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M34509T2-CPE

User's Manual

Compact Emulator for 4508/4509 Group

User's Manual

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Renesas Technology
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Preface

The M34509T2-CPE is a compact emulator for the 4508/4509 Group MCUs with the real-time trace function.
This user's manual mainly describes specifications of the M34509T2-CPE compact emulator and how to setup it. For details on the following products included with the M34509T2-CPE, refer to each product's online manual.

- Emulator debugger: M3T-PD45M
- Assembler: ASM45

All the components of this product are shown in "1.1 Package Components" (page 13). 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 debugger	M3T-PD45M User's Manual
Assembler	ASM45 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) Compact emulator main unit
(2) 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 4500 Series 4508/4509 Group of Renesas 4-bit 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 this 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:

(1) We assume no responsibility for any damage or infringement on patent rights or any other rights arising from the use of any information, products or circuits presented in this user's manual.
(2) The information or data in this user's manual does not implicitly or otherwise grant a license for patent rights or any other rights belonging to us or third parties.
(3) This user's manual and this emulator are copyrighted, with all rights reserved by us. This user's manual may not be copied, duplicated or reproduced, in whole or part, without prior written consent of us.

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

Notes on Connecting the Power Supply of the Emulator:

- Do not use any power cable other than the one that is included with the product.
- The power cable included with the product has its positive and negative poles color-coded by red and black, respectively.
- Pay attention to the polarities of the power supply. If its positive and negative poles are connected in reverse, the internal circuit may be broken.
- Do not apply any voltages exceeding the product's rated power supply voltage (5.0 V ±5%). Extreme voltages may cause a burn due to abnormal heat or cause the internal circuit to break down.

Cautions to Be Taken for Turning On the Power:

- Turn ON/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 directly. Static electricity may damage the internal circuits.
- Do not pull this emulator by the communications interface cable or the flexible cable for connecting the user system. And, excessive flexing or force may break conductors.

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 button on the emulator upper panel.
  (2) If normal operation is not restored after step (1), shut OFF 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 H/W Tool Customer Registration Sheet is included with this manual, fill it in and email 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 M34509T2-CPE
This means the compact emulator (this product) for 4508/4509 Group MCUs.

Emulator system
This means an emulator system built around the M34509T2-CPE emulator. The M34509T2-CPE emulator system is configured with an emulator main unit M34509T2-CPE, emulator debugger M3T-PD45M and host machine.

Emulator debugger M3T-PD45M
This means a software tool which you can control the emulator from a host machine through the USB interface.

Firmware
This means a program stored in the flash ROM of the emulator. It analyzes contents of communication with the emulator debugger and controls the emulator M34509T2-CPE. This program is downloadable from the emulator debugger to upgrade, etc.

Host machine
This means a personal computer used to control the emulator system.

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

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

User program
This means a user's application program to be debugged.

Evaluation MCU
This means a microcomputer mounted on the emulator which is operated in the special mode for the emulator.

#
In this user's manual, this symbol is used to show active LOW. (e.g. RESET#)

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 M34509T2-CPE package consists of the following items. When unpacking it, check to see if your M34509T2-CPE contains all of these items.

Table 1.1 Package components

Item	Quantity
M34509T2-CPE compact emulator	1
26-wire normal pitch cable for connecting user system	1
External trace cable	1
M34501T-PTC converter board	1
OSC-2 (6MHz) oscillator circuit board	1
OSC-2 oscillator circuit bare board	1
USB interface cable for connecting host machine and emulator	1
Power supply cable for compact emulator	1
H/W Tool Customer Registration Sheet (English)	1
H/W Tool Customer Registration Sheet (Japanese)	1
M34509T2-CPE User's Manual (this manual)	1
M34509T2-CPE User's Manual (Japanese)	1
M34509T2-CPE Release Notes (English)	1
M34509T2-CPE Release Notes (Japanese)	1
CD-ROM - Emulator debugger M3T-PD45M - Assembler ASM45	1

* Please keep the M34509T2-CPE'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 System Configuration

1.2.1 System Configuration

Figure 1.1 shows a configuration of the M34509T2-CPE system.

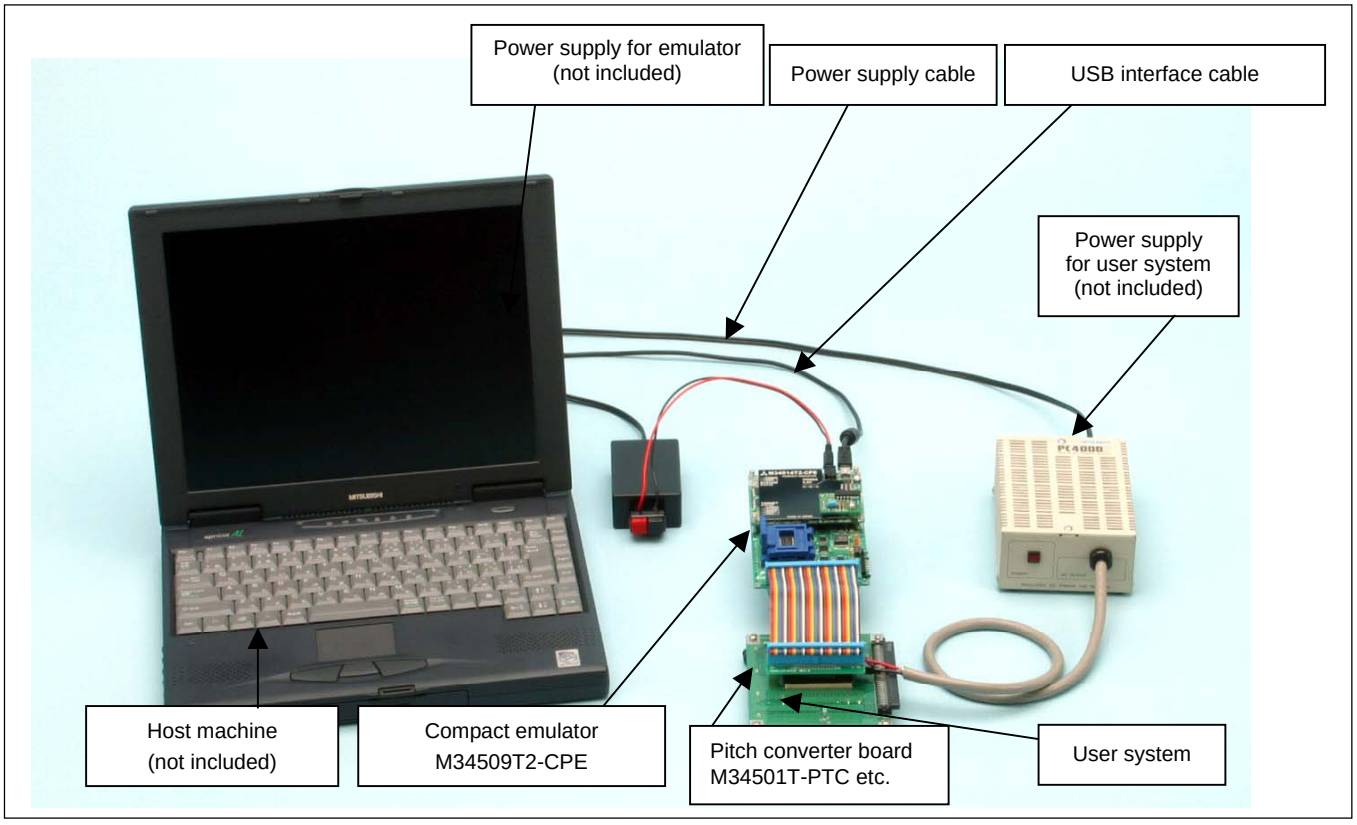


Figure 1.1 System configuration

(1) Compact emulator M34509T2-CPE (this product)
This is a compact emulator for the 4508/4509 Group with the real-time trace functions (hereafter, emulator).

(2) USB interface cable (included)
This is an interface cable for the host machine and the emulator.

(3) Power supply for emulator
This is a power supply for the emulator. Supply 5.0 V ±5% (DC).
Prepare a power supply separately. The power cable is included with this product.
Note: Be aware that there are some AC adapters whose power supply voltage varies rather widely with its load. You are recommended to use an AC adapter with a switching power supply or a stabilized power supply.

(4) User system
This is your application system. This emulator can be used without the user system.

(5) Power supply for the user system
This is a power supply for the user system. As this emulator cannot supply the power to the user system, supply the power to the user system separately from the emulator.

(6) Host machine
This is a personal computer for controlling the emulator.

(7) Pitch converter board such as the M34501-PTC
This is a pitch converter board for connecting to an MCU foot pattern on the user system. For details, refer to "2.7 Connecting the User System" (page 30).

1.2.2 Names and Functions of each part of the Emulator

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

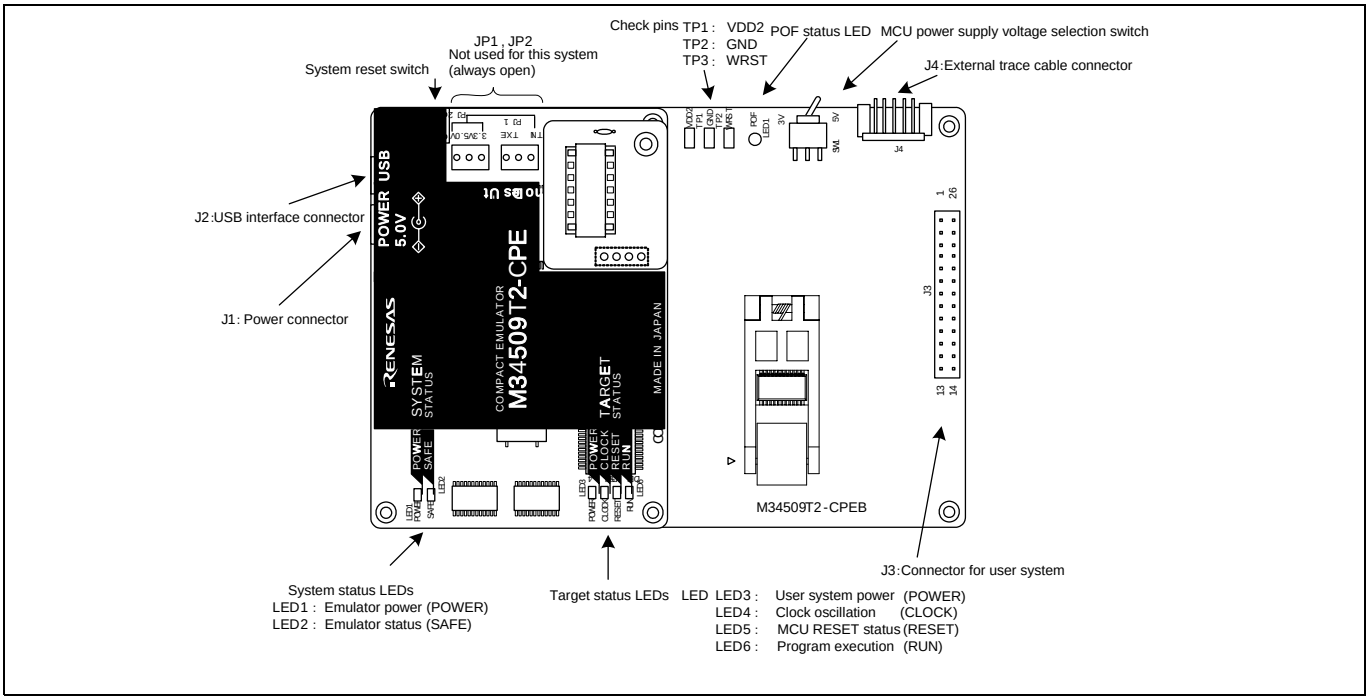


Figure 1.2 Names of the LEDs on the upper panel of the M34509T2-CPE

(1) System Status LEDs

The system status LEDs indicate the emulator main unit's operating status etc. Table 1.2 lists the definition of the system status LEDs.

Table 1.2 Definitions of the system status LEDs

Name	Number	Color	Status	Meaning
POWER	LED1	Orange	ON	Power is supplied to the emulator.
			OFF	Power is not supplied to the emulator.
SAFE	LED2	Green	ON	Emulator system has started normally.
			OFF	Emulator system has not started normally.

(2) Target Status LEDs

The target status LEDs indicate the target MCU's power supply and operating status. Table 1.3 lists the definition of each target status LED.

Table 1.3 Definitions of the target status LEDs

Name	Number	Color	Status	Meaning
POWER	LED3	Orange	ON	Power is supplied to the target MCU.
			OFF	Power is not supplied to the target MCU.
CLOCK	LED4	Green	ON	Clock is supplied to the target MCU.
			OFF	Clock is not supplied to the target MCU.
RESET	LED5	Red	ON	Target MCU is being reset.
			OFF	Target MCU is not being reset.
RUN	LED6	Green	ON	User program is being executed.
			OFF	User program is not being executed.

(3) POF Status LED

This LED shows whether the MCU is in a state of power down.

Table 1.4 Definitions of the target status LEDs

Name	Color	Status	Meaning
POF	Orange	ON	MCU is in a state of power down.
		OFF	MCU is not in a state of power down, but normal.

(4) System Reset Switch

By pressing the system reset switch, you can initialize the emulator system. Table 1.5 shows the functions of the system reset switch depending on the state of the emulator.

Table 1.5 Definitions of the target status LEDs

State of Emulator	Function
Pressing the system reset switch when the user's program is halted	Initializes the emulator and waits for a command from the emulator debugger
Pressing the system reset switch when the user's program is executed	Stops the user's program, initializes the emulator, and waits for a command from the emulator debugger.

IMPORTANT

Notes on a System Reset:

- After pressing the system reset switch, restart the emulator debugger M3T-PD45M. Otherwise the display of emulator debugger and the actual value (in the emulator) may not match.
- When the emulator debugger does not start up normally even after rebooting, turn off the emulator and then turn on again.

(5) Power Connector (J1)

This is a connector for connecting the power supply to this product. For details, refer to "2.3 Connecting the Power Supply for the Emulator" (page 22).

(6) USB Cable Connector (J2)

This is a USB cable connector for connecting the host machine to this product. For details, "2.4 Connecting the Host Machine" (page 23).

(7) External Trace Cable Connector (J4)

This is an external trace cable connector when using an external trace function. For details, "2.9 Connecting the External Trace/Trigger Cable" (page 36).

(8) MCU Power Supply Voltage Selection Switch (SW1)

This is a setting for an MCU power supply voltage. For details, refer to "2.5.1 MCU Power Supply Voltage Selection Switch" (page 24).

1.3 Specifications

Table 1.6 lists specifications of the M34509T2-CPE.

Table 1.6 M34509T2-CPE specifications

Applicable MCUs	4508/4509 Group		
Evaluation MCU	M34509G4FP ROM size: 4096 words, RAM size: 256 words		
Maximum operating frequency	3.0 V Set the MCU power supply voltage selection switch (SW1) to 3V.	Divided-by 8-mode	6.0 MHz
		Divided-by 4-mode	
		Divided-by 2-mode	
		Through mode	4.4 MHz
	5.0 V Set the MCU power supply voltage selection switch (SW1) to 5V.	Divided-by 8-mode	6.0 MHz
		Divided-by 4-mode	
		Divided-by 2-mode	
		Through mode	
Applicable power supply	3.0 V ±5 % or 5.0 V ±5 % - The power supply can be selected by a switch on the M34509T2-CPEB - Available only from the emulator, not from the user system		
Basic debugging functions	- Download - Software break (max. 8 points, break after execution) - Program execution/stop (allows free-run execution supporting software breaks) - Memory reference/setting - Register reference/setting - Disassemble display		
Real-time trace function	Recording cycle	32768 cycles	
	Trace point	- 2 address points (range/pass count can be set) - 1 external trigger point	
	Trace mode	- Before Break mode (Records 32768 cycles before program stops) - Before Trace mode (Records 32768 cycles before event on) - About Trace mode (Records 32768 cycles before/after event on) - After Trace mode (Records 32768 cycles after event on)	
Hardware break function	Hardware break point	- 2 address points (range/pass count can be set) - 1 external trigger point	
	Break mode	- Address break or trigger break - Stack over/under flow - Trace event - Break at end of trace - Timer	
Time measurement	Time measurement point: 2 address point designation (range can be set) Resolution: 100 ns Measurement interval: 8 types Count source: Emulator timer or MCU cycle		
Coverage	C0 coverage		
Connection to user system (see "2.7 Connecting the User System" on page 30)	For 26-pin 2.54mm pitch DIP 26-wire normal-pitch cable (included) For 20-pin 1.778mm pitch SDIP M34501T-PTC (included with the M34509T2-CPE)		
Power supply for emulator	DC 5.0 V ±5 %/(2 A) externally supplied (Prepare a power supply separately.)		
Host machine interface	USB (USB 1.1 full-speed, mini-B standard connector)		

1.4 Operating Environment

Be sure to use this emulator with the operating environmental of the emulator and host machine listed in Tables 1.7 and 1.8.

Table 1.7 Operating environmental conditions

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

Table 1.8 Operating environment of the host machine

Item	Description
Host machine	IBM PC/AT compatibles with USB1.1
OS	Windows Me Windows 98 Windows XP Windows 2000
CPU	Pentium III 233 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.
CD drive	Needed to install the emulator debugger or refer to the user's manual

* Windows and Windows 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 Flowchart of Starting Up the Emulator

The procedure for starting up the emulator is shown in Figure 2.1. For details, refer to each section hereafter. And, when the emulator does not start up normally, refer to "5. Troubleshooting" (page 66).

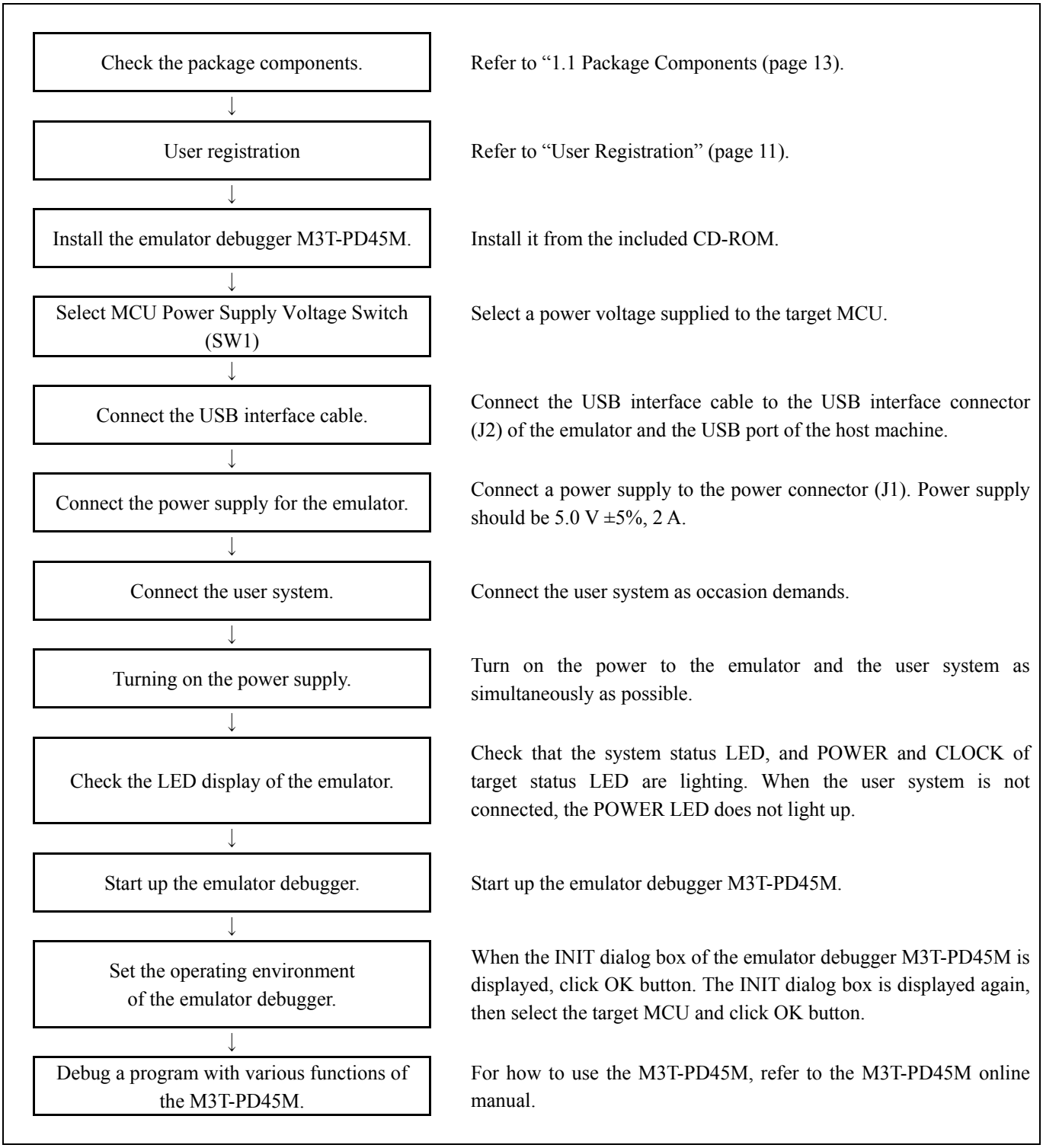


Figure 2.1 Flowchart of starting up the emulator

2.2 Installing the Emulator Debugger

If the OS used in your host machine is Windows XP or 2000, this installation must be executed by a user with administrator rights. Be aware that users without administrator rights cannot complete the installation.

2.2.1 Installing the Emulator Debugger M3T-PD45M

From the CD-ROM included with your product, install the emulator debugger M3T-PD45M following the procedure described below.

(1) Launching the installer
From Windows Explorer, etc., start the "setup.exe" program present in the \PD45M\W95E folder of the product disc.

(2) Entering the user information
In the "user information" dialog box, enter the user information (contractor, section, contact address, and host machine). The supplied information will be turned into a format by which technical support will be provided by e-mail.

(3) Selecting components
In the "component selection" dialog box, select the components you want to install. In this dialog box you can change the directory in which to install.

(4) Completing the installation
A dialog box will be displayed indicating that setup has been completed. It means that the installation you made is completed.

2.2.2 Installing the USB Device Driver

Install the USB device driver following the procedure described below.

(1) Connect the host machine and the compact emulator M34509T2-CPE with the USB cable.

(2) Turn on the power to the compact emulator M34509T2-CPE.

(3) A USB device will be detected, and the wizard to install the corresponding device driver will start up.
Follow the instructions of the wizard, and a dialog box for specifying the setup information file (inf file) will appear. In this dialog box, specify the musbdrv.inf file present in or below the directory in which you installed the M3T-PD45M (e.g., c:\mtool\pdxx\drivers).

While you are installing, a message may be output indicating that the device driver proper musbdrv.sys cannot be found. Because musbdrv.sys is stored in the same directory as is the musbdrv.inf file, look into the directory and specify it.

2.3 Connecting the Power Supply for the Emulator

Connect the power supply for the emulator to the power connector (J1). The specification of the power supply for the emulator is listed in Table 2.1.

Table 2.1 Specification of power supply of the emulator

Power supply voltage	DC 5.0 V±5%/2 A

Figure 2.2 shows the specifications of the power connector (J1), and Figure 2.3 shows an applicable plug, respectively.

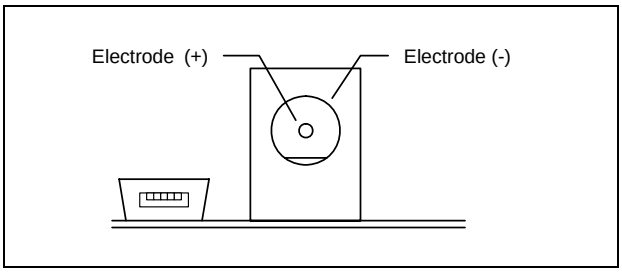


Figure 2.2 Power connector specifications

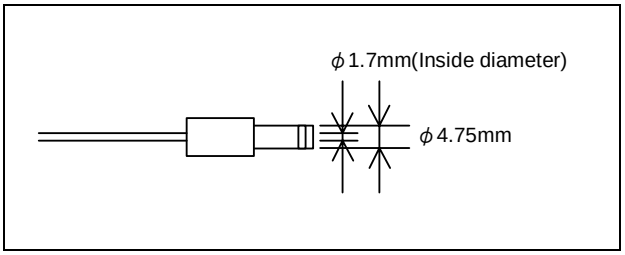


Figure 2.3 Applicable plug specifications

⚠ CAUTION

Notes on Connecting a Power Supply of the Emulator:

- The power cable included in this product package is colored red (+) and black (-).
- Be careful about the polarity of the power supply. Connecting to the wrong electrode could destroy internal circuits.
- Do not apply a voltage exceeding the specified voltage of the product (5.0 V ±5%), because it may cause burn injuries and the failure of internal circuits.

2.4 Connecting the Host Machine

Connect the emulator and the host machine with the USB interface cable.
Connect the USB interface cable (included) to the USB interface connector (J2) and the USB port of the host machine (see Figure 2.4).

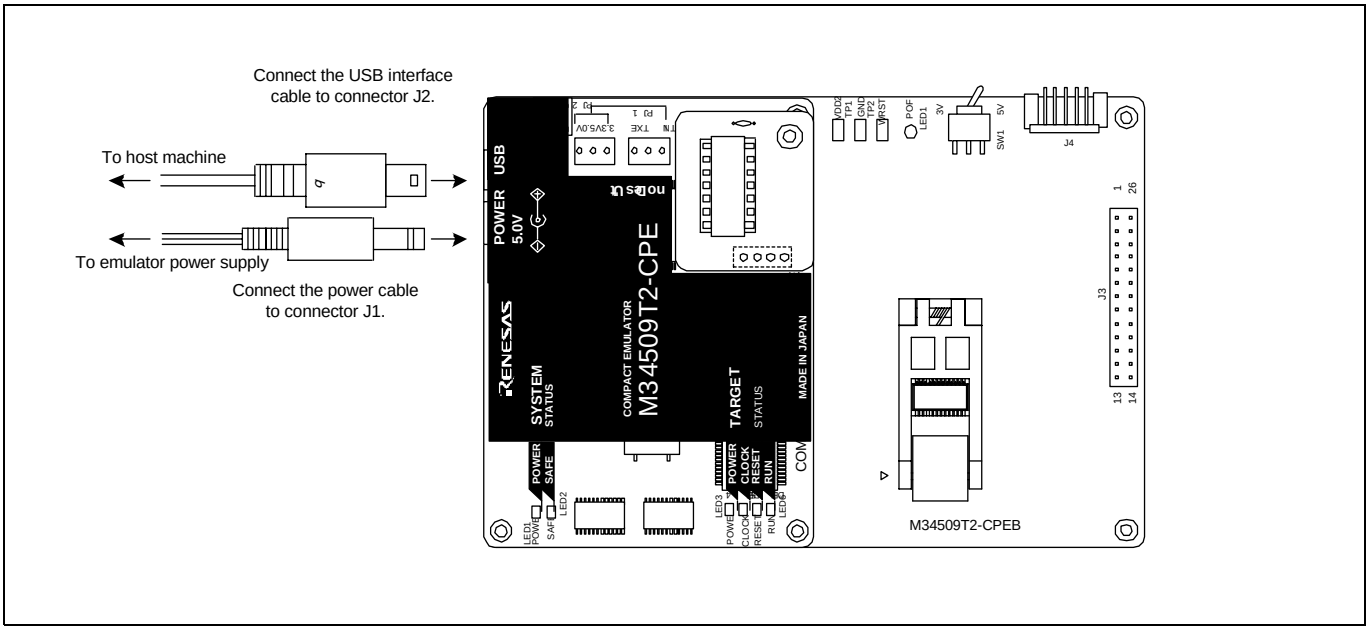


Figure 2.4 Connecting the emulator system

2.5 Turning ON the Power

2.5.1 MCU Power Supply Voltage Selection Switch

Set the MCU power supply source selection switch of the emulator according to conditions of use.

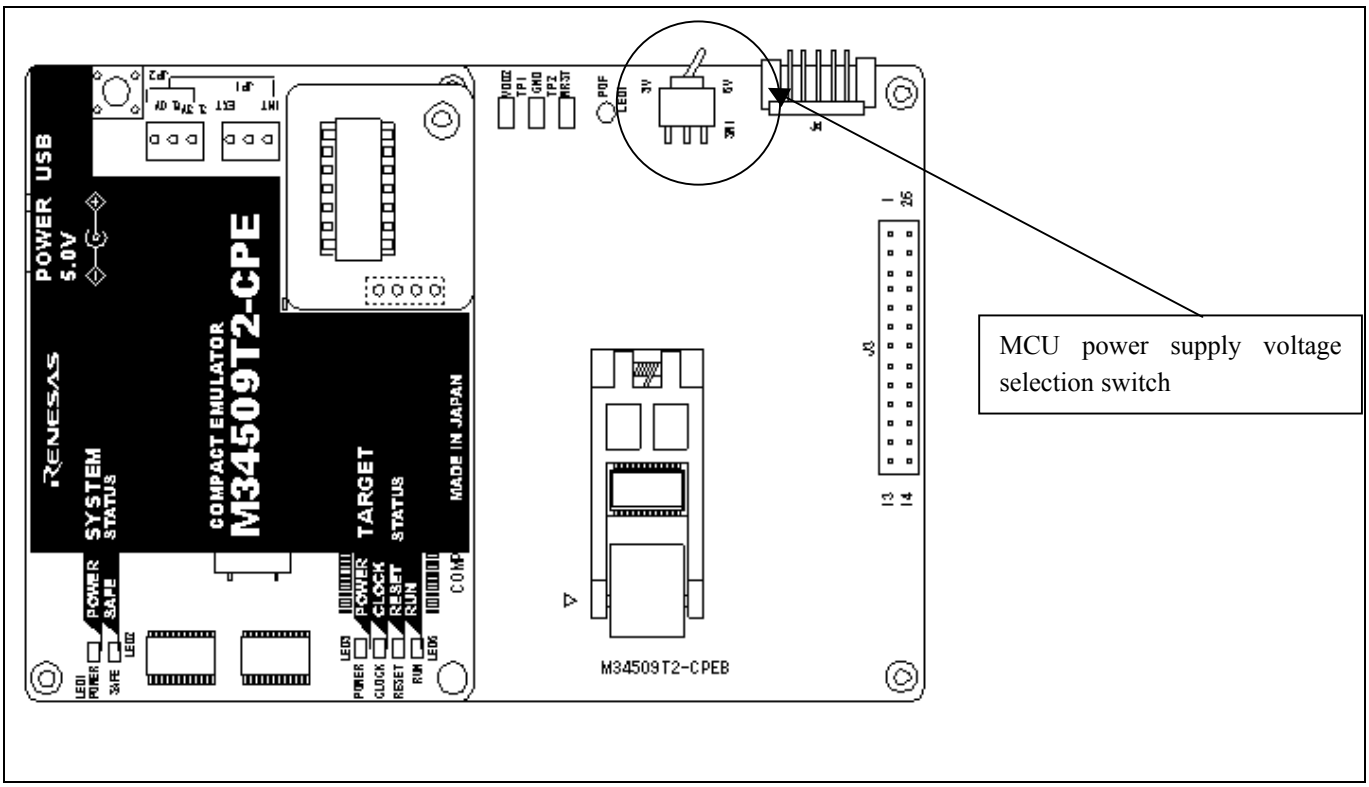


Figure 2.5 Jumper switch locations of the emulator

These are the jumper switches to select power supply to the MCU and its power voltage. As shown in Table 2.2 below, set the switch according to the connection to the user system.

Table 2.2 Setting jumper switches

MCU power supply voltage selection switch (SW1)	Description
3V	Supplied from the emulator. The MCU operating voltage is 3.0 V.
5V	Supplied from the emulator. The MCU operating voltage is 5.0 V.

⚠ CAUTION

Note on Jumper Switch Settings:

- Always shut OFF the emulator before changing the setting of the jumper switches, and connecting the cable. Otherwise the internal circuit may cause a break.

2.5.2 Checking Connections of the Emulator System

Before turning the power ON, check the connection of the interface cable to the host machine, emulator, and user system.

2.5.3 Turning ON/OFF the Power

Turn ON/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 for about 10 seconds.

2.5.4 Power Supply to the User System

This emulator cannot supply the power to the user system. Therefore design your system so that the user system is powered separately.
The voltage of the user system should be within the range of 3.0 V±5% or 5.0 V±5%. Do not change the voltage of the user system after turning on the power.

2.5.5 LED Display When the Emulator Starts Up Normally

After the emulator starts up, check the status of the LEDs to see whether the emulator operation is enabled or not. Figure 2.6 shows the positions of the emulator status LEDs.

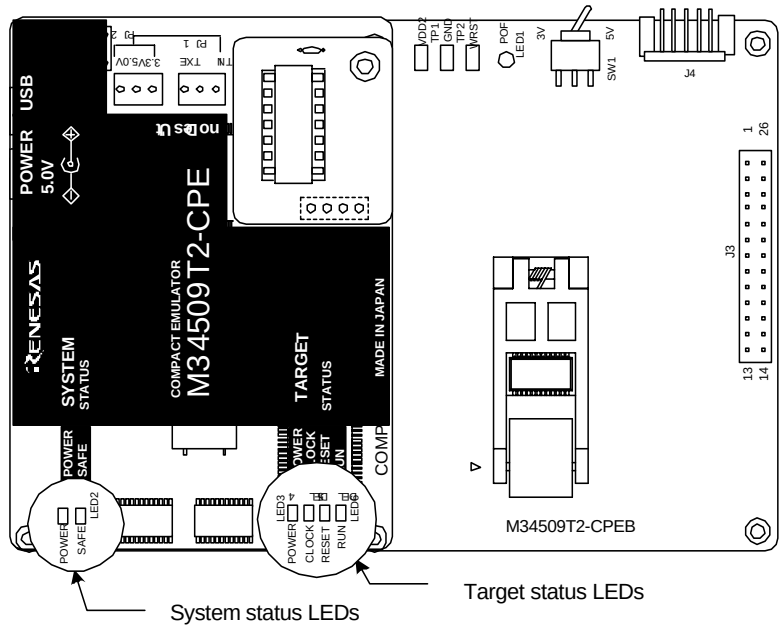


Figure 2.6 Positions of the system status LEDs and target status LEDs

(1) System status LEDs

Check that the LED1 and LED2 of the system status LEDs are lit immediately after the power is activated. If it is not lit, shut off the emulator and check the power supply for the emulator is properly connected.

(2) Target status LEDs

Target status LEDs light as shown in Figure 2.7 when the user system is not connected and as shown in Figure 2.8 when a user system is connected. When the self-check is terminated after turning the power on, only the LED2 (SAFE) lights on as shown in Figures 2.7 and 2.8

When the target status LEDs do not display as shown in Figures 2.7 and 2.8, refer to "5. Troubleshooting" (page 66).

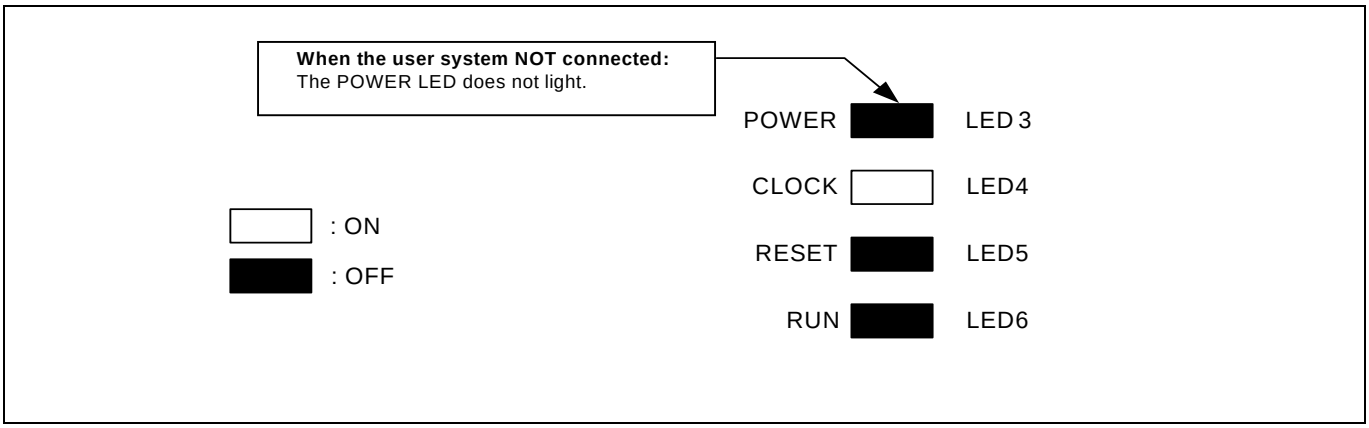


Figure 2.7 Target status LEDs display when the emulator starts up normally (when user system not connected)

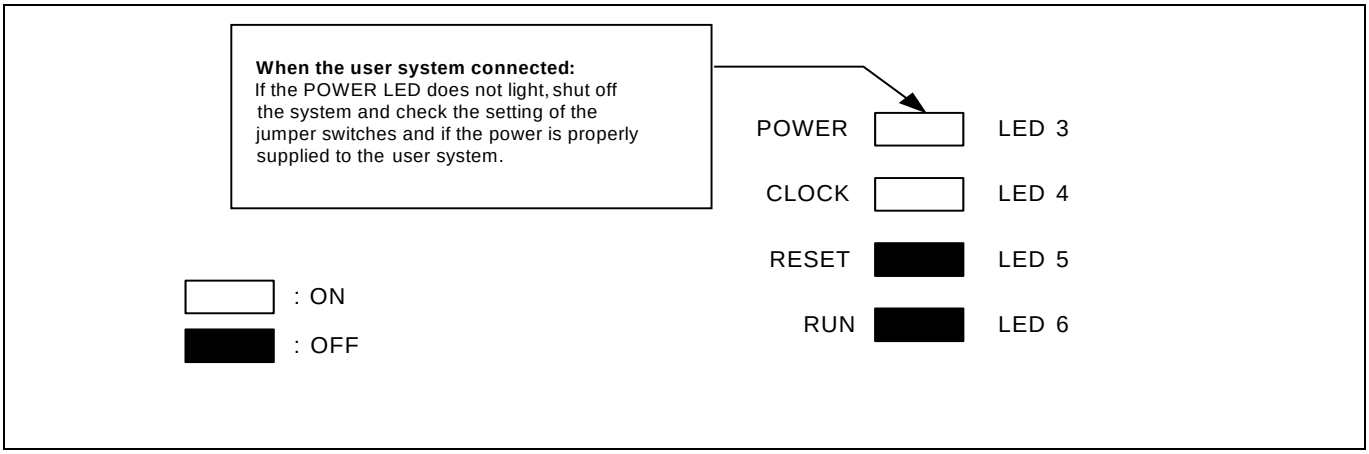


Figure 2.8 Target status LEDs display when the emulator starts up normally (when user system connected)

IMPORTANT

Note on the Target Status CLOCK LED:

- If the LED is not turned on, check the following.

(1) After powering on the emulator (before starting up the emulator debugger):
Make sure that the oscillator circuit board is properly installed in the emulator and it is oscillating normally.

2.6 Self-check

2.6.1 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 2.9.

(1) If the user system is connected, disconnect it.
(2) Set the switches as the factory-settings to execute the self-check (see Table 2.3).
(3) Within 2 seconds of activating power to the emulator, press the system reset switch on the emulator upper panel.
(4) Check the SAFE LED starts flashing and then press the system reset switch again.
(5) The self-check will start. If the normal result is displayed in about 10 seconds, the self-check terminated normally.

Table 2.3 Switch settings for the self-check

Switch	Setting
MCU power supply voltage selection swtich (SW1)	5V

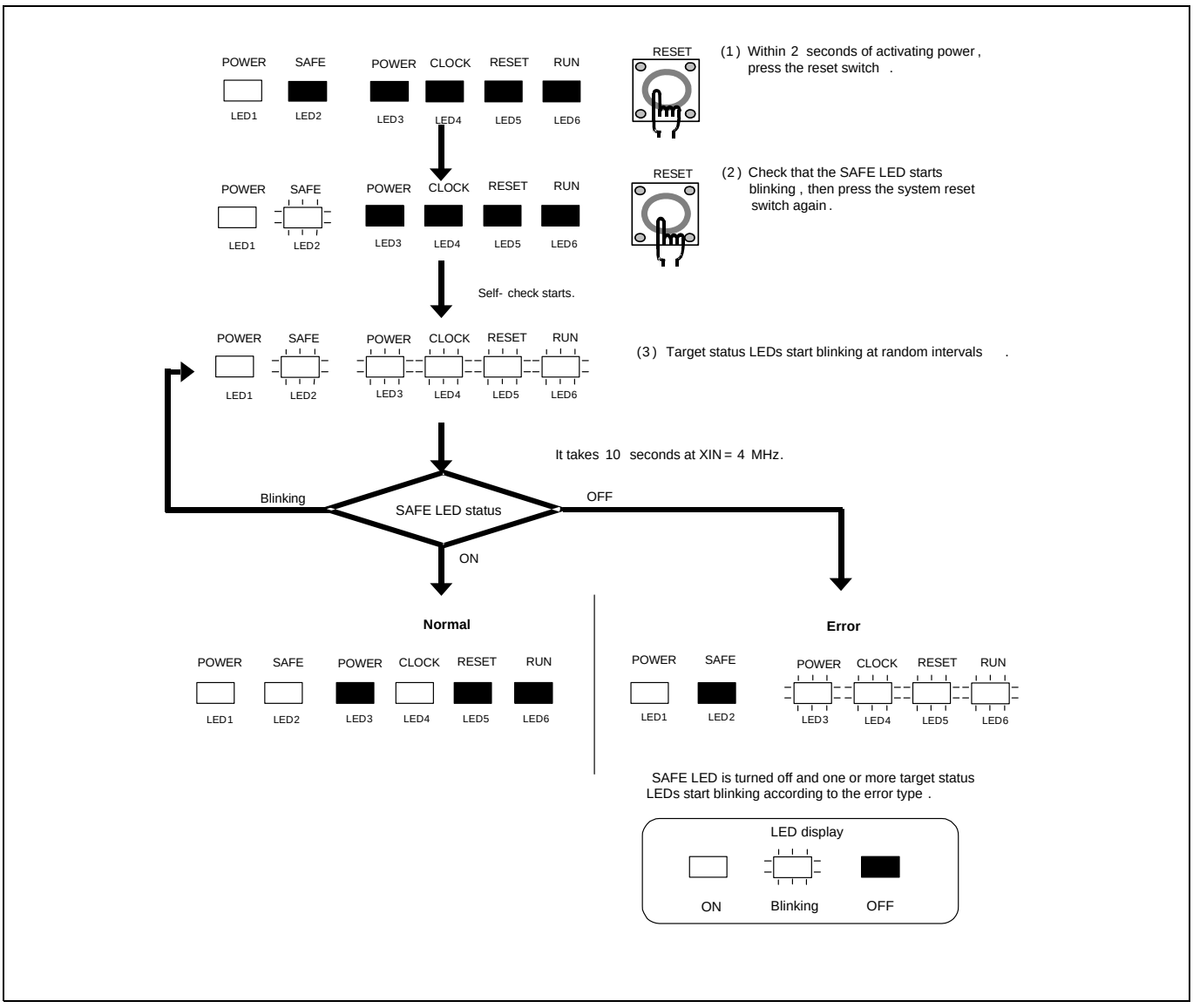


Figure 2.9 Self-check procedure

2.6.2 If an Error is Detected in the Self-check

Table 2.4 lists how to remedy the troubles if the target status LED display is abnormal in the self-check. When an error is detected, shut off the emulator and the user system and follow the steps in the Table 2.4.

Table 2.4 Error display in the self-check and how to remedy it

LED display (Blinking / OFF)				Problem & Remedy
POWER	CLOCK	RESET	RUN	
■	■	■	■	The emulator system is not working properly. - Check that power is supplied to the emulator. - The emulator may be damaged. Contact your local distributor.
■	■	■	Blinking	
■	■	Blinking	■	
■	Blinking	■	■	A clock is not supplied to the emulator. - Check that the oscillator circuit board (OSC-2) is attached. - Check that the oscillator or oscillation module on an oscillator circuit board (OSC-2) is operating normally.
■	Blinking	Blinking	Blinking	The MCU is not controlled properly. - Check that the MCU is mounted properly - Check that the oscillation frequency of the oscillator circuit board (OSC-2) is within the MCU specifications.
Others				The emulator system is not working properly. - The emulator may be damaged. Contact your local distributor.

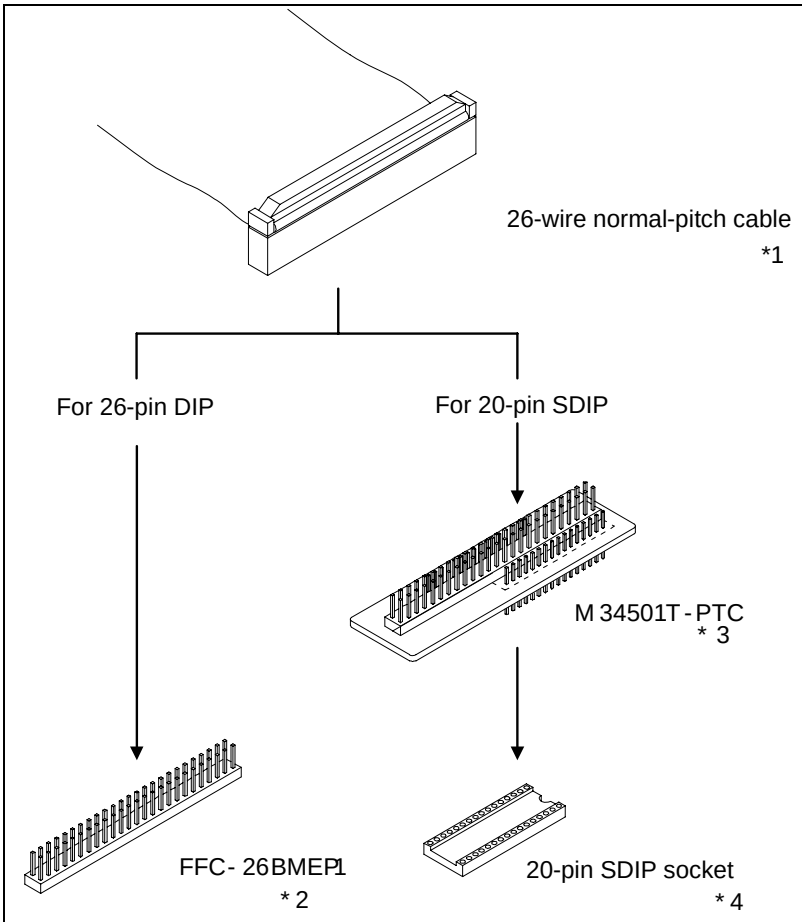
IMPORTANT

Notes on the Self-check:

- **Be sure to disconnect the user system** before executing the self-check.
  Use the preinstalled oscillator circuit board (OSC-2, 6MHz) to execute the self-check.
- If the self-check does not result normally (excluding target status errors), the emulator may be damaged. Then, contact your local distributor.

2.7 Connecting the User System

Figure 2.10 shows the connection of the M34509T2-CPE and the user system.



*1 26-wire normal-pitch cable is included with the product.
*2 Not included. Prepare it separately. FFC-26BMEP1 made by Honda Tsushin Kogyo Co., Ltd.
*3 M34501T-PTC is included with the product.
*4 Not included. Prepare it separately.

Figure 2.10 Connection of the M34509T2-CPE and 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 emulator and the user system.

2.7.1 Connecting to a 2.54mm pitch 26-conductor Dual-line Pins (applicable to 4508/4509)

Here following is a procedure of connecting 2.54mm pitch 26-conductor dual-line pins to a 26-wire normal-pitch cable (included with the M34509T2-CPE). Table 2.5 list the connector assignment of the 26-wire normal-pitch cable and Figure 2.11 show the connection of the 2.54 mm pitch 26-conductor.

(1) Mount the 26-conductor dual line pins to the user system.
(2) Attach the 26-wire normal-pitch cable (included) to the J3 connector of the M34509T2-CPE.
(3) Attach the 26-conductor dual line pins on the user system to the backside of the 26-wire normal-pitch cable.

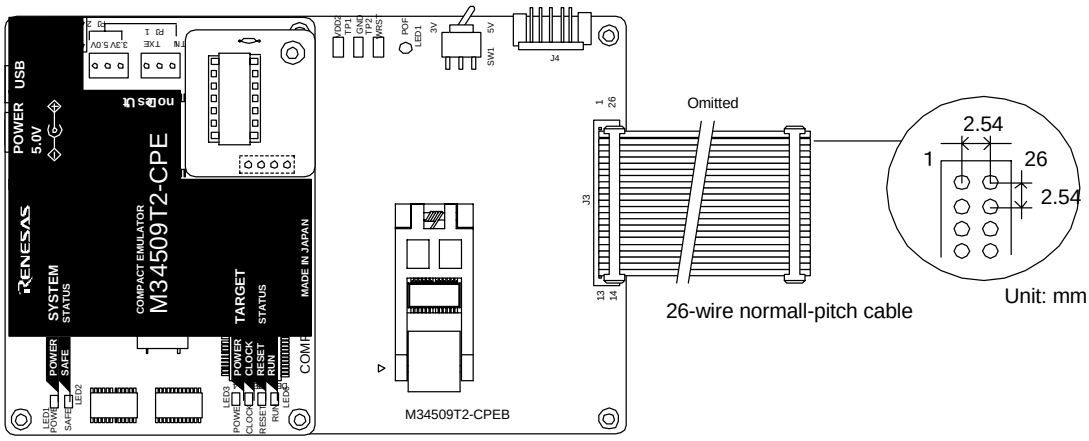


Figure 2.11 Connecting to a 26-pin 2.54mm pitch user system

Table 2.5 Connector assignments of the 26-wire normal-pitch cable

Connector pin No.	MCU pin No.	Signal	Connector pin No.	MCU pin No.	Signal
1	1	VDD*1	26	24	P30/AIN2
2	2	VSS	25	23	P31/AIN3
3	3	NC (XIN)*2	24	22	P00/SIN
4	4	NC (XOUT)*2	23	21	P01/SOUT
5	5	NC (CNVSS)*2	22	20	P02/SCK
6	6	RESET#	21	19	P03
7	7	P21/AIN1	20	18	P10
8	8	P20/AIN0	19	17	P11/CNTR1
9	9	D5	18	16	P12/CNTR0
10	10	D4	17	15	P13/INT
11	11	D3/AIN5	16	14	D0
12	12	D2/AIN4	15	13	D1
13	-	NC	14	-	NC

*1 VDD is connected for the emulator system to monitor power supply of the target, and the emulator system does not supply power to the user system

*2 XIN, XOUT and CNVSS are not connected. XIN is input from oscillator board OSC-2 to the MCU, and it is not input from an oscillator circuit on the user system.

⚠ CAUTION

Notes on Connecting the User System:

- Take care not to attach a converter board in a wrong direction. It may cause a fatal damage to the emulator and user system.

2.7.2 Connecting to a 20-pin 1.778mm pitch User System (applicable to 4508)

Here following is a procedure of connecting to a 20-pin 1.778mm pitch foot pattern on the user system using the M34501T-PTC (included with the M34509T2-CPE). Table 2.6 lists the connector assignments of pitch converter board M34501T-PTC. When attaching the pitch converter board, check the No.1 pin positions of the cable and the connector.

(1) Mount the 20-pin SDIP connector to the user system.
(2) Attach the 26-wire normal-pitch cable (included) to the J3 of the M34509T2-CPE.
(3) Attach the backside of the 26-wire normal-pitch cable to the J1 connector of the M34501T-CPE.
(4) Attach the J2 connector of the M34501T-PTC to the 20-pin SDIP socket on the user system.

Table 2.6 Connector assignments of the M34501T-PTC

Connector pin No.	MCU pin No.	Signal	Connector pin No.	MCU pin No.	Signal
1	1	VDD*1	20	20	P00/SIN
2	2	VSS	19	19	P01/SOUT
3	3	NC (XIN)*2	18	18	P02/SCK
4	4	NC (XOUT)*2	17	17	P03
5	5	NC (CNVSS)*2	16	16	P10
6	6	RESET#	15	15	P11/CNTR1
7	7	P21/AIN1	14	14	P12/CNTR0
8	8	P20/AIN0	13	13	P13/INT
9	9	D3/AIN5	12	12	D0
10	10	D2/AIN4	11	11	D1

*1 VDD is connected for the emulator system to monitor power supply of the target, and the emulator system does not supply power to the user system

*2 XIN, XOUT and CNVSS are not connected. XIN is input from oscillator board OSC-2 to the MCU, and it is not input from an oscillator circuit on the user system.

⚠ CAUTION

Notes on Connecting the User System:

- Take care not to attach a converter board in a wrong direction. It may cause a fatal damage to the emulator and user system.

2.8 Changing Settings

2.8.1 Changing the Power Supply Voltage to the MCU

As shown in Table 2.7 below, set the switch according to the connection to the user system.

Table 2.7 Setting switch

MCU power supply voltage selection switch (SW1)	Description
3 V	Supplied from the emulator. The MCU operating voltage is 3 V.
5 V	Supplied from the emulator. The MCU operating voltage is 5 V.

⚠ CAUTION

Note on Setting Switches:

- Always shut OFF the emulator before changing the setting of the switch, and connecting the cable. Otherwise the internal circuit may cause a break.

2.8.2 Selecting Clock Supply

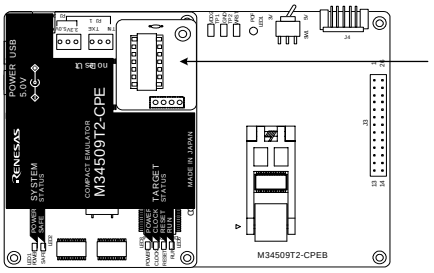
This product always uses the internal oscillator circuit as a clock supply to the evaluation MCU.

1. Kinds of Oscillator Boards

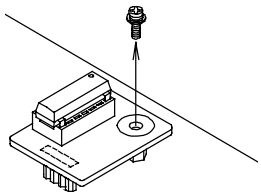
The M34509T2-CPE comes with an oscillator circuit board OSC-2 (6 MHz). And an oscillator circuit bare board OSC-2 is included with this product. A clock supplied to an MCU can be changed by replacing oscillator circuit boards.

2. Replacing Oscillator Circuit Boards

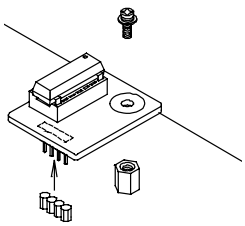
Figure 2.12 shows how to replace the oscillator circuit boards.



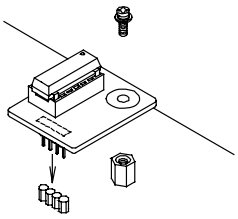
The oscillator circuit board of the emulator is placed as described on the left.



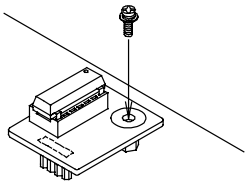
Unscrew the screw securing the oscillator circuit board.



Lift off the oscillator circuit board.



Attach the oscillator circuit board for replacement to the connector of the emulator.



Secure the new oscillator circuit board with the screw.

Figure 2.12 Replacing oscillator circuit boards

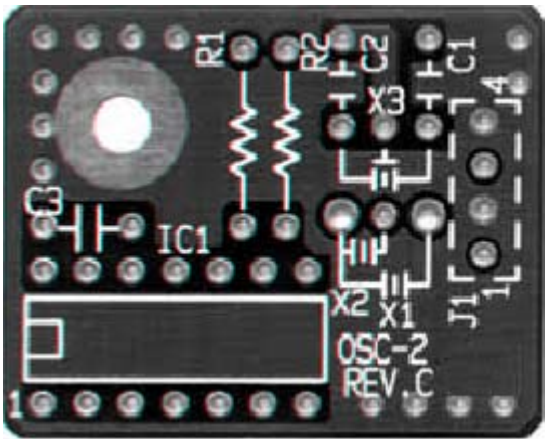
⚠ CAUTION

Note on Replacing the Oscillator Circuit Board:

- When removing the upper cover or replacing the oscillator circuit boards, be sure to shut OFF the power supply. Otherwise the internal circuit may cause a break.

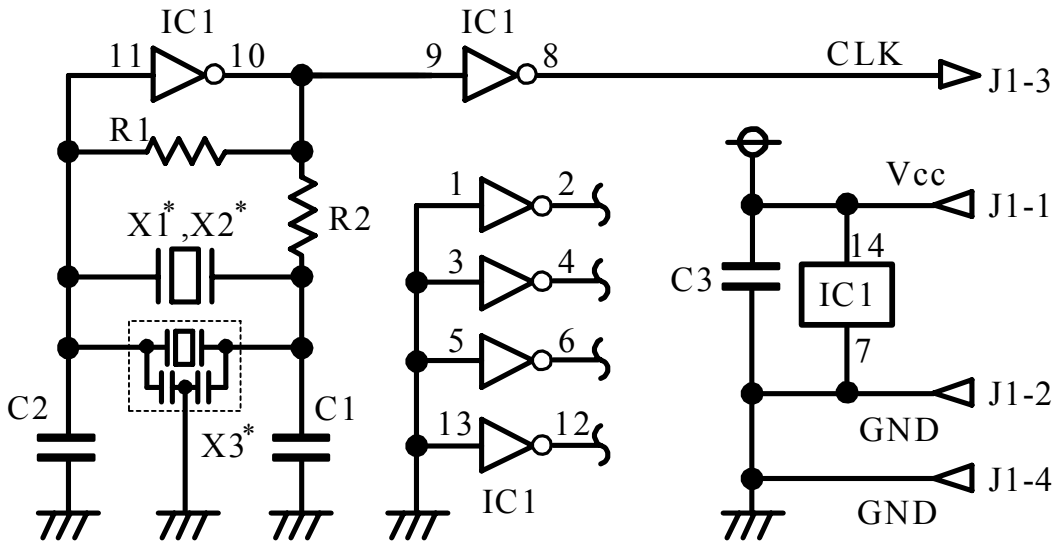
3. Using the Internal Oscillator Circuit Bare Board

To use this product at a frequency you like, build a desired oscillator circuit on the included OSC-2 oscillator circuit bare board. Figure 2.13 shows an external view of the OSC-2 oscillator circuit bare board and the connector pin locations. Figure 2.14 shows the circuitry of the oscillator circuit bare board OSC-2. Use the number of oscillator circuits recommended by the oscillator manufacturer.



J1-4: GND
J1-3: Oscillation output
J1-2: GND
J1-1: VCC

Figure 2.13 External view of the oscillator circuit board OSC-2 and its connector pin locations



*X1:5.08-mm-pitch 2-pin oscillator
X2:2.54-mm-pitch 2-pin oscillator
X3:2.54-mm-pitch 3-pin oscillator

IC1:Inverter (Unbuffer)

Figure 2.14 Circuits of the oscillator circuit bare board OSC-2

2.9 Connecting the External Trace/Trigger Cable

Using the external trace/trigger cable enables record/reference a hardware break by the external trigger, and changes of an external signal level in the trace window

2.9.1 Connecting the External Trace/Trigger Cable to the Emulator System

Connect the external trace/trigger cable to the connector J4 of the emulator

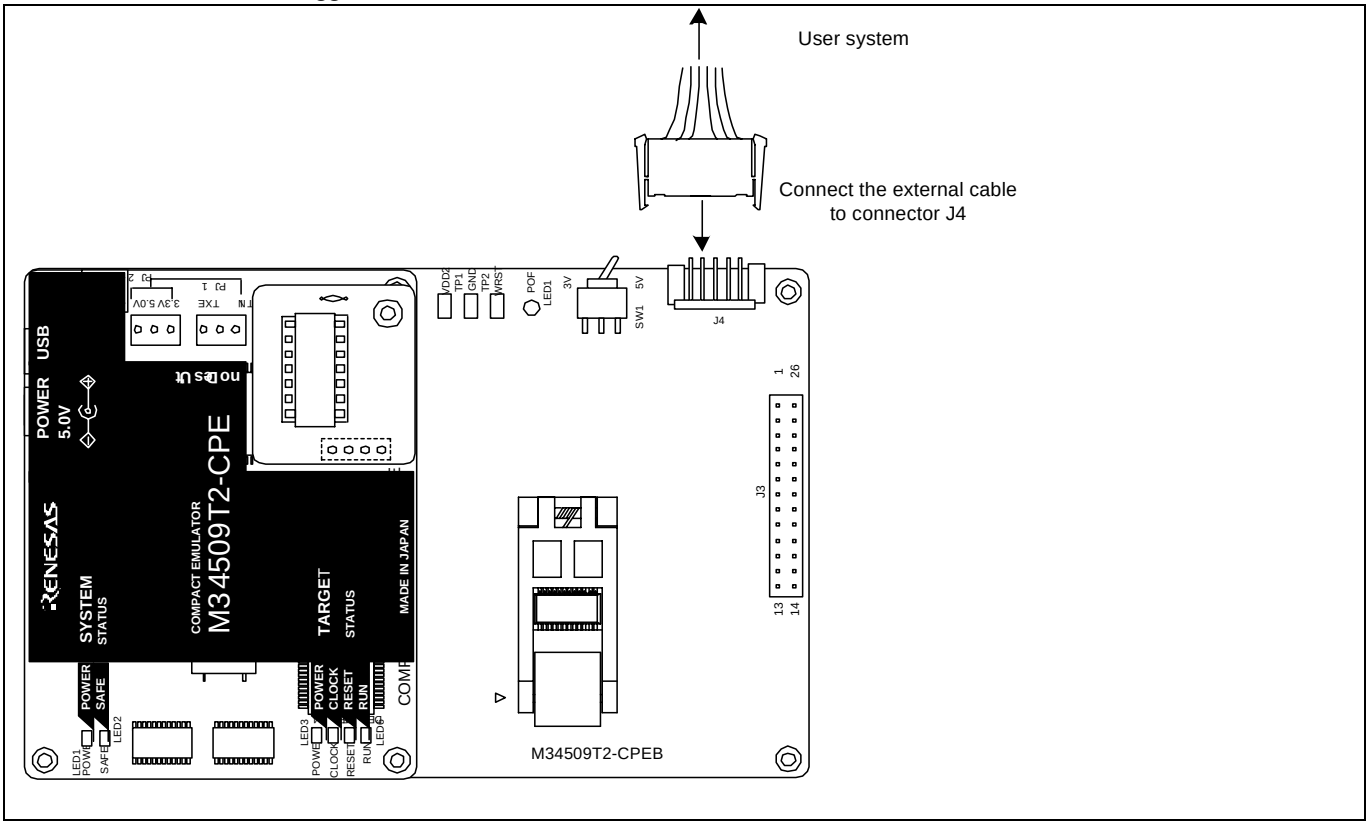


Figure 2.15 Connecting the external trace/trigger cable

2.9.2 Connecting the External Trace/Trigger Cable to the User System

Connect the GND, TRG and EXT0 to EXT3 of the external trace cable to the user system. Figure 2.16 shows the pin assignment of the external trace cable.

Pin No.	Label	Color of IC clip	Purpose
1	GND	Black	GND
2	TRG	White	External trigger input
3	EXT0	Yellow	External trace input
4	EXT1	Yellow	
5	EXT2	Yellow	
6	EXT3	Yellow	

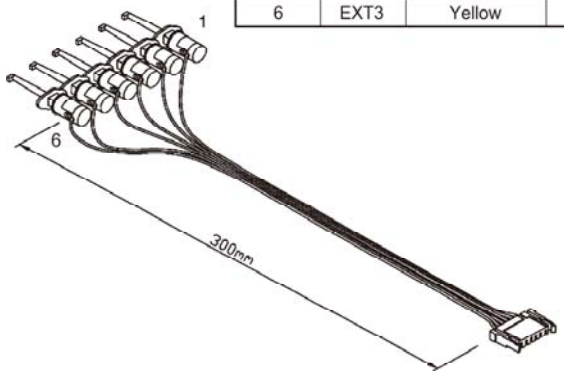


Figure 2.16 Pin assignment of the external trace cable

2.9.3 Specifications of the External Trace/Trigger Cable

Voltage input characteristics of external trace input and external trigger input are as follows.

Table 2.8 Input characteristics of the external trace cable

Item	Symbol	Min.	Max.
Input voltage	V_{IN}	0V	5.5V
"H" level input voltage	V_{IH}	2.0V	-
"L" level input voltage	V_{IL}	-	0.8V

External trace input is latched in the timing shown in Figure 2.17, and external trigger input is latched in the timing shown in Figure 2.18.

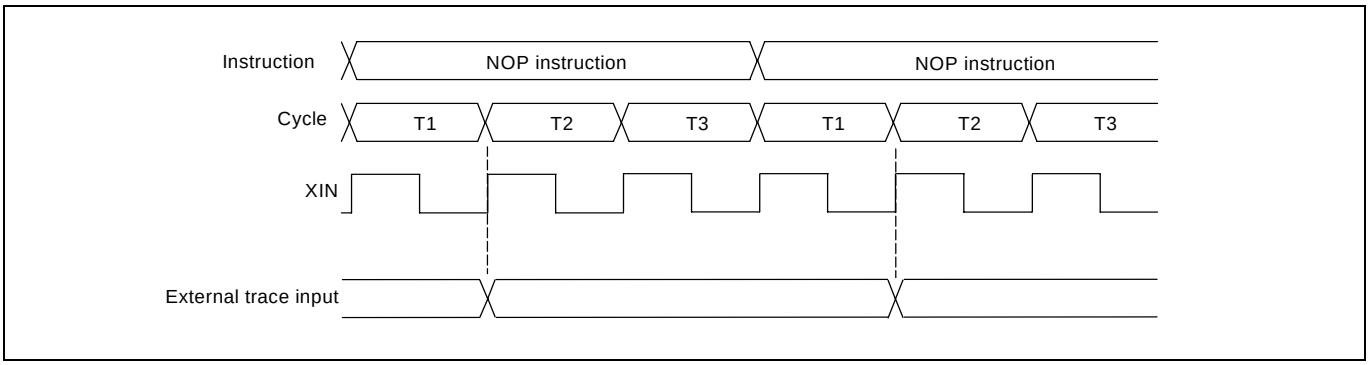


Figure 2.17 Latch timing of external trace input

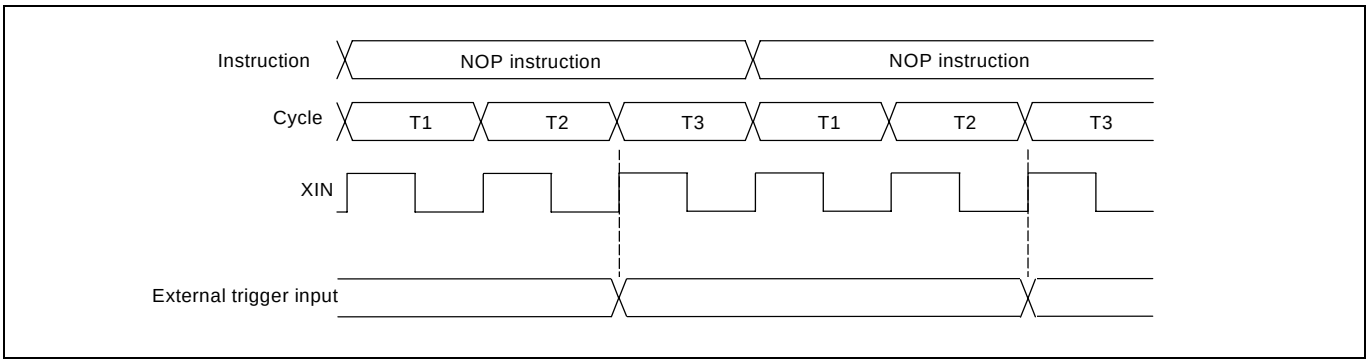


Figure 2.18 Latch timing of external trace input

2.10 Watchdog Timer Initialization Cycle Check Pin

The watchdog timer cannot be used with this emulator system. The watchdog timer initialization cycle can be verified by observing the waveform at the check pin (WRST) of the emulator.

2.10.1 Check pin WRST (TP3) on the Emulator Main Unit

Figure 2.19 shows the positions of the check pins WRST (TP3) and GND (TP2).

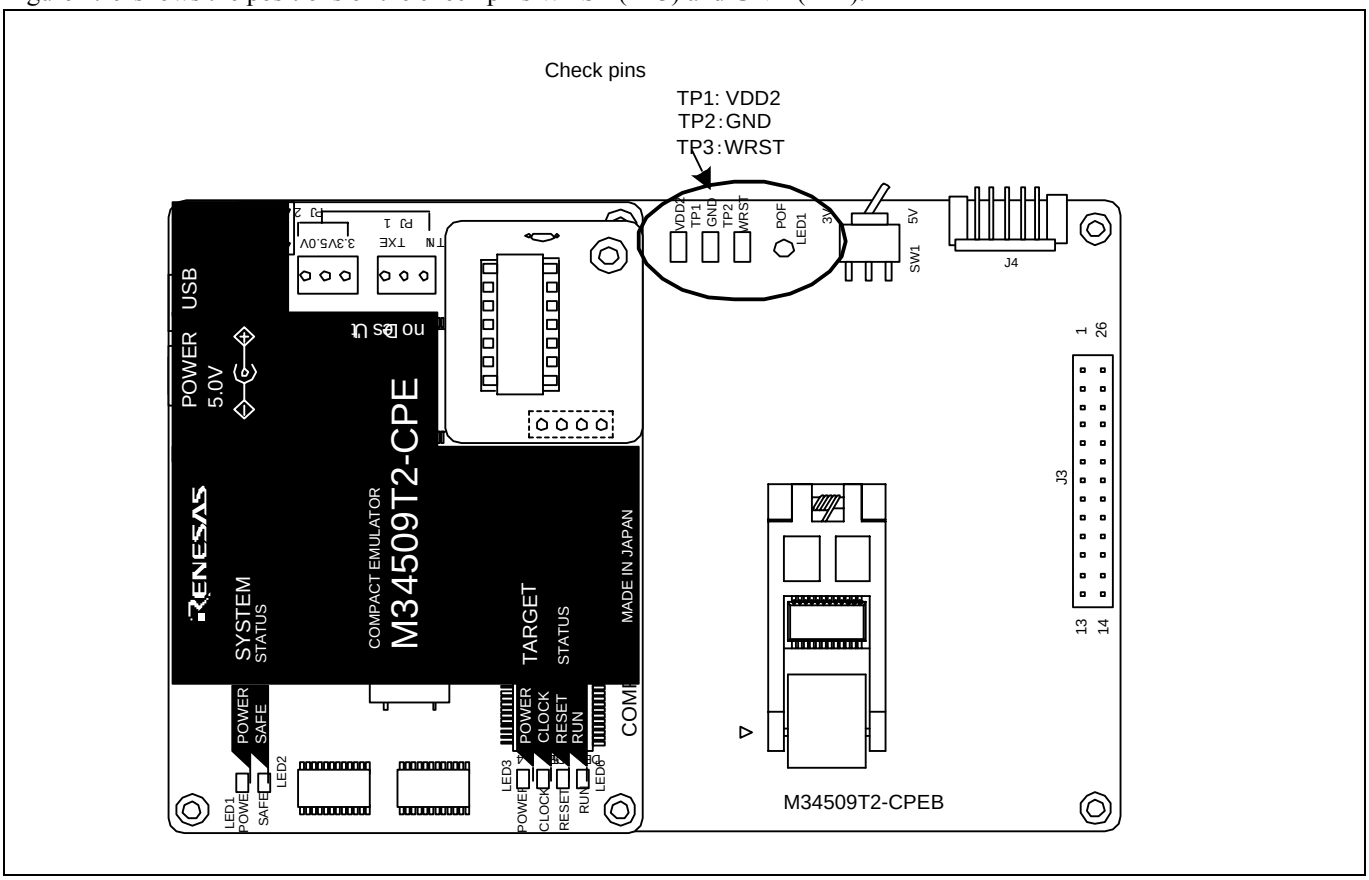


Figure 2.19 Positions of the check pins

2.10.2 Output Waveform of the Check Pin WRST

A waveform similar to the one shown in Figure 2.20 is output when executing the SRST instruction hat initializes the watchdog timer. By observing a period in which the check pin (WRST) is goes high, it is possible to know when the watchdog timer is initialized.

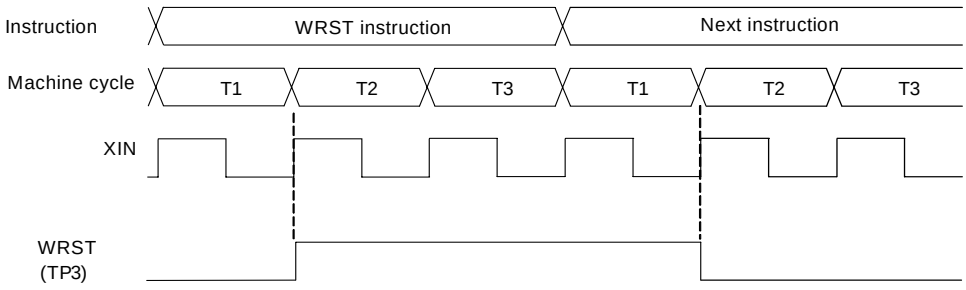


Figure 2.20 Output waveform of the check pin WRST

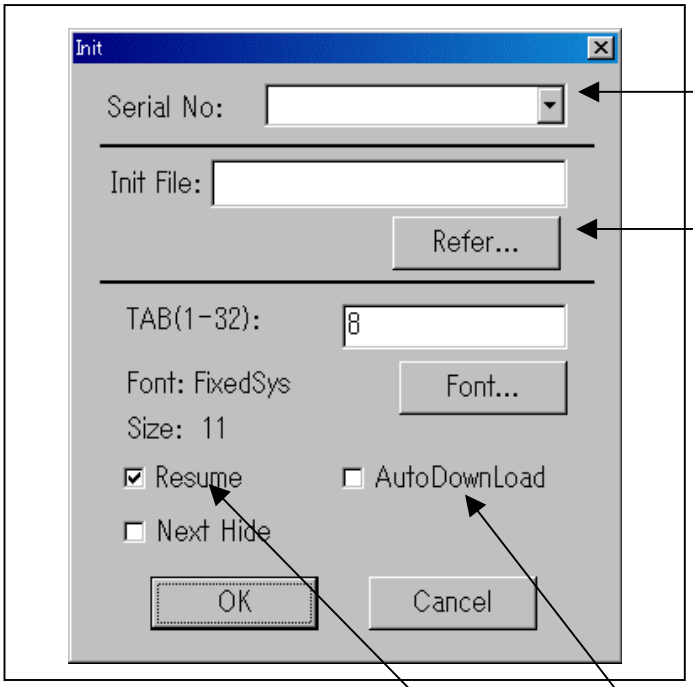
3. Usage (How to Use the Emulator Debugger)

This chapter describes how to start up the emulator debugger and how to use the major windows.

3.1 Starting Up the Emulator Debugger (Init Dialog Box)

To launch the emulator debugger, click the Start menu of Windows and then select
Programs (P) >> [Renesas] >> [PD45M V.xx.xx Release x] >> [PD45M].
When the emulator debugger started up, the Init dialog box appears.

(1) Setting the Init dialog box (1/2)



Serial No.

Shows the currently connected emulators in list form. Select the serial No. of the emulator you want to be connected.

Automatically executing a script command

To automatically execute a script command when starting up the debugger, click the "Refer..." button and specify the script file to be executed.

Clicking the "Refer..." button brings up a file selection dialog box. The script file you have selected is displayed in the Init File: section of the dialog box shown here. If you do not want to automatically execute a script command, delete the character string displayed in the Init File: section of the dialog box.

What you specify here is reflected at only startup. If you specify back again in the Init dialog box after startup, whatever you specified has no effect. (Be sure to restart the emulator debugger.)

Redownloading the load module

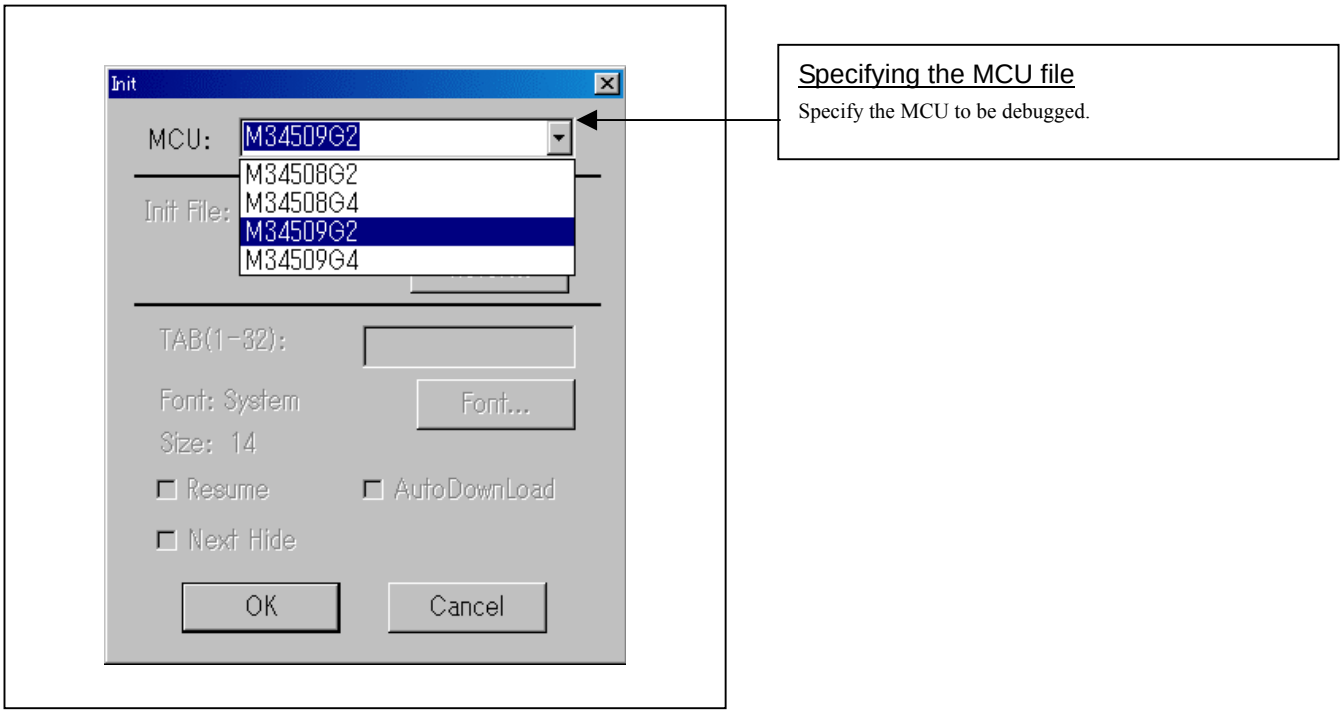
To download the load module (user program) again, select the "AutoDownLoad" check box. (By default, it is unselected)

Restoring the last window state

To restart the state of the window in which it was when it was finished previously (e.g., window position and size), select the "Resume" check box (flagged by a check mark when selected). (By default, it is selected)

(2) Setting the Init dialog box (2/2)

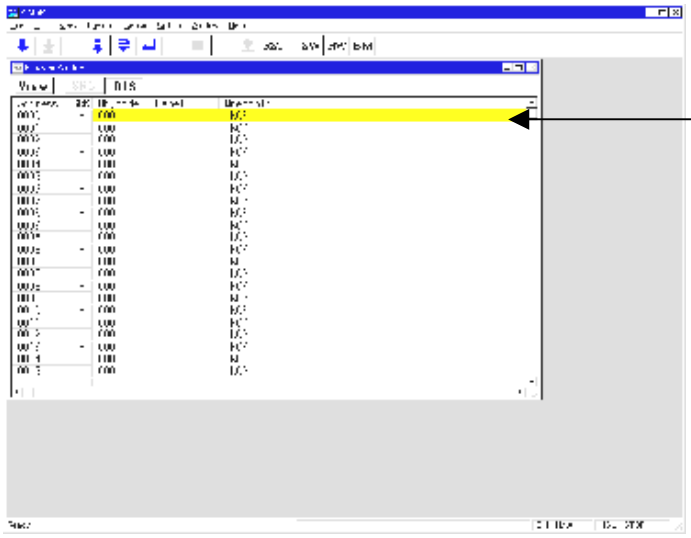
By pressing [OK] after setting the Init dialog box (1/2), the following Init dialog box will be displayed.



3.2 Program Window

(1) Downloading a program

1. Initial screen of the program window



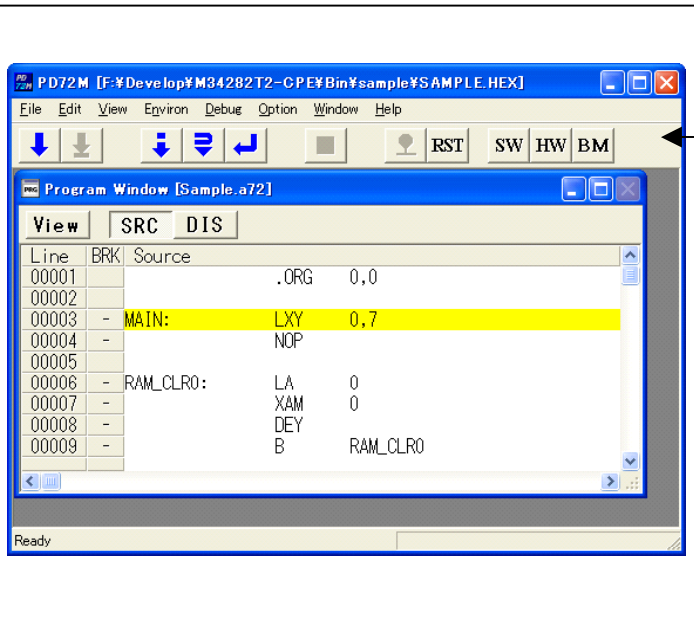
Initial screen of the program window

The program window is a window that always shows the content of the source file corresponding to the current position of the program counter. It automatically opens when the emulator starts up. The program counter position is identified by the yellow background color. Here, you can execute the program up to the cursor position, and set or clear software breakpoints.

With the emulator system, the ROM area at power-on in initialized to 000h (NOP instruction).

2. Downloading the program

Menu	Menu item	Function
File	Download Load Module... Memory Image... Symbol...	Downloads the user program. Downloads machine language data and debug information. Downloads only machine language data. Downloads only debug information.
	Reload...	Reloads the user program.
	Upload...	Uploads the user program.
	Save Disasm...	Saves the disassembled result.



Display after downloading the program

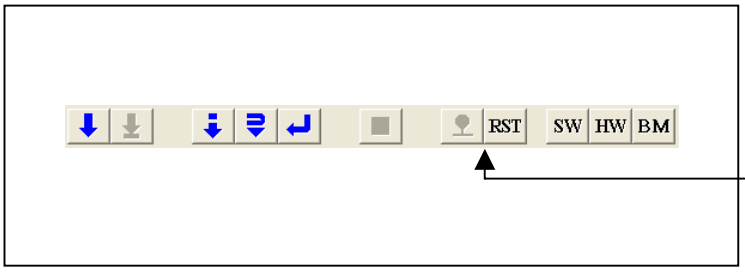
The program window has the following two display modes.

- Source display mode
  Displays the source file of the user program.

- Disassemble display mode
  Displays the disassembled result of the user program.

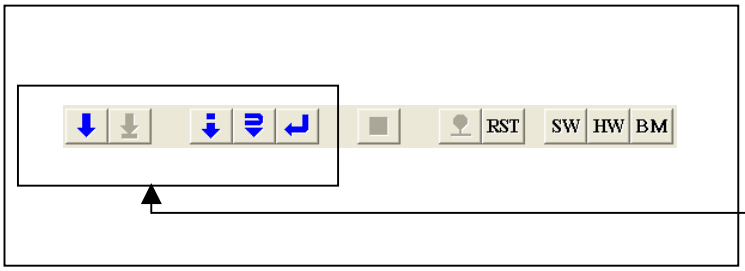
(2) Executing the program

1. Resetting the user program



RESET
Resets the program.

2. Executing the user program



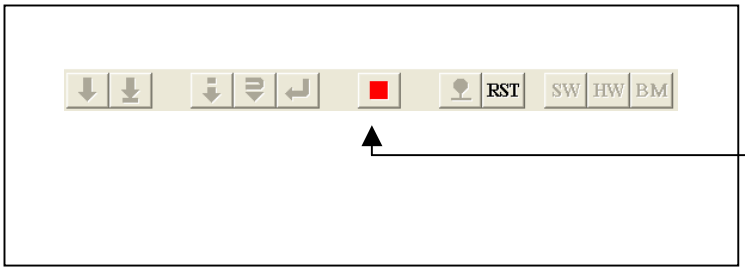
GO
Executes the program from the current PC position.

STEP
Execute one step.

OVER
Execute one over-step.

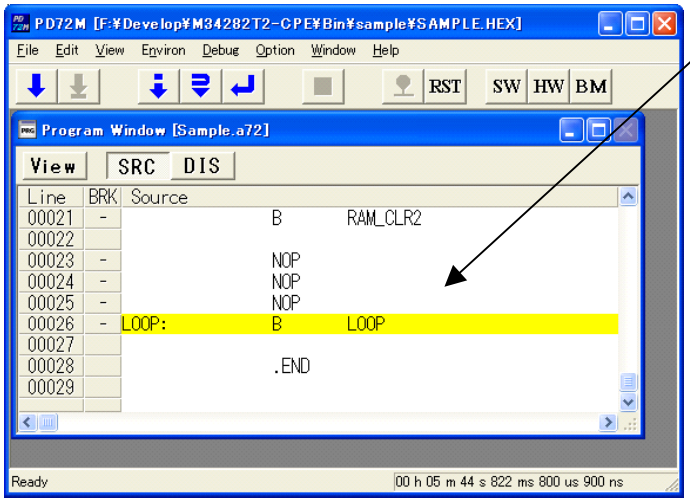
RETURN
Executes the program up to the high-order subroutine.

3. Stopping the user program



STOP
Stops the program.

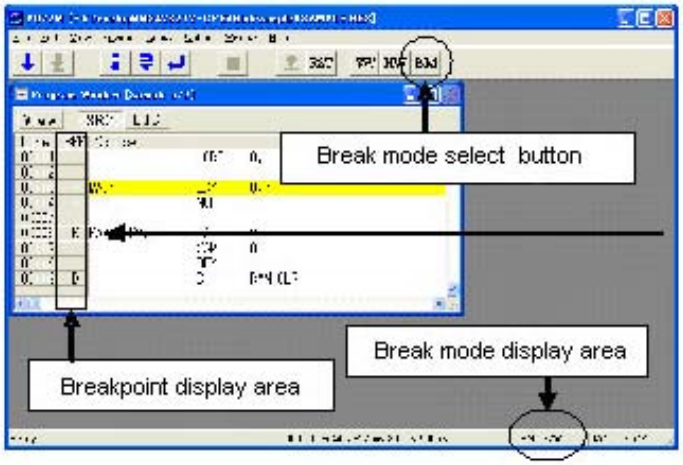
4. Program window screen after the user program has stopped



Program window screen
The program position at which the program has stopped is identified by the yellow background color.

(3) Setting breakpoints

1. Screen after breakpoint setup



Breakpoint setup screen

There are two types of breakpoints as described below. It is necessary to select the breakpoint by the break mode button. The current breakpoint is displayed in the break mode display area.

BM:SW Software break mode

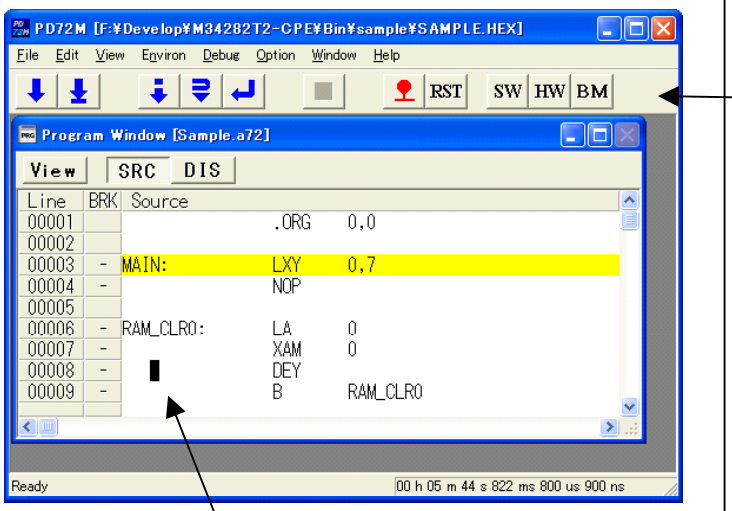
BM:HW Hardware break mode

.

- Software breakpoint (B)
  A software breakpoint can be set or cleared by double-clicking the breakpoint display area.
  If the breakpoint you set is a software breakpoint, the program stops after executing the instruction at the set breakpoint. Up to eight breakpoints can be set.
- Hardware breakpoint
  A hardware breakpoint can be set or cleared by the hardware break point setting dialog box.
  If the breakpoint you set is a hardware breakpoint, the program stops after executing the instruction at the set breakpoint. Up to two breakpoints can be set, and conditions of an address range or external trigger, etc., can be also set.

(4) Executing up to the cursor position (Come command)

1. Specifying the Come command



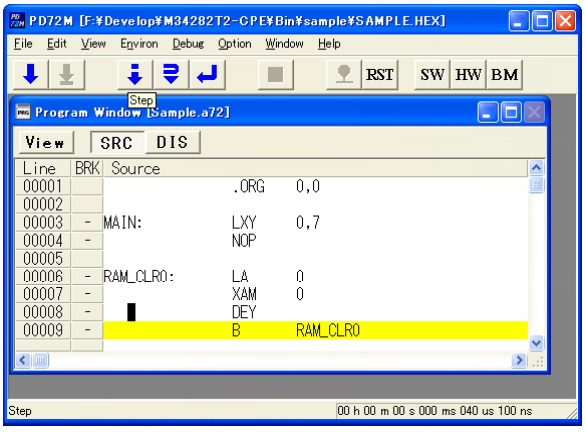
Click the line in the program display area at which you want the program to execute.

Setup procedure for executing COME command

(1) Click the line in the program display area at which you want the program to execute.

(2) Click the Come button.

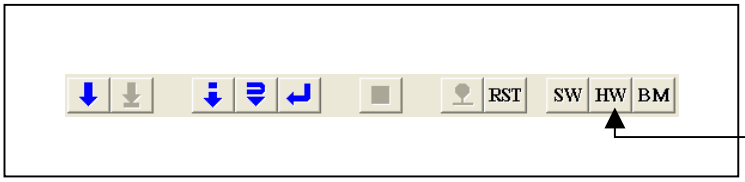
2. After the Come command has finished



3.3 Hardware Breakpoint Setting Window

(1) Breakpoint setup dialog box

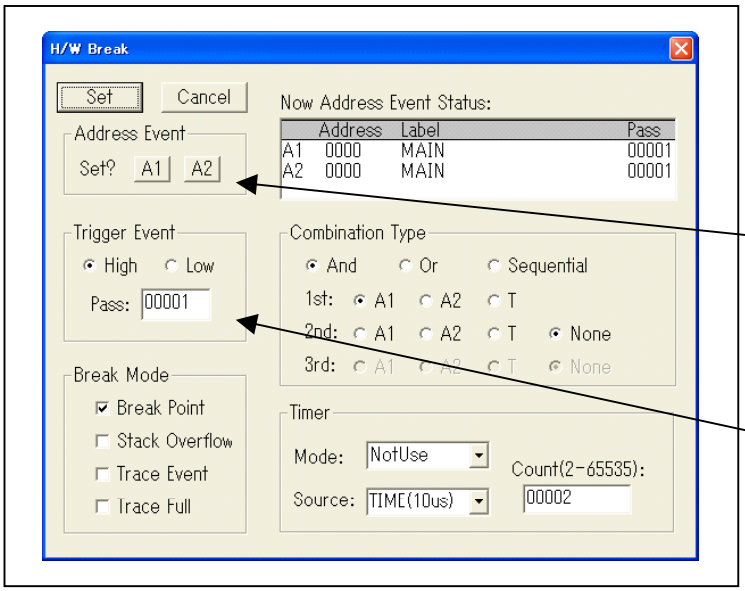
1. Opening the hardware breakpoint setup dialog box



Hardware Break Point

Clicking this button opens the hardware breakpoint setup dialog box.

2. Hardware Break Point Setting Window in initial state



Hardware breakpoint setup dialog box

You can use a combination of address event (A1 or A2) and T (external trigger event) as a hardware break event.

Setting an address event

By selecting A1 or A2, the address event dialog box will be displayed.

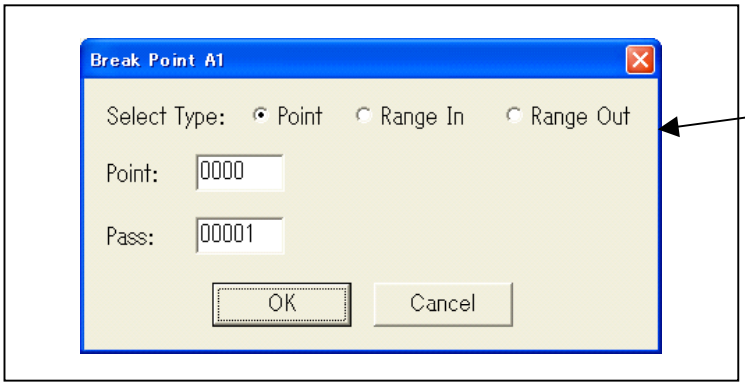
Setting an external trigger event

You can set edges or pass count of external trigger event.

High: Falling edge

Low: Rising edge

3. Address event setting dialog box



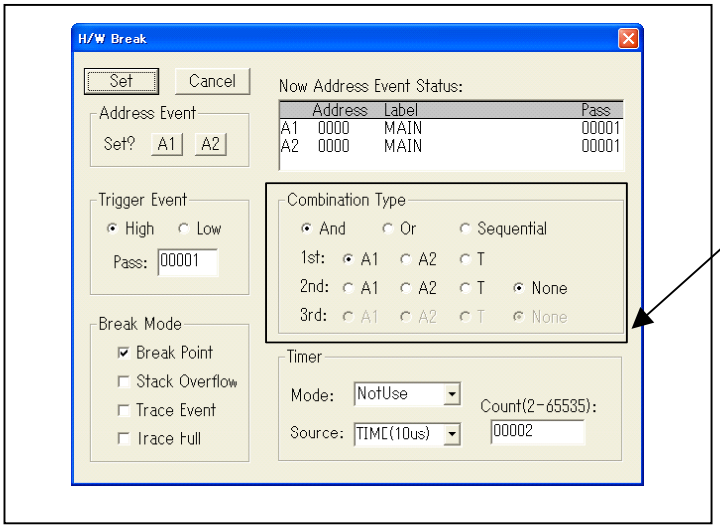
Setting an address event

You can select one of three conditions, and you can also set a pass count.

Point: Specified address
Range In: Specified address range
Range Out: Outside of specified address range

(2) Setting the combinatorial event condition

1. Window for setting the combinatorial event condition



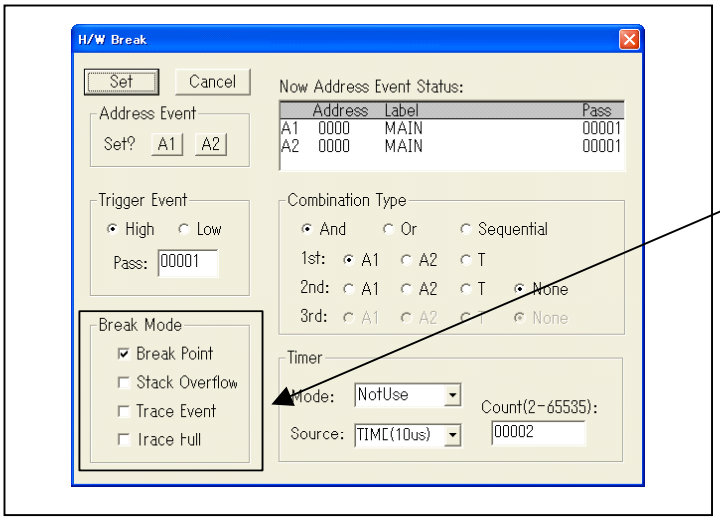
Setting the combinatorial event condition

Select a combinatorial condition for A1, A2, and T. One of the following three combinatorial conditions can be selected.

- AND: All of the specified conditions are met.
- OR: One of the specified conditions is met.
- Sequential: The specified conditions are met sequentially in a specified order.

When you have finished setting the combinatorial event condition, click the "Set" button.

2. Setting a break event



Setting a break event

The following four break conditions can be set. You can set two or more break conditions at the same time.

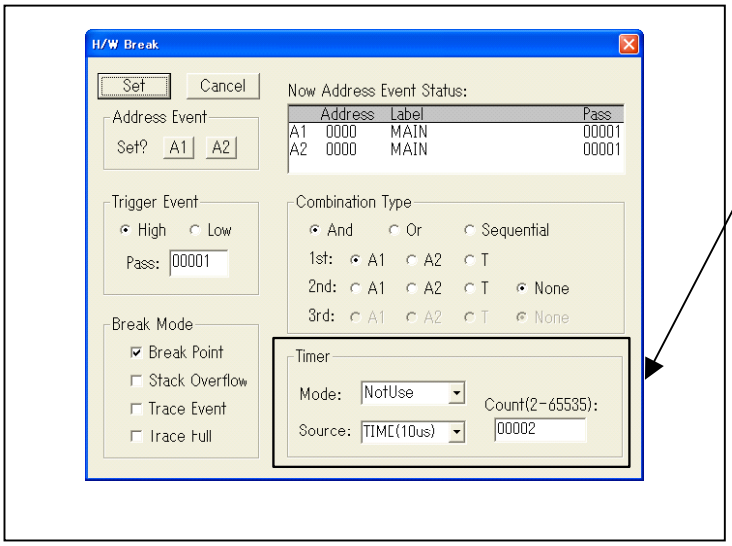
Break Point: The program breaks when a breakpoint is reached.

Stack Overflow: The program breaks when the stack overflow or underflows.

Trace Event: The program breaks when a trace event is met.

Trace Full: The program breaks when it finished writing to the trace memory.

3. Timer setup area



Timer setup area

The following four operation modes of the timer can be specified.

NotUse: The timer is not used.

TimeOut: The program loops at a constant frequency breaks when a breakpoint is reached within a specified time again. As an operating condition, a breakpoint must be reached at least once.

TimeCount: The program breaks when a specified time has elapsed after it started running.

DelayCount: The program breaks when a specified time has elapsed after a breakpoint is reached.

One of the following two can be specified as the count source for the timer.

TIME (10us): The passage of time if counted using the emulator's timer(10us fixed)

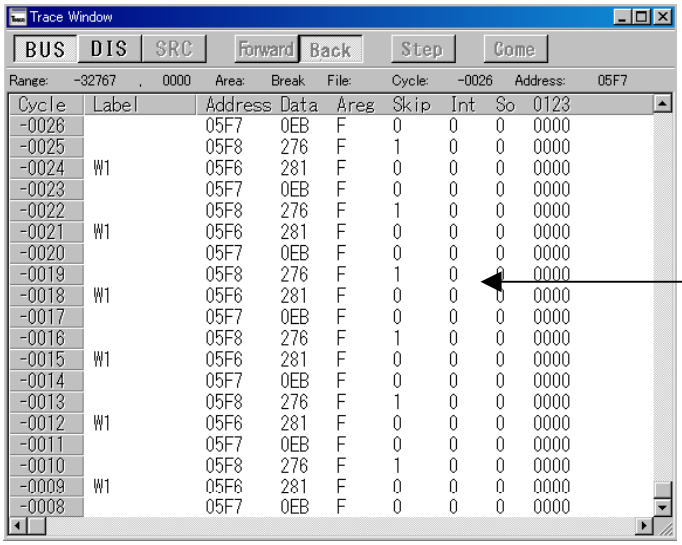
CYCLE: The passage time is counted by using MCU cycle.

3.4 Trace Window

(1) Trace window

1. Trace window

Menu	Menu item	Function
Windows	Trace Window	Opens the trace window.



Trace window

The trace window is used to show the results of real-time trace measurements. It has the following three display modes:

- Bus mode

  Bus information per cycle can be inspected. The contents are displayed in order of execution paths.

- Disassemble mode

  The execution paths of the executed instructions can be inspected. The contents are displayed in order of execution paths.

- Source mode

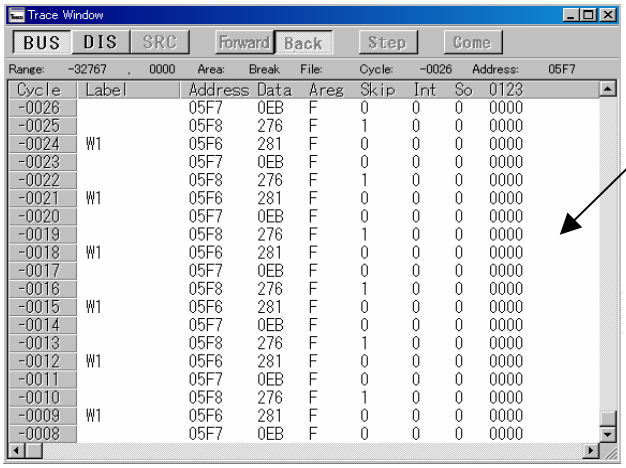
  The execution paths of the source program can be inspected.

  These modes can be switched over using the respective toolbar buttons.

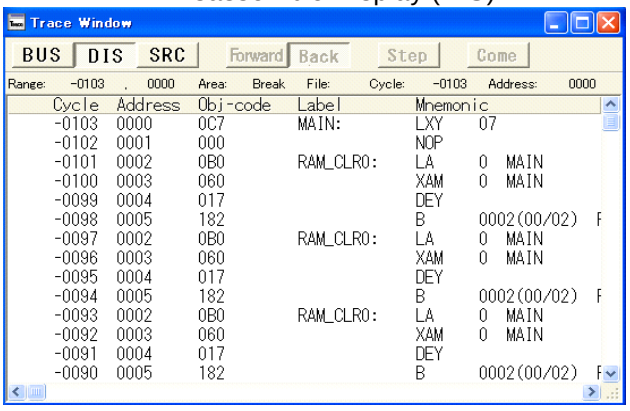
The trace window shows the measurement result when a real-time trace measurement has finished. The trace window remains blank until the real-time trace measurement in progress finishes.

2. Trace window (bus display)

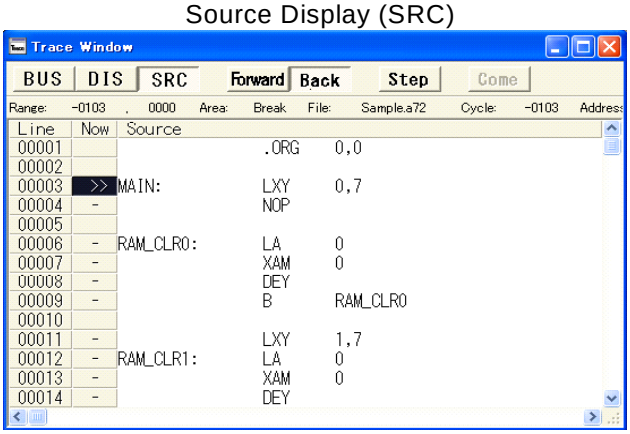
Bus Display (BUS)



Disassemble Display (DIS)



Source Display (SRC)



Explanation of the trace window (bus display)

The following explains the displayed contents, from left to right.

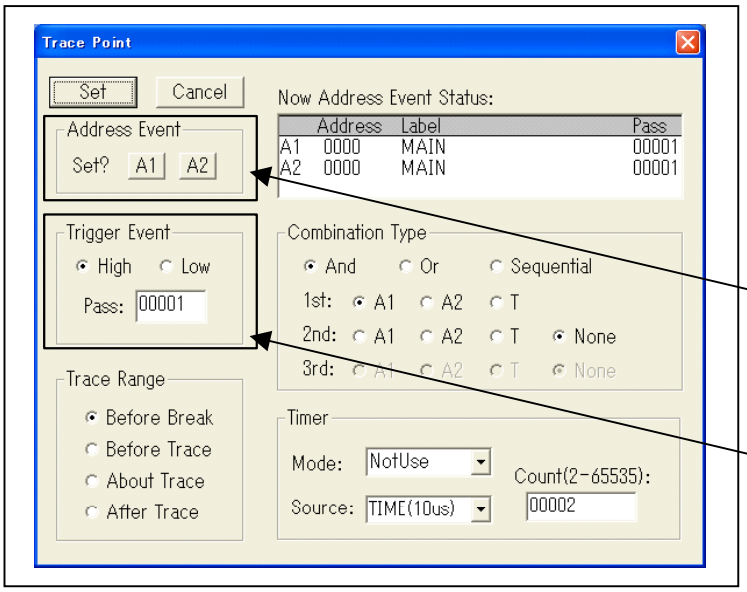
- Address
  Shows the status of the address bus.
- Data
  Shows the status of the data bus.
- Areg
  Shows the status of the register A.
- Skip
  When marked by 1, it means a skipped instruction.
- Int
  When marked by 1, it means an interrupt has occurred.
- So
  When marked by 1, it means that stack overflow or underflow has occurred.
- 0123
  Shows the signal level of external trace cable of EXT0 to EXT3

(2) Trace point setup dialog box

Opening the trace point setup dialog box

Menu	Menu item	Function
Debug	Trace Point	Setting the trace point dialog box

1. Setting the trace point dialog box



Trace point setup dialog box

You can use a combination of address event (A1 or A2) and external trigger event (T) as a trace event.

Setting an address event

By selecting A1 or A2, the address event dialog box will be displayed.

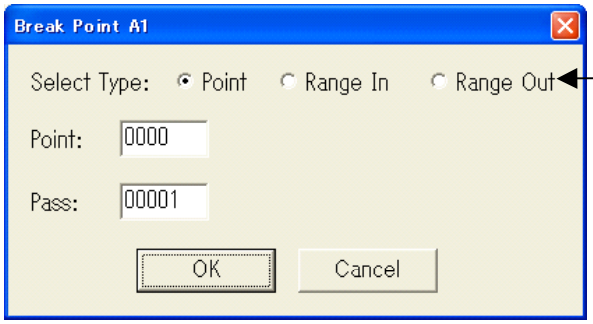
Setting an external trigger event

You can set edges or pass count of external trigger event.

High: Falling edge

Low: Rising edge

2. Address event setting window in initial state



Setting an address event

You can select one of three conditions, and you can also set a pass count.

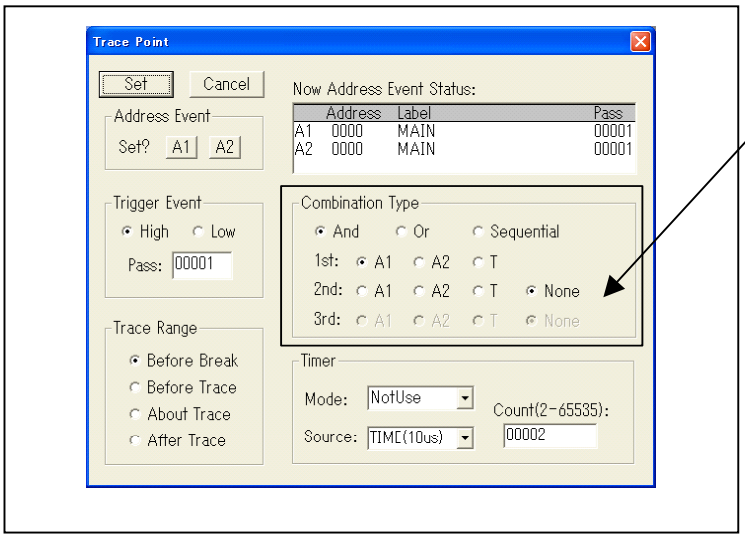
Point: Specified address

Range In: Specified address range

Range Out: Outside of specified address range

(3) Setting the combinatorial event condition

1. Window for setting the combinatorial event condition



Setting the combinatorial event condition

Select a combinatorial condition for A1, A2, and T. One of the following three combinatorial conditions can be selected..

- AND

  All of the specified conditions are met.

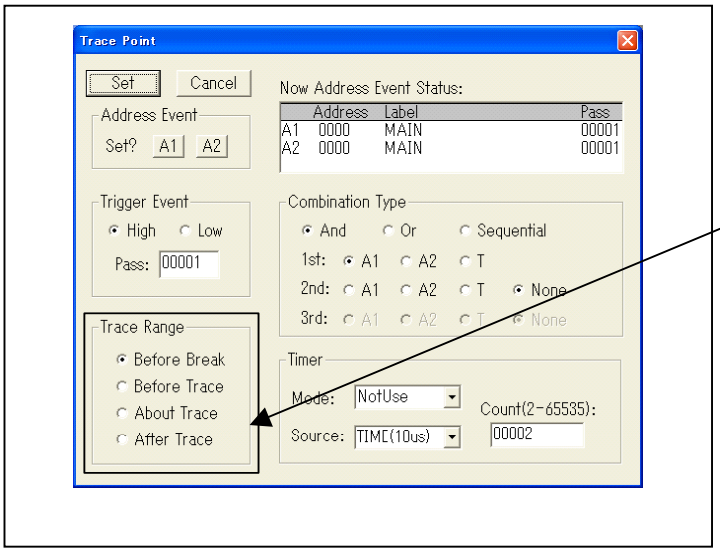
- OR

  One of the specified conditions is met.

- Sequential

  The specified conditions are met sequentially in a specified order.

2. Setting a break event



Setting a break event

The following four break conditions can be set. You can set two or more break conditions at the same time.

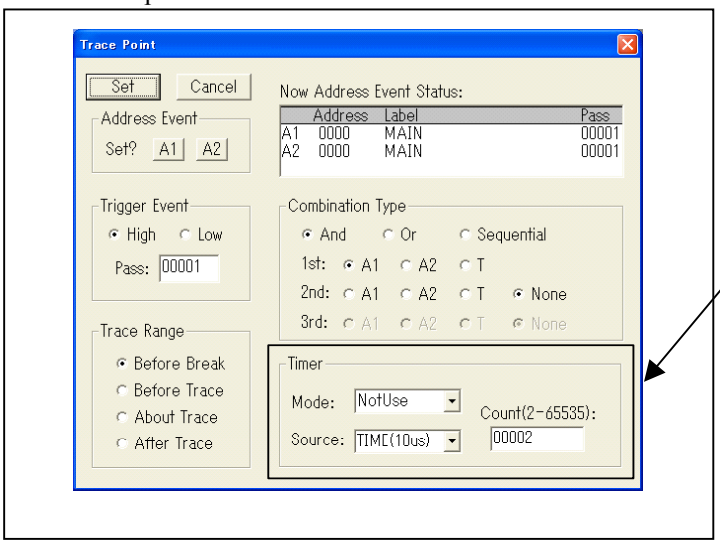
Before break: 32K cycles of instruction execution before the user program stopped is recorded.

Before Trace: 32K cycles of instruction execution before the user program stopped is recorded.

About Trace: 32K cycles of instruction execution before and after a trace point condition was met is recorded.

After Trace: 32K cycles of instruction execution after a trace point condition was met is recorded.

3. Timer setup area



Timer setup area

The following four operation modes of the timer can be specified.

NotUse: The timer is not used.

TimeOut: The program breaks when a breakpoint is not reached within a specified time.

TimeCount: The program breaks when a specified time has elapsed after it started running.

DelayCount: The program breaks when a specified time has elapsed after a breakpoint is reached.

One of the following two can be specified as the count source for the timer.

TIME (10us): The passage of time if counted using the emulator's timer (10us fixed)

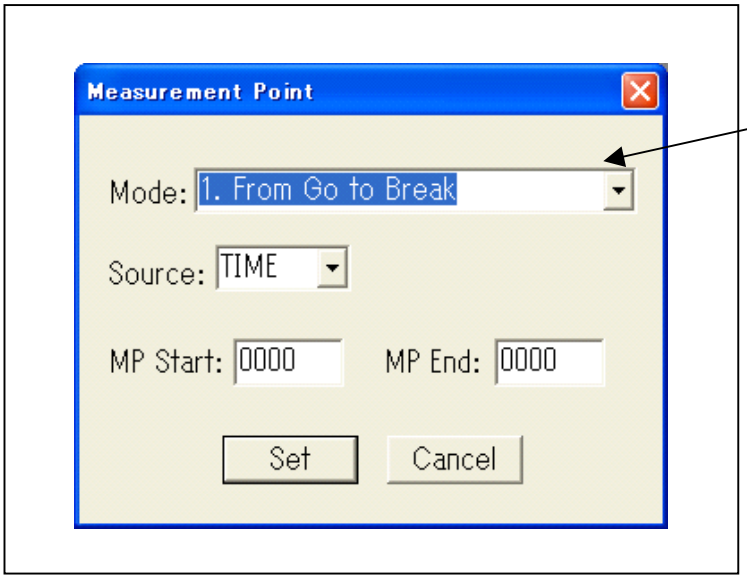
CYCLE: The passage time is counted by using MCU cycle.

3.5 Time Measurement

(1) Trace window

1. Setting time measurement points

Menu	Menu item	Function
Debug	Measurement Point	Sets up the time measurement points dialog box.



Setting time measurement points

A time measurement range can be specified by selecting one of the following eight time intervals.

1.From Go to Break:
From when the program starts running to when it stops.

2.From Go to MP End:
From when the program starts running to when the end of measurement point passed.

3.From Go to Trace Event:
From when the program starts running to when a trace event is met.

4.From Trace Event to MP End:
From where trace event is met to when the measurement end point passed.

5.From Trace Event to Break:
From when a trace event is met to when execution of the program finished.

6.From MP Start to MP End:
From when the measurement start point passed to when a trace even is met.

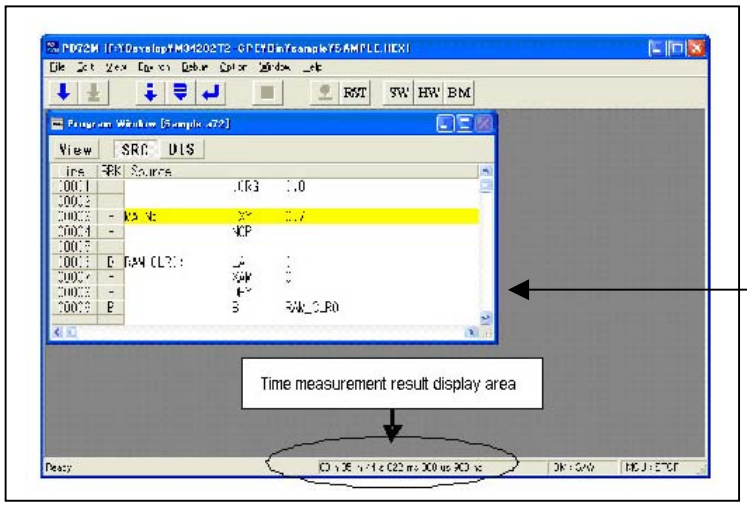
7.From MP Start to Trace Event:
From when the measurement start point passed to when a trace even is met.

8.From MP Start to Break:
From when the measurement start point passed to when execution of the program finished.

Furthermore, one of the following two can be specified as the count source for the timer.

TIME(100ns): The passage of time is counted using the emulator's timer (100ns fixed).

CYCLE: The passage time is counted by using MCU cycle.



Display of the time measurement result

The time measurement result is displayed in the status bar at the bottom of the window.

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 M34509T2-CPE

<table>
<tr><th>Item</th><th colspan="6">Description</th></tr>
<tr><td>Applicable MCU</td><td colspan="6">4500 Series 4508/4509 Group</td></tr>
<tr><td>Evaluation MCU</td><td colspan="6">M34509G4FP</td></tr>
<tr><td>Applicable power supply</td><td colspan="6">3.0 V ±5 % or 5.0 V ±5 %
- Available only from the emulator, not from the user system</td></tr>
<tr><td rowspan="5">Maximum operating frequency</td><td colspan="3" rowspan="3">3.0 V
Set the MCU power supply voltage selection switch (SW1) to 3V.</td><td>Divided-by 8-mode</td><td colspan="2" rowspan="3">6.0 MHz</td></tr>
<tr><td>Divided-by 4-mode</td></tr>
<tr><td>Divided-by 2-mode</td></tr>
<tr><td colspan="3">Through mode</td><td colspan="2">4.4 MHz</td></tr>
<tr><td colspan="3" rowspan="4">5.0 V
Set the MCU power supply voltage selection switch (SW1) to 5V.</td><td>Divided-by 8-mode</td><td colspan="2" rowspan="4">6.0 MHz</td></tr>
<tr><td>Divided-by 4-mode</td></tr>
<tr><td>Divided-by 2-mode</td></tr>
<tr><td>Through mode</td></tr>
<tr><td>Clock supply</td><td colspan="3">Main clock (X_{IN})</td><td colspan="3">Clock mounted on emulator
(6MHz: preinstalled, replacable)</td></tr>
<tr><td rowspan="6">Port emulation</td><td>Pin</td><td>Output type</td><td>Direction</td><td colspan="3">Device</td></tr>
<tr><td>P00-P03</td><td rowspan="5">N-channel open drain or C-MOS output</td><td rowspan="4">I/O</td><td>Input</td><td colspan="2">74HC4050</td></tr>
<tr><td>P10-P13</td><td rowspan="2">Output</td><td colspan="2">74ALS641A(N-ch)</td></tr>
<tr><td>D0, D1,
D4, D5</td><td colspan="2">74VHC126(C-MOS)</td></tr>
<tr><td>P20-P21</td><td>I/O</td><td>I/O</td><td colspan="2">74HC4066</td></tr>
<tr><td>Connection to the user system</td><td colspan="6">Connected by 2.54mm pitch 26-pin flat cable</td></tr>
</table>

4.2 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) Initial values of internal resource data of an MCU at power-on
With the emulator system, the ROM area at power-on in initialized to 000h (NOP instruction).

(2) Voltage drop detection circuit
Because the operating voltage of this product is fixed to 3V or 5V, it cannot evaluate any system using a voltage drop detection circuit.

(3) Power-on reset
You can reset this emulator system by the reset command of the emulator debugger M3T-PD45M, however, this emulator system cannot emulate operation at a power-on reset. Therefore, check the operation at a power-on reset using an actual MCU.

(4) RESET# output
Because an emulation circuit exists in pin RESET#, systems that use RESET output cannot be evaluated.

(5) Internal pull-up transistor control
Because this product has an emulation circuit present in ports P0 and P1, you cannot use the MCU's internal pullup transistors. Therefore, the M34509T2-CPE controls on/off of external pullup resistors (68kΩ) by decoding the pullup control register transfer instruction (TPU0A or TPU1A).

(6) Unconnected pins
Following pins are not connected to the user system.
Xin, Xout, CNVss

Note on RESET# Input:

- A low input to pin RESET# from the user system is accepted only when a user program is being executed (when the RUN status LED on the emulator's upper panel is lit).
- You cannot use an SRST instruction. If it is executed, it acts as a NOP instruction

Notes on Operating Clock:

- The clock generated on the OSC board only is usable as the operating clock, and the clocks listed below cannot be used.

(1) External input clocks on the user system
(2) Clocks generated by external RC oscillation circuit
(3) Clocks generated by external ceramic resonators
(4) Clocks generated by internal on-chip oscillators

* No operations are performed when the CRCK instruction is executed.

- In the initial state after reset, although the clock generated on the OSC board is usable as the operating clock, the MR0 register (system clock oscillation source selection bit) is set to 1 (on-chip oscillator selected).
- Clock input to the MCU is supplied from the oscillator circuit board OCS-2 in the emulator, and cannot be supplied from the oscillator circuit in the user system. If the system clock frequency needs to be changed, alter the circuit on the oscillator circuit board OCS-2 before use. For details, refer to Section 2.8.2, "Selecting Clock Supply" (page 34).

IMPORTANT

Note on Watchdog Timer:

- With this product, the watchdog function cannot be used. However, the watchdog timer initialization cycle can be verified by observing the waveform at the check pin (WRST) of the emulator. For details, refer to "2.10 Watchdog Timer Initialization Cycle Check Pin" (page 38).
- With this product, DWDT instruction (stop of the watchdog timer function enabled) cannot be used.

Note on Port Electrical Characteristics:

- Because the following ports are configured with port emulation circuits, electrical characteristics differ from those of the actual MCU.

  - P00-P03
  - P10-P13
  - D0-D1, D4-D5
  - RESET#

  For more details, refer to "4.3 Connection Diagram" (page 60).

Notes on Port I/O Timings:

- Port input timings
  Port input timings are the same as with the actual MCUs.

- Port I/O timings
  Port I/O timings are different from those of the actual MCUs for the following ports that are configured with port emulation circuits:
  - P00-P03
  - P10-P13
  - D0-D1, D4-D5

  With the actual MCUs, changes occur at the beginning of the T3 state of an output instruction. With this product, changes occur at the beginning of the T2 state of the next output instruction. Figure 4.1 shows the port I/O timing for this product.
  The output timings of ports D2, D3 and ports P30, P31 are the same as with the actual MCUs.

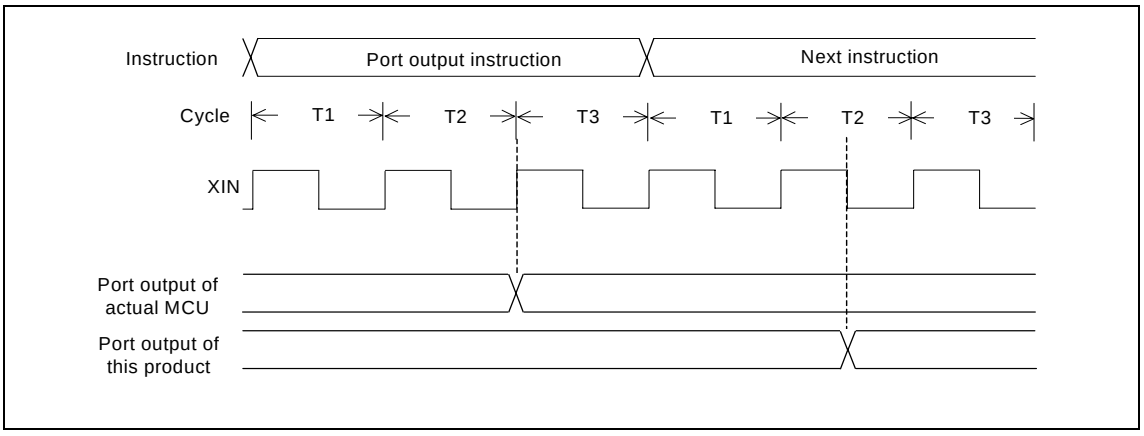


Figure 4.1 Port I/O timings

- As a pitch converter board and other devices are used between the evaluation MCU and the user system. Some characteristics are slightly different from those of the actual MCU. Therefore, be sure to evaluate your system with an evaluation MCU.

IMPORTANT

Note on Operation in Power Down State:

- In RAM backup mode, this product operates differently from the actual MCUs. Although the actual MCU enters RAM backup mode depending on a combination of the EPOF and POF instructions, this product is placed in RAM backup mode by only executing the POF instruction. The EPOF instruction has no effect on this product.
- Table 4.2 shows the operation in RAM backup modes when executing each program.

Table 4.2 Operation in RAM backup modes when executing each program

Program example	Actual MCU	M34571T2-CPE
1-1	Yes	Yes
1-2	-	Yes
1-3	-	-

Yes: RAM backup mode
-: No RAM backup mode

Program example 1-1 (POF and EPOF instructions executed)

```
RC
INY
EPOF
POF
:
```

Program example 1-2 (Only POF instruction executed)

```
RC
INY
POF
:
```

Program example 1-3 (Only EPOF instruction executed)

```
RC
INY
EPOF
```

Note on A/D Converter Function:

- As the operating voltage of this product is 3 V or 5 V, the results of the A/D conversion may differ from the theoretical values because of the difference with the voltage of the user system. As a flat cable and pitch converter board, etc. are used between the evaluation MCU and the user system. Some characteristics are slightly different from those of the actual MCU.

Note on W1 Register:

- If the control mode in which the program has halted is "clock stop mode," the W1 register may not be modified. In such a case, change this control mode to "DI instruction insertion mode."

  * If the W1 register is modified while the PWM1 signal is high, the content of the W1 register is not altered until after the PWM1 signal returns low. This is because if the control mode in which the program has halted is "clock stop mode," timer 1 remains idle while the user program is inactive and the PWM1 signal is not altered during that time.

IMPORTANT

Notes on Timer Input:

- In this product, when the external input such as CNTR0 and CNTR1 is used for timer count source for Timer 1 and Timer2, the operation timing of the CNTR pin is different from that of an actual MCU because the CNTR pin is the emulation port. Note that the set timing of timer interrupt request flag such as T1F and T2F is also different.

  Figure 4.2 shows that the operation timing when the external input such as CNTR0 and CNTR1 is used for timer count source for Timer 1 and Timer 2.
- Therefore, in this product, the timer external input frequency, f(CNTR), is limited to the maximum value shown below:

  f(CNTR): f(STCK)/6 x 0.9(Max)[Hz]

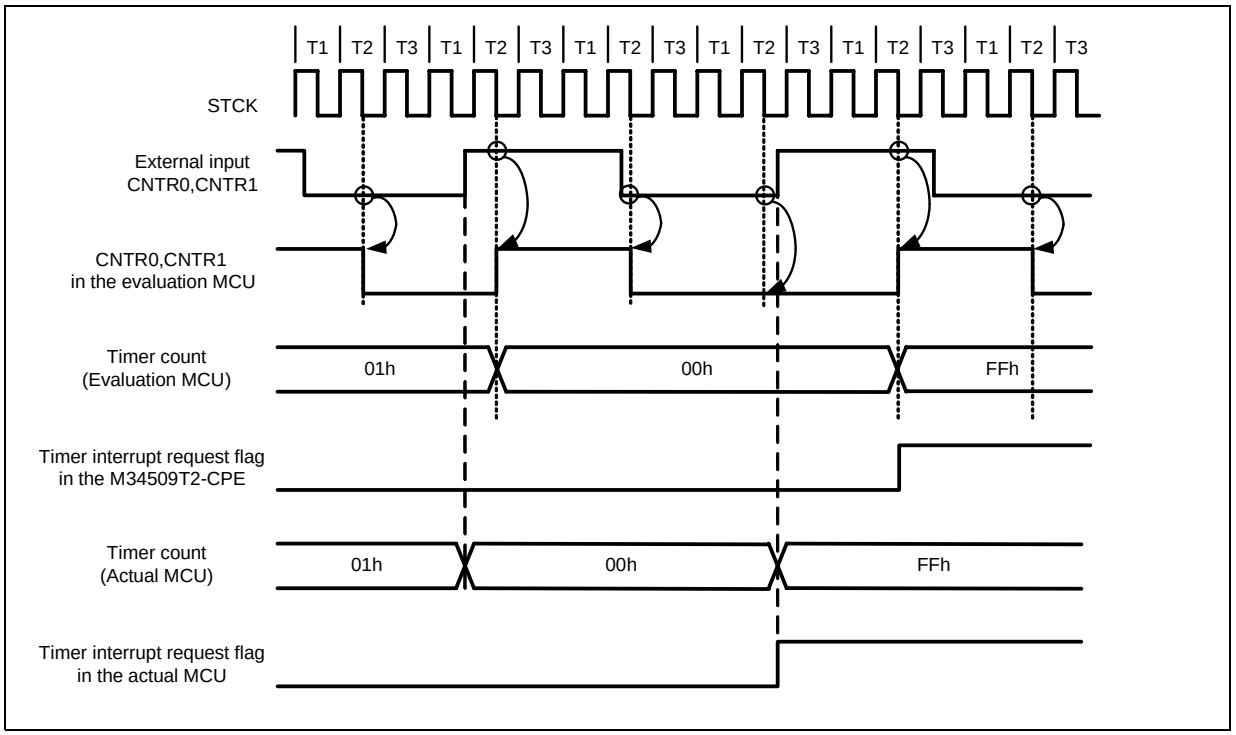


Figure 4.2 Timing of the timer input

*The external timer input such as CNTR0 and CNTR1 is taken in the evaluation MCU at the system clock falling edge in the middle of the T2 state.

IMPORTANT

Notes on Timer Output:

- In this product, when the timer output such as CNTR0 and CNTR1 is used, the operation timing of the CNTR pin is different from that of an actual MCU because the CNTR pin is the emulation port.
  Figure 4.3 shows that the operation timing when the timer output such as CNTR0 and CNTR1 is used.

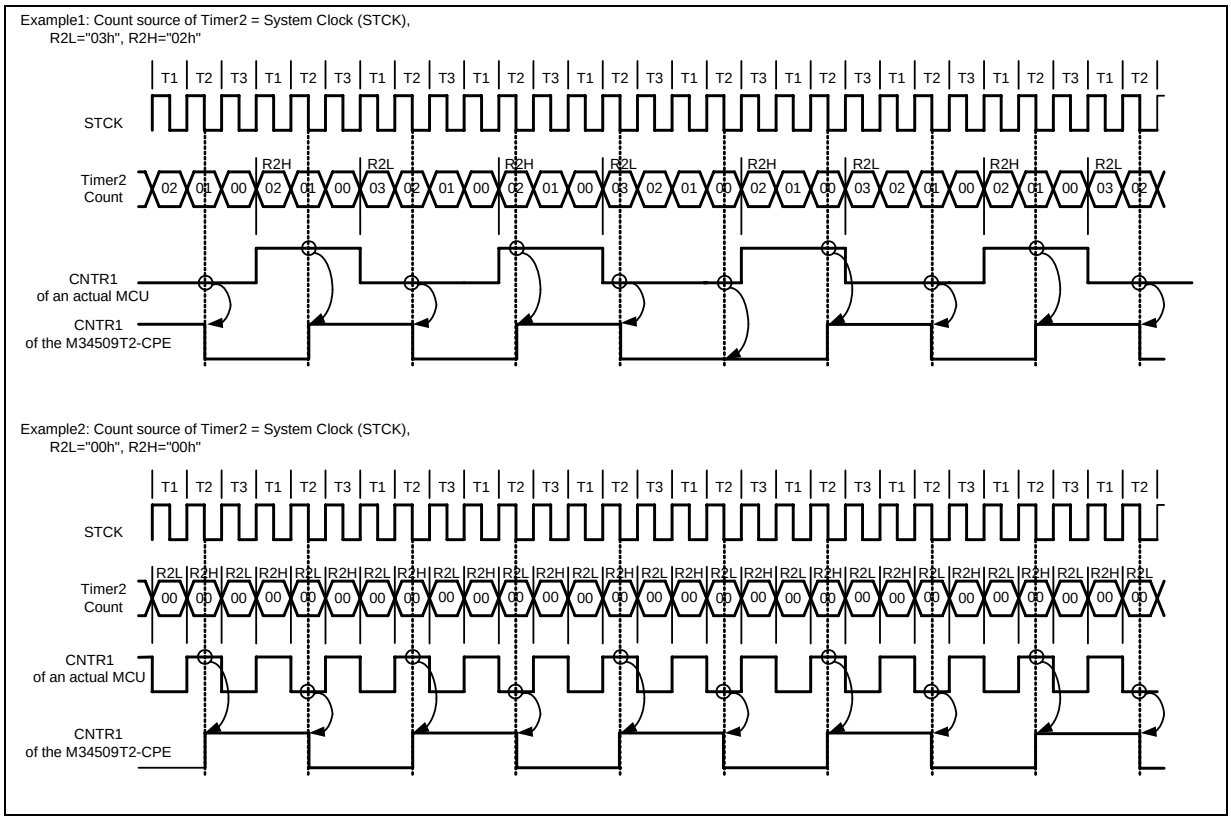


Figure 4.3 Timing of the timer output

*1 Timer output such as CNTR0 and CNTR1 of this product can only be changed at T2 state.

*2 The timer count timing in the evaluation MCU is the same as the one in the actual MCU.
(Except when external input is used for the count source)

*3 In this product, the set timing of the timer output such as CNTR0 and CNTR1 may be different from that of the timer interrupt request flag.

重要

Notes on Serial Input:

- In this product, when the external clock (SCK) is used for the serial interface synchronous clock, the operation timing of the SCK pin is different from that of an actual MCU because the SCK pin is the emulation port.
  Make sure that the set timing of the serial interface transmit/receive completion flag (SIOF) is also different.
  Figure 4.4 shows that the operation timing when the external clock (SCK) is used for the serial interface synchronous clock.
- Therefore, in this product, the serial I/O external input frequency, f(SCK) is limited to the maximum value shown below:
  f(SCK): f(STCK)/6 x 0.9(Max)[Hz]

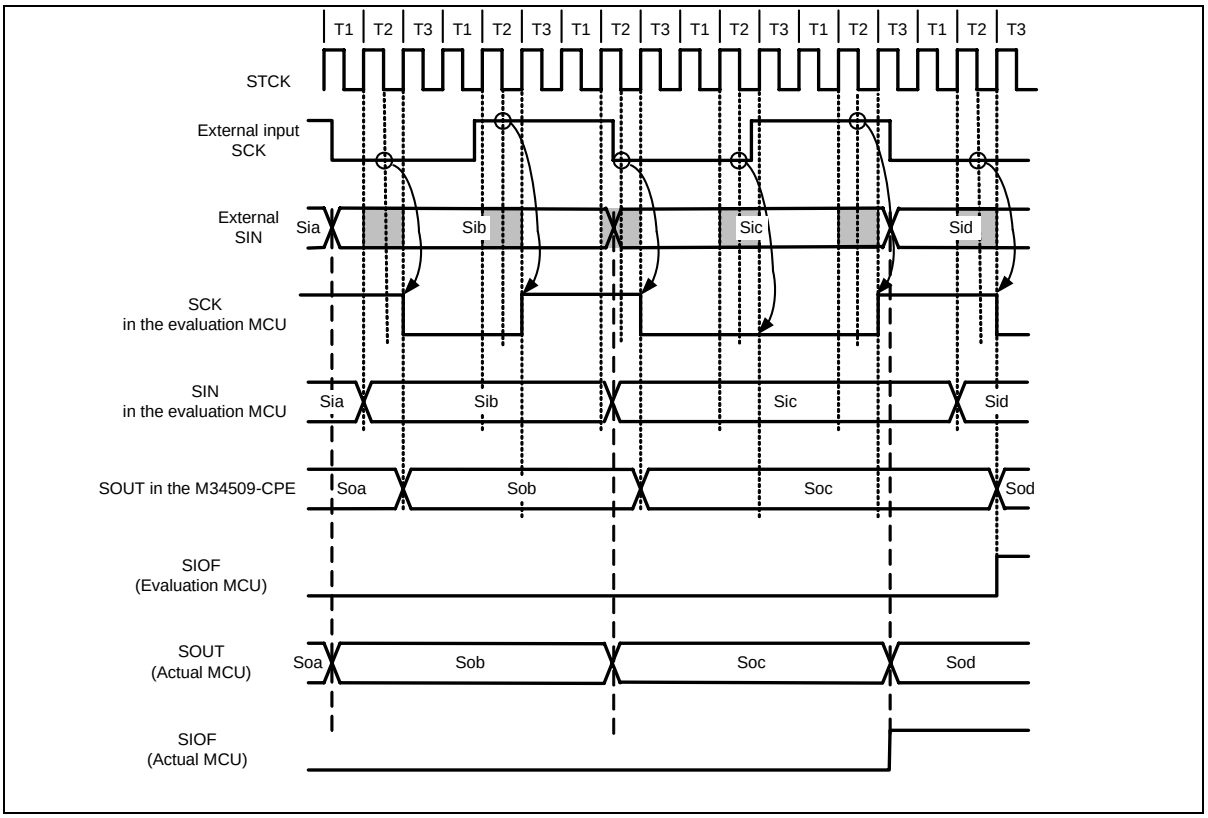


Figure 4.4 Timing of the serial input/output

*External clock (SCK) input at the system clock falling edge in the middle of the T2 state is taken in the evaluation MCU at the system clock rising edge in the beginning of the T3 state. And serial data input (SIN) is taken in the evaluation MCU in the first half of the T2 state.

IMPORTANT

Note on Register Operation:

- Tables 4.3 and 4.4 list the registers that can be operated from the M3T-PD45M. The "Yes" in the tables means that the register can be operated; the "No" means that the register can not be operated.

Table 4.3 Registers that can be operated when debugging 4508 Group MCUs

Register	Reference	Modification	Register	Reference	Modification
PC	Yes	Yes	MR	Yes	Yes
CY	Yes	Yes	PA	No	Yes
A	Yes	Yes	PU0	Yes	Yes
B	Yes	Yes	PU1	Yes	Yes
X	Yes	Yes	PU2	Yes	Yes
Y	Yes	Yes	Q1	Yes	Yes
Z	Yes	Yes	R1L	No	Yes
D	Yes	Yes	R1H	No	Yes
E	Yes	Yes	R2L	No	Yes
SP	Yes	No	R2H	No	Yes
FR0	No	Yes	V1	Yes	Yes
FR1	No	Yes	V2	Yes	Yes
FR2	No	Yes	W1	Yes	Yes
FR3	No	Yes	W2	Yes	Yes
I1	Yes	Yes	W5	Yes	Yes
J1	Yes	Yes	W6	Yes	Yes
K0	Yes	Yes	RG	No	Yes
K1	Yes	Yes	RPS	No	Yes
K2	Yes	Yes	SI	Yes	Yes
L1	Yes	Yes			

Table 4.4 Registers that can be operated when debugging 4509 Group MCUs

Register	Reference	Modification	Register	Reference	Modification
PC	Yes	Yes	MR	Yes	Yes
CY	Yes	Yes	PA	No	Yes
A	Yes	Yes	PU0	Yes	Yes
B	Yes	Yes	PU1	Yes	Yes
X	Yes	Yes	PU2	Yes	Yes
Y	Yes	Yes	Q1	Yes	Yes
Z	Yes	Yes	R1L	No	Yes
D	Yes	Yes	R1H	No	Yes
E	Yes	Yes	R2L	No	Yes
SP	Yes	No	R2H	No	Yes
FR0	No	Yes	V1	Yes	Yes
FR1	No	Yes	V2	Yes	Yes
FR2	No	Yes	W1	Yes	Yes
FR3	No	Yes	W2	Yes	Yes
I1	Yes	Yes	W5	Yes	Yes
J1	Yes	Yes	W6	Yes	Yes
K0	Yes	Yes	RG	No	Yes
K1	Yes	Yes	RPS	No	Yes
K2	Yes	Yes	C1	No	Yes
L1	Yes	Yes	SI	Yes	Yes

Note on Final Evaluation:

- Be sure to evaluate your system with an evaluation MCU.

4.3 Connection Diagram

Figure 4.2 shows a part of the connection diagram of the M34509T2-CPE. 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 4.2 connect the evaluation MCU and the user system directly. Tables 4.5, 4.6, 4.7, 4.8 and 4.9 show IC electric characteristics of this product for reference purposes.

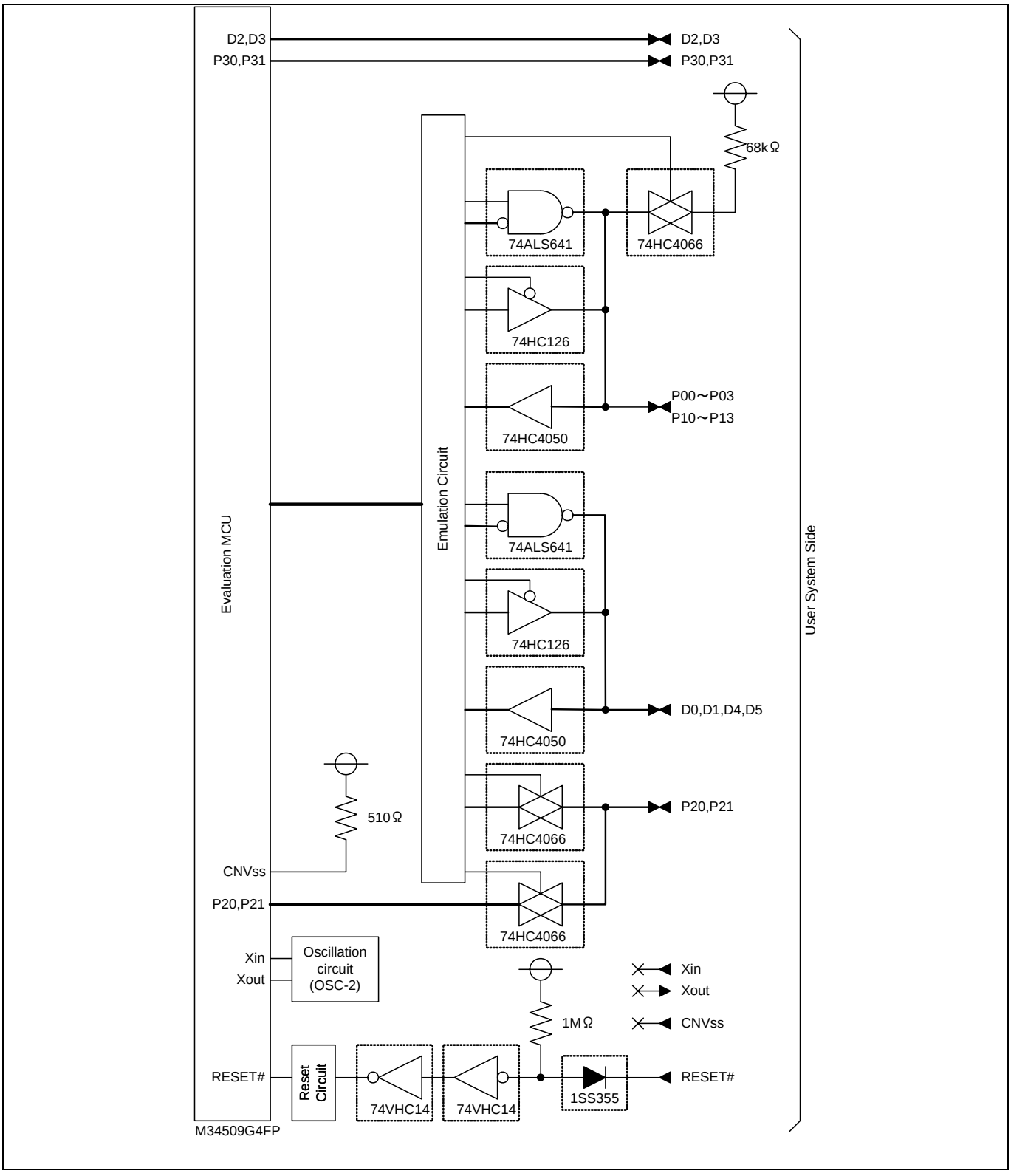


Figure 4.5 A part of connection diagram of the M34509T2-CPE

Table 4.5 Electrical characteristics of the 74HC4050

Signal	Item	Condition	Standard values		Unit
			Min.	Max.	
V_{IH}	"H" level threshold voltage	Vcc=2.0V	1.50	-	V
		Vcc=4.5V	3.15	-	
		Vcc=6.0V	4.20	-	
V_{IL}	"L" level threshold voltage	Vcc=2.0V	-	0.50	
		Vcc=4.5V	-	1.35	
		Vcc=6.0V	-	1.80	

Table 4.6 Electrical characteristics of the 74ALS641A

Signal	Item	Condition	Standard values			Unit
			Min.	Standard	Max.	
V_{OL}	"L" output voltage	Vcc=4.5V, I_{OL}=24mA	-	0.35	0.5	V
I_{OL}	"L" output current		-	-	24	mA

Table 4.7 Electrical characteristics of the 74VHC126

Signal	Item	Condition	Standard values			Unit
			Min.	Standard	Max.	
V_{OH}	"H" output voltage	Vcc=3.0V, I_{OH}=-4mA	2.58	-	-	V
		Vcc=4.5V, I_{OH}=-8mA	3.94	-	-	
V_{OL}	"L" output voltage	Vcc=3.0V, I_{OL}=4mA	-	-	0.36	
		Vcc=4.5V, I_{OL}=8mA	-	-	0.36	

Table 4.8 Electrical characteristics of the 74HC4066

Symbol	Item	Condition	Standard values			Unit
			Min.	Standard	Max.	
R_{ON}	ON resistor	Vcc=4.5V	-	96	170	Ω
ΔR_{ON}	ON resistor difference	Vcc=4.5V	-	10	-	
I_{OFF}	Leak current (Off)	Vcc=12.0V	-	-	±100	nA
I_{IZ}	Leak current (On, output: open)	Vcc=12.0V	-	-	±100	

Table 4.9 Electrical characteristics of the 74VHC14

Signal	Item	Condition	Standard values		Unit
			Min.	Max.	
V_P	"H" level threshold voltage	Vcc=3.0V	-	2.20	V
		Vcc=4.5V	-	3.15	
		Vcc=5.5V	-	3.85	
V_N	"L" level threshold voltage	Vcc=3.0V	0.90	-	
		Vcc=4.5V	1.35	-	
		Vcc=5.5V	1.65	-	
V_H	Hysteresis voltage	Vcc=3.0V	0.30	1.20	
		Vcc=4.5V	0.40	1.40	
		Vcc=5.5V	0.50	1.60	

4.4 External Dimensions

4.4.1 External Dimensions of the Compact Emulator

Figure 4.3 shows external dimensions of the M34509T2-CPE.

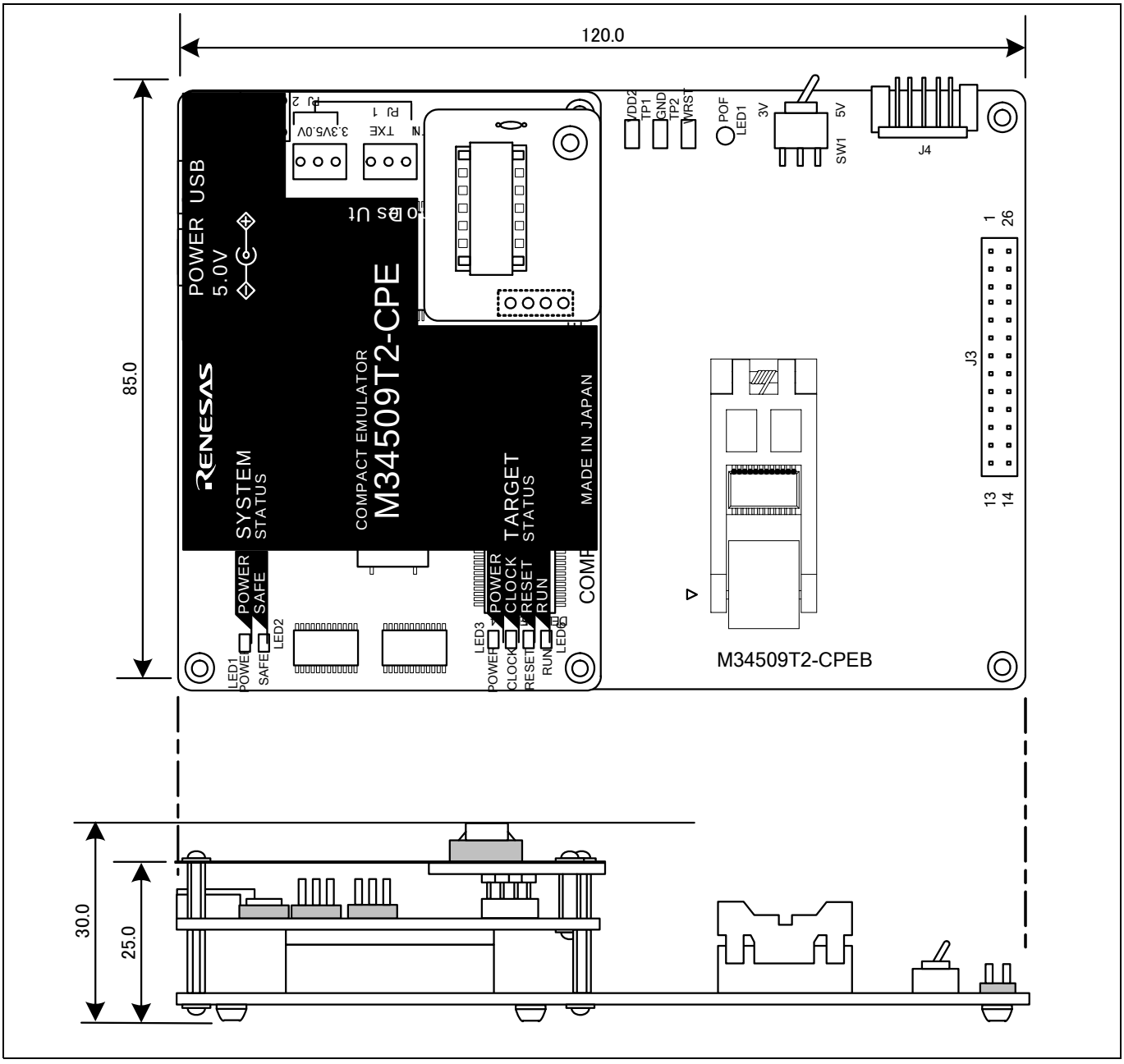


Figure 4.6 External dimensions of the compact emulator

4.4.2 External Dimensions of the Converter Board M34501T-PTC

Figure 4.7 shows external dimensions of the converter board M34501T-PTC (included with the M34509T2-CPE) for a 20-pin 1.778mm pitch SDIP.

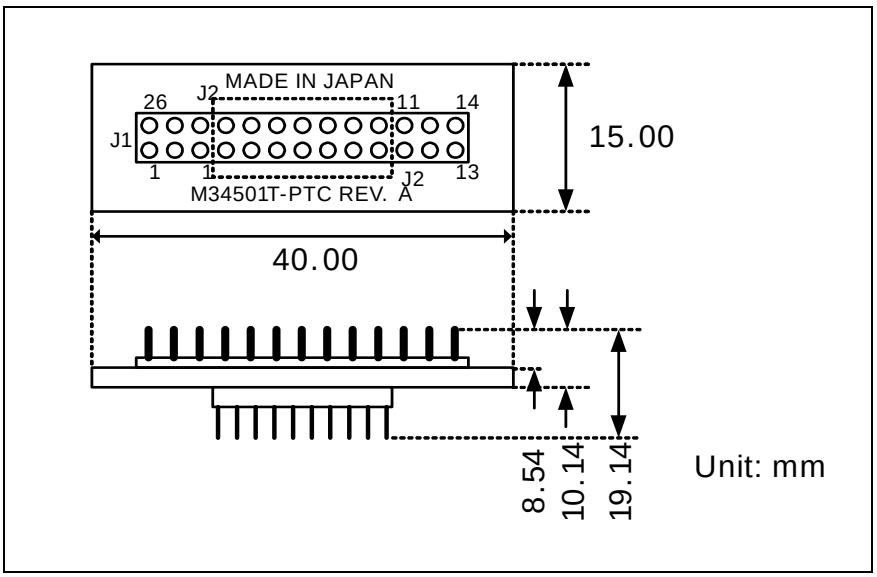


Figure 4.7 External dimensions of the converter board M34501T-PTC

4.5 Notes on Using This Product

Notes on using this product are listed below. When debugging the MCU using this product, be careful about the following precautions.

IMPORTANT

Notes on the Self-check:

- If the self-check does not result normally (excluding target status errors), the emulator may be damaged. Then contact your local distributor.
- Run the self-check with the user system not connected.

Note on Quitting the Emulator Debugger:

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

Notes on the User System (Power Supply, Order of Powering On):

- This emulator cannot supply the power to the user system. Therefore design your system so that the user system is powered separately.
- The voltage of the user system should be as follows.
  3.0V ±5 % or 5.0V ±5 %
- 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, 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 emulator as simultaneously as possible.
  (2) When the emulator debugger starts up, check the target status LEDs on the emulator to see if this product is ready to operate.
  Is the power supplied? Check that target status LED (POWER) is ON.*1
  Is the clock supplied? Check that target status LED (CLOCK) is ON.

  *1 When the user system is not connected the target status LED (POWER) does not light.

IMPORTANT

Note on the RAM Backup Mode:

- Although this emulator allows you to execute a program using POF instructions, execution of such programs is subject to the following limitations:
  - The POF instruction cannot be stepped and over-stepped. Therefore, do not attempt to step and step-over the POF instruction..
  - No events (hardware breaks and trace points) can be set in execution cycles of the POF instruction. The events set in execution cycles of the POF instruction, if any, have no effect.
  - During RAM backup mode, no commands of the emulator debugger M3T-PD45M except for RESET can be executed. Exit RAM backup mode by applying key-on wakeup input or reset input before executing the commands.

Note on the MCU Status While the Program is Idle:

- The MCU status while the program is idle show below.

  DI insertion mode: DI insertion mode is executed while the user program has stopped.
  Clock stop mode: Clock stops while the user program has stopped.

*In the clock stop mode, the timer and other internal peripheral functions are stopped. However, if the internal RAM reference/setting, Register reference/setting, step execution, etc. are performed, a clock is supplied.

Note on a Break Operation When Skipping Instructions

- In cases when the next instruction is skipped by a skip instruction, if a break operation (hardware, software or forcible break) in the skipped instruction is attempted, no break occurs. If a skip and a break occur at the same time, the cause of the break is cleared and the program continues running until the next cause of break occurs.

  Example: If a break operation is attempted when executing an instruction at address 0002h, the intended break is canceled and the program continues running.

```
[ADDR] [CODE]
0000   RC
0001   SZC
0002   TABP 1     : Skipped instruction
0003   TAM
0004   BL 0004    : The program continues to execute
                    instruction without breaking.
```

Note on a Break Operation in a Train of Successive Instructions:

- The program does not break in a train of successive instructions. If a break operation (hardware, software or forcible break) is attempted in a train of successive instructions, the intended break occurs in an instruction at which the successive instructions ended. An example is shown below.

  Example: If a break operation is attempted while executing the instructions at addresses 0000--0003h, the break occurs at address 0004h.

```
[ADDR] [CODE]
0000   LA 0   ┐
0001   LA 1   │
0002   LA 2   ├ Successive instructions
0003   LA 3   │
0004   NOP   ┘ < A break occurs at this address.
```

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 the troubles from when power to the emulator is activated until the emulator debugger starts up. Check this while the user system is disconnected. For the latest FAQs visit the Renesas Tools Homepage.

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

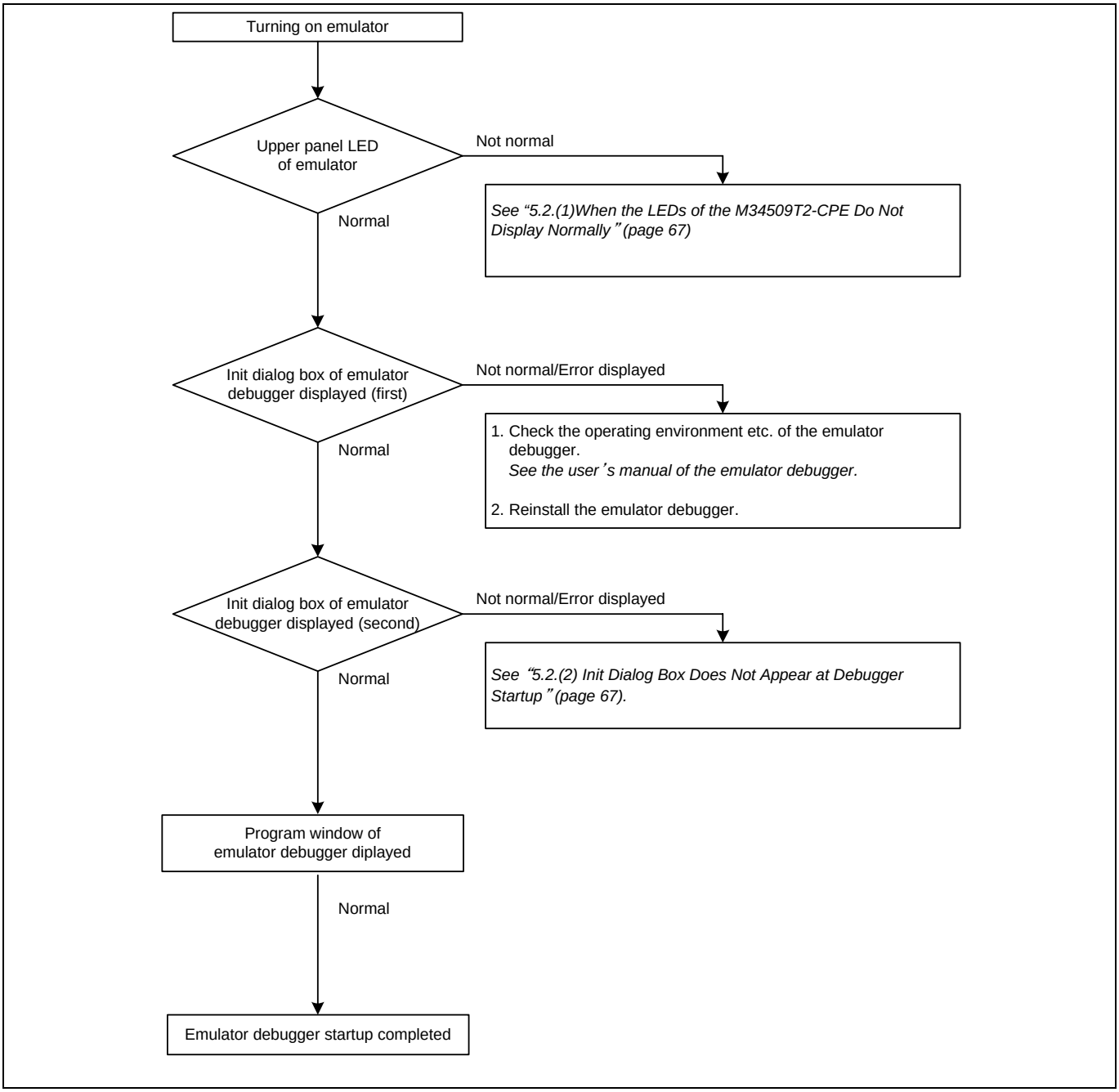


Figure 5.1 Flowchart to remedy the troubles

5.2 When the Emulator Debugger Does Not Start Up Properly

(1) When the LEDs of the M34509T2-CPE Do Not Display Normally

Table 5.1 Errors LEDs show and their checkpoints 1

Error	Connection to the user system	Checkpoint
System Status POWER LED does not light up.	-	Check that the power cable is connected. See "2.3 Connecting the Power Supply for the Emulator" (page 22).

Table 5.2 Errors LEDs show and their checkpoints 2

Target Status LED display Blinking OFF POWER / CLOCK / RESET / RUN	Connection to the user system	Problem & Remedy
■	Connected	Check that power (Vcc) is properly supplied to the user system and that the user system is properly grounded.
■	Disconnected	The emulator system is working properly. Target Status POWER LED does not light up when the user system is disconnected
■ ■ ■ ■	-	The emulator system is not working properly. - Check that power is supplied to the emulator. - The emulator may be damaged. Contact your local distributor.
■ ■ ■ ▯	-	
■ ■ ▯ ■	-	
■ ▯ ■ ■	-	A clock is not supplied to the emulator. - Check that the oscillator circuit board (OSC-2) is attached. - Check that the oscillator on the oscillator circuit board (OSC-2) or the oscillation module is oscillating properly. Refer to "2.8.2 Selecting Clock Supply" (page 34)
■ ▯ ▯ ▯	-	The MCU cannot be controlled. - Check that the MCU is properly attached. - Check that the oscillation frequency of the oscillator circuit board (OSC-2) is within the specified range.
Others	-	The emulator system is not working properly. - The emulator may be damaged. Contact your local distributor.

(2) Init Dialog Box Does Not Appear at Debugger Startup

Table 5.3 Checkpoints of errors at debugger startup

Error	Checkpoint
Communication error occurred. Data was not sent to the target.	- Check the target status LED display. If the LED is blinking, the emulator did not start up normally. See "2.5.5 LED Display When the Emulator Starts Up Normally" (page 26). - Check that the USB cable is connected properly. See "2.4 Connecting the Host Machine " (page 23). - USB device driver has been installed before the emulator debugger start up? See "2.2.2 Installing the USB Device Driver" (page 21)
Not compact emulator.	Check that an emulator other than the compact emulator (such as PC4701, PC7501) is not connected.

5.3 How to Request for Support

After checking the items in "5 Troubleshooting", fill in the text file which is downloaded from the following URL, then send the information to your local distributor.

http://tool-support.renesas.com/eng/toolnews/registration/support.txt

For prompt response, please specify the following information:

(1) Operating environment
- Operating voltage: _____ [V]
- Operating frequency: _____ [MHz]
- User system: Connected/Disconnected

(2) Product information
- Target MCU: _____
- Emulator: _____

(3) 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 ( )

(4) 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 11) 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

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.

⚠ 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.

Compact Emulator for 4508/4509 Group
M34509T2-CPE User's Manual

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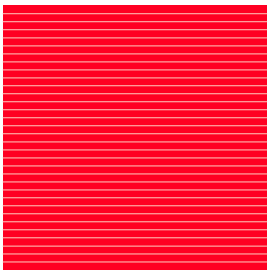
M34509T2-CPE
User's Manual



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