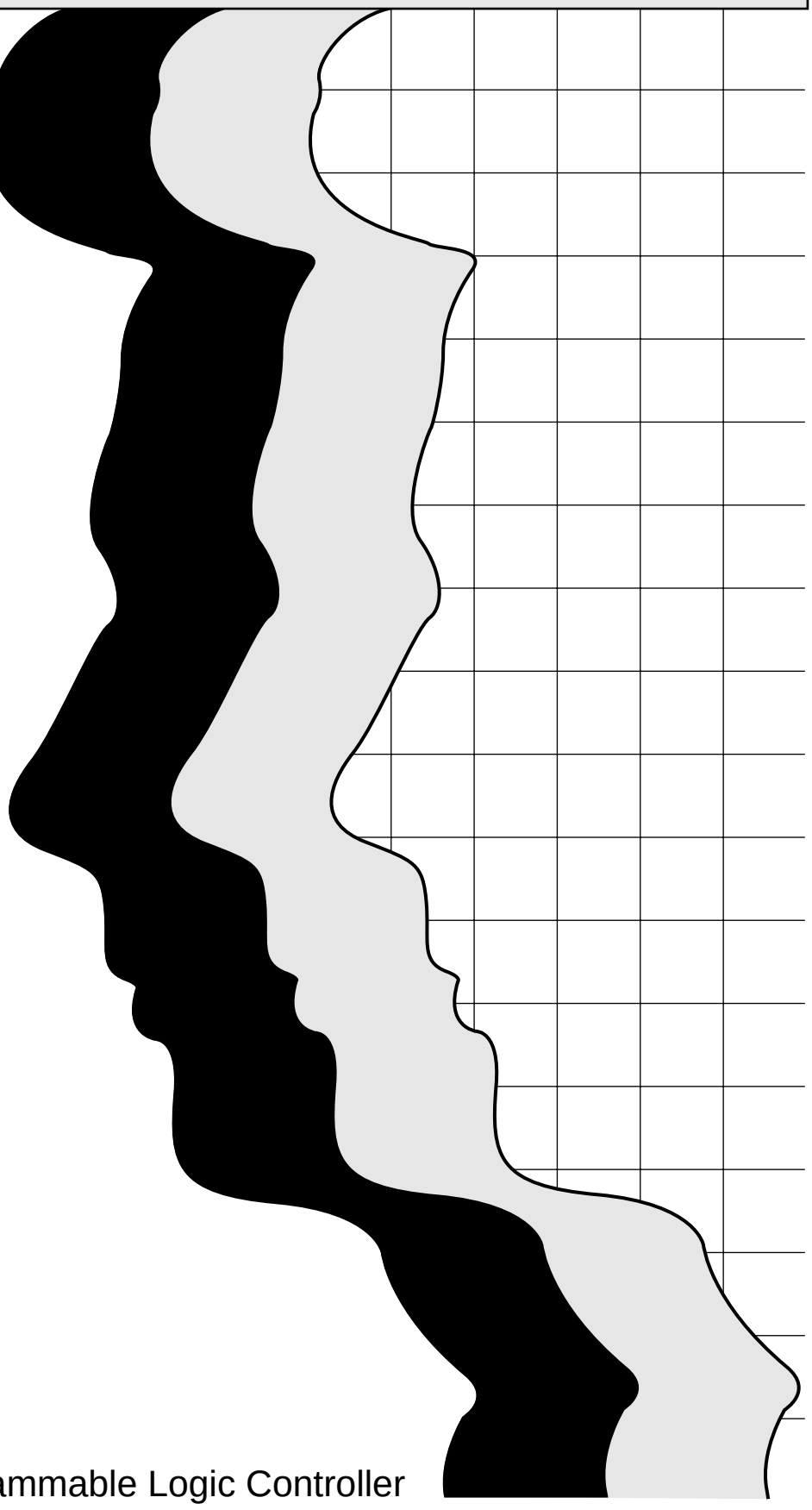
MITSUBISHI

# type A2USHCPU-S1

# User's Manual



MELSEC

Mitsubishi Programmable Logic Controller

# ● SAFETY PRECAUTIONS ●

(Read these precautions before using.)

When using Mitsubishi equipment, thoroughly read this manual and the associated manuals introduced in the manual. Also pay careful attention to safety and handle the module properly.

These ● SAFETY PRECAUTIONS ● classify the safety precautions into two categories: “DANGER” and “CAUTION”.

| | |
|---|---|
| **DANGER** | **Procedures which may lead to a dangerous condition and cause death or serious injury if not carried out properly.** |
| **CAUTION** | **Procedures which may lead to a dangerous condition and cause superficial to medium injury, or physical damage only, if not carried out properly.** |

Depending on circumstances, procedures indicated by **CAUTION** may also be linked to serious results.

In any case, it is important to follow the directions for usage.

Store this manual in a safe place so that you can take it out and read it whenever necessary. Always forward it to the end user.

## [DESIGN PRECAUTIONS]

### DANGER

- Install a safety circuit external to the PC that keeps the entire system safe even when there are problems with the external power supply or the PC main module. Otherwise, trouble could result from erroneous output or malfunction.
  (1) Configure the following circuits outside the PC: emergency stop circuit, protection circuit, interlocking circuit for opposite operations such as forward and reverse operations, and interlocking circuit for machine damage prevention such as upper/lower limit for positioning.
  (2) When the PC detects the following problems, it will stop calculation and turn off all output.
    - The power supply module has an over current protection device and over voltage protection device.
    - The PC CPUs self-diagnostic functions, such as the watchdog timer error, detect problems.

    In addition, all output will be turned on when there are problems that the PC CPU cannot detect, such as in the I/O controller. Build a failsafe circuit exterior to the PC that will make sure the equipment operates safely at such times.

    Refer to the Section 8.1 in this manual for example failsafe circuits.
  (3) Output could be left on or off when there is trouble in the output module’s relay or transistor. So, build an external monitoring circuit that will monitor any single output that could cause serious trouble.
- If current over the rating or over-current due to a load short-circuit flows for a long term, it may cause smoke or fire. Prepare an external safety circuit, such as a fuse.
- Build a circuit that turns on the external power supply when the PC main module power supply is turned on. If the external power supply is turned on first, it could result in erroneous output or malfunction.

**[DESIGN PRECAUTIONS]**

**⚠ DANGER**

- Build a circuit that turns on the external power supply after the PLC main module power is turned on.
  If the external power supply is turned on first, it could result in accidents due to erroneous outputs or a malfunction.
- When there are communication faulty with the data link, the communication faulty station will enter the following condition. Build an interlock circuit into the PLC program that will make sure the system operates safely by using the communication state information.
  Not doing so could result in erroneous output or malfunction.
  (1) For the data link data, the data prior to the communication error will be held.
  (2) The MELSECNET (II, /B, /10) remote I/O station will turn all output off.
  (3) The MELSECNET/MINI-S3 remote I/O station will hold the output or turn all output off depending on the E.C. mode setting.
  Refer to manuals for corresponding data link system for how to detect the communication faulty station and the operation status when a communication error occurred.
- When configuring a system, do not leave any slots vacant on the base. Should there be any vacant slots, always use a blank cover (A1SG60) or dummy module (A1SG62).
  If the cover is not attached, the module's internal parts may be dispersed when a short-circuit test is performed or overcurrent/overvoltage is accidentally applied to the external I/O area.

**⚠ CAUTION**

- Do not bunch the control wires or communication cable with the main circuit or power wires, or install them close to each other.
  They should be installed 100mm (3.94 inch) or more from each other.
  Not doing so could result in noise that would cause malfunction.
- When controlling items like lamp load, heater or solenoid valve using an out put module, large current (approximately ten times greater than that present in normal circumstances) may flow when the output is turned OFF → ON. Take measures such as replacing the module with one having sufficient rated current.

**[INSTALLATION PRECAUTIONS]**

**⚠ CAUTION**

- Use the PLC in the environment given in the general specification section of the manual.
  Using the PLC outside the range of the general specifications may result in electric shock, fire, or malfunction or may damage or degrade the product.
- Before mounting the module, securely insert the projection at the bottom of the module into the fixing hole on the base module.
  (The AnS series module must be tightened to the base module at the specified tightening torque.)
  An improperly mounted module may result in malfunction, failure, or falling.
  Excessive screw tightening may cause falling due to the breakage of the screw or module, short-circuit, or malfunction.

**[INSTALLATION PRECAUTIONS]**

**⚠ CAUTION**

- Tighten the screw within the range of specified torque.
  If the screws are loose, it may result in fallout, short circuits, or malfunctions.
  Tightening the screws too far may cause damage to the screw and/or the module, resulting in fallout, short circuits, or malfunction.
- When installing extension cables, be sure that the base unit and the module connectors are installed correctly. After installation, check them for looseness. Poor connections could result in erroneous input and erroneous output.
- Correctly connect the memory card installation connector to the memory card. After installation, make sure that the connection is not loose. A poor connection could result in malfunction.
- Do not directly touch the module's conductive parts or electronic components.
  Doing so could cause malfunction or failure in the module.

**[WIRING PRECAUTIONS]**

**⚠ DANGER**

- Completely turn off the external power supply when installing or wiring. Not completely turning off all power supply could result in electric shock or damage to the product.
- When turning on the power or operating the module after installation or wiring work, be sure that the module's terminal covers are correctly attached. Not attaching the terminal covers could result in electric shock.

**⚠ CAUTION**

- Be sure to ground the FG terminals and LG terminals with a special PLC ground of Type 3 or above. Not doing so could result in electric shock or malfunction.
- When wiring in the PLC, check the rated voltage and terminal layout of the wiring, and make sure the wiring is done correctly. Connecting a power supply that differs from the rated voltage or wiring it incorrectly may cause fire or breakdown.
- Do not connect multiple power supply modules in parallel.
  Doing so could cause overheating, fire, or damage to the power supply module.
- Tighten the terminal screws with the specified torque.
  If the terminal screws are loose, it could result in short circuits, fire, or malfunction.
  Tightening the screws too far may cause damage to the screw and/or the module, resulting in fallout, short circuits, or malfunction.
- Take care so that foreign matter such as chips and wiring scraps do not enter the module as it could result in fire, trouble or a malfunction.
- External connections shall be crimped or pressure welded with the specified tools, or correctly soldered.
  For information regarding the crimping and pressure welding tools, refer to the I/O module's user manual. Imperfect connections could result in short circuit, fires, or malfunction.

**[STARTING AND MAINTENANCE PRECAUTIONS]**

**⚠ DANGER**

- Do not touch the terminals while power is on. Doing so could cause shock or malfunction.
- Correctly connect the battery. Also, do not change, disassemble, heat, place in fire, short circuit, or solder the battery.
  Mishandling of the battery can cause overheating or cracks which could result in injury and fires.
- Make sure to switch all phases of the external power supply off before cleaning or re-tightening screws. If you do not switch off the external power supply, it will cause electric shock.
  If the screws are loose, it may result in fallout, short circuit, or malfunction. Tightening the screws too far may cause damages to the screws and/or the module, resulting in fallout, short circuits, or malfunction.

**⚠ CAUTION**

- Carefully read manuals and confirm that it is safe enough before performing on-line operations which require to connect peripheral devices to an operating CPU module. (especially when modifying a program, performing forced output, or modifying the operation status.)
  Misoperation may damage the module or cause accidents.
- Do not disassemble or rebuild the module.
  It may cause accidents, malfunction, injury, or fire.
- When using a cellular phone, keep it 25 cm or more away from the PLC.
  Otherwise, malfunction may result.
- Make sure to switch all phases of the external power supply off before mounting or removing the module. If you do not switch off the external power supply, it will cause failure or malfunction of the module.

**[DISPOSAL PRECAUTIONS]**

**⚠ CAUTION**

- Disposing of this product, treat it as industrial waste.

## Revisions

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

| Print Date | *Manual Number | Revision |
|---|---|---|
| Jun. 1997 | IB(NA)-66789-A | First printing |
| Jun. 2002 | IB(NA)-66789-B | Equivalent to the Japanese version C<br>Correction<br>SAFETY PRECAUTIONS, Chapter 1, Section 1.2, Section 2.1, 2.2.1, 2.2.2, 2.2.3, 2.3, Chapter 3, Section 4.1.4, 4.2.2, 4.2.5, Section 5.1, 5.2, Section 6.1.2, 6.1.3, Section 7.1.1, 7.1.5, Section 8.1, Chapter 9, Section 10.3.2, Appendix 2.1, 2.2, Appendix 4.2 |
| | | |

# Introduction

Thank you for choosing a Mitsubishi MELSEC-A Series General Purpose Programmable Controller.
Before using your new PC, please read this manual thoroughly to gain an understanding of its functions so you can use it properly.
Please forward a copy of this manual to the end user.

# Table of Contents

## About This Manual

The following table lists manuals regarding this product.

**Related Manuals**

| Manual Name | Manual No. (Model Code) |
|---|---|
| ACPU Programming Manual (Fundamentals)<br>Describes programming methods necessary for creating programs, device names, parameters, program types, memory area configuration, and so on.<br>(Sold separately) | IB-66249<br>(13J740) |
| ACPU Programming Manual (Common Instructions)<br>Describes how to use the sequence instruction, basic instructions, applied instructions and microcomputer programs.<br>(Sold separately) | IB-66250<br>(13J741) |
| AnACPU/AnUCPU/QCPU-A (A mode) Programming Manual (Dedicated Instructions)<br>Describes instructions that have been expanded for A2USHCPU-S1.<br>(Sold separately) | IB-66251<br>(13J742) |
| AnACPU/AnUCPU Programming Manual (AD57 Instructions)<br>Describes dedicated instructions for A2USHCPU-S1 to control the AD57(S1)/AD58 controller module.<br>(Sold separately) | IB-66257<br>(13J743) |
| AnACPU/AnUCPU Programming Manual (PID Instructions)<br>Describes dedicated instructions for A2USHCPU-S1 to perform the PID control.<br>(Sold separately) | IB-66258<br>(13J744) |
| AnS Module type I/O User's Manual<br>Describes the specification of the compact building block type I/O module.<br>(Sold separately) | IB-66541<br>(13JE81) |

# 1. OVERVIEW

This User's Manual describes the performance, functions, and handling method of the A2USHCPU-S1 general purpose PC (abbreviated as A2USHCPU-S1 hereafter), as well as the specifications and handling of the memory cassette, power supply module and the base module.

The A2USHCPU-S1 has higher performance compared with the conventional A2USCPU, with faster instruction processing speed, increased program size, and so on. Utilize these enhanced capabilities to operate the A2USHCPU-S1 in the most efficient way.

The instructions used in the sequence programs of the A2USHCPU-S1 are as follows:

- Sequence instructions ..... 25 instructions
- Basic and application instructions ..... 243 instructions
- Dedicated instructions ..... 204 instructions

Refer to Appendix-1 for the complete list of instructions.

The programming modules and software packages have to be compatible with the upgraded A2UCPU, A2UCPU-S1, A3UCPU, and A4UCPU (abbreviated as AnUCPU hereafter).
When the conventional programming modules and software packages are used, the usable range varies depending on the model of the CPU (PC model name). --- Refer to Section 2.2.3.

Refer to the list of components in Section 2.3 for various modules which can be used with the A2USHCPU-S1.
Refer to Section 2.2.1 for the special function modules which have limited range of usable devices.

## 1.1 Features

The A2USHCPU-S1 has the following features when compared with A2USCPU(S1) and A1SCPU:

(1) The program size was greatly increased in the A2USHCPU-S1 to a maximum of 30k steps, compared with 14k steps of the A2USCPU(S1).

(2) The operation speed (sequence instructions) was substantially improved.
The processing speed of the A2USHCPU-S1 has been improved to 0.09μs/step, compared with 0.2μs/step for the A2USCPU.

(3) The A2USHCPU-S1 has 256k bytes of built-in RAM memory.
The built-in RAM memory has a capacity of 256k bytes with battery backup.
In addition, an optional memory cassette (EPROM, EEPROM) can be attached.

(4) MELSECNET/10-compatible for fast and large-capacity networking
The MELSECNET/10 network system can be constructed by installing a network module (A1SJ71LP21, A1SJ71BR11) to the extension base module and setting the network parameters.
It is also compatible with the MELSECNET II system.

(5) The A2USHCPU-S1 has more points for the I/O devices, link devices, and data registers than those of the A1SCPU.
- I/O device (X/Y) ..... 8192 points (X/Y0 to 1FFF)
- Link relay (B) ..... 8192 points (B0 to B1FFF)
- Link register (W) ..... 8192 points (W0 to W1FFF)
- Data register (D) ..... 8192 points (D0 to 8191)

(6) The A2USHCPU-S1 can execute the batch processing of the data communication requests.
- All of the data communication requests from the A1SJ71UC24-R2, A1SD51S, peripheral devices, and others, can be processed by single END processing. (Normally, one END processing processes one communication request.)
- The batch processing of the data communication requests can be activated by selecting "YES" on the "END Batch Processing Setup" in the supplementary function setup of the parameter, or by turning ON the M9029 from the sequence program.
- Delay of the data transfer to each module will be prevented by using the batch processing of the data communication requests.
  (M9029: When OFF, only one request is processed by one scan.)

(7) The A2USHCPU-S1 can execute the dedicated instructions for the AnA/AnUCPU.
Dedicated instructions for AnA/AnUCPU, AD57 instructions, and PID control instructions can be executed.

## 1.2 Comparison of Performance and Specifications with A2USCPU(S1)

The differences in performance and specifications between A2USHCPU-S1 and A2USCPU(S1) are as follows. Performance and specifications which are not listed here are the same between A2USHCPU-S1 and A2USCPU(S1).

| Item \ CPU Model | | A2USHCPU-S1 | A2USCPU(S1) |
|---|---|---|---|
| I/O Control method | | Refresh method | Refresh method |
| Processing speed (Sequence instruction) (μs/step) | | 0.09 | 0.2 |
| Number of instructions | Sequence instructions | 25 | 25 |
| | Basic and application instructions | 243 | 243 |
| | Dedicated instructions | 204 | 204 |
| Constant scan (ms) | | 10 to 190 | 10 to 190 |
| Main program capacity | | A maximum of 30k steps | A maximum of 14k steps |
| Memory capacity and memory cassette model | Memory capacity (built-in RAM) | 256k bytes | 64k bytes (256k bytes)*1 |
| | EPROM-type memory cassette | A2SMCA-14KP | A2SMCA-14KP |
| | $E^2$PROM-type memory cassette | A2SNMCA-30KE | A2SNMCA-30KE |
| Number of I/O device points (points) | | 8192 | 8192 |
| Number of I/O points (points) | | 1024 | 512 (1024)*1 |
| Number of device points | Internal relay [M, L, S] (points) | 8192 | 8192 |
| | Link relay [B] (points) | 8192 | 8192 |
| | Link register [W] (points) | 8192 | 8192 |
| | Data register [D] (points) | 8192 | 8192 |
| | File register [R] (points | 8192 | 8192 |
| | Annunciator [F] (points) | 2048 | 2048 |
| | Timer [T] (points) | 2048 | 2048 |
| | Counter [C] (points) | 1024 | 1024 |
| | Index register [V, Z] (points) | 14 | 14 |
| Comment (points) | | MAX 4032 | MAX 4032 |
| Expanded comment (points) | | MAX 3968 | MAX 3968 |
| Watchdog timer setting | | Fixed to 200(ms) | Fixed to 200(ms) |
| Data link | | MELSECNET/10<br>MELSECNET(II)<br>MELSECNET/B | MELSECNET/10<br>MELSECNET(II)<br>MELSECNET/B |

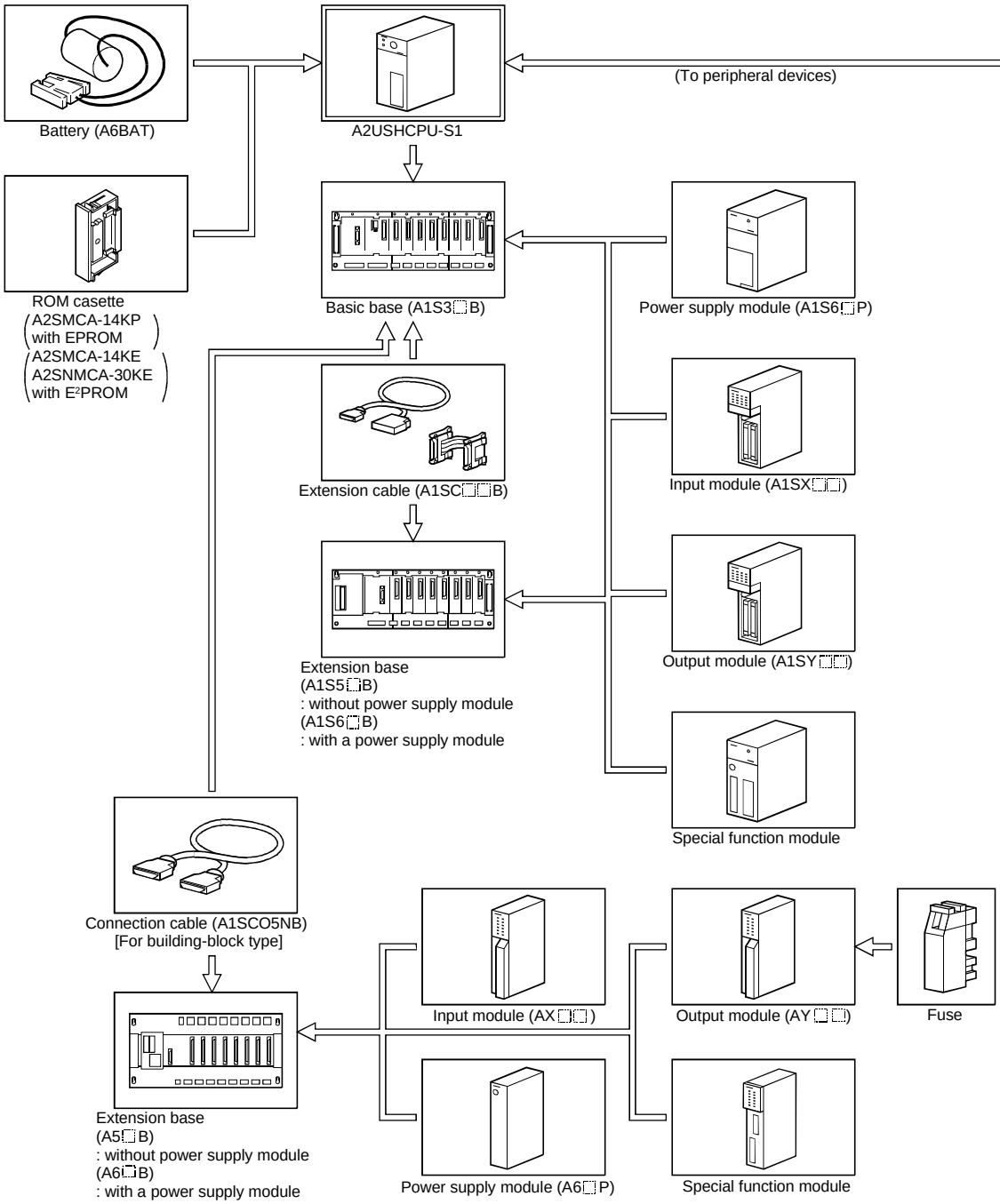
*1 When A2USCPU-S1 is used.

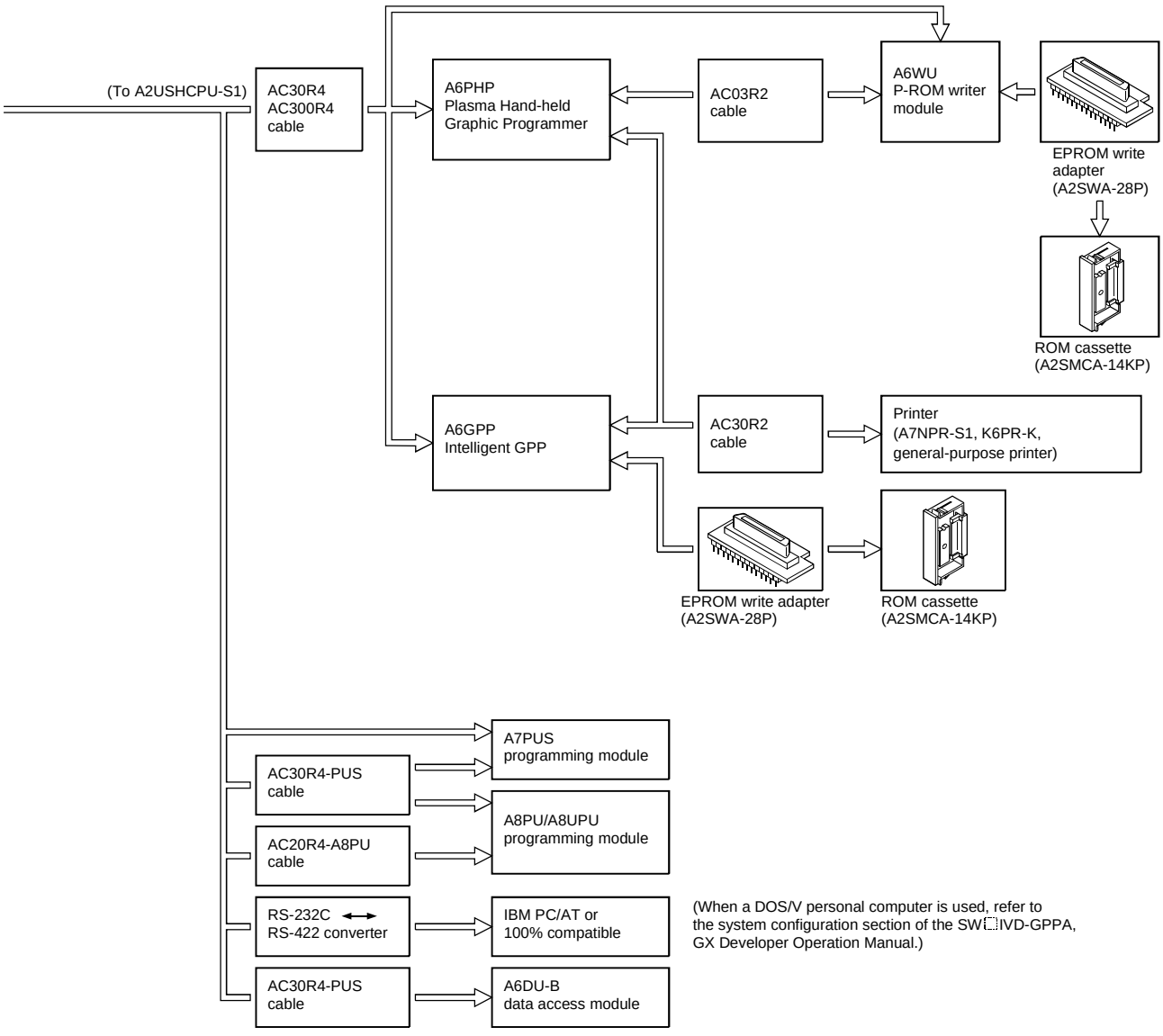
# 2. SYSTEM CONFIGURATION

The possible system configuration with A2USHCPU-S1, the precautions when the system is configured, and system components are described.

## 2.1 Overall Configuration

The system configurations of the A2USHCPU-S1 stand-alone system and the peripheral devices are as follows:




(To A2USHCPU-S1)
AC30R4
AC300R4
cable
A6PHP
Plasma Hand-held
Graphic Programmer
AC03R2
cable
A6WU
P-ROM writer
module
EPROM write
adapter
(A2SWA-28P)
ROM cassette
(A2SMCA-14KP)
A6GPP
Intelligent GPP
AC30R2
cable
Printer
(A7NPR-S1, K6PR-K,
general-purpose printer)
EPROM write adapter
(A2SWA-28P)
ROM cassette
(A2SMCA-14KP)
A7PUS
programming module
AC30R4-PUS
cable
A8PU/A8UPU
programming module
AC20R4-A8PU
cable
RS-232C
RS-422 converter
IBM PC/AT or
100% compatible
AC30R4-PUS
cable
A6DU-B
data access module
(When a DOS/V personal computer is used, refer to
the system configuration section of the SW□IVD-GPPA,
GX Developer Operation Manual.)

## 2.2 Precautions When Configuring the System

The hardware and software packages which can be used for the A2USHCPU-S1 are described.

### 2.2.1 Hardware

**(1) I/O module**

All the building-block-type I/O modules for A N and A A can be used by installing them to the extension base module of A5 B/A6 B.

**(2) Special function module**

(a) Special function modules for A N and A A can be used by installing them in the extension base module of A5 B/A6 B.

(b) The special function modules of the following models have a limitation in the number of installable modules.

<table>
<tr><td colspan="2">AJ71C22-S1<br>AJ71C23-S3<br>AD51H-S3 *2<br>AJ71UC24<br>AJ71E71-S3 *2<br>AJ61BT11 (Only when in the intelligent mode.)</td><td colspan="2" rowspan="4">A maximum of 6 modules in total can be installed.</td></tr>
<tr><td colspan="2">A985GOT (Only when the bus connection is used.)<br>A975GOT (Only when the bus connection is used.)<br>A970GOT (Only when the bus connection is used.)<br>A960GOT (Only when the bus connection is used.)<br>A956WGOT (Only when the bus connection is used.)<br>A956GOT (Only when the bus connection is used.)<br>A951GOT</td></tr>
<tr><td colspan="2">A1SJ71UC24-R2(PRF/R4)<br>A1SJ71E71-B2-S3(-B5-S3)<br>A1SD51S A1SD21-S1<br>A1SJ61BT11(Only when in the intelligent mode.)</td></tr>
<tr><td colspan="2">AI61(S1)<br>A1SI61</td><td colspan="2">Only one module can be installed.</td></tr>
<tr><td>AJ71AP21 (S3) *2<br>AJ71AT21B *2</td><td>AJ71AR21 *2</td><td rowspan="2">A maximum of 2 modules in total can be installed.</td><td rowspan="3">A maximum of 4 modules in total can be installed.</td></tr>
<tr><td>A1SJ71AP21 (S3) *2<br>A1SJ71AT21B *2</td><td>A1SJ71AR21 *2</td></tr>
<tr><td>AJ71LP21<br>AJ71LR21<br>A1SJ71LP21<br>A1SJ71LR21</td><td>AJ71BR11<br>A1SJ71BR11</td><td>A maximum of 4 modules in total can be installed.</td></tr>
<tr><td colspan="2">AJ71PT32-S3 (Only when in the extension mode.)<br>AJ71T32-S3 (Only when in the extension mode.)<br>A1SJ71PT32-S3 (Only when in the extension mode.)<br>A1SJ71T32-S3 (Only when in the extension mode.)</td><td colspan="2">A maximum of 10 modules in total can be installed.</td></tr>
</table>

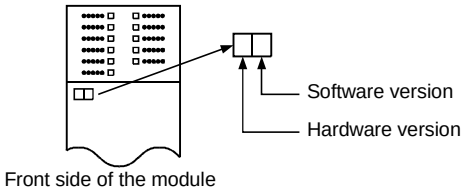
*1: Accessible within the device range of A3HCPU.

*2: Accessible within the device range of A3ACPU.

Refer to the user's manual of the corresponding special function module for the accessible device ranges.

(c) When a remote I/O network is constructed with the MELSECNET/10 network system, use the A2USHCPU-S1 software of version "A" or later, and the AJ7ILP21/BR11, A1SJ71LP21/BR11-type network software of version "J" or later.

<Example> For AJ71LP21/BR11:




**REMARK**

The special function modules which cannot be used by the A2USHCPU-S1 are as follows:

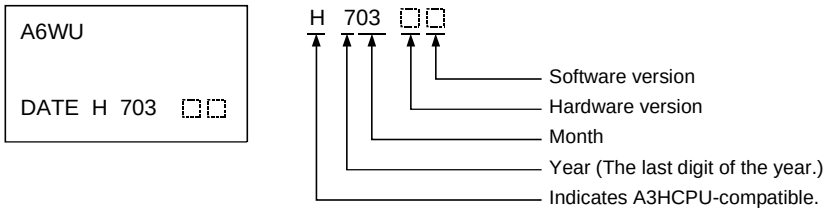
- AJ71C23
- AJ71C24 (modules dated before February 1987)
- AD57-S2
- AD51 (modules dated before March 1987)

Confirm the manufactured date on the rating plate.

**(3) Peripheral devices**

(a) Use an A6WU P-ROM writer of the hardware version "E" or later.

<Example> If manufactured date is March 1987:




(b) The A6WU P-ROM writer module cannot be installed as an add-on to be directly attached to the A2USHCPU-S1.

(c) Among the programming modules (A7PUS, A8PU, A8UPU), only A7PUS is installed as an add-on.
Other models (A8PU, A8UPU) use only the hand-held method with a cable.

**(4) Writing on the ROM for EPROM memory cassettes**

An optional A2SWA-28P memory write adapter is required to write on a ROM for the A2SMCA-14KP EPROM memory cassette using the A6GPP, A6WU, or ROM writer. (The conventional A6WA-28P cannot be used.)

**(5) Writing while running when operated by $E^2$PROM (with A2SNMCA-30KE installed)**

When "write while running " to the $E^2$PROM is executed, the program transfer in progress status is displayed on the peripheral device, then the processing for the sequence program is stopped for approximately two seconds until the transfer finishes to complete the "write while running ".

Because the program processing stops for two seconds, stop the CPU while writing instead of executing the "write while running " if it affects the operation of the controlled device.

When "A3A" or "A3H" is specified as the PC's model to startup the GPP function software package which is not AnU-compatible, the "write while running" cannot be executed to the $E^2$PROM.

If "write while running" to the $E^2$PROM is executed, the changed circuit block and any PLF instruction included in the steps after the instruction will not operate normally.

If the execution condition for the PLF instruction is turned off upon completion of writing, the PLF instruction is executed.

**(6) Writing while in operation by the $E^2$PROM (with A2SNMCA-30KE installed)**

(a) When writing a program to the $E^2$PROM after the GPP function software package is started up with the PC's model specified as "A3A" or "A3H", cancel the memory protection of both the A2USHCPU-S1 main module and the memory cassette for the E2PROM (A2SNMCA-30KE) before execution.

(b) The writing of the program cannot be executed from the computer link module or from a peripheral device connected to other stations on the MELSECNET.
Perform writing of the program from a peripheral device connected to the RS-422 of the A2USHCPU-S1.

## 2.2.2 Software package

**(1) GPP function software packages and model name setting at the startup**

The table below shows the GPP function software packages allowing you to create an A2USHCPU-S1 program and PLC model settings at startup.

When creating an A2USHCPU-S1 program, if "A2USH-S1" is not available as a PLC model, set "A3U". If "A3U" is not available, set "A3A". If both "A3U" and "A3A" are not available, set "A3H" .

| Peripheral Device | Software package for system startup | PC CPU model setting | Remarks |
|---|---|---|---|
| A6PHP | SW3GP-GPPA | A3H | Write on the ROM is not allowed. |
| | SW4GP-GPPA | A3A | |
| | SW GP-GPPAU | A3U | |
| A6GPP | SW3-GPPA<br>SW3GP-GPPA | A3H | Write on the ROM is not allowed. |
| | SW4GP-GPPA | A3A | |
| | SW GP-GPPAU | A3U | |
| IBM PC/AT | SW IVD-GPPA; is 0 to 3 | A3U | |
| | SW IVD-GPPA; is 4 or later | A2USH-S1 | |
| | GX Developer | | |

**NOTE**

1. As the PC's model for the GPP function software package (SW IVD-GPPA; is older than 3) is set to "A3U", attention should be paid to the following:
   1) When a LED or LEDC instruction is written, it is not usable but no error will be issued.
   2) When a CHG instruction is written, it is not usable, and the error code 13 and detailed error code 134 will be detected.
   3) When a subprogram is set, it is not usable, and the error code 11 and detailed error code 111 will be detected.

2. When the MELSECNET(II), MELSECNET/10 parameters are used up to the maximum of 16k bytes, program capacity will be limited to 22k steps.
   The A2USHCPU-S1 uses the same memory area for the sequence program as that for the parameters of MELSECNET(II) and MELSECNET/10. Therefore, the remainder in the max. 30k steps after subtracting the memory area used by the MELSECNET(II) and MELSECNET/10 parameters can be used for the sequence program.

**POINT**

(1) Old software packages other than SW3-GPPA, SW3GP-GPPA, and SW4GP-GPPA cannot be used as the software package for system startup for A6GPP/A6PHP.

(2) When a MELSECNET/10 network system is configured with the A2USHCPU-S1, use an AnU/A2USH-S1-compatible GPP function software package (which contains "A3U" / "A2USH-S1" in the PC's model name). The network function cannot be set with GPP function software packages not compatible with AnU (no "A3U" / "A2USH-S1" in the PC's model name).

**(2) Utility package**

(a) None of the following utility packages for A6GPP/A6PHP can be used:

- SW□-AD57P
- SW□-UTLP-FN0
- SW□-UTLP-FN1
- SW□-UTLP-PID

*

- SW□-SIMA
- SW□-UTLP-FD1
- SW□-SAPA

The packages marked with * can execute the same functions using the dedicated instructions. Refer to AnACPU/AnUCPU Programming Manual (Dedicated Instruction) for details.

**REMARK**

The characters generators and canvas, which are necessary for AD57(S1), are created on the peripheral device using the SW□-AD57P.

**POINT**

(1) Packages which access the A2USHCPU-S1 by specifying a device in the utility package can specify only in the device range for A3ACPU or A3HCPU equivalent. (Refer to Section 2.2.3.)

(2) Use an AnU-compatible utility package to use the device range for the A2USHCPU-S1. (Example: SW1IVD-SAP2, etc.)

### 2.2.3 Precautions when using GPP function software packages and A8PU peripheral devices which are not compatible with AnU

When the A2USHCPU-S1 is started up using a GPP function software package not compatible with AnU, A2USH-S1 (the PC model name is "A3A" or "A3H") or from an A8PU peripheral device (including A7PUS), the usable device range is limited as follows:

**(1) Usable device range**

| System FD peripheral device / Item | AnACPU-compatible module | | A3HCPU-compatible module | |
|---|---|---|---|---|
| | **Modules whose PC model for system FD startup is "A3A"** | **A8PU** | **Modules whose PC model for system FD startup is "A3H"** | **A7PUS** |
| Instruction (sequence/basic/ application/dedicated) | All instructions can be used. | | | |
| Program capacity | A maximum of 30k steps can be used for the main program. | | | |
| I/O device points (X/Y) | X/Y0 to 7FF can be used. (X/Y800 to 1FFF cannot be used.) | | X/Y0 to 7FF can be used. (X/Y800 to 1FFF cannot be used.) | |
| M, L, S relay | M/L/S0 to 8191 can be used. | | M/L/S0 to 2047 can be used. (M/L/S2048 to 8191 cannot be used.) | |
| Link relay (B) | B0 to BFFF can be used (B1000 to B1FFF cannot be used.) | | B0 to B3FF can be used. (B400 to B1FFF cannot be used.) | |
| Timer (T) | T0 to T2047 can be used. | | T0 to T255 can be used. (T256 to T2047 cannot be used.) | |
| Counter (C) | C0 to C1023 can be used. | | C0 to C255 can be used. (C256 to C1023 cannot be used.) | |
| Data register (D) | D0 to D6143 can be used. (D6144 to D8191 cannot be used.) | | D0 to D1023 can be used. (D1024 to D8191 cannot be used.) | |
| Link register (W) | W0 to WFFF can be used. (W1000 to W1FFF cannot be used.) | | W0 to W3FF can be used. (W400 to W1FFF cannot be used.) | |
| Annunciator (F) | F0 to F2047 can be used. | | F0 to F255 can be used. (F256 to F2047 cannot be used.) | |
| Index register (V, Z) | V, $V_1$ to $V_6$, Z, and $Z_1$ to $Z_6$ can be used. | | V and Z can be used. ($V_1$ to $V_6$ and $Z_1$ to $Z_6$ cannot be used.) | |
| Expanded comment | A maximum of 3968 points | | Unusable | |
| Latch (power failure compensation) range | The device range shown above can be latched. | | The device range shown above can be latched. | |
| I/O assignment | Number of I/O occupied points and the module model can be registered. | | Number of I/O occupied points can be registered. | |

(1) The device range other than listed above is the same as that of A2USHCPU-S1.
(2) Refer to the operation manual of each peripheral device for available functions.

## 2.3 System Equipment

Various components of each module and peripheral device which can be used by the A2USHCPU-S1 are listed.

**(1) Modules dedicated to A1S**

| Item | Model | Description | | Number of occupied points (points) [I/O allocation module type] | Current consumption | | Remark |
|---|---|---|---|---|---|---|---|
| | | | | | 5VDC (A) | 24VDC (A) | |
| CPU module | A2USHCPU-S1 | 1024 real I/O points, 256k bytes memory capacity | | — | 0.32 | — | Built-in RAM memory |
| Power supply module | A1S61PN | 5VDC, 5A | 100/200VAC input | — | — | — | Installed in the power supply slot of the basic base module and expansion base module. |
| | A1S62PN | 5VDC, 3A/24VDC, 0.6A | | | | | |
| | A1S63P | 5VDC, 5A | 24VDC input | | | | |
| Input module | A1SX10 | 16-point 100 to 120 VAC input module | | 16 [16 input points] | 0.05 | — | |
| | A1SX10EU | 16-point 100 to 120 VAC input module | | 16 [16 input points] | 0.05 | — | |
| | A1SX20 | 16-point 200 to 240 VAC input module | | 16 [16 input points] | 0.05 | — | |
| | A1SX20EU | 16-point 200 to 240 VAC input module | | 16 [16 input points] | 0.05 | — | |
| | A1SX30 | 16-point 12/24VDC, 12/24VAC input module | | 16 [16 input points] | 0.05 | — | |
| | A1SX40 | 16-point 12/24VDC input module | | 16 [16 input points] | 0.05 | — | |
| | A1SX40-S1 | 16-point 24VDC input module | | 16 [16 input points] | 0.05 | — | |
| | A1SX40-S2 | 16-point 24VDC input module | | 16 [16 input points] | 0.05 | — | |
| | A1SX41 | 32-point 12/24VDC input module | | 32 [32 input points] | 0.08 | — | |
| | A1SX41-S1 | 32-point 24VDC input module | | 32 [32 input points] | 0.12 | — | |
| | A1SX41-S2 | 32-point 24VDC input module | | 32 [32 input points] | 0.08 | — | |
| | A1SX42 | 64-point 12/24VDC input module | | 64 [64 input points] | 0.09 | — | |
| | A1SX42-S1 | 64-point 24VDC input module | | 64 [64 input points] | 0.16 | — | |
| | A1SX42-S2 | 64-point 24VDC input module | | 64 [64 input points] | 0.09 | — | |
| | A1SX71 | 32-point 5/12/24VDC input module | | 32 [32 input points] | 0.075 | — | |
| | A1SX80 | 16-point 12/24VDC sink/source input module | | 16 [16 input points] | 0.05 | — | |
| | A1SX80-S1 | 16-point 24VDC sink/source input module | | 16 [16 input points] | 0.05 | — | |
| | A1SX80-S2 | 16-point 24VDC sink/source input module | | 16 [16 input points] | 0.05 | — | |
| | A1SX81 | 32-point 12/24VDC sink/source input module | | 32 [32 input points] | 0.08 | — | |
| | A1SX81-S2 | 32-point 24VDC sink/source input module | | 32 [32 input points] | 0.08 | — | |
| | A1SX82-S1 | 64-point 24VDC sink/source input module | | 64 [64 input points] | 0.16 | — | |
| Output module | A1SY10 | 16-point relay contact output module (2A) | | 16 [16 output points] | 0.12 | 0.09 | |
| | A1SY10EU | 16-point relay contact output module (2A) | | 16 [16 output points] | 0.12 | 0.09 | |
| | A1SY14EU | 12-point relay contact output module (2A) | | 16 [16 output points] | 0.12 | 0.10 | |
| | A1SY18A | 8-point relay contact output module (2A) for independent contacts | | 16 [16 output points] | 0.24 | 0.075 | |
| | A1SY18AEU | 8-point relay contact output module (2A) for independent contacts | | 16 [16 output points] | 0.24 | 0.075 | |
| | A1SY22 | 16-point Triac output module (0.6A) | | 16 [16 output points] | 0.27 | (220VAC) 0.002 | |
| | A1SY28EU | 8-point Triac output module (0.6A) | | 16 [16 output points] | 0.27 | — | |

| Item | Model | Description | Number of occupied points (points) [I/O allocation module type] | Current consumption | | Remark |
|---|---|---|---|---|---|---|
| | | | | 5VDC (A) | 24VDC (A) | |
| Output module | A1SY28A | 8-point Triac output module (1A)<br>All points independent | 16 [16 output points] | 0.13 | — | |
| | A1SY40 | 16-point 12/24VDC transistor output module(0.1A) sink type | 16 [16 output points] | 0.27 | 0.008 | |
| | A1SY41 | 32-point 12/24VDC transistor output module(0.1A) sink type | 32 [32 output points] | 0.50 | 0.016 | |
| | A1SY42 | 64-point 12/24VDC transistor output module(0.1A) sink type | 64 [64 output points] | 0.93 | 0.008 | |
| | A1SY50 | 16-point 12/24VDC transistor output module(0.5A) sink type | 16 [16 output points] | 0.12 | 0.06 | |
| | A1SY60 | 16-point 24VDC transistor output module(2A) sink type | 16 [16 output points] | 0.12 | 0.015 | |
| | A1SY60E | 16-point 5/12/24VDC transistor output module(2A) source type | 16 [16 output points] | 0.20 | 0.01 | |
| | A1SY68A | 8-point 5/12/24/48VDC transistor output module (2A) sink/source type<br>All points independent | 16 [16 output points] | 0.11 | — | |
| | A1SY71 | 32-point 5/12VDC transistor output module(0.016A) sink type | 32 [32 output points] | 0.40 | 0.15 | |
| | A1SY80 | 16-point 12/24VDC transistor output module(0.8A) source type | 16 [16 output points] | 0.12 | 0.02 | |
| | A1SY81 | 32-point 12/24VDC transistor output module(0.1A) source type | 32 [32 output points] | 0.50 | 0.016 | |
| | A1SY82 | 64-point 12/24VDC transistor output module(0.1A) source type | 64 [64 output points] | 0.93 | 0.008 | |
| I/O hybrid module | A1SH42 | 32-point 12/24VDC input module<br>32-point 12/24VDC transistor output module(0.1A) sink type | 32 [32 output points] | 0.50 | 0.008 | |
| | A1SH42-S1 | 32-point 24VDC input module<br>32-point 24VDC transistor output module(0.1A) sink type | 32 [32 output points] | 0.50 | 0.008 | |
| | A1SX48Y18 | 8-point 24VDC input module<br>8-point relay contact output module (2A) | 16 [16 output points] | 0.085 | 0.045 | |
| | A1SX48Y58 | 8-point 24VDC input module<br>8-point 12/24VDC transistor output module (0.5A) | 16 [16 output points] | 0.06 | 0.06 | |
| Dynamic input module | A1S42X | 16/32/48/64 points<br>12/24VDC dynamic input module | Specified number of points [Input specified number of points] | 0.08 | — | |
| Dynamic output module | A1S42Y | 16/32/48/64 points<br>12/24VDC dynamic output module | Specified number of points [Output specified number of points] | 0.10 | 0.008 | |
| Blank cover | A1SG60 | Dust-proof cover for unused slot | 16 [Empty] | — | — | |
| Dummy module | A1SG62 | 16-point, 32-point, 48-point, or 64-point selectable module | Specified number of points [Input specified number of points] | — | — | |
| Pulse catch module | A1SP60 | 16-point input module for short ON-time pulse input<br>(pulse with a minimum of 0.5ms) | 16 [16 output points] | 0.055 | — | |
| Analog timer module | A1ST60 | 8-point analog timer module whose timer setting value can be changed for different volumes (0.1 to 1.0s, 1 to 10s, 10 to 60s, 60 to 600s) | 16 [16 output points] | 0.055 | — | |
| Interrupt module | A1SI61 | Interrupt module for specifying the interrupt program (16-point interrupt input) | 32 [32 special points] | 0.057 | — | |

| Item | Model | Description | Number of occupied points (points) [I/O allocation module type] | Current consumption | | Remark |
|---|---|---|---|---|---|---|
| | | | | 5VDC (A) | 24VDC (A) | |
| High-speed counter module | A1SD61 | 32-bit signed binary<br>50kBPS, 1 channel | 32 [32 special points] | 0.35 | — | |
| | A1SD62 | 24-bit signed binary, 2 channels<br>100kPPS, DC input<br>Transistor output (sink type) | 32 [32 special points] | 0.1 | — | |
| | A1SD62D | 24-bit signed binary, 2 channels<br>200kPPS, difference input<br>Transistor output (sink type) | 32 [32 special points] | 0.25 | — | |
| | A1SD62D-S1 | 24-bit signed binary, 2 channels<br>200kPPS, difference input<br>Transistor output (sink type) | 32 [32 special points] | 0.27 | — | |
| | A1SD62E | 24-bit signed binary, 2 channels<br>100kPPS, DC input<br>Transistor output (source type) | 32 [32 special points] | 0.1 | — | |
| A/D converter module | A1S64AD | 4 to 20mA/0 to 10V<br>4 analog channels | 32 [32 special points] | 0.4 | — | |
| | A1S68AD | 4 to 20mA/0 to 10V<br>8 analog channels | 32 [32 special points] | 0.4 | — | |
| Temperature/ digital converter module | A1S62RD3N | For Pt100 (3-wire type) connection<br>2 channels of temperature input | 32 [32 special points] | 0.49 | — | |
| | A1S62RD4N | For Pt100 (4-wire type) connection<br>2 channels of temperature input | 32 [32 special points] | 0.39 | — | |
| | A1S68TD | Thermocouple input, 8 channels | 32 [32 special points] | 0.32 | — | |
| D/A converter module | A1S62DA | 4 to 20mA/0 to 10V<br>2 analog output channels | 32 [32 special points] | 0.8 | — | |
| | A1S68DAV | -10 to 10V input<br>Analog output, 8 channels | 32 [32 special points] | 0.65 | — | |
| | A1S68DAI | 4 to 20mA input<br>Analog output, 8 channels | 32 [32 special points] | 0.85 | — | |
| Analog I/O module | A1S63ADA | Analog input, 2 channels, simple loop control is allowed.<br>Analog output, 1 channel | 32 [32 special points] | 0.8 | — | |
| | A1S66ADA | Analog input, 4 channels, simple loop control is allowed.<br>Analog output, 2 channels | 32 [32 special points] | 0.21 | 0.16 | |
| Temperature regulating module | A1S64TCTT-S1 | Thermocouple input - transistor input, 4 channels | 32 [32 special points] | 0.33 | — | |
| | A1S64TCTTBW-S1 | Thermocouple input - transistor input, 4 channels<br>With disconnection detection function | 32 [32 special points] | 0.42 | — | |
| | A1S64TCRT-S1 | Platinum resistance temperature sensor input - transistor input, 4 channels | 32 [32 special points] | 0.33 | — | |
| | A1S64TCRTBW-S1 | Platinum resistance temperature sensor input - transistor input, 4 channels<br>With disconnection detection function | 32 [32 special points] | 0.42 | — | |
| | A1S62TCTT-S2 | Thermocouple input - transistor output (overheat cooling), 2 channels | 32 [32 special points] | 0.19 | — | |
| | A1S62TCTTBW-S2 | Thermocouple input - transistor output (overheat cooling), 2 channels<br>With disconnection detection function | 32 [32 special points] | 0.28 | — | |
| | A1S62TCRT-S2 | Platinum resistance temperature sensor input - transistor output (heat cooling), 2 channels | 32 [32 special points] | 0.19 | — | |

| Item | Model | Description | Number of occupied points (points) [I/O allocation module type] | Current consumption | | Remark |
|---|---|---|---|---|---|---|
| | | | | 5VDC (A) | 24VDC (A) | |
| Temperature regulating module | A1S62TCRTBW-S2 | Platinum resistance temperature sensor input - transistor output (heat cooling), 2 channels<br>With disconnection detection function | 32 [32 special points] | 0.28 | — | |
| Computer link module | A1SJ71UC24-R2 | Computer link function<br>RS-232C, 1 channel | 32 [32 special points] | 0.1 | — | |
| | A1SJ71UC24-PRF | Computer link function, printer function<br>RS-232C, 1 channel | 32 [32 special points] | 0.1 | — | |
| | A1SJ71UC24-R4 | Computer link function, multidrop link function RS-422/RS-485, 1 channel | 32 [32 special points] | 0.1 | — | |
| Ethernet interface module | A1SJ71E71N-B2 | 10 Base 2 (for Cheapernet) | 32 [32 special points] | 0.64 | — | Only AnACPU-equivalent device range accessible File register and program read/write disabled. |
| | A1SJ71E71N-B5T | 10 Base 5 (for Ethernet), 10 Base T | 32 [32 special points] | 0.42 | — | |
| Intelligent communication module | A1SD51S | BASIC (interpreter/compiler)<br>RS-232C, 2 channels<br>RS-422/485, 1 channel | 32 [32 special points] | 0.4 | — | |
| Positioning module | A1SD70 | Analog voltage output (0 to ±10V) for 1-axis positioning control, speed control, and speed-positioning control. | 48 [First half: 16 empty points] [Second half: 32 special points] | 0.3 | — | |
| | A1SD71-S2 | For positioning control, speed control, and speed-positioning control.<br>Pulse train output, 2-axis (independent, 2-axis simultaneous, linear interpolation | | 0.8 | — | |
| | A1SD71-S7 | For positioning control, setting for manual pulse output speed can be changed.<br>Pulse train output, 2-axis (independent, 2-axis simultaneous, linear interpolation) | | 0.8 | — | |
| | A1SD75P1-S3 | For positioning control, pulse output, 1-axis | 32 [32 special points] | 0.7 | — | |
| | A1SD75P2-S3 | For positioning control, pulse output, 2-axis (independent, 2-axis simultaneous, linear interpolation, circular interpolation) | 32 [32 special points] | 0.7 | — | |
| | A1SD75P3-S3 | For positioning control, pulse output, 3-axis (independent, 3-axis simultaneous, 2-axis linear interpolation, 2-axis circular interpolation) | 32 [32 special points] | 0.7 * | — | * When differential driver is connected : 0.78 |
| | A1SD75M1 | For positioning control, digital output, for MR-H-B/MR-J-B/MR-J2-B, 1-axis SSCNET | 32 [32 special points] | 0.7 | — | |
| | A1SD75M2 | For positioning control, digital output, for MR-H-B/MR-J-B/MR-J2-B, 2-axis SSCNET (independent, 2-axis simultaneous, linear interpolation, circular interpolation) | 32 [32 special points] | 0.7 | — | |
| | A1SD75M3 | For positioning control, digital output, for MR-H-B/MR-J-B/MR-J2-B, 3-axis SSCNET (independent, 3-axis simultaneous, 2-axis linear interpolation, 2-axis circular interpolation) | 32 [32 special points] | 0.7 | — | |

| Item | Model | Description | Number of occupied points (points) [I/O allocation module type] | Current consumption | | Remark |
|---|---|---|---|---|---|---|
| | | | | 5VDC (A) | 24VDC (A) | |
| ID interface module | A1SD35ID1 | ID interface module<br>One reader/writer module can be connected. | 32 [32 special points] | 0.25 | 0.17 | |
| | A1SD35ID2 | ID interface module<br>Two reader/writer modules can be connected. | 32 [32 special points] | 0.25 | 0.33 | |
| MELSECNET(II) data link module | A1SJ71AP21 | For the master and local stations of MELSECNET(II) data link system (for the optical fiber cable) | 32 [32 special points] | 0.33 | — | Access is allowed within the device range of the A3ACPU. |
| | A1SJ71AP21-S3 | For the master and local stations of MELSECNET(II) data link system (for the GI-type optical fiber cable) | 32 [32 special points] | 0.33 | — | |
| | A1SJ71AR21 | For the master and local stations of MELSECNET(II) data link system (for the coaxial cable) | 32 [32 special points] | 0.8 | — | |
| MELSECNET/B data link module | A1SJ71AT21B | For the master and local stations of MELSECNET/B data link system | 32 [32 special points] | 0.66 | — | |
| | A1SJ72T25B | For the remote I/O station of MELSECNET/B data link system | — | 0.3 | — | |
| B/NET data link module | A1SJ71B62-S3 | Master module for B/NET | 32 [32 special points] | 0.08 | — | |
| MELSECNET/10 data link module | A1SJ71LP21 | For the control, master, and normal stations of the MELSECNET/10 data link module system (For the dual loop SI-type optical fiber cable) | 32 [32 special points] | 0.65 | — | Accessible only within MELSECNET (II) range |
| | A1SJ71BR11 | For the control, master, and normal stations of the MELSECNET/10 data link module system (For the single bus coaxial cable) | 32 [32 special points] | 0.80 | — | |
| | A1SJ71LR21 | For the control, master, and normal stations of the MELSECNET/10 data link module system (For the single bus coaxial cable)<br>(For the coaxial cable dual loop) | 32 [32 special points] | 1.14 | — | |
| CC-Link system master module | A1SJ61BT11 | For the master and local stations of the CC-Link data link system(For the twisted pair shield cable only.) | 32 [32 special points] | 0.40 | — | |
| MELSECNET /MINI-S3 master module | A1SJ71PT32-S3 | For MELSECNET/MINI-S3 master stations (max. 64 stations). Performs remote I/O and remote terminal control of a total of 512 I/O points. | I/O dedicated mode 32 [32 special points]<br>Expanded mode 48 [48 special points] | 0.35 | — | |
| | A1SJ71T32-S3 | MELSECNET/MINI-S3 master station Performs remote I/O and remote terminal control of a maximum 64 stations and a total of 512 I/O points.(For the twisted pair cable only.) | I/O dedicated mode 32 [32 special points]<br>Expanded mode 48 [48 special points] | 0.30 | — | |
| MELSECNET-I/O LINK master module | A1SJ51T64 | MELSECNET-I/O LINK master station. Controls I/O LINK remote I/O module of a maximum of 64 stations and a total of 128 I/O points. | 64 [64 output points] | 0.115 | 0.09 | |
| S-LINK interface module | A1SJ71SL92N | Master module for S-LINK<br>I/O total 128 points | 32 [32 special points] | 0.20 | — | |
| JEMANET (JPCN-1) interface module | A1SJ71J92-S3 | JEMANET (JPCN-1) master module | 32 [32 special points] | 0.40 | — | |
| | A1SJ72J95 | JEMANET (JPCN-1) slave module | 32 [32 special points] | 0.40 | — | |
| DeviceNet interface module | A1SJ71DN91 | Master module for DeviceNet<br>I/O total 4096 points | 32 [32 special points] | 0.24 | — | |

| Item | Model | Description | Number of occupied points (points) [I/O allocation module type] | Current consumption | | Remark |
|---|---|---|---|---|---|---|
| | | | | 5VDC (A) | 24VDC (A) | |
| PROFIBUS-DP slave module | A1SJPB93D | Slave module for PROFIBUS-DP<br>I/O data total 192 words | 32 [32 special points] | 0.36 | — | |
| AS-I interface module | A1SJ71AS92 | Master module for AS-I<br>I/O total 496 points | 32 [32 special points] | 0.15 | — | |
| Modem interface module | A1SJ71CMO-S3 | Modem interface module | 32 [32 special points] | 0.26 | — | |
| Paging interface module | A1SD21-S1 | Paging interface module | 32 [32 special points] | 0.14 | — | |
| Position detection module | A1S62LS | Absolute position detection module | 32 [32 special points] | 0.55 | — | |
| PC easier monitoring module | A1SS91 | PC easier monitoring module | 32 [32 special points] | 0.08 | — | |
| Memory card interface module | A1SD59J-S2 | Memory card interface module | 32 [32 special points] | 0.05 | — | |
| Simulation module | A6SIM-X64Y64 | An I/O simulation unit used connected to the base module. Debugging can be executed without connecting the I/O module to the base module.<br>Use an expansion cable of the AnS series between the basic base module of the AnS series and the A6SIM-X64Y64. | 64 [64 input points]<br>64 [64 output points] | TYP. 0.3 (when all points "ON".) | — | |
| Graphic operation terminal | A985GOT | Large-size graphic operation terminal<br>256 colors, TFT color, 800 × 600 dots, high intensity | 32 [32 special points] * | 0.22 * | — | * When bus-connected |
| | A975GOT | Large-size graphic operation terminal<br>256 colors, TFT color, 640 × 480 dots, high intensity | 32 [32 special points] * | 0.22 * | — | |
| | A970GOT | Large-size graphic operation terminal<br>16 colors, TFT color, 640 × 480 dots, high intensity/16 colors, TFT color, 640 × 480 dots, wide viewing angle/8 colors, STN color, 640 × 480 dots/2 colors, STN monochrome, 640 × 480 dots | 32 [32 special points] * | 0.22 * | — | |
| | A960GOT | Large-size graphic operation terminal<br>2 colors, EL, 640 × 400 dots | 32 [32 special points] * | 0.22 * | — | |
| | A956GOT | Medium-size graphic operation terminal<br>8 colors, STN color, 320 × 240 dots/STN monochrome, 320 × 240 dots/256 colors, TFT color, 320 × 240 dots | 32 [32 special points] * | 0.22 * | — | |
| | A956WGOT | Medium-size graphic operation terminal<br>256 colors, TFT color, 480 × 234 dots | 32 [32 special points] * | 0.22 * | — | |
| | A953GOT | Medium-size graphic operation terminal<br>8 colors, STN color, 320 × 240 dots/STN monochrome, 320 × 240 dots/256 colors, TFT color, 320 × 240 dots | — | — | — | For RS-232C connected only |
| | A951GOT | Medium-size graphic operation terminal<br>8 colors, STN color, 320 × 240 dots/STN monochrome, 320 × 240 dots/256 colors, TFT color, 320 × 240 dots | 32 [32 special points] * | 0.22 * | — | * When bus-connected |
| | A950GOT | Medium-size graphic operation terminal<br>8 colors, STN color, 320 × 240 dots/STN monochrome, 320 × 240 dots/256 colors, TFT color, 320 × 240 dots | — | — | — | For RS-422 connected only |

| Item | Model | Description | Number of occupied points (points) [I/O allocation module type] | Current consumption | | Remark |
|---|---|---|---|---|---|---|
| | | | | 5VDC (A) | 24VDC (A) | |
| Basic base unit | A1S32B | 2 I/O module can be installed. | — | — | — | Extension connector on the right and left side each. |
| | A1S33B | 3 I/O module can be installed. | | | | |
| | A1S35B | 5 I/O module can be installed. | | | | |
| | A1S38B | 8 I/O module can be installed. | | | | |
| Extension base unit | A1S52B | 2 I/O module can be installed. | — | — | — | The power supply module cannot be installed. (Power is supplied from the basic base module.) |
| | A1S55B | 5 I/O module can be installed. | | | | |
| | A1S58B | 8 I/O module can be installed. | | | | |
| | A1S65B | 5 I/O module can be installed. | — | — | — | The power supply module is required. |
| | A1S68B | 8 I/O module can be installed. | | | | |
| Extension cable | A1SC01B | 55mm (2.17 in.) long flat cable | — | — | — | For extension towards right. |
| | A1SC03B | 330mm (13 in.) long | — | — | — | Connection cable for the extension base module. |
| | A1SC07B | 700mm (27.56 in.) long | | | | |
| | A1SC12B | 1200mm (47.24 in.) long | | | | |
| | A1SC30B | 3000mm (118.11 in.) long | | | | |
| | A1SC60B | 6000mm (236.22 in.)long | | | | |
| | A1SC05NB | 450mm (17.72 in.)long | — | — | — | Cable for the A□N, A□A extension base module. |
| | A1SC07NB | 700mm (27.56 in.) long | | | | |
| | A1SC30NB | 3000mm (118.11 in.) long | | | | |
| | A1SC50NB | 5000mm (196.86 in.) long | | | | |

| Item | | Model | Contents | Applicable models |
|---|---|---|---|---|
| Memory cassette | EPROM | A2SMCA-14KP | With a 14k-step EPROM (direct connection) | A2SWA-28P is required |
| | $E^2$PROM | A2SNMCA-30KE | With a 30k-step $E^2$PROM (direct connection) | Direct writing to and reading from a peripheral device is feasible. |
| Memory write adapter | | A2SWA-28P | Adapter for the memory cassette attachment connector/28-pin EPROM | Used for the ROM writing of A2SMCA-I4KP |
| Battery | | A6BAT | IC-RAM memory backup | Installed in the A2USHCPU-S1 main module |
| Connector/terminal block converter unit | | A6TBXY36 | For the sink-type input module and sink-type output module. (standard type) | A1SX41(S1/S2), A1SX42(S1/S2), A1SY41, A1SY42, A1SY82, A1SH42(S1) |
| | | A6TBXY54 | For the sink-type input module and sink-type output module. (2-wire type) | |
| | | A6TBX70 | For the sink-type input module. (3-wire type) | A1SX41(S1/S2), A1SX42(S1/S2), A1SH42(S1) |
| | | A6TBX36-E | For the source-type input module. (standard type) | A1SX81(S2), A1SX71, A1SX82-S1 |
| | | A6TBY36-E | For the source-type output module. (standard type) | A1SY81, A1SY82 |
| | | A6TBX54-E | For the source-type input module. (2-wire type) | A1SX81(S2), A1SX71, A1SX82-S1 |
| | | A6TBY54-E | For the source-type output module. (2-wire type) | A1SY81, A1SY82 |
| | | A6TBX70-E | For the source-type input module. (3-wire type) | A1SX81(S2), A1SX71, A1SX82-S1 |
| Cable for the connector/terminal block converter unit | | AC05TB | 0.5m (1.64 ft.) for the source module | A6TBXY36<br>A6TBXY54<br>A6TBX70 |
| | | AC10TB | 1m (3.28 ft.) for the source module | |
| | | AC20TB | 2m (6.56 ft.) for the source module | |
| | | AC30TB | 3m (9.84 ft.) for the source module | |
| | | AC50TB | 5m (16.40 ft.) for the source module | |
| | | AC80TB | 8m for the sink module | |
| | | AC100TB | 10m for the sink module | |
| | | AC05TB-E | 0.5m (1.64 ft.) for the source module | A6TBX36-E<br>A6TBY36-E<br>A6TBX54-E<br>A6TBY54-E<br>A6TBX70-E |
| | | AC10TB-E | 1m (3.28 ft.) for the source module | |
| | | AC20TB-E | 2m (6.56 ft.) for the source module | |
| | | AC30TB-E | 3m (9.84 ft.) for the source module | |
| | | AC50TB-E | 5m (16.40 ft.) for the source module | |
| Relay terminal unit | | A6TE2-16SRN | For the sink-type output module | A1SY41, A1SY42, A1SH42(S1) |
| Cable for connecting the relay terminal unit | | AC06TE | 0.5m (1.64 ft.) long | A6TE2-16SRN |
| | | AC10TE | 1m (3.28 ft.) long | |
| | | AC30TE | 3m (9.84 ft.) long | |
| | | AC50TE | 5m (16.40 ft.) long | |
| | | AC100TE | 10m (32.81 ft.) long | |
| Terminal block cover for the A1S I/O module and the special module | | A1STEC-S | Slim-type terminal block cover for the A1S I/O module and the special module (terminal block type). | All terminal block connector type modules |
| Insulation displacement terminal block adapter | | A1S-TA32 | Insulation displacement terminal block adapter for 32 points 0.5mm$^2$ (AWG20) | A1SX41(S1/S2), A1SX71, A1SY41, A1SY71 |
| | | A1S-TA32-3 | Insulation displacement terminal block adapter for 32 points 0.3mm$^2$ (AWG22) | |
| | | A1S-TA32-7 | Insulation displacement terminal block adapter for 32 points 0.75mm$^2$ (AWG18) | |
| Terminal block adapter | | A1S-TB32 | For 32 points, conversion into Europe type terminal block | A1SX41(S1/S2), A1SX71, A1SY41, A1SY71 |
| 40-pin connector | | A6CON1 | Soldering type, straight out | Sink type (40p FCN) |
| | | A6CON2 | Solderless type, straight out | |
| | | A6CON3 | Press-fit type, flat cable | |
| | | A6CON4 | Soldering type, straight/diagonal out | |
| 37-pin D-sub connector | | A6CON1E | Soldering type, straight out | Source type (37p D-sub) |
| | | A6CON2E | Solderless type, straight out | |
| | | A6CON3E | Press-fit type, flat cable | |

### (2) Peripheral devices

| Item | Model | Remark | |
|---|---|---|---|
| Plasma hand-held graphic programmer | A6PHP-SET | • A6PHP main module<br>• SW GP-GPPA ..... GPP function startup floppy disk for the A series.<br>• SW GP-GPPK ..... GPP function startup floppy disk for the K series.<br>• SW0-GPPU ..... User floppy disk (2DD).<br>• AC30R4 ..... 3m (9.84 ft.)-long RS-422 cable. | |
| Intelligent GPP | A6GPP-SET | • A6GPP main module<br>• SW GP-GPPA ..... GPP function startup floppy disk for the A series.<br>• SW GP-GPPK ..... GPP function startup floppy disk for the K series.<br>• SW0-GPPU ..... User floppy disk (2DD).<br>• AC30R4 ..... 3m (9.84 ft.)-long RS-422 cable. | |
| Composite video cable | AC10MD | • Connection cable for the monitor display of the A6GPP screen. 1m (3.28 ft.)long | |
| RS-422 cable | AC30R4 | 3m (9.84 ft.) long | Connection cable for between the CPU main module and A6GPP/A6PHP |
| | AC300R4 | 30m (98.43 ft.) long | |
| User floppy disk | SW0-GPPU | 2DD-type | Floppy disk for storing user programs (3.5-inch, pre-formatted) |
| Cleaning floppy disk | SW0-FDC | For A6GPP/A6PHP | Floppy disk for cleaning the floppy disk drive. |
| Optional keyboard for A6PHP | A6KB-SET-H | • A6KB keyboard<br>• AC03R4H ..... 0.3m (0.98 ft.)-long connection cable between A6KB and A6PHP.<br>• A6KB-C ..... Key sheet for the GPP mode of A6KB. | |
| Optional keyboard for A6GPP | A6KB-SET | • A6KB keyboard<br>• AC03R4L ..... 0.3m (0.98 ft.)-long connection cable between A6KB and A6GPP.<br>• A6KB-C Key sheet for the GPP mode of A6KB. | |
| Printer | K6PR-K<br>A7NPR-S1 | • For printing out program circuit diagrams and various lists. | |
| RS232C cable | AC30R2 | Connection cable for between A6GPP/A6PHP and printer (K6PR-K, A7NPR-S1, and a general-purpose printer with RS-232C interface)<br>3m (9.84 ft.) long | |
| Printer paper | K6PR-Y<br>K7PR-Y | Printer paper for K6PR(S1) and K6PR-K. 9-inch paper. 2000 sheets per unit.<br>Printer paper for A7PR and A7NPR. 11-inch paper. 2000 sheets per unit. | |
| Inked ribbon for K6PR(K) | K6PR-R | Replacement inked ribbon for K6PR-K. | |
| Inked ribbon for A7NPR-S1 | A7NPR-R | Replacement inked ribbon for A7NPR-S1. | |
| Programming module | A7PUS | Read/write of the program is performed by connecting to the CPU main module with a RS-422 cable (AC30R4-PUS). (5VDC 0.4A) | |
| | A8PU<br>A8UPU | Read/write of the program is performed by connecting to the CPU main module with a RS-422 cable (AC30R4-PUS, AC20R4-A8PU). (5VDC 0.4A) | |

| Item | Model | Remark |
|---|---|---|
| RS-422 cable | AC30R4-PUS | Connection cable for between the CPU main module and A7PUS, A8PU, A8UPU.<br>3m (9.84 ft.) long |
| | AC20R4-A8PU | Connection cable for between the CPU main module and A8PU, A8UPU.<br>2m (6.56 ft.) long |
| P-ROM write module | A6WU | • Used to write the program in the CPU/A6PHP main module to a ROM, or to read out the program in the ROM for the CPU main module.<br>• Connect to the CPU/A6PHP with an AC30R4/AC03WU cable. |
| Data access module | A6DU-B | • Used for monitoring the CPU devices, changing the setting values/ current values, and displaying the operation status. (5VDC 0.23A)<br>• Connect to the CPU with an AC30R4-PUS cable. |
| Modem interface module | A6TEL | • An interface module which connects the PC CPU and the modem. Using a telephone line, the communication is performed between a remote peripheral device and the CPU. (5VDC 0.2A)<br>• Connect to the CPU with an AC30R4-PUS cable. |
| RS-422 cable | AC30R4<br>AC300R4 | Connection cable for between the CPU main module and A6WU. 3m/30m (9.84 ft./98.43 ft.) long. |
| | AC03WU | Connection cable for between the A6PHP main module and A6WU. 0.3m (0.98 ft.) long. |

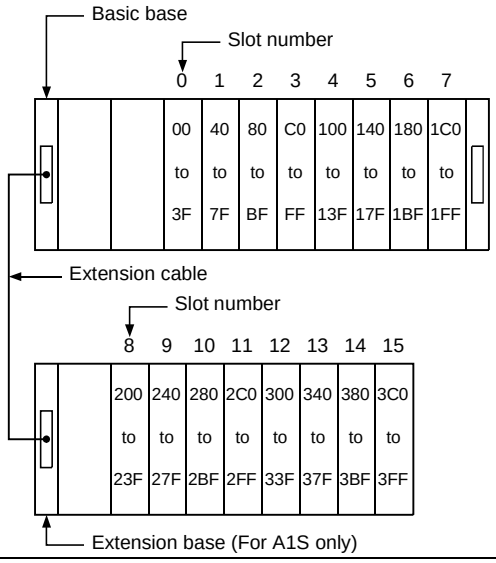
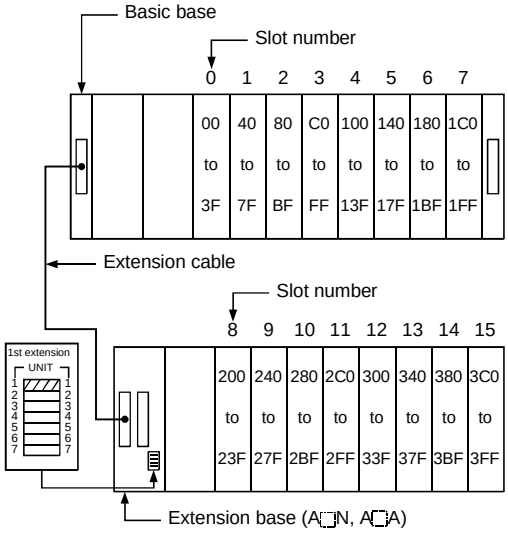
## 2.4 System Configuration Overview

There are four system configuration types as follows:

(1) --**Stand-alone system** ..... A system with a basic base module only, or with a basic base system and an extension base module connected with the expansion cable.
(2) --**Network system**..... A system for controlling multiple PCs and remote I/O modules.
(3) **Computer link system**..... A system for data exchange between the A2USHCPU-S1 and the computer (personal computer, etc.) by using an A1SJ71UC24 computer link module.
(4) **Composite system** ..... A system which has a combination of a network system and a computer link system.

The details of the system configuration, number of I/O points, I/O number assignment, etc., of a stand-alone system are listed on the following page.

A2USHCPU-S1 system

<table>
<tr><td>System configuration</td><td>[When the A1S dedicated extension base is used]<br>An example when a 64-point module is installed to each slot is shown.<br> 
</td><td>[When the AcN or AcA extension base is used]<br>An example when a 64-point module is installed to each slot is shown.<br> 
</td></tr>
<tr><td>Maximum number of extension</td><td>1 extension unit</td><td>1 extension unit</td></tr>
<tr><td>Maximum number of I/O modules</td><td colspan="2">16 modules</td></tr>
<tr><td>Maximum number of I/O points</td><td colspan="2">1024 points</td></tr>
<tr><td>Basic base unit model</td><td colspan="2">A1S32B, A1S33B, A1S35B, A1S38B</td></tr>
<tr><td>Extension base unit model</td><td>A1S65B, A1S68B, A1S52B, A1S55B, A1S58B</td><td>A62B, A65B, A68B, A52B, A55B, A58B</td></tr>
<tr><td>Extension cable model</td><td>A1SC03B, A1SC07B, A1SC12B, A1SC30B,<br>A1SC01B (right-side installation), A1SC60B</td><td>A1SC05NB. A1SC07NB<br>A1SC30NB, A1SC50NB</td></tr>
<tr><td>Notes</td><td colspan="2">(1) Only one extension base module can be used. (The second extension module cannot be used.)<br>(2) When the extension base A1S52B, A1S55B, A1S58B, A55B or A58B is used, the 5VDC power is supplied from the power supply module of the basic base module. Before use, refer to Section 6.1.3 and examine if it can be used.<br>(3) Limit the length of extension cable to 6m or shorter.<br>(4) If an extension cable is used, do not tie it with the main circuit cables, which has high voltage, large current, or install them close to each other.</td></tr>
<tr><td>Assignment of the I/O numbers<br>(When I/O is not assigned)</td><td colspan="2">(1) Assign I/O numbers to the basic base unit first, then to the extension base unit.<br>(2) Assign I/O numbers as if both basic base unit and extension base unit have 8 slots each. When the A1S32B/A1S33B/A1S35B for 2/3/5 slots are used as the basic base unit, add 6/5/3 slots (96 points/48 points) and assign the extension base unit I/O numbers.<br>(3) 16 points are assigned to an empty slot.<br>(4) When an extension base unit for A□N or A□A is used, be sure to set to a single extension level. If it is set to the number of skipped unit, 16 points/slot are assigned to all of "skipped unit x 8 slots", and thus it does not work.<br>(5) Items (2) to (4) can be changed by the I/O assignment. Refer to the ACPU Programming Manual (Fundamentals) for details.</td></tr>
</table>

# 3. GENERAL SPECIFICATION

The general specification common to various modules is shown.

**Table 3.1 General specification**

<table>
<tr><th>Item</th><th colspan="5">Specification</th></tr>
<tr><td>Operation ambient temperature</td><td colspan="5">0 to 55°C</td></tr>
<tr><td>Storage ambient temperature</td><td colspan="5">-20 to 75°C</td></tr>
<tr><td>Operation ambient humidity</td><td colspan="5">10 to 90%RH, no condensation</td></tr>
<tr><td>Storage ambient humidity</td><td colspan="5">10 to 90%RH, no condensation</td></tr>
<tr><td rowspan="9">Vibration durability</td><td rowspan="9">Conforms to the JIS B 3502 and IEC 61131-2</td><td colspan="4">When there is intermittent vibration</td></tr>
<tr><td>Frequency</td><td>Acceleration</td><td>Amplitude</td><td>Sweep count</td></tr>
<tr><td>10 to 57Hz</td><td>—</td><td>0.075mm (0.003 in.)</td><td rowspan="5">10 times each in X, Y, and Z directions (80 minutes)</td></tr>
<tr><td>57 to 150Hz</td><td>9.8m/s$^2$</td><td>—</td></tr>
<tr><td colspan="3">When there is continuous vibration</td></tr>
<tr><td>Frequency</td><td>Acceleration</td><td>Amplitude</td></tr>
<tr><td>10 to 57Hz</td><td>—</td><td>0.035mm (0.001 in.)</td></tr>
<tr><td>57 to 150Hz</td><td>4.9m/s$^2$</td><td>—</td></tr>
<tr><td>Shock durability</td><td colspan="5">Conforms to the JIS B 3502 and IEC 61131-2 (147 m/s$^2$ ), 3 times each in 3 directions)</td></tr>
<tr><td>Operation ambiance</td><td colspan="5">No corrosive gas</td></tr>
<tr><td>Operation height *3</td><td colspan="5">2000m(6562 ft.) or less</td></tr>
<tr><td>Installation area</td><td colspan="5">On the control panel</td></tr>
<tr><td>Over-voltage category *1</td><td colspan="5">II or less</td></tr>
<tr><td>Pollution level *2</td><td colspan="5">2 or less</td></tr>
</table>

*1 Indicates the location the device is connected, from the public cable network to the device structure wiring area.
Category II applies to the devices to which the power is supplied from a fixed equipment.
Surge withstand voltage for devices with up to 300V of rated voltage is 2500V.

*2 This is an index which indicates the degree of conductive object generation in the environment where the device is used. Pollution level 2 is when only non-conductive pollution occurs. A temporary conductivity caused by condensation must be expected occasionally.

*3 Do not use or store the PC in the environment where the pressure is higher than the atmospheric pressure at sea level. Otherwise, malfunction may result. To use the PC in high-pressure environment, contact your nearest Mitsubishi representative.

# 4. CPU MODULE

## 4.1 Performance Specification

Performance specifications of A2USHCPU-S1 module are shown below.

**Performance specifications**

| Item | | | Model | Remark |
|---|---|---|---|---|
| | | | A2USHCPU-S1 | |
| Control method | | | Repeated operation of stored program | |
| I/O control method | | | Refresh method | Partial direct input and output possible by instruction |
| Program language | | | Dedicated language for sequence control<br>Relay Symbol Language, Logic Symbolic Language, MELSAP-II (SFC) | |
| Processing speed (sequence instructions) (μs/step) | | | 0.09 | |
| Number of instructions (type) | | Sequence instructions | 25 | |
| | | Basic and application instructions | 233 | |
| | | Dedicated instruction | 204 | |
| Constant scan (ms) (Program startup with a constant time interval) | | | 10 to 190 (setup possible with 10ms units) | Setup to special register D9020 |
| Memory capacity | | | 256k bytes (built-in RAM) | A2SMCA-14KP/14KE A2SNMCA-30KE (64k bytes) installation possible |
| Program capacity (steps) | | Main sequence program | Maximum 30k step | Set by parameters |
| | | Sub sequence program | None | |
| I/O device points | | | 8192 (X/Y0 to 1FFF) | Number of points which can be used in a program |
| I/O points | | | 1024 (X/Y0 to 3FF) | Number of points accessible from I/O module |
| Device points | Internal relay [M] (points) | | 7144 (M0 to M999, M2048 to M8191) | The range can be changed by parameters. |
| | Latch relay [L] (points) | | 1048 (L1000 to L2047) | |
| | Step relay [S] (points) | | 0 (None for the initial state) | |
| | | | Total 8192 shared by M, L, S | |
| | Link relay [B] (points) | | 8192 (B0 to B1FFF) | |
| | Timer [T] (points) | | 2048 (Default 256 points)<br>• 100ms timer (T0 to T199) ..... Setting time: 0.1 to 3276.7s<br>• 10ms timer (T200 to T255) ..... Setting time: 0.01 to 327.67s<br>• 100ms retentive timer (none for initial)..... Setting time: 0.1 to 3276.7s<br>• Expansion timer (T256 to T2047)..... Time set by word device (D, W, R) | The range and number of points for use set by parameters (Refer to Section 4.2.1) |
| | Counter [C] (points) | | 1024 (Default: 256 points)<br>• Normal counter (C0 to C255)..... Setting range : 1 to 32767 times<br>• Interrupt counter (none for initial)..... C224 to C255 possible depending on setting<br>• Expansion counter (C256 to C1023)..... Count value set by word device (D,W,R) | The range and number of points for use set by parameters (Refer to Section 4.2.1) |
| | Data register [D] (points) | | 8192 (D0 to D8191) | |
| | Link register [W] (points) | | 8192 (W0 to W1FFF) | |
| | Annunciator [F] (points) | | 2048 (F0 to F2047) | Device for failure detection |
| | File register [R] (points) | | 8192 (R0 to R8191) | Points set by parameters |

**Performance specifications (Continued)**

| Item | | Model | Remark |
|---|---|---|---|
| | | A2USHCPU-S1 | |
| Device points | Accumulator [A] (points) | 2(A0, A1) | |
| | Index register [V, Z] (points) | 14(V, V1 to V6, Z, Z1 to Z6) | |
| | Pointer [P] (points) | 256 (P0 to P255) | |
| | Interrupt pointer [I] (points) | 32 (I0 to I31) | |
| | Special relay [M] (points) | 256 (M9000 to M9255) | |
| | Special register [D] (points) | 256 (D9000 to D9255) | |
| Comment (points) | | Maximum 4032 (Set with the unit of 64 points) | Set by parameters |
| Expanded comment (points) | | Maximum 3968 (Set with the unit of 64 points) | |
| Switch output mode from STOP to RUN | | Select either re-output the operation status before stopping (default) or output after execution of operation. | Set by parameters |
| Self-diagnosis function | | Operation watching time monitor (watchdog timer fixed to 200ms)<br>Error detection in the memory, CPU, I/O, battery, etc. | Refer to Section 4.1.4 for details. |
| Operation mode upon error | | Select stop or continue | Set by parameters (refer to Section 4.2.1.) |
| RUN time startup method | | Initialization start (upon power supply on/power restoration after power failure, automatic restart by turning the "RUN" switch of the CPU to ON.) | |
| Latch (power failure compensation) range | | L1000 to L2047 (default)<br>(Possible to setup latch ranges for L, B, T, C, D, W) | Range set by parameters |
| Remote RUN/PAUSE contacts | | Possible to setup one contact point for each of RUN/PAUSE from X0 to X1FFF. | Set by parameters |
| Title for printing registration | | YES (128 characters) | Set by parameters |
| Keyword registration | | YES | Set by parameters |
| I/O allocation | | Possible to register occupied I/O points and module model names. | |
| Step operation | | Possible to execute or stop sequence program operations. | Refer to Section 4.3. |
| Interrupt processing | | Possible to operate an interrupt program by the interrupt module or constant period interrupt signal. | |
| Data link | | MELSECNET/10, MELSECNET(II)/B | |
| Clock function | | Year, month, day, hour, minute, second, day of the week (automatic detection of the leap year)<br>Precision -3.2 to +5.1s (TYP. +1.6s)/d at 0°C<br>-1.2 to +5.3s (TYP +2.2s)/d at 25°C<br>-8.2 to +3.5s (TYP -1.6s)/d at 55°C | |
| Allowable period of momentary power failure | | By power supply module | Refer to Section 5.1. |
| 5VDC internal power consumption (A) | | 0.32 | |
| Weight (kg(lb)) | | 0.46 (1.01) | |
| External dimensions (mm(inch)) | | 130 (5.12) × 54.5 (2.15) × 93.6 (3.69) | |

**NOTE**

When conventional system S/W packages and peripheral devices are used, be careful as the usable ranges of devices are limited.

Details are provided in Section 2.2.3.

### 4.1.1 Overview of operation processing

An overview of processing subsequent to starting power supply for A2USHCPU-S1 to execution of the sequence program is explained.
A2USHCPU-S1's processing may be categorized roughly into the following four kinds:

**(1) Initial processing**

This is a preprocess to execute sequence operations, and is performed only once upon power-on or reset.

(a) Resets the I/O module and initialize it.
(b) Initializes the range of data memory for which latch is not set up (sets the bit device to OFF and the word device to 0).
(c) Allocates I/O address of the I/O module automatically based on the I/O module number or the position of installation on the extension base module.
(d) Executes the check items for power-on and reset among the PC CPU's self-diagnosis items (Refer to 4.1.4).
(e) For the control station of the MELSECNET/10 or the master station of MELSECNET (II)/B, sets the network/link parameter information to the network/data-link module, and commences the network communication/data link.

**(2) Refresh processing of I/O module**

Executes the refresh processing of I/O module. (Refer to the ACPU Programming Manual (Fundamentals).)

**(3) Operation processing of a sequence program**

Executes a sequence program from step 0 to the END instruction written in the PC CPU.

**(4) END processing**

This is a post-process to finish one cycle of operation processing of the sequence program and to return the execution of the sequence program to the step 0.

(a) Performs self-diagnosis checks, such as fuse blown, I/O module verification, and low battery. (Refer to Section 4.1.4.)
(b) Updates the current value of the timer, sets the contact ON/OFF, updates the current value of the counter and sets the contact to ON. (Refer to the ACPU Programming Manual (Fundamentals).)
(c) Performs data exchange between PC CPU and computer link module when there is a data read or write request from a computer link module. (A1SJ71UC24-R2, AJ71C24(S3), AD51(S3), etc.)
(d) Performs the refresh processing when there is a refresh request from the network module or link module.
(e) When the trace point setting of sampling trace is by each scan (after the execution of END instruction), stores the condition of the device for which it is setup into the sampling trace area.

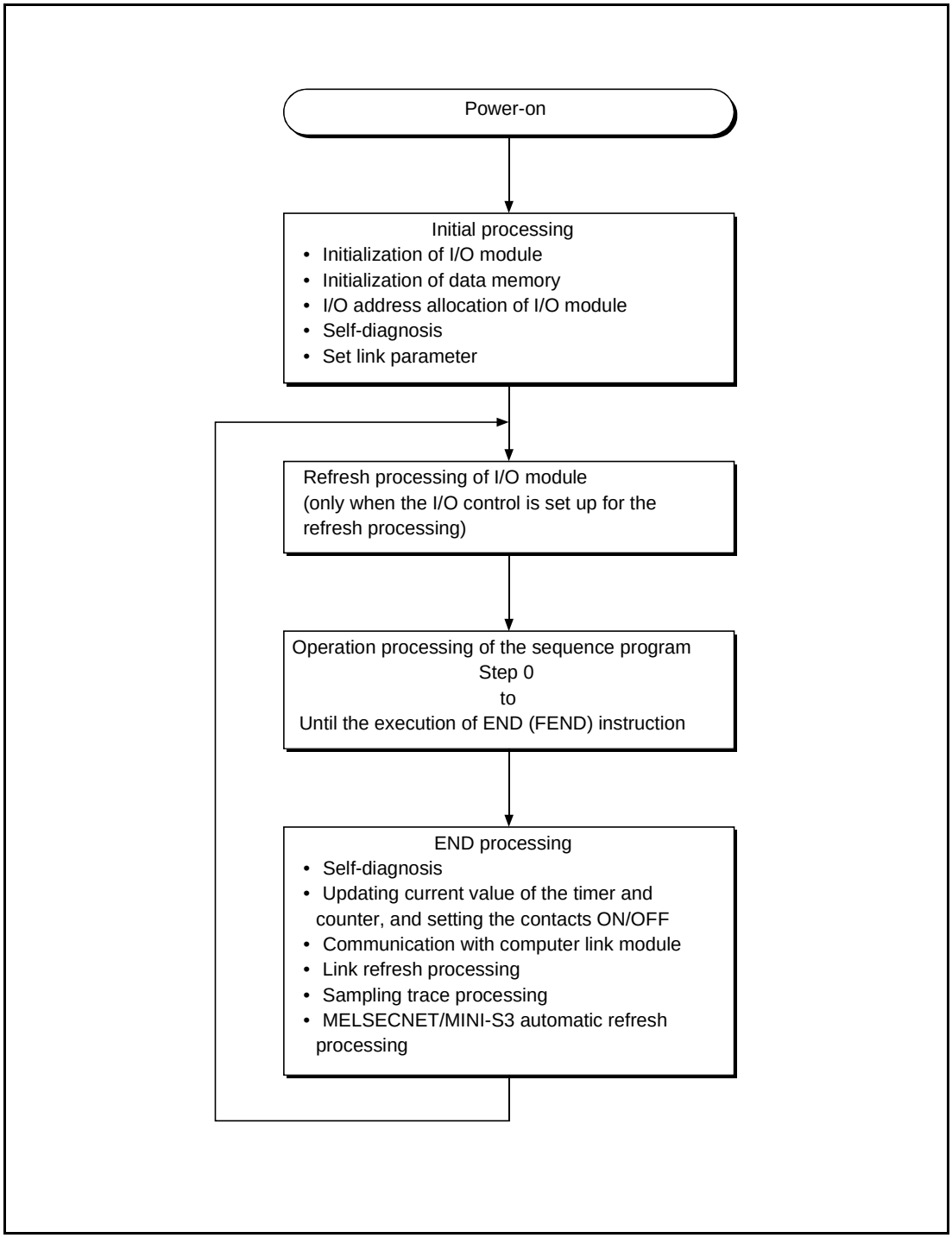



**Figure 4.1 A2USHCPU-S1 operation processing**

### 4.1.2 Operation processing of RUN, STOP, PAUSE, and STEP RUN

The PC CPU has four kinds of operation states: RUN state, STOP state, PAUSE state, and step operation (STEP RUN) state.
Operation processing of PC CPU in each operation state is explained.

**(1) RUN state operation processing**

(a) The repetition of sequence program operation in the order from step 0 → END (FEND) instruction → step 0 is called the RUN state.

(b) When entering the RUN state, the output state escaped by STOP is output depending on the output mode setting of parameter upon STOP → RUN.

(c) Processing time from switching from STOP to RUN until the startup of sequence program is usually one to three seconds, yet it may vary depending on the system configuration.

**(2) STOP state operation processing**

(a) The termination of operation of the sequence program by the use of RUN/STOP key switch or the remote STOP is called the STOP state. (Refer to Section 4.3.)

(b) When entering the STOP state, it escapes the output state and sets all output points to OFF. Data memories except for output (Y) are retained.

**(3) PAUSE state operation processing**

(a) The termination of operation of sequence program while retaining output and data memories is called the PAUSE state. (Refer to Section 4.3.)

**(4) Step operation (STEP RUN) operation processing**

(a) Step operation is an operation mode wherein operation processing of a sequence program can be paused/resumed by each instruction from peripheral device(s). (Refer to Section 4.3.)

(b) Since an operation processing is paused while retaining the output and data memories, condition of the execution can be confirmed.

### (5) Operation processing of PC CPU when RUN/STOP key switch is operated

| PC CPU operation processing / RUN/STOP key switch operation | Operation processing of the sequence program | External output | Data memories (Y, M, L, S, T, C, D) | Remark |
|---|---|---|---|---|
| RUN → STOP | Executes up to the END instruction, then stops. | OS escapes the output state, and sets all the output points to OFF. | Maintains the condition immediately prior to entering the STOP state. | |
| STOP → RUN | Starts. | Determined by the output mode of the parameter upon STOP → RUN. | Starts operations from the condition immediately prior to entering the STOP state. | |

**POINTS**

Whether in the RUN, STOP or PAUSE state, PC CPU is performing the following:

- Refresh processing of I/O module
- Data communication with computer link module
- Link refresh processing.

Thus, even in the STOP or PAUSE state, monitoring or testing I/O with peripheral devices, reading or writing from a computer link module, and communication with other stations by MELSECNET are possible.

### 4.1.3 Operation processing upon momentary power failure

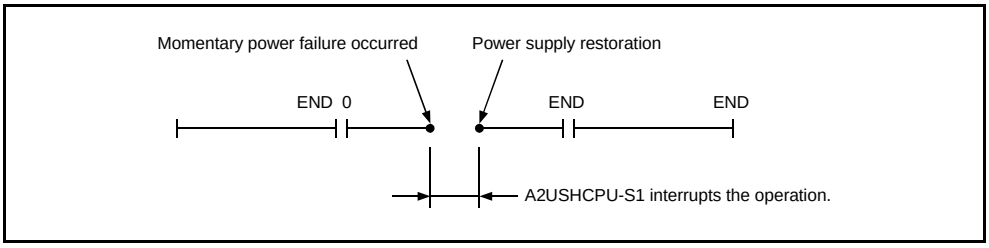
The PC CPU detects a momentary power failure when input power voltage supplied to the power supply module becomes lower than the specified range.
When the PC CPU detects a momentary power failure, following operation processing is performed.

**(1) When a momentary power failure shorter than allowable period of momentary power failure occurred:**

(a) When a momentary power failure occurred, operation processing is interrupted while the output state is retained.

(b) When the momentary power failure is reset, operation processing will be continued.

(c) When a momentary power failure occurred and the operation was interrupted, measurement of the watchdog timer (WDT) continues. For instance, when the scan time is 190ms and a momentary power failure of 15ms occurs, it causes the watchdog timer error (200ms).




**Operation processing upon momentary power failure**

**(2) When a momentary power failure longer than the allowable period of momentary power failure occurred:**

The PC CPU performs the initial start. The operation processing is the same as power-on or reset operation with the reset switch.

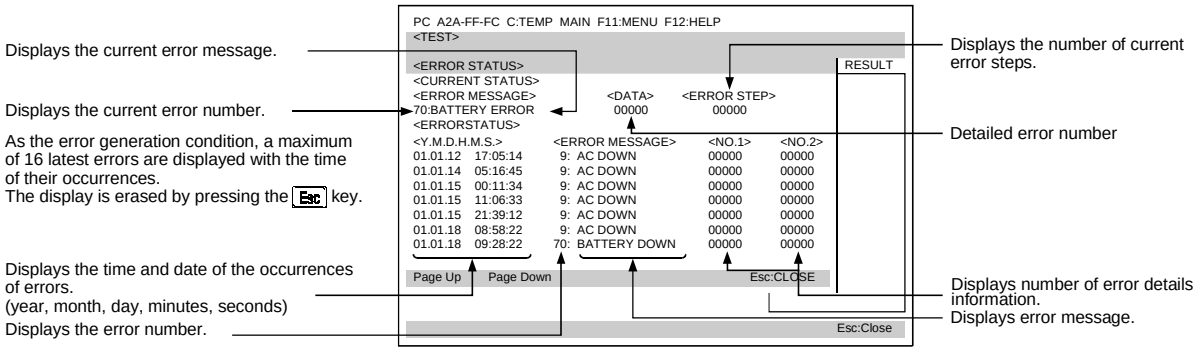
### 4.1.4 Self-diagnosis

Self-diagnosis is a function with which A2USHCPU-S1 diagnoses itself for the presence of any abnormalities.

(1) Upon turning on the power supply to PC or when an abnormality occurred while the PC is running, the A2USHCPU-S1's self-diagnosis processing prevents malfunctions of the PC and performs preventive maintenance by detecting the abnormality, displaying an error display, halting the operation of A2USHCPU-S1, and so on.

(2) A2USHCPU-S1 stores the error occurred last to a special register D9008 as an error code, and stores further detailed error code to a special register D9091.

(3) Even with the power-off, the latest error information and 15 errors in the past are stored by battery back-up. With the AnUCPU-supporting system FD, contents of up to 16 errors can be confirmed from the peripheral devices. Display example with SW IVD-GPPA is shown below:




(4) When the self-diagnosis detects an error, the module will be in one of the two modes below:

- Mode wherein operation of the PC is stopped
- Mode wherein operation of the PC continues

In addition, there are errors with which the operation can be selected to stop or to continue by the parameter setting.

(a) When a stop-operation mode error is detected by the self-diagnosis, the operation is stopped at the time of detection of the error, and sets the all outputs(Y) to OFF.

(b) When a continue-operation mode error is detected, the only part of the program with the error is not executed while the all other part is executed. Also, in case of I/O module verification error, the operation is continued using the I/O address prior to the error.

When an error is detected, error generation and error contents are stored in the special relay (M) and special register (D), so that in case of the continue-operation mode, the program can use the information to prevent any malfunctions of the PC or devices.

Error descriptions detected by the self-diagnosis are shown in the next page.

**REMARK**

1) As to the LED display message, the order of priority of the LED display can be changed if CPU is in the operation mode. (An error code is stored in the special register).
2) When the special relay M9084 is ON, checking on blown fuse, I/O verification and the battery are not performed (an error code is not stored in the special register).
3) The "Error display of peripheral device" in the table of self-diagnostic functions are messages displayed by the PC diagnosis of peripheral devices.

**Self-diagnostic functions**

| Diagnosis item | | Diagnosis timing | CPU status | Status of "RUN" LED | Error display of peripheral devices | Error code (D9008) |
|---|---|---|---|---|---|---|
| Memory error | Instruction code check | Upon execution of each instruction | Stop | Flickering | INSTRCT. CODE ERR. | 10 |
| | Parameter setting check | • Upon power-on and reset<br>• Upon switching from (STOP, PAUSE) to (RUN, STEP-RUN) | | | PARAMETER ERROR | 11 |
| | No END instruction | • When M9056 or M9057 is ON<br>• Upon switching from (STOP, PAUSE) to (RUN, STEP-RUN) | | | MISSING END INS. | 12 |
| | Unable to execute instruction | • CJ SCJ JMP CALL(P) FOR to NEXT CHG<br>Upon execution of each instruction<br>• Upon switching from (STOP, PAUSE) to (RUN, STEP-RUN) | | | CAN'T EXECUTE (P) | 13 |
| | Format (CHK instruction) check | Upon switching from (STOP, PAUSE) to (RUN, STEP-RUN) | | | CHK FORMAT ERR. | 14 |
| | Unable to execute instruction | • When interruption occurred<br>• Upon switching from (STOP, PAUSE) to (RUN, STEP-RUN) | | | CAN'T EXECUTE (I) | 15 |
| CPU error | RAM check | • Upon power-on and reset<br>• When M9084 is ON during STOP | Stop | Flickering | RAM ERROR | 20 |
| | Operation circuit check | • Upon power-on and reset | | | OPE. CIRCUIT ERR. | 21 |
| | Watchdog error supervision | • Upon execution of END instruction | | | WDT ERROR | 22 |
| | END instruction not executed | • Upon execution of END instruction | | | END NOT EXECUTE | 24 |
| | Main CPU check | Always | | | MAIN CPU DOWN | 26 |
| I/O error | I/O module verification *1 (Default: stop) | Upon execution of END instruction (However, not checked when M9084 or M9094 is ON.) | Stop / Operate | Flickering / ON | UNIT VERIFY ERR. | 31 |
| | Fuse blown *1 (Default: operate) | Upon execution of END instruction (However, not checked when M9084 or M9094 is ON.) | | | FUSE BREAK OFF. | 32 |
| Special function module error | Control bus check | Upon execution of FROM, TO instruction | Stop | Flickering | CONTROL-BUS ERR. | 40 |
| | Special function module error | Upon execution of FROM, TO instruction | | | SP. UNIT DOWN | 41 |
| | Link module error | • Upon power-on and reset<br>• Upon switching from (STOP, PAUSE) to (RUN, STEP-RUN) | | | LINK UNIT ERROR | 42 |
| | I/O interrupt error | When interruption occur | | | I/O INT. ERROR | 43 |
| | Special function module allocation error | • Upon power-on and reset<br>• Upon switching from (STOP, PAUSE) to (RUN, STEP-RUN) | | | SP. UNIT LAY. ERR. | 44 |
| | Special function module error *1 (Default: stop) | Upon execution of FROM, TO instructions | Stop | Flickering | SP. UNIT ERROR | 46 |
| | Link parameter error | • Upon power-on and reset<br>• Upon switching from (STOP, PAUSE) to (RUN, STEP-RUN) | Stop / Operate | Flickering / ON | LINK PARA. ERROR | 47 |
| Battery | Low battery | Always (However, not checked when M9084 is ON.) | Operate | Flickering | BATTERY ERROR | 70 |
| Operation check error *1 (Default: operate) | | Upon execution of each instruction | Stop / Operate | Flickering / ON | OPERATION ERROR *2 [<CHK> ERROR ⬚⬚⬚] | 50 |

*1: Can be changed by the parameter settings of a peripheral device.

*2: Displayed as a three-digit trouble code only for errors with the "CHK" instruction.

### 4.1.5 Device list

Usage range of A2USHCPU-S1 devices is shown below.

**Device list**

| Device | | Range of usage (points) | Description of device |
|---|---|---|---|
| | | A2USHCPU-S1 | |
| X | Input | X, Y<br>0 to 3FF (1024 points) | Used to supply PC commands and data from peripheral devices such as push buttons, select switches, limit switches and digital switches. |
| Y | Output | | Used to output control results of a program to external devices such as solenoids, magnetic switches, signal lights and digital display device. |
| X | Input | X, Y<br>0 to 1FFF (8192 points) | • Possible to use in a program after the I/O points usage range per each A2USHCPU-S1 (described above) to a maximum of 8192 points (external output is not allowed).<br>• Objective is to allocate for automatic I/O refresh of MELSECNET/MINI, for remote I/O of MELSECNET/10, for remote I/O of MELSECNET(B), or for CC-Link. |
| Y | Output | | |
| M | Special relay | M9000 to 9255 (256 points) | An auxiliary relay used inside a PC set in advance for a specialized use. |
| | Internal relay | M/L/S 0 to 8191 (8192 points)<br>8192 points as a total of M, L, S | An auxiliary relay inside a PC which cannot output directly to external devices. |
| L | Latch relay | | An auxiliary relay inside a PC which cannot output directly to external devices. Has the power failure compensation function. |
| S | Step relay | | Used in the same manner as the internal relay (M). Used as a relays to indicate the stage number of process stepping program, etc. |
| B | Link relay | B0 to B1FFF (8192 points) | An internal relay for data link and cannot output to external devices. The range not setup by link parameters can be used as the internal relay. |
| F | Annunciator | F0 to F2047 (2048 points) | For fault detection. A fault detection program is created in advance, and if it becomes ON during RUN, the number is stored in a special register D. |
| T | 100ms timer | T0 to T2047 (2048 points)<br>(Register for storing setting value(s) is required for T256 and later.) | Up-timing-timer. There are three kinds: 100ms timer, 10ms timer and 100ms retentive timer. |
| | 10ms timer | | |
| | 100ms retentive timer | | |
| C | Counter | C0 to C1023 (1024 points)<br>(Interrupt counter C224 to C255 fixed. Register for storing setting value(s) is required for C256 and later.) | There are two kinds: up-timing counter used in PC programs and interrupt counter which counts number of interrupts. |
| | Interrupt counter | | |
| D | Data register | D0 to D8191 (8192 points) | Memory used to store data inside PC. |
| | Special register | D9000 to D9255 (256 points) | Data memory set up in advance for a specialized use. |
| W | Link register | W0 to W1FFF (8192 points) | Register for data link. The range not set by link parameters can be used as a substitute for a data register. |
| R | File register | R0 to R8191 (8192 points) | For expanding the data register. User memory area is used for this. |
| A | Accumulator | A0, A1 (2 points) | Data register used to store a operation result of basic and application instructions. |
| Z<br>V | Index register | V, $V^1$ to $V^6$, Z, $Z^1$ to $Z^6$ (14 points) | Used for qualification of devices (X, Y, M, L, B, F, T, C, D, W, R, K, H, P) |
| N | Nesting | N0 to N7 (8 levels) | Indicates nesting structure of master control. |
| P | Pointer | P0 to P255 (256 points) | Indicates destination of branch instructions (CJ, SCJ, CALL, JMP). |
| I | Interrupt pointer | I0 to I31 (32 points) | When an interruption factor is generated, it indicates the destination of the interrupt program corresponding to the interruption factor. |
| K | Decimal constant | K-32768 to 32767 (16-bit instruction)<br>K-2147483648 to 2147483647 (32-bit instruction) | Used to set timer/counter, pointer number, interrupt pointer number, bit device digits, and values for basic and application instructions. |
| H | Hexadecimal constant | H0 to FFFF (16-bit instruction)<br>H0 to FFFFFFFF (32-bit instruction) | Used to set values for basic and application instructions. |

## 4.2 Parameter Setting Ranges

A list of parameter setting ranges is provided below. User memory allocation contents, I/O device allocation method and automatic refresh procedure for MELSECNET/MINI-S3 are also explained.

### 4.2.1 List of parameter setting range

Parameters are used for allocating the user memory area inside the memory cassette, setting various functions and device ranges.

A parameter is usually stored in the first 3k bytes of the user memory area.

Among the parameters, the network parameter for MELSECNET/10 is allocated and stored after the main sequence program area. (Refer to Section 4.2.2 for details).

As shown in the list below, a default value is given to each parameter.

Even though a default value can be used, parameter value can be changed to a value suitable for a particular application within a setting range by a peripheral device.

| Setting / Item | | Default value | Setting range |
|---|---|---|---|
| | | | A2USHCPU-S1 |
| Main sequence program capacity | | 6k steps | 1 to 30k steps (1k steps = in 2k-byte units) |
| File register | | — | 0 to 8k points (1k points = in 2k-byte units) |
| Expansion file register | | — | 1 block = 16k bytes<br>(Block setting for from No.1 to No.8, from No.10 to the end of unused area in the memory)<br>[Automatically setup in the unused area in the memory based on the file register setting.] |
| Comment capacity | | — | 0 to 4032 points (64 point unit = in 1k byte units)<br>[When comment capacity is set up, 1k byte is added to the memory area.] |
| Expansion comment capacity | | — | 0 to 3968 points (64 point unit = in 1k byte units) |
| Status latch | | — | No parameter setting<br>Performed by setting up expansion file registers to store device and result in each of status latch and sampling trace modes.<br>Refer to ACPU Programming Manual (Fundamentals). |
| Sampling trace | | — | |
| Latch range setting (power failure compensation) | Link relay (B) | • Latch: L1000 to L2047 only.<br>• None for others. | B0 to B1FFF (unit: 1 point) |
| | Timer (T) | | T0 to T255 (unit: 1 point)<br>T256 to T2047 (unit: 1 point) |
| | Counter (C) | | C0 to C255 (unit: 1 point)<br>C256 to C1023 (unit: 1 point) |
| | Data register (D) | | D0 to D8191 (unit: 1 point) |
| | Link register (W) | | W0 to W1FFF (unit: 1 point) |
| Link range setting for MELSECNET/10 | Number of link stations | — | Optical link: maximum 64 stations<br>Coaxial link: maximum 32 stations |
| | I/O (X/Y) | | X/Y0 to X/Y1FFF (unit: 16 points) |
| | Link relay (B) | | B0 to B1FFF (unit:16 points) |
| | Link register (W) | | W0 to W1FFF (unit: 1 point) |
| Settings for internal relay (M)<br>latch relay (L)<br>step relay (S) | | M0 to M999<br>M2048 to M8191<br>L1000 to L2047<br>None for S | M/L/S 0 to 8191<br>(where M, L, S are continuous numbers) |
| Timer settings | T0 to T255 | T0 to T199 (100ms)<br>T200 to T255(10ms) | • 256 points by 100ms, 10ms, and retentive timers (in 8 point units)<br>• Timers are continuously numbered. |
| | T256 to T2047 | — | • 1792 points by 100ms, 10ms, and retentive timers (in 16 point units)<br>• Timers are continuously numbered.<br>• Devices set: D, R, W (Setting required if 257 points or more.) |
| Counter setting | Interrupt counter setting | — | • Sets whether to use interrupt counter (C224 to C225) or not. |
| | Points used | 256 points<br>(C0 to C255) | • 0 to 1024 points (in 16 point units)<br>• Devices set: D, R, W (Setting required if 257 points or more.) |

| Item \ Setting | | Default value | Setting range<br>A2USHCPU-S1 |
|---|---|---|---|
| I/O number allocation | | — | • 0 to 64 points (in 16 point units)<br>.....Input module/output module/special function module/empty slot<br>• Module model name registration is possible. |
| Remote RUN/PAUSE contact setting | | — | • X0 to X1FFF<br>• RUN/PAUSE ..... 1 point (Setting of PAUSE contact only is not allowed.) |
| Operation modes when error occurred | Fuse blown | Continue | Stop/Continue |
| | I/O verification error | Stop | |
| | Operation error | Continue | |
| | Special function module check error | Stop | |
| | END batch processing | No | Yes/No |
| STOP → RUN display mode | | Re-output operation status prior to the stop | Output before STOP/after operation |
| Print title registration | | — | • 128 characters |
| Keyword registration | | — | • Up to 6 characters in hexadecimal (0 to 9, A to F) |
| Link range settings for MELSECNET II | Number of link stations | — | • 0 to 64 station(s) |
| | I/O (X/Y) | | X/Y0 to 3FF (in 16 point units) |
| | Link relay (B) | | • B0 to BFFF (in 16 point units) |
| | Link register (W) | | • W0 to WFFF (in 1 point units) |
| Link range settings for MELSECNET/MINI, MELSECNET/MINI-S3 | | — | Number of supported modules : 0 to 8 |
| | | | Head I/O number 0 to 1FF0 (in $10^H$ units) |
| | | | Model name registration : MINI, MINI-S3 |
| | | | Transmission/reception data : X, M, L, B, T, C, D, W, R, none (16 point units for bit devices) |
| | | | Number of retries : 0 to 32 times |
| | | | FROM/TO response setting : Link priority; CPU priority |
| | | | Data clear setting at faulty station : Retain/ Clear |
| | | | Faulty station detection : M, L, B, T, C, D, W, R, none (16 point units for bit devices) |
| | | | Error number : T, C, D, W, R |
| | | | Number of total remote stations : 0 to 64 station(s) |
| | | | Sending state setting during communication error : Test message, OFF data, retain (sending data) |

### 4.2.2 Memory capacity setting (for main program, file register, comment, etc.)

A2USHCPU-S1 has 256k bytes of user memory (RAM) as a standard. Parameters, T/C set value main program, MELSECNET/10 network parameters, expansion comment, file register, and comment data are stored in the user memory.

**(1) Calculation of memory capacity**

Determine the data types to be stored and the memory capacity with parameters before using the user memory.

Calculate the memory capacity according to Table 4.1.

**Table 4.1 Parameter setting and memory capacity**

| Item | | Setting unit | Memory capacity | Change into a ROM | Remark |
|---|---|---|---|---|---|
| Parameter, T/C set value | | — | 4k bytes (fixed) | Yes | The parameter and T/C set value occupy 4k bytes. |
| Main program | Sequence program | 1k step | [Main sequence program capacity] × 2k bytes | | |
| | Microcomputer program | 2k bytes | [Main microcomputer program capacity] k bytes | | The microcomputer program area is dedicated to SFC. |
| MELSECNET/10 network parameter | | — | (Network module) × 4k bytes | | One network module occupies up to a maximum of 4k bytes. |
| Expansion comment | | 64 points | $\left[\frac{\text{(Extension comment points)}}{64} + 1\right]$ k byte | No | If the expansion comment capacity is set, the system occupies 1k byte. |
| File register | | 1k point | (File register points) × 2k bytes | | |
| Comment | | 64 points | $\left[\frac{\text{(Comment points)}}{64} + 1\right]$ k byte | | If the comment capacity is set, the system occupies 1k byte. |

*(1) The capacity for network parameters of MELSECNET/10 changes depending on the contents set. The area for the network parameters shall be secured in 2k byte units based on the total of capacity for each setting. The memory capacity of each network parameter is as follows:

| Item | Memory capacity (bytes) |
|---|---|
| Internal data | 30 |
| Routing parameter | 390 |
| Transfer parameter between data links | 246 |
| Common parameter | 2164/module *1 |
| Refresh parameter | 92/module |
| Station specific parameter | 1490/module |

*1 It is 2722 bytes in case of a remote master station.

The network parameter capacity for MELSECNET/10 is determined from the total of the memory capacities calculated from above.

| Total of the capacity | Capacity for network parameter setting |
|---|---|
| 30 to 2048 bytes | 2k bytes |
| 2049 to 4096 bytes | 4k bytes |
| 4097 to 6144 bytes | 6k bytes |
| 6145 to 8192 bytes | 8k bytes |
| 8193 to 10240 bytes | 10k bytes |
| 10241 to 12288 bytes | 12k bytes |
| 12289 to 14336 bytes | 14k bytes |
| 14337 to 16384 bytes | 16k bytes |

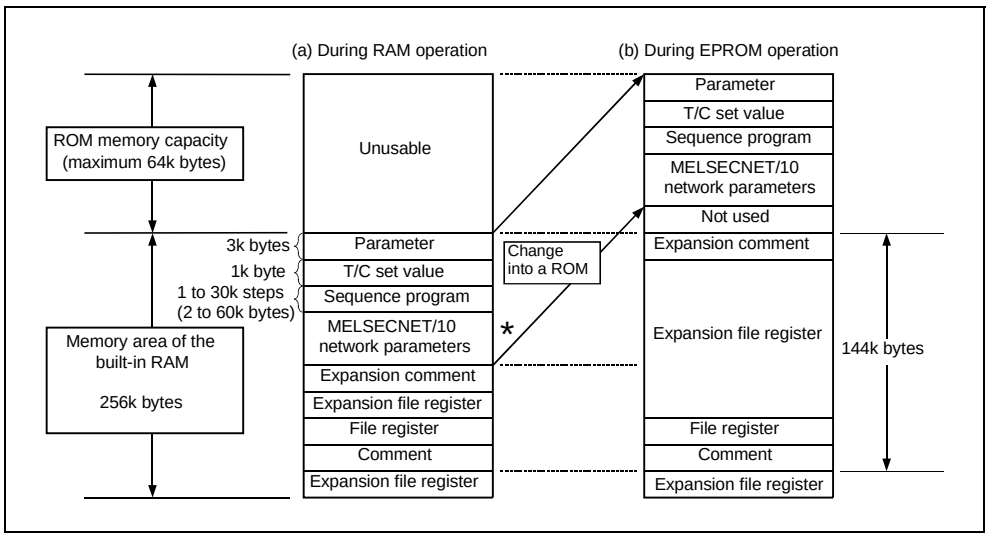
(2) If the MELSECNET(II) data link system is configured using a GPP function software package for the A2USH CPU, two-kilo bytes (for kilo steps) are occupied as a link parameter area.

**(2) Storing order in the user memory**

Each data set by the parameters are stored in the order shown below:

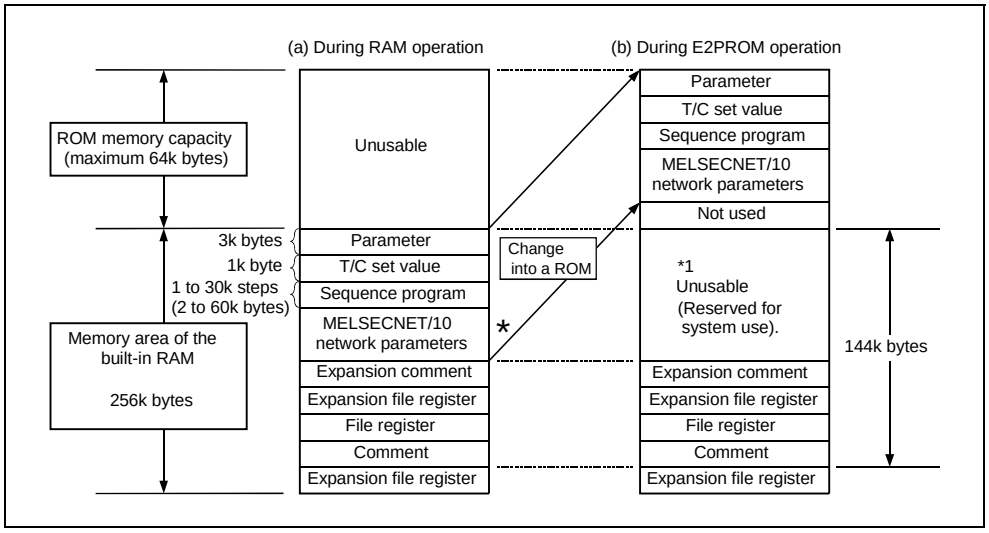
(a) When the main program is made into EPROM

By making the main program into EPROM, the expansion file register can be enlarged.




(b) Making the main program to $E^2$PROM

Even when the main program is made into $E^2$PROM, the system uses the same built-in RAM area (area*1 in figure below) as during RAM operation, so the expansion file register cannot be enlarged.




* When MELSECNET(II) data link system is constructed using the GPP function software package which is compatible to AnU, 2k bytes (equivalent to 1k step) are occupied for link parameter area.

**POINT**

Note that the sequence program can use only up to 22k steps when the maximum 16k bytes are used for the MELSECNET/10 network parameters.

The memory area for the sequence program for A2USHCPU-S1 is the same as that for MELSECNET/10. Therefore, the remainder of subtracting the memory area used by MELSECNET/10 network parameters from the maximum 30k steps can be used for the memory area for the sequence program.

### 4.2.3 Setting ranges of timer and counter

**(1) Timer setting range**

(a) Default values of the timer setting ranges are as follows:

Timer points : 256 points
100ms timer : T0 to T199
10ms timer : T200 to T255
Retentive timer : none

(b) When timer-use points are set to 257 or more, the default values will be as follows:

100ms timer : T0 to T199
10ms timer : T200 to T255
100ms timer : T256 to T2047

(c) The timer type can be arbitrarily set in continuous numbers, with T0 to T255 in 8 point units, and T256 to T2047 in 16 point units.
By setting the timer points actually to be used, the timer processing time subsequent to the END instruction can be shortened.

(d) Timer setting values are as follows:

T0 to T255 : constant or word device (D)
T256 to T2047 : word device (D, W, R)
(Allocate a storage device for the set value by setting parameters.)

**(2) Counter setting range**

(a) Default values of counter setting ranges are as follows:

Counter points : 256 points
Normal counter : C0 to C255
Interrupt counter : none

(b) When the counter-use points are set to 256 points or more, the default values will become as follows:

Normal counter : C0 to C255
Normal counter : C256 to C1024

(c) A counter which can be setup as an interrupt counter must only be in the range C244 to C255, and any counters outside the range cannot be set up.
Set up is made with parameters in C224 to C255 in one point unit for the interrupt counter.
Any counter in the range C224 to C255 which is not set up as an interrupt counter can be used as a normal counter.

The interrupt counters in C224 to C255 are allocated to the interrupt pointers I0 toI31 as shown below, and count the occurrences of interrupts in I0 to I31.

| Interrupt pointer | Interrupt counter | Interrupt pointer | Interrupt counter | Interrupt pointer | Interrupt counter | Interrupt pointer | Interrupt counter |
|---|---|---|---|---|---|---|---|
| I0 | C224 | I8 | C232 | I16 | C240 | I24 | C248 |
| I1 | C225 | I9 | C233 | I17 | C241 | I25 | C249 |
| I2 | C226 | I10 | C234 | I18 | C242 | I26 | C250 |
| I3 | C227 | I11 | C235 | I19 | C243 | I27 | C251 |
| I4 | C228 | I12 | C236 | I20 | C244 | I28 | C252 |
| I5 | C229 | I13 | C237 | I21 | C245 | I29 | C253 |
| I6 | C230 | I14 | C238 | I22 | C246 | I30 | C254 |
| I7 | C231 | I15 | C239 | I23 | C247 | I31 | C255 |

(d) Counter-use points can be set arbitrarily in 16 point units using continuous numbers. By setting the counter which points to the number actually used, the counter processing time subsequent to the END instruction can be shortened.

(e) The counter set values are as follows:
C0 to C255 : constant or word device (D)
C256 to C1023 : word device (D, W, R)
(Allocate a storage device for the set value by setting parameters.)

**POINT**

When timer-use points are set to 257 points or more or counter-use points are set to 256 points or more, the set value storage devices (D, W, R), specified at the time of timer/counter use point setup, are automatically set in continuous numbers.

<Example>

When timer-use points are set to 512 points and set value storage device is set to D1000, D equivalent to 256 points (D1000 to D1255) in T256 to T511 become the devices, with continuous numbers, for the set values

### 4.2.4 I/O devices

A2USHCPU-S1 has 8192 I/O device points (X/Y0 to 1FFF) each for input (X) and output (Y).
There are actual I/O devices and remote I/O devices in this I/O range.

**(1) Actual I/O device**

This is the device range where an I/O module or special function module can be installed to the basic base module/extension base module and controlled.
A2USHCPU-S1: 1024 points (X/Y0 to 3FF)

**(2) Remote I/O device**

The remote I/O devices, following the actual I/O devices, can be used for the following objectives:

(a) Allocate to a remote I/O station in the MELSECNET(II) data link system.
(b) Allocate to a remote I/O station in the MELSECNET/10 network system.
(c) Allocate to the reception data storage device or transmission data storage device in the MELSECNET/MINI-S3's automatic refresh setting.
(d) Use as the substitute to an internal relay.

### 4.2.5 I/O allocation of special function modules

By registering the model name of the following special function modules upon the I/O allocation from a peripheral device, dedicated commands for special function modules can be used.

| Model name of special function module | Model name of the module to be set |
|---|---|
| AD61 | AD61 |
| AD61-S1 | AD61S1 |
| AD59 | AD59 |
| AD59-S1 | AD59S1 |
| AJ71C24 | AJ71C24 |
| AJ71C24-S3 | AJ71C24S3 |
| AJ71C24-S6 | AJ71C24S6 |
| AJ71C24-S8 | AJ71C24S8 |
| AJ71UC24 | AJ71UC24 |
| AJ71C21 | AJ71C21 |
| AJ71C21-S1 | AJ71C21S1 |
| AJ71PT32-S3 | PT32S3 |
| AD57 | AD57 |
| AD57-S1 | AD57S1 |
| AD58 | AD58 |
| A1SJ71UC24-R2 | A1SJ71UC24 |
| A1SJ71UC24-R4 | |
| A1SJ71UC24-PRF | |
| A1SJ71PT32-S3 | A1SPT32S3 |

**POINTS**

If a FROM or TO instruction is executed to the special function module frequently with short scanning intervals, the special function module may not be processed normally.
When you execute a FROM or TO instruction to the special function module, adjust the processing time and conversion time using the timer, constant scan and other measures of the special function module.

### 4.2.6 MELSECNET/MINI-S3 automatic refresh

By setting link information, I/O storage device, etc. of MELSECNET/MINI-S3 to parameters, the module automatically communicates with the buffer memory area for the batch refresh send/received data of A1SJ71PT32-S3/AJ71PT32-S3 master module (abbreviated as the master module hereafter).

Sequence programs can be created using the I/O devices as they are allocated to send/received by the automatic refresh setting. (The FROM/TO instructions are not required.)

**POINTS**

(1) Since up to 8 master modules can be set for automatic refresh by the parameter, automatic refresh is possible for up to 8 modules. If 9 or more modules are desired, use the FROM/TO instruction in the sequence program from the 9th module.

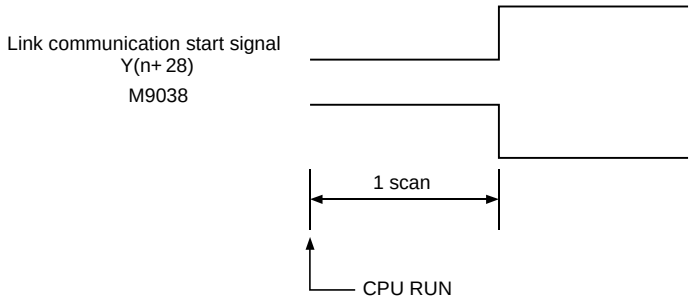
(2) Since automatic refresh is not possible with send/received data for separate refresh I/O module and for remote terminal modules No.1 to No.14, use the FROM/TO instruction for them. However, the remote terminal modules shown below are subject of automatic refresh in a limited area:

- AJ35PTF-R2 RS-232C interface module
- AJ35PT-OPB-M1-S3 mount-type tool box
- AJ35PT-OPB-P1-S3 portable type tool box

(3) For the master modules set up for automatic refresh, CPU automatically turns ON the link communication start signal Y(n+ 18) or Y(n+ 28), so it is not necessary to turn it on from the sequence program.

(4) Automatic refresh of I/O data is performed by batch after the CPU executes the END instruction. (Automatic refresh processing is performed when the CPU is in the RUN/PAUSE/STEP RUN state).

(5) The master module may perform the processing while link communication start signal Y(n+ 28) is OFF depending on the remote terminal module connected.
For instance, if the AJ35PTF-R2 RS-232C interface module is used without protocol, it is necessary to write parameters to the parameter area (buffer memory address 860 to 929) while the link communication start signal is OFF.
The link communication start signal becomes ON after CPU enters the RUN state and one scan is performed, so write the parameters during the first 1 scan.



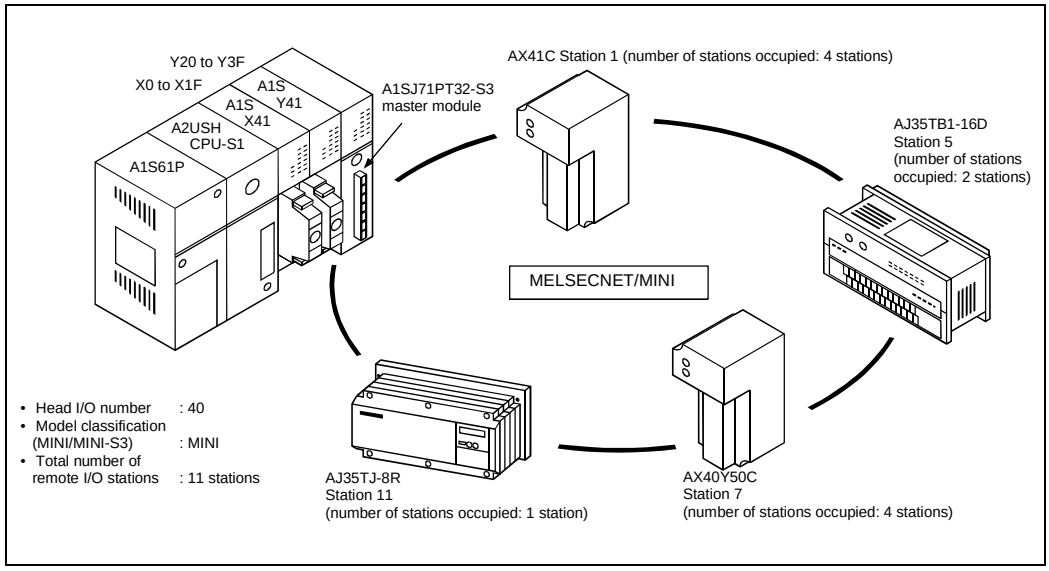
(1) Parameter setting items, setting ranges and contents of automatic refresh, as well as the buffer memory address of the master module which is used for exchanging data with A2USHCPU-S1 are shown below.
Set the parameters for the number of A1SJ71PT32-S3/AJ71PT32-S3 master modules used.

| I/O signal from the master module | Buffer memory address of the master module | Item | Setting range | Description |
|---|---|---|---|---|
| — | — | Number of master modules | 1 to 8 module(s) | • Sets the total number of master modules to be used. |
| — | — | Head I/O No. | I/O points of CPU | • Sets the head I/O number where the master module is installed. |
| — | — | Model classification of MINI/MINI-S3 | • MINI or MINI-S3 | • MINI.....In I/O mode (occupies 32 points)<br>• MINI-S3 .....In expansion mode (occupies 48 points) |
| — | 0 | Total number of remote I/O stations | 0 to 64 station(s) | • Set only when MINI is set.<br>• In MINI-S3, the number of master module's initial ROMs becomes valid, so the setting is not necessary .(When it is set, the setting is ignored). |
| — | 110 to 141 | Received data storage device | • X<br>• M, L, B, T, C, D, W, R, none(Bit device: multiples of 16) | • Sets the devices to store received/send data for batch refresh.<br>• Specify the head number of a device.<br>• Occupies as the automatic refresh area from the head of the device for the number of stations (8 points/station x 64 station = 512 points: bit device) *2<br>• Use of X/Y remote I/O range is recommended for devices. |
| — | 10 to 41 | Send data storage device | • Y<br>• M, L, B, T, C, D, W, R, none(Bit device: multiples of 16) | |
| — | 1 | Number of retries | 0 to 32 times | • Sets the number of retries upon a communication error.<br>• Error is not output if communication is restored within the number of retries set. |
| *1 Y(n + 1A) | — | FROM/TO response specification | Link priority, CPU priority (Priority selection of access to the master module buffer memory) | (1) Link priority .....Link access by MINI-S3 has the priority. During the link access, FROM/TO is caused to wait.<br>• Possible to read out the received data refreshed at the same timing.<br>• Maximum (0.3ms+ 0.2ms x number of separate refresh stations) of FROM/TO instruction wait time may be generated.<br>(2) CPU priority.....Access by FROM/TO instruction of CPU has the priority. Even during the link access, it interrupts and accesses.<br>• Depending on the timing, received data in the midst of I/O refresh may be read.<br>• No wait time for FROM/TO instruction. |
| *1 Y(n + 1B) | — | Data clear specification for communication faulty station | Retain, clear (received data) | • Retain.....Retains the received data for batch and separate refresh.<br>• Clear.....Sets all points to OFF |
| — | 100 to 103 195 | Error station detection | M, L, B, T, C, D, W, R, none (Bit device: multiples of 16) | • Sets the head device to store the faulty station detection data.<br>• MINI.....occupies 4 words; MINI-S3: occupies 5 words. |
| — | 107 196 to 209 | Error No. | T, C, D, W, R | • Sets the head device to store the error code on the occurrence of an error.<br>• MINI.....occupies 1 word; MINI-S3.....occupies (1+ number of remote terminal modules) words |
| — | 4 | Line error check setting (Line error) | • Test message sending<br>• OFF data sending<br>• Transmit data immediately before line error | • Sets data sending method for verification of error location on the occurrence of a line error. |

*1 "n" is determined by the installation location of the master module.

*2 When the total number of remote I/O station is odd, add 1 to the station number to obtain storage devices occupied.

(2) Setting of send/received data storage device is explained using the system example shown below.
<Example> When device X/Y400 and later are used as remote I/O stations:



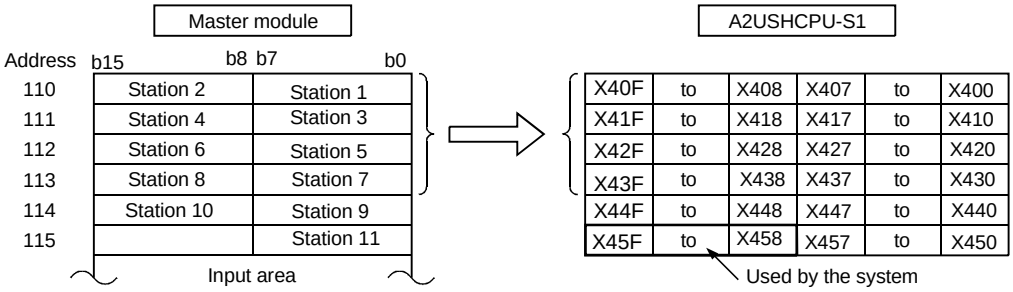

Sample parameter setting of the GPP function software package for the above system configuration is shown below:

Number of modules [1] (0-8)

| | |
|---|---|
| I/O No. | 0040 |
| Model | MINI |
| Number of stations | 11 |
| Received | X0400 |
| Send | Y0400 |
| Retries | 5 |
| Response | CPU |
| Data clear | Clear |
| Detection | |
| Error number | |
| Error | Retain |

The storage devices for send/received data for the present system example are as follows:

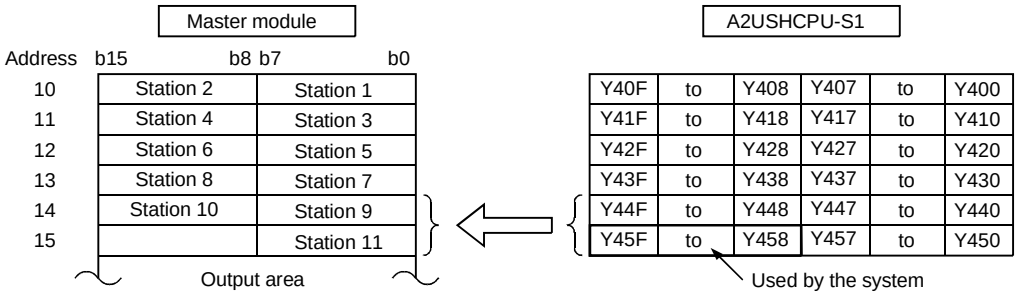
(a) Storage device for received data




1) Set the device number (X400) for b0 of the station 1 as a received data storage device.
2) The received data storage device occupies from X400 to X45F.
For the present system example, the total number of stations is odd, so it is occupied for one extra station.
3) The device numbers of input modules connected are as follows:
Stations 1 to 4 AX41C → X400 to X41F
Stations 5 to 6 AJ35TB-16D → X420 to X42F
Stations 7 to 8 AX40Y50C → X430 to X43F

With respect to X440 to X45F, they are simultaneously refreshed, and set to OFF at any time.
Do not use X440 to X45F in the sequence program.

(b) Send data storage device




1) Set the device number (Y400) for b0 of the station 1 as a send data storage device.
2) The send data storage device occupies from Y400 to Y45F.
   For the present system example, the total number of the stations is odd, so it occupies for one extra station.
3) The device numbers of output modules connected are as follows:
   Stations 9 to 10 AX40Y50C → Y400 to Y44F
   Station 11 AJ35TJ-8R → Y450 to Y457

With respect to Y400 to Y43F and Y458 to Y44F, they are simultaneously refreshed, but are not output.

**POINTS**

(1) Set the send and received data storage devices so that device numbers do not overlap.
When the received data storage device is set to B0 in the system configuration example, it occupies B0 to B5F as the device range.
Set the send data storage device to B60 or later. When the send data storage device is set to B60, the device range will be B60 to BBF.

(2) If a bit device is specified as the send/received data storage device, the device number set must be a multiple of 16.

<Example>
X0, X10 ..... X100, .....
M0, M16, ..... M256, .....
B0, B10, ..... B100, .....

(3) Device range used is (8 points) x (Number of stations).
When the number of stations is an odd number, extra 8 points are necessary.

## 4.3 Function List

Various functions of A2USHCPU-S1 are explained below.

| Function (application) | Description | Outline of setting and operation |
|---|---|---|
| Constant scan<br>(Program execution at constant intervals<br>Simplified positioning) | • Makes the processing time for a single scan in the sequence program constant.<br>• Set the processing time within the range of 10ms to 190ms in 10ms units. | • Write to the special register D9020 by the sequence program |
| Latch (power failure compensation)<br>(Continuous control by data retention on power failure) | • On power supply failure of 20ms or longer/CPU reset/power supply off, data contents of the devices for which latches have been set up in advance are retained.<br>• Latch-enabled devices: L, B, T, C, D, W<br>• Latched data are stored in the CPU and backed up by the batteries of the memory cassette. | • Latch device and latch range are specified by setting of peripheral device parameters. |
| Automatic refresh of MELSECNET/MINI-S3<br>(Simplification of sequence program) | • Performs I/O automatic refresh communication with send/received data area for the batch refresh of AJ71PT32-S3/A1SJ71PT32-S3 up to a maximum of 8 modules.<br>• Automatic refresh is executed in a batch after END processing.<br>• The FROM/TO instruction for I/O in the sequence program becomes unnecessary. Programming is possible with I/O devices which are allocated directly. | • Performed by setting the automatic refresh parameter of a peripheral device. (Refer to Section 4.2.6.) |
| Remote RUN/STOP<br>(When performing RUN/STOP control from outside the PC) | • When PC CPU is in RUN (the key switch is set to RUN), performs the PC's STOP/RUN from outside the PC (external input, peripheral devices, computer) with a remote control. | • When performed with the external input (X), parameter is set with a peripheral device.<br>• When performed by a peripheral device, perform in the PC test mode.<br>• When performed via a computer link module, perform using dedicated commands. |
| PAUSE<br>(• When stopping operation of CPU while retaining the output (Y)<br>• When performing RUN/PAUSE control from outside the PC) | • Stops the operation processing of PC CPU while retaining the ON/OFF of all the outputs (Y).<br>(When the operation is stopped by STOP, all the outputs (Y) are set to OFF.)<br>• When PC CPU is in RUN (the key switch is set to RUN), performs the PC's PAUSE/RUN from outside the PC (external input, peripheral devices) with a remote control. | • Performed by a peripheral device in the PC test mode.<br>• When performed with the external input (X), perform parameter setting with a peripheral device, set the special relay M9040 to ON with the sequence program, then perform. |
| Status latch<br>(Carries out operation check and failure factor check on each device when debugging or a failure condition is met.) | • With respect to devices to which status latches are set up, when status latch conditions are met, data contents of the devices are stored in the extension file register for status latch area in the memory cassette. (Stored data are cleared by the latch clear operation).<br>• The criteria for satisfied condition can be selected from when the SLT instruction is executed by the sequence program or when the device value matches the set condition. | • Using a peripheral device, set the device to which the status latch is performed and the extension file register where the data will be stored.<br>• Using a peripheral device, monitor the status latch data. |
| Sampling trace<br>(Performs chronological checking on the behavior status of devices set up when debugging or an abnormal behavior is detected.) | • With respect to a device to which the sampling trace is set up, the operating condition of the device is sampled for the number of times specified per scan or per period, and the results are stored in the expansion file register for sampling trace (the data stored are cleared by the latch clear operation).<br>• Sampling trace is performed by the STRA instruction in the sequence program. | • Using a peripheral device, set up the device to perform sampling trace, trace point, and the expansion file register where number of times and the data will be stored.<br>• Using a peripheral device, monitor the result of sampling trace. |

| Function (application) | Description | Outline of setting and operation |
|---|---|---|
| Step operation<br>(Checks conditions of program execution and behavior during debugging, etc.) | • Executes operations of the sequence program with one of the conditions (1) to (5) given below, then stops.<br>(1) Executes by each instruction.<br>(2) Executes by each circuit block.<br>(3) Executes by the step intervals and the number of loops.<br>(4) Executes by the number of loops and break point.<br>(5) Executes when the device values concur. | • Chooses a stepping operation condition for the peripheral device and executes. |
| Clock<br>(Program control by clock data/external display of clock data | • Executes operation of the clock built into the CPU module.<br>• Clock data: year, month, day , hour, minute, second, day of the week<br>• When the clock data read request (M9028) is ON, the clock data are read out and stored in D9025 to D9028 by the clock element after the END processing of the sequence operation.<br>• The clock element is backed up by the battery of the memory cassette. | • Sets data for D9025 to D9028 by a peripheral device, turns M9025 ON, then write to the clock element.<br>• Writes to the clock element by the sequence program. (Dedicated instructions can be used.) |
| Priority order of LED display<br>(Changing priority order of display/canceling display | • Changes the display order of or cancels the ERROR LED displays other than the error display by an operation stop and the default display items on the LED display device. | • Writes data as to whether change order/cancel display to D9038 or D9039 by the sequence program. |
| Self-diagnostic function<br>(Detection of abnormal CPU behavior<br>Preventive maintenance | • When an error that matches one of the self-diagnosis items is generated at the CPU power on or during RUN, it prevents malfunctions by stopping the CPU operation and displaying the error.<br>• Stores the error code corresponding to the self-diagnosis item. | • There is a self-diagnosis item with which an operation can be continued or stopped by the setting of peripheral device parameters.<br>• Reads out error code with a peripheral device and performs troubleshooting. (Refer to Section 4.1.4.) |

## 4.4 Precautions When Handling the Module

Precautions when handling the CPU module, I/O module, and extension base module, from unpacking to installation, are described below.

**⚠CAUTION**

- Use the PC in the environment given in the general specifications of this manual. Using the PC outside the range of the general specifications may result in electric shock, fire or malfunctioning, or may damage or degrade the module.
- Insert the tabs at the bottom of the module into the mounting holes in the base module before installing the module, and tighten the module fixed screws with the specified torque. Improper installation may result in malfunctioning, breakdowns or cause the module to fall out.
- Tighten the screws with the specified torque. If the screws are loose, it may result in short circuits, malfunctioning or cause the module to fall out.
  If the screws are tightened too much, it may damage the screws and the module may result in short circuits, malfunctioning or cause the module to fall out.
- Make sure the memory cassette is installed securely in its installation connector. After installation, confirm that it is securely tightened. Defective contact may cause malfunctioning.
- Do not touch the conducted part of the module or electric parts. This may cause malfunctioning or breakdowns.

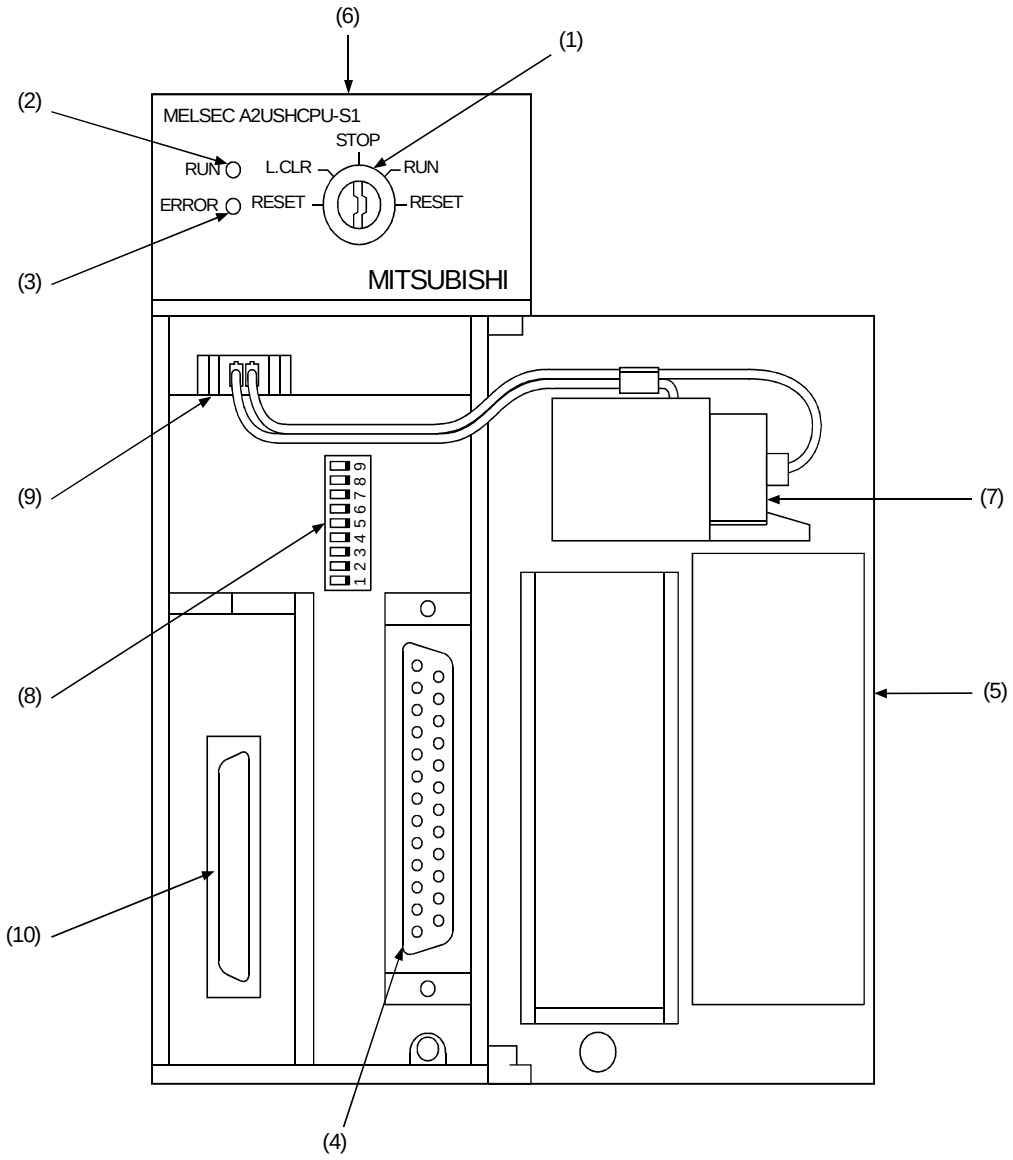
(1) The module case, memory cassette, terminal block connector and pin connector are made of resin. Do not fall them or apply a strong shock to them.
(2) Do not remove the printed board of each module from its case. Doing so may cause breakdown.
(3) While wiring, be careful not to let foreign matter such as wire chips get inside the module. If it does get in, remove it immediately.
(4) Perform tightening of module installation screws and terminal screws on the CPU module, power supply module, I/O module and special function module with the following torque:

| Screw location | Tightening torque range |
|---|---|
| Module installation screws (M4 screw) | 78 to 118N·cm |
| Terminal screws for power supply module and I/O module (M3.5 screw) | 59 to 88N·cm |

## 4.5 Name and Setting of Each Part

The name of each part of the A2USHCPU-S1 module and the switch settings necessary to use the A2USHCPU-S1 are explained.

### 4.5.1 The name of each part of the A2USHCPU-S1

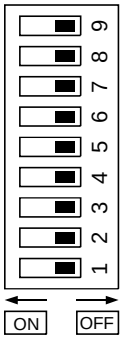



| No. | Name | Application |
|---|---|---|
| (1) | RUN/STOP key switch | • RUN/STOP: Executes/stops the operation of the sequence program.<br>• RESET: Resets the hardware.<br>Performs reset and initialization of operation when abnormality in operation occurs.<br>• LATCH CLEAR (L.CLR): Clears the data in the latch area (to OFF or 0) set by parameters. (With LATCH CLEAR, data in area other than the latch area is also cleared.)<br>For the operation method of the latch clear, refer to Section 4.5.3. |

| NO. | Name | Application |
|---|---|---|
| (2) | "RUN" LED | • ON: RUN/STOP key switch is in the "RUN" position, and the sequence program operation is being executed. (In case of an error which continues the operation of sequence program occurs (refer to Section 10.3), the LED remains lit.)<br>• OFF: The "RUN" LED turns off in the following cases:<br>• When RUN/STOP key switch is in the "STOP" position.<br>• Remote STOP is being performed.<br>• Remote PAUSE is being performed.<br>• Flashing: The "RUN" LED flashes in the following cases:<br>• An error which causes operation of the sequence program to stop has been detected by self-diagnosis.<br>• The latch clear operation is being performed. |
| (3) | "ERROR" LED | • ON: An error has been detected by self-diagnosis. (When an error which has been set to LED OFF in the priority order setting of the LED display is detected, the LED remains OFF.)<br>• OFF: Normal or when a failure is detected by CHK instruction.<br>• Flashing: The annunciator (F) is turned ON by the sequence program. |
| (4) | RS-422 connector | • Connector to write/read, monitor and test the main program with peripheral device.<br>• Cover it with a lid when no peripheral device is to be connected. |
| (5) | Cover | • Protective cover for printed circuit board of A2USHCPU-S1, memory cassette, RS-422 connector, battery, etc.<br>• Open the cover to perform the following operations:<br>• Installation and removal of the memory cassette<br>• Setting DIP switches<br>• Connecting the battery to the connector<br>• Battery replacement |
| (6) | Module fixed screws | • Screws to fix the module to the base module. |
| (7) | Battery | • For the retention of data for program, latch range devices and file registers (for installation and removal of battery, refer to Section 7.2). |
| (8) | DIP switches | • The switch to set whether memory protection is enabled or not, when built-in RAM is used. (Refer to Section 4.5.2 for details of the setting.) |
| (9) | Battery connector | • For the connection with the connector on the battery side. |
| (10) | Connector for memory cassette installation | • Connector to install a memory cassette (A2SMCA-14KP/14KE, A2SNMCA-30KE). (It automatically enters into ROM operation when a memory cassette is installed.) |

### 4.5.2 Settings for memory protection switch

The memory protection switch is to protect the data in the RAM memory from overwritten by mis-operation from peripherals. (When the memory cassette is installed and it is running with ROM or $E^2$PROM, the setting of memory protection switch is invalid.)
It is used to prevent overwriting and deletion of a program after the program is created.
Cancel the memory protection switch (OFF) to make corrections on the content of RAM memory.
Upon factory shipment, the memory protection is set to OFF.




| Range of memory protection (k bytes) | Switch setting |
|---|---|
| | A2USHCPU-S1 |
| 0 to 16 | ON 1 |
| 16 to 32 | ON 2 |
| 32 to 48 | ON 3 |
| 48 to 64 | ON 4 |
| 64 to 80 | ON 5 |
| 80 to 96 | ON 6 |
| 96 to 112 | ON 7 |
| 112 to 144 | ON 8 |
| 144 to 256 | ON 9 |

**POINTS**

(1) When the memory protection is used, refer to the address (step number) of each memory area (sequence program, comment, sampling trace, status latch and file register) to set protection.

(2) When sampling trace or status latch is executed, do not apply the memory protection to the data storage area. If the protection is applied, the execution results cannot be stored in the memory.

**REMARK**

When A2SMCA-14KE or A2SNMCA-30KE is used, memory protection is possible with the memory protection setting pins on the body of the A2SMCA-14KE or A2SNMCA-30KE. Refer to Section 7.1.4.

### 4.5.3 Latch clear operation

When latch clear is performed with the RUN/STOP switch, follow the procedures below.
If latch clear is performed, devices outside the latch range and error information by self-diagnosis of A2USHCPU-S1 (information on the newest error and the past 15 errors) are also cleared.

(1) Flip the RUN/STOP switch from the "STOP" position to "L.CLR" position for several times and make the "RUN" LED to high-speed flicker (ON for about 0.2s, OFF for 0.2s). When the "RUN" LED flickers at high speed, the latch clear is ready for operation.

(2) While the "RUN" LED is flickering at high-speed, flip the RUN/STOP switch from the "STOP" position to the "L.CLR" position again to complete latch clear and the "RUN" LED turns off.
To cancel the latch clear operation midway, flip the RUN/STOP switch to the "RUN" position to set the A2USHCPU-S1 to RUN state, or flip it to the "RESET" position to reset.

**REMARK**

The latch clear can also be performed by the operation of GPP function.
For instance, latch clear by A6GPP can be performed by "Device memory all clear" of the PC mode test function.
For the operation procedure, refer to the operating manual for GPP functions.

# 5. POWER SUPPLY MODULE

## 5.1 Specifications

The specification of the power supply module are shown below.

**Table 5.1 Power supply module specifications**

| Item | | Performance specifications | | |
|---|---|---|---|---|
| | | A1S61PN | A1S62PN | A1S63P |
| Base installation location | | Power supply module installation slot | | |
| Input power supply | | 100 to 240VAC $^{+10\%}_{-15\%}$ (85 to 264VAC) | | 24VDC $^{+30\%}_{-35\%}$ (15.6 to 31.2VDC) |
| Input frequency | | 50/60Hz±5% | | ——— |
| Maximum input apparent power | | 105VA | | 41W |
| Inrush current | | 20A 8ms or less | | 81A 1ms or less |
| Output current rating | 5VDC | 5A | 3A | 5A |
| | 24VDC | ——— | 0.6A | ——— |
| Overcurrent protection | 5VDC | 5.5A or above | 3.3A or above | 5.5A or above |
| | 24VDC | ——— | 0.66A or above | ——— |
| Overvoltage protection | 5VDC | 5.5 to 6.5V | | |
| | 24VDC | ——— | | |
| Efficiency | | 65% or above | | |
| Allowable period of momentary power failure | | 20ms or less | | 1ms or less |
| Dielectric withstand voltage | Primary-5VDC | Between input: batch LG and output: batch FG, 2,830VAC rms/3 cycle (altitude 2,000m (6562 ft) | | 500VAC |
| | Primary-24VDC | | | ——— |
| Insulation resistance | | Between input: batch LG and output: batch FG 500VAC (5MΩ or above by insulation resistance tester) | | 5MΩ or above by insulation resistance tester |
| Noise durability | | • By noise simulator with noise voltage of 1,500Vp-p, noise width of 1μs, and noise frequency of 25 to 60Hz.<br>• Noise voltage IEC801-4, 2kV | | By noise simulator with noise voltage of 500Vp-p, noise width of 1μs, and noise frequency of 25 to 60Hz. |
| Operation display | | LED display (ON for 5VDC output) | | |
| Terminal screw size | | M3.5 × 7 | | |
| Applicable wire size | | 0.75 to 2mm$^2$ | | |
| Applicable crimp-style terminal | | RAV1.25-3.5, RAV2-3.5 | | |
| Applicable tightening torque | | 59 to 88N·cm | | |
| External dimensions (mm (inch)) | | 130 (5.12) × 55 (2.17) × 93.6 (3.69) | | |
| Weight (kg) | | 0.60 | 0.60 | 0.50 |

*1 Since a varistor is installed between AC and LG, do not apply a voltage of 400 volts or more between AC and LG.

**POINT**

***1: Overcurrent protection**

If the current above the spec value flows in the 5VDC or 24VDC circuit, overcurrent protection device interrupts the circuit and stops the system operation. LED display of the power supply module is either OFF or ON dimly, due to the voltage drop.

When this device is once activated, remove factors of insufficient current capacity and short-circuit before starting up the system. When the current restores to the normal value, the system performs the initial start.

***2: Overvoltage protection**

When 5.5V to 6.5V of overvoltage is applied to the 5VDC circuit, overvoltage protection device interrupts the circuit and stops the system operation.

LED display of the power supply module turns OFF. To restart the system, turn OFF the input power supply, then back to ON. The system performs the initial start.

If the system does not start and LED display remains OFF, the power supply module needs to be replaced

***3: Allowable period of momentary power failure**

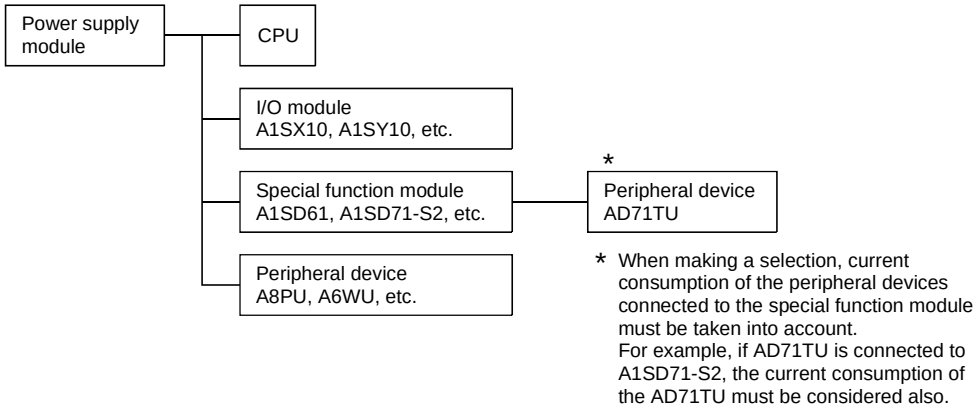
This indicates allowable period of momentary power failure of PC CPU, and is determined by the power supply module used. Allowable period of momentary power failure for a system using A1S63P is the period it takes until the 24VDC falls below the specified voltage (15.6VDC) after cutting off the primary power supply of the stabilized power supply, which supplies the 24VDC power to A1S63P.

# MEMO

### 5.1.1 Selecting a power supply module

Power supply module is selected based on to the total current consumption of the I/O module, special function module and peripheral devices to which power is supplied by the subject power supply module. When extension base module A1S52B, A1S55B, A1S58B, A52B, A55B or A58B is used, take into consideration that the power to the module is supplied by the power supply module of the basic base.

For 5VDC current consumption of I/O modules, special function modules and peripheral devices, refer to Section 2.3.




**(1) Power supply module selection when extension base module A1S52B, A1S55B, A1S58B, A52B A55B, or A58B is used**

When extension base module A1S52B, A1S55B, A1S58B, A52B A55B, or A58B is used, 5VDC power is supplied from the power supply module of the basic base module via extension cable. Thus, when one of these modules is used, be careful with the following:

(a) Select a 5VDC power supply module of the basic base module with sufficient capacity to supply 5VDC current consumed by A1S52B, A1S55B, A1S58B, A52B A55B, or A58B.

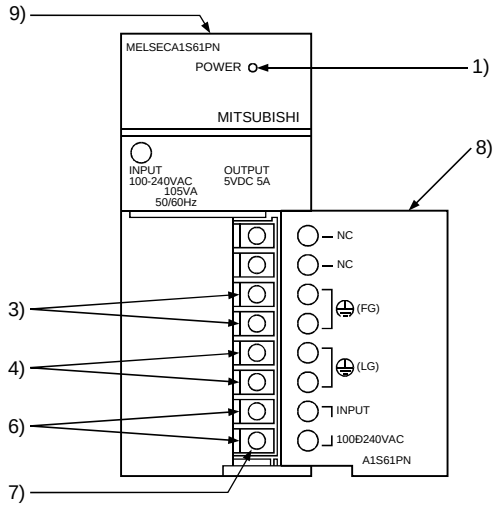
Example

If 5VDC current consumption on the basic base module is 3A and
5VDC current consumption on the A1S55B is 1A,
then, the power supply module installed to the basic base module must be A1S61P(5VDC 5A).

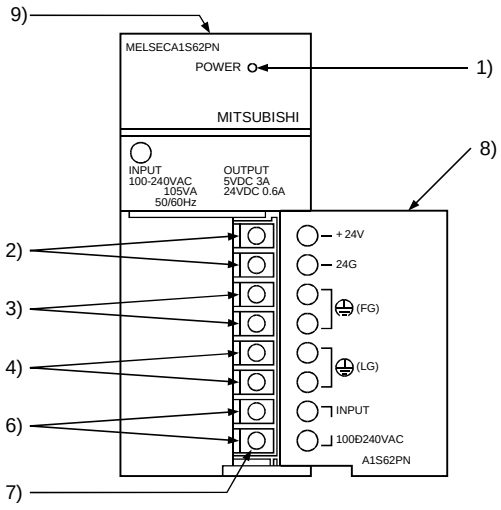
(b) Since the power to A1S52B, A1S55B, A1S58B, A52B A55B, or A58B is supplied via extension cable, a voltage drop occurs through the cable. It is necessary to select a power supply module and cable with proper length so that 4.75VDC or more is available at the receiving end. For the details of voltage drop, refer to Section 6.1.3, the operation standard of extension base module.

## 5.2 Name and Setting of Each Part

Name of each part of different power supply modules is provided below.

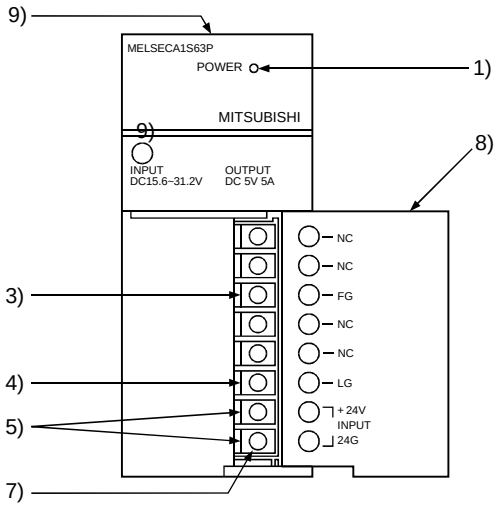



(1) A1S61PN




(2) A1S62PN

| No. | Name | Application |
|---|---|---|
| 1) | "POWER" LED | LED for the display of 5VDC power supply |
| 2) | 24VDC, 24GDC terminal | For power supply to the module which requires 24VDC power at inside the output module (supplied to the module via external wiring). |
| 3) | FG terminal | Ground terminals connected to shielding patterns on the printed circuit board. |
| 4) | LG terminal | For grounding the power supply filter. In case of A1S61P and A1S62P, it has a potential of half the input voltage. |




(3) A1S63P

(Continued to the following page)

| No. | Name | Application |
|---|---|---|
| 5) | Power supply input terminals | Input terminal for power supply. Connect the 24VDC direct current power supply. |
| 6) | Power supply input terminals | Input terminal for power supply. Connect the 100VAC to 200VAC alternating current power supply. |
| 7) | Terminal screw | M3.5 × 7 |
| 8) | Terminal cover | A protective cover for the terminal block. |
| 9) | Module fixing screws | Screws to fix the module to the base module.<br>(M4 screw; tightening torque range: 78 to 118N·cm) |

**POINT**

(1) Do not wire to terminals not used by FG or LG on the terminal block (terminals for which no name is provided on the terminal block cover).

(2) The protective ground terminal ⏚ LG must be grounded with class D (class-3) grounding or above.

# 6. BASE UNIT AND EXTENSION CABLE

## 6.1 Specification

Specifications of the base units (basic base unit and extension base unit) applicable to the system and of extension cables, and the usage standards of extension base unit are explained.

### 6.1.1 Base unit specifications

**(1) Basic base unit specifications**

**Table 6.1 Basic base unit specifications**

| Item \ Model | A1S32B | A1S33B | A1S35B | A1S38B |
|---|---|---|---|---|
| I/O module installation range | 2 modules can be installed. | 3 modules can be installed. | 5 modules can be installed. | 8 modules can be installed. |
| Extension connection capability | Possible | | | |
| Dimensions of the installation hole | $\phi$6 bell-shaped holes (for M5 screws) | | | |
| External dimensions (mm (inch)) | 220 (8.66) × 130 (5.12) × 28 (1.10) | 255 (10.03) × 130 (5.12) × 28 (1.10) | 325 (12.80) × 130 (5.12) × 28 (1.10) | 430 (16.92) × 130 (5.12) × 28 (1.10) |
| Weight (kg) | 0.52 | 0.65 | 0.75 | 0.97 |
| Accessories | Installation screws; M5 × 25, 4 pcs. | | | |

**(2) Extension base unit specifications**

**Table 6.2 Extension base unit specifications**

| Item \ Model | A1S65B | A1S68B | A1S52B | A1S55B | A1S58B |
|---|---|---|---|---|---|
| I/O module installation range | 5 modules can be installed. | 8 modules can be installed. | 2 modules can be installed. | 5 modules can be installed. | 8 modules can be installed. |
| Power supply module installation requirement | Power supply module required | | Power supply module not required | | |
| Dimensions of the installation hole | $\phi$6 bell-shaped holes (for M5 screw) | | | | |
| Dimensions of terminal screw | ——— | ——— | M4 × 6 (FG terminal) | | |
| Applicable wire size | ——— | ——— | 0.75 to 2mm$^2$ | | |
| Applicable crimp-style terminal | ——— | ——— | (V) 1.25-4 (V) 1.25-YS4(V)2-YS4A (Applicable tightening torque: 118N·cm) | | |
| External dimensions (mm (inch)) | 315 (12.40) × 130 (5.12) × 28 (1.10) | 420 (16.54) × 130 (5.12) × 28 (1.10) | 135 (5.31) × 130 (5.12) × 28 (1.10) | 260 (10.24) × 130 (5.12) × 28 (1.10) | 365 (14.37) × 130 (5.12) × 28 (1.10) |
| Weight (kg) | 0.71 | 0.95 | 0.38 | 0.61 | 0.87 |
| Accessories | Installation screws; M5 × 25, 4 pcs. | | *1 Dustproof cover (for I/O module): 1 pc. Attachment screws: M5 × 25, 4 pcs. | | |

*1 For the installation of the rustproof cover, refer to Section 8.6.

**POINT**

For the usage of the base units which do not require power supply module A1S52B, A1S55B and A1S58B, refer to the power supply module selection in Sections 5.1.2 and 6.1.3.

### 6.1.2 Extension cable specifications

The specifications of the extension cables applicable to the A2USHCPU-S1 system are shown in Table 6.3.

**Table 6.3 Extension cable specifications**

| Item | A1SC01B | A1SC03B | A1SC07B | A1SC12B | A1SC30B | A1SC60B | A1SC05NB | A1SC07NB | A1SC30NB | A1SC50NB |
|---|---|---|---|---|---|---|---|---|---|---|
| Cable length (m (ft)) | 0.055 (0.18) | 0.33 (1.08) | 0.7 (2.30) | 1.2 (3.94) | 3.0 (9.84) | 6.0 (19.69) | 0.45 (1.48) | 0.7 (2.30) | 3 (9.86) | 5 (16.43) |
| Resistance of 5VDC supply line (Ω(at 55 °C)) | 0.02 | 0.021 | 0.036 | 0.055 | 0.121 | 0.182 | 0.037 | 0.045 | 0.12 | 0.18 |
| Application | Connection between the basic base and the extension base | | | | | | | | | |
| Weight (kg) | 0.025 | 0.10 | 0.14 | 0.20 | 0.4 | 0.65 | 0.2 | 0.22 | 0.4 | 0.56 |

When an extension cable is used, do not bunch it with the main circuit (high voltage, large current) line or place close to each other.

### 6.1.3 Usage standards of extension base units (A1S52B, A1S55B, A1S58B, A52B, A55B, A58B)

When the A1S52B, A1S55B, A1S58B, A52B, A55B or A58B extension base unit is used, confirm that the receiving port voltage (voltage of the module installed to the last slot of the extension base unit) is 4.75V or higher.

Since the power supply module on the basic base unit supplies 5VDC to A1S52B, A1S55B, A1S58B, A52B, A55B and A58B extension base unit, a voltage drop occurs through base unit or extension base unit. If the specified voltage is not supplied at the receiving end, misinput and misoutput may result.

When voltage at the receiving end is less than 4.75V, change the extension base unit to A1S65B, A1S68B, A62B, A65B or A68B with the power supply.

**(1) Conditions for selection**

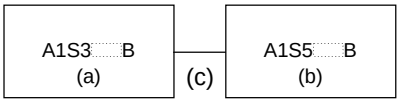
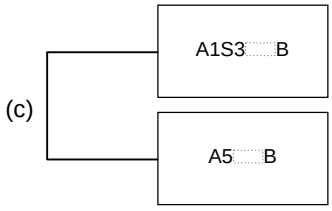
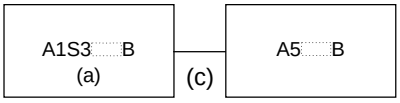
Receiving voltage of the module installed to the final slot of A1S52B, A1S55B, A1S58B, A52B, A55B or A58B type extension base unit must be 4.75V or above.

The output voltage of the power supply module is set to 5.1V or above. Thus, it can be used if the voltage drop is 0.35V or less.

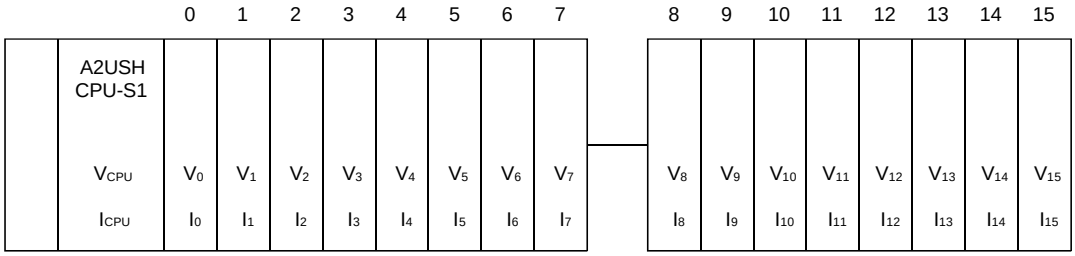
**(2) Elements of voltage drop**

Elements of voltage drop (a) to (c) are shown in figure below according to the connection method of the extension base unit and the type of extension base unit.

(a) A voltage drop at the basic base unit is shown.
(b) A voltage drop at the extension base unit is shown.
(c) A voltage drop through the extension cable is shown.

| | **Extension base unit is connected to the left side of the basic base unit (series installation).** | **Extension base unit is connected to the right side of the basic base unit (parallel installation).** |
|---|---|---|
| A1S52B, A1S55B or A1S58B extension base unit is used. |  * The voltage drop at the basic base unit is negligible. |  |
| A52B, A55B or A58B extension base unit is used. |  * The voltage drop at the basic base unit is negligible. |  * The voltage drop at the extension base unit is negligible. |

**(3) Voltage drop calculation method**




$V_{CPU}$, $V_0$ to $V_7$ : Voltage drop at each slot of the basic base unit
$I_{CPU}$, $I_0$ to $I_7$ : Current consumption at each slot of the basic base unit
$V_8$ to $V_{15}$ : Voltage drop at each slot of extension base unit
$I_8$ to $I_{15}$ : Current consumption at each slot of the extension base unit

(a) Calculation of voltage drops with the basic base unit (A1S32B, A1S33B, A1S35B, A1S38B)
Resistance with the basic base unit is 0.007Ω per slot. Calculate a voltage drop at each slot and obtain the total voltage drop.

1) Voltage drop at the CPU module: $V_{CPU}$
$V_{CPU} = 0.007 \times (I_{CPU} + I_0 + I_1 + I_2 + I_3 + I_4 + I_5 + I_6 + I_7 + I_8 + I_9 + I_{10} + I_{11} + I_{12} + I_{13} + I_{14} + I_{15})$

2) Voltage drop at slot 0: $V_0$
$V_0 = 0.007 \times (I_0 + I_1 + I_2 + I_3 + I_4 + I_5 + I_6 + I_7 + I_8 + I_9 + I_{10} + I_{11} + I_{12} + I_{13} + I_{14} + I_{15})$

3) Voltage drop at slot 1: $V_1$
$V_1 = 0.007 \times (I_1 + I_2 + I_3 + I_4 + I_5 + I_6 + I_7 + I_8 + I_9 + I_{10} + I_{11} + I_{12} + I_{13} + I_{14} + I_{15})$

4) Voltage drop at slot 2: $V_2$
$V_2 = 0.007 \times (I_2 + I_3 + I_4 + I_5 + I_6 + I_7 + I_8 + I_9 + I_{10} + I_{11} + I_{12} + I_{13} + I_{14} + I_{15})$

5) Voltage drop at slot 3: $V_3$
$V_3 = 0.007 \times (I_3 + I_4 + I_5 + I_6 + I_7 + I_8 + I_9 + I_{10} + I_{11} + I_{12} + I_{13} + I_{14} + I_{15})$

6) Voltage drop at slot 4: $V_4$
$V_4 = 0.007 \times (I_4 + I_5 + I_6 + I_7 + I_8 + I_9 + I_{10} + I_{11} + I_{12} + I_{13} + I_{14} + I_{15})$

7) Voltage drop at slot 5: $V_5$
$V_5 = 0.007 \times (I_5 + I_6 + I_7 + I_8 + I_9 + I_{10} + I_{11} + I_{12} + I_{13} + I_{14} + I_{15})$

8) Voltage drop at slot 6: $V_6$
$V_6 = 0.007 \times (I_6 + I_7 + I_8 + I_9 + I_{10} + I_{11} + I_{12} + I_{13} + I_{14} + I_{15})$

9) Voltage drop at slot 7: $V_7$
$V_7 = 0.007 \times (I_7 + I_8 + I_9 + I_{10} + I_{11} + I_{12} + I_{13} + I_{14} + I_{15})$

10) Total voltage drop at the basic base unit : $V_K$
$V_K = V_{CPU} + V_0 + V_1 + V_2 + V_3 + V_4 + V_5 + V_6 + V_7$

(b) Calculation of voltage drops of the extension base unit (A1S52B, A1S55B, A1S58B)
Resistance with the extension base unit is 0.006 Ω per slot. Calculate a voltage drop at each slot and obtain the total voltage drop.

1) Voltage drop at slot 8: $V_8$
$V_8 = 0.006 \times (I_8 + I_9 + I_{10} + I_{11} + I_{12} + I_{13} + I_{14} + I_{15})$
2) Voltage drop at slot 9: $V_9$
$V_9 = 0.006 \times (I_9 + I_{10} + I_{11} + I_{12} + I_{13} + I_{14} + I_{15})$
3) Voltage drop at slot 10: $V_{10}$
$V_{10} = 0.006 \times (I_{10} + I_{11} + I_{12} + I_{13} + I_{14} + I_{15})$
4) Voltage drop at slot 11: $V_{11}$
$V_{11} = 0.006 \times (I_{11} + I_{12} + I_{13} + I_{14} + I_{15})$
5) Voltage drop at slot 12: $V_{12}$
$V_{12} = 0.006 \times (I_{12} + I_{13} + I_{14} + I_{15})$
6) Voltage drop at slot 13: $V_{13}$
$V_{13} = 0.006 \times (I_{13} + I_{14} + I_{15})$
7) Voltage drop at slot 14: $V_{14}$
$V_{14} = 0.006 \times (I_{14} + I_{15})$
8) Voltage drop at slot 15: $V_{15}$
$V_{15} = 0.006 \times I_{15}$
9) Total voltage drop of the extension base unit : Vz
$Vz = V_8 + V_9 + V_{10} + V_{11} + V_{12} + V_{13} + V_{14} + V_{15}$

(c) Calculation of voltage drop through the extension cable

[1] Total current consumption of the extension base unit: Iz
$Iz = I_8 + I_9 + I_{10} + I_{11} + I_{12} + I_{13} + I_{14} + I_{15}$

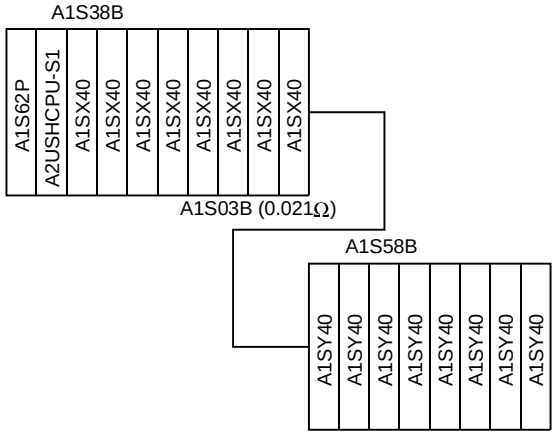
[2] Voltage drop of the extension cable: Vc
Vc= (Resistance of the extension cable) x Iz

Resistance of extension cable

| | |
|---|---|
| A1SC01B ..... 0.02 Ω | A1SC30B ..... 0.121 Ω |
| A1SC03B ..... 0.021 Ω | A1SC60B ..... 0.182 Ω |
| A1SC07B ..... 0.036 Ω | A1SC05NB ..... 0.037 Ω |
| A1SC12B ..... 0.055 Ω | A1SC07NB ..... 0.045 Ω |

(d) Confirmation of voltage at the receiving end
$(5.1(V) - V_K - V_Z - V_C) \geq 4.75(V)$

**(4) Calculation examples**




(a) Calculation of voltage drop of the basic base unit

$V_K = 0.007 \times \{0.32 + 0.05 \times (9+8+7+6+5+4+3+2) + (0.27 \times 8)\} \times 9 = 0.15372$

(b) Calculation of voltage drop of the extension base unit

$V_Z = 0.006 \times 0.27 \times (8+7+6+5+4+3+2+1) = 0.05832$

(c) Calculation of voltage drop through the extension cable

$V_C = 0.021 \times (0.27 \times 8) = 0.04536$

(d) Confirmation of voltage at the receiving end

5.1 - 0.15372 - 0.05832 - 0.04536 = 4.8426(V)

Above system can be used, since the voltage at the receiving end is more than 4.75V.

**(5) Scheme to reduce the voltage drop**

Following methods are effective in reducing the voltage drop:

(a) Change the installation location of the module

Install modules with a large current consumption subsequently starting from slot 0 of the basic base unit.

Install modules with a small current consumption to the extension base unit.

(b) Attachment of base units in series

By attaching base units in series (connect the extension cable to the left side of the basic base module), the voltage drop with the basic base unit can be made negligible.

However, if the extension cable used is long, the voltage drop through it may become larger than that with the basic base unit, so calculate the voltage drop according to (3) above.

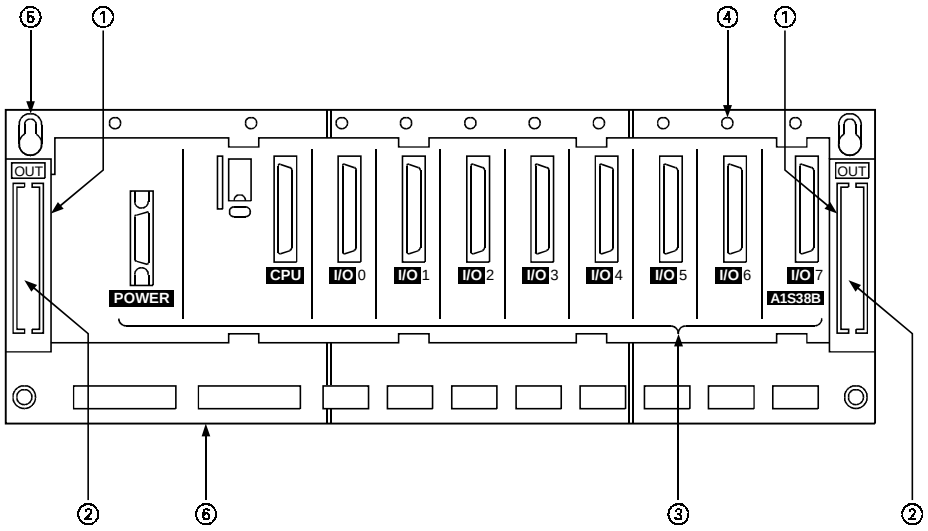
(c) Use of a short extension cable

The shorter the extension cable is, the smaller the resistance and the voltage drop become. Use the shortest extension cable possible.

## 6.2 Name and Setting of Each Part

Name of each part of the base unit is explained.

**(1) Basic base u nit (A1S32B, A1S33B, A1S35B, A1S38B)**



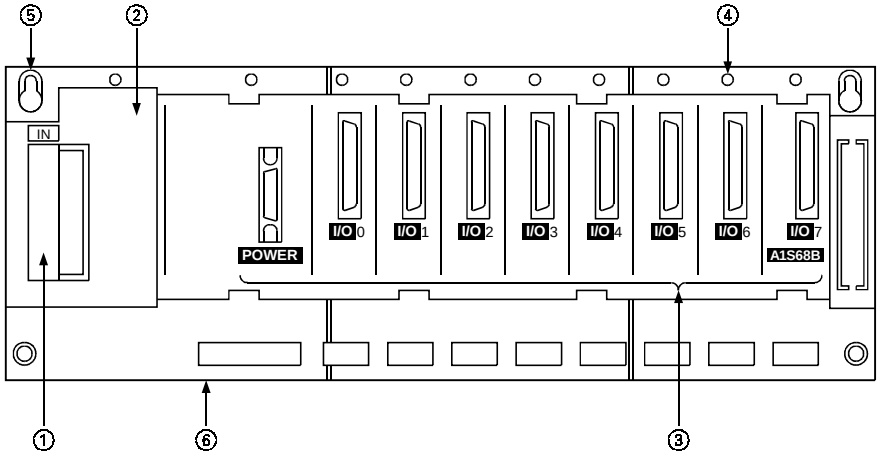

| No. | Name | Application |
|---|---|---|
| 1) | Connector for extension cable | Connects the extension cable with the connector for exchanging signals with the extension base unit. |
| 2) | Base cover | A protective cover for the connector for the extension cable. When installing an extension, it is necessary to remove the area enclosed by the groove below the OUT sign on the base cover with a tool, such as a cutting nipper, etc. |
| 3) | Module connector | Connectors for power supply module, CPU module, I/O module, and the special function module.<br>To prevent the intrusion of dust, install the accessory connector cover or a blank cover (A1SG60) to the connectors to which no module is installed. |
| 4) | Module fixing screw | Screw to fix the module to the base. Screw size: M4 × 12 |
| 5) | Base installation hole | A bell-shaped hole to mount the present base unit to a panel, such as the control panel. (For M5 screw) |
| 6) | Hook for DIN rail | Hook for DIN rail attachment.<br>A1S32B, A1S33B: .....1 pc.<br>A1S35B, A1S38B: .....2 pcs |

**IMPORTANT**

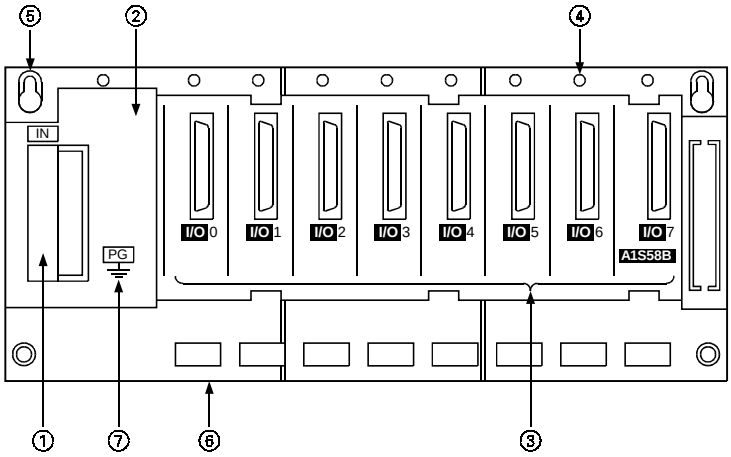
Only one extension base unit can be connected to the basic base unit. If an extension base unit is connected to each of the two connectors of the basic base unit, misinput and misoutput may result.

### (2) Extension base unit

A1S65B, A1S68B




A1S52B, A1S55B, A1S58B




| No. | Name | Application |
|---|---|---|
| 1) | Connector for extension cable | A connector for exchanging signals with the basic base unit. An extension cable is connected to it. Remove the accessory connector cover to connect an extension cable. |
| 2) | Base cover | A protective cover for the connector for the extension cable. |
| 3) | Module connector | Connectors for the power supply module, CPU module, I/O module, and the special function module.<br>To prevent the intrusion of dust, install the accessory connector cover or a blank cover (A1SG60) to the connectors to which no module is installed. |
| 4) | Module fixing screw | Screw to fix the module to the base. Screw size: M4 × 12 |
| 5) | Base installation hole | A bell-shaped hole to mount the present base unit to a panel, such as the control panel. (for M5 screw) |
| 6) | Hook for DIN rail | Hook for DIN rail attachment.<br>A1S52B, A1S55B: .....1 pc.<br>A1S65B, A1S68B A1S58B: .....2 pcs |
| 7) | FG terminal | Ground terminal connected to the shielding pattern on the printed circuit board. |

# 7. MEMORY CASSETTE AND BATTERY

## 7.1 Memory Cassette

Specifications, precautions when handling, and procedures for installation and removal of the memory are described.

### 7.1.1 Specifications

Specifications of the memory are shown in Table 7.1.

**Table 7.1 Specifications of the memory**

| Item \ Model | A2SMCA-14KP | A2SNMCA-30KE |
|---|---|---|
| Memory specification | EPROM | $E^2$PROM |
| Memory capacity | 64k bytes<br>(Maximum 14k steps) | 64k bytes<br>(Maximum 30k steps) |
| External dimensions (mm (inch)) | 15 (0.59)× 68.6 (2.70) × 42 (1.65) | 15 (0.59) × 69.6 (2.74)<br>× 40.5 (1.59) |
| Weight (kg) | 0.03 | |

### 7.1.2 Precautions when handling the memory cassette

Precautions when handling the memory cassette are as follows:

(1) The memory cassette and the pin connector are made of resin; do not fall them to the ground or apply a strong shock to them.
(2) Do not remove the printed board of each memory cassette from the case. Doing so may cause breakdowns.
(3) Be careful not to let foreign matter such as wire chips get inside the module. If it does get inside the module, remove it immediately.
(4) When installing the memory cassette to the A2USHCPU-S1 main module, securely connect it to the connector.
(5) Do not place memory cassettes on a metal with or with a possibility of leak, or on a wooden material, plastic, vinyl, fiber, electric wire, paper, etc. that bears static electricity.
(6) Do not touch the lead of the memory. This may damage the memory.
(7) Do not touch the connector of the memory cassette for the CPU. This may result in false contact.

**IMPORTANT**

(1) When the memory cassette is installed to or removed from the A2USHCPU-S1, the power supply must be OFF. If it is installed or removed while the power supply is ON, the content of the memory of the memory cassette will be destroyed.
(2) The RAM memory built in the A2USHCPU-S1 (parameter, T/C set value, main program, MELSECNET/10 network parameters) will not be overwritten by installing the EEP-ROM memory cassette and turning ON the power to the A2USHCPU-S1.
If an EP-ROM memory cassette is installed, the main program will not be overwritten.
However, when contents of the RAM memory are important, make the backup of the data using a peripheral device, then install the memory cassette.
(3) The A1SMCA- KE/ KP memory cassette cannot be installed to the A2USHCPU-S1.

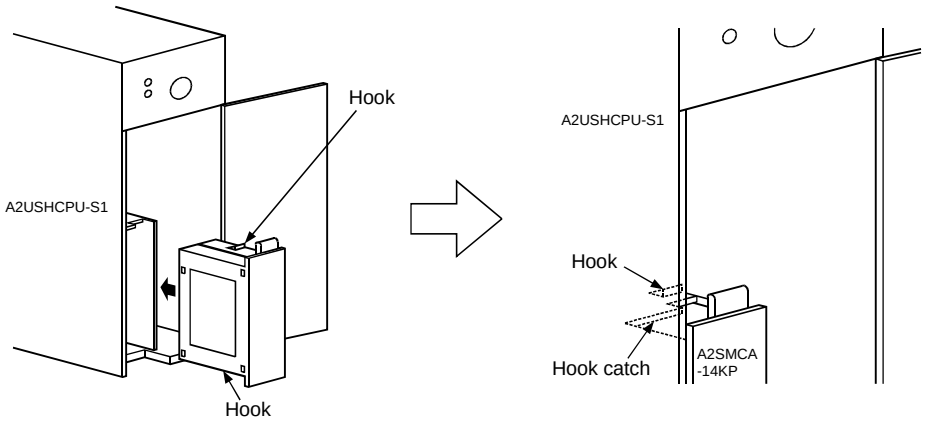
### 7.1.3 Installation and removal of memory cassette

**⚠CAUTION**

- Make sure the memory cassette is installed securely in its installation connector. After installation, confirm that it is securely tightened. Defective contact may cause malfunctioning.

How to install and remove the memory cassette is described below.

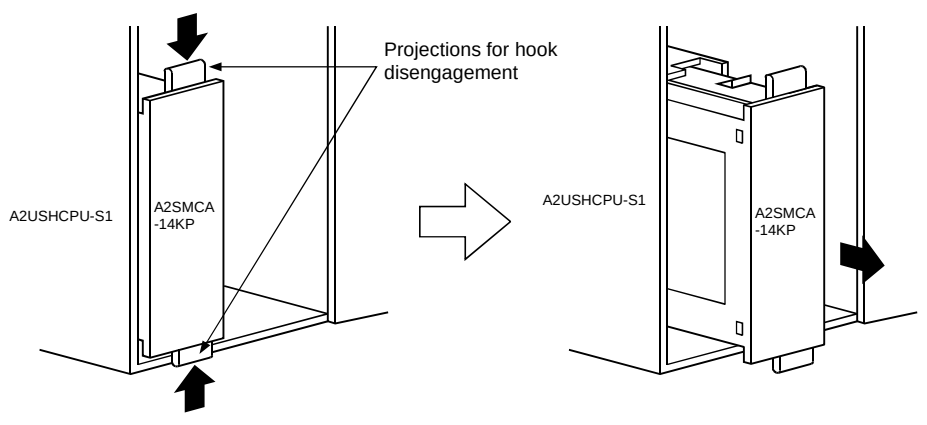
**(1) Installation of the memory cassette**




(a) Position the side of the memory cassette with the model name facing the operator, then turn it so that the model name is displayed on the top. Insert it into the memory cassette installation port of the A2USHCPU-S1 until it makes a clicking sound (until the clip catches it).

(b) Confirm that the hooks provide on the top and bottom of the memory cassette are firmly engaged with the hook catches. (If the memory cassette is not installed correctly, the front cover of the A2USHCPU-S1 module does not close.)

**(2) Removal of the memory cassette**




(a) Pull the memory cassette while holding the projections for hook disengagement provided on the top and bottom areas of the memory cassette by hand.

### 7.1.4 Procedure for writing sequence program to A2SMCA-14KP

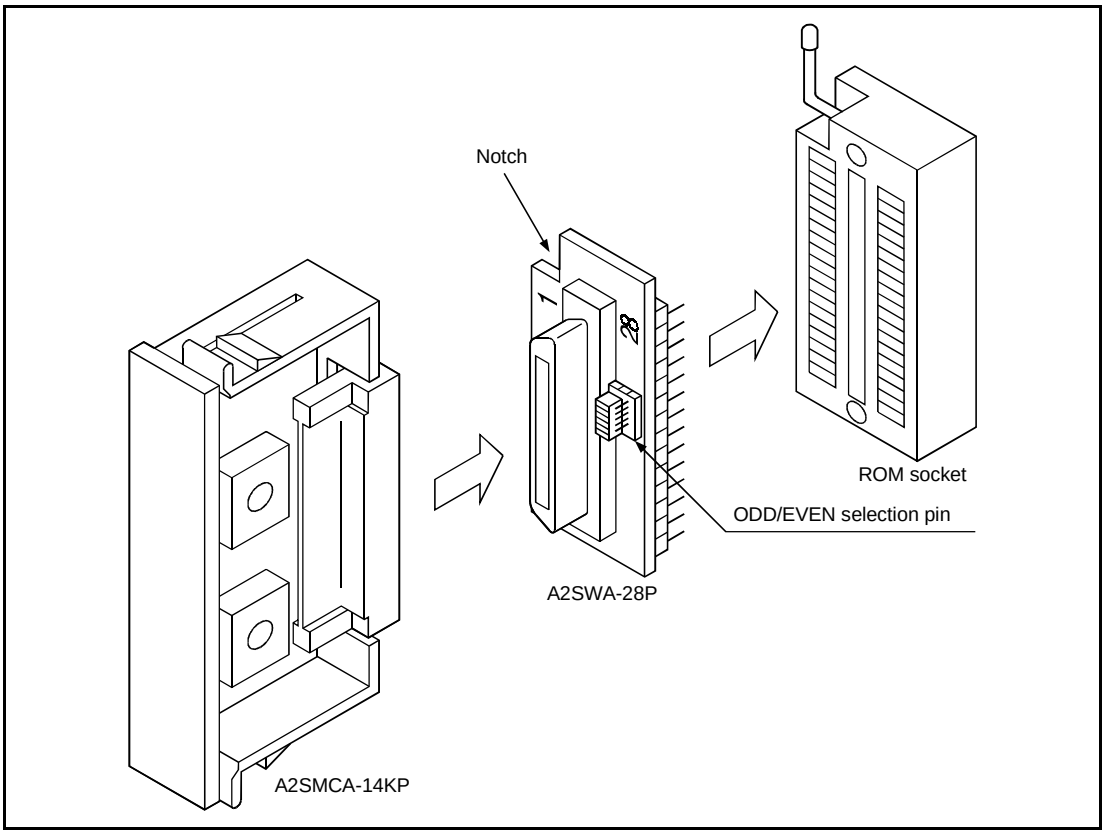
Writing a program to and erasing from A2SMCA-14KP can be accomplished by a ROM writer/eraser.

If A2SMCA-14KP is installed to the ROM socket of A6GPP or A6WU, the memory write adapter (A2SWA-28P) is necessary. How to use the A2SWA-28P is explained below.

(1) To write a program to the A2SMCA-14KP, it is necessary to divide it into odd-number addresses and even-number addresses. Set the address type to write using the ODD/EVEN selection pin of the A2SWA-28P.

(2) Connect the A2SMCA-14KP to the connector of A2SWA-28P. Be careful with the direction of the connector.

(3) Connect the A2SWA-28P to which A2SMCA-14KP is connected to a ROM socket of A6GPP or A6WU. At this juncture, pay attention not to mistake the connecting position. The pin near the notched corner of the A2SWA-28P is the pin No.1.



### 7.1.5 Memory protection setting of A2SNMCA-30KE

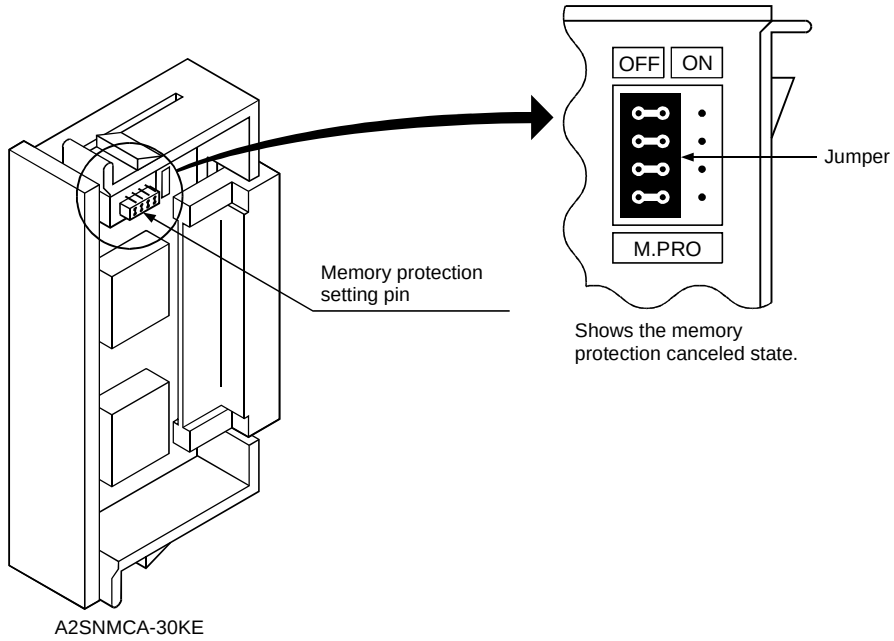
When A2USHCPU-S1 with A2SNMCA-30KE installed is used, it is necessary to setup the memory protection on the body of A2SNMCA-30KE to prevent overwriting $E^2$PROM memory contents due to misoperation from a peripheral device.

64k bytes of the user memory area is protected as a whole by setting the memory protection setting pin to ON.

To correct the ROM memory contents, cancel the memory protect (OFF).

At the time of factory shipment, memory protection setting pin is set to OFF.

For memory area allocation, refer to Section 4.2.2.



# 7.2 Battery

Specification, precaution when handling and the installation procedure or the battery are described below.

## 7.2.1 Specifications

Specifications of the battery used for the power failure retention function are shown in Table 7.2.

**Table 7.2 Battery specifications**

| Item \ Model | A6BAT |
|---|---|
| Nominal voltage | 3.6VDC |
| Battery warranty period | 5 years |
| Application | For IC-RAM memory back up and power failure retention function |
| External dimensions (mm (inch)) | $\phi$ 16 (0.63) $\times$ 30 (1.18) |

## 7.2.2 Precautions when handling

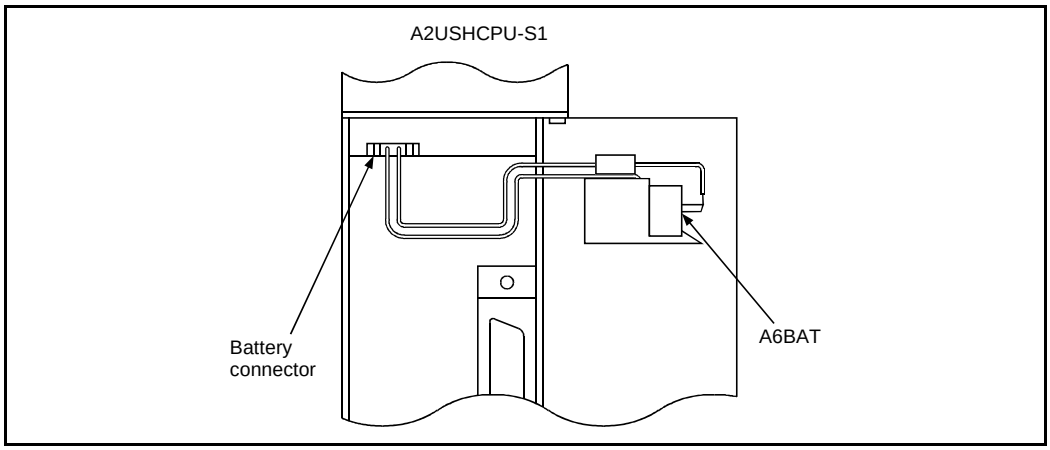
Precautions when handling the battery are provided below.

(1) Do not short it.
(2) Do not disassemble it.
(3) Do not put it in a fire.
(4) Do not heat it.
(5) Do not solder to the electrodes.

## 7.2.3 Battery installation

Battery connector is removed to prevent consumption of the battery during shipping and storage. Connect the lead connector of the battery to the battery connector on the A2USHCPU-S1 print board before using A2USHCPU-S1 for the following objectives:

- To use the sequence program in the user program area in the A2USHCPU-S1.
- To use the power failure retention function.



# 8. LOADING AND INSTALLATION

To increase the system reliability and fully utilize the functions, procedures and cautions concerning loading and installation are described below.

## 8.1 Concept of Failsafe Circuit

When turning the power supply of the PC ON or OFF, because of the delay and the difference in the startup time between the power supply in the PC main module and the external power supply for processing (especially DC), processing output may not operate normally for a moment.

For instance, when the PC power supply is turned on after a DC output module is turned on with the external power supply for processing, the DC output module may misoutput momentarily upon PC power-on. Therefore, it is necessary to construct a circuit whereby the power supply of the PC main module can be energized first.

In addition, it may cause an abnormal operation when there is an abnormality in the external power supply or a failure with the PC.

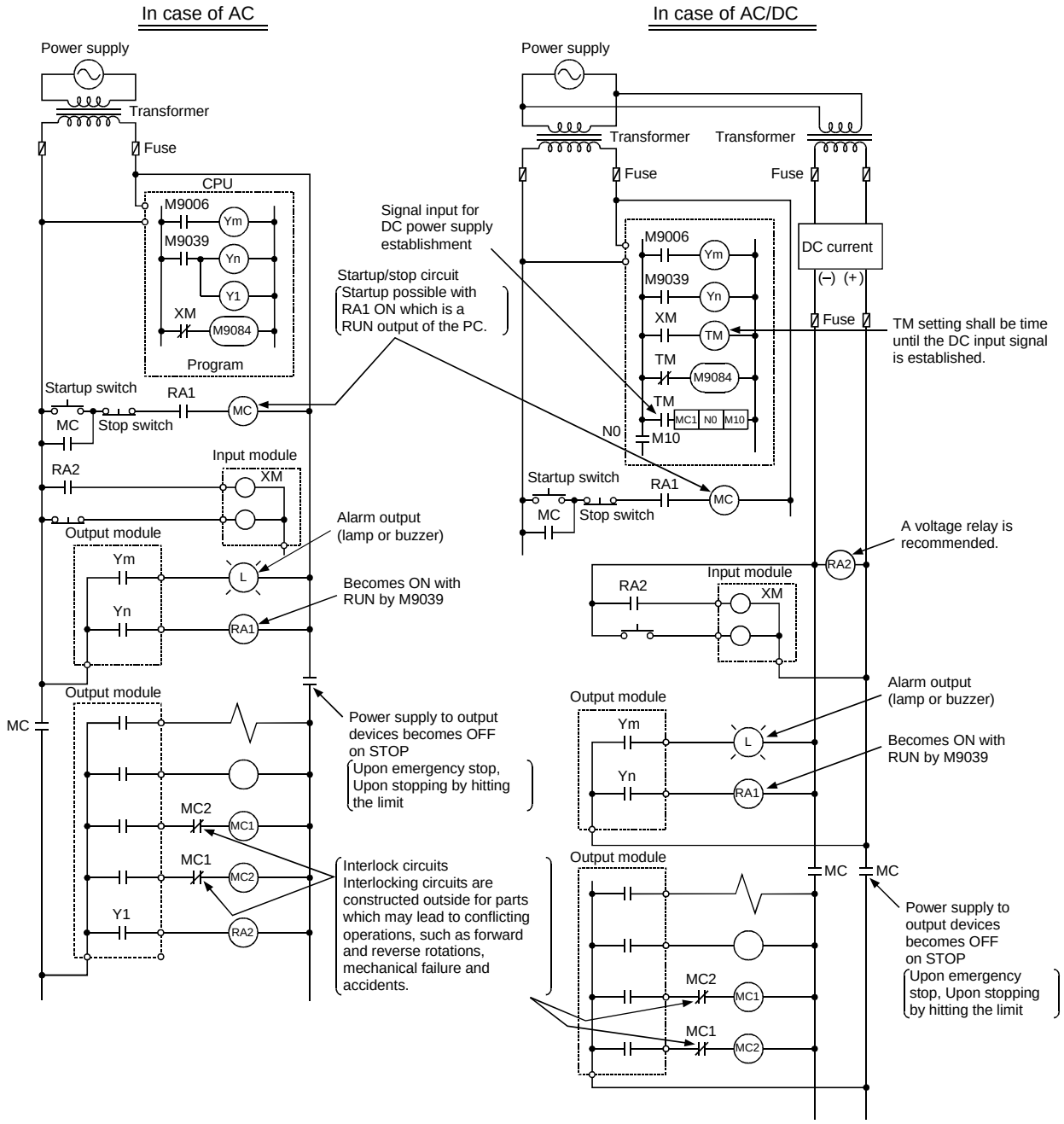
To prevent these abnormalities from causing abnormal behaviors of the system as a whole, and from the stand point of failsafe, the circuits which may cause mechanical failures or accidents (the emergency stop circuit, protection circuit, interlock circuits, etc.) should be constructed outside the PC. An example of system circuit design in accordance with the view point mentioned above is shown on the next page.

**DANGER**

- Provide safety circuits in the outside of the PLC to ensure that the whole system will operate safely if an external power supply fault or PLC failure occurs. Not doing so may cause accidents due to improper output or malfunction.
  (1) Configure circuits, such as emergency stop circuits, protective circuits, oppositely operating interlock circuits, e.g. forward rotation and reverse rotation, and machine damage prevention interlock circuits, e.g. upper and lower limits of positioning, in the outside of the PLC.
  (2) If the PLC detects either of the following faulty states, it stops arithmetic operation and turns off all outputs.
    - When the overcurrent or overvoltage protection device of the power supply module operates.
    - When a fault is detected by the self-diagnostic function of the PLC CPU such as a watchdog timer error.

  At the occurrence of a fault in the I/O control section, etc. that cannot be detected by the PLC CPU, all outputs may turn on. Configure failsafe circuits or provide mechanisms in the outside of the PLC to ensure that the machine operation will be performed safely at such times.
  (3) Depending on the failures of the output module relays, transistors, etc., the outputs may remain on or off. Provide external monitoring circuits for the output signals that may lead to serious accidents.
- If excessive current higher than the rating or caused by a load short circuit, etc. keeps flowing in the output module for a long period of time, smoking or ignition may occur. Therefore, provide external safety circuits such as fuses.

### (1) Example of system circuit design




Startup procedure of power supply is as follows:

In case of AC

[1] Set CPU module to "RUN."
[2] Turn the power "ON."
[3] Set the start switch to "ON."
[4] Set the magnetic contactor (MC) "ON" to start driving drive output devices by a program.

In case of AC/DC

[1] Set CPU module to "RUN."
[2] Turn the power "ON."
[3] Set RA2 to "ON" when DC power supply is established.
[4] Set the timer (TM) to "ON" upon 100% establishment of DC power supply.
(Set value for TM shall be the period from RA2 turned "ON" to 100% establishment of DC power supply. Use the set value of 0.5s.)
[5] Set the start switch to "ON."
[6] Set the magnetic contactor (MC) "ON" to start driving drive output devices by a program.
(When a voltage relay is used for RA2, the timer in the program (TM) is not necessary.)

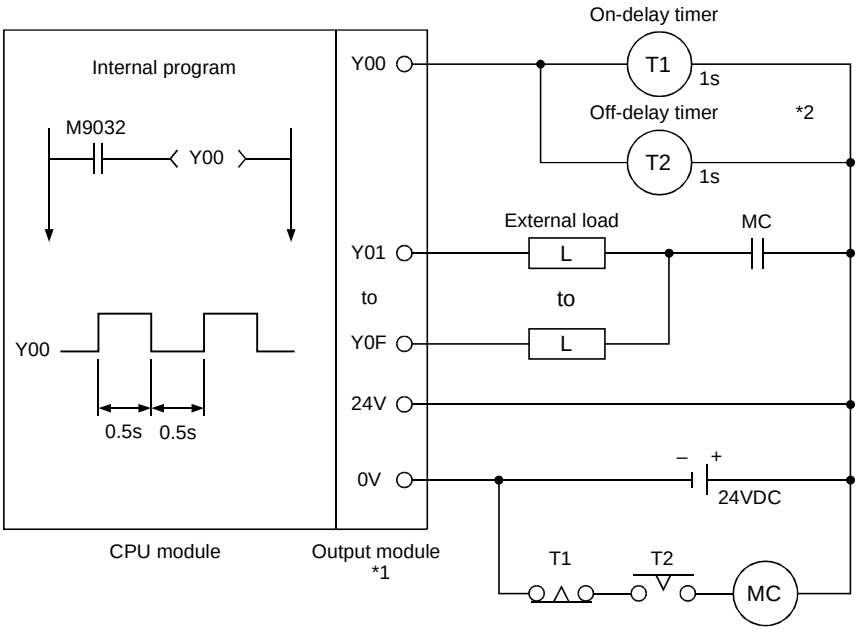
**(2) Failsafe measures against PC failure**

Failures in the PC CPU and memory are detected by the self-diagnostic function, but the CPU may not be able to detect abnormalities in the I/O control area, etc.

In such cases, there is a possibility of setting all points to ON or OFF, or a situation may develop where normal operations and safety of the controlled subject cannot be assured, depending on the condition of the failure.

Although as a manufacturer, every possible measure is implemented to assure the product quality, the failsafe circuit should be constructed outside by the user so that if the PC fails for some reason, it would not cause any mechanical damages or accidents.

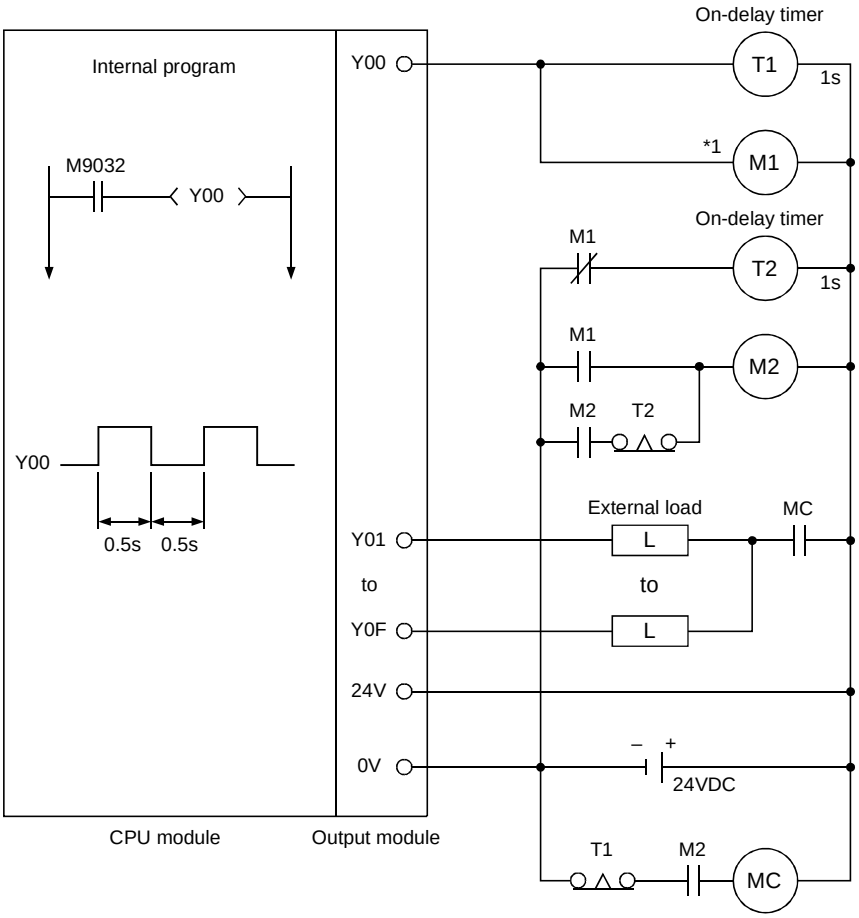
An example of failsafe circuit is shown below.




*1 Since Y00 repeats ON/OFF with 0.5s intervals, use a contactless output module (transistor is used in the above example).

*2 If an offdelay timer (especially miniature timer) is not available, construct the failsafe circuit using an ondelay timer shown on the next page.

When constructing a failsafe circuit using ondelay timers only




*1 Use a solid state relay for the M1 relay.

## 8.2 Installation Environment

Avoid the following conditions for the installation location of A2USHCPU-S1 system:

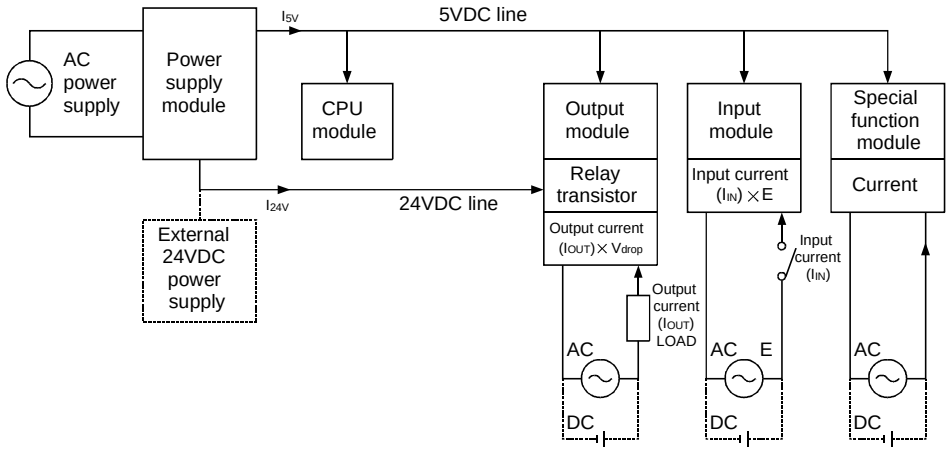
(1) Location where the ambient temperature exceeds the range of 0 to 55°C.
(2) Location where the ambient humidity exceeds the range of 10 to 90%RH.
(3) Location where condensation occurs due to a sudden temperature change.
(4) Location where corrosive gas or flammable gas exists.
(5) Location where a lot of conductive powdery substance such as dust and iron filing, oil mist, salt, or organic solvent exists.
(6) Location exposed to direct sunlight.
(7) Location where strong electric fields or magnetic fields form.
(8) Location where vibration or impact is directly applied to the main module.

## 8.3 Calculation Method of Heat Amount Generated by the PC

It is necessary to keep the temperature of the panel which stores the PC to the operating ambient temperature of the PC, which is 55°C, or below.
For radiation design of the panel, it is necessary to know the average power consumption (heat generation) of the devices and machinery stored inside. In this section, a method to obtain the average power consumption of the A2USHCPU-S1 system is explained. Calculate the temperature increase in the panel from the power consumption.

Calculation method of average power consumption

The power consuming parts of the PC may be roughly classified into the blocks as shown below:




**(1) Power consumption by power supply module**

The power conversion efficiency of the power supply module is about 70%, and 30% is consumed as heat generated, thus, 3/7 of the output power is the power consumption. Therefore, the calculation formula is:

$$W_{pw} = \frac{3}{7} \{ (I_{5V} \times 5) + (I_{24V} \times 24) \} \ (W)$$

$I_{5V}$ : Current consumption of 5VDC logic circuit of each module
$I_{24V}$: Average current consumption of 24VDC power supply for internal consumption of the output module
(Current consumption equivalent to the points simultaneously ON)
..... Not applicable to a system where 24VDC is supplied externally and a power module which does not have a 24VDC output is used.

**(2) Total power consumption of each module at 5VDC logic part**

Power of the 5VDC output circuit of the power supply module is the power consumption of each module.

$$W_{5V} = I_{5V} \times 5 \ (W)$$

**(3) Total 24VDC average power consumption of the output module (power consumption equivalent to the points simultaneously ON)**

Average power of the 24VDC output circuit of the power supply module is the total power consumption of each module.

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

**(4) Average power consumption of the output modules due to voltage drops at the output part (power consumption equivalent to the points simultaneously ON)**

$W_{OUT} = I_{OUT} \times Vdrop \times$ Output points $\times$ Simultaneous ON ratio (W)

$I_{OUT}$ : Output current (current actually used) (A)
Vdrop : Voltage drop of each output module (V)

**(5) Average power consumption of the input modules at the input part (power consumption equivalent to the points simultaneously ON)**

$W_{IN} = I_{IN} \times E \times$ Input points $\times$ Simultaneous ON ratio (W)

$I_{IN}$ : Input current (actual value in case of AC) (A)
E : Input voltage (voltage for actual usage) (V)

**(6) Power consumption of the power supply part of the special function module is:**

$W_S = I_{5V} \times 5 \times I_{24V} \times 24 + I_{100V} \times 100$ (W)

The total of the power consumption calculated for each block as above is the power consumption of the PC system as a whole.

$W = W_{PW} + W_{5V} + W_{24V} + W_{OUT} + W_{IN} + W_S$ (W)

Calculate the amount of heat generation and temperature increase inside the panel from the total power consumption (W).
Simplified calculation formula to obtain temperature increase inside panel is shown next:

$$T = \frac{W}{UA} \quad [°C]$$

W : Power consumption of the PC system as a whole (the value obtained above)
A : Inside surface area of the panel [$m^2$]
U : When inside temperature of the panel is kept constant by a fan, etc. .....6
When the air inside the panel is not circulated .....4

**POINT**

When the temperature increase inside the panel exceeds the specified range, it is recommended to lower the temperature inside the panel by installing a heat exchanger to the panel.

If a conventional ventilation fan is used, it sucks dust along with the outside air, which may affect the PC, so care must be taken.

# 8.4 Installation of Base Unit

Precautions concerning installation of the basic base unit and extension base unit are described next.

## 8.4.1 Precautions when installing PC

Precautions concerning the installation of PC to the panel, etc. are explained below.

(1) To improve the ventilation and to facilitate the exchange of the module, provide at least 30mm (1.18in.) of distance between the top part of the module and any structure or part.
However, when A52B, A55B, A58B, A62B, A65B or A68B extension base module is used, provide at least 80mm (3.15in.) of distance between the top of the module and any structural part.

(2) Do not install vertically or horizontally, because of concerns with ventilation.

(3) If there are any protrusions, dents or distortion on the installation surface of the base unit, an excessive force is applied to the print board and causes problems, so, install to a flat surface.

(4) Avoid sharing the same panel with any source of vibration such as a large magnetic contactor or no-fuse breaker, and install to a separate panel or away from such devices.

(5) Provide wiring ducts as necessary.
However, when the clearance of the top and bottom of the PC are smaller than those shown in figure 8.1, pay attention to the following:
   (a) When installing to the top of PC, to improve the ventilation, keep the height of the duct to 50mm (1.97in.) or below.
   In addition, the distance from the top of the PC should be sufficient for tightening and loosening works for the installation screws on the top of the module.
   The module cannot be replaced if the screws on the top of the module cannot be loosened or tightened.
   (b) When installing to the bottom part of the PC, provide a sufficient space so that the 100/200VAC input line of the power module, input and output cables of I/O modules and 12/24VDC lines are not affected.

(6) If any device is installed in front of the PC (i.e. installed in the back of the door), position it to secure at least 100mm (3.94in.) of distance to avoid the effects of noise emission and heat.
Also, keep at least 50mm (1.97in.) distance from the base unit to any device placed on right or left or the module.

### 8.4.2 Installation

Installation location of the basic base unit and the extension base unit is shown below.

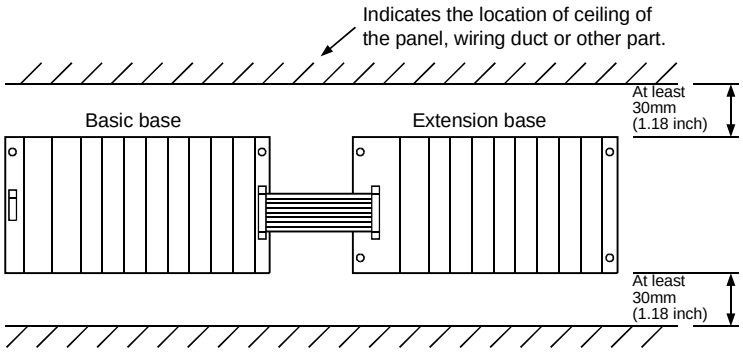



**Figure 8.1 Parallel installation**

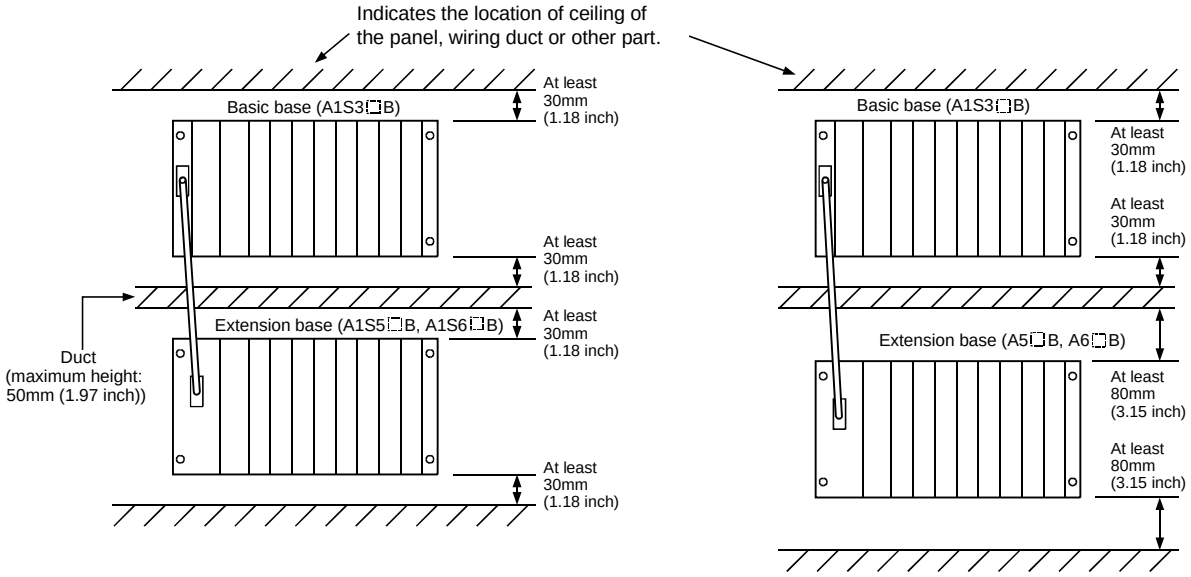



**Figure 8.2 Series installation**

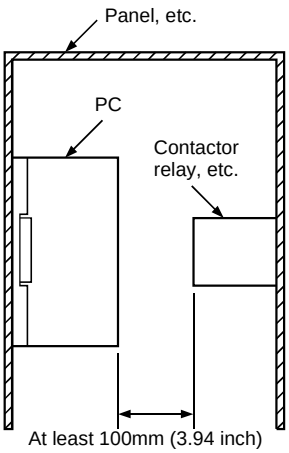



**Figure 8.3 Distance between the front face of the PC and other devices**

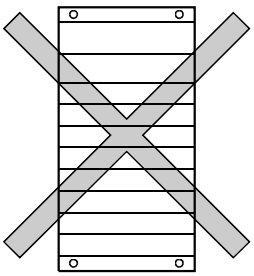


**Figure 8.4 Vertical installation (not allowed)**

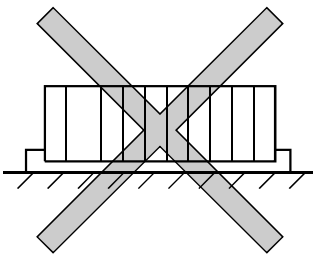


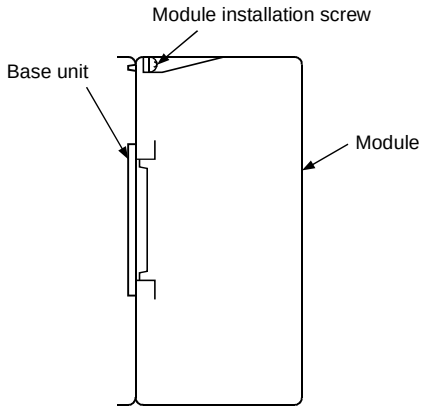
**Figure 8.5 Horizontal installation (not allowed)**

## 8.5 Installation and Removal of the Modules

How to install and remove the power supply module, CPU module, I/O module and special function module, etc. to/from the base unit are explained.

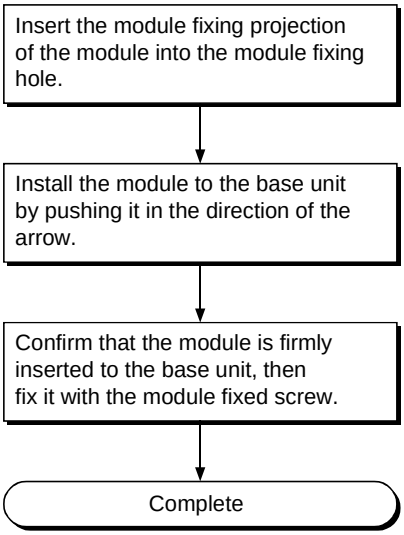
**⚠CAUTION**

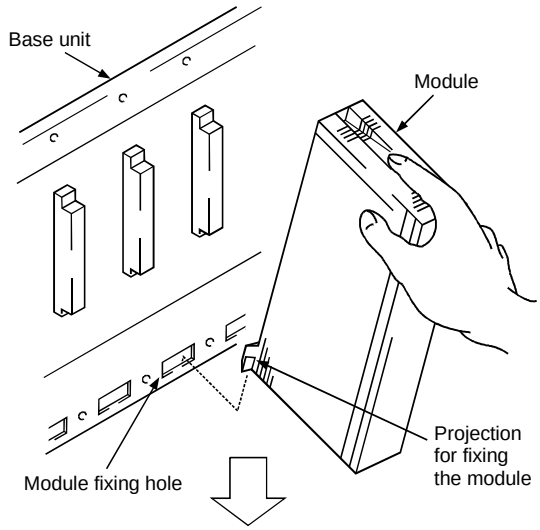
- Install the module by firmly inserting the projection for fixing the module at the bottom of the module to the fixing hole of the base unit, then tighten the module fixed screw with the specified torque. If the module is not installed correctly or the screws are loose, malfunctions, failures and fall out may result.
- Tighten the screws with the specified torque.
  If the screws are loose, it may cause short-circuit, malfunctions, or the module may fall out.
  If the screw is tightened too much, it may cause short-circuit, malfunctions or the module may fall out due to damaged screws or the module.
- Before beginning any installation or wiring work, make sure all phases of the power supply have been obstructed from the outside. Failure to completely shut off the power-supply phases may cause breakdowns or malfunctions.

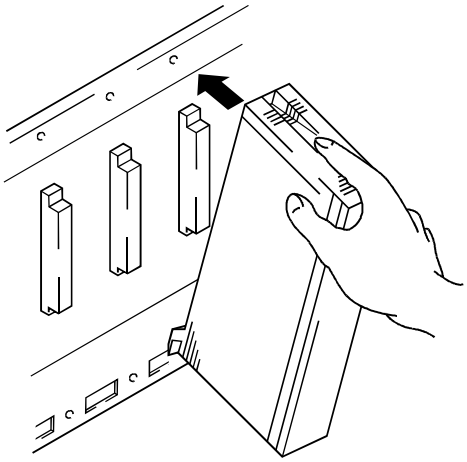


**(1) Installation of the module**

Installation procedure of the module is explained.

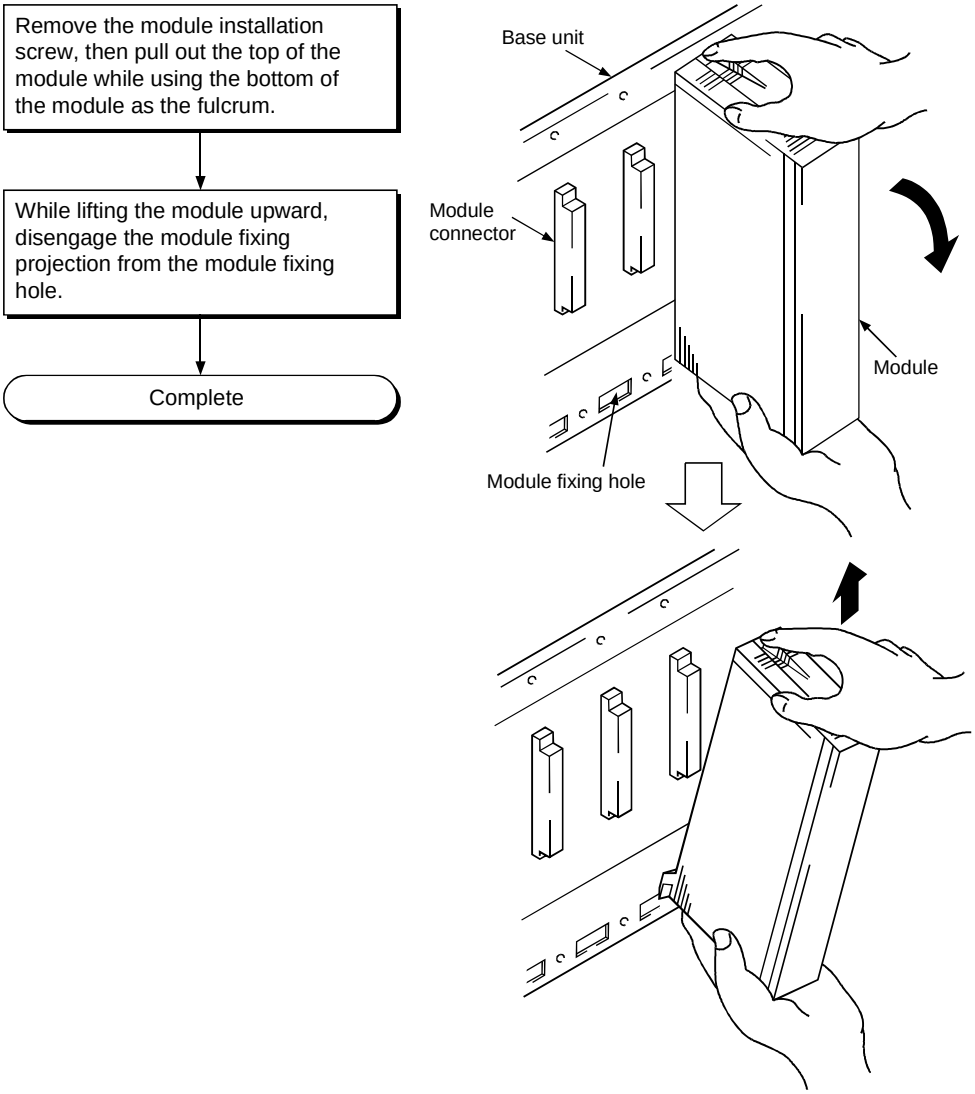


**(2) Removal of the module**

Removal procedure of the module is explained.



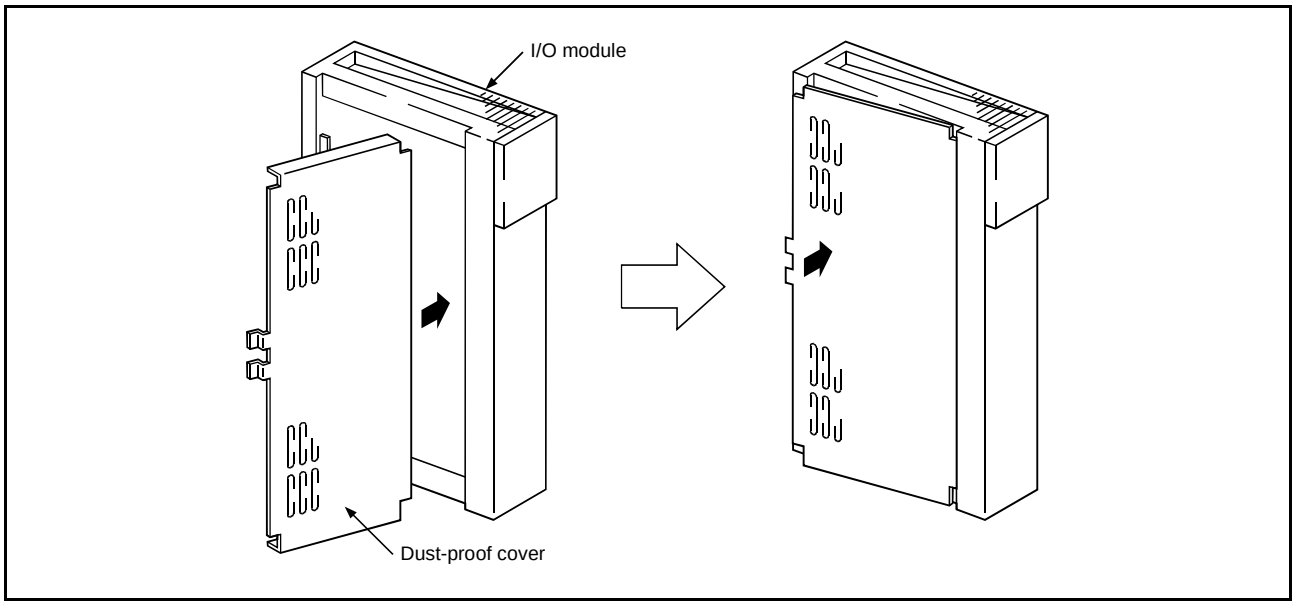

**POINT**

To remove the module, the module installation screw must be removed first, then disengage the projection for fixing the module from the module fixing hole. If the module is forcibly removed the projection for fixing the module will be damaged.

## 8.6 Installation and Removal of the Dustproof Cover

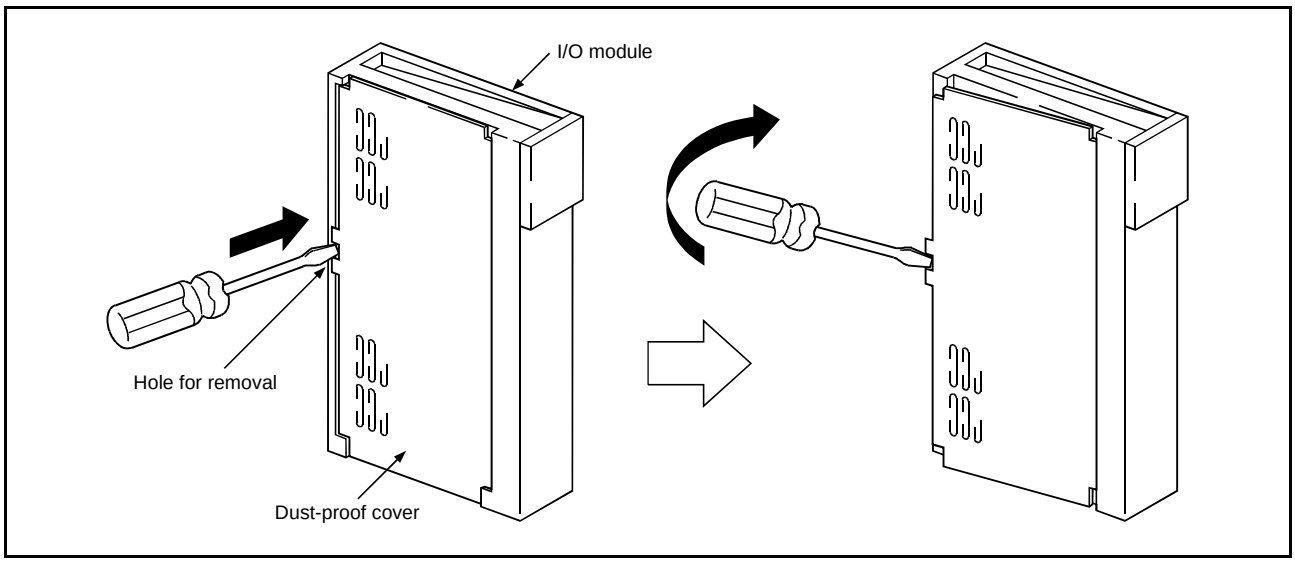
When A1S52B, A1S55B or A1S58B is used, it is necessary to install the dustproof cover, which is supplied with base to the I/O module to be installed to the left end in order to prevent intrusion of foreign material into the I/O module. Intrusion of foreign materials into the I/O module may cause breakdowns. Procedures for installing and removing the dustproof cover are described below.

**(1) Installation**




To insert the dustproof cover to the I/O module, insert the cover to the connector or terminal side first as shown in the figure, then push the cover to the I/O module side.

**(2) Removal**




To remove the dustproof cover from the I/O module, insert the tip of a flat-tip screwdriver into the removal hole as shown in the figure, then move the screwdriver towards the rear of the module to separate the clip from the removal hole and remove the cover.

## 8.7 Wiring

### 8.7.1 Precautions when wiring

**DANGER**

- Before beginning any installation or wiring work, make sure all phases of the power supply have been obstructed from the outside. Failure to completely shut off the power-supply phases may cause electric shock and/or damage to the module.
- When turning on the power or operating the module after installation or wiring work, be sure the module's terminal covers are correctly attached. Failure to attach the terminal covers may result in electric shock.

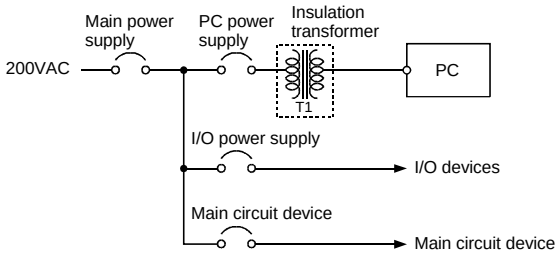
**CAUTION**

- The FG and LG terminals should always be grounded using the class-3 or higher grounding designed specially for PC. Failure to ground these terminals may cause electric shock or malfunctioning.
- When wiring the PC, check the rated voltage and terminal layout of the wiring, and make sure the wiring is done correctly. Connecting a power supply that differs from the rated voltage or wiring it incorrectly may cause fire or breakdown.
- Do not connect output from multiple power supply modules in parallel.
  This may heat up the power supply module and cause fire or breakdowns.
- Tighten the terminal screws with the specified torque. If the terminal screws are loose, it may result in short circuits, fire or malfunctioning.
  If the terminal screws are tightened too much, it may damage the screws and the module may result in short circuits, malfunctioning or cause the module to fall out.
- Be careful not to let foreign matter such as filings or wire chips get inside the unit. These can cause fire, breakdowns and malfunctioning.
- Perform correct pressure-welding, crimp-contact or soldering for connectors for the outside using the specified tools. Refer to the User's Manual of the corresponding I/O module for tools required to perform pressure-welding and crimp-contact.
  Incorrect connection may cause short circuits, fire, or malfunctioning.
- Do not bunch the control wires or communication cables with the main circuit or power wires, or install them close to each other. They should be installed 100 mm (3.94in.) or more from each other. Failure to do so may result in noise that would cause malfunctioning.

Precautions when wiring power supply cable are described.

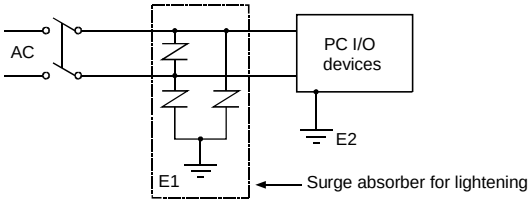
**(1) Wiring power supply**

(a) Separate the PC's power supply line from the lines for I/O devices and power devices as shown below.
When there is much noise, connect an insulation transformer.




(b) 100VAC, 200VAC and 24VDC wires should be twisted as dense as possible. Connect the modules with a shortest distance.
Also, to reduce the voltage drop to the minimum, use thickest wires possible (maximum $2mm^2$ ($0.0031in.^2$)).

(c) As a countermeasure to power surge due to lightening, connect a surge absorber for lightening as shown below.




**POINT**

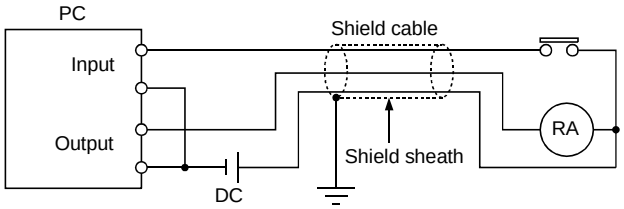
(1) Separate the ground of the surge absorber for lightening ($E_1$) from that of the PC ($E_2$).
(2) Select a surge absorber for lightening whose power supply voltage does not exceed the maximum allowable circuit voltage even at the time of maximum power supply voltage elevation.

**(2) Wiring I/O devices**

(a) The suitable wire size for the connection to the terminals on a terminal block is 0.75 to 1.25mm$^2$ (0.0012 to 0.0019in.$^2$), but in view of ease of use, the wiring with wire size 0.75mm$^2$ is recommended.

(b) Route the input wires separate from the output wires.

(c) When it is impossible to separate the input/output wires from the main circuit wires and the power line, use a batch-shield cable and ground them at the PC side.
However, grounding them on the other side may be necessary in some cases.




(d) When duct wiring is performed, ground the duct securely.

(e) Separate the 24VDC input and output lines from the 100VAC and 200VAC lines.

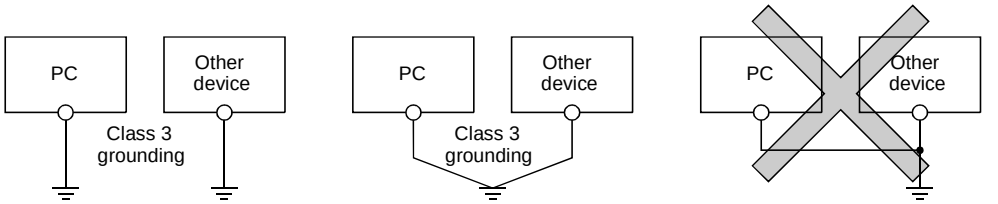
(f) With a long distance wiring of 200m (656.2ft.) or longer, leak current due to line capacity may cause troubles. Implement the countermeasures described in Section 10.4.

**(3) Grounding**

Perform grounding according to (a) to (c) below.

(a) Employ independent grounding whenever possible. Grounding work shall be done with class D (class 3) grounding. (Grounding resistance is 100Ω or less.)

(b) When independent grounding is not feasible, use shared grounding, shown as (2) in the figure below.



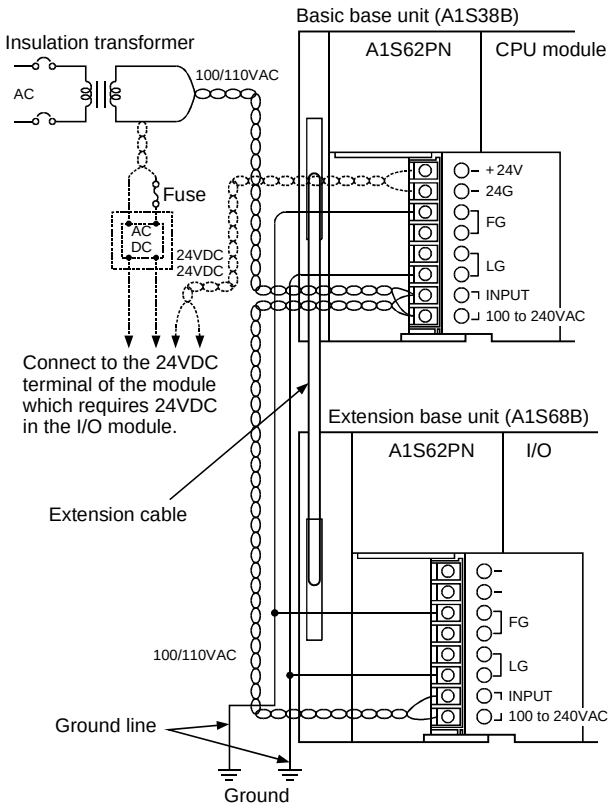

(1) Independent grounding ····· Good (2) Independent grounding ····· O.K. (3) Independent grounding ····· Not allowed

(c) Use electrical wires having a thickness of at least 2mm$^2$ (0.0031in.$^2$) for grounding. Grounding point shall be as close to the PC as possible. Make the length of the ground wire short.

### 8.7.2 Wiring to the module terminals

Examples of wiring power supply line and ground line to the basic base and the extension base are shown below.

Wiring example




**POINT**

(1) For 100/200VAC and 24VDC power supply line, use the thickest electrical wire possible (maximum 2mm$^2$ (0.0031in.$^2$)). The lines must be twisted from the connecting terminals. For the crimp-style terminals, use crimp-style terminals with an insulation sleeve in order to avoid short-circuiting when screws are loosened.

(2) When LG and FG terminals are connected, it must be grounded. When it is not grounded with LG and FG terminals connected, it will be susceptible to noises. Since the LG terminal has a potential of half the input voltage, touching the terminal may result in an electrical shock.

## 8.8 Precautions When Unfailure Power System (UPS) is Connected

When Unfailure Power System (abbreviated as UPS hereafter) is connected to the CPU system, care must be taken on the following matter:

Use an UPS of inverter power supply type at all time with 5% or less voltage distortion. Do not use a UPS of commercial power supply type.

# 9. EMC DIRECTIVE AND LOW-VOLTAGE INSTRUCTION

## 9.1 Requirements for Compliance to EMC Directive (89/336/EEC)

The EMC Directive (89/336/EEC) will become mandatory within Europe from January 1st 1996. The EMC directive in essence defines the amount of electromagnetic output a product is allowed to produce and how susceptible that product is to electromagnetic interference. Any manufacturer or importer of electrical/electronic apparatus must before releasing or selling products within Europe after that date have either a CE mark attached to their goods. Testing to comply with the directive is done by use of agreed European standards which define limits for radiated and mains conducted electromagnetic emissions from equipment, levels of immunity to radiated emissions, ability for equipment to cope with transient voltage surges and electro-static discharges.

When installed in the specified manner this unit will be compliant with the relevant standards EN50081-2 and prEN50082-2 as applicable in the EMC directive. Failure to comply with these instructions could lead to impaired EMC performance of the equipment and as such Mitsubishi Electric Corporation can accept no liability for such actions.

### 9.1.1 EMC standards

When the PLC is installed following the directions given in this manual its EMC performance is compliant to the following standards and levels as required by the EMC directive.

| Specifications | Test Item | Test Description | Standard Values |
|---|---|---|---|
| EN50081-2 : 1995 | EN55011<br>Radiated noise | Measure the electric wave released by the product. | 30 M-230 M Hz QP : 30 dBμ V/m (30 m measurement) *1<br>230 M-1000 M Hz QP : 37 dBμ V/m (30 m measurement) |
| | EN55011<br>Conduction noise | Measure the noise released by the product to the power line. | 150 K-500k Hz QP: 79 dB, Mean : 66 dB *1<br>500 K-30M Hz QP : 73 dB, Mean: 60 dB |
| prEN50082-2 : 1991 | IEC801-2<br>Static electricity immunity *2 | Immunity test by applying static electricity to the module enclosure. | 4 k V contact discharge<br>8 k V air discharge |
| | IEC801-3<br>Radiated electromagnetic field *2 | Immunity test by radiating an electric field to the product. | 10 V/m, 27-500 M Hz |
| | IEC801-4<br>First transient burst noise | Immunity test by applying burst noise to the power line and signal cable. | 2 k V |
| EN50082-2 : 1995 | EN61000-4-2<br>Static electricity immunity *2 | Immunity test by applying static electricity to the module enclosure. | 4 k V contact discharge<br>8 k V air discharge |
| | EN61000-4-4<br>First transient burst noise | Immunity test by applying burst noise to the power line and signal cable., 2 k V | 2 k V |
| | ENV50140<br>Radiated electromagnetic field AM modulation *2 | Immunity test by radiating an electric field to the product. | 10 V/m, 80-1000 M Hz, 80 % AM modulation@1 k Hz |
| | ENV50204<br>Radiated electromagnetic field Pulse modulation *2 | Immunity test by radiating an electric field to the product. | 10 V/m, 900 M Hz, 200 Hz pulse modulation, 50 % duty |
| | ENV50141<br>Conduction noise | Immunity test by inducting electromagnetic field to the power line signal cable. | 10 Vrms, 0.15-80 M Hz, 80 % modulation@1 k Hz |

(*1) QP: Quasi-peak value, Mean : Average value

(*2) The PLC is an open type device (device installed to another device) and must be installed in a conductive control box.
The tests for the corresponding items were performed while the PLC was installed to inside the control box.

### 9.1.2 Installation inside the control cabinet

Since the PLC is an open type device (device incorporated into another device), it must be installed in the control cabinet. This has a good effect of not only for assuring safety but also for shielding noise emitted from the PLC, by means of the control cabinet.

(1) Control cabinet

(a) Use a conductive control cabinet.

(b) When attaching the control cabinet's top plate or base plate, mask painting and weld so that good surface contact can be made between the cabinet and plate.

(c) To ensure good electrical contact with the control cabinet, mask the paint on the installation bolts of the inner plate in the control cabinet so that contact between surfaces can be ensured over the widest possible area.

(d) Earth the control cabinet with a thick wire so that a low impedance connection to ground can be ensured even at high frequencies. (22 $mm^2$ wire or thicker is recommended.)

(e) Holes made in the control cabinet must be 10 cm (3.94 in.) diameter or less. If the holes are 10 cm (3.94 in.) or larger, radio frequency noise may be emitted.

(2) Connection of power and earth wires

Earthing and power supply wires for the PLC system must be connected as described below.

(a) Provide an earthing point near the power supply module. Earth the power supply's LG and FG terminals (LG : Line Ground, FG : Frame Ground) with the thickest and shortest wire possible. (The wire length must be 30 cm (11.18 in.) or shorter.) The LG and FG terminals function is to pass the noise generated in the PLC system to the ground, so an impedance that is as low as possible must be ensured. As the wires are used to relieve the noise, the wire itself carries a large noise content and thus short wiring means that the wire is prevented from acting as an antenna.

Note) A long conductor will become a highly efficient antenna at high frequency.

(b) The earth wire led from the earthing point must be twisted with the power supply wires. By twisting with the earthing wire, noise flowing from the power supply wires can be relieved to the earthing. However, if a filter is installed on the power supply wires, the wires and the earthing wire may not need to be twisted.

### 9.1.3 Cables

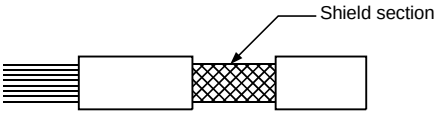
The cables led from the control cabinet contain a high frequency noise element and outside the control panel these cables act as antennae and radiate noise. The cables connected to input/output modules or special modules which leave the control panel must always be shielded cables.
Mounting of a ferrite core on the cables is not required (excluding some models) but if a ferrite core is mounted, the noise radiated through the cable can be suppressed further.
Use of a shielded cable is also effective for increasing the noise immunity level. The PLC system's input/output and special function module provide a noise immunity level of equivalent to that stated in IEC801-4 : 2 k V when a shielded cable is used. If a shielded cable is not used or if the shield earthing treatment is not suitable even when used (See Section 9.1.2.4), the noise immunity level is less than 2 k V.

Note) prEN50082-2 specifies the noise resistance level based on the signal wire application.
Signals involved in process control : 2 k V
Signals not involved in process control : 1 k V

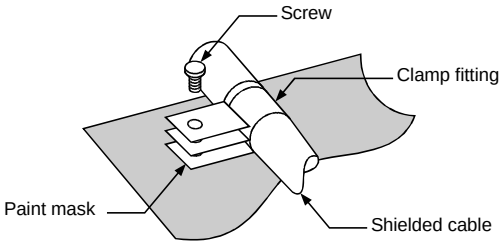
The meaning of "involved in process control" is not defined in prEN50082-2. However, when the purposes of the EMC Directive are considered, the signals that could cause personal injury or risks in the facility if a malfunction occurs should be defined as "signals involved in process control". Thus, it is assumed that a high noise immunity level is required.

(1) Shield earthing

When a shield of the shielded cable is earthed to the cabinet body, please ensure that the shield contact with the body is over a large surface area. If the cabinet body is painted it will be necessary to remove paint from the contact area. All fastenings must be metallic and the shield and earthing contact must be made over the largest available surface area. If the contact surfaces are too uneven for optimal contact to be made either use washers to correct for surface inconsistencies or use an abrasive to level the surfaces. The following diagrams show examples of how to provide good surface contact of shield earthing by use of a cable clamp.

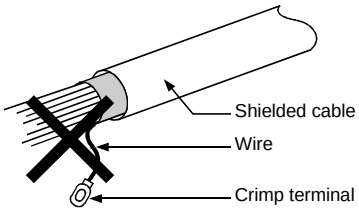



(a) Peal the cable insulation off and expose the shield section.



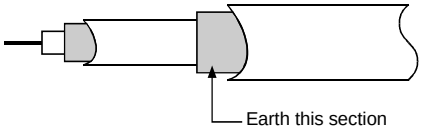

(b) Sandwich the exposed shield section with the and earth to the control cabinet over a wide area.

Note) The method of earthing by soldering a wire onto the shield section of the shielded cable as shown below is not recommended. The high frequency impedance will increase and the shield will be ineffective.




(2) MELSECNET/II, MELSECNET/10 module

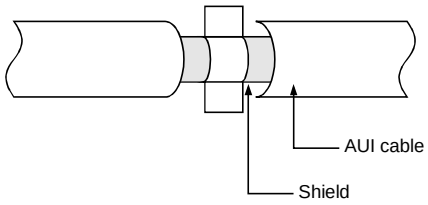
(a) The following requirements apply to A1SJ71AR21, A1SJ71BR11, AnNCPUR21, AnACPUR21.
Always use a triaxial cable for the module. The radiated noise in the band of 30 M Hz or higher can be suppressed by using a triax cable. Earth the outer shield by the method described in (1).




(b) Always mount a ferrite core onto the triaxial cable. Mount the ferrite core near the control cabinet outlet of each cable. Use of the TDK ZCAT3035 ferrite core is recommended.

(3) Ethernet module

(a) Always earth the AUI cable connected to the A1SJ71E71-B5. The AUI is a shielded cable so remove the outer insulation and connect to earth the exposed shield section using as wide a surface area as possible in the manner shown below.




(b) Always use a triaxial cable for the coaxial cable connected to the A1SJ71E71-B2. The earthing precautions are the same as (1).

(c) For A1SJ71E71-B2/B5, always mount a ferrite core in addition to items (1) and (2) above. Use of the TDK ZCAT3035 ferrite core is recommended.

Ethernet is the registered trademark of XEROX Corporation in the US.

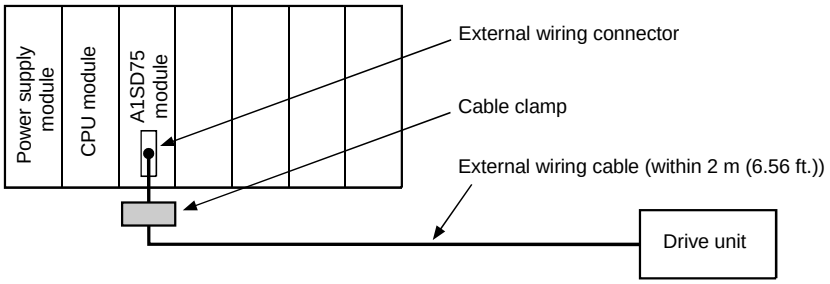
(4) Positioning Modules

(a) When wiring with a 2 m (6.6 ft.) or less cable

Ground the shield section of the external wiring cable with the cable clamp.
(Ground the shield at the closest location to the A1SD75 external wiring connector.)

Wire the external wiring cable to the drive unit and external device with the shortest distance.

Install the drive unit in the same panel.

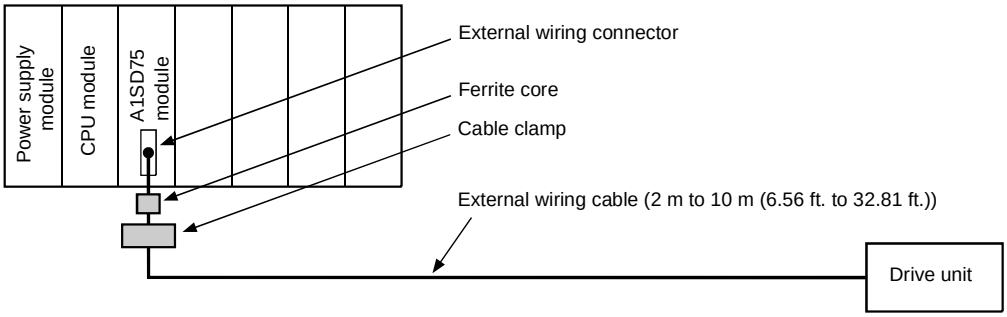



(b) When wiring with cable that exceeds 2 m (6.6 ft.), but is 10 m (32.8 ft.) or less

Ground the shield section of the external wiring cable with the cable clamp.
(Ground the shield at the closest location to the A1SD75 external wiring connector.)

Install a ferrite core.

Wire the external wiring cable to the drive unit and external device with the shortest distance.




(c) Ferrite core and cable clamp types and required quantities

- Cable clamp
  Type : AD75CK (Mitsubishi Electric)
- Ferrite core
  Type : ZCAT3035-1330 (TDK ferrite core)
- Required quantity

| Cable length | Prepared part | Required Qty | | |
|---|---|---|---|---|
| | | 1 axis | 2 axes | 3 axes |
| Within 2 m (6.6 ft.) | AD75CK | 1 | 1 | 1 |
| 2m (6.6 ft.) to 10m (32.8 ft.) | AD75CK | 1 | 1 | 1 |
| | ZCAT3035-1330 | 1 | 2 | 3 |

(5) I/O and other communication cables

Always earth the shield section of the I/O signal cables and other communication cables (RS-232-C, RS-422, etc.) in the same manner as described in Section 9.1.2.4 if the cables go outside of the control cabinet.

### 9.1.4 Power supply module

The precautions required for each power supply module are described below. Always observe the items noted as precautions.

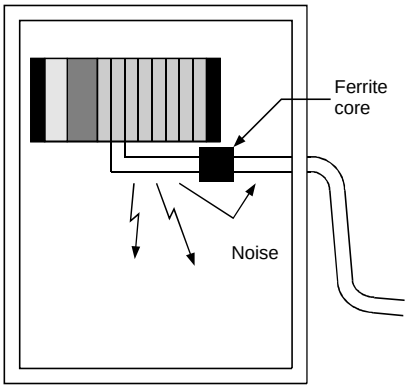
| Model | Precautions |
|---|---|
| A1S61PN<br>A1S62PN | Always ground the LG and FG terminals after short-circuiting them. |
| A1SJHCPU<br>A1SJHCPU-S8 | |
| A1S63P *1 | Use a CE-compliant 24VDC internal power supply. |

*1 If a sufficient filter circuitry is built into a 24 V DC external power supply module, the noise generated by A1S63P will be absorbed by that filter circuit, so a line filter may not be required.

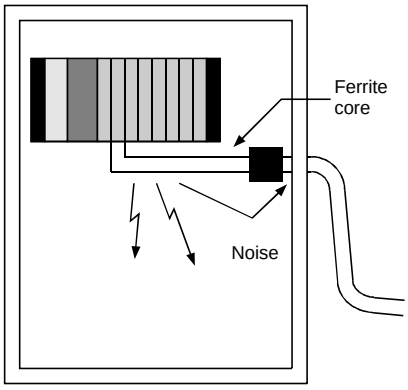
Filtering circuitry of version F or later of A1S63P is improved so that a external line filter is not required.

### 9.1.5 Ferrite core

A ferrite core is effective for reducing noise in the band of 30 M Hz to 100 M Hz. Mounting of a ferrite core is not necessary except for some particular models described in Section 9.1.3 (2), (3). However if further attenution of noise is necessary, mounting of a ferrite core on cables which radiate noise is recommended. When a ferrite core is mounted, mount the ferrite core just before the point where the cable goes outside of the cabinet. The ferrite will not be effective if the mounting position is not adequate.




(a) When there is a distance from the cable exit hole, the noise will jump over the ferrite, thus the effect will be halved.




(b) When mounted by the cable exit hole, the noise will not jump over the ferrite.

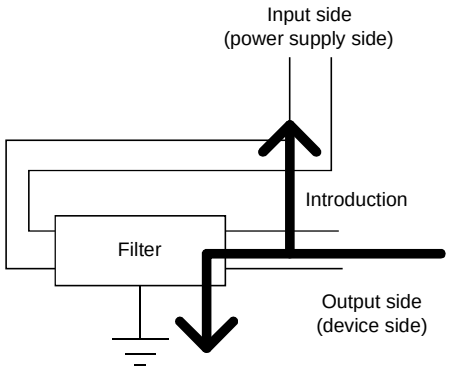
### 9.1.6 Noise filter (power supply line filter)

The noise filter (power supply line filter) is a device effective to reduce conducted noise. Except some particular models described in Section 9.1.3 (5), installation of a noise filter onto the power supply lines is not necessary. However conducted noise can be reduced if it is installed. (The noise filter is generally effective for reducing conducted noise in the band of 10 M Hz or less.) Usage of the following filters is recommended.

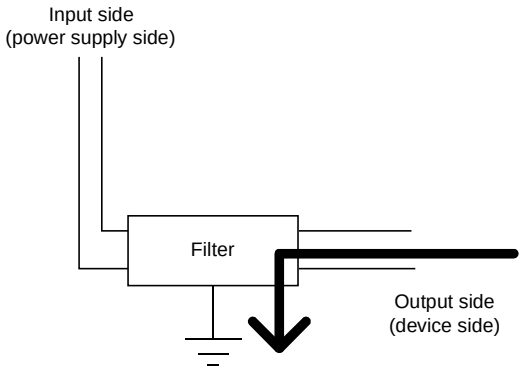
| Model name | FN343-3/01 | FN660-6/06 | ZHC2203-11 |
|---|---|---|---|
| Manufacturer | SCHAFFNER | SCHAFFNER | TDK |
| Rated current | 3 A | 6 A | 3 A |
| Rated voltage | 250 V | | |

The precautions required when installing a noise filter are described below.

(1) Do not bundle the wires on the input side and output side of the noise filter. When bundled, the output side noise will be induced into the input side wires from which the noise was filtered.




(a) The noise will be included when the input and output wires are bundled.




(b) Separate and lay the input and output wires.

(2) Earth the noise filter earthing terminal to the control cabinet with the shortest wire possible (approx. 10 cm (3.94 in.)).

## 9.2 Requirement to Conform to the Low-Voltage Instruction

The low-voltage instruction, one of the European Instructions, is now regulated.

The low-voltage instruction require each device which operates with power supply ranging from 50 V AC to 1000 V and 75 V DC to 1500 V to satisfy necessary safety items.

In the Sections from 9.2.1 to 9.2.8, cautions on installation and wiring of the MELSEC-AnS series PLC to conform to the low-voltage instruction regulation are described.

We have put the maximum effort to develop this material based on the requirements and standards of the regulation that we have collected. However, compatibility of the devices which are fabricated according to the contents of this manual to the above regulation is not guaranteed. Each manufacturer who fabricates such device should make the final judgement about the application method of the low-voltage instruction and the product compatibility.

### 9.2.1 Standard applied for AnS series

The standard applied for AnS series is EN61010-1 safety of devices used in measurement rooms, control rooms, or laboratories.

For the modules which operate with the rated voltage of 50 V AC/75 V DC or above, we have developed new models that conform to the above standard.

For the modules which operate with the rated voltage under 50 V AC/75 V DC, the conventional models can be used, because they are out of the low-voltage instruction application range.

### 9.2.2 Precautions when using the AnS series

Module selection

(1) Power module

For a power module with rated input voltage of 100/200 V AC, select a model in which the internal part between the first order and second order is intensively insulated, because it generates hazardous voltage (voltage of 42.4 V or more at the peak) area.

For a power module with 24 V DC rated input, a conventional model can be used.

(2) I/O module

For I/O module with rated input voltage of 100/200 V AC, select a model in which the internal area between the first order and second order is intensively insulated, because it has hazardous voltage area.

For I/O module with 24 V DC rated input, a conventional model can be used.

(3) CPU module, memory cassette, base unit

Conventional models can be used for these modules, because they only have a 5 V DC circuit inside.

(4) Special module

Conventional models can be used for the special modules including analog module, network module, and positioning module, because the rated voltage is 24 V DC or smaller.

(5) Display device

Use an A900 series GOT CE compatible model.

### 9.2.3 Power supply

The insulation specification of the power module was designed assuming installation category II. Be sure to use the installation category II power supply to the PLC.

The installation category indicates the durability level against surge voltage generated by a thunderbolt. Category I has the lowest durability; category IV has the highest durability.

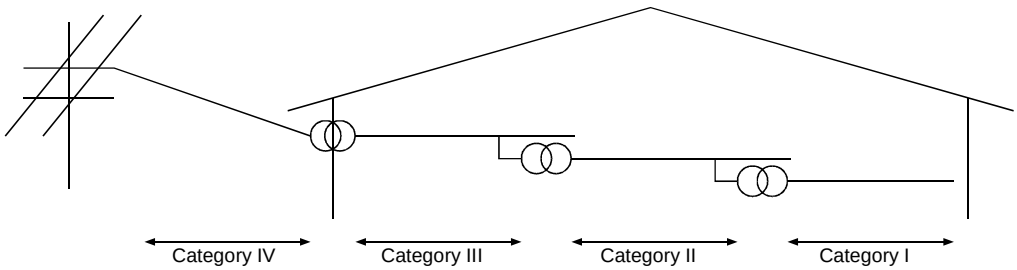



Figure 1. : Installation Category

Category II indicates a power supply whose voltage has been reduced by two or more levels of isolating transformers from the public power distribution.

### 9.2.4 Control box

Because the PLC is an open device (a device designed to be stored within another module), be sure to use it after storing in the control box.

(1) Electrical shock prevention

In order to prevent persons who are not familiar with the electric facility such as the operators from electric shocks, the control box must have the following functions :

(a) The control box must be equipped with a lock so that only the personnel who has studied about the electric facility and have enough knowledge can open it.

(b) The control box must have a structure which automatically stops the power supply when the box is opened.

(2) Dustproof and waterproof features

The control box also has the dustproof and waterproof functions. Insufficient dustproof and waterproof features lower the insulation withstand voltage, resulting in insulation destruction. The insulation in our PLC is designed to cope with the pollution level 2, so use in an environment with pollustion level 2 or below.

| | |
|---|---|
| Pollution level 1 : | An environment where the air is dry and conductive dust does not exist. |
| Pollution level 2 : | An environment where conductive dust does not usually exist, but occasional temporary conductivity occurs due to the accumulated dust. Generally, this is the level for inside the control box equivalent to IP54 in a control room or on the floor of a typical factory. |
| Pollution level 3 : | An environment where conductive dust exits and conductivity may be generated due to the accumulated dust. An environment for a typical factory floor. |
| Pollution level 4 : | Continuous conductivity may occur due to rain, snow, etc. An outdoor environment. |

As shown above, the PLC can realize the pollution level 2 when stored in a control box equivalent to IP54.

### 9.2.5 Module installation

(1) Installing modules contiguously

In AnS series PLCs, the left side of each I/O module is left open. When installing an I/O module to the base, do not make any open slots between any two modules. If there is an open slot on the left side of a module with 100/200 V AC rating, the printed board which contains the hazardous voltage circuit becomes bare. When it is unavoidable to make an open slot, be sure to install the blank module (A1SG60).

When using the A1S5□B expansion base with no power supply, attach the cover packaged with the expansion base to the side of the leftmost module.

### 9.2.6 Grounding

There are two kinds of grounding terminals as shown below. Either grounding terminal must be used grounded.

Be sure to ground the protective grounding for the safety reasons.

Protective grounding ⏚ : Maintains the safety of the PLC and improves the noise resistance.

Functional grounding ⏚ : Improves the noise resistance.

### 9.2.7 External wiring

(1) 24 V DC external power supply

For special modules that require a 24 V DC I/O module or external power supply, use a model whose 24 V DC circuit is intensively insulated from the hazardous voltage circuit.

(2) External devices

When a device with a hazardous voltage circuit is externally connected to the PLC, use a model whose circuit section of the interface to the PLC is intensively insulated from the hazardous voltage circuit.

(3) Intensive insulation

Intensive insulation refers to the insulation with the dielectric withstand voltage shown in Table 2.

Table 2 : Intensive Insulation Withstand Voltage (Installation Category II, source : IEC664)

| Rated voltage of hazardous voltage area | Surge withstand voltage (1.2/50 μs) |
|---|---|
| 150 V AC or below | 2500 V |
| 300 V AC or below | 4000 V |

# 10. MAINTENANCE AND INSPECTION

**DANGER**

- Do not touch the terminals while the power is on. Doing so may cause electric shock or malfunctioning.
- Be sure to connect the battery correctly. Do not charge, disassemble, heat, throw into fire, short, or solder batteries.
  Improper handling of batteries may cause injury to the operator or fire due to heat generation, explosion, or ignition.
- Before cleaning the module or retightening the screws, make sure all phases of the power supply have been obstructed from the outside. Failure to completely shut off the power-supply phases may cause electric shock.
  If the screws are loose, it may result in short circuits, fire or malfunctioning.
  If the screws are tightened too much, it may damage the screws and the module may result in short circuits, malfunctioning or cause the module to fall out.

**CAUTION**

- Carefully read manuals and confirm that it is safe enough before performing online operations which require to connect peripheral devices to an operating CPU module. (especially when modifying a program, performing forced output, or modifying the operation status.)
  Misoperation may damage the module or cause accidents.
- Do not disassemble or rebuild the module.
  It may cause accidents, malfunction, injury, or fire.
- Make sure to switch all phases of the external power supply off before mounting or removing the module. If you do not switch off the external power supply, it will cause failure or malfunction of the module.
- When using a cellular phone, keep it 25 cm or more away from the PLC. Otherwise, malfunction may result.

In order to use the PC always in good condition, conducting daily and periodical maintenance/inspection on the following items are strongly recommended.

## 10.1 Routine Inspection

Routine inspection items recommended are shown in Table 10.1.

**Table 10.1 Routine inspection**

| Item | Inspection item | | Content of inspection | Decision criteria | Action |
|---|---|---|---|---|---|
| 1 | Installation condition of the base unit | | Confirm if installation screws are not loose or cover is not detached. | It is installed securely. | Retighten the screw. |
| 2 | Installation condition of the I/O modules | | Confirm if the module installation screw is firmly tightened. | The installation screws are firmly tightened. | Tighten the module installation screw firmly. |
| 3 | Connection conditions | | Loosening of terminal screw | No loosening. | Retighten the terminal screw. |
| | | | Closeness of crimp-style terminals | There is an appropriate distance. | Correct the distance. |
| | | | Connectors of extension cable | No loosening at connectors. | Retighten the connector fixed screw. |
| 4 | LEDs on the main module | "POWER" LED | Confirm it is lit. | The LED is ON. (Faulty if it is OFF.) | Per Section 11.2.2. |
| | | "RUN" LED | Confirm it is lit in the "RUN" state. | The LED is ON. (Faulty if it is OFF or flashing.) | Per Sections 11.2.3 and 11.2.4. |
| | | "ERROR" LED | Confirm it is lit at error occurrence. | The LED is OFF. (ON when error has occurred.) | Per Sections 11.2.5 and 11.2.6. |
| | | Input LED | Confirm if it correctly turns on and off. | The LED is ON when input is ON, and OFF when input is OFF. (Faulty other than the above.) | Per Section 11.4.1. |
| | | Output LED | Confirm if it correctly turns on and off. | The LED is ON when output is ON, and OFF when output is OFF. (Faulty other than the above.) | Per Section 11.4.2. |

## 10.2 Periodic Inspection

Inspection on items shown below should be conducted once or twice every six months to a year. Conduct the inspection when the equipment is moved or modified, or wiring is changed.

**Table 10.2 Periodic inspection**

| Item | Inspection item | | Content of inspection | Decision criteria | Action |
|---|---|---|---|---|---|
| 1 | Ambient environment | Ambient temperature | Measure with temperature and humidity gauge. Measure presence of corrosive gasses. | 0 to 55°C | When used in a panel, temperature inside the panel is the ambient temperature. |
| | | Ambient humidity | | 10 to 90%RH | |
| | | Atmosphere | | There is no corrosive gas present. | |
| 2 | Power supply voltage check | | Measure voltage between 100/200VAC. | 85 to 132VAC | Change the power supply source. |
| | | | | 170 to 264VAC | |
| 3 | Installation condition | Loosening, play | Test by moving the module. | Must be attached solidly. | Retighten the screw. |
| | | Adhesion of dirt or foreign substance | Visual inspection | No adhesion. | Remove and clean. |
| 4 | Connection conditions | Loosening of terminal screw | Retighten with a screwdriver. | No loosening. | Retighten. |
| | | Closeness of crimp-style terminals | Visual inspection | There is an appropriate distance. | Correct the distance. |
| | | Loosening of connector | Visual inspection | No loosening. | Retighten the connector fixed screw. |
| 5 | Battery | | Confirm M9006 or M9007 is OFF with a peripheral device in the monitor mode. | (Preventive maintenance) | Even when there is no low-battery display, replace if specified battery life is over. |

## 10.3 Battery Replacement

M9006 or M9007 is turned ON when voltage of the battery for backing up programs and power failure retention function drops. Even though programs and contents of power failure retention function are not erased immediately when these special relays become ON, the contents could be erased if the ON-status of the special relay fails to be recognized.
Replace the battery while the total period of power failure is less than shown in Table 10.3 from when the M9006 or M9007 is turned ON.
Yardstick for battery service life and the specifics of replacement are explained below.

### 10.3.1 Service life of the battery

Service life of the battery is shown in Table 10.3.

**Table 10.3 Service life of the battery**

| Battery service life (total period of power failures) [Hr] | | |
|---|---|---|
| Guaranteed value (MIN) | Actual value (TYP) | After M9006 or M9007 turns ON |
| 3600 | 9000 | 168 |

* Actual value indicates a rough average value and guaranteed value indicates the minimum value.

Yardsticks for preventive maintenance are as follows:

[1] Replace in 4 to 5 years even when the total period of power failures is less than the guaranteed value shown in the table above.
[2] Replace when the total period of power failures exceeds the guaranteed value shown in the table above and the M9006 is ON.

### 10.3.2 Battery replacement procedure

Replace the battery according to the following procedure when service life of the battery is over. Even when the battery is removed memory is backed up by the condenser for a while. However, if replacement takes longer than the guaranteed value shown in Table 10.4, the content of the memory may be erased, so replace the battery quickly.

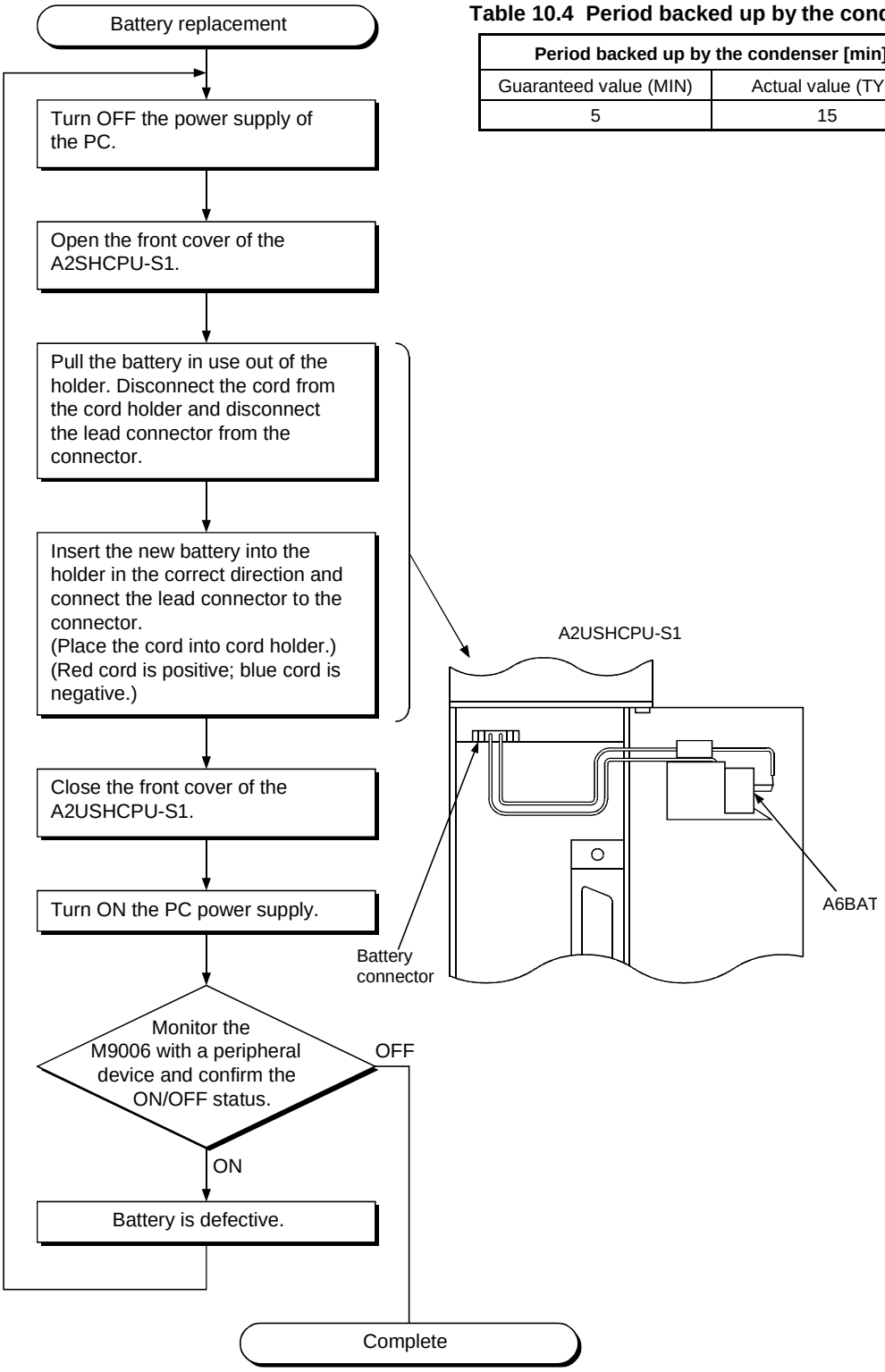



**Table 10.4 Period backed up by the condenser**

| Period backed up by the condenser [min] | |
|---|---|
| Guaranteed value (MIN) | Actual value (TYP) |
| 5 | 15 |

# 11. TROUBLESHOOTING

The description, cause determination, and corrective actions of each error which may occur during system usage are described.

## 11.1 Fundamentals of Troubleshooting

Besides using obviously highly-reliable devices to increase system reliability, it is an important point to quickly startup the system again when an error occurs.
In order to quickly startup the system, find the cause of the problem and resolve it. There are the following three basic points to be aware of when performing troubleshooting.

**(1) Visual confirmation**

Confirm the following points:

(a) Machine operation (stop status and operation status)
(b) Power supply ON/OFF
(c) I/O equipment status
(d) Wiring status (I/O line and cable)
(e) Display status of each display module (POWER LED, RUN LED, ERROR LED, I/O LED, etc.)
(f) Status of each setting switch (extension base, power failure protection, etc.)

After confirming (a) to (f), connect a peripheral device and observe the operation status of the PC and program contents.

**(2) Error confirmation**

Observe how the error changes by performing the following operations:

(a) Set the RUN/STOP key switch to "STOP."
(b) Reset using the RUN/STOP key switch.
(c) Turn ON/OFF the power.

**(3) Narrow down the range**

By performing the (1) and (2) above, assume the faulty area in the following:

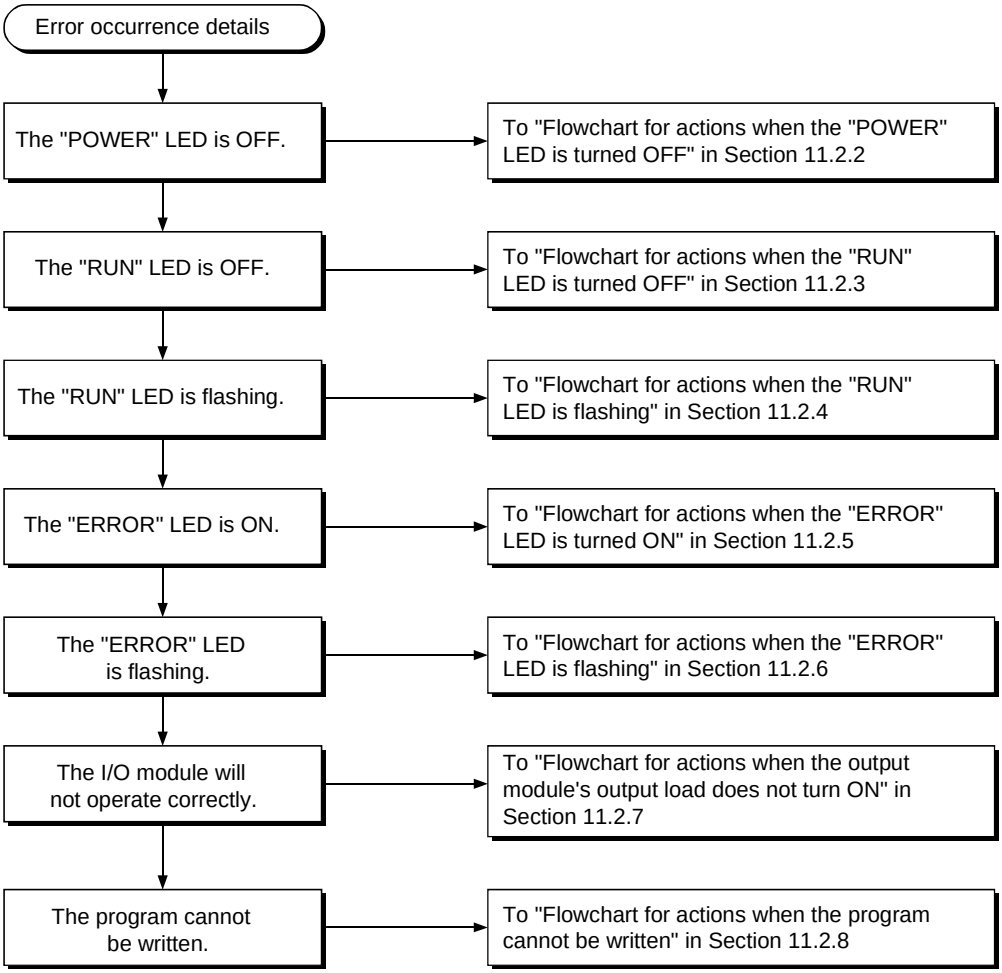
(a) PC or external?
(b) I/O module or others?
(c) Sequence program?

## 11.2 Troubleshooting

The error detail determination method, error details corresponding to the error code, and corrective actions are described.

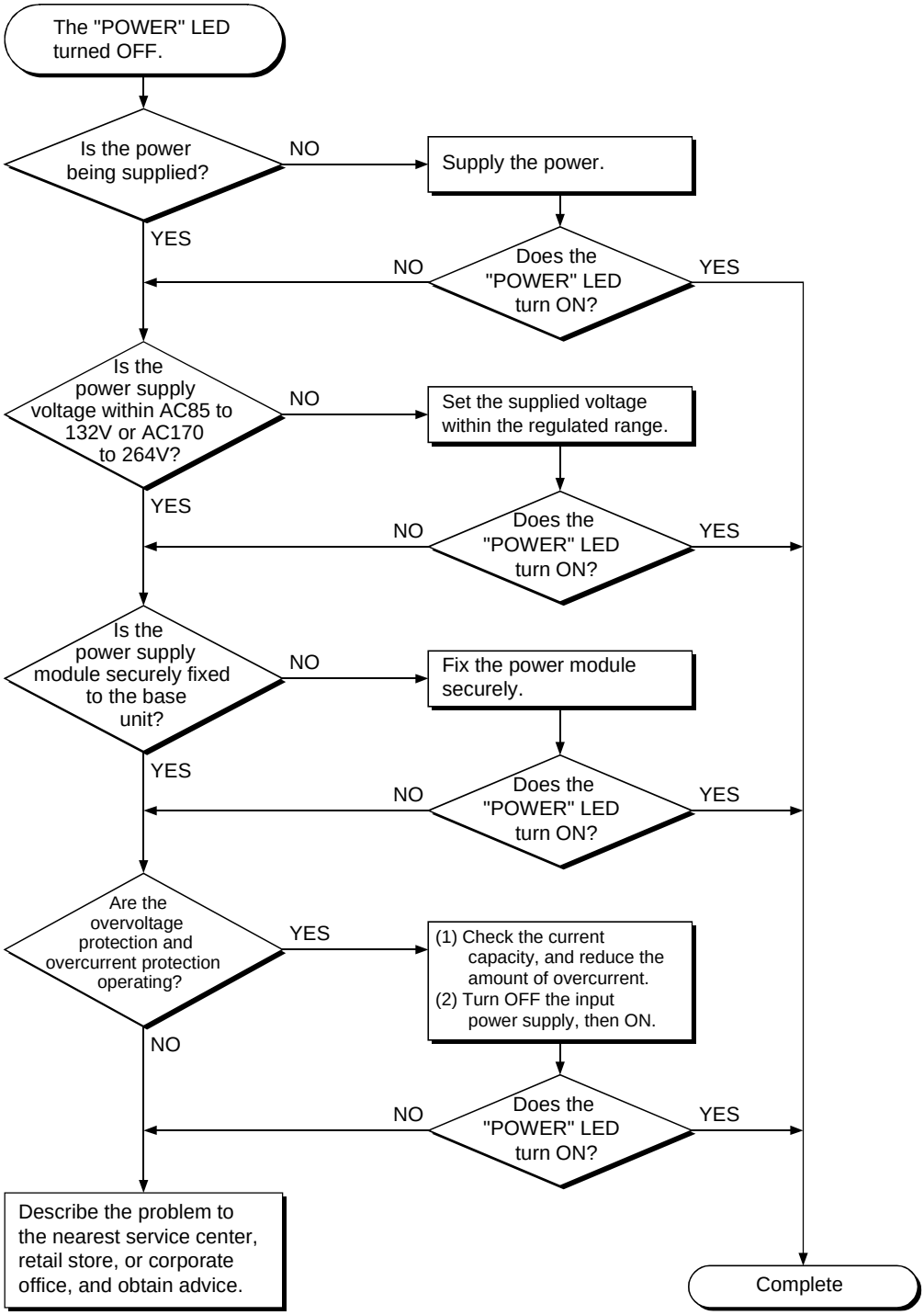
### 11.2.1 Troubleshooting flowchart

The error details are described by events.



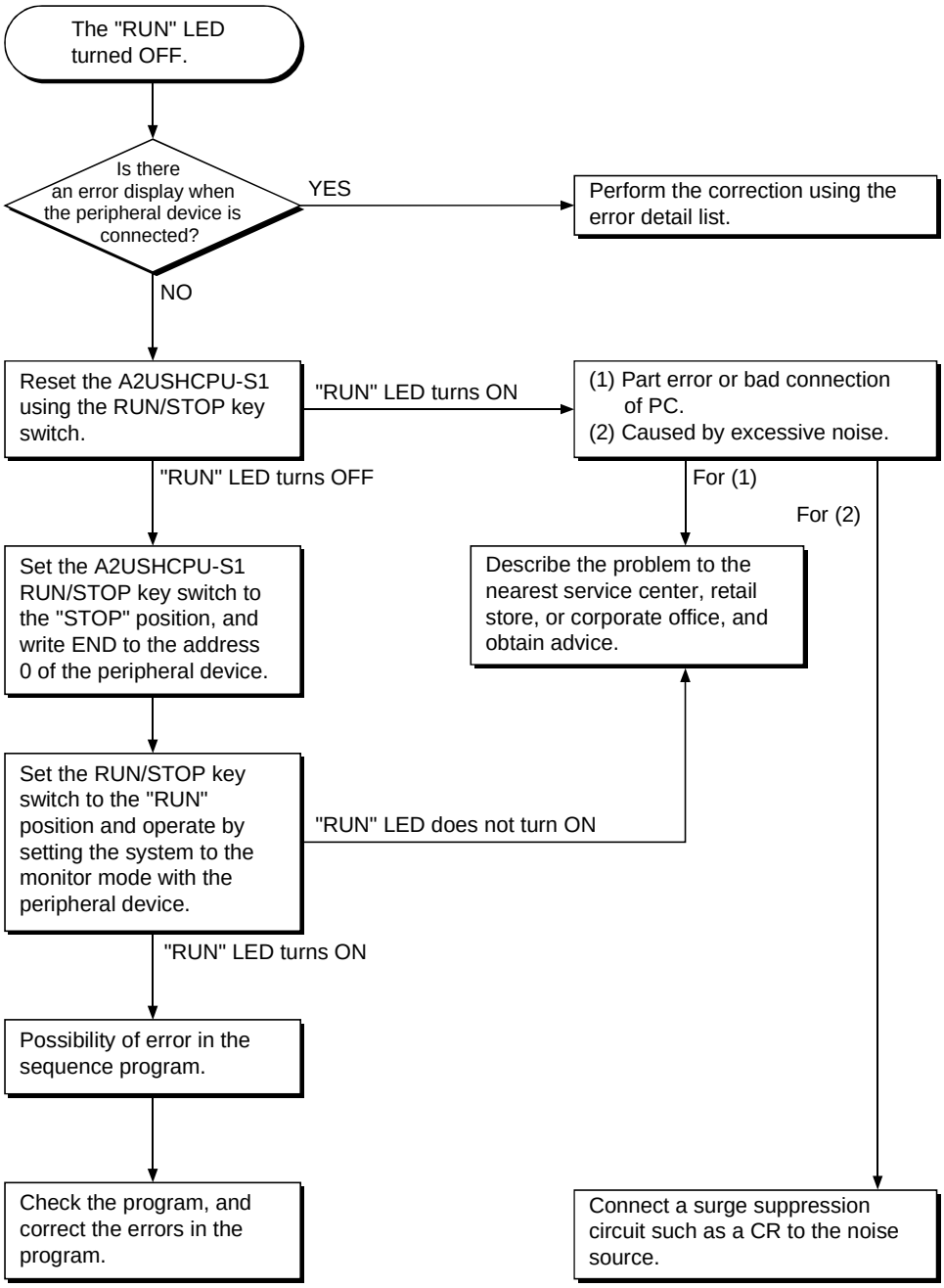
### 11.2.2 Flowchart for actions when the "POWER" LED is turned OFF

The corrective action when the "POWER" LED turns OFF when the power is turned ON or during operation is described.



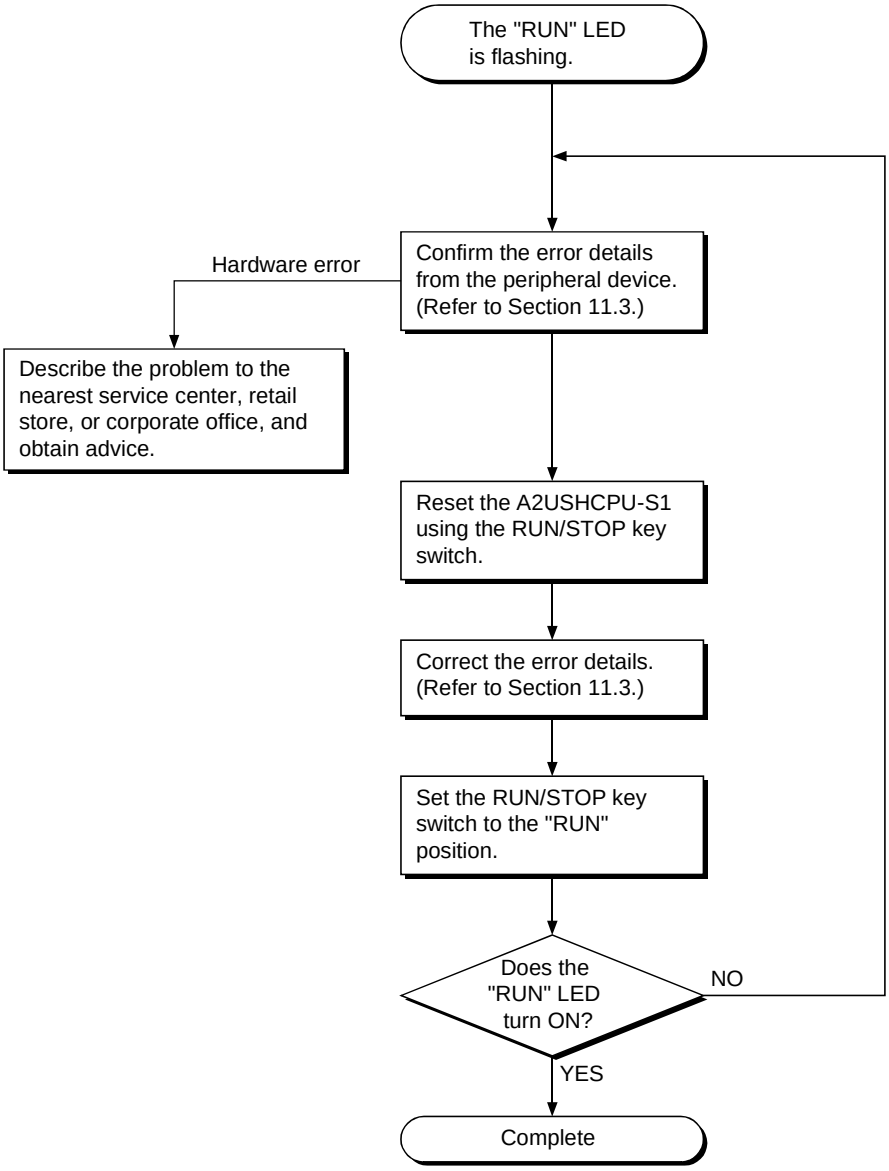
### 11.2.3 Flowchart for actions when the "RUN" LED is turned OFF

The corrective action when the "RUN" LED turns OFF during operation is described.



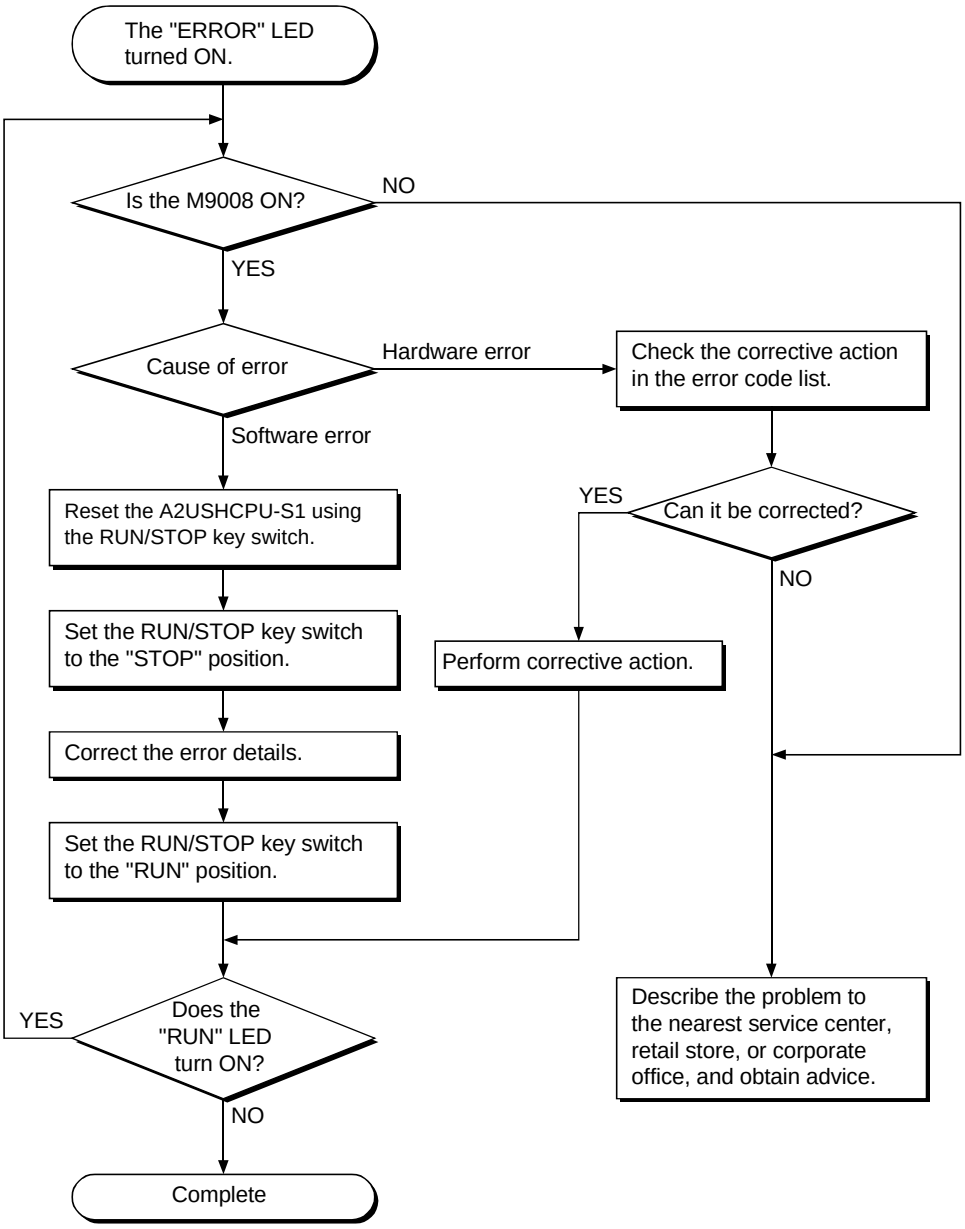
### 11.2.4 Flowchart for actions when the "RUN" LED is flashing

The corrective action when the "RUN" LED is flashing when turning on the power, starting operation, or during operation is described.



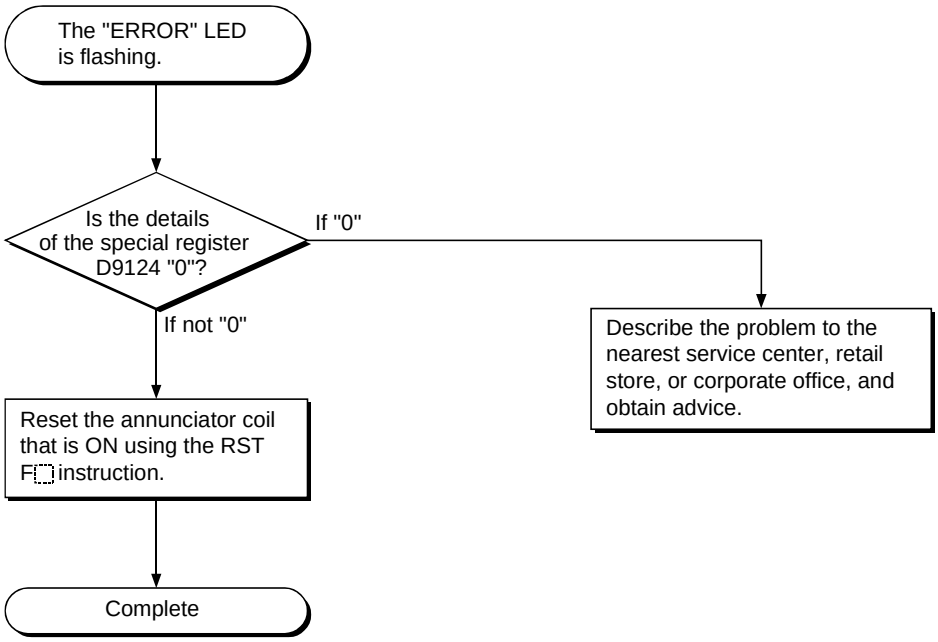
### 11.2.5 Flowchart for actions when the "ERROR" LED is turned ON

The flowchart when the "ERROR" LED turns ON during operation is described.



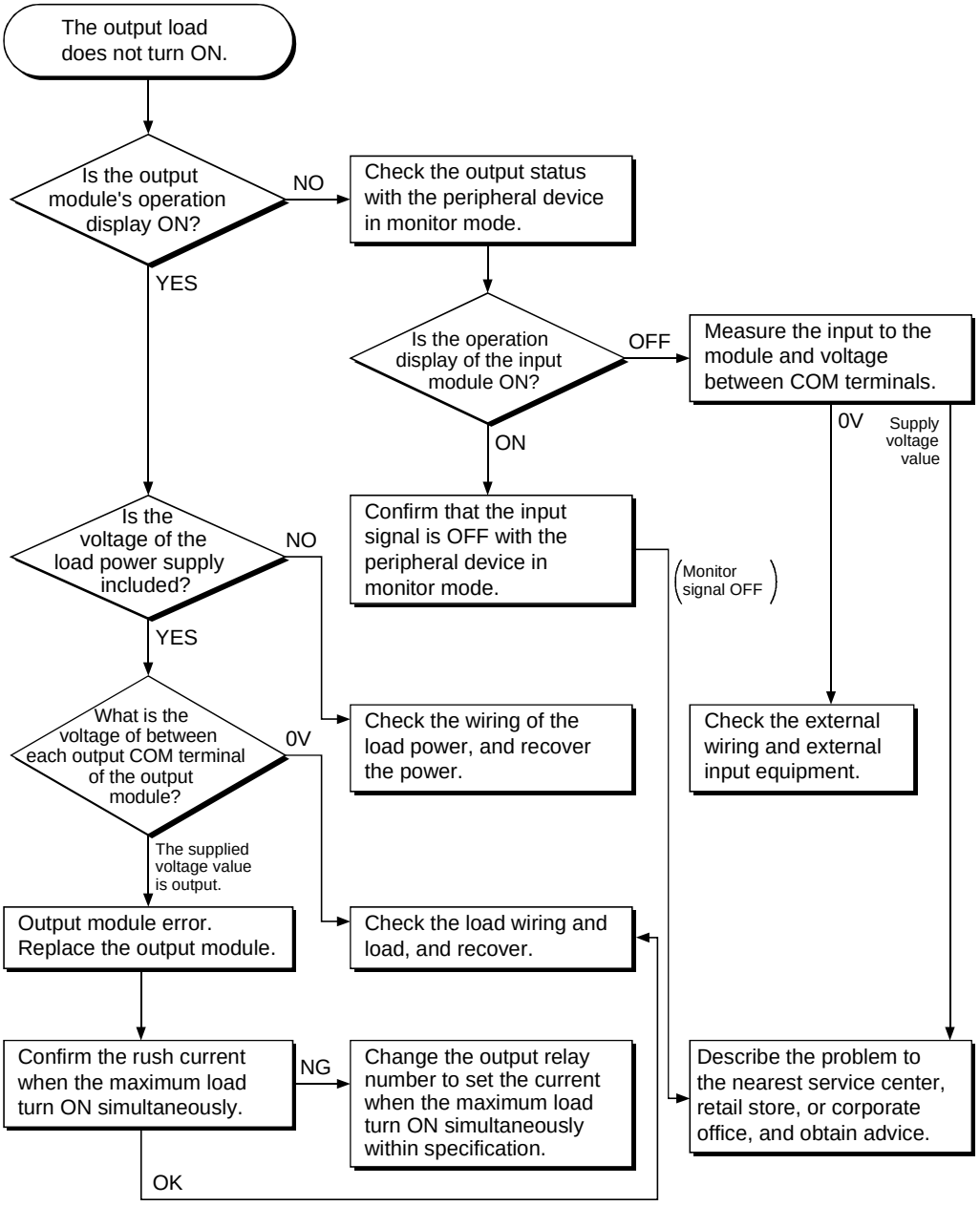
### 11.2.6 Flowchart for actions when the "ERROR" LED is flashing

The flowchart when the "ERROR" LED is flashing during operation is described.



### 11.2.7 Flowchart for actions when the output module's output load does not turn ON

The corrective action when the output load of the output module does not turn ON during operation is described.

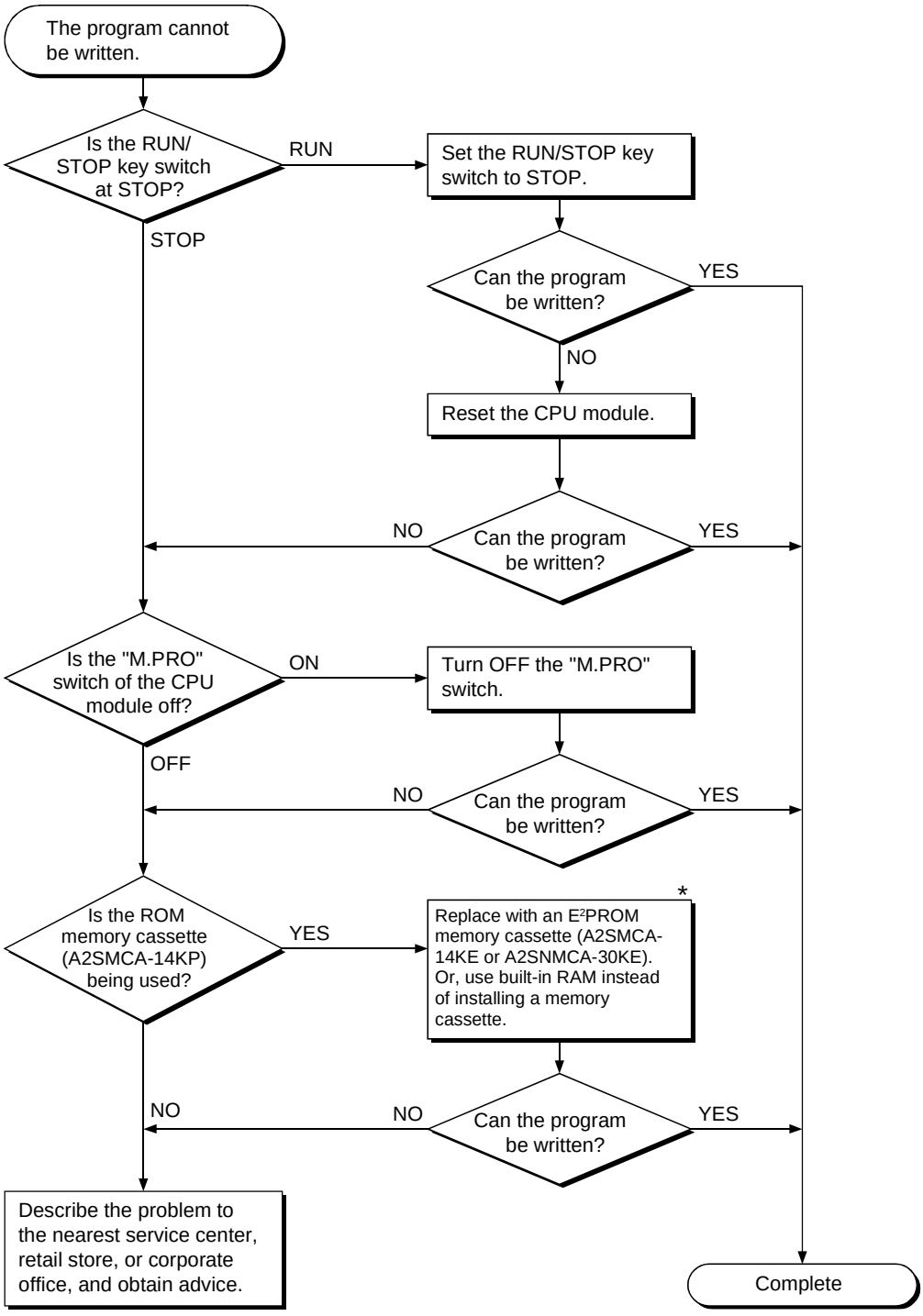



**POINT**

For problems when the input signal does not turn off and load does not turn off, perform troubleshooting by referring to the problem examples for the I/O module in section 10.4.

### 11.2.8 Flowchart for actions when the program cannot be written

The flowchart when the program and other data cannot be written to the CPU is described.




* When using the $E^2$PROM memory cassette, confirm that the memory protect setting pin is at "OFF" on the A2SMCA-14KE and A2SNMCA-30KE modules.

# 11.3 Error Code List

When an error occurs while the PC is running or during RUN, error is displayed, or error code, detailed error code and error step are stored to special registers, D9008, D9091 and D9010, respectively, by the self-diagnosis function.
Details of errors and corrective actions are shown below.

## 11.3.1 Procedure to read an error code

When an error occurs, the error code can be read with a peripheral device. Refer to the operating manuals of the peripheral device for operating procedures.

## 11.3.2 Error code list

Meanings and causes of error message, error codes, detailed error codes and corrective actions are described.

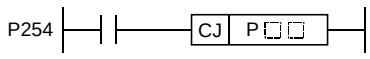
**Error code list**

| Error message | Error code (D9008) | Detailed error code (D9091) | Details and cause of error | Corrective action |
|---|---|---|---|---|
| "INSTRCT CODE ERR." | 10 | 101 | Program contains codes, which CPU module cannot comprehend. | (1) Read the error step with a peripheral device and correct the program in the step.<br>(2) Check to see whether it is a ROM, which contains incomprehensible instruction codes, and replace it with a ROM with correct codes. |
| | | 102 | Index qualification is made to 32-bit constant. | Read the error step with a peripheral device and correct the program in the step. |
| | | 103 | Device specified by dedicated instruction is not correct. | |
| | | 104 | Program structure of dedicated instruction is wrong. | |
| | | 105 | Command name of dedicated instruction is wrong. | |
| | | 106 | Program in LEDA/B IX to LEDA/B IXEND contains index qualification by Z and V. | |
| | | 107 | (1) Index qualification is made to the device number and set value of OUT instruction for timer and counter.<br>(2) Index qualification is made to: the label number of the pointer (P) placed to the head of the destination to the following instructions CJ SCJ CALL CALLP JMP LEDA/B FCALL LEDA/B BREAK ; or the label number of interrupt pointer (I) placed to the head of interrupt program. | |
| Check on STOP → RUN or execution of an instruction | | 108 | Error(s) other than 101 to 107 mentioned above. | |

**Error code list (continued)**

| Error message | Error code (D9008) | Detailed error code (D9091) | Details and cause of error | Corrective action |
|---|---|---|---|---|
| "PARAMETER ERROR"<br>(Check on power startup or STOP/PAUSE→RUN) | 11 | 111 | • Settings for the capacities of main program, microcomputer program, file register comment, status latch, sampling trace and expansion file register are not in the ranges CPU can use.<br>• The capacity is set to that of the subprogram. | Read the parameters in the CPU module memory and rewrite them after checking the contents and making necessary corrections. |
| | | 112 | Sum of the capacities set for main program, file register comment, status latch, sampling trace, and expansion file register exceeds the capacity of the memory cassette. | |
| | | 113 | Latch range with parameter or settings for M,L,S are wrong. | |
| | | 114 | Sum check error | |
| | | 115 | One of the parameter settings for the following is not correct: remote RUN/PAUSE contact, operation mode on error, annunciator display mode, or STOP→RUN display mode. | |
| | | 116 | Parameter setting for MNET-MINI automatic refresh is not correct. | |
| | | 117 | Parameter setting for timer is not correct. | |
| | | 118 | Parameter setting for counter is not correct. | |
| "MISSING END INS."<br>(Check on STOP→RUN) | 12 | 121 | There is no END (FEND) instruction in the main program. | Write END to the end of the main program. |
| "CAN'T EXECUTE (P)" | 13 | 131 | Duplicated device number for pointer (P), which is used as a label attached to the head of the destination, and interrupt pointer (I). | Correct the number so it does not duplicate by eliminating the same pointer number attached to the head of destination.<br>Read the error step with a peripheral device, check the content and insert the destination pointer (P). |
| | | 132 | The label for pointer (P) specified by the instructions CJ SCJ CALL CALLP JMP LEDA/B FCALL LEDA/B BREAK is not located before the END instruction. | |
| | | 133 | (1) Even though there is no CALL instruction, the program contains the RET instruction, and it was executed.<br>(2) Even though there is no FOR instruction, the program contains the NEXT or LEDA/B BREAK instruction, and it was executed.<br>(3) CALL, CALLP and FOR instructions are nested to more than 6 levels and the 6th nesting was executed.<br>(4) There is no RET or NEXT upon execution of CALL or FOR. | (1) Read the error step with a peripheral device, check the content and correct the program in the step.<br>(2) Make the nesting of CALL, CALLP and FOR instructions to 5 levels or less. |
| (Check on execution of an instruction) | | 134 | There is no subprogram but the main program contains CHG instruction and it was executed. | Read the error step with a peripheral device, check the content and correct the program in the step. |

**Error code list (continued)**

| Error message | Error code (D9008) | Detailed error code (D9091) | Details and cause of error | Corrective action |
|---|---|---|---|---|
| "CAN'T EXECUTE (P)"<br>(Check on execution of an instruction) | 13 | 135 | (1) LEDA/B IX to LEDA IXEND instructions are not paired.<br>(2) There are 33 or more pairs of LEDA/B IX to LEDA IXEND instructions. | (1) Read the error step with a peripheral device, check the content and correct the program in the step.<br>(2) Make less than 32 pairs of LEDA/B IX to LEDA IXEND instructions. |
| "CHK FORMAT ERR."<br>(Check on STOP/ PAUSE→RUN | 14 | 141 | There is an instruction other than LDX, LDIX, ANDX, and ANIX (including NOP) on the CHK instruction circuit block. | Check the program concerning CHK instruction and correct using the content of detailed error code as a reference. |
| | | 142 | Several CHK instructions are present. | |
| | | 143 | Number of contacts on the CHK instruction circuit block exceeds 150. | |
| | | 144 | LEDA CHK and LEDA CHKEND instructions are not paired, or two or more of them are present. | |
| | | 145 | Format of the block shown below, which is present before CHK instruction, is incorrect.<br>  | |
| | | 146 | The device (number) of D1 for CHK D1 D2 instructions and the device (number) of the contact before CJ instruction are not same. | |
| | | 147 | An index qualification is made to an area on the check pattern circuit. | |
| | | 148 | (1) Multiple check pattern circuits exist for LEDA CHK to LEDA CHKEND.<br>(2) There are 7 or more of check condition circuits in LEDA CHK to LEDA CHKEND.<br>(3) The check condition circuit in LEDA CHK to LEDA CHKEND is structured with instructions other than contact instructions for X and Y or comparison instructions.<br>(4) The check pattern circuit in LEDA CHK to LEDA CHKEND instructions is created with 257 steps or more. | |
| "CAN'T EXECUTE (I)"<br>(Check on interrupt) | 15 | 151 | IRET instruction is present in the area other than the interrupt program and it was executed. | Read the error step with a peripheral device, and delete the IRET instruction. |
| | | 152 | IRET instruction is not written in the interrupt program. | Check whether IRET instruction is present in the interrupt program, and if not, write the IRET instruction. |
| | | 153 | Interrupt module is used without interrupt pointer (I) in the program corresponding to the module. When an error occurs, the number of subject pointer (I) is stored to D9011. | Monitor the special register D9011 with a peripheral device, and check the presence of interrupt program corresponding to the value stored or duplicate interrupt pointer (I) number, and correct. |

**Error code list (continued)**

| Error message | Error code (D9008) | Detailed error code (D9091) | Details and cause of error | Corrective action |
|---|---|---|---|---|
| "RAM ERROR"<br><br>(Check on power supply startup) | 20 | 201 | Error in the RAM for storage of sequence program inside CPU | Since it is a CPU module hardware failure, contact the nearest service center, representative, or branch, and report them the symptoms of the problem and ask for advice. |
| | | 202 | Error in the RAM for work area inside CPU | |
| | | 203 | Error in the device memory inside CPU | |
| | | 204 | Error in the address RAM inside CPU | |
| "OPE. CIRCUIT ERR."<br><br>(Check on power supply startup) | 21 | 211 | Operation circuit in CPU which performs index qualification does not operate normally. | Since it is a CPU module hardware failure, contact the nearest service center, representative, or branch, and report them the symptoms of the problem and ask for advice. |
| | | 212 | Hardware (logic) in CPU does not operate normally. | |
| | | 213 | Operation circuit in CPU which performs sequence processing does not operate normally. | |
| | | 214 | During the END process check on the CPU module, the operation circuit for index modification in the CPU module does not work normally. | |
| | | 215 | During the END process check on the CPU module, the hardware in the CPU module does not work normally. | |
| "WDT ERROR"<br><br>(Check on execution of END processing) | 22 | ——— | Scan time took longer than busy operation watchdog time<br>(1) Depending on a condition, scan time of a user program has been taking too long.<br>(2) A momentary power failure occurred during the scan and scan time became long. | (1) Calculate and confirm the scan time of the user program, and make the scan time shorter by using CJ instruction, etc.<br>(2) Monitor the content of the special register D9005 with a peripheral device. If it is not 0, power supply voltage is unstable. In this case, check the power supply and reduce the voltage surge. |
| "END NOT EXECUTE"<br><br>(Check on execution of END processing) | 24 | 241 | Instead of executing END instruction, all programs equivalent to the program capacity were executed.<br>(1) During execution of END instruction, it was read as a code for different instruction due to noise, etc.<br>(2) The END instruction is changed to a code for other instruction for some reason. | (1) Reset, then RUN again.<br>If the same error is displayed again, it is a CPU hardware failure. Contact the nearest service center, representative, or branch, and report them the symptoms of the problem and ask for advice. |
| "MAIN CPU DOWN" | 26 | ——— | Main CPU is malfunctioning or has a problem. | Since it is a CPU module hardware failure, contact the nearest service center, representative, or branch, and report them the symptoms of the problem and ask for advice. |
| "UNIT VERIFY ERR."<br><br>(Always check) | 31 | ——— | It is different from the I/O module information received at the time of power startup.<br>(1) An I/O module (including the special function module) was about to be disconnected or disconnected during operation, or different module was installed. | Read the detailed error with a peripheral device, and check or replace the module corresponding to the value (head I/O number).<br>Or, monitor the special registers D9116 to D9123 with a peripheral device, and check or replace the corresponding module where the data bit is "1." |

**Error code list (continued)**

| Error message | Error code (D9008) | Detailed error code (D9091) | Details and cause of error | Corrective action |
|---|---|---|---|---|
| "FUSE BREAK OFF"<br><br>(Always check) | 32 | ——— | (1) A fuse has been blown in some output module.<br>(2) The external power supply for output load is turned off or not connected. | (1) Confirm the ERR-LED of the output module, and replace the module on which the LED is lit.<br>(2) A blown fuse on a peripheral device can be confirmed as well. A bit corresponding to the module with a blown fuse is set as "1" for special registers D9100 to D9107. You can check it by monitoring the registers.<br>(3) Confirm ON/OFF state of the external power supply for output load. |
| "CONTROL-BUS ERR." | 40 | 401 | FROM/TO instruction cannot be executed due to failure of control bus for special function module. | Since it is a hardware failure of the special function module, CPU module or base unit, replace the module and check the defective module. As to the defective module, contact the nearest service center, representative, or branch and report them the symptoms of the problem and ask for advice. |
| | | 402 | When I/O allocation of parameters is being performed, special function module cannot be accessed during the initial communication. When the error occurs, the head I/O number (upper 2 digits of the 3-digit expression) of the special function module subject to the error is stored to D9011. | |
| "SP. UNIT DOWN" | 41 | 411 | During execution of FROM/TO instruction, special function module was accessed but the module is not responding. | Since it is a hardware failure of the special function module accessed, contact the nearest service center, representative, or branch and report them the symptoms of the problem and ask for advice. |
| | | 412 | When I/O allocation of parameters is being performed, special function module does not respond during the initial communication. When the error occurs, the head I/O number (upper 2 digits of the 3-digit expression) of the special function module subject to the error is stored to D9011. | |
| "LINK UNIT ERROR" | 42 | ——— | Both A1SJ71AP21/R21 and A1SJ71AT21B, both AJ71AP21/R21 and AJ71AT21B are set as master stations. | For A1SJ71AP21/R21 and A1SJ71AT21B, and AJ71AP21/R21 and AJ71AT21B, set one module as the master station and the other as a local station. |
| "I/O INT. ERROR" | 43 | ——— | Interrupt occurred even though interrupt module is not installed. | Since it is a hardware failure of one of the modules, replace the module and check the defective module. As to the defective module, contact the nearest service center, representative, or branch and report them the symptoms of the problem and ask for advice. |

**Error code list (continued)**

| Error message | Error code (D9008) | Detailed error code (D9091) | Details and cause of error | Corrective action |
|---|---|---|---|---|
| "SP. UNIT LAY. ERR." | 44 | 441 | During parameter setting with a peripheral device, I/O allocation is made to a special function module at a place where it must be allocated to an I/O module, or vice versa. | Perform I/O allocation of parameter setting with a peripheral device again, so that it is appropriate for the actual installation condition of special function module. |
| | | 442 | 11 or more cards of special function modules (excluding AI61(S1)) which can activate the interrupt to CPU modules are installed. | Decrease the number of special function modules which can activate interrupt (excluding AI61(S1)) to 10 cards or less. |
| | | 443 | Three cards or more of A1SJ71AP21/R21, A1SJ71AT21B, AJ71AP21/R21, AJ71AT21B are installed. | Decrease A1SJ71AP21/R21, A1SJ71AT21B, AJ71AP21/R21, AJ71AT21B to 2 cards or less. |
| | | 444 | 7 cards or more of computer link modules are installed to one CPU module. | Decrease the number of computer link modules to 6 cards or less. |
| | | 445 | Two or more AI61(S1)/A1SI61 are installed. | Use only one AI61/A1SI61. |
| | | 446 | With respect to parameter setting with a peripheral device, the model name of the module allocated for MNET/MINI automatic refresh and that of the module at the station actually linked do not match. | Perform the module allocation of parameter setting for MNET/MINI automatic refresh to the match the module at the station actually linked. |
| | | 447 | Too may special function modules that can use dedicated instructions to one CPU module are registered (installed) for I/O allocation. (Total number of modules for each computer is 1344 or more, as shown below)<br>Number of AD59 installed × 5<br>Number of AD57(S1)/AD58 installed × 8<br>Number of A1SJ71UC24-R2 (PRF/R4) installed × 10<br>Number of AJ71C24(S3/S6/S8) installed × 10<br>Number of AJ71UC24 installed × 10<br>Number of AJ71C21(S1) installed × 29<br>Number of extension mode A1SJ71PT32-S3, AJ71PT32(S3)<br>+ installed × 125<br>Total > 1344 | Decrease number of special function modules installed. |
| | | 448 | (1) 5 cards or more of AJ71LP21, AJ71BR11 are installed.<br>(2) 5 cards or more of A1SJ71AP21/R21, A1SJ71AT21B, AJ71AP21/R21, AJ71AT21B, AJ71LP21, AJ71BR11 are installed in total. | (1) Make it 4 cards or less.<br>(2) Make it 4 cards or less as a total. |
| "SP. UNIT ERROR"<br>(Check on FROM/TO instruction or execution of dedicated instruction for special function module) | 46 | 461 | A location specified by the FROM/TO instruction is not a special function module. | Read the error step with a peripheral device, and correct the content of the FROM/TO instruction in the step. |
| | | 462 | A location specified by a dedicated instruction for special function module is not a special function module, or a pertinent special function module. | Read the error step with a peripheral device, and correct the content of dedicated instruction for the special function module in the step. |

**Error code list (continued)**

| Error message | Error code (D9008) | Detailed error code (D9091) | Details and cause of error | Corrective action |
|---|---|---|---|---|
| "LINK PARA. ERROR" | 47 | ———— (MELSECNET II) | (1) Link range was setup with the parameter setting of peripheral device but the content written into the parameter area of the link and the content of the link parameter the CPU read are different for some reason, or link parameter is not written.<br>(2) Total number of slave stations is set to 0. | (1) Write the parameter again and check.<br>(2) Check the station number setup.<br>(3) If the error is displayed again, then, it is a hardware failure. Contact the nearest service center, representative, or branch and report them the symptoms of the problem and ask for advice. |
| | | 470 | (1) MELSECNET/10 network refresh parameter error<br>(2) The network parameter is different from the switch settings of the link module. | |
| | | 471 | MELSECNET/10 parameter error for transmission through data link | |
| | | 472 | MELSECNET/10 routing parameter error | |
| | | 473 | MELSECNET/10 network parameter error on the first card | |
| | | 474 | MELSECNET/10 network parameter error on the second card | |
| | | 475 | MELSECNET/10 network parameter error on the third card | |
| | | 476 | MELSECNET/10 network parameter error on the fourth card | |
| "OPERATION ERROR" | 50 | 501 | (1) When file register (R) is used, operation was performed with the device number and block number of the file register (R) out of specified ranges.<br>(2) The file register is used in the program without setting the capacity of the file register. | Read the error step with a peripheral device and correct the program in the step. |
| | | 502 | Combination of devices specified by a instruction is not correct. | |
| | | 503 | The storage data or constant of a device to be specified is out of the usable range. | |
| | | 504 | Quantity of data setup for processing is out of the range allowed. | |
| | | 505 | (1) The station number specified by LEDA/B LRDP LEDA/B LWTP LRDP LWTP instructions is not a local station.<br>(2) The head I/O number specified by LEDA/B RFRP LEDA/B RTOP RFRP RTOP instructions is not a remote station. | |
| (Check on execution of an instruction) | | 506 | The head I/O number specified by LEDA/B RFRP LEDA/B RTOP RFRP RTOP instructions is not a special function module. | |

**Error code list (continued)**

| Error message | Error code (D9008) | Detailed error code (D9091) | Details and cause of error | Corrective action |
|---|---|---|---|---|
| "OPERATION ERROR"<br><br>(Check on execution of an instruction) | 50 | 507 | (1) While AD57(S1) or AD58 is executing an instruction with split processing, other instruction was executed to the module.<br>(2) While AD57(S1) or AD58 is executing an instruction with split processing, other instruction was executed to other AD57(S1) or AD58 module with split processing. | Read the error step with a peripheral device. While executing instruction to AD57(S1) or AD58 with a division processing, do not let the module execute other instruction. Or, to prevent executing instruction by split processing to other AD57(S1) or AD58, take an interlock with a special relay M9066 or modify the program structure to correct the problem. |
| | | 509 | (1) Inapplicable instruction was executed to a remote terminal module which is actually connected to MNET/MINI-S3.<br>(2) While the number of instructions which are registered to memory area waiting for processing is 32, separate PRC instruction was executed. Thus, the mail box (execution wait area) overflowed.<br>(3) PIDCONT instruction was executed without executing PIDINIT.<br>PID57 was executed without executing PIDINIT instruction and PIDCONT instruction. | (1) Read the error step with a peripheral device, and modify the program according to the actual installed condition of the remote terminal module.<br>(2) Correct PRC instruction by using a special register D9081 (the number of vacant mail boxes) or a special relay M9081 (mail box BUSY signal) so that it does not register when the mail box (memory area for waiting for execution) has no vacant area.<br>(3) Execute the next instruction after executing each instruction. |
| "MAIN CPU DOWN" | 60 | ——— | (1) CPU misoperated due to noise, etc.<br>(2) Hardware failure | (1) Implement counteraction to noise.<br>(2) Replace the CPU. |
| "BATTERY ERROR"<br><br>(Check on power supply startup) | 70 | ——— | (1) Battery voltage dropped below specified value.<br>(2) Battery lead connector is not installed. | (1) Replace the battery.<br>(2) When built-in RAM memory or power failure retention function is used, install the lead connector. |

## 11.4 Possible Troubles with I/O Modules

Examples of troubles concerning I/O circuits and the countermeasures are explained.

### 11.4.1 Troubles with the input circuit and the countermeasures

Examples of troubles concerning input circuits and the countermeasures are explained.

**Table 11.2 Troubles with the input circuit and the countermeasures**

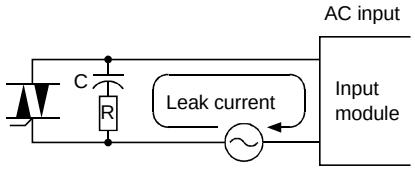
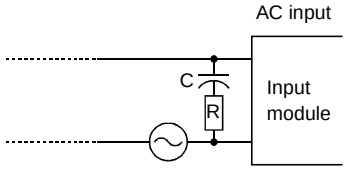
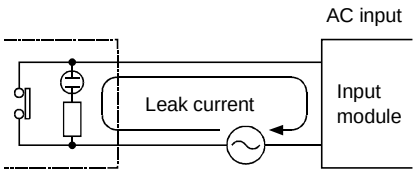
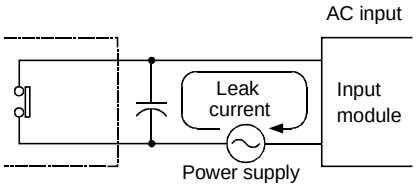
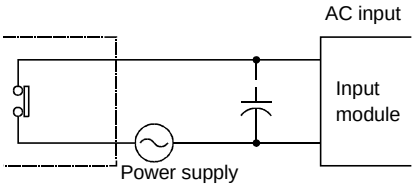
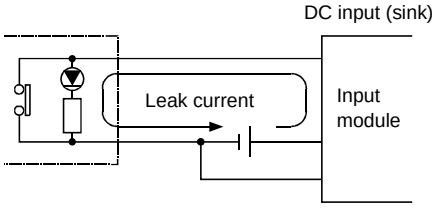
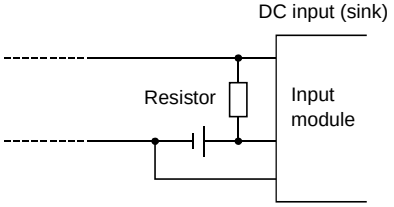
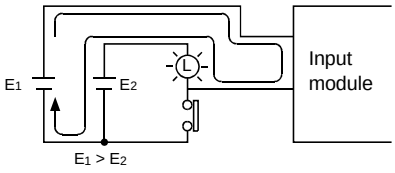
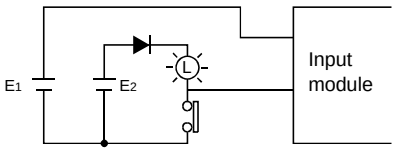
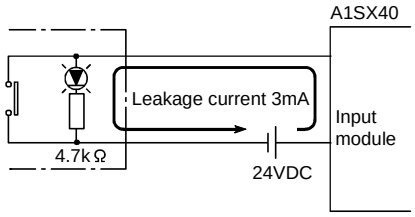
| | Situation | Cause | Countermeasure |
|---|---|---|---|
| Example 1 | Input signal does not turn OFF. | • Leak current from input switch (driven by a contactless switch, etc.)<br>  | • Connect an appropriate resistance so that voltage between the terminals of the input module is lower than the OFF voltage.<br>  <br>For OR constant, 0.1 to 0.47μF+ 47 to 120Ω (1/2W) is recommended. |
| Example 2 | Input signal does not turn OFF. | • Driven by a limit switch with a neon lamp<br>  | • Same as the example 1.<br>• Or, provide a totally independent display circuit separately. |
| Example 3 | Input signal does not turn OFF. | • Line capacity C of the leak current twisted pair cable due to line capacity of the wiring cable is about 100PF/m.<br>  | • Same as the example 1.<br>• However, it does not occur when power supply is on the side of input device as shown below.<br>  |
| Example 4 | Input signal does not turn OFF. | • Driven by a switch with LED display<br>  | • Connect an appropriate resistance so that voltage between the terminal of the input module and the common is lower than the OFF voltage as shown below.<br>  <br>* An example of calculation of resistance to be connected is provided on the following page. |

**Table 11.2 Troubles with the input circuit and the countermeasures**

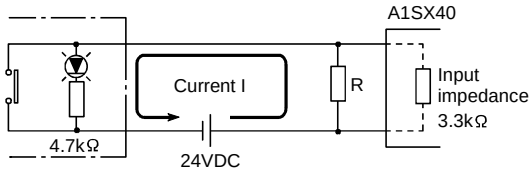
| | Situation | Cause | Countermeasure |
|---|---|---|---|
| Example 5 | Input signal does not turn OFF. | • Revolving path due to the use of two power supplies.<br>  | • Use only one power supply.<br>• Connect a diode to prevent the revolving path (figure below).<br>  |

<Example 4s Calculation Example>




If a switch with an LED display is connected to A1SX40 and a leak current of 3 mA is observed

- Voltage $V_{TB}$ across the terminal and common base is:
  $V_{TB}$ = 3 [mA] × 3.3 [kΩ] = 9.9 [V] (Ignore the voltage drop caused by the LED.)
  Because the condition for the OFF voltage (≤ 4 [V]) is not satisfied, the input does not turn off. To correct this, connect a resistor as shown below.




- Calculation of resistance of connected resistor R
  The voltage of A1SX40 across the terminals must be reduced to within 4 [V]. The current for reducing the voltage across the terminals to within 4 [V] is:
  (24 − 4 [V] ÷ 4.7 [kΩ] = 4.26 mA)
  Therefore resistor R for flowing current I of 4.26 [mA] must be connected.

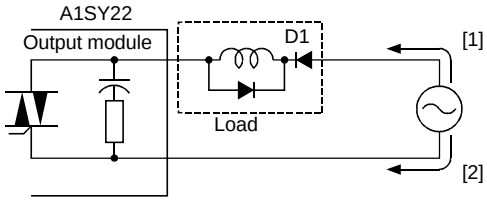
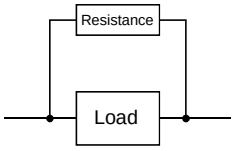
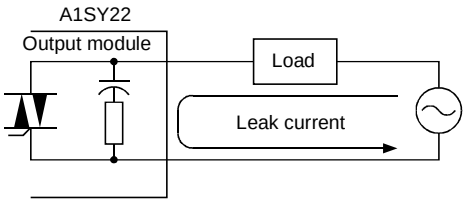
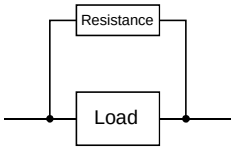
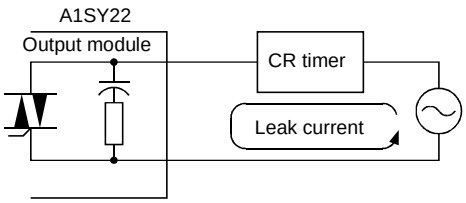
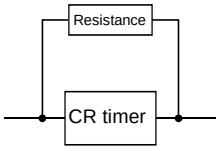
- Resistance of the connected resistor R is obtained in the following equations.
  4 [V] ÷ R > 4.26 − 1.21 [mA] ← 4 [V] ÷ Input impedance 3.3 [kΩ]
  4 [V] ÷ 3.05 [mA] > R
  1.31 [kΩ] > R
  Suppose that the resistance R is 1.2 [kΩ].
  The power capacity W of the resistor when the switch turned on is:
  W = (Applied voltage)$^2$/R
  W = (26.4 [V])$^2$/ 1.2 [kΩ] = 0.58 [W]

- Because the resistance is selected so that the power capacity is three to five times the actual power consumption, 2 to 3 [W] should be selected.
  From the above, the resistor to be connected across the terminal in question and COM is 1.2 [kΩ] 2 to 3 [W].

## 11.4.2 Possible troubles in the output circuit

Examples of troubles concerning output circuits and the countermeasures are explained.

**Table 11.3 Troubles with the output circuit and the countermeasures**

| | Situation | Cause | Countermeasure |
|---|---|---|---|
| Example 1 | An excessive voltage is impressed to the load when output is off. | • When the load is subjected to half wave rectification inside. (Solenoids have these types).<br>  <br>• When the polarity of the power supply is [1], C is charged, and when the polarity is [2], the voltage charged in C + voltage of the power supply are impressed to the both ends of D1. The maximum value of the voltage is about 2.2E. | • Connect a resistance at several tens to several hundred of k to the both ends of the load.<br>( With this kind of usage, there is no problem with the output element, but the diode built-in to the load may deteriorate and burn-out. )<br>  |
| Example 2 | Load does not OFF<br>(Triac output) | • Leak current caused by built-in surge killer<br>  | • Connect a resistance to the both ends of the load.<br>( When the wiring distance from the output card to the load is long, be aware of the risk of a leak current due to line capacity. )<br>  |
| Example 3 | When load is CR type timer, the time limit fluctuates.<br>(Triac output) |  | • Start the relay first, then start the CR-type timer at the contact.<br>( In some timers, internal circuit may be half wave rectification type, so the caution as to the example 1 is necessary here. )<br>  <br>Calculate the constant of the resistance based on the load. |

# APPENDIX

## Appendix 1 Instruction List

The list of instructions that can be used with the A2USHCPU-S1 is shown.
Refer to the following programming manuals for the details of the instructions.

| | |
|---|---|
| • ACPU Programming Manual (Basics) | IB-66249 |
| • ACPU Programming Manual (Common Instructions) | IB-66250 |
| • AnACPU/AnUCPU Programming Manual (Dedicated Instructions) | IB-66251 |
| • AnACPU/AnUCPU Programming Manual (AD57 Instructions) | IB-66257 |
| • AnACPU/AnUCPU Programming Manual (PID Control Instructions) | IB-66258 |

**(1) Sequence instructions**

(a) Contact instruction

| | |
|---|---|
| Contact | LD, LDI, AND, ANI, OR, ORI |

(b) Connection instruction

| | |
|---|---|
| Contact | ANB, ORB, MPS, MRD, MPP |

(c) Output instruction

| | |
|---|---|
| Output | OUT, SET, RST, PLS, PLF |

(d) Shift instruction

| | |
|---|---|
| Shift | SFT, SFTP |

(e) Master control instruction

| | |
|---|---|
| Master control | MC, MCR |

(f) End instruction

| | |
|---|---|
| Program end | FEND, END |

(g) Other instructions

| | |
|---|---|
| Stop | STOP |
| No operation | NOP |
| Page break (Page break operation for printer output) | NOPLF |

**(2) Basic instructions**

(a) Comparison instruction

| | | |
|---|---|---|
| = | 16-bit | LD= , AND= , OR= |
| | 32-bit | LDD= , ANDD= , ORD= |
| < > | 16-bit | LD< >, AND< >, OR< > |
| | 32-bit | LDD< >, ANDD< >, ORD< > |
| > | 16-bit | LD>, AND>, OR> |
| | 32-bit | LDD>, ANDD>, ORD> |
| ≤ | 16-bit | LD<= , AND<= , OR<= |
| | 32-bit | LDD<= , ANDD<= , ORD<= |
| < | 16-bit | LD<, AND<, OR< |
| | 32-bit | LDD<, ANDD<, ORD< |
| ≥ | 16-bit | LD>= , AND>= , OR>= |
| | 32-bit | LDD>= , ANDD>= , ORD>= |

(b) BIN arithmetic operation instructions

| | | |
|---|---|---|
| + Addition | 16-bit | Two types each for + , + P |
| | 32-bit | Two types each for D+ , D+ P |
| – Subtraction | 16-bit | Two types each for –, – P |
| | 32-bit | Two types each for D –, D – P |
| * Multiplication | 16-bit | *, * P |
| | 32-bit | D *, D *P |
| / Division | 16-bit | /, /P |
| | 32-bit | D/, D/P |
| + 1 Addition | 16-bit | INC, INCP |
| | 32-bit | DINC, DINCP |
| -1 Subtraction | 16-bit | DEC, DECP |
| | 32-bit | DDEC, DDECP |

(c) BCD arithmetic operation instructions

| | | |
|---|---|---|
| + Addition | BCD 4-digit | Two types each for B+ , B+ P |
| | BCD 8-digit | Two types each for DB+ , DB+ P |
| – Subtraction | BCD 4-digit | Two types each for B–, B–P |
| | BCD 8-digit | Two types each for DB, DB–P |
| * Multiplication | BCD 4-digit | B *, B * P |
| | BCD 8-digit | DB *, DB *P |
| / Division | BCD 4-digit | B/, B/P |
| | BCD 8-digit | DB/, DB/P |

(d) BCD-BIN conversion instructions

| | | |
|---|---|---|
| BIN → BCD | 16-bit | BCD, BCDP |
| | 32-bit | DBCD, DBCDP |
| BCD → BIN | 16-bit | BIN, BINP |
| | 32-bit | DBIN, DBINP |

(e) Data transfer instructions

| | | |
|---|---|---|
| Transfer | 16-bit | MOV, MOVP |
| | 32-bit | DMOV, DMOVP |
| Exchange | 16-bit | XCH, XCHP |
| | 32-bit | DXCH, DXCHP |
| Negation transfer | 16-bit | CML, CMLP |
| | 32-bit | DCML, DCMLP |
| Batch transfer | 16-bit | BMOV, BMOVP |
| Batch transfer same data | 16-bit | FMOV, FMOVP |

(f) Program branch instructions

| | |
|---|---|
| Jump | CJ, SCJ, JMP |
| Call subroutine | CALL, CALLP, RET |
| Enable/disable an interrupt program | EI, DI, IRET |

(g) Refresh instructions

| | |
|---|---|
| Link refresh | COM |
| Partial refresh | SEG |

### (3) Application instructions

(a) Logical operation instructions

| | | |
|---|---|---|
| Logical product | 16-bit | Two types each for WAND, WANDP |
| | 32-bit | DAND, DANDP |
| Logical sum | 16-bit | Two types each for WOR, WORP |
| | 32-bit | DOR, DORP |
| Exclusive logical sum | 16-bit | Two types each for WXOR, WXORP |
| | 32-bit | DXOR, DXORP |
| Not exclusive logical sum | 16-bit | Two types each for WXNR, WXNRP |
| | 32-bit | DXNR, DXNRP |
| Complements of 2 (sign invert) | 16-bit | NEG, NEGP |

(b) Rotation instructions

| | | |
|---|---|---|
| Right rotation | 16-bit | ROR, RORP, RCR, RCRP |
| | 32-bit | DROR, DRORP, DRCR, DRCRP |
| Left rotation | 16-bit | ROL, ROLP, RCL, RCLP |
| | 32-bit | DROL, DROLP, DRCL, DRCLP |

(c) Shift instructions

| | | |
|---|---|---|
| Right shift | 16-bit | SFR, SFRP, BSFR, BSFRP |
| | Device | DSFR, DSFRP |
| Left shift | 16-bit | SFL, SFLP, BSFL, BSFLP |
| | Device | DSFL, DSFLP |

(d) Data processing instruction

| | | |
|---|---|---|
| Search data | 16-bit | SER, SERP |
| Check bit | 16-bit | SUM, SUMP |
| | 32-bit | DSUM, DSUMP |
| Decode | $2^n$-bit | DECO, DECOP |
| | 16-bit | SEG |
| Encode | $2^n$-bit | ENCO, ENCOP |
| Set bit | 16-bit | BSET, BSETP |
| Reset bit | 16-bit | BRST, BRSTP |
| Separate | 16-bit | DIS, DISP |
| Connection | 16-bit | UNI, UNIP |

(e) FIFO instructions

| | | |
|---|---|---|
| Write | 16-bit | FIFW, FIFWP |
| Read | 16-bit | FIFR, FIFRP |

(f) ASCII instructions

| | |
|---|---|
| ASCII conversion | ASC |
| Print ASCII | PR (two types), PRC |

(g) Buffer memory access instructions

| | | |
|---|---|---|
| Read data | 1 word | FROM, FROMP |
| | 2 word | DFRO, DFROP |
| Write data | 1 word | TO, TOP |
| | 2 word | DTO, DTOP |

(h) FOR to NEXT instructions

| | |
|---|---|
| Repeat | FOR, NEXT |

(i) Display instructions

| | |
|---|---|
| Display | LED, LEDC |
| Reset display | LEDR |

(j) Data link module instructions

| | | |
|---|---|---|
| Read data | 1 word | LRDP, RFRP |
| Write data | 1 word | LWTP, RTOP |

(k) Other instructions

| | | |
|---|---|---|
| Reset WDT | | WDT, WDTP |
| Failure check | | CHK |
| Status latch | | SLT, SLTR |
| Sampling trace | | STRA, STRAR |
| Set/reset carry flag | 1-bit | STC, CLC |
| Timing clock | 1-bit | DUTY |

**(4) Dedicated instructions**

(a) Direct processing instructions

| | |
|---|---|
| Direct output | DOUT |
| Direct set | DSET |
| Direct reset | DRST |

(b) Structured program instructions

| | |
|---|---|
| Add circuit index | IX, IXEND |
| Repeat forced end | BREAK |
| Call subroutine | FCALL |
| Change failure check circuit pattern | CHK, CHKEND |

(c) Data operation instructions

| | |
|---|---|
| Search 32-bit data | DSER |
| Swap 16-bit upper/lower byte | SWAP |
| Separate data | DIS |
| Connection data | UNI |
| Test bit | TEST, DTEST |

(d) I/O operation instructions

| | |
|---|---|
| Flip-flop control | FF |
| Numeric key input from keyboard | KEY |

(e) Real value processing instructions (BCD format processing)

| | |
|---|---|
| BCD 4-digit square root | BSQR |
| BCD 8-digit square root | BDSQR |
| SIN (sine) operation | BSIN |
| COS (cosine) operation | BCOS |
| TAN (tangent) operation | BTAN |
| $SIN^{-1}$ (arcsine) operation | BASIN |
| $COS^{-1}$ (arccosine) operation | BACOS |
| $TAN^{-1}$ (arctangent) operation | BATAN |

(f) Real value processing instructions (Floating point format real value processing)

| | |
|---|---|
| Real value → 16/32-bit BIN conversion | INT, DINT |
| 16/32-bit BIN → real value conversion | FLOAT, DFLOAT |
| Addition | ADD |
| Subtraction | SUB |
| Multiplication | MUL |
| Division | DIV |
| Angle → radian conversion | RAD |
| Radian → angle conversion | DEG |
| SIN (sine) operation | BSIN |
| COS (cosine) operation | BCOS |
| TAN (tangent) operation | BTAN |
| $SIN^{-1}$ (arcsine) operation | BASIN |
| $COS^{-1}$ (arccosine) operation | BACOS |
| $TAN^{-1}$ (arctangent) operation | BATAN |
| Square root | SQR |
| Exponential | EXP |
| Logarithm | LOG |

(g) Text string processing instructions

| | |
|---|---|
| 16/32-bit BIN → decimal ASCII conversion | BINDA, DBINDA |
| 16/32-bit BIN → hexadecimal ASCII conversion | BINHA, DBINHA |
| 16/32-bit BCD → decimal ASCII conversion | BCDDA, DBCDDA |
| Decimal ASCII → 16/32-bit BIN conversion | DABIN, DDABIN |
| Hexadecimal ASCII → 16/32-bit BIN conversion | HABIN, DHABIN |
| Decimal ASCII → 16/32-bit BCD conversion | DABCD, DDABCD |
| Read device comment data | COMRD |
| Detect text string length | LEN |
| 16/32-bit BIN → decimal text string conversion | STR, DSTR |
| Decimal text string → 16/32-bit BIN conversion | VAL, DVAL |
| Hexadecimal data → ASCII conversion | ASC |
| ASCII → hexadecimal data conversion | HEX |
| Transfer text string | SMOV |
| Concatenate text string | SADD |
| Compare text string | SCMP |
| Separate in byte units | WTOB |
| Concatenate byte-unit data | BTOW |

(h) Data control instructions

| | |
|---|---|
| Control upper/lower limit | LIMIT, DLIMIT |
| Control dead band | BAND, DBAND |
| Control zone | ZONE, DZONE |

(i) Clock instructions

| | |
|---|---|
| Read clock data | DATERD |
| Write clock data | DATEWR |

(j) Extension file register instructions

| | |
|---|---|
| Expansion file register block number conversion | RSET |
| Block transfer between expansion file registers | BMOVR |
| Block exchange between expansion file register | BXCHR |
| Direct read of expansion file register in 1 word units | ZRRD |
| Direct read of expansion file register in 1 byte units | ZRRDB |
| Direct write of expansion file register in 1 word units | ZRWR |
| Direct write of expansion file register in 1 byte units | ZRWRB |

(k) Data link instructions

*1: New instructions set for exclusive use with AnUCPU

| | | |
|---|---|---|
| | Read local station word device | LRDP |
| | Write local station word device | LWTP |
| | Read data from the remote I/O station special function module | RFRP |
| | Write data from the remote I/O station special function module | RTOP |
| *1 | Read word device from connected station | ZNRD |
| *1 | Write word device to connected station | ZNWR |
| *1 | Network refresh instruction | ZCOM |

(l) AD61(S1) high-speed counter module control instructions

(The AD61 dedicated instructions cannot be executed with A1SD61.)

| | |
|---|---|
| Set preset value | PVWR1, PVWR2 |
| Write setting data for large/small/match determination | SVWR1, SVWR2 |
| Read current value from CH1/CH2 | PVRD1, PVRD2 |

(m) AJ71C24(S8) computer link module control instructions

| | | |
|---|---|---|
| Data send | Character up to 00H code | PR |
| | Intended number of characters | PRN |
| Data received | | INPUT |
| Read communication status | | SPBUSY |
| Communication processing forced interrupt | | SPCLR |

(n) AJ71C21(S1) terminal interface module control instructions

| | |
|---|---|
| Output data to RS-232C (data up to 00H code) | PR2 |
| Output data to RS-422 (data up to 00H code) | PR4 |
| Output data to RS-232C (for number of intended points) | PRN2 |
| Output data to RS-422 (for number of intended points) | PRN4 |
| Read input data from RS-232C | INPUT2 |
| Input data from RS-422 | INPUT4 |
| Read data from RAM | GET |
| Write data to RAM | PUT |
| Read communication status | SPBUSY |
| Communication processing forced interrupt | SPCLR |

(o) MELSECNET/MINI-S3 master module control instructions

| | |
|---|---|
| Key input from operation box | INPUT |
| Data send/received for specified number of bytes to/from AJ35PTF-R2 | PR, PRN, INPUT |
| Read/write data for MINI standard protocol module | MINI |
| Reset error for remote terminal module | MINIERR |
| Read communication status | SPBUSY |
| Communication status forced interrupt | SPCLR |

(p) PID operation instructions

| | |
|---|---|
| Set control data | PIDINIT |
| PID operation | PIDCONT |
| Monitor PID operation result for AD57(S1) | PID57 |

(q) AD59(S1) memory card/centronix interface module control instructions

| | | |
|---|---|---|
| Output to printer | Characters up to $00_H$ code | PR |
| | Intended number of characters | PRN |
| Read data to memory card | | GET |
| Write data to memory card | | PUT |

(r) AD57(S1) control instructions

| | | |
|---|---|---|
| Display mode setting instructions | | CMODE |
| Screen display control instructions | Display canvas screen | CPS1 |
| | Change VRAM display address | CPS2 |
| | Transfer canvas | CMOV |
| | Clear screen | CLS |
| | Clear VRAM | CLV |
| | Scroll up/down | CSCRU, CSCRD |
| Cursor control instructions | Display cursor | CON1, CON2 |
| | Erase cursor | COFF |
| | Set cursor position | LOCATE |
| Display condition setting instructions | Normal/inverted display of characters to be displaye | CNOR, CREV |
| | Normal/inverted display of characters | CRDSP, CRDSPV |
| | Specify color of characters | COLOR |
| | Change color characters | CCDSP, CCDSPV |
| Specified character display instructions | Display ASCII character | PR, PRN |
| | Write ASCII character | PRV, PRNV |
| | Display character | EPR, EPRN |
| | Write character | EPRV, EPRNV |
| | Continuous display same character | CR1, CR2, CC1, CC2 |
| Fixed character display instructions | Display – (minus) | CINMP |
| | Display - (hyphen) | CINHP |
| | Display . (period, decimal point) | CINPT |
| | Display numeric characters | CIN0 to CIN9 |
| | Display alphanumeric characters | CINA to CINZ |
| | Display space | CINSP |
| Specified column clear instruction | | CINCLR |
| Conversion instructions for displayed text string into ASCII code | | INPUT |
| VRAM data control instructions | Read data | GET |
| | Write data | PUT |
| Display status read instruction | | STAT |

# Appendix 2 Lists of Special Relays and Special Registers

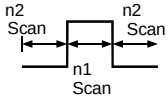
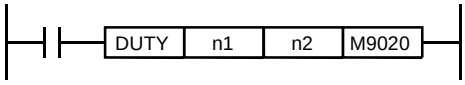
The list of the special relays and special registers that can be used by the A2USHCPU-S1 is shown below:

## Appendix 2.1 List of special relays

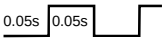
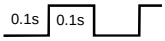
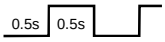
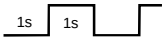
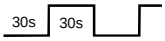
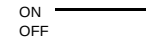
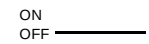
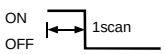
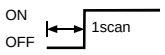
The special relays are the internal relays that have specific applications in the sequencer. Therefore, the coil cannot be turned ON/OFF on the program. (Except for the ones marked by *1 or *2 in the table.)

Refer to the Network System Reference Manual for the special relays after M9200.

**List of special relays**

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

**List of special relays**

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

**List of special relays**

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

**List of special relays**

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

**List of special relays**

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

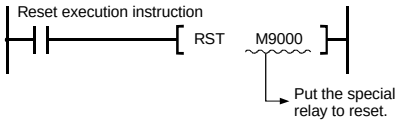
**POINT**

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

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

1 From the user program

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




2 From the peripheral device

Force reset by the test function of the peripheral device.

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

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

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

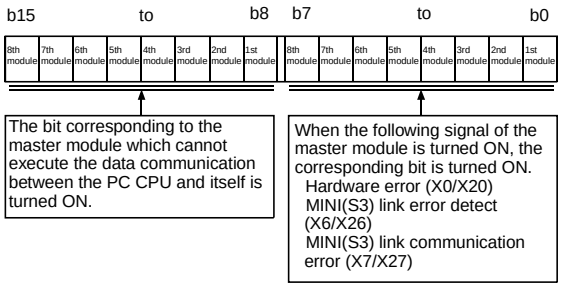
(4) For the relays marked by *3, ON/OFF can be controlled by the test mode of the peripheral device.

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

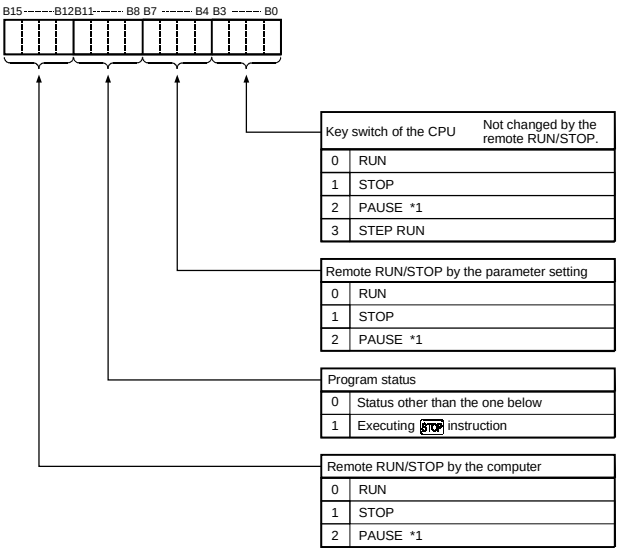
## Appendix 2.2 List of special registers

The special registers are data registers which have specific purposes in the PC. Therefore, do not write data to the special registers from a program. (Except for the ones marked by *2 in the list.) Refer to the Network System Reference Manual for the special registers D9200 and above.

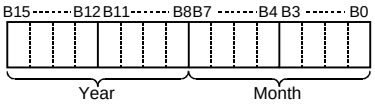
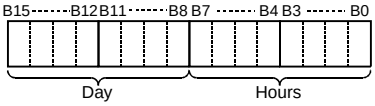
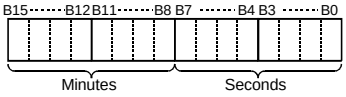
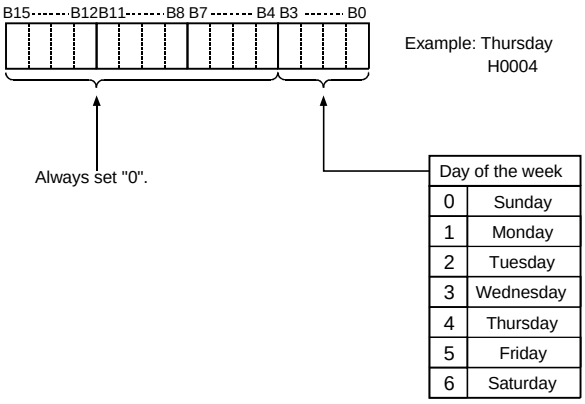
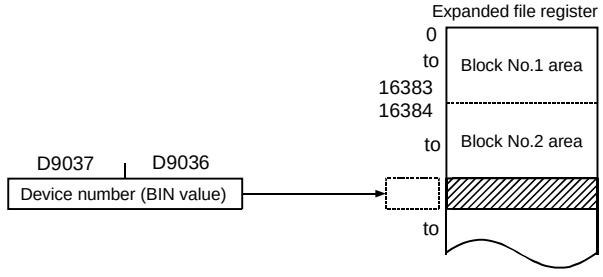
**List of special registers**

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

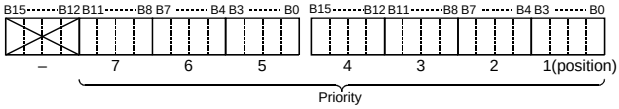
**List of special registers**

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

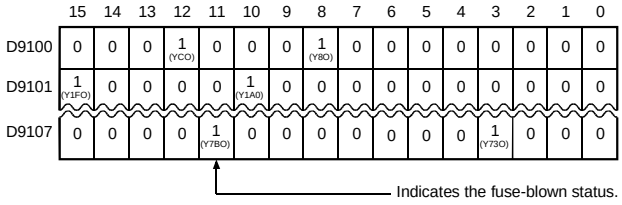
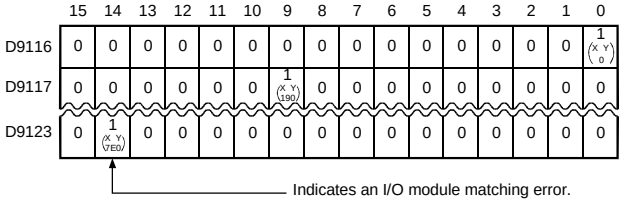
**List of special registers**

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

**List of special registers**

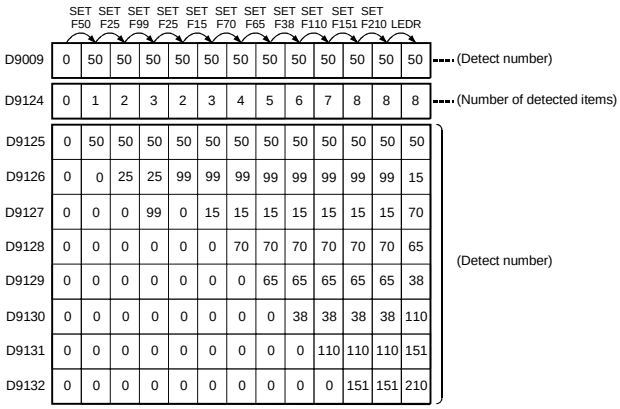
<table>
<tr><th>Number</th><th>Name</th><th>Description</th><th>Details of contents</th></tr>
<tr><td>*2<br>D9038</td><td rowspan="2">LED display priority</td><td>Priority 1 to 4</td><td rowspan="2">• Set and change the element number in the LED display of the CPU module. (Priority 1 to 4 are in the D9038 and 5 to 7 are in the D9039.)<br>  <br><br>Even if "0" is set, the error which stops the operation of the CPU (including the parameter setting) is displayed on the LED unconditionally.<br>Default values : D9038= H4321<br>D9039= H0765<br><table><tr><th>Element Number</th><th>Description</th></tr><tr><td>0.</td><td>No display</td></tr><tr><td>1.</td><td>I/O matching,<br>fuse blown</td></tr><tr><td>2.</td><td>Special module,<br>link parameter,<br>operation error</td></tr><tr><td>3.</td><td>CHK instruction error</td></tr><tr><td>4.</td><td>Annunciator</td></tr><tr><td>5.</td><td>LED instruction related</td></tr><tr><td>6.</td><td>Battery error</td></tr><tr><td>7.</td><td>Clock data</td></tr></table></td></tr>
<tr><td>*2<br>D9039</td><td>Priority 5 to 7</td></tr>
<tr><td>D9044</td><td>For the sampling trace</td><td>Step or time of the sampling trace</td><td>• When the M9044 is turned ON/OFF in peripheral device and the sampling trace STRA or STRAR is activated, the value stored in the D9044 as a sampling trace condition is used.<br>For scan ––––––0<br>For time ––––––time (in 10ms unit) } Stored in BIN code.</td></tr>
<tr><td>D9049</td><td>Work area for the SFC</td><td>Block number of the expanded file register</td><td>• The block number of the expanded file register which is used as a work area for the SFC is stored.<br>Upper 8 bits ····· The block number is stored.<br>Lower 8 bits ····· The step number is stored.</td></tr>
<tr><td>D9050</td><td>Error number of the SFC program</td><td>Number of the error which occurred in the SFC program</td><td>• The error number which occurred in the SFC program is stored as a BIN value.<br>0 : No error<br>80 : Parameter error of the SFC program<br>81 : Number of steps to be executed simultaneously exceeded the limit.<br>82 : Block startup error<br>83 : Operation error of the SFC program</td></tr>
<tr><td>D9051</td><td>Error block</td><td>Block number where the error occurred</td><td>• The block number where the error occurred in the SFC program is stored as a BIN value. When error 82 occurs, however, the block number of the startup source is stored.</td></tr>
<tr><td>D9052</td><td>Error step</td><td>Step number where the error occurred</td><td>• The step number where error 83 occurred in the SFC program is stored as a BIN value. "0" is stored when error 80 or 81 occurs. When error 82 occurs, the step number of the block startup is stored.</td></tr>
<tr><td>D9053</td><td>Error migration</td><td>Migration condition number where the error occurred</td><td>• The migration condition number where error 83 occurred in the SFC program is stored as a BIN value.<br>"0" is stored when error 80, 81, or 82 occurred.</td></tr>
<tr><td>D9054</td><td>Error sequence step</td><td>Sequence step number where the error occurred</td><td>• In the migration condition or step where error 83 occurred in the SFC program, the order of the sequence step (n-th step) in the migration condition or operation output where the error occurred is stored as a BIN value.</td></tr>
<tr><td>D9055</td><td>Status latch</td><td>Status latch step</td><td>• The number of the step which was being executed at the time of the status latch is stored as a BIN code.</td></tr>
<tr><td>D9072</td><td>PC communication check</td><td>Data check of the computer link</td><td>• Used for the self-loopback check.</td></tr>
<tr><td>D9081</td><td>Number of empty areas of the communication request register area</td><td>Number of available spaces of the communication request register area</td><td>• The number of available spaces in the communication request register area to the MNET/MINI(-S3) is stored. (a maximum of 32)</td></tr>
<tr><td>D9085</td><td>Time check value setting register</td><td>The default value is 10s.</td><td>• The time check value, which is used when the link instruction (ZNRD, ZNWR) for the MELSECNET/10 is executed, is stored.<br>• Setting range : 1 to 65535s<br>• Setting unit : in 1s unit<br>• The default value, 10s, is used when 0 is set.</td></tr>
</table>

**List of special registers**

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

**List of special registers**

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



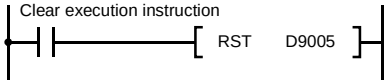

**POINT**

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

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

1 From the user program

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




2 From the peripheral device

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

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

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

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

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

# Appendix 3 Peripheral Devices

(1) The following table shows whether the peripheral devices and system FD which are used by the conventional system can be used or not.

| Model name of the peripheral device | Model name of the software package | Usable or not | Usable range | Model name of the PC at the startup |
|---|---|---|---|---|
| A6GPP/A6PHP | SW4GP-GPPAA | Usable | Device range of A3ACPU | A3A |
| | SW3GP-GPPA | Usable | Device range of A3HCPU | A3H |
| | Prior to SW2 -type | Not usable | ———— | ———— |
| A6HGP | SW3-HGPA | Usable | Device range of A3HCPU | A3H |
| | Prior to SW2 -type | Not usable | ———— | ———— |
| A8PU | ———— | Usable | Device range of A3ACPU | A2USH (displayed at the startup) |
| A7PU<br>A7PUS | ———— | Usable | Device range of A3HCPU | A2USH (displayed at the startup) |
| A6WU | Software version "E" or later | Usable | Device range of A3ACPU | ———— |
| | Software version "D" or earlier | Not usable | ———— | ———— |

(2) The compatibility of the conventional products (existing system products) and the new products (AnU-compatible products) are listed in the following table.

| No. | Product used to write to the CPU | Product used to read from the CPU | Compatible |
|---|---|---|---|
| 1 | Conventional product (PC: A3A startup) | New Product (PC: A3A startup) | • All the data is compatible. |
| 2 | New Product (PC: A3A startup) | Conventional product (PC: A3A startup) | |
| 3 | Conventional product (PC: A3A startup) | New Product (PC: A3U startup) | • Because the model names of the PCs for write and read are different, the following things apply.<br>1) When the verification is executed after the readout, the verification fails. (The data is usable.)<br>2) The setting values (data stored in the CPU) of the sampling trace/status latch cannot be displayed.<br>3) When the network parameters are set in the new product, they cannot be displayed on the conventional product. |
| 4 | New Product (PC: A3U startup) | Conventional product (PC: A3A startup) | |

**POINT**

Do not execute readout and the following operations to a conventional product from the A2USHCPU-S1 in which the MELSECNET/10 network parameters have been set by the new product, because "LINK PARA.ERROR" (CPU error) will occur:

(a) Modifying and writing in the main sequence program area (memory capacity).

(b) Writing the readout parameters to another A2USHCPU-S1 in the network system.

# Appendix 4 Precautions When the Existing Sequence Programs Are Diverted for the A2USHCPU-S1

The precautions for diverting the sequence programs created for the A1SCPU and A2SCPU for the A2USHCPU-S1 are explained.
The sequence programs created for the A2USCPU(S1) can directly be used for the A2USHCPU-S1.

**POINT**

(1) The following three instructions created exclusively for the AnUCPU can be used by adding to the existing sequence program.
- ZNWR instruction ·····For writing to word devices of the stations connected to the MELSECNET/10
- ZNRD instruction ·····For reading from word devices of the stations connected to the MELSECNET/10
- ZCOM instruction·····MELSECNET/10 network refresh instruction

(2) All of the sequence programs for the A1SCPU and A2SCPU can be used.

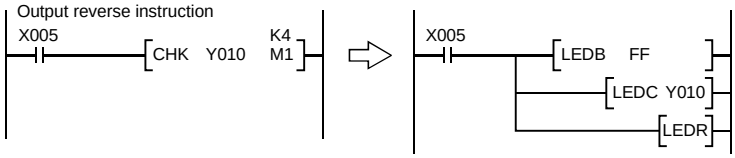
(3) The following instructions cannot be used by the A2USHCPU-S1 as they cannot be used by the A2USCPU(S1). Please note, however, that the handling is different between the A2USCPU(S1) and A2USHCPU-S1 when they are used mistakenly.

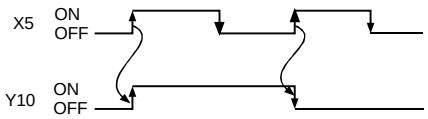
| Item | A2USHCPU-S1 | A2USCPU(S1) |
|---|---|---|
| LED, LEDC instruction | No error occurs. | "INSTRCT CODE ERR." occurs. |
| CHG instruction | Error code 13 occurs. | Error code 10 occurs. |

## Appendix 4.1 Instructions with different specifications

Modifications to the sequence program to use the instructions of different specifications are explained.
Basically, the instructions which are not listed in this section do not require modifications.

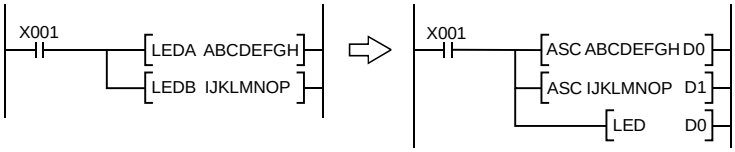
(1) CHK instruction·····Modifications are necessary when the A1SCPU and A2SCPU are used in the refresh method.




(2) DI/EI instruction·····Modifications are necessary when the special relay M9053 is ON.
- Enable and disable (EI, DI) of the link refresh is executable when M9053 is turned ON.
- Because the A2USHCPU-S1 executes the link refresh by the END processing, the link refresh cannot be enabled and disabled while the sequence program is being executed.
- Modify the sequence program.

(3) LEDA/LEDB instruction



(4) SUB, SUBP instruction·····Unusable
- The SUB instruction cannot be used because the A2USHCPU-S1 cannot store the microcomputer program.
- All of the contents which are processed by the microcomputer area need to be changed to the program using the dedicated instructions in order to be used by the A2USHCPU-S1.

## Appendix 4.2 Special relays and special registers with different specifications

The A2USHCPU-S1 does not use the following special relays and special registers.
Even though no error occurs when the following special relays and special registers exist in the diverted program (ignored), it is recommended that they are deleted from the program.
- M9010·····Turned ON when a operation error occurs and turned OFF when the error disappears.
- M9053·····Link refresh enable of the EI instruction /interrupt enable instruction of the interrupt program, DI instruction to the link refresh disable/interrupt disable instruction of the interrupt program.

## Appendix 4.3 Parameter setting

The parameters set by the existing CPU can be used as is if the following items do not apply to them.

| Setting item | Description |
|---|---|
| Microcomputer program capacity | The microcomputer area of the A2USHCPU-S1 is for the SFC only.<br>"PARAMETER ERROR" occurs if a utility package of the microcomputer program is stored in the microcomputer area of the existing CPU. |
| Registering the model name of the module by the I/O assignment<br>(By the system FD which is compatible with the A2USHCPU-S1) | When the AD57 module or AD57-S1 module is used in the existing system, the utility package of the SW□-AD57P is stored in the microcomputer program area.<br>The utility package mentioned above cannot be stored in the A2USHCPU-S1 because it does not have a microcomputer program area.<br>In order to provide the functions of this utility package, the A2USHCPU-S1 provides the dedicated instructions for the special function module.<br>To use the dedicated instructions of the A2USHCPU-S1, the model name of the module has to be registered in advanced by the I/O assignment.<br>Conclusion: When a module of AD57 or AD57-S1 exists, be sure to register the model name of the module by the system FD which is compatible with the A2USHCPU-S1. |

The following items are executed differently from the parameter setting of the existing CPU.
- Watchdog timer setting·····The setting time is ignored and processed by 200ms.
- Interrupt counter setting·····The interrupt counter set by the A1SCPU and A2SCPU are ignored and treated as a normal counter by the sequence program.

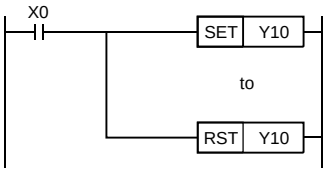
## Appendix 4.4 I/O control method

The I/O control method of the A2USHCPU-S1 is the refresh method (partial direct I/O depending on the instruction), and is different from that of the A1SCPU and A2SCPU. Therefore, pay attention to the input timing of the input (X) and the output timing of the output (Y).

**(1) Program to process to pulses by the SET/RST instruction**

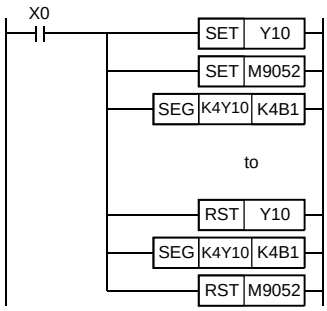
Program as follows in order for the A2USHCPU-S1 to execute the pulse output to the outside by the SET/RST instruction while in the direct method of the A1SCPU and A2SCPU.

For direct method of the A1SCPU and A2SCPU

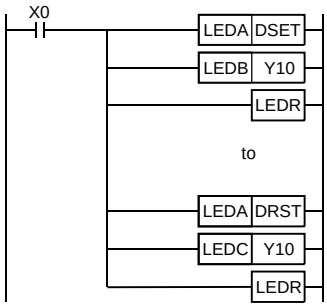



(a) When the instructions common to the ACPU are used:

For direct method of the A2USHCPU-S1




(b) When the instructions dedicated to the A2USHCPU-S1 are used:




**POINT**

Use the program above in order to send the pulse signal output to the special function module when a special function module is used, such as the AD61(S1)-type high-speed counter module.

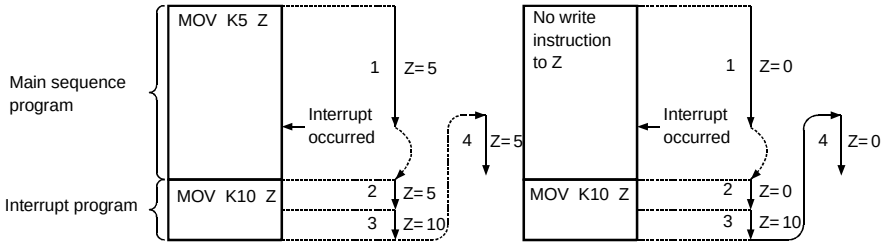
## Appendix 4.5 Microcomputer program

The utility software packages and the microcomputer programs created by the user which are used by the A1SCPU and A2SCPU cannot be used by the A2USHCPU-S1 because it does not have the microcomputer mode. (The microcomputer program area of the A2USHCPU-S1 is for the SFC only.) When the utility software packages or the microcomputer programs above are used, delete all of the SUB instructions (microcomputer program call) used for executing them from the sequence program. When the following utility package is used, modify the program using instructions dedicated to the A2USHCPU-S1.

1) SW□-AD57P ····· AnACPU/AnUCPU Programming Manual (AD57) IB-66257
   (Usable for creating the canvas and character generators.)
2) SW□-UTLP-FNO····· AnACPU/AnUCPU Programming Manual (Dedicated Instruction) IB-66251
3) SW□-UTLP-PID ····· AnACPU/AnUCPU Programming Manual (PID) IB-66258
4) SW□-SIMA
5) SW□-UTLP-FDI } Unusable
6) SW□-SAPA

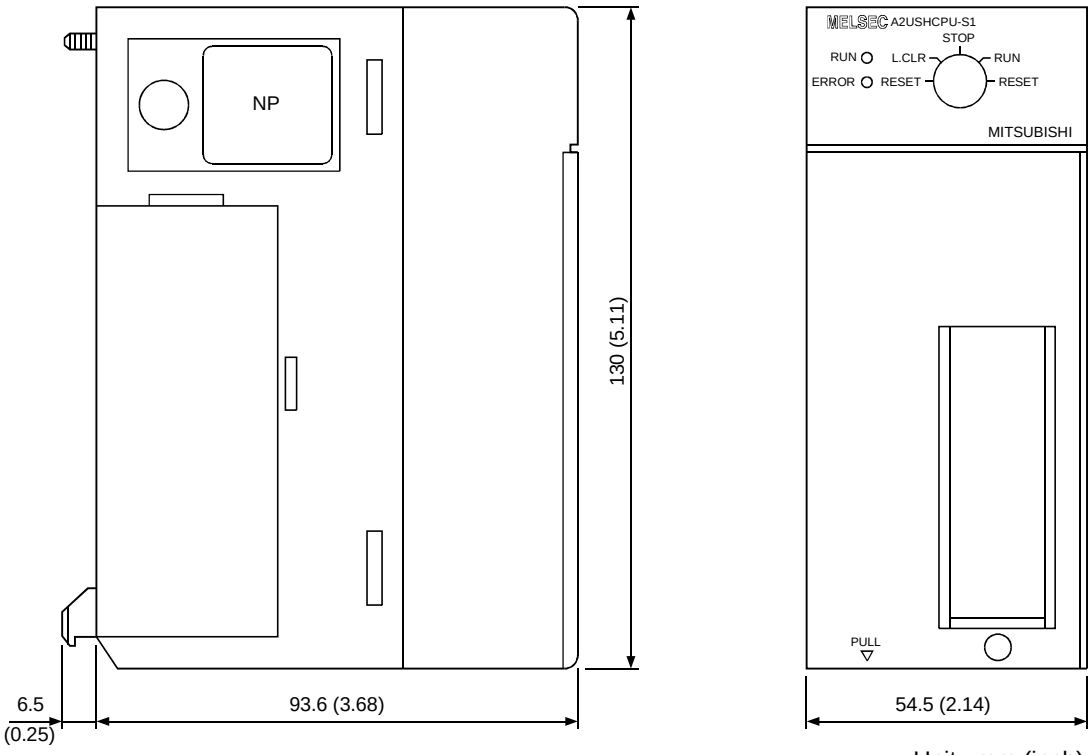
## Appendix 4.6 Processing of the index register

The index register of the A2USHCPU-S1 is written over again to the value prior to the execution of the interrupt program when the processing is handed over to the main or sequence program even if the value was updated by the interrupt program.



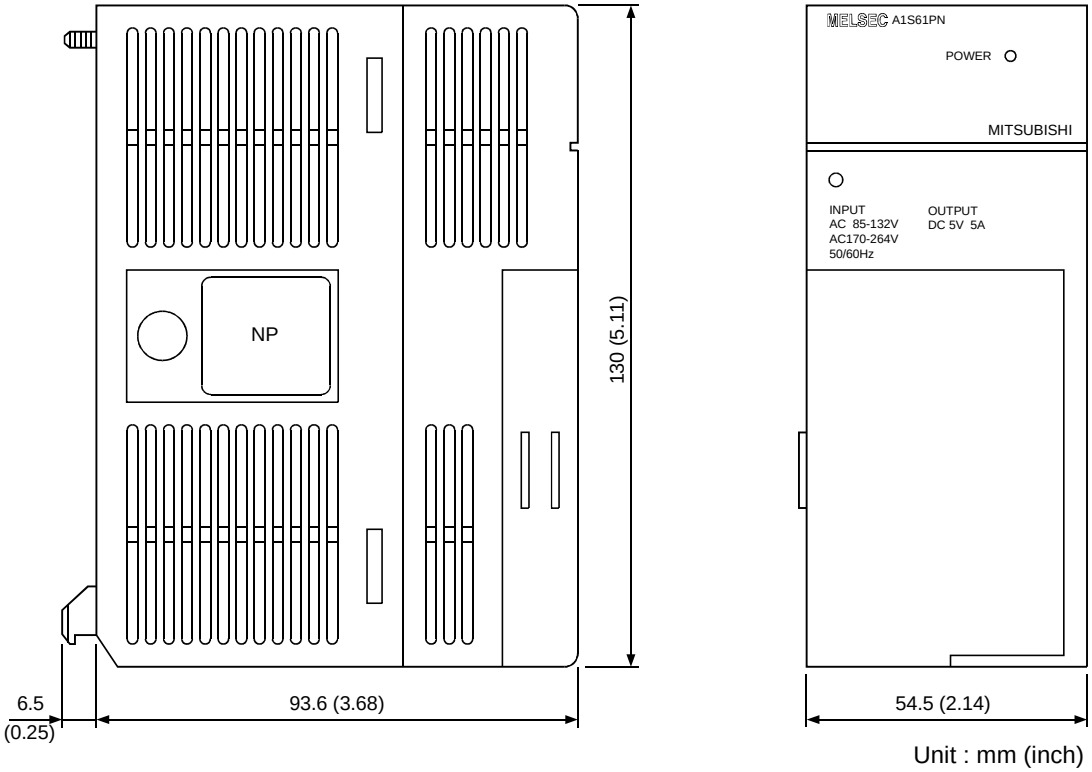
# Appendix 5 External Dimension Diagrams

## Appendix 5.1 A2USHCPU-S1 module




Unit : mm (inch)

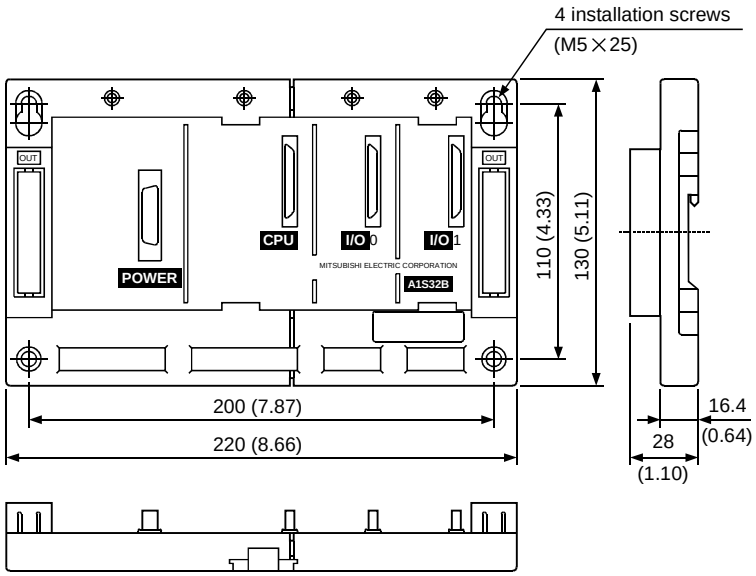
## Appendix 5.2 A1S61PN, A1S62PN and A1S63P power supply modules




Unit : mm (inch)

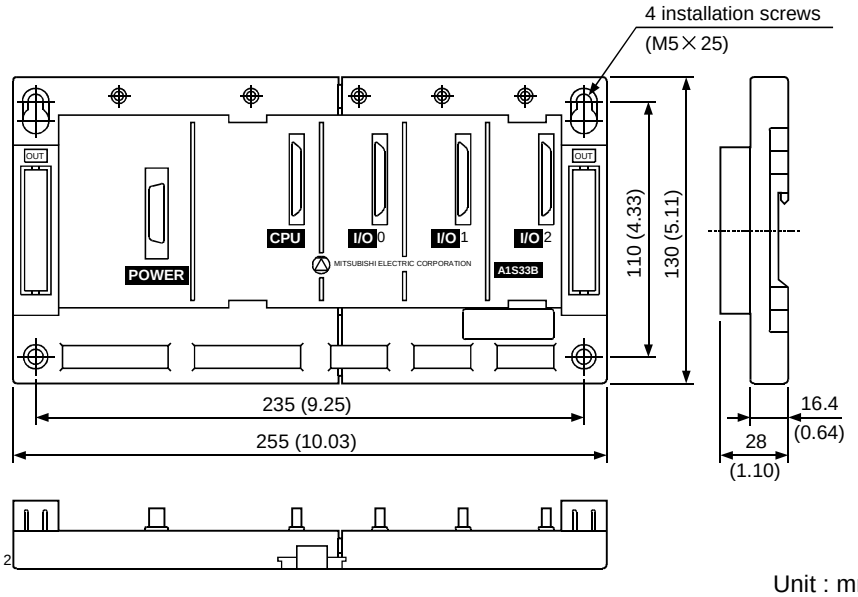
## Appendix 5.3 Basic Base Unit

### Appendix 5.3.1 A1S32B basic base unit



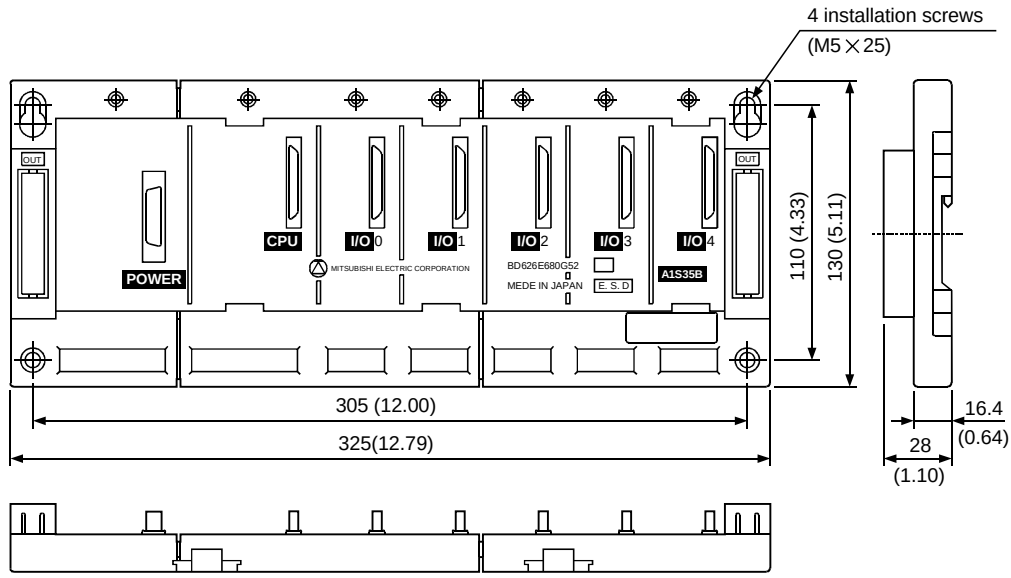

Unit : mm (inch)

### Appendix 5.3.2 A1S33B basic base unit



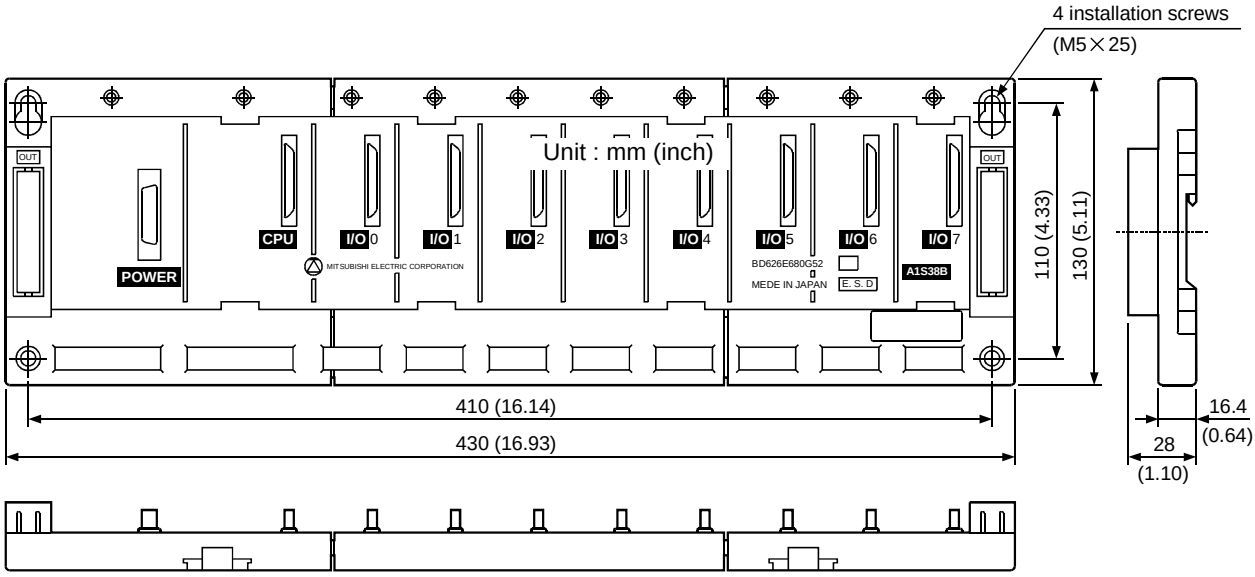

Unit : mm (inch)

### Appendix 5.3.3 A1S35B basic base unit




Unit : mm (inch)

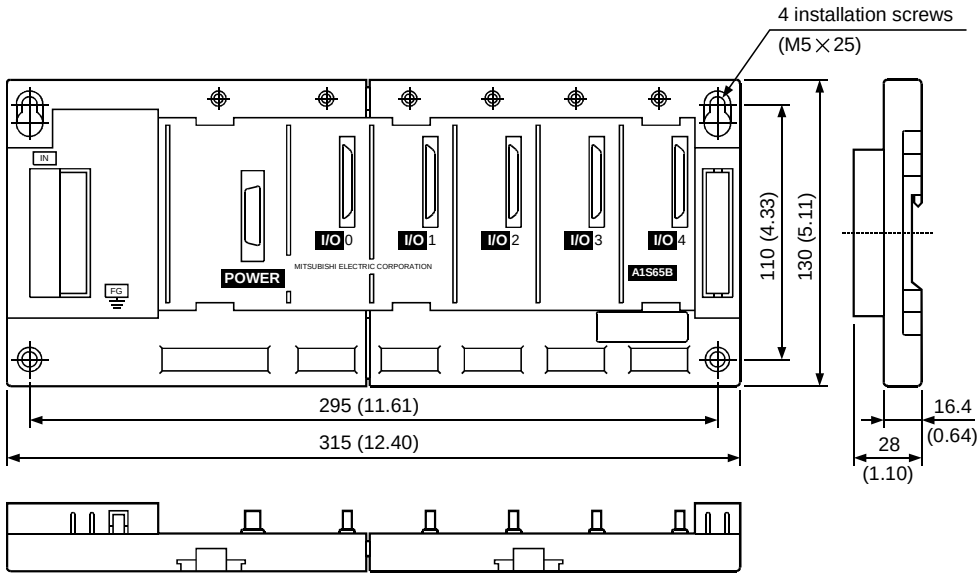
### Appendix 5.3.4 A1S38B basic base unit




Unit : mm (inch)

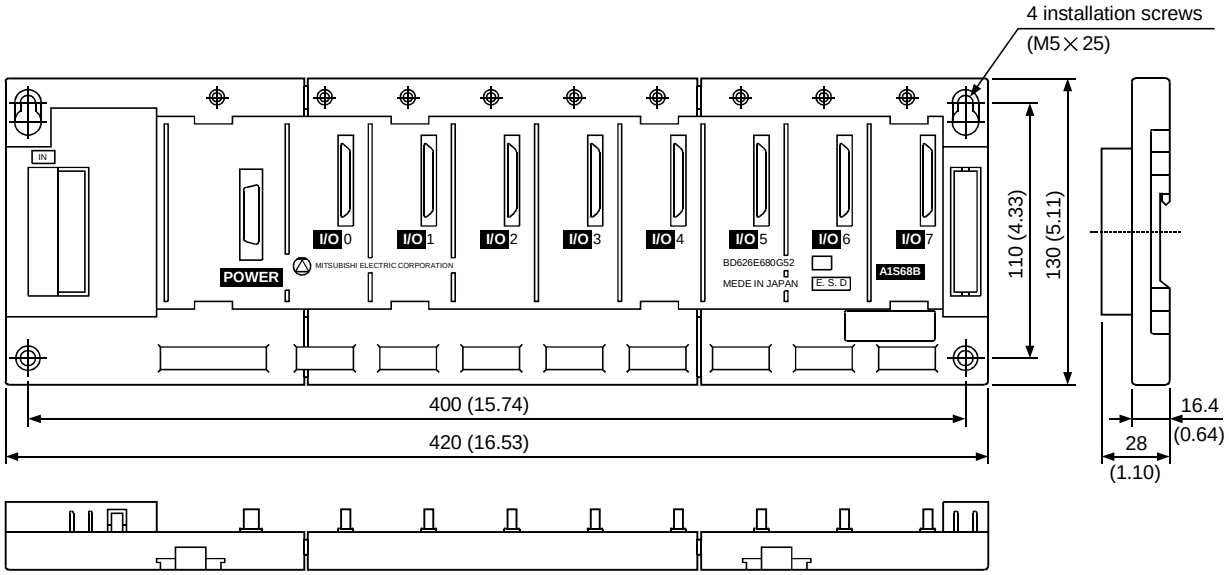
## Appendix 5.4 Extension Base Unit

### Appendix 5.4.1 A1S65B extension base unit



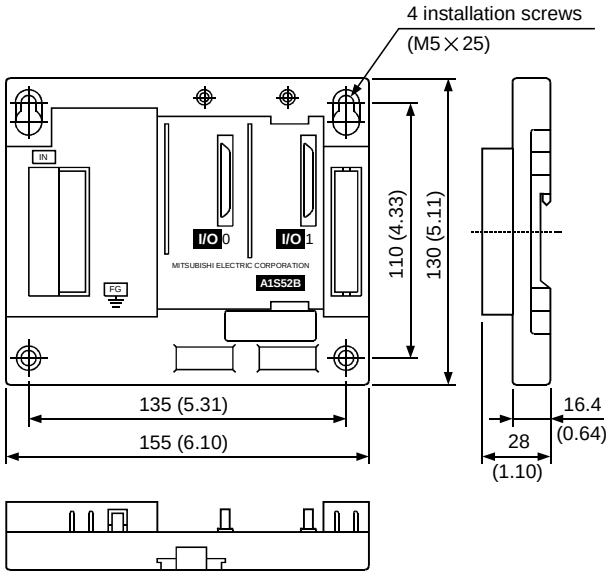

Unit : mm (inch)

### Appendix 5.4.2 A1S68B extension base unit



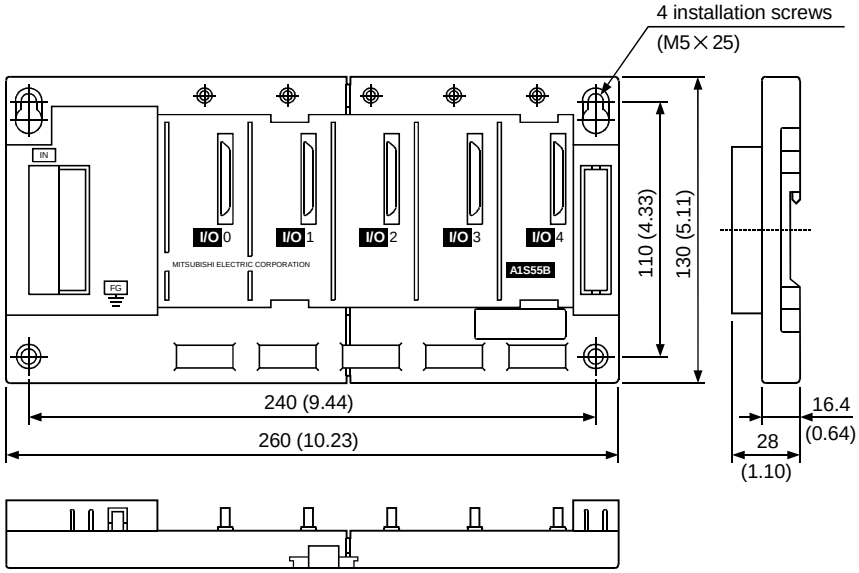

Unit : mm (inch)

### Appendix 5.4.3 A1S52B extension base unit



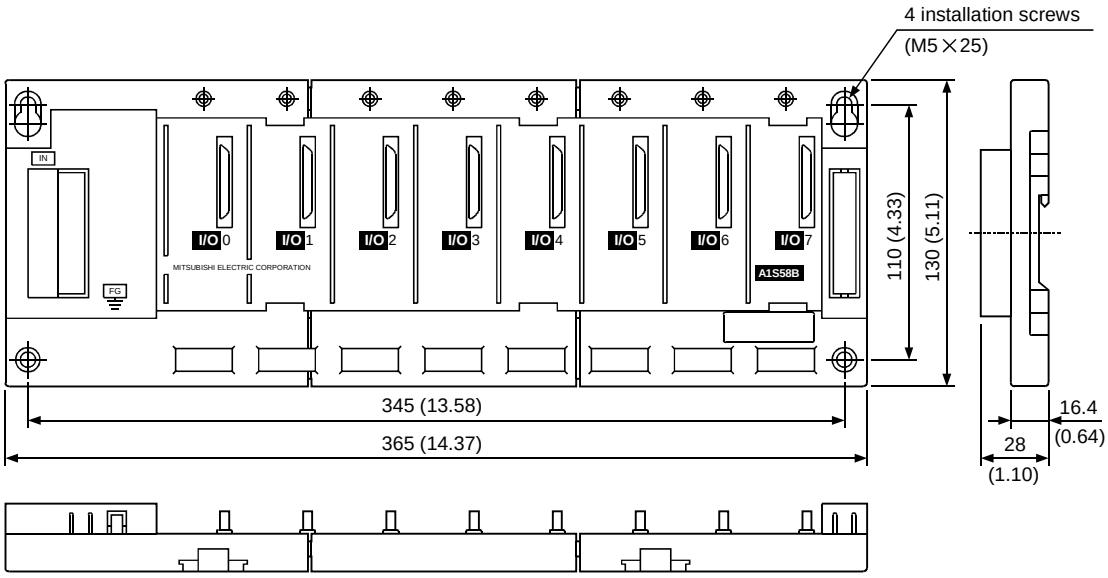

Unit : mm (inch)

### Appendix 5.4.4 A1S55B extension base unit




Unit : mm (inch)

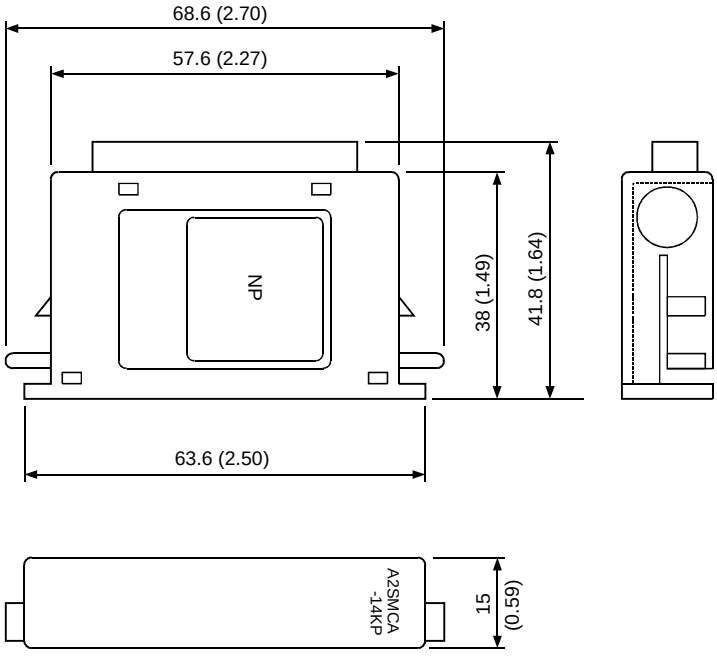
### Appendix 5.4.5 A1S58B extension base unit




Unit : mm (inch)

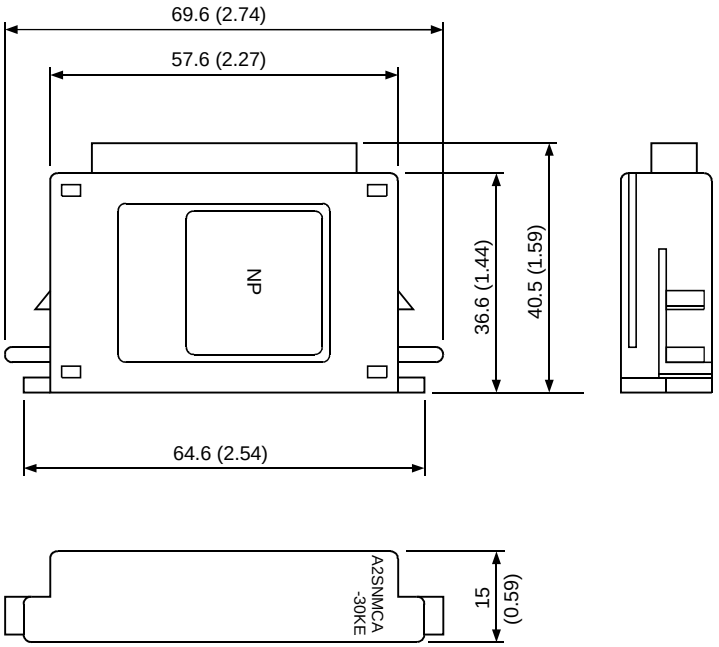
## Appendix 5.5 Memory Cassette

### Appendix 5.5.1 A2SMCA- memory cassette



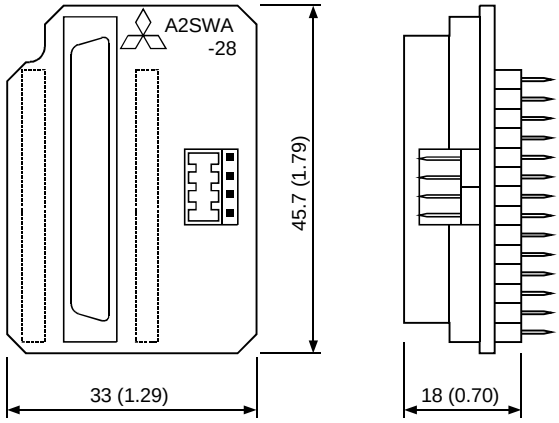

Unit : mm (inch)

### Appendix 5.5.2 A2SNMCA-30KE memory cassette




Unit : mm (inch)

## Appendix 5.6 A2SWA-28P Memory Write Adapter




Unit : mm (inch)

# Appendix 6 Precautions When Writing Data on a ROM Using PECKER

When the PECKER series ROM writer by Abar Data, Inc. is used to create a data ROM, care should be taken for the version of the PECKER-side adapter used, since some are not compatible with the module.
The versions of PECKER-side adapters that can be used are shown below.

| Product model name | | | A2SMCA-14KP | 16KROM | | |
|---|---|---|---|---|---|---|
| EP ROM used | | | AT27C256R –15KC | D27256 | AM27C256 –150DC | TMS27C256 –15JL |
| Manufacturer | | | ATMEL | INTEL | AMD | TI |
| Adapter model name | PECKER10 (PKW1000) | FX-1 | Not compatible | 1.1 | Not compatible | 1.1 |
| | | FX-1a | Not compatible | 1.1 | Not compatible | 1.1 |
| | | FX-5 | Not compatible | 1.1 | Not compatible | 1.1 |
| | PECKER11 (PKW1100) | RX-1 | 4.3 | 1.0 | 1.0 | 1.0 |
| | | RX-40 | 4.3 | 3.0 | 4.1 | 4.1 |
| | PECKER30 (PKW3100) | ADP-B | 2.9 | 2.0 | 2.0 | 2.0 |
| | | ADP-D | 1.5 | 1.0 | 1.0 | 1.0 |

Use adapter of the above versions or later to write data on a ROM.

# WARRANTY

Please confirm the following product warranty details before starting use.

## 1. Gratis Warranty Term and Gratis Warranty Range

If any faults or defects (hereinafter "failure") found to be the responsibility of Mitsubishi occurs during use of the product within the gratis warranty term, the product shall be repaired at no cost via the dealer or Mitsubishi Service Company. Note that if repairs are required at a site overseas, on a detached island or remote place, expenses to dispatch an engineer shall be charged for.

### [Gratis Warranty Term]

The gratis warranty term of the product shall be for one year after the date of purchase or delivery to a designated place. Note that after manufacture and shipment from Mitsubishi, the maximum distribution period shall be six (6) months, and the longest gratis warranty term after manufacturing shall be eighteen (18) months. The gratis warranty term of repair parts shall not exceed the gratis warranty term before repairs.

### [Gratis Warranty Range]

(1) The range shall be limited to normal use within the usage state, usage methods and usage environment, etc., which follow the conditions and precautions, etc., given in the instruction manual, user's manual and caution labels on the product.

(2) Even within the gratis warranty term, repairs shall be charged for in the following cases.

1. failure occurring from inappropriate storage or handling, carelessness or negligence by the user. Failure caused by the user's hardware or software design.
2. Failure caused by unapproved modifications, etc., to the product by the user.
3. When the Mitsubishi product is assembled into a user's device, failure that could have been avoided if functions or structures, judged as necessary in the legal safety measures the user's device is subject to or as necessary by industry standards, had been provided.
4. Failure that could have been avoided if consumable parts (battery, backlight, fuse, etc.) designated in the instruction manual had been correctly serviced or replaced.
5. Failure caused by external irresistible forces such as fires or abnormal voltages, and failure caused by force majeure such as earthquakes, lightning, wind and water damage.
6. Failure caused by reasons unpredictable by scientific technology standards at time of shipment from Mitsubishi.
7. Any other failure found to not be the responsibility of Mitsubishi or the user.

## 2. Onerous repair term after discontinuation of production

(1) Mitsubishi shall accept onerous product repairs for seven (7) years after production of the product is discontinued. Discontinuation of production shall be notified with Mitsubishi Technical Bulletins, etc.

(2) Product supply (including repair parts) is not possible after production is discontinued.

## 3. Overseas service

Overseas, repairs shall be accepted by Mitsubishi's local overseas FA Center. Note that the repair conditions at each FA Center may differ.

## 4. Exclusion of chance loss and secondary loss from warranty liability

Regardless of the gratis warranty term, Mitsubishi shall not be liable for compensation to damages caused by any cause found not to be the responsibility of Mitsubishi, chance losses, lost profits incurred to the user by failures in Mitsubishi products, damages and secondary damages caused from special reasons regardless of Mitsubishi's expectations, compensation for accidents, and compensation for damages to products other than Mitsubishi products and other duties.

## 5. Changes in product specifications

The specifications given in the catalogs, manuals or technical documents are subject to change without prior notice.

## 6. Product application

(1) In using the Mitsubishi MELSEC programmable logic controller, the usage conditions shall be that the application will not lead to a major accident even if any problem or fault should occur in the programmable logic controller device, and that backup and fail-safe functions are systematically provided outside of the device for any problem or fault.

(2) The Mitsubishi general-purpose programmable logic controller has been designed and manufactured for applications in general industries, etc. Thus, applications in which the public could be affected such as in nuclear power plants and other power plants operated by respective power companies, and applications in which a special quality assurance system is required, such as for each Japan Railways company or the Department of Defense shall be excluded from the programmable logic controller applications.

Note that even with these applications, if the user approves that the application is to be limited and a special quality is not required, application shall be possible.

When considering use in aircraft, medical applications, railways, incineration and fuel devices, manned transport devices, equipment for recreation and amusement, and safety devices, in which human life or assets could be greatly affected and for which a particularly high reliability is required fin terms of safety and control system, please consult with Mitsubishi and discuss the required specifications.

# type A2USHCPU-S1

# User's Manual

| | |
|---|---|
| MODEL | A2USHCPU-S1-U-E |
| MODEL CODE | 13JL30 |
| IB(NA)-66789-B(0212)MEE | |

MITSUBISHI ELECTRIC CORPORATION

HEAD OFFICE : 1-8-12, OFFICE TOWER Z 14F HARUMI CHUO-KU 104-6212,JAPAN
NAGOYA WORKS : 1-14 , YADA-MINAMI 5 , HIGASHI-KU, NAGOYA , JAPAN