

RZ/T1 Group

EtherNet/IP Transfer Procedure Startup Manual

R01AN4279EJ0100 Rev.1.00 Jul.31, 2018

APPLICATION NOTE

(for Products with the R-IN Engine)

Outline

This manual explains the procedure for connecting the CODESYS software programmable logic controller (PLC) with the Renesas Electronics RZ/T1 evaluation board to enable EtherNet/IP[™] transfer.

The RZ/T1 EtherNet/IP stack sample program in this package ("sample program") runs on the Arm[®] Cortex[®] -R4 or Cortex-M3 core. Its configuration is intended for those who wish to start developing EtherNet/IP devices with products of the RZ/T1 Group that incorporate an R-IN Engine.

For details of the functions of the program, you can separately download the relevant documents from the Renesas Electronics website.

Target Devices

RZ/T1 Group

Sample Program

This sample program uses the evaluation version of EtherNet/IP stack manufactured by our partner Sherpa Inc.

For purchase of the official version, contact our partner Sherpa Inc.

Sherpa Inc. : <u>https://www.sherpa-tech.net/</u>



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1. Operating Environment

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

Item	Description
Board used	RZ/T1 evaluation board RTK7910018C00000BE
MCU	RZ/T1 (version incorporating an R-IN engine) R7S910018
Operating frequency	CPU clock (CPUCLK): 450 MHz (Cortex-R4) System clock (ICLK): 150 MHz (Cortex-M3)
Operating voltage	3.3 V
Operating mode	SPI boot mode
Device used	Serial flash memory MX25L51245GMI-10G from Macronix International Co., Ltd.
Communications protocol	EtherNet/IP
Integrated development environment	Embedded Workbench for Arm Version 7.80 from IAR Systems
Emulator	I-jet from IAR Systems
Software PLC	CODESYS V3.5 SP11 from 3S-Systems GmbH

Table 1.1 Operating Environment	able 1.1 Or	perating	Environment
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Note: This manual assumes that you have installed the IDE and software PLC.

The software PLC is available from the Linx website (http://linx.jp/download/codesysv3).

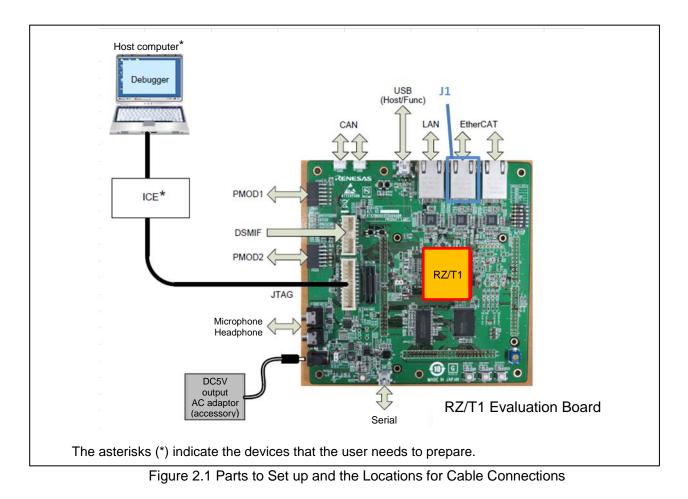


2. Setting up and Connecting the RZ/T1 Evaluation Board

For detailed information on the board, refer to the RZ/T1 Evaluation Board User's Manual.

2.1 Setting up the RZ/T1 Evaluation Board

Before supplying power, set up the DIP switches and jumpers and connect the cables. The figure below shows the locations of the related parts.





2.1.1 Selecting the Operating Mode

The levels on external pins (MD0, MD1, and MD2) of the RZ/T1 select the operating mode.

The table below shows the relationship between the levels on the mode-setting pins and the operating mode.

Mode Setting Pin		Pin	Operating Mode				
MD2	MD1	MD0					
Low	Low	Low	SPI boot mode (serial flash memory) The system is booted from the serial flash memory connected to the SPI multi-I/O bus space.				
Low	High	Low	16-bit bus boot mode (NOR flash memory) The system is booted from the NOR flash memory (with a bus width of 16 bits) connected to the CS0 space.				
The system is booted from		High	32-bit bus boot mode (NOR flash memory) The system is booted from the NOR flash memory (with a bus width of 32 bits) connected to the CS0 space (the setting is prohibited in the RZ/T1 evaluation board).				
Other	than the a	above	Reserved (setting prohibited)				

Table 2.1 Operating Mode Selection

As a mechanism to select these operating modes, the above MD0, MD1, and MD2 pins are connected to switches on a DIP-switch block (SW4-1, 4-2, and 4-3) on the RZ/T1 evaluation board and they are set up to suit the sample program you are using.

The table below lists the operating modes of the sample program and all corresponding settings on SW4.

Sample Program	SW4-1	SW4-2	SW4-3	SW4-4	SW4-5	SW4-6		
16-bit bus boot mode version	ON	OFF	ON	ON	ON	OFF		
SPI boot mode version	ON	ON	ON	ON	ON	OFF		
RAM execution version		Either of the above combinations						

Table 2.2 Settings on SW4

The operating mode should be selected before power is supplied.



2.1.2 Selecting the Power Supply

The RZ/T1 evaluation board has jumper blocks for power-supply selection (JP2 and JP7).

The jumpers should be set according to the settings shaded in gray in the table below.

Jumper	Setting	Function
JP2 System power-supply	1-2	The system power-supply voltage is from 7 to 12 V.
selection	2-3	The system power-supply voltage is 5 V.
JP7 VCCQ33B supply source	1-2	Power for VCCQ33B is from the RZ/T1's digital 3.3-V power supply.
selection	2-3	Power for VCCQ33B is from the RZ/T1's digital 1.2-V power supply.

Table 2.3 JP2 and JP7 Settings

The jumpers for power-supply selection should be in place before power is supplied.

2.2 Connecting the RZ/T1 Evaluation Board

Connect the cables as described below.

- (1) Connect the Ethernet cable (category 5 is recommended) to J1.
- (2) Connect the JTAG connector for ICE (I-jet) to J10 (ARM JTAG20) to connect the host computer over the USB.
- (3) Connect an AC adapter with DC 5 V output to J17 to supply power.

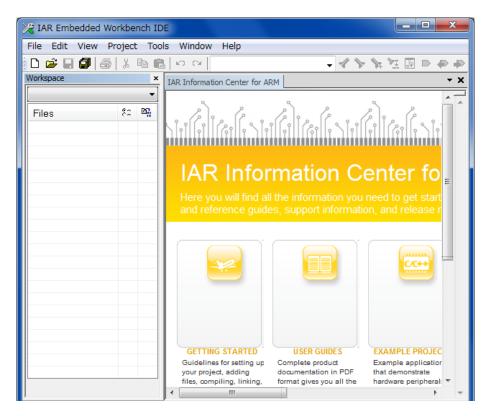


3. Starting the RZ/T1 EtherNet/IP Stack Sample Program

3.1 Starting and Building a Project

(1) From the Windows Start menu, click on [All Programs] \rightarrow [IAR Systems] \rightarrow [IAR Embedded Workbench for ARM x.xx] \rightarrow [IAR Embedded Workbench] to start the IAR Embedded Workbench.







(2) Select [File] \rightarrow [Open] \rightarrow [Workspace] and double-click on the "rzt1_ethernetip.eww" filename in ¥an-r01an4279ej0100_rzt1_ethernetip¥RZT1_ETHERNETIP_sample to open the workspace.

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(3) Click on "Release" to select building

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demo_ethernetip_app_rzt1			



(4)Select [Project] \rightarrow [Rebuild All] to run a build.

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3.2 Starting the Program

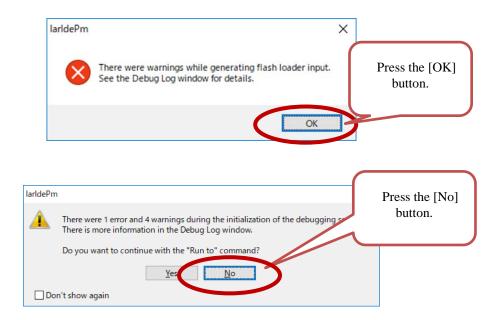
Select [Project] \rightarrow [Download and Debug] to program the flash memory. Click on the [Go] button to start the program.

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		81 ldr sp, =SFE (ABT STA		
		82 cps #27 ; Undef mod		
		83 ldr sp, =SFE(UND_STA	CK)	
		84 cps #31 ; System mo	de	
		85 ldr sp, =SFE(CSTACK)		
		86 cps #19 ; SVC mode		
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The following are the ways of responding when either of the below messages is output when writing the program.





4. Confirming Transfer to and from CODESYS

4.1 Starting CODESYS

- (1) From the Windows Start menu, select [All Programs] > 3S CODESYS > CODESYS > CODESYS Vx.x (x.x represents the version number). You can also start the program by double-clicking on the CODESYS icon, which will be created after the installation of the program.
- (2) Click on [File] → [Open Project …] and double-click on the "Renesas_RZT1_EtherNetIP.project" filename in the "¥an-r01an4279ej0100_rzt1_ethernetip¥" folder to open the project.

Regarding the procedures for building new CODESYS projects and for creating and simulating a user interface, refer to the *R-IN*, *RZ/T1*, *EC-1*, *TPS-1* Groups Software PLC Guide: Configuring Projects and Creating User Interfaces.

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(3) When the project is started, the "Devices" tree will be displayed.

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4.2 Updating the Slave Device

Only follow the procedure described in this section the first time you start "Renesas_RZT1_EtherNetIP.project" in the "¥an-r01an4279ej0100_rzt1_ethernetip¥" folder.

4.2.1 Installing Device Information

To use the EtherNet/IP slave device, you need to install the Electronic Data Sheet (EDS) file which contains information on the device. Use the file which is included in the stack.

Select [Device Repository] from the [Tool] menu in CODESYS.

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In the "Device Repository" dialog box, click on [Install]. A file dialog box will appear. Specify the EDS file "RZT1-EthernetIP-Adapter_R2.eds" in

¥an-r01an4279ej0100_rzt1_ethernetip¥ RZT1_ETHERNETIP_sample¥devicedescription¥etnernetip. The result of installation will be indicated within the area in the blue frame in the figure below. The "^①" icon is displayed next to the result of a successful installation.

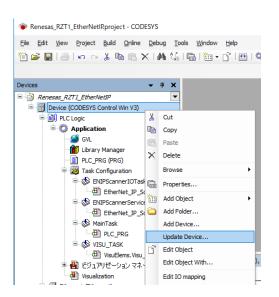
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						Close



4.2.2 Updating the Devices

(1) Updating the Device

Right-click on "Device (CODESYS Control Win V3)" in the "Devices" tree, then select [Update Device...].



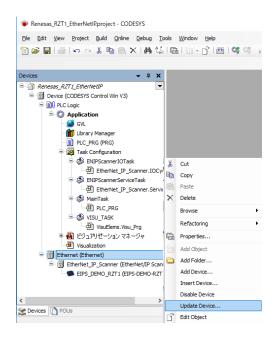
In the "Update Device" dialog box, select "CODESYS Control Win V3" under "PLCs", "SoftMotion PLCs", then click on the [Update Device] button.

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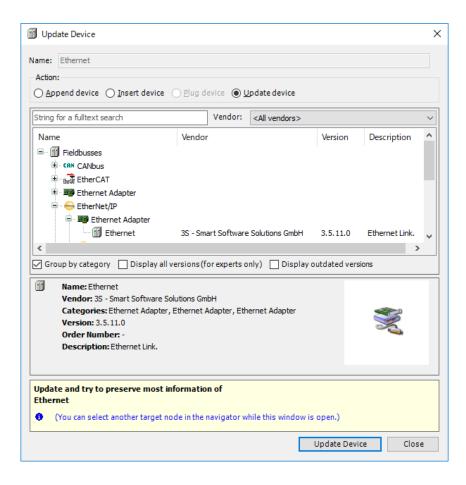


(2) Updating the Ethernet Settings

Right-click on "Ethernet (Ethernet)" in the "Devices" tree, then select [Update Device...].



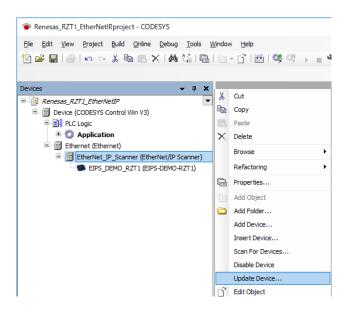
In the "Update Device" dialog box, select "Ethernet" under "Fieldbusses", "EtherNet/IP", "Ethernet Adapter", then click on the [Update Device] button.





(3) Updating the EtherNet/IP Scanner

Right-click on "EtherNet_IP_Scanner (EtherNet_IP_Scanner)" in the "Devices" tree, then select [Update Device...].



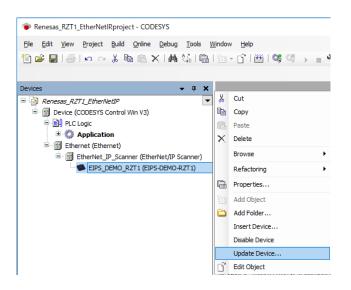
In the "Update Device" dialog box, select "EtherNet/IP Scanner" under "Fieldbusses", "EtherNet/IP", "EtherNet/IP Scanner", then click on the [Update Device] button.

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		Upd	ate Device	Close



(4) Updating EIPS_DEMO_RZT1

Right-click on "EIPS_DEMO_RZT1 (EIPS_DEMO_RZT1)" in the "Devices" tree, then select [Update Device...].



In the "Update Device" dialog box, select "EIPS_DEMO_RZT1" under "Fieldbusses", "EtherNet/IP", "EtherNet/IP Remote Adapter", then click on the [Update Device] button.

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Name 	Vendor		Version			
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Group by category Display all versions (fo Name: EIPS-DEMO-RZT1 Vendor: Renesas Electronics Categories: EtherNet/IP Remote Adapter Version: Major Revision=16#2, Minor Revi Order Number: RZT1-EIP-SHERPA Description: Ethernet/IP Target imported Adapter_R2.eds Device: EIPS-DEMO-RZT1	ision = 16#1	1	versions			
Insert selected device as sibling before EIPS_DEMO_RZT1 (You can select another target node in the navigator while this window is open.)						
		Insert De	evice Close			

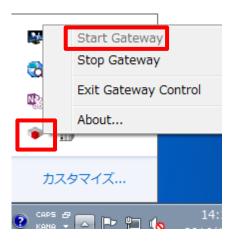


4.3 Connecting to the Software PLC

This section describes the procedure for connecting to the target software PLC from the development environment via a gateway.

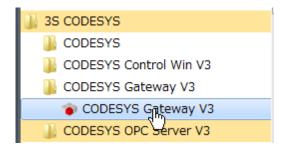
4.3.1 Starting the Gateway Server

Check the operating state of the gateway server in the system tray. If the server is stopped, click on the "• icon and select [Start Gateway] to start up the server. Usually, the server will be automatically started as a standard service when Windows is started. An icon in the system tray at the bottom-right corner of the desktop indicates the state of operation.



Note: If you cannot find the icon in the system tray, start up the gateway server by selecting All Programs > 3S CODESYS > CODESYS Gateway V3.

If the icon still does not appear in the system tray, try rebooting your computer.





4.3.2 Starting the Software PLC

Check the operating state of the software PLC in the system tray. If the software PLC is stopped, click on the

" III " icon and select [Start PLC] to start it. Usually, the software PLC will be automatically started as a standard service when Windows is started. An icon in the system tray at the bottom-right corner of the desktop indicates the state of operation.

	Start PLC
	Stop PLC
2 3	Exit PLC Control
<u> </u>	About
1	
カスタマ	マイズ
САРБ 🗗 КАНА 🔻 🔽	14:

Note: If you cannot find the icon in the system tray, start up the gateway server by selecting All Programs > 3S CODESYS > CODESYS Gateway V3.

If the icon still does not appear in the system tray, try rebooting your computer.





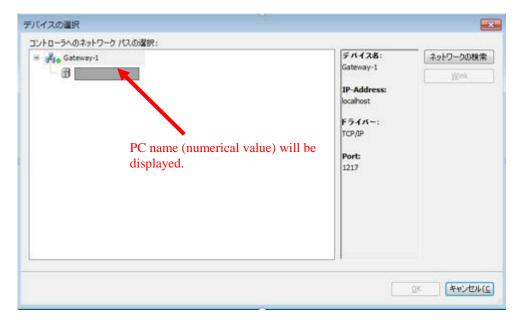
4.3.3 Setting up Connection with the Software PLC

Double-click on "Device (CODESYS Control Win V3)" in the "Devices" tree. The "Communication Settings" pane will open. In this pane, you can make communications settings for connecting the software PLC service from your development environment. Click on the [Scan Network...] button on the "Communication Settings" tabbed page.

Renesas_RZT1_EtherNetIRproject - CODESYS	
<u>File Edit View Project Build Online Debug Tools V</u>	<u>V</u> indow <u>H</u> elp
🎦 🚔 📕 I 🎒 🗠 🗠 🐰 🖿 🛍 🗙 I 🛤 🌿 I 🛍	🛅 🗕 🔓 🟙 🥞 🧐 🖒 📲 💐 🗊 🖆 🗉
Devices 👻 🕈 🗙	Device X
Renesas_RZT1_EtherNetIP Device (CODESYS Control Win V3)	Communication Settings Scan Network
PLC Logic B PL Application	Applications
	Backup and Restore
EIPS_DEMO_RZT1 (EIPS-DEMO-RZT1)	Files

The "Select Device" window appears and a search for available devices that can use the local network automatically starts. The search is successful if a software PLC service is found. Double-click on the PC name displayed.

If the PC name is not displayed, re-check the settings described in sections 4.3.1, Starting the Gateway Server and 4.3.2, Starting the Software PLC.



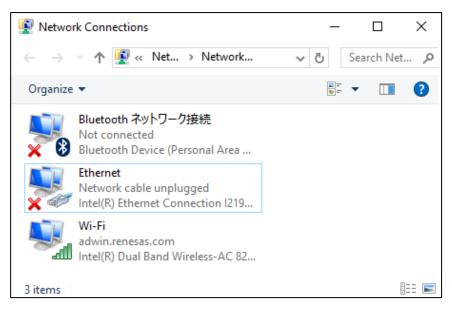


4.4 Network Settings for Devices

4.4.1 Configuring the Host IP Address

Before setting the devices, set the IP address of the host PC. Open "Network Settings".

In Windows 7, go to Control Panel -> Network and Sharing Center -> Change Adapter Settings.



Double-click (or right-click) on Local Area Connection and select Properties.

General		
Connection		
IPv4 Connectivit	y: Internet	
IPv6 Connectivit	y: No network access	
Media State:	Enabled	
SSID:	REL-W5G	
Duration:	1 day 03:24:23	
Speed:	300.0 Mbps	
Signal Quality:	at l	
Details	Wireless Properties	
Activity		_
	Sent — 💭 — Received	
Bytes:	3,610,325 58,960,147	
Properties	Diagnose	



Select "Internet Protocol Version 4 (TCP/IPv4)" and click on the [Properties] button.

Ethernet Properties	×
Networking Sharing	
Connect using:	
👳 Intel(R) Ethernet Connection 1219–LM	
Configure This connection uses the following items:	Ī
🔲 🏪 Microsoft ネットワーク用ファイルとプリンター共有 🔹 🔺	1
🔲 🏪 QoS パケット スケジューラ	
インターネット プロトコル パージョン 6 (TCP/IPv6)	
🗹 👝 インターネット プロトコル パージョン 4 (TOP/IPv4)	
📋 🔔 Link–Layer Topology Discovery Mapper I/O Driver	
🔲 📲 Microsoft Network Adapter Multiplexor Protocol 🛛 🎽	
< >>	
Install Uninstall Properties	
Description	
伝送制御ブロトコル/インターネット ブロトコル。相互接続されたさまざ まなネットワーク間の通信を提供する、既定のワイド エリアネットワーク プロトコルです。	
OK Cancel	

Select the IP address and subnet mask in the area indicated by the red frame in the figure below.

You can get IP settings assigned automatically if your network supports this capability. Otherwise, you need to ask your network administrator for the appropriate IP settings.				
Ouse the following IP address:				
IP address:				
Subnet mask:				
Default gateway:				
Obtain DNS server address auto	omatically			
Use the following DNS server ac	dresses:			
 Ouse the following DNS server ac Preferred DNS server: 	idresses:			
0				
Preferred DNS server:	Idresses:			

You have now completed the settings.



4.4.2 Configuring the Ethernet

Double-click on "Ethernet (Ethernet)" in the "Devices" tree to open the configuration window.

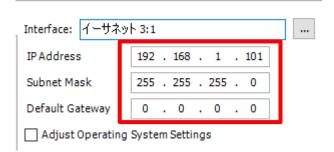
On the "General" tabbed page, click on the icon next to the text box for "Interface" selection indicated by the red frame below to display the "Network Adapters" window.

Ethernet X		
General	Interface:	
Status	Operating State	ystem Settings
Information	🔵 Change Operatin	ng System Settings
	IP address	192 . 168 . 0 . 1
	Subnet mask	255 . 255 . 255 . 0
	Default Gateway	0.0.0.0

The names of connected ports will be displayed in the "Network Adapters" window. Select the port you will be using.

Network Adapters		Х
Interfaces:		
Name	Description	IP Address
イーサネット	TwinCAT-Intel PCI Ethernet Adapter (Gigabit)	0.0.0.0
イーサネット 3	ASIX AX88179 USB 3.0 to Gigabit Ethernet Adapter	192.168.0.10
イーサネット 3:1	ASIX AX88179 USB 3.0 to Gigabit Ethernet Adapter	192.168.1.101
Wi-Fi	Intel(R) Dual Band Wireless-AC 8260	10.166.84.160
ローカル エリア接続* 2	Microsoft Wi-Fi Direct Virtual Adapter	0.0.0.0
IP Address Subnet Mask Default Gateway MAC Address	192 .168 .1 .101 255 .255 .255 .0 0 .0 .0 .0 34:95:DB:2B:49:48	OK Cancel

Check whether the IP address of the selected port has been correctly set.





4.4.3 Configuring EtherNet_IP_Scanner

You do not need to make settings for this device.

4.4.4 Configuring EIPS_DEMO_RZT1

Double-click on "EIPS_DEMO_RZT1 (EIPS_DEMO_RZT1)" in the "Devices" tree to open the configuration window. In this window, make settings on the "General" tabbed page.

In EtherNet/IP, a slave device is identified by its IP address. Here, set the value of the IP address which has been set for the device.

EIPS_DEMO_RZT1 X		
General	Address Settings	
Connections	IP Address: 192 . 168 . 1 . 10	EtherNet/IP
Assemblies		
User-Defined Parameters	Electronic Keying	
EtherNet/IP I/O Mapping	O Compatibility Check	
Status	Strict Identity Check	



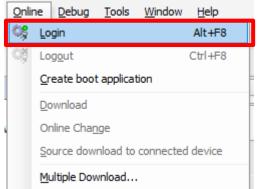
4.5 Confirming the Connection with the Device

This section describes the procedures for running a program in the CODESYS development environment and confirming connection of the device.

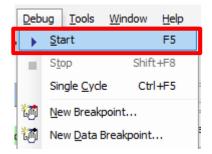
Select [Build] from the [Build] menu.

Buik	<u>B</u> uild <u>O</u> nline		<u>D</u> ebug	<u>T</u> ools	<u>W</u> indow
🛗 Build F11			F11		
	Rebuild				
	<u>G</u> enerate code				
	Generate runtime system files			e <u>s</u>	
c	<u>C</u> lean				
	(Clean <u>a</u> ll			
on					

Select [Login] from the [Online] menu.

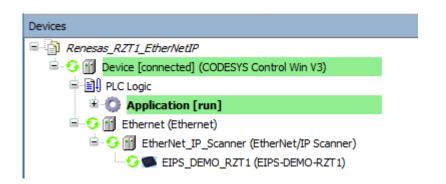


Select [Start] from the [Debug] menu. The project will automatically start on Windows.





The state of connection will be indicated next to each device name. Successful connection is indicated by the "9 " icon as shown in the tree view below.



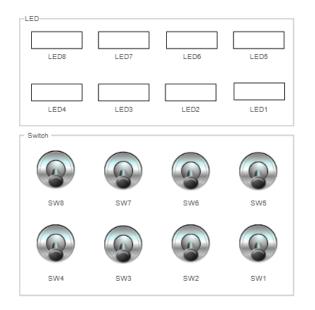
The icons indicating the state of each device are listed below.

- 5 : The PLC is connected and the application is running.
- 3 : The PLC is connected and the application is stopped.
- **A** : Error. Check the details of the error and the settings of the device.
- I The device information could not be found in the device repository. Recheck the device information file and reinstall the device.

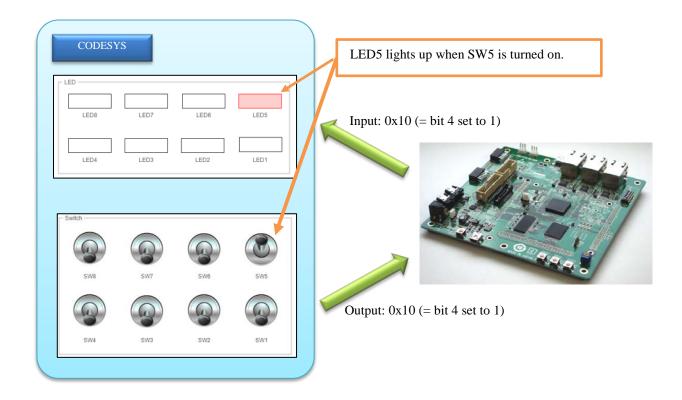


4.6 Operations of CODESYS

When CODESYS starts running, the following display will appear. The evaluation board receives the states of the switches in the display and transmits the states of the switches as they are.



The following shows the image when SW5 is turned on.





5. Documents for Reference

- Documents, Application Notes, and Sample Code
 - RZ/T1 Group Initial Settings
 - RZ/T1 Group User's Manual: Hardware
 - RZ/T1 Evaluation Board RTK7910022C00000BR User's Manual
 - R-IN, RZ/T1, EC-1, TPS-1 Groups Software PLC Guide: Configuring Projects and Creating User Interfaces
 - R-IN, RZ/T1 Groups Software PLC Guide: EtherNet/IP

Download the latest version from the Renesas Electronics website.

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- Development Environment
 Download the latest versions from the websites of the respective companies.

The latest version for the IAR integrated development environment (IAR Embedded Workbench® for Arm) is available from the IAR Systems website.

The latest version for the software PLC (CODESYS) is available from the Linx website.



Appendix A Changing the Configuration of the RZ/T1 Evaluation Board

By serially connecting the host PC and the RZ/T1 evaluation board, the following settings can be changed through terminal software running on the host PC.

Name	Default Value
Device Name	dut
IP Address	192.168.1.10
Netmask	255.255.255.0
Gateway	0.0.0.0
MAC Address	74:90:50:f0:09:2e
MAC Port1	74:90:50:f0:09:01
MAC Port2	74:90:50:f0:09:02

If the EtherNet/IP stack program had already been written to the RZ/T1 evaluation board at the time the board was shipped so will run on the board, the above default values will have been written to the flash ROM. The initial values written to the flash ROM are given priority from the second startup.

A-1 System Configuration

The figure below shows the configuration of the system.

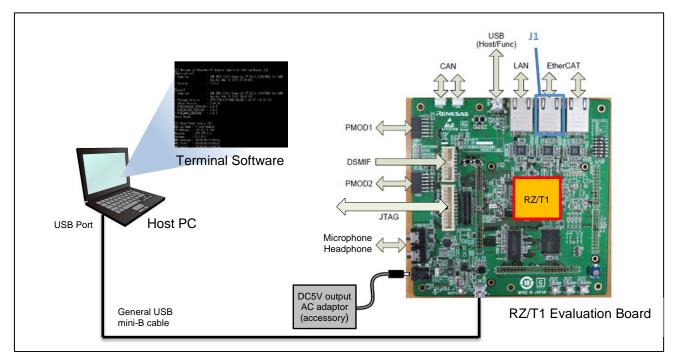


Figure A.1 System Configuration



A-2 Changing the Configuration

A-2-1 Connecting the RZ/T1 Evaluation Board

Follow the procedure below to connect the cables.

(1) Connect the mini-B end of the general USB mini-B cable to the J8 USB serial port connector to connect the host computer with the USB port on the evaluation board.

(2) Connect an AC adapter with 5-V DC output to J17 to supply power.

A-2-2 Changing the Configuration

(1) Starting the Terminal Software

Start the terminal software and make settings for serial communications. The table below lists the settings for serial communications.

Bit rate	115200 bps
Data	8 bits
Parity	None
Stop	1 bit
Flow control	None

The following shows the settings for the line-feed codes of the terminal software.

New-line		
Receive:	CR	~
Trans <u>m</u> it:	CR	~



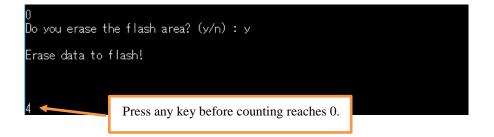
(2) Resetting and Starting the RZ/T1 Evaluation Board

Press the reset button. This produces the following display.

Before the count-down reaches 0, enter any number on the key board.

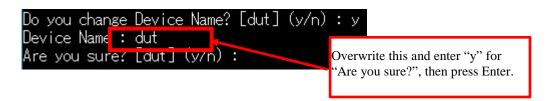


To delete the flash ROM area, enter "y" for "Do you erase the flash area? (y/n):" and press Enter. Before the count-down reaches 0 again, enter any number on the keyboard.



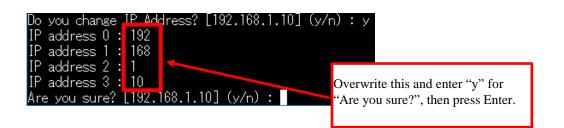
(3) Changing the Device Name

To change the device name "dut", enter "y" and press Enter. Otherwise, enter "n" and press Enter.



(4) Changing the IP Address

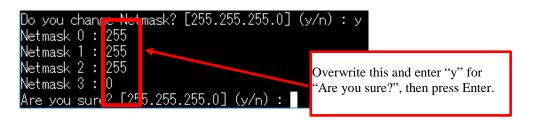
To change the IP address "192.168.1.10", enter "y" and press Enter. Otherwise, enter "n" and press Enter.





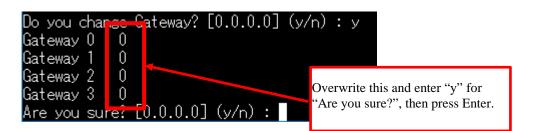
(5) Changing the Netmask

To change the netmask "255.255.255.0", enter "y" and press Enter. Otherwise, enter "n" and press Enter.



(6) Changing the Gateway

To change the gateway "0.0.0.0", enter "y" and press Enter. Otherwise, enter "n" and press Enter.



(7) Changing the MAC Address

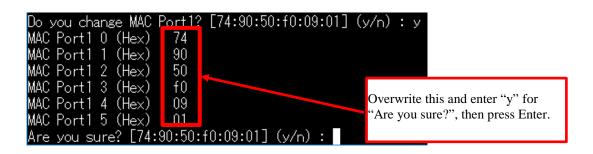
To change the MAC address "74:90:50:f0:09:2e", enter "y" and press Enter. Otherwise, enter "n" and press Enter.

Do you change MAC Address2 [74:90:50:f0:09:2e] (y/n) : y
MAC address 0 (Hex) : 74
MAC address 1 (Hex) : 90
MAC address 2 (Hex) : 50
MAC address 3 (Hex) : f0
MAC address 4 (Hex) : 09 Overwrite this and enter "y" for
MAC address 5 (Hex) : 2e "Are you sure?", then press Enter.
Are you sure? [74:90:50:f0:09:2e] (y/n) :



(8) Changing MAC Port 1

To change MAC port 1 "74:90:50:f0:09:01", enter "y" and press Enter. Otherwise, enter "n" and press Enter.



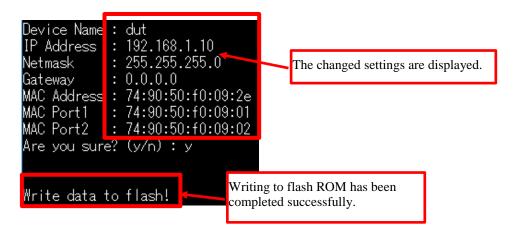
(9) Changing MAC Port 2

To change MAC port 2 "74:90:50:f0:09:02", enter "y" and press Enter. Otherwise, enter "n" and press Enter.

Do you change MAC Po	-t2? [74:90:50:f0:09:02] (y/n) : y
MAC Port2 0 (Hex) :	4
MAC Port2 1 (Hex) :	00
MAC Port2 2 (Hex) :	50
MAC Port2 3 (Hex) :	:0
MAC Port2 4 (Hex) :	9 Overwrite this and enter "y" for
MAC Port2 5 (Hex) :	"Are you sure?", then press Enter.
Are you sure? [74:90	50:f0:09:02] (y/n) :

(10) Writing to the Flash ROM

If you have no problem with the changed settings, enter "y" and press Enter. If "Write data to flash!" appears, writing to the flash ROM has been completed successfully. If you want to change the settings again, enter "n" and press Enter.





Appendix B Notes on the Sample Program

• Timeout

The sample program is for evaluation and therefore has functionality for timeout if communications continue for more than 24 hours. If you want to release the timeout functionality, contact our partner Sherpa Inc. (https://www.sherpa-tech.net/).

• Vendor ID

The sample program is for evaluation and therefore uses the vendor ID owned by Renesas Electronics. If you want to use your own vendor ID, contact our partner Sherpa Inc. (<u>https://www.sherpa-tech.net/</u>).



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Revision History

		Description	
Rev.	Date	Page	Summary
1.00	Jul.31, 2018	—	First edition issued

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

The following usage notes are applicable to all Microprocessing unit and Microcontroller unit products from Renesas. For detailed usage notes on the products covered by this document, refer to the relevant sections of the document as well as any technical updates that have been issued for the products.

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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 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. Unused pins should be handled as described under Handling of Unused Pins in the manual.
- 2. Processing at Power-on

The state of the product is undefined at the moment 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 moment 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 moment 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 moment when power is supplied until the power reaches the level at which resetting has been specified.
- 3. Prohibition of Access to Reserved Addresses

Access to reserved addresses is prohibited.

- The reserved addresses are provided for the possible future expansion of functions. Do not access
 these addresses; the correct operation of LSI is not guaranteed if they are accessed.
- 4. Clock Signals

After applying a reset, only release the reset line after the operating clock signal has become stable. When switching the clock signal during program execution, wait until the target clock signal has 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.
 Moreover, 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.
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