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April 1st, 2010
Renesas Electronics Corporation

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RENESAS

User's Manual

IE-V850ES-G1

In-Circuit Emulator

Target Device
V850ES

Document No. U16313EJ2V0UM00 (2nd edition)
Date Published January 2007 NS CP(K)

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- When the product is disassembled, reconstructed, or modified by the user
- When the product receives a heavy shock such as being dropped or falling down
- When the product is used with excessive voltage or is stored outside the guaranteed temperature range
- When power is applied while the AC adapter, PC interface cable, or target system is not connected securely
- When the AC adapter cable, PC interface cable, or emulation probe is excessively twisted or stretched
- When an AC adapter cable other than the one supplied with the IE-V850ES-G1 is used
- When water is spilled on the product
- When the product and target system are connected in a system in which the voltage potential between the GND of the product and the target system GND differ
- When the connector or cable is connected or disconnected while the power is being applied to the product
- When an excessive load is applied to the connector or socket

2. Cautions on safe use

- The AC adapter cable supplied with the product is exclusively for this product, so do not use it with other products.
- The product heats up (to approx. 50 to 60°C) when it operates for a long time. Take care not to receiver injuries such as burns from a rise in the temperature.
- Be very careful to avoid electric shocks. There is risk of electrical shock if the product is used as described in **1. Cases in which NEC Electronics warranty does not apply**.
- This equipment is intended for indoor use only.
- Before connecting the equipment to AC-mains the casing must be closed.

INTRODUCTION

Target Readers

This manual is intended for users who design and develop application systems using V850ES microcontrollers.

Purpose

Debugging can be performed efficiently with this emulator (IE-V850ES-G1) connected to a dedicated emulation board when designing and developing application systems using V850ES microcontrollers.
The purpose of this manual is to describe the proper operation of the IE-V850ES-G1 and its basic specifications.

Organization

This manual is broadly divided into the following parts.

- Overview
- Names and functions of parts
- Connection of parts
- Factory settings

How to Read This Manual

It is assumed that the reader of this manual has general knowledge in the fields of electrical engineering, logic circuits, and microcontrollers.

To learn about the basic specifications and operation
→Read this manual in the order listed in the **CONTENTS**. The mark <R> shows major revised points. The revised points can be easily searched by copying an "<R>" in the PDF file and specifying it in the "Find what:" field.

To learn the operation methods, command functions, etc., of the IE-V850ES-G1
→Read the user's manual of the debugger (sold separately) that is used.

Conventions

Note: Footnote for item marked with **Note** in the text
Caution: Information requiring particular attention
Remark: Supplementary information
Numeral representation: Binary ··· ×××× or ××××B
Decimal ··· ××××
Hexadecimal ··· ××××H
Prefix representing a power of 2 (address space, memory capacity):
K (kilo): $2^{10} = 1024$
M (mega): $2^{20} = 1024^2$

Terminology

The meanings of terms used in this manual are listed below.

Target device	This is the device to be emulated.
Target system	The system (user-built system) to be debugged. This includes the target program and hardware configured by the user.
Emulation CPU	CPU that executes the program created by the user in the emulator.

Related Documents When using this manual, refer to the following manuals.
The related documents (user's manuals) indicated in this publication may include preliminary versions. However, preliminary versions are not marked as such.

○ **Documents Related to Development Tools (User's Manuals)**

Document Name		Document Number
IE-V850ES-G1 (In-Circuit Emulator for V850ES)		This manual
IE-703204-G1-EM1 (In-Circuit Emulator Emulation Board for V850ES/SA2, V850ES/SA3)		U16622E
IE-703220-G1-EM1 (In-Circuit Emulator Emulation Board for V850ES/ST2)		U17205E
IE-703228-G1-EM1 (In-Circuit Emulator Emulation Board for V850ES/PM1)		U16879E
IE-703288-G1-EM1 (In-Circuit Emulator Emulation Board for V850ES/SG1, V850ES/SG2, V850ES/SJ2, V850ES/SG3, V850ES/SJ3)		U16697E
PM+ Ver.6.00 Project Manager		U17178E
CA850 Ver.3.00 (C Compiler Package)	Operation	U17293E
	C Language	U17291E
	Link Directives	U17294E
	Assembly Language	U17292E
ID850 Ver.3.00 (Integrated Debugger)	Operation Windows™ Based	U17358E
SM850 Ver.2.50 (System Simulator)	Operation Windows Based	U16218E
SM850 Ver. 2.00 or Later System Simulator	External Parts User Open Interface Specifications	U14873E
RX850 Ver. 3.20 or Later Real-Time OS	Basics	U13430E
	Installation	U17419E
	Technical	U13431E
	Task Debugger	U17420E
RX850 Pro Ver. 3.21 Real-Time OS	Function	U18165E
	Internal Structure	U18164E
	Task Debugger	U17422E
AZ850 Ver.3.30 System Performance Analyzer		U17423E
TW850 Ver.2.00 Performance Analysis Tuning Tool		U13737E
PG-FP4 Flash Memory Programmer		U15260E

Caution The related documents listed above are subject to change without notice. Be sure to use the latest version of each document for designing.

CONTENTS

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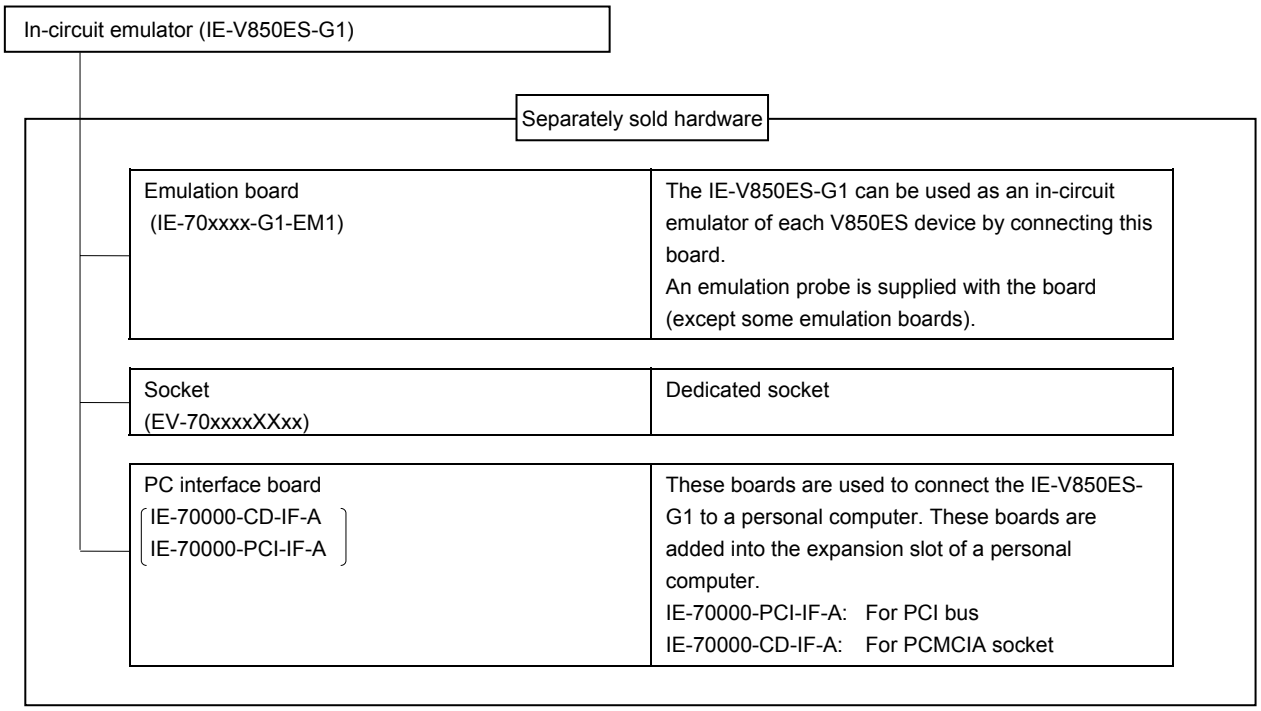
CHAPTER 1 OVERVIEW

The IE-V850ES-G1 is an in-circuit emulator that efficiently debugs hardware and software during the development of systems that employ V850ES microcontrollers.

This in-circuit emulator incorporates functions such as a break/trace function using events, a coverage function for program performance evaluation, and a timer/counter function.

To perform debugging, the emulation board (sold separately) corresponding to the relevant device must be connected.

1.1 Hardware Configuration



1.2 Features

- Maximum operating frequency: 20 MHz
- A configuration that provides the highest possible equivalence with the target device is realized by omitting buffers between signal lines.
- The following pins can be masked (although these differ depending on the emulation board to be used).
  $\overline{\text{RESET}}$, NMI, $\overline{\text{WAIT}}$, $\overline{\text{HLDRQ}}$
- The dimensions and environmental conditions for operation are as follows.

Parameter		Value
Maximum operating frequency		20 MHz
Supply voltage		AC 100 to 240 V
Power consumption		50 W (max.)
External dimensions (Refer to **APPENDIX A DIMENSIONS**)	Height	210 mm
	Width	105 mm
	Depth	249 mm
Weight		2400 g
Operating temperature range		0 to 40°C
Storage temperature range		0 to 45°C
Ambient humidity range		10 to 80% RH

1.3 Function Specifications

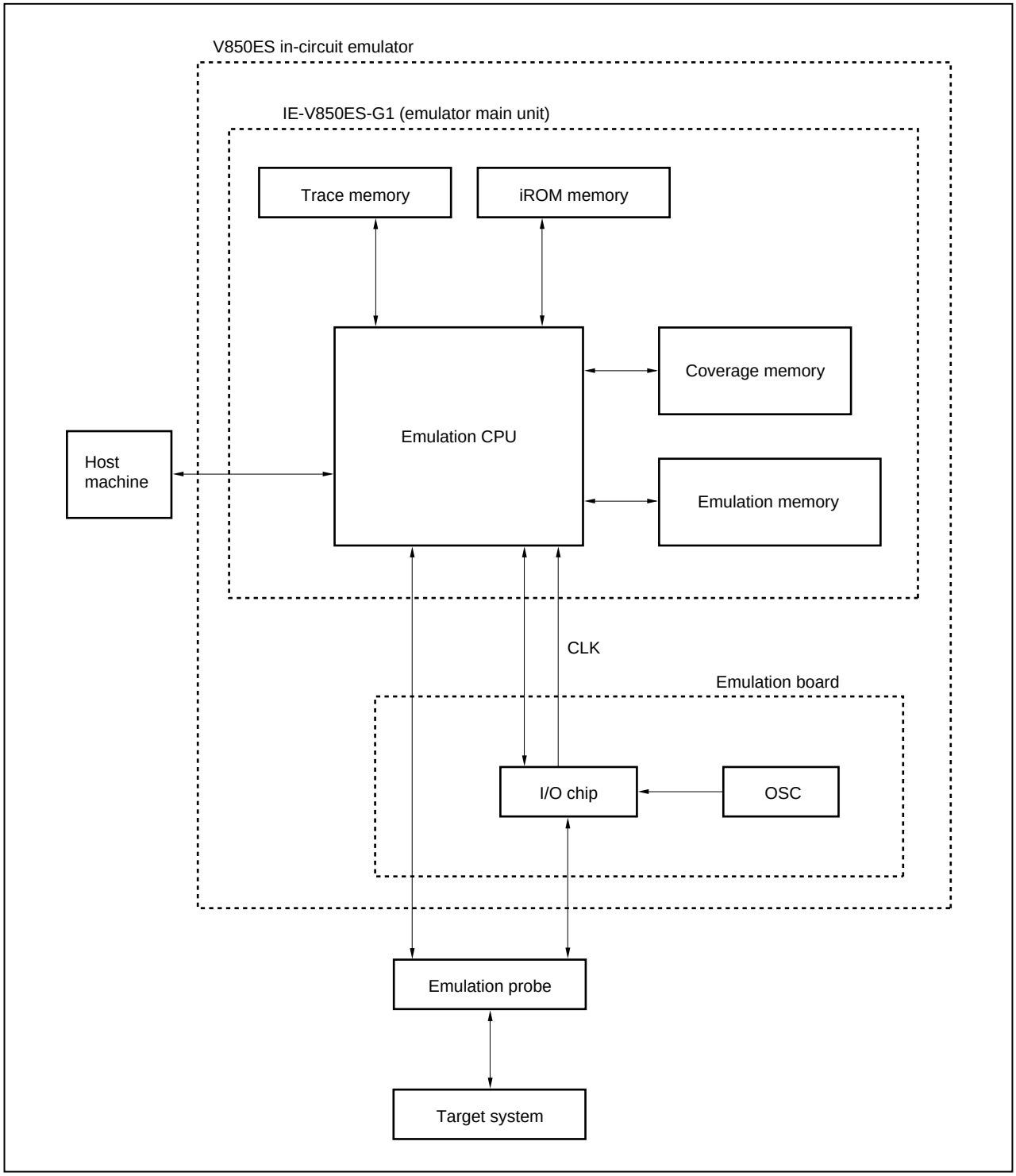
Item			Specification
Emulation memory capacity	Internal ROM		1 MB
	External memory		4 MB
Execution/pass detection coverage memory capacity	Internal ROM		1 MB
	External memory	In ROMless mode	2 MB
		When using iROM	1 MB
Trace memory capacity			168 bits × 32 K frames
Time measurement function			Measurement enabled with time tag or three timers
External logic probe			8-bit external trace possible
			Trace/break event setting possible
Break function			Event break
			Step execution break
			Forced break
			Fail safe break • Illegal access to peripheral I/O • Access to guard space • Write into ROM space

Caution Some of the functions may not be supported depending on the debugger used.

1.4 Hardware Configuration

The basic hardware configuration of the IE-V850ES-G1 is as follows.

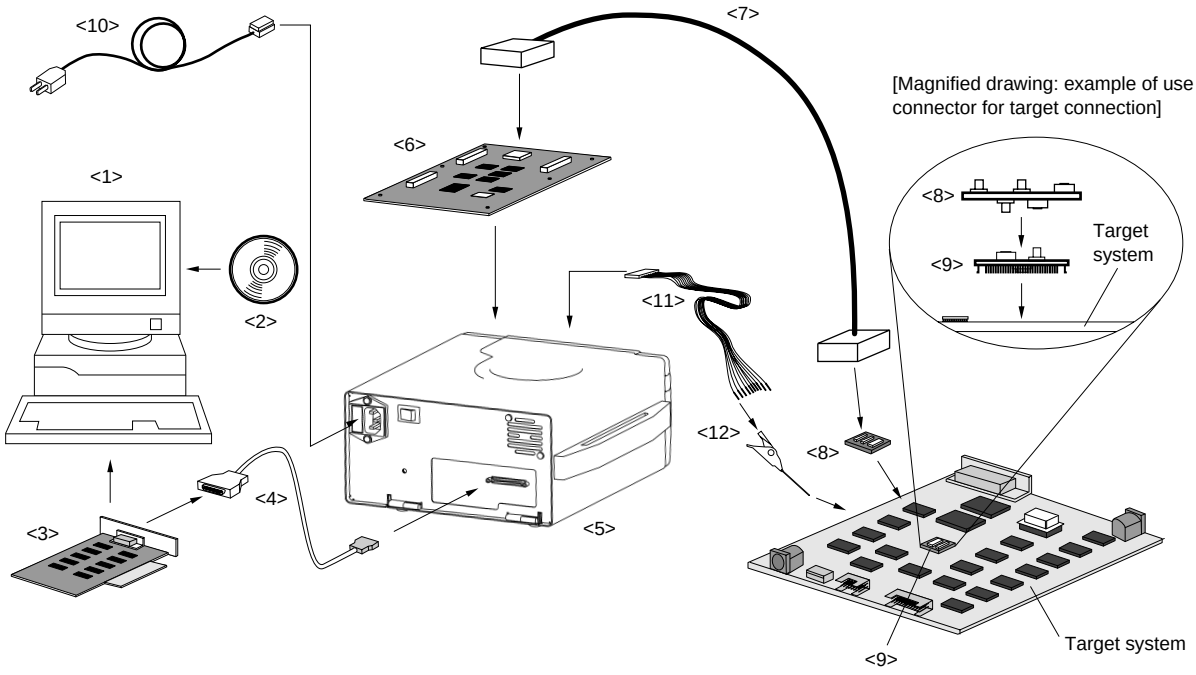
Figure 1-1. Basic Hardware Configuration



1.5 System Configuration

The system configuration when connecting the emulation board to the IE-V850ES-G1, which is then connected to a personal computer (PC-9800 series, PC/AT™ or compatibles) is illustrated below.

Figure 1-2. System Configuration



Remark

<1> Personal computer (PC-9800 series, PC/AT or compatibles)

<2> Debugger (sold separately), device file (available separately)[Note 1]

<3> PC interface board
(IE-70000-PCI-IF-A, IE-70000-CD-IF-A: Sold separately)

<4> Two types of PC interface cables (included)

<5> IE-V850ES-G1 (this product)

<6> Emulation board (sold separately)

<7> Emulation probe[Note 2]

<8> Conversion adapter[Note 2]

<9> Target connector[Note 2]

<R> <10> Power cable (included)

<11> External logic probe (included)

<12> External logic clip (included)

Notes 1. The device file can be downloaded from the website of NEC Electronics (http://www.necel.com/micro).

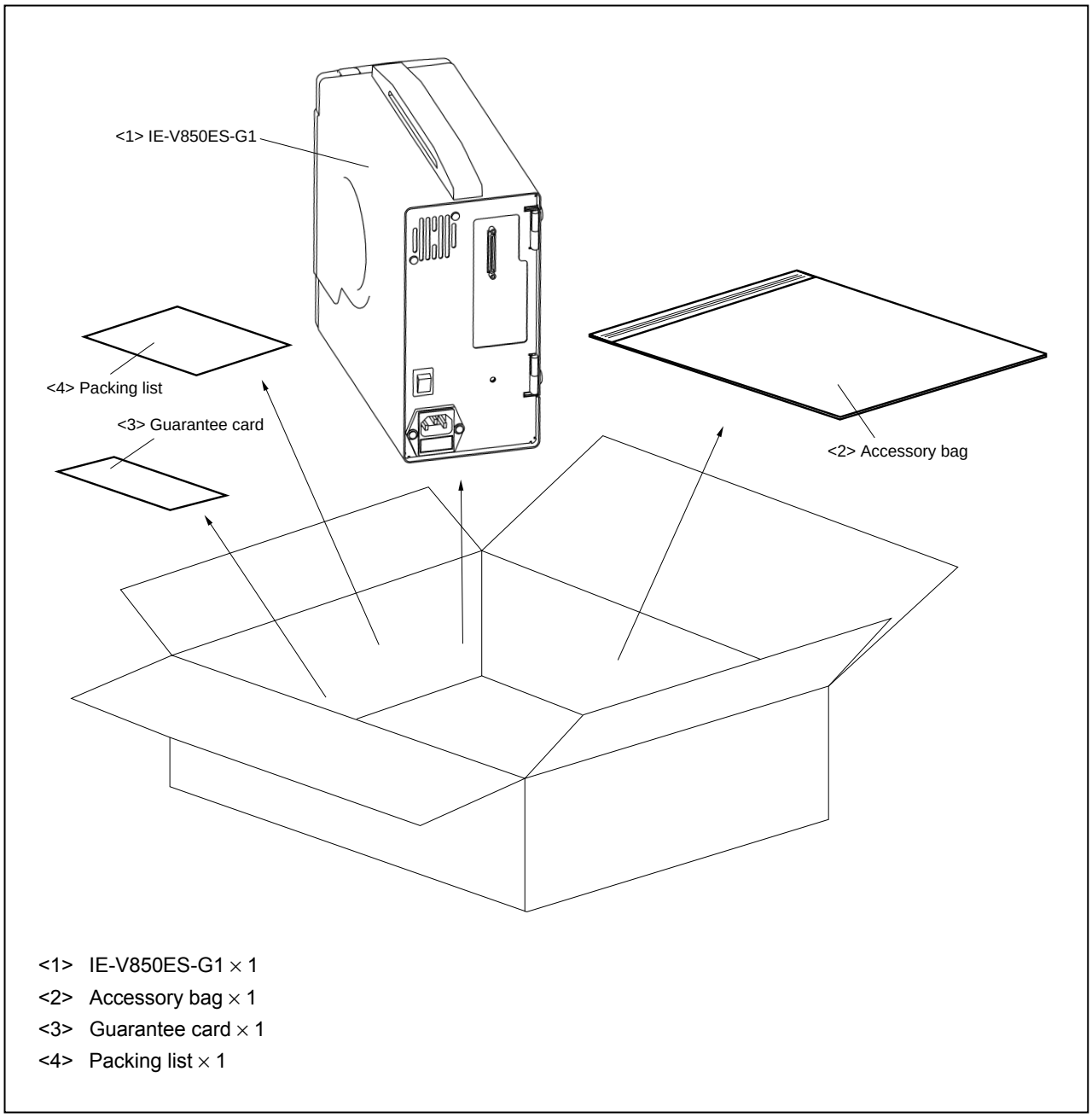
2. For the emulation probe, conversion adapter, and target connector, refer to the user's manual of the emulation board.

1.6 Contents in Carton

The carton of the IE-V850ES-G1 contains a main unit, guarantee card, packing list, and accessory bag.

Make sure that the accessory bag includes this manual and cables. In case of missing or damaged contents, please contact an NEC Electronics sales representative or an NEC Electronics distributor.

Figure 1-3. Contents in Carton



<1> IE-V850ES-G1 × 1
<2> Accessory bag × 1
<3> Guarantee card × 1
<4> Packing list × 1

Check that the accessory bag contains this manual, an accessory list, and the following accessories.

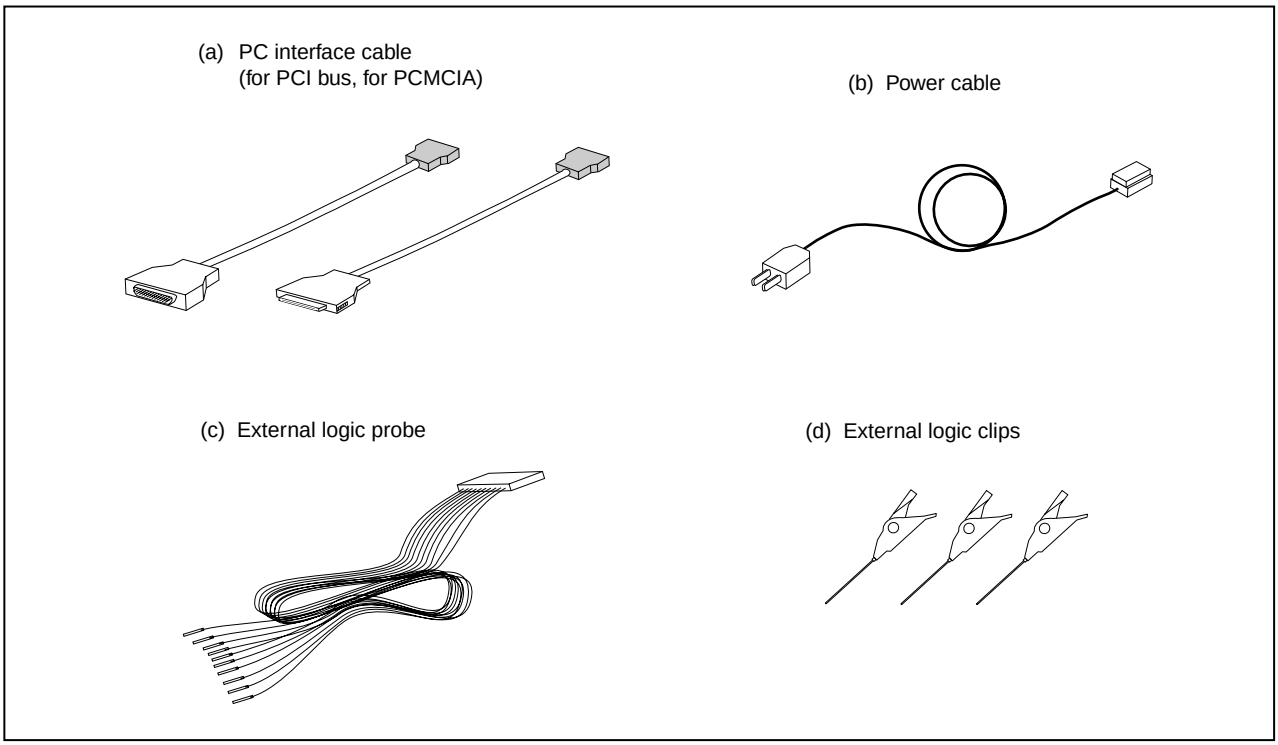
(a) PC interface cable (for PCI bus, for PCMCIA): × 1 each

<R> (b) Power cable: × 1

(c) External logic probe: × 1

(d) External logic clips: 1 set (10 clips)

<R> **Figure 1-4. Accessories**



1.7 Setup

The following two system configurations for the IE-V850ES-G1 are possible, depending on the purpose.
This section describes the setup procedure according to each purpose as follows.

Step	Reference section

1.7.1 When using the emulator on a stand-alone basis for performing software debugging

(1)	Connect interface board to PC	**3.1 Connection to Personal Computer**

Before connecting, turn off the PC.

(2)	Connect emulation board	Refer to the user's manual of the emulation board
(3)	Set operation clock of emulator	Refer to the user's manual of the emulation board
(4)	Connect PC interface cable	**3.4 Cable Connections**

Connect cable.

(5)	Power up PC, then IE-V850ES-G1	**3.5 System Power-on and Power-off**

1.7.2 When performing hardware debugging with target system

(1) Connect interface board to PC — **3.1 Connection to Personal Computer**

Before connecting, turn off the PC.

(2) Connect emulation board — Refer to the user's manual of the emulation board

(3) Set operation clock of emulator — Refer to the user's manual of the emulation board

(4) Connect PC interface cable — **3.4 Cable Connections**

Connect cable.

(5) Connect IE-V850S-G1 to target system — **3.2 Connection to Target System**

(6) Power up PC, then IE-V850ES-G1, then target system — **3.5 System Power-on and Power-off**

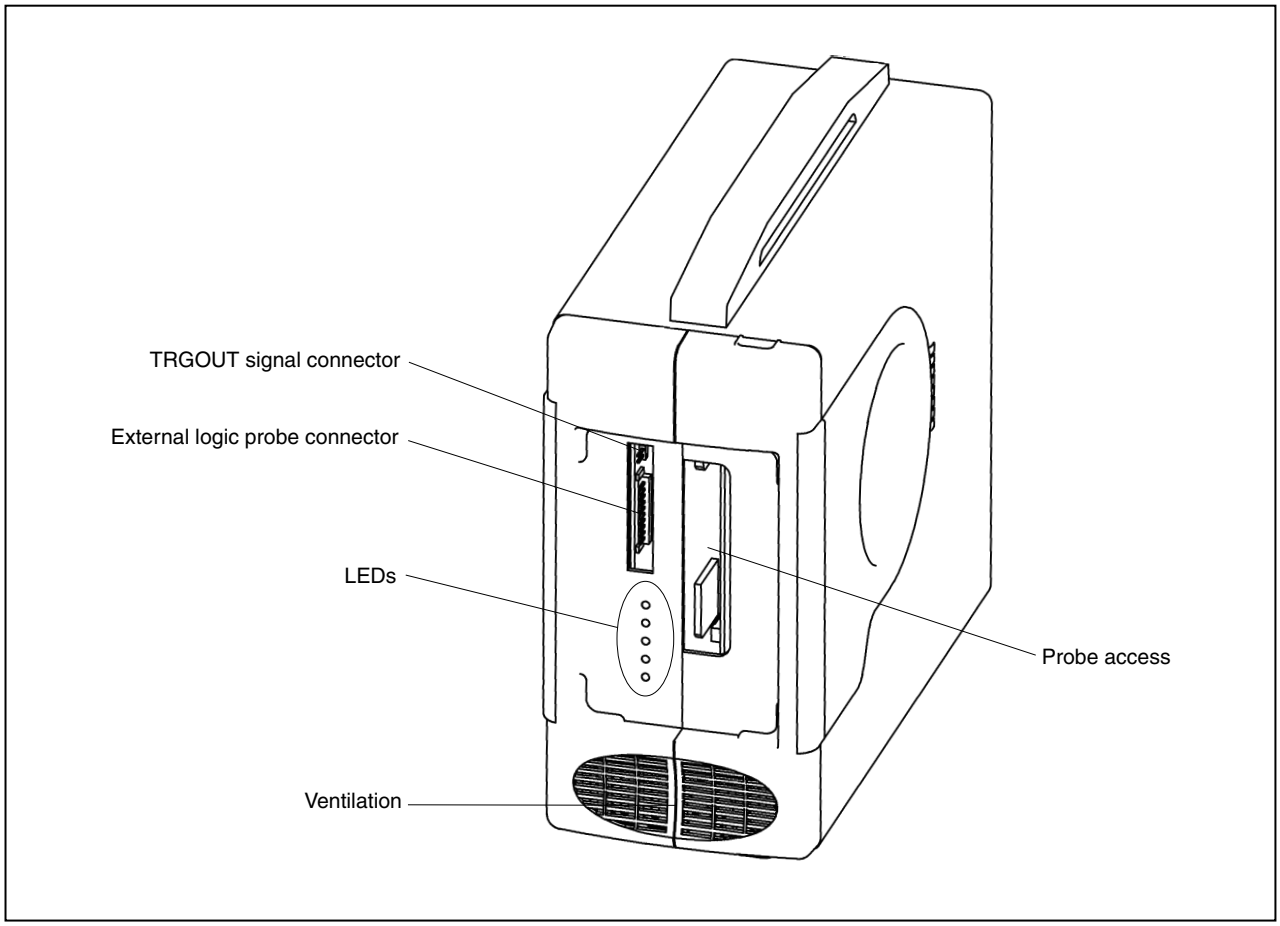
Caution Before turning on the power of the target system, make sure that the power of the IE-V850ES-G1 is turned on. If the target system is turned on while the IE-V850ES-G1 is off, the target system or the IE-V850ES-G1 may be damaged.

CHAPTER 2 PART NAMES AND FUNCTIONS

This chapter describes the name and function of each part of the IE-V850ES-G1, as well as switch settings.

2.1 Part Names and Functions of IE-V850ES-G1

Figure 2-1 Part Names and Functions of IE-V850ES-G1 on Front Side



(1) LEDs

- Power (red): Turns on/off when the power switch is turned on/off.
  ON: Lit
  OFF: Off
- TARGET (amber): Indicates the status of the target power supply.
  Power supplied to target: Lit
  Power not supplied to target: Off
- STATUS (green): Indicates various statuses of the emulator.
  Indication varies depending on the emulation board to be connected.
  For details, refer to the user's manual of the emulation board.

(2) External logic probe connector

Connect the external logic probe (included) to this connector.

(3) TRGOUT signal connector

This connector comprises the TRGOUT signal output and GND pins.

Figure 2-2. TRGOUT Signal Connector

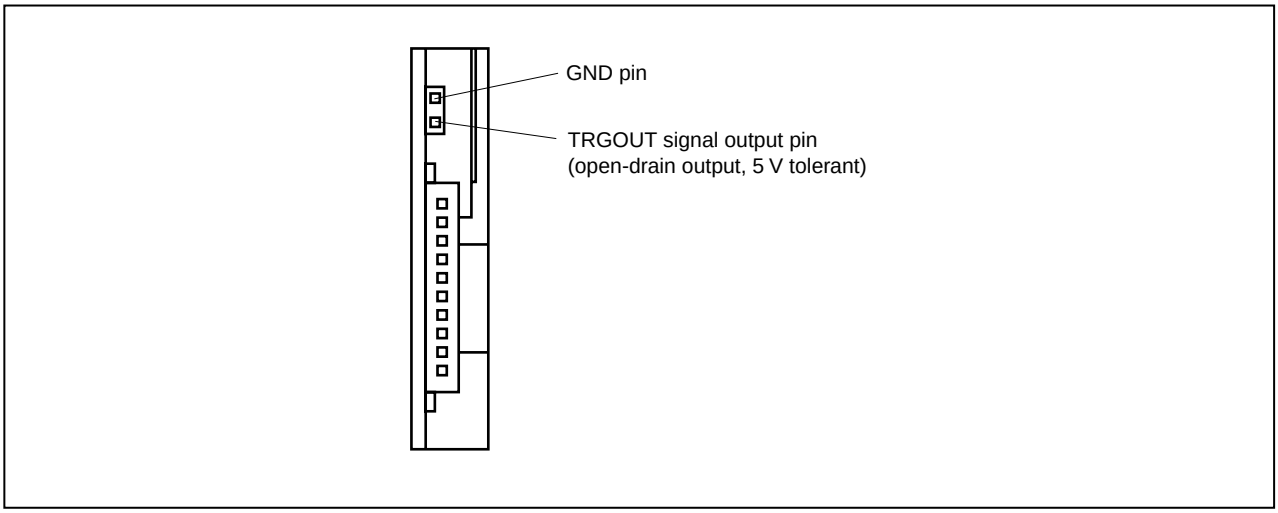
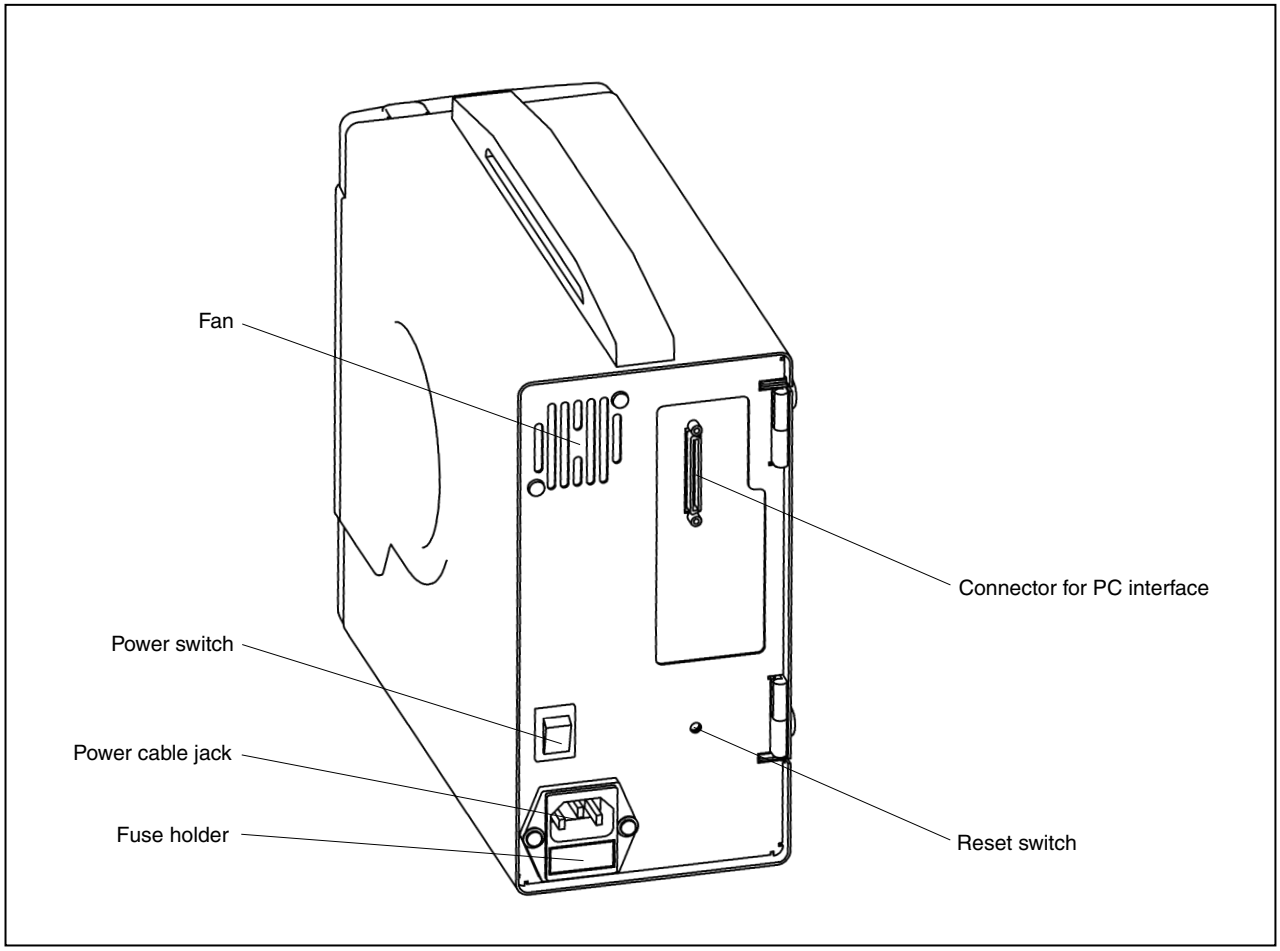


Figure 2-3. Part Names and Functions of IE-V850ES-G1 on Back Side



(1) Power switch

This is the main power supply switch of the emulator.

I: ON

O: OFF

(2) Fuse holder

Set the fuse here.

Rating: 250 V, 3.15 A

(3) Power cable jack

Connect the power cable (included) here.

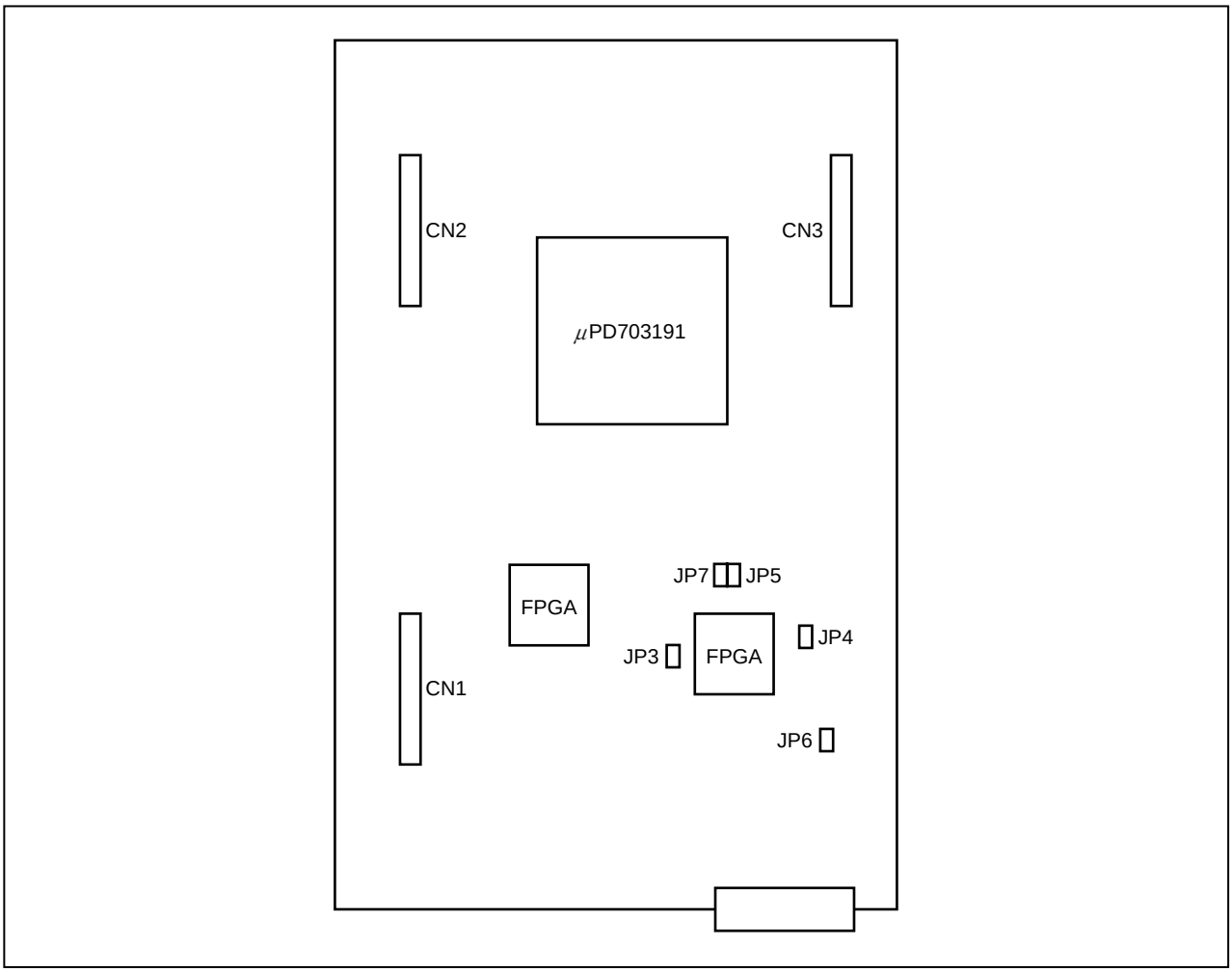
(4) Connector for PC interface

Connect the PC interface cable (included) here.

(5) Reset switch

This is the switch for resetting the IE-V850ES-G1.

Figure 2-4. Part Names and Functions of Board



(1) Jumpers (JP3 to JP7)

Jumper setting is not required. Do not change the factory settings.

If the user's manual of the emulation board describes the setting of JP3 to JP7 of the IE-V850ES-G1, follow the setting described in the manual.

(2) Connectors for connecting emulation board (CN1 to CN3)

These connectors are for connecting the emulation board (sold separately).

2.2 Clock Settings

For the operation clock settings of the IE-V850ES-G1, refer to the user's manual of each emulation board.

2.3 CPU Operating Voltage Range

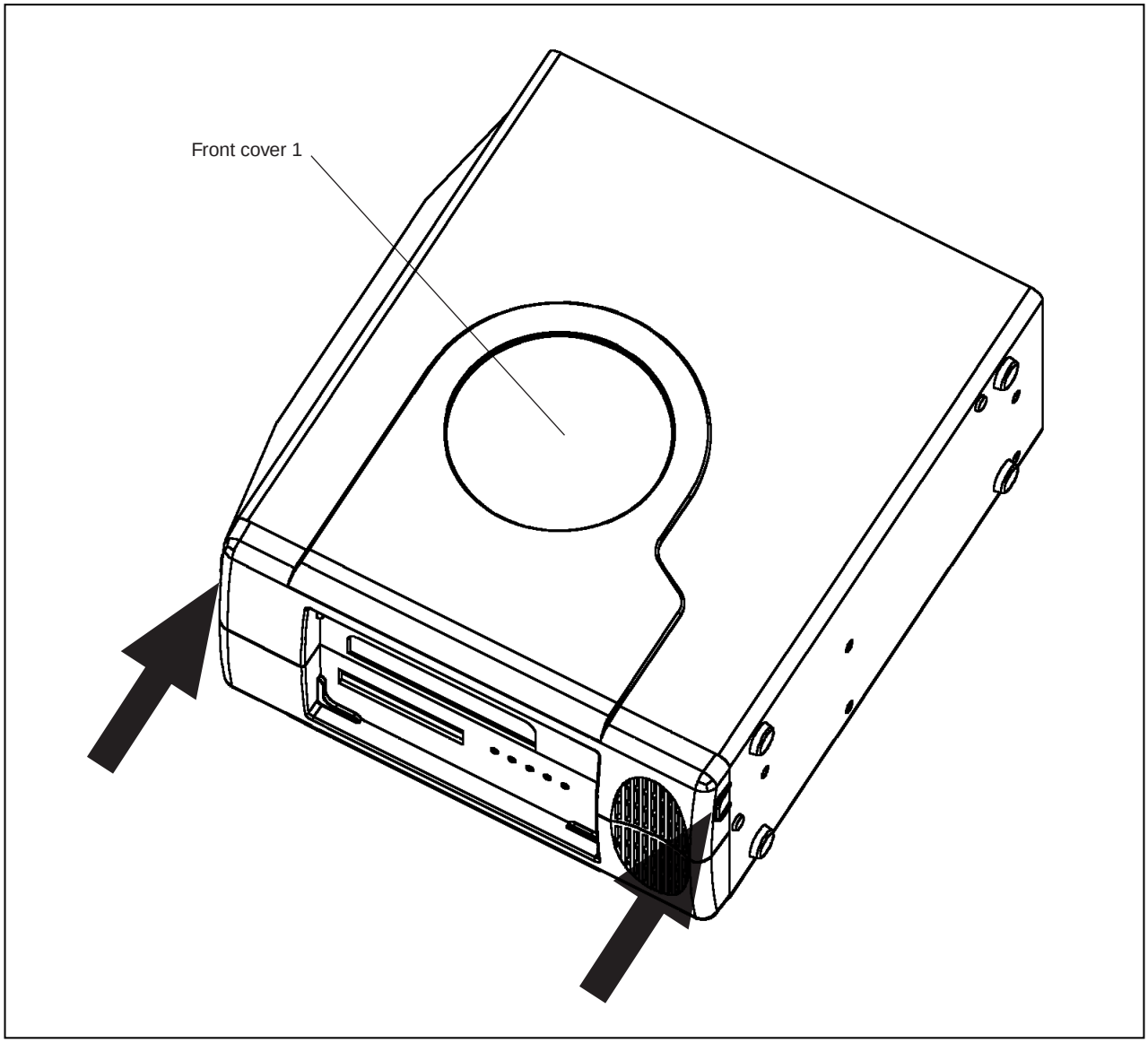
For the CPU operating voltage range, refer to the user's manual of each emulation board.

2.4 Cover Open/Close Procedure

2.4.1 Removing probe and replacing clock module

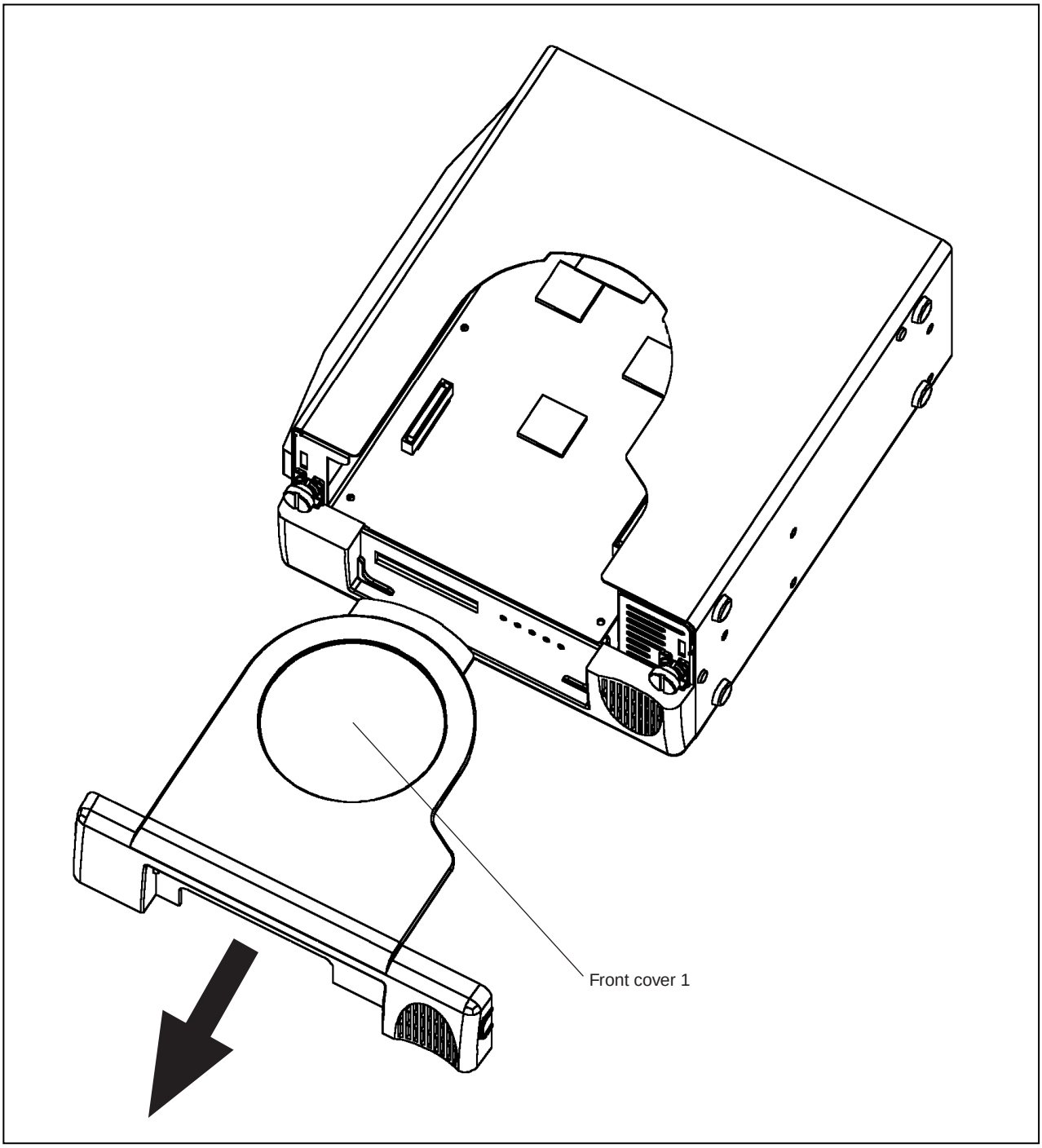
<1> Place your fingers at the positions indicated by the arrows below and pull front cover 1.

Figure 2-5. Cover Open/Close Procedure 1 (Removing Front Cover 1)



<2> Remove the probe or change the clock in the status shown below.

Figure 2-6. Cover Open/Close Procedure 1 (After Front Cover 1 Is Removed)

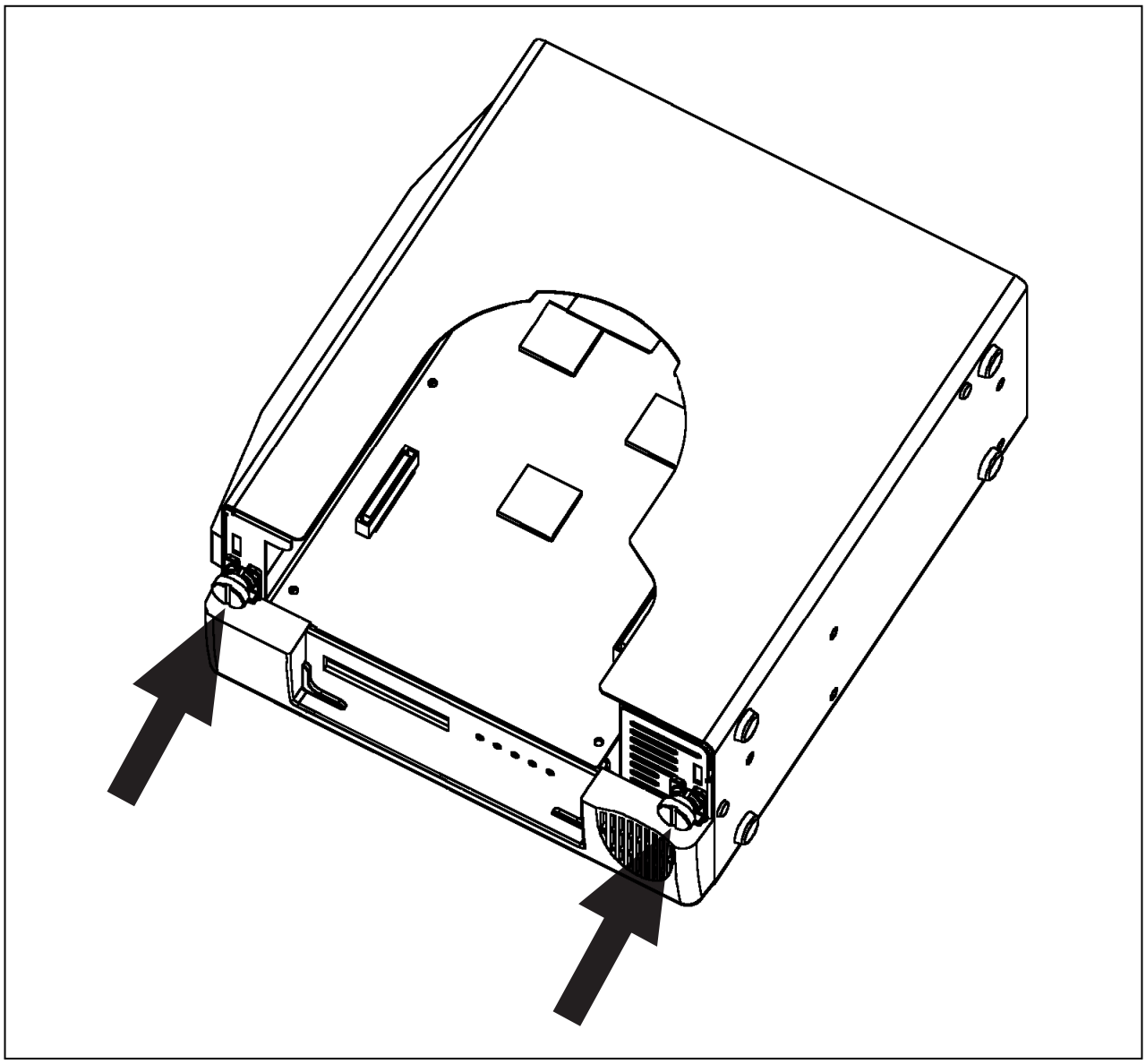


2.4.2 Replacing board

<1> Remove front cover 1 following the procedures described in 2.4.1 Removing probe and replacing clock module.

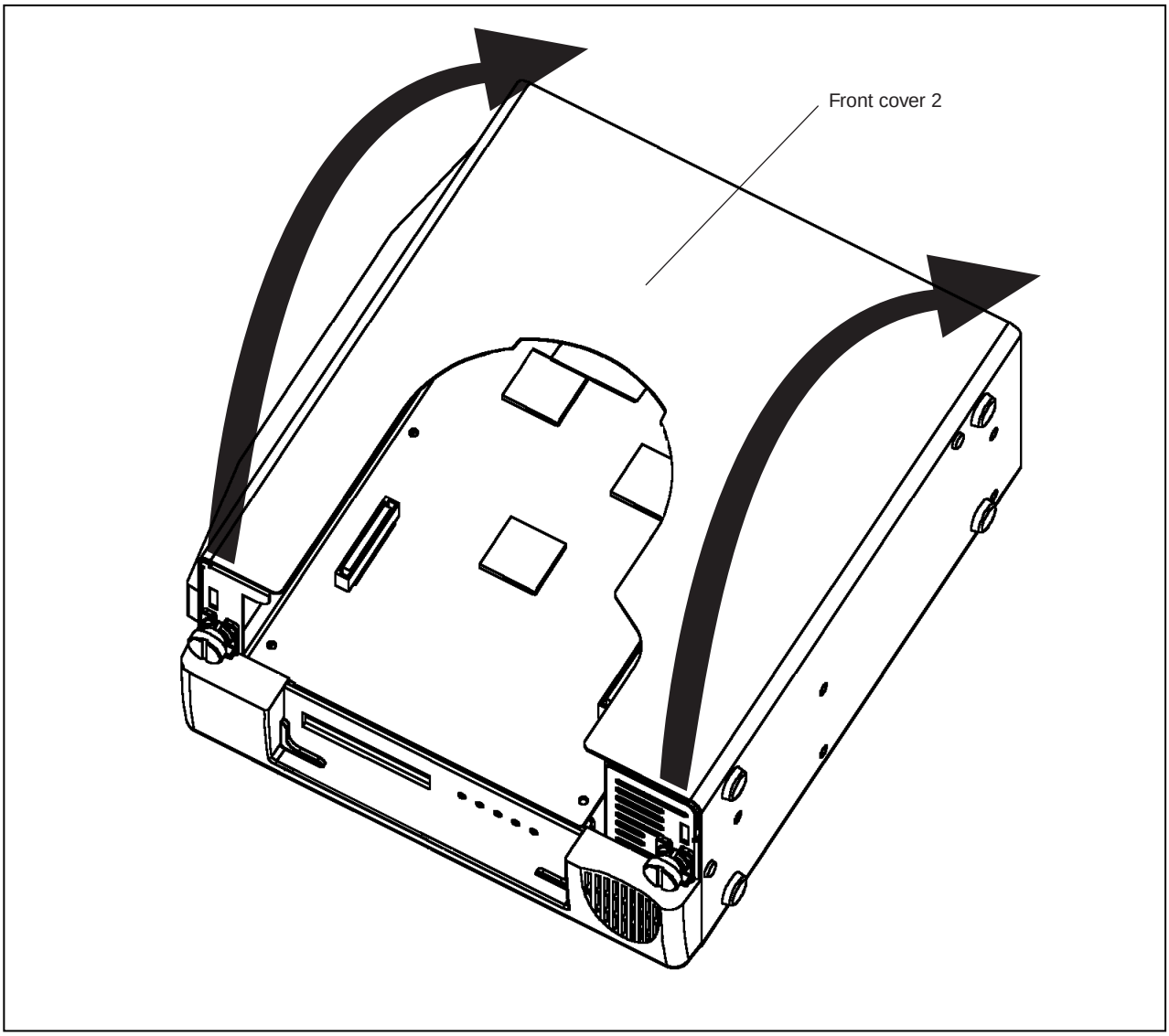
<2> Loosen the two screws indicated by the arrows below.

Figure 2-7. Cover Open/Close Procedure 2 (Loosening Screws)



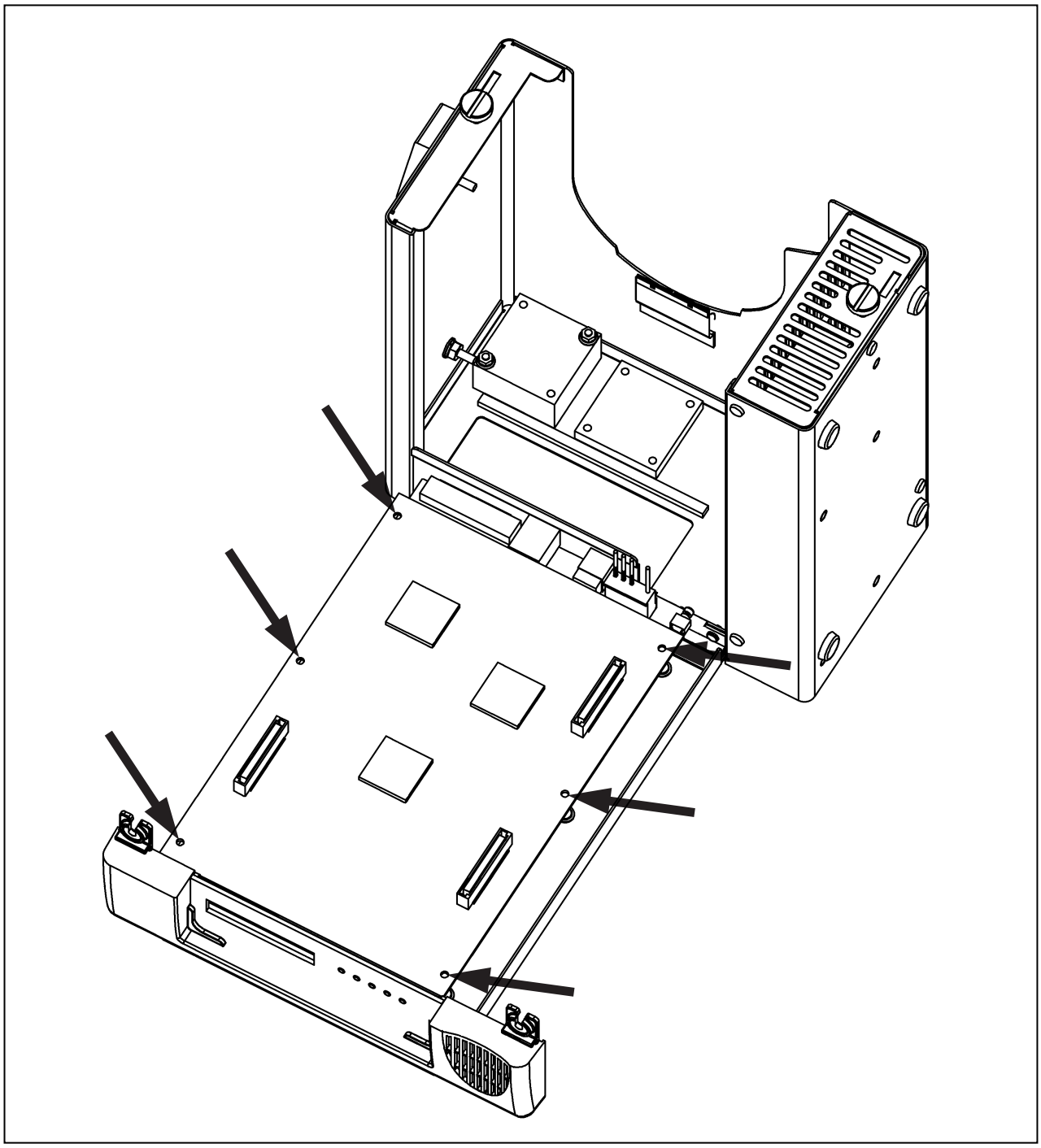
<3> Grip and pull up front cover 2 with the hinge installed on the rear panel as the center, and rotate the casing main unit as shown.

Figure 2-8. Cover Open/Close Procedure 2 (Pulling up Front Cover 2)



<4> Remove the six screws on the board indicated by the arrows and replace the board.
For replacement of the emulation board, refer to the user's manual of each emulation board.

Figure 2-9. Cover Open/Close Procedure 2 (After Front Cover Is Pulled up)



2.4.3 Closing cover

Close the cover in the reverse procedure as that used when opening the cover.

CHAPTER 3 CONNECTION OF COMPONENTS

The IE-V850ES-G1 enables debugging and programming of target devices by connecting several components and configuring the desired system.

This chapter describes the various components and their connection. Read this chapter when connecting system components. For the sequence of system configuration, refer to **1.7 Setup**.

For the details on software startup, refer to the user's manual of the debugger that is used.

3.1 Connection to Personal Computer

3.1.1 Overview of connection

The IE-V850ES-G1 can use a personal computer (PC-9800 series, or PC/AT compatible) as the host machine. The connection to each type of personal computer is described below.

(1) Desktop PC

When using a desktop PC, insert the following PC interface board in the external expansion slot of the desktop PC and connect the computer to the IE-V850ES-G1.

- IE-70000-PCI-IF-A: For PCI bus (can also be used in a PC98-NX series, PC/AT or compatible)

(2) Notebook-type personal computer

When using a notebook-type personal computer, insert the interface card (IE-70000-CD-IF-A: Sold separately) in the PC card slot of the computer and connect the computer to the IE-V850ES-G1.

3.1.2 Connection procedure

(1) Powering off

Perform connection while the power of each unit is off.

Before connecting, turn off the power of the IE-V850ES-G1 and the PC.

(2) PC interface board setting

When the IE-70000-PCI-IF-A is shipped, an 8-bit connector board is premounted. However, when the IE-V850ES-G1 is connected, this must be changed to a 32-bit connector board.

The 32-bit connector board is supplied with the IE-70000-PCI-IF-A. For details, refer to the IE-70000-PCI-IF-A User's Manual.

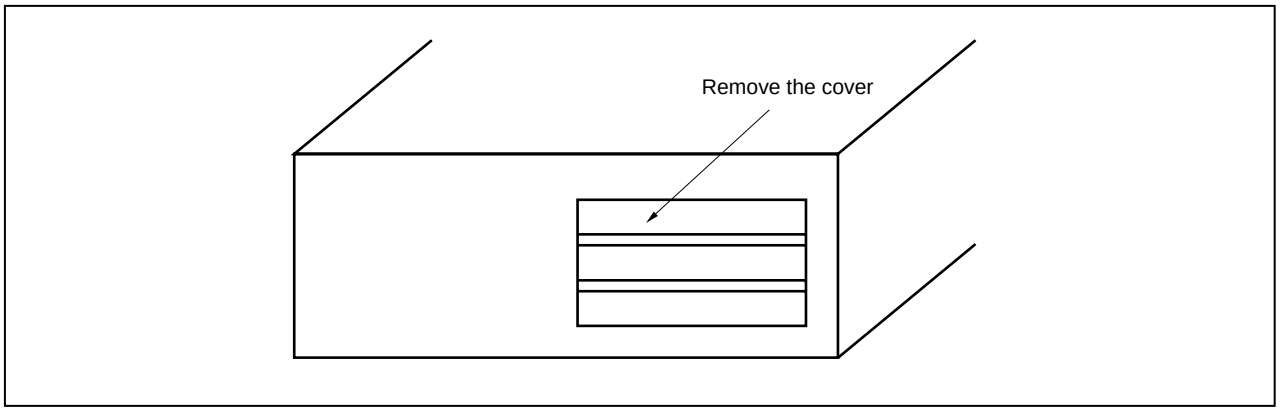
3.1.3 Insertion of PC interface board

The following describes the settings and connection of an IBM PC/AT (including its compatibles) and the IE-70000-PCI-IF-A.

Figures 3-1 and 3-2 show how to mount the PC interface board.

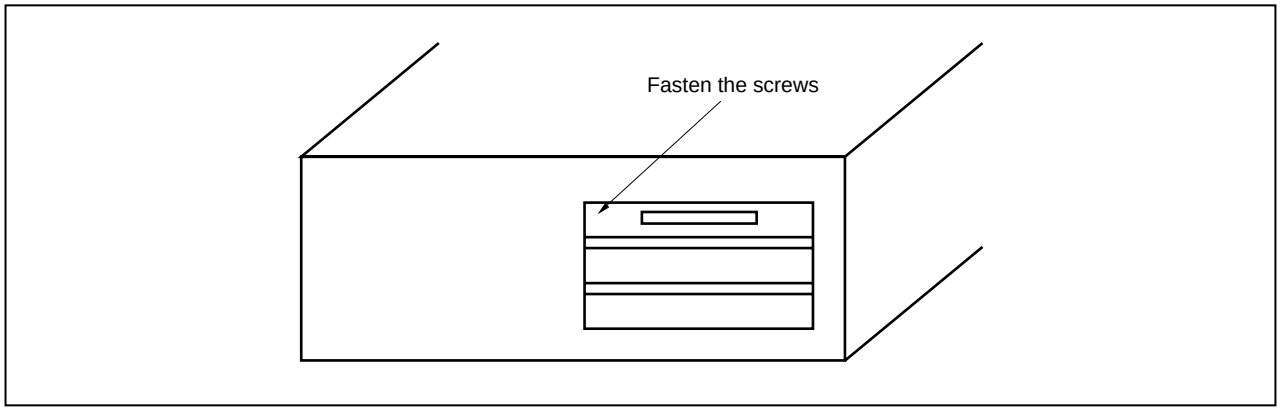
<1> Before starting, turn off the power of the PC.
<2> Remove the casing of the PC.
<3> Remove the cover of the PCI bus slot.

Figure 3-1. Rear View of PC



<4> Insert the PC interface board.
<5> Fix the PC interface board by fastening the screws.

Figure 3-2. Inserting PC Interface Board



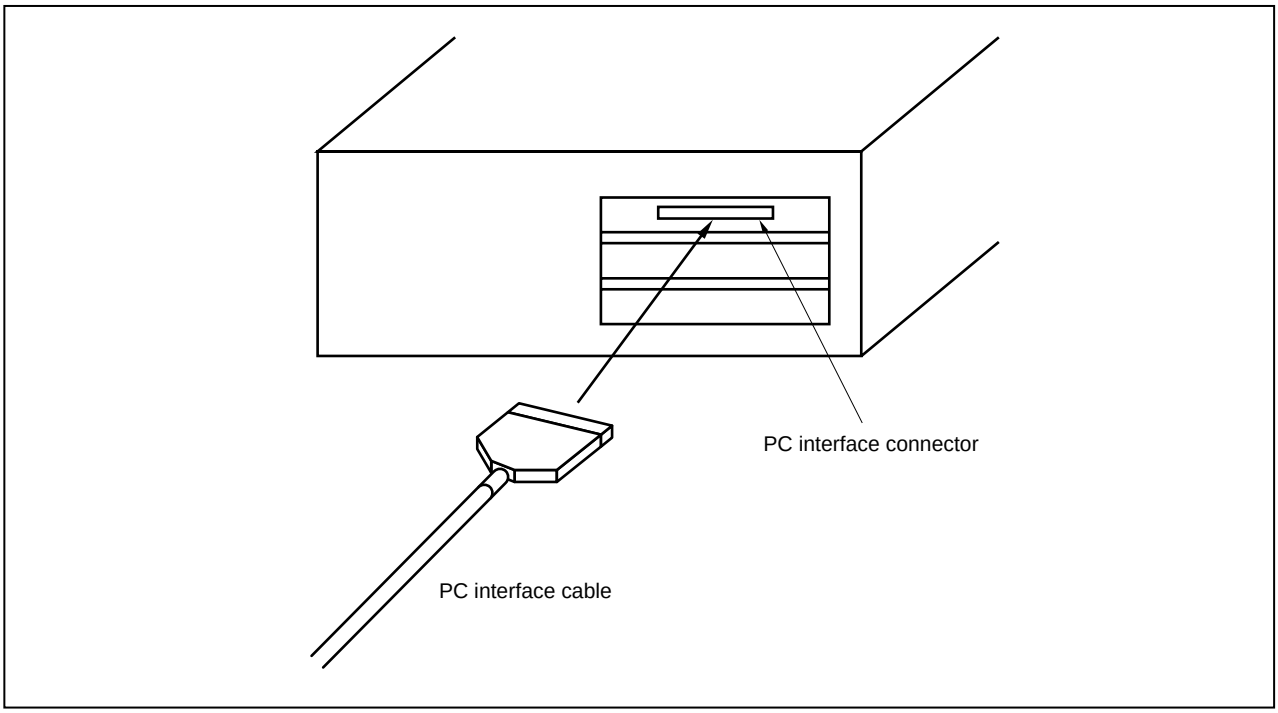
<6> Replace the casing of the PC.

3.1.4 Connection of PC interface cable

Figure 3-3 shows how to connect the PC interface cable.

Connect the PC interface cable (for PCI bus) supplied with the IE-V850ES-G1 to the PC interface connector of the PC interface board.

Figure 3-3. Connection of PC Interface Board and PC Interface Cable



3.2 Connection to Target System

For how to connect the IE-V850ES-G1 and target system, refer to the user's manual of the emulation board.

3.3 Connection of External Logic Probe

When using the external logic probe, connect it to the external logic probe connector of the IE-V850ES-G1. Connect the external logic clips to the tips of the external logic probe.

Figure 3-4. Connection of External Logic Probe

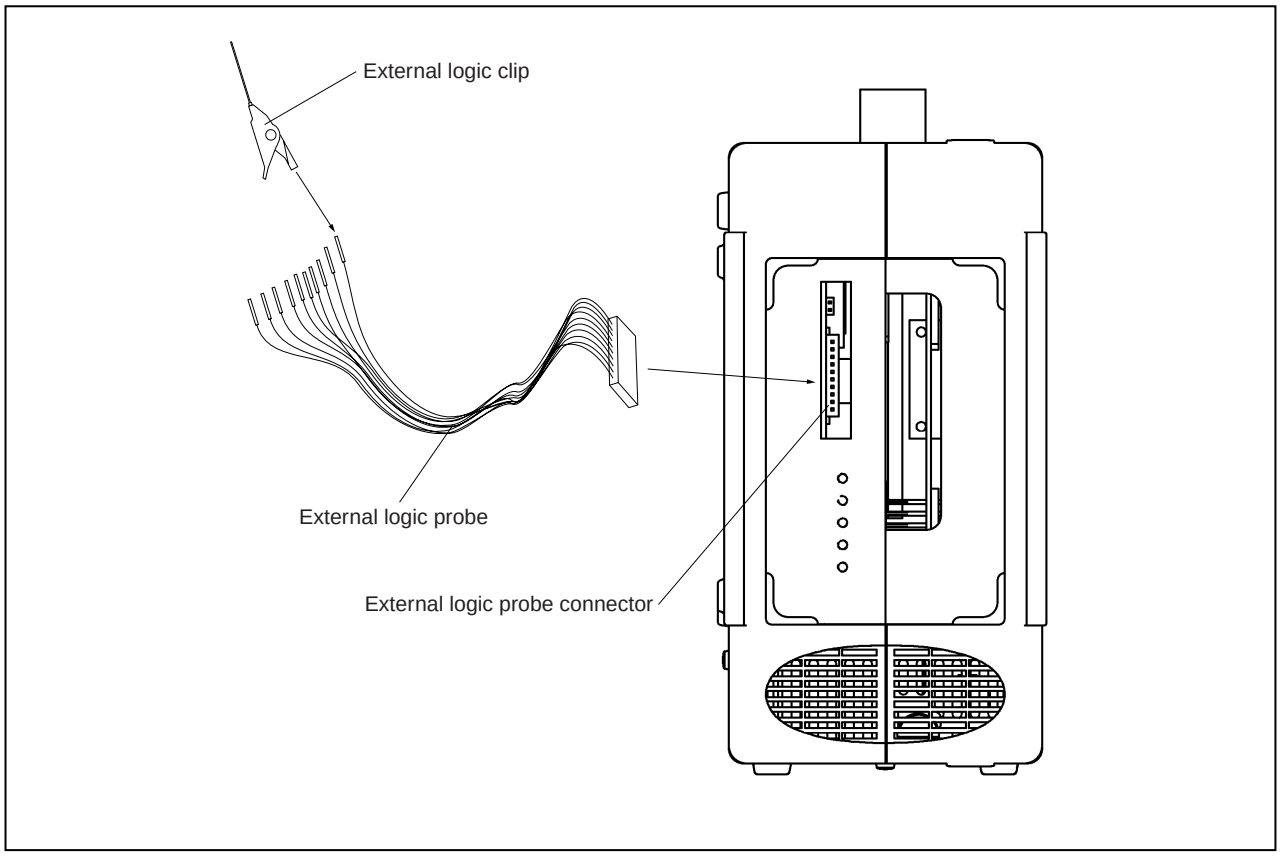


Figure 3-5. External Logic Probe Connector Pins

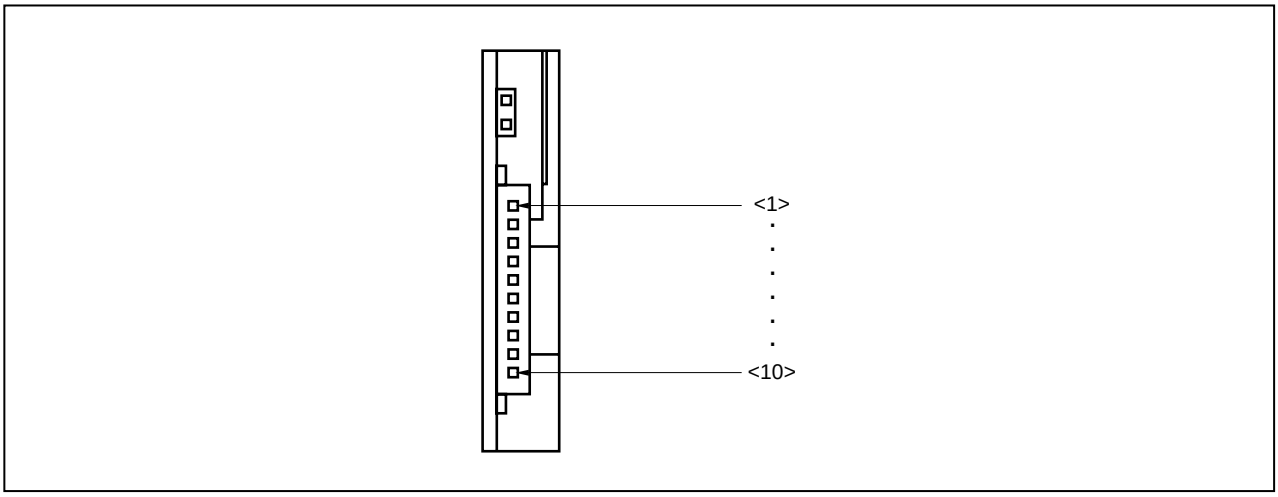


Table 3-1. Pins of External Logic Probe Connector

Pin No.	<1>	<2>	<3>	<4>	<5>	<6>	<7>	<8>	<9>	<10>
Description	Bit 0	Bit 1	Bit 2	Bit 3	Bit 4	Bit 5	Bit 6	Bit 7	No connection	GND

Table 3-2. Electrical Characteristics of External Logic Probe Connector

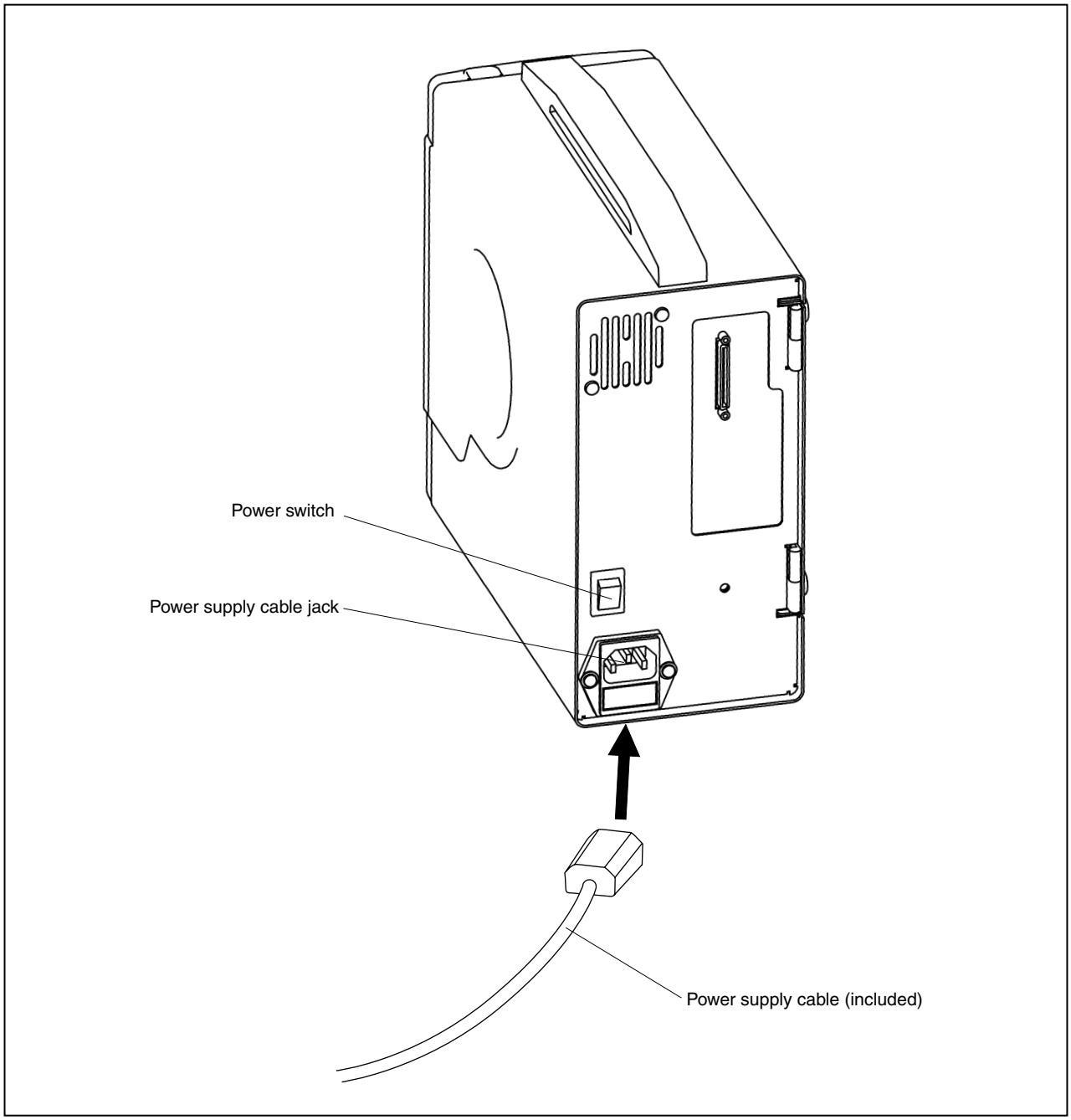
Parameter	Min. [V]	Max. [V]
Input voltage, high	Target voltage × 0.7	Target voltage
Input voltage, low	0	Target voltage × 0.3

3.4 Cable Connections

3.4.1 Connection of power supply cable

Connect the connector of the power supply cable (included) to the power supply cable jack on the main unit of the IE-V850ES-G1.

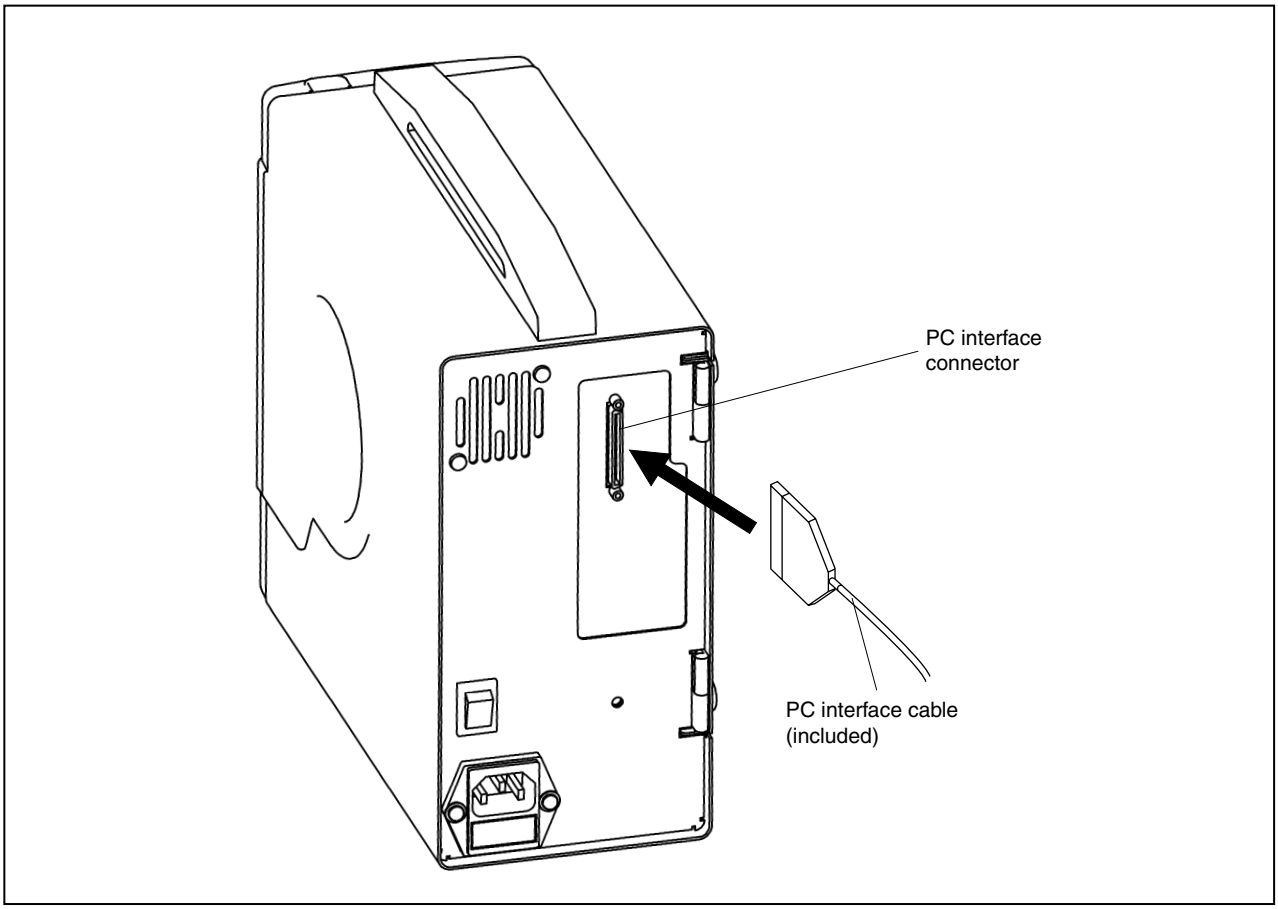
Figure 3-6. Connection of Power Supply Cable



3.4.2 PC interface cable connection

Connect the PC interface cable to the PC interface connector of the IE-V850ES-G1.

Figure 3-7. PC Interface Cable Connection



3.4.3 External logic probe connection

When using the external logic probe, connect it to the external logic probe connector.

For details, refer to the emulation board user's manual.

3.4.4 Additional information

The IE-V850ES-G1 can perform real-time tracing of the emulation CPU bus cycle. For details of this function, refer to the debugger user's manual.

(1) Any eight signals can be traced in real-time.
(2) Tracer start/stop is enabled using any eight signals.
(3) Break setting is enabled using any eight signals.

Cautions 1. Connect the external logic probe only to a TTL-level signal line. High level and low level cannot be detected correctly if connected to lines other than TTL-level signal lines. Note that the sensor of the IE-V850ES-G1 and emulation board may be damaged by an excessive voltage level.

2. When connecting the external logic probe, use the included external logic clips.

Procedure

(1) Turn off the power of the target system.
(2) Turn off the power of the IE-V850ES-G1.
(3) Connect the external logic probe to any device on the target system.
(4) Connect the GND of the external logic probe to the GND of the target system.

3.5 System Power-on and Power-off

After connecting the IE-V850ES-G1 and each system component (PC, target system, etc.), start up and shut down the system using the following procedure.

3.5.1 Power-on procedure

Cautions 1. Make sure that the IE-V850ES-G1 is correctly connected to the PC.
2. If the IE-V850ES-G1 is powered on or the system is terminated using a procedure other than the following, the IE-V850ES-G1 or the target system may be damaged.

(1) Turn on the power switch of the PC.
(2) Turn on the power switch of the IE-V850ES-G1.
Set the power switch to “ON” after connecting the power cable to the power jack of the IE-V850ES-G1 and the plug to the power outlet.
(3) Turn on the power of the target system.
(4) Start the debugger.

3.5.2 Power-off procedure

(1) Terminate the debugger.
(2) Turn off the power switch of the target system.
(3) Turn off the power switch of the IE-V850ES-G1.
(4) Turn off the power switch of the PC.

CHAPTER 4 FACTORY SETTINGS

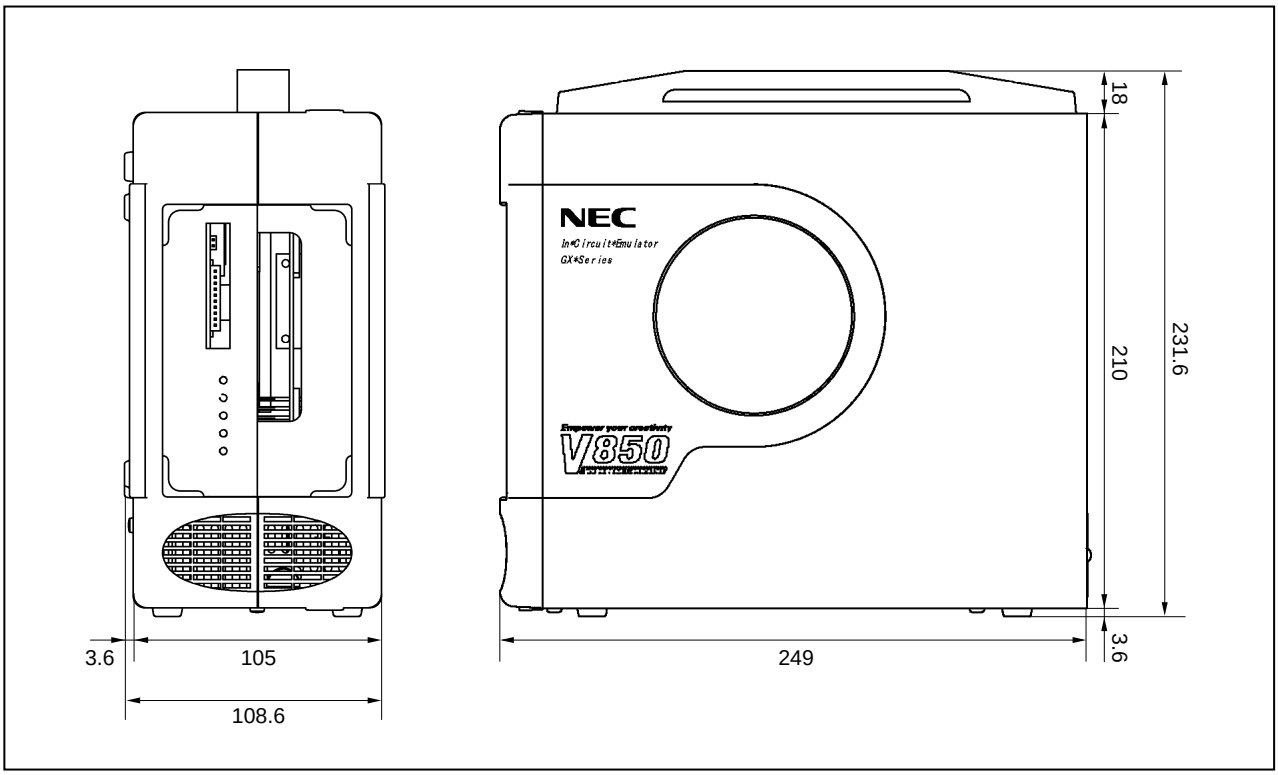
This chapter describes the switch settings when the product is shipped.

4.1 Factory Settings

Table 4-1. Factory Settings of Switches

	Setting	Description
Power switch	OFF	Power off
Jumper (JP3)	Shorted	Leave the setting.
Jumper (JP4)	Open	Leave the setting.
Jumper (JP5)	Shorted	Leave the setting.
Jumper (JP6)	Shorted	Leave the setting.
Jumper (JP7)	Open	Leave the setting.

APPENDIX A DIMENSIONS



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APPENDIX B REVISION HISTORY

B.1 Major Revisions in This Edition

Page	Description
Throughout	Modification of the types of the power cable from three to one.
p. 40	Addition of **APPENDIX B REVISION HISTORY**

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