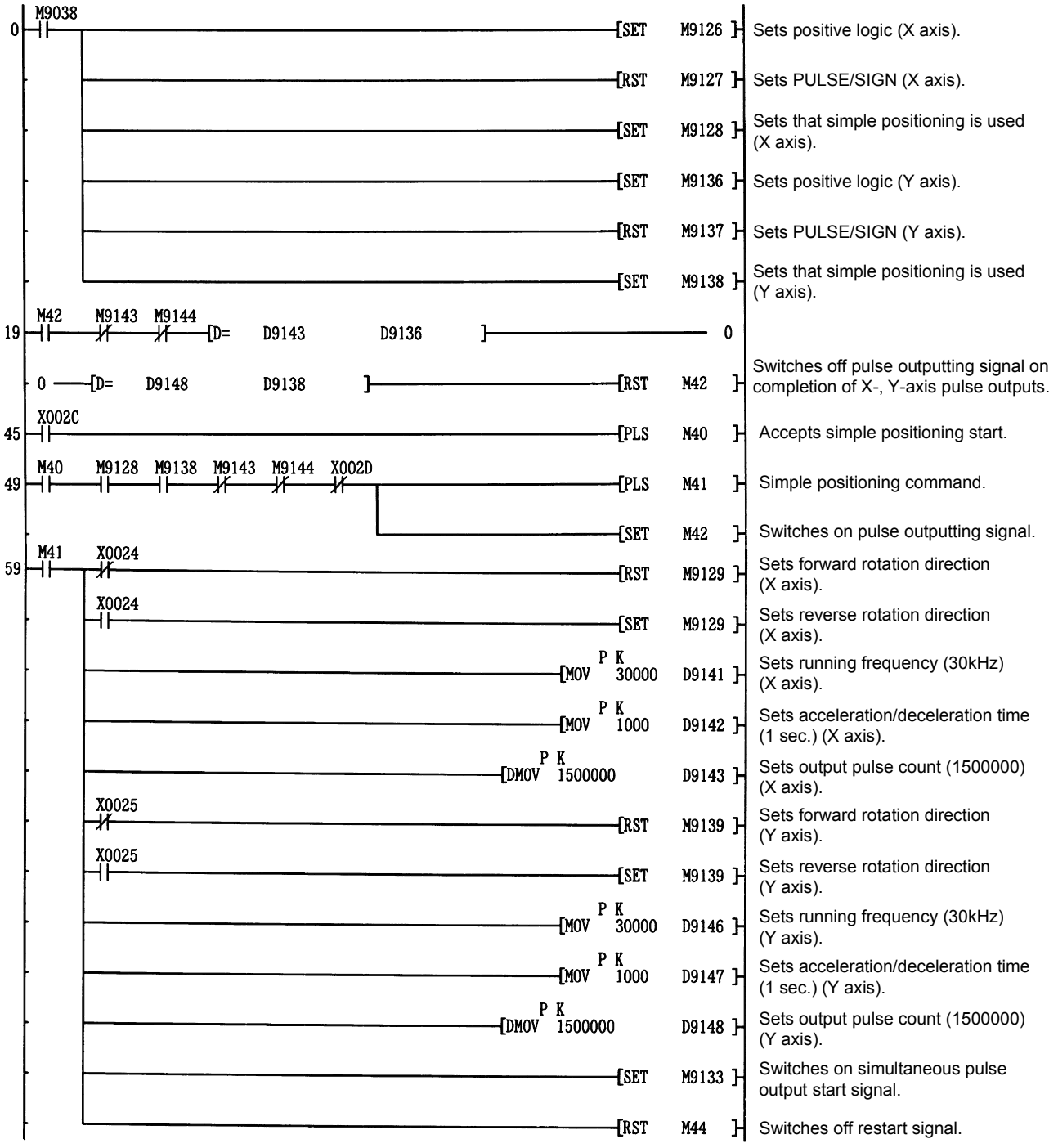
- X and Y axis pulse outputs start when simultaneous start (X2C) is turned on. At this time, the rotation directions are set by rotation direction setting (ON/OFF of X24 and X25).

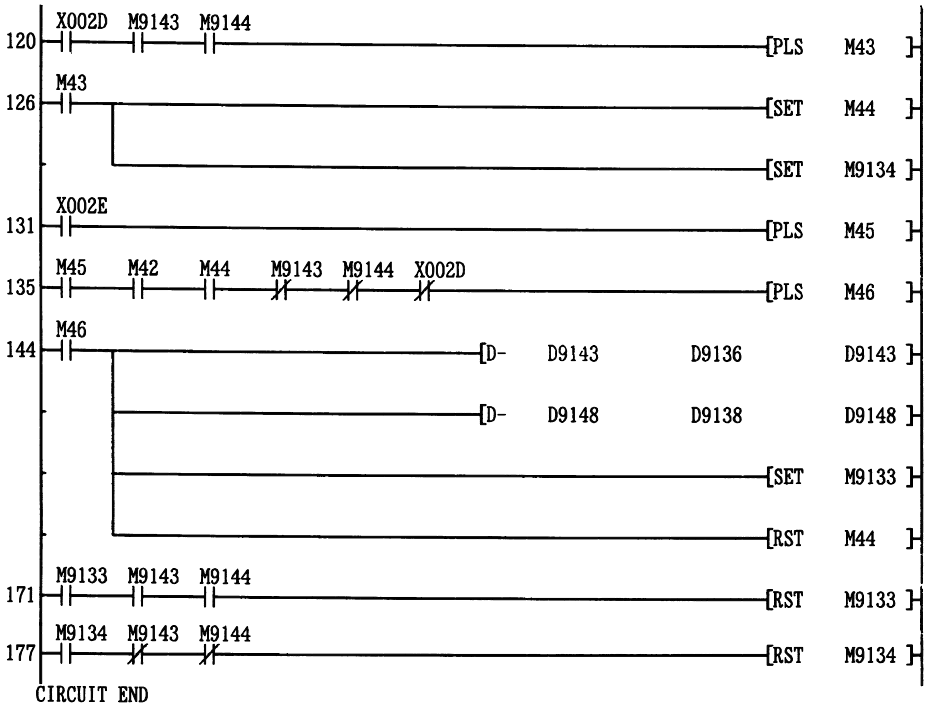
Rotation Direction Setting	X24		X25	
	OFF	ON	OFF	ON
X axis	Forward rotation	Reverse rotation	—	—
Y axis	—	—	Forward rotation	Reverse rotation

- The axes are decelerated to a stop when the stop command (X2D) is turned on during pulse output.
- When the restart command (X2E) is turned on after deceleration to stop, the axes are restarted from the stop position (output of remaining pulses).
- When simultaneous start (X2C) is turned on after deceleration to stop, the specified numbers of pulses are output to the axes at the stop position.


Frequency
30000
X-axis operation
Time
1s
1s
Frequency
30000
Y-axis operation
Time
1s
1s
ON
Pulse output start (M9133)
OFF
ON
Simultaneous start (X2C)
OFF
ON
Stop command (X2D)
OFF
ON
Restart command (X2E)
OFF
X-axis output pulses (D9144, D9143)
150000
(150000 - n)
X-axis present output pulses (D9137, D9136)
0 ~ n
0 ~
Number of output pulses at deceleration to stop
Setting of remaining pulse count
Y-axis output pulses (D9149, D9148)
150000
(150000 - n)
Y-axis present output pulses (D9139, D9138)
0 ~ n
0 ~
Number of output pulses at deceleration to stop
Setting of remaining pulse count

(b) Program example



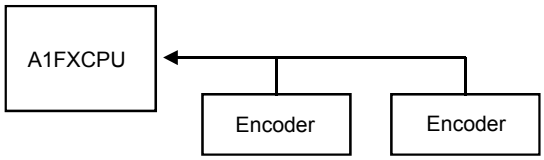

120 X002D M9143 M9144 [PLS M43] Accepts stop command.
126 M43 [SET M44] Switches on restart signal.
[SET M9134] Switches on simultaneous deceleration-to-stop signal.
131 X002E [PLS M45] Accepts restart command.
135 M45 M42 M44 M9143 M9144 X002D [PLS M46] Restart command.
144 M46 [D- D9143 D9136 D9143] Sets output pulse count for restart (X axis).
[D- D9148 D9138 D9148] Sets output pulse count for restart (Y axis).
[SET M9133] Switches on pulse output start signal (restart).
[RST M44] Switches off restart signal.
171 M9133 M9143 M9144 [RST M9133] Switches off simultaneous pulse output signal when X and Y axis pulse outputs start.
177 M9134 M9143 M9144 [RST M9134] Switches off simultaneous deceleration-to-stop signal when X and Y axis pulse outputs stop.
CIRCUIT END

5.4 High-Speed Counter Function

(1) High-speed counter function

Two encoders may be connected to count up to 60kpps pulses input.

When the set value matches the count value, an interrupt program (I12, I13) can be executed.



(2) Counter function

The following counters can be used for the high-speed counter function.

Name		Description
Preset function		Changes the present value of the counter. Preset operation can be done either by a sequence program or by an external preset input.
Ring counter function		Counting alternates between the preset value and the ring counter value
Counter function selection	Count disable function	Stops counting pulses while the signal of the counter function selection start command is ON.
	Latch counter function	Stores the present value of the counter into the special registers when the signal of the counter function selection start command is input.
Coincidence output function		Outputs an ON/OFF signal internally (switches on/off the special relay) in a preset output status of any channel, comparing it with the present value of the counter. An interrupt program (I12/I13) can also be run.

5.4.1 Instructions for the high-speed counter function

(1) Encoders that may be connected

"Open collector output type" encoders can be connected for the high-speed counter function of the A1FXCPU.

(2) High-speed counter data setting

The following high-speed counter function data should be set before count enable (M9154/M9174) is turned on.

- Ring counter setting (M9157/M9177) (only when ring counter function is used)
- Counter function selection setting (D9159/D9169)
- Counting speed selection (M9158/M9178)
- Pulse input mode (D9154/D9164)

(3) Restrictions made when ring counter function is selected

(a) When the ring counter function is selected (M9157/M9177: ON), the coincidence interrupt function cannot be used.

(b) The ring counter function is not activated when counter value coincidence (M9148/M9168) is on. After setting the "coincidence output set value (D9157, D9158/D9167, D9168)" used for the ring counter, turn on the coincidence signal reset command (M9151/M9171) to reset the counter value coincidence.

(4) Interrupt input priority

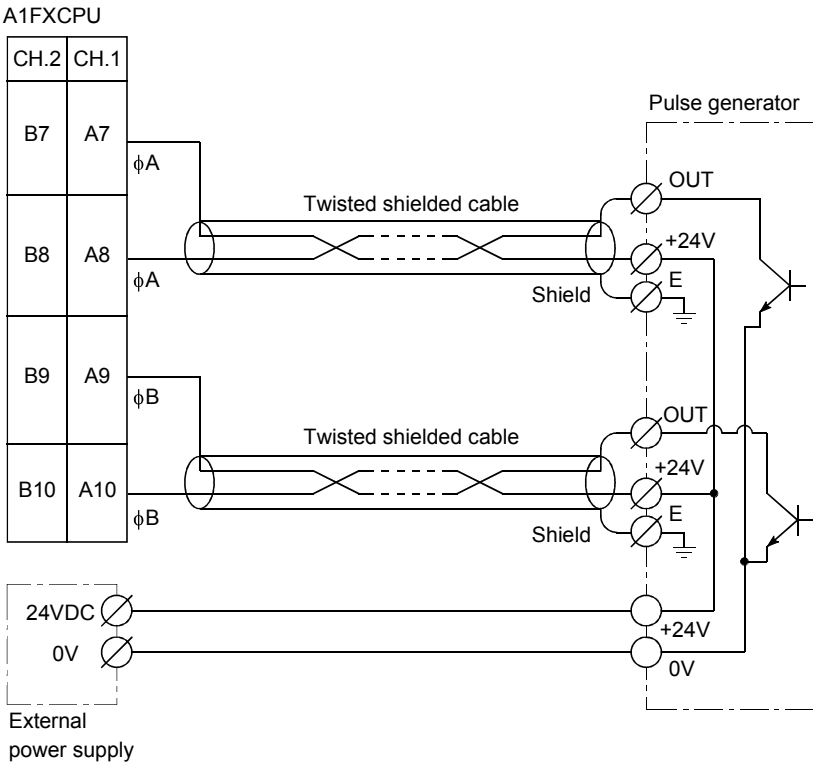
- The interrupt priority is as follows.

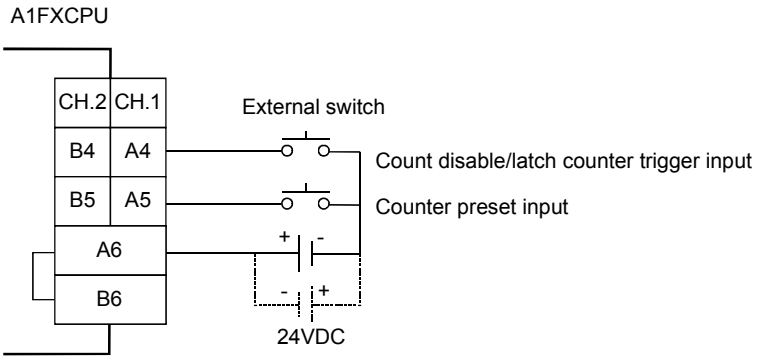
Priority	Interrupt Pointer	Name
High	10	External interrupt input (X0)
↑	11	External interrupt input (X1)
	12	External interrupt input (X2)
	13	External interrupt input (X3)
	14	External interrupt input (X4)
	15	External interrupt input (X5)
	112	Coincidence output of high-speed counter function (CH.1)
	113	Coincidence output of high-speed counter function (CH.2)
	131	Time interrupt (10ms)
↓	130	Time interrupt (20ms)
Low	129	Time interrupt (40ms)

- When one interrupt occurs during interrupt program execution, the interrupt program corresponding to the next interrupt is executed on completion of that interrupt program execution.
- When two or more interrupts occur during interrupt program execution, the interrupt program corresponding to the highest-priority interrupt is executed on completion of that interrupt program execution.
- For example, when interrupt inputs corresponding to I5 and I2 take place during execution of the I4 interrupt program, I2 interrupt is executed on a priority basis. (When using interrupt programs, refer to the instructions in Section 5.5.1.)

5.4.2 Wiring for use of the high-speed counter function

The connection example shown below is designed for use of the high-speed counter function.





5.4.3 Special relays/special registers for use of the high-speed counter function

This section explains the special relays and special registers used when the high-speed counter function is used.

(1) Special relays

The high-speed counter function uses the special relays indicated in Table 5.10.

Table 5.10 Special Relays for High-Speed Counter

Device Numbers		Signal Name		Operation Timing	ON/OFF by User
CH.1	CH.2				
M9147	M9167	Counter value greater		——	Disallowed
M9148	M9168	Counter value coincidence		——	
M9149	M9169	Counter value less		——	
M9150	M9170	External preset request detection		——	
M9151	M9171	Coincidence signal reset command		During ON	Allowed
M9152	M9172	Preset command		OFF→ON	
M9153	M9173	Down count command		During ON	
M9154	M9174	Count enable		During ON	
M9155	M9175	Present value read request		OFF→ON	
M9156	M9176	External preset detection reset command		During ON	
M9157	M9177	Ring counter setting		During ON	
M9158	M9178	Counting speed selection		During ON	
M9159	M9179	Counter function selection start command	Disable function	During ON	
			Latch counter function	OFF→ON	

(a) Counter value greater (M9147/M9167)

1) Turned on when (count value)>(coincidence output set value).
2) Turned off when (count value)≦(coincidence output set value).

(b) Counter value coincidence (M9148/M9168)

1) Turned on when (count value)=(coincidence output set value).
2) Latched on if (count value)≠(coincidence output set value).
   Counter value coincidence can be reset (turned off) by turning on the coincidence signal reset command (M9151/M9161).

POINT

(1) When the A1FXCPU is switched on or reset by the RESET switch, M9148/M9168 turns on because the count value and coincidence output set value are both 0.
Switch on the coincidence signal reset command (M9151/M9161) after starting count operation or after writing data to the coincidence output set value.

(c) Counter value less (M9149/M9169)
1) Turned on when (count value)<(coincidence output set value).
2) Turned off when (count value)≥(coincidence output set value).

(d) External preset request detection (M9150/M9170)
1) Turned on the leading edge of the external preset request signal (X8, X9).
2) Latched on if the external preset request signal (X8, X9) switches off.
3) Reset (turned off) when the external preset detection reset command (M9156/M9176) is turned on.

(e) Coincidence signal reset command (M9151/M9171)
1) Turn this signal on when resetting the counter coincidence signal (M9148/M9168).
2) The coincidence reset command is valid while it is on.

(f) Preset command (M9152/M9172)
1) Turn this signal on when writing the data of the preset value storing special registers (D9152, D91543/D9162, D9163) as a preset value.
2) The preset command is valid on its leading edge (OFF to ON).
Preset cannot be made if it remains on.

(g) Down count command (M9153/M9173)
1) Turn this signal on when performing down counting in the 1-phase mode of the pulse input system.
2) Up counting is performed when the down count command is off.
3) In the 2-phase mode of the pulse input system, ON/OFF of the down count command is invalid.

(h) Count enable (M9154/M9174)
1) Turn this signal on when performing the count operation of the high-speed counter.

(i) Present value read request (M9155/M9175)
1) Turn this signal on when storing the present value of the counter into the present value storing special registers (D9155, D9156/D9165, D9166).
2) The present value read request is made valid when it turns from off to on (leading edge).

(j) External preset detection reset command (M9156/M9176)
1) Turn this signal on when resetting (turning off) the external preset request detection signal (M9150/M9170).
2) The external preset detection reset command is valid while it is on.

(k) Ring counter setting (M9157/M9177)
1) Turn this signal on when executing the ring counter function.(Refer to Section 5.4.5 for full information on the ring counter function.)

(l) Counting speed selection (M9158/M9178)

1) Turn this signal on when using the high-speed counter on the 10k side.
   On the 10k side, pulses are counted in the following counting speed.
   - For 1-phase input: 10kpulses/s
   - For 2-phase input: 7kpulses/s
2) When counting speed selection is off, the high-speed counter operates on the 60k side.
   On the 60k side, pulses are counted in the following counting speed.
   - For 1-phase input: 60kpulses/s
   - For 2-phase input: 60kpulses/s

(m) Counter function selection start command (M9159/M9179)

1) Used for the following functions.
   - Latch counter function
   - Count disable function
2) For the latch counter function, turn on this signal when the present value is stored into the latch count value storing special registers.
   The counter function selection start command is made valid when it turns from off to on (leading edge).
   (For details of the latch counter function, refer to Section 5.4.7.)
3) For the count disable function, counting stops while the counter function selection start command is on.
   Counting resumes when the counter function selection start command is switched off.
   (For details of the count disable function, refer to Section 5.4.6.)

(2) Special registers

The special registers indicated in Table 5.11 are used for the high-speed counter function.

Table 5.11 Special Registers for the High-Speed Counter

Device		Name	Write	Read
CH.1	CH.2			
D9152	D9162	Preset value (lower 16 bits)	Allowed	Allowed
D9153	D9163	Preset value (upper 8 bits)		
D9154	D9164	Pulse input mode selection	Allowed	Allowed
D9155	D9165	Present value (lower 16 bits)	Inhibited	Allowed
D9156	D9166	Present value (upper 8 bits)		
D9157	D9167	Coincidence output set value (lower 16 bits)	Allowed	Allowed
D9158	D9168	Coincidence output set value (upper 8 bits)		
D9159	D9169	Counter function selection	Allowed	Allowed
D9160	D9170	Latch count value (lower 16 bits)	Inhibited	Allowed
D9161	D9171	Latch count value (upper 8 bits)		
D9172		Status	Inhibited	Allowed

(a) Preset value (D9152, D9153/D9162, D9163)

1) Set the preset values used for the following functions.
   - Preset function
   - Ring counter function
2) The preset value may be set in the range 0 to 16777215.

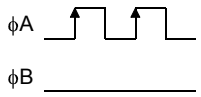
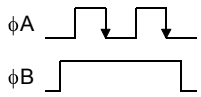
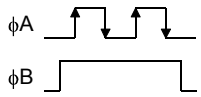
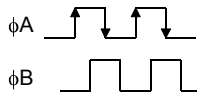
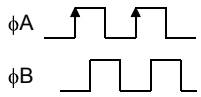
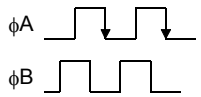
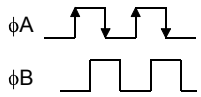
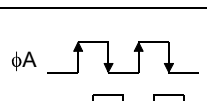
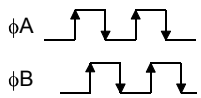
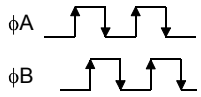
(b) Pulse input mode (D9154/D9164)

1) Set the pulse input system with the following data.

Phase	Pulse Input System	Data Written
1-phase	Multiplied by 1	0
	Multiplied by 2	8
2-phase	Multiplied by 1	2
	Multiplied by 2	10
	Multiplied by 4	18

2) The high-speed counter function is not activated when the data written to the pulse input mode setting special register is other than any of the above values.
   At this time, bit 3 (b3) "CH.1"/bit 7 (b7) "CH.2" of D9172 turns to "1".
3) The pulse input mode setting special registers turn to "0" when the A1FXCPU is switched on or reset.

Table 5.12 Pulse Input Selection and Count Timing

Pulse Input Mode Selection	Pulse Input System	Count Timing		
0	1-phase multiplied by 1	Up counting		Counts a pulse on leading edge of phase A Phase B and M9153 (M9173) are off.
		Down counting		Counts a pulse on trailing edge of phase A. Phase B or M9153 (M9173) is on.
8	1-phase multiplied by 2	Up counting		Counts a pulse on leading and trailing edges of phase A. Phase B and M9153 (M9173) are off.
		Down counting		Counts a pulse on leading and trailing edges of phase A. Phase B or M9153 (M9173) is on.
2	2-phase multiplied by 1	Up counting		Counts a pulse on leading edge of phase A. Count increases in response to phase difference between phases A and B.
		Down counting		Counts a pulse on trailing edge of phase A. Count decreases in response to phase difference between phases A and B.
10	2-phase multiplied by 2	Up counting		Counts a pulse on leading and trailing edges of phase A. Count increases in response to phase difference between phases A and B.
		Down counting		Counts a pulse on leading and trailing edges of phase A. Count decreases in response to phase difference between phases A and B.
18	2-phase multiplied by 4	Up counting		Counts a pulse on leading and trailing edges of phases A and B. Count increases in response to phase difference between phases A and B.
		Down counting		Counts a pulse on leading and trailing edges of phases A and B. Count decreases in response to phase difference between phases A and B.

(c) Present value (D9155, D9156/D9165, D9166)

1) The present value of the counter is stored when the present value read request (M9155/M9175) turns from off to on (leading edge).
2) For up counting, when the count value exceeds 16777215, the present value turns to 0 and the count value stored starts with 0.

   Example: 16777214→16777215→0→1→2 .....

   For down counting, when the count value exceeds 0, the present value turns to 16777215 and the count value stored starts with 16777215.

   Example: 2→1→0→16777215→16777214 .....

(d) Coincidence output set value (D9157, D9158/D9167, D9168)

1) Set the coincidence output values used for the following functions.
   - Coincidence output function
   - Ring counter function
2) The coincidence output value may be set in the range 0 to 16777115.

(e) Counter function selection (D9159/D9169)

1) Select the count disable function or latch counter function by setting the following data. (Refer to Section 5.4.6 for the count disable function and to Section 5.4.7 for the latch counter function.)

Counter Function	Set Value
Count disable function	0
Latch counter function	1

   If the value set in counter function selection is other than 0 and 1, the high-speed counter function will not be activated.
   At this time, bit 3 (b3)/bit 7 (b7) of D9172 turns to "1".
2) The counter function selected with the counter function selection setting special register is made valid when the corresponding signals of the following signals turn from off to on (leading edge).
   The counter function should be changed when the corresponding signals of the following signals are off.
   - Counter function selection start command (M9159/M9169)
   - A4/B4 of the Built-in function connector
   - Count enable (M9154/M9174)

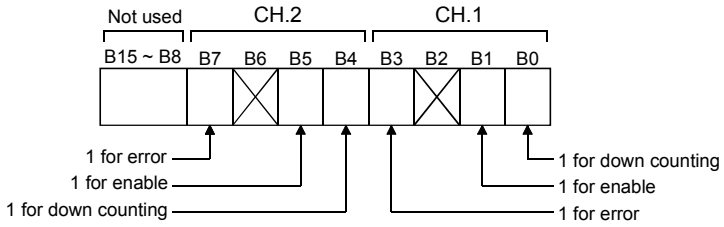
(f) Latch counter value (D9160, D9161/D9170, D9171)

1) The present value of the counter is stored when the counter function selection start command (M9159/M9179) or A4/B4 of the general-purpose Built-in function connector turns from off to on (leading edge) in the latch counter function.

(g) Status (D9172)

1) The status of the high-speed counter function is stored into bits 0-7 (b0-b7).

• Bit locations of D9172



• Application of each bit

CH.1	CH.2	Signal Name	Description
b0	b4	Down counting	"1" indicates down counting. • When down count designation (M9153/M9163) is on in the 1-phase mode. • A- and B-phase pulses are in the down count phase in the 2-phase mode.
B1	b5	Enable	"1" indicates the count input acceptable status. (The count input acceptable status means that count enable (M9154/M9174) is on and count disable (M9159/ M9179 or A4/B4) is off)
b2	b6	Not used	—
b3	b7	Error	"1" indicates that any of the following data is outside the setting range. • Preset value (D9152, D9153/D9162, D9163) • Coincidence output set value (D9157, D9158/D9167, D9168) • Pulse input mode selection (D9154/D9164) • Counter function selection (D9159/D9169) Data check is made on the leading edge of the count enable signal (M9154/M9174).

5.4.4 Preset function

The preset function is used to rewrite the high-speed counter function's present value into any value. (This new value is called the preset value.)
The preset function can be used to start pulse counting from the set value.
The preset function is available in two methods: "sequence program method" and "external control signal method".

(1) Example of using the preset function

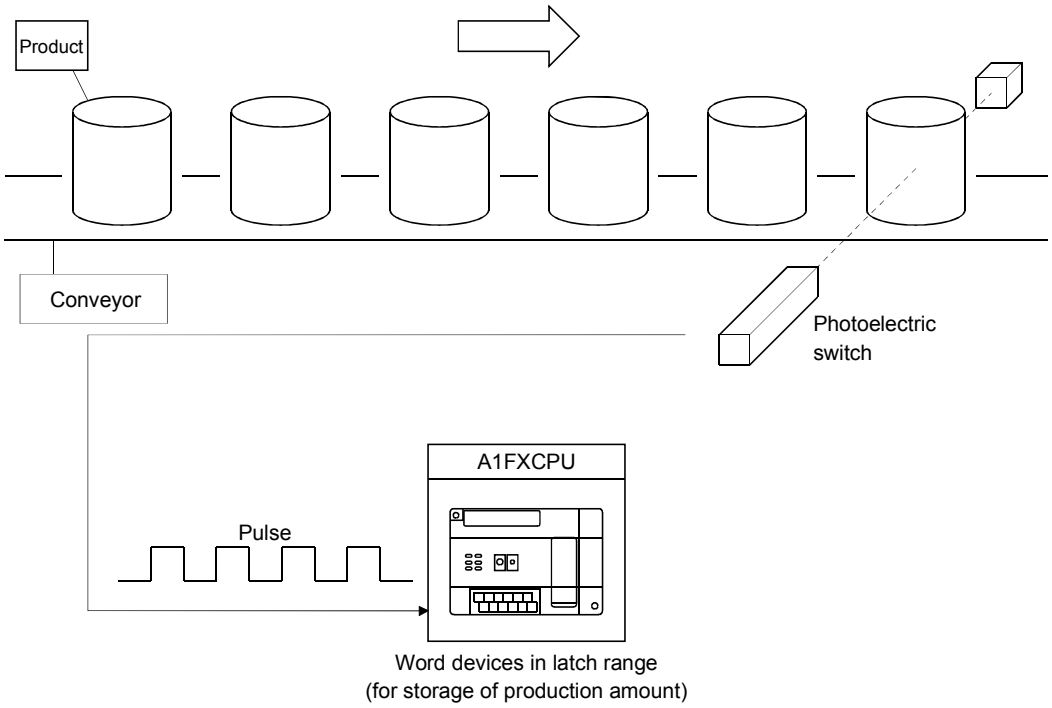
The following example indicates that the production count is continued from the previous day in a system for counting the number of products.
In this system, each product carried on a conveyor is detected by a photoelectric switch and counted by the high-speed counter function.

(a) Production amount of the previous day stored in the A1FXCPU is written to the preset area of the A1FXCPU for presetting.

(b) Products are carried on the conveyor.

(c) Production amount is counted in response to the pulse input from the photoelectric switch.

(d) At the end of daily production, the count value in the present value storing special registers is stored into the word devices (e.g. D, W, R) in the A1FXCPU latch range.

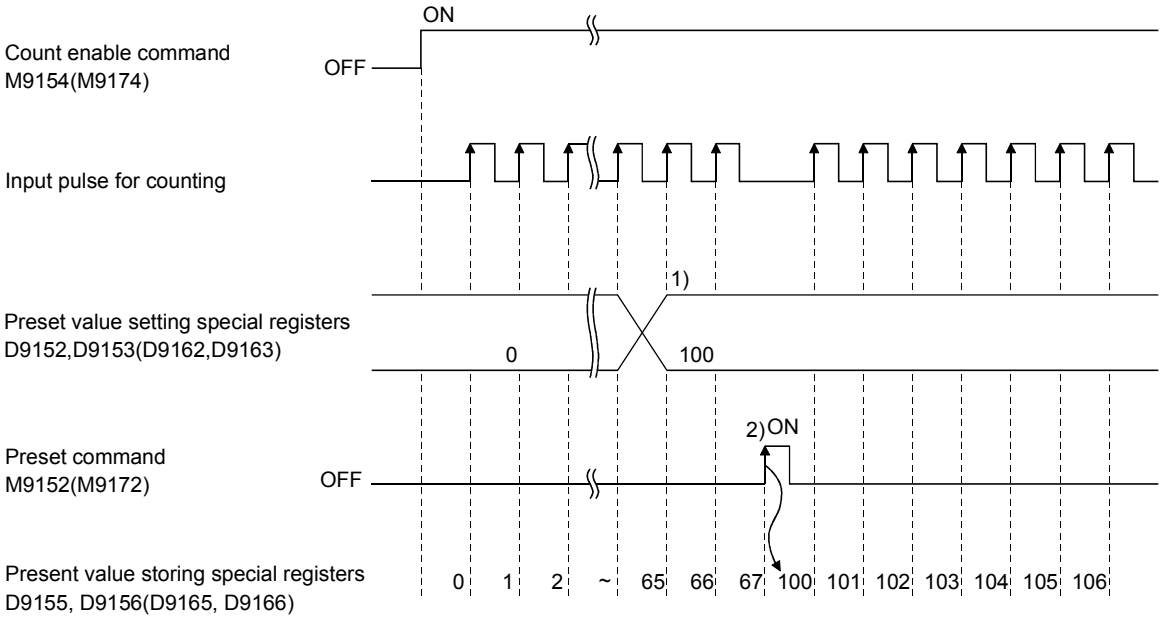


(2) Presetting methods

There are two presetting methods: sequence program and external control signal methods.

(a) Sequence program method

Turn on the preset command (M9152/M9172) in the sequence program to execute the preset function.



1) Write any value to the preset value storing special registers (D9152, D9153/D9162, D9163). (Setting range: 0 to 16777215)

When the value set is outside the setting range, the high-speed counter function is not activated.

At this time, bit 3 (b3)/bit 7 (b7) of D9172 turns to "1".

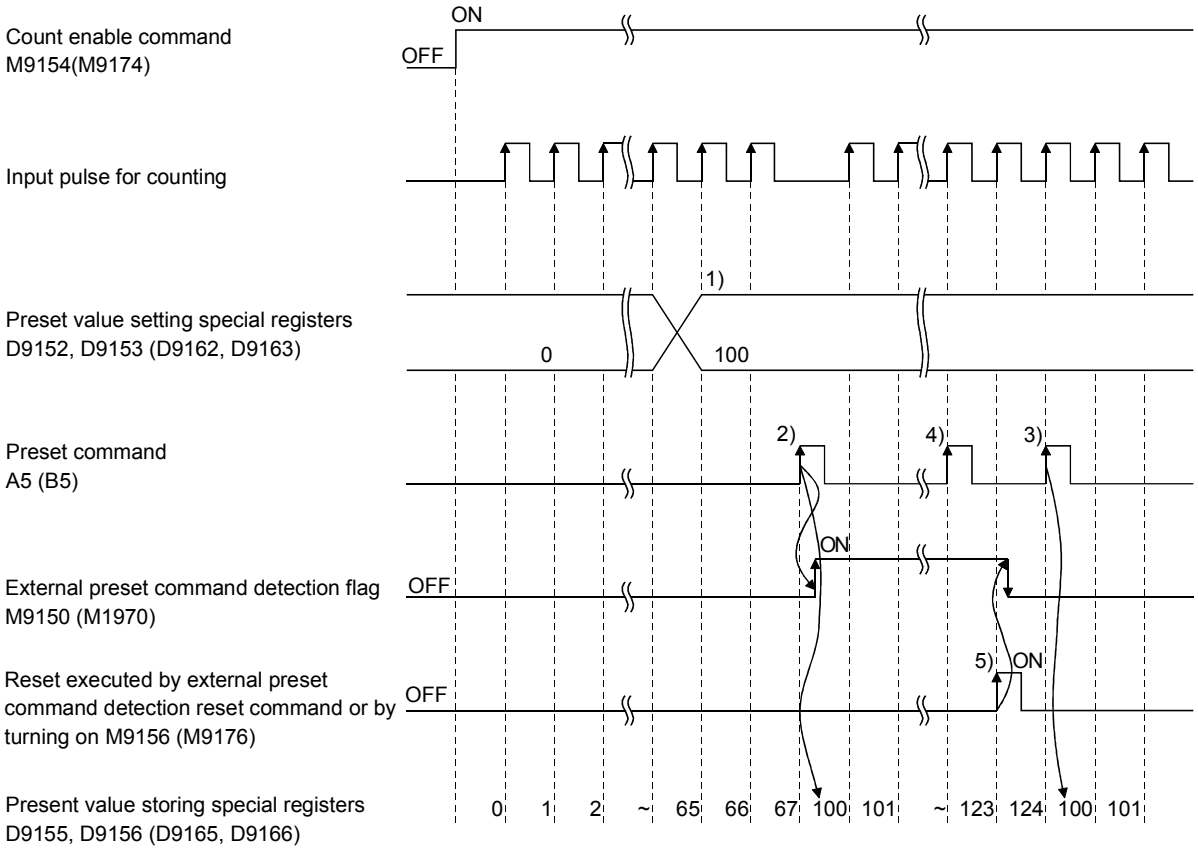
2) Turn the preset command (M9152/M9172) from off to on.

On the leading edge (OFF to ON) of the preset command, the present value in the present value storing special registers is changed to the preset value in the preset value storing special registers.

Preset can be executed independently of whether the count enable command (M9154/M9174) is on or off.

(b) External control signal method

A voltage is applied to the "A5/B5" terminal of the general-purpose I/O connector to execute presetting.



1) Write any value to the preset value storing special registers (D9152, D9153/D9162, D9163). (Setting range: 0 to 16777215)
   When the value set is outside the setting range, the high-speed counter function is not activated.
   At this time, bit 3 (b3)/bit 7 (b7) of D9172 turns to "1".
2) Apply a voltage to the "A5/B5" terminal of the I/O connector.
   This causes the present value in the present value storing special registers to be changed to the preset value in the preset value storing special registers.
3) Preset can be executed independently of whether the count enable command (M9154/M9174) is on or off.

POINT

While the external preset command detection flag (M9150/M9170) is on 4), presetting cannot be performed if a voltage is applied to the A5/B5 terminal.
When the external preset command detection flag is on, switch on the the external preset command detection reset command (M9156/M9176) ⑤ to switch off the external preset command detection flag, thereby enabling presetting.

5.4.5 Ring counter function

The ring counter function repeats counting between the preset value set by the ring counter command and the ring counter value.
The ring counter function can be used for control such as fixed-pitch feed.

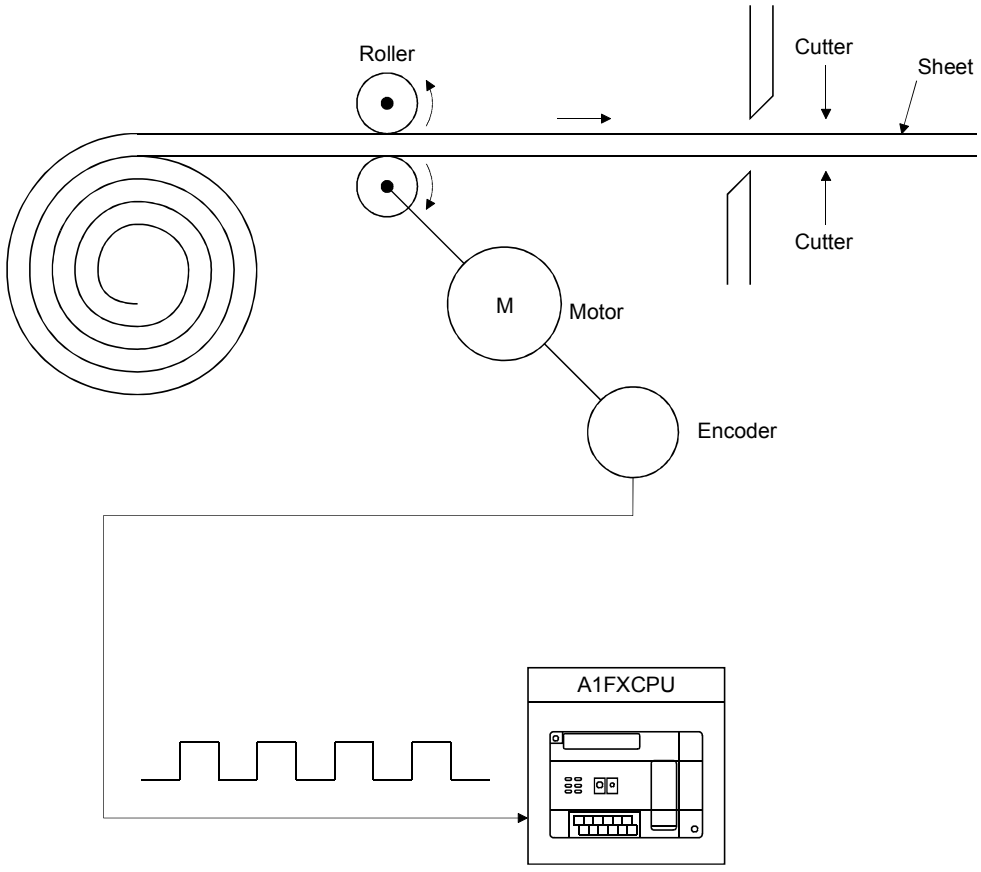
(1) Example of using the ring counter function
In a system where a sheet is cut to the specified size, set the ring counter value to roller-feed a sheet in fixed pitch and cut it to the given length.
(a) Set the preset and ring counter values to execute the ring counter function.

(b) The motor is run to rotate the rollers.

(c) The motor is stopped as soon as the given length of the sheet is fed by the rollers.

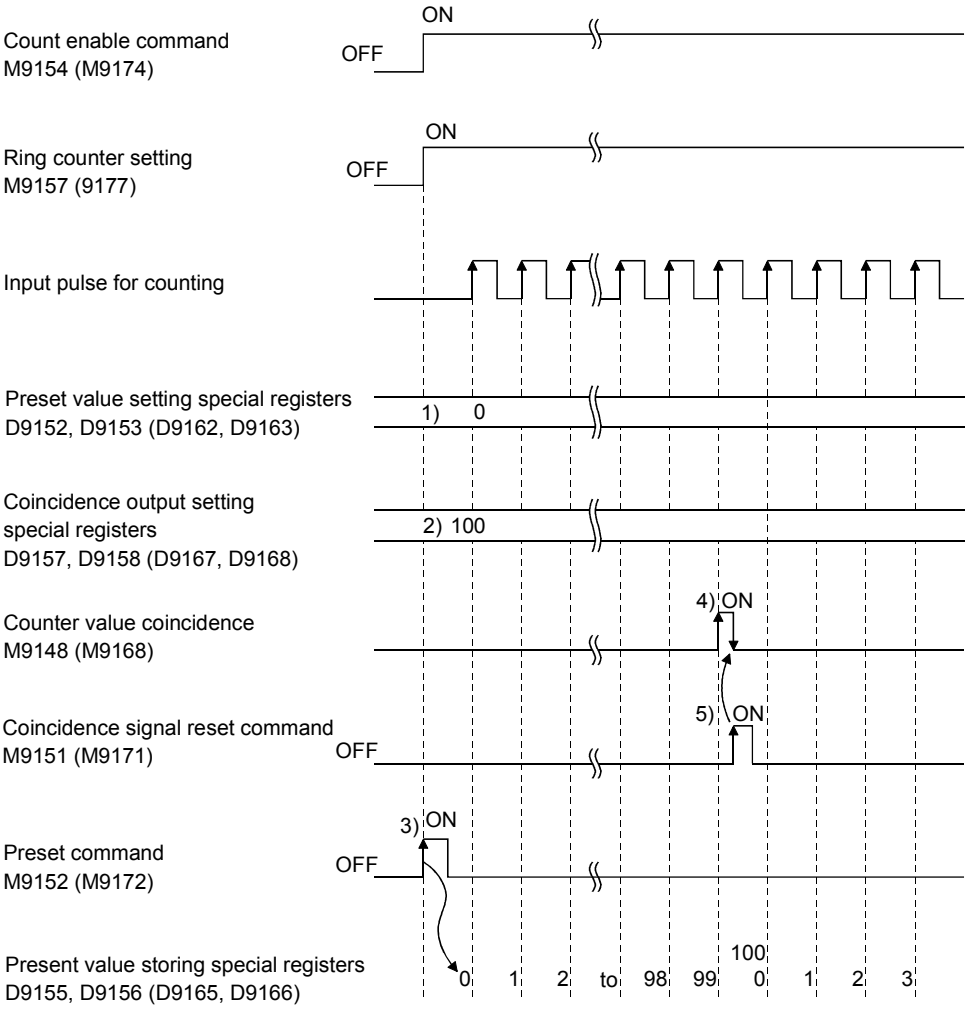
(d) The sheet is cut.

(e) The operations in steps (b) to (d) are repeated.



(2) Ring counter function operation

The operation of the ring counter function is shown below:



1) Set a preset value in the preset value setting special registers (D9152, D9153/D9162, D9163). (Setting range: 0 to 13777215)
   When the value set is outside the setting range, the high-speed counter function is not activated.
   At this time, bit 3 (b3)/bit 7 (b7) of D9172 turns to "1".
2) Set a ring count value in the coincidence output setting special registers (D9157, D9158/D9167, D9168). (Setting range: 0 to 13777215)
   When the value set is outside the setting range, the high-speed counter function is not activated.
   At this time, bit 3 (b3)/bit 7 (b7) of D9172 turns to "1".
3) Switch on the preset command (M9152/M9172).
   On the leading edge (OFF → ON) of the preset command, the present value in the present value storing special registers is changed to the preset value in the preset value storing special registers.
   Preset can be executed independently of whether the count enable command (M9154/M9174) is on or off.

4) Turn on the ring counter setting (M9157/M9177).
During execution of the ring counter function, the preset value and ring count value cannot be written.

5) When the count value reaches the ring count value, the counter coincidence signal switches on to execute presetting.
When the present value is read during execution of presetting, the ring count value or preset value is read.

6) The coincidence signal reset command is switched on to reset the count value coincidence signal.
Keep the count value coincidence signal (M9148/M9168) off until the second next presetting.
If the count value coincidence signal remains on, the next presetting is not performed.

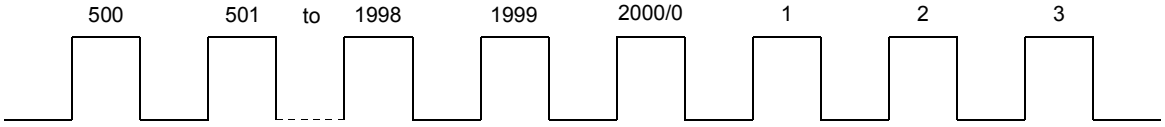
(3) Counting range

The counting range of the ring counter function differs according to the relationships between the preset value, ring count value, present value and counting mode (up/down count).

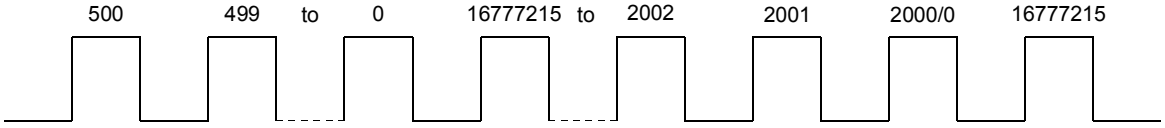
(a) If (preset value)≦(present value)≦(ring count value)

The following operation is performed when the ring counter function is executed at the preset value of 0, ring count value of 2000, and present value of 500.

1) In up counting, the present value (0) turns to the preset value as soon as it is counted up to the ring count value (2000).



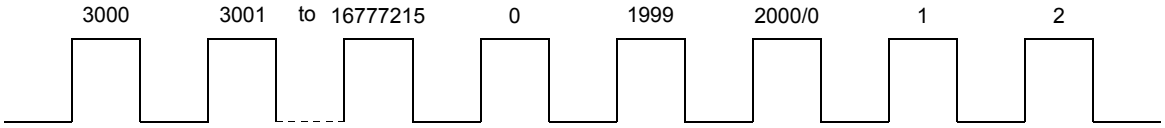
2) In down counting, the present value turns to the maximum value (16777215) when it is counted down to the preset value (0).
Then, when the present value (0) is counted down from the maximum value to the ring count value, it turns to the preset value.



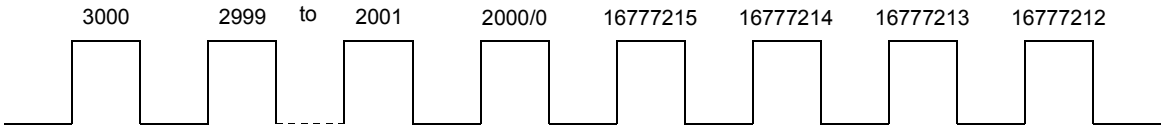
(b) If (preset value)≦(ring count value)≦(present value)

The following operation is performed when the ring counter function is executed at the preset value of 0, ring count value of 2000, and present value of 3000.

1) In up counting, the present value turns to the minimum value (0) when it is counted up to the maximum value (16777215).
Then, when the present value is counted up from the minimum value (2000) to the ring count value, it turns to the preset value (0).



2) In down counting, the present value turns to the preset value (0) when it is counted down to the ring counter value (2000).



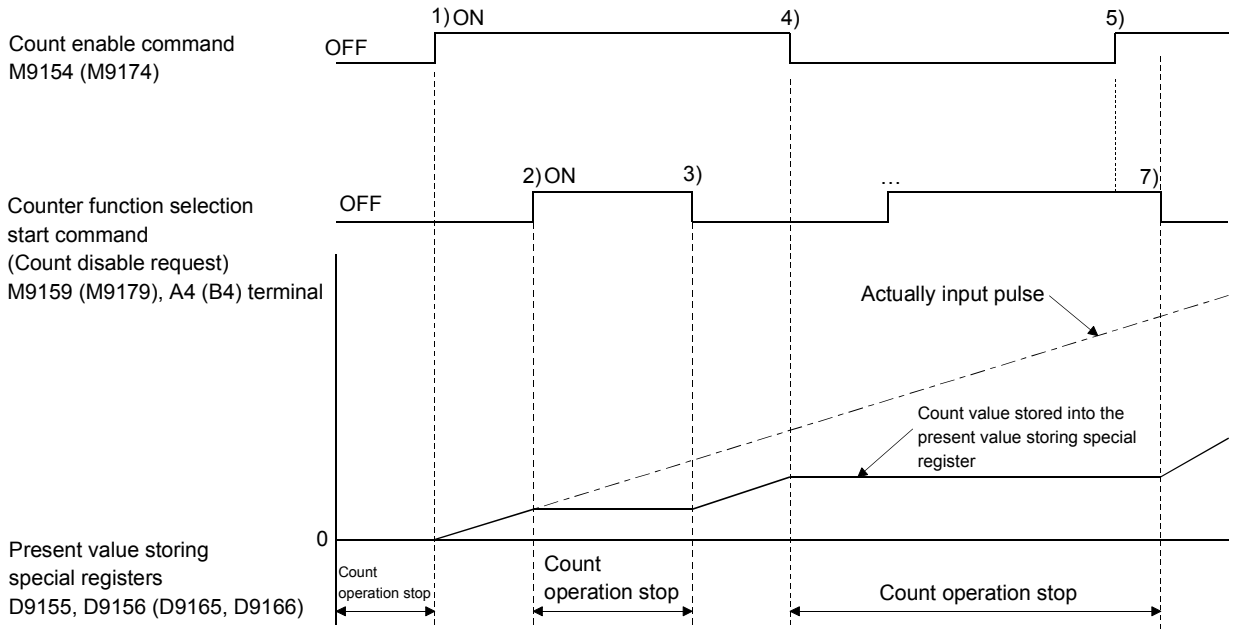
POINTS

(1) During execution of the ring counter function, the preset and ring count values cannot be written.

(2) During execution of the ring counter function, any interrupt of the coincidence output function cannot take place.

5.4.6 Count disable function

The count disable function stops the counting operation while the count enable command (M9154/M9174) is on.
When the count disable function is used, the relationships between the count enable command, the counter function selection start command and the counter's present value are as shown below.



1) Count operation starts when the count enable command (M9154/M9174) switches on.

2) Count operation stops when the counter function selection start command (M9159/M9179) switches on or when a voltage to the A4/B4 terminal of the Built-in function connector switches on.

3) Count operation resumes when the counter function selection start command (M9159/M9179) switches off or when a voltage to the A4/B4 terminal of the Built-in function connector switches off.

4) Count operation stops when the count enable command (M9154/M9174) switches off.

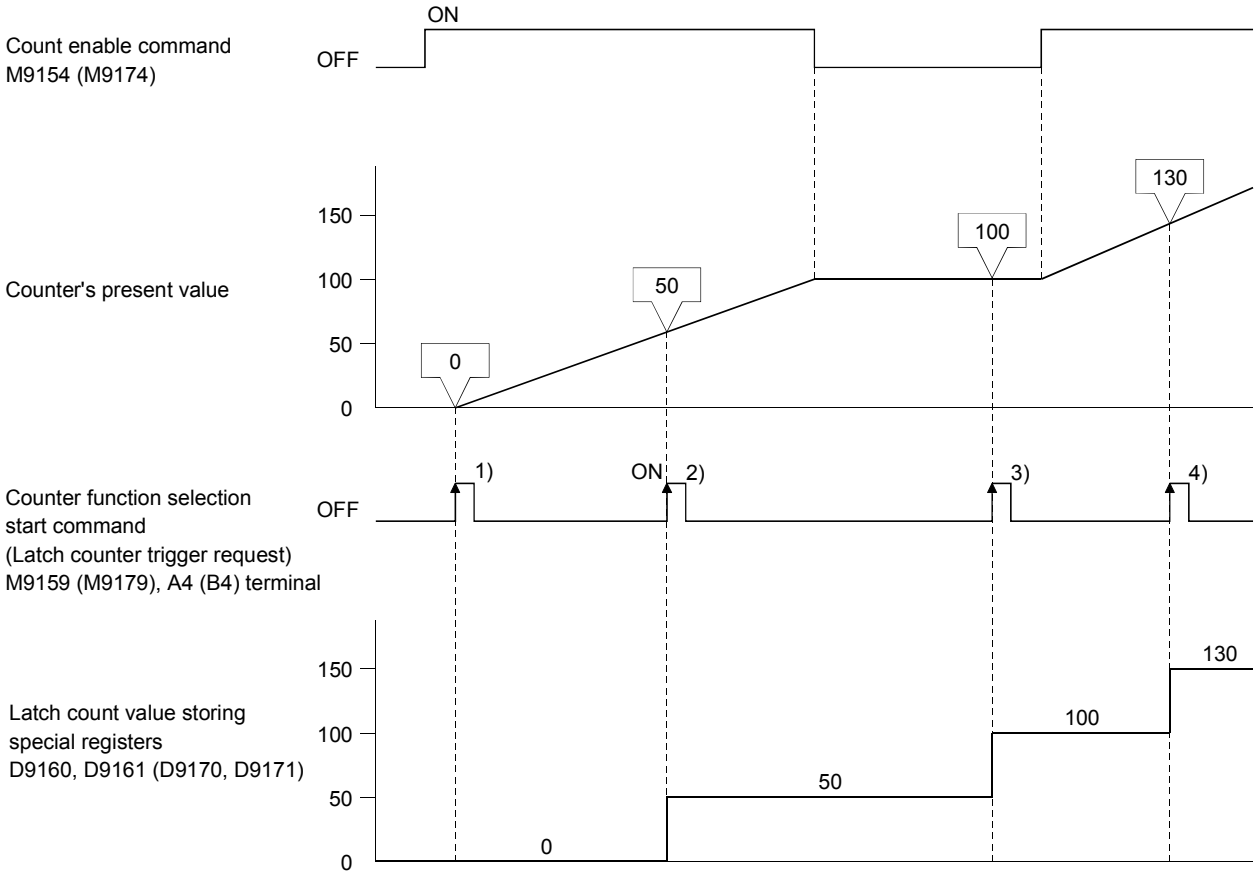
5) Since the count enable command (M9154/M9174) is off, count operation remains stopped independently of whether the counter function selection start command (M9159/M9179) is on or off or whether the voltage to the A4/B4 terminal of the Built-in function connector is on or off.

6) If the count enable command (M9154/M9174) is switched on, count operation remains stopped since the counter function selection start command (M9159/M9179) is on or the voltage to the A4/B4 terminal of the Built-in function connector is on.

7) Count operation resumes when the counter function selection start command (M9159/M9179) switches off or the voltage to the A4/B4 terminal of the Built-in function connector switches off.

5.4.7 Latch counter function

The latch counter function latches the present value at a time when an external signal is input.
When the latch counter function is used, the relationships between the counter's present value, counter function selection start command and latch count value storing special registers are as shown below.



1) to 4) On the leading edge (OFF to ON) of the counter function selection command (M9159/M9179) or the Built-in function connector's A4/B4 terminal signal, the counter's present value is stored into the latch count value storing special registers (D9160, D9161/D9170, D9171).
The latch counter function can be executed independently of whether the count enable command (M9154/M9174) is on or off.

5.4.8 Coincidence output function

The coincidence output function turns on the counter coincidence special relay (M9148/M9168) or runs the interrupt program (I12/I13) when the preset value matches the present value of the counter.

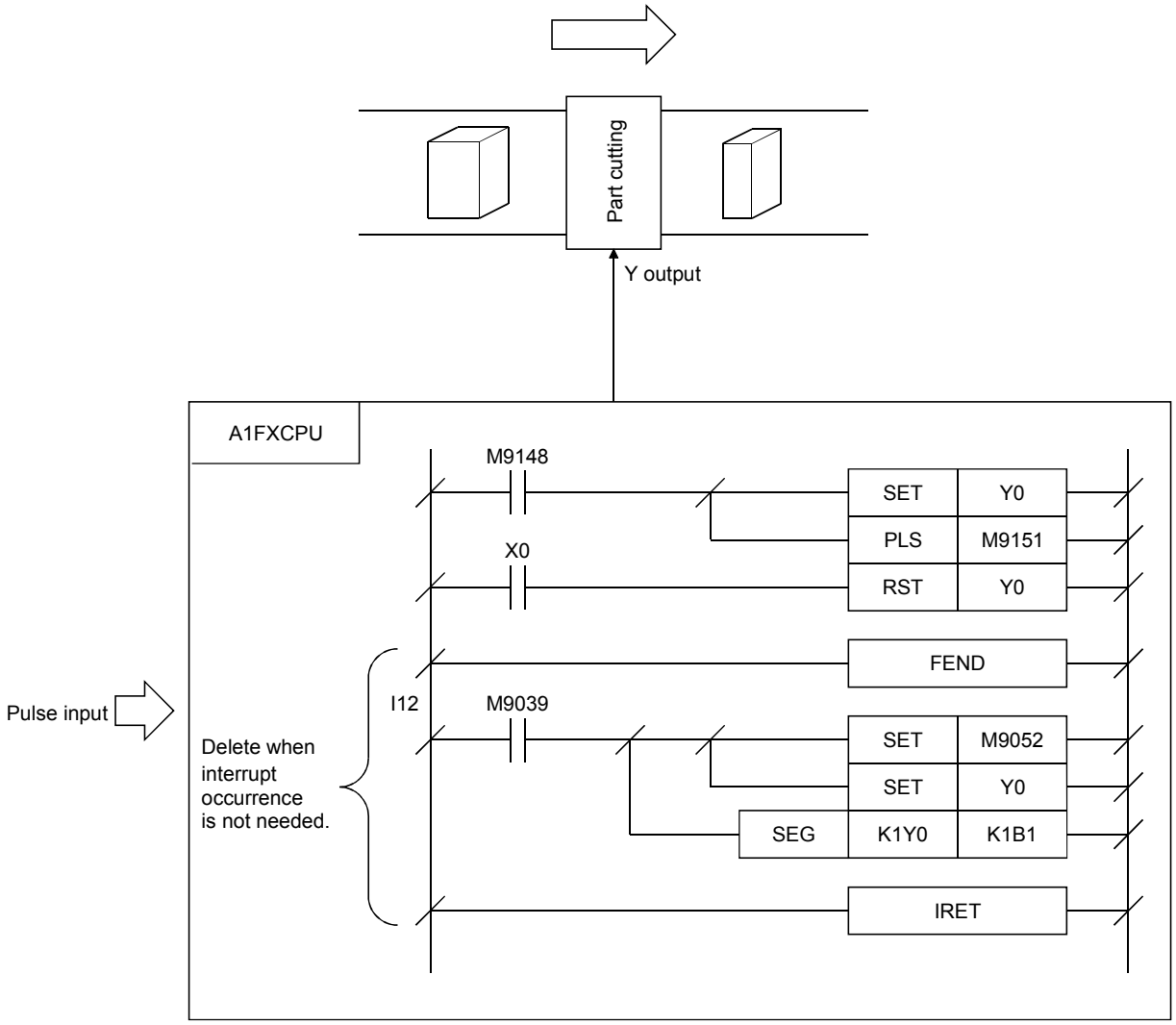
(1) Example of using the function

In a machining line system, machining operations are performed in response to the corresponding coincidence outputs to turn out products as shown below.

(a) Materials are carried on a belt conveyor.

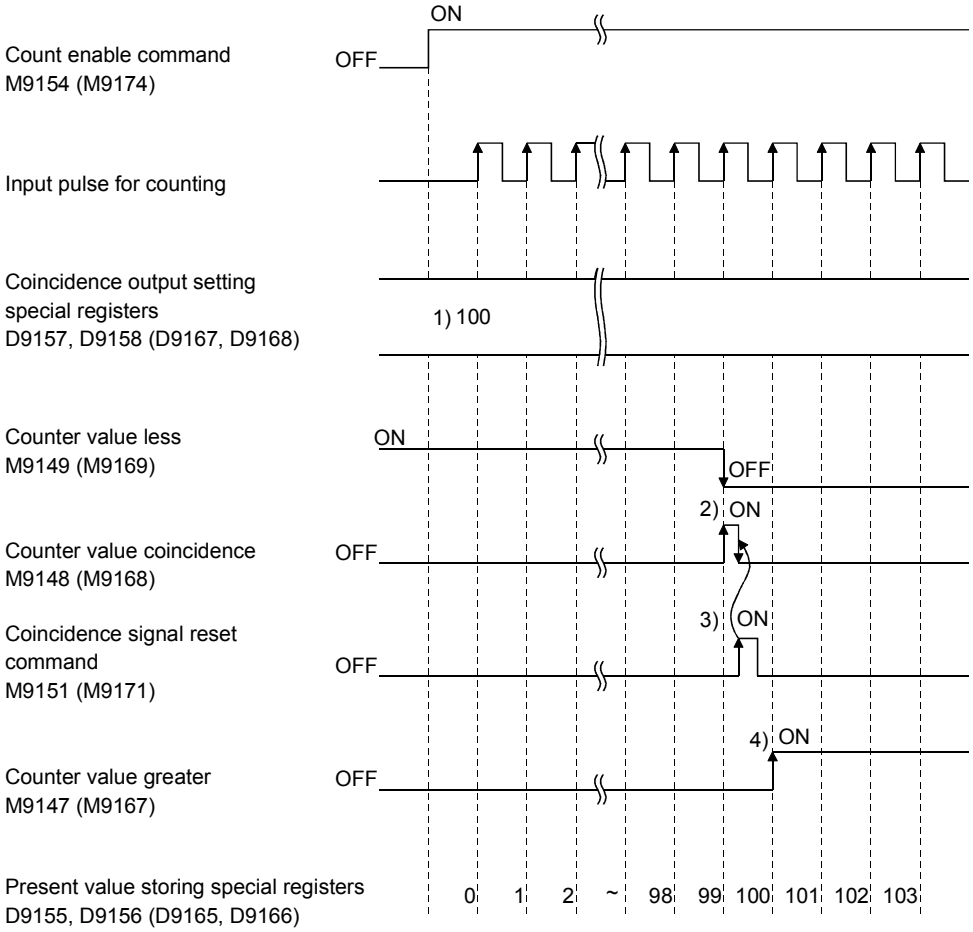
(b) Each material position is identified as the present count value determined by the pulse entered into the A1FXCPU.

(c) When the material reaches the preset position, the counter coincidence special relay (M9148/M9168) is turned on or the interrupt program (I12/I13) is executed to perform the required operation.



(2) Coincidence output function operation

The operation of the coincidence output function is shown below.



1) Set a coincidence output set value in the coincidence output setting special registers (D9157, D9158/D9167, D9168). (Setting range: 0 to 16777215)
When the value set is outside the setting range, the high-speed counter function is not activated.
At this time, bit 3 (b3)/bit 7 (b7) of D9172 turns to "1".

2) When the count value reaches the coincidence output set value, the counter value less signal (M9149/M9169) switches off and the counter value coincidence signal (M9148/M9168) switches on.
When there is an interrupt program (I12/I13), it is executed.
(When the ring counter function has been selected, the interrupt program cannot be executed.)

3) The coincidence signal reset signal (M9151/M9171) is switched on to reset the counter value coincidence signal (M9148/M9168).
If the counter value coincidence signal remains on, the next coincident signal cannot be issued.

4) When the counter value becomes greater than the coincidence output set value, the counter value greater signal (M9147/M9167) switches on.

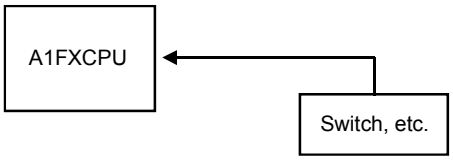
POINT

(1) The interrupt program (I12/I13) is not executed when (present value) = (coincidence output set value) from the beginning after power is switched on or the RESET switch is turned on.
I12/I13 is ready to be run after the present value has changed or the coincidence output set value has been changed.

5.5 External Interrupt Function

(1) External interrupt function

By switching X0 to X5 (A1 to A3, B1 to B3 terminals) of the A1FXCPU's Built-in function connector from OFF to ON or from ON to OFF, the corresponding interrupt programs (I0 to I5) can be run by the A1FXCPU.



5.5.1 Instructions for the external interrupt function

Observe the following instructions for the external interrupt function.

(1) Interrupt enable setting

Interrupt disable (DI) is activated when the A1FXCPU is switched on or reset by the RESET switch.

To run the interrupt program, enable interrupt by using the interrupt enable instruction (EI).

For the EI/DI instructions, refer to the ACPU Programming Manual (Common Instructions).

(2) Restrictions on PLS/PLF instructions

The device turned on by the PLS/PLF instruction in the interrupt program remains on until the same interrupt program is executed again.

(3) Status during interrupt program execution

During interrupt program execution, interrupt disable (DI) is activated.

In the interrupt program, do not execute the interrupt enable/disable instruction (EI/DI).

(4) Use of timers in interrupt programs

Timers cannot be used in the interrupt programs.

If a timer is used in an interrupt program, its contact may be on though its coil is off or the present value may become equal to the set value.

(5) Interrupt program execution time

If the execution time of the interrupt program to be run is 8ms or longer, the present value of the timer may delay by the following period every time the interrupt program is run.

- $0 < t < 8$ No delay
- $8 \leqq t \leqq 10$ 0 or 10ms depending on timing
- $20 \leqq t \leqq 30$ 10ms or 20ms depending on timing

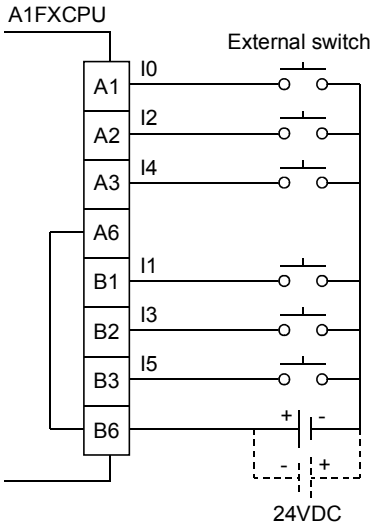
Also, every time the interrupt program is executed, the scan time and constant scan time may increase.

5.5.2 Wiring for use of the external interrupt function

When using the external interrupt function, wire the interrupt inputs to X0-X5 (A1 to A3, B1 to B3 terminals) of the Built-in function connector.

Relationships between X0-X5 of the Built-in function connector and interrupt pointers are as indicated below.

- X0: Interrupt pointer I0
- X1: Interrupt pointer I1
- X2: Interrupt pointer I2
- X3: Interrupt pointer I3
- X4: Interrupt pointer I4
- X5: Interrupt pointer I5



5.5.3 Setting for executing the external interrupt function

Use the special relays to set the external interrupt function.

Table 5.13 indicates the special relays used to set the external interrupt function.

Table 5.13 Special Relays Used for Setting the External Interrupt Function

Number	Name	Operation at ON/OFF	
		OFF	ON
M9119	Interrupt control during execution of FROM/TO instruction	FROM/TO instruction overrides interrupt.	Interrupt overrides FROM/TO instruction.
M9120	Interrupt pointer I0 polarity setting	X0: Executed on leading edge	X0: Executed on trailing edge
M9121	Interrupt pointer I1 polarity setting	X1: Executed on leading edge	X1: Executed on trailing edge
M9122	Interrupt pointer I2 polarity setting	X2: Executed on leading edge	X2: Executed on trailing edge
M9123	Interrupt pointer I3 polarity setting	X3: Executed on leading edge	X3: Executed on trailing edge
M9124	Interrupt pointer I4 polarity setting	X4: Executed on leading edge	X4: Executed on trailing edge
M9125	Interrupt pointer I5 polarity setting	X5: Executed on leading edge	X5: Executed on trailing edge

(1) Interrupt control during execution of FROM/TO instruction

Set whether the interrupt program may be executed or not during execution of the FROM/TO instruction.

(a) When M9119 is OFF (FROM/TO instruction overrides interrupt)

During execution of the FROM/TO instruction, interrupt is disabled and no interrupt program is executed if an interrupt occurs.

For an interrupt occurring during execution of the FROM/TO instruction, the interrupt program corresponding to that interrupt is executed after completion of the FROM/TO instruction execution.

If M9119 is off, the FROM/TO instruction can be used in the interrupt program.

(b) When M9119 is ON (Interrupt overrides FROM/TO instruction)

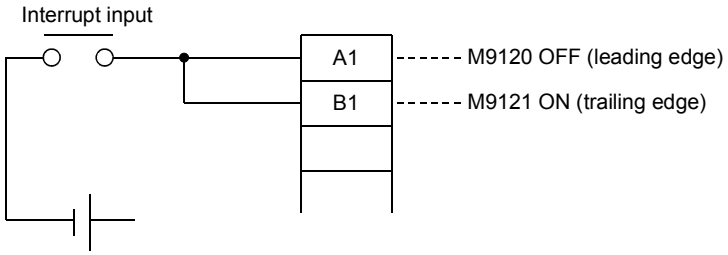
If an interrupt occurs during execution of the FROM/TO instruction, the execution of the FROM/TO instruction is suspended and the interrupt program corresponding to that interrupt is executed.

If M9119 is on, the FROM/TO instruction cannot be used in the interrupt program.

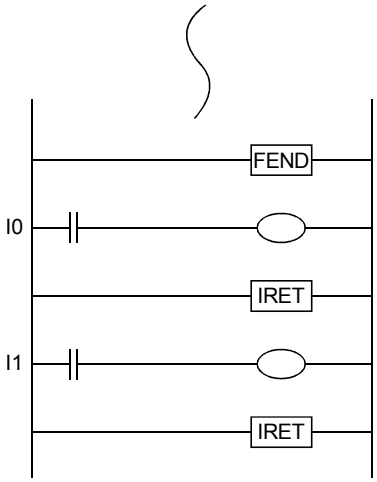
(2) Interrupt pointer In polarity setting (M9120 to M9125)

(a) To be turned on when running an interrupt program on the trailing edge of the corresponding interrupt input.
For the polarity setting of the interrupt pointer, the leading or trailing edge can be specified with a single interrupt pointer.

(b) When running an interrupt program on the leading and trailing edges, enter one interrupt signal into two places.
For example, wire as shown below when specifying interrupt pointer I0 for the leading edge and I1 for the trailing edge.



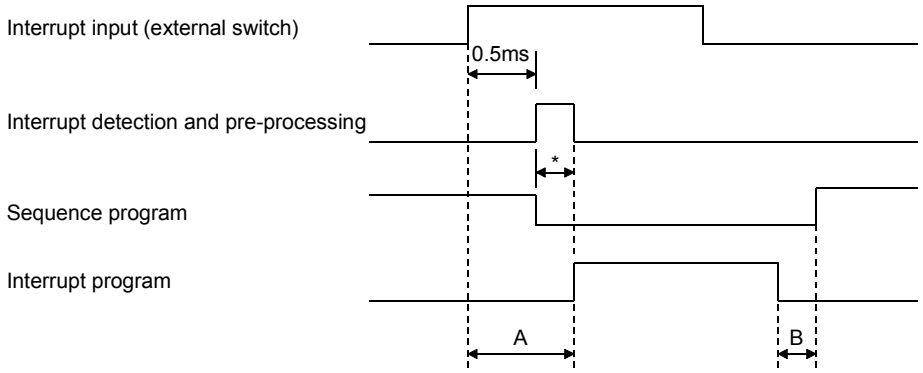
Also write interrupt programs as shown below in the ladder mode of the peripheral.



5.5.4 Interrupt processing timing

When an external interrupt signal comes in, the interrupt program corresponding to that interrupt signal is executed.
There is a time delay between entry of the interrupt signal and actual execution of the interrupt program.
When another interrupt program is being executed, the next program waits until the end of the currently run program.
Delay time between external interrupt signal entry and interrupt program execution will be described below.

(1) Ordinary interrupt input delay
(a) The following processing is performed between interrupt signal entry and interrupt program execution.



A: Time between interrupt input ON and interrupt program execution
B: Post-processing time of interrupt program

* Indicates the interrupt disable processing time and the interrupt program waits for that period.
The maximum execution time is listed below.

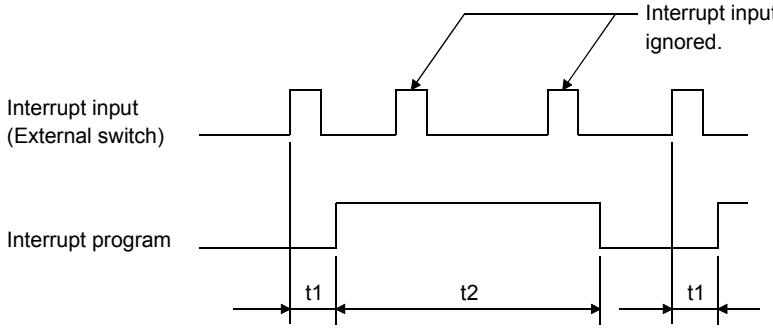
Item	During Ordinary Sequence Execution	During Execution of Any of I12, I13 and I29 to I31	General Data Processing of Simple Link Function	Interrupt from Peripheral
Time marked *	0.5ms	1ms + (execution time of interrupt program corresponding to any of I12, I13 and I29 to I31)	1.5ms	0.65ms (when monitoring device 128 bytes)

When one of the above processings takes place during execution of the other, the time marked * is the sum of individual periods. For example, when there is an interrupt input during general data processing, the time marked * is 0.5ms + 1.5ms.

(b) Minimum intervals of consecutive identical interrupt inputs

The intervals of identical interrupts executed consecutively should be not shorter than the sum of the time between when the interrupt input signal turns on and when the corresponding program is run (t1) and the execution time of the interrupt program (t2). (Times t1 + t2 or longer)

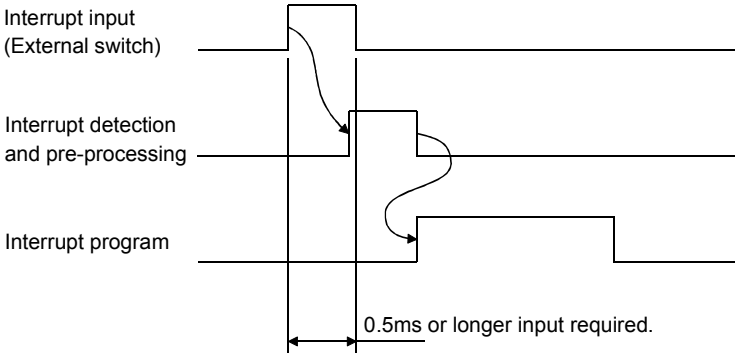
If interrupt signals corresponding to the interrupt program being executed come in, their interrupt requests are ignored.



t1: Time from interrupt input to interrupt program execution
t2: Interrupt program execution time

(c) Pulse width of interrupt input signal

It takes 0.5ms for the interrupt input of the A1FXCPU to turn from OFF to ON. Hence, the interrupt input may not be accepted if the pulse width of the interrupt input signal is less than 0.5ms.



(d) Interrupt input priority

- The interrupt priority is as follows.

Priority	Interrupt Pointer	Name
High	10	External interrupt input (X0)
▲	11	External interrupt input (X1)
▲	12	External interrupt input (X2)
▲	13	External interrupt input (X3)
▲	14	External interrupt input (X4)
▲	15	External interrupt input (X5)
▲	112	Coincidence output of high-speed counter function (CH.1)
▲	113	Coincidence output of high-speed counter function (CH.2)
▲	131	Time interrupt (10ms)
▲	130	Time interrupt (20ms)
Low	129	Time interrupt (40ms)

- When one interrupt occurs during interrupt program execution, the interrupt program corresponding to the next interrupt is executed on completion of that interrupt program execution.
- When two or more interrupts occur during interrupt program execution, the interrupt program corresponding to the highest-priority interrupt is executed on completion of that interrupt program execution.
- For example, when interrupt inputs corresponding to I5 and I2 take place during execution of the I4 interrupt program, I2 interrupt is executed on a priority basis.

6. I/O NUMBER ASSIGNMENT

This chapter describes I/O number assignment made to transfer data between the A1FXCPU and extension modules/extension blocks.

6.1 What Are I/O Numbers?

"Inputs (X)" are used to import data from the extension modules/extension blocks to the A1FXCPU, and "outputs (Y)" are used to output data from the A1FXCPU to the extension modules/extension blocks.

I/O numbers are addresses of the inputs/outputs built in the A1FXCPU and the extension modules/extension blocks.

The number of input/output points that may be controlled by the A1FXCPU is 242 (built in A1FXCPU: 14 input points/4 output points, extension modules/extension blocks: 224 points).

However, one special module or special block occupies 8 points.
Hence, when special modules/special blocks are used, the number of points available for extension modules/extension blocks is found by:

242 points – 8 × (number of special modules/special blocks)

- The A1FXCPU contains 14 input points and 4 output points and occupies X0 to XD as inputs and Y10 to Y13 as outputs.
  Therefore, extension modules/extension blocks use X/Y20 to X/YFF.

REMARKS

The number of I/O device points indicates the number of device points sfor which programming can be done with inputs (X) and outputs (Y).

6.2 I/O Number Assignment

When switched on or reset by the RUN/STOP switch, the A1FXCPU makes the following I/O number assignment.
When writing a sequence program, specify the I/O numbers assigned in accordance with the following items.

(1) I/O number assignment

(a) I/O numbers are assigned to the extension module/extension block connected on the right-hand side of the A1FXCPU, starting with X/Y20.
Numbers X ☐☐☐ are assigned to the inputs of extension modules/extension blocks and Y ☐☐☐ to their outputs.

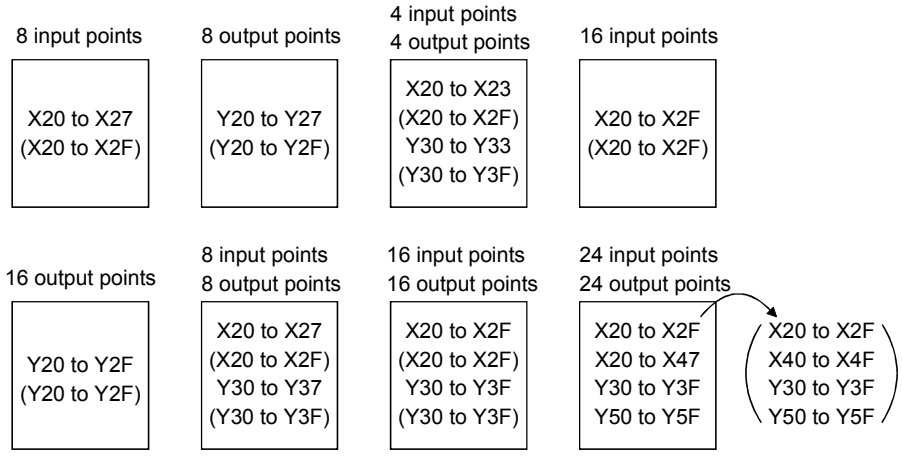
(b) I/O numbers are assigned in hexadecimal.

(c) Inputs/outputs start at X/Yn0.
The I/O numbers of each module are indicated below.

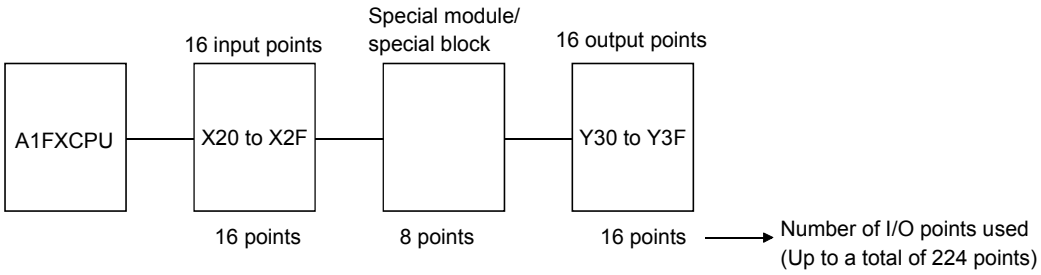
Number of I/O Points of Extension Module/Extension Block	I/O Numbers
8 input points	Xn0 to Xn7 (Xn8 to XnF must not be used)
8 output points	Yn0 to Yn7 (Yn8 to YnF are handled as internal relays) *1
4 input points, 4 output points	Xn0 to Xn3 (Xn4 to XnF must not be used) Y[n+1]0 to Y[n+1]3 (Y[n+1]4 to Y[n+1]F are handled as internal relays) *1
16 input points	Xn0 to XnF
16 output points	Yn0 to YnF
8 input points, 8 output points	Xn0 to Xn7 (Xn8 to XnF must not be used) Y[n+1]0 to Y[n+1]7 (Y[n+1]8 to Y[n+1]F are handled as internal relays) *1
16 input points, 16 output points	Xn0 to XnF, Y[n+1]0 to Y[n+1]7
24 input points, 24 output points	Xn0 to XnF, X[n+2]0 to X[n+2]7 Y[n+1]0 to Y[n+1]F, Y[n+3]0 to Y[n+3]7 (Y[n+3]8 to Y[n+3]F are handled as internal relays) *1

*1: Can be switched on/off in the sequence program but cannot be provided to the outside.

For example, I/O numbers are as follows when an extension module/extension block is connected on the right-hand side of the A1FXCPU. I/O numbers in parentheses are occupied by each extension module/extension block.

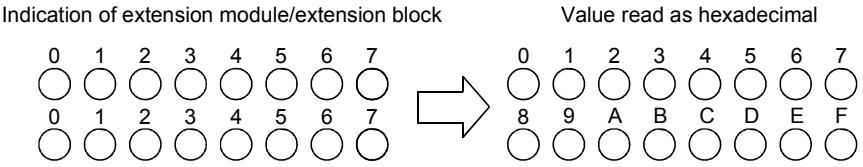


(d) One special module/special block occupies 8 points but does not use I/O numbers.
Hence, when special modules/special blocks are used, skip them over when setting the I/O numbers.

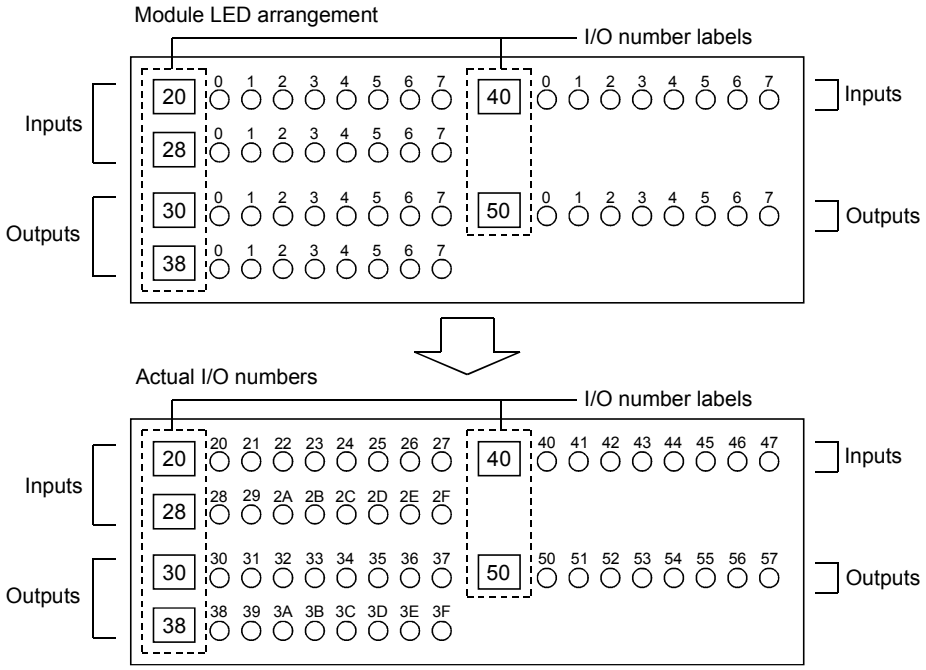


REMARKS

The LED indication of the extension module/extension block is in octal.
When using the A1FXCPU to control the extension module/extension block, read the octal of the LED indication as hexadecimal.



When a 48-point extension module (24 input points, 24 output points) is connected next to the A1FXCPU



7. COMMUNICATION WITH SPECIAL MODULE/SPECIAL BLOCK

This chapter explains how the A1FXCPU reads data from the special module/special block and write data to the special module/special block.

(1) Special module/special block

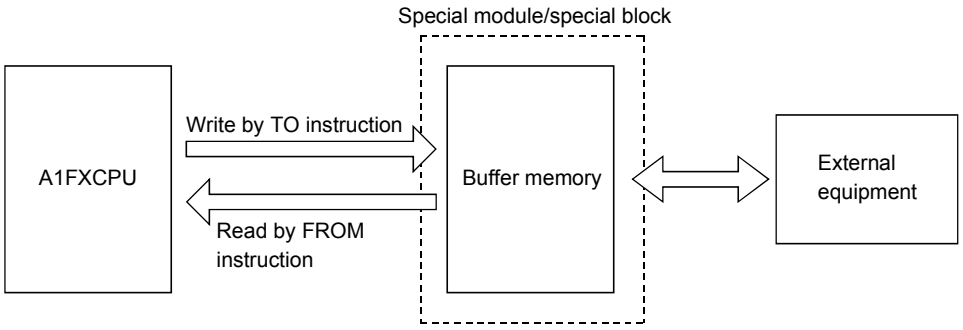
The special module/special block is a module designed for the A1FXCPU to handle analog values, high-speed pulses, etc. which cannot be handled by the extension module/extension block.

The special module has memory (buffer memory) which stores data imported from external equipment and data to be output to the external equipment.

(2) Read/write of data from/to A1FXCPU

The FROM/TO instruction is used by the A1FXCPU to read/write data from/to the special module/special block.

- Execution of the FROM instruction allows reading of the data stored in the buffer memory of the special module/special block.
- Execution of the TO instruction allows writing of data to the buffer memory of the special module/special block.



POINT

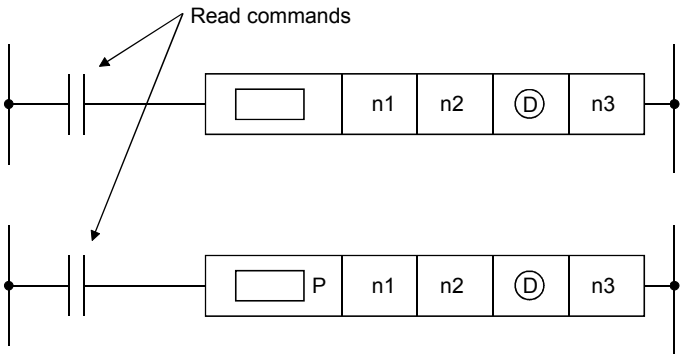
Note that a frequent execution of FROM/TO instructions on the target special module/special block may not be processed normally. When executing the FROM/TO instructions on the special module/special block, set the special module/special block timer or a constant scan with the FROM/TO instruction timings.

7.1 Reading 1- or 2-word data from the special module/special block

..... FROM, FROMP, DFRO, DFROP

	Available Device																				Digit Specification	Subset	Index	Carry Flag	Error Flag
	Bit device							Word device									Cons-tant		Pointer		Level					
	X	Y	M	L	S	B	F	T	C	D	W	R	A0	A1	Z	V	K	H	P	I	N				M9012	M9010 M9011
n1																	O	O				*		O		O
n2																	O	O								
Ⓓ		O	O	O		O	O	O	O	O	O	O														
n3																	O	O								

*: The digit specification of the FROM(P) instruction is K1 to K4. The digit specification of the DFRO(P) instruction is K1 to K8.



Instruction symbols in parentheses

FROM, DFRO

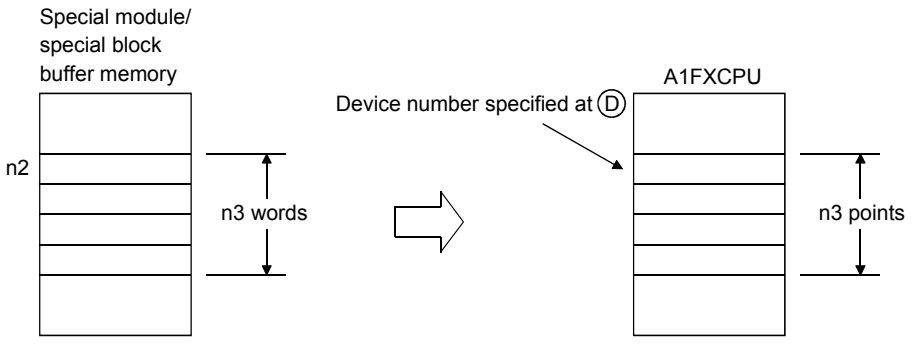
Set data

n1	Position of special module/special block counted from A1FXCPU (0 to 7)
n2	Head address of special module/ special block from which data is to be read
Ⓓ	Device number of A1FXCPU which stores data to be read
n3	Number of data to be read

Functions

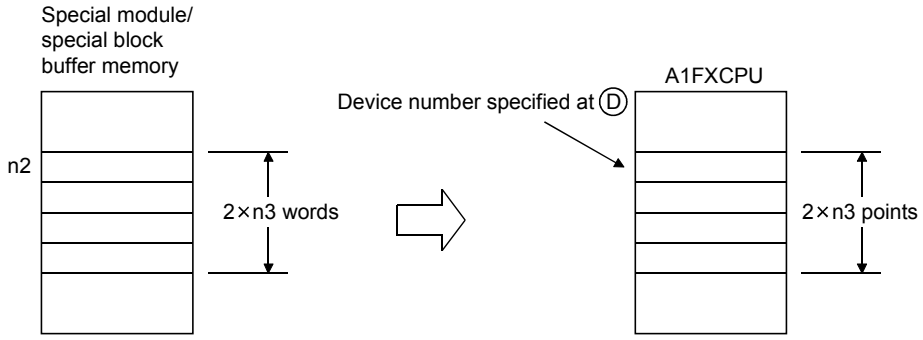
FROM

Reads n3-word data at the addresses beginning with the one specified at n2 in the buffer memory of the special module/special block specified at n1 and writes that data into the devices number starting from the one specified at Ⓓ.



DFRO

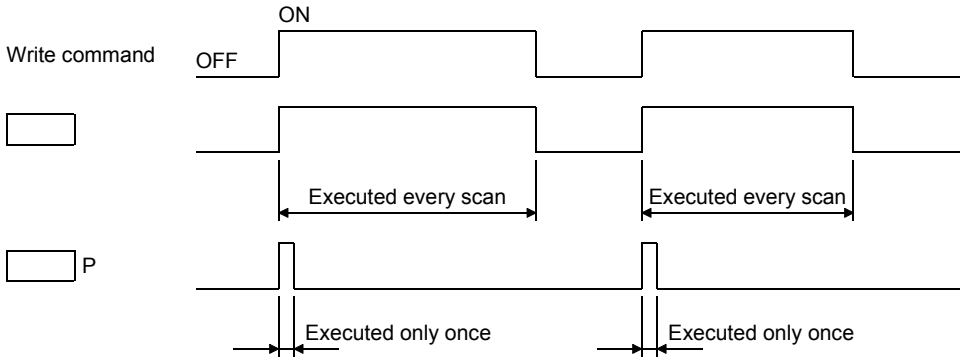
Reads (2 × n3)-word data from the address beginning with the one specified at n2 in the buffer memory of the special module/special block specified at n1 and writes that data into the devices number starting from the one specified at Ⓓ.



Execution Conditions

The FROM and DFRO instructions are executed every scan while the read command is ON.

The FROMP and DFROP instructions are executed only once on the leading edge (OFF → ON) of the read command.



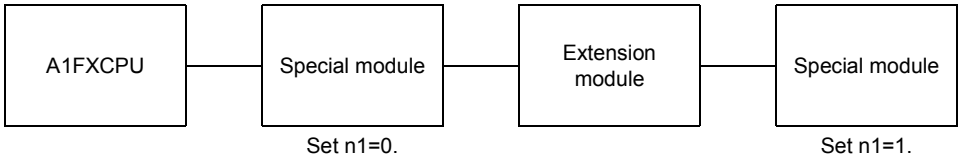
Operation Error

Any of the following conditions will result in an operation error and the error flag switch on.

- The special module/special block cannot be accessed.
- The value specified at n1 is other than 0 to 7.
- n3-point data from the device specified at Ⓓ exceeds the specified device range.

REMARKS

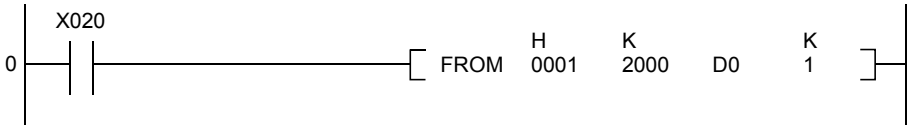
In n1, set the position of the special module/special block counted from the A1FXCPU.



Program Examples

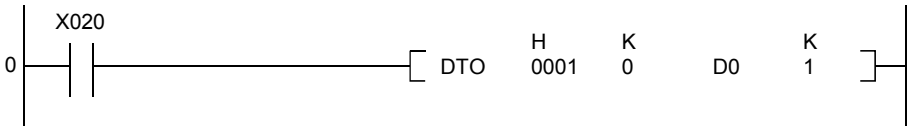
FROM

The following program reads 1-word data from K2000 of the buffer memory of the special module/special block located in the second position from the A1FXCPU to D0 when X20 is switched on.



DFRO

The following program reads 2-word data from K2000 of the buffer memory of the special module/special block located in the second position from the A1FXCPU to D0 and D1 when X20 is switched on.



REMARKS

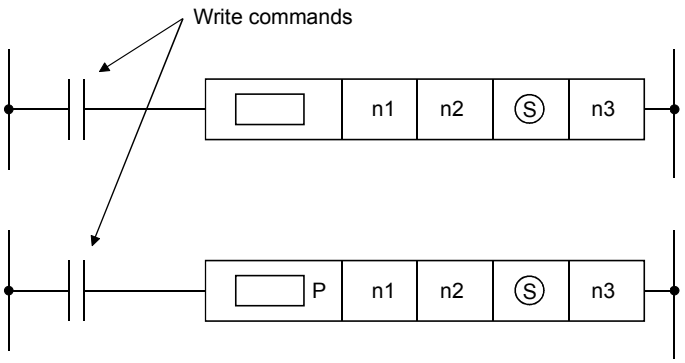
During execution of the FROM/DFRO/TO/DTO instruction, interrupt program execution control can be exercised by M9119.

- When M9119 is off (FROM/TO instruction overrides interrupt)
  While the FROM/DFRO/TO/DTO instruction is being executed, interrupt is disabled and an interrupt program is not run if an interrupt occurs.
  For any interrupt that occurred during execution of the FROM/DFRO/TO/DTO instruction, the corresponding interrupt program is run after completion of the FROM/DFRO/TO/DTO instruction execution.
  When M9119 is off, the FROM/DFRO/TO/DTO instruction can be used in an interrupt program.
- When M9119 is on (interrupt overrides FROM/TO instruction)
  When an interrupt occurs during execution of the FROM/DFRO/TO/DTO instruction, the FROM/DFRO/TO/DTO instruction execution is suspended and the corresponding interrupt program is run.
  When M9119 is turned on, the FROM/DFRO/TO/DTO instruction cannot be used in an interrupt program.
- Relevant interrupts are I0 to I5, I12, I13 and I29 to I31.

7.2 Writing 1- or 2-word data to the special module/special block ..... TO, TOP, DTO, DTOP

	Available Device																				Digit Specification	Subset	Index	Carry Flag	Error Flag
	Bit device							Word device									Cons-tant		Pointer		Level					
	X	Y	M	L	S	B	F	T	C	D	W	R	A0	A1	Z	V	K	H	P	I	N				M9012	M9010 M9011
n1																	O	O				*		O		O
n2																	O	O								
Ⓢ		O	O	O	×	O	O	O	O	O	O	O					O	O								
n3																	O	O								

*: The digit specification of the TO instruction is K1 to K4. The digit specification of the DTO instruction is K1 to K8. When K or H is specified at Ⓢ, the setting range is H0 to HFFFF or K-32768 to K32767.



Instruction symbols in parentheses

TO, DTO

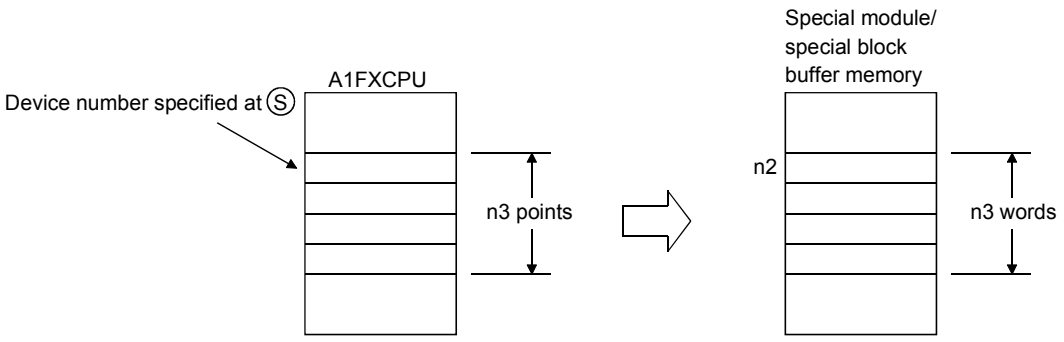
Set data

n1	Position of special module/special block counted from A1FXCPU (0 to 7)
n2	Head address of special module/ special block to which data is to be written
Ⓢ	Device number of A1FXCPU which stores data to be written
n3	Number of data to be written

Functions

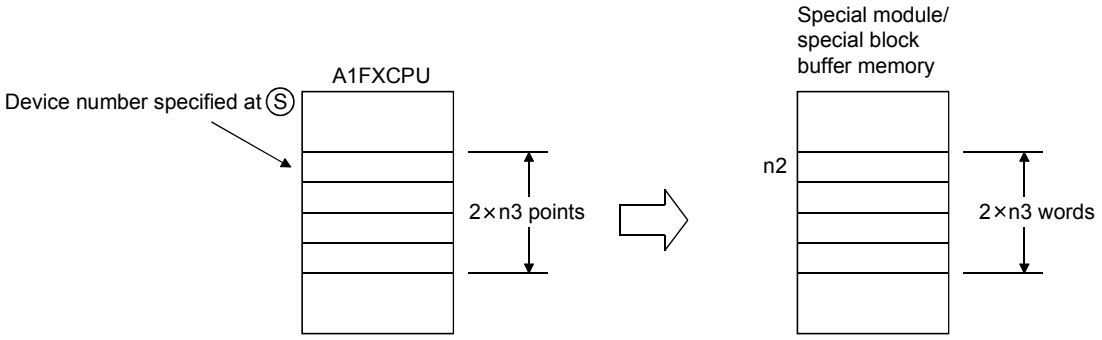
TO

Writes n3-point data in the devices number starting from the one specified at Ⓢ to the addresses beginning with the one specified at n2 in the buffer memory of the special module/special block specified at n1.



DTO

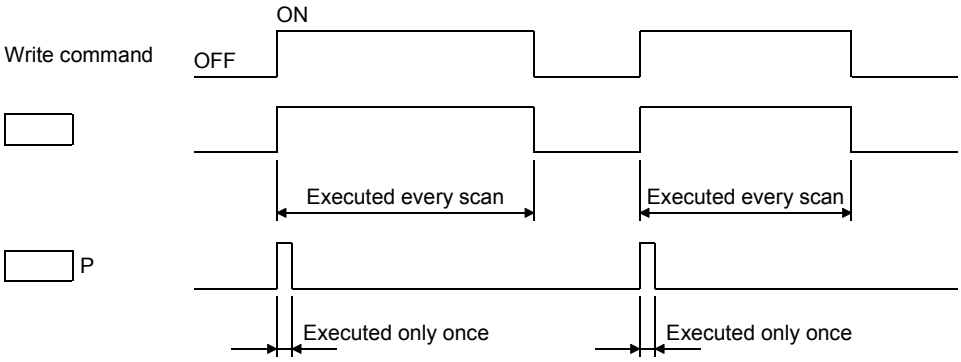
Writes (2 × n3)-point data in the devices number starting from the one specified at Ⓢ to the addresses beginning with the one specified at n2 in the buffer memory of the special module/special block specified at n1.



Execution Conditions

The TO and DTO instructions are executed every scan while the write command is ON.

The TOP and TOP instructions are executed only once on the leading edge (OFF → ON) of the write command.



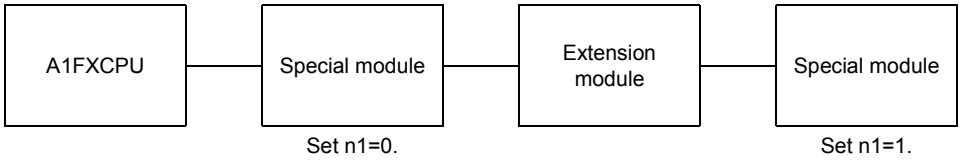
Operation Error

Any of the following conditions will result in an operation error and the error flag switch on.

- The special module/special block cannot be accessed.
- The value specified at n1 is other than 0 to 7.
- n3-point data from the device specified at Ⓢ exceeds the specified device range.

REMARKS

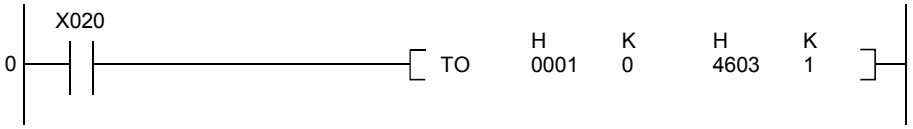
In n1, set the position of the special module/special block counted from the A1FXCPU.



Program Examples

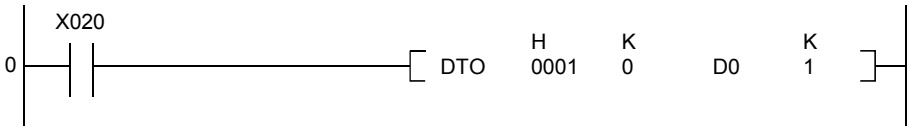
TO

The following program writes 4603H to K0 of the buffer memory of the special module/special block located in the second position from the A1FXCPU when X20 is switched on.



DTO

The following program writes 2-point data starting from the one specified at D0 to K0 of the buffer memory of the special module/special block located in the second position from the A1FXCPU when X20 is switched on.



REMARKS

During execution of the FROM/DFRO/TO/DTO instruction, interrupt program execution control can be exercised by M9119.

- When M9119 is off (FROM/TO instruction overrides interrupt)
  While the FROM/DFRO/TO/DTO instruction is being executed, interrupt is disabled and an interrupt program is not run if an interrupt occurs.
  For any interrupt that occurred during execution of the FROM/DFRO/TO/DTO instruction, the corresponding interrupt program is run after completion of the FROM/DFRO/TO/DTO instruction execution.
  When M9119 is off, the FROM/DFRO/TO/DTO instruction can be used in an interrupt program.
- When M9119 is on (interrupt overrides FROM/TO instruction)
  When an interrupt occurs during execution of the FROM/DFRO/TO/DTO instruction, the FROM/DFRO/TO/DTO instruction execution is suspended and the corresponding interrupt program is run.
  When M9119 is turned on, the FROM/DFRO/TO/DTO instruction cannot be used in an interrupt program.
- Relevant interrupts are I0 to I5, I12, I13 and I29 to I31.

8. ERROR CODE LIST

If an error occurs when the PLC power is on or while it is on, the self-diagnostic function causes the error to be displayed or the error code (including the step number) to be stored in the special register.
Table 8.1 indicates how to read the error code at error occurrence, error causes, and how to take action. Take proper action to remove the error cause.
Error messages, error codes, definitions and causes of errors, and corrective actions are given below.

Table 8.1 Error Code List

Error Message	Content of Special Register D9008 (BIN Value)	CPU Status	Error and Cause	Action
"INSTRUCT CODE ERR."	10	Stop	An unrecognized instruction code is included in the program. (1) The program including an unrecognized instruction code was written from the peripheral. (2) Memory contents changed for some reason, causing the unrecognized instruction code to be included. (3) Though the DIP switch is set to E^2PROM, the program is not written to E^2PROM.	(1) Read the error step with the peripheral and correct the program in that step. (2) Write the program to E^2PROM. (3) Write the program from the peripheral to E^2PROM.
"PARAMETER ERROR"	11	Stop	Parameter data in CPU memory changed due to noise.	Read the parameter data of CPU memory with the peripheral, check and correct the data, and write them to memory again.
"MISSING END INS."	12	Stop	There is no END (FEND) instruction in the program.	Write END at the end of the program.
"CAN'T EXECUTE (P)"	13	Stop	(1) No jump destination or several destinations specified for the CJ, SCJ, CALL(P) or JMP instruction. (2) The RET instruction has been executed with no corresponding CALL(P) instruction. (3) The CJ, SCJ, CALL(P) or JMP instruction has been executed with jump destination located after the END instruction. (4) The number of FOR instructions does not match that of NEXT instructions. (5) The JMP instruction is provided between FOR and NEXT to exit from FOR-NEXT. (6) Before the RET instruction is executed, the JMP instruction has been executed to exit from the subroutine. (7) The JMP instruction has been executed to jump into the step between FOR and NEXT or into the subroutine.	Read the error step with the peripheral and correct the program in that step. (Correct by inserting a jump destination or reducing destinations to one.)

Table 8.1 Error Code List (Continued)

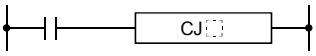
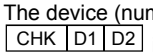
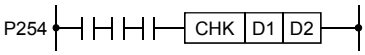
Error Message	Content of Special Register D9008 (BIN Value)	CPU Status	Error and Cause	Action
"CHK FORMAT ERR."	14	Stop	(1) The CHK instruction ladder block contains an instruction (including NOP) other than LD X□, LDI X□, AND X□ and ANI X□. (2) There are several CHK instructions. (3) There are more than 150 contacts in the CHK instruction ladder block. (4) The X device number in the CHK instruction ladder block is greater than X1FE. (5) There is no following ladder block before the CHK instruction ladder block.  (6) The device (number) of D1 in the  instruction is not the same as that of the contact before the CJ□ instruction. (7) Pointer P254 is not provided at the beginning of the CHK instruction ladder block. 	(1) Check for any of (1) to (7) error causes in the CHK instruction ladder block. If any, correct the fault with the peripheral and restart operation.
"CAN'T EXECUTE (I)"	15	Stop	(1) There are several interrupt pointer I numbers. (2) No IRET instruction in the interrupt program. (3) IRET instruction used outside the interrupt program.	(1) Create a corresponding number of interrupt programs or remove the same I numbers. (2) Check for IRET instruction in the interrupt program. If not found, write the IRET instruction. (3) Check for the IRET instruction outside the interrupt program. If found, delete the IRET instruction.
"RAM ERROR"	20	Stop	(1) The CPU could not access the data memory area of the CPU.	CPU hardware fault, contact your sales representative.
"OPE. CIRCUIT ERR."	21	Stop	(1) The sequence processing operation circuit in the CPU does not operate properly.	
"WDT ERROR"	22	Stop	Scan time exceeds watchdog error monitor time. (1) User program scan time has increased. (2) Instantaneous power failure during program scan has caused scan time to increase.	(1) Calculate or check user program scan time and reduce it using CJ instruction, etc. (2) Check for instantaneous power failure by monitoring special register D9005 with the peripheral. If the value is other than 0, power supply voltage is instable. Check the power supply and reduce voltage fluctuation.

Table 8.1 Error Code List (Continued)

Error Message	Content of Special Register D9008 (BIN Value)	CPU Status	Error and Cause	Action
"END NOT EXECUTE"	24	Stop	(1) When executed, the END instruction was read as another instruction code due to noise, etc. (2) The END instruction has changed into another instruction code for some reason.	(1) Reset the CPU and run it again. If the error still persists, it is a CPU hardware fault. Consult your sales representative.
"WDT ERROR"	25	Stop	The CJ instruction or like caused the sequence program to enter a loop, making the END instruction inexecutable.	Check for programs which may go into an endless loop and correct if any.
"UNIT VERIFY ERR."	31	Stop (Run)	I/O data different from those at power-on. (1) The connection cable of extension module, extension block, special module or special block unplugged.	(1) Monitor the special register D9116 (in blocks of 16 points) with the peripheral to check for "1" in the bit corresponding to the extension module, extension block, special module or special block resulting in verify error. Change the corresponding module or block. (2) Monitor the special register D9116 (in blocks of modules) with the peripheral to check for "1" in the bit corresponding to the extension module, extension block, special module or special block resulting in verify error. Change the corresponding module or block. (3) When the current module may be kept connected, reset the CPU with the RESET switch.
"FUSE BREAK OFF"	32	Run (Stop)	(1) Power of the extension module not on.	(1) The peripheral may also be used to check whether the power of the extension module is off or not. Monitor the special registers D9100-D9101 to check for "1" in the bit corresponding to the extension module/special extension module resulting in power-off. (2) Check whether the power of the extension module/special extension module is on or off.
"CONTROL-BUS ERR."	40	Stop	FROM and/or TO instruction not executed. (1) Special module control bus error.	(1) Special module, CPU module or extension cable hardware fault. Change the module and check the faulty module. Consult your sales representative.

Table 8.1 Error Code List (Continued)

Error Message	Content of Special Register D9008 (BIN Value)	CPU Status	Error and Cause	Action
"SP. UNIT ERROR"	46	Stop (Run)	(1) Access to where no special module exists (FROM/TO instruction executed). (2) Extension module/special block not supplied with power.	(1) Read the error step with the peripheral, and check and correct the FROM/TO instruction in that step with the peripheral. (2) Switch on power of special module. Switch on power of extension module which supplies power to special block.
"LINK PARA. ERROR"	47	Run	(1) Link setting program setting data is outside setting range. (LINK RUN LED flickers)	(1) Correct the link setting program.
"OPERATION ERROR"	50	Run (Stop)	(1) BCD conversion result exceeded specified range (9999 or 99999999). (2) Setting in excess of specified device range made operation inexecutable. (3) File registers used in program without file register capacity being set.	(1) Read the error step with the peripheral, and check and correct the program in that step. (Check device setting range, BCD conversion value, etc.)
"MAIN CPU DOWN"	60	Stop	(1) Interrupt (INT) instruction used in microcomputer program. (2) CPU misoperated due to noise, etc. (3) CPU hardware fault.	(1) Remove INT instruction as it cannot be used in microcomputer program. (2) Eliminate noise. (3) Change CPU.
"BATTERY ERROR"	70	Run	(1) Battery voltage dropped below specified level. (2) Battery not connected.	(1) Change battery. (2) Connect battery when built-in RAM memory or power failure compensation is used.

APPENDICES

Appendix 1 General Specifications

Table 1.1 lists the general specifications of the A1FXCPU used independently, and Table 1.2 lists those of the A1FXCPU used with the FX series.

Table 1.1 General Specifications (of the A1FXCPU Used Independently)

Item	Specifications					
Operating ambient temperature	0 to 55°C					
Storage ambient temperature	–20 to 75°C					
Operating ambient humidity	10 to 90%RH, non-condensing					
Storage ambient humidity	10 to 90%RH, non-condensing					
Vibration resistance	Conforms to JIS B 3502 and IEC 1131-2.		Frequency	Acceleration	Amplitude	Sweep Count
		In case of intermittent vibration	10 to 57Hz	—	0.075mm	10 times in each of X, Y and Z directions (for 80 minutes)
			57 to 150Hz	9.8m/s^2	—	
		In case of continuous vibration	10 to 57Hz	—	0.035mm	
			57 to 150Hz	4.9m/s^2	—	
Shock resistance	Conforms to JIS B 3502 and IEC 1131-2 (147m/s^2 , 3 times in each of X, Y and Z directions).					
Operating atmosphere	No corrosive gas					
Operating altitude	2000m (610feet) max.					
Installation site	Inside control box					
Overvoltage category*1	II or less					
Contamination level*2	2 or less					
Noise durability	By noise simulator of 1,500Vp-p noise voltage, 1 μs noise width and 25 to 60Hz noise frequency					
Dielectric withstand voltage	1,500VAC for 1 minute across AC external terminals and ground 500VAC for 1 minute across DC external terminals and ground					
Insulation resistance	10MΩ or larger for 1 minute by 500VDC insulation resistance tester across AC external terminals and ground					
Grounding	Always ground the terminal to the protective ground connector					

*1: Indicates the element in the distribution system between the public electricity grid and the mechanical equipment inside the premises that the relevant device is assumed to be connected to.
Category II applies to devices such as those that draw their power supply from fixed installations.
The surge voltage withstand capability of devices with ratings up to 300V is 2,500V.

*2: This index gives a measure of the incidence of conductive materials in the environment in which the device is used.
A contamination level of 2 indicates an environment in which there is only contamination by non-conducting materials, but due to occasional condensation, conductivity may occur.

The specifications in the following table apply when the A1FXCPU is used with the FX series.
However, when the A1FXCPU is mounted on an enclosure, the vibration resistance should be as in the A1FXCPU range (Table 1.1).
When the A1FXCPU is mounted on the DIN rail, the vibration resistance should be as in the FX series range (Table 1.2).

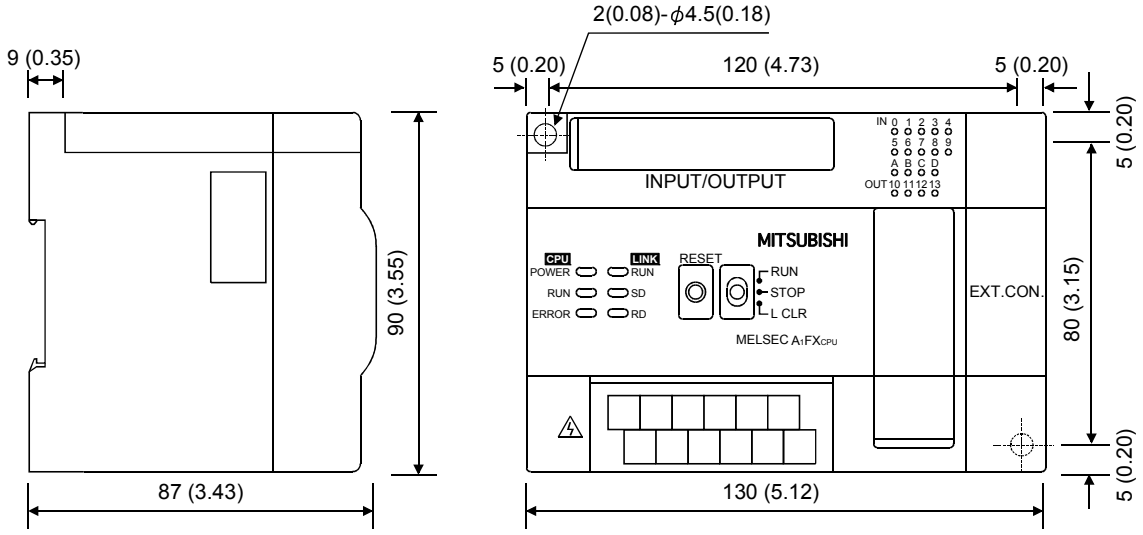
Table 1.2 General Specifications (of the A1FXCPU Used with the FX Series)

Item	Specifications	
Ambient temperature	0 to 55°C…Operating, -20 to 70°C … Storage	
Relative humidity	35 to 85%RH (non-condensing) … Operating	
Vibration resistance	Conforms to JIS C 0911. 10 to 55Hz, 0.5mm (max. 2G)*1, in each of three axial directions for 2 hours.	
Shock resistance	Conforms to JIS C 0912. 10G, 3 times in each of three axial directions.	
Noise durability	By noise simulator of 1,000Vp-p noise voltage, 1 μs noise width and 30 to 100Hz noise frequency	
Dielectric withstand voltage	1,500VAC for 1 minute	Across all terminals and ground
Insulation resistance	5MΩ or larger by 500VDC insulation resistance tester	
Grounding	Always ground the terminal to the protective ground connector (no joint grounding with power control system)	
Operating atmosphere	No corrosive and combustible gases and little conductive dirt and dust.	

*1: 0.5G when mounted to DIN rail

Appendix 2 Outline Dimension Drawings

Appendix 2.1 A1FXCPU module



Unit: mm (inch)

Appendix 3 Available Instructions and Processing Time

Appendix 3.1 Sequence instructions

Classification	Instruction	Condition (Device)					Processing Time (μs)
Contact instruction	LD LDI AND ANI OR ORI	X,Y,M,L,B,F,T,C					0.25
Association instruction	ANB ORB MPS MRD MPP	———					0.25
Output instruction	OUT	Y,L,B M(Other than special M)	Unchanged (OFF→OFF, ON→ON)				0.25
			Changed (OFF→ON, ON→OFF)				
		Special M					7.2
		F	Unexecuted				12.3
			Executed				52.2
		T	Instruction execution time				0.25
			Processing time at END	Unexecuted			0
				Executed	After time-out		20.0
					Added	K	22.0
						D	24.0
		C	Instruction execution time				0.25
			Processing time at END	Unexecuted			0
				Executed	Uncounted		0
					After count-out		0
					Counted	K	12.0
						D	15.2

Classification	Instruction	Condition (Device)			Processing Time (μs)	
Output instruction	SET	Y	Unexecuted		0.25	
			Executed	Unchanged (ON→ON)		
				Changed (OFF→ON)		
		M,L,B	Unexecuted		0.25	
			Executed	Unchanged (ON→ON)		
				Changed (OFF→ON)		
		Special M B	Unexecuted		1.0	
			Executed		6.2	
		F	Unexecuted		1.0	
			Executed		46.1	
	RST	Y	Unexecuted		0.32	
			Executed	Unchanged (OFF→OFF)		
				Changed (ON→OFF)		
		M,L,B	Unexecuted		0.32	
			Executed	Unchanged (OFF→OFF)		
				Changed (ON→OFF)		
		Special M B	Unexecuted		1.0	
			Executed		6.2	
		F	Unexecuted		1.0	
			Executed		OFF→OFF 8.5	ON→OFF 57.1
		T,C	Unexecuted		1.0	
			Executed		OFF→OFF 8.3	ON→OFF 9.0
		D,W A0,A1 V,Z	Unexecuted		1.0	
			Executed		5.2	
		R	Unexecuted		1.0	
			Executed		6.7	
	PLS PLF	Y	Unexecuted		11.7	
			Executed	On	11.6	
				Off	11.7	
		M,L B,F	Unexecuted		11.7	
			Executed	On	11.6	
				Off	11.7	
	CHK	Bit inversion			23.2	

Classification		Instruction	Condition (Device)		Processing Time (μs)
Shift instruction		SFT SFTP	Y	Unexecuted	1.0
				Executed	8.1
			M,L B,F	Unexecuted	1.0
				Executed	8.1
Master control instruction		MC	Y	Unexecuted	8.8
				Executed	8.0
			M,L B,F	Unexecuted	8.8
				Executed	8.0
		MCR	——		5.2
End instruction		FEND END	When M9084 is on		466.6
			When M9084 is off		451.3
Other instructions	Stop	STOP	——		——
	No operation	NOP	——		0.25
	Line feed*	NOPLF	——		0.25

*: Line feed processing is performed when printer output is provided.

Appendix 3.2 Basic instructions

Classification			Instruction	Condition	S		D		Processing Time(μs)
					(S1)	(S2)	(D1)	(D2)	
Comparison instruction	=	16 bits	LD=		D0		D1		14.7
			AND=		D0		D1		12.9
			OR=		D1		D0		13.7
		32 bits	LDD=		D0		D2		27.5
			ANDD=		D0		D2		25.3
			ORD=		D0		D2		27.3
	< >	16 bits	LD < >		D0		D1		14.5
			AND < >		D0		D1		12.3
			OR < >		D0		D1		13.1
		32 bits	LDD < >		D0		D2		26.9
			ANDD < >		D0		D2		26.7
			ORD < >		D0		D2		25.9
	>	16 bits	LD >		D0		D1		14.3
			AND >		D0		D1		12.7
			OR >		D0		D1		12.9
		32 bits	LDD >		D0		D2		27.5
			ANDD >		D0		D2		27.1
			ORD >		D0		D2		26.5
	>=	16 bits	LD >=		D0		D1		14.9
			AND >=		D0		D1		12.5
			OR >=		D0		D1		14.1
		32 bits	LDD >=		D0		D2		28.3
			ANDD >=		D0		D2		26.1
			ORD >=		D0		D2		28.3
	<	16 bits	LD <		D0		D1		14.7
			AND <		D0		D1		12.5
			OR <		D0		D1		13.1
		32 bits	LDD <		D0		D2		27.3
			ANDD <		D0		D2		27.1
			ORD <		D0		D2		26.5
	<=	16 bits	LD <=		D0		D1		14.9
			AND <=		D0		D1		12.3
			OR <=		D0		D1		13.9
		32 bits	LDD <=		D0		D2		28.5
			ANDD <=		D0		D2		26.3
			ORD <=		D0		D2		28.3

Classification			Instruction	Condition	S		D		Processing Time(μs)
					(S1)	(S2)	(D1)	(D2)	
BIN arithmetic operation instruction	Addition	16 bits	+		D0		D1		8.7
			+P		D0		D1		8.6
		32 bits	D+		D0		D2		13.7
			D+P		D0		D2		13.6
		16 bits	+		D0	D1	D2		15.3
			+P		D0	D1	D2		15.2
		32 bits	D+		D0	D2	D4		19.3
			D+P		D0	D2	D4		19.4
	Subtraction	16 bits	-		D0		D1		8.7
			-P		D0		D1		8.6
		32 bits	D-		D0		D2		13.7
			D-P		D0		D2		13.6
		16 bits	-		D0	D1	D2		15.7
			-P		D0	D1	D2		15.8
		32 bits	D-		D0	D2	D4		20.3
			D-P		D0	D2	D4		20.4
	Multiplication	16 bits	*		D0	D1	D2		16.5
			*P		D0	D1	D2		16.6
		32 bits	D*		D0	D2	D4		73.7
			D*P		D0	D2	D4		73.6
	Division	16 bits	/		D0	K1	D2		17.7
			/P		D0	K1	D2		17.4
		32 bits	D/		D0	K1	D4		80.1
			D/P		D0	K1	D4		80.2
	+1	16 bits	INC				D0		5.7
			INCP				D1		5.4
		32 bits	DINC				D0		8.1
			DINCP				D0		7.9
	-1	16 bits	DEC				D0		6.1
			DECP				D0		5.9
		32 bits	DDEC				D0		8.1
			DDECP				D0		8.1

Classification			Instruction	Condition	S		D		Processing Time(μs)
					(S1)	(S2)	(D1)	(D2)	
BCD arithmetic operation instruction	Addition	16 bits	B+		D0		D1		25.3
			B+P		D0		D1		25.2
		32 bits	DB+		D0		D2		35.2
			DB+P		D0		D2		35.4
		16 bits	B+		D0	D1	D2		26.5
			B+P		D0	D1	D2		26.6
		32 bits	DB+		D0	D2	D4		37.7
			DB+P		D0	D2	D4		37.5
	Subtraction	16 bits	B-		D0		D1		24.9
			B-P		D0		D1		24.9
		32 bits	DB-		D0		D2		35.3
			DB-P		D0		D2		35.1
		16 bits	B-		D0	D1	D2		27.3
			B-P		D0	D1	D2		27.1
		32 bits	DB-		D0	D2	D4		38.1
			DB-P		D0	D2	D4		37.9
	Multiplication	16 bits	B*		D0	D1	D2		60.1
			B*P		D0	D1	D2		59.7
		32 bits	DB*		D0	D2	D4		184.3
			DB*P		D0	D2	D4		184.3
	Division	16 bits	B/		D0	K1	D1		46.2
			B/P		D0	K1	D2		46.1
		32 bits	DB/		D0	K1	D2		185.1
			DB/P		D0	K1	D4		184.5
BCD to BIN conversion instruction	BIN→BCD	16 bits	BCD		D0		D1		16.3
			BCDP		D0		D1		16.7
		32 bits	DBCD		D0		D2		44.3
			DBCDP		D0		D2		44.5
	BCD→BIN	16 bits	BIN		D0		D1		15.7
			BINP		D0		D1		15.7
		32 bits	DBIN		D0		D2		43.9
			DBINP		D0		D2		43.7

Classification			Instruction	Condition	S		D		Processing Time(μs)
					(S1)	(S2)	(D1)	(D2)	
Data transfer instruction	Transfer	16 bits	MOV		D0		D2		9.1
			MOVP		D0		D2		8.9
		32 bits	DMOV		D0		D2		13.1
			DMOVP		D0		D2		13.1
	Exchange	16 bits	XCH				D0	D1	11.9
			XCHP				D0	D1	11.9
		32 bits	DXCH				D0	D2	21.7
			DXCHP				D0	D2	21.7
	Negative transfer	16 bits	CML		D0		D1		8.3
			CMLP		D0		D1		8.3
		32 bits	DCML		D0		D2		15.1
			DCMLP		D0		D2		15.3
	Batch transfer	16 bits	BMOV		D0		D1	K5	44.4
			BMOVP		D0		D1	K5	44.5
	Same data batch transfer	32 bits	FMOV		D0		D1	K5	25.4
			FMOVP		D0		D1	K5	25.5
Program branch instruction	Jump		CJ	Without index qualification					7.6
				With index qualification					9.5
			SCJ	Without index qualification					13.3
				With index qualification					15.1
			JMP						7.6
	Subroutine call		CALL	Without index qualification					13.3
				With index qualification					15.1
			CALLP	Without index qualification					13.2
				With index qualification					15.1
			RET						9.3
	Interrupt program enable/disable		EI						7.1
			DI						6.5
			IRET						43.2
	Microcomputer program call		SUB	Without index qualification					19.0
				With index qualification					20.0
			SUBP	Without index qualification					19.0
				With index qualification					20.0

Appendix 3.3 Application instructions

Classification			Instruction	Condition	S		D		Processing Time(μs)
					(S1)	(S2)	(D1)	(D2)	
Logical operation instruction	Logical product	16 bits	WAND		D0		C0		11.5
			WANDP		D0		C0		11.5
		32 bits	DAND		D0		C0		27.1
			DANDP		D0		C0		27.1
		16 bits	WAND		C0	D0	D100		19.3
			WANDP		C0	D0	D100		19.3
	Logical add	16 bits	WOR		C0		D0		11.1
			WORP		C0		D0		11.1
		32 bits	DOR		D0		C0		27.3
			DORP		D0		C0		27.3
		16 bits	WOR		D0	C0	D100		19.3
			WORP		D0	C0	D100		19.3
	Exclusive logical add	16 bits	WXOR		C0		D0		11.5
			WXORP		C0		D0		11.5
		32 bits	DXOR		C0		D0		27.1
			DXORP		C0		D0		27.3
		16 bits	WXOR		C0	D0	D10		19.3
			WXORP		C0	D0	D10		19.3
	NOT exclusive logical add	16 bits	WXNR		C0		D0		11.7
			WXNRP		C0		D0		11.7
		32 bits	DXNR		C0		D0		27.5
			DXNRP		C0		D0		27.5
		16 bits	WXNR		C0	D0	D10		19.3
			WXNRP		C0	D0	D10		19.5
	2's complement	16 bits	NEG				D0		9.5
			NEGP				D0		9.5

Classification			Instruction	Condition	S		D		Processing Time(μs)
					(S1)	(S2)	(D1)	(D2)	
Rotation instruction	Right rotation	16 bits	ROR	n=3					9.5
			RORP	n=3					9.5
			RCR	n=3					10.9
			RCRP	n=3					10.9
		32 bits	DROR	n=3					13.7
			DRORP	n=3					13.7
			DRCR	n=3					13.5
			DRCRP	n=3					13.5
	Left rotation	16 bits	ROL	n=3					9.9
			ROLP	n=3					9.9
			RCL	n=3					11.3
			RCLP	n=3					11.5
		32 bits	DROL	n=3					13.7
			DROLP	n=3					13.1
			DRCL	n=3					14.1
			DRCLP	n=3					14.1
Shift instruction	Right shift	16 bits	SFR	n=5			D0		13.7
			SFRP	n=5			D0		13.7
			BSFR	n=5			M0		23.7
				n=15			M0		25.1
			BSFRP	n=5			M0		23.5
				n=15			M0		25.3
		32 bits	DSFR	n=5			C0		22.5
			DSFRP	n=5			C0		22.7
	Left shift	16 bits	SFL	n=5			C0		14.3
			SFLP	n=5			C0		14.3
			BSFL	n=5			M64		25.7
				n=15			M64		26.9
			BSFLP	n=5			M64		25.9
				n=15			M64		27.1
		32 bits	DSFL	n=5			C0		22.7
			DSFLP	n=5			C0		22.9

Classification			Instruction	Condition	S		D		Processing Time(μs)
					(S1)	(S2)	(D1)	(D2)	
Data processing instruction	Data search	16 bits	SER	n=5	D0	C0			37.3
			SERP	n=5	D0	C0			37.5
	Bit check	16 bits	SUM		D0				23.1
			SUMP		D0				23.3
		32 bits	DSUM		D0				40.3
			DSUMP		D0				40.5
	Decode	2^n bits	DECO	n=2	C0		D0		32.3
			DECOP	n=2	C0		D0		32.5
	Encode	2^n bits	ENCO	n=2	C0		D0		69.5
			ENCOP	n=2	C0		D0		69.4
		16 bits	SEG						19.8
	Bit set	16 bits	BSET	n=5			C0		17.7
			BSETP	n=5			C0		17.5
	Bit reset	16 bits	BRST	n=5			D0		18.7
			BRSTP	n=5			D0		18.7
	Dissociation	16 bits	UNI	n=1	C0		D0		21.5
			UNIP	n=1	C0		D0		21.5
	Association	16 bits	DIS	n=1	C0		D0		28.1
			DISP	n=1	C0		D0		28.1
FIFO instruction	Write	16 bits	FIFW		D0		C0		55.3
			FIFWP		C0		D0		20.5
	Read	16 bits	FIFR				C0	D0	40.3
			FIFRP				C0	D0	40.3
ASCII instruction	ASCII conversion		ASC						23.1
			ASC	Z					26.3
	ASCII print		PR						52.5
			PRC						31.5

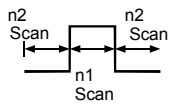
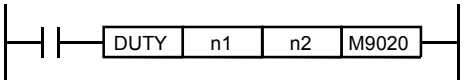
Classification			Instruction	Condition	S		D		Processing Time(μs)
					(S1)	(S2)	(D1)	(D2)	
Buffer memory access instruction	Data read	16 bits	FROM	n=1					686.9
				n=30					18583.3
			FROMP	n=1					662.5
				n=30					18488.3
		32 bits	DFRO	n=1					1264.5
				n=15					18503.3
			DFROP	n=1					1237.9
				n=15					18368.3
	Data write	16 bits	TO	n=1					714.7
				n=30					19523.3
			TOP	n=1					702.3
				n=30					19518.3
		32 bits	DTO	n=1					1371.9
				n=15					19293.3
			DTOP	n=1					1297.7
				n=15					19193.3
FOR-NEXT instruction	Repetition		FOR						10.1
			NEXT						7.5
Display instruction	Display reset		LEDR						56.9
Other instructions	WDT reset		WDT						12.2
			WDTP						12.2
	Status latch		SLT	Device memory only					878.7
			SLT	Device memory + R					2480.7
			SLTR						5.8
	Sampling trace		STRA						5.7
			STRAR						5.4
	Carry flag set		STC						5.4
	Carry flag reset		CLC						5.7
	Timing clock		DUTY						13.1

Appendix 4 List of Special Relays and Special Registers

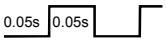
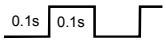
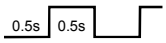
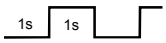
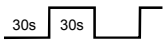
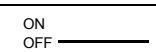
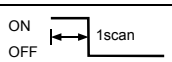
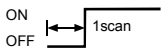
Appendix 4.1 List of Special relays

The special relays are the internal relays that have specific applications in the sequencer. Therefore, the coil cannot be turned ON/OFF on the program. (Except for the ones marked by *1 or *2 in the table.)

Appendix Table 4.1 List of Special Relays

Number	Name	Description	Details of contents
*1 M9000	Fuse blown	OFF : Normal ON : Module with fuse blown exists.	• This is ON when at least one module has a fuse blown, and stays ON even if it returns to normal later.
*1 M9002	I/O module verify error	OFF : Normal ON : Error occurred	• This is ON if the I/O module status is different from the status registered at the power up. It stays ON even if it returns to normal later.
*1 M9004	MINI link error	OFF : Normal ON : Error occurred	• This is turned ON if a module in a master station of the MINI link detects an error. It stays ON even if it returns to normal later.
*4 M9005	AC DOWN detect	OFF : No AC DOWN ON : AC DOWN occurred	• This is turned ON when there is a momentary power interruption for 20ms or less, and is reset when the power is turned ON after it was turned OFF.
M9006	Battery low	OFF : Normal ON : Battery low	• This is turned ON when the battery voltage drops below the specified level, and turned OFF when the battery voltage returns to normal.
*1 M9007	Battery low latch	OFF : Normal ON : Battery low	• This is turned ON when the battery voltage drops below the specified level, and stays ON even if the battery voltage returns to normal.
*1 M9008	Self-diagnosis error	OFF : No error ON : Error occurred	• This is turned ON when an error is detected as a result of a self-diagnosis.
M9009	Annunciator detect	OFF : Not detected ON : Detected	• This is turned ON when the OUT F or SET F instruction is executed, and turned OFF when the contents of the D9124 becomes 0.
*1 M9011	Operation error flag	OFF : No error ON : Error occurred	• This is turned ON when a operation error occurs while the application instruction is executed, and stays ON even if it returns to normal.
M9012	Carry flag	OFF : Carry OFF ON : Carry ON	• This is a carry flag used during the application instruction.
M9016	Data memory clear flag	OFF : No processing ON : Clear the output	• When M9016 is ON, it clears all data memory (except for the special relays and registers) including the area that are latched by the remote RUN from the computer.
M9017	Data memory clear flag	OFF : No processing ON : Clear the output	• When M9017 is ON, it clears all data memory (except for the special relays and registers) that are not latched by the remote RUN from the computer.
M9020	User timing clock No. 0		• Relays that repeat ON/OFF by a constant scan interval. • Starts from OFF when the power supply is turned ON or reset. • Sets the ON/OFF interval by the DUTY instruction. 
M9021	User timing clock No. 1		
M9022	User timing clock No. 2		
M9023	User timing clock No. 3		
M9024	User timing clock No. 3		

Appendix Table 4.1 List of Special Relays (Continued)

Number	Name	Description	Details of contents
*2 M9025	Clock data set request	OFF : No processing ON : Set request exists	• After the END instruction is executed during a scan in which the M9025 changes from OFF to ON, the clock data stored in D9025 to D9028 is written into the clock device.
M9026	Clock data error	OFF : No error ON : Error occurred	• ON when an error occurred in the value of the clock data (D9025 to D9028), and OFF when there is no error.
*2 M9028	Clock data read request	OFF : No processing ON : Read request	• When the M9028 is ON, the clock data is loaded to D9025 to D9028 as a BCD value.
*2 M9029	Batch processing of data communication request	OFF : Batch processing is not executed. ON : Batch processing is executed.	• By turning ON the M9029 from the sequence program, the data communication requests which are received during one scan are processed by the END processing of the same scan. • Batch processing of the data communication requests can be changed to ON/OFF during the RUN. • The default is OFF. (One data communication request is processed per each END processing in the order the requests are received.)
M9030	0.1s clock		• 0.1s, 0.2s, 1s, 2s, and 1min clocks are generated. • These are not turned ON/OFF at each scan, but turned ON/OFF after the specified time interval even during a scan. • Starts from OFF when the power supply is turned ON or reset.
M9031	0.2s clock		
M9032	1s clock		
M9033	2s clock		
M9034	1min clock		
M9036	Always ON		• Used for the initialization or as a dummy contact by application instructions in the sequence program. • The M9036 and M9037 are turned ON and OFF regardless of the key switch status on the CPU front panel, while the M9038 and M9039 change depending on the key switch status. OFF when the key switch is set at STOP. When the key switch is not set at STOP, the M9038 is turned ON for one scan only and the M9039 is turned OFF for one scan only.
M9037	Always OFF		
M9038	ON for one scan only after the RUN started.		
M9039	RUN flag (OFF for one scan only after the RUN started.)		
M9040	PAUSE enable coil	OFF : PAUSE disable ON : PAUSE enable	• When the RUN key switch is set at the PAUSE position or the remote PAUSE contact is ON, if the M9040 is ON, it will be in the PAUSE status and the M9041 will be turned ON.
M9041	PAUSE status contact	OFF : Not in PAUSE status ON : In PAUSE status	
M9042	Stop status contact	OFF : Not in STOP status ON : In STOP status	• Turned ON when the RUN key switch is set at the STOP position.
M9043	Sampling trace completed	OFF : Sampling trace in progress ON : Sampling trace completed	• After the [STRA] instruction is executed, this is turned ON when the sampling trace is completed for the number of times specified by the peripheral device. Then it is reset by executing the [STRAR] instruction.
M9044	Sampling trace	0 → 1 Same as executing [STRA] 1 → 0 Same as executing [STRAR]	• Pseudo [STRA] / [STRAR] instruction can be executed by turning ON/OFF M9044. (Forcibly turn ON/OFF M9044 from the peripheral device.) [STRA] instruction when the M9044 changes from OFF to ON [STRAR] instruction when the M9044 changes from ON to OFF The sampling trace condition depends on the D9044.
M9045	Watchdog timer (WDT) reset	OFF : WDT is not reset. ON : WDT is reset.	• By turning the M9045 ON, WDT is reset while the ZCOM instruction or the batch processing of the data communication requests is executed. (Used when the scan time exceeds 200ms.)

Appendix Table 4.1 List of Special Relays (Continued)

Number	Name	Description	Details of contents
M9046	Sampling trace	OFF : Trace is not in progress. ON : Trace is in progress.	• ON while the sampling trace is executed.
M9047	Sampling trace standby	OFF : Abort sampling trace ON : Start sampling trace	• The sampling trace cannot be executed unless the M9047 is turned ON. The sampling trace is stopped when the M9047 is turned OFF.
M9049	Number of output characters switch	OFF : Output until the NUL code ON : Output 16 characters	• When M9049 is OFF, the characters up to the NUL(00H) code are sent to the output. • When the M9049 is ON, 16 characters of ASCII code are sent to the output.
M9051	CHG instruction execution disable	OFF : Enable ON : Disable	• Turn it ON to disable executing the CHG instruction. • Turn it ON when the program transfer is requested and it is automatically turned OFF when the transfer is finished.
*2 M9052	SEG instruction switch	OFF : 7-segment display ON : Refresh of the I/O part	• Refresh of the I/O part instruction is executed when the M9052 is ON. 7-SEG display instruction is executed when the M9052 is OFF.
M9054	STEP RUN flag	OFF : Step RUN is not in progress. ON : Step RUN is in progress.	• Turned ON when the RUN switch is at step RUN.
M9055	Status latch complete flag	OFF : Not finished ON : Finished	• Turned ON when the status latch is completed. Turned OFF by a reset instruction.
M9065	Split processing execution detect	OFF : Split processing is not in progress. ON : Split processing is in progress.	• Turned ON while the instructions to the AD57(S1) and AD58 are processed by split processing, and turned OFF when the execution is finished (not in split processing).
*2 M9066	Split processing request flag	OFF : Batch processing ON : Split processing	• For a instruction to the AD57(S1) and AD58 which requires a long processing time, the instruction is split and processed by turning ON the M9066 because the scan time is substantially extended.
*2 M9070	Search time by A8CPU	OFF : No acceleration of the readout time ON : Acceleration of the readout time	• By turning this ON, the search time by the A8UPU can be reduced. (In this case, the scan time of the CPU is extended by 10%.)
M9081	BUSY signal of the communication request register area	OFF : Space left in the communication request register area ON : No space left in the communication request register area	• There are 32 areas for registering the execution standby instruction (FROM/TO) to the MNET/MII(-S3), and this is turned ON when there is no available space for registering.
*2 M9084	Error check	OFF : Execute the error check ON : No error check	• Set if the following error checks are executed when the END instruction is processed. (In order to reduce the time for processing the END instruction.) • Fuse blown check, I/O module matching check. • Battery check.
*1 M9091	Instruction error flag	OFF : No error ON : Error occurred	• Turned ON when an error related to the instruction occurs. It stays ON even if it returns to normal afterwards.
M9100	SFC program exists or not	OFF : No SFC program ON : SFC program exists	• Turned ON when the SFC program is registered and the work area for the SFC is secured. • Turned OFF when the SFC program is not registered or the work area for the SFC could not be secured.

Appendix Table 4.1 List of Special Relays (Continued)

Number	Name	Description	Details of contents
*2 M9101	Start/stop of the SFC program	OFF : Stop the SFC program ON : Start the SFC program	• Turned ON by the user to start the SFC program. When this is OFF, the output of the executing step is turned OFF and the SFC program is stopped.
*2 M9102	Startup status of the SFC program	OFF : Initial start ON : Continue Start	• When the SFC program is restarted by the M9101, the startup step is selected. ON : Clears all execution status at the moment when the SFC program was stopped, and starts up from the initial step of block 0. OFF : Starts up from the execution block and execution step of the moment when the SFC program was stopped. • Once turned ON, it is latched (power failure compensation) by the system.
*2 M9103	Continuous migration or not	OFF : No continuous migration ON : Execute the continuous migration	• When all conditions for migrating the continuous steps are met, select whether all steps which meet the conditions in one scan should be executed or not. ON : Execute continuously. (Continuous migration) OFF : Execute one step per scan. (No continuous shift)
M9104	Continuous migration inhibit flag	OFF : When the migration is finished. ON : When the migration is not executed.	• This is ON when the continuous migration exists but not in progress, and OFF when the migration for one step is finished. Add M9104 by AND logic to the migration conditions to inhibit the continuous migration of the applicable step.
*2 M9108	Start the step migration monitor timer (applies to D9108)	OFF : Reset the monitor timer ON : Start the monitor timer reset	• Turn this ON to start measurement of the step migration monitor timer. The monitor timer is reset when this is turned OFF.
*2 M9109	Start the step migration monitor timer (applies to D9109)		
*2 M9110	Start the step migration monitor timer (applies to D9110)		
*2 M9111	Start the step migration monitor timer (applies to D9111)		
*2 M9112	Start the step migration monitor timer (applies to D9112)		
*2 M9113	Start the step migration monitor timer (applies to D9113)		
*2 M9114	Start the step migration monitor timer (applies to D9114)		
M9180	Active sampling trace complete flag	OFF : Trace start ON : Trace complete	• Turned ON when the sampling traces of all specified blocks are finished. Turned OFF when the sampling trace is started.
M9181	Active sampling trace execution flag	OFF : Trace is not execution ON : In trace execution	• Turned ON while the sampling trace is in progress and turned OFF when finished or aborted.

Appendix Table 4.1 List of Special Relays (Continued)

<table>
<tr><th>Number</th><th>Name</th><th>Description</th><th>Details of contents</th></tr>
<tr><td>*2
M9182</td><td>Active step sampling trace enable</td><td>OFF : Trace disable/abort
ON : Trace enable</td><td>• Enable/disable of executing the sampling trace is selected.
ON : Execution of the sampling trace is allowed.
OFF : Execution of the sampling trace is prohibited.
The trace is aborted if this is turned OFF while the sampling trace is being executed.</td></tr>
<tr><td>*2
M9196</td><td>Operation output when the block is stopped</td><td>OFF : Coil output OFF
ON : Coil output ON</td><td>• Operation output when the block is stopped is selected.
ON : The ON/OFF status of the coil, which was used by the operation output of the step being executed at the time when the block was stopped, is retained.
OFF : All of the coil outputs are turned OFF.
(The operation output by the SET instruction is retained regardless of ON/OFF of the M9196.)</td></tr>
<tr><td>M9197
M9198</td><td>Display selection between fuse blown and I/O verify error</td><td>The display is switched depending on the combinations of ON/OFF of the M9197 and ON/OFF of the M9198.</td><td><table><tr><th>M9197</th><th>M9198</th><th>Display range</th></tr><tr><td>OFF</td><td>OFF</td><td>Status of X/Y0 to 7F0</td></tr><tr><td>ON</td><td>OFF</td><td>Status of X/Y800 to FF0</td></tr><tr><td>OFF</td><td>ON</td><td>Status of X/Y1000 to 17F0</td></tr><tr><td>ON</td><td>ON</td><td>Status of X/Y1800 to 1FF0</td></tr></table>• The I/O module numbers of the fuse blown module display (D9100 to D9107) and the I/O module verify error display (D9116 to D9123) are switched.
• Execute the switching of display at the END.</td></tr>
<tr><td>M9199</td><td>Data recovery of the on-line sampling trace status latch</td><td>OFF : No data recovery
ON : Perform data recovery</td><td>• When the sampling trace/status latch is executed, the setup data stored in the CPU is recovered for starting again.
• Turn ON the M9199 when executing again.
(It is not necessary to write data again from the peripheral device.)</td></tr>
</table>

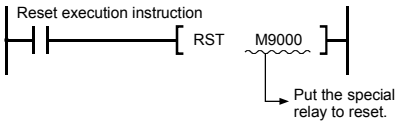
POINT

(1) The content of the special relay M is turned "OFF" when any of the following is executed; turning off the power supply, latch clear operation, reset operation by the reset key switch. The contents are preserved when the RUN key switch is in the "STOP" position.

(2) The special relays marked by *1 in the list maintain "ON" even after the status returns to normal. Therefore, use the following methods to turn it "OFF":

1 From the user program

Insert the circuit shown to the right in the program, and turn ON the reset execution instruction contact to clear the special relay M.



2 From the peripheral device

Force reset by the test function of the peripheral device.

Refer to the manual of each peripheral device for the operation.

3 It can be turned "OFF" by flipping the reset key switch on the CPU front panel to the reset side.

(3) For the relays marked by *2, ON/OFF can be controlled by the sequence program.

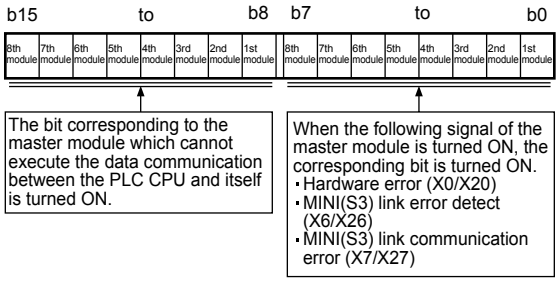
(4) For the relays marked by *3, ON/OFF can be controlled by the test mode of the peripheral device.

(5) For the relays marked by *4, they can be reset only when the power supply is turned ON from OFF.

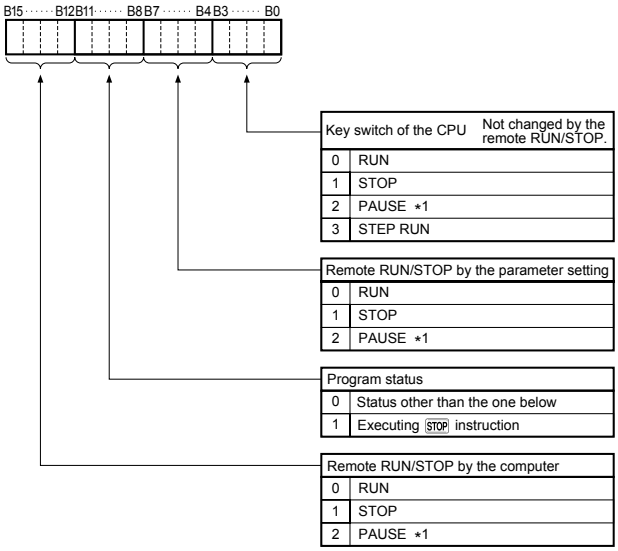
Appendix 4.2 List of Special registers

The special registers are data registers having predetermined applications in the PC. Therefore, data should not be written to these registers (except those marked *1 and *2 in the table) in the program. Data should not be written to the registers not given in the table, either.

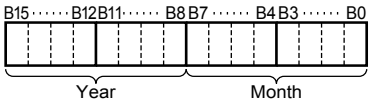
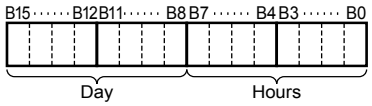
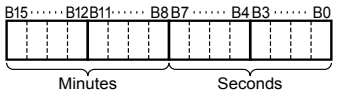
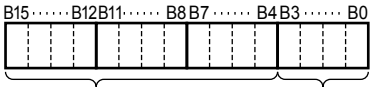
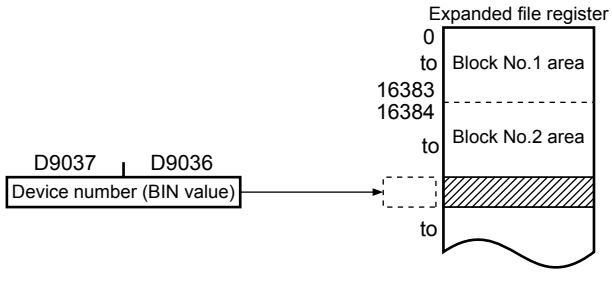
Appendix Table 4.2 List of Special Registers

Number	Name	Description	Details of contents
D9000	Fuse blown	Module number of the fuse blown	• When the module with a fuse blown is detected, the smallest number of the detected module is stored in hex. (Example: When the fuse of the output module Y50 to 6F is blown, "50" in hex is stored.) Monitor in hex to monitor from a peripheral device. (It is cleared when the contents of D9100 to D9107 become all 0.)
D9002	I/O module verify error	Module number of the I/O module verify error	• When an output module other than the one registered at the power supply startup is detected, the head of the smallest I/O number of the detected module is stored in hex. (The storing method is the same as that for D9000.) Monitor in hex to monitor from a peripheral device. (It is cleared when the contents of D9116 to D9123 become all 0.)
*1 D9004	MINI link error	Set by the parameter Status of (1 to 8 units) are stored.	• The error detect status of the MINI(S3) link is stored to the installed A1SJ71PT32-S3. 
*4 D9005	AC DOWN counter	Number of AC DOWN times	• Every time the input voltage drops below 80% of the rated voltage during the operation by the CPU module, the value is incremented by one and stored in BIN code.
*1 D9008	Self-diagnosis error	Self- diagnosis error number	• The error number of the error which occurred during the self-diagnosis is stored in BIN code.
D9009	Annunciator detected	F-number where the external failure occurred.	• When one of F0 to 2047 is turned ON by OUT F or SET F, the F-number which was turned ON and detected first is stored in BIN code. • The D9009 can be cleared by executing the RST F or LEDR instruction. If another F-number is detected, the next number is stored in D9009 when D9009 is cleared.
D9010	Error step	Step number where the operation error occurred.	• When access failed to the module which has the setting of the special module at the transition from STOP to RUN, the module number of the special module is stored. • When a operation error occurred while executing the application instruction, the step number where the error occurred is stored in BIN code and the contents of the D9010 is updated every time the operation error occurs after that.
D9011	Error step	Step number where the operation error occurred.	• When a operation error occurred while executing the application instruction, the step number where the error occurred is stored in BIN code. The contents of the D9011 cannot be updated unless M9011 is cleared by the user program, because the storing to D9011 is executed when M9011 changes from OFF to ON.
D9014	I/O control method	I/O control method number	• The I/O control method is returned as the following number. 3. Refresh method for both input and output.

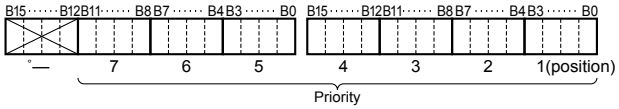
Appendix Table 4.2 List of Special Registers (Continued)

Number	Name	Description	Details of contents
D9015	CPU operation status	CPU operation status	• The CPU's operation status is stored in the D9015 as shown in the following diagram  *1 The RUN status stays when changed to PAUSE while the CPU is in RUN status and the M9040 is OFF.
D9016	Program number	The sequence program being executed is stored as a BIN value.	• The sequence program which is currently being executed is stored by the code number as follows: 0 : ROM 8 : E^2PROM 1 : RAM
D9017	Scan time	Minimum scan time (in 10ms unit)	• For each END, if the scan time is smaller than that of the D9017, the value is stored. In other words, the minimum value of the scan time is stored in the D9017 as a BIN code.
D9018	Scan time	Scan time (in 10ms unit)	• For each END, the scan time is stored as a BIN code and always updated.
D9019	Scan time	Maximum scan time (in 10ms unit)	• For each END, if the scan time is larger than that of the D9019, the value is stored. In other words, the maximum value of the scan time is stored in the D9019 as a BIN code.
D9020	Constant scan	Constant scan time (set in 10ms unit by the user)	• The execution interval is set in 10ms unit when the user program is executed at a constant interval. 0 : No constant scan function 1 to 20 : Constant scan function is available. Executed at an interval of setting value × 10ms.
D9021	Scan time	Scan time (in 1ms unit)	• For each END, the scan time is stored as a BIN code and always updated.
D9022	Time	Time	• Incremented by one for every second.

Appendix Table 4.2 List of Special Registers (Continued)

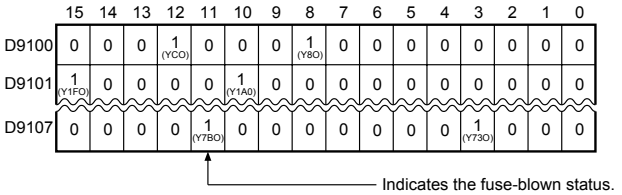
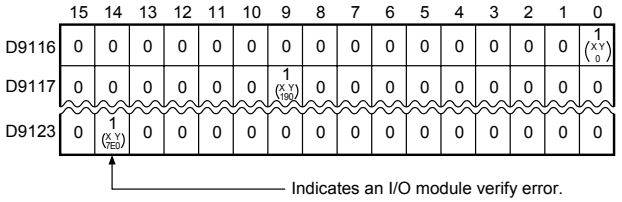
Number	Name	Description	Details of contents
*2 D9025	Clock data	Clock data (year, month)	• Year (the last two digits) and month are stored as BCD code in the D9025 as follows.  Example: July 1997 H9707
*2 D9026	Clock data	Clock data (day, hour)	• Day and hours are stored as BCD code in the D9026 as follows.  Example: 31st, 10 o'clock H3110
*2 D9027	Clock data	Clock data (minute, second)	• Minutes and seconds are stored as BCD code in D9027 as follows.  Example: 35 minutes, 48 seconds H33548
*2 D9028	Clock data	Clock data (day of the week)	• Day of the week is stored as BCD code in D9028 as follows.  Example: Thursday H0004 Always set "0". Day of the week: 0 Sunday; 1 Monday; 2 Tuesday; 3 Wednesday; 4 Thursday; 5 Friday; 6 Saturday
D9035	Expanded file register	Block number being used	• The block number of the expanded file register which is currently being used is stored as BIN code.
D9036 D9037	For specifying the device number of the expanded file register	Device number when each device of the extended file register is directly accessed	• To directly read from and write to an extended file register, specify the device number of the extended file register by two words of BIN value in the D9036 and D9037. The device number is independent of the block number and is specified by a serial number from R0 of block No.1. 

Appendix Table 4.2 List of Special Registers (Continued)

<table>
<tr><th>Number</th><th>Name</th><th>Description</th><th>Details of contents</th></tr>
<tr><td>*2
D9038</td><td rowspan="2">LED display priority</td><td>Priority 1 to 4</td><td rowspan="2">• Set and change the element number in the LED display of the CPU module. (Priority 1 to 4 are in the D9038 and 5 to 7 are in the D9039.)
 

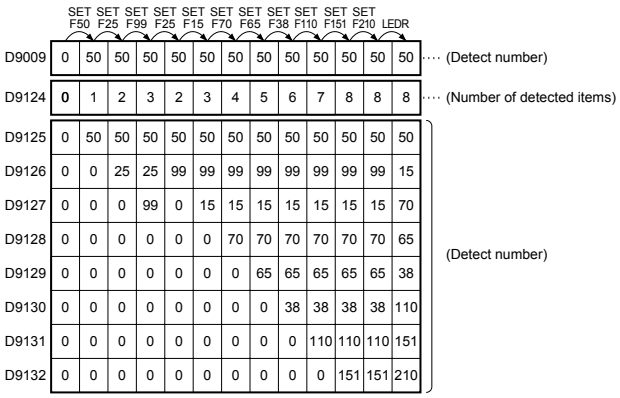
Even if "0" is set, the error which stops the operation of the CPU (including the parameter setting) is displayed on the LED unconditionally.
Default values : D9038=H4321
D9039=H0765
<table><tr><th>Element Number</th><th>Description</th></tr><tr><td>0.</td><td>No display</td></tr><tr><td>1.</td><td>I/O matching,
fuse blown</td></tr><tr><td>2.</td><td>Special module,
link parameter,
operation error</td></tr><tr><td>3.</td><td>CHK instruction error</td></tr><tr><td>4.</td><td>Annunciator</td></tr><tr><td>5.</td><td>LED instruction related</td></tr><tr><td>6.</td><td>Battery error</td></tr><tr><td>7.</td><td>Clock data</td></tr></table></td></tr>
<tr><td>*2
D9039</td><td>Priority 5 to 7</td></tr>
<tr><td>D9044</td><td>For the sampling trace</td><td>Step or time of the sampling trace</td><td>• When the M9044 is turned ON/OFF in peripheral device and the sampling trace [STRA] or [STRAR] is activated, the value stored in the D9044 as a sampling trace condition is used.
For scan ——— 0
For time ——— time (in 10ms unit)
} Stored in BIN code.</td></tr>
<tr><td>D9049</td><td>Work area for the SFC</td><td>Block number of the expanded file register</td><td>• The block number of the expanded file register which is used as a work area for the SFC is stored.
Upper 8 bits ····· The block number is stored.
Lower 8 bits ····· The step number is stored.</td></tr>
<tr><td>D9050</td><td>Error number of the SFC program</td><td>Number of the error which occurred in the SFC program</td><td>• The error number which occurred in the SFC program is stored as a BIN value.
0 : No error
80 : Parameter error of the SFC program
81 : Number of steps to be executed simultaneously exceeded the limit.
82 : Block startup error
83 : Operation error of the SFC program</td></tr>
<tr><td>D9051</td><td>Error block</td><td>Block number where the error occurred</td><td>• The block number where the error occurred in the SFC program is stored as a BIN value. When error 82 occurs, however, the block number of the startup source is stored.</td></tr>
<tr><td>D9052</td><td>Error step</td><td>Step number where the error occurred</td><td>• The step number where error 83 occurred in the SFC program is stored as a BIN value. "0" is stored when error 80 or 81 occurs. When error 82 occurs, the step number of the block startup is stored.</td></tr>
<tr><td>D9053</td><td>Error migration</td><td>Migration condition number where the error occurred</td><td>• The migration condition number where error 83 occurred in the SFC program is stored as a BIN value.
"0" is stored when error 80, 81, or 82 occurred.</td></tr>
<tr><td>D9054</td><td>Error sequence step</td><td>Sequence step number where the error occurred</td><td>• In the migration condition or step where error 83 occurred in the SFC program, the order of the sequence step (n-th step) in the migration condition or operation output where the error occurred is stored as a BIN value.</td></tr>
<tr><td>D9055</td><td>Status latch</td><td>Status latch step</td><td>• The number of the step which was being executed at the time of the status latch is stored as a BIN code.</td></tr>
<tr><td>D9072</td><td>PC communication check</td><td>Data check of the computer link</td><td>• Used for the self-loopback check.</td></tr>
<tr><td>D9081</td><td>Number of empty areas of the communication request register area</td><td>Number of available spaces of the communication request register area</td><td>• The number of available spaces in the communication request register area to the MNET/MINI(-S3) is stored. (a maximum of 32)</td></tr>
</table>

Appendix Table 4.2 List of Special Registers (Continued)

Number	Name	Description	Details of contents
D9085	Time check value setting register	The default value is 10s.	• The time check value, which is used when the link instruction (ZNRD, ZNWR) for the MELSECNET/10 is executed, is stored. • Setting range : 1 to 65535s • Setting unit : in 1s unit • The default value, 10s, is used when 0 is set.
*1 D9090	Number of special function modules over	Number of special function modules over	• When the number of special function modules exceeds the limit, the starting I/O number of the last special function module which could be registered is divided by 16 and stored as a BIN value.
*1 D9091	Detailed error number	Detailed error number of the self-diagnosis	• The detailed error number of the self-diagnosis is stored in BIN code.
D9100 D9101 D9102 D9103 D9104 D9105 D9106 D9107	Module with a fuse blown	Bit pattern of the modules with a fuse blown in 16-point unit.	• The output module numbers (in 16-point unit) with a fuse blown is stored as a bit pattern. (The setting number is stored if it is set by the parameter.) • The fuse blown status of the output modules in the remote station can also be detected.  • The I/O module number range to be displayed can be selected by switching ON/OFF of the M9197 and M9198. • Clearing data of the fuse blown module can be executed by turning the M9000 (fuse blown) OFF.
D9116 D9117 D9118 D9119 D9120 D9121 D9122 D9123	I/O module verify error	Bit pattern of the modules with verify error in 16-point unit.	• When a different I/O module which is different from the one registered when the power was turned ON is detected, such I/O module number (in 16-point unit) is stored. (The I/O module number set by the parameter is stored if set by the parameter.) • The I/O module information of the remote station can also be detected.  • The I/O module number range to be displayed can be selected by switching ON/OFF of the M9197 and M9198. • Clearing data of the matching error can be executed by turning M9002 (matching error) OFF.
D9124	Number of items detected by the annunciator	Number of items detected by the annunciator	• The content of the D9124 increments by 1 when one of F0 to 2047 is turned ON by [OUT F] or [SET F], and the content of the D9124 decrements by 1 when [RST F] or [LEDR] instruction is executed. The number of items which were turned ON by [OUT F] or [SET F] is stored up to 8.

Appendix Table 4.2 List of Special Registers (Continued)

Number	Name	Description	Details of contents
D9125 D9126 D9127 D9128 D9129 D9130 D9131 D9132	Annunciator detect number	Annunciator detect number	When one of F0 to 2047 is turned ON by OUT F or SET F, the F-number which was turned ON is registered in D9125 to D9132 in their order. The F-numbers which were turned OFF by RST F are deleted from D9125 to D9132, then moved to the data register which is after the data register that the deleted number had been stored. The contents of D9125 to 9132 are shifted upwards by one by executing the LEDR instruction. When there are 8 items which were detected by the annunciator, the 9th is not stored in D9125 to 9132 even if it is detected.



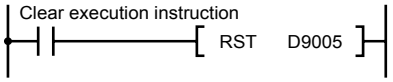
POINT

(1) All of the contents are cleared when any of the following is executed; turning off the power, latch clear operation, reset operation. The contents are preserved when the RUN key switch is in "STOP" position.

(2) The contents of the special registers marked by *1 in the above list cannot be cleared even after the status returns to normal. Therefore, use the following methods to clear the contents:

1 From the user program

Insert the circuit shown to the right in the program, and turn ON the clear execution instruction contact to clear the contents of the register.



2 From the peripheral device

Use the current value modification function of the test function or force reset from the peripheral device to change to 0. Refer to the manual of each peripheral device for the operation.

3 It can be changed to "0" by flipping the reset key switch on the CPU front panel to the reset side.

(3) For the registers marked by *2, the data is written by the sequence program.

(4) For the registers marked by *3, the data is written by the test mode of the peripheral device.

(5) For the registers marked by *4, it is cleared only when the power is turned ON from OFF.

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.
1. Failure occurring from inappropriate storage or handling, carelessness or negligence by the user. Failure caused by the user's hardware or software design.
2. Failure caused by unapproved modifications, etc., to the product by the user.
3. 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.
4. Failure that could have been avoided if consumable parts (battery, backlight, fuse, etc.) designated in the instruction manual had been correctly serviced or replaced.
5. 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.
6. Failure caused by reasons unpredictable by scientific technology standards at time of shipment from Mitsubishi.
7. 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 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 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 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 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 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 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.

Type A1FXCPU Module

User's Manual (Function description)

MODEL	A1FXCPU-U-E-KINOU
MODEL CODE	13JL59
SH(NA)-4002-D(0707)MEE	

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