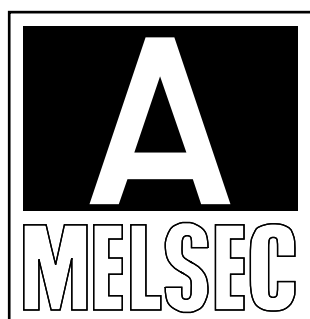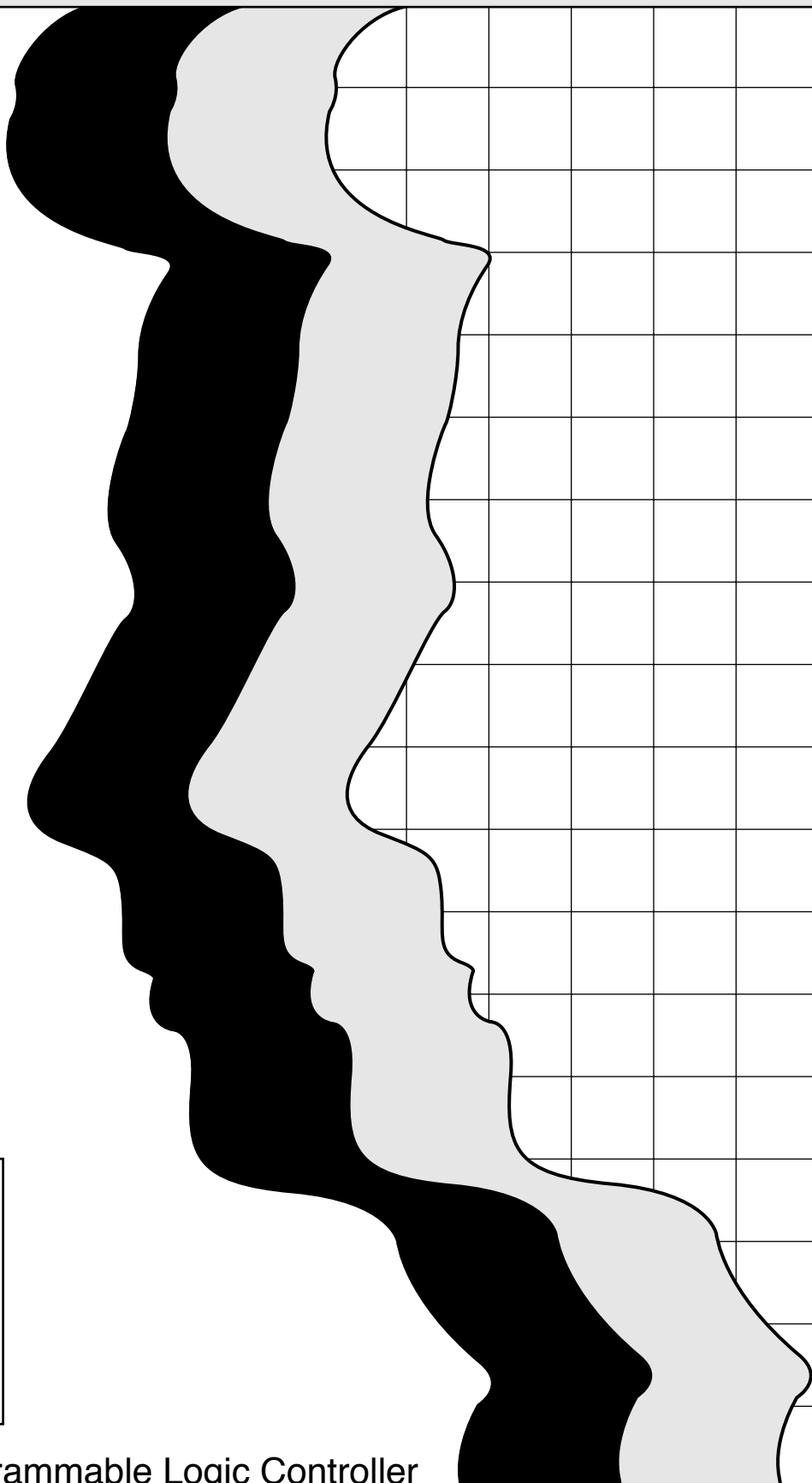# MITSUBISHI

PC Fault Detection Module Type AS91,A1SS91,A0J2-S91

User's Manual

A
MELSEC

Mitsubishi Programmable Logic Controller

SAFETY CAUTIONS

(You must read these cautions before using the product)

In connection with the use of this product, in addition to carefully reading both this manual and the related manuals indicated in this manual, it is also essential to pay due attention to safety and handle the product correctly.

The safety cautions given here apply to this product in isolation. For information on the safety of the PC system as a whole, refer to the CPU module User's Manual.

These **SAFETY CAUTIONS** are classified into two grades: "DANGER" and "CAUTION".

◇!◇ DANGER	Safety caution given when incorrect handling could result in hazardous situations involving the possibility of death or serious injury.
⚠ CAUTION	Safety caution given when incorrect handling could result in hazardous situations involving the possibility of moderate or light injury or damage to property.

Note that, depending on the circumstances, failing to follow a ⚠ CAUTION may also have very serious consequences.

Both of these classes of safety caution are very important and must be observed.

Store this manual carefully in a place where it is accessible for reference whenever necessary, and forward a copy of the manual to the end user.

[Cautions on Design]

◇!◇ DANGER
• Provide safety circuits external to the PC to ensure that the system as a whole can continue to operate safely even if there is a fault in the external power supply or in the PC itself. Otherwise, accidents could occur as a result of erroneous outputs and malfunctions. (1) The PC fault detection module serves only to detect faults of the PC CPU and bus; it cannot prevent mechanical problems. Configure circuits such as emergency stop circuits, protective circuits, interlock circuits for mutually exclusive operations (e.g. forward/reverse), and interlock circuits to prevent machine breakage - such as those for upper and lower limits - external to the PC.

⚠ CAUTION
• Do not bundle the control wire with the main circuit or power line or keep them close to one another. Keep the control wire and the communicaiton cable at least 100 mm away from the main circuit or power line: otherwise, noise or malfunctions will occur.

[Cautions on Installation]

◇ DANGER
• Use the PC in the environment specified in the General Specifications section in this manual. Using it in an environment which does not meet the general specifications could cause electric shock, fire or malfunctions, and damage or deterioration of the module. • Install the module by engaging the module mounting projections on the lower part of the module in the mounting holes of the base unit. Incorrect installation could result in malfuncitons, failure of detachment. • Check that the extension cable is correctly engaged with the module's connector, and firmly secured. If it is not correctly engaged, erroneous inputs and outputs could occur.

[Cautions on Wiring]

⚠ CAUTION
• Carry out wiring to the module correctly, checking the terminal arrangement. • Take all possible measures to prevent chips or wire scraps from entering the module. Entry of foreign material will cause fire, failure of malfunctions. • Tighten the terminal screws to the special torque. Loose terminal screws will cause a short, fire or malfunctions. Overtightening of screws can cause damages to the screws and/or the module, resulting in fallout, short circuits,or malfunction.

[Cautions on Start-Up and Maintenance]

◇ DANGER
• Do not touxh the terminals shile they are live You could receive an electric shock or cause malfunctions. • Switch all phases of the external power supply off when cleaning the module or retightening the terminal or module mounting screws. Not doing so could result in electric shock. Undertightening of terminal screws can cause a short circuit or malfunction. Overtightening of screws can cause damages to the screws and/or the module, resulting in fallout, short circuits, or malfunction.

⚠ CAUTION
• Do not disassemble or tamper with the module. This will cause failure, malfunctions, injuries or fire. • 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. • Always make sure to touch the grounded metal to discharge the electricity charged in the electricity charged in the body, etc., before touching the module. Failure to do say cause a failure or malfunctions of the module.

[Cautions on Disposal]

⚠ CAUTION
• Dispose of this product as industrial waste.

INTRODUCTION

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

REVISIONS

Print Date	*Manual Number	Revision
Dec., 1995	IB (NA) 66626-A	First edition
Dec., 2003	IB (NA) 66626-B	[Addition] WARRANTY [Partial Correction] SAFETY PRECAUTIONS, Section 2.1, 2.2, 3.2.1 , 3.3.1

CONTENTS

1. GENERAL DESCRIPTION

This manual describes the specifications, handling, and programming procedures for the following PC fault detection modules:

- AS91 PC fault detection module
- A1SS91 PC fault detection module
- A0J2-S91 PC fault detection unit

Hereafter referred to as "PC fault detection module" except in cases where model distinctions are required.
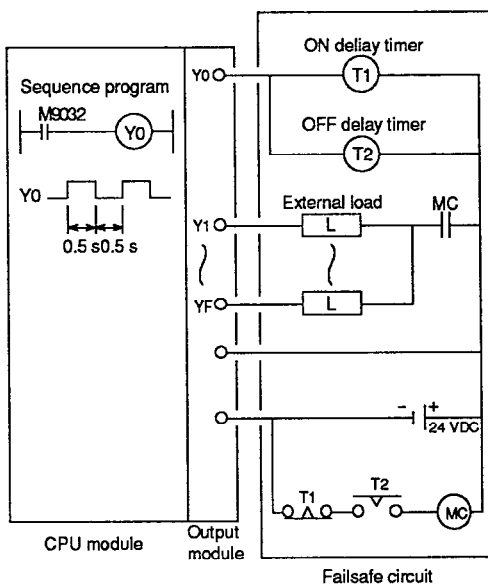
Although programmable controller CPU and memory failures are normally detected by the self-diagnosis function, such detection becomes impossible when errors occur at the input/output control area (bus error), etc., resulting in an all-points ON or all-points OFF condition which makes it impossible to maintain normal and safe control.

An external failsafe circuit is provided to prevent accidents or machine damage when programmable controller CPU failure occurs.

In previous systems this failsafe circuit was an external "hard" circuit.

Now, however, the use of this PC fault detection module simplifies the external circuit by allowing it to be incorporated inside the programmable controller CPU as shown below. (See fig. below)

- External Failsafe Circuit Configuration
- Configuration When This Module Is Used

Failsafe circuit — CPU module / Output module

CPU module   PC fault detection module
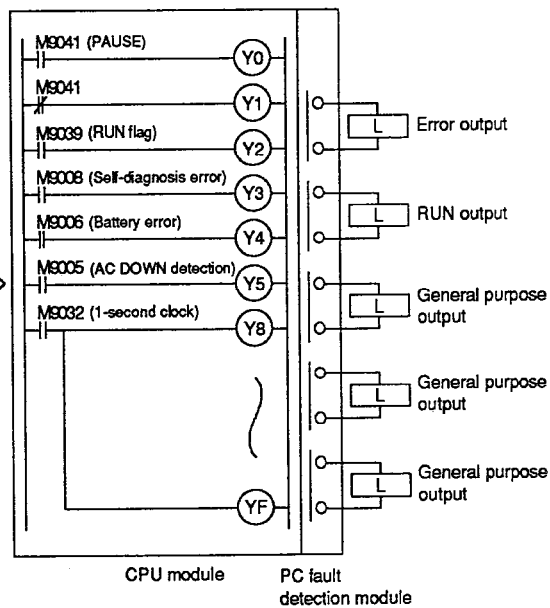
- Output Y0, which is output in accordance with M9032 (0.5 seconds ON, 0.5 seconds OFF) is monitored with an ON delay timer and OFF delay timer. When the Y0 output's ON/OFF switching is abnormal, [MC] is actuated. MC is interlocked with the external load to prevent erroneous operation.

- An error detection program can be created which enables the PC fault detection module to monitor outputs Y8 to YF (8 points) in accordance with M9032 (0.5 secs. ON/0.5 secs. OFF) . If any of these points remains ON or OFF, the PC fault detection module's "RUN" and "general purpose" external outputs will be switched OFF, and the "error output " will be switched ON.
These external outputs are interlocked with the external load to prevent erroneous operation.

2.   SYSTEM CONFIGURATION

The CPU models which can be used with the PC fault detection module, and precautions related to the system configuration are described in this section.

2.1   Applicable CPU Models

The CPU models which can be used with the PC fault detection module are shown below.

Applicable CPU Models	Usable Modules	Remarks
A1(N)CPU A2(N)CPU A2NCPU-S1 A3(N)CPU A3HCPU A3MCPU A2ACPU A2ACPU-S1 A3ACPU A2UCPU A2UCPU-S1 A3UCPU A4UCPU A3VCPU Q2ACPU Q2ACPU-S1 Q3ACPU Q4ACPU	AS91 A0J2-S91	• Only 1 of these modules can be installed with one CPU.
A1SJ(H)CPU A1S(H)CPU A1S(H)CPU-S1 A2S(H)CPU A2S(H)CPU-S1 A2ASCPU A2ASCPU-S1/S30 AZUSHCPU-S1 Q2AS(H)CPU	AS91 A1SS91 A0J2-S91	
A0J2(H)CPU	A0J2-S91 AS91	

2.2 System Configuration Precautions

The installation position of the PC fault detection module, and the setting procedure for setting switches are described in this section.

(1) When AnN, AnA, AnU, QnACPU are used

(a) When vacant slot exists:
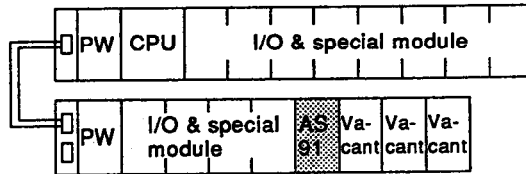
● Installed at slot subsequent to slot of final module which is actually being used.

(b) When no vacant slots exist (EX. 2nd step extension)

● Settings for A0J2-S91 are as follows:

    • A, A1S base ↔ A0J2 switch ... Set to "A, A1S base".

    • "Number of extension stages" setting switch
    .... Number of extension base stages used + 1.
    ("2" for the example above)

    • I/O module No. setting rotary switch
    .... Set to "0".

    • CPU5V ↔ EX5V switch .... Set to "EX5V".

(2) When AnS(H), A2AS(H), A2USH, Q2AS(H)CPU is used

(a) When vacant slot exists:
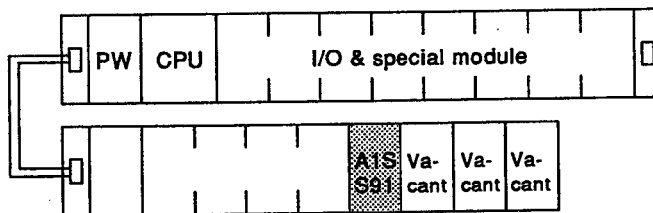
● Installed at slot subsequent to slot of final module which is actually being used.

(b) When no vacant slots exist

* A0J2 type used
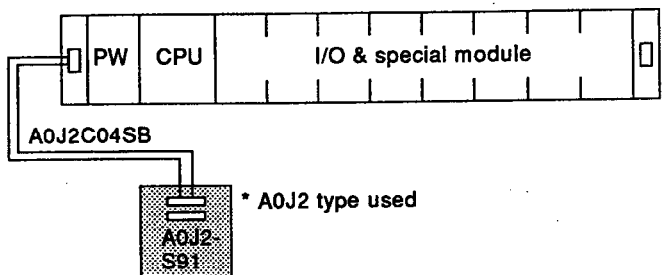
● Connection is possible at either the right or left extension connector (at main base module).
   However, an extension base cannot be used when the A0J2-S91 is connected.

● Settings for A0J2-S91 are as follows:

   • A, A1S base ↔ A0J2 switch .... Set to "A, A1S base".

   • "Number of extension stages" setting switch .. Set to "1".

   • I/O module No. setting rotary switch .... Setting to "0".

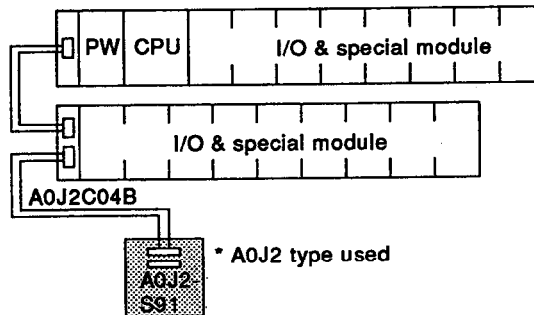   • CPU5V ↔ EX5V switch .... Set to "EX5V".

(3) When A0J2(H)CPU is used

   (a) When A0J2-S91 is connected:
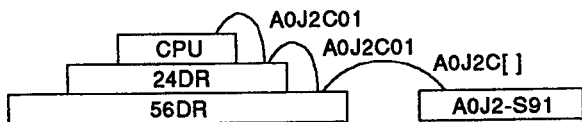
● Settings for A0J2-S91 are as follows:

   • A, A1S base A0J2 switch ..... Set to "A0J2".

   • "Number of extension stages" setting switch
      .... Not used. (any setting OK)

   • I/O module No. setting rotary switch
      .... I/O No. of unit used + 1
                                      ("2" for the example above)

   • CPU5V EX5V switch .... Set to "CPU5V" when there is no extension power supply module, or to "EX5V" when there is an extension power supply module.

(b) When an extension base is used

I/O address

| | 100 to 13F | 140 to 17F | 180 to 1BF | 1C0 to 1FF |
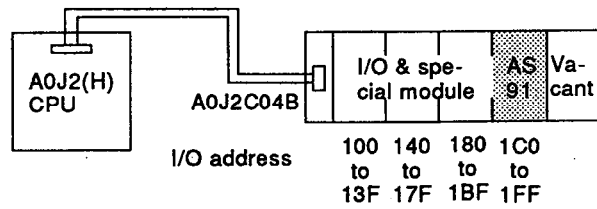
● Installed at slot subsequent to slot of final module which is actually being used. However, no more than 4 slots may be used (including the AS91 slot).

POINTS

(1) Install the PC fault detection module at the slot which immediately follows that of the final active module
(final active module slot + 1). The same applies for the I/O module No. setting.
* Install AS91, A1S91, or A0J2-S91 not to the final I/O assignment or extension stage setting, but to the final slot in a physical sense, as shown in the example below.
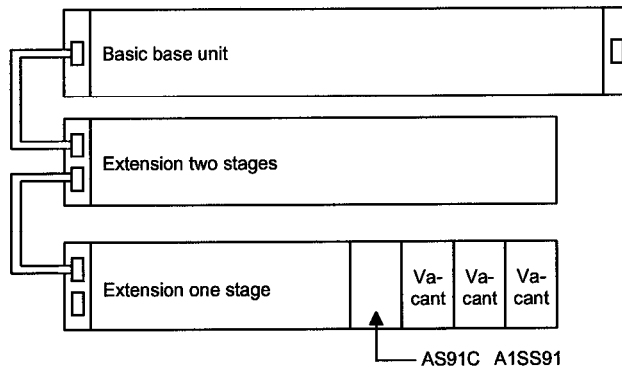
If active modules exist at slots subsequent to the PC fault detection module, the PC fault detection module will be unable to detect failures (due to pattern disconnections or poor cable contact, etc.) at those modules.

(2) There are 64 exclusive points for the A0J2-S91, and 16 for the AS91 and A1SS91. Make sure that the total number of points (including those for the PC fault detection module) does not exceed the maximum number available at the CPU in question.

(3) The total extension length for the extension cable is 6.6 meters, including the A0J2-S91. The system design should be such that the cable doesn't exceed this length.

(4) If the PC fault detection module is installed in a slot following an active module subject to restrictions (must be installed in the last slot, cannot be installed next to a relay output module, etc.), a vacant slot should be left between the PC fault detection module and that module, or the number of extension stages should be changed.

(5) No A0J2 unit other than the A0J2-S91 should be connected to an AnN, AnA, AnU, QnA, AnS(H), A2AS, A2USH or Q2AS(H)CPU.
If any other module is connected, normal system operation will be impossible.

3.   SPECIFICATIONS

The PC fault detection module specifications are discribed in this section.

3.1   General Specifications

The following specifications are common to all module models.

General Specifications

Item	Specifications				
Ambient operating temperature	0 to 55 °C				
Ambient storage temperature	-20 to 75 °C				
Ambient operating humidity	10 to 90 % RH, no condensation				
Ambient storage humidity	10 to 90 % RH, no condensation				
Vibration resistance	Conforms to JIS B 3501, IEC 1131-2 standards *1	For intermittent vibration			
		Frequency	Acceleration	Amplitude	Number of sweeps
		10 to 57 Hz	—	0.0075 mm (0.003 inch)	10 times in each of X, Y and Z directions (for 80 minutes)
		57 to 150 Hz	9.8 m/s^2 (1 g)	—	
		For continuous vibration			
		Frequency	Acceleration	Amplitude	
		10 to 57 Hz	—	0.035 mm (0.0014 inch)	
		57 to 150 Hz	4.9 m/s^2 (0.5 g)	—	
Shock resistance	Conforms to JIS B 3501, IEC 1131-2 standards (147 m/s^2 {15 g} x 3 times in 3 directions)				
Operating atmosphere	Free of corrosive gas				
Operating altitude	2000 m or less				
Installation location	Control panel				
Overvoltage category *2	11 or less				
Contamination level *3	2 or less				

*1   JIS: Japanese Industrial Standard

*2   The value indicates the power distribution unit between the public distribution network and the in-plant machinery to which the device is assumed to be connected.
Category II applies to devices powered by fixed equipment.
The surge voltage withstand capability of devices whose rated voltage is 300 V or lower is 2500 V.

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

3.2 Performance Specifications

The PC fault detection module's performance specifications are discribed in this section.
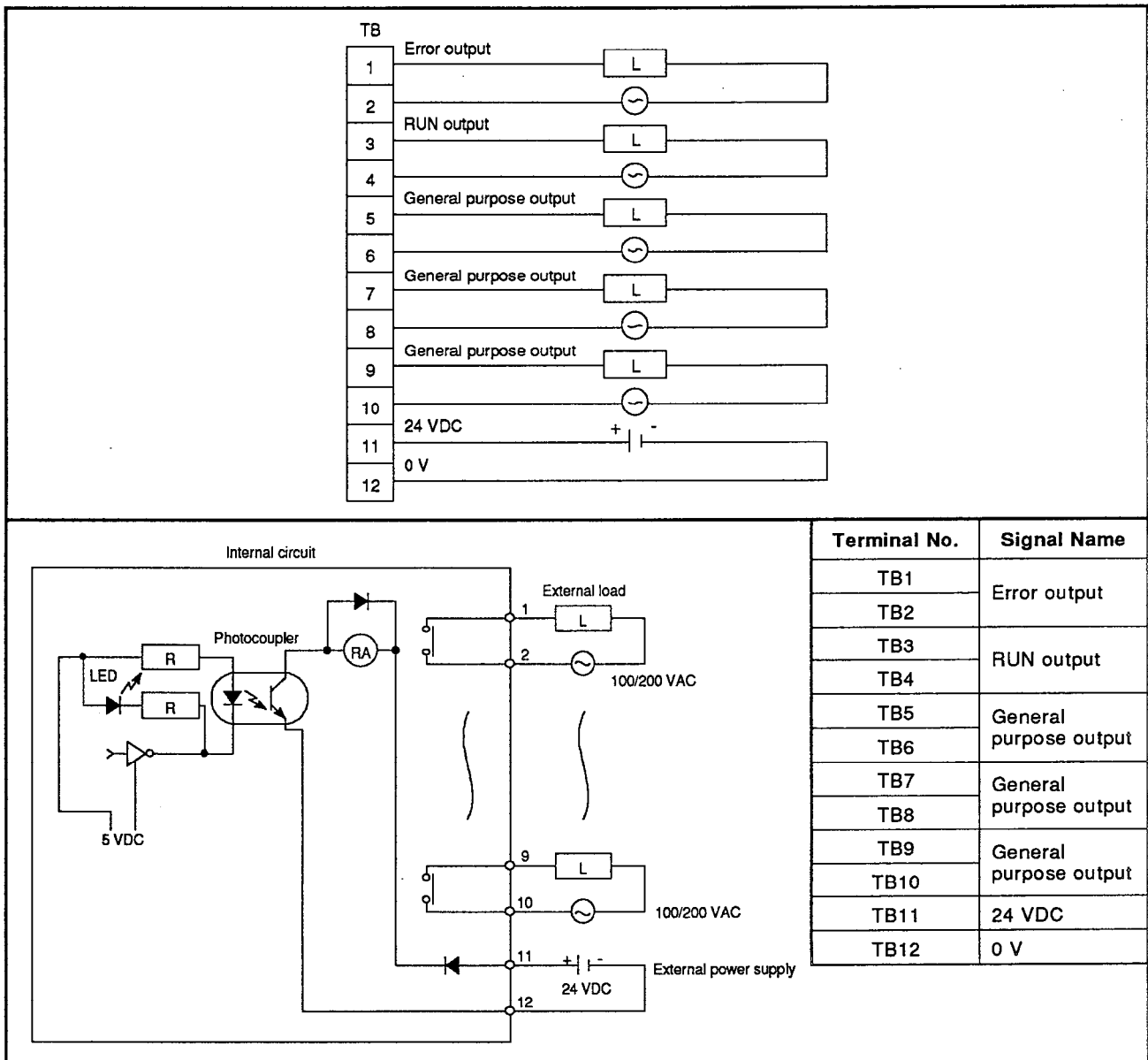
3.2.1 Performance specifications list

Item		Performance/Spec.		
		AS91	**A1SS91**	**A0J2-S91**
Output format		Contact output		
RUN output contact		1 point (ON at RUN)		
Error output contact		1 point (OFF when normal, ON at error)		
General purpose output points		3 points (switched ON/OFF by program)		
Isolation method		By photo-coupler		
Rated switching voltage & current		24 VDC 2 A (resistance load) / 1 point 5 A/all points 240 VAC 2 A (COS ϕ = 1)		
Minimum switching load		5 VDC 1 mA		
Maximum switching voltage		264 VDC 125 VDC		
Response time	OFF → ON	10 ms or less		
	ON → OFF	12 ms or less		
Life	Mechanical	20,000,000 times or more		
	Electrical	100,000 times or more at rated switching voltage & current load		
		100,000 times or more at 200 VAC 1.5 A, 240 VAC 1 A (COS ϕ = 0.7)		
		100,000 times or more at 200 VAC 0.75 A, 240 VAC 0.5 A (COS ϕ = 0.35)		
		100,000 times or more at 24 VDC 1 A, 100 VDC 0.1 A (L/R = 7 ms)		
Maximum switching frequency		3600 times per hour		
Surge suppressor		None		
Common method		No common (all points individual contact)		
Operation display		ON indicator (LED)		
External power supply	Voltage	24 VDC ±10 %, ripple voltage of 4 Vp-p or less		
	Current	30 mA (TYP.24 VDC all points ON)		
Internal current consumption (5 VDC)		80 mA	80 mA	90 mA
Number of occupied points		16 points (I/O allocation: 16 output points)	16 points (I/O allocation: 16 output points)	64 points (I/O allocation: 64 output points)
External cable connection format		12-point terminal board connector	13-point terminal board connector	
Power cable size		0.75 to 2 mm^2 (tightening torque: 68.6 N-cm		
Applicable solderless terminals		1.25-3 1.25-YS3A 2-S3 2-YS3A V1.25-3 V1.25-YS3A V2-S3 V2-YS3A		
Weight kg (lb)		0.410 (0.9)	0.225 (0.5)	0.580 (1.28)

3.2.2 External connections

(1) AS91
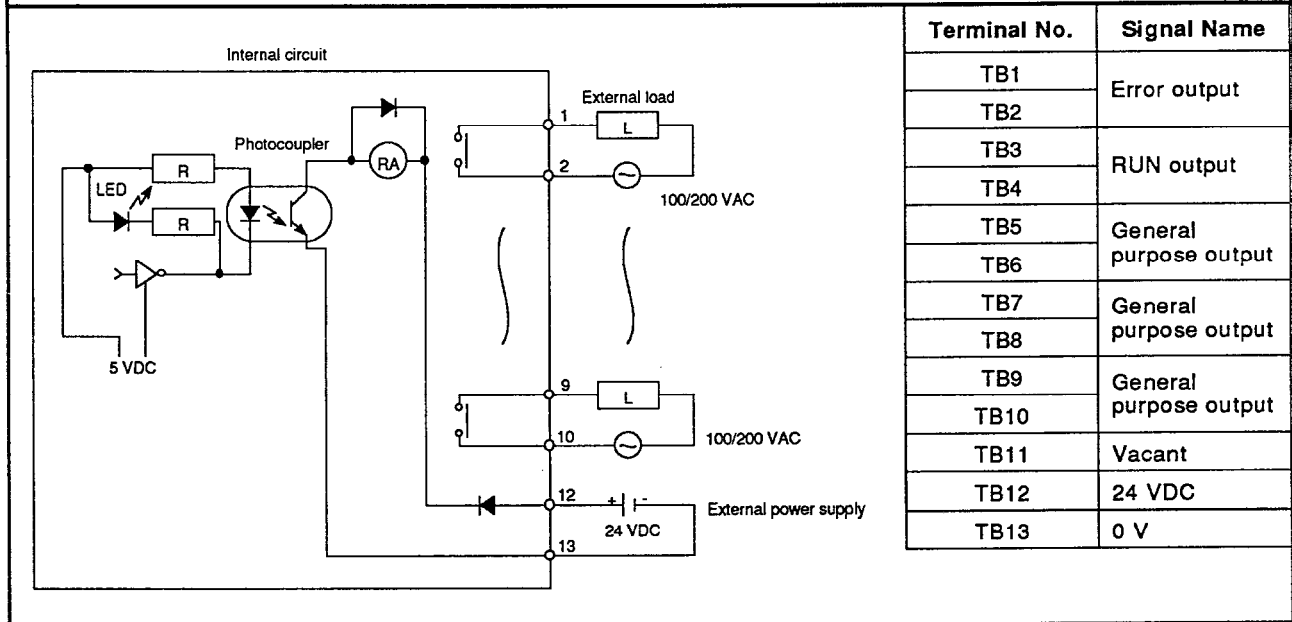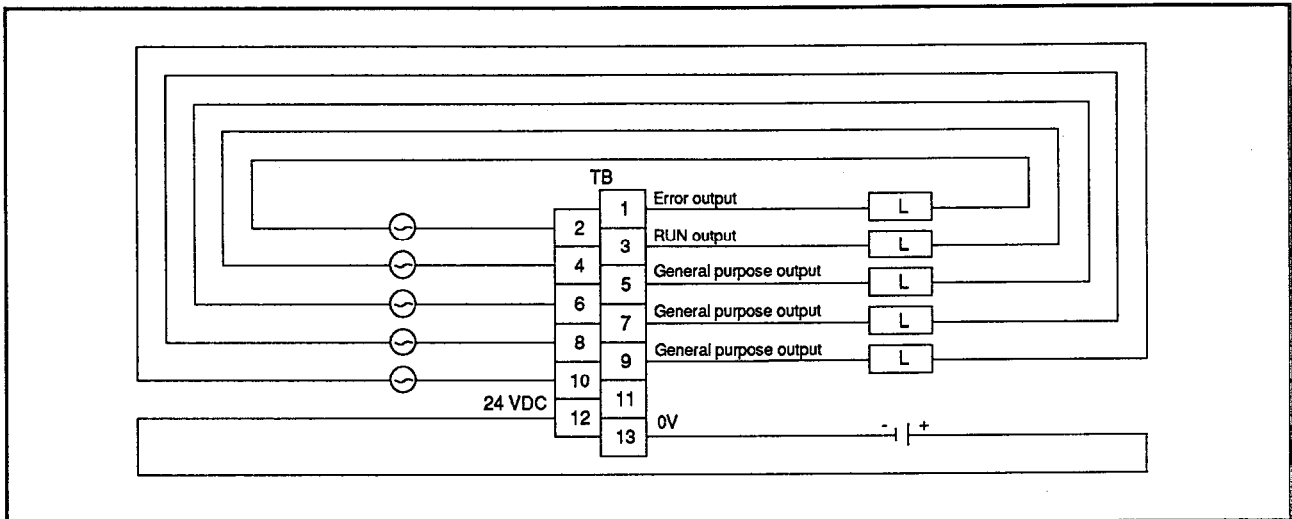
TB
1 — Error output — L
2 — ~
3 — RUN output — L
4 — ~
5 — General purpose output — L
6 — ~
7 — General purpose output — L
8 — ~
9 — General purpose output — L
10 — ~
11 — 24 VDC — + | | –
12 — 0 V

Internal circuit

LED — R — Photocoupler — RA — External load
R
5 VDC

1 — L
2 — ~ — 100/200 VAC

9 — L
10 — ~ — 100/200 VAC

11 — + | | – — External power supply
12 — 24 VDC

Terminal No.	Signal Name
TB1	Error output
TB2	
TB3	RUN output
TB4	
TB5	General purpose output
TB6	
TB7	General purpose output
TB8	
TB9	General purpose output
TB10	
TB11	24 VDC
TB12	0 V

(2) A1SS91

Terminal No.	Signal Name
TB1	Error output
TB2	
TB3	RUN output
TB4	
TB5	General purpose output
TB6	
TB7	General purpose output
TB8	
TB9	General purpose output
TB10	
TB11	Vacant
TB12	24 VDC
TB13	0 V

(3)   A0J2-S91

Terminal No.	Signal Name
TB1	Error output
TB2	
TB3	RUN output
TB4	
TB5	General purpose output
TB6	
TB7	General purpose output
TB8	
TB9	General purpose output
TB10	
TB11	24 VDC
TB12	0 V
TB13	FG
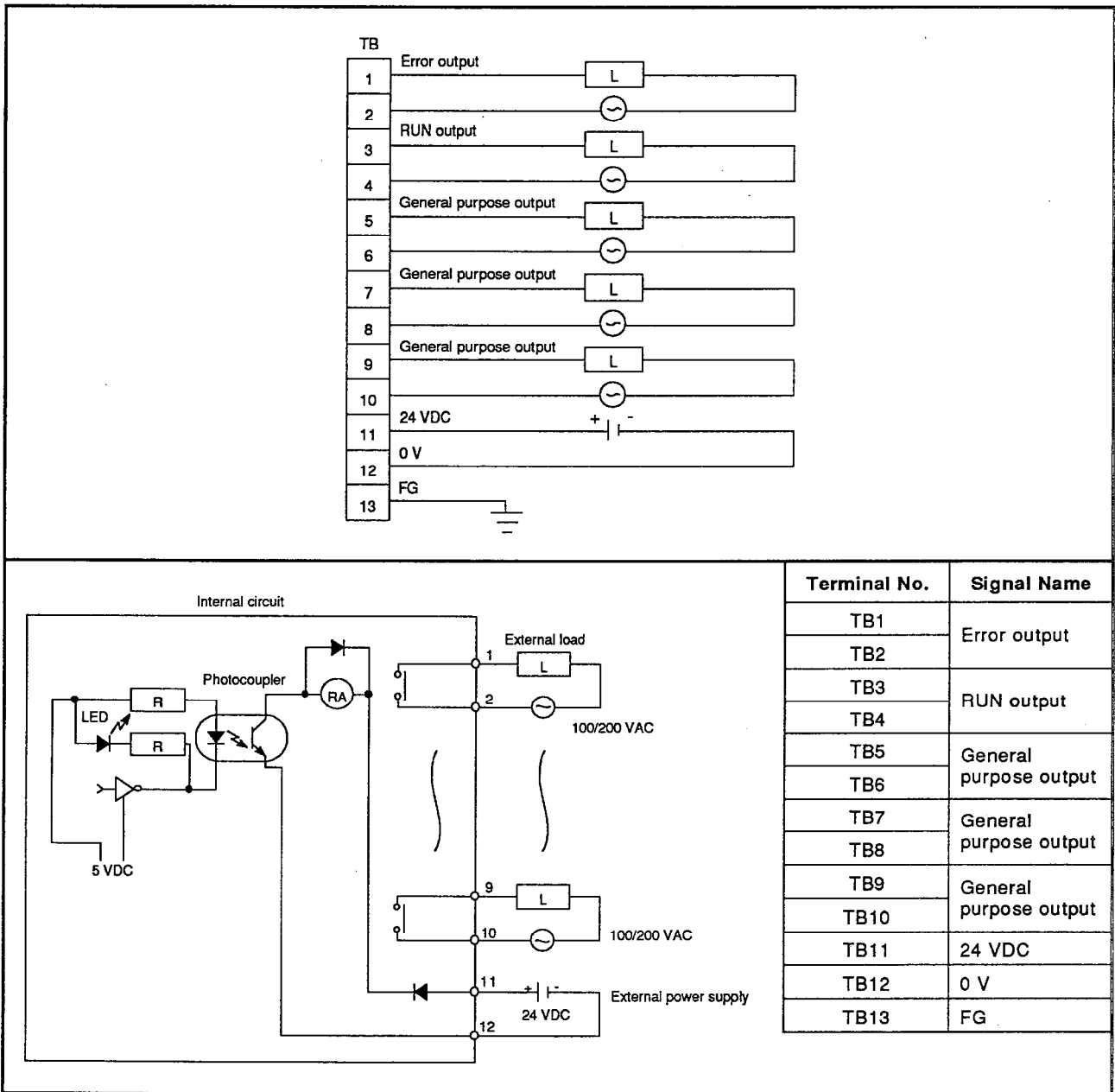
3.2.3 Connecting cable specifications

The specifications for the cable which connects the A0J2-S91 to the main base unit or the extension base unit, and which connects the A0J2-S91 to the A0J2CPU or the A0J2 I/O unit are shown below.

Cable Model	Cable Length (including connector) mm (inch)	5 VDC Supply Line Resistance (Ω [at 55 °C])	Weight kg (lb)	Connected Items
A0J2C04B	400 (15.75)	0.0626	0.160 (0.35)	Cable connecting "A" base to A0J2-S91
A0J2C10B	1000 (39.37)	0.126	0.260 (0.57)	
A0J2C04SB	400 (15.75)	0.025	0.11 (0.24)	Special cable connecting A1S base to A0J2-S91
A0J2C10SB	1000 (39.37)	0.048	0.18 (0.4)	
A0J2C01	80 (3.15)	0.047	0.025 (0.06)	Special cable for A0J2 stacking
A0J2C03	300 (11.81)	0.0617	0.085 (0.19)	Special cable for A0J2 arranged side by side
A0J2C06	550 (21.65)	0.0882	0.130 (0.29)	Special cable for A0J2 arranged end to end

3.3 Functions

The PC fault detection module functions are described below.

Function	Description	Reference Section
Error detection function	• Detects bus errors when at CPU RUN & STOP (error detection occurs approx. 1.5 seconds after bus error occurs.) *1 *2	Section 3.3.1
Self-loopback test function	• Determines if the PC fault detection module is functioning normally.	Section 3.3.2
Reset function	• Resets the system after a bus error has been detected. • Resets the system after a self-loopback test.	Section 3.3.3
5 V voltage check function	• Measures the PC fault detection module's internal 5 V voltage.	Section3.3.4

*1 When the CPU is set in the PAUSE status, the output status which existed immediately prior to the PAUSE is maintained, and the error detection outputs (Y8 to YF) therefore remain ON or OFF, resulting in detection of a bus error.
If M9040 (disable) is switched ON, the PC fault detection module will detect the CPU PAUSE status, and a bus error will not occur even if the Y8 to YF outputs remain ON or OFF. (Does not apply to A0J2CPU.)

*2 When a CPU STEP-RUN status occurs, the error detection Y output's (Y8 to YF) ON/OFF interval becomes irregular, resulting in an erroneous bus error detection. This bus error detection can be prevented by switching M9040 ON and the PC fault detection module's Y0 ON, and Y1 OFF, immediately prior to designating the CPU STEP-RUN status.

3.3.1 Error detection function

This function is used to monitor the Y-outputs allocated to the PC fault detection module in order to detect bus errors. The error detection program is run prior to the user sequence program.

(1) Error detection program

(a) When AS91 or A1SS91 is used at AnS(H), A2AS, A2USH, AnN, AnA, and AnUCPU

The following is an error detection program for the system configuration example shown below.

Power supply module	CPU	Input/output modules & special-function module			AS91/ A1SS91

```
X/Y
 0      10     20     30     40
 to     to     to     to     to
 F      1F     2F     3F     4F
```


Rung	Contact	Description	Output	Grouping
0	M9036	(constant ON contact)	[SET M9040]	Mandatory program
4	M9041	(PAUSE flag)	(Y0040)	
6	M9041 (NC)		(Y0041)	
8	M9039	(RUN contact)	(Y0042)	
10	*M9008	(self-diagnosis error)	(Y0043)	User error detection circuit. Contacts indicated by asterisks (*) are only examples. Conditions (multiple contacts OK) can be freely designated by the user.
12	*M9006	(battery error)	(Y0044)	
14	*M9005	(AC DOWN detection)	(Y0045)	
16	M9032	(1-second clock)	(Y0048)	Mandatory program
			(Y0049)	
			(Y004A)	
			(Y004B)	
			(Y004C)	
			(Y004D)	
			(Y004E)	
			(Y004F)	

User program
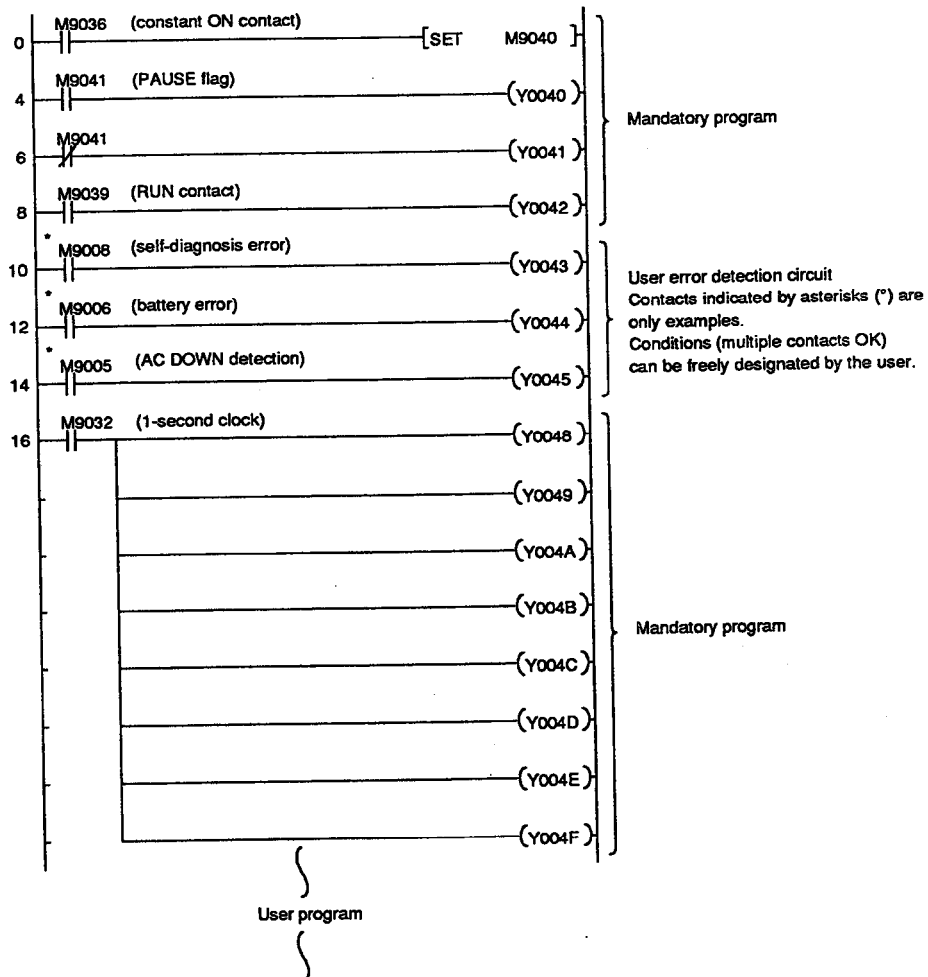
(b) When AS91 is used at Q2AS(H),QnACPU

The following is an error detection program for the system configuration example shown below.

Power supply module	CPU	Input/output modules & special-function module			AS91/A1SS91

```
                          X/Y
                          0      10     20     30     40
                          to     to     to     to     to
                          F      1F     2F     3F     4F
```
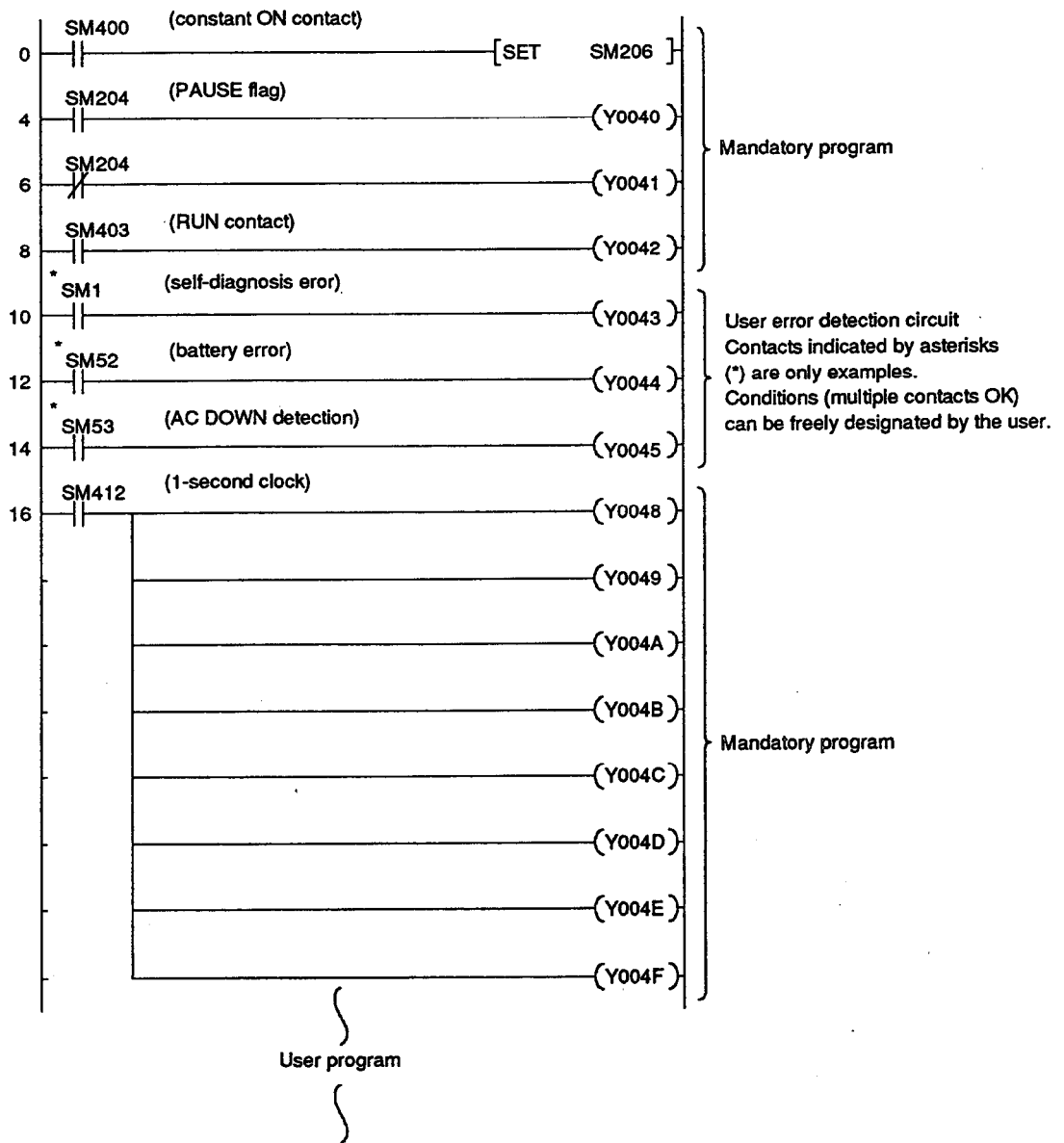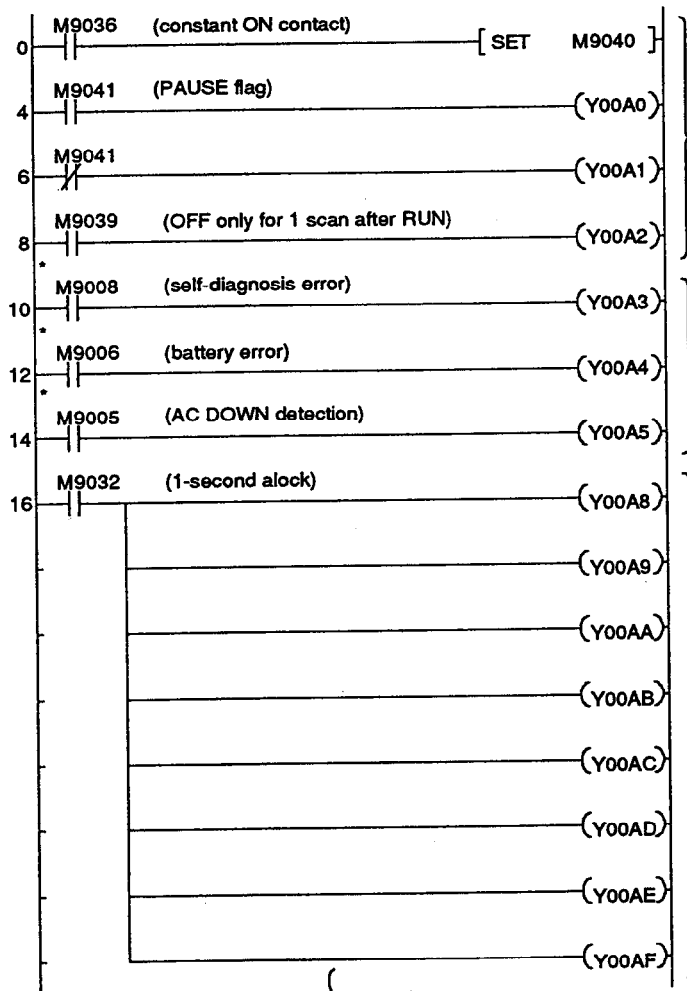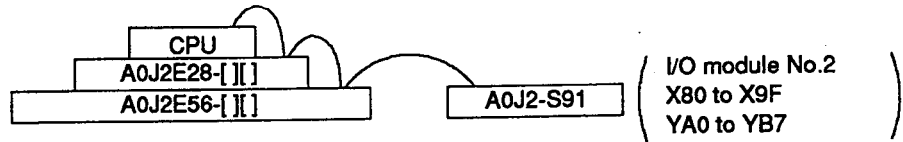
```
     SM400  (constant ON contact)
 0   ─┤├─────────────────────────────[SET    SM206 ]┐
                                                      │
     SM204  (PAUSE flag)                              │
 4   ─┤├──────────────────────────────────(Y0040)    │
                                                      │  Mandatory program
     SM204                                            │
 6   ─┤/├─────────────────────────────────(Y0041)    │
                                                      │
     SM403  (RUN contact)                             │
 8   ─┤├──────────────────────────────────(Y0042)   ─┘

     *SM1   (self-diagnosis eror)
10   ─┤├──────────────────────────────────(Y0043)   ─┐   User error detection circuit
                                                      │   Contacts indicated by asterisks
     *SM52  (battery error)                           │   (*) are only examples.
12   ─┤├──────────────────────────────────(Y0044)    │   Conditions (multiple contacts OK)
                                                      │   can be freely designated by the user.
     *SM53  (AC DOWN detection)                       │
14   ─┤├──────────────────────────────────(Y0045)   ─┘

     SM412  (1-second clock)
16   ─┤├──┬───────────────────────────────(Y0048)   ─┐
          │
          ├───────────────────────────────(Y0049)    │
          │
          ├───────────────────────────────(Y004A)    │
          │
          ├───────────────────────────────(Y004B)    │
          │                                           │  Mandatory program
          ├───────────────────────────────(Y004C)    │
          │
          ├───────────────────────────────(Y004D)    │
          │
          ├───────────────────────────────(Y004E)    │
          │
          └───────────────────────────────(Y004F)   ─┘
```
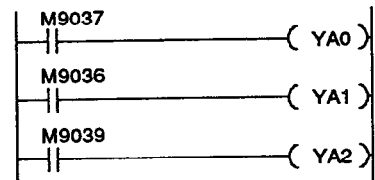
User program

(c) When A0J2-S91 is used at A0J2(H)CPU

The following is an error detection program for the system configuration example shown below.

CPU
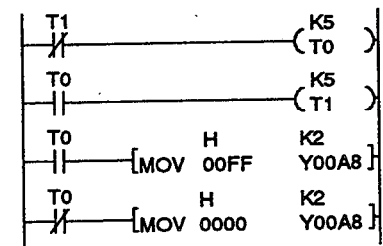A0J2E28-[ ][ ]
A0J2E56-[ ][ ]   A0J2-S91   (I/O module No.2
                                     X80 to X9F
                                     YA0 to YB7)

0   M9036 (constant ON contact)   [SET   M9040]

4   M9041 (PAUSE flag)   (Y00A0)

6   M9041   (Y00A1)

8   M9039 (OFF only for 1 scan after RUN)   (Y00A2)

10   M9008 (self-diagnosis error)   (Y00A3)

12   M9006 (battery error)   (Y00A4)

14   M9005 (AC DOWN detection)   (Y00A5)

16   M9032 (1-second alock)   (Y00A8)
                                               (Y00A9)
                                               (Y00AA)
                                               (Y00AB)
                                               (Y00AC)
                                               (Y00AD)
                                               (Y00AE)
                                               (Y00AF)

User program

Mandatory program
However the following program must be substituted because the A0J2CPU has no PAUSE function.

M9037   (YA0)
M9036   (YA1)
M9039   (YA2)

User error detectioncircuit
Contacts indicated by asterisks (*) are only examples.
Conditions (multiple contacts OK) can be freely designated by the user.

Mandatory program.
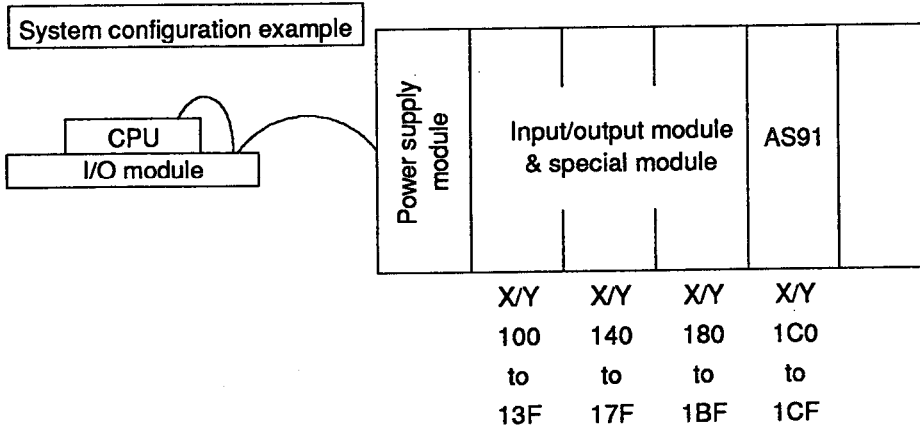However the following program must be substituted because the A0J2 has no M9032.

T1   K5
               (T0   )
T0   K5
               (T1   )
T0   H   K2
       [MOV 00FF   Y00A8]
T0   H   K2
       [MOV 0000   Y00A8]

POINTS

(1) The I/O numbers when A0J2-S91 is connected to AnS(H), A2AS, A2USH, Q2AS(H), AnN, AnA, AnU, and QnACPU are shown below. When programming, substitute different numbers for "Yn" used in the program example.

| System configuration example |

Power supply module | CPU | Input/output module & special module

X/Y 0 to F

X/Y 120 to 12F

A0J2-S91

"Number of extensionstages" setting is "1"
(X130 to X14F)
(Y150 to Y16F)
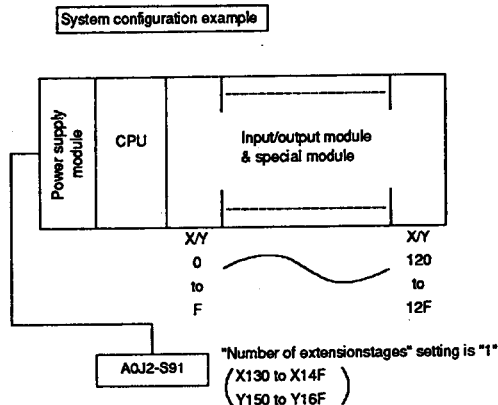
* The error detection "Y" in the above example is Y150 to Y15F.

(2) The I/O numbers when AS91 is used at A0J2(H)CPU are as shown below.

| System configuration example |

CPU
I/O module

Power supply module | Input/output module & special module | AS91

X/Y	X/Y	X/Y	X/Y
100	140	180	1C0
to	to	to	to
13F	17F	1BF	1CF

* When a building-block type extension base is connected to A0J2(H)CPU, the first address of the extension base is fixed as X/Y100. Moreover, the number of occupied points is set as 64 regardless of the modules installed at each slot.

(2) Error detection method

When an error is detected during monitoring of the "Y-outputs" (Y40 to 4F in item 1 example above) assigned to the PC fault detection module, the following processing occurs.

Device	Description	PC Fault Detection Module Status		Self-Diagnosis Result At CPU	Remarks
		LED	External Output		
Y0 Y1	• These outputs are used to cancel bus monitoring at a CPU PAUSE status, and is unrelated to the diagnosis function.	—	—	—	
Y2	• Switches ON/OFF according to the CPU operation status.	• LED OFF during RUN status.	• RUN output contact switches OFF. • Error output contact switches ON at bus error detection.	• Varies according to the type of CPU error.	• "ERROR" LED switches ON at bus error detection corresponding to Y2 when CPU RUN status is in effect.
Y3 to Y5	• Switched ON/OFF by user sequence program.	• LEDs corresponding to Y3 to Y5 switch ON/OFF according to the program.	• General purpose output contacts switch ON/OFF.	—	• General purpose output contacts switch OFF at bus error detection.
Y6 Y7	Unused	—	—	—	• Cannot be switched ON/OFF by user.
Y8 to YF	• If any point fails to alternate between 0.5 seconds ON and 0.5 seconds OFF, a bus error will be detected within 1.5 seconds.	• "ERROR" LED switches ON. • Y8 to YF switch ON/OFF according to content detected by the PC fault detection module.	• User output contact switches ON. • RUN and general purpose output contacts switch OFF.	• M9000 (blown fuse) ON. • M9008 (self-diagnosis error) ON.	• When a parameter error occurs in the RUN mode, CPU operation can be stopped by designating a "stop" setting for a blown fuse. (Default setting is "continue".)

POINTS

(1) If a CPU PAUSE status occurs when no PAUSE circuit (Y0, Y1, or Y40, Y41 in the program example) has been created, this will be erroneously processed as an error. If this occurs, the PC fault detection module's "ERROR" LED will switch ON, the error external output will switch ON, and the RUN external output will switch OFF. (For details, see Section 3.3)

(2) If the scan time exceeds 500 ms at CPU types with variable watchdog timers, this will be interpreted as an error even if the bus is normal. When the scan time exceeds 500 ms, an error detection program should be used as an interrupt program in order to enable program execution within 500 ms.

3.3.2 Self-loopback test function

The self-loopback test function is used to check the operation of the PC fault detection module as an isolated unit.

- Unit test procedure:
  1. Stop the CPU.
  ↓
  2. Press and hold the module's TEST switch for 1.5 seconds or longer.
  ↓
  3. Operation is normal if the "ERROR" LED switches ON, and the error output contact switches ON.

POINTS

(1) If the self-loopback test is conducted during a CPU RUN status, an error will be detected, and the status described in Section 3.3.1 (2) will be established.
Stop the CPU before conducting the self-loopback test.

(2) The self-loopback test will not be performed if a CPU or bus error is active. Cancel any errors before conducting the self-loopback test.

3.3.3 Reset function

This function is used to reset the error output contact which switches ON when a bus error is detected (error output contact is switched OFF). It is also used to reset the error output contact which switches ON when a self-loopback test error occurs.
The error output contact can be switched OFF by pressing the RESET switch on the module.

POINT

PC fault detection module errors are not reset when a CPU reset occurs. Either press the RESET switch, or turn the CPU power OFF.

3.3.4 5 V voltage check function

This function is used to measure the 5 V voltage supplied via the bus. The measurement should be conducted at the PC fault detection module's 5V check terminal, using a tester.

4. NOMENCLATURE AND SETTINGS

The PC fault detection module nomenclature and settings are described in this section.

No.	Name	Description			
(1)	Output LED, error LED		Normal	Error	
				Data Bus	Other Than Data Bus
		CPU RUN status	ERR LED: OFF RUN LED: ON Y3 to Y5 : Varies according to application Y8 to YF : Flicker	ERR LED: ON RUN LED: OFF Y3 to Y5 : OFF Y8 to YF : Varies	
		CPU STOP status	ERR LED: OFF RUN LED: OFF Y3 to Y5 : OFF Y8 to YF : OFF		
(2)	Test switch	Switch is pressed continuously for self-loopback test.			
(3)	5 V check terminal	Test terminal for measuring internal 5 V power supply by tester.			
(4)	Reset switch	Resets (cancels) an error output without switching the CPU power OFF.			
(5)	Rotary switch *	For this module, must be designated at the final station number.			
(6)	5 V supply line switching SW *	For A0J2 systems, set to CPU5V or EX5V depending on the A0J2 system configuration. For "A", "A1S" base unit systems, set to EX5V.			
(7)	Error output terminal	Output when a bus error is detected.			
(8)	RUN output terminal	Output at CPU RUN and PAUSE statuses. (Forced OFF when bus error occurs.)			
(9)	General purpose output terminal	Output when general purpose outputs are used. (Forced OFF when bus error occurs.)			
(10)	External power supply terminal	Supplies 24 VDC from an external source.			
(11)	"Number of extension stages" setting switch *	Designates the number of extension stages for "A" base → A0J2-S91 systems.			
(12)	"A" base → A0J2-S91 switching switch	Used for switching in systems configured with A0J2 units, and in "A" base → A0J2-S91 systems.			
(13)	Extension cable connector *	Connector for cable which connects units in systems consisting of A0J2 units.			

*: Applies only to A0J2-S91.

5. EXAMPLES OF PC FAULT DETECTION MODULE APPLICATIONS

Programming and hardware examples when using the PC fault detection module are discribed in this section.

Although PC CPU and memory failures are normally detected by the self-diagnosis function, such detection becomes impossible when errors occur at the input/output control area (bus error), etc., resulting in an all-points ON or all-points OFF condition which makes it impossible to maintain normal and safe control.

A failsafe circuit must be therefore be installed to prevent machine damage or accidents in the event of a programmable controller failure.

In order to detect bus errors, the PC fault detection module monitors Y-outputs which are switched ON/OFF by the sequence program.

This function enables part of the failsafe circuit functions described in the CPU user's manuals to be executed by the PC fault detection module.

Examples of the PC fault detection module applications are shown in the following pages.
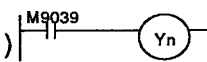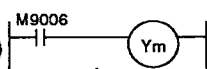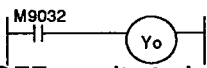
Example of system circuit design shown in CPU user's manual

For AC

For AC/DC
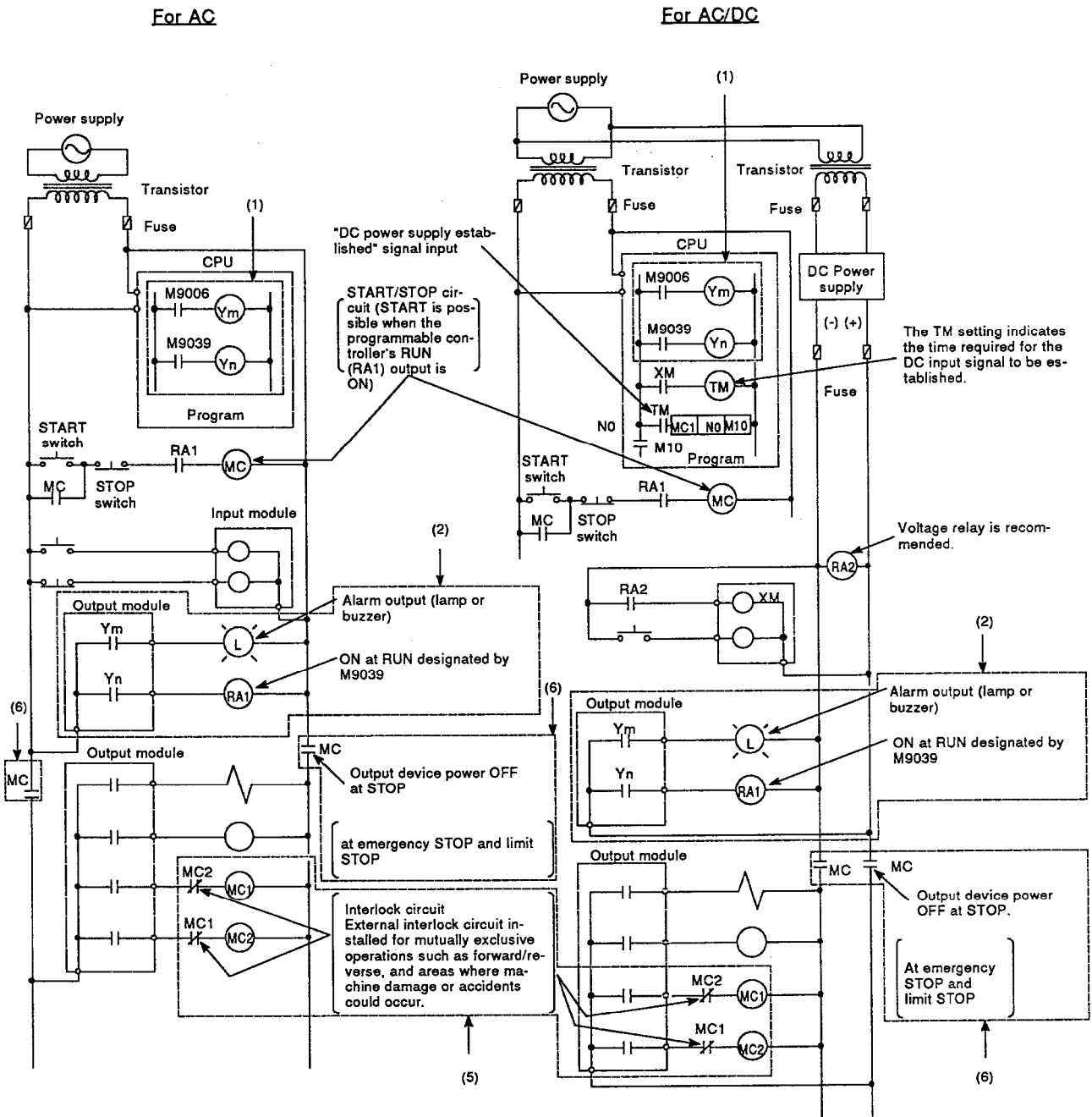
> **POINT**
>
> For details regarding the power ON procedure, refer to the relevant CPU user's manual.

Example of bus error detection circuit design shown in CPU user's manual
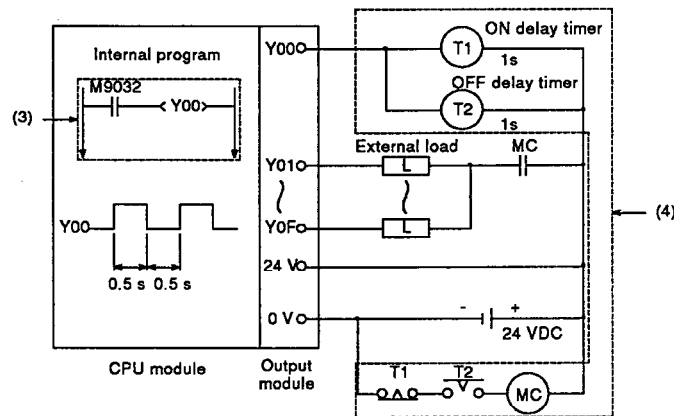
(1) Designating the "Yn" in sequence program (1) $\left[\!\!\!\begin{array}{c} \text{M9039} \\ \dashv\vdash \end{array}\!\!\!\right.$──(Yn)──┤ as "Yn2" ("n" varies according to the slot where the PC fault detection module is installed), will cause the PC fault detection module's RUN contact output to switch ON.
The CPU RUN status can be monitored by connecting the (RA1) at (2) to the PC fault detection module's RUN contact output.

(2) Designating "Ym" in sequence program (1) $\left[\!\!\!\begin{array}{c} \text{M9006} \\ \dashv\vdash \end{array}\!\!\!\right.$──(Ym)──┤ as "Yn3" will cause the PC fault detection module's general purpose contact output to switch ON.
An external output of the error output designated by the user is possible by connecting the (L) at (2) to the PC fault detection module's general purpose contact output.
There are 3 general purpose outputs: Yn3 to Yn5.
General output conditions can be designated as desired by the user, or by the CPU's self-diagnosis special relay.
Because general purpose outputs switch OFF when a bus error, etc., is detected by the PC fault detection module, they can be used as an interlock function to prevent erroneous external load related operation.

(3) Designating "Y0" in sequence program (3) $\left[\!\!\!\begin{array}{c} \text{M9032} \\ \dashv\vdash \end{array}\!\!\!\right.$──(Yo)──┤ as "Yn8 to YnF" (8 coils) will cause the program ON/OFF results to be transmitted to the PC fault detection module via the bus. If any point remains ON or OFF at this time, the error contact output will switch ON approx. 1.5 seconds after this error is detected.
(MC) outputs can be received as error contact outputs by using the external ON delay timer and OFF delay timer in (4).

POINT

The PC fault detection module is used to detect errors at the programmable controller CPU and at the bus. It cannot prevent mechanical problems such as that shown at (6).
Mechanical interlocks should be devised by the user through the use of external circuits.
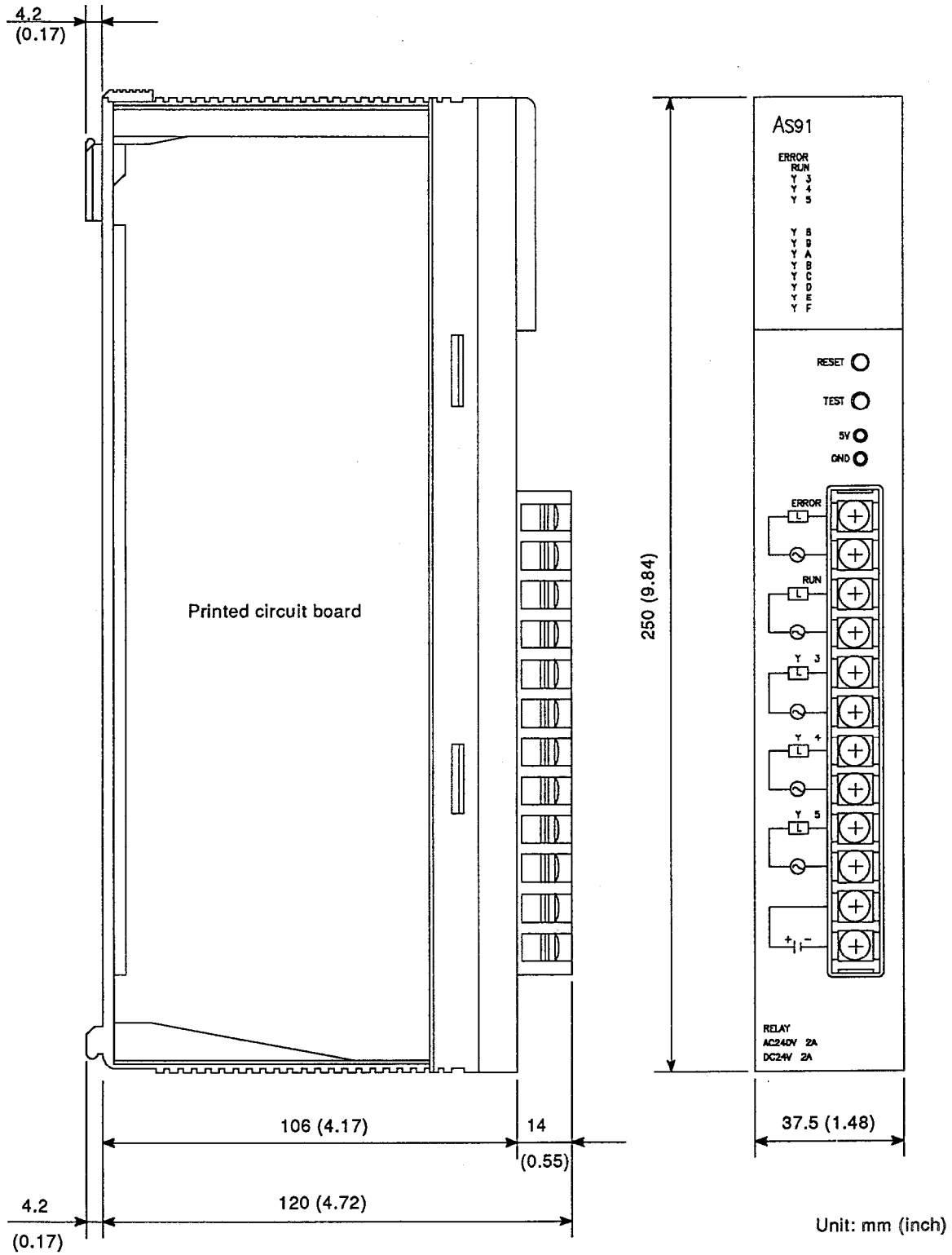
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6. TROUBLESHOOTING

This section describes the troubleshooting when the PC fault detection module detects errors.

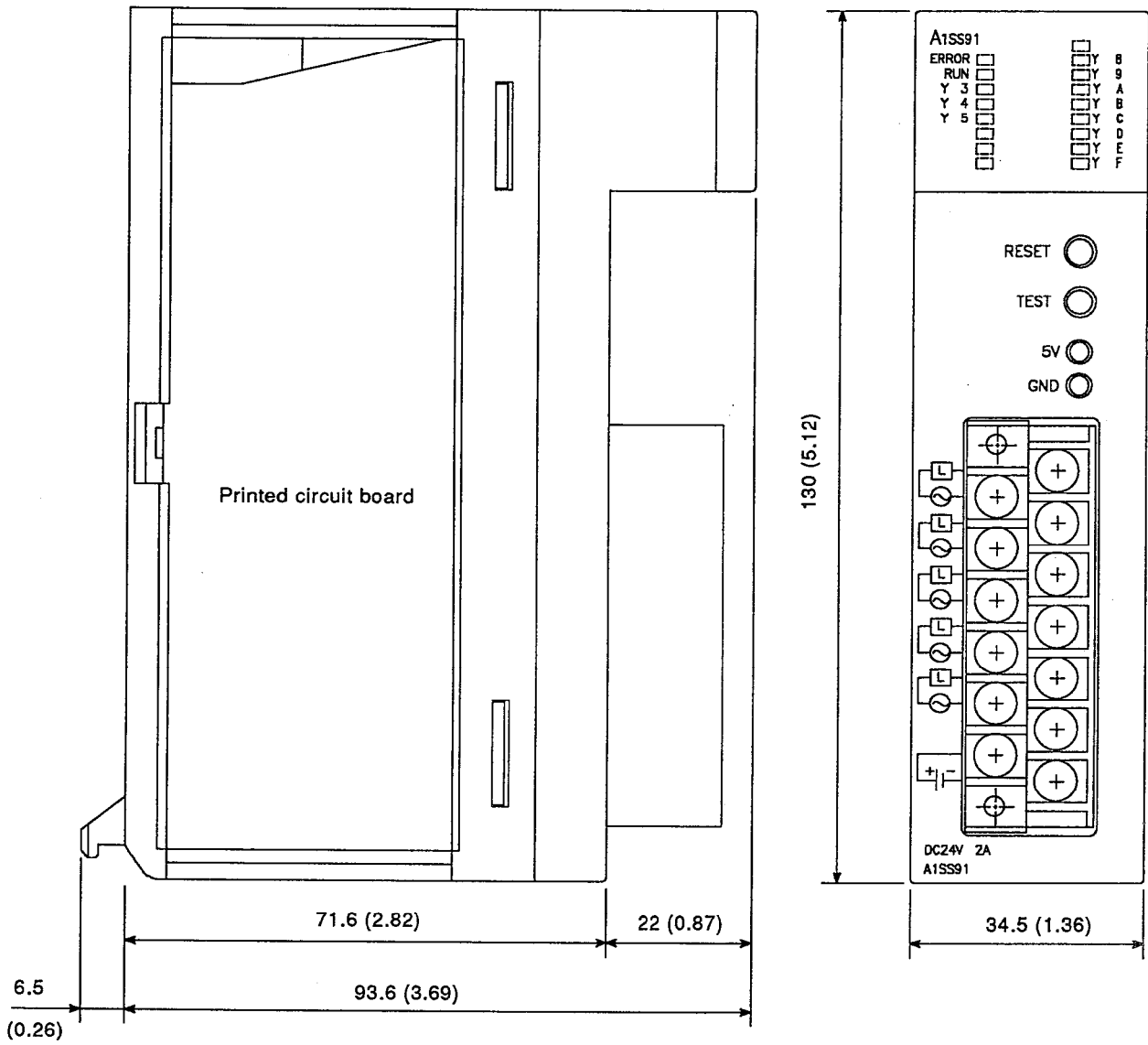| PC Fault Detection Module Status	CPU Status	Problem Cause	Corrective Action
Error detection (ERR LED OFF, RUN LED OFF)	RUN LED ON (normal operation)	• CPU or main base/extension base failure	• Remove all I/O and special-function modules, and switch the CPU power ON with only the PC fault detection module installed. . . . If operation is normal: One of the I/O or special-function modules is faulty. . . . If error occurs again: CPU or base hardware is faulty. Replace the CPU or base and repeat the procedure until the problem source is identified. (If there are extension base units, check the main base unit first, then check each of the extension base units one at a time.)
		• Extension cable failure	• Plug the cable in securely or replace it if required. . . . If operation is normal after plugging in cable: The problem was caused by poor contact at a cable connector. . . . If operation is normal when cable is replaced: The cable was severed, or had bent pins, etc. . . . If error occurs again: Faulty base or module.
		• I/O module or special module failure	• Remove all I/O and special modules, then install the modules one at a time. . . . If error occurs: The module just installed is faulty, causing erroneous signal outputs to the bus.
	RUN LED flashing or OFF	• CPU self-diagnosis error	• Check the CPU error code, and eliminate the error cause.

APPENDIX

APPENDIX 1 EXTERNAL DIMENSIONS

(1) AS91

Printed circuit board

4.2
(0.17)

250 (9.84)

106 (4.17)

14
(0.55)

4.2
(0.17)

120 (4.72)

37.5 (1.48)

AS91

ERROR
RUN
Y 3
Y 4
Y 5

Y 8
Y 9
Y A
Y B
Y C
Y D
Y E
Y F

RESET
TEST
5V
GND

ERROR
RUN
Y 3
Y 4
Y 5

RELAY
AC240V 2A
DC24V 2A

Unit: mm (inch)

(2) A1SS91

Printed circuit board

71.6 (2.82)   22 (0.87)

93.6 (3.69)

6.5
(0.26)

130 (5.12)

A1SS91
ERROR
RUN
Y 3
Y 4
Y 5

Y B
Y 9
Y A
Y B
Y C
Y D
Y E
Y F

RESET

TEST

5V

GND

DC24V 2A
A1SS91

34.5 (1.36)

Unit: mm (inch)

(3) A0J2-S91

Unit: mm (inch)

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 not to 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 of 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 Railway companies or National Defense purposes 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 in terms of safety and control system, please consult with Mitsubishi and discuss the required specifications.

PC Fault Detection Module Type AS91,A1SS91,A0J2-S91

User's Manual

MODEL	A1SS91-U-E
MODEL CODE	13J828
IB(NA)-66626-B(0312)MEE	

When exported from Japan, this manual does not require application to the Ministry of Economy, Trade and Industry for service transaction permission.

Specifications subject to change without notice.