

RX72M Group

R01AN4853EJ0101

Rev.1.01

Communications Board PROFIBUS (Master) Startup Manual

Jan. 31, 2020

Introduction

This is a quick start guide to running PROFIBUS communications on the RX72M communications board for evaluating industrial networks.

Target Device

RX72M Group

Sample Program

This sample program uses the evaluation version of the PROFIBUS stack produced by one of our partners, M2M craft Co., Ltd. The stack's major communications specifications are as follows.

- Communications protocol: PROFIBUS DP M1(DP Master Class 1)
- Supported baud rate: 9600bps, 19.2kbps, 93.75kbps, 187.5kbps, 500kbps, 1.5Mbps

For purchase of the official version of the stack and the specifications of the sample program, contact M2M craft Co., Ltd.

M2M craft Co., Ltd. Web site: <http://m2mcraft.co.jp/>

[Restrictions]

The evaluation version of the PROFIBUS stack consists of library files which were built with the functional limitations as listed below. This version is only made available for purposes of evaluation.

- I / O communication is only possible with one slave
- Size of IO data: Fixed to 8 bytes for both

Please note that the evaluation stack cannot be used in commercial products. Purchasing the official version of the PROFIBUS stack is required if it is to be used in a commercial product.

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1. Operating Environment

The sample program covered in this manual runs in the environment below.

Table 1.1 Operating Environment

Item	Description
Board	RX72M communications board TS-TCS07298 from Tessera Technology
CPU	RX CPU (RXv3)
Operating frequency	CPU clock (CPUCLK): 240 MHz
Operating voltage	3.3 V
Operating modes	Single chip mode
Device requirements	R5F572MNDDBD <ul style="list-style-type: none"> • Code flash memory Capacity: 4 Mbytes ROM cache: 8 Kbytes • Data flash memory Capacity: 32 Kbytes • RAM/extended RAM Capacity: 512 Kbytes / 512 Kbytes
Communications protocol	PROFIBUS (master)
Integrated development environment	e ² studio (V7.5.0 or later) with the CC-RX compiler (V3.01.00)
Emulator (ICE)	Renesas E2 Lite

2. Setting up and Connecting the Evaluation Board

For detailed information on the board, refer to the *RX72M Group Communications Board Hardware Manual*.

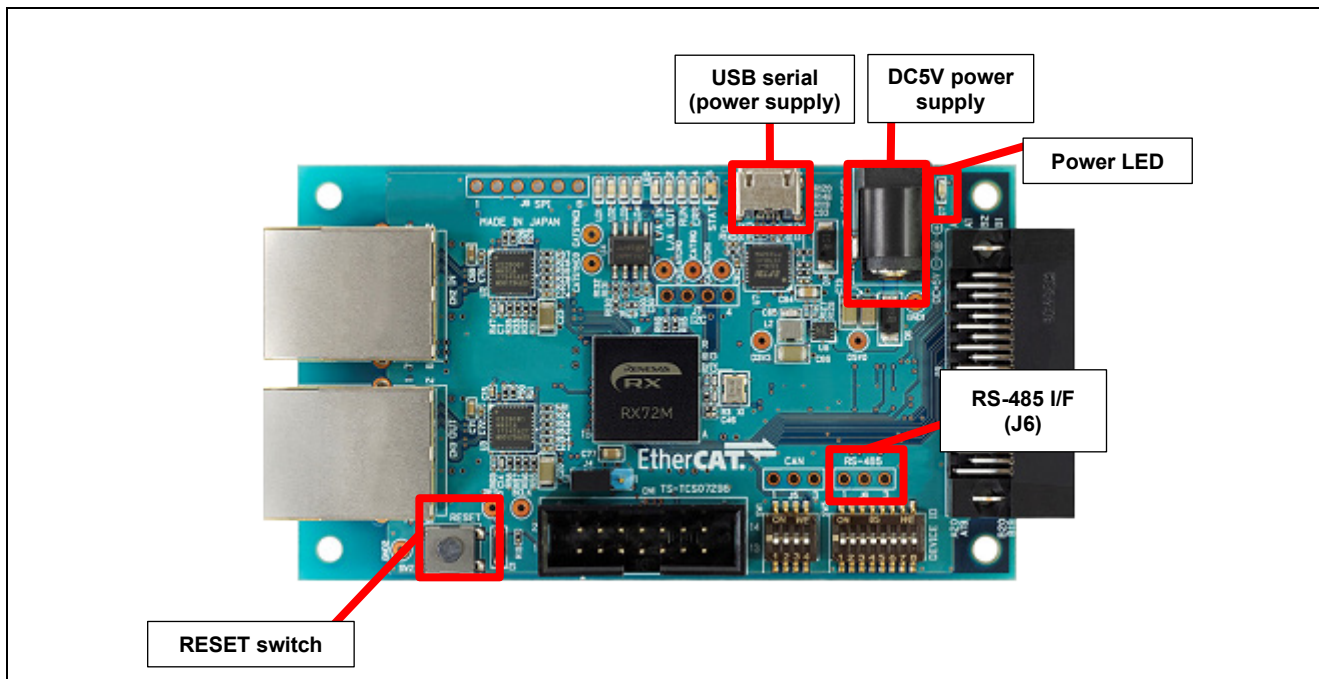


Figure 2.1 Configuration of the RX72M Communications Board

Table 2.1 RS-485 Interface (J6)

Pin Number	I/O	Signal Name
1	I/O	A
2	I/O	B
3	—	GND

2.1 Setting up the Board

Before supplying power to the board, set up jumpers and connect the cables. In addition, make settings for the JTAG configuration mode. This mode is normally used with a short circuit between jumper pins 2 and 3.

For the detailed locations of the related parts, refer to the *RX72M Communications Board Hardware Manual*.

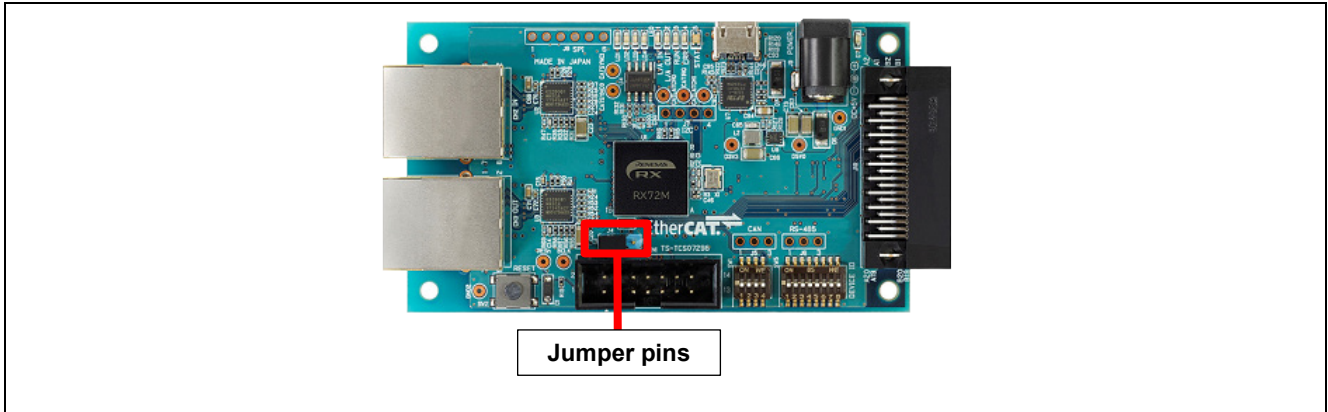


Figure 2.2 Setting up Jumper Pins

2.2 Selecting the Power Source

Power to the RX72M can be supplied from a 5-V DC power source or through the USB port. Use whichever is suitable for the configuration of your operating environment.

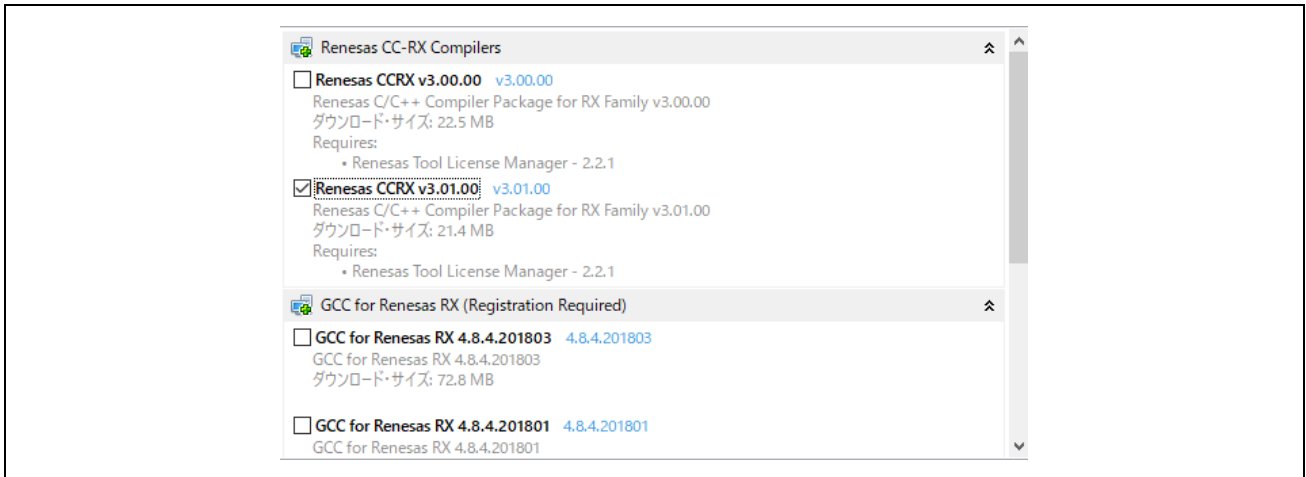
3. Installing the e² studio

Download the e² studio for RX72M (V7.5.0 or later) from the Web site below.

https://www.renesas.com/e2studio_download

3.1 Installing the CC-RX Compiler V3.01.00

The compiler selection dialog box appears while installing the e² studio. Click [Renesas CCRX v3.01.00] and select [Next]. CC-RX V3.01.00 Compiler for RX72M will be installed with the e² studio.

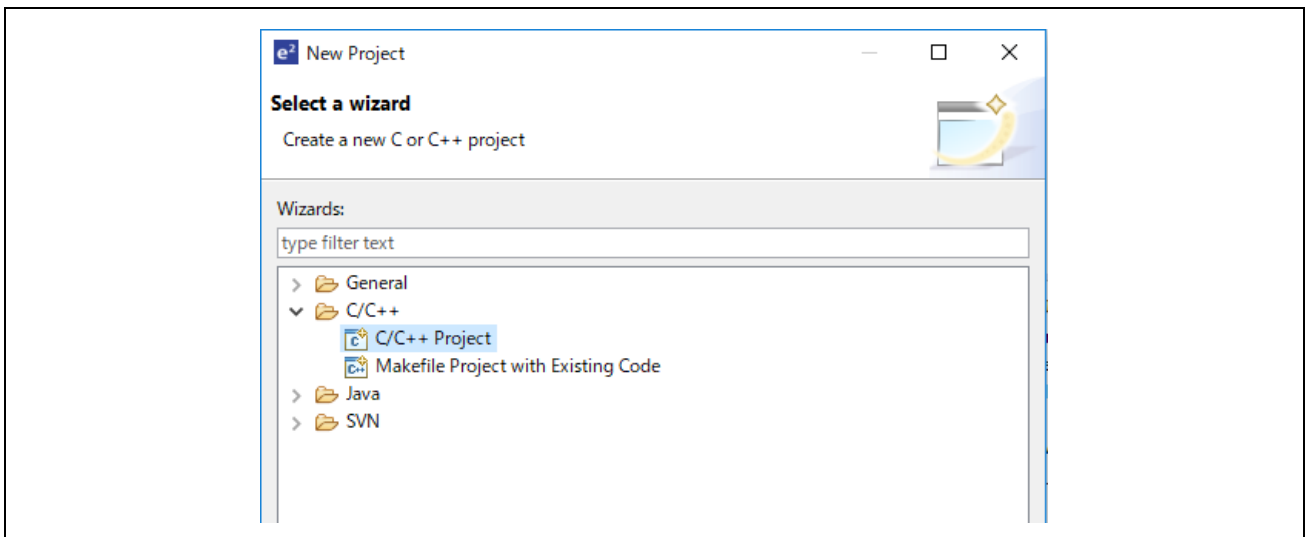


To start the e² studio, execute "e2studio.exe" in the following installation folder.

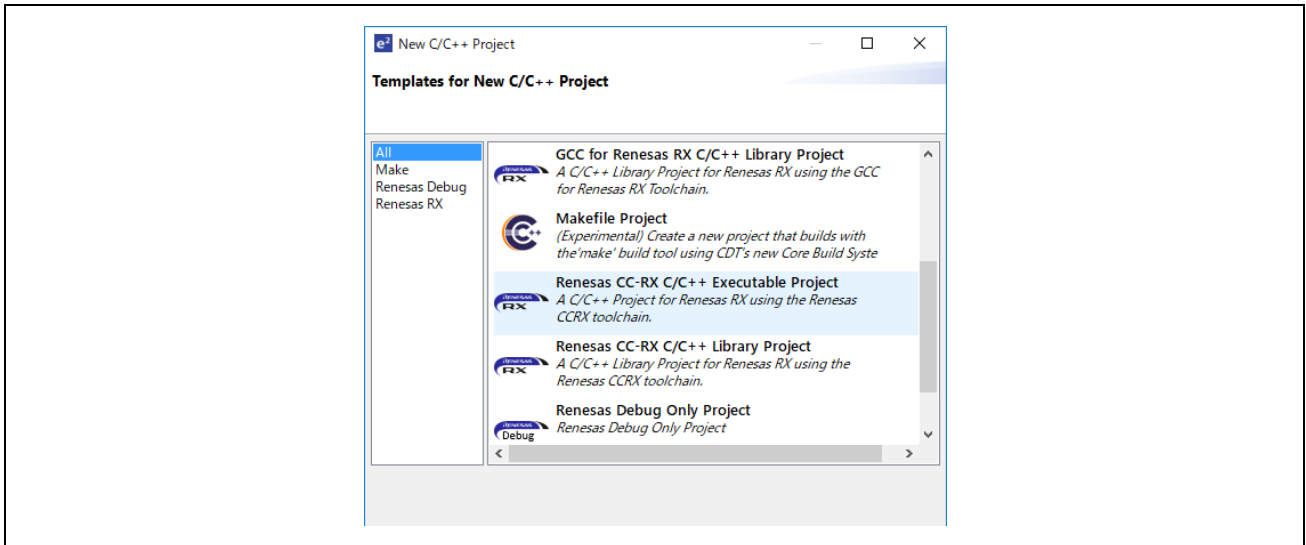
e2_studio_rx72m\eclipse

3.2 How to check the registered Compiler

- (1) Start the e² studio.
- (2) Select [File] → [New] → [C/C++Project] → [Next].



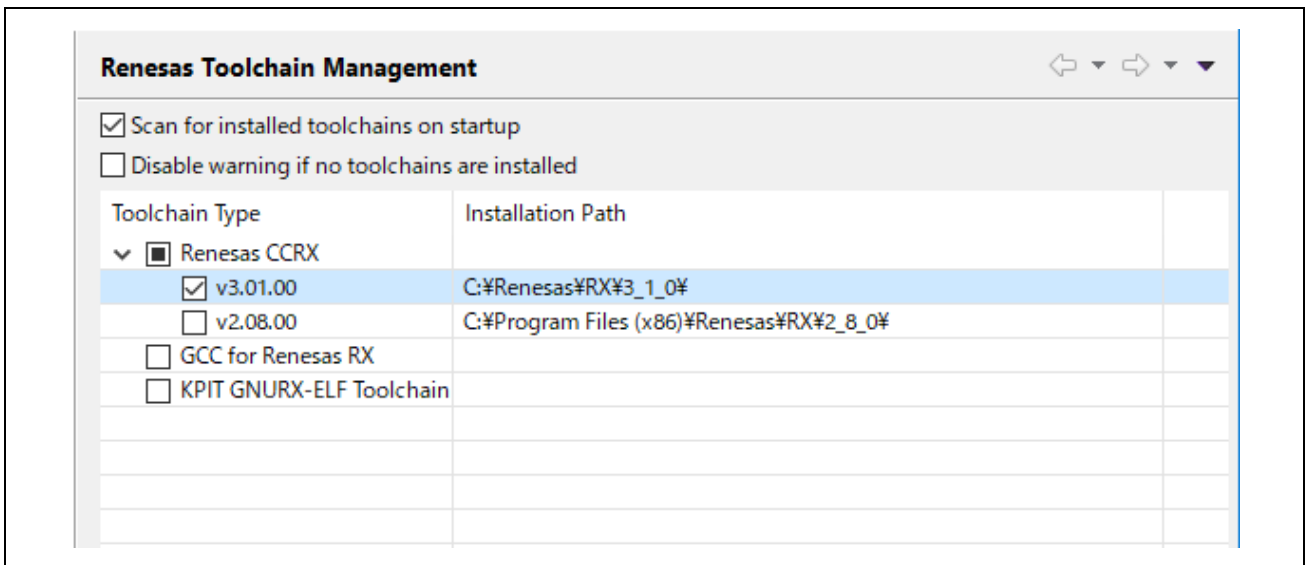
(3) In the [Templates for New C/C++ Project] dialog box, select [Renesas RX] → [Renesas CC-RX C/C++ Executable Project] → [Next].



(4) In the [New Renesas CC-RX C/C++ Executable Project] dialog box, enter a desired project name and select [Next].

(5) In the [Select toolchain, device & debug settings] dialog box, select [Manage Toolchains...] under [Toolchain Settings].

(6) In the [Renesas Toolchain Management] dialog box, the registration was successful if "v3.01.00" has been added under "Renesas CCRX".



4. Connections

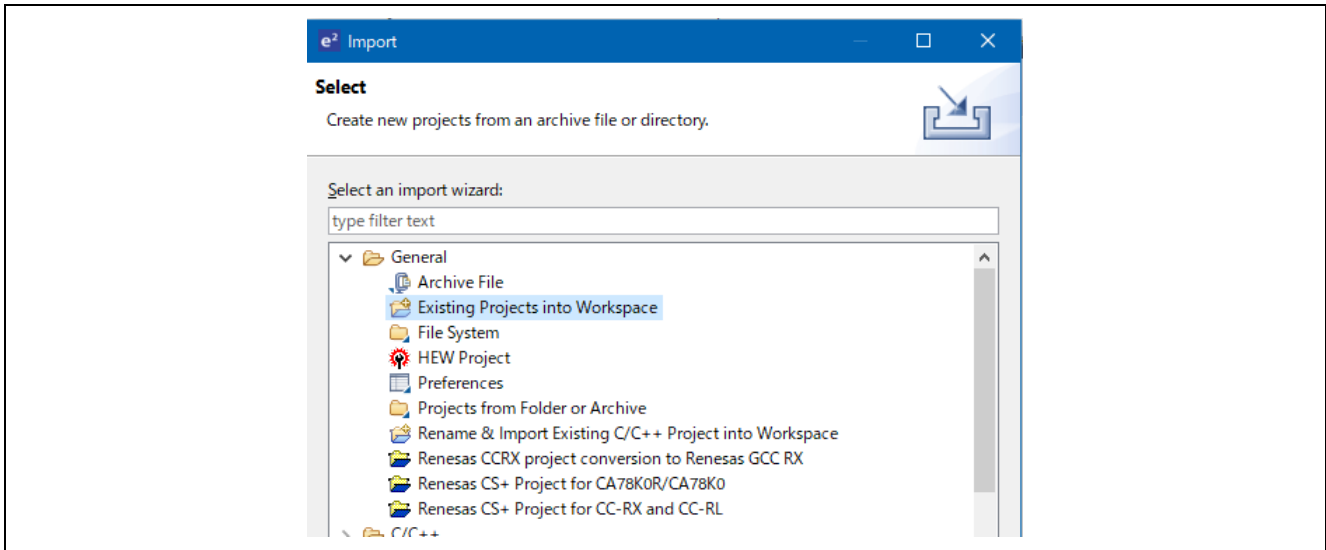
- (1) Connect the RS-485 interface to the RS-485 bus. Refer to "7.1.1, Configuration of Connections" for connection configuration.
- (2) Connect the E2 Emulator Lite to the JTAG connector on the communications board with the user interface cable.
- (3) Connect the E2 Emulator Lite to a USB port of the PC you are using. The "ACT" LED on the E2 Emulator Lite starts to blink.
- (4) The "Found new hardware" wizard appears. Follow the procedure described below to install the driver. Installation on a PC running Windows™ 7, 8, or 8.1 requires logging in with a user name that has administrator rights.
 - Windows™ 7/8/8.1: A notice appears on the Windows taskbar when the installation is finished.
 - Windows™ 10: A button for device configuration appears on the Windows taskbar and installation is automatic.
- (5) Supply power to the communications board from a 5-V DC power source or through the USB port.

5. Importing a Sample Project to the e² studio

(1) Store the archived sample in any folder.

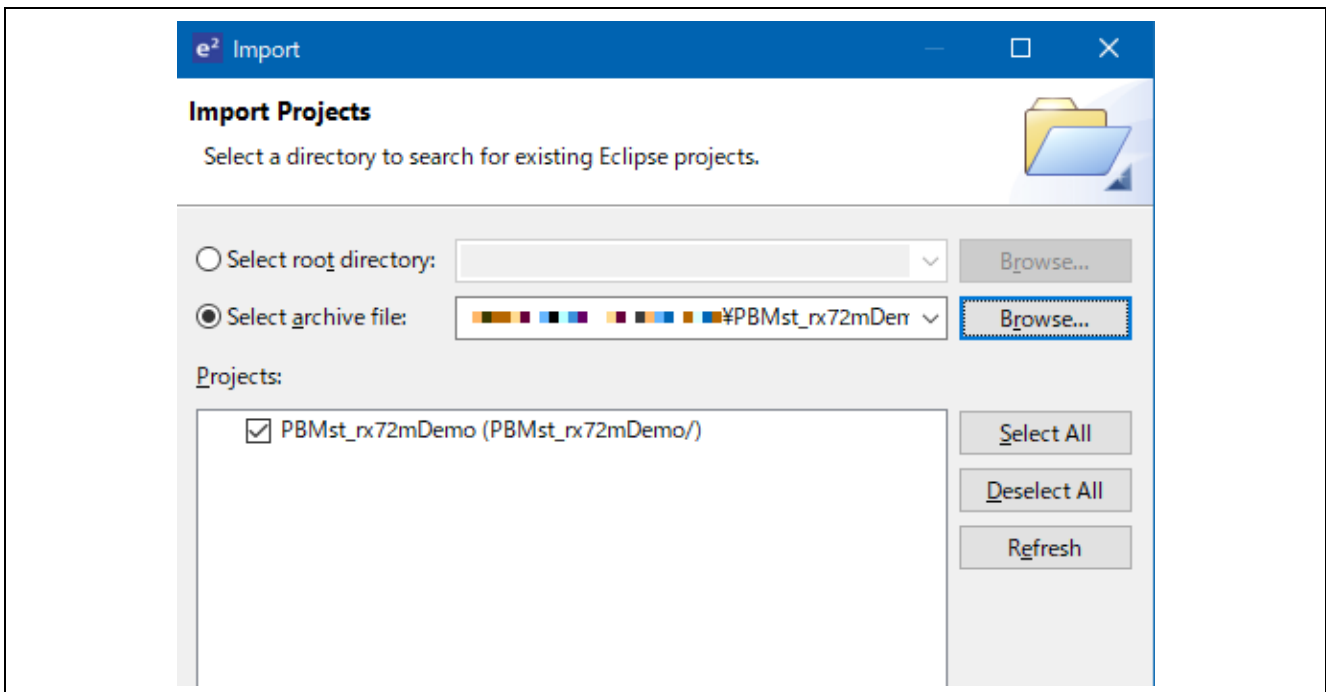
(2) Select [File] → [Import].

(3) In the [Select] dialog box, select [General] → [Existing Projects into Workspace] and select [Next].



(4) In the [Import Projects] dialog box, check the "Select archive file:" button, then select [Browse...].

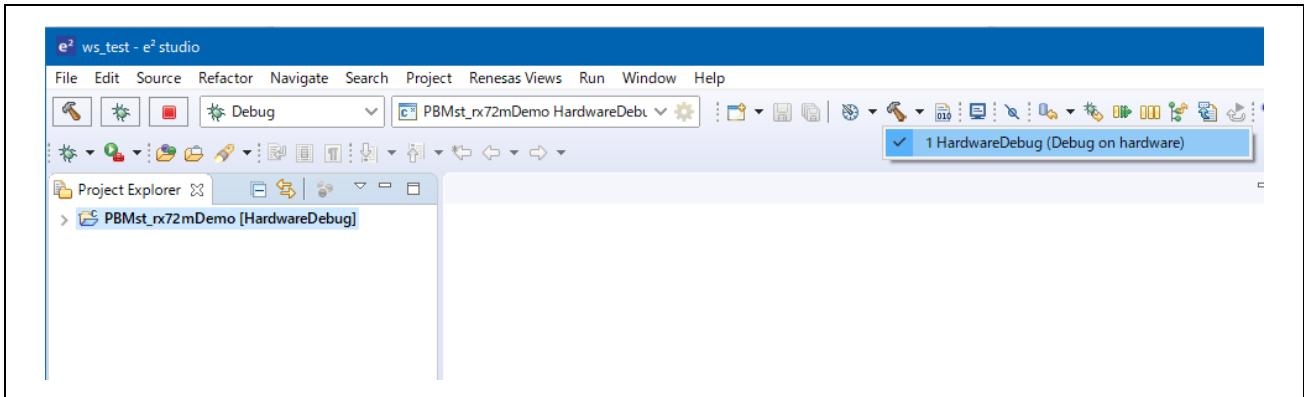
(5) Select the "PBMst_rx72mDemo.zip" file as a sample project stored in any folder in (1), and select [Open].



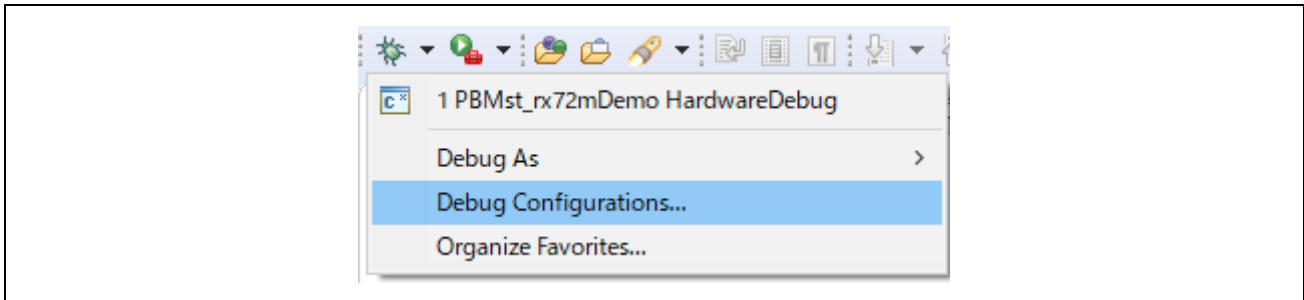
Check "PBMst_rx72mDemo (PBMst_rx72mDemo/)" under the "Projects" label and select [Finish]. The project will be imported into the workspace.

6. Programming and Debugging

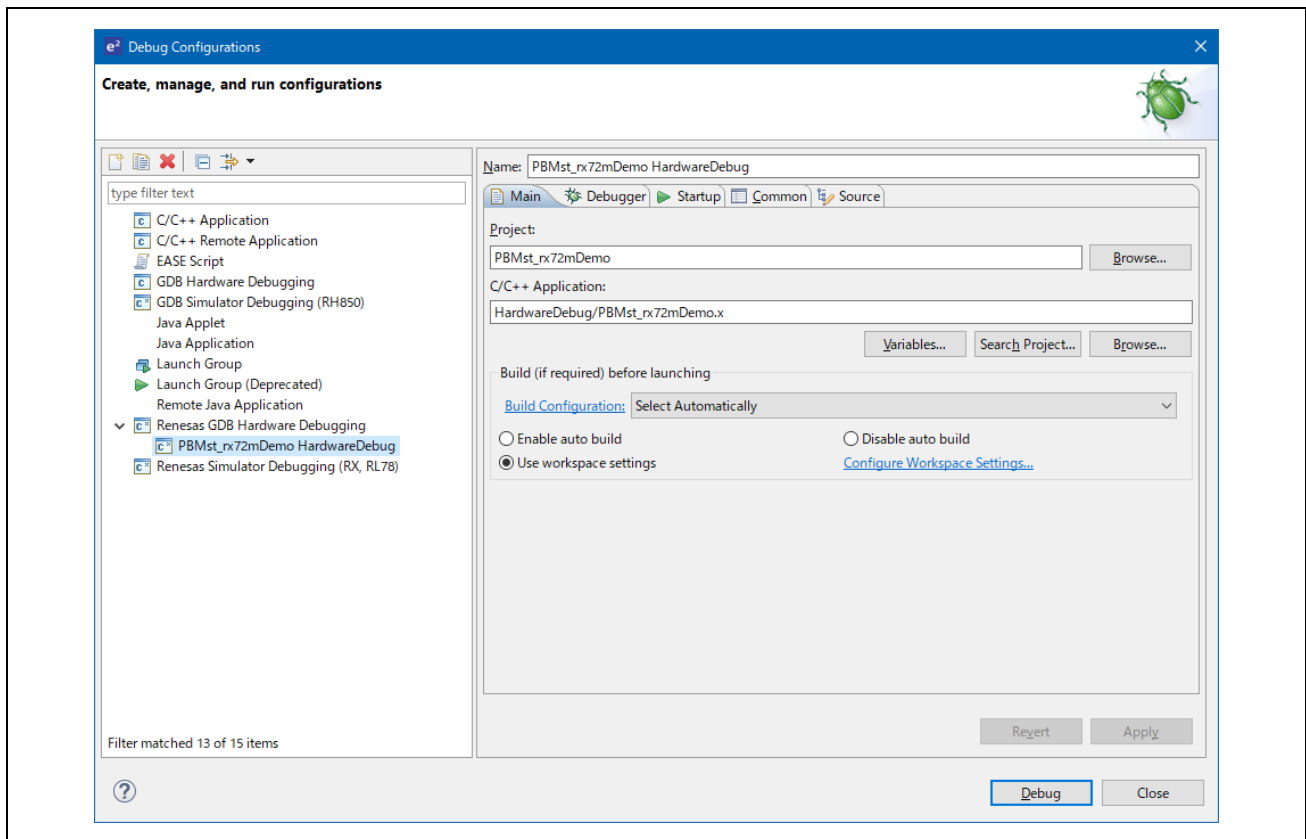
- (1) Select the "PBMst_rx72mDemo" project in the Project Explorer view. Select the arrow next to the build button (hammer icon) and select [HardwareDebug] from the drop-down menu.



- (2) e2 studio will build the project. After the build is completed, select the arrow next to the debug button (bug icon). You can start debugging by selecting [Debug Configurations...].



- (3) Select the file "PBMst_rx72mDemo HardwareDebug" and click on the [Debug] button. The program will be downloaded to the target device.



- (4) If a firewall warning is displayed for "e2-server-gdb.exe", check the checkbox for [Private networks, such as my home or work network] and select [Allow access].
- (5) The User Account Control (UAC) dialog box may appear. Enter the administrator's password and select [Yes].
- (6) If the Confirm Perspective Switch dialog box appears prompting you to switch the perspective, check the checkbox for [Remember my decision] and select [Yes].
- (7) The green "ACT" LED on the E2 Lite debugger will be continuously lit.
- (8) After downloading the code, select the [Resume] button to run the code. The code will break at the address where the main function starts. Select the [Resume] button again to continue to run the code.

7. Appendix

7.1 Verifying Operation of the Sample Program

Operation of the sample program can be verified as follows.

7.1.1 Configuration of Connections

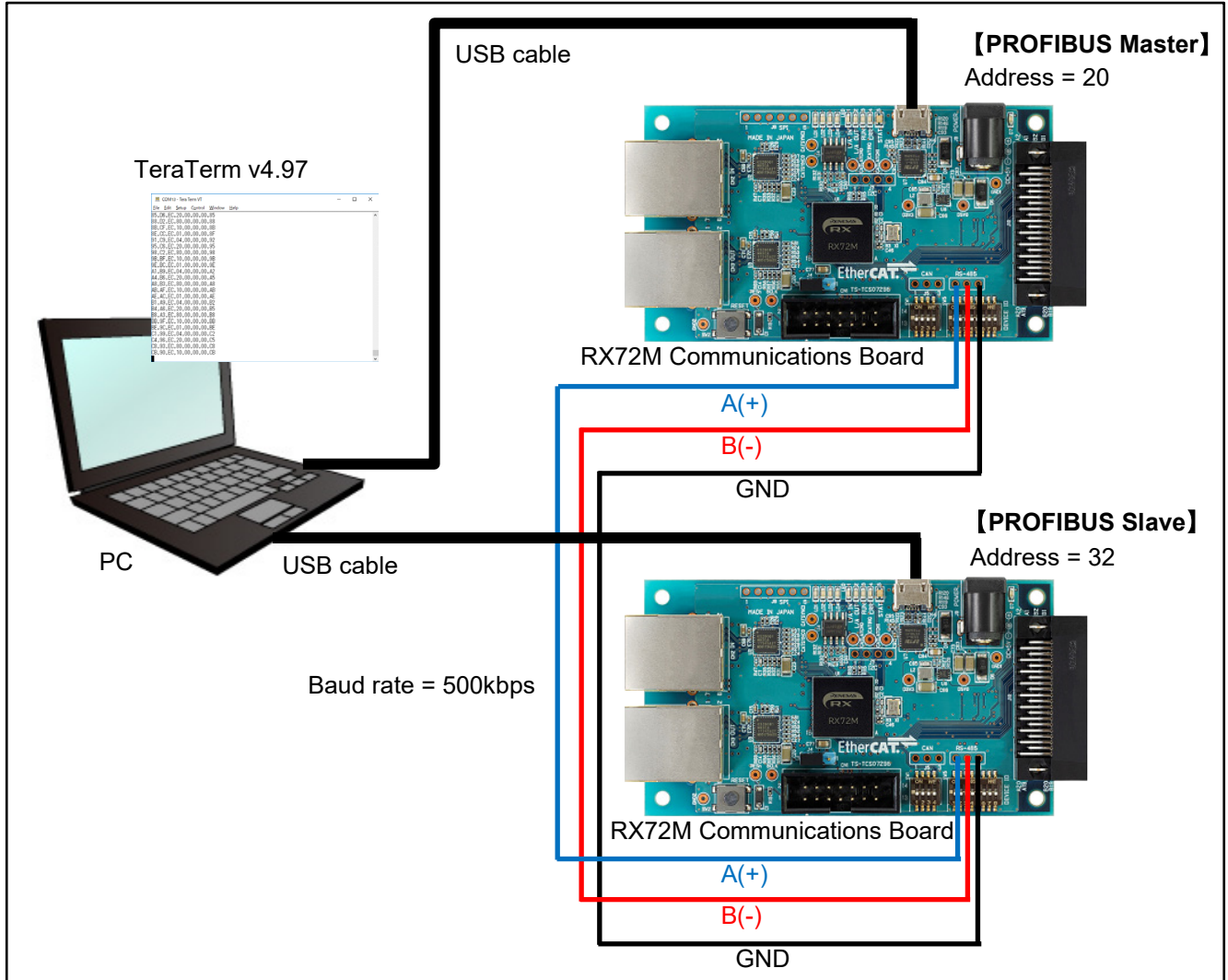


Figure 7.1 Configuration of Connections

Table 7.1 List of Devices

Item	Description
PROFIBUS master device	RX72M communications board (with this sample program already written to it) TS-TCS02796 from Tessera Technology
PROFIBUS slave device *1	RX72M communications board TS-TCS02796 from Tessera Technology
Terminal software	TeraTerm v4.97 *2

Notes: 1. Download the PROFIBUS slave program for PROFIBUS slave devices from the Renesas Electronics Web site.

2. This manual is written on the assumption that TeraTerm has already been installed on the PC you are using.

7.1.2 Overview of PROFIBUS Master Operations

To aim the simple communication verification with slave device, PROFIBUS master specializes in the PROFIBUS communication functions. The master's major operations are as follows.

- Internal Initialization as a master
- Establish the communication with slave device
- Periodically communication with slave device (10ms interval)
 - Receive data from slave (8 bytes)
 - Send data to slave (8 bytes)
(The send data is that added the byte index (1st byte is +0, 2nd byte is +1, ..., 8th byte is +7) each byte basing on the receive data.)
- Among the communication data, output the data thinned out in 1 second cycles to Terminal software for debug

In this master sample program, baud rate is 500kbps, master address is 20, and slave address is 32 *1.

Notes: 1. The slave address is based on default address of PROFIBUS slave sample (refer to 7.1.1). If you adapt the slave device that has the same input / output data length (8 bytes), you can use this sample as is except changing the slave address.

7.1.3 Evaluation procedure

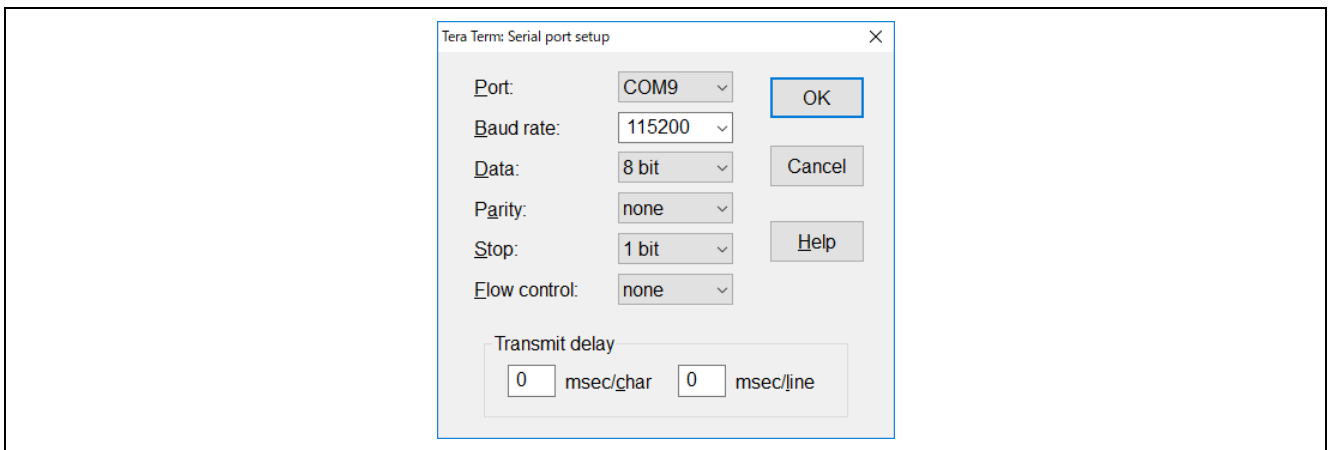
7.1.3.1 Connection with the Communication Board

Connect the communications board and the host PC as described in section 7.1.1, Configuration of Connections. Power to the communications board is supplied by connecting the host PC with the USB port on the communications board.

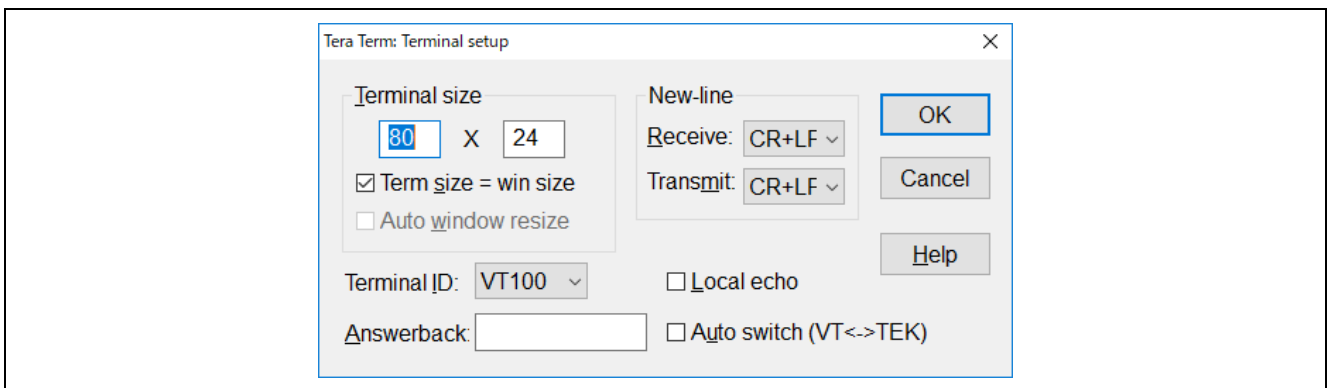
7.1.3.2 Starting the Terminal Software

Follow the procedure described below to start the two Terminal software (for master and slave).

- (1) Start TeraTerm installed on your PC to make settings for communications. From the menu in TeraTerm, select [Setup] → [Serial port...].



- (2) To make terminal settings, select [Setup] → [Terminal...] from the menu. Select "CR+LF" for "Receive" and "Transmit" under "New-line".



7.1.4 Verifying the result of operations

The results of communications between PROFIBUS master and PROFIBUS slave are shown below.

- For master

Input data from slave (8 bytes) and output data to slave (8 bytes) are displayed on TeraTerm, thinned out in 1 second cycles.

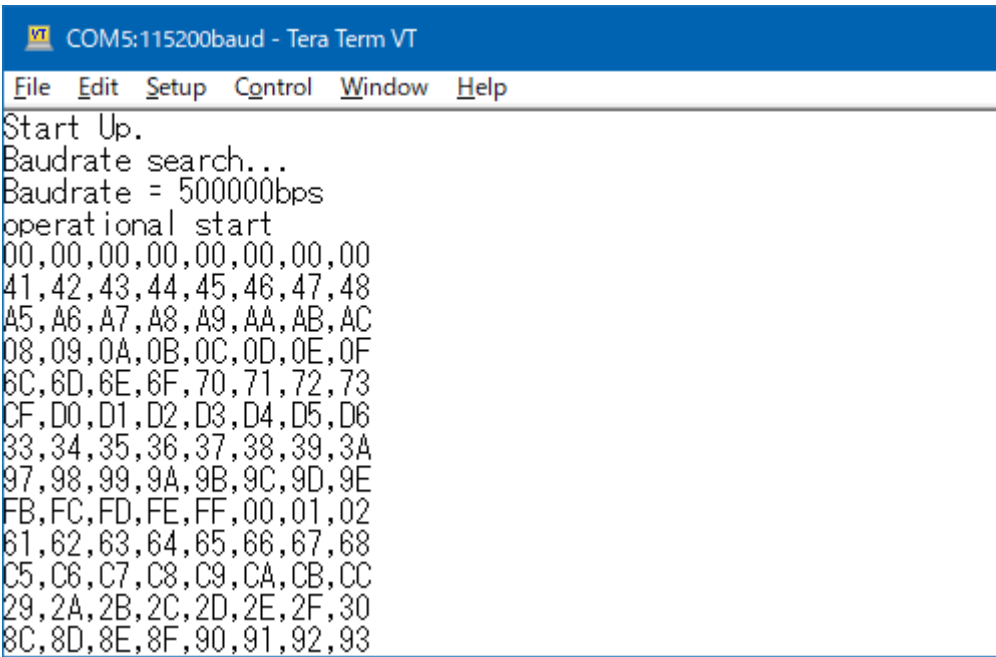
```

COM125:115200baud - Tera Term VT
File Edit Setup Control Window Help
-----
Starting PROFIBUS Master Sample Program...
-----
[APP] Input data 41 41 41 41 41 41 41 41
[APP] Output data 41 42 43 44 45 46 47 48
[APP] Input data A5 A5 A5 A5 A5 A5 A5 A5
[APP] Output data A5 A6 A7 A8 A9 AA AB AC
[APP] Input data 08 08 08 08 08 08 08 08
[APP] Output data 08 09 0A 0B 0C 0D 0E 0F
[APP] Input data 6C 6C 6C 6C 6C 6C 6C 6C
[APP] Output data 6C 6D 6E 6F 70 71 72 73
[APP] Input data CF CF CF CF CF CF CF CF
[APP] Output data CF D0 D1 D2 D3 D4 D5 D6
[APP] Input data 33 33 33 33 33 33 33 33
[APP] Output data 33 34 35 36 37 38 39 3A
[APP] Input data 97 97 97 97 97 97 97 97
[APP] Output data 97 98 99 9A 9B 9C 9D 9E
[APP] Input data FB FB FB FB FB FB FB FB
[APP] Output data FB FC FD FE FF 00 01 02
[APP] Input data 61 61 61 61 61 61 61 61
[APP] Output data 61 62 63 64 65 66 67 68
[APP] Input data C5 C5 C5 C5 C5 C5 C5 C5
[APP] Output data C5 C6 C7 C8 C9 CA CB CC
[APP] Input data 29 29 29 29 29 29 29 29
[APP] Output data 29 2A 2B 2C 2D 2E 2F 30
[APP] Input data 8C 8C 8C 8C 8C 8C 8C 8C
[APP] Output data 8C 8D 8E 8F 90 91 92 93

```

- For slave

Input data from master (8 bytes) is displayed on TeraTerm, thinned out in 1 second cycles.



The screenshot shows a TeraTerm window titled "COM5:115200baud - Tera Term VT". The menu bar includes File, Edit, Setup, Control, Window, and Help. The main text area displays the following output:

```
Start Up.  
Baudrate search...  
Baudrate = 500000bps  
operational start  
00,00,00,00,00,00,00,00  
41,42,43,44,45,46,47,48  
A5,A6,A7,A8,A9,AA,AB,AC  
08,09,0A,0B,0C,0D,0E,0F  
6C,6D,6E,6F,70,71,72,73  
CF,D0,D1,D2,D3,D4,D5,D6  
33,34,35,36,37,38,39,3A  
97,98,99,9A,9B,9C,9D,9E  
FB,FC,FD,FE,FF,00,01,02  
61,62,63,64,65,66,67,68  
C5,C6,C7,C8,C9,CA,CB,CC  
29,2A,2B,2C,2D,2E,2F,30  
8C,8D,8E,8F,90,91,92,93
```


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Revision History

Rev.	Date	Description	
		Page	Summary
1.00	Aug. 2, 2019	-	First edition issued
1.01	Jan. 31, 2020	-	Changed the name of the development partner

General Precautions in the Handling of Microprocessing Unit and Microcontroller Unit Products

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1. Precaution against Electrostatic Discharge (ESD)

A strong electrical field, when exposed to a CMOS device, can cause destruction of the gate oxide and ultimately degrade the device operation. Steps must be taken to stop the generation of static electricity as much as possible, and quickly dissipate it when it occurs. Environmental control must be adequate. When it is dry, a humidifier should be used. This is recommended to avoid using insulators that can easily build up static electricity. Semiconductor devices must be stored and transported in an anti-static container, static shielding bag or conductive material. All test and measurement tools including work benches and floors must be grounded. The operator must also be grounded using a wrist strap. Semiconductor devices must not be touched with bare hands. Similar precautions must be taken for printed circuit boards with mounted semiconductor devices.

2. Processing at power-on

The state of the product is undefined at the time when power is supplied. The states of internal circuits in the LSI are indeterminate and the states of register settings and pins are undefined at the time when power is supplied. In a finished product where the reset signal is applied to the external reset pin, the states of pins are not guaranteed from the time when power is supplied until the reset process is completed. In a similar way, the states of pins in a product that is reset by an on-chip power-on reset function are not guaranteed from the time when power is supplied until the power reaches the level at which resetting is specified.

3. Input of signal during power-off state

Do not input signals or an I/O pull-up power supply while the device is powered off. The current injection that results from input of such a signal or I/O pull-up power supply may cause malfunction and the abnormal current that passes in the device at this time may cause degradation of internal elements. Follow the guideline for input signal during power-off state as described in your product documentation.

4. Handling of unused pins

Handle unused pins in accordance with the directions given under handling of unused pins in the manual. The input pins of CMOS products are generally in the high-impedance state. In operation with an unused pin in the open-circuit state, extra electromagnetic noise is induced in the vicinity of the LSI, an associated shoot-through current flows internally, and malfunctions occur due to the false recognition of the pin state as an input signal become possible.

5. Clock signals

After applying a reset, only release the reset line after the operating clock signal becomes stable. When switching the clock signal during program execution, wait until the target clock signal is stabilized. When the clock signal is generated with an external resonator or from an external oscillator during a reset, ensure that the reset line is only released after full stabilization of the clock signal. Additionally, when switching to a clock signal produced with an external resonator or by an external oscillator while program execution is in progress, wait until the target clock signal is stable.

6. Voltage application waveform at input pin

Waveform distortion due to input noise or a reflected wave may cause malfunction. If the input of the CMOS device stays in the area between V_{IL} (Max.) and V_{IH} (Min.) due to noise, for example, the device may malfunction. Take care to prevent chattering noise from entering the device when the input level is fixed, and also in the transition period when the input level passes through the area between V_{IL} (Max.) and V_{IH} (Min.).

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