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User's Manual A2CCPU

A Series
Programmable
Controllers

MITSUBISHI

Cat. No UMA2C

REVISIONS

※The manual number is given on the bottom left of the back cover.

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INTRODUCTION

Thank you for choosing the Mitsubishi MELSEC-A Series of General Purpose Programmable Controllers. Please read this manual carefully so that the equipment is used to its optimum. A copy of this manual should be forwarded to the end User.

CONTENTS

1. INTRODUCTION

This manual gives the system, specifications and handling of the A2CCPU General-purpose Programmable Controller (referred to as A2C in this manual).
The A2C is a baseless building block type CPU which does not use a base unit for system construction which includes remote I/O and terminal modules (*1).
The A2C uses the MELSECNET/MINI-S3 data link system (*2) (referred to as MINI-S3 in this manual) in place of a base unit for data communication with the remote I/O module and the remote terminal module through 5-core flat cables or twisted pair cables. Using 5-core flat cables, the system modules can be arranged close to each other just as the building block type CPU is used. Using twisted pair cables, the system modules can be separated up to 100 meters (328.1 ft) away from each other (*3). This feature makes it possible to install the remote I/O module and the remote terminal module to suit with the arrangement of equipment to be controlled.

REMARK

① *1 ····· "Remote I/O module" and "remote terminal module" are general terms for the modules mentioned below.
Remote I/O module : Input/output modules connectable to the A2C, Mitsubishi general-purpose inverter FR-Z200 series, MELSEC-F series programmable controllers
Remote terminal module : Special function modules connectable to the A2C, RS-232C interface modules
See Section 2.3 for names and types of the remote I/O modules and the remote terminal modules.

② *2 ····· The MELSECNET/MINI-S3 data link system has been designed to save the amount of wiring between the PC and equipment to be controlled. Since the PC, the remote I/O module and the remote terminal module are connected with twisted pair cables or optical fiber cables, it is possible to install the remote I/O module and the remote terminal module to suit with the arrangement of equipment to be controlled.

③ *3 ····· Distance allowed when twisted pair cables of 0.5mm^2 (20 AWG) or thicker are used.
The maximum allowable distance is 50 meters (164.1 ft) when twisted pair cables of 0.3mm^2 (22 AWG) or thinner are used.

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1.1 General Description of Operation

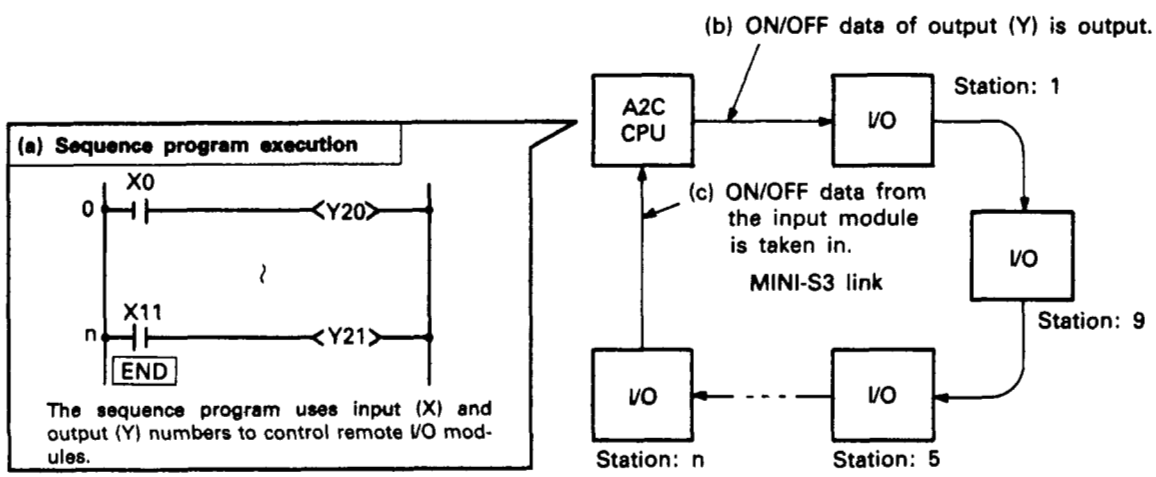
This section describes the data communication between the A2C, the remote I/O module and the remote terminal module.
See Section 4.2 for the A2C functions.

1.1.1 ON/OFF data communication between the A2C and the remote I/O module

ON/OFF data communication is performed using inputs (X) and outputs (Y).

(1) Input/output number assignment of the remote I/O module
The input/output numbers of the A2C system are assigned from X/Y000 to X/Y1FF in the order of the station number (1 to 64) set for each remote I/O module.
Data communication with a remote I/O module is performed using inputs (X) and outputs (Y) assigned for each module.
See Section 4.7 for the relationship between station numbers and I/O numbers.

(2) ON/OFF data communication with the remote I/O module
The ON/OFF data communication with the remote I/O module is performed in the refresh mode.
Fig. 1.1 shows the data communication between the A2C and the remote I/O modules.



When the A2C is running, operations (a), (b) and (c) mentioned below are executed repeatedly.
(a) The sequence program is executed from step 0 to END (FEND).
(b) ON/OFF data of an output (Y) in the sequence program is output by the MINI-S3 link.
(c) ON/OFF data from an input module is taken in by the MINI-S3 link.

Fig. 1.1 ON/OFF Data Communication between the A2C and the Remote I/O Modules

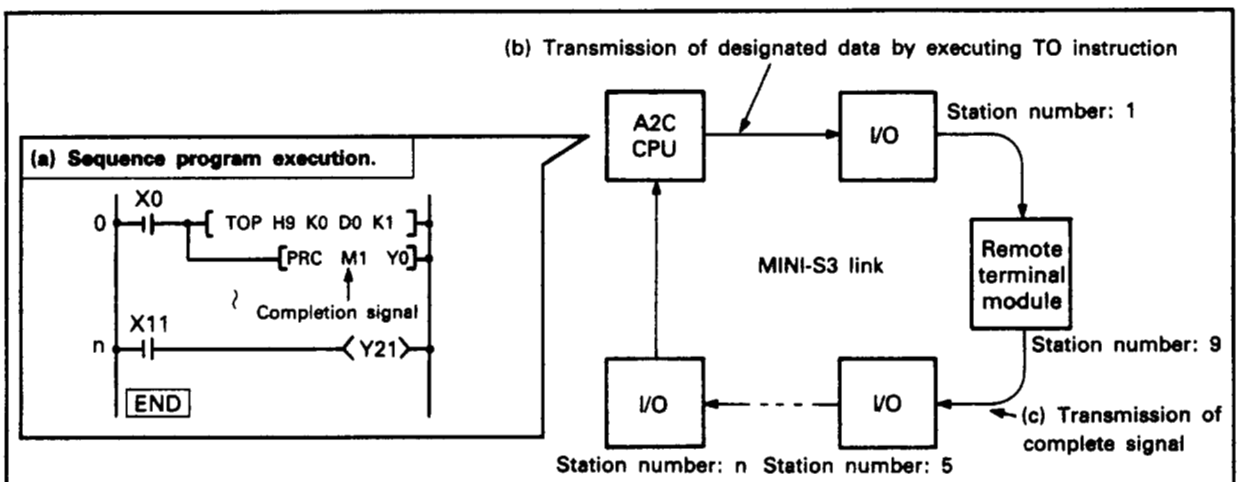
(3) Input/output response time
The data communication response time bwteen the A2C and the remote I/O modules is as described below.
(a) To take in an ON/OFF change from the input module, 1 scan at maximum is required.
(b) When an output ON/OFF is changed by the sequence program, 1 scan at maximum is required to output the change to the output module.
(c) When ON/OFF control of the output module is done by ON/OFF data of the input module, 2 scans at maximum are required till the ON/OFF status of the output module changes after an ON/OFF input changed.

1.1.2 Data communication between the A2CCPU and the remote terminal module

(1) Maximum number of remote terminal modules to be connected
A maximum of 14 remote terminal modules can be connected to the A2C.

(2) Data communication with remote terminal modules
(a) Perform the following initial setting.
1) The first station number of the remote terminal module
2) Protocol
See Section 4.2.9 for details of initial setting.

(b) Execute data communication with the FROM/TO instruction.
See the ACPU Programming Manual (Common Instructions) for details of the FROM/TO instruction.



Data communication with the remote terminal module is executed as described below.
(a) The FROM/TO and PRC instructions are executed by the sequence program.
(b) The request to send designated data or the data is transmitted by executing the FROM/TO instruction after executing the PRC instruction.
1) At FROM instruction execution : Data send request
2) TO instruction : Data sending
(c) The remote terminal module sends the completion signal of data send or receive to the A2C.
(d) The A2C turns ON the complete signal (M1) when it received the send/receive complete signal from the remote terminal module.

Fig. 1.2 Data Communication between the A2C and the Remote Terminal Module

(3) Response time
Communication of 8 data with one FROM/TO instruction requires approximately 400 ms (when scan time is 100 ms).

1.2 Features

The A2C has the following features.

(1) Compact size
The A2C has compact outside dimensions: 170 mm (6.7 in) (height) × 100 mm (3.9 in) (width) × 80 mm (3.1 in) (length)
Also, the A2CI/O module has a short width of 64 mm (2.5 in).

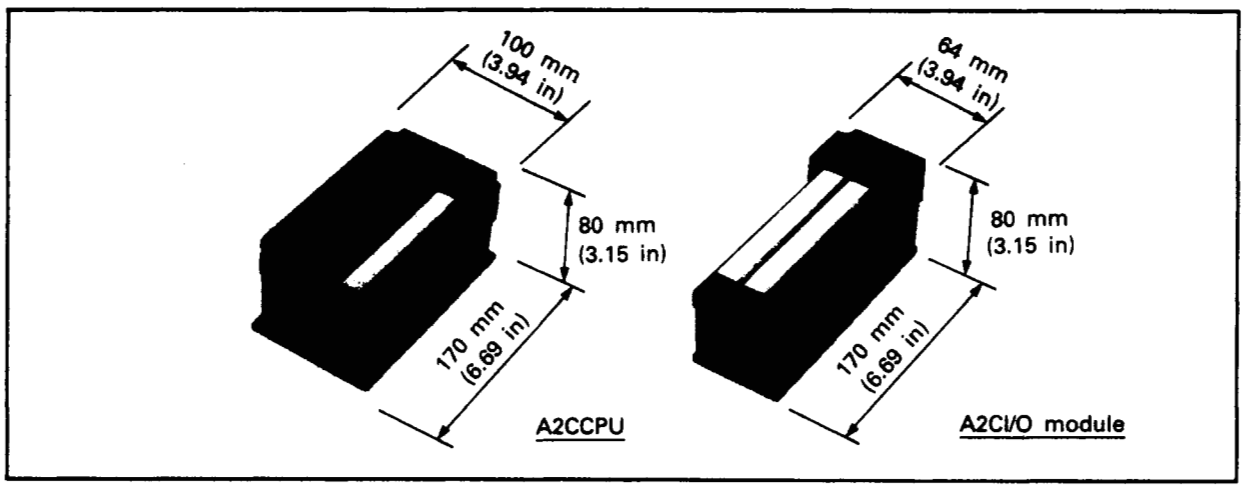


Fig. 1.3 A2C Outside Dimensions

(2) 512 points of input/output control
The A2C is capable of controlling input/output operation at 512 points specified between X/Y0 and X/Y1FF.

(3) A maximum of 8K steps can be contained in one program. With sequence instructions, basic instructions and application instructions, a maximum of 8K steps can be contained in one sequence program. Also, microcomputer programs and utility programs made by the user can be run in combination with a sequence program.

(4) Cable connection between modules
Cables designed exclusively for the A2C or twisted pair shield cables are used for connection between the A2C and the A2CI/O module and between the A2CI/O modules.

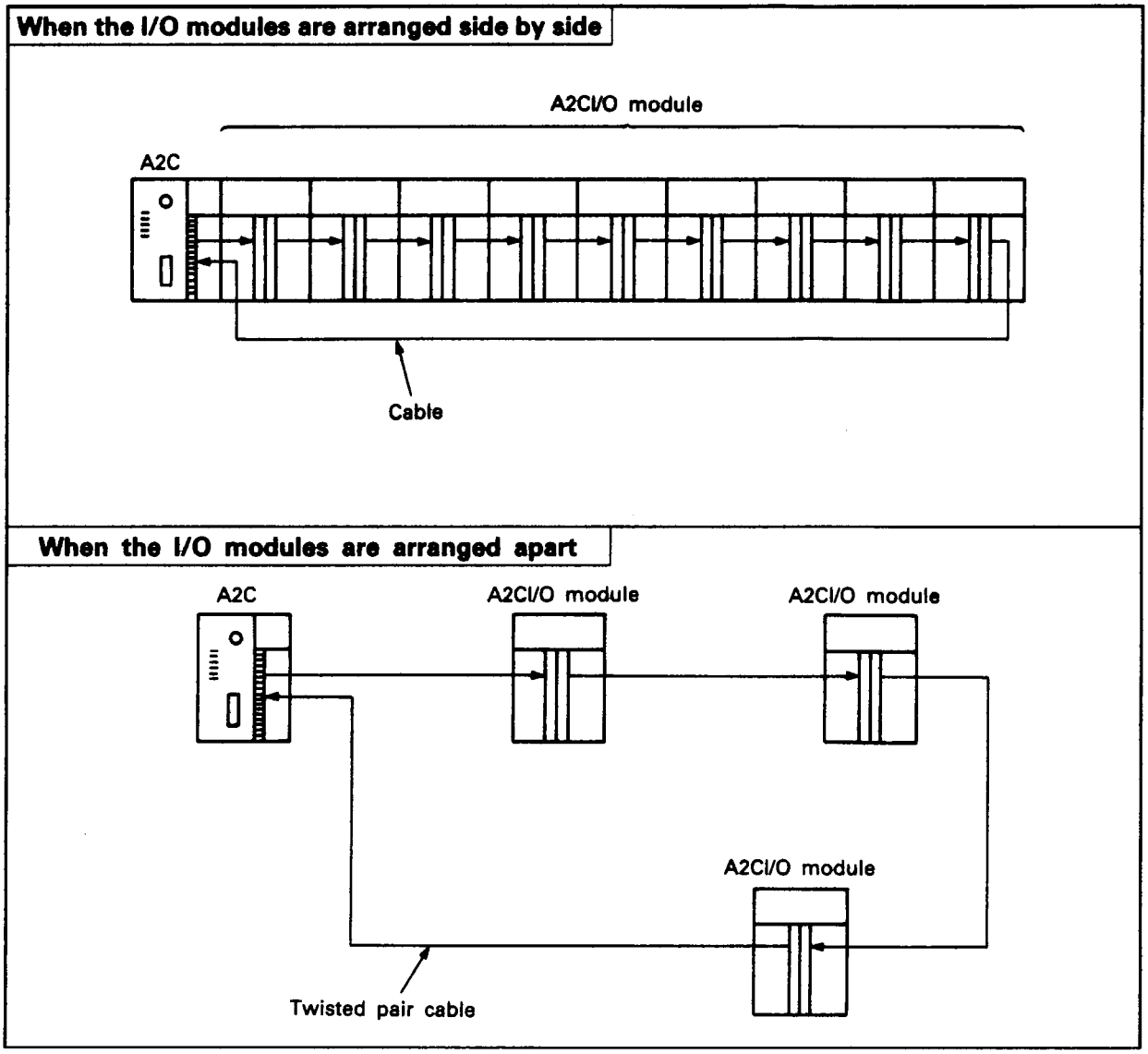


Fig. 1.4 Connection of the A2C System

(5) Connection with the MINI-S3 link remote I/O modules and remote terminal modules is possible.
The A2C can be connected with the MINI-S3 link remote I/O modules, remote terminal modules and disclose devices. (See Section 2.3.1.)
The A2CI/O modules, MINI-S3 link remote I/O modules, remote terminal modules and disclose devices can be used together.

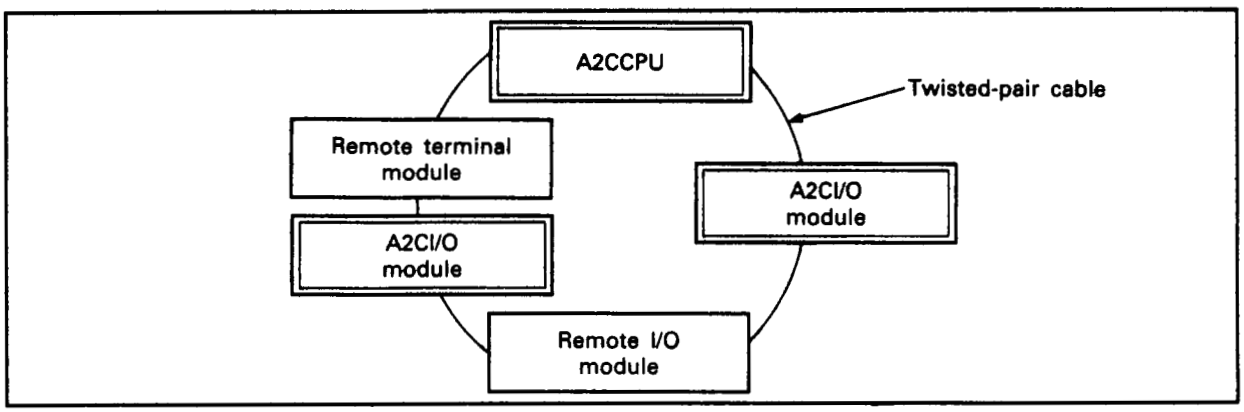


Fig. 1.5 Use with the MINI-S3 Link Modules

(6) Vertical and horizontal positions and mounting on a flat base are possible.
The A2C and A2CI/O modules can be installed in three different positions.

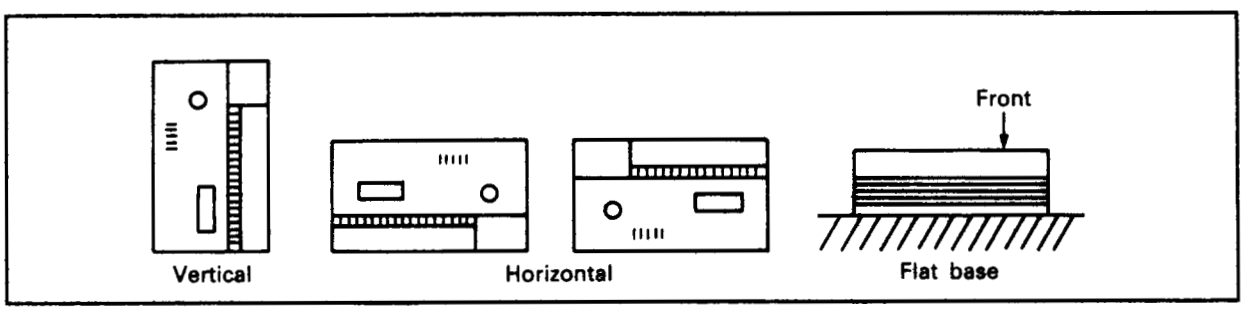


Fig. 1.6 Installing Positions of the A2C and A2CI/O Modules

(7) Can be mounted to the DIN rail.
The A2C and A2CI/O modules are usually mounted directly to a control panel or equipment to be controlled using screws. Using the DIN rail adapter, however, the A2C modules can be mounted to the DIN rail. (A clearance of 4 mm between modules is obtained when the DIN adapters are mounted side by side without leaving clearance between them. (See App. 1.))

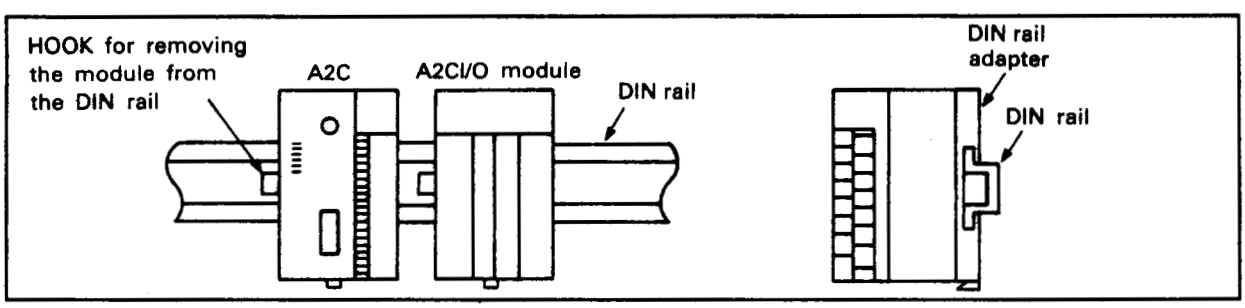


Fig. 1.7 A2C and A2CI/O Modules Mounted to the DIN Rail

1.3 General Terms and Abbreviations

General terms and abbreviations used in this manual are explained.

(1) A2C
An abbreviation of the A2CCPU general-purpose programmable controller.

(2) A2CI/O module
A general term for the following I/O modules which are of the same type as the A2CCPU.
a) 32-point input modules
b) 32-point output modules
c) 32-point I/O modules
See Section 2.3 for type classification of the A2CI/O modules.

(3) A2C special function module
A general term for the following special function modules which are of the same type as the A2CCPU.
a) High speed counter module
b) Analog-digital conversion module
See Section 2.3 for type classification of the A2C special function modules.

(4) MINI-S3 link
An abbreviation of the MELSECNET/MINI-S3 data link system.

(5) Peripheral devices
A general term for A6GPP, A6PHP, A6HGP and A7PU.

(6) Remote I/O module
A general term for the following modules.
a) A2CI/O modules
b) MINI-S3 link remote I/O modules
1) Out-of-panel type remote I/O modules
2) Compact type remote I/O modules
3) AJ72PT35 type link module
4) MELSEC-F series programmable controllers
5) Mitsubishi general-purpose inverters
6) Manifold solenoid valves
See Section 2.3 for type classification of A2CI/O modules and applicable MINI-S3 link remote I/O modules.

(7) Remote module
A general term for remote I/O modules and remote terminal modules.

(8) Remote terminal module
A general term for the A2C special function modules and the MINI-S3 link remote terminal modules.
See Section 2.3 for type classification of A2C special function modules and applicable MINI-S3 link remote terminal modules.

1.4 Reference Manuals

Refer to the manuals listed below to use the A2C.

(1) ACPU Programming Manual (Fundamentals): IB(NA)-66249
For details of the programming method, devices, parameters and kind of program necessary for the programming for the A2C.

(2) ACPU Programming Manual (Common instructions): IB(NA)-66250
For details of operation by the sequence instructions, common instructions and application instructions feasible with the A2C.

(3) A2CI/O Module User's Manual: IB(NA)-66236
For specifications and outside dimensions of the A2CI/O modules.

(4) MELSECNET/MINI-S3 Batch Refresh Type Remote I/O Module User's Manual: IB(NA)-66215
For specifications and handling of the batch refresh type remote I/O modules.

(5) AJ35PTF-R2 Type RS-232C Interface Module User's Manual: IB(NA)-66219
For specifications and handling for communication with calculators using the RS-232C interface module.

(6) Special Function Modules Manual
For specifications, handling and programming for special function modules used.

(7) MELSEC-F Series Programmable Controllers Manual
For specifications, handling and programming for the MELSEC-F series PCs.

(8) FR-Z200 Series General-Purpose Inverters Manual
For specifications and handling of the FR-Z200 series general-purpose inverters.

2. SYSTEM CONFIGURATION

2.1 Overall Configuration

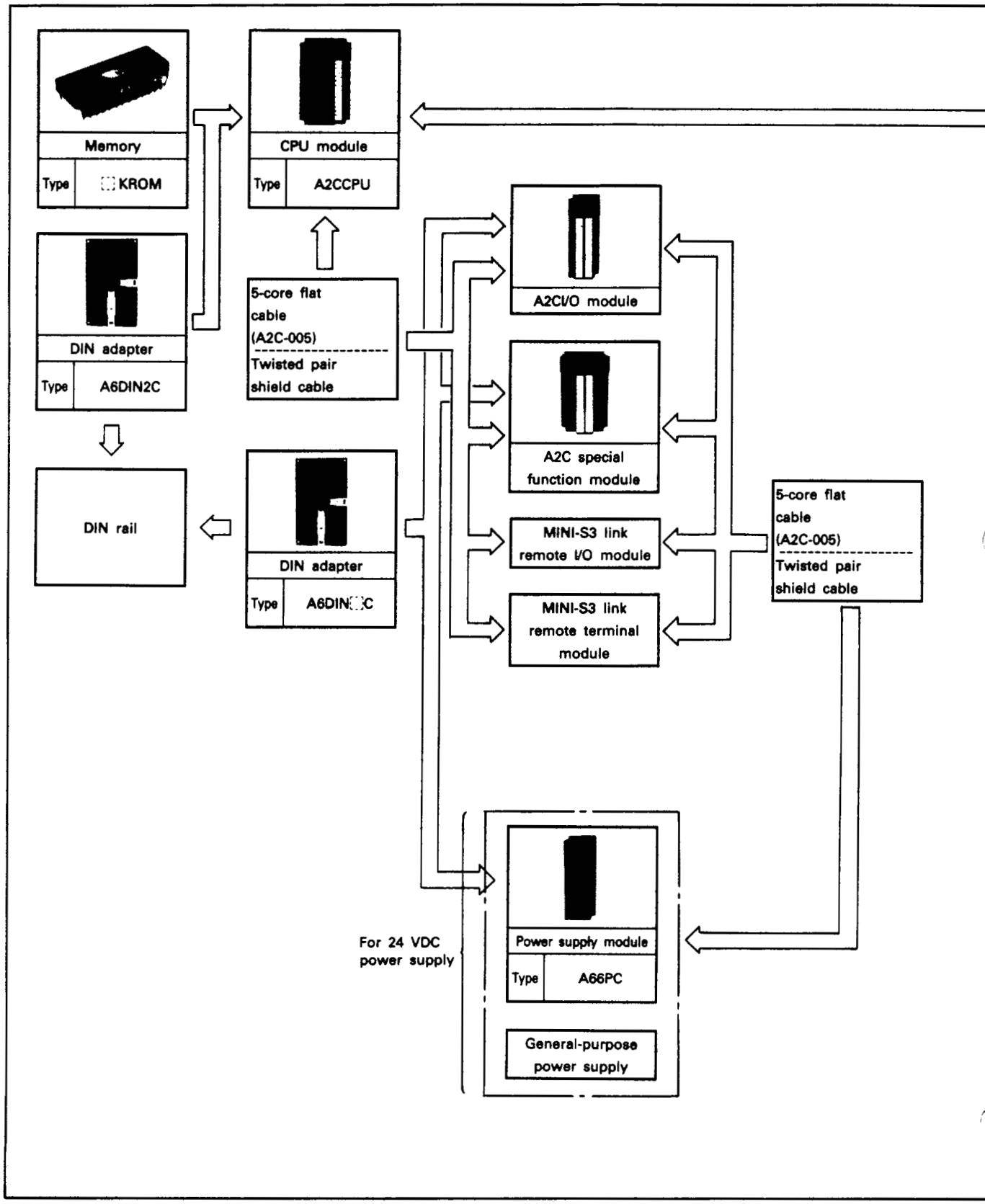
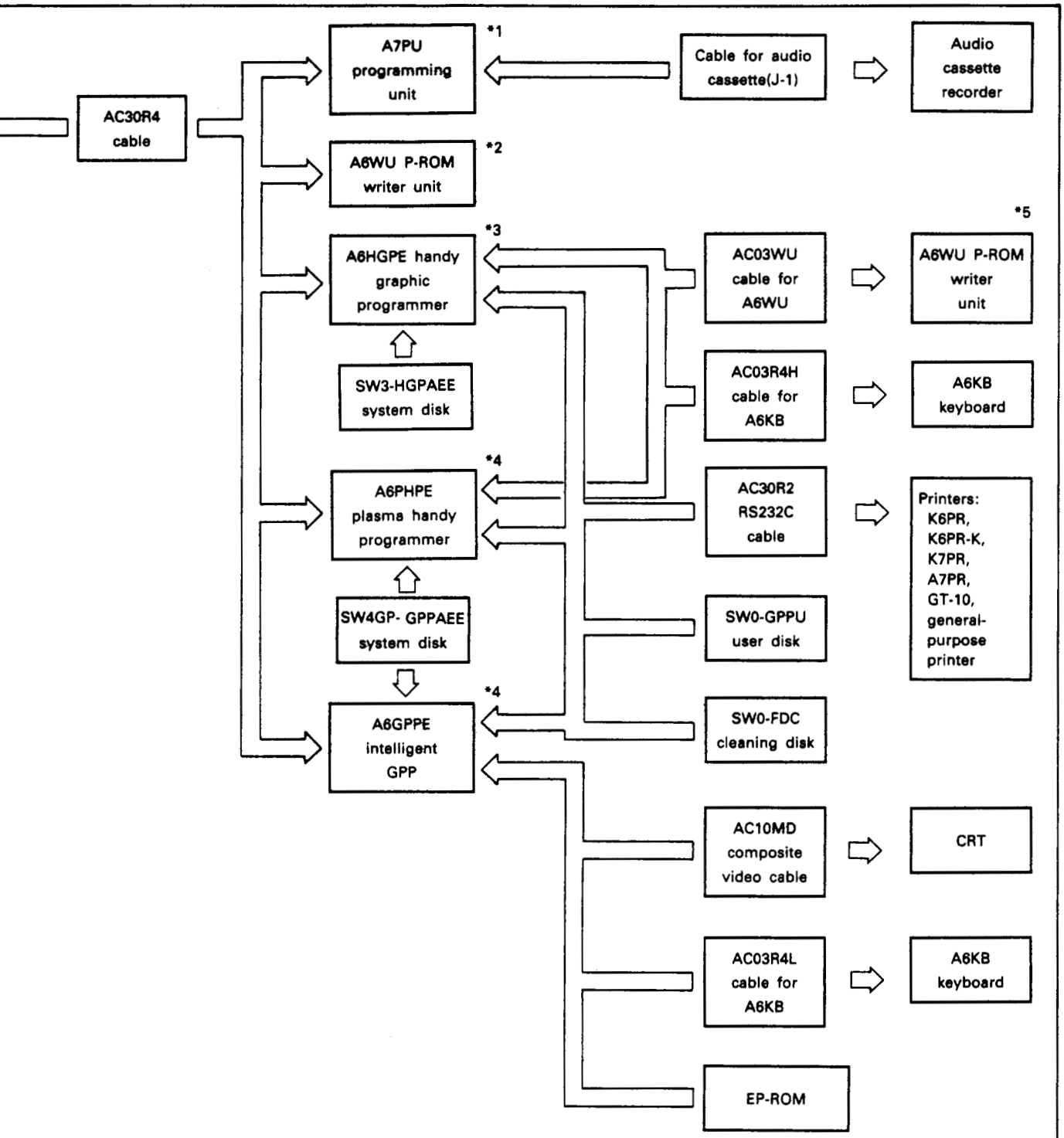


Fig. 2.1 Overall Configuration



REMARK

1) See App. 4 for restrictions for use of *1 to *5.
2) See Section 5.3 for specifications of 5-core flat cables and twisted pair cables *.

2.2 Notes on System Construction

(1) Connection of remote I/O modules and remote terminal modules
A maximum of 64 stations of remote I/O modules and remote terminal modules can be connected to the A2C.
Also, the MINI-S3 link disclose devices can be connected. (See Section 2.3.)

(2) Applicable remote terminal modules
A maximum of 14 remote terminal modules among those mentioned below can be connected to the A2C. However, when only the AJ35PTF-R2 RS-232C interface module is used, up to 7 modules can be connected.

a) A68ADC A/D conversion module

b) AD61C high speed counter module

c) AJ35PTF-R2 RS-232C interface module (no-protocol mode only)

(3) Use of the MINI-S3 link modules
The following restrictions are applied when the MINI-S3 link remote I/O modules and remote terminal modules are used.

a) Twisted pair data link module:
No restriction is applied.

b) Optical/twisted pair data link module:
Usable when the optical data link module is used.

c) Optical data link module:
Usable when the optical/twisted pair data link module is used as the optical data link module.

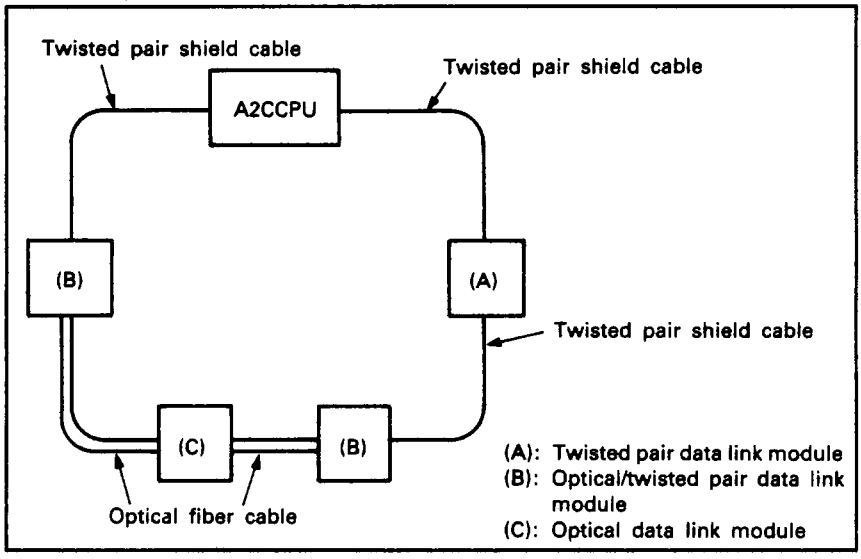


Fig. 2.2 Connection of the MELSECNET/MINI-S3 Modules

(4) Power supply for the A2CI/O module and the A2C special function modules
The A2CI/O modules and the A2C special function modules require 24 VDC power supply. Use the A66PC power supply module or a general-purpose 24 VDC power supply.

(5) Both remote I/O modules and remote terminal modules, when used with the A2C, need station number setting.
If two or more different modules are set for one same station number, incorrect input and output will occur. Make sure that there are no modules which are set for one same station number before the power is turned ON.
See Section 4.7 for details of station setting.

(6) To eliminate incorrect input at the remote I/O modules, design the A2C system considering the following.

a) Measures on turning ON and OFF the power

1) When turning ON the power, turn ON the remote I/O modules first, and then, turn ON the A2C. Or, turn ON the A2C and the remote I/O modules together at the same time.

2) When turning OFF the power, turn OFF the A2C first, and then, turn OFF the remote I/O modules. Or, turn them OFF together at the same time.

REMARK

Power supply for the remote I/O modules indicates the following.
1) I/O module power supply: Power supplied to the I/O moudle power supply is converted to 5 VDC inside the system and used in the internal circuit of the I/O module.
2) Input external power supply: Power supply for input modules
3) Output external power supply: Power supply for output modules

See the following manual for details.
- A2CI/O Module User's Manual

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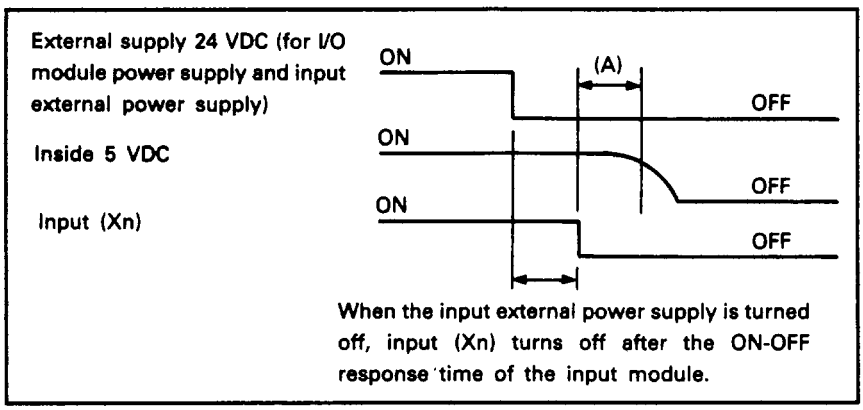
b) Measures againt momentary power failure for the I/O module
Momentary power failure of the power supply of the I/O module may cause incorrect input.

1) Cause for incorrect input due to momentary power failure
The I/O module hardware converts the I/O module power supply (24 VDC) to 5 VDC inside the module. If momentary power failure occurs in the I/O module, incorrect input occurs if I/O refresh is executed within duration (A) shown below because: (Time from occurrence of external power supply OFF to turning OFF of internal 5VDC) > (ON to OFF response time of input module).



2) Prevention of incorrect input
Connect the A2C, A66PC, stabilized power supply and AC input to one same power supply.

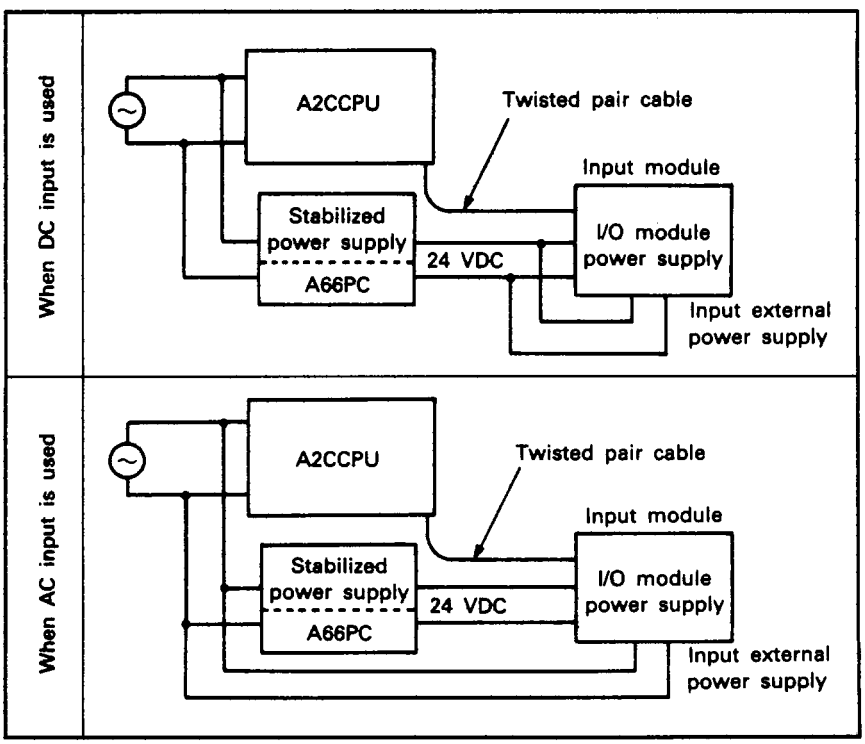


Fig. 2.3 Power Supply Wiring Example

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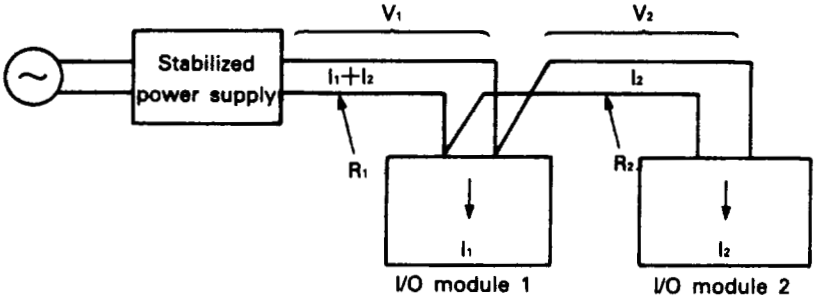
(7) If two or more I/O modules are connected to one power supply, choose cables and wiring route considering voltage drop caused by cables. The figure below explains the voltage drop caused by cables.



V_1: Voltage drop between stabilized power supply and I/O module 1
V_2: Voltage drop between I/O module 1 and I/O module 2
R_1: Resistance between stabilized power supply and I/O module 1
R_2: Resistance between I/O module 1 and I/O module 2
I_1: Current consumption of I/O module 1
I_2: Current consumption of I/O module 2

Voltage drop calculation

$V_1 = R_1 \times (I_1 + I_2)$
$V_2 = R_2 \times I_2$

Receiving port voltage of I/O module

(Receiving port voltage of I/O module 1)
=(Voltage of stabilized power supply)$-V_1$

(Receiving port voltage of I/O module 2)
=(Voltage of stabilized power supply)$-V_1-V_2$

An I/O module can be connected if the receiving port voltage of I/O module is higher than the rated voltage of the I/O module to be used.

2.3 System Equipment

In this section, the I/O modules and peripheral devices which can be used with the A2C are listed.

2.3.1 Modules which can be connected to the A2CCPU

The remote I/O modules and remote terminal modules which can be connected to the A2CCPU are listed in Table 2.1.

Module		Type	Description	Occupied Stations	Occupied Points	Power Consumption (VA)	Current Consumption 24 VDC (A)	Application	Remark
CPU module		A2CCPU	Program capacity: Maximum 8K steps I/O points: 512 points T: 256 points, C: 256 points, D: 1024 points, M, L, S: 2048 points • User memory area: 32K bytes (Program area: 8K steps Comment and file registers: 12K bytes)	—	—	110	—	○	Built-in power supply
EP-ROM		4KROM	For 2K steps	—	—	—	—	○	*
		8KROM	For 6K steps						
		16KROM	For 8K steps						
I/O module power supply		A66PC	Input: 100/200 VAC Output: 24 VDC, 0.6 A	—	—	110	—	○	
A2CI/O module	Input module	AX11C	Input module 100-120 VAC, 32 points	4 stations	32 points	—	0.056	○	
		AX41C	DC input module (sink loading) 12/24 VDC, 32 points				0.055		
	Output module	AY51C	Transistor sink output module (sink loading) 12/24 VDC, 0.3 A, 32 points	4 stations	32 points	—	0.09	○	
		AY23C	Triac output module 100-240 VAC, 0.3 A, 32 points				0.18		
		AY13C	Relay output module 24 VDC, 0.5 A, 110 VAC, 0.5 A, 32 points				0.093		
	I/O composite module	AX10Y10C	AC input, relay output module Input: 100-120 V, 16 points Output: 24 VDC, 0.5 A, 110 VAC, 0.5 A, 16 points	4 stations	32 points	—	0.074	○	
		AX40Y10C	DC sink input, relay output module Input: 12/24 VDC (sink loading) 16 points Output: 24 VDC, 0.5 A, 100 VAC, 0.5 A, 16 points				0.116		
		AX40Y50C	DC sink input, transistor sink output module Input: 12/24 VDC (sink loading) 16 points Output: 12/24 VDC (sink loading) 0.3 A, 16 points				0.072		
		AX10Y22C	AC input, triac output module Input: 100-120 VAC, 16 points Output: 100-240 VAC, 0.3 A, 16 points				0.074		
DIN adapter		A6DIN1C	Used to mount to DIN rail (optional)	—	—	—	—	○	For A2CI/O
		A6DIN2C						○	For A2CI/O

Table 2.1 List of Remote Modules

REMARK

1) Symbols ○, △ and × in the "Application" column indicate applicability of module as follows.
   ○: Applicable.
   △: Applicable with restrictions. (See Section 2.2.)
   ×: Not applicable.

2) *: EP-ROM is used for running the PC using a program stored in ROM; one EP-ROM can be used. EEP-ROM cannot be used for the A2C.

Module		MINI-S3 Link: Optical	MINI-S3 Link: Twisted pair	MINI-S3 Link: Optical/twisted pair	Type	Discription	Occupied Stations	Occupied Points	Power Consumption (VA)	Current Consumption 24 VDC (A)	Application	Remark
MINI-S3 remote I/O module	Out-of-panel type	○			AJ35PJ-8A	AC input module 100-120 VAC, 8 points	1 station	8 points	—	0.04	△	
					AJ35PJ-8D	DC input module (sink loading) 12/24 VDC, 8 points				0.04		
					AJ35PJ-8R	Contact output module 24 VDC, 2 A, 240 VAC, 2 A, 8 points				0.13		
					AJ35PJ-8T1	Transistor output module (sink loading) 12/24 VDC, 0.1 A/point, 8 points				0.08		
					AJ35PJ-8T2	Transistor output module (sink loading) 12/24 VDC, 0.5 A/point, 8 points				0.03		
					AJ35PJ-8T3	Transistor output module (sink loading) 12/24 VDC, 2 A/point, 8 points				0.065		
					AJ35PJ-8S1	Triac output module 100/240 VAC, 0.6 A/point, 8 points				0.065		
					AJ35PJ-8S2	Triac output module 100/240 VAC, 2 A/point, 8 points				0.08		
	Out-of-panel type		○		AJ35TJ-8A	AC input module 100-120 VAC, 8 points	1 station	8 points	—	0.05	△	
					AJ35TJ-8D	DC input module (sink loading) 12/24 VDC, 8 points				0.05		
					AJ35TJ-8R	Contact output module 24 VDC, 2 A, 240 VAC, 2 A, 8 points				0.13		
					AJ35TJ-8T1	Transistor output module (sink loading) 12/24 VDC, 0.1 A/point, 8 points				0.09		
					AJ35TJ-8T2	Transistor output module (sink loading) 12/24 VDC, 0.5 A/point, 8 points				0.03		
					AJ35TJ-8T3	Transistor output module (sink loading) 12/24 VDC, 2 A/point, 8 points				0.065		
					AJ35TJ-8S1	Triac output module 100/240 VAC, 0.6 A/point, 8 points				0.065		
					AJ35TJ-8S2	Triac output module 100/240 VAC, 2 A/point, 8 points				0.09		

Table 2.1 Remote I/O Modules and Remote Terminal Modules Operable with the A2C (Continue)

REMARK

1) Symbols ○, △ and × in the "Application" column indicate applicability of module as follows.
   ○: Applicable.
   △: Applicable with restrictions. (See Section 2.2.(3))
   ×: Not applicable.

Module		MINI-S3 Link: Optical	MINI-S3 Link: Twisted pair	MINI-S3 Link: Optical/twisted pair	Type	Description	Occupied Stations	Occupied Points	Power Consumption (W)	Current Consumption 24 VDC (A)	Application	Remark
MINI-S3 remote I/O module	Compact type			○	AJ35PTF-32A	AC input module 100-120 VAC, 32 points	4 stations	32 points	—	0.11	△	
					AJ35PTF-32D	DC input module (sink loading) 12/24 VDC, 32 points				0.11		
					AJ35PTF-24R	Contact output module 24 VDC, 2 A, 240 VAC, 2 A, 24 points				0.12		
					AJ35PTF-24S	Triac output module 100/240 VAC, 0.6 A/point, 24 points				0.20		
					AJ35PTF-24T	Transistor output module (sink loading) 12/24 VDC, 0.5 A/point, 24 points				0.13		
					AJ35PTF-28AR	AC input contact output module Input: 100-120 V, 16 points Output: 24 VDC, 2 A, 240 VAC, 2 A, 12 points				0.12		
					AJ35PTF-28AS	AC input, triac output module Input: 100-120 VAC, 16 points Output: 100-240 VAC, 0.6 A/point, 12 points				0.14		
					AJ35PTF-28DR	DC input, contact output module Input: Sink loading, 12/24 VDC, 16 points Output: 24 VDC, 2 A, 240 VAC, 2 A, 12 points				0.12		
					AJ35PTF-28DS	DC input, triac output module Input: Sink loading, 12/24 VDC, 16 points Output: 100-240 VAC, 0.6 A/point, 12 points				0.15		
					AJ35PTF-28DT	DC input, transistor output module Input: 12/24 VDC (sink loading) 16 points Output: 12/24 VDC (sink loading) 0.5 A/point, 12 points				0.11		
					AJ35PTF-56AR	AC input, contact output module Input: 100-120 V, 32 points Output: 24 VDC, 2 A, 240 VAC, 2 A, 24 points	8 stations	64 points	—	0.15		
					AJ35PTF-56AS	AC input, triac output module Input: 100-120 VAC, 32 points Output: 100-240 VAC, 0.6 A/point, 24 points				0.23		
					AJ35PTF-56DR	DC input, contact output module Input: Sink loading, 12/24 VDC, 32 points Output: 24 VDC, 2 A, 240 VAC, 2 A, 24 points				0.15		
					AJ35PTF-56DS	DC input, triac output module Input: Sink loading, 12/24 VDC, 32 points Output: 100-240 VAC, 0.6 A/point, 24 points				0.23		
					AJ35PTF-56DT	DC input, transistor output module Input: 12/24 VDC (sink loading) 32 points Output: 12/24 VDC (sink loading) 0.5 A/point, 24 points				0.16		
	Data link module				AJ72PT35	Used when the building block type I/O module is used as the remote I/O module. • Max. of I/O modules: 8 • Max. I/O points: 128 • Occupied stations: 4, 8, 12, 16 (selectable)	See left.	See left.	—	—	△	

Table 2.1 Remote I/O Modules and Remote Terminal Modules Operable with the A2C (Continue)

REMARK

1) Symbols ○, △ and × in the "Application" column indicate applicability of module as follows.
   ○: Applicable.
   △: Applicable with restrictions. (See Section 2.2.)
   ×: Not applicable.

Module		MINI-S3 Link: Optical	MINI-S3 Link: Twisted pair	MINI-S3 Link: Optical/twisted pair	Type	Discription		Occupied Stations	Occupied Points	Power Consumption (VA)	Current Consumption 24 VDC (A)	Application	Remark
Remote terminal module	A/D conversion module		○		A68ADC	8 channels, 4 to 20 mA/0 to ±10 V, 12-bit analog input		4 stations	32 points	—	0.3	○	Conforms to the Mitsubishi Standard Protocol.
	High speed counter module				AD61C	2 channels, binary 24 bits, 1/2 phase input, reversible counter, 50 kpps					0.15		
MINI-S3 remote I/O module	RS-232C interface module (optical/twisted pair data link)			○	AJ35PTF-R2	Connecting module for external devices of RS-232C interface specifications	No-protocol	4 stations	32 points	—	0.20	○	
							Bar code reader					×	
							ID plate					×	
Interface module	For connecting MELSEC-F series PCs	○			F-16NP	Used for connecting MELSEC-F series PCs to the A2C.		2 stations	16 points	—	✳1	△	
			○		F-16NT							○	
	For connecting FR-Z200 general-purpose inverters	○			FR-ZDL	Used for connecting the Mitsubishi FR-Z200 series general-purpose inverters to the A2C.		4 stations	32 points	—	✳1	△	

Table 2.1 Remote I/O Modules and Remote Terminal Modules Operable with the A2C

REMARK

1) Symbols ○, △ and × in the "Application" column indicate applicability of module as follows.
   ○: Applicable.
   △: Applicable with restrictions. (See Section 2.2.)
   ×: Not applicable.

2) ✳1: For current consumption, see the manuals of interface modules.

2.3.2 Peripheral devices

<table>
<tr><th>Unit</th><th>Description</th><th>Type</th><th>Remark</th></tr>
<tr><td rowspan="2">Programming unit with CRT</td><td>Intelligent GPP</td><td>*1
A6GPPE-SET</td><td>• Consists of the following models:
<table>
<tr><th>Type</th><th>Remarks</th></tr>
<tr><td>A6GPPE</td><td>• Programming unit with CRT
• Equipped with ROM writer, FDD and printer interface functions.</td></tr>
<tr><td>SW□GP-GPPAEE</td><td>A series system disk</td></tr>
<tr><td>SW□GP-GPPKEE</td><td>K series system disk</td></tr>
<tr><td>SW0-GPPU</td><td>User disk (3.5 inch, formatted)</td></tr>
<tr><td>AC30R4</td><td>Cable for connection of CPU and A6GPPE
3 m/9.84 ft length</td></tr>
</table></td></tr>
<tr><td>Composite video cable</td><td>AC10MD</td><td>Cable for connection of GPP and expanded monitor display. 1 m/3.28 ft length.</td></tr>
<tr><td>Programming unit with LCD</td><td>Handy graphic programmer</td><td>*2
A6HGPE-SET</td><td>• Consists of the following models:
<table>
<tr><th>Type</th><th>Remarks</th></tr>
<tr><td>A6HGPE</td><td>• Programming unit with LCD
• Equipped with FDD, printer interface and memory card interface functions.</td></tr>
<tr><td>SW□-HGPAEE</td><td>A series system disk</td></tr>
<tr><td>SW□-HGPKEE</td><td>K series system disk</td></tr>
<tr><td>SW0-GPPU</td><td>User disk (3.5 inch, formatted)</td></tr>
<tr><td>AC30R4</td><td>Cable for connection of CPU and A6HGPE
3 m/9.84 ft length</td></tr>
</table></td></tr>
<tr><td>Programming unit with plasma display</td><td>Plasma handy programmer</td><td>*3
A6PHPE-SET</td><td>• Consists of the following models:
<table>
<tr><th>Type</th><th>Remarks</th></tr>
<tr><td>A6PHPE</td><td>• Programming unit with plasma display
• Equipped with FDD, printer interface and memory card interface functions.</td></tr>
<tr><td>SW□GP-GPPAEE</td><td>A series system disk</td></tr>
<tr><td>SW□GP-GPPKEE</td><td>K series system disk</td></tr>
<tr><td>SW0-GPPU</td><td>User disk (3.5 inch, formatted)</td></tr>
<tr><td>AC30R4</td><td>Cable for connection of CPU and A6PHPE
3 m/9.84 ft length</td></tr>
</table></td></tr>
<tr><td rowspan="4">Common to programming units with CRT and LCD</td><td rowspan="2">RS-422 cable</td><td>AC30R4</td><td colspan="2" rowspan="2">Cable for connection of CPU and A6GPP/A6HGP/A6PHP</td><td>3 m/9.84 ft length</td></tr>
<tr><td>AC300R4</td><td>30 m/98.4 ft length</td></tr>
<tr><td>User disk</td><td>SW0-GPPU</td><td colspan="2">User disk (3.5 inch, formatted) for storing programs</td></tr>
<tr><td>Cleaning disk</td><td>SW0-FDC</td><td colspan="2">Cleaning disk for disk drive</td></tr>
</table>

Table 2.2 List of Peripheral Devices (Continue)

Unit	Description	Type	Remark
Printer	Printer	K6PR(S1)	• For print out of program ladder diagrams and lists.
		K6PR-K	
		K7PR(S1)	
		A7PR	
		A7NPR	
	RS-232C cable	AC30R2	Cable for connection of A6GPP/A6HGP/A6PHP and K6PR(S1), K6PR-K, K7PR(S1), A7PR printers and general-purpose printers with RS-232C interface. Length: 3 m (9.8 ft)
	Printer paper	K6PR-Y	Paper for K6PR(S1) and K6PR-K. Size: 9" Packing unit: 2000 sheets.
	Ink ribbon	K6PR-R	K6PR-R: For K6PR(S1) and K6PR-K
		A7PR-R	A7PR-R: For A7PR
		A7NPR-R	A7NPR-R: For A7NPR
Programming unit	Programming unit	A7PU *4	• Connected to the CPU directly or via cable to read and write programs. Equipped with MT function. • The A7PU is supplied with a cable for connection of the A7PU and audio cassette recorder.
	RS-422 cable	AC30R4 AC300R4	Cable for connection of CPU and A7PU. 3 m(9.84 ft)/30 m(98.4 ft) length.
P-ROM writer unit	P-ROM writer unit	A6WU *5	• Used to store programs onto ROM and read programs from ROM to the CPU. • Connection by RS-422 cable.
	RS-422 cable	AC30R4 AC300R4	Cable for connection of CPU and A6WU. 3 m(9.84 ft)/30 m(98.4 ft) length.

Table 2.2 List of Peripheral Devices

POINT

(1) *1 ··· Use the SW4GP-GPPA system disk upgraded for the A2C.
If SW□GPPA or SW3GP-GPPA is used, operate the A6GPP following the cautions given in App. 4.

(2) *2 ··· The system disk is not upgraded for the A2C. If SW□HGPA is used, operate the A6HGP following the cautions given in App. 4.

(3) *3 ··· Use the SW4GP-GPPA system disk upgraded for the A2C.
If SW3-GPPA is used, operate the A6PHP following the cautions given in App. 4.

(4) *4 ··· The A7PU is not upgraded for the A2C. If A7PU is used, operate the A7PU following the cautions given in App. 4.

(5) *5 ··· Use the A6WU upgraded for the A2C. (Versions "E" and later are applicable to the A2C.) Those EP-ROMs written by the A6WU of versions "D" and older cannot be installed to the A2C.
(Only one ROM can be installed in A2C. However, the A6WU regards the A2C as "A2", and if writing to the EP-ROM is attempted, the ROM is divided to the "even" and "odd" numbered address areas.

3. GENERAL SPECIFICATIONS

Table 3.1 shows the common specifications of various modules used.

Item	Specifications				
Operating ambient temperature	0 to 55℃				
Storage ambient temperature	−20 to 75℃				
Operating ambient humidity	10 to 90% RH, non-condensing				
Storage ambient humidity	10 to 90% RH, non-condensing				
Vibration resistance	Conforms to * JIS C 0911	Frequency	Acceleration	Amplitude	Sweep Count
		10 to 55 Hz	—	0.075 mm (0.003 in)	10 times *(1 octave/minute)
		55 to 150 Hz	1 G	—	
Shock resistance	Conforms to JIS C 0912 (10 g × 3 times in 3 directions)				
Noise durability	By noise simulator of 1500 Vpp noise voltage, 1 μs noise width and 25 to 60 Hz noise frequency				
Dielectric withstand voltage	1500 VAC for 1 minute across AC external terminals and ground 500 VAC for 1 minute across DC external terminals and ground				
Insulation resistance	5 MΩ or larger by 500 VDC insulation resistance tester across AC external terminals and ground				
Grounding	Class 3 grounding; grounding is not required when it is impossible.				
Operating ambience	Free of corrosive gases. Dust should be minimal.				
Cooling method	Self-cooling				

Table 3.1 General Specifications

REMARK

One octave marked * indicates a change from the initial frequency to double or half frequency. For example, any of the changes from 10 Hz to 20 Hz, from 20 Hz to 40 Hz, from 40 Hz to 20 Hz, and 20 Hz to 10 Hz are referred to as one octave. When checking the module with withstanding voltage, apply voltage after disconnecting the FG, LG and ground terminals.

Note: * JIS: Japanese Industrial Standard

4. A2CCPU

4.1 Performance

Item		Performance	
Control system		Repeated operation (using stored program)	
I/O control method		Refresh mode	
Programming language		Language dedicated to sequence control (Combined use of relay symbol type, logic symbolic language, and Sequence Action Program language)	
Number of instructions	Sequence instruction	22	
	Basic instruction	131	
	Application instruction	97	
Processing speed (sequence instruction) (μ sec/step)		1.25	
I/O points		512	
Watch dog timer (WDT) (msec)		10 to 2000	
Memory capacity		32K byte *	
Program capacity		Max. 16K (8K step)	
Device: Internal relay (M) (point)		1000 (M0 to 999)	The number of Ms + Ls + Ss = 2048 (set in parameters)
Device: Latch relay (L) (point)		1048 (L1000 to 2047)	
Device: Number of step relays (S) (point)		0 (Defaults to no value)	
Device: Link relay (B) (point)		1024 (B0 to 3FF)	
Device: Timer	Number of points	256	
	Specifications	100ms timer: setting time 0.1 to 3276.7sec (T0 to 199) 10ms timer: setting time 0.01 to 327.67sec (T200 to 255) 100ms retentive timer: depending on setting (setting time 0.1 to 3276.7sec)	Set in parameters
Device: Counter	Number of points	256	
	Specifications	Setting range 1 to 32767 (C0 to 255)	
Device: Data register (D) (points)		1024 (D0 to 1023)	
Device: Link register (W) (points)		1024 (W0 to 3FF)	
Device: Annunciator (F) (points)		256 (F0 to 255)	
Device: File register (R) (points)		Max. 4096 (R0 to 4095)	
Device: Accumulator (A) (points)		2 (A0, A1)	
Device: Index register (V, Z) (points)		2 (V, Z)	
Device: Nesting (N) (points)		8 (N0 to 7)	
Device: Pointer (P) (points)		256 (P0 to 255)	
Device: Special relay (M) (points)		256 (M9000 to 9255)	
Device: Special register (D) (points)		256 (D9000 to 9255)	

Table 4.1 List of Performance (Continue)

Item		Performance
Comment (points)		Max. 1600 (Specify in batches of 64 points) *1
Self-diagnostic functions		Watch dog error monitor (watch dog timer 200ms) Memory error detection, CPU error detection, I/O error detection, battery error detection, etc.
Operation mode at the time of error		STOP/CONTINUE
STOP → RUN output mode		Output data at time of STOP restored/data output after operation execution
Weight kg (lb)		1.1 (2.41)
A2C internal power supply	Input power	100 to 120 VAC/200 to 240 VAC $^{-15\%}_{+10\%}$ (85 to 132 VAC/170 to 264 VAC)
	Input frequency	50/60 Hz ±3 Hz
	Maximum input apparent power	110 VA or less
	Inrush current	20 AP/20 AP or less
	Efficiency	65% or over
	Allowable momentary power failure	20 msec or less

Table 4.1 List of Performance

*: Total memory capacity for parameters, T/C set values, program capacity, file registers, comment points, sampling trace and status latch. See Section 4.4 for memory capacity calculation.

*1: With GPP/PHP/HGP, comments up to 4032 points can be used. Note that the maximum of storage capacity of the A2C is 1600 points.

4.1.1 Repeated operation processing

Sequence programs are written by the peripheral device and stored to the A2C user program area (maximum 8K steps). The A2CPU reads the required program sequentially from the user program area and performs the repeated operation processing in order of step 0 to the [END] (FEND) instruction.

(1) Stored program system

Sequentially reads and operates the program stored in the user program area.

(2) Scanning

Operates the program in order of step numbers from step 0 to the [END] (FEND).

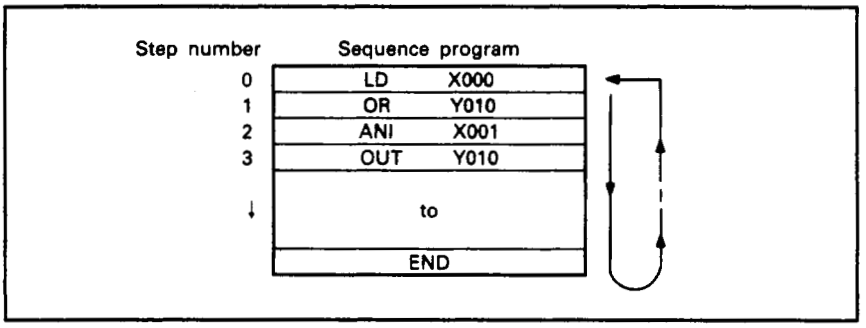


Fig. 4.1 Sequence Program Operation Processing

4.1.2 Initial processing

Initial processing initiates the sequence program operation processing. The following initial processing is executed when the A2C is turned [ON] or reset by the [RUN] key switch.
Initial processing time is 2 to 3 seconds though it varies with system configuration.

(1) I/O modules initialization

Resets and initializes the I/O modules.

(2) Data memory clear

Clears the data memory which is not latched by the peripheral.

(3) Self-diagnosis

The PC CPU conducts self-checks when it is powered up or reset.
For further details, see Section 4.3.1.

4.1.3 END processing

END processing returns the A2C to step 0 after the END (FEND) instruction execution to allow repeated operation processing.

(1) CPU error check

Checks battery power, etc.. See Section 4.3.1 for details.

(2) Timer/counter processing

Updates timer/counter present values and contact status. For further details, see Section 4.1.4 and 4.1.5.

(3) Sampling trace processing

Stores the specified device status to the sampling trace area when the sampling trace is executed every scan (after END execution).

(4) Operation state check

Checks operation state of the A2C and switches to the RUN, STOP or PAUSE state. For transition processings to the RUN, STOP and PAUSE states, see Section 4.1.9.

(5) Constant scan processing

Allows the repeated operation processing to be initiated after the specified constant scan time (set to special data register D9020) is reached.

4.1.4 Timer processing and accuracy

The A2C uses up-timing timers which increase present value as measuring time increases. Three kinds of timers are provided; 100 msec timer, 10 msec timer and 100 msec retentive timer.

- 100 msec timers...setting range: 0.1 to 3276.7 sec in 100 msec increments
- 10 msec timers...setting range: 0.01 to 327.67 sec in 10 msec increments
- 100 msec retentive timers... setting range: 0.1 to 3276.7 sec in 100 msec increments.
  Processing when the coil is turned off differs from the processing of 100 msec timers.

The following paragraphs explain timer processing.

(1) Timer present value and contact status update
With continuity in front of a timer coil, the timer present value and contact status are updated after the execution of the [END] (or FEND) instruction and the timer contacts close after the timer has timed out.

(a) 100ms and 10ms timers
When the continuity is removed from in front of the timer coil, the present value is reset to 0 and the timer contacts open.

(b) 100ms retentive timer
When the continuity is removed from in front of the timer coil, the present value update is stopped but the present value is retained.

(2) [RST] T[ ] instruction executed
When the timer is reset by the [RST] T[ ] instruction, the present value is reset to 0 and the timer contacts open.
The retentive timers retain their present value and contact status, and are reset using the [RST] T[ ] instruction.

(3) OUT T[ ] jumped
If the [OUT] T[ ] instruction is jumped after the timer has started timing, it continues to time. The contacts are closed when the timer times out.

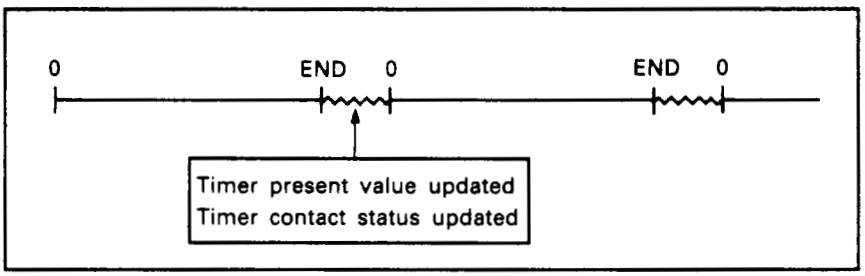


Fig. 4.2 Timer Processing

REMARK

Accuracy of timers when external inputs are used is within 0 to +2 from the scan time.
For timer timing and accuracy, read the ACPU Programming Manual (Fundamentals).

4.1.5 Counter processing and maximum counting speed

The A2C uses up-timing counters which increase their present values on the leading edge of an input signal.
Counters are used by incorporating in the main routine programs or sub routine programs.

(1) Counter present value and contact status update

Counter coil is switched on and off by the [OUT] C[ ] instruction. The counter present value is updated on the leading edge of the coil signal after the [END] (FEND) instruction is executed. The counter contacts close after the counter has counted out. The counters retain their present value and contact status even if the counter coil is switched off.

(2) [RST] C[ ] instruction executed

When the counter is reset by the [RST] C[ ] instruction, the present value is reset to 0 and the counter contacts open.

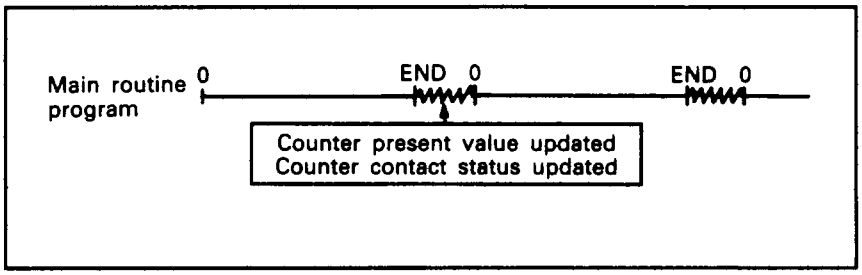


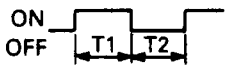
Fig. 4.3 Counter Processing

REMARK

The maximum counting speed of the counter depends on the scan time. Counting is only possible if the input condition is on for more than one scan time. For further details, see the ACPU Programming Manual.

$$\text{Maximum counting speed } Cmax = \frac{n}{100} \times \frac{1}{ts} \text{ (times/sec)}$$

where, n = duty (%)
Duty is the ratio of the input signal's on time to off time as a percentage.

Count input signal 

If $T1 \leq T2$ $\quad n = \frac{T1}{T1+T2} \times 100$ (%)

If $T1 > T2$ $\quad n = \frac{T2}{T1+T2} \times 100$ (%)

ts: Program scan time (sec)

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4.1.6 Operation processing at instantaneous power failure

The A2C detects instantaneous power failure when the input line voltage to the power supply module falls below the defined range. The A2C performs two different operation processing depending on the length of instantaneous power failure time across 20ms allowable value.

(1) Instantaneous power failure within 20 ms

(a) The operation processing is stopped with the output retained.

(b) The operation processing is resumed when normal status is restored.

(c) The watch dog timer (WDT) keeps timing while the operation is at a stop. For instance, if the WDT and scan time settings are 200 ms and 190 ms respectively, an instantaneous power failure of 20 ms will result in a WDT error.

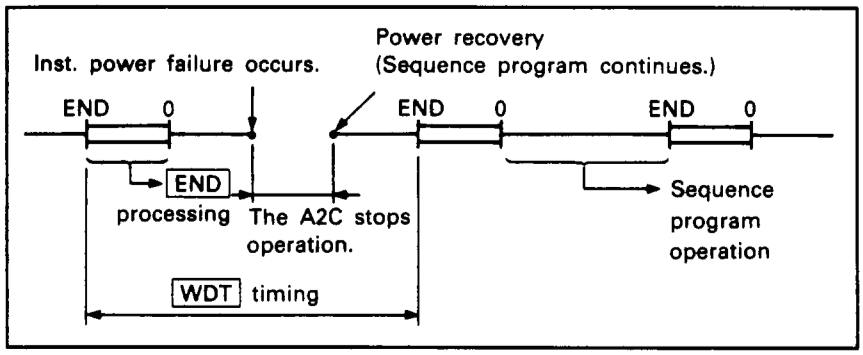

Fig. 4.4 Instantaneous Power Failure within 20 ms

(2) Instantaneous power failure over 20 ms
The A2C is reset. The A2C performs the initial start processing as it does when it is turned on or reset by the RUN key switch operation.

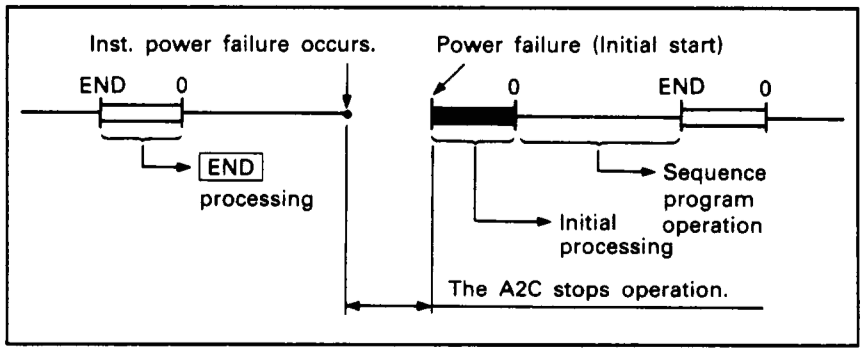

Fig. 4.5 Instantaneous Power Failure Over 20 ms

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4.1.7 Scan time

(1) Scan time

Scan time is the period in which PC one scan [0 to END (FEND)] is executed.

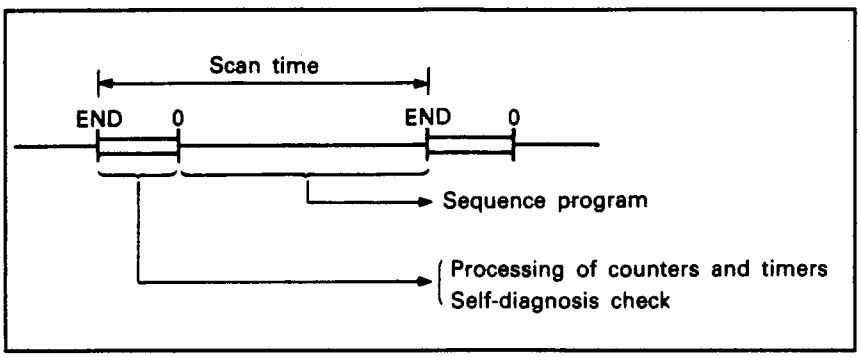


Fig. 4.6 Scan Time

(2) Scan time confirmation

The A2CCPU counts the scan time between an END (FEND) instruction to the next END (FEND) instruction and registers the counted scan time in special registers D9017 to D9019.

1) Special register data (D9017 to D9019)
   - D9017 ····· The minimum scan time
   - D9018 ····· Present scan time
   - D9019 ····· The maximum scan time

2) Accuracy of scan time
   The accurate to scan time counted by the programmable controller is accurate to ±10 ms.
   Therefore, if the data in D9017 to D9019 is 5, actual scan time is in the range of 40 to 60 ms.

3) The data in D9017 to D9019 is not cleared when the WDT instruction is executed; the scan time between an END (FEND) instruction and the next END (FEND) instruction is registered.

REMARK

1) The scan time can be confirmed by the circuit monitoring operation using a peripheral device.
   - Scan time of 0 to 20 ms ····· 10 ms is displayed
   - Scan time of 10 to 30 ms ····· 20 ms is displayed

2) The constant scan function allows the scan time of every scan to be fixed to a constant value. For more details on the constant scan function, see 4.2.1.

4.1.8 Watch dog timer (WDT)

The watch dog timer is an internal timer used to detect errors in the PC's repeated operation function. It also monitors the time of one scan of a sequence program.

(1) Watch dog timer setting
The watch dog timer default value is 200 ms.
This setting can be changed to between 10 and 2000 ms (in intervals of 10 ms) using a parameter.

(2) Watch dog timer operation
(a) The watch dog timer is reset after the execution of the [END] instruction as long as PC operation is normal (scan time is within the setting).
(b) A watch dog timer error will occur if processing is not completed within the predetermined time due to a long sequence program scan time or faulty hardware. In this case, operation stops.

(3) Response to watch dog timer errors
After the watch dog timer counts up, the following processing occurs.
(a) Infinite loop
1) All outputs (Y) are turned off electrically.
However, sequence program operation continues though the [RUN] key switch is set for [STOP] because switching from [RUN] to [STOP] is to be done after the execution of the [END] instruction.
2) The A2CCPU can be monitored with a peripheral.
Test operation of the A2CCPU or read/write/verify of a sequence program using the peripheral is not possible.
3) Error code "25" is stored in D9008.

(b) END instruction executed after the watch dog timer setting expires
1) All outputs (Y) are turned off electrically.
Only sequence program operation continues (even when the [RUN] switch is set in the [STOP] position).
2) After the exeuction of the [END] instruction, the A2CCPU can communicate with a peripheral.
3) After the execution of the [END] instruction, error code "22" is stored in D9008.
4) The scan time required until the execution of the [END] instruction is stored in D9019 and D9018.

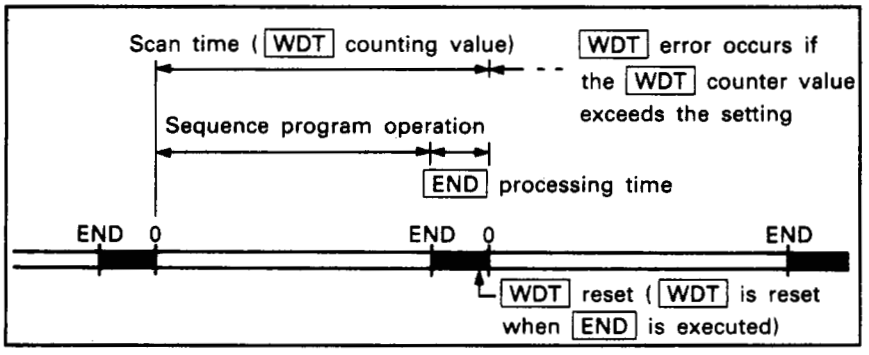


Fig. 4.7 Resetting Watch Dog Timer

(4) Watch dog timer error processing
Do one of the following if the scan time of a sequence program is greater than the watch dog timer setting.

(a) Change the sequence program so that the operation time is within the watch dog timer setting.

(b) Change the watch dog timer setting.
Setting range: 10 to 2000 ms

(c) Reset the watch dog timer with the WDT instruction in the sequence program.
The watch dog timer is reset at the time the WDT instruction is executed and it begins counting again from "0".
Note that the scan time values registered in D9017 to D9019 are not reset when the WDT instruction is executed.

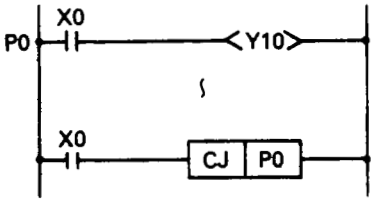
POINT

The watch dog timer setting must be as indicated below if constant scan (see 4.2.1) is set.

(Constant scan setting) + 10 ms ≦ (Watch dog timer setting)

REMARK

1) ✳ ····· An infinite loop may be caused if a program execution sequence is jumpes to a smaller step number because of a CJ instruction.
Example:



An infinite loop is caused if there is no jump instruction calling for a jump to a step beyond step CJ P0 to between point P0 and step CJ P0, thereby precluding the execution of the END instruction.

2) Data stored in special registers D9017 to 9019
a) D9017 ····· Smallest value of scan time
b) D9018 ····· Present value of scan time
c) D9019 ····· Largest value of scan time

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4.1.9 RUN, STOP, PAUSE operation processing

The A2CCPU operates in one of the following three states:

(a) RUN state
The PC CPU operates the sequence program repeatedly from step to the END (FEND) instruction.

(b) STOP state
All outputs (Y) are turned off and sequence program operation is not executed.

(c) PAUSE state
Execution of a sequence program is suspended. The status of all outputs (Y) before entering the PAUSE state are saved.

The PC CPU's operation processing in each operation state is described below.

(1) Operation processing in [RUN] state

(a) The [RUN] state indicates the state in which the PC CPU operates a sequence program repeatedly from step 0 to the [END] (FEND) instruction.

(b) The output status of the outputs (Y) at the entry to the [RUN] state varies according to the "[STOP] to [RUN] output" mode set with a parameter.

1) Output of operation state before [STOP]
After the outputs (Y) saved before the entry to the [STOP] state are output, the PC CPU executes the sequence program.

2) Output after operation
Outputs (Y) are output after one scan of the sequence program.

The time required before starting sequence program operation after the changing the switch from [STOP] to [RUN] varies according to the system configuration; it is usually between 1 and 3 seconds.

(c) In the [RUN] state, the processing illustrated in Fig. 4.7 is repeated until the operation state is changed from [RUN] to [STOP] or [PAUSE].

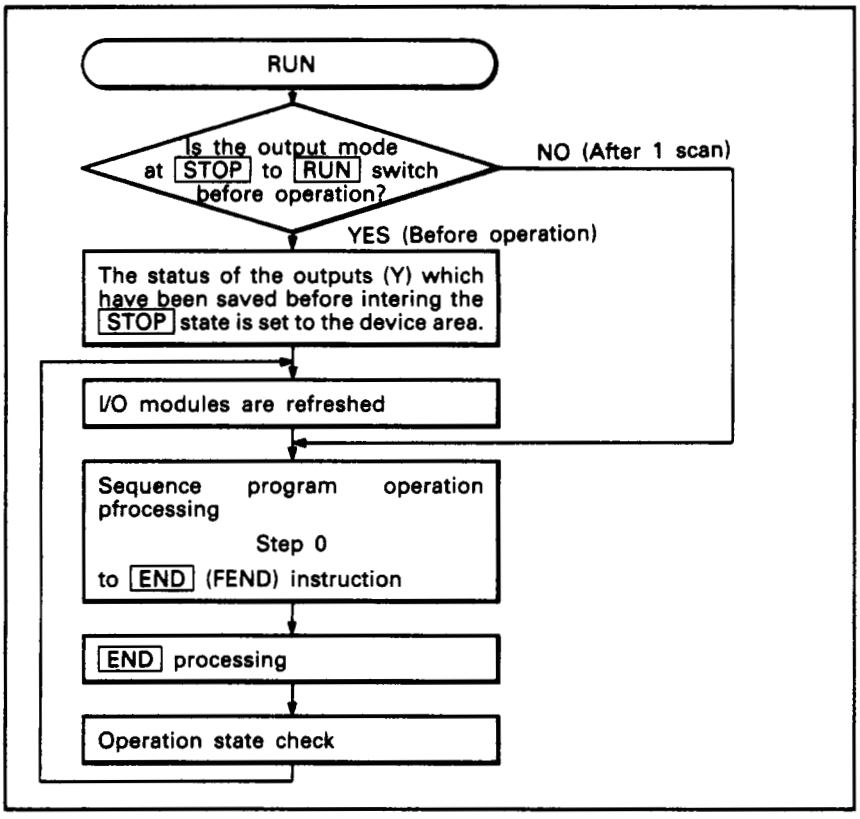


Fig. 4.8 [RUN] Operation Processing

REMARK

For details on individual processing in Fig. 4.8, refer to 4.1.1 to 4.1.3.

(2) STOP operation processing

(a) The STOP state indicates the state in which sequence program operation has been stopped using the RUN switch or the remote STOP switch.

(b) When the PC CPU enters the stop state, it saves the output statuses before turning off all outputs (Y). Note that the status of devices other than the outputs (Y) is retained.

(c) In the STOP state, the processing illustrated in Fig. 4.9 is repeated until the operation state is changed from STOP to RUN or PAUSE.

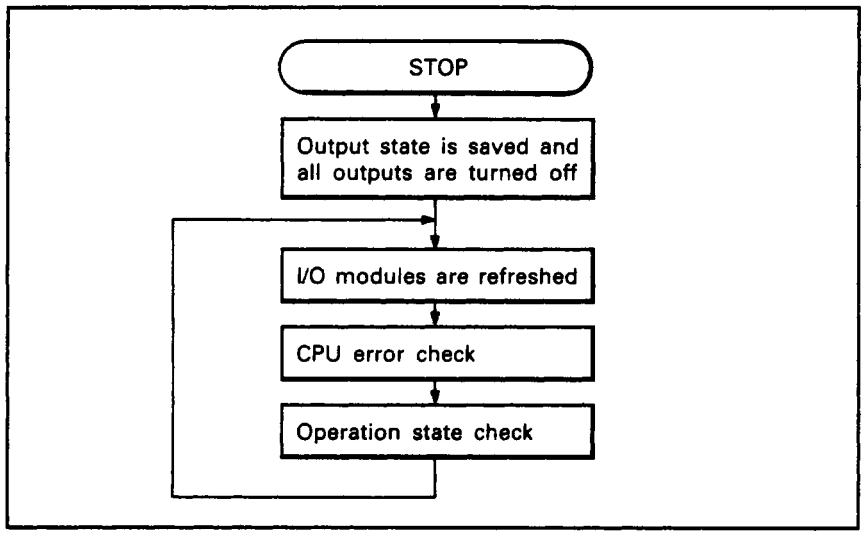


Fig. 4.9 STOP Operation Processing

REMARK

To set the PC CPU in the stop state, use one of the following methods:

a) RUN switch
b) Remote STOP contact
c) Peripheral device } ·····For details, refer to 4.2.3.
d) STOP command ····· For details on individual processing, refer to the ACPU Programming Manual (Common instructions).

(3) PAUSE operation processing

(a) The PAUSE state indicates the state in which sequence operation processing is stopped by the remote PAUSE signal. The status of the outputs (Y) and the data memory are retained.

(b) In the PAUSE state, the processing illustrated in Fig. 4.10 is repeated until the operation state is changed from PAUSE to RUN or STOP.

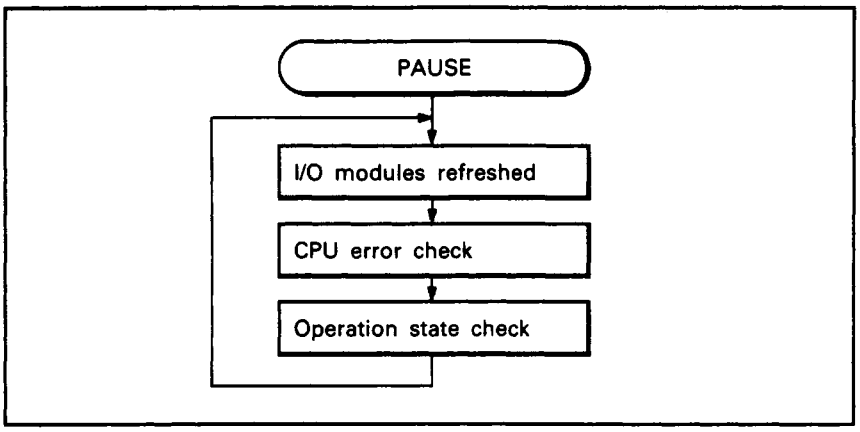


Fig. 4.10 PAUSE Operation Processing

REMARK

To set the PC CPU in the pause state, use one of the following methods:
a) Remote PAUSE contact
b) Peripheral device
For details, refer to 4.2.4.

(4) The relationship between the A2CCPU operation state and operation processing is indicated in Table 4.2.

PC CPU operation processing / A2C state	Sequence Program Operation	External Output	Data Memory (M, L, S, T, C, D)
RUN → STOP	Stopped	Output status is saved by the OS and all outputs switched off.	Status at the time of STOP is retained.
STOP → RUN	Started	Depends on the STOP → RUN output mode set in the parameter.	Operation is resumed in the status at the time of STOP.
RUN → PAUSE	Stopped	Output status is retained.	Status at the time of PAUSE is retained.
PAUSE → RUN	Started	Operation resumes in the PAUSE output status.	Operation resumes in the status at the time of PAUSE.

Table 4.2 A2C Operation Processings

(5) Processing while sequence program operation processing is stopped is indicated in Table 4.3.

Processing / A2C State	I/O Refresh	CPU Error Check	Timer/Counter Present Value and Contact Status Update	Constant Scan Processing (with constant scan set)	Sampling Trace Processing	Operation State Check
RUN (END processing)	Executed	Executed	Executed	Executed	Executed	Executed
STOP	Executed	Executed	—	—	—	Executed
PAUSE	Executed	Executed	—	—	—	Executed

Table 4.3 Processing During Program Operation Stop

4.2 Functions

Functions of the CPU module are listed in Table 4.4.

Function	Description	Refer to:
Constant scan	○ Executes the sequence program at the predetermined intervals independently of the scan time. ○ Setting allowed between 10 and 2000ms.	Section 4.2.1
Latch (power failure compensation)	○ Retains device data if the PC is switched off or reset or instantaneous power failure occurs 20ms or longer. ○ L, B, T, C, D and W can be latched.	Section 4.2.2
Remote RUN/STOP	○ Allows remote run/stop from external device (e.g. peripheral, external input, computer) with RUN/STOP switch in RUN position.	Section 4.2.3
Pause	○ Stops operation with the output (Y) status retained. ○ Pause function may be switched on by any of the following ways: ● RUN/STOP switch on the front of the CPU ● Remote pause contact ● Peripheral	Section 4.2.4
Status latch	○ Stores all device data in the status latch area in the A2C when the status latch condition is switched on. ○ The stored data can be monitored by the peripheral.	Section 4.2.5
Sampling trace	○ Samples the specified device operating status at predetermined intervals and stores the sampling result in the sampling trace area in the A2C. ○ The stored data can be monitored by the peripheral.	Section 4.2.6
Offline switch	○ Allows the device (Y, M, L, S, F, B) used with the OUT instruction to be disconnected from the sequence program operation processing.	Section 4.2.7
Priority setting of ERROR LED	○ Sets on/off of the ERROR LED in the case of error occurrence.	Section 4.2.8

Table 4.4 List of Functions

4.2.1 Constant scan

Because the processing time of each individual instruction in a sequence program differs depending on whether or not the instruction is executed, the scan time differs accordingly for each scan.
The constant scan function sets such varying scan times to a fixed value regardless of the sequence program processing time.

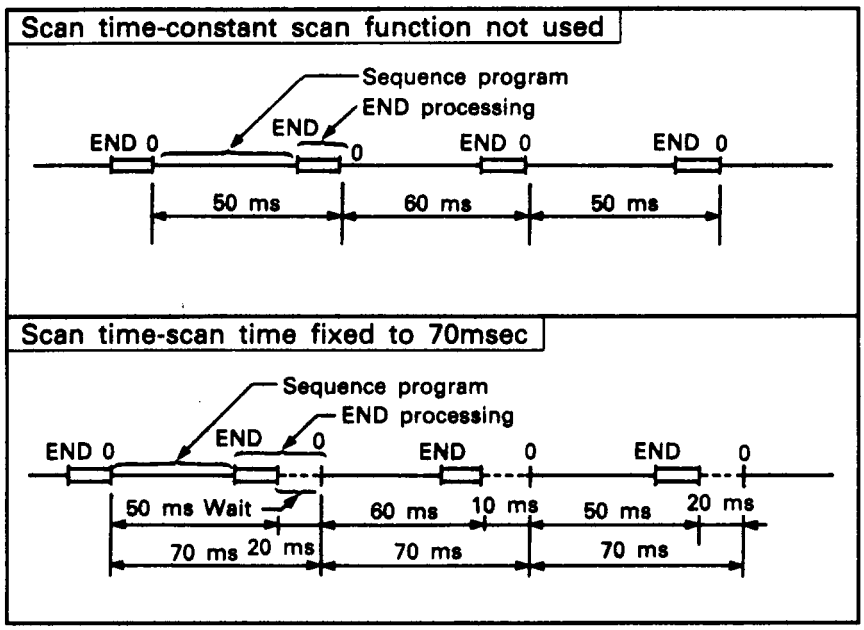


Fig. 4.11 Constant Scan Function

(1) Setting range

(a) Constant scan time can be set in the range of 10 msec to 200 msec.
Enter the required constant scan time to special register D9020 in units of 10 msec (setting value between 10 and 2000).
If D9020 is set outside the range of 1msec to 2000 msec, the constant scan time will be set as indicated below.

Setting for D9020	Constant Scan Time
−32768 to 0	Not set
1 to 200	10 msec to 2000 msec
201 to 32767	2000 msec

(b) The watch dog timer setting must be greater than the constant scan time setting.
If the watch dog timer setting is smaller than the constant scan time setting, a WDT error might occur.
The relationship between the constant scan time setting and the watch dog timer setting is indicated below.

$$0 < \text{Constant scan time setting} \leqq \text{WDT setting} - 1$$

(c) The set constant scan time must be greater than the maximum scan time of the sequence program.
If the sequence program scan time is longer than the constant scan time, the constant scan function is not performed correctly.

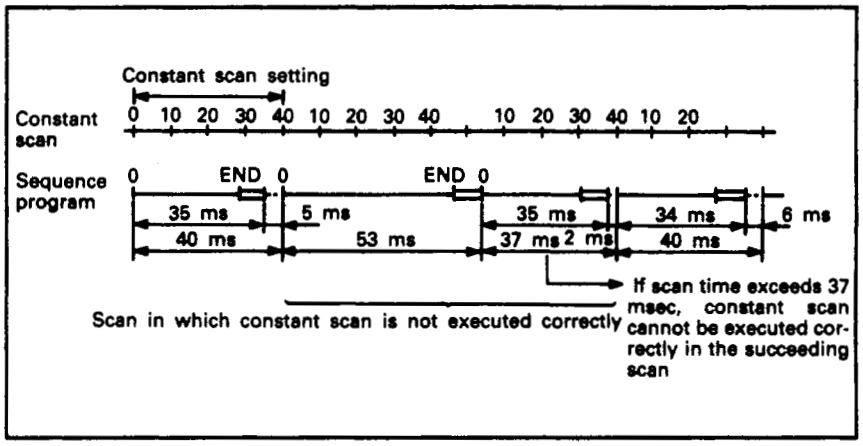


Fig. 4.12 Scan Time Larger than Constant Scan Setting

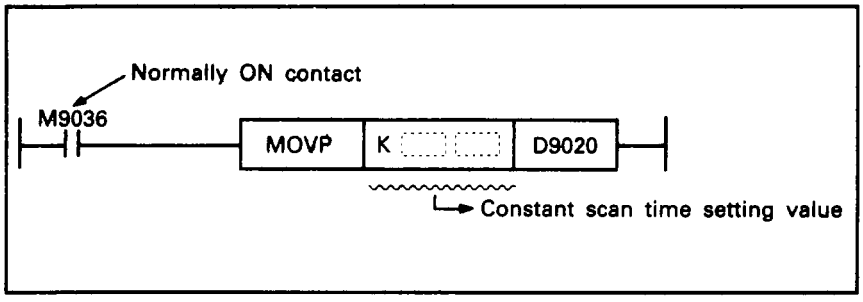
(2) Setting for constant scan execution

(a) Constant scan execution
A constant scan time setting is written to D9020 using the sequence program or the peripheral device.

(b) Constant scan not executed
The value "0" is written to D9020 using the sequence program or the peripheral device.

(3) Caution

(a) The constant scan time setting value stored in D9020 is cleared to zero (0) when the A2CCPU is powered up or reset using the RUN switch.
Therefore, it is necessary to write the following program if constant scan is required from the first scan immediately after the A2CCPU is started or reset.



(b) If a momentary power failure of less than 20 msec has occurred, the constant scan time is lengthened accordingly. In this case, the constant scan function is not executed correctly.

(c) If a peripheral device is connected to the A2CCPU, the set scan time is lengthened by the time (0.2 msec) required for communication between the A2CCPU and the peripheral device.

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4.2.2 Power failure compensation for device data in the A2C (LATCH function)

Each individual device of the A2CCPU is reset when the A2CCPU is powered up. Device will be cleared when a momentary power failure occurs for more than 20 msec. After being reset or cleared, all device data is reset to the default values (OFF for bit devices and 0 for word devices).
The latch function retains the device data in the event that the A2CCPU is reset by turning on the power or pressing using the RUN switch or a momentary power failure occurs for more than 20 msec.
Sequence program operation is the same regardless whether the data is latched or not.

(1) Applications

The latch function is used to continue the control by retaining data such as the number of completed products, the number of defective products, and the addresses should a momentary power failure occur for more than 20 msec.

(2) Latch devices and latch range setting

(a) The devices whose data can be latched are listed below:

1) Latch relay (L0 to L2047)
2) Link relay (B0 to B3FF)
3) Timer (T0 to T255)
4) Counter (C0 to C255)
5) Data register (D0 to D1023)
6) Link register (W0 to W3FF)

(b) The latch range is set in the peripheral parameters per device.

POINT

Device date within the latch range is backed by the battery (A6BAT) installed to the A2C.
(a) The battery is required even when operation is performed using a ROM which stores the sequence program.
(b) Device data within the latch range is corrupted if the battery connector is disengaged from the A2C when the A2C is being turned off.

(3) Clearing the latched data

(a) To clear the latched data to the initial value, "latch clear" is performed. "Latch clear" clears unlatched device data also, as mentioned below.
After the latch clear operation, the data in the each device is set to the following:

1) Y, M/L/S, F, B ..... Turned off
2) Special relays (9000 to 9255) ..... Data is retained
3) T, C ..... Contacts and coils are turned off; present value is set to 0.
4) D, Z, V, W, A ..... Data is set to zero.
5) R ..... Data is retained.
6) Special registers (9000 to 9127) ..... Data is retained.

(b) Latched data can be cleared in either of the following two methods.

1) Using the RUN switch

a) Turn the RUN switch from the STOP position to the L.CLR position three times.

b) The RUN LED starts flashing. This indicates that the latched data is ready to be cleared.

c) Turn the RUN switch from the STOP position to the L.CLR position while the RUN LED is flashing; the latched data is cleared.

POINT

To cancel the data latch clear operation, turn the RUN switch to the RUN or RESET position while latch clear operation is being attempted.
(a) RUN position
The A2CCPU starts operation in the same manner as when the RUN switch is placed in the RUN position from the STOP position.
(b) RESET position
The A2CCPU is reset.

2) Using GPP/PHP/HGP
"ALL DEVICE CLEAR" of the test functions in the PC mode can be used for latch clear. (For details, read the GPP/PHP/HGP Operating Manual.)

4.2.3 Running and Stopping the A2C from external devices (Remote RUN/STOP function)

The RUN switch is used for A2CCPU run/stop control. The operation "remote RUN/STOP" means controlling of A2CCPU run/stop with external signals (peripheral devices, remote RUN contact) with the RUN switch placed in the RUN position.

(1) Application of remote RUN/STOP
Remote RUN/STOP control is possible in the following cases.

(a) The A2CCPU is out of reach.
(b) The A2CCPU is located in a control box.

(2) Operation
Execution of sequence program operation is controlled as indicated below in response to the remote RUN/STOP operation.

(a) Remote stop ····· The A2CCPU stops after the sequence program is executed to the END (FEND) instruction.
(b) Remote RUN····· The sequence program is executed again from step 0 by the remote RUN operation after the A2CCPU has been stopped by the remote STOP operation.

(3) Executing remote RUN/STOP
Remote RUN/STOP operation is possible by the following methods:

(a) Remote RUN contacts
Remote RUN/STOP control is possible by turning on and off the remote RUN contacts which are set with parameters.

1) When remote RUN contacts is turned ON, the A2C is set to the RUN state.
2) When remote RUN contacts is turned OFF, the A2C is set to the STOP state.
Switching between RUN and STOP is executed after END(FEND) execution.

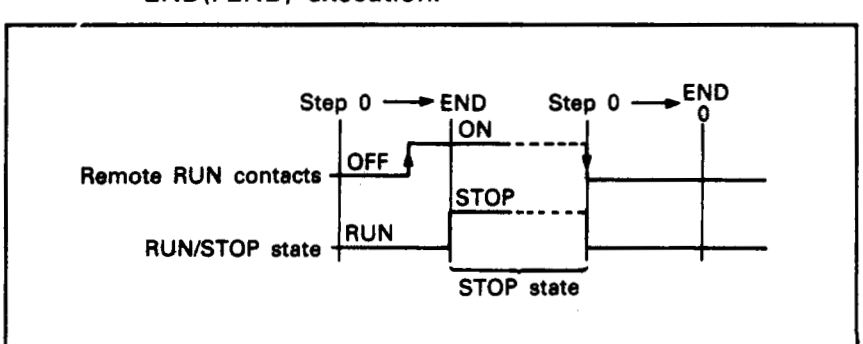


Fig. 4.13 Remote RUN/STOP Timing Using the Remote Run Contacts

(b) Peripheral device

Remote RUN/STOP control is possible using the remote RUN/STOP command from a peripheral device.

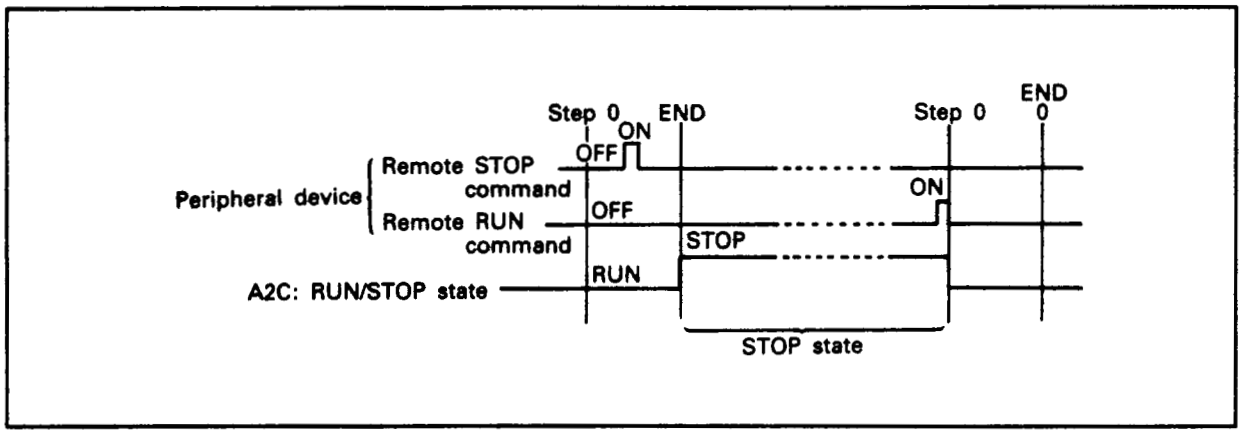


Fig. 4.14 Remote RUN/STOP Timing Using the Remote RUN/STOP Command from a Peripheral Device

(4) Caution

(a) Note the following points because the A2CCPU gives priority to the STOP command.

1) The A2CCPU is set to the STOP state when the STOP command is given from the remote RUN contact or a peripheral device.

2) To set the A2CCPU from the STOP state back to the RUN state, it is necessary to set all external factors (remote RUN contact, peripheral device) which caused the remote STOP to the RUN state.

REMARK

For details on A2CCPU operation processing in a RUN or STOP state, refer to Section 4.1.9.

4.2.4 Stopping the sequence program operation retaining outputs (PAUSE function)

The pause function stops A2CCPU operation while retaining the status of all outputs (Y).

(1) Application

In process control, it is often required retain the status of the outputs (Y) when the A2CCPU stops operating.

(2) Using remote PAUSE contacts

(a) The PAUSE state contacts (M9041) close after the execution of the END(FEND) instruction of the scan during which the remote PAUSE contacts close and the PAUSE permission flag (M9040) is set.
When the END(FEND) instruction of the scan after M9041 has set is executed, the A2C is set to PAUSE and its operation stops.

(b) By opening the remote PAUSE contacts or by switching off M9040 on a peripheral device, the PAUSE state is canceled, and sequence program operation resumes from step 0.

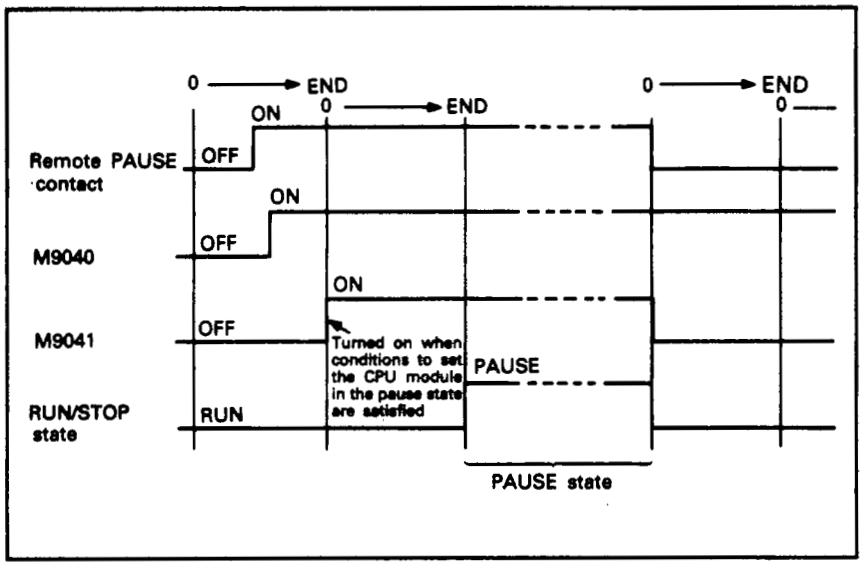


Fig. 4.15 PAUSE Timing by the Remote PAUSE Contact

(3) Peripheral device

(a) The PAUSE state contacts (M9041) close after the execution of the END (FEND) instruction of the scan during which the remote PAUSE command from a peripheral device is received.
When the END (FEND) instruction of the scan after M9041 has set is executed, the A2C is set to PAUSE and its operation stops.

(b) When the remote RUN command from a peripheral device is received, the PAUSE state is canceled, and sequence program operation resumes from step 0.

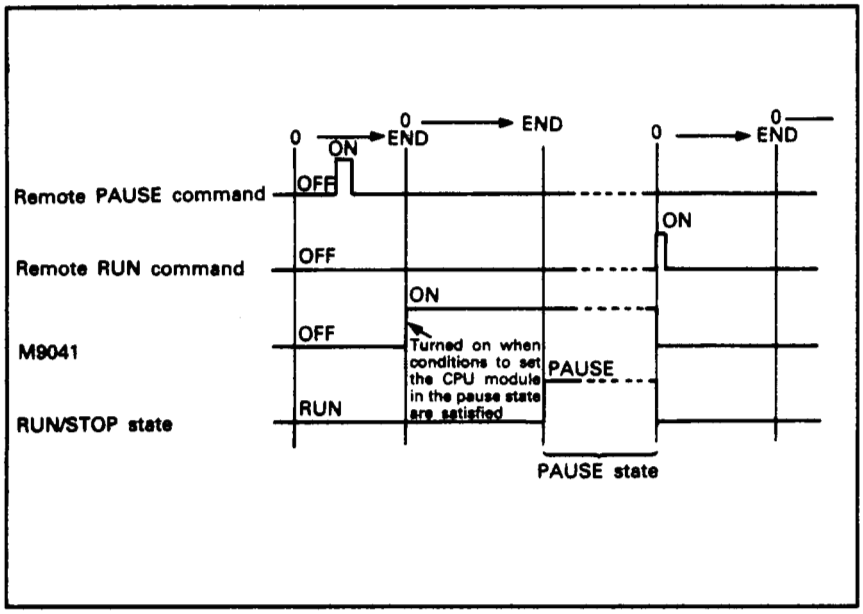
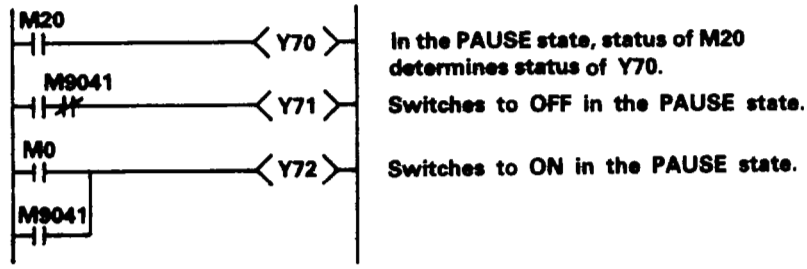


Fig. 4.16 PAUSE Timing by a Peripheral Device

POINT

To switch on or off the output (Y) in the PAUSE state, take interlock with the PAUSE state contacts (M9041).



In the PAUSE state, status of M20 determines status of Y70.

Switches to OFF in the PAUSE state.

Switches to ON in the PAUSE state.

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4.2.5 Status latch

The monitoring function of a peripheral cannot confirm the status of each device all the time. The status latch function transfers and saves the device data to the status latch area when the SLT instruction is executed in the sequence program.
The device data saved using the SLT instruction can be read by the GPP/PHP/HGP to monitor it.

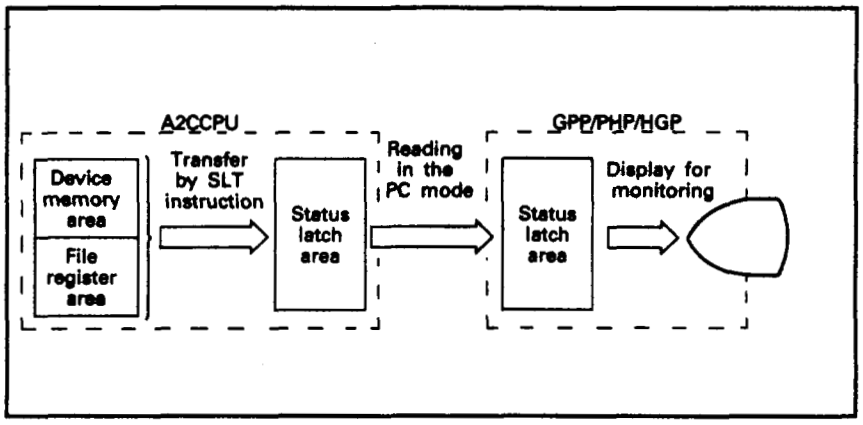


Fig. 4.17 Status Latch Sequence

(1) Application

The status latch function can be used to check the device data when a fault condition exists during debugging.
It is also used to find causes when a fault condition exists during sequence program execution by making a program that will execute the SLT instruction if such a condition exists.

(2) Processing

(a) The following data is stored in the status latch area when the SLT instruction is executed.

1) Device memory
- X, Y, M, L, S, F, B ··· ON/OFF data
- T, C ····· Contact and coil ON/OFF data and present value
- D, W, A, Z, V ····· Stored data

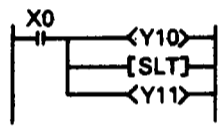
2) File register (R) ····· Stored data

(b) Data is stored to the status latch area when the SLT instruction is executed.
With devices which turn on/off or store data using the same condition, the data to be stored in the status latch area differs before and after the execution of the SLT instruction.

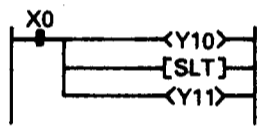
Example:

If a device which turns on and off with the same condition is present before and after the SLT instruction in a program, the ON/OFF state will differ before and after the execution of the SLT instruction.

[Circuit example]



[Monitor display of status latch data]



When the SLT instruction is executed, Y10 is ON; ON is displayed for the monitor.
When the SLT instruction is executed, Y11 is OFF; OFF is displayed for the monitor.

(3) Caution

(a) Execution of the SLT instruction causes the scan time to be increased by the value indicated below.
Therefore, take this in consideration when determining the watch dog timer setting and constant scan time setting for the A2CCPU taking these into consideration.

	Device Memory Only	Device Memory and File Register
Processing time (ms)	11 ms	31 ms

Table 4.5 SLT Instruction Execution Time

4.2.6 Sampling trace

It is not possible to check the transition of the ON/OFF state for bit devices and the data in the word devices with a peripheral device monitor function.
The sampling trace function samples data from the designated devices at fixed intervals and stores the sample data to the sampling trace area.
Upon execution of the STRA instruction, the data stored in the sampling trace area is sampled for the designated number of times and the device data is latched.
It is possible to monitor the data stored in the sampling trace area by reading it with the GPP/PHP/HGP.

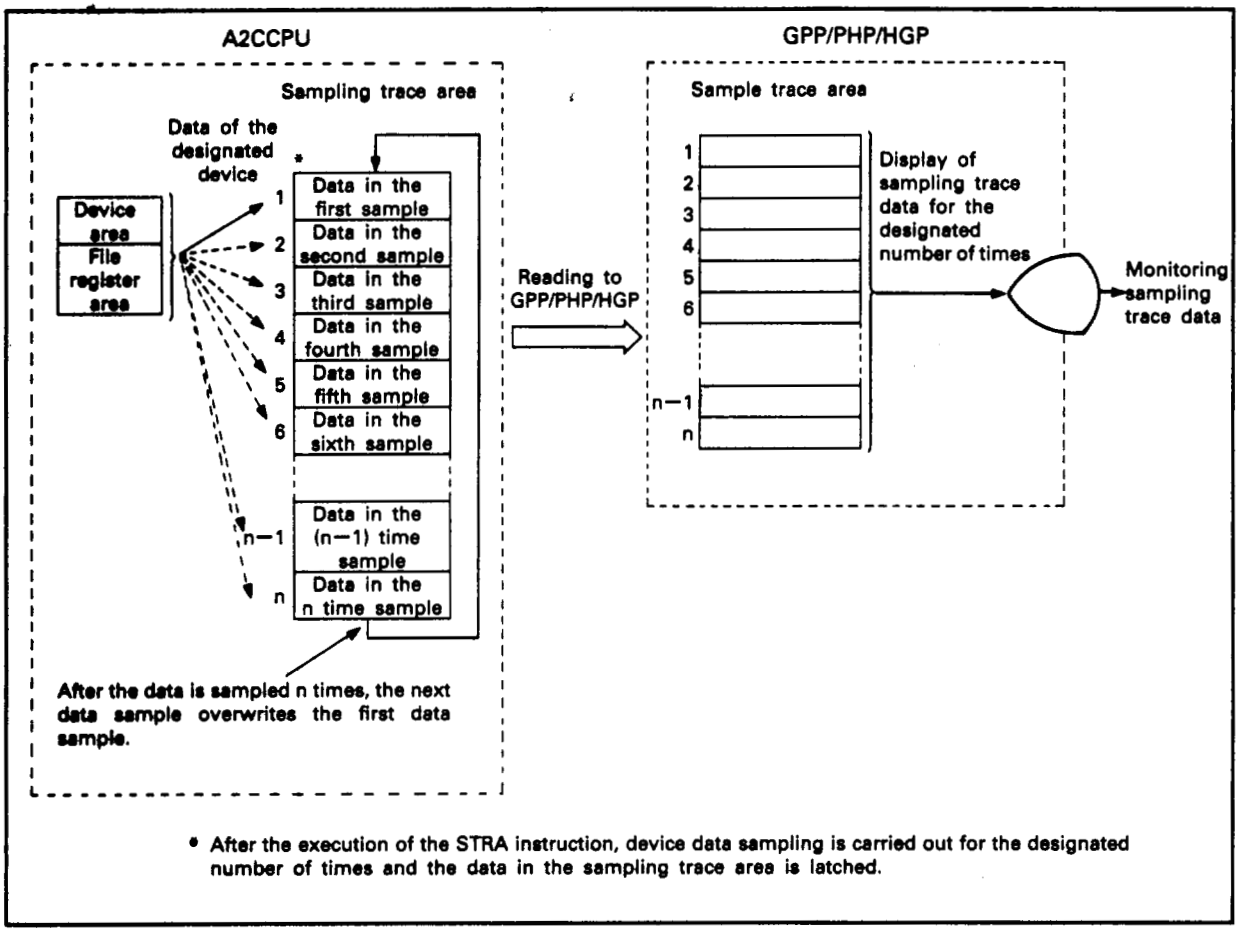


Fig. 4.18 Sampling Trace

(1) Application
By using the sampling trace function, it is possible to shorten debugging time by confirming the data of the designated devices in defined intervals during debugging.

(2) Devices which can be sampled
Devices and the number of points which can be sampled are indicated below.

(a) Bit devices
(X, Y, M, L, S, F, B, T/C coil, T/C contact)····· Max. 8 points

(b) Word devices
(T/C present value, D, W, R, A, Z, V)····· Max. 3 points

(3) Number of sampling times

The number of sampling times involves the following two cases: total number of sampling times and the number of sampling times after the execution of the STRA instruction.

(a) Total number of sampling times
This sets the area where the sampling data is stored.
Setting is possible in the range of 0 to 1024 times (in units of 128 times).

(b) Number of sampling times after the execution of the STRA instruction
This setting is used to end the sampling trace and latch the sampling trace data after the execution of the STRA instruction.
Setting is possible in the range of 0 to 1024 times (in units of 128 times.)

The number of sampling times after the execution of the STRA instruction	≦	Total number of sampling times	≦	1024 times

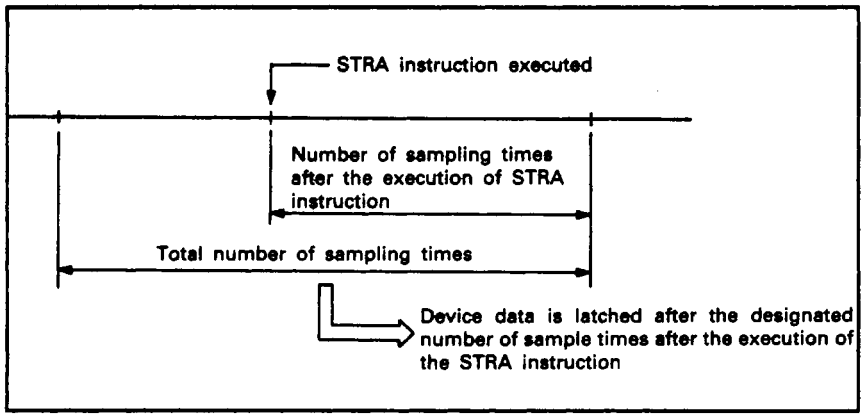


Fig. 4.19 Number of Sampling Times

(4) Sampling intervals

Sampling intervals are set in one of the following methods: after the execution of END instruction or in defined intervals.

(a) After execution of END instruction

Sampling trace data is taken each time the END instruction of the sequence program is executed.

(b) In defined intervals

Sampling trace data is taken in defined intervals, 10 X nmsec (n: 0 to 199).

(In this setting, sampling trace data is even taken during the execution of a sequence program.)

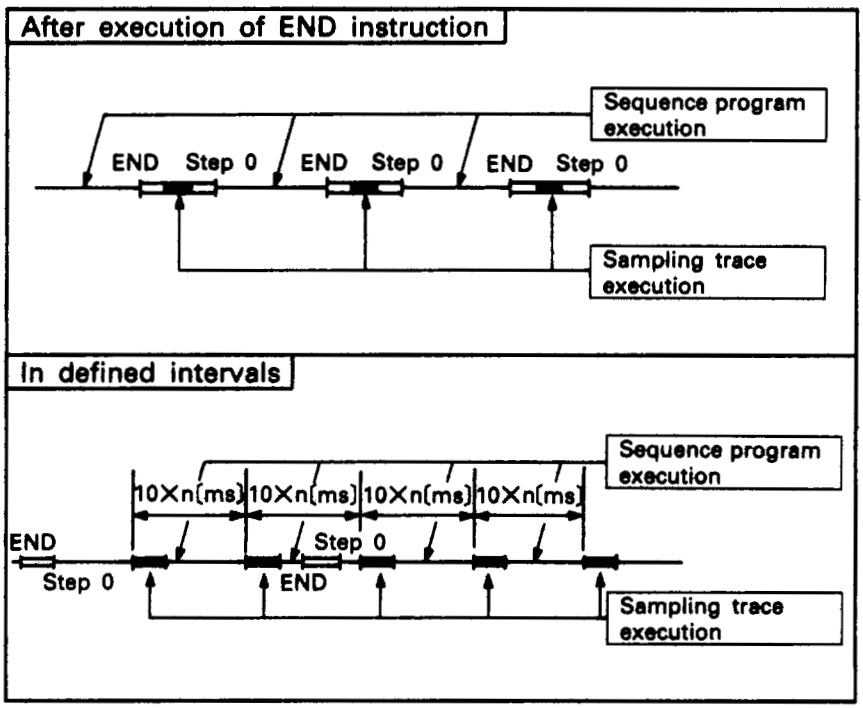
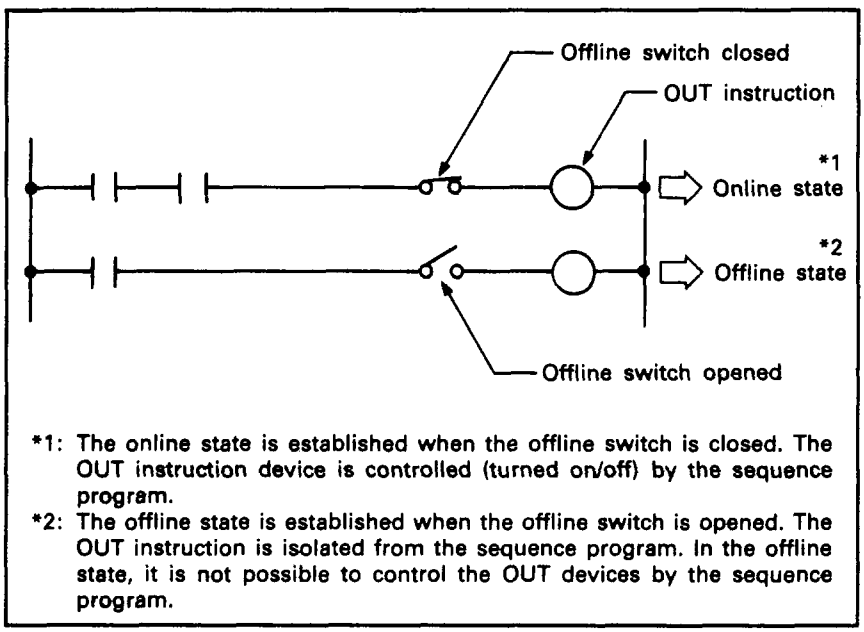


Fig. 4.20 Execution of Sampling Trace

4.2.7 Offline switch function

While the A2CCPU is running (sequence program being executed), it is possible to turn the sequence program OUT instruction devices on and off with a peripheral device test function.
The offline switch function allows these devices to be turned on and off while the A2CCPU is running with a peripheral device the test function.
It is possible to check operation of OUT instruction devices, which are not turned on/off by the sequence program, and to check the wiring between the output module and an external device with the offline switch function.



*1: The online state is established when the offline switch is closed. The OUT instruction device is controlled (turned on/off) by the sequence program.
*2: The offline state is established when the offline switch is opened. The OUT instruction is isolated from the sequence program. In the offline state, it is not possible to control the OUT devices by the sequence program.

Fig. 4.21 Offline and Online State

(1) Devices which can be used by the offline switch function
The devices which can be used by the offline switch function are indicated below:

(a) Outputs (Y)
(b) Internal relays (M)
(c) Latch relays (L)
(d) Step relays (S)
(e) Link relays (B)
(f) Annunciators (F)

(2) Status of devices in the offline state
The device status in the offline state (offline switch opened) is described below.

(a) The ON/OFF state that exists before just before the offline state is established is retained.

(b) When a forced set/reset is conducted using a peripheral in the offline state, the reset/set state after the forced set/reset is retained.

(3) Operation procedure

(a) To set the A2CCPU in the offline state, set the offline switch with a peripheral device.

(b) To return the A2CCPU back from the offline state to the online state, use either of the following two methods.

1) Reset the offline switch setting with a peripheral device.
2) Reset the A2CCPU with the RUN key-switch.

POINT

(1) Devices set in the offline state cannot be turned ON/OFF with a sequence program.
The devices set in the offline state during testing, must be returned to the online state by resetting the offline switch after the completion of test operation.

(2) The devices returned from the offline state to the online state can be turned ON/OFF with a peripheral device.
Before returning these devices to the online state, check the input conditions of an OUT instruction. Return to the online state after making sure that no problems will arise when the devices are returned to the online state.

4.2.8 Setting priority for ERROR LED indication

Priority of A2C ERROR LED lighting is indicated in Table 4.6.

Priority	Error Contents	Error item number	ERR LED
High ↑	Error which causes the A2CCPU to stop unconditionally.	—	Lit
	I/O module verify error Fuse blown error	1	
	Special module error Link parameter error Operation error	2	
	CHK instruction execution	3	
	Annunciator (F) turning ON	4	Flashes
↓ Low	Battery error	6	Lit

Table 4.6 Error Indication Priority

(1) Changing priority

(a) ERROR LED lighting priority can be changed from the default setting for the error which permit sequence program operation to be continued after an occurrence of an error.
Note that the priority level of the error which causes A2CCPU to stop operation unconditionally cannot be changed.

(b) Error indication priority can be changed by changing the required priority order in D9038 and D9039 (LED indication priority order storing registers).
Priority in D9038 and D9039 and the error setting items are illustrated in Fig. 4.22.

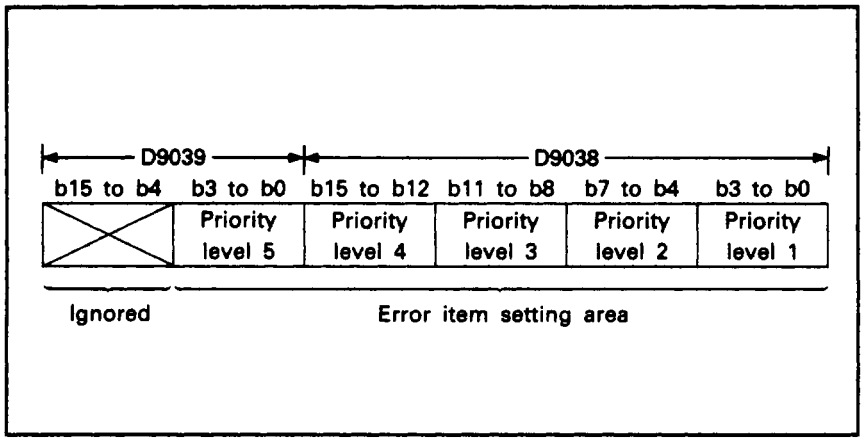


Fig. 4.22 Error Priority in D9038 and D9039 and Error Setting Items

(c) The ERROR LED is not lit if an error, for which error indication priority order has not been set, occurs. If all bits are "0" in D9038 and D9039, for example, the ERROR LED will not be lit when any error of error item numbers 1 to 6 occurs.
In this case, however, the M9088 (CPU error flag) is set and the corresponding error code is stored in D9009 (CPU error register).

(2) Relationship between priority order and annunciator resetting

(a) If an annunciator (F□) is turned ON, the number of that annunciator is stored in D9009 and D9125 to D9132.
Once the annunciator number is set in the registers, the number cannot be reset using the RST F□ or LEDR instruction if an error for which higher error indication priority is set than the annunciator ON.
To reset the set annunciator number at an occurrence of another error, set a priority for the annunciator error item number 1.

POINT

The priority order active when the power is turned ON or the CPU is reset becomes effective. Changing the priority simply in the registers is ignored unless the CPU is reset or the power is turned off once and then back on again.

4.2.9 Control functions of remote I/O modules and remote terminal modules

The following functions and settings are provided for the A2C to control remote I/O modules and remote terminal modules.
To use only remote I/O modules, set the total number of stations and the mode.
When remote terminal modules are used in combination with remote I/O modules, execute setting for remote terminal modules in addition to the total number of stations and the mode.
For these settings, use either of the following methods:

(a) Set with special registers by a sequence program when system FD prior to SW3GP-GPAA is used.

(b) Use parameter remote terminal setting when SW4GP-GPPA system FD is used.

Setting Item		Default	Setting Range	Special Register Number
Total number of stations		64	1 to 64	D9036
Mode		Automatic online return provided	0: Automatic online return provided 1: Automatic online return not provided 2: Transmission stop at an occurrence of online error	D9173
Remote terminal setting	Station number	None	1 to 61	D9021 to D9034
	Attribute	Mitsubishi standard protocol	0: Mitsubishi standard protocol 1: No-protocol	D9035

POINT

If any one of the settings is outside the allowable setting range, it causes the MINI-S3 line error and following processing occurs:

- **All the settings are reset to defaults to execute the control.**
- **The M9061 (communication error flag) is set and "1" is stored in D9061 (communication error cause storing register).**

Settings for remote terminals using parameters

For the procedure of initial setting of the A2C using parameters provided by the GPP/PHP, refer to the A6GPP/A6PHP (SW4GP-GPPAEE) Operating Manual.

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Initial Setting Using Sequence Program

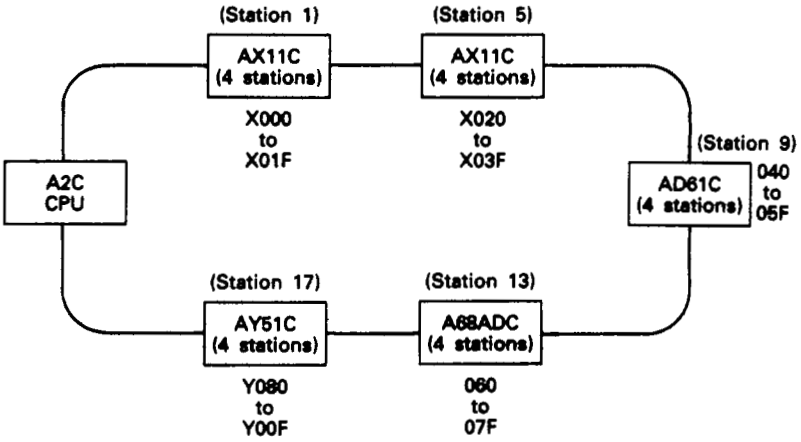
The following gives an example of programming for executing A2C initial setting with a sequence program.

(a) Start programming from step 0.
(b) Begin with designation of "LD M9038" instruction.
(c) The program should end at a step where a device other than D9021 to D9036 and D9173 is used.
(d) Use an MOV instruction to store data to D9021 to D9036 and D9173.

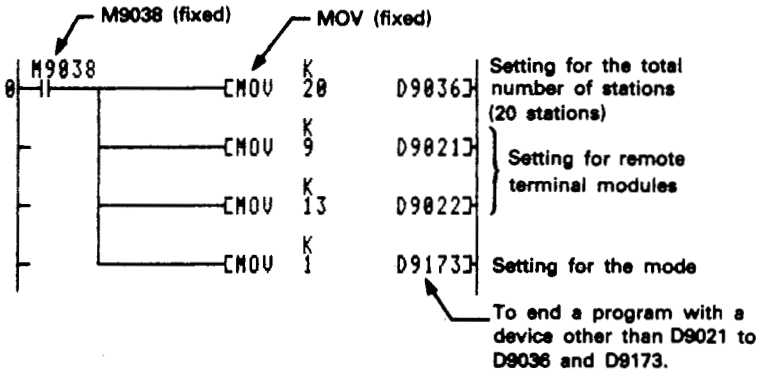
A program which does not follow the rules stated above is not regarded as an initial setting program.

Example

An example initial setting program for the following network is indicated below.



[Initial Setting Program]



(1) Total number of stations

(a) The total number of stations is set to determine the range for I/O refresh.
Set the last station number of remote I/O modules or remote terminal modules connected to the A2C.
If the last station (remote I/O module or remote terminal module) occupies two or more stations, this number of stations must be taken into account. If the setting is required for station number "10" remote I/O module which occupies 4 stations, for example, the setting for the total number of stations is "13".

(b) I/O refresh is executed for up to the remote module assigned with the station number which is set as the total number of stations.
If the setting for the total number of stations is "20", for example, I/O refresh is executed for remote I/O modules and remote terminal modules whose station number is in the range of 1 to 20. With this setting, remote I/O modules and remote terminal modules having a station number larger than 20 is not refreshed.

(c) If the setting for the total number of stations is "0", or "65" or greater, the setting is replaced with a default.

(d) Setting of a number which is larger than the number of stations actually connected to the A2C, a communication error occurs with the stations that are not actually connected.

(2) Mode
The mode setting is used for data communications between the A2C and a remote I/O module or remote terminal module. The set mode becomes effective when the A2C is turned on, it is reset, or its operation status changes from STOP/PAUSE to RUN.

(a) Automatic online return provided
If a communication error occurs with any of the modules in the link, data communication is executed only with modules operating correctly.
Data communication with the faulty station will restart automatically when it recovers normal operating state.

(b) Automatic online return not provided
If a communication error occurs with any of the modules in the link, data communication is executed only with modules operating correctly.
Once a module is disconnected from the link, it cannot restart data communications when it recovers normal operating state.
To restart data communication with a module, disconnected from the link, turn off the power to A2C and then turn it back on again or reset it with the RUN key switch.

(c) Transmission stop at an occurrence of online error

1) If data communication error occurs with any one of the stations in the link, data communication stops over entire link.
To restart data communication in the link, turn off the power to A2C and then turn it back on again or reset it with the RUN key switch.

2) The setting for the total number of stations should be the last station number of remote I/O modules and remote terminal modules connected to the A2C.
If a number is greater than the last station number, such a station is regarded as the faulty station precluding data communication.

(3) Remote terminal
The remote terminal setting is necessary to use remote terminals modules (up to 14 modules); the setting includes the station number and attribute.

(a) Station number
The head station number (station number set with the station number setting switch) of the remote terminal modules to be used should be set for the station number.

(b) Attribute
Set attribute for each remote terminal module.

1) Mitsubishi standard protocol (MINI protocol)
Setting for remote terminal modules other than RS-232C interface module should be the Mitsubishi standard protocol.

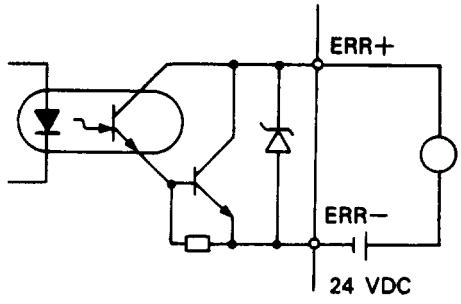
2) No-protocol
Setting for an RS-232C interface module (AJ35PTF) should be the no-protocol.

4.2.10 Output from the ERR terminals

The ERR terminals are used to output the signals of MINI-S3 link line errors and self-diagnosis errors (at operation stop) mentioned below. Output of these signals is enabled even when the A2C has stopped operation with the sequence program. (When the ERR terminals are turned ON, M9090 is also turned ON.)
Output of error signals other than those mentioned below is also enabled from the ERR terminals by turning ON M9089 by use of the sequence program.

Errors		ERR terminals	Error LED	RUNLED	M9090
MINI-S3 link line errors	Initial setting circuit error	OFF	On	On	OFF
	• Communication error due to line breakage • Station error in the stop at faulty station detection mode • Send under error • Receive overrun error	ON			ON
self-diagnosis error (Operation stop)	INSTRUCT CODE ERROR PARAMETER ERROR MISSING END INS. CAN'T EXECUTE (P) CHK FORMAT ERROR RAM ERROR OPE. CIRCUIT ERROR WDT ERROR END NOT EXECUTE UNIT VERIFY ERROR (Stop) FUSE BRERN OFF (Stop) SP. UNIT ERROR (Stop) ROM ERROR	ON	On	Flicker	ON

Specification and external connection of the ERR terminals

Item	Specification
Insulation method	Photocoupler insulation
Rated load voltage	24 VAC
Operating load voltage range	10.2 to 31.2 VDC
Maximum load current	50 mA
Leak current at OFF	0.1 mA
Maximum voltage drop at ON	1.5 V (50 mA)
External connection	

4.3 Fault Detection

4.3.1 Self-diagnosis

The self-diagnosis function checks occurrence of errors and faults by the A2C itself.
The A2C self-diagnosis function includes the following:

(a) CPU error

(b) MINI link line error

(c) Remote terminal error

(1) CPU error
CPU error includes faulty A2C, battery error, and operation check error.
If a CPU error is detected, the CPU error flag (M9008) is set and the corresponding error code (see Table 4.7.) is set in the CPU error register (D9008).

(a) Operation at a detection of CPU error
If a CPU error is detected, sequence program operation is processed in the following manner.

1) Stop····· Sequence program operation stops if an error is detected.
At this time, the outputs (Y) of the remote I/O module and remote terminal module are as indicated below.

Remote I/O Module	EC Mode	ON/OFF Status of Output (Y)
A2C I/O module	—	OFF
Remote I/O module for MINIS-3 link	OFF	Output ON/OFF state is retained
	ON	OFF
Remote terminal module	—	OFF

2) Continue ····· Sequence program operation continues if an error is detected.
If an operation error is detected while a sequence program is executed, an instruction causing the error is skipped to continuously execute the program.

Diagnosis Contents		Error Code (D9008)	Diagnosing Timing	A2C Status	RUN LED Status	ERROR LED Status
CPU error	Instruction code check	10	• At an execution of each individual instruction	Stop	Flickers	Lit
	Parameter setting check	11	• When power is turned ON or A2C is reset. • When A2C status is changed from STOP/PAUSE to RUN.			
	No END instruction	12	• When A2C status is changed from STOP/PAUSE to RUN.			
	Instruction not executable	13	• When following instructions are executed: CJ, SCJ, JMP, CALL(P), FOR~NEXT • When A2C status is changed from STOP/PAUSE to RUN.			
	RAM check	20	• When power is turned ON or A2C is reset.			
	Operation circuit check	21	• When power is turned ON or A2C is reset.			
	Watchdog timer error	22	• At an execution of END instruction			
	END instruction not executed	24	• At an execution of END instruction			
	Infinite loop execution	25	• Always			—
Battery	Low battery voltage *1	70	• Always	Run	Lit	Lit
Operation check error *2		50	• At an execution of each individual instruction	Stop / Run	Flickers / lit	

Table 4.7 Self-diagnosis List

REMARK

1. If two status is given in the "A2C Status" and "RUN LED Status" columns, status setting can be selected by the setting on a peripheral device.

2. *1 ····· Low battery voltage state can be detected by reading the set/reset state of the low battery flag (M9006) or low battery latch flag (M9007). (For the low battery flag and low battery latch flag, see Appendix 2.)

3. *2 ····· The operation check error can be detected by reading the set/reset status of the operation error flag (M9010, M9011). By reading the error step registers (D9010, D9011), the number of the step causing the operation error can be confirmed. (For the operation error flag, see Appendix 2 and for the error step register, see Appendix 3.)

(2) MINI-S3 link line error

MINI-S3 link error indicates a communication error caused by breakage of the cable connecting a remote module to the A2C or by turning off the power to a remote module.
If a MINI-S3 link line error occurs, the M9061 (communication error flag) is set and the error cause number is stored in the D9061 (communication error cause storing register).

Error Cause Number	Error Contents		Action To Take
1	Initial setting error	• The initial setting data is outside the allowable setting range. In this case, communication is controlled by the default settings.	• Correct the initial settings. • Follow any of the operations indicated below to execute communications according to the corrected initial setting data. • Turn OFF the power to the A2C and turn it back ON. • Reset the A2C. • Change the operation mode from STOP to RUN.
2	Disconnected line	• Broken cable	• Change the cable connected to the data receive terminal of the remote module for which the RUN LED is not lit.
		• Loose cable connection	• Check the cable connection at the data receive terminal of the remote module for which the RUN LED is not lit. • Check the cable connection at the data send terminal of the remote station preceding the station for which RUN LED is not lit.
		• Power supply to the remote module turned OFF	• Turn ON the power supply for the remote module for which the power is OFF.
3	Faulty remote module (Set mode: transmission stop at an occurrence of online error)	• There is a remote module with which communication is stopped due to a fault.	• Read D9196 to D9199 (faulty station storing registers) to find a faulty station; remove the cause of fault.
		• The set number of stations is greater than the number of stations actually connected to the A2C.	• Change the total number of stations set as the initial setting.
4	Transmission underrun error	• During data transmission, data being transmitted is discontinued halfway.	• Execute communication again using any of the following operations: • Turn OFF the power to the A2C and turn it back ON. • Reset the A2C. • Change the operation mode from STOP to RUN. • If the same error reoccurs, replace the A2C.
5	Receive overrun error	• Before the processing of received data is completed, the next data is received.	

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(a) Initial setting error

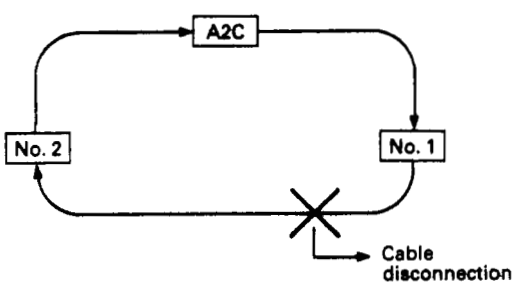
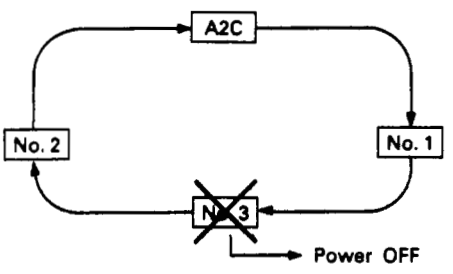
1) If an initial setting error occurs, the settings are reset to the defaults (see below) to execute communications with a remote I/O module.

Item	Default
Total number of stations	64 stations
Number of remote terminal stations	0
Mode	Automatic online return supported

2) After correcting the initial setting data, reset the A2C using the RUN key switch or change the operation status from STOP to RUN. Communications are executed with the remote I/O modules and remote terminal modules according to the newly set initial setting data.

(b) Processing at an occurrence of disconnected line error

1) When a disconnected line error occurs, outputs are determined according to the communication mode and the setting for processing at an occurrence of communication error.
The output state varies between the stations preceding and succeeding the cable disconnection point or power OFF remote station.

Line Error due to Cable Disconnection	Line Error due to Remote Station Power OFF
	

Item		Output Processing at an Occurrence of Communication Error	
Communication mode (M9069)		Output OFF (M9069: OFF)	Output by sequence program (M9069: ON)
Automatic online return provided	No. 1	OFF	Results of sequence program operation are output
	No. 2	• A2C I/O module: OFF • Remote I/O module for MINI-S3: Depends on EC mode	
Automatic online return not provided	No. 1	• A2C I/O module: OFF • Remote I/O module for MINI-S3: Depends on EC mode	
	No. 2		
Communication stop	No. 1	• A2C I/O module: OFF • Remote I/O module for MINI-S3: Depends on EC mode	
	No. 2		

(c) Processing at detection of faulty remote module

1) If communication is stopped due to faulty remote module, outputs of the modules are as follows:
   a) A2C I/O module: OFF
   b) Remote I/O module for MINI-S3: Depends on EC mode

2) The output state as obtained by running the sequence program is restored by removing the error cause in the faulty station and by resetting the A2C with the RUN key switch or changing the operation status of the A2C from STOP to RUN.

(d) Processing at an occurrence of transmission underrun error

1) If the transmission underrun error occurs, data communication stops. In this case, outputs of the module are as indicated below.
   a) A2C I/O module: OFF
   b) Remote I/O module for MINI-S3: Depends on EC mode

2) Communications start when the following operation is carried out.
   a) Turn OFF the power to the A2C and turn it back ON.
   b) Reset the A2C.
   c) Change the operation mode from STOP to RUN.

(e) Processing at an occurrence of receive underrun error

1) If receive underrun error occurs, the same processing as executed at an occurrence of disconnected line error is executed.

2) Communications start when the following operation is carried out.
   a) Turn OFF the power to the A2C and turn it back ON.
   b) Reset the A2C.
   c) Change the operation mode from STOP to RUN.

(3) Remote terminal error

The remote terminal error indicates an error in which communications between the A2C and a remote terminal connected to the A2C cannot be executed correctly. If the remote terminal error, with an exception of the initial setting error, occurs, the M9060 is set and the error code is stored in D9180 to D9193.
Remove the cause of the error for the faulty terminal module.

4.3.2 Fault detection with annunciator (F)

An annunciator (F) is used to in a user's fault detection program. If the annunciator is turned ON, associated control differs from the control executed when an internal relay (M) or latch relay (L) is turned ON.

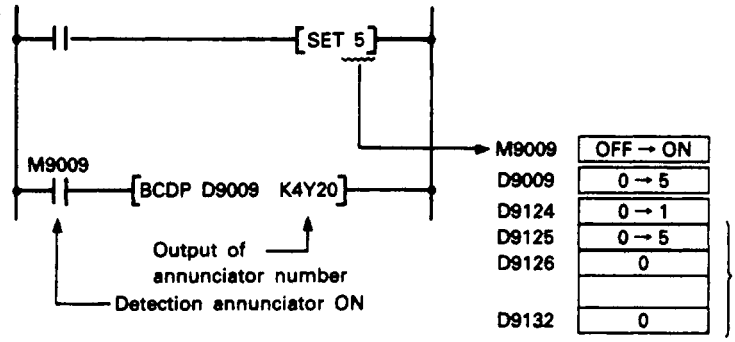
(a) If the annunciator is turned ON by the sequence program, the special relay (M9009) is turned ON with the number of annunciator which is turned ON stored in the special register (D9009).

(b) Registers D9124 to D9132 store the number of annunciators which have been turned ON and those annunciator numbers.
The annunciator number stored in D9125 and that in D9009 are the same number.
By monitoring M9009 and D9009 with an annunciator used in a fault detection program, it is possible to check whether or not an error has occurred and contents of the error.

Example

In the sequence program shown below, M9009 is turned ON when F5 is turned ON and "5" is stored in D9009.

[Fault detection program]



M9009	OFF → ON	(Annunciator ON detection)
D9009	0 → 5	(Number of annunciator turned ON)
D9124	0 → 1	(Number of annunciators turned ON)
D9125	0 → 5	
D9126	0	(Annunciator numbers are stored in order that annunciators are turned ON. (up to 8))
D9132	0	

(1) Turning ON an annunciator

An OUT instruction (OUT F[ ]) or SET instruction (SET F[ ]) is used to turn ON an annunciator.

(a) An annunciator can be turned ON/OFF by turning ON/OFF the input conditions when an OUT instruction is used. The OUT instruction is executed each scan.
Contents in M9009, D9009, and D9124 to D9132 do not change if the annunciator is turned OFF using an OUT instruction.

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(b) A SET instruction is executed only at the leading edge of an input condition to turn ON an annunciator.
The annunciator stays ON when the input condition is turned off.
When a number of annunciators are used, it is recommended to use an SET instruction rather than OUT instruction to reduce scan time.

(2) Turning OFF an annunciator

An RST instruction (RST F[ ]) or LEDR instruction is used to turn OFF an annunciator.

(a) To turn off (reset) the annunciator which has been turned ON, use an RST instruction (RST F[ ]).

(b) To turn off the annunciator which is stored in D9009 and D9125, use an LEDR instruction.
An example program used to turn OFF an annunciator using an LEDR instruction is shown in Fig. 4.23.

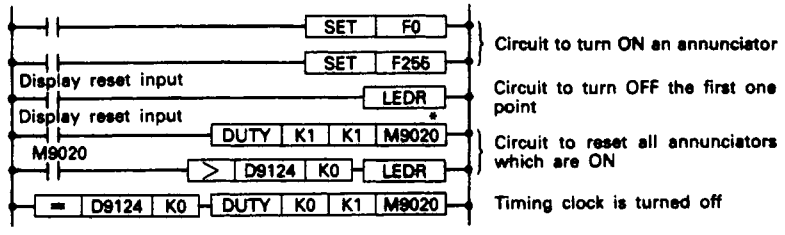


Fig. 4.23 Program To Turn OFF Annunciator

POINT

When an annunciator (F) is turned ON using an instruction other than OUT and SET instructions, the annunciator has the same function as an internal relay.
(In this case, M9009 is not set; annunciator number is not stored in D9009, D9124 to D9132, either.)

REMARK

Setting is possible whether the ERR LED should be lit or blink when an annunciator is turned ON. For details, see Section 4.2.8.

4.4 Parameter Setting Range

Parameters are used to allocate user memory area or the use range of the functions.
The parameter data is stored in the first 3K bytes in the user memory area.

(1) Default values

Each parameter has default value as indicated in Table 4.8. It is not necessary to change parameter data; programs can be run with default settings.

(2) Changing parameter setting

Parameter settings can be changed in the range as indicated in Table 4.8 to meet specific operation needs. A peripheral device should be used to change the setting.
See the Operation Manual for the peripheral device to be used for the procedure to set the parameter data.

REMARK

1. Conversion of main sequence program capacity, file register capacity and comment capacity from "steps" and "points" to "bytes" is described below.

Item	Setting Units	Number of Bytes
Main sequence program capacity	1K steps	2K bytes
File register capacity	1K points	2K bytes
Comment capacity	64 points	1K bytes

2. When comment capacity is set with a peripheral device, 1K byte area is automatically taken in addition to the setting; the comment capacity displayed is, therefore, 1K bytes larger than the set value.

Item \ Setting Contents		Default Value	Setting Range	Peripheral Devices				Refer to
				PU	GPP	HGP	PHP	
Main sequence program capacity		6K steps	1 to 8K steps (1K step increments)	○	○	○	○	4.4.1
File register capacity		None	1 to 4K points (1K point increments)	○	○	○	○	
Comment capacity		None	0 to 4032 points *1 (64 point increments)	—	○	○	○	
Status latch	Memory capacity	None	0/8 to 12K bytes	—	○	○	○	
	Data memory		No/Yes					
	File register		No/Yes (2 to 8K bytes)					
Sampling trace	Memory capacity	None	0/8K bytes	—	○	○	○	
	Device setting		Device number					
	Execution conditions		Each scan					
			Set time intervals					
	Number of samplings		0 to 1024 times (128 time increments)					

Table 4.8 Parameter Setting Range

Item \ Setting Contents		Default Value	Setting Range	Peripheral Devices PU	GPP	HGP	PHP	Refer to
Remote terminal setting	Total number of slave stations	64	1 to 64	—	*2 ○	—	*2 ○	—
	Protocol	MINI standard	MINI standard/no-protocol					
	First station number	0	1 to 61					
	Mode setting	0	0: Automatic online return provided 1: Automatic online return not provided 2: Transmission stop at an occurrence of online error					
Latch range setting	Link relay (B)	L1000 to L2047	B0 to B3FF (1 point increments)	○	○	○	○	4.2.2
	Timer (T)		T0 to T255 (1 point increment)					
	Counter (C)		C0 to C255 (1 point increment)					
	Data register (D)		D0 to D1023 (1 point increment)					
	Link register (W)		W0 to W3FF (1 point increment)					
Setting for internal relay (M), latch relay (L) and step relay (S)		M0 to M999 L1000 to L2047 None for S	M/L/S0 to 2047 Must be consecutive numbers for M, L, and S	○	○	○	○	—
Watchdog timer setting		200 msec	10 msec to 2000 msec (10 msec increment)	○	○	○	○	4.1.8
Timer setting		100 msec: T0 to T199 10 msec: T200 to T255	256 points (8 points increments) for 100 msec timers, 10 msec timers, and 100 msec retentive timers. Must be consecutive numbers	○	○	○	○	4.1.4
Remote RUN/PAUSE contact setting		None	X0 to X1FF (1 point each for RUN/PAUSE setting not possible for PAUSE contact)	—	○	○	○	4.2.3 4.2.4
Operation mode at an occurrence of error	Fuse blown	Continue	Stop/continue	—	○	○	○	4.4.2
	I/O verify error	Stop						
	Operation error	Continue						
	Special function module check error	Stop						
STOP → RUN output mode		Operation state just before the STOP is output	Output of operation state before/after execution of operation	—	○	○	○	4.4.3
Print title registration		None	128 characters using all MELSAP keys	—	○	○	○	4.4.4
Entry code registration		None	Hexadecimal (0 to 9, A to F) Maximum 6 digits	○	○	○	○	4.4.5

Table 4.8 Parameter Setting Range

POINT

(1) Do not set the following with a peripheral device.
   a) Link range
   b) Interruption counter
   c) I/O number assignment

(2) *1 ····· Up to 4032 comments can be created with a peripheral device.

(3) *2 ····· Setting is possible with a system FD later SW4GP-GPPA.
   Use a sequence program when a system FD of SW3GP-GPPA or earlier version.

4.4.1 Memory capacity setting

(1) The A2C provides 32K byte user memory area.
The following data can be stored in this user memory area.

(a) Parameters
(b) Main programs
(c) File registers
(d) Comments
(e) Status latch
(f) Sampling trace

{ Sequence programs
Microcomputer programs

Allocation of user memory area sets the areas where each data should be stored.

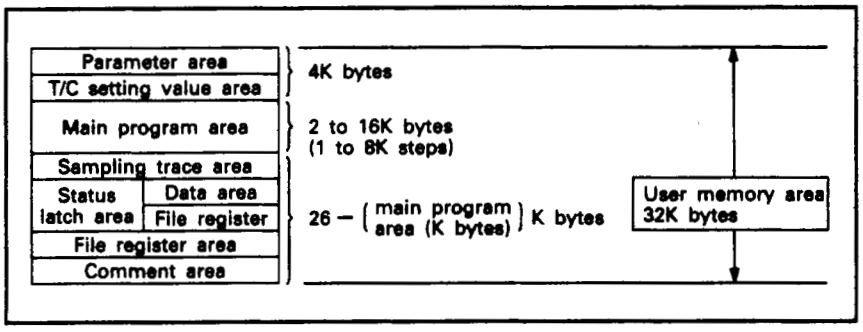


Fig. 4.24 User Memory Area Allocation

(2) The first 20K bytes in the user memory area is write protected. If the memory protect switch will be set ON for operation, file register area and status latch area must not be within the write-protect area (first 20K bytes).

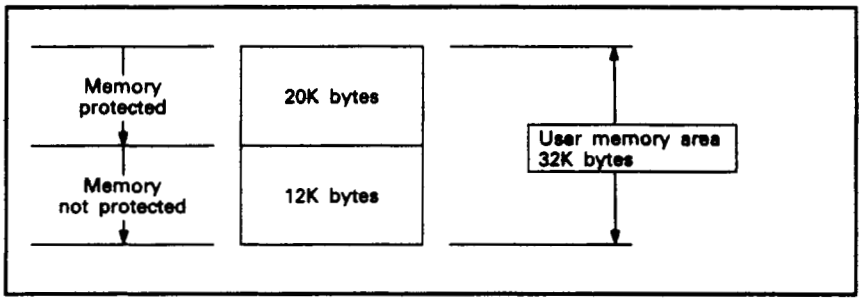


Fig. 4.25 Memory Protect Areas

POINT

(1) The maximum area that can be used for file register area, comment area, status latch area, and sampling trace area is 26K bytes (with main program area of 1K steps).

(2) The areas allocated to parameter area, T/C setting value area, and main program area cannot be used for file register area, comment area, status latch area, or sampling trace area even when the A2C runs with ROM stored programs.

(3) The microcomputer program area can store the following utility packages.

Utility Package	Usability in A2C	Remark
SW0-AD57P	×	• Not usable because no AD57/ AD58 can be connected to A2C.
SW1GP-AD57P	×	
SW0C-PID	△	• PID operation status display is not possible because no AD57 can be connected to A2C.
SW1GHP-PID	△	
SW0C-UTLP-FN0	○	• Utility programs can be stored in the microcomputer program area (maximum 14K bytes) when a sequence program occupies 1K steps.
SW0GHP-UTLPC-FN0	○	
SW0C-UTLP-FN1	○	
SW0GHP-UTLPC-FN1	○	
SW0GHP-UTLP-FD1	○	

For details of utility packages, refer to each utility package manual.

(4) The file register area is not cleared when the power is turned ON, the A2C is reset with the RUN key switch, or latch clear operation is executed.

4.4.2 Operation mode at an occurrence of error

Whether the sequence program operation is continued or stopped at an occurrence of an error is set.

	Error Contents	CPU Status								
		Default			Setting			Special Relays to be Turned ON	Data Storing Special Register	Self-diagnosis Error No. (D9008)
		Operation	"RUN" LED	"ERR" LED	Operation	"RUN" LED	"ERR" LED			
Operation error	An error in a sequence program; a value outside the range of 0 to 9999 (or 0 to 99999999) is converted into BCD data.	Continue	ON	ON/OFF	Continue /Stop	*1 ON/Flash	*2 ON/OFF	M9010 M9011	D9010 D9011	50
I/O module verify error	Status of a remote I/O station module of the MELSECNET data link system status different from the I/O module status recognized when the power was turned ON is detected. (removal/locating of a 32-point module, etc.)	Stop	Flash	ON				M9002	D9002	31
Fuse blown error	Fuse blown in a remote I/O station module of the MELSECNET data link system fuse blown is detected	Continue	ON	ON/OFF				M9000	D9000	32
Function module error	A FROM - TO instruction is executed for a station which has not been set as a remote terminal.	Stop	Flash	ON				M9010 M9011	D9010 D9011	46

Table 4.9 A2C Status at an Occurrence of Error

*1: The "RUN" LED is lit or flashes according to the setting for operation (continue or stop).
- Continue·····ON
- Stop·····Flash

*2: The "ERROR" LED is lit or not lit according to the setting for "ERROR" LED display order. For details, see Section 4.2.8.

4.4.3 STOP → RUN output mode

The status of outputs (Y) at the time the RUN key switch is set from the STOP position to the RUN position is set.

(a) Status before operation:
The output status just before the operation is output.

(b) Status after operation execution:
Sequence program is executed one scan with the output status (OFF) at the time the A2C was in the STOP state; the resulting status is output.

Example

How the output status varies according to the setting is explained using a sample circuit shown below.

	ON/OFF status of Y20	
	Status before operation	Status after operation execution
X0 is turned ON during RUN	ON	ON
RUN → STOP	OFF	OFF
X0 is turned OFF		
STOP → RUN	ON	OFF

4.4.4 Entry code registration

An entry code is used to protect programs (parameters and main programs) and comments stored in the A2C memory area from being read to or written by a peripheral device.

When an entry code is registered, reading or writing of parameters, main programs, and comments using a peripheral device is not allowed unless the entry code is keyed in to the peripheral device.

4.4.5 Print title registration

Print title is a comment such as machine name and program name which is printed with a sequence program.

The print title set by the GPP/PHP/HGP is stored in the A2C parameter area.

The maximum length of a print title is 128 characters.

4.5 Devices

Devices indicate contacts, coils, timers, etc. used in the PC program operation.

4.5.1 Device list

Table 4.10 shows the devices and their ranges to be used with the PC.

Devices indicated with an asterisk (✳) can be set as appropriate by setting the ranges with parameters using a peripheral device.

For details of parameter setting, see Section 4.3.

Device			Application Range (Number of points)		Explanation
	X	Input	X, Y0 to 1FF (Number of X + Y = 512)		Provides PC command and data from external device, e.g. pushbutton, select switch, limit switch, digital switch.
	Y	Output			Provides program control result to external device, e.g. solenoid, magnetic switch, signal light, digital display.
	M	Special relay	M9000 to 9255 (256)		Predefined auxiliary relay for special purpose and for use in the PC.
✳		Internal relay	M0 to 999 (1000)	Number of Ms+Ls+Ss = 2048	Auxiliary relay in the PC which cannot be output directly.
✳	L	Latch relay	L1000 to 2047 (1048)		Auxiliary relay in the PC which cannot be output directly. Backed up during power failure.
✳	S	Step relay	Can be used by setting the parameter (0)		Used in the same manner as an internal relay (M), e.g. as a relay indicating the stage number of a step-by-step process operation program.
	B	Link relay	B0 to 3FF (1024)		Internal relay for data link which cannot be output. May be used as an internal relay if not set for link parameter.
	F	Annunciator	F0 to 255 (256)		Used to detect a fault. When switched on during RUN by a fault detection program, stores a corresponding number in special register D.
✳	T	100 ms timer	T0 to 199 (200)		Up timers available in 100 ms, 10 ms and 100 ms retentive types.
		10 ms timer	T200 to 255 (56)		
		100 ms retentive timer	Can be used by setting the parameter. (0)		
	C	Counter	C0 to 255 (256)		Up counters available in normal and interrupt types.
	D	Data register	D0 to 1023 (1024)		Memory for storing PC data.
		Special register	D9000 to 9255 (256)		Predefined data memory for special purpose.
	W	Link register	W0 to 3FF (1024)		Data register for use with data link.
✳	R	File register	Can be used by setting the parameter.(0)		Used for data link. In the range which is not set by link parameters, file registers can be used as data registers.

Table 4.10 Device List (Continue)

Device			Application Range (Number of points)	Explanation
	A	Accumulator	A0, A1 (2)	Data register for storing the operation results of basic and application instructions.
	Z	Index register	Z (1)	Used to modify devices (X, Y, M, L, B, F, T, C, D, W, R, K, H, P).
	V		V (1)	
	N	Nesting	N0 to 7 (8 levels)	Indicates the nesting of master controls.
	P	Pointer	P0 to 255 (256)	Indicates the destination of the branch instruction (CJ, SCJ, CALL, JMP).
	K	Decimal constant	K−32768 to 32767 (16-bit instruction)	Used to specify the timer/counter set value, pointer number, interrupt pointer number, the number of bit device digits, and basic and application instruction values.
			K−2147483648 to 2147483647 (32-bit instruction)	
	H	Hexadecimal constant	H0 to FFFF (16-bit instruction)	Used to specify the basic and application instruction values.
			H0 to FFFFFFFF (32-bit instruction)	

Table 4.10 Device List

REMARK

The step relay (S) may be used in the same manner as the internal relay (M). For instance, the step relay comes in useful when writing a program which has two functions or applications, i.e. the step relay can be used specifically in accordance with the function or application, independently of the internal relay.

4.6 INSTRUCTIONS

4.6.1 Sequence instructions

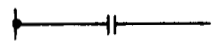
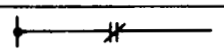
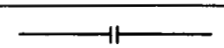
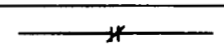
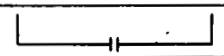
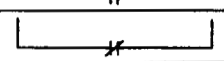
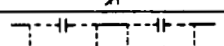
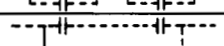
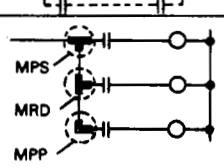
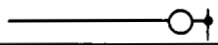
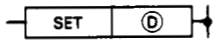
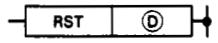
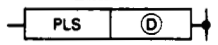
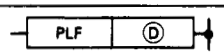
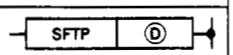
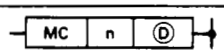
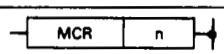
Classification	Instruction Symbol	Symbol	Contents of Processing
Contact instructions	LD		Logical operation start (NO contact operation start)
	LDI		Logical NOT operation start (NC contact operation start)
	AND		Logical product (NO contact series connection)
	ANI		Logical product NOT (NC contact series connection)
	OR		Logical add (NO contact parallel connection)
	ORI		Logical add NOT (NC contact parallel connection)
Connection instructions	ANB		ANDs logical blocks. (Series connection of blocks)
	ORB		ORs logical blocks. (Parallel connection of blocks)
	MPS		Stores the operation result.
	MRD		Reads the operation result from MPS.
	MPP		Reads the operation result from MPS and clears the result.
OUT instructions	OUT		Device output
	SET		Device set
	RST		Device reset
	PLS		Generates one-program cycle pulses on the leading edge of input signal.
	PLF		Generates one-program cycle pulses on the trailing edge of input signal.
Shift instructions	SFT		Shifts device 1 bit
	SFTP		
Master control instructions	MC		Master control start
	MCR		Master control reset

Table 4.11 Sequence Instructions (Continue)

Classification		Instruction Symbol	Symbol	Contents of Processing
Program branch instructions	Jump	CJ	CJ P✱✱	Jumps to P✱✱ after the input condition is enabled.
		SCJ	SCJ P✱✱	Jumps to P✱✱ beginning with the next scan after the input condition is enabled.
		JMP	JMP P✱✱	Unconditionally jumps to P✱✱.
	Subroutine call	CALL	CALL P✱✱	Executes the subroutine program at P✱✱ after the input condition is enabled.
		CALLP	CALLP P✱✱	
		RET	RET	Returns execution from the subroutine program to the sequence program.
	Micro-computer program call	SUB	SUB n	Executes the microcomputer program specified by n.
		SUBP	SUBP n	
FOR to NEXT	Repetition	FOR	FOR n	Executes the program area between FOR and NEXT "n" times.
		NEXT	NEXT	
Refresh instructions	Link refresh	COM	COM	Executes link refresh, general data processing.
	Link refresh enable, disable	EI	EI	Enables link refresh. Valid when M9053 is on.
		DI	DI	Disables link refresh. Valid when M9053 is on.
Termination instructions	Program end	FEND	FEND	Always used at the end of the main routine program to terminate processing.
		END	—	Always used at the end of the sequence program to return to step 0.
Other instructions	Stop	STOP	STOP	Resets output after the input condition is enabled, and stops the sequence program. The sequence program is resumed by setting the RUN key switch to RUN.
	No operation	NOP	—	No operation For program erasure or space

Table 4.11 Sequence Instructions

4.6.2 Basic instructions

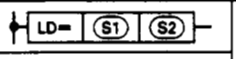
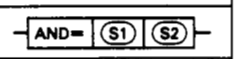
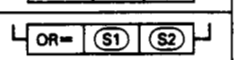
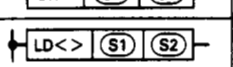
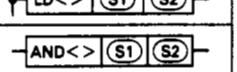
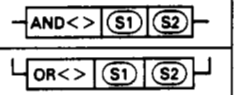
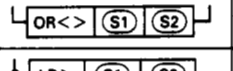
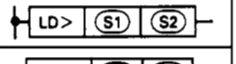
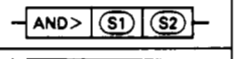
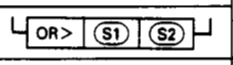
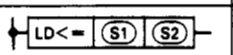
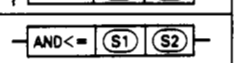
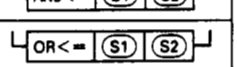
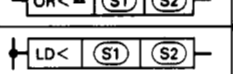
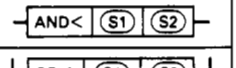
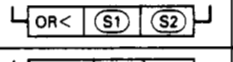
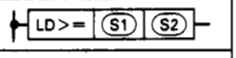
Classification		Instruction Symbol	Symbol	Contents of Processing
Comparison instructions	16-bit data comparison	LD=		Continuity when (S1)=(S2) Non-continuity when (S1)≠(S2)
		AND=		
		OR=		
		LD<>		Continuity when (S1)≠(S2) Non-continuity when (S1)=(S2)
		AND<>		
		OR<>		
		LD>		Continuity when (S1)>(S2) Non-continuity when (S1)≦(S2)
		AND>		
		OR>		
		LD<=		Continuity when (S1)≦(S2) Non-continuity when (S1)>(S2)
		AND<=		
		OR<=		
		LD<		Continuity when (S1)<(S2) Non-continuity when (S1)≧(S2)
		AND<		
		OR<		
		LD>=		Continuity when (S1)≧(S2) Non-continuity when (S1)<(S2)
		AND>=		
		OR>=		

Table 4.12 Basic Instructions (Continue)

Classification		Instruction Symbol	Symbol	Contents of Processing
Comparison instructions	32-bit data comparison	LDD=	LDD= (S1) (S2)	Continuity when (S1+1, S1)=(S2+1, S2) Non-continuity when (S1+1, S1)≠(S2+1, S2)
		ANDD=	ANDD= (S1) (S2)	
		ORD=	ORD= (S1) (S2)	
		LDD<>	LDD<> (S1) (S2)	Continuity when (S1+1, S1)≠(S2+1, S2) Non-continuity when (S1+1, S1)=(S2+1, S2)
		ANDD<>	ANDD<> (S1) (S2)	
		ORD<>	ORD<> (S1) (S2)	
		LDD>	LDD> (S1) (S2)	Continuity when (S1+1, S1)>(S2+1, S2) Non-continuity when (S1+1, S1)≤(S2+1, S2)
		ANDD>	ANDD> (S1) (S2)	
		ORD>	ORD> (S1) (S2)	
		LDD<=	LDD<= (S1) (S2)	Continuity when (S1+1, S1)≤(S2+1, S2) Non-continuity when (S1+1, S1)>(S2+1, S2)
		ANDD<=	ANDD<= (S1) (S2)	
		ORD<=	ORD<= (S1) (S2)	
		LDD<	LDD< (S1) (S2)	Continuity when (S1+1, S1)< (S2+1, S2) Non-continuity when (S1+1, S1)≥(S2+1, S2)
		ANDD<	ANDD< (S1) (S2)	
		ORD<	ORD< (S1) (S2)	
		LDD>=	LDD>= (S1) (S2)	Continuity when (S1+1, S1)≥ (S2+1, S2) Non-continuity when (S1+1, S1)<(S2+1, S2)
		ANDD>=	ANDD>= (S1) (S2)	
		ORD>=	ORD>= (S1) (S2)	

Table 4.12 Basic Instructions (Continue)

Classification		Instruction Symbol	Symbol	Contents of Processing
Arthmetic operation instructions	BIN 16-bit addition/ subtraction	+	+ Ⓢ Ⓓ	(D) + (S) → (D)
		+P	+P Ⓢ Ⓓ	
		+	+ (S1) (S2) Ⓓ	(S1) + (S2) → (D)
		+P	+P (S1) (S2) Ⓓ	
		−	− Ⓢ Ⓓ	(D) − (S) → (D)
		−P	−P Ⓢ Ⓓ	
		−	− (S1) (S2) Ⓓ	(S1) − (S2) → (D)
		−P	−P (S1) (S2) Ⓓ	
	BIN 16-bit addition/ subtraction	D+	D+ Ⓢ Ⓓ	(D + 1, D) + (S + 1, S) → (D + 1, D)
		D+P	D+P Ⓢ Ⓓ	
		D+	D+ (S1) (S2) Ⓓ	(S1 + 1, S1) + (S2 + 1, S2) → (D + 1, D)
		D+P	D+P (S1) (S2) Ⓓ	
		D−	D− Ⓢ Ⓓ	(D + 1, D) − (S + 1, S) → (D + 1, D)
		D−P	D−P Ⓢ Ⓓ	
		D−	D− (S1) (S2) Ⓓ	(S1 + 1, S1) − (S2 + 1, S2) → (D + 1, D)
		D−P	D−P (S1) (S2) Ⓓ	
	BIN 16-bit addition/ subtraction	✳	✳ (S1) (S2) Ⓓ	(S1) × (S2) → (D + 1, D)
		✳P	✳P (S1) (S2) Ⓓ	
		/	/ (S1) (S2) Ⓓ	(S1) ÷ (S2) → Quotient (D), Remainder (D + 1)
		/P	/P (S1) (S2) Ⓓ	
	BIN 32-bit addition/ subtraction	D✳	D✳ (S1) (S2) Ⓓ	(S1 + 1, S1) × (S2 + 1, S2) → (D + 3, D + 2, D + 1, D)
		D✳P	D✳P (S1) (S2) Ⓓ	
		D/	D/ (S1) (S2) Ⓓ	(S1 + 1, S1) ÷ (S2 + 1, S2) → Quotient (D + 1, D), Remainder (D + 3, D + 2)
		D/P	D/P (S1) (S2) Ⓓ	

Table 4.12 Basic Instructions (Continue)

Classification		Instruction Symbol	Symbol	Contents of Processing
Arithmetic operation instructions	BCD 4-digit multiplication, division	B*	B* S1 S2 D	(S1) × (S2) → (D +1, D)
		B*P	B*P S1 S2 D	
		B/	B/ S1 S2 D	(S1) ÷ (S2) → Quotient (D) Remainder (D + 1)
		B/P	B/P S1 S2 D	
	BCD 8-digit multiplication, division	DB*	DB* S1 S2 D	(S1 + 1, S1) × (S2 + 1, S2) → (D + 3, D + 2, D + 1, D)
		DB*P	DB*P S1 S2 D	
		DB/	DB/ S1 S2 D	(S1 + 1, S1) ÷ (S2 + 1, S2) → Quotient (D + 1, D), Remainder (D + 3, D + 2)
		DB/P	DB/P S1 S2 D	
	BIN data increment	INC	INC D	(D) + 1 → (D)
		INCP	INCP D	
		DINC	DINC D	(D + 1, D) + 1 → (D + 1, D)
		DINCP	DINCP D	
	BIN data decrement	DEC	DEC D	(D) − 1 → (D)
		DECP	DECP D	
		DDEC	DDEC D	(D + 1, D) − 1 → (D + 1, D)
		DDECP	DDECP D	
BCD↔BIN conversion instructions	BCD conversion	BCD	BCD S D	BCD conversion (S) → (D); BIN (0 to 9999)
		BCDP	BCDP S D	
		DBCD	DBCD S D	BCD conversion (S1 + 1, S1) → (D + 1, D); BIN (0 to 99999999)
		DBCDP	DBCDP S D	
	BIN conversion	BIN	BIN S D	BIN conversion instructions (S) → (D); BCD (0 to 9999)
		BINP	BINP S D	
		DBIN	DBIN S D	BIN conversion (S1 + 1, S1) → (D + 1, D); BCN (0 to 99999999)
		DBINP	DBINP S D	
Arithmetic operation instructions	BCD 4-digit addition and delection	B+	B+ S D	(D) + (S) → (D)
		B+P	B+P S D	
		B+	B+ S1 S2 D	(S1) + (S2) → (D)
		B+P	B+P S1 S2 D	
		B−	B− S D	(D) − (S) → (D)
		B−P	B−P S D	
		B−	B− S1 S2 D	(S1) − (S2) → (D)
		B−P	B−P S1 S2 D	

Table 4.12 Basic Instructions (Continue)

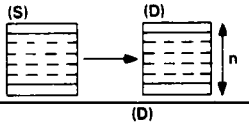
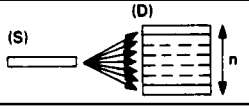
Classification		Instruction Symbol	Symbol	Contents of Processing
Arithmetic operation instructions	BCD 8-digit addition and delection	DB+	DB+ Ⓢ Ⓓ	(D + 1, D) + (S + 1, S) → (D + 1, D)
		DB+P	DB+P Ⓢ Ⓓ	
		DB+	DB+ (S1) (S2) Ⓓ	(S1 + 1, S1) + (S2 + 1, S2) → (D + 1, D)
		DB+P	DB+P (S1) (S2) Ⓓ	
		DB−	DB− Ⓢ Ⓓ	(D + 1, D) − (S + 1, S) → (D + 1, D)
		DB−P	DB−P Ⓢ Ⓓ	
		DB−	DB− (S1) (S2) Ⓓ	(S1 + 1, S1) − (S2 + 1, S2) → (D + 1, D)
		DB−P	DB−P (S1) (S2) Ⓓ	
Data transfer instructions	Transfer	MOV	MOV Ⓢ Ⓓ	(S) → (D)
		MOVP	MOVP Ⓢ Ⓓ	
		DMOV	DMOV Ⓢ Ⓓ	(S + 1, S) → (D + 1, D)
		DMOVP	DMOVP Ⓢ Ⓓ	
	Negation transfer	CML	CML Ⓢ Ⓓ	$\overline{(S)}$ → (D)
		CMLP	CMLP Ⓢ Ⓓ	
		DCML	DCML Ⓢ Ⓓ	$\overline{(S + 1, S)}$ → (D + 1, D)
		DCMLP	DCMLP Ⓢ Ⓓ	
	Block transfer	BMOV	BMOV Ⓢ Ⓓ n	
		BMOVP	BMOVP Ⓢ Ⓓ n	
		FMOV	FMOV Ⓢ Ⓓ n	
		FMOVP	FMOVP Ⓢ Ⓓ n	
	Exchange	XCH	XCH (D1) (D2)	(D1) ⟷ (D2)
		XCHP	XCHP (D1) (D2)	
		DXCH	DXCH (D1) (D2)	(D1 + 1, D1) ⟷ (D2 + 1, D2)
		DXCHP	DXCHP (D1) (D2)	

Table 4.12 Basic Instructions

4.6.3 Application instructions

Classification		Instruction Symbol	Symbol	Contents of Processing
Logical operation instructions	Logical product	WAND	WAND Ⓢ Ⓓ	(D) AND (S) → (D)
		WANDP	WANDP Ⓢ Ⓓ	
		WAND	WAND Ⓢ1 Ⓢ2 Ⓓ	(S1) AND (S2) → (D)
		WANDP	WANDP Ⓢ1 Ⓢ2 Ⓓ	
		DAND	DAND Ⓢ Ⓓ	(D + 1, D) AND (S + 1, S) → (D + 1, D)
		DANDP	DANDP Ⓢ Ⓓ	
	Logical sum	WOR	WOR Ⓢ Ⓓ	(D) OR (S) → (D)
		WORP	WORP Ⓢ Ⓓ	
		WOR	WOR Ⓢ1 Ⓢ2 Ⓓ	(S1) OR (S2) → (D)
		WORP	WORP Ⓢ1 Ⓢ2 Ⓓ	
		DOR	DOR Ⓢ Ⓓ	(D + 1, D) OR (S + 1, S) → (D + 1, D)
		DORP	DORP Ⓢ Ⓓ	
	Exclusive logical sum	WXOR	WXOR Ⓢ Ⓓ	(D) XOR (S) → (D)
		WXORP	WXORP Ⓢ Ⓓ	
		WXOR	WXOR Ⓢ1 Ⓢ2 Ⓓ	(S1) XOR (S2) → (D)
		WXORP	WXORP Ⓢ1 Ⓢ2 Ⓓ	
		DXOR	DXOR Ⓢ Ⓓ	(D + 1, D) XOR (S + 1, S) → (D + 1, D)
		DXORP	DXORP Ⓢ Ⓓ	
	NOT exclusive logical sum	WXNR	WXNR Ⓢ Ⓓ	$\overline{(D) \text{ XOR } (S)} \rightarrow (D)$
		WXNRP	WXNRP Ⓢ Ⓓ	
		WXNR	WXNR Ⓢ1 Ⓢ2 Ⓓ	$\overline{(S1) \text{ XOR } (S2)} \rightarrow (D)$
		WXNRP	WXNRP Ⓢ1 Ⓢ2 Ⓓ	
		DXNR	DXNR Ⓢ Ⓓ	$\overline{(D + 1, D) \text{ XOR } (S + 1, S)} \rightarrow (D + 1, D)$
		DXNRP	DXNRP Ⓢ Ⓓ	
	2's complement	NEG	NEG Ⓓ	$\overline{(D)} + 1 \rightarrow (D)$
		NEGP	NEGP Ⓢ Ⓓ	

Table 4.13 Application Instructions (Continue)

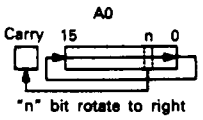
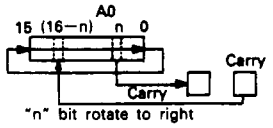
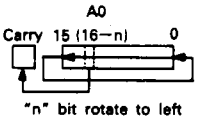
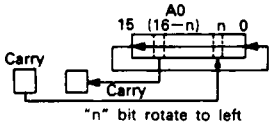
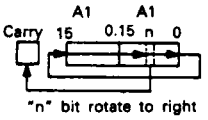
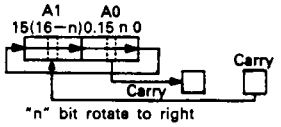
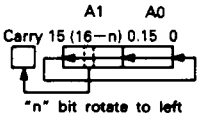
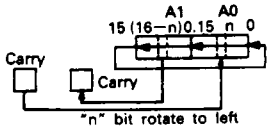
Classification		Instruction Symbol	Symbol	Contents of Processing
Rotation instructions	Right ward rotation	ROR	ROR n	
		RORP	RORP n	
		RCR	RCR n	
		RCRP	RCRP n	
	Left ward rotation	ROL	ROL n	
		ROLP	ROLP n	
		RCL	RCL n	
		RCLP	RCLP n	
	Right ward rotation	DROR	DROR n	
		DRORP	DRORP n	
		DRCR	DRCR n	
		DRCRP	DRCRP n	
	Left ward rotation	DROL	DROL n	
		DROLP	DROLP n	
		DRCL	DRCL n	
		DRCLP	DRCLP n	

Table 4.13 Application Instructions (Continue)

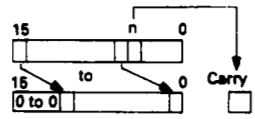
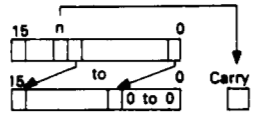
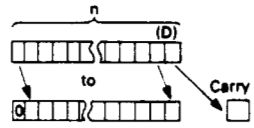
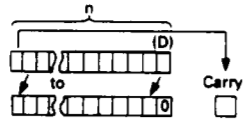
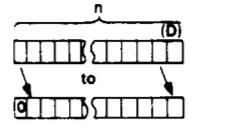
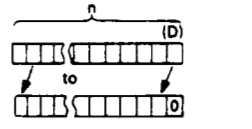
Classification		Instruction Symbol	Symbol	Contents of Processing
Shift instructions	n bitshift	SFR	SFR Ⓓ n	
		SFRP	SFRP Ⓓ n	
		SFL	SFL Ⓓ n	
		SFLP	SFLP Ⓓ n	
	1 bit shift	BSFR	BSFR Ⓓ n	
		BSFRP	BSFRP Ⓓ n	
		BSFL	BSFL Ⓓ n	
		BSFLP	BSFLP Ⓓ n	
	1 ward shift	DSFR	DSFR Ⓓ n	
		DSFRP	DSFRP Ⓓ n	
		DSFL	DSFL Ⓓ n	
		DSFLP	DSFLP Ⓓ n	

Table 4.13 Application Instructions (Continue)

Classification		Instruction Symbol	Symbol	Contents of Processing
Data Processing instructions	Data search	SER	SER (S1) (S2) n	(S1) (S2) n; A0 : Coinciding number; A1 : Coinciding quantity
		SERP	SERP (S1) (S2) n	
	Bit check	SUM	SUM (S)	(S) 15 0; A0 : Quantity of 1
		SUMP	SUMP (S)	
		DSUM	DSUM (S)	(S+1) (S); A0 : Quantity of 1
		DSUMP	DSUMP (S)	
	Decode Encode	DECO	DECO (S) (D) n	8 → 256 decode; (S) n; Decode; (D) 2^n bits
		DECOP	DECOP (S) (D) n	
		ENCO	ENCO (S) (D) n	256 → 8 encode; (S) 2^n bits; Encode; (D) n
		ENCOP	ENCOP (S) (D) n	
	7 segment decode	SEG	SEG (S) (D)	(S) 3 0; 7SEG (D) n 0; Valid for AON, A3H when M9052 is off; Decode
	Bit set reset	BSET	BSET (D) n	(D) 15 n 0; 1
		BSETP	BSETP (D) n	
		BRST	BRST (D) n	(D) 15 n 0; 0
		BRSTP	BRSTP (D) n	

Table 4.13 Application Instructions (Continue)

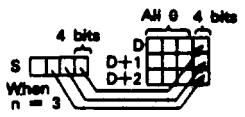
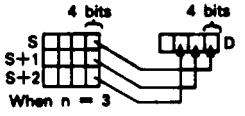
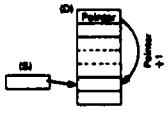
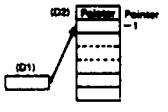
Classification		Instruction Symbol	Symbol	Contents of Processing
Data Processing instructions	Accociation Dissociation	DIS	DIS Ⓢ Ⓓ n	
		DISP	DISP Ⓢ Ⓓ n	
		UNI	UNI Ⓢ Ⓓ n	
		UNIP	UNIP Ⓢ Ⓓ n	
	ASCII conversion	ASC	ASC Alphanumeric character Ⓓ	Converts alphanumeric characters into ASCII codes and stores into 4 points beginning with the device, D.
FIFO instructions	Write	FIFW	FIFW Ⓢ Ⓓ	
		FIFWP	FIFWP Ⓢ Ⓓ	
	Read	FIFR	FIFR Ⓓ1 Ⓓ2	
		FIFRP	FIFRP Ⓓ1 Ⓓ2	
Buffer memory Access instructions	Data read	FROM	FROM n1 n2 Ⓓ n3 PRC m1 n	Reads data from the special function module.
		FROMP	FROMP n1 n2 Ⓓ n3 PRC m1 n	
		DFRO	DFRO n1 n2 Ⓓ n3 PRC m1 n	
		DFROP	DFROP n1 n2 Ⓓ n3 PRC m1 n	
	Data write	TO	TO n1 n2 Ⓢ n3 PRC m1 n	Writes data to the special function module.
		TOP	TOP n1 n2 Ⓢ n3 PRC m1 n	
		DTO	DTO n1 n2 Ⓢ n3 PRC m1 n	
		DTOP	DTOP n1 n2 Ⓓ n3 PRC m1 n	

Table 4.13 Application Instructions (Continue)

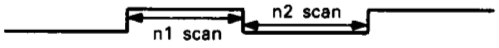
Classification			Instruction Symbol	Symbol	Contents of Processing
Local station access instructions	Local station data		LRDP	LRDP n1 Ⓢ Ⓓ n2	Reads data from the local station.
	Read, write		LWTP	LWTP n1 Ⓓ Ⓢ n2	Writes data to the local station.
remote I/O station access instructions	remote I/O station data		RFRP	RFRP n1 n2 Ⓓ n3	Reads data from the special function module in the remote I/O station.
	Read, write		RTOP	RTOP n1 n2 Ⓓ n3	Writes data to the special function module in the remote I/O station.
Display instructions	Display reset		LEDR	LEDR	Reset the display indication.
Other instructions	Failure check		CHK	CHK (D1) (D2)	Failure → (D1): ON (D2): Failure NO Normal → (D1): OFF (D2): 0
	Status latch	set	SLT	SLT	At the condition set by parameter setting, data are stored into memory for status latch.
		reset	SLTR	SLTR	Status latch is reset and [SLT] instruction is enabled.
	Sampling trace	set	STRA	STRA	At the condition set by parameter setting, sampling data are stored into memory for status latch.
		reset	STRAR	STRAR	Sampling trace is resumed. ([STRA] instruction is enabled.)
	Carry	set	STC	STC	Carry flag contact (M9012) is turned on.
		reset	CLC	CLC	Carry flag contact (M9012) is turned off.
	Timing clock		DUTY	DUTY n1 n2 Ⓓ	Timing clock shown below is generated. Special relay (D) 

Table 4.13 Application Instructions

4.7 I/O Numbers and Station Number Setting

The A2C manages communications with I/O modules and remote terminal modules based on I/O numbers.
The I/O numbers are assigned in the range of X/Y0 to X/Y1FF in the order of station numbers set with a station number setting switch of each module.

(1) Setting station numbers and I/O numbers
I/O numbers are assigned for each module in units of 8 points; setting is possible in the range of 1 to 64 stations.
The correspondence between the station numbers and I/O numbers is shown in Table 4.14.

Station No.	I/O No.	Station No.	I/O No.	Station No.	I/O No.	Station No.	I/O No.
1	X/Y0 to 7	17	X/Y80 to 87	33	X/Y100 to 107	49	X/Y180 to 187
2	X/Y8 to F	18	X/Y88 to 8F	34	X/Y108 to 10F	50	X/Y188 to 18F
3	X/Y10 to 17	19	X/Y90 to 97	35	X/Y110 to 117	51	X/Y190 to 197
4	X/Y18 to 1F	20	X/Y98 to 9F	36	X/Y118 to 11F	52	X/Y198 to 19F
5	X/Y20 to 27	21	X/YA0 to A7	37	X/Y120 to 127	53	X/Y1A0 to 1A7
6	X/Y28 to 2F	22	X/YA8 to AF	38	X/Y128 to 12F	54	X/Y1A8 to 1AF
7	X/Y30 to 37	23	X/YB0 to B7	39	X/Y130 to 137	55	X/Y1B0 to 1B7
8	X/Y38 to 3F	24	X/YB8 to BF	40	X/Y138 to 13F	56	X/Y1B8 to 1BF
9	X/Y40 to 47	25	X/YC0 to C7	41	X/Y140 to 147	57	X/Y1C0 to 1C7
10	X/Y48 to 4F	26	X/YC8 to CF	42	X/Y148 to 14F	58	X/Y1C8 to 1CF
11	X/Y50 to 57	27	X/YD0 to D7	43	X/Y150 to 157	59	X/Y1D0 to 1D7
12	X/Y58 to 5F	28	X/YD8 to DF	44	X/Y158 to 15F	60	X/Y1D8 to 1DF
13	X/Y60 to 67	29	X/YE0 to E7	45	X/Y160 to 167	61	X/Y1E0 to 1E7
14	X/Y68 to 6F	30	X/YE8 to EF	46	X/Y168 to 16F	62	X/Y1E8 to 1EF
15	X/Y70 to 77	31	X/YF0 to F7	47	X/Y170 to 177	63	X/Y1F0 to 1F7
16	X/Y78 to 7F	32	X/YF8 to FF	48	X/Y178 to 17F	64	X/Y1F8 to 1FF

Table 4.14 Station Numbers and I/O Numbers

(2) Relationship between occupied number of points and station numbers

(a) I/O modules and remote terminal modules which have 8 or more I/O points occupy station numbers to be assigned to several stations; station numbers to be occupied are consecutive.
The station number occupied by one module cannot be set for other modules.
For the number of stations to be occupied by an I/O module and remote terminal module, see Section 2.3.1.

(b) Station numbers to be assigned to I/O modules and remote terminal modules must be consecutive.
When a module which has more than 8 I/O points is used, the station number of the next module must be assigned by skipping the number of stations corresponding to the occupied stations.

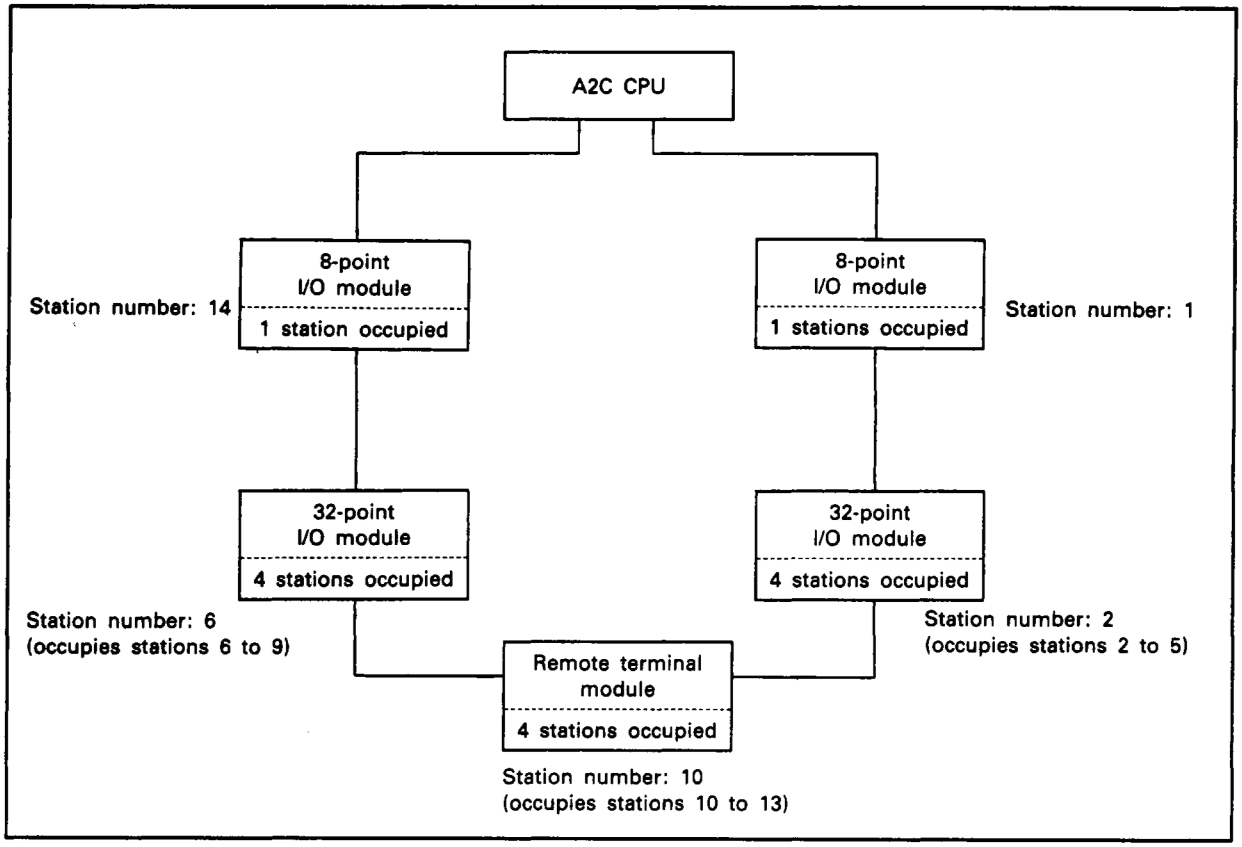


Fig. 4.26 Example of Station Number Setting

POINT

If the same station number is set for two or more stations, input or output error might occur.
When setting station numbers, take the number of stations to be occupied by each module so that the same station number will not be used by more than one station.

4.8 Handling

4.8.1 Precautions on handling

(1) Resin terminal connectors and pin connectors are used by the A2C CPU unit. Do not drop the CPU unit or apply hard shock to the unit.

(2) Never remove PCBs from the module. If a PCB is removed, it will cause troubles.

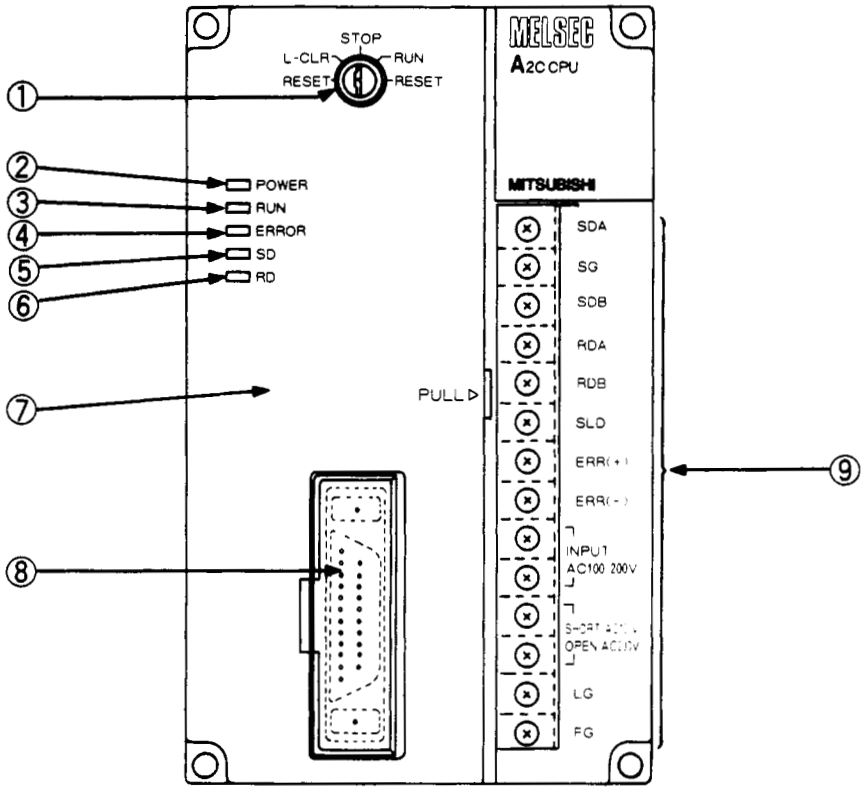
(3) Observe tightening torque for each screw.

Screws	Torque kg-cm (lb-in)
Terminal screws (terminal block) (M3.5 screws)	8.5 (7.36) to 11.5 (9.96)
Module mounting screws (M4 screws)	8 (6.93) to 12 (10.4)

(4) M4 screws should be 10 to 14 mm (0.39 to 0.55 in) long.

4.8.2 Part identification

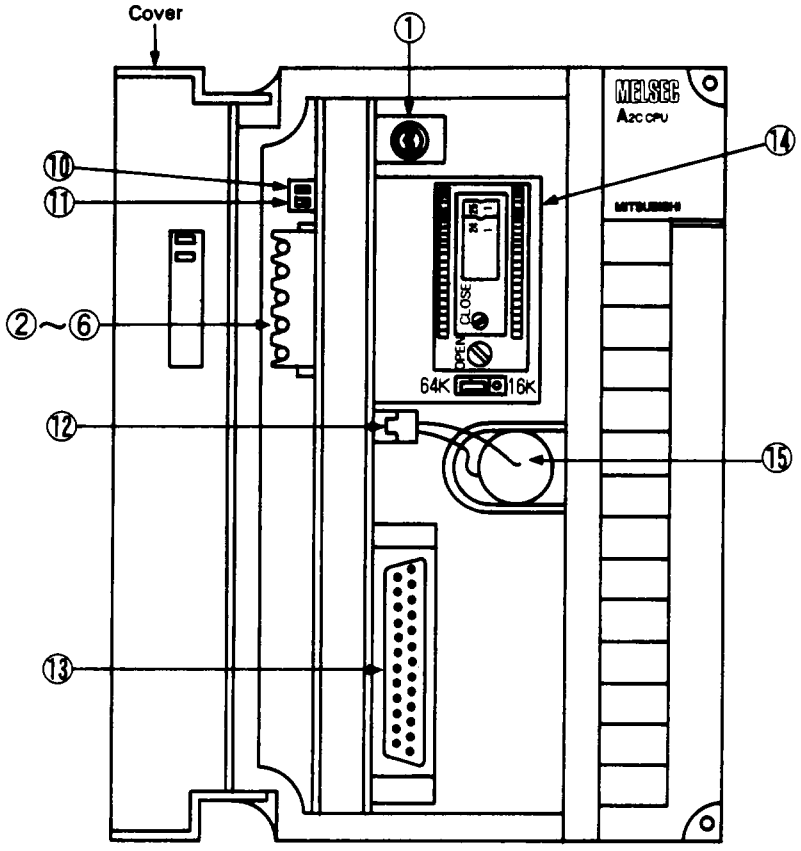
(1) External view of A2C



No.	Name	Function
①	RUN key switch	A2C operation status setting key • RUN/STOP: To start/stop running a sequence program • RESET: To reset the hardware To reset an error occurring during operation to initialize operation. • LATCH CLEAR: To clear (turning OFF, or clearing to "0") the devices in the latch range and non-latch range which are set by parameters. For the latch clear operation procedure, refer to Section 4.2.2.
②	POWER LED	5V DC power supply indicator LED • ON: 100/200 VAC is supplied to the A2C and converted into 5 VDC correctly. • OFF: 100/200 VAC is not supplied to the A2C. Supplied 100/200 VAC is not converted into 5 VDC correctly.

No.	Name	Function
③	RUN LED	A2C run status indicator LED • ON: A sequence program operation is being executed with the RUN key switch set in the RUN position. The LED remains lit if an error, which permits sequence operation to continue, occurs. • OFF: The RUN LED goes out in the following cases. • 100/200 VAC is not supplied to the A2C. • The RUN key switch is in the STOP position. • The remote STOP signal is input. • The remote PAUSE signal is input. • Flicker: The RUN LED flickers in the following cases. • An error which causes sequence operation to stop is detected by the self-diagnosis function. • The latch clear operation is executed. See Section 4.2.2.
④	ERROR LED	The self-diagnosis error detection status indicator LED • ON: An error is detected by the self-diagnosis function. The LED remains off when an error for which the indicator LED should remain OFF by the LED indication priority setting is detected. • OFF: The A2C is running correctly. • Flicker: The annunciator (F) is set ON by the sequence program.
⑤	SD LED	The data transmission state indicator LED (transmission to I/O modules and remote terminal modules) • ON: The A2C is transmitting data to an I/O module or remote terminal module correctly. • OFF: The SD LED goes out in the following cases. • Data is not being transmitted an I/O module or remote terminal module. • There is an error in the initial data or the initial program error. • The A2C hardware is faulty.
⑥	RD LED	The data receiving state indicator LED (receiving from I/O modules and remote terminal modules) • ON: The A2C is receiving data from an I/O module or remote terminal module correctly. • OFF: The RD LED goes out in the following cases. • The A2C is not receiving data from an I/O module or terminal module. • Cable connecting to the RDA or RDB terminal is broken or connection at the terminal is loose. • Hardware faulty of the A2C, I/O module, and/or remote terminal module.
⑦	Cover 1	A2C CPU cover • The cover protecting the A2C PCBs, EP-ROM, battery, etc. • Open the cover 1 to carry out following operations: • Installing and removing an EP-ROM. • Setting for used memory (IC-RAM/EP-ROM) • Connecting battery connector • Changing battery Note: Before opening or closing the cover 1, remove the RUN key switch and RS-422 connector.
⑧	Cover 2	RS-422 cover • The cover for the RS-422 connector used to connect a peripheral device to the A2C.
⑨	Terminal block	Terminal block for connecting external devices to the A2C. • The terminals used to connect the following devices: • 100/200 VAC power supply • I/O modules and remote terminal modules • Grounding cable • Changing input voltage (100/200 VAC).

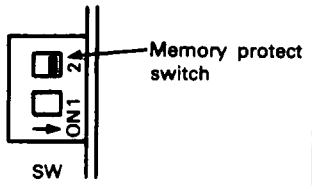
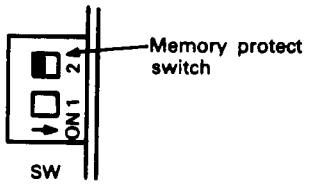
(2) Switch and connector layout inside the A2C

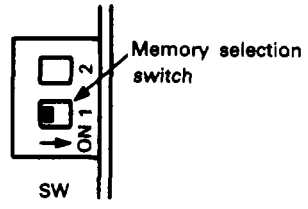
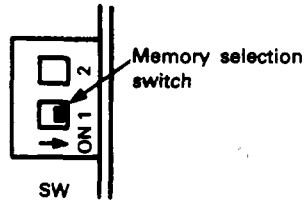


REMARK

For part numbers ① to ⑥, see preceding item (1).

No.	Name	Function
⑩	Memory protect switch	• The switch used to protect the data in the user memory area from being rewritten mistakenly by operating an external device carelessly. • For memory protect range, see Section 4.4.1.

Memory Protected	Memory Not Protected
	

No.	Name	Function
⑪	Memory selection switch	• The switch used to set the type of memory (RAM installed in the A2C or EP-ROM) used to store programs. • RAM in the A2C: Set the switch in the OFF position. • EP-ROM: Set the switch in the ON position. **Memory Selection Switch Setting** **Internal RAM**:  **EP-ROM**: 
⑫	Battery connector	• The connector used to connect a battery lead connector. For connector connection, see Section 5.2.
⑬	RS-422 connector	• Connector where a peripheral device is connected. • Connect a peripheral device to write/read, monitor, or test a program with a peripheral device.
⑭	Memory connection socket	• The socket used to install an EP-ROM. For memory installation, see Section 5.1.
⑮	Battery	• The battery used to retain the program and the device and file register data in the latch range. For the procedure to connect a battery, see Section 5.2.

5. MEMORY ICs, BATTERY, CABLES AND DIN RAIL ADAPTER

5.1 Memory ICs

This section describes specifications, handling instructions and installation of the memory ICs used in the A2C.

5.1.1 Specifications

Table 5.1 shows specifications of the ROMs to be installed to the program memory sockets of the A2C.

Item \ Type	4KROM	8KROM	16KROM
Memory specifications	EP-ROM (only read is possible)		
Memory capacity (bytes)	8K (Max. 2K steps)	16K (Max. 6K steps)	32K (Max. 8K steps)
Structure	28-pin IC package	28-pin IC package	28-pin IC package
Remarks	Make sure the correct installing direction.		

Table 5.1 Memory Specifications

5.1.2 Handling instructions

This chapter explains the handling instructions from unpacking to installation and also the nomenclature and setting of various conditions.

(1) When loading the memory into the socket, press the memory securely against the socket and the lock it with the lever. After loading, check that the memory is flush with the socket.

(2) Never place the memory on metal, which may allow current flow, or on an object which is charged with static electricity, such as wood, plastic, vinyl, fiber, cable, and paper.

(3) Do not touch the legs of the memory. Also, do not bend the legs.

(4) When mounting the memory, be sure to fit the memory the right way round as indicated on the socket. If reversely installed, the memory will be damaged.

5.1.3 Installation

(1) How to hold
Hold the memory IC as shown in Fig. 5.1 so that fingers may not touch the memory leads. If touched, the memory may be destroyed by static electricity or leads may be bent and cause incomplete contact.

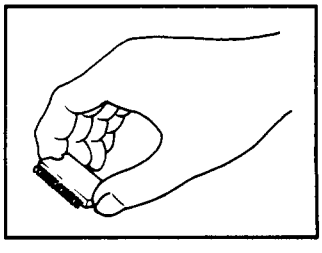


Fig. 5.1 How to Hold

(2) Installing direction
Install the memory IC into the direction marked on the memory socket matching the notch position. If installed in wrong direction, the memory will be destroyed when the A2C is turned on.

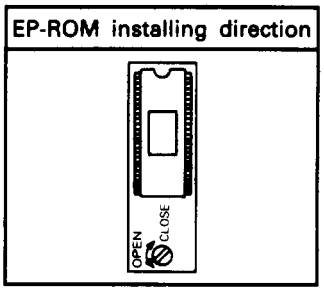


Fig. 5.2 Installing Direction

(3) Procedure
a) Set memory type with the memory select switch.
1) Sequence programs stored in the user memory area in the A2C is used: OFF
2) EP-ROM is installed: ON

b) Install the EP-ROM.
Match the notch mark on the ROM socket with the notch of the EP-ROM.
After installing the EP-ROM, cover it with the masking tape supplied with the ROM.

IB (NA) 66238-A

5.2 Battery

This section describes specifications, handling instructions and installation of the battery used in the A2C.

5.2.1 Specifications

Table 5.2 shows specifications of the battery used to retain memory stored if power failure occurs.

Item \ Type	A6BAT
Nominal voltage	3.6 VDC
Guaranteed life	5 years
Application	For IC-RAM memory backup and power failure compensation function
External dimensions mm (in)	ϕ16 (0.63) × 30 (1.18)

Table 5.2 Battery Specifications

5.2.2 Handling instructions

(1) Do not shortcircuit.

(2) Do not disassemble.

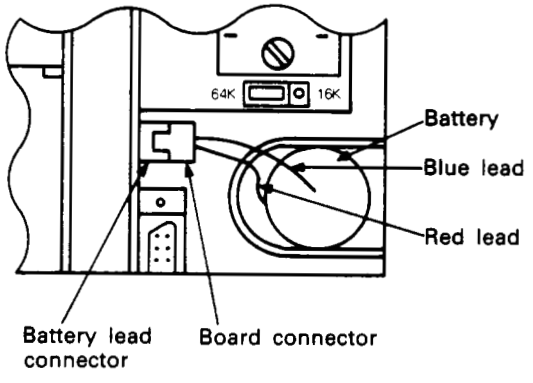
(3) Do not throw into flames.

(4) Do not heat.

(5) Do not solder its terminals.

5.2.3 Installation

Battery lead connector is disconnected from the battery connector on the A2C board to prevent discharge during transportation and storage.
Before starting the A2C, plug the battery connector into the battery connector on the A2C board.



IB (NA) 66238-A

5.3 Cables

This section describes the specifications recommended for the cables used for the A2C.

(1) 5-core flat cables

Used to connect the A2C system modules arranged side by side. The cables are used for data communication and supply of 24 VDC. Table 5.3 shows specifications of 5-core flat cables.

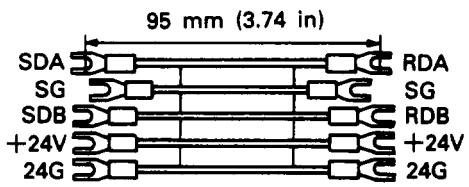
Type	A2C-005
Connecting distance	0 to 34 mm (1.34 in)
Conductor resistance	0.2 Ω
Insulation resistance	15 MΩ/km or over
Withstanding voltage	200 VAC
Shape	

Table 5.3 Specifications of 5-core Flat Cables

(2) Twisted pair cables

Used for data communication in the A2C system.

Table 5.5 shows specifications of applicable twisted pair cables.

Item	Specification
Type of cable	Shielded twisted pair cable
Number of pairs	2 pairs or more
Connecting distance	For 0.3 mm² or less in section: 50 m (164.05 ft)
	For 0.5 mm² or more in section: 100 m (328.1 ft)
Conductor resistance	88.0 Ω/km or less
Electrostatic capacity	Average 60 nF/km or less
Characteristic impedance	110±10 Ω

Table 5.5 Specifications of Twisted Pair Cables

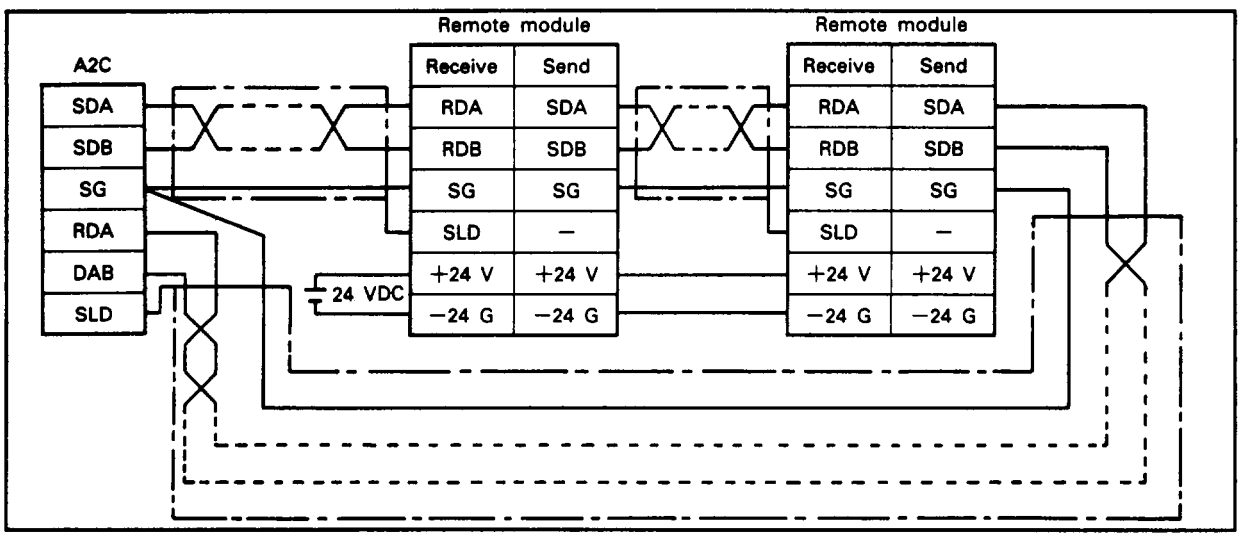


Fig. 5.1 Connection of twisted pair cables

5.4 DIN Rail Adapter

This section describes specifications and handling instructions of the DIN rail adapters.

5.4.1 Specifications

Table 5.6 shows specifications of the DIN rail adapters.

Item \ Type	A6DIN2C	A6DIN1C
Applicable module	A2C CPU and special function modules for A2C	A2C I/O module
External dimensions mm (in)	172 (6.77) × 106 (4.17) × 10 (0.39)	172 (6.77) × 68 (2.67) × 10 (0.39)
Weight g (lb)	100 (0.22)	50 (0.11)

Table 5.6 Specifications of the DIN adapter

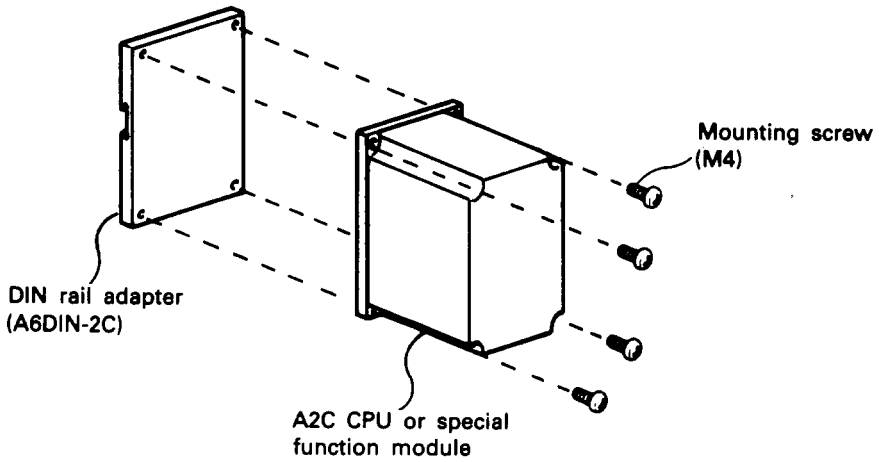
5.4.2 Handling instructions

(1) Do not drop or give hard shocks to the DIN rail adapter since it is made of plastic.

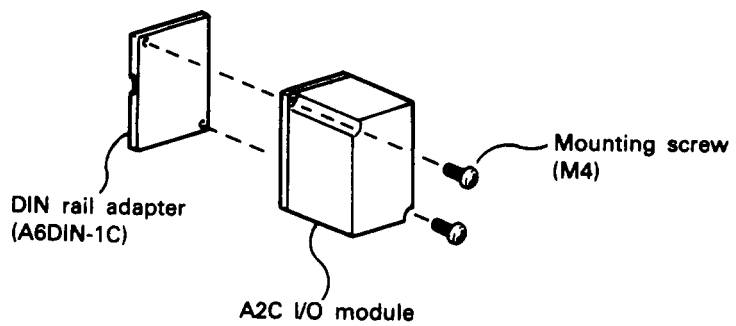
(2) Use M4 screws of 10 mm (0.39 in) to 14 mm (0.55 in) long to fix a DIN rail adapter to a module. Torque range should be 8 to 12 kg·cm (6.93 to 10.4 lb·in).

5.4.3 Fixing a DIN rail adapter to a module

(1) A2C CPU and special function modules
Fix a DIN rail adapter to an A2C CPU or special function modules with 4 M4 screws (10 to 14 mm (0.39 to 0.55 in) long). Tightening torque should be 8 to 12 kg·cm (6.93 to 10.4 lb·in).



(2) A2C I/O module
Fix a DIN rail adapter to an A2C I/O module or a power supply module (A66PC) with 2 M4 screws (10 to 14 mm (0.39 to 0.55 in) long). Tightening torque should be 8 to 12 kg·cm (6.93 to 10.4 lb·in).

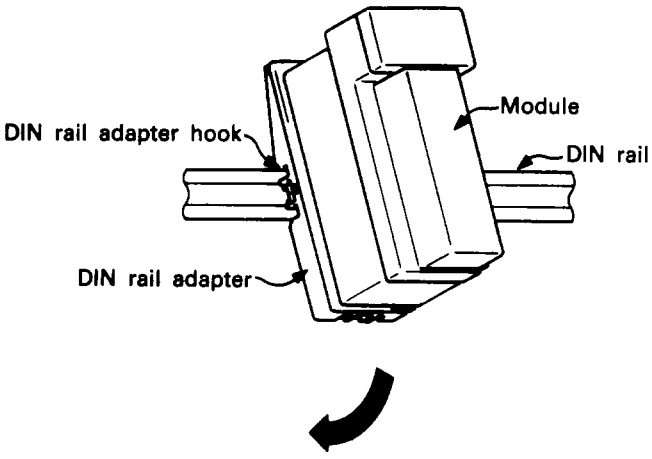


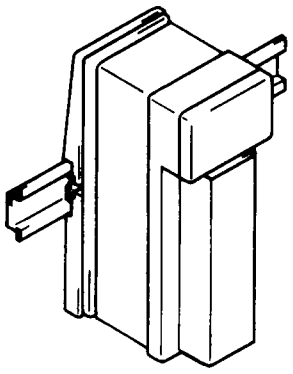
5.4.4 Mounting to the DIN rail

(1) Mounting procedure
After fixing the DIN rail adapter to the module, mount the module to the DIN rail as follows.

a) Engage the hook of the adapter with the rail from above the rail.

b) Push the module onto the rail and fix it in position.





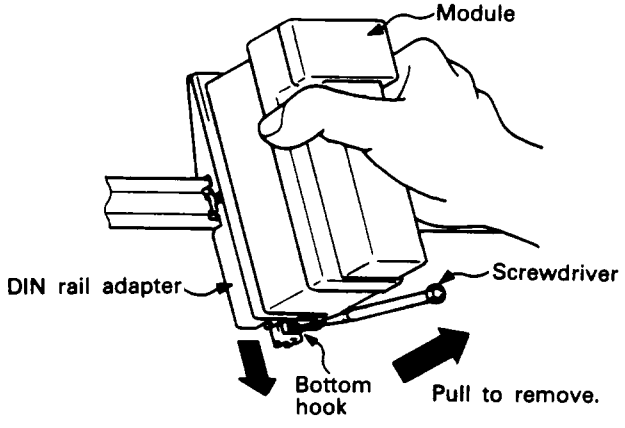
A module mounted to DIN rail

c) When two adapters with module are mounted to the rail side by side without leaving a clearance between them, a 4 mm clearance is allowed between the modules. (See Appendix 1, External Dimensions for dimensions of the DIN adapter.)

(2) Removing procedure
Remove the module from the DIN rail as follows.

a) Pull down the bottom hook of the adapter using a screwdriver.

b) Pull the module away from the rail while pulling down the bottom hook.



6. LOADING AND INSTALLATION

This section gives procedures and cautions to be used for loading and installation of system modules to improve system reliability and make the most of system functions.

6.1 Fail-safe Circuit

Conduct system designing considering the following points and prevent mis-input from remote I/O modules and remote terminal modules.

(a) Measure against mis-input at power on and off

(b) Measure against mis-input due to momentary power failure of remote I/O modules or remote terminal modules (See Section 2.2, (6) for details.)

The system may malfunction when external power supply or the PC module causes a failure.
To prevent a circuit failure from developing to malfunction of the whole system and to realize a fail-safe system, construct those circuits of which failure will lead to breakage or accidents of machine equipment (e. g., emergency stop circuit, protection circuit, interlock circuit) outside the PC.

6.2 Installation Environment

Never install the A2C system modules in the following environmental conditions.

(1) Locations where ambient temperature is outside the range 0 to 55°C.

(2) Locations where ambient humidity is outside the range of 10 and 90% RH.

(3) Locations where dew condensation takes place due to sudden temperature changes.

(4) Locations where there are corrosive gasses and combustible gasses.

(5) Locations where there is a high level of conductive powder such as dust and iron filings, oil mist, salt, and organic solvent.

(6) Locations exposed to the direct rays of the sun.

(7) Locations where strong power and magnetic fields are generated.

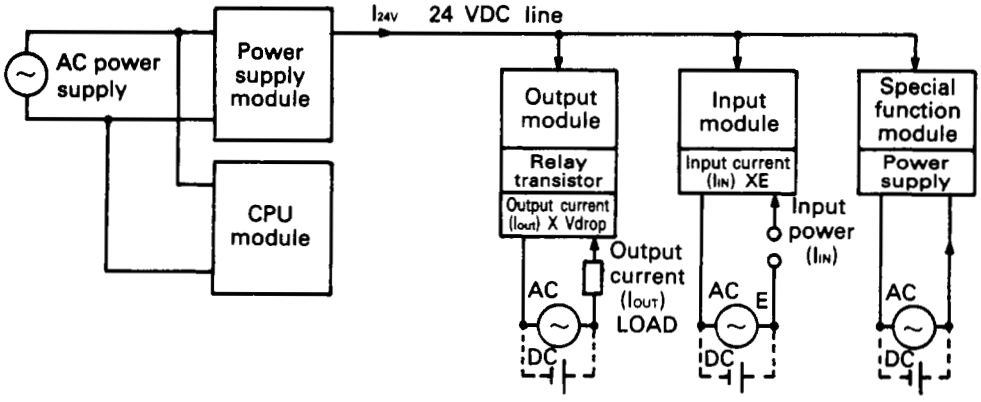
(8) Locations where vibration and shock are directly transmitted to the main unit.

6.3 Calculation of Heat Generated by the A2C System

The operating temperature inside the panel to where the A2C system is installed must be kept below 55°C. It is necessary to include heat dissipation in the design of the installing panel employing heat calculation of the system modules to be installed. In this section, the calculation procedure of average power consumption of the A2C system is explained. Perform heat calculation using the result of power consumption calculation.

Average power consumption

Power is consumed by the following areas.



(1) Power supply module
Approximately 70% of the power supply module current is converted into power with the remaining 30% dissipated as heat, i.e., 3/7 of the output power is used.

$$Wpw = \frac{3}{7} \times (I_{24V} \times 24)\ (W)$$

I_{24V}: Average current consumption of 24 VDC power supply for output module internal consumption (current consumption of simultaneous ON points)
... Not applicable when 24 VDC is supplied from outside and the power supply module does not have 24 VDC output.

(2) Total 24 VDC output module power consumption (with an average number of points switched on)
24V is supplied to drive output devices.

$$W_{24V} = I_{24V} \times 24\ (W)$$

(3) Power consumption of output circuits (with an average number of points switched on)

Wout = Iout × Vdrop × average number of outputs on at one time (W)
where, Iout = output current (actual operating current) (A)
Vdrop = voltage dropped across each output load (V)

(4) Power consumption of input circuits (with an average number of points switched on)

$W_{in} = I_{in} \times E \times$ average number of inputs on at one time (W)

Where, I_{in} = input current (effective value for AC) (A)

E = input voltage (actual operating voltage) (V)

(5) Power consumption of the special function unit power supply is expressed as:

$W_S = I_{24V} \times 24 + I_{100V} \times 100$ (W)

The sum of the above values is the power consumption of the entire PC system.

$W = W_{PW} + W_{24V} + W_{OUT} + W_{IN} + W_S$ (W)

Further calculations are necessary to work out the power dissipated by the other equipment in the panel.

Generally temperature rise in the panel is expressed as:

$$T = \frac{W}{UA} (°C)$$

where, W = power consumption of the entire PC system (obtained as above)

A = panel inside surface area (m^2)

U = 6 if the panel temperature is controlled by a fan, etc.

4 if panel air is not circulated.

POINT

Fans, heat exchangers or cooling units must be installed if the panel temperature is likely to exceed 55°C.
Fans should be fitted with suitable filters and guards.

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6.4 Wiring

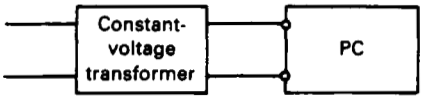
Wiring instructions for the system.

6.4.1 Wiring Instructions

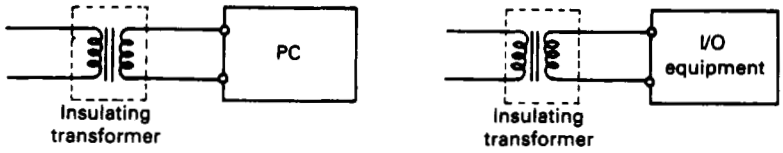
Instructions for wiring the power cable or I/O cables.

(1) Wiring of power source

(a) When voltage fluctuations are larger than the specified value, connect a constant-voltage transformer.



(b) Use a power supply which generates minimal noise across wire and across PC and ground. When excessive noise is generated, connect an insulating transformer.

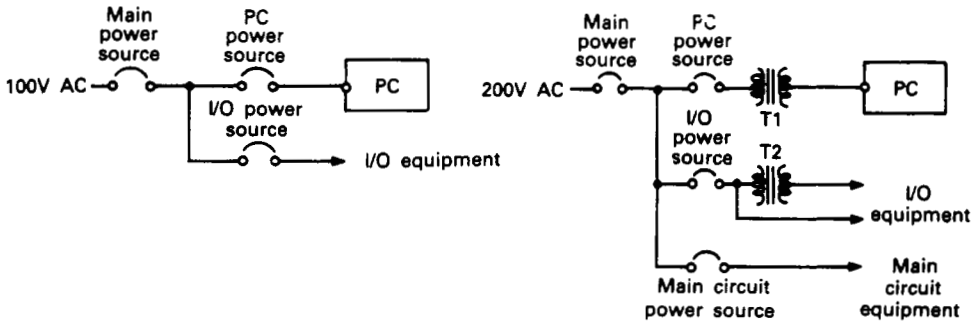


(c) When a power transformer or insulating transformer is employed to reduce the voltage from 200 VAC to 100 VAC, use one with a capacity greater than that indicated in the following table.

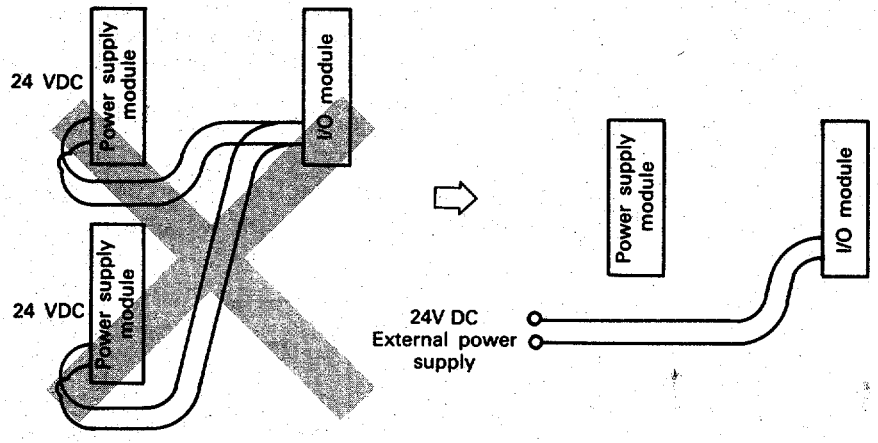
Power Supply Module	Transformer Capacity
A2C	110VA × n
A66PC	

"n" stands for the number of power supply modules.

(d) When wiring, separate the PC power source from those for I/O equipment and power equipment as shown below.



(e) Note on using 24 VDC output of the A66PC power supply modules.
To protect the power supply modules, do not supply one I/O module with 24 VDC from several power supply modules connected in parallel.
If 24 VDC output capacity is insufficient for one power supply module, supply 24 VDC from the external 24 VDC power supply as shown below:

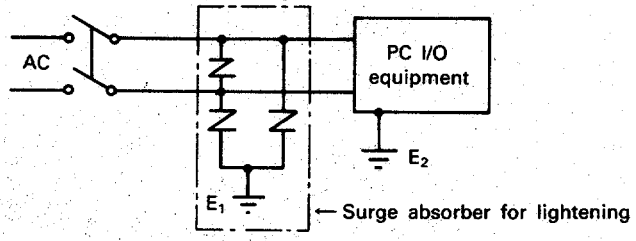


(f) Twist the 100 VAC, 200 VAC, and 24 VDC cables as closely as possible. Connect modules with the shortest possible wire lengths.

(g) To minimize voltage drop, use the thickest (max. 2 mm^2 (14 AWG)) wires possible for the 100 VAC, 200 VAC, and 24 VDC cables.

(h) Do not bundle the 100 VAC and 24 VDC cables with main-circuit wires or the I/O signal wires (high-voltage, large-current). Also, do not wire the above indicated cables close to the aforementioned wires. If possible, provide more than 100 mm (3.94 in) distance between the cables and wires.

(i) As a measure against verylarge surges (e.g. due to lightening), connect a surge absorber as shown below.



POINT

(1) Ground the surge absorber (E_1) an the PC (E_2) separately from each other.

(2) Select a surge absorber making allowances for power voltage rises.

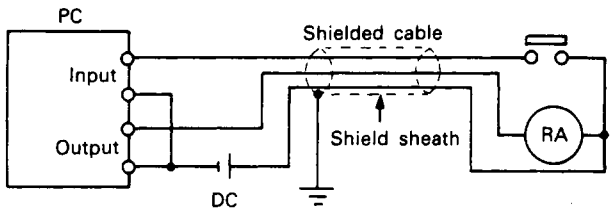
(2) Wiring of I/O equipment

(a) Applicable size of wire to the terminal block connector is 0.3 (18) to 2 mm^2 (14 AWG). However, it is recommended to use wires of 0.75 mm^2 (18 AWG) for convenience.

(b) Separate the input and output lines.

(c) I/O signal wires must be at least 100 mm (3.94 in) away from high-voltage and large-current main circuit wires.

(d) When the I/O signal wires cannot be separated from the main circuit wires and power wires, ground on the PC side with batch-shielded cables. Under some conditions it may be preferable to ground on the other side.



(e) If wiring has been done with of piping, ground the piping.

(f) Separate the 24 VDC I/O cables from the 100 VAC and 200 VAC cables.

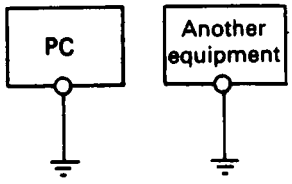
(g) If wiring over 200 m (7.87 in) or longer distance, trouble can be caused by leakage currents due to line capacity. Take corrective action as described in Section 8.4.

(3) Grounding

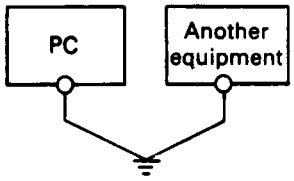
(a) The A series PC has good noise resistance. Therefore, the PC may be used without grounding except when there is excessive noise.
However, follow (b) to (e) described below.

(b) Ground the PC as independently as possible. Class 3 grounding should be used (grounding resistance 100 Ω or less).

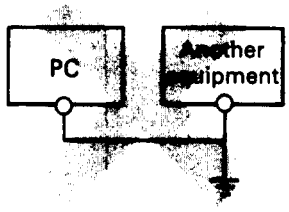
(c) When independent grounding is impossible, use the joint grounding method as shown in the figure below (2).



(1) Independent grounding ····· Best



(2) Joint grounding ····· Good



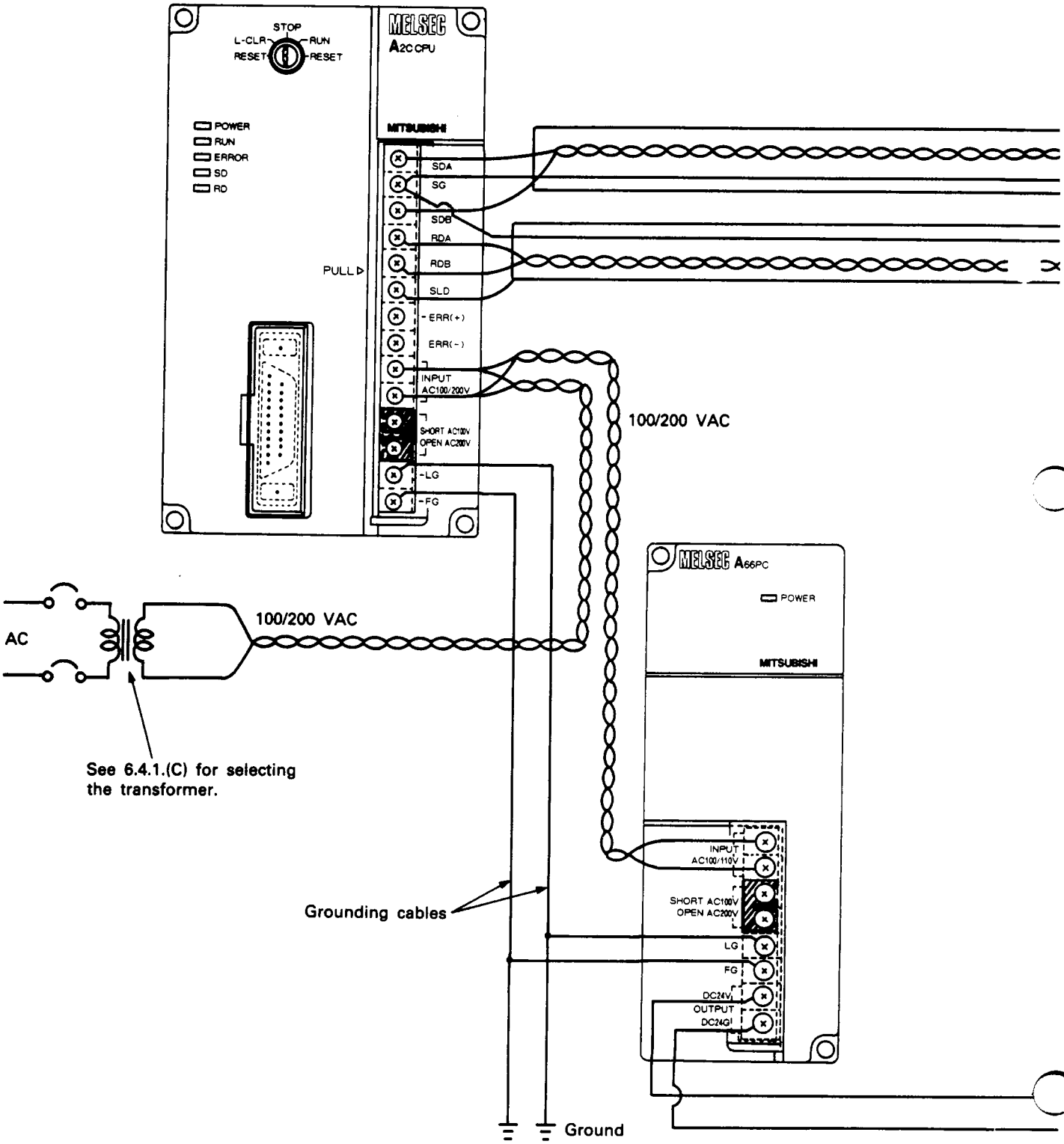
(3) Joint grounding ····· Not allowed

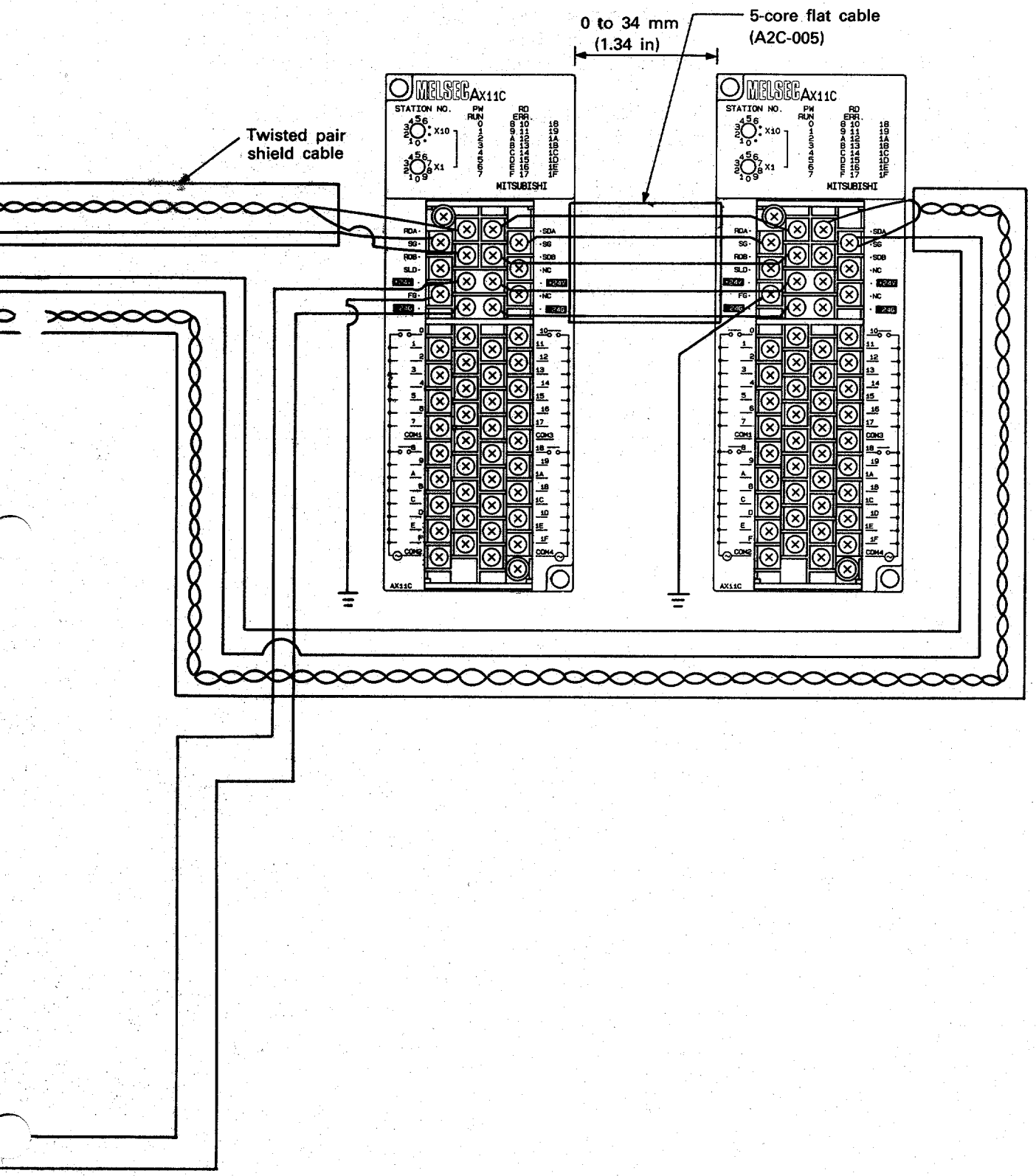
(d) Use 2 mm^2 (14 AWG) or thicker grounding wire. Grounding point should be as near as possible to the PC to minimize the distance of grounding cable.

(e) Should incorrect operation occur due to grounding, disconnect one or both of the LG and FG terminals of base units from the grounding.

6.4.2 Connection between modules

This illustration shows an example of connection of the power supply cables and grounding cables between the A2C modules and power supply modules.




0 to 34 mm
(1.34 in)
5-core flat cable
(A2C-005)
Twisted pair
shield cable
MELSEC AX11C
STATION NO.
PW
RUN
RD
ERR.
X10
X1
MITSUBISHI
RDA
SG
RDB
SLD
FG
SDA
SG
SDB
NC
NC
COM1
COM2
COM3
COM4
AX11C

POINT

(1) Use the thickest possible (max. 2 mm² (14 AWG)) wires for the 100/200 VAC and 24 VDC power cables. Be sure to twist these wires starting at the connection terminals. To prevent short-circuit should any screws loosen, use solderless terminals with insulation sleeves.

(2) When the LG terminals and FG terminals are connected, be sure to ground the wires. Do not connect the LG terminals and FG terminals to anything other than ground. If LG terminals and FG terminals are connected without grounding the wires, the PC may be susceptible to noise, also since the LG terminals have potential, the operator may get an electric shock when touching metal parts.

(3) ✳··· Open/shortcircuit switching is performed by power supply voltage.
100 VAC: Shortcircuit
200 VAC: Open

6.5 Installing The A2C CPU

This section gives conditions of installation of the A2C to a panel.

(1) To provide good ventilation and to make module replacement easy, allow a clearance of 80 mm (3.11 in) or more between the top side of the module and surrounding structures or parts. (See Fig. 6.1.)

(2) If the A2C I/O module, A66PC or other module is to be installed on the left side of the A2C, provide a clearance of 10 mm (0.39 in) or more between them to allow Cover 1 (CPU cover: See 4.8.2.) to be opened and closed.

(3) Mount the module on a separate panel or away from large electromagnetic contactors and no-fuse circuit breakers which produce vibrations.

(4) To avoid influence of radiation of noise or heat, allow a clearance of 100 mm (3.94 in) or more if the A2C faces such noise or heat radiating devices (when such devices are mounted on the back side of the door). (See Fig. 6.2.)
Also, allow a clearance of 50 mm (1.97 in) or more between the side face of the A2C, A2C I/O or other modules and devices.

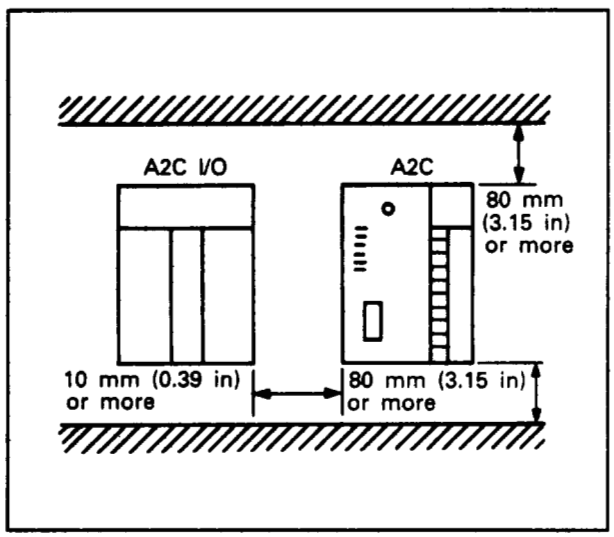


Fig. 6.1 Installing Position

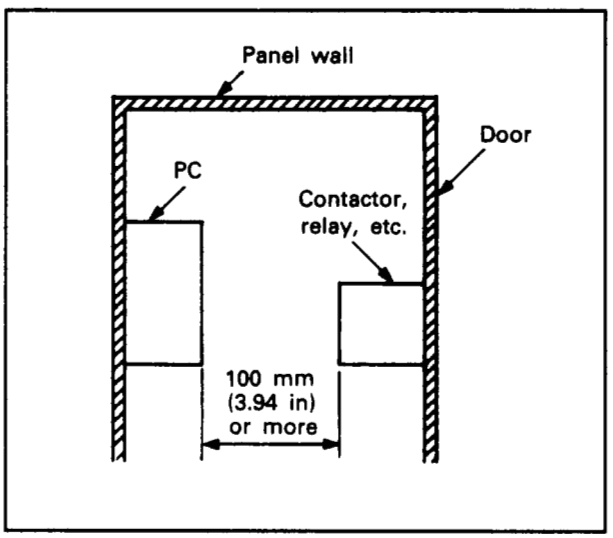


Fig. 6.2 Clearance between PC and Other Devices

7. TEST RUN

This section describes check points before test run and test run procedures.

7.1 Check Points before Test Run

Table 7.1 shows the check points to be confirmed before conducting test run.

Module	Check point
CPU module	(1) RAM/ROM setting should be correct.
	(2) The EP-ROM should be installed securely to the ROM socket. (when the EP-ROM is used)
	(3) The memory protect switch should be set at ON.
	(4) The battery (A6BAT) lead connector should be connected securely with the battery connector on the PC board.
	(5) Battery voltage should be within specified range. (Nominal: 3.6 V)
	(6) Voltage setting of the power supply module should conform to supplied voltage.
	(7) Wiring of the FG and LG terminals should be correct.
	(8) Terminal screws should be tight.
	(9) Connecting cables should use wires of correct size.
Power supply module (A66PC)	(1) Voltage setting of the power supply module should conform to supplied voltage.
	(2) Wiring of the FG and LG terminals should be correct.
	(3) Terminal screws should be tight.
	(4) Connecting cables should use wires of correct size.
A2C I/O module	(1) Cables connected to the terminals on the terminal block should correspond with signal names.
	(2) Terminal screws should be tight.
	(3) Connecting cables should use wires of correct size.
	(4) The external power supply should be connected correctly. (24 VDC and others)
	(5) Station numbers should be set correctly. (Set range: 1 to 61)
Special function module	(1) Switches should be set correctly.
	(2) Cables connected to the terminals on the terminal block should correspond with signal names.
	(3) Terminal screws should be tight.
	(4) Connecting cables should use wires of correct size.
	(5) The external power supply should be correctly connected. (24 VDC and others)
	(6) Station numbers should be correctly set. (Set range: 1 to 61)
Cables between modules	(1) Wiring between modules should be correct.
	(2) The longest cable should be 100 m (32.81 ft) or less.
	(3) Polarity of the I/O modules, remote terminal modules and 24 VDC power supply modules (A66PC or general-purpose power supply) should match between them.

Table 7.1 Check Points Before Test Run

7.2 Test Run Procedures

This section describes the procedures from installation to test run of the A2C.

(1) Installing modules
Install the A2C, remote I/O modules and remote terminal modules to specified positions.

(2) Wiring between modules and external devices

(a) Connect the power supply cables (100/200 VAC) of the A2C CPU and A66P. Set the power supply voltage of each module.

(b) Connect remote I/O modules and remote terminal modules with external devices.

(c) Connect the ERR terminal of the A2C if output is provided directly from it.

(3) Cable connection between modules
Perform connection between connect cables for MINI-S3 link connecting the A2C, remote I/O modules, and remote terminal modules as well as connecting 24 VDC power supply cables to each individual modules.

(4) Setting the CPU module

(a) Memory protect switch ····· OFF

(b) Memory select switch ····· RAM side

(c) Connect the battery.

(5) Setting remote I/O modules and remote terminal modules
Set station number of each remote I/O module and remote terminal module. (See 4.7 for station number setting.)

(6) Turning on the power

(a) Check the input supply voltage for the CPU module and A66PC (general-purpose power supply).

(b) Check the supplied power for I/O modules.

(c) Set the RUN key switch of the A2C at STOP.

(d) Turn on the power for the A2C and A66PC (general-purpose power supply).

(e) Make sure that the "POWER" LED of the A2C and A66PC lights.

(f) Make sure that the "SD" LED and "RD" LED of the A2C light or flicker.

(7) Programming

(a) Connect a peripheral device to the A2C.

(b) Write the sequence programs made with GPP/PHP/HGP in the A2C. Or perform programming with the PU.

(8) Checking external output wiring

(a) Perform forced output (Y) ON/OFF using the forced output function of the "TEST" mode of the peripheral device. Check that the LED for the designated output is lit.

(b) Check that the external wiring for the output turned ON forcibly is correct.

(9) Checking the wiring for external input devices

(a) Turn on the input devices and check that corresponding LED on each module is lit.

(b) Check that the input (X) number of the input device is correct by monitoring with a peripheral device.

(10) Debugging sequence programs

(a) Place the RUN key switch of the A2C in the RUN position and check that the "RUN" LED lights.

(b) Turn on and off the input devices and check that operation by sequence programs is correct.

(11) Storing sequence programs

(a) Store sequence programs after debugging.

1) GPP ..... Floppy disk and EP-ROM
2) PHP, HGP ..... Floppy disk
3) WU ..... EP-ROM
4) PU ..... Cassette tape

(b) Connect a printer to GPP/PHP/HGP and print out stored sequence programs.

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8. MAINTENANCE AND INSPECTION

This section describes items for daily and periodic maintenance and inspection in order to maintain the programmable controller in the normal and best conditions.

8.1 Daily Inspection

Table 8.1 shown the inspection items which are to be checked daily.

Number	Check Item		Check Point	Judgement	Corrective Action
1	Connecting conditions		Check for loose terminal screws.	Screws should not be loose.	Retighten terminal screws.
			Check distance between solderless terminals.	Proper clearance should be provided between solderless terminals.	Correct.
			Check connectors of extension cable.	Connections should not be loose.	Retighten connector mounting screws.
2	CPU module indicator lamps	"POWER" LED	Check that the LED is on.	On. (Off indicates an error.)	See section 9.2.2.
		"RUN" LED	Check that the LED is on during run.	On. (Off or flicker indicates an error.)	See Section 9.2.3 and 9.2.4.
		"ERROR" LED	Check that the LED is on when an error has occurred.	Off. (On when an error has occurred.)	See Section 9.2.5.
		"SD" LED	Check that the LED flickers while data is transmitted.	Flickers while data is transmitted. Off in other cases.	See Section 9.2.6.
		"RD" LED	Check that the LED flickers while data is received.	Flickers while data is received. Off in other cases.	See Section 9.2.6.

Table 8.1 Daily Inspection

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8.2 Periodic Inspection

This section explains the inspection items which are to be checked every six months to one year. If the equipment have been moved or modified or wiring has been changed, also make the inspection.

Number	Check Item		Checking Method	Judgement	Corrective Action
1	Ambient environment	Ambient temperature	Measure with thermometer and hygrometer. Measure corrosive gas.	0 to 55°C	When PC is used inside a panel, the temperature in the panel is ambient temperature.
		Ambient humidity		10 to 90% RH	
		Ambience		There should be no corrosive gases.	
2	Line voltage check		Measure voltage across 100/200V AC terminal.	85 to 132 VAC 170 to 264 VAC	Change supply power. Change transformer tap.
3	Condition of each module	Ingress of dust or foreign material	Visual check.	There should be no dust or foreign material, in the vicinity of the P.C.	Remove and clean.
4	Connecting conditions	Loose terminal screws	Retighten.	Connectors should not be loose.	Retighten.
		Distances between solderless terminals.	Visual check.	Proper clearance should be provided between solderless terminals.	Correct.
		Loose connector	Visual check.	Connectors should not be loose.	Retighten connector mounting screws.
5	Battery		Check battery status by monitoring special auxiliary relays M9006 and M9007. Replace battery if necessary.	Preventive maintenance	If battery capacity reduction is not indicated, change the battery when specified service life is exceeded.

Table 8.2 Periodic Inspection

8.3 Replacement of Battery

M9006 or M9007 turns on when the voltage of battery for program backup and power failure compensation reduces.
Even if this special relay turns on, the contents of the program and power failure compensation are not lost immediately.
However, if the ON state is overlooked, the PC contents may be lost.

8.3.1 Battery life

The period in which stored data is guaranteed will vary depending on device memory capacity to be retained or length of power failure. However, as a preventive maintenance measure, it is recommended to replace the battery after 4 or 5 years of use even if the total power failure time is less than the guaranteed period.

Battery Life (Total power failure time) [Hr]		
Guaranteed value (Min)	Actually applied value (Typ)	M9006 or M9007 Turns ON
5400	13000	168

*The actually applied value indicates a typical value and the guaranteed value indicates the minimum value.

Table 8.3 Battery Life

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8.3.2 Replacing procedures

(1) Procedures

(a) Turn off the A2C.

(b) Disconnect the battery lead connector from the connector on the A2C board.

(c) Remove the battery from the battery holder by pressing down the holder lug.

(d) Insert a new battery.

(e) Connect the battery lead connector with the battery connector on the A2C board.

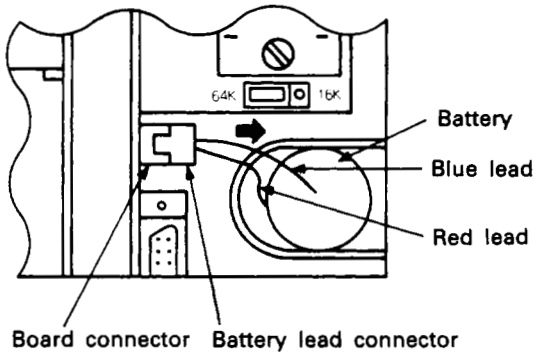
(f) Turn on the A2C.

(g) Check that the low battery flag (M9006) is reset. If it is set, replace the battery again.

(2) Caution
Replace the battery within the guaranteed period specified in Table 8.4. If it takes longer than the guaranteed period, sequence programs or latched data would be lost.

Capacitor backup time (minute)	
Guaranteed period (MINIMUM)	Under normal operating conditions
9	20

Table 8.4 Capacitor Backup Time



9. TROUBLESHOOTING

This section describes various procedures for establishing the nature of any faults, and corrective action.

9.1 Basic Troubleshooting

System reliability depends not only on reliable equipment but also on short down-time in the event of faults.
The basic points to be kept in mind in troubleshooting are the following three.

(1) Visual checks

Check the following points.
1) Machine motions (in stop and operating statuses)
2) On or off of power
3) Status of I/O devices
4) Conditions of wiring (I/O wires, cables)
5) Display states of various indicators (such as POWER LED, RUN LED, and ERROR LED)
6) States of various setting switches (such as extension base and power failure compensation)

After checking 1) to 6), connect the peripheral devices and check the running status of PC and the contents of program.

(2) Trouble check

Observe any changes in the error condition during the following.
1) Set the RUN key switch to the "STOP" position.
2) Perform reset by the RESET key switch.
3) Turn the power on and off.

(3) Narrow down the possible causes of the trouble

Deduce where the fault lies i.e:
1) Inside or outside of PC.
2) I/O modules or other modules.
3) Sequence program.

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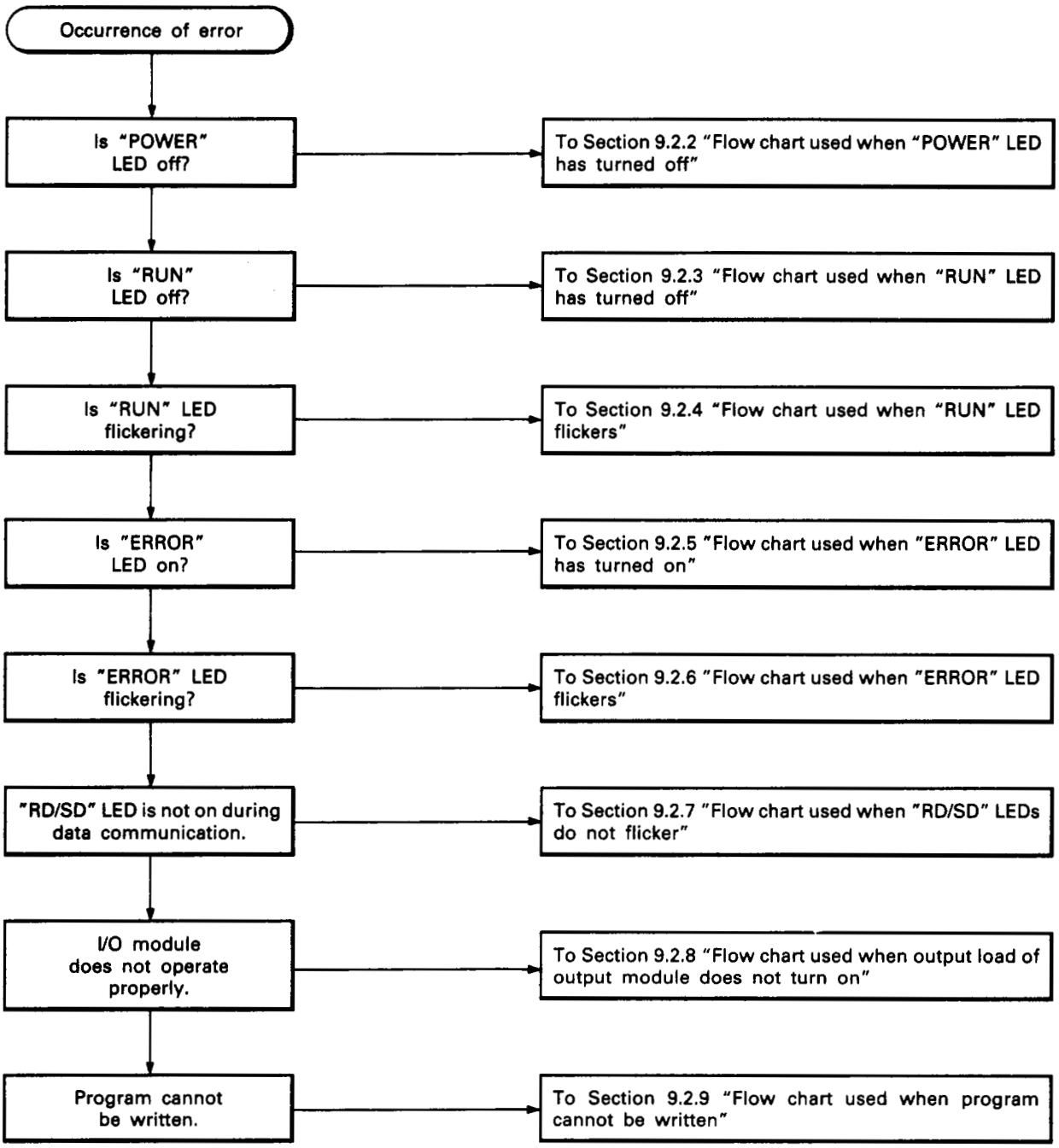
9.2 Troubleshooting

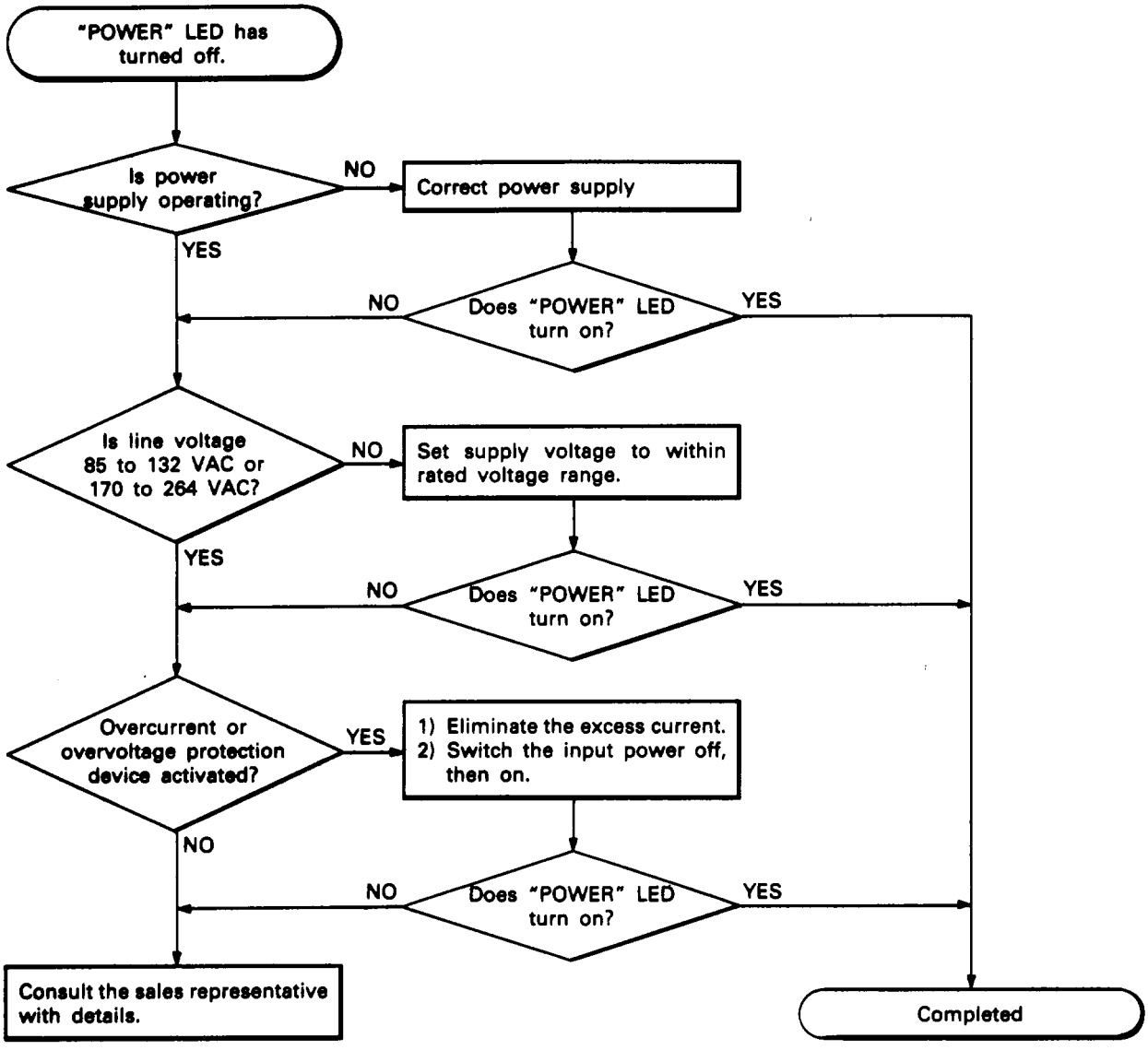
This section explains the procedure for determining the cause of problems and the errors and corrective actions for error codes.

9.2.1 Troubleshooting flow charts

Details for fault finding may be found as follows.



9.2.2 Flow chart used when "POWER" LED of the A2CCPU has turned off



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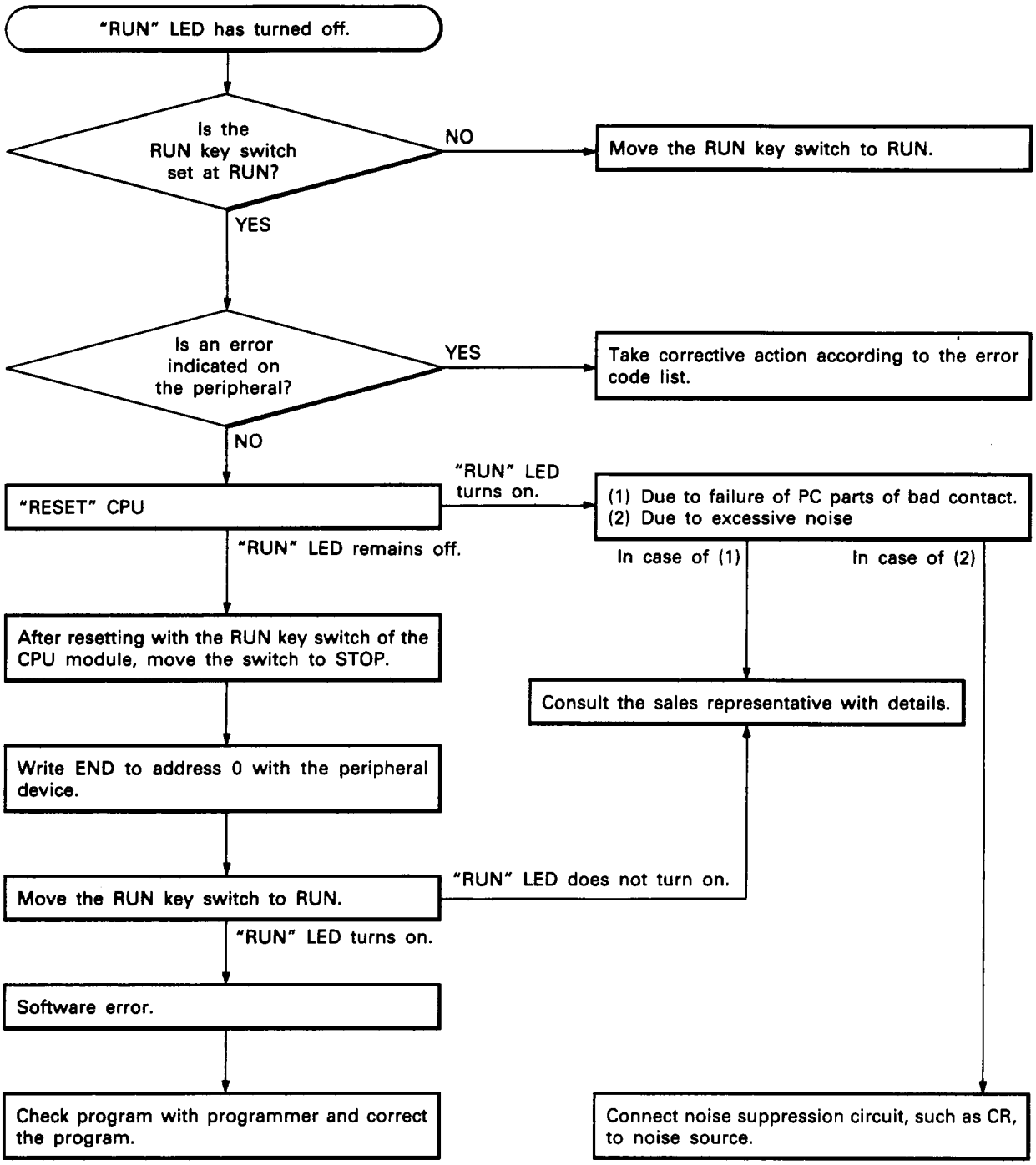
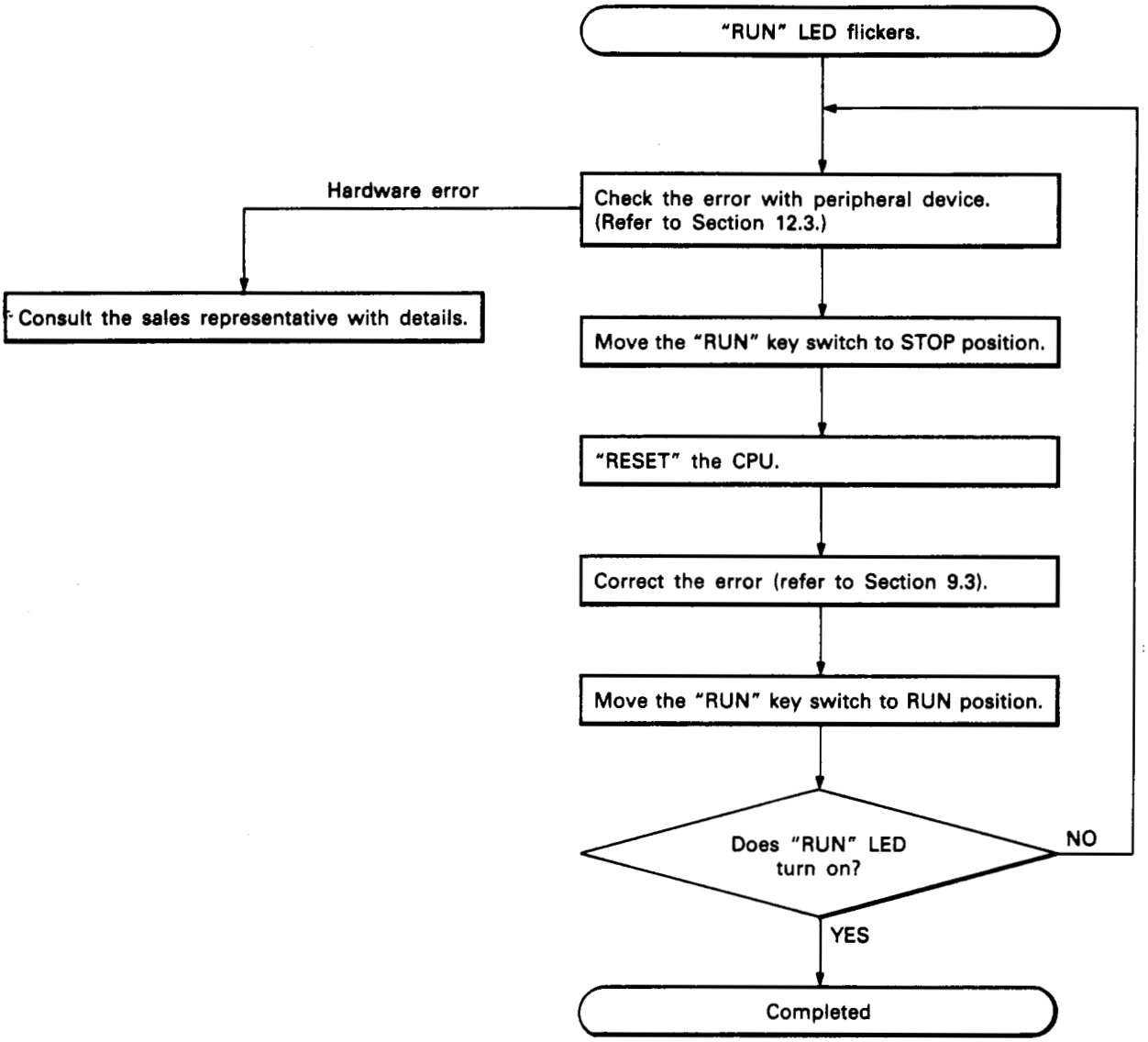
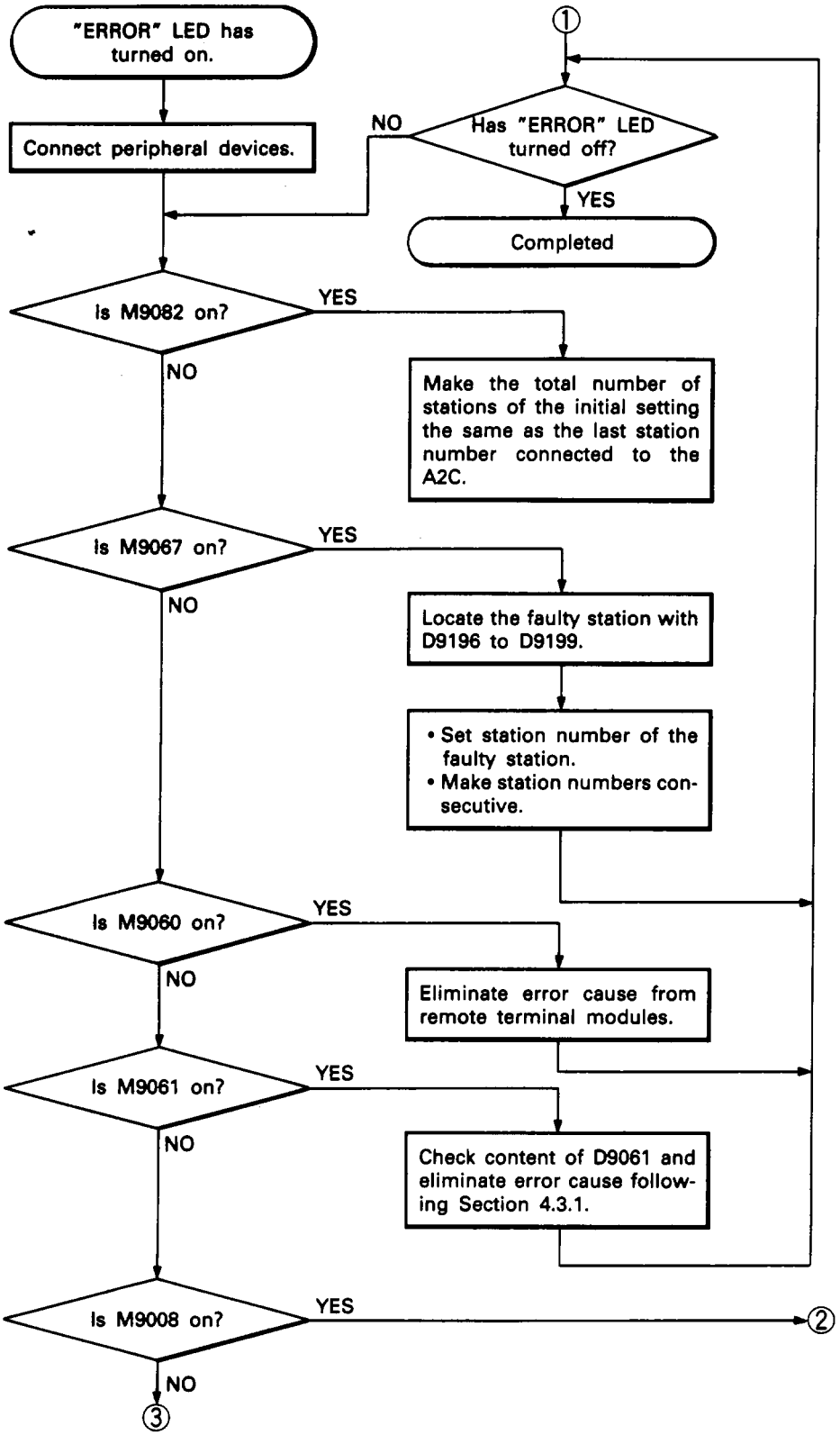
9.2.3 Flow chart used when "RUN" LED of the A2CCPU has turned off

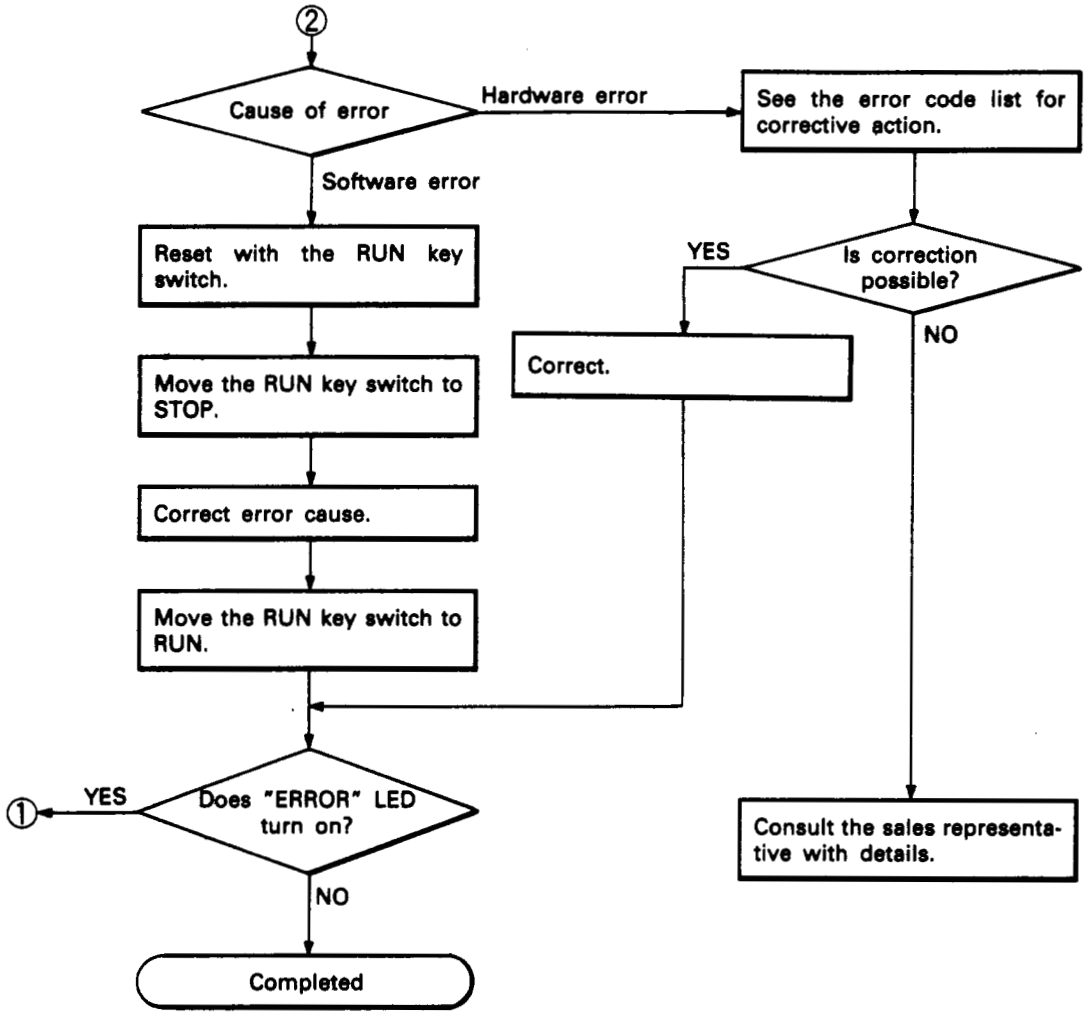


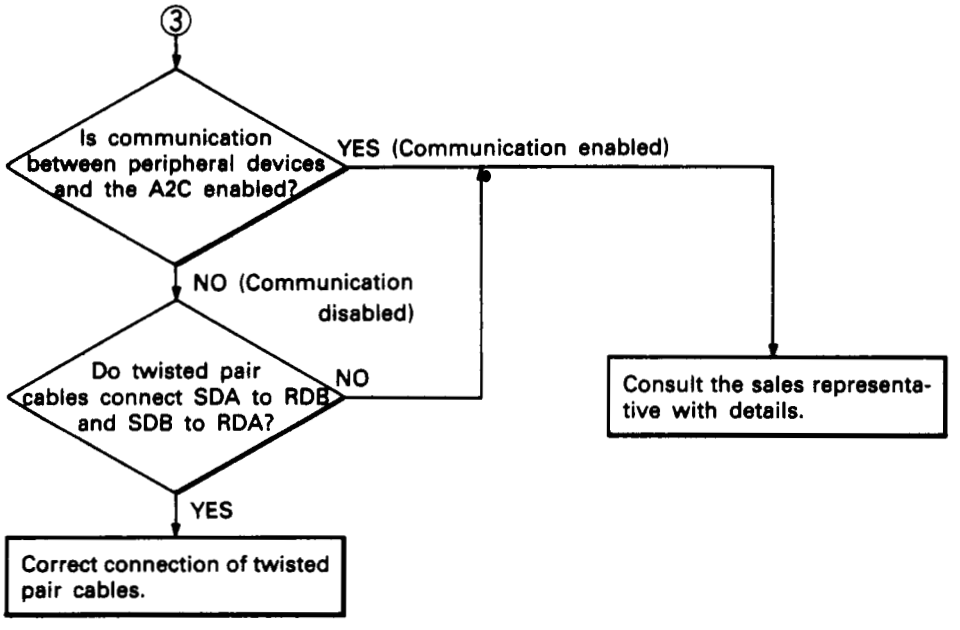
9.2.4 Flow chart used when "RUN" LED of the A2CCPU flickers



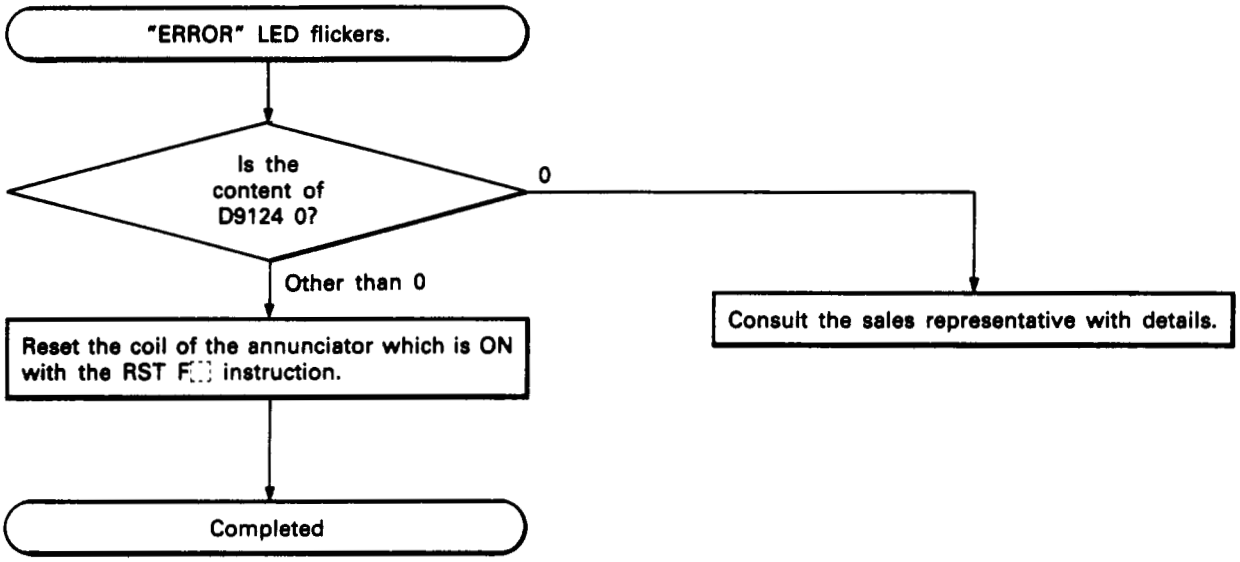
9.2.5 Flow chart used when "ERROR" LED of the A2CCPU has turned on



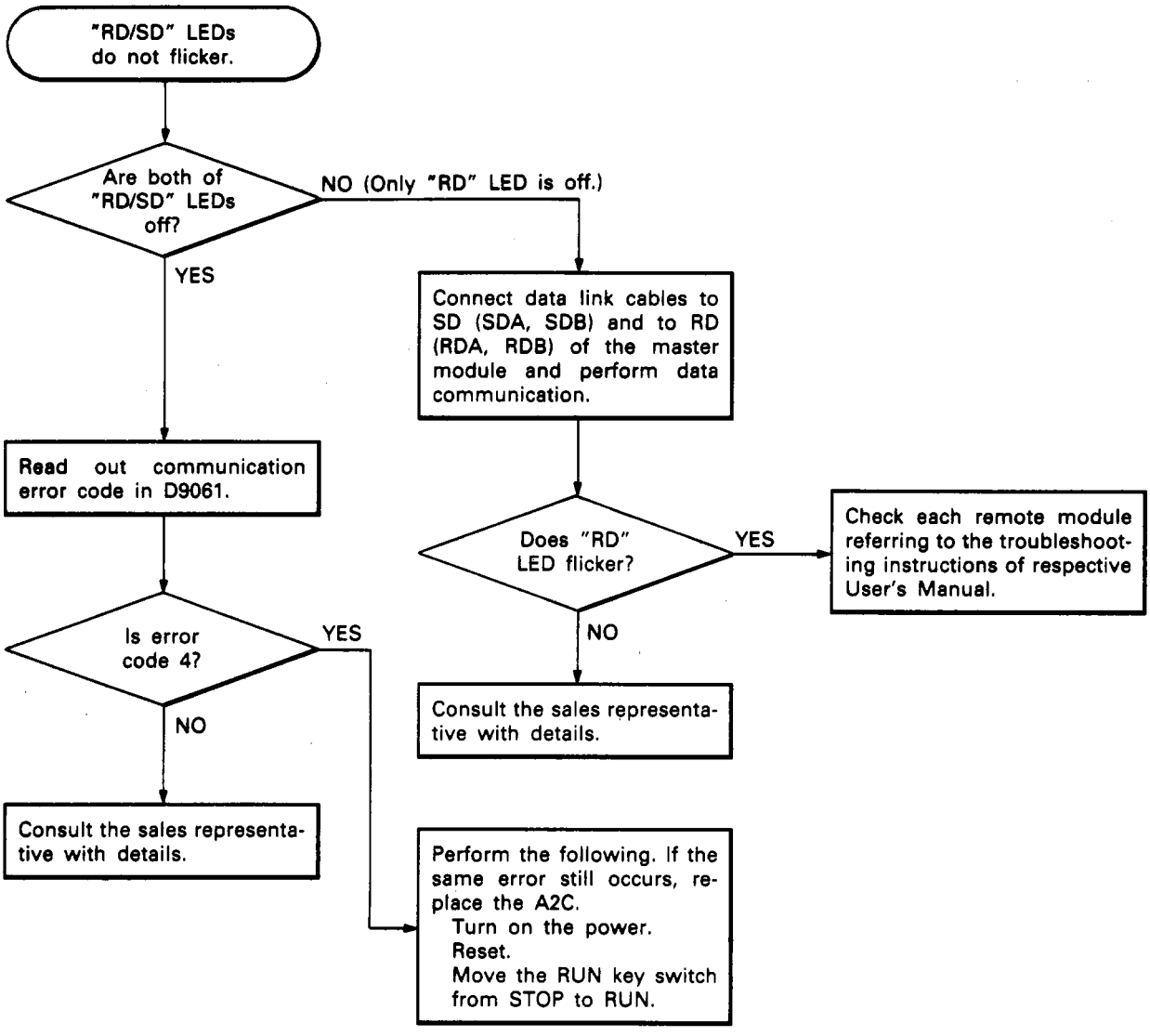

②
Cause of error
Hardware error
See the error code list for corrective action.
Software error
Reset with the RUN key switch.
YES
Is correction possible?
NO
Correct.
Move the RUN key switch to STOP.
Correct error cause.
Move the RUN key switch to RUN.
①
YES
Does "ERROR" LED turn on?
Consult the sales representative with details.
NO
Completed


③
Is communication between peripheral devices and the A2C enabled?
YES (Communication enabled)
NO (Communication disabled)
Do twisted pair cables connect SDA to RDB and SDB to RDA?
NO
Consult the sales representative with details.
YES
Correct connection of twisted pair cables.

9.2.6 Flow chart used when "ERROR" LED of the A2CCPU flickers



9.2.7 Flow chart used when "RD/SD" LEDs of the A2CCPU do not flicker



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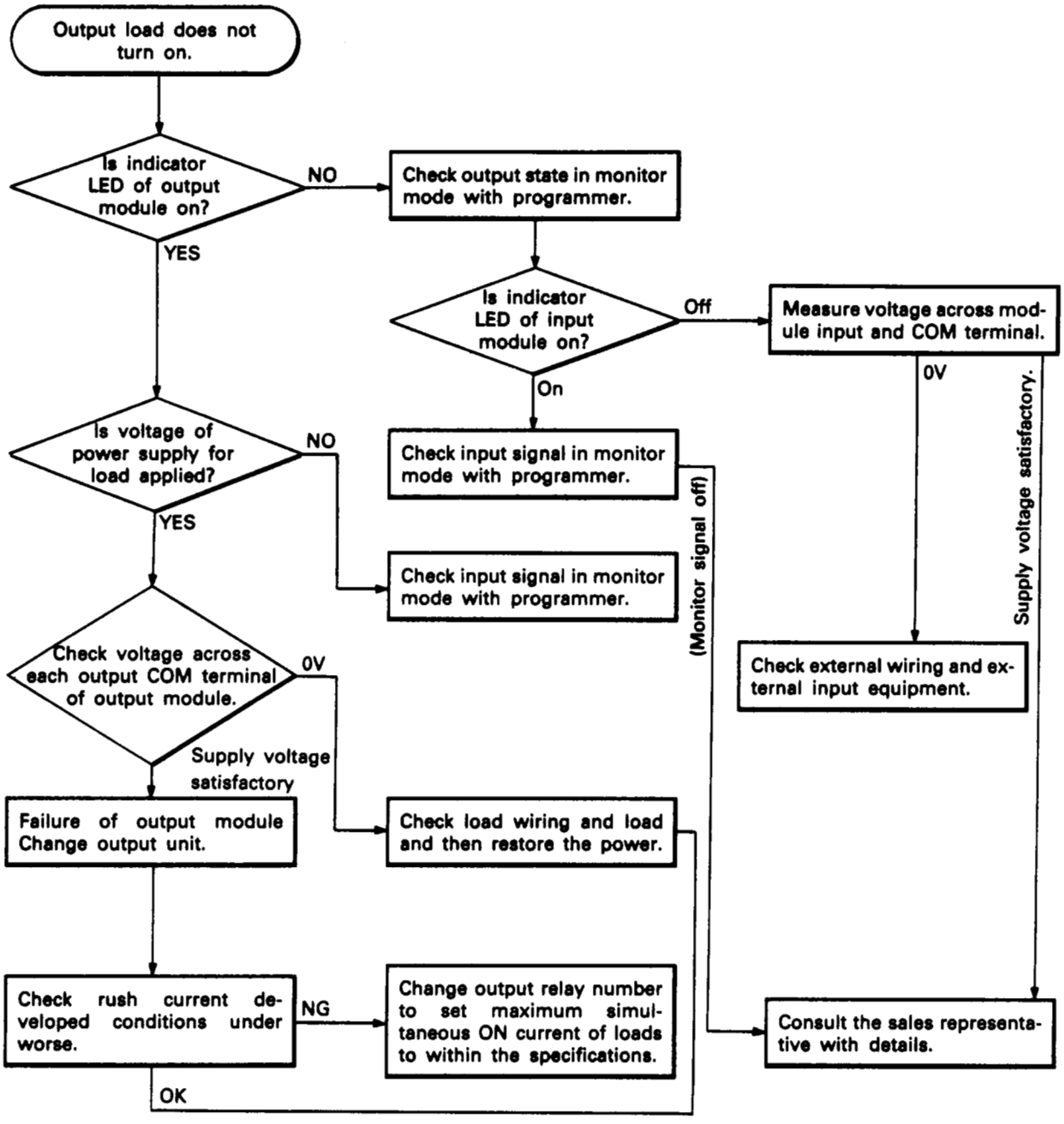
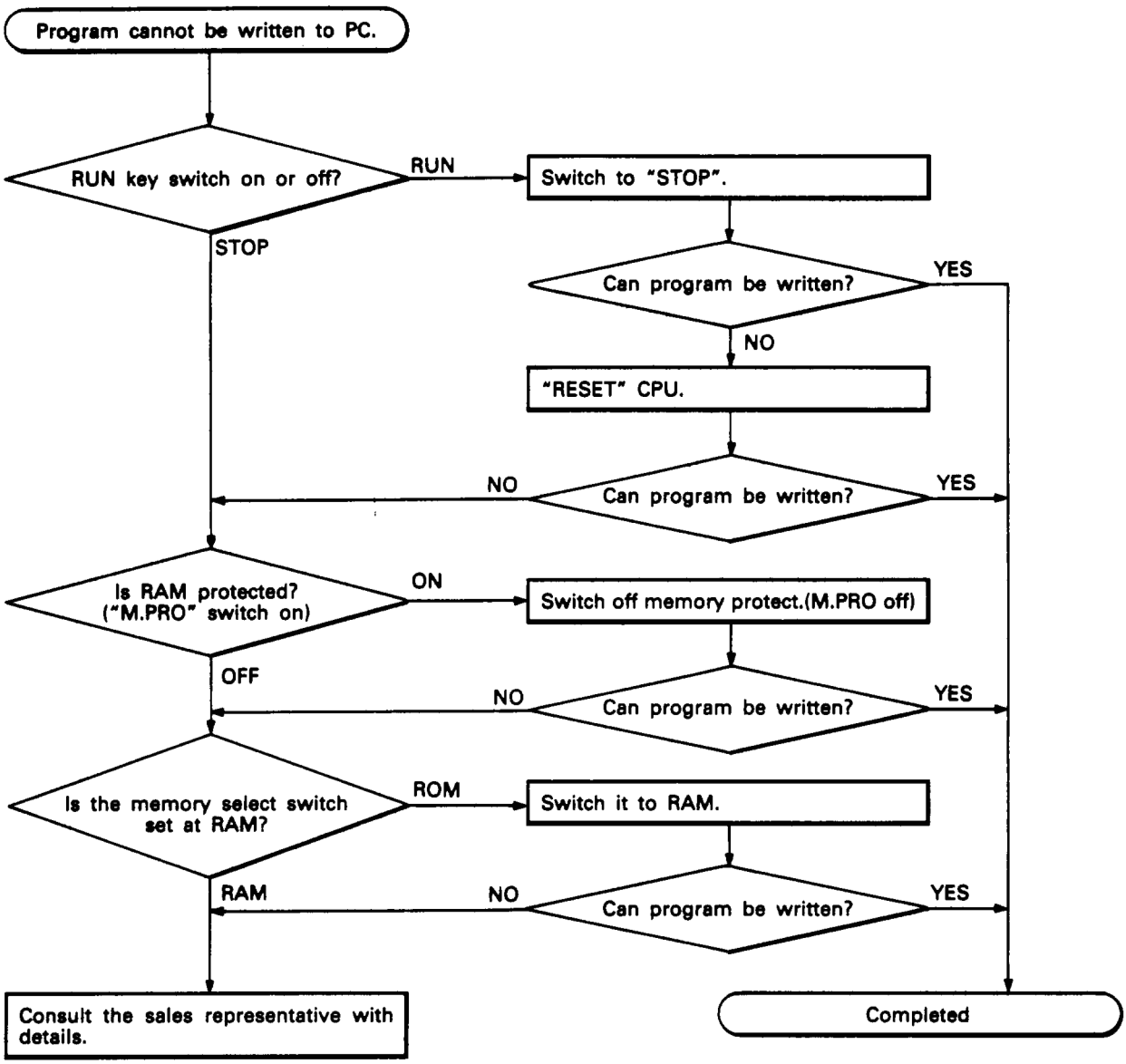
9.2.8 Flow chart used when output load of output module does not turn on



NOTE

If the input signal or load is not switched off, see Section 9.4.

9.2.9 Malfunction in program down load to PC



9.3 Error Code List

If an error occurs in the RUN mode, an error display or error code (including a step number) is stored in the special register by the self-diagnostic function. The error code reading procedure and the causes and corrective actions for errors are shown in Table 9.1.

9.3.1 Error code list

Error Message	Content of Special Register D9008 (BIN value)	CPU States	Error and Cause	Corrective Action
"INSTRCT. CODE ERR" (Checked during instruction execution)	10	Stop	Instruction code, which cannot be decoded by CPU, is included in the program. (1) ROM including invalid instruction code, has been loaded. (2) Memory contents have been corrected. (3) The PR and IRET instructions are used.	(1) Read the error step by use of peripheral device and correct the program at that step. (2) In the case of ROM, rewrite the contents of the ROM or change the ROM.
"PARAMETER ERROR" (Checked at power on, reset, STOP to RUN, PAUSE to RUN)	11	Stop	The parameter contents of CPU memory are changed due to noise or incorrect loading.	(1) Check the loading of CPU memory and load it correctly. (2) Read the parameter contents of CPU memory, check and correct the contents, and write them to the memory again.
"MISSING END INS." (Checked at M9056 or M9057 ON, STOP to RUN, PAUSE to RUN)	12	Stop	There is no END (FEND) instruction in the program.	Write END at the end of the program/subprogram.
"CAN'T EXECUTE (P)" (Checked at CJ, SCJ, JMP, CALL (P), FOR to NEXT execution, STOP to RUN, PAUSE to RUN)	13	Stop	(1) There is no jump destination or plural destinations specified by the CJ, SCJ, CALL, CALLP or JMP instruction. (2) Although there is no CALL instruction, the RET instruction exists in the program and has been executed. (3) The CJ, SCJ, CALL, CALLP or JMP instruction has been executed with its jump destination located below the END instruction. (4) The number of FOR instructions does not match that of NEXT instruction. (5) The JMP instruction specified between FOR to NEXT has caused execution to deviate from between FOR to NEXT. (6) The JMP instruction has caused execution to deviate from the subroutine before the RET instruction is executed. (7) The JMP instruction has caused execution to jump to a step or subroutine between FOR to NEXT.	Read the error step by use of peripheral device and correct the program at that step. (Make correction such as the insertion of jump destination or the changing of jump destinations to one.)

Table 9.1 Error Code List (Continue)

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Error Message	Content of Special Register D9008 (BIN value)	CPU States	Error and Cause	Corrective Action
"CHK FORMAT ERR" (Checked at STOP to RUN and PAUSE to RUN)	14	Stop	(1) There are instructions (including NOP) other than LDX, LDIX, ANDX and ANIX in the CHK instruction circuit block. (2) There is more than one CHK instruction. (3) The number of contact points in the CHK instruction circuit block exceeds 150. (4) The X device number in the CHK instruction circuit block exceeds X1FE. (5) There is not ⊣⊢ CJ ⊣ circuit block above the CHK instruction circuit block. (6) D1 device (number) of the CHK D1 D2 instruction is different from the contact device (number) above the CJ instruction. (7) Pointer P254 is not attached to the start of the CHK instruction circuit block. P254 ⊣⊢⊢⊢ CHK D1 D2	(1) Check the program of the CHK instruction circuit block for (1) to (6) in the left column. Correct errors using a peripheral device and start operation again.
"ROM ERROR" (Checked at power on and reset)	17	Stop	(1) Parameters and sequence programs are not correctly written to installed EP-ROM. (2) EP-ROM is destroyed.	Replace EP-ROM with another EP-ROM to which parameters and sequence programs are correctly written.
"MEMORY PROTECT ERROR" (Checked at power on and reset)	18	Stop	The MEMORY PROTECT switch is set in the ON position while operating the A2C system using ROM stored programs.	Set the MEMORY PROTECT switch in the OFF position.
"RAM ERROR" (Checked at power on, reset, M9084 ON during STOP)	20	Stop	The CPU has checked if write and read operations can be performed properly to the data memory area of CPU, and as a result, either or both has not been performed.	Since this is CPU hardware error, consult Mitsubishi representative.
"OPE. CIRCUIT ERR." (Checked at power on, reset)	21	Stop	The operation circuit, which performs the sequence processing in the CPU, does not operate properly.	
"WDT ERROR" (Checked at the execution of END instruction)	22	Stop	Scan time exceeds watch dog error monitor time. (1) Scan time of user program has become excessive. (2) Scan time has lengthened due to instantaneous power failure which occurred during scan.	(1) Calculate and check the scan time of user program and reduce the scan time by use of CJ instruction, etc. (2) Monitor the content of special registcr D9005 by use of peripheral equipment. When the content is other than 0, line voltage is insufficient. Therefore, check the power and eliminate the voltage fluctuation.

Table 9.1 Error Code List (Continue)

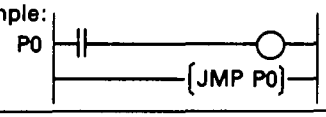
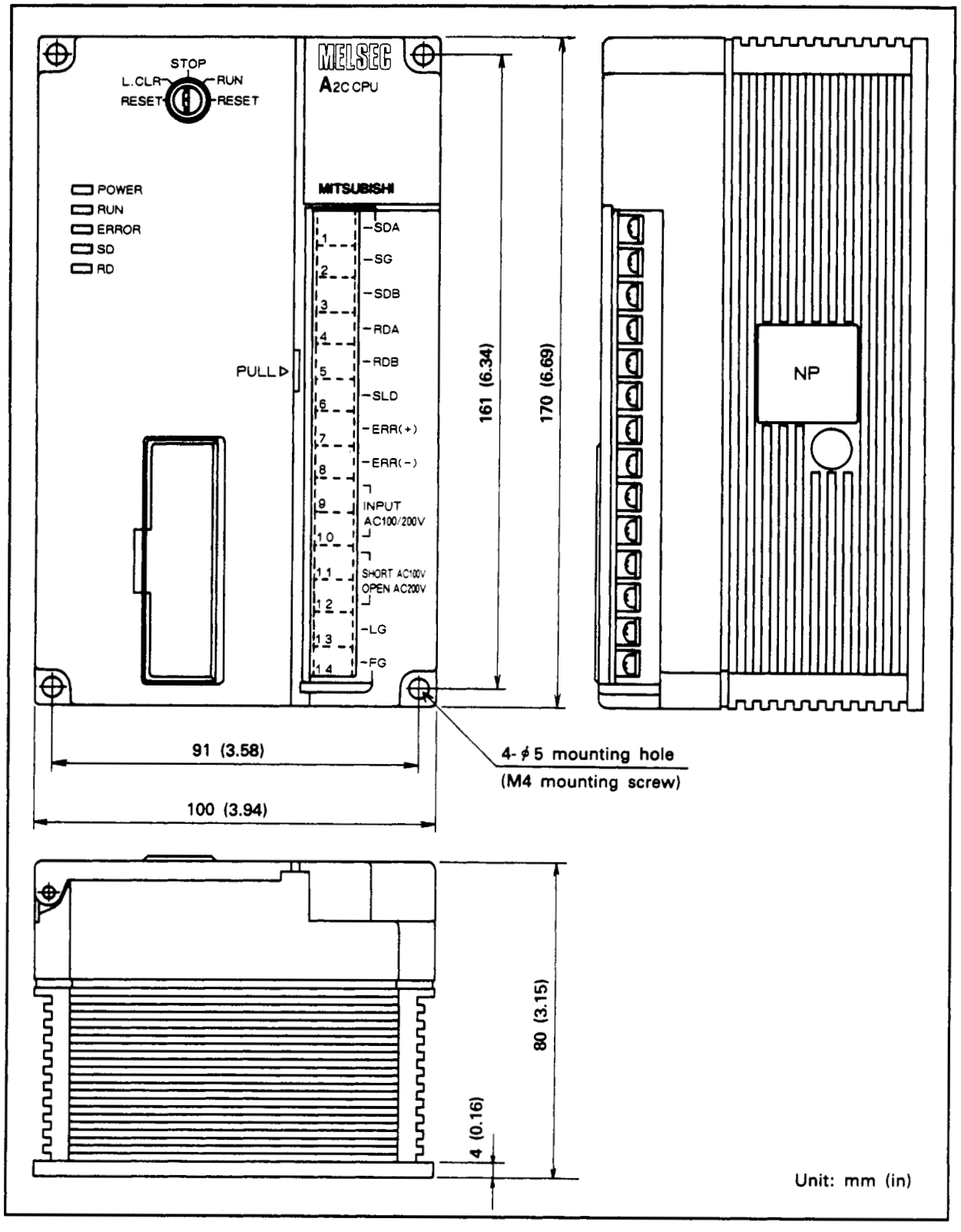
Error Message	Content of Special Register D9008 (BIN value)	CPU States	Error and Cause	Corrective Action
"END NOT EXECUTE" (Checked at the execution of END instruction)	24	Stop	(1) When the [END] instruction is executed, another instruction code has been read due to noise, etc. (2) The [END] instruction has changed to another instruction code for some reason.	Perform reset and run. If the same error is displayed again, it is the CPU hardware error. Therefore, consult Mitsubishi representative.
"WDT ERROR" (Checked continuously)	25	Stop	The CPU is executing an endless loop. example: 	Switch the CPU to STOP and reset it with the RUN key switch. Check the position of JMP, CJ and SCJ in the program and the pointer (P).
"SP. UNIT ERROR" (Checked at the execution of FROM and TO instructions)	46	Stop	The [FROM/TO] instructions were executed for the station (1 to 61) which was not designated by the initial setting.	(1) Perform initial setting of the stations which is designated by the [FROM/TO] instructions. (2) Change the station number designated by the [FROM/TO] instructions.
"OPERATION ERROR" (Checked at instruction execution)	50	Run (Stop)	(1) The result of BCD conversion has exceeded the specified range (9999 or 99999999). (2) Setting has been performed exceeding the specified device range and operation cannot be performed. (3) File registers are used in the program without performing the capacity setting of file registers. (4) Station designation of the [FROM/TO] instructions is 0 or over 62.	Read the error step by use of peripheral device, and check and correct the program at that step. • Device setting range • BCD conversion value • Parameter setting for file registers • Station number designated by the [FROM/TO] instructions
"BATTERY ERROR" (Checked continuously (Not checked when M9084 is on))	70	Run	(1) The battery voltage has reduced to less than the specified value. (2) The battery lead is disconnected.	(1) Change the battery. (2) When RAM or power failure compensation is used, connect the battery.

Table 9.1 Error Code List

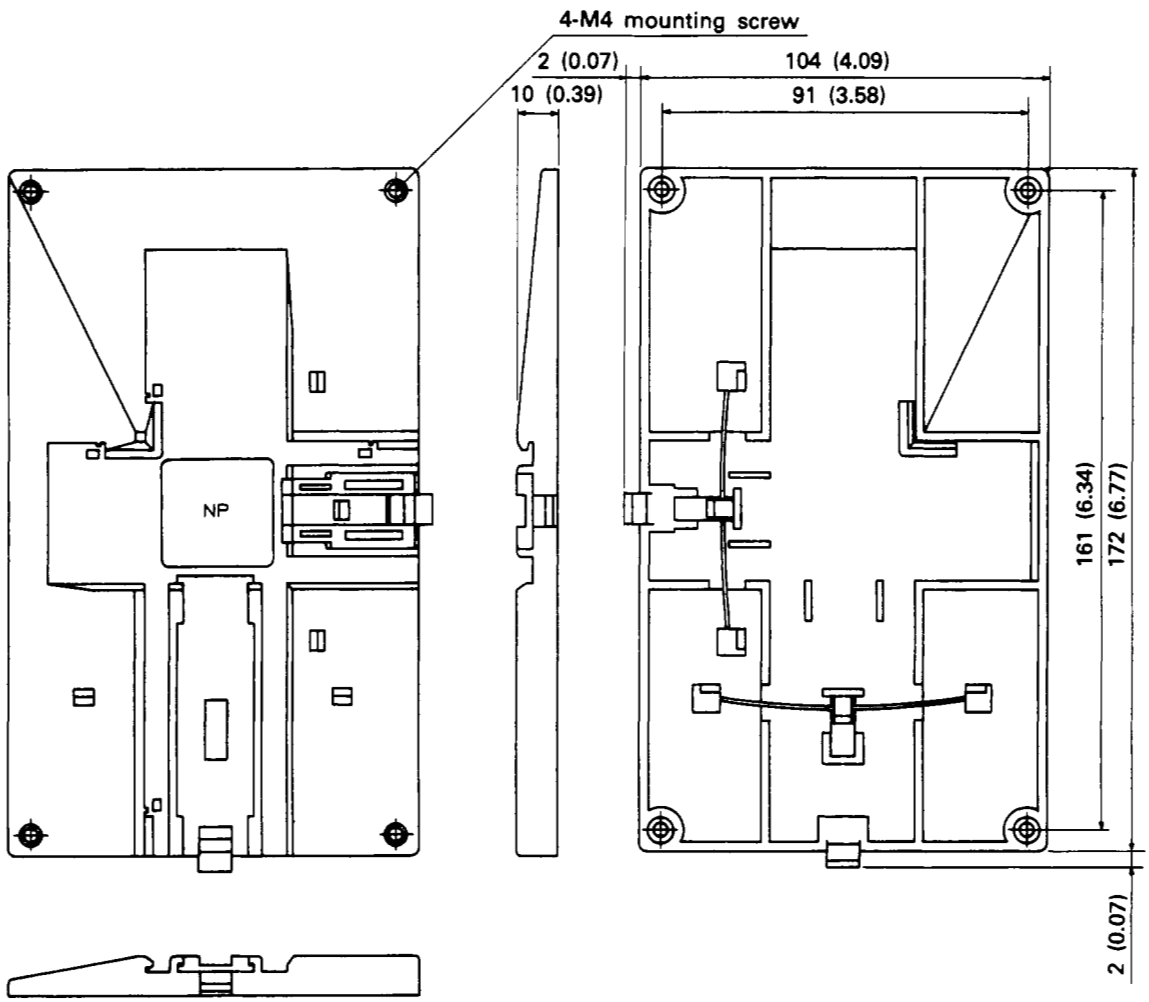
APPENDICES

Appendix 1 Outside Dimensions

1.1 CPU Module



1.2 A6DIN2C



Unit: mm (in)

Appendix 2 List of Special Relays

The special relays are internal relays used for specific purposes.

Table 2.1 shows the special relays and their functions.
Those special relays not marked with *1 or *2 cannot be switched ON or OFF.
(a) *1 Special relays: OFF only.
(b) *2 Special relays: ON/OFF is possible depending on purpose.

Check their purposes when used in the sequence program.

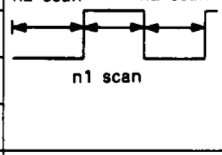
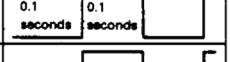
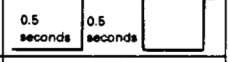
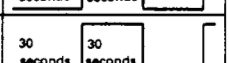
Number	Name	Description	Details	Related Special Registers
*1 M9000	Fuse blown	OFF: Normal ON: Presence of fuse blow module	•Turned on when there is one or more output modules of which fuse has been blown. Remains on if normal status is restored.	D9000 D9100 to D9107
*1 M9002	I/O module verify error	OFF: Normal ON: Presence of error	•Turned on if the status of I/O module is different from entered status when power is turned on. Remains on if normal status is restored.	D9001 D9116 to D9132
*1 M9005	AC DOWN detection	OFF: AC is good ON: AC is down	•Turned on if power failure of within 10 ms occurs. Reset when POWER switch is moved from OFF to ON position.	D9005
M9006	Battery low	OFF: Normal ON: Battery low	•Turned on when battery voltage reduces to less than specified. Turned off when battery voltage becomes normal.	D9006
*1 M9007	Battery low latch	OFF: Normal ON: Battery low	•Turned on when battery voltage reduces to less than specified. Remains on if battery voltage becomes normal.	D9007
*1 M9008	Self-diagnostic error	OFF: Absence of error ON: Presence of error	•Turned on when error is found as a result of self-diagnosis.	D9008
M9009	Annunciator detection	OFF: Absence of detection ON: Presence of detection	•Turned on when OUT F or SET F instruction is executed. Switched off when D9124 value is set to 0.	D9009 D9124 to D9132
M9010	Operation error flag	OFF: Absence of error ON: Presence of error	•Turned on when operation error occurs during execution of application instruction. Turned off when error is eliminated.	D9010
*1 M9011	Operation error flag	OFF: Absence of error ON: Presence of error	•Turned on when operation error occurs during execution of application instruction. Remains on if normal status is restored.	D9011
M9012	Carry flag	OFF: Carry off ON: Carry on	•Carry flag used in application instruction.	—
M9016	Data memory clear flag	OFF: No processing ON: Output clear	•Clears all data memory (except special relays and special registers) in remote run mode from computer, etc. when M9016 is 1.	—
M9017	Data memory clear flag	OFF: No processing ON: Output clear	•Clears all unlatched data memory (except special relays and special registers) in remote run mode from computer, etc. when M9017 is 1.	—
M9020	User timing clock No. 0		•Relay which repeats on/off at intervals of predetermined scan. •When power is turned on or reset is performed, the clock starts with off. •Set the intervals of on/off 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. 4			
M9030	0.1 second clock		•0.1 second, 0.2 second, 1 second, 2 second, and 1 minute clocks are generated. •Not turned on and off per scan but turned on and off even during scan if corresponding time has elapsed. •Starts when power is turned on or reset is performed.	—
M9031	0.2 second clock			
M9032	1 second clock			
M9033	2 second clock			
M9034	1 minute clock			

Table 2.1 List of Special Relay (Continue)

Number	Name	Description	Details	Related Special Registers
M9036	Normally ON	ON OFF	• Used as dummy contacts of initialization and application instruction in sequence program. • M9036 and M9037 are switched on/off independently of the CPU RUN/STOP switch position. M9038 and M9039 are switched on/off in accordance with the RUN/STOP switch position, i.e. switched off when the switch is set to STOP. When the switch is set to other than STOP, M9038 is only switched on during 1 scan and M9039 is only switched off during 1 scan.	—
M9037	Normally OFF	ON OFF		
M9038	On only for 1 scan after run	ON OFF 1 scan		
M9039	RUN flag (off only for 1 scan after run)	ON OFF 1 scan		
M9040	PAUSE enable coil	OFF: PAUSE disabled ON: PAUSE enabled	• When RUN key switch is at PAUSE position or remote pause contact has turned on and if M9040 is on, PAUSE mode is set and M9041 is turned on.	—
M9041	PAUSE status contact	OFF: During pause ON: Not during pause		
M9042	Stop status contact	OFF: During stop ON: Not during stop	• Switched on when the RUN/STOP switch is set to STOP.	—
M9043	Sampling trace completion	OFF: During sampling trace ON: Sampling trace completion	• Turned on upon completion of sampling trace performed the number of times preset by parameter after STRA instruction is executed. Reset when STRAR instruction is executed.	—
M9044	Sampling trace	0→1: Same as STRA execution 1→0: Same as STRAR execution	• Has the same functions as the STRA and STRAR instructions. (M9044 is forced to switch on/off by the peripheral device.) When switched on, M9044 provides the same function as the STRA instruction. When switched off, M9044 provides the same function as the STRAR instruction. At this time, the sampling trace condition is based on the value in D9044. (0 for scan, time for time (10 ms increments))	—
M9046	Sampling trace	OFF: Except during trace ON: During trace	• On during sampling trace.	—
*2 M9053	EI/DI instruction switching	OFF: Sequence interrupt control ON: Link interrupt control	• Switch on to execute the link refresh enable, disable (EI, DI) instructions.	—
M9055	Status latch completion flag	OFF: Uncompleted ON: Completed	• Turned on when status latch is completed. Turned off by reset instruction.	—
M9060	Remote terminal module fault detection	OFF: Normal ON: Fault	• Switched ON when one of remote terminal modules has become faulty. (Communication error is detected when normal communication is not restored after the number of retries set with D9174.) • Switched OFF when normal communication with all remote terminal modules is restored with automatic return enable. • Remains ON without automatic return. • If communication is stopped at fault detection, this is not switched ON/OFF.	D9180 to D9193 D9174
M9061	Communication error	OFF: Normal ON: Error	• Switched ON when communication with I/O modules or remote terminal modules has become abnormal. • Communication error is caused by the following. · Initial data error · Cable disconnection · Power OFF of I/O modules or remote terminal modules • Switched OFF when normal communication is restored with automatic return enable. • Remains ON when communication is suspended at abnormal detection without automatic return.	D9061
M9067	I/O module fault detection	OFF: Normal ON: Fault	• Switched ON when one of I/O modules has become faulty. (Communication error is detected when normal communication is not restored after the number of retries set with D9174.) • Switched OFF when normal communication with all I/O module is restored with automatic return enable. • Remains ON without automatic return. • If communication is stopped at fault detection, this is not switched ON/OFF.	D9174 D9196 to D9199
M9069	Processing at communication error	OFF: All outputs are turned off. ON: Normal output	• For setting OFF/ON of all outputs at an occurrence of communication error. · OFF: All outputs are turned OFF at communication error. · ON: Output status at an occurrence of communication error is retained.	—
M9081	Communication request to remote terminal modules	OFF: Communication request to remote terminal modules enabled. ON: Communication request to remote terminal modules disabled.	• For determining enable/disable of communication request to remote terminal modules using the FROM/TO instructions.	—

Table 2.1 List of Special Relay (Continue)

Number	Name	Description	Details	Related Special Registers
M9082	Final station number unmatched	OFF: Final station number matched. ON: Final station number unmatched.	• Switched ON when the final station number of remote I/O modules or remote terminal modules connected to the A2C is different from the total number of stations of initial setting. • Switched OFF when the final station number is same as the total number of stations when the operation status is switched from STOP to RUN.	D9082
M9090	ERR terminal output	OFF: ERR terminals OFF ON: ERR terminals ON	• Turned ON at MINI-S3 link errors or sequence program errors (at operation stop) • Turned OFF when the MINI-S3 link or sequence program is restored to normal	—
*2 M9089	ERR terminal output	OFF: ERR terminals OFF ON: ERR terminals ON	• Turned on when output from the ERR terminals is executed by the sequence progrdm. • Turned OFF when both M9089 and M9090 are OFF.	—

Table 2.1 List of Special Relay

Appendix 3 List of Special Registers

The special registers are used for specific purposes in the A2C.

Table 3.1 shows the special registers and their purposes.
It is impossible to write data to those special registers not marked with *1 or *2. (Read only)
(a) *1 Special registers: Reset (0) only.
(b) *2 Special relays: Data can be written.

Check their purposes when used in the sequence program.

Number	Name	Stored Data	Explanation	Related Special Relays	Related Special Registers
D9000	Fuse blown	Fuse blow module number	•When fuse flow modules are detected, the lowest number of detected units is stored in hexadecimal. (Example: When fuses of Y50 to 6F output modules have blown, "50" is stored in hexadecimal) The module number monitored by the peripheral is hexadecimal. (Cleared when all contents of D9100 to D9107 are reset to 0.)	M9000	D9100 to D9107
D9002	I/O unit verify error	I/O module verify error module number	•If I/O module data is different from data entered are detected when the power is turned on, the first I/O number of the lowest number module among the detected modules stored in hexadecimal. (Storing method is the same as that of D9000.) The module number monitored by the peripheral is hexadecimal. (Cleared when all contents of D9116 of D9123 are reset to 0.)	M9001	D9116 to D9123
*1 D9005	AC DOWN counter	AC DOWN time count	•1 is added each time input voltage becomes 80% or less of rating while the CPU unit is performing operation, and the value is stored in BIN code.	M9005	—
*1 D9008	Self-diagnostic error	Self-diagnostic error number	• When error is found as a result of self-diagnosis, error number is stored in BIN code.	M9008	—
D9009	Annunciator detection	F number at which external failure has occurred	•When one of F0 to 255 is turned on by [OUT F] or [SET F], the F number, which has been detected earliest among the F numbers which have turned on, is stored in BIN code. •D9009 can be cleared by [RST F] or [LEDR] instruction. If another F number has been detected, the clearing of D9009 causes the next number to be stored in D9009.	M9009	D9124 to D9132
D9010	Error step	Step number at which operation error has occurred	• When operation error has occurred during execution of application instruction, the step number, at which the error has occurred, is stored in BIN code. Thereafter, each time operation error occurs, the contents of D9010 are renewed.	M9010	—
D9011	Error step	Step number at which operation error has occurred	•When operation error has occurred during execution of application instruction, the step number, at which the error has occurred, is stored in BIN code. Since storage into D9011 is made when M9011 changes from off to on, the contents of D9010 cannot be renewed unless M9011 is cleared by user program.	M9011	—
D9014	I/O control mode	I/O control mode number	•The set mode is represented as follows: 0 = I/O in direct mode 1 = Input in refresh mode, output in direct mode 3 = I/O in refresh mode	—	—

Table 3.1 List of Special Registers (Continue)

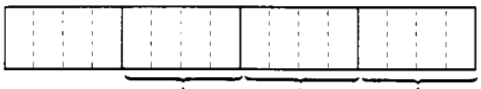
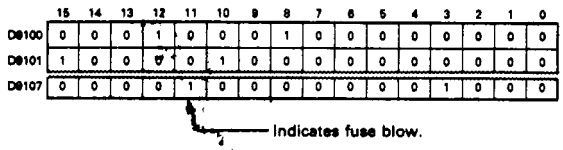
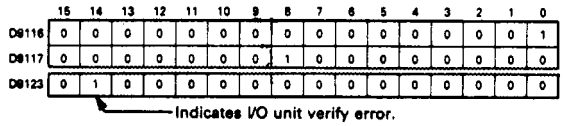
<table>
<tr><th>Number</th><th>Name</th><th>Stored Data</th><th>Explanation</th><th>Related Special Relays</th><th>Related Special Registers</th></tr>
<tr><td>D9015</td><td>CPU operating states</td><td>Operating states of CPU</td><td>• The operating states of CPU as shown below are stored in D9015.
B15 ····· B12 B11 ····· B8 B7 ····· B4 B3 ····· B0
 
CPU RUN/STOP switch: Remains unchanged in remote run/stop mode.
0 RUN
1 STOP
Remote RUN/STOP by parameter setting
0 RUN
1 STOP
2 PAUSE*1
Status in program
0 Except below
1 STOP instruction execution
*1 When the CPU is in RUN mode and M9040 is off, the CPU remains in RUN mode if changed to PAUSE mode.</td><td>—</td><td>—</td></tr>
<tr><td>D9016</td><td>Program number</td><td>0: Main program (ROM)
1: Main program (RAM)</td><td>• Indicates which sequence program is urn presently. One value of 0 to 1 is stored in BIN code.</td><td>—</td><td>—</td></tr>
<tr><td>D9017</td><td>Scan time</td><td>Minimum scan time (per 10 ms)</td><td>• If scan time is smaller than the content of D9017, the value is newly stored at each END. Namely, the minimum value of scan time is stored into D9017 in BIN code.</td><td rowspan="3">—</td><td rowspan="3">—</td></tr>
<tr><td>D9018</td><td>Scan time</td><td>Scan time (per 10 ms)</td><td>• Scan time is stored in BIN code at each END and always rewritten.</td></tr>
<tr><td>D9019</td><td>Scan time</td><td>Maximum scan time (per 10 ms)</td><td>• If scan time is larger than the content of D9019, the value is newly stored at each END. Namely, the maximum value of scan time is stored into D9019 in BIN code.</td></tr>
<tr><td>*2
D9020</td><td>Constant scan</td><td>Constant scan time (User specified in 10 ms increments)</td><td>• Sets user program execution intervals in 10 ms increments.
0: Constant scan function unused
1 to 490: Constant scan function used, program executed at intervals of (set value) × 10 ms.</td><td>—</td><td>—</td></tr>
</table>

Table 3.1 List of Special Registers (Continue)

Number	Name	Stored Data	Explanation	Related Special Relays	Related Special Registers
D9021 to D9034	Remote terminal module station number	1 to 61	• Set the head station number (1 to 61) of remote terminal modules connected to the A2C. Order of setting may not be in order of station numbers. • Data structure D9021: Remote terminal module No. 1 area D9022: Remote terminal module No. 2 area D9033: Remote terminal module No. 13 area D9034: Remote terminal module No. 14 area	—	D9180 to D9193
D9035	Remote terminal module attribute	0: MINI standard protocol 1: No protocol	• Set type of remote terminal module connected to the A2C with 0/1 for each bit. 0: MINI standard protocol 1: No protocol See Section 2.1.2 for details. • Data structure b15 b14 b13 b12 b11 b10 b9 b8 b7 b6 b5 b4 b3 b2 b1 b0 D9035: 0/1 0/1 0/1 0/1 0/1 0/1 0/1 0/1 0/1 0/1 0/1 0/1 0/1 0/1 Remote terminal No. 1 Remote terminal No. 2 Remote terminal No. 3 Remote terminal No. 13 Remote terminal No. 14	—	—
D9036	Total number of stations	1 to 64	• Set the total number of stations (1 to 64) of I/O modules and remote terminal modules connected to the A2C. • Default is 64.	—	—
D9038	LED indication priority	Priority 1 to 4	• Set priority of "ERROR" LED lighting (or flickering) for error indication with error code numbers. • Priority setting areas are as follows. Priority 4 b15 to b12: Priority 4 b11 to b8: Priority 3 b7 to b4: Priority 2 b3 to b0: Priority 1 D9038 D9039 Priority 5 • See Section 4.2.8 for details.	—	—
D9039		Priority 5			
*1 D9056 to D9059	Faulty station detection	0: Normal 1: Communication fault	• Bits which correspond to I/O modules and remote terminal modules which caused communication fault are set at 1 (set). (Bits which correspond to faulty stations are set at 1 if communication cannot be restored to normal after the number of retries set at D9174.) • Retained at ON after fanlty stations have returned to normal. • Data structure Adress b15 b14 b13 b12 b11 b10 b9 b8 b7 b6 b5 b4 b3 b2 b1 b0 D9196: Station 16 Station 15 Station 14 Station 13 Station 12 Station 11 Station 10 Station 9 Station 8 Station 7 Station 6 Station 5 Station 4 Station 3 Station 2 Station 1 D9197: Station 32 Station 31 Station 30 Station 29 Station 28 Station 27 Station 26 Station 25 Station 24 Station 23 Station 22 Station 21 Station 20 Station 19 Station 18 Station 17 D9198: Station 48 Station 47 Station 46 Station 45 Station 44 Station 43 Station 42 Station 41 Station 40 Station 39 Station 38 Station 37 Station 36 Station 35 Station 34 Station 33 D9199: Station 64 Station 63 Station 62 Station 61 Station 60 Station 59 Station 58 Station 57 Station 56 Station 55 Station 54 Station 53 Station 52 Station 51 Station 50 Station 49 • Corresponding bit is set at 1 (set) after fuse blow of a remote I/O module is detected.	M9067	D9174 D9196 to D9199
*1 D9061	Communication error	0: Normal 1: Initial data error 2: Line fault	• Error code number is stored when M9061 is set (communication with an I/O module or remote terminal module is impossible). • 1: Initial program contains an error. (The total number of stations of I/O modules and remote terminal modules, or the number of retries is incorrect.) • 2: Cable is broken, or an I/O module or remote terminal module is turned off.	M9061	—

Table 3.1 List of Special Registers (Continue)

<table>
<tr><th>Number</th><th>Name</th><th>Stored Data</th><th>Explanation</th><th>Related Special Relays</th><th>Related Special Registers</th></tr>
<tr><td>D9081</td><td>Number of requests for communication with remote terminal modules</td><td>0 to 32</td><td>• The number of requests for communication with remote terminal modules made with the FROM/TO instructions is stored.
• The number of requests decreases by 1 every time the communication with remote terminal modules is completed.</td><td>M9081</td><td>——</td></tr>
<tr><td>D9082</td><td>Final connection station number</td><td>Final connection station number</td><td>The final station number of remote I/O modules or remote terminal modules connected to the A2C is stored.</td><td>M9082</td><td>——</td></tr>
<tr><td>*1D9100
*1D9101
*1D9102
*1D9103
*1D9104
*1D9105
*1D9106
*1D9107</td><td>Fuse blown module</td><td>Bit pattern in modules of 16 points of fuse blow modules</td><td>• Output module numbers (in units of 16 points), of which fuses have blown, are entered in bit pattern. (Preset output number when parameter setting has been performed.)
 

(If normal status is restored, clear is not performed. Therefore, it is required to perform clear by user program.)</td><td>M9000</td><td>D9000</td></tr>
<tr><td>*1D9116
*1D9117
*1D9118
*1D9119
*1D9120
*1D9121
*1D9122
*1D9123</td><td>I/O module verify error</td><td>Bit pattern in modules of 16 points of verify error modules</td><td>• When I/O module data is different from those entered at power-on have been detected, the I/O module numbers (in units of 16 points) are entered in bit pattern. (Preset I/O module numbers when parameter setting has been performed.)
 

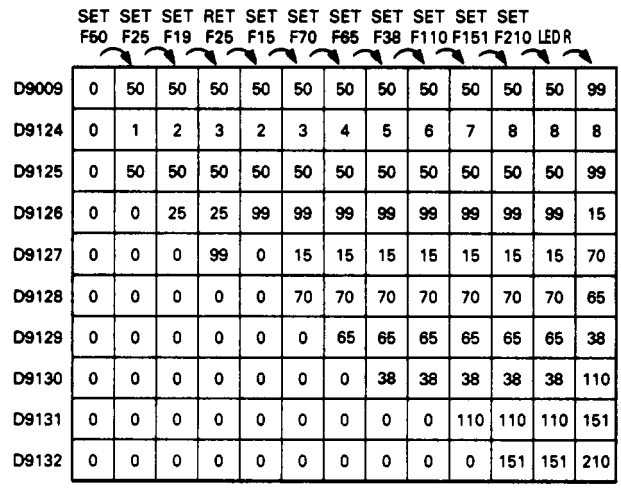
(If normal status is restored, clear is not performed. Therefore, it is required to perform clear by user program.)</td><td>M9001</td><td>D9001</td></tr>
<tr><td>D9124</td><td>Annunciator detection quantity</td><td>Annunciator detection quantity</td><td>• When one of F0 to 255 is turned on by OUT F or SET F, 1 is added to the contents of D9124. When RST F or LED R instruction is executed, 1 is subtracted from the contents of D9124. (For A3NCPU, it can be performed by use of INDICATOR RESET switch on front face of CPU module.)
• Quantity, which has been turned on by OUT F or SET F is stored into D9124 in BIN code. The value of D9124 is maximum 8.</td><td>M9009</td><td>D9009</td></tr>
<tr><td>D9125
D9126
D9127
D9128
D9129
D9130
D9131
D9132</td><td>Annunciator detection number</td><td>Annunciator detection number</td><td>• When one of F0 to 255 is turned on by OUT F or SET F, F number, which has turned on, is entered into D9125 to D9132 in due order in BIN code.
• F number, which has been turned off by RST F, is erased from D9125 to D9132, and the contents of data registers succeeding the data register, where the erased F number was stored, are shifted to the preceding data registers.
• By executing LED R instruction, the contents of D9125 to D9132 are shifted upward by one. (For A3NCPU, it can be performed by use of INDICATOR RESET switch on front of CPU unit.)
• When there are 8 annunciator detections, the 9th one is not stored into D9125 to 9132 even if detected.
 
</td><td>M9009</td><td>D9009</td></tr>
</table>

Table 3.1 List of Special Registers (Continue)

<table>
<tr><th>Number</th><th>Name</th><th>Stored Data</th><th>Explanation</th><th>Related Special Relays</th><th>Related Special Registers</th></tr>
<tr><td>D9133
to
D9140</td><td>I/O module and remote terminal module information</td><td>00: Absence of remote modules Initial communication disabled
01: Input module or remote terminal module
10: Output module
11: Remote terminal</td><td>• Information of I/O modules and remote terminal modules connected to the A2C is stored corresponding to station number.
• Information of I/O modules and remote terminal modules is for input, output and remote terminal module identification and expressed in 2 bits.
• 00: Absence of I/O modules or remote terminal modules, or initial communication is disabled.
• 01: Input module or remote terminal module
• 10: Output module
• 11: Remote terminal
• Data structure
b15 b14 b13 b12 b11 b10 b9 b8 b7 b6 b5 b4 b3 b2 b1 b0
D9133: Station 8 | Station 7 | Station 6 | Station 5 | Station 4 | Station 3 | Station 2 | Station 1
Station 16 | Station 15 | Station 14 | Station 13 | Station 12 | Station 11 | Station 10 | Station 9
to
Station 24 | Station 23 | Station 22 | Station 21 | Station 20 | Station 19 | Station 18 | Station 17
Station 56 | Station 55 | Station 54 | Station 53 | Station 52 | Station 51 | Station 50 | Station 49
D9140: Station 64 | Station 63 | Station 62 | Station 61 | Station 60 | Station 59 | Station 58 | Station 57</td><td>—</td><td>—</td></tr>
<tr><td>D9141
to
D9172</td><td>Retry counter</td><td>Number of retries</td><td>• The number of times of retry performed to the I/O module or remote terminal module which caused communication error is stored. (Retry is performed the number of times set in D9174.)
• When normal communication is restored, the count number becomes 0.
• Station numbers of I/O modules and remote terminal modules are as follows.
b15 to b8 | b7 to b0
D9141: Station 2 | Station 1
D9142: Station 4 | Station 3
Station 6 | Station 5
D9171: Station 62 | Station 61
D9172: Station 64 | Station 63
• The retry counter for one station consists of 8 bits.
b(n+7) b(n+6) b(n+5) b(n+4) b(n+3) b(n+2) b(n+1) b(n+0)
0/1: 0: Normal, 1: Error | Number of times
* "n" is determined by the station number of I/O modules and remote terminal modules.
1, 3, 5, 7,……61, 63 odd stations: b0 to b7 (n = 0)
2, 4, 6, 8,……62, 64 even stations: b8 to b15 (n = 8)</td><td>—</td><td>D9174</td></tr>
<tr><td>D9173</td><td>Mode setting</td><td>0: With automatic online return
1: Without automatic online return
2: Communication stop at online error
3: Line check</td><td><table><tr><th>Mode setting</th><th>Processing</th></tr><tr><td>0: With automatic online return</td><td>• Faulty stations (I/O modules and remote terminal modules) are disconnected from the link. Communication with normal stations continues.
• When faulty stations have returned to normal, communication restarts automatically.</td></tr><tr><td>1: Without automatic online return</td><td>• Faulty stations (I/O modules and remote terminal modules) are disconnected from the link. Communication with normal stations continues.
• When faulty stations have returned to normal, communication can be resumed by rebooting.</td></tr><tr><td>2: Communication stop at online error</td><td>• When one of I/O modules and remote terminal modules has become faulty, communication with all stations stops.
• When the faulty station has returned to normal, communication can be resumed by rebooting.</td></tr></table></td><td>—</td><td>—</td></tr>
</table>

Table 3.1 List of Special Registers (Continue)

<table>
<tr><th>Number</th><th>Name</th><th>Stored Data</th><th>Explanation</th><th>Related Special Relays</th><th>Related Special Registers</th></tr>
<tr><td>D9174</td><td>Retry count setting</td><td>Number of retries</td><td>• Set the number of retries to be executed with an I/O module or remote terminal module if communication is faulty.
• Default: 5
• Setting range: 0 to 32
• If communication with any I/O modules or remote terminal modules cannot be executed correctly within the preset number of times of retry, a communication error occurs.</td><td>—</td><td>D9175
D9196
to
D9199</td></tr>
<tr><td>D9175</td><td>Line error retry counter</td><td>Number of retries</td><td>• The number of retries is stored when line error (time over) has occurred.
• When the line has returned to normal and communication with I/O modules and remote terminal modules has resumed, the count number is reset to 0.</td><td>M9061</td><td>D9174</td></tr>
<tr><td>D9180
to
D9193</td><td>Remote terminal module error code number</td><td>0: Normal</td><td>• The error code number of faulty remote terminal module is stored when M9060 is switched on.
• The storage areas for remote terminal module error code numbers are as shown below.
D9180 Remote terminal module No.1
D9181 Remote terminal module No.2
D9182 Remote terminal module No.3
D9192 Remote terminal module No.13
D9193 Remote terminal module No.14
Station numbers for remote terminal modules No.1 to 14 are set with D9021 to D9034.
• Error code is cleared in the following cases.
· When the RUN key switch is moved from STOP to RUN. (D9180 to D9183 are all cleared.)
· When Yn4 of each remote terminal module is switched from OFF to ON.</td><td>M9060</td><td>D9021
to
D9034</td></tr>
<tr><td>D9196
to
D9199</td><td>Faulty station detection</td><td>0: Normal
1: Communication fault</td><td>• Set the bit which corresponds to the faulty station at "1". (The bit which corresponds with the faulty station becomes "1" when normal communication cannot be restored within preset number of retries set with D9174.)
• With automatic return enabled, such corresponding bit is reset to "0" when normal communication is restored.
• Data structure
Adress b15 b14 b13 b12 b11 b10 b9 b8 b7 b6 b5 b4 b3 b2 b1 b0
D9196 Station 16 Station 15 Station 14 Station 13 Station 12 Station 11 Station 10 Station 9 Station 8 Station 7 Station 6 Station 5 Station 4 Station 3 Station 2 Station 1
D9197 Station 32 Station 31 Station 30 Station 29 Station 28 Station 27 Station 26 Station 25 Station 24 Station 23 Station 22 Station 21 Station 20 Station 19 Station 18 Station 17
D9198 Station 48 Station 47 Station 46 Station 45 Station 44 Station 43 Station 42 Station 41 Station 40 Station 39 Station 38 Station 37 Station 36 Station 35 Station 34 Station 33
D9199 Station 64 Station 63 Station 62 Station 61 Station 60 Station 59 Station 58 Station 57 Station 56 Station 55 Station 54 Station 53 Station 52 Station 51 Station 50 Station 49
• At the remote I/O module fuse blow detection, its corresponding bit is set at "1".</td><td>M9067</td><td>D9174</td></tr>
</table>

Table 3.1 List of Special Registers

Appendix 4 Instructions for Use with Peripheral Devices

This section gives the instructions for use of the A6GPP, A6PHP, A6HGP, A7PU, and A6WU modules with the A2C.

4.1 A6GPP

The system disk for the A2C is SW4GP-GPPA.
If SW3GP-GPPA or other system disks of former versions is used, follow the instructions described below.

(1) CPU type
On the A6GPP booted with the SW3GP-GPPA disk, set the CPU type as "A2".

(2) Program capacity
The A2C has 8K steps of capacity for sequence programs and microcomputer programs.
By parameter setting, program capacity less than 8K steps should be set.

(3) Number of I/O points
The A2C has 512 input and output points from X/Y0 to X/Y1FF.

(4) Interrupt programs and interrupt counters are unusable.
On the A2C, interrupt programs (I to IRET) cannot be executed. Do not set interrupt counters using parameters. Counters set for interrupt counters cannot execute count processing with main routine programs and subroutine programs.

(5) Unusable devices
Since the A2C does not execute interrupt programs, I (interrupt pointer) is not usable.

(6) Unusable instructions
The following instructions are not usable on the A2C.
(a) PR (ASCII print instruction)

(b) EI/DI (Interrupt program enable/disable)

(c) IRET (Interrupt program return)

(7) Remote terminal setting
Remote terminal setting of the A2C is executed with the initial program of the sequence program. (See Section 4.2.9 for details of the initial program.)

(8) Writing to EP-ROM impossible
It is impossible to prepare the ROM for ROM operation in the ROM mode.
It is possible to prepare two ROMs (even numbered addresses and odd numbered addresses) for storage.

4.2 A6PHP

The system disk for use with the A2C is SW4GP-GPPA.
If the SW3GP-GPPA system disk is used for booting, follow the instructions described below.

(1) CPU type
On the A6PHP booted with the SW3GP-GPPA disk, set the CPU type as "A2".

(2) Program capacity
The A2C has 8K steps of capacity for sequence programs and microcomputer programs.
By parameter setting, program capacity less than 8K steps should be set.

(3) Number of I/O points
The A2C has 512 input and output points from X/Y0 to X/Y1FF.

(4) Interrupt programs and interrupt counters are unusable.
On the A2C, interrupt programs (I to IRET) cannot be executed. Do not set interrupt counters using parameters. Counters set for interrupt counters cannot execute count processing with main routine programs and subroutine programs.

(5) Unusable devices
Since the A2C does not execute interrupt programs, I (interrupt pointer) is not usable.

(6) Unusable instructions
The following instructions are not usable on the A2C.
(a) PR (ASCII print instruction)

(b) EI/DI (Interrupt program allow/disallow)

(c) IRET (Interrupt program return)

(7) Remote terminal setting
Remote terminal setting of the A2C is executed with the initial program of the sequence program. (See Section 4.2.9 for details of the initial program.)

(8) Writing to EP-ROM impossible
It is impossible to prepare the ROM for ROM operation using the A6WU (in the ROM mode).
It is possible to prepare two ROMs (even numbered addresses and odd numbered addresses) for storage.

4.3 A6HGP

The system disk of current version is used for use with the A2C. Follow the instructions described below.

(1) CPU type
On the A6HGP booted with the SW3-HGPA disk, set the CPU type as "A2".

(2) Program capacity
The A2C has 8K steps of capacity for sequence programs and microcomputer programs.
By parameter setting, program capacity less than 8K steps should be set.

(3) Number of I/O points
The A2C has 512 input and output points from X/Y0 to X/Y1FF.

(4) Interrupt programs and interrupt counters are unusable.
On the A2C, interrupt programs (I to IRET) cannot be executed.

(5) Unusable devices
Since the A2C does not execute interrupt programs, I (interrupt pointer) is not usable.
Do not set interrupt counters using parameters. Counters set for interrupt counters cannot execute count processing with main routine programs and subroutine programs.

(6) Unusable instructions
The following instructions are not usable on the A2C.
(a) PR (ASCII print instruction)

(b) EI/DI (Interrupt program allow/disallow)

(c) IRET (Interrupt program return)

(7) Remote terminal setting
Remote terminal setting of the A2C is executed with the initial program of the sequence program. (See Section 4.2.9 for details of the initial program.)

(8) Writing to EP-ROM impossible
It is impossible to prepare the ROM for ROM operation using the A6WU (in the ROM mode).
It is possible to prepare two ROMs (even numbered addresses and odd numbered addresses) for storage.

4.4 A6PU/A7PU

The system disk of current version is used for use with the A2C.

(1) CPU type
When the A6PU/A7PU is connected, the CPU type is set as "A2".

(2) Program capacity
The A2C has 8K steps of capacity for sequence programs and microcomputer programs.
By parameter setting, program capacity less than 8K steps should be set.

(3) Number of I/O points
The A2C has 512 input and output points from X/Y0 to X/Y1FF.

(4) Interrupt programs and interrupt counters are unusable.
On the A2C, interrupt programs (I to IRET) cannot be executed.

(5) Unusable devices
Since the A2C does not execute interrupt programs, I (interrupt pointer) is not usable.
Do not set interrupt counters using parameters. Counters set for interrupt counters cannot execute count processing with main routine programs and subroutine programs.

(6) Unusable instructions
The following instructions are not usable on the A2C.
(a) PR (ASCII print instruction)

(b) EI/DI (Interrupt program allow/disallow)

(c) IRET (Interrupt program return)

(7) Remote terminal setting
Remote terminal setting of the A2C is executed with the initial program of the sequence program. (See Section 4.2.9 for details of the initial program.)

(8) Connection to the A2C
The A6PU/A7PU can be connected to the A2C only by the hand held system. (The add-on system cannot be used.)

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4.5 A6WU

Versions "E" and later are applicable to use with the A2C. Versions "D" and former cannot prepare the ROM (for ROM operation) for use with the A2C. It is possible to prepare two, even and odd ROMs for storage.

(1) Connection to the A2C
The A6WU can be connected to the A2C only by the hand held system. (The add-on system cannot be used.)

(2) When connected to the A6PHP
To prepare the ROM (for ROM operation) for use with the A2C by connecting to the A6PHP, the two conditions mentioned below must be satisfied.
(a) Boot the A6PHP with the SW4GP-GPPA system.

(b) Use the A6WU of version "E" or later.

Even though these two conditions are not satisfied, it is possible to prepare two (even numbered addresses and odd numbered addresses) for storage.

(3) When connected to the A6HGP
Since the A6HGP is not adapted to use with the A2C, it is impossible to prepare the ROM (for ROM operation) for use with the A2C. It is possible to prepare two (even numbered addresses and odd numbered addresses) for storage.

Appendix 5 Cautions on Editing Programs

This section gives matters to be attended in editing the sequence programs stored in the A2C.

(1) Program reading
Read the programs stored in the A2C in combination of "parameters + main program" using the GPP/PHP/HGP.

(2) Editing with the GPP/PHP booted with the SW4GP-GPPA
Sequence programs written with the SW3GP-GPP/SW3-HGPA or former system disk can be edited.
If a sequence program written with the SW3GP-GPPA/SW3-HGPA or former system disk is edited with the SW4GP-GPP, parameters remain unchanged from those set with the SW3GP-GPPA/SW3-HGPA or former system disk.
To change the initial setting from sequence program setting to parameter setting, use the remote terminal setting with parameters.

(3) Editing with the GPP/PHP/HGP booted with the SW3GP-GPPA/SW3-HGPA or former system disk
Sequence programs written with the SW4GP-GPPA system disk can be edited.
It is impossible to change remote terminal setting with parameters.
To change remote terminal setting, follow the procedures below.
(a) Clear all parameters to defaults.

(b) Set parameters other than defaults.

(c) Add the initial setting program to the sequence program.

IMPORTANT

The components on the printed circuit boards will be damaged by static electricity, so avoid handling them directly. If it is necessary to handle them take the following precautions.

(1) Ground human body and work bench.

(2) Do not touch the conductive areas of the printed circuit board and its electrical parts with any non-grounded tools etc.

Under no circumstances will Mitsubishi Electric be liable or responsible for any consequential damage that may arise as a result of the installation or use of this equipment.

All examples and diagrams shown in this manual are intended only as an aid to understanding the text, not to guarantee operation. Mitsubishi Electric will accept no responsibility for actual use of the product based on these illustrative examples.

Owing to the very great variety in possible applications of this equipment, you must satisfy yourself as to its suitability for your specific application.

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