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Renesas Electronics Corporation

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User's Manual

M306H5T3-RPD-E

User's Manual

Emulation Pod for M16C/6H Group M306H5

Renesas Electronics
www.renesas.com

Rev.1.00 2004.12

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Preface

The M306H5T3-RPD-E is an emulation pod for the M16C/6H Group M306H5 of 16-bit MCUs. It is used with a PC4701 emulator (excluding the PC4700L and PC4701L).
This user's manual mainly describes specifications of the M306H5T3-RPD-E emulation pod and how to setup it. For details on the following products, which are used with the M306H5T3-RPD-E, refer to each product's user's manual or online manual.

All the components of this product are shown in "1.1 Package components" (page 14). If there is any question or doubt about this product, contact your local distributor.

The related manuals for using this product are listed below. You can download the latest manuals from the Renesas Tools homepage (http://www.renesas.com/en/tools).

Related manuals

Item	Manual
Emulator main unit	PC4701U User's Manual
	PC4701M User's Manual
	PC4701HS User's Manual
Emulator debugger	M3T-PD30 User's Manual
C compiler	NC30 User's Manual
Assembler	AS30 User's Manual

Important

Before using this product, be sure to read this user's manual carefully.
Keep this user's manual, and refer to this when you have questions about this product.

Emulator:

The emulator in this document refers to the following products that are manufactured by Renesas Technology Corp.:

(1) PC4701 main unit
(2) Emulation pod
(3) Package converter board for connecting the user system

The emulator herein does not include the customer's user system and host machine.

Purpose of use of the emulator:

This emulator is a device to support the development of a system that uses the M16C Family M16C/60 Series M16C/6H Group/M306H5 of Renesas 16bit single-chip MCUs. It provides support for system development in both software and hardware.
Be sure to use this emulator correctly according to said purpose of use. Please avoid using this emulator for other than its intended purpose of use.

For those who use this emulator:

This emulator can only be used by those who have carefully read the user's manual and know how to use it.
Use of this emulator requires the basic knowledge of electric circuits, logical circuits, and MCUs.

When using the emulator:

(1) This product is a development supporting unit for use in your program development and evaluation stages. In mass-producing your program you have finished developing, be sure to make a judgment on your own risk that it can be put to practical use by performing integration test, evaluation, or some experiment else.
(2) In no event shall Renesas Solutions Corp. be liable for any consequence arising from the use of this product.
(3) Renesas Solutions Corp. strives to renovate or provide a workaround for product malfunction at some charge or without charge. However, this does not necessarily mean that Renesas Solutions Corp. guarantees the renovation or the provision under any circumstances.
(4) This product has been developed by assuming its use for program development and evaluation in laboratories. Therefore, it does not fall under the application of Electrical Appliance and Material Safety Law and protection against electromagnetic interference when used in Japan.
(5) Renesas Solutions Corp. cannot predict all possible situations or possible cases of misuse where a potential danger exists. Therefore, the warnings written in this user's manual and the warning labels attached to this emulator do not necessarily cover all of such possible situations or cases. Please be sure to use this emulator correctly and safely on your own responsibility.
(6) This product is not qualified under UL or other safety standards and IEC or other industry standards. This fact must be taken into account when taking this product from Japan to some other country.

Usage restrictions:

This emulator has been developed as a means of supporting system development by users. Therefore, do not use it as a device used for equipment-embedded applications. Also, do not use it for developing the systems or equipment used for the following purposes either:

(1) Transportation and vehicular
(2) Medical (equipment where human life is concerned)
(3) Aerospace
(4) Nuclear power control
(5) Undersea repeater

If you are considering the use of this emulator for one of the above purposes, please be sure to consult your local distributor.

About product changes:

We are constantly making efforts to improve the design and performance of this emulator. Therefore, the specification or design of this emulator or its user's manual may be changed without prior notice.

About the rights:

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About diagrams:

The diagrams in this user's manual may not all represent exactly the actual object.

Precautions for Safety

Definitions of Signal Words

In both the user's manual and on the product itself, several icons are used to insure proper handling of this product and also to prevent injuries to you or other persons, or damage to your properties.

This chapter describes the precautions which should be taken in order to use this product safely and properly. Be sure to read this chapter before using this product.

⚠	This symbol represents a warning about safety. It is used to arouse caution about a potential danger that will possibly inflict an injury on persons. To avoid a possible injury or death, please be sure to observe the safety message that follows this symbol.
⚠ **DANGER**	**DANGER** indicates an imminently dangerous situation that will cause death or heavy wound unless it is avoided. However, there are no instances of such danger for the product presented in this user's manual.
⚠ **WARNING**	**WARNING** indicates a potentially dangerous situation that will cause death or heavy wound unless it is avoided.
⚠ **CAUTION**	**CAUTION** indicates a potentially dangerous situation that will cause a slight injury or a medium-degree injury unless it is avoided.
CAUTION	**CAUTION** with no safety warning symbols attached indicates a potentially dangerous situation that will cause property damage unless it is avoided.
IMPORTANT	This is used in operation procedures or explanatory descriptions to convey exceptional conditions or cautions to the user.

In addition to the five above, the following are also used as appropriate.

△ means WARNING or CAUTION.
Example:  CAUTION AGAINST AN ELECTRIC SHOCK

⃠ means PROHIBITION.
Example:  DISASSEMBLY PROHIBITED

● means A FORCIBLE ACTION.
Example:  UNPLUG THE POWER CABLE FROM THE RECEPTACLE.

⚠ WARNING

Warnings for AC Power Supply:

- If the attached AC power cable does not fit the receptacle, do not alter the AC power cable and do not plug it forcibly. Failure to comply may cause electric shock and/or fire.
- Use an AC power cable which complies with the safety standard of the country.
- Do not touch the plug of the AC power cable when your hands are wet. This may cause electric shock.
- This product is connected signal ground with frame ground. If your developing product is transformless (not having isolation transformer of AC power), this may cause electric shock. Also, this may give an unrepairable damage to this product and your developing one.
  While developing, connect AC power of the product to commercial power through isolation transformer in order to avoid these dangers.
- If other equipment is connected to the same branch circuit, care should be taken not to overload the circuit.

- When installing this equipment, insure that a reliable ground connection is maintained.

- If you smell a strange odor, hear an unusual sound, or see smoke coming from this product, then disconnect power immediately by unplugging the AC power cable from the outlet.
  Do not use this as it is because of the danger of electric shock and/or fire. In this case, contact your local distributor.
- Before setting up this emulator and connecting it to other devices, turn off power or remove a power cable to prevent injury or product damage.

Warnings to Be Taken for This Product:

- Do not disassemble or modify this product. Personal injury due to electric shock may occur if this product is disassembled and modified. Disassembling and modifying the product will void your warranty.
- Make sure nothing falls into the cooling fan on the top panel, especially liquids, metal objects, or anything combustible.

Warning for Installation:

- Do not set this product in water or areas of high humidity. Make sure that the product does not get wet. Spilling water or some other liquid into the product may cause unrepairable damage.

Warning for Use Environment:

- This equipment is to be used in an environment with a maximum ambient temperature of 35°C. Care should be taken that this temperature is not exceeded.

⚠ CAUTION

Cautions to Be Taken for Turning On the Power:

- Turn ON the power of the emulator and user system as simultaneously as possible. Turn OFF the power of the emulator and user system as simultaneously as possible.
- Do not leave either the emulator or user system powered on, because of leakage current the internal circuits may be damaged.
- When turning ON the power again after shutting OFF the power, wait about 10 seconds.

Cautions to Be Taken for Handling This Product:

- Use caution when handling the main unit. Be careful not to apply a mechanical shock.
- Do not touch the connector pins of the emulator main unit and the target MCU connector pins. Static electricity may damage the internal circuits.
- Do not pull the emulation pod main unit by the flexible cable (FLX120-RPD) for connecting to the emulator main unit or the flexible cable (M3T-FLX160C) for connecting the user system. The cable may cause a break.
- Flexible cable (FLX120-RPD) for connecting to the emulator main unit and the flexible cable (M3T-FLX160C) for connecting the user system are different from earlier models. The slits make them more flexible. However, excessive flexing or force may break conductors.
- Do not use inch-size screws for this equipment. The screws used in this equipment are all ISO (meter-size) type screws. When replacing screws, use same type screws as equipped before.

Caution to Be Taken for System Malfunctions:

- If the emulator malfunctions because of interference like external noise, do the following to remedy the trouble.
  (1) Press the RESET switch on the emulator front panel.
  (2)If normal operation is not restored after step (1), shut OFF power to the emulator once and then reactivate it.

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User Registration

When you have purchased the emulator presented in this user's manual, please be sure to register it. As the hardware tool user registration FAX sheet is included with this manual, fill it in and FAX it to your local distributor or email the same contents to the following address. Your registered information is used for only after-sale services, and not for any other purposes. Without user registration, you will not be able to receive maintenance services such as a notification of field changes or trouble information. So be sure to carry out the user registration.
For more information about user registration, please email to the following address.

regist_tool@renesas.com

Terminology

Some specific words used in this user's manual are defined as follows:

Emulator system
This means an emulator system built around the PC4701 emulator. The PC4701 emulator system is configured with an emulator main unit, emulation pod, host machine and emulator debugger.

Emulator main unit (Hereafter PC4701)
This means a generic name for emulators for M16C, 7700, 740 Families. Take note of the fact that the M306H5T3-RPD-E (this product) does not support the PC4701L and PC4700L emulators. For details on specific models of PC4701, visit the Renesas Tools Homepage at http://www.renesas.com/en/tools.

Emulation pod
This means the emulation pod (this product) for the M16C/6H Group M306H5.

Emulator debugger
This means a software tool to control the emulator from the emulation pod through an interface.
For the emulator system including this product, the emulator debugger M3T-PD30 is available.

Firmware
Program that analyzes contents of communication with the emulator debugger and controls the emulator hardware. This program is installed in the flash memory in the emulator main unit. This program is downloadable from the emulator debugger to upgrade the firmware or to support other MCUs.

Host machine
This means a personal computer used to control the emulator main unit and emulation pod.

Software break
A software break is a function to break the program before the system executes an instruction at the specified address. The instruction at the preset address will not be executed.

Hardware break
A hardware break is a function to break the program when the system detects a write/read of data to/from memory or a leading/trailing edge of the signal entered from the external trace cable. The former break function is called address break; and the latter break function is called trigger break. While the instruction at the address where the software break is set is not executed, a hardware break is performed after the specified instruction is executed.

Target MCU
This means the MCU you are going to debug.

User system
This means a user's application system using the microcomputer to be debugged.

Target program
This means the program you are going to debug.

Evaluation MCU
This means the MCU mounted on the emulation pod which is operated in the specific mode for tools.

*****
In this user's manual, this symbol is used to show active Low. (e.g. RESET*: Reset signal)

1. Outline

This chapter describes the package components, the system configuration and the preparation for using this product for the first time.

1.1 Package Components

The M306H5T3-RPD-E package consists of the following items. When unpacking it, check to see if your M306H5T3-RPD-E contains all of these items.

Table 1.1 Package components

Item	Quantity
M306H5T3-RPD-E emulation pod main unit	1
FLX120-RPD flexible cable for connecting PC4701	1
FLX160-PRB converter board for M3T-FLX160C (preinstalled)	1
OSC-3 16MHz oscillator circuit board for main clock (preinstalled)	1
OSC-2 oscillator circuit board (bare board)	1
M306H2T-PTC converter board for connecting 116-pin 0.65-mm-pitch (116P6A-A) foot pattern (including YQPACK116SB x 1, NQPACK116SB x 1, YQ-Guide x 4)	1
Network resistors for pulling up ports P0--P5 (51kΩ x 8)	6
Hardware tool user registration FAX sheet (English)	1
Hardware tool user registration FAX sheet (Japanese)	1
Repair request sheet (English)	1
Repair request sheet (Japanese)	1
M306H5T3-RPD-E Supplementary Document (English)	1
M306H5T3-RPD-E Supplementary Document (English)	1
M306H5T3-RPD-E User's Manual (This manual)	1
M306H5T3-RPD-E User's Manual (Japanese)	1

* Please keep the M306H5T3-RPD-E's packing box and cushion material in your place for reuse at a later time when sending your product for repair or other purposes. Always use these packing box and cushion material when transporting this product.
* If there is any question or doubt about the packaged product, contact your local distributor.

1.2 Other Tool Products Required for Development

To bring forward programs development on the M16C/6H Group M306H5, the products listed below are necessary in addition to those contained package above. Get them separately.

Table 1.2 Other tool products required for development

Product	Product name	Notes
Emulator main unit	PC4701(excluding PC4700L and PC4701L)	Required
Emulator debugger	M3T-PD30	Required

* To purchase these products, contact your local distributor.

1.3 System Configuration

1.3.1 System Configuration

Figure 1.1 shows a configuration of the PC4701 system.

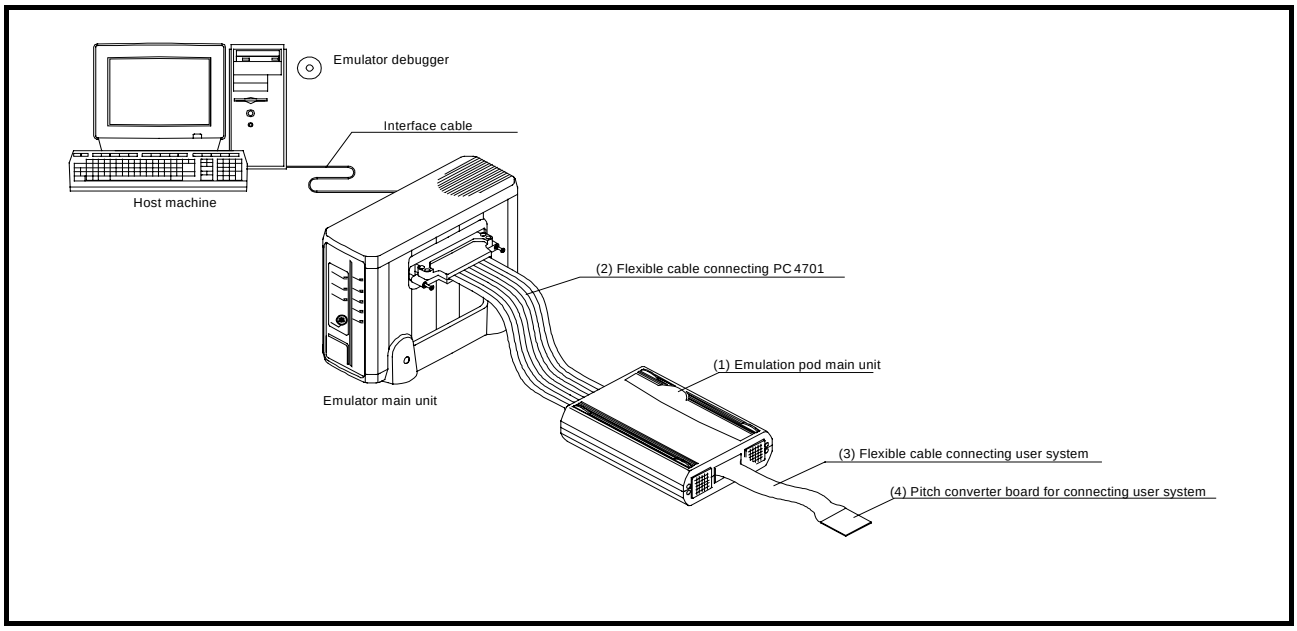


Figure 1.1 System configuration

(1) Emulation pod M306H5T3-RPD-E (this product)
This emulation pod contains an evaluation MCU, emulation memory and circuit to feature the debugging functions.

(2) Flexible cable FLX120-RPD (included)
This is a 120-conductor flexible cable for connecting the PC4701 emulator and the emulation pod.

(3) Flexible cable M3T-FLX160C (included)
This is a 160 conductor flexible cable for connecting the emulation pod and the user system.

(4) Pitch converter board M306H2T-PTC (included)
This is a pitch converter board for connecting to the user system. For details, refer to "2.9 Connecting the User System" (page 35).

1.3.2 Names and Functions of the PC4701 Front Panel LEDs

Figure 1.2 shows the names of the LEDs on the front panel of the emulator.

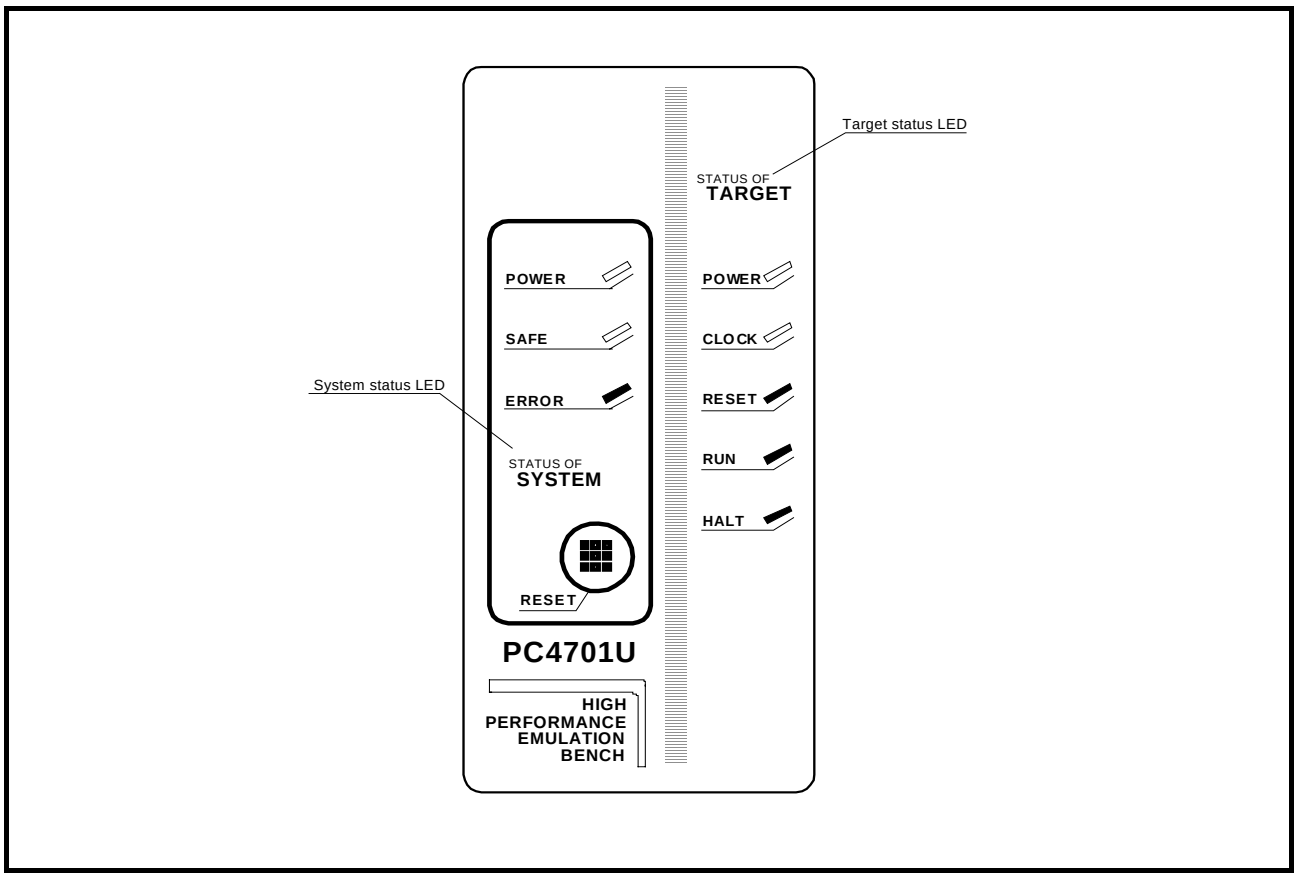


Figure 1.2 Names of the LEDs on the front panel of the PC4701

(1) System Status LEDs

The system status LEDs indicate the emulator PC4701's power supply, firmware operating status, etc. Table 1.3 lists the definition of each system status LED.

Table 1.3 Definitions of the system status LEDs

Name	Status	Meaning
POWER	ON	Emulator system power supply is turned ON.
	OFF	Emulator system power supply is turned OFF.
SAFE	ON	Emulator system is operating normally.
	Flashing	Special mode (maintenance mode) for downloading firmware. The emulator system does not operate except for downloading firmware and the self-check.
	OFF	Emulator system is not operating normally.
ERROR	ON	Emulator is not operating normally.
	Flashing	Downloading firmware.
	ON	Emulator is operating normally.

(2) Target Status LEDs

The target status LEDs indicate the target MCU's operating status and target board's power supply. Table 1.4 lists the definition of each target status LED.

Table 1.4 Definitions of the target status LEDs

Name	Status	Meaning
POWER	ON	Power is supplied to the target MCU.
	OFF	Power is not supplied to the target MCU.
CLOCK	ON	Target MCU clock is supplied.
	OFF	Target MCU clock is not supplied.
RESET	ON	Target MCU is being reset.
	OFF	Target MCU is not being reset.
RUN	ON	User program is being executed.
	OFF	User program has been halted.
HALT	ON	Target MCU internal clock is not oscillating.
	OFF	Target MCU internal clock is oscillating.

IMPORTANT

Caution for Target Status POWER LED:

- If your MCU has two or more power supply terminals (VCC), you need to supply power to all the terminals.

1.4 Specifications

Tables 1.5 lists the specifications of the M306H5T3-RPD-E.

Table 1.5 M306H5T3-RPD-E specification

Item	Desctiption	
Applicable MCU	M16C/6H Group M306H5	
Evaluation MCU	M306H3FCFP and M306H5MG-002FP (1 piece each)	
Usable mode	Single-chip mode Memory expansion mode Microprocessor mode	
Emulation Memory	1MB	
Maximum operating frequency	16MHz	
Applicable power supply	VCC2=4.0V--5.5V, VCC1=3.0V--VCC2 (Xin: when operating without division) VCC2=2.9V--5.5V, VCC1=2.9V--VCC2 (Xin: when operating in a divide-by-16 or 8-mode) VCC2=2.0V--5.5V, VCC1=2.0V--VCC2 (Xcin when operating) *VCC2=2.0V--2.6V operates only in low power dissipation mode.	
Clock supply	XIN-XOUT	Internal oscillator circuit board (OSC-3) Switchable to external oscillator input
	XCIN-XCOUT	Internal oscillator circuit (fixed 32.768kHz) Switchable to external oscillator input
Basic debugging functions	- Download - Software break (max. 64 points) - Program execution/stop (allows free-run execution supporting software breaks) - Memory reference/setting (reference/setting C-variables, run-time execution) - Register reference/setting - Disassemble display - C-level debugging, etc.	
Real-time trace function	- 32K-cycle bus information recordable (Bus, external trigger, time stamp) - 5 trace modes supported (Break/Before/About/After/Full) - Can be recorded ON/OFF by events	
Real-time RAM monitor function	- 1,024 bytes - Data/last access result	
Hardware break function	6 points (Bus detection, interrupt, external trace signal)	
Execution time measurement function	Time between program start and stop Maximum/minimum/average execution time and pass count of specified four zones. Count clock: Equal to MCU Clock or 16 MHz	
C0 coverage	256KB	
Event output	Break x1, Event x6	
External trigger input	TTL level x8	
Host machine interface	Dedicated parallel (PC4701HS) LPT parallel (PC4701M/PC4701U) Serial (PC4701HS/PC4701M) USB (PC4701U) LAN (PC4701HS/PC4701U)	
Power supply to emulator	AC100V--120V, AC200--240V (50/60Hz)	
Connection to user system (see "2.9 Connecting the User System" on page 35)	Converter board for connecting a 116-pin 0.65-mm-pitch (116P6A-A): M306H2T-PTC (included)	

1.5. Operating Environment

Be sure to use this emulator with the operating environmental of the emulator and host machine listed in Tables 1.6 and 1.7.

Table 1.6 Operating environmental conditions

Item	Description
Operating temperature	5 to 35°C (no dew)
Storage temperature	-10 to 60°C (no dew)

Table 1.7 Operating environment of the host machine

Item	Description
Host machine	IBM PC/AT compatibles
OS	Windows Me Windows 98 Windows XP Windows 2000
CPU	Pentium III 600 MHz or more recommended
Memory	128 MB or more recommended
Pointing device such as mouse	Mouse or any other pointing device usable with the above OS that can be connected to the main body of the host machine.

* Windows and Window NT are either registered trademarks or trademarks of Microsoft Corporation in the United states and other countries.

2. Setup

This chapter describes the preparation for using this product, the procedure for starting up the emulator and how to change settings.

2.1 Removing/Attaching the Upper Cover

To use this emulation pod with your user system, it is necessary to set as follows. Set the following after removing the upper cover.

- Input frequency
- Switches
- Mounting/removing network resistors for pullup

(1) To open the upper cover, remove the four screws of both sides of this product and lift off the upper cover (see Figure 2.1)

(2) To close the upper cover, attach the upper cover and secure the four screws of both sides of this product.

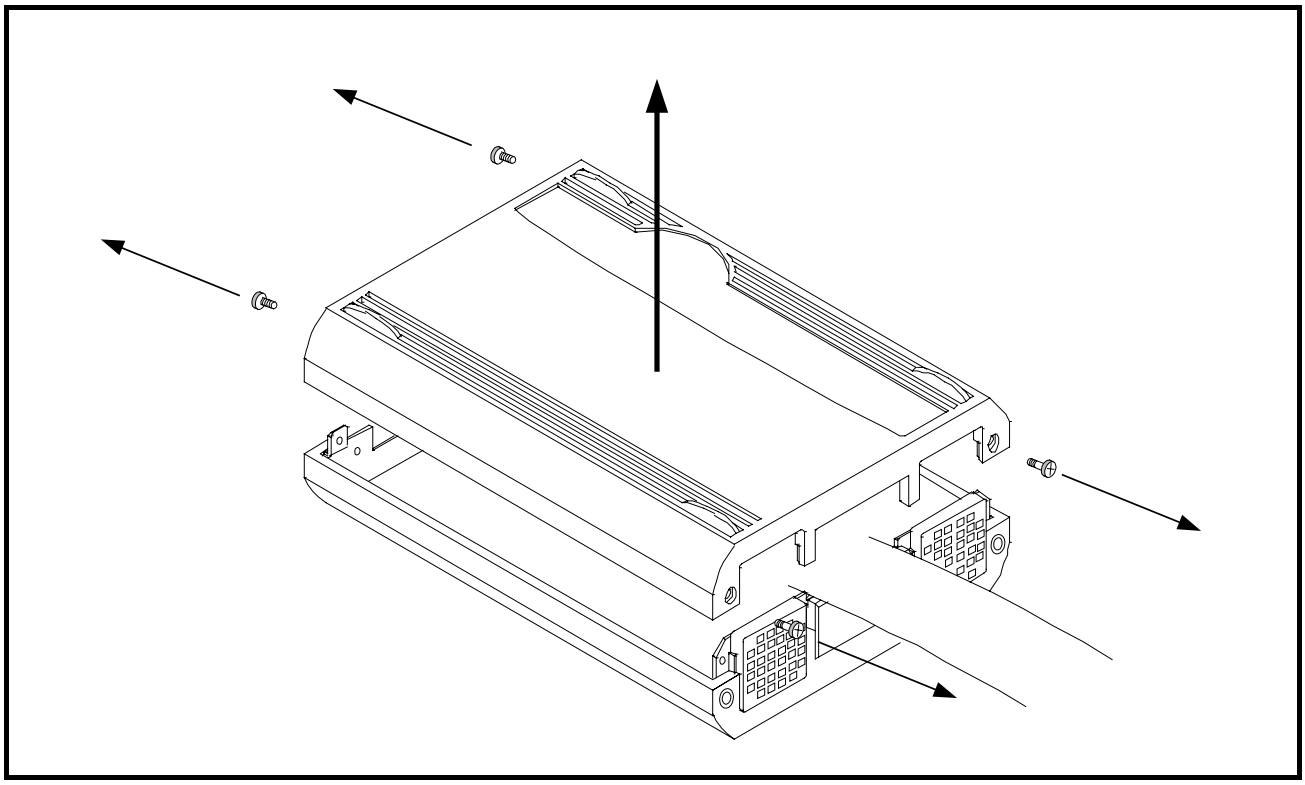


Figure 2.1 Removing the upper cover

⚠ CAUTION

Note on Removing and Attaching the Upper Cover:

- Always shut OFF power when removing/attaching the upper cover or changing the switch settings. Otherwise the internal circuit may be damaged.

2.2 Each Setting

Figure 2.2 shows the positions of the following parts.

(1) Oscillator circuit board
(2) Switches
(3) Socket for mounting network resistor for pullup
(4) Bypass capacitor for A/D converter

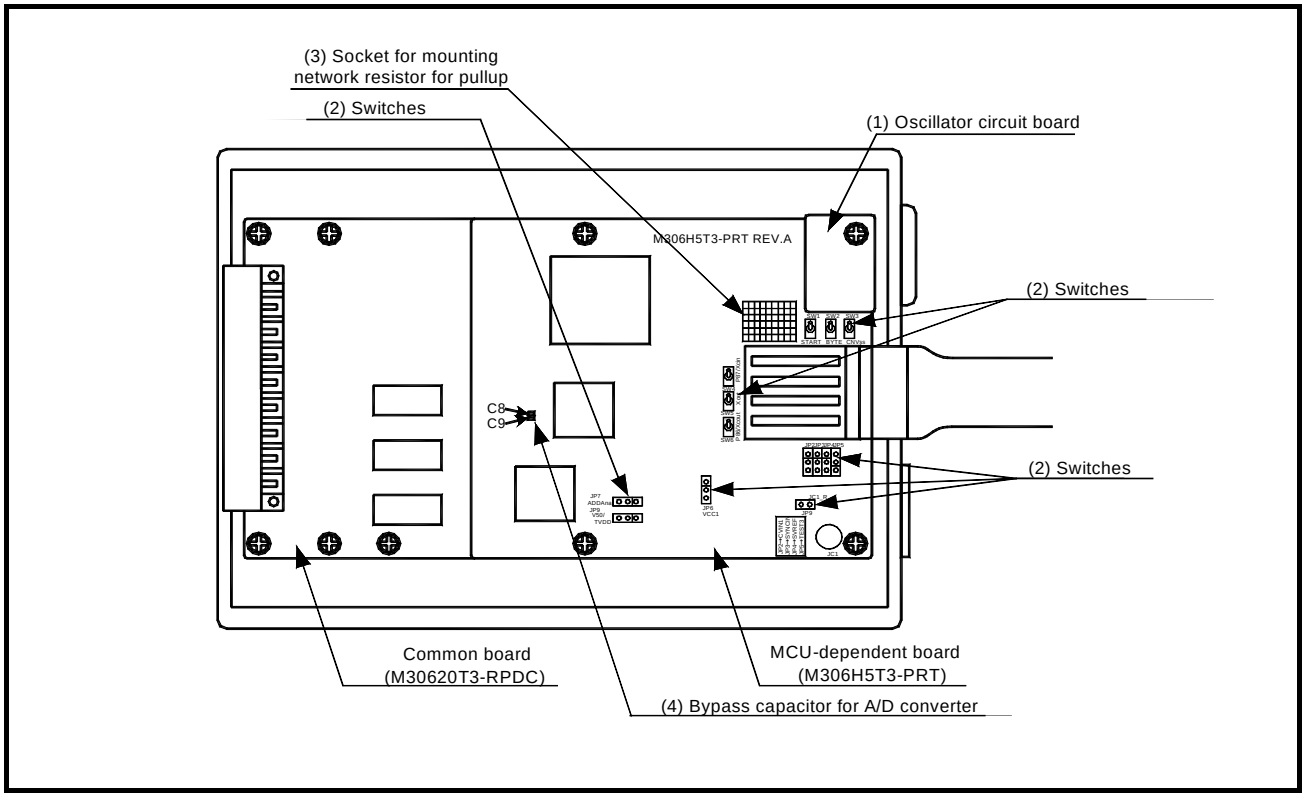


Figure 2.2 Positions of each part

2.3 Selecting Clock Supply and Replacing Oscillator Circuit Boards

2.3.1 Clock Supply to the MCU

There are two ways to supply a clock to the MCU, using the oscillator circuit of the emulation pod or using the oscillator circuit on the user system. Table 2.1 lists the factory-settings of each clock supply when you install the emulator debugger. The clock supply can be set in the Init dialog box when starting up the emulator debugger or inputting CLK command on the script window

Table 2.1 Clock Supply to the MCU

Clock	Description	Display of emulator debugger	Default setting
X_{IN}-X_{OUT}	Internal oscillator circuit of emulation pod (OSC-3: 16.0 MHz or OSC-2)	Internal	Yes
	User system	External	-
X_{CIN}-X_{COUT}	Internal oscillator circuit of emulation pod (32.768 kHz)	Internal	-
	User system	External	Yes

IMPORTANT

Note on Changing the Clock Supply:

- The clock supply can be set in the Init dialog box when starting up the emulator debugger or inputting CLK command on the script window.
- For pins X_{CIN}-X_{COUT}, it is necessary to set the switches in the emulation pod. For details, refer to "2.4 Switch Settings" (page 27)

2.3.2 Using the Internal Oscillator Circuit Board

An oscillator circuit board for 16.0 MHz (OSC-3) is mounted on this product. Also the oscillator circuit board (OSC-2) is attached to change the oscillation frequency. When you use an internal oscillator circuit as a main clock, "Internal" can be set by the emulator debugger.

2.3.3 Changing the Internal Oscillator Circuit of the Emulation Pod

To use the emulation pod at a frequency other than 16.0 MHz, build the desired oscillator circuit on the included OSC-2 oscillator circuit board (bare board) and replace the board installed in the emulation pod when shipped from the factory.
Figure 2.3 shows an external view of the OSC-2 oscillator circuit board (bare board) and where connector pins are located. Figure 2.4 shows the circuitry of the OSC-2 oscillator circuit board (bare board). Use the number of oscillator circuits recommended by the oscillator manufacturer.

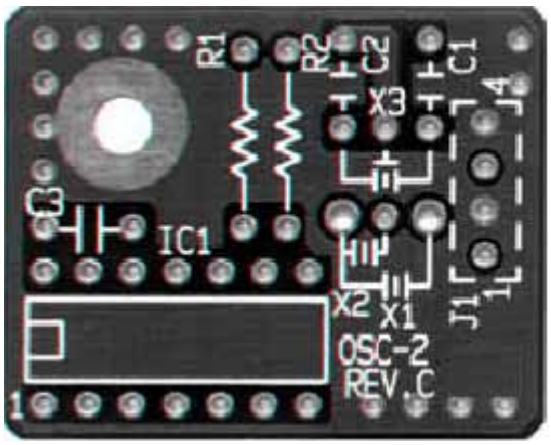


Figure 2.3 External view of the OSC-2 oscillator circuit board and its connector pin positions

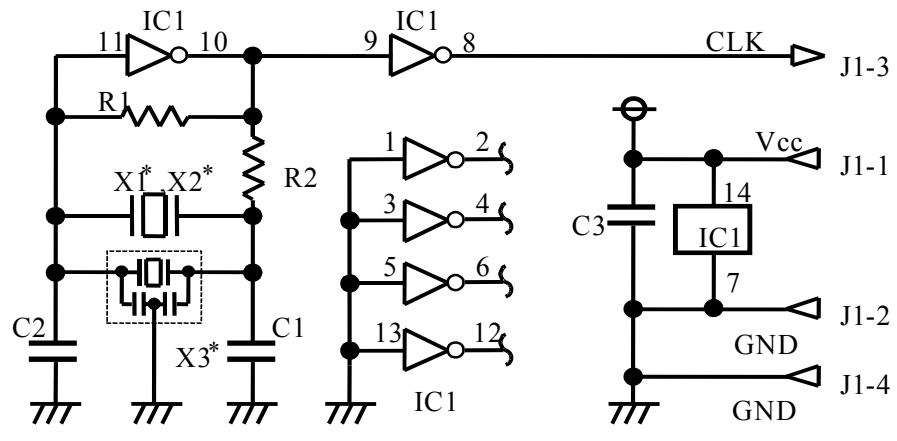
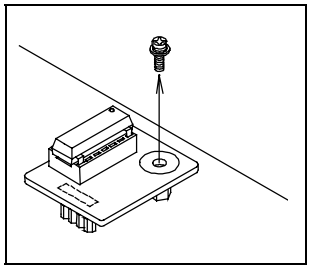


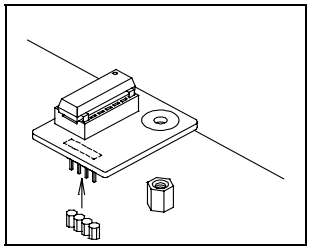
Figure 2.4 Circuits of the OSC-2 oscillator circuit bare board

2.3.4 Replacing Oscillator Circuit Boards

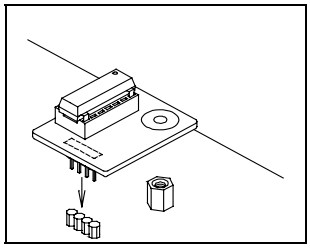
Figure 2.5 shows how to replace the oscillator circuit boards. For the position of the oscillator circuit board, see Figure 2.2.



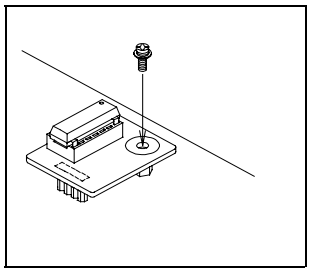
Unscrew the screw securing the oscillator circuit board.



Lift off the oscillator circuit board.



Insert the J1 connector of a new oscillator circuit board to the connector of the main board.



Secure the new oscillator circuit board with the screw.

Figure 2.5 Replacing oscillator circuit boards

⚠ CAUTION

Note on Replacing the Oscillator Circuit Board:

- Always shut OFF power when removing the upper cover or replacing oscillator circuit board. Otherwise, internal circuits may be damaged.

2.3.5 Using the Oscillator Circuit on the User System

To operate this product with an external clock, construct the oscillator circuit as shown in Figure 2.6 in the user system and input the oscillator output at 50% duty (within the operating range of the evaluation MCU) into pin X_{IN}. And pin X_{OUT} should be open. Choose "External" in the emulator debugger to use this clock.

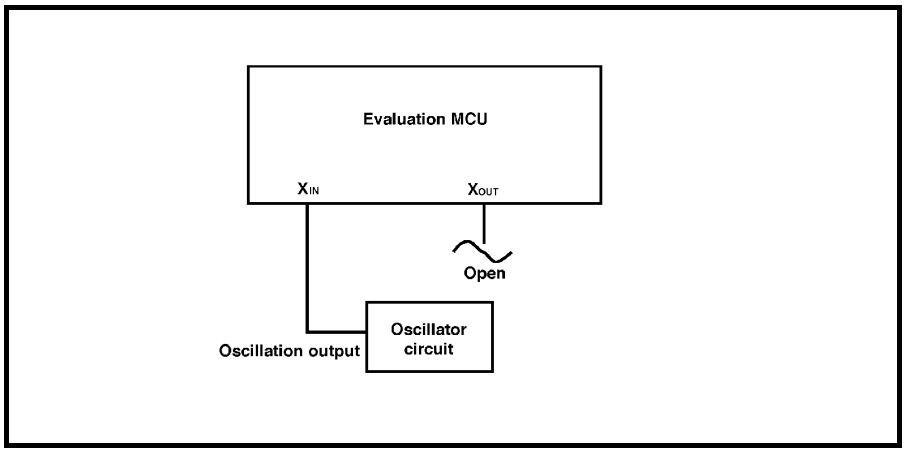


Figure 2.6 External oscillator circuit

Make note that in the oscillator circuit shown in Figure 2.7 where a resonator is connected between pins X_{IN} and X_{OUT}, oscillation does not occur because a converter board and other devices are used between the evaluation MCU and the user system. It is same for sub-clock oscillator circuits (X_{CIN} and X_{COUT}).

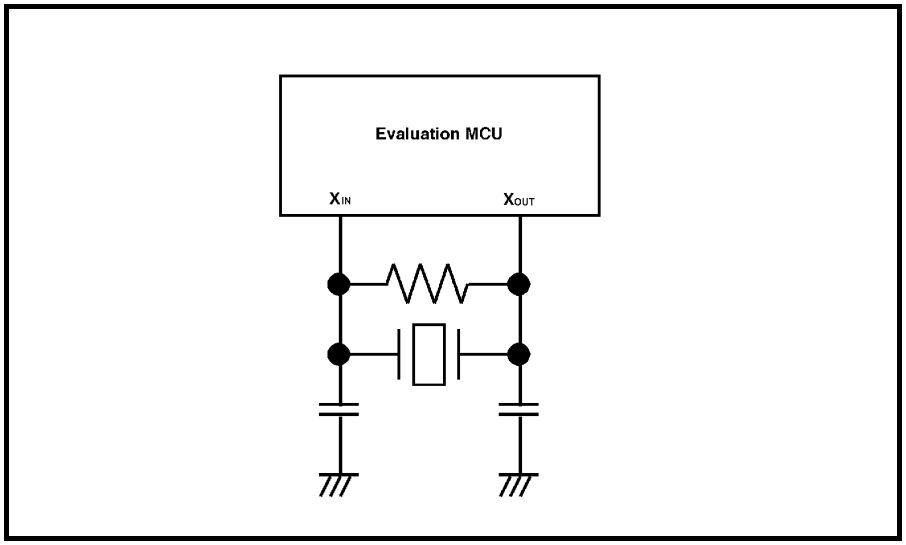


Figure 2.7 Circuit in which oscillation does not occur (same for X_{CIN}-X_{COUT})

2.4 Switch Settings

Here follows explanations of the switches of the M306H5T3-RPD-E.

Tables 2.2 and 2.3 list how to set toggle switches SW1 to SW6 of the M306H5T3-PRT board (MCU-dependent). Tables 2.4 and 2.5 list how to set jumper switches JP2 to JP9 on the M306H5T3-PRT (MCU-dependent board).

2.4.1 Toggle Switches SW1 to SW6 on the M306H5T3-PRT Board (MCU-dependent)

Table 2.2 Switch settings of the M306H5T3-RPD-E (1)

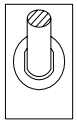
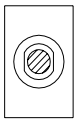
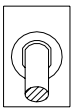
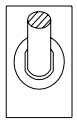
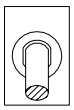
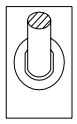
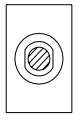
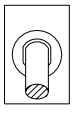
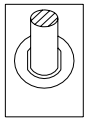
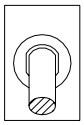
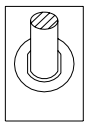
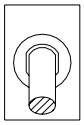
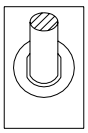
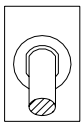
Signal	Switch	Setting		Description
START	SW1	 (Factory-setting)	H OPEN L	Pulls up pin START of the MCU with a resistance of 10 kΩ. Xin-Xout is selected as an operation clock after releasing reset.
			H OPEN L	Does not pull up/down pin START of the MCU. **Be sure to use this setting when the user system is connected.**
			H OPEN L	Pulls down pin START of the MCU with a resistance of 10 kΩ. Xcin-Xcout is selected as an operation clock after releasing reset.
BYTE	SW2	 (Factory-setting)	L OPEN H	Pulls down pin BYTE of the MCU with a resistance of 33 kΩ. Be sure to use this setting when the user system is not connected in 16-bit bus mode.
			L OPEN H	Does not pull up/down pin BYTE of the MCU. **Be sure to use this setting when the user system is connected.**
			L OPEN H	Pulls up pin BYTE of the MCU with a resistance of 33 kΩ. Be sure to use this setting when the user system is not connected in 8-bit bus mode.
CNVSS	SW3	 (Factory-setting)	L OPEN H	Pulls down pin CNVSS of the MCU with a resistance of 1 kΩ. Be sure to use this setting when the user system is not connected in single-chip mode or memory expansion mode.
			L OPEN H	Does not pull up/down pin CNVSS of the MCU. **Be sure to use this setting when the user system is connected.**
			L OPEN H	Pulls up pin CNVSS of the MCU with a resistance of 1 kΩ. Be sure to use this setting when the user system is not connected in microprocessor mode.

Table 2.3 Switch settings of the M306H5T3-RPD-E (2)

Signal	Switch	Setting		Description
P87/Xcin	SW4	 (Factory-setting)	P87 Xcin	Sets pin P87/Xcin to port P87 and connects to the user system.
			P87 Xcin	Sets pin P87/Xcin to Xcin and connects to the user system.
Xout	SW5	 (Factory-setting)	OPEN Xout	Does not connect pin Xout to the user system.
			OPEN Xout	Does not connect pin Xout to the user system.
P86/Xcout	SW6	 (Factory-setting)	P86/ Xcout OPEN	Connects pin P86/Xcout to the user system.
			P86/ Xcout OPEN	Does not connect pin P86/Xcout to the user system.

⚠ CAUTION

Note on Switch Settings:

- Always shut OFF power before changing switch setting. Othewise, internal circuit board may be damaged.

IMPORTANT

Note on START, BYTE and CNVSS Switche Settings:

- Switch settings of the START, BYTE and CNVSS are for debugging without the user system connected.

2.4.2 Jumper Switches JP2 to JP9 on the M306H5T3-PRT Board (MCU-dependent)

Table 2.4 Switch settings of the M306H5T3-RPD-E (3)

Signal	Switch	Setting of jumper switches	
CVIN1	JP2	FLX  INT Connects pin CVIN1 to the user system via the M3T-FLX160C.	FLX  INT Connects pin CVIN1 to internal circuit of the M306H5T3-PRT. (Factory-setting)
SYNCIN	JP3	FLX  INT Connects pin SYNCIN to the user system via the M3T-FLX160C.	FLX  INT Connects pin SYNCIN to internal circuit of the M306H5T3-PRT. (Factory-setting)
SVREF	JP4	FLX  INT Connects pin SVREF to the user system via the M3T-FLX160C.	FLX  INT Connects pin SVREF to variable resistor VR1 on the M306H3T3-PRT. (Factory-setting)
TEST3	JP5	FLX  INT Pin TEST3 is fixed to High.	FLX  INT Connects pin TEST3 to the user system via the M3T-FLX160C. (Factory-setting)
VCC1	JP6	INT  FLX Connects pin VCC1 of MCU to the internal power supply of pod (equipotential of VCC2).	INT  FLX Connects pin VCC1 of MCU to the user system. Be sure to use this setting when the potentials of VCC1 and VCC2 are different. (Factory-setting)
$VDDA_{na}$	JP7	 Do not use this setting.	 Be sure to use this setting. (Factory-setting)

Table 2.5 Switch settings of the M306H5T3-RPD-E (4)

Signal	Switch	Setting of jumper switches	
JC1_R	JP8	JC1_R  Does not pull down video input signal (RCA connector).	JC1_R  Pulls down video input signal (RCA connector) with a resistance of 75 Ω (Factory-setting)
TVDD	JP9	 Do not use this setting.	 Be sure to use this setting. (Factory-setting)

⚠ CAUTION

Note on Switch Settings:

- Always shut OFF power before changing switch setting. Otherwise, internal circuit board may be damaged.

2.5 Installing and Removing Network Resistors for Pullup

In this product, you cannot control pullup for ports P0 to P5 by pullup control registers (pullup control register read/write are possible).

A socket for installing the network resistor for pullup is mounted in this product. Mount the 51 kΩ network resistor supplied with this product to the port for which pullup control is required. For the mounting location, refer to Figure 2.8 below. And for the positions of each part, refer to Figure 2.2.

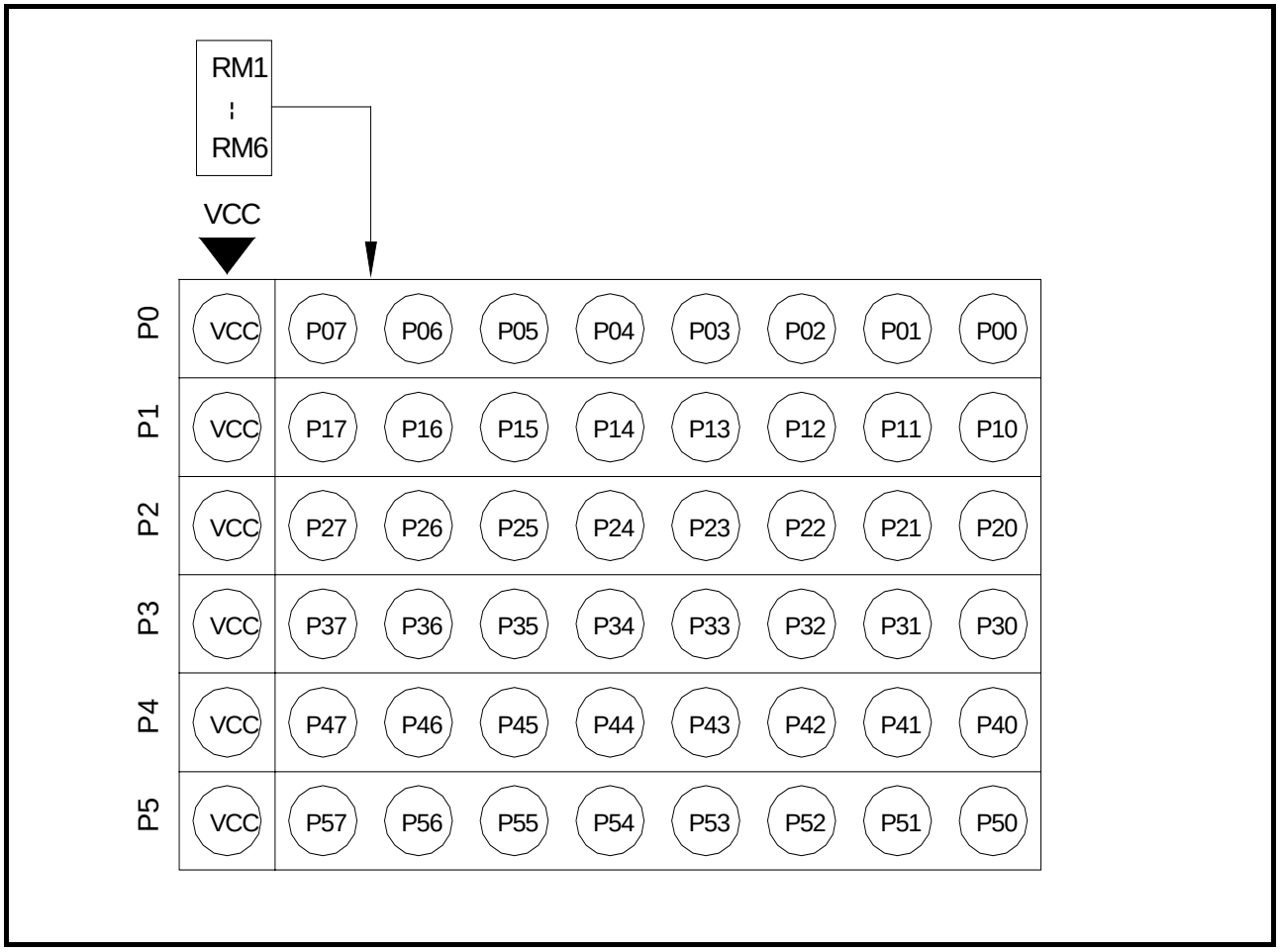


Figure 2.8 Position for mounting network resistors for pullup

⚠ CAUTION

Note on Installing and Removing Network Resistors for Pullup:

- Always shut OFF power before installing or removing network resistors for pullup. Otherwise, internal circuit board may be damaged. Also install network resistors for pullup properly. Otherwise, the emulation pod will be damaged.

2.6 Bypass Capacitors for A/D Converter

The M306H5T3-RPD-E has the M306H5T3-PRT board which has a foot pattern for installing bypass capacitors for A/D converter near the MCU and premounted 0.1µF capacitors. Mount suitable bypass capacitors as occasion demands. Figure 2.2 shows where they are installed and Figure 2.9 shows their connection.

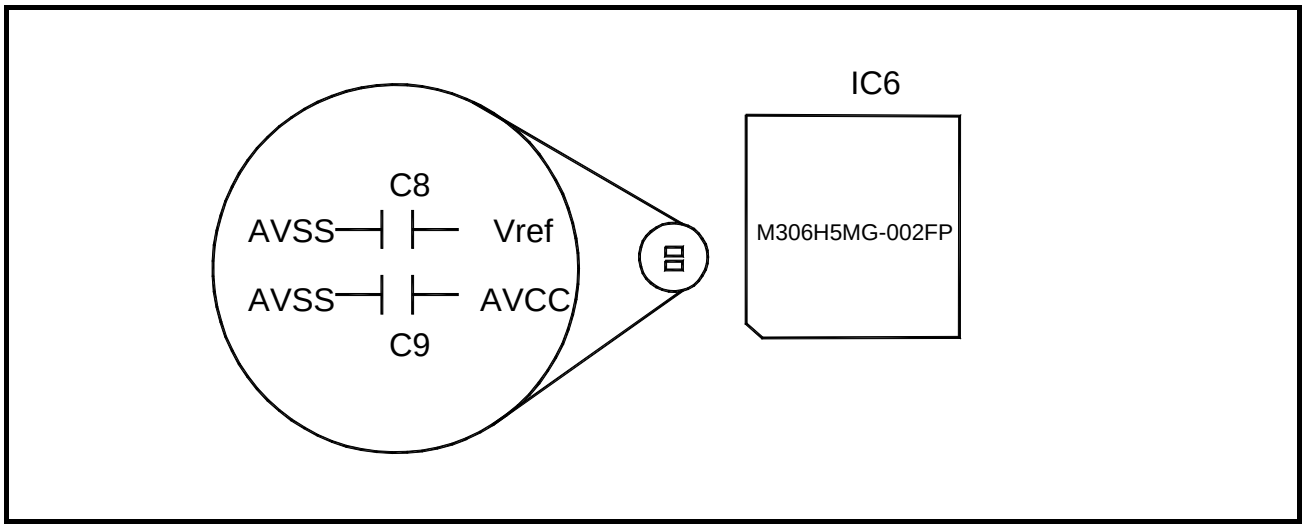


Figure 2.9 Foot patterns of bypass capacitors for A/D converter

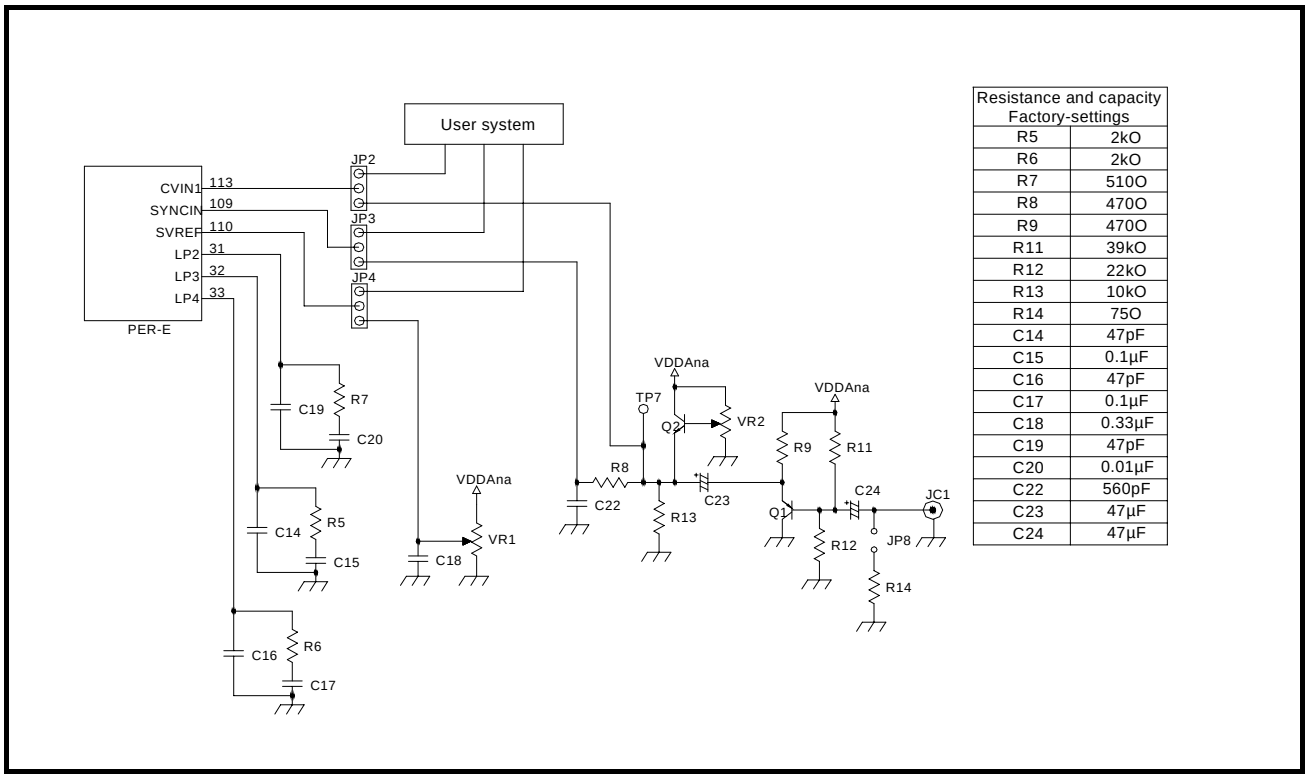
IMPORTANT

Note on the A/D Converter Function:

- Because a flexible cable and other devices are used between the evaluation MCU and the user system, the A/D converter operates differently from that of the actual MCU. Make the final evaluation of the A/D converter with the actual MCU.

2.7 Connection Diagram of Data Slicer

This product has on-board sockets to change parts used for circuits connected to a data slicer. The circuit and the arrangement of the parts used for each circuit are shown in Figure 2.10 and Figure 2.11, respectively.



Resistance and capacity Factory-settings	
R5	2kO
R6	2kO
R7	510O
R8	470O
R9	470O
R11	39kO
R12	22kO
R13	10kO
R14	75O
C14	47pF
C15	0.1µF
C16	47pF
C17	0.1µF
C18	0.33µF
C19	47pF
C20	0.01µF
C22	560pF
C23	47µF
C24	47µF

Figure 2.10 Connection diagram of circuits connected to the data slicer

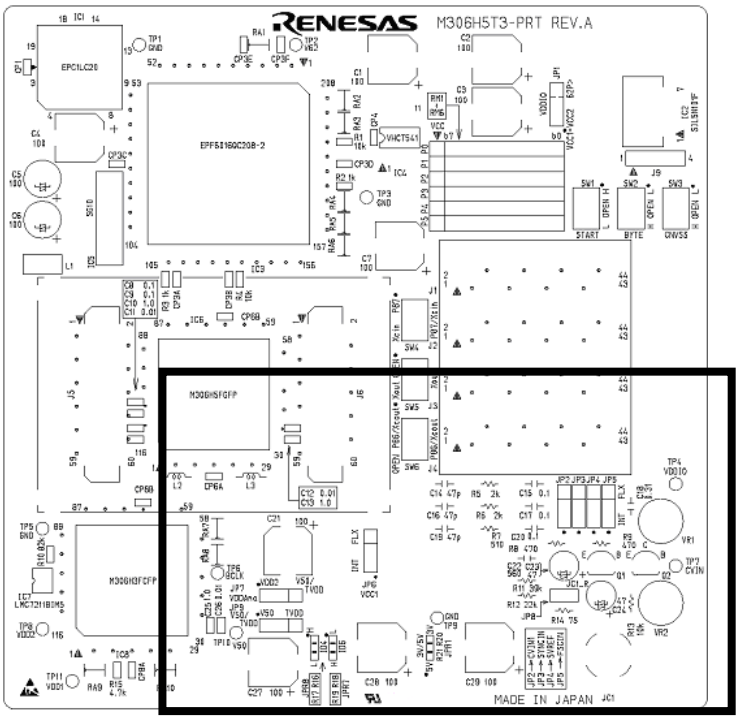


Figure 2.11 Arrangement of the parts used for each circuit

2.8 Connecting the PC4701

To connect the emulation pod to the PC4701, use the FLX120-RPD 120-pin flexible cable included with this product package. Connect the PC4701 side connector of the FLX120-RPD to the cable connector of the PC4701, then secure with screws the FLX120-RPD.

2.8.1 Connecting the Cable to the PC4701

Figure 2.12 shows how to connect the PC4701 and FLX120-RPD.

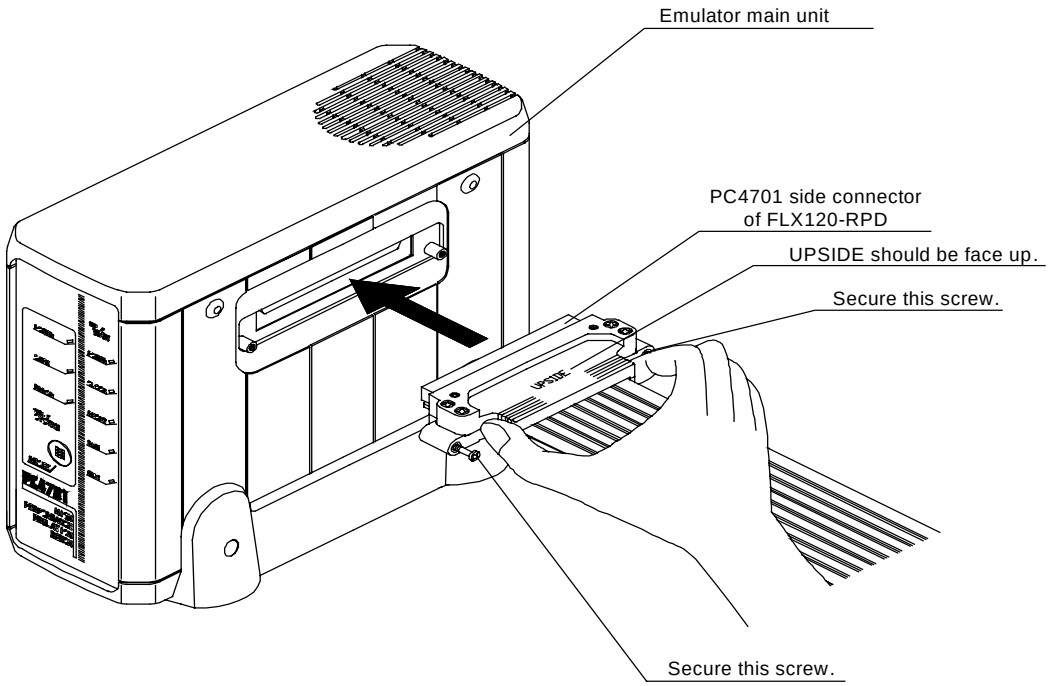


Figure 2.12 Connecting the cable to the PC4701

⚠ CAUTION

Note on Connecting the Cable:

- Always shut OFF power before connecting the cable. Otherwise, the internal circuits may be damaged.

IMPORTANT

Notes on Connecting the Cable and Securing the Screws:

- To connect the FLX120-RPD, be sure to hold the both sides of the PC4701 side connector horizontally with the "UPSIDE" facing up.
- After connecting the cable to the emulator main unit PC4701, be sure to secure the screws mounted in both sides of the connector.

2.8.2 Connecting the Cable to the Emulation Pod

Figure 2.13 shows how to connect the FLX120-RPD and the emulation pod.

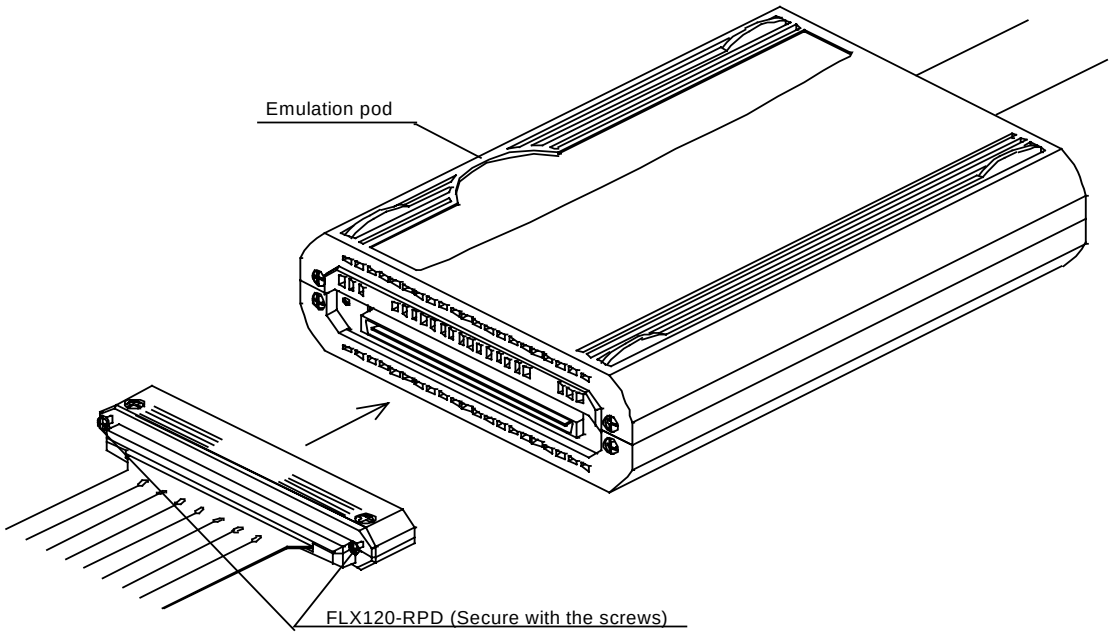


Figure 2.13 Connecting the cable to the emulation pod

⚠ CAUTION

Note on Connecting the Cable:

- Always shut OFF power before connecting the cable. Otherwise, the internal circuits may be damaged.

IMPORTANT

Note on Securing the Screws:

- After connecting the emulation pod and the FLX120-RPD, be sure to secure the screws mounted in both sides of the connector cover

2.9 Connecting the User System

Connect the emulation pod to the user system as shown in Figure 2.14.

(1) Mount the NQPACK116SB to the user system.
(2) Attach the YQPACK116SB to the NQPACK116SB.
(3) Fix the YQPACK116SB with the included YQ-GUIDE's.
(4) Attach the CN2 side of the M306H2T-PTC to the tip (CN2 side) of the pitch converter board FLX160-PRB connected to the emulation pod probe.
(5) Attach the M306H2T-PTC to the fixed YQPACK116SB.

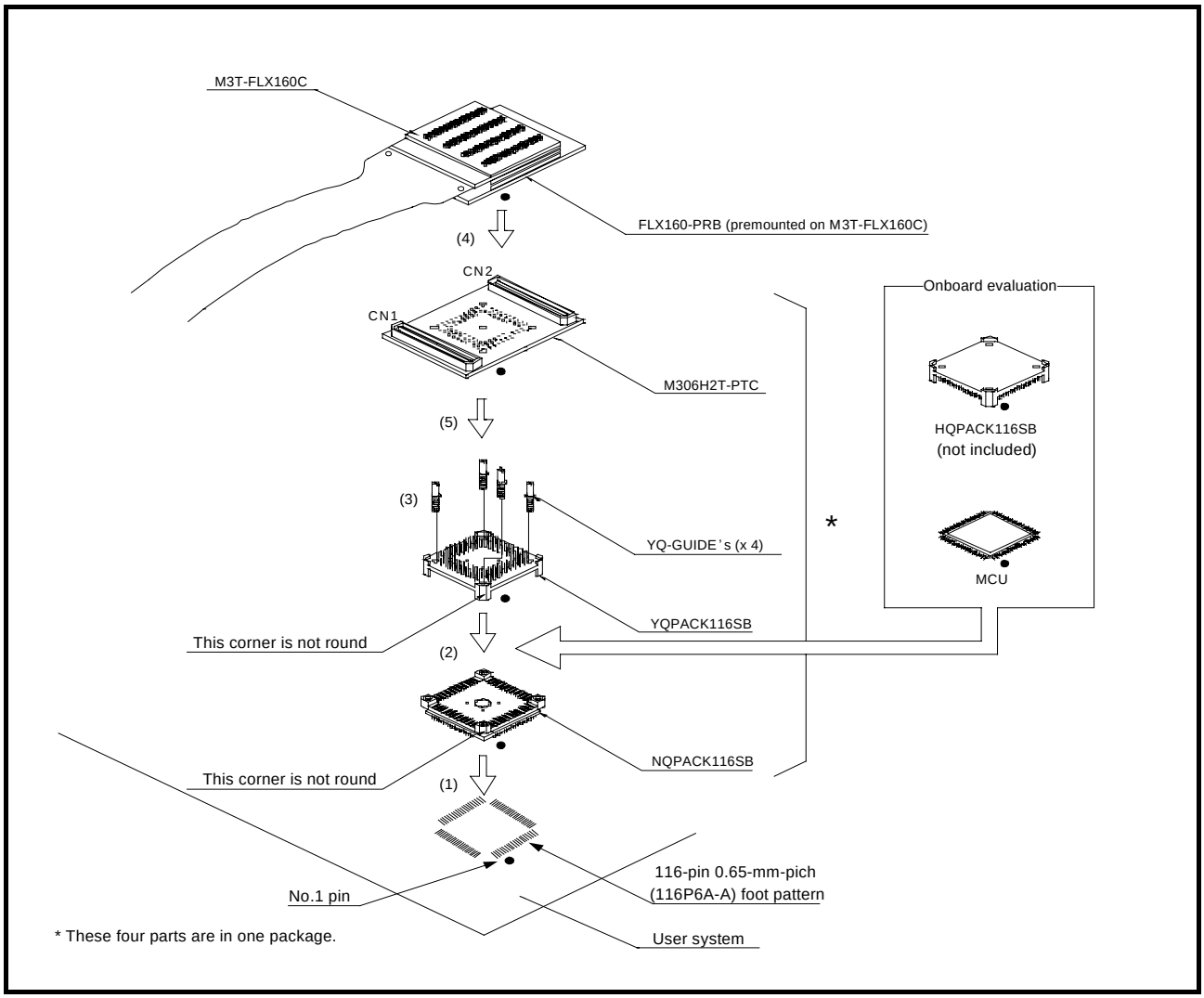


Figure 2.14 Connecting the user system

⚠ CAUTION

Note on Connecting the user system:

- Take care not to attach the converter board in a wrong direction. It may cause a fatal damage to the emulation pod.

IMPORTANT

Note on Connector of the Converter Board:

- The connectors of the FLX160-RPB and M306H2T-PTC are guaranteed for only 50 insertion/removal iterations.

3. Usage

This chapter describes the setting when you use this product for the first time and the workflow, from turning on the power of this product to starting up the emulator debugger.

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3.1 When Using This Product for the First Time

3.1.1 Making an MCU File

It is necessary to make an MCU file to use this product with the emulator debugger M3T-PD30. According to the MCU you use, change the contents of the MCU file. Make the MCU file following the description below using a text editor and store it in the "mcufiles" folder in the directory where the emulator debugger is installed.

The MCU file contains information such as, SFR area, internal RAM area, internal ROM area, firmware file name. The contents of the MCU file when using the M306H5FGFP (8KB RAM, 256KB ROM) are as follows:

```
0       : SFR area          Start address
3FF     :                   End address
400     : Internal RAM      Start address
23FF    :                   End address
C0000   : Internal ROM      Start address
FFFFF   :                   End address
M30620P : Name of firmware (Do not change.)
0       : Expansion No.     (Do not change.)
```

When using this product in microprocessor mode, set the internal ROM area as follows.

```
00000   : Internal ROM      Start address
00001   :                   End address
```

3.1.2 Setting the Work Area

With this product, the emulator uses 54 bytes as a work area in emulation memory. Therefore, according to the memory mapping of the MCU you use, specify the work area addresses.

In single-chip mode, set the work area address at 10000h.

In memory expansion or microprocessor mode, the areas listed below cannot be used as a work area, specify a work area other than the areas listed below. And the top address of the work area should be an even-numbered address.

(1) SFR area (0000h--003FFh)
(2) External area of multiplex bus setting
(3) Reserved area of 27000h--27FFFh
(4) Stack area used by the emulator for reset command execution (0FFF9h--0FFFFh)

The area used as a work area (54 bytes) is specified in the F/W and Work Area tab of the INIT dialog box of the emulator debugger M3T-PD30. And set the work area as MAP=INT.

3.2 Turning On the Power

3.2.1 Checking Connections of the Emulator System

Before turning the power ON, check the connections of the PC4701, emulation pod, converter board and user system.

3.2.2 Turning ON/OFF the Power

(1) Turn on the power of the emulator and user system as simultaneously as possible.
(2) Turn off the power of the emulator and user system as simultaneously as possible.
(3) Do not leave either the emulator or user system powered on, because of leakage current the internal circuits may be damaged.
(4) When turning on the power again after shutting off the power, wait about 10 seconds.

IMPORTANT

Notes on Power Supply:

- The Vcc2 terminal of the emulator is connected to the user system to observe the voltage of the user system. Therefore design your system so that the user system is powered by an external power supply.
- The voltage of the user system should be within the MCU's specified range.
- Do not change the voltage of the user system after turning on the power.

3.2.3 LED Display When the Emulator Starts Up Normally

After the emulator starts up, check the status of the LEDs on the front panel to see whether emulation pod operation is enabled or not. Figure 3.1 shows front panel LED lighting status when the emulator is turned ON.

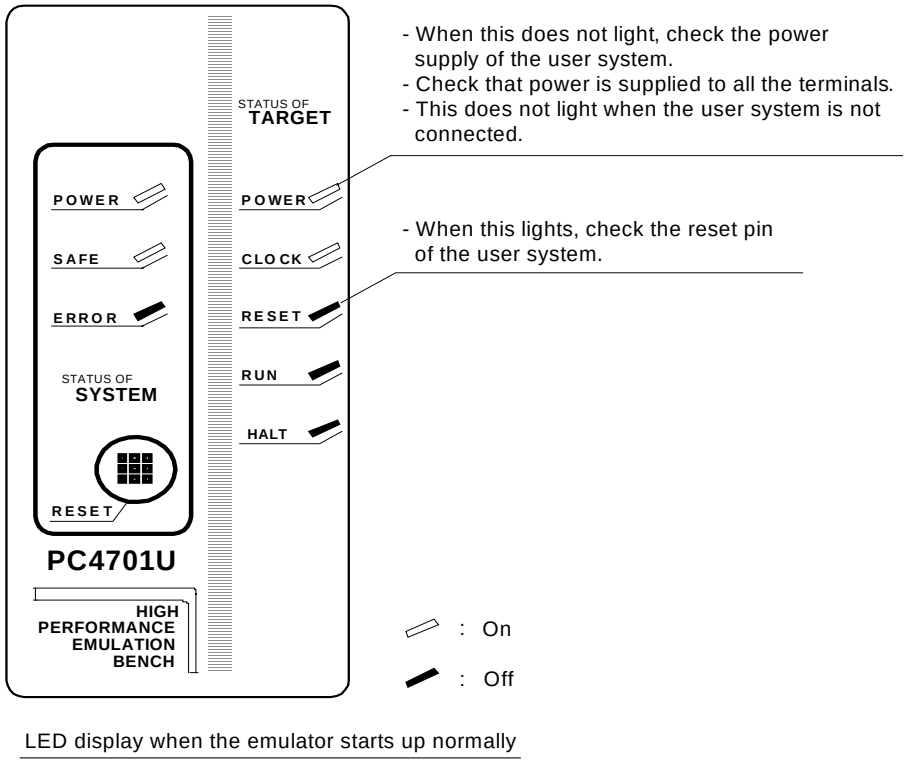

Figure 3.1 LED display when the power turned on

IMPORTANT

Note on Memory Expansion and Microprocessor Modes:

- To use memory expansion or microprocessor mode, be sure to set pins RDY* and HOLD* so that they are not active at startup. Otherwise the emulator system will not start up correctly.

Note on the Target Status POWER LED:

- If the MCU has two or more Vcc terminals, the LED does not light unless power is supplied to all the terminals.

Note on the Target Status CLOCK LED:

- If the LED is not turned on, check the following.
  (1) After powering on the PC4701 (before starting up the emulator debugger):
  Make sure that the oscillator circuit board is properly installed in the PC4701 and it is oscillating normally.
  (2) After the emulator debugger is started up (after the Init dialog box settings are complete):
  Make sure that the oscillator selected in the Init dialog box is oscillating normally.

3.3 Downloading Firmware

3.3.1 When It is Necessary to Download Firmware

It is necessary to download the firmware in the cases listed below. Normally, the following are automatically detected when the emulator debugger is started up, and the firmware is downloaded.

(1) When you use this product for the first time
(2) When the emulator debugger or firmware has been upgraded
(3) When you use this product with a PC4701 which was used with another emulation probe before

If you use this product for the first time or have accidentally failed to download the firmware, redownload the firmware in maintenance mode.

3.3.2 Downloading Firmware in Maintenance Mode

Download the firmware in maintenance mode as explained here following. Figure 3.2 shows LED display during firmware download. **The user system must not be connected when downloading the firmware.**

(1) Within 2 seconds of activating power to the emulator, press the system reset switch on the emulator front panel to switch the emulator to maintenance mode. Then the system status SAFE LED will start blinking.
(2) Start up the emulator debugger. When the Init dialog box setup is complete, the dialog which urges to download the firmware will appear. Download the firmware following messages. Required time for downloading the firmware depends on the connection of the interface.

- USB and LPT interface: about 20 seconds
- Dedicated parallel interface about 30 seconds
- Serial interface about 5 minutes

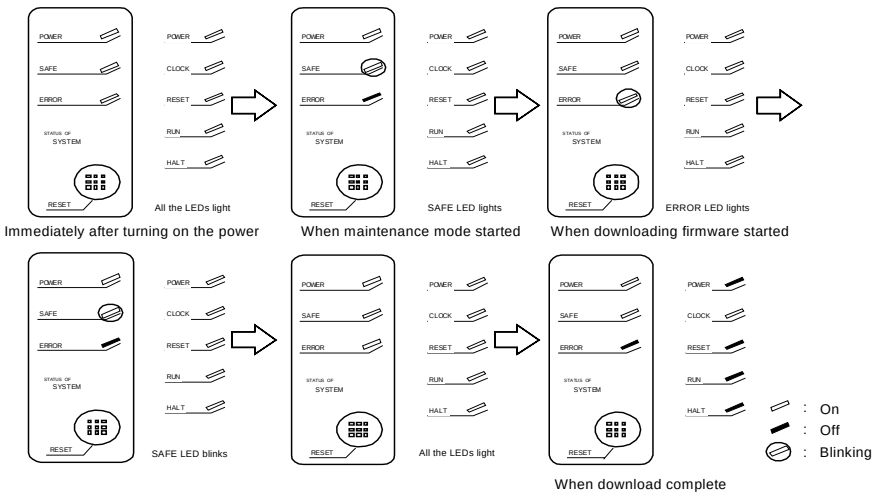

Figure 3.2 Downloading firmware in maintenance mode

IMPORTANT

Note on Downloading Firmware:

- Do not shut OFF power while the firmware is being downloaded. Doing so, the emulator will not start up properly. If power is shut OFF by mistake, redownload the firmware in maintenance mode.

3.4 Self-check

3.4.1 Self-check Procedure

To run the self-check of the emulator, do so as explained here below. While the self-check is in progress, the LEDs will change as shown in Figure 3.4.

(1) If the user system is connected, disconnect it.
(2) Set the switches in the emulation pod to the factory settings as shown in Figure 3.3.
(3) Within 2 seconds of activating power to the emulator, press the system reset switch on the emulator front panel to switch the emulator to maintenance mode.
(4) Check the SAFE LED starts blinking and then press the system reset switch again.
(5) The self-check will start. If the normal result is displayed in about 40 seconds, the self-check has terminated normally.

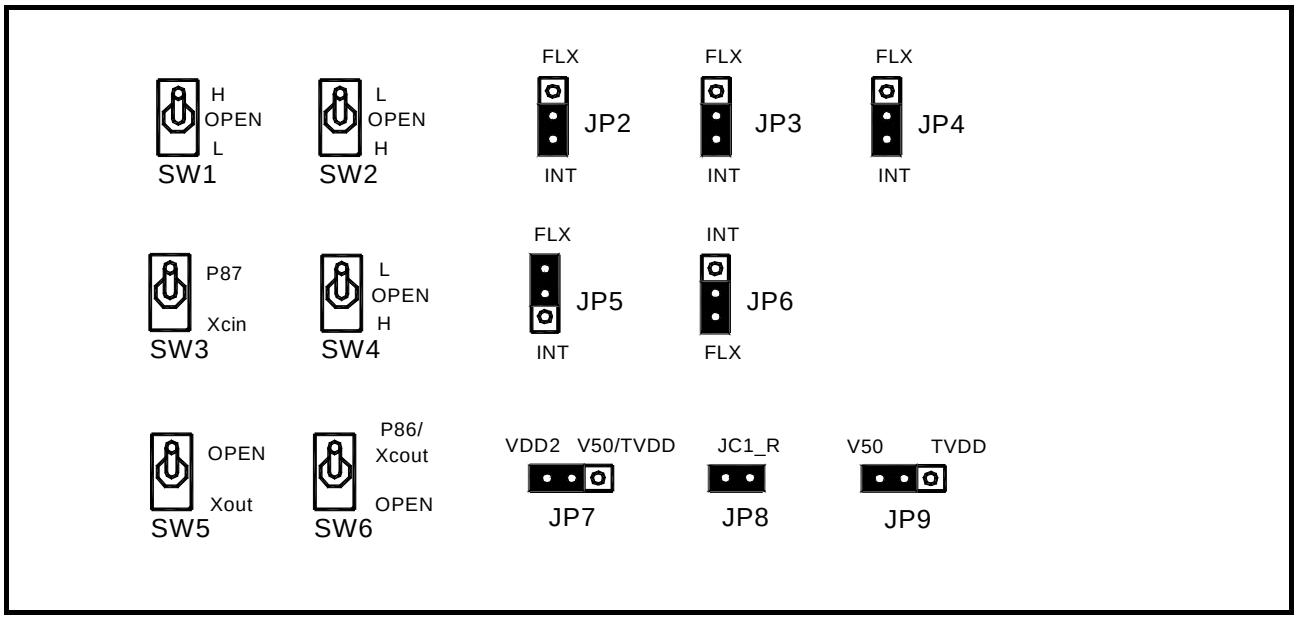

Figure 3.3 Switch settings for the self-check (factory-settings)

3.4.2 If an Error is Detected in the Self-check

f the self-check does not result normally (system status error or target status error in Figure 3.4), check the following.

- Whether the emulation pod and PC4701 are connected properly
- Whether the proper firmware has been downloaded
- Whether the switch settings of this product are the factory-settings (Figure 3.3)

IMPORTANT

Note on Self-check:

- If the self-check does not result normally (excluding user system error), the emulation pod may be damaged. Then contact your local distributor.

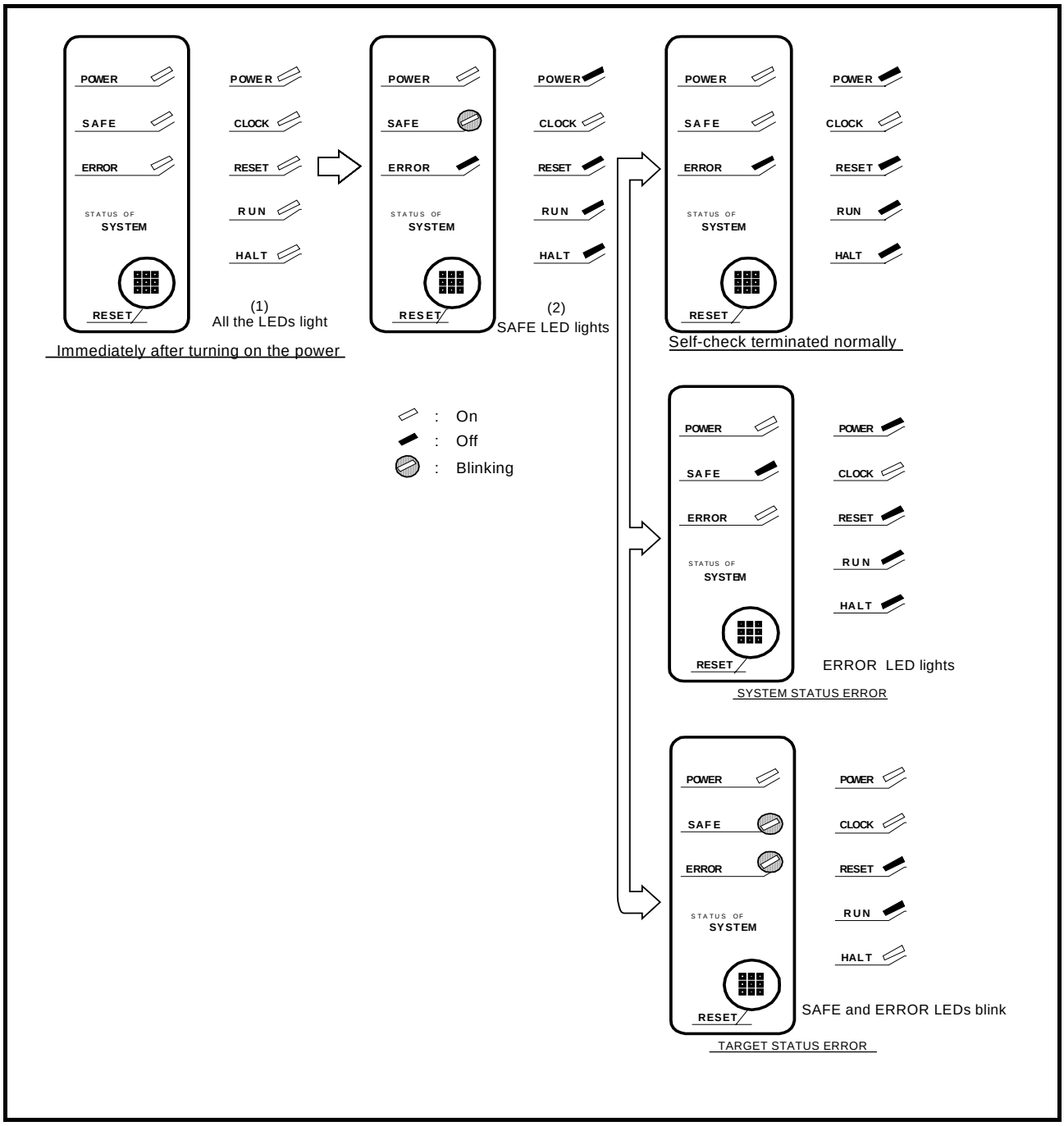

Figure 3.4 Self-check procedure

4. Hardware Specifications

This chapter describes specifications of this product.

4.1 Target MCU Specifications

Table 4.1 lists the specifications of target MCUs which can be debugged with this product.

Table 4.1 Specifications of target MCUs for the M306H5T3-RPD-E

Item	Description
Applicable MCU	M16C/6H Group M306H5
Applicable MCU mode	Single-chip mode, memory expansion mode, microprocessor mode
Emulation Memory	1 MB
Max. operating frequency	16MHz (VCC2=4.2--5.5 V, VCC1=3.0V--VCC2)
Operating voltage	VCC2=4.2--5.5 V, VCC1=3.0V--VCC2 (Xin: when operating without division) VCC2=2.9--5.5 V, VCC1=2.9V--VCC2 (Xin: when operating in a divide-by-16 or 8-mode) VCC2=2.0--5.5 V, VCC123.0V--VCC2 (Xcin when operating) *VCC2=2.0V--2.6V operates only in low power dissipation mode.

Vcc=5V

4.2 Operation Timing in Memory Expansion and Microprocessor Modes

4.2.1 Separate Bus Timing

Table 4.2 and Figure 4.1 show the bus timing in memory expansion and microprocessor modes (3-wait, accessing external area).

Table 4.2 Memory expansion and microprocessor modes (3-wait, accessing external area)

Symbol	Item	Actual MCU [ns]		This product [ns]	
		Min.	Max.	Min.	Max.
td(BCLK-AD)	Address output delay time		40		See left
th(BCLK-AD)	Address output hold time (BCLK standard)	4		See left	
th(RD-AD)	Address output hold time (RD standard)	0		-1	
th(WR-AD)	Address output hold time (WR standard)	(*2)		See left	
td(BCLK-CS)	Chip-select output delay time		40		See left
th(BCLK-CS)	Chip-select output hold time (BCLK standard)	4		See left	
td(BCLK-ALE)	ALE signal output delay time		40		See left
th(BCLK-ALE)	ALE signal output hold time	-4		See left	
td(BCLK-RD)	RD signal output delay time		40		See left
th(BCLK-RD)	RD signal output hold time	0		See left	
td(BCLK-WR)	WR signal output delay time		40		See left
th(BCLK-WR)	WR signal output hold time	0		See left	
td(BCLK-DB)	Data output delay time (BCLK standard)		40		See left
th(BCLK-DB)	Data output hold time (BCLK standard)	4		See left	
td(DB-WR)	Data output delay time (WR standard)	(*1)		See left	
th(WR-DB)	Data output hold time (WR standard)	(*2)		See left	

*1 Calculated by the following formula according to the frequency of BCLK.

$$\frac{(n-0.5)\times 10^9}{f(BCLK)} - 40$$ n: "3" for 3-wait

*2 Calculated by the following formula according to the frequency of BCLK.

$$\frac{0.5\times 10^9}{f(BCLK)} - 10$$ [ns]

Vcc=5V

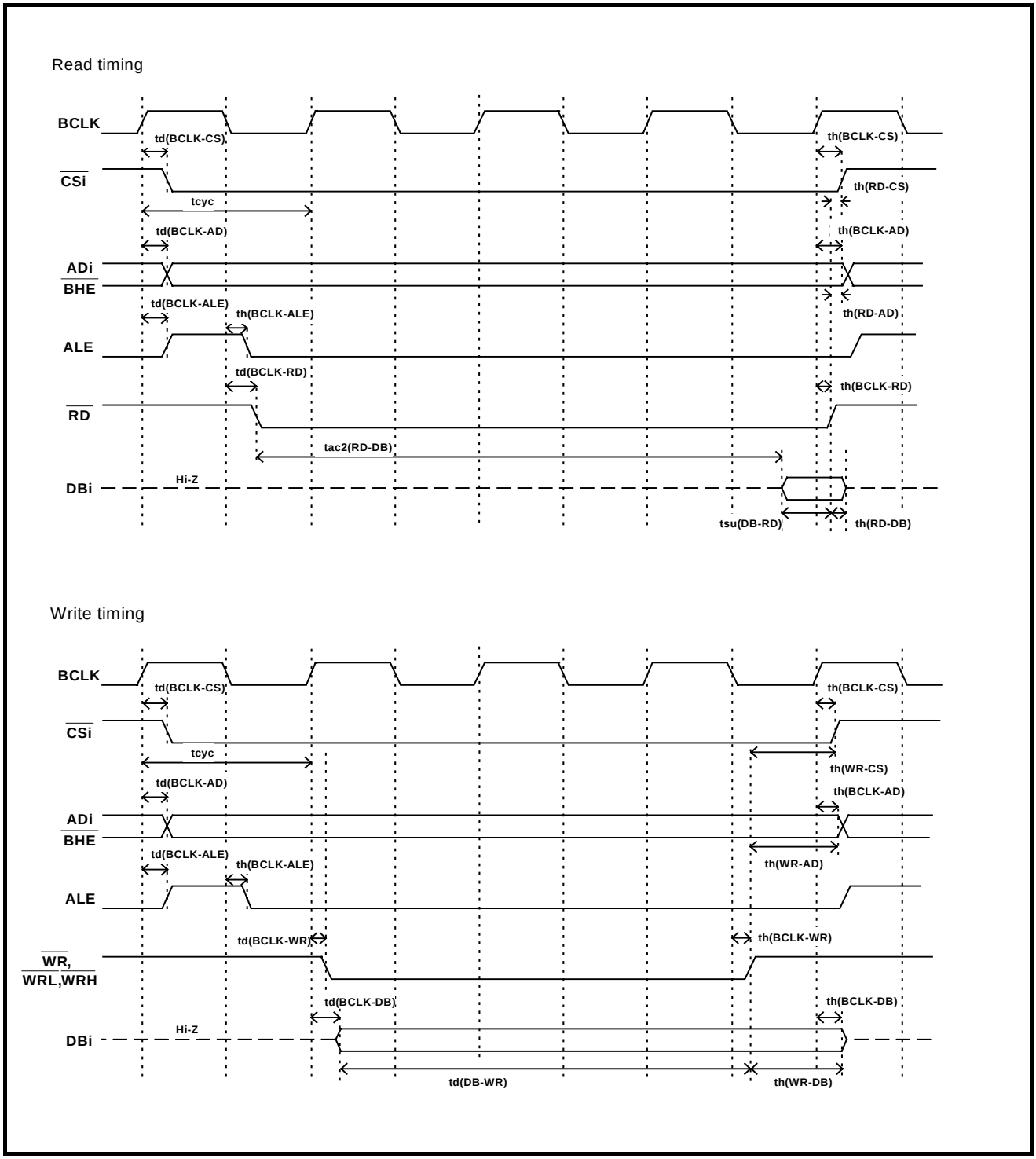

Figure 4.1 Memory expansion and microprocessor modes (3-wait, accessing external area)

Vcc=5V

4.2.2 Multiplex Bus Timing

Table 4.3 and Figure 4.2 show the bus timing in memory expansion and microprocessor modes (2-wait, accessing external area, using multiplex bus).

Table 4.3 Memory expansion and microprocessor modes
(2-wait, accessing external area, using multiplex bus)

Symbol	Item	Actual MCU [ns]		This product [ns]	
		Min.	Max.	Min.	Max.
td(BCLK-AD)	Address output delay time		40		See left
th(BCLK-AD)	Address output hold time (BCLK standard)	4		See left	
th(RD-AD)	Address output hold time (RD standard)	(*1)		See left	
th(WR-AD)	Address output hold time (WR standard)	(*1)		See left	
td(BCLK-CS)	Chip-select output delay time		40		See left
th(BCLK-CS)	Chip-select output hold time (BCLK standard)	4		See left	
th(RD-CS)	Chip-select output hold time (RD standard)	(*1)		See left	
th(WR-CS)	Chip-select output hold time (WR standard)	(*1)		See left	
td(BCLK-RD)	RD signal output delay time		40		See left
th(BCLK-RD)	RD signal output hold time	0		-1	
td(BCLK-WR)	WR signal output delay time		40		See left
th(BCLK-WR)	WR signal output hold time	0		-4	
td(BCLK-DB)	Data output delay time (BCLK standard)		40		See left
th(BCLK-DB)	Data output hold time (BCLK standard)	4		See left	
td(DB-WR)	Data output delay time (WR standard)	(*2)		See left	
th(WR-DB)	Data output hold time (WR standard)	(*1)		See left	
td(BCLK-ALE)	ALE output delay time (BCLK standard)		40		See left
th(BCLK-ALE)	ALE output hold time (BCLK standard)	-4		See left	
td(AD-ALE)	ALE output delay time (Address standard)	(*3)		See left	
th(ALE-AD)	ALE output hold time (Address standard)	(*4)		See left	
td(AD-RD)	After address RD signal output delay time	0		-4	
td(AD-WR)	After address WR signal output delay time	0		-3	
tdz(RD-AD)	Address output floating start time		8		17

*1 Calculated by the following formula according to the frequency of BCLK.

$$\frac{0.5\times10^9}{f(BCLK)}-10 \quad [\text{ns}]$$

*2 Calculated by the following formula according to the frequency of BCLK.

$$\frac{(n-0.5)\times10^9}{f(BCLK)}-40$$ n: "2" for 2-wait

*1 Calculated by the following formula according to the frequency of BCLK.

$$\frac{0.5\times10^9}{f(BCLK)}-25 \quad [\text{ns}]$$

*2 Calculated by the following formula according to the frequency of BCLK.

$$\frac{0.5\times10^9}{f(BCLK)}-15 \quad [\text{ns}]$$

Vcc=5V

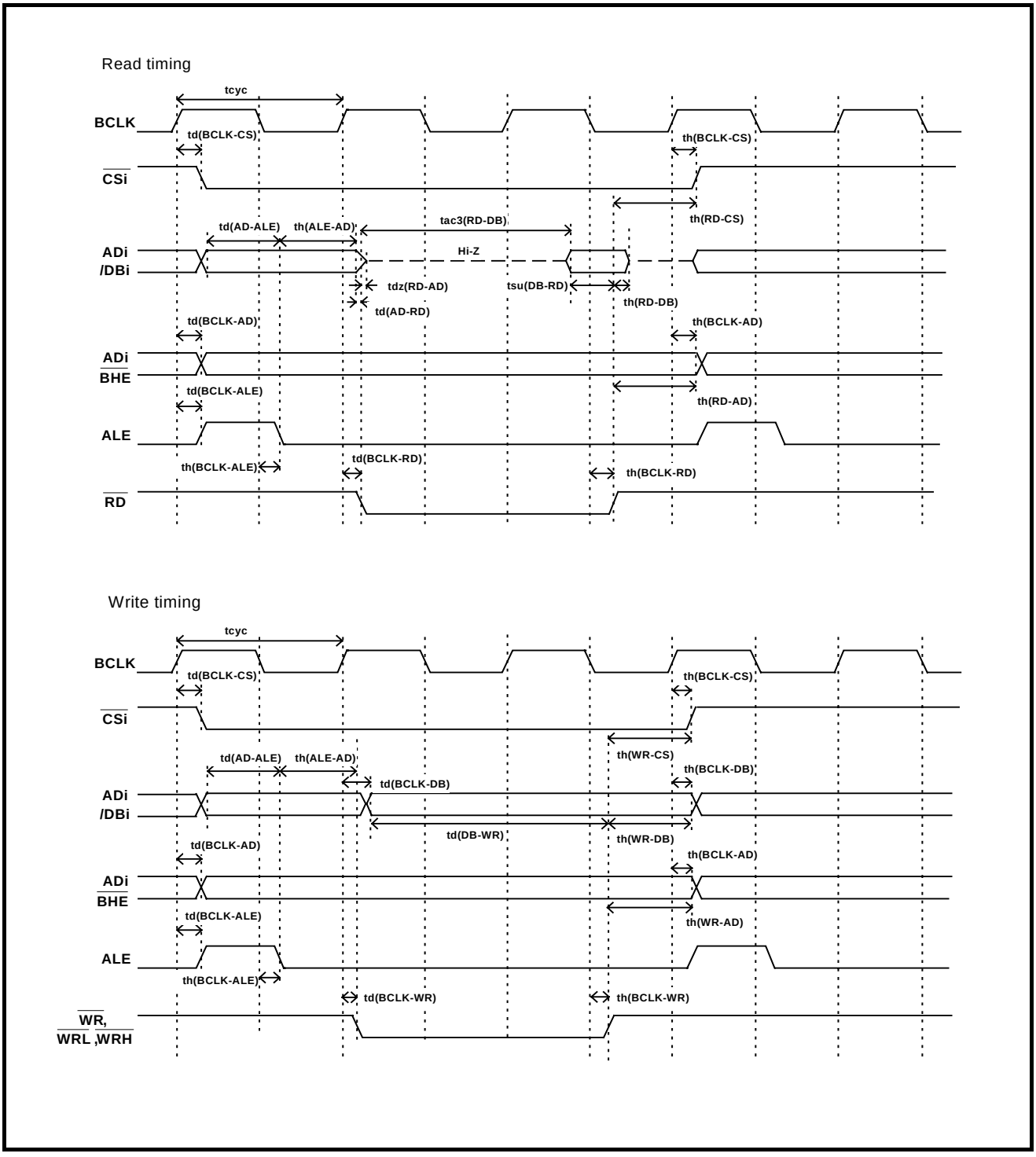

Figure 4.2 Memory expansion and microprocessor modes
(2-wait, accessing external area, using multiplex bus)

Vcc=5V

4.2.3 Timing Requirements

Table 4.4 and Figure 4.3 show the timing requirements.

Table 4.4 Timing requirements

Symbol	Item	Actual MCU [ns]		This product [ns]	
		Min.	Max.	Min.	Max.
tsu(DB-RD)	Data input setup time	40		65	
tsu(RDY-BCLK)	RDY* input setup time	30		55	
tsu(HOLD-BCLK)	HOLD* input setup time	40		80	
th(RD-DB)	Data input hold time	0		See left	
th(BCLK-RDY)	RDY* input hold time	0		See left	
th(BCLK-HOLD)	HOLD* input hold time	0		See left	
td(BCLK-HLDA)	HLDA* output delay time		40		See left

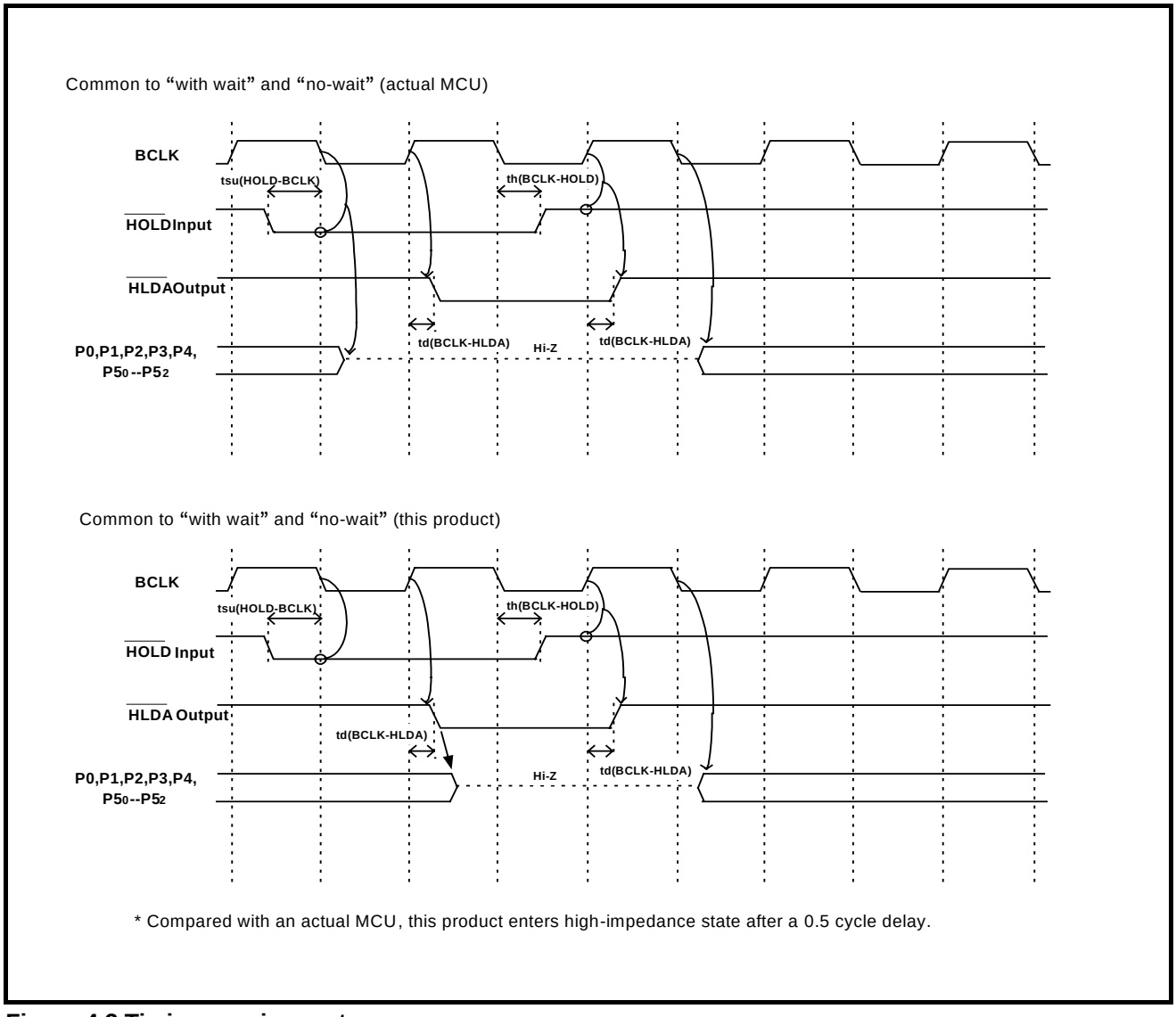

Figure 4.3 Timing requirements

4.3 Differences between the Actual MCU and Emulator

Differences between the actual MCU and emulator are shown below. When debugging the MCU using this product, be careful about the following precautions.

IMPORTANT

Note on Differences between the Actual MCU and Emulator:

- Operations of the emulator system differ from those of actual MCUs as listed below.

(1) Reset condition
Set the time for starting up (0.2 Vcc to 0.8 Vcc) 1 μs or less.

(2) Initial values of internal resource data of an MCU at power-on

(3) Internal memories (ROM and RAM) capacities etc.
With this emulator system, regardless of ROM and RAM of the MCU you use, all the areas other than the SFR area and a reserved area (addresses 27000h--27FFFh) can be read and written into.

(4) Characteristics of ports P0 to P5 and P10
- Ports P0 to P5 are connected via emulation circuits. The device used for the port emulation circuit is the IC23 (ALTERA EPF6016QC208-2).
- Output of port P10 is connected via the CMOS output buffer (TC7WH125FU). Input of that is connected via the IC23 (ALTERA EPF6016QC208-2).

(5) Oscillator circuit
In the oscillator circuit where an oscillator is connected between pins X_{IN} and X_{OUT}, oscillation does not occur because a converter board is used between the evaluation MCU and the user system. It is same for pins X_{CIN} and X_{COUT}. For notes on when using the oscillator circuit on the user system, refer to "2.3.5 Using the Oscillator Circuit on the User System" (page 25).

(6) A/D converter function
Because a flexible cable and other devices are used between the evaluation MCU and the user system, the A/D converter operates differently from that of the actual MCU.

(7) DBC, single-step and BRK instruction interrupt vector table addresses
As the emulator uses the DBC, single-step and BRK instruction interrupt vector table addresses, when reading these addresses, the downloaded data cannot be read (see Table 4.5).

Table 4.5 Vector table addresses for the emulator

Factor of interruption	Vector table addresses	Data read
DBC*1	FFFF4h--FFFF7h	Indefinite
Single-step*1	FFFECh--FFFEFh	Indefinite
BRK instruction	FFFE4h--FFFE7h	Indefinite

*1 Interruption for the emulator only

(8) Address and status of BHE*
When the internal RAM or ROM area of an MCU is accessed during user program execution, actual MCUs retain a preceding address and status of BHE*, while this product does not.

(9) Status of a data bus
In stop or wait mode, actual MCUs retain a preceding status of a data bus, while with this product a data bus is floating.

(10) ALE signal
When the internal RAM or SFR area of the MCU is accessed during user program execution, with the actual MCU, ALE output is fixed to Low, while this product outputs ALE signal.

(11) When pins P57/RDY/CLKout are used for CLKout function and Fc is selected by Clock output selection in stop mode, CLKout output does not stop.

Note on RESET* Input:

- "L" input from the user system to pin RESET* is accepted only while a user program is being executed (only while the RUN status LED on the PC4701's front panel is lit).

IMPORTANT

Note on NMI* Input:

- L" input from the user system to pin NMI* is accepted only while a user program is being executed (only while the RUN status LED on the PC4701's front panel is lit).

Note on RDY* Input:

- Be sure to input "L" to pin RDY* of the user system during the user program executing (only while the RUN status LED on the PC4701's front panel is lit). Inputting "L" to pin RDY* during the user program stopping may cause a malfunction of the emulator.

Note on HOLD* Input:

- You cannot use the hold function with this product. Be sure to input "H" to pin HOLD* of the user system when you use a processor mode other than single-chip mode. If "L" is input to pin HOLD*, this product will not work normally.

Notes on Maskable Interrupts:

- Even if a user program is not being executed (including when run-time debugging is being performed), the evaluation MCU keeps running so as to control the emulation pod. If a maskable interrupt is requested when the user program is not being executed (including when run-time debugging is being performed), the maskable interrupt request cannot be accepted, because the emulator disables interrupts. The interrupt request is accepted immediately after the user program execution is started.
- Take note that when the user program is not being executed (including when run-time debugging is being performed), a peripheral I/O interruption is not accepted.

Note on DMA Transfer:

- With this product, the program is stopped with a loop program to a specific address. Therefore, if a DMA request is generated while the program is stopped, a DMA transfer is executed, but it may not be performed correctly. Also note that the below registers have been changed to generate a DMA transfer as explained here even when the program is stopped.

  DMA0 and DMA1 transfer counter registers : TCR0 and TCR1

Note on Pullup Control:

- With this product, ports P0 to P5 are not pulled up by the pullup control register. To pull up the ports P0 to P5, mount the included network resistor (51 kΩ) to the inside of the emulator as occasion demands. How to mount it, refer to "2.5 Installing and Removing Network Resistors for Pullup" (page 30).

  *Note: Ports P6 to P10 are pulled up by the pullup control registers.
  *Note: Pullup control registers themselves can be read and written into properly.

Note on Final Evaluation:

- Be sure to evaluate your system with an evaluation MCU. Before starting mask production, evaluate your system and make final confirmation with a CS (Commercial Sample) version MCU.

4.4 Connection Diagram

Figure 4.4 shows a connection diagram of the M306H5T3-RPD-E. This connection diagram mainly shows the interface section. The circuits not connected to the user system such as the emulator's control system are omitted. The signals not shown in Figure 4.4 connect the evaluation MCU and the user system directly.

Tables 4.6 to 4.8 show IC electric characteristics of this product for reference purposes.

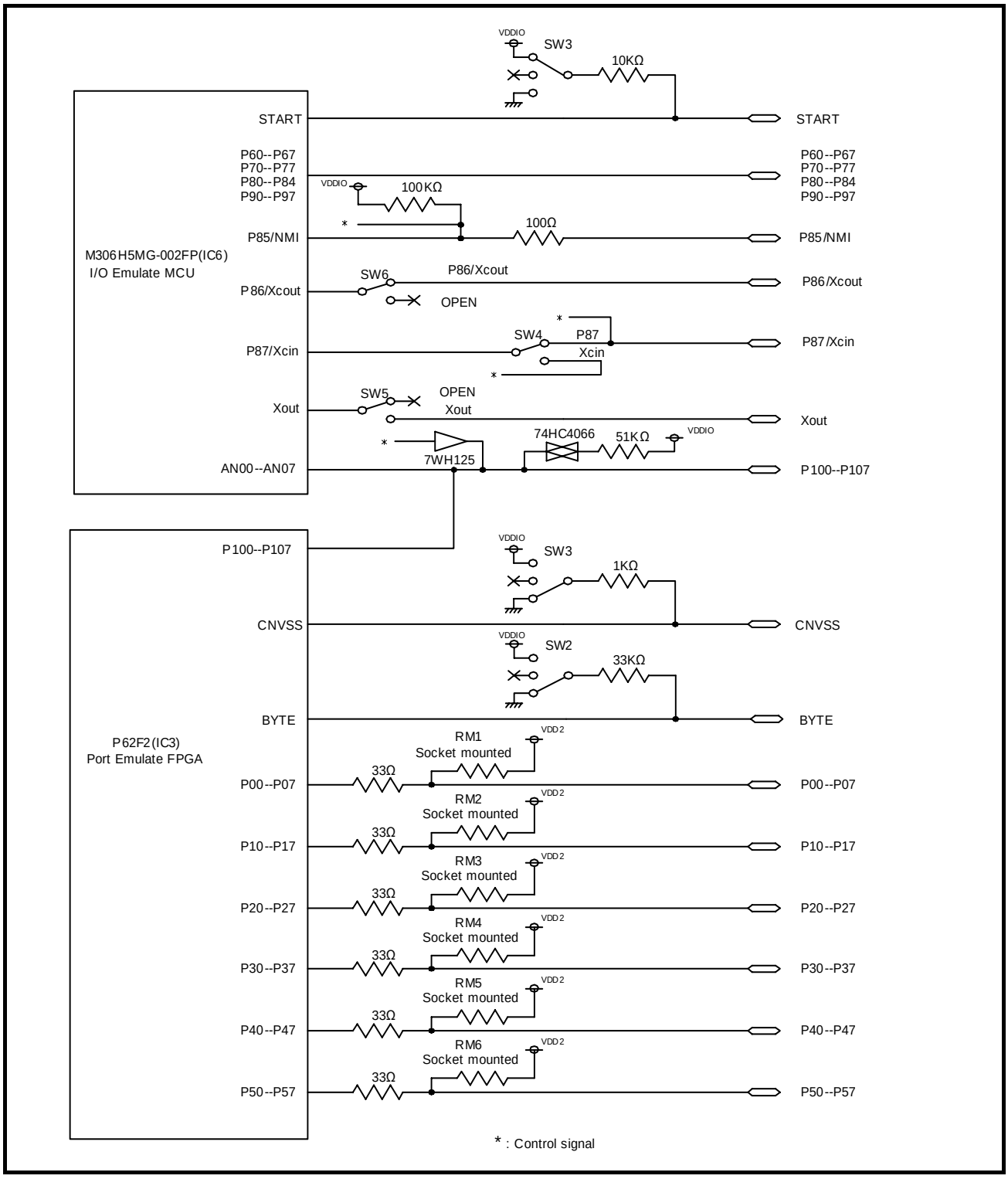

Figure 4.4 Connection diagram

Table 4.6 Electrical characteristics of the 74HC4066

Symbol	Item	Condition	Standard values			Unit
			Min.	Standard	Max.	
R_{ON}	ON resistor	Vcc=4.5V	-	96	200	[Ω]
ΔR_{ON}	ON resistor difference	Vcc=4.5V	-	10	-	
I_{OFF}	Leak current (Off)	Vcc=12.0V	-	-	±1	[μA]
I_{IZ}	Leak current (On, output: open)	Vcc=12.0V	-	-	±1	

Table 4.7 Electrical characteristics of the 7WH125

Symbol	Item	Condition	Standard values			Unit
			Min.	Standard	Max.	
V_{IH}	"H" level input voltage	Vcc=3.0--5.5V	Vcc x 0.7	-	-	[V]
V_{IL}	"L" level input voltage	Vcc=3.0--5.5V	-	-	Vcc x 0.3	
V_{OH}	"H" level output voltage	I_{OH}=-4mA, Vcc=3.0V	2.48	-	-	
		I_{OH}=–8mA, Vcc=4.5V	3.80	-	-	
V_{OL}	"L" level output voltage	I_{OH}=4mA, Vcc=3.0V	-	-	0.44	
		I_{OH}=8mA, Vcc=4.5V	-	-	0.44	
I_{OZ}	Leak current (Tristate)	V_{IN}=V_{IH} or V_{IL}, Vo=V_{CC} or GND, Vcc=5.5V	-2.5	-	2.5	[μA]
C_{IN}	I/O pin input capacitance	V_{IN}=0V, f=1.0MHz	-	-	10	[pF]

Table 4.8 Electrical characteristics of the port emulation FPGA

Symbol	Item	Condition	Standard values			Unit
			Min.	Standard	Max.	
V_{IH}	"H" level input voltage		2.0	-	5.5	[V]
V_{IL}	"L" level input voltage		-0.5	-	0.8	
V_{OH}	"H" level output voltage	I_{OH}=-8mA DC, Vcc=4.75V	2.4	-	-	
		I_{OH}=-8mA DC, Vcc=3.00V	2.4	-	-	
V_{OL}	"L" level output voltage	I_{OL}=8mA DC, Vcc=4.75V	-	-	0.45	
		I_{OL}=8mA DC, Vcc=3.00V	-	-	0.45	
I_{OZ}	Leak current (Tristate)	Vo=Vcc or GND	-40	-	40	[μA]
C_{IN}	I/O pin input capacitance	V_{IN}=0V, f=1.0MHz	-	-	8	[pF]

4.5 External Dimensions

4.5.1 External Dimensions of the Emulation Pod

Figure 4.5 shows external dimensions of the M306H5T3-RPD-E.

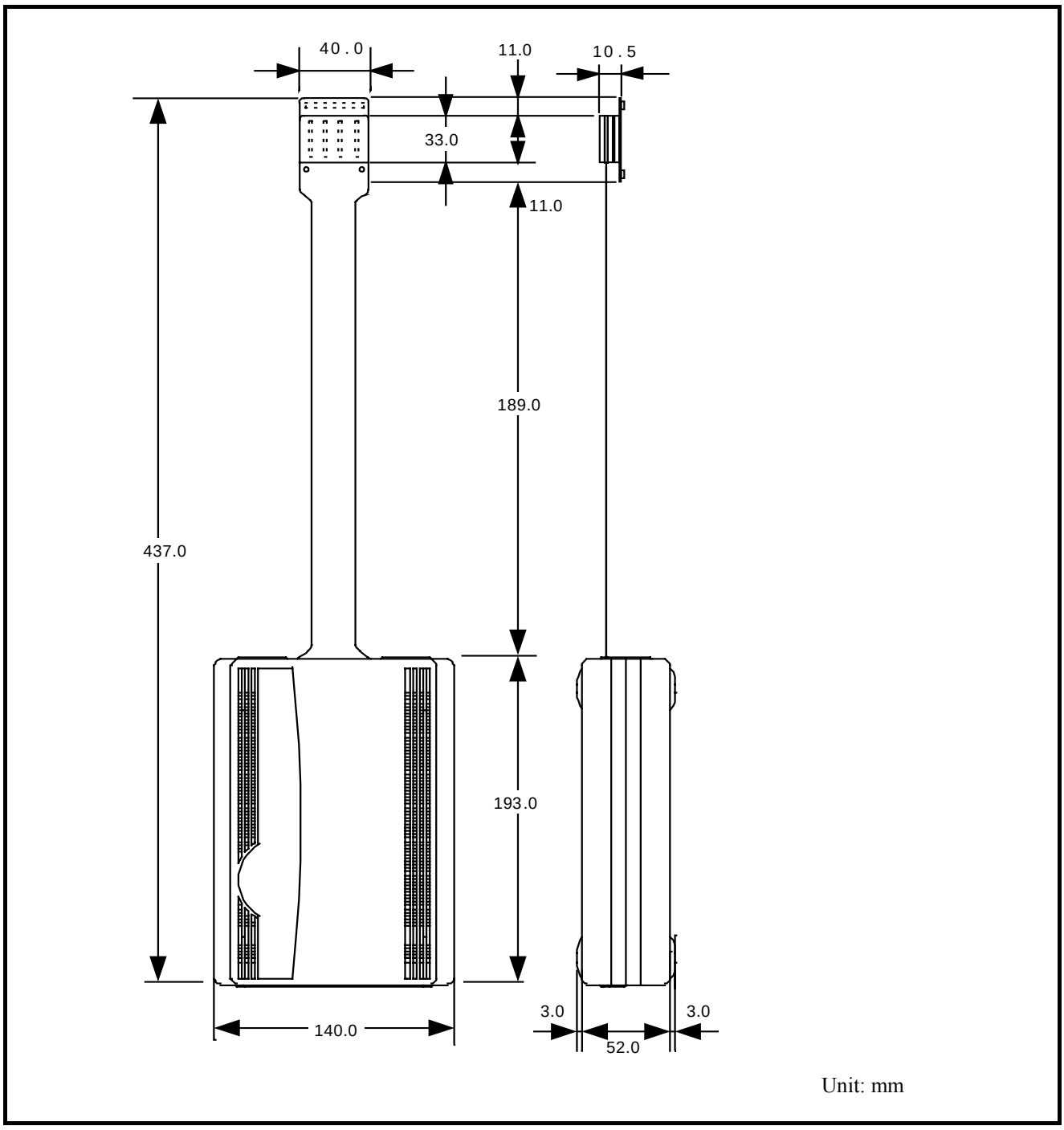

Figure 4.5 External dimensions of the emulation pod

4.5.2 External Dimensions of the Converter Board M306H2T-PTC

Figure 4.6 shows external dimensions of the pitch converter board M306H2T-PTC for 116-pin LQFP (116P6A-A) and a sample foot pattern for NQPACK116SB.

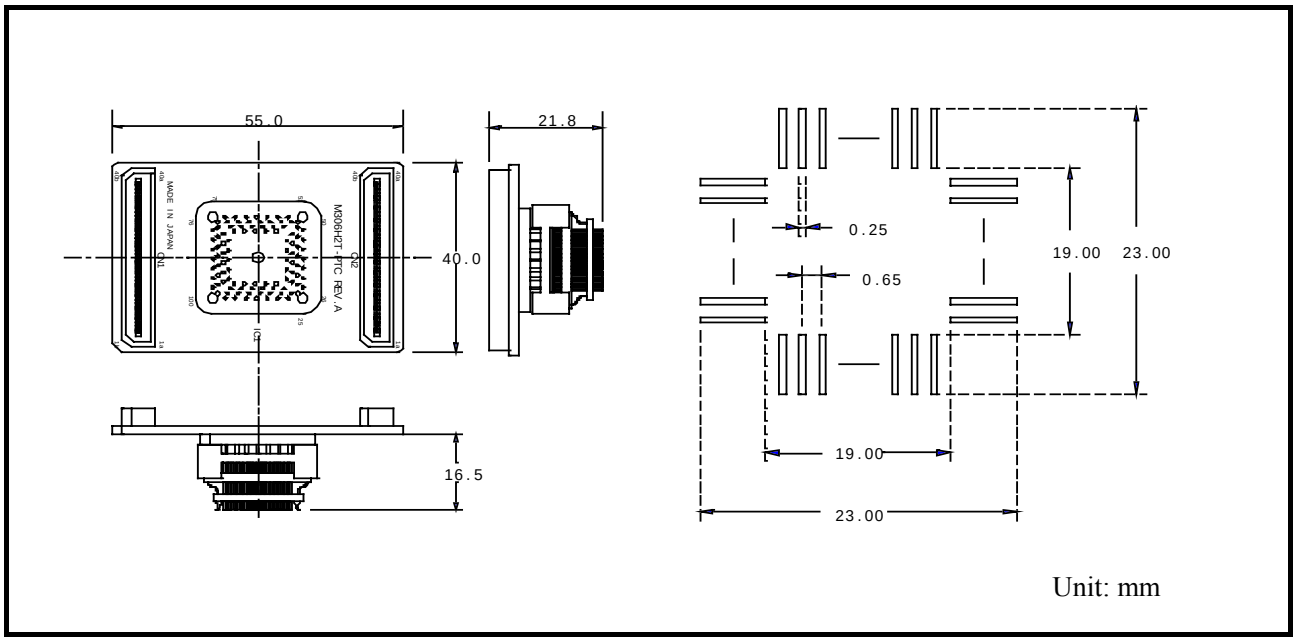

Figure 4.6 External dimensions of the converter board M306H2T-PTC and a sample foot pattern for the NQPACK116SB

4.6 Precautions for Safety

This chapter describes the precautions which should be taken in order to use this product safely and properly. Be sure to read this chapter before using this product.

IMPORTANT

Note on Malfunctions in the PC4701 System

- If the emulator malfunctions because of interference like external noise, do the following to remedy the trouble
  (1) Press the RESET switch on the emulator upper panel.
  (2) If normal operation is not restored after step (1), shut OFF power to the emulator once and then reactivate it.

Notes on Downloading Firmware:

- Before using this product for the first time, it is necessary to download the dedicated firmware. Please note that, to do this, it is necessary to start up the emulator main unit in maintenance mode. For firmware download procedures, see "3.3 Downloading Firmware" (page 39). Once the firmware has been downloaded, the product can be used by simply turning on the power.
- Do not shut off the power while downloading the firmware. If this happens, the product will not start up properly. If power is shut off unexpectedly, redownload the firmware in maintenance mode.
- Be sure to disconnect the user system before downloading the firmware.

Notes on the Self-check:

- If the self-check does not result normally (excluding user system error), the emulation pod may be damaged. Then contact your local distributor.
- Be sure to disconnect the user system before executing the self-check. For details on the self-check, see "3.4 Self-check" on page 40.

Note on Quitting the Emulator Debugger:

- To restart the emulator debugger after it ends, always shut power to the emulator off once and then on again.

Notes on Power Supply to the User System:

- The Vcc2 terminal of the emulator is connected to the user system to observe the voltage of the user system. Therefore design your system so that the user system is powered by an external power supply.
- The voltage of the user system should be within the MCU's specified range.
- Do not change the voltage of the user system after turning on the power.
- Before powering on your emulator system, check that the host machine, the emulator main unit, the converter board and user system are all connected correctly. Next, turn on the power to each equipment following the procedure below.
  (1) Turn ON/OFF the user system and the PC4701 emulator as simultaneously as possible.
  (2) When the PC4701 and emulator debugger start up, check the target status LEDs on the emulator main unit's front panel to see if this product is ready to operate.
  Is the power supplied? Check target status LED (POWER) is ON.
  Is the reset is released? Check target status LED (RESET) is OFF.
  For details, refer to "3. Usage" (page 36)

IMPORTANT

Note on Clock Supply to the MCU:

- A clock supplied to the evaluation MCU is selected by the Clock tab in the Init dialog box of the emulator debugger.
  (1) When Internal is selected:
  A clock generated by the oscillation circuit in the emulation pod is supplied to the evaluation MCU. The clock is continually supplied to the evaluation MCU regardless of "user system clock status" and "user program execution status"
  (2) When External is selected:
  Clock supply to the evaluation MCU depends on oscillation status (oscillate/off) of the user system.

Notes on Setting the Work Area When Starting Up the Emulator Debugger:

- With this product, the emulator uses 54 bytes as a work area in emulation memory. In single-chip mode, set the work area address at 10000h. In memory expansion or microprocessor mode, set the work area address in an area other than SFR area (00000h--003FFh), external area of multiplex bus setting, reserved area of 27000h--27FFFh and stack area used by the emulator for reset command execution (0FFF9h--0FFFFh). For more details, see "3.1.2 Setting the Work Area" (page 36).
- The top address of the work area should be an even-numbered address.
- Set the work area as MAP=INT.
  For example, if the work area is set at 10000h, the emulator uses 54 byte area of 10000h to 10036h.

Notes on Stack Area:

- With this product, a maximum 7 bytes of the user stack is consumed. Therefore, ensure the +7 bytes maximum capacity used by the user program as the user stack area. If the user stack does not have enough area, do not use areas which cannot be used as stack (SFR area, RAM area which stores data, or ROM area) as a work area. Using areas like this is a cause of user program crashes and destabilized emulator control.

IMPORTANT

Notes on MAP References and Settings:

- For details on referencing and setting MAP information, see the emulator debugger M3T-PD30 user's manual.

  Make settings as follows:

  (1) MAP = INT

  The emulation memory inside this product becomes effective.

  Set this at MCU internal ROM debugging.

  (2) MAP = EXT

  The emulation memory inside this product is not used.

  Set this where the MCU internal resource (SFR) or resources on the user system are used.
- Be sure to set the SFR area of the MCU to EXT, and the reserved area of the MCU to INT
- Be sure to set mappings in word units.
- When setting 0FFF8h to 0FFFFh to EXT:

  This product uses the 7 byte area 0FFF9h through 0FFFFh as the stack area when executing the RESET command of the emulator debugger M3T-PD30. If this 7 byte memory cannot be read or written to, RESET cannot be properly effected. As a result, you need to alter the map settings if either of the conditions given below is met.

  (1) With the system which shifts from single-chip mode to memory expansion (or microprocessor) mode, using the 8 byte area of 0FFF8h to 0FFFFh set to EXT.

  (2) With the system which starts up in microprocessor mode, using the 8 byte area of 0FFF8h to 0FFFFh set to EXT and there is not enough memory to read or write.

  The procedures to alter the MAP settings when either of the conditions (1) or (2) above is met.

  (1) Set the 8 byte area of 0FFF8h to 0FFFFh to INT.

  (2) Execute the RESET command of the emulator debugger M3T-PD30.

  (3) Set the stack pointer.

  (Example)

  ```
  RESET:  FCLR I
          LDC #0480H, SP <-- Set the stack pointer
                             (Stop the program after executing this instruction)
  ```

  (4) Set the 8 byte area 0FFF8h through 0FFFFh to EXT.

Note on Operation When Not Executing the User Program:

- With this product, bit 7 of processor mode register 1 (wait bit PM17) is forcibly set to "1" (with wait) when the user program is not executed (e.g. when the program is stopped or when run-time debugging is being performed). Therefore, if the external area set to 0 wait is accessed by other than the user program (such as debugging operation), one wait is inserted. However, when wait bit PM17 is referenced by the dump window etc. the value set during user program execution is displayed.

Note on Making an MCU File:

- To debug an MCU which has any other size of memory (SFR, ROM, RAM), be sure to make an MCU file for it. For details on making the MCU file, see "3.1.1 Making an MCU File" on page 36. For memory maps of each MCU, refer to the datasheet of the MCU.

IMPORTANT

Notes on Address-Match Interrupts:

- To debug address-match interrupts, set a software break or hardware break at the top address of the address-match interrupt process. If you set a software break or hardware break at an address where an address-match interrupt occurs, the program may run out of control.
- When an address at which an address-match interrupt occurs is executed in one-step mode, the program stops after executing the first instruction after returning from the address-match interrupt processing.

Note on BRK Instruction and BRK Interrupt:

- With this emulator system, a BRK interrupt by a BRK instruction is exclusively used for software break functions. Therefore, you can not use them for your program.

Notes on Software and Hardware Breaks:

- The software break generates BRK interrupts by substituting the proper instruction to the BRK instruction "00h". Therefore, when referencing the result of a trace in bus mode, "00h" is displayed for the instruction fetch address where a software break is set, and when referencing in disassemble mode, "BRK" instruction is displayed.
- It is not possible to use a software break and a hardware break at the same time. If doing so, it may not operate normally.
- In the area where the MAP setting is EXTERNAL, software breaks cannot be used.

Note on Stop and Wait Modes:

- Do not perform step execution at addresses in the stop or wait mode. It may cause communication errors.

Note on Watchdog Function:

- The MCU's watchdog timer can be used only while programs are being executed. To use it otherwise, disable the watchdog timer.

Note on M1 (Mode Selection Input) Pin:

- As the evaluation MCU in this product and the M1 pin (pin No. 36) of the user system are not connected, this product is not affected by the status ("H", "L" or "OPEN") of the M1 pin of the user system. Be sure to check the status of the M1 pin when evaluating with an actual MCU.

IMPORTANT

Note on Reading Internal Resources of the MCU:

- When the registers listed in Table 4.9 are read with an emulator, those results will be the following (the data in the MCU are not effected).
  (1) Results of real-time trace
  The data values of the cycles read are not displayed correctly.
  (2) Real-time RAM monitor
  The data values read are not displayed correctly.

Table 4.9 Resisters and symbols not displayed normally

Resister	Symbol
DMA source pointers 0, 1	SAR0, SAR1
DMA destination pointers 0, 1	DAR0, DAR1
DMA transfer counters 0, 1	TCR0, TCR1
DMA control resisters 0, 1	DM0CON, DM1CON

Note on Protect Register (PRC2):

- Make note of the fact that the protect is not canceled when protect register (PRC2), which enables writing in the port P9 direction register and the SI/Oi control register, is changed with the below procedure.
  (1) Step execution of the "instruction for setting ("1") PRC2"
  (2) Execution from the instruction setting "1" to PRC2 where a software breakpoint is set
  (3) Setting the break point from the "instruction for setting ("1") PRC2" to when the "setting the port P9 direction register and the SI/Oi control register"
  (4) Setting ("1") PRC2 from the dump window or script window

Note on Accessing Addresses 00000h and 00001h:

- With the M16C/60 Series MCUs, when a maskable interrupt is generated, the interrupt data (interrupt number and interrupt request level) stored in addresses 00000h and 00001h are read out. Also, the interrupt request bit is cleared when address 00000h or 00001h is read out. Consequently, when the address 00000h readout instruction is executed or when address 00000h or 00001h is read out in the cause of a program runaway, a malfunction occurs in that the interrupt is not executed despite the interrupt request, because the request bit of the highest priority interrupt factor enabled is cleared.
  For this malfunction, when the reading out to the address 00000h or 00001h is generated excluding the interrupt, the WANING LED (yellow) lights up to alarm. When this LED lights, there is a possibility of wrong access, therefore check the program. This LED is turned off by the system reset switch of the emulator main unit.

Note on Debugging Operations After Releasing a Reset from the Target:

- Do not execute debugging operations such as setting a software or hardware break, runtime debugging after releasing a reset from the user system until an interrupt stack pointer (ISP) is set in the user program.

5. Troubleshooting

This chapter describes how to troubleshoot when this product does not work properly.

5.1 Flowchart to Remedy the Troubles

Figure 5.1 shows the flowchart to remedy troubles from when power to the emulator is activated until the emulator debugger starts up. **Check this while the user system is not connected**. For the latest FAQs visit the Renesas Tools Homepage.

http://www.renesas.com/en/tools

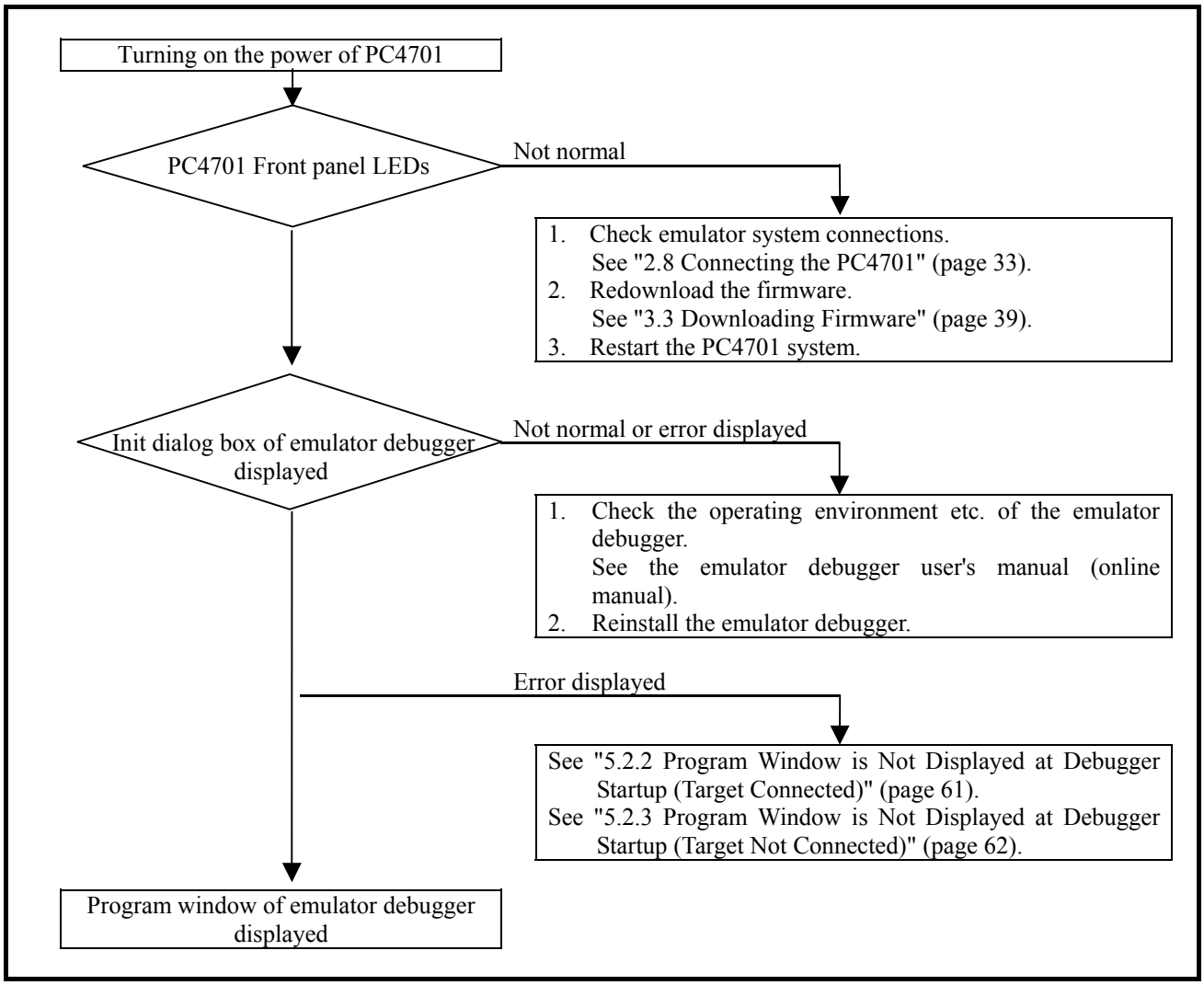

Figure 5.1 Flowchart to remedy troubles

5.2 When the Emulator Debugger Does Not Start Up Properly

5.2.1 When the LED Display of the PC4701 is Abnormal

Table 5.1 LED's abnormal display and its checkpoints

Error	Connection to the user system	Checkpoint
LEDs do not light up.	-	Check that the power cable is connected to the PC4701. *See the PC4701 user's manual.*
All LEDs remain lit.	-	Check the connection between the PC4701 and this product. *See "2.8 Connecting the PC4701" (page 33).*
The "POWER" LED of "STATUS OF TARGET" does not light up.	Connected	Check that power (Vcc and GND) is properly supplied to the user system.
The "CLOCK" LED of "STATUS OF TARGET" does not light up.	Disconnected	(1) Check that both the main/sub clocks are not set to "External" in the emulator debugger.. *See the CLK command of the emulator debugger.* (2) Check the oscillator circuit board is mounted on this product and it is oscillating properly. *See "2.3 Selecting Clock Supply and Replacing Oscillator Circuit Boards " (page 22).*
	Connected	(1) When the clock supply is set to "External", check that the oscillation circuit on the user system is oscillating correctly. (2) Check the switches in the emulation pod are correctly set. *See "2.4 Switch settings" (page 26)*
The "RESET" LED of "STATUS OF TARGET" does not go out.	Connected	Check the reset pin of the user system is held high.

5.2.2 Program Window is Not Displayed at Debugger Startup (Target Connected)

Table 5.2 Checkpoints of errors when starting up the emulator debugger (target connected)

Error	Checkpoint
ERROR 16005: Can't connect with the target.	(1) Check the connection between the PC4701 and host machine. *See the PC4701 User's Manual.* (2) Check that the PC4701 is powered on. *See the PC4701 User's Manual.* (3) Check that all switch settings on the rear of the PC4701 and interface cable settings of the emulator debugger match. *See the PC4701 User's Manual and the emulator debugger user's manual (online manual).*
ERROR 16211: The version of M3T-PD30 and the firmware on the target are not same.	(1) Check the connection between the PC4701 and this product. *See "2.8 Connecting the PC4701" (page 33)* (2) Download the proper firmware. *See "3.3 Downloading Firmware" (page 39).* (3) Choose the proper MCU file in the Init dialog box. See the emulator debugger user's manual (online manual). (4) Check that the descriptions in the MCU file are correct. *See "3.1.1 Making an MCU File" (page 36).*
ERROR 16215: Cannot communicate with the debugging monitor.	(1) Check the connection between the PC4701 and this product. *See "2.8 Connecting the PC4701" (page 33)* (2) Check the reset pin of the user system is held high. *See the MCU specifications.* (3) If the CNVSS is held high at startup, check that pins HOLD* and RDY* are held high, too. *See the MCU specifications.* (4) Check that the oscillator circuit of the emulation pod is oscillating properly. *See "2.3 Selecting Clock Supply and Replacing Oscillator Circuit Boards" (page 22)*
ERROR 16014: Communication ERROR. Can't accept data.	(1) Check that the oscillator circuit of the user system is oscillating properly. *See "2.3 Selecting Clock Supply and Replacing Oscillator Circuit Boards" (page 22).* (2) Check that the PC4701 LEDs at startup show normal operation. *See "3.2.3 LED Display When the Emulator Starts Up Normally" (page 38).*
ERROR 16231: There was sent undefined data from PC4700.	Check that the emulator debugger has not been started up without shutting down the PC4701. *See "4.6 IMPORTANT: Note on Quitting the Emulator Debugger" (page 54).*

5.2.3 Program Window is Not Displayed at Debugger Startup (Target Not Connected)

Table 5.3 Checkpoints of errors when starting up the emulator debugger (target not connected)

Error	Checkpoint
ERROR 16005: Can't connect with the target.	(1) Check the connection between the PC4701 and host machine. *See the PC4701 User's Manual.* (2) Check that the PC4701 is powered on. *See the PC4701 User's Manual.* (3) Check that all switch settings on the rear of the PC4701 and interface cable settings of the emulator debugger match. *See the PC4701 User's Manual and the emulator debugger user's manual (online manual).*
ERROR 16211: The version of M3T-PD30 and the firmware on the target are not same.	(1) Check the connection between the PC4701 and this product. *See "2.8 Connecting the PC4701" (page 33).* (2) Download the proper firmware. *See "3.3 Downloading Firmware" (page 39).* (3) Choose the proper MCU file in the Init dialog box. *See the emulator debugger user's manual (online manual).* (4) Check that the descriptions in the MCU file are correct. *See "3.1.1 Making an MCU File" (page 36).*
ERROR 16215: Cannot communicate with the debugging monitor.	(1) Check that switch settings in the emulation pod are correct. *See "2.4 Switch Settings" (page 26).* (2) Check that the oscillator circuit of the emulation pod is oscillating properly. *See "2.3 Selecting Clock Supply and Replacing Oscillator Circuit Boards" (page 22).*
ERROR 16014: Communication ERROR. Can't accept data.	Check that the PC4701 LEDs at startup show normal operation. *See "3.2.3 LED Display When the Emulator Starts Up Normally" (page 38).*
ERROR 16231: There was sent undefined data from PC4700.	Check that the emulator debugger has not been started up without shutting down the PC4701. *See "4.6 IMPORTANT: Note on Quitting the Emulator Debugger" (page 54).*

5.3 How to Request for Support

After checking the items in "5 Troubleshooting", fill in the text file the installer of the emulator debugger generates in the following directory and email to your local distributor.

\SUPPORT\product-name\SUPPORT.TXT

For prompt response, please specify the following information:

(1) Operating environment
- Operating voltage: _____ [V]
- Operating frequency: _____ [MHz]
- Operating mode: Single-chip, memory expansion, or microprocessor mode
- Clock supply to the MCU: Internal oscillator/External oscillator

(2) Condition
- The emulator debugger starts up/does not start up
- The error is detected/not detected in the self-check
- Frequency of errors: always/frequency ( )

(3) Problem

6. Maintenance and Guarantee

This chapter describes how to maintenance, repair provisions and how to request for repair.

6.1 User Registration

When you purchase our product, be sure register as a user. For user registration, refer to "User registration" (page 12) of this user's manual.

6.2 Maintenance

(1) If dust or dirt collects on any equipment of your emulation system, wipe it off with a dry soft cloth. Do not use thinner or other solvents because these chemicals can cause the equipment's surface coating to separate.

(2) When you do not use this product for a long period, for safety purposes, disconnect the power cable from the power supply.

6.3 Guarantee

If your product becomes faulty within one year after its purchase while being used under good conditions by observing "IMPORTANT" and "Precautions for Safety" described in this user's manual, we will repair or replace your faulty product free of charge. Note, however, that if your product's fault is raised by any one of the following causes, we will repair it or replace it with new one with extra-charge:

- Misuse, abuse, or use under extraordinary conditions
- Unauthorized repair, remodeling, maintenance, and so on
- Inadequate user's system or misuse of it
- Fires, earthquakes, and other unexpected disasters

In the above cases, contact your local distributor. If your product is being leased, consult the leasing company or the owner.

6.4 Repair Provisions

(1) Repair with extra-charge

The products elapsed more than one year after purchase can be repaired with extra-charge.

(2) Replacement with extra-charge

If your product's fault falls in any of the following categories, the fault will be corrected by replacing the entire product instead of repair, or you will be advised to purchase new one, depending on the severity of the fault.

- Faulty or broken mechanical portions
- Flaw, separation, or rust in coated or plated portions
- Flaw or cracks in plastic portions
- Faults or breakage caused by improper use or unauthorized repair or modification
- Heavily damaged electric circuits due to overvoltage, overcurrent or shorting of power supply
- Cracks in the printed circuit board or burnt-down patterns
- Wide range of faults that makes replacement less expensive than repair
- Unlocatable or unidentified faults

(3) Expiration of the repair period

When a period of one year elapses after the model was dropped from production, repairing products of the model may become impossible.

(4) Transportation fees at sending your product for repair

Please send your product to us for repair at your expense.

6.5 How to Make Request for Repair

If your product is found faulty, follow the procedure below to send your product for repair.

Customer	Fill in the Repair Request Sheet included with this product, then send it along with this product for repair to your local distributor. Make sure that information in the Repair Request Sheet is written in as much detail as possible to facilitate repair.
Distributor	After checking the contents of fault, the distributor should please send the faulty product along with the Repair Request Sheet to Renesas Solutions Corp.
Renesas Solutions	When the faulty product is repaired, it will be returned to the customer at the earliest convenience.

⚠ CAUTION

Note on Transporting the Product:

- When sending your product for repair, use the packing box and cushion material supplied with this product when delivered to you and specify handling caution for it to be handled as precision equipment. If packing of your product is not complete, it may be damaged during transportation. When you pack your product in a bag, make sure to use conductive polyvinyl supplied with this product (usually a blue bag). When you use other bags, they may cause a trouble on your product because of static electricity.

Emulation Pod M306H5 for M16C/6H Group
M306H5T3-RPD-E User's Manual

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Renesas Electronics Corporation
1753, Shimonumabe, Nakahara-ku, Kawasaki-shi, Kanagawa 211-8668 Japan

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