User's Manual

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GCPX3 Evaluation Kit J70D1
RTK0EE0003D01002BJ

User's Manual

RENESAS
PLC modem LSI R9A06G037

Renesas Electronics
www.renesas.com

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(2012.4)

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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.

1. 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 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.
5. Differences between Products
   Before changing from one product to another, i.e. to a product with a different part number, confirm that the change will not lead to problems.
   — The characteristics of Microprocessing unit or Microcontroller unit products in the same group but having a different part number may differ in terms of the internal memory capacity, layout pattern, and other factors, which can affect the ranges of electrical characteristics, such as characteristic values, operating margins, immunity to noise, and amount of radiated noise. When changing to a product with a different part number, implement a system-evaluation test for the given product.

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This product complies with the following EU Directives. (These directives are only valid in the European Union.)

CE Certifications:
- Directive 2014/35/EU (LVD) : EN 50065-4-2:2002 +A1:2003 +A2:2005
- Directive 2014/30/EU (EMC) : EN 50065-1:2001 +A1:2010, EN 50065-2-3:2003 +A1:2005, EN 50065-7:2001
- Directive 2011/65/EU (RoHS) : EN 50581:2012

- Information for traceability
  - Authorised representative
    Name: Renesas Electronics Corporation
    Address: 5-20-1, Josuihon-cho, Kodaira-shi, Tokyo 187-8588, Japan
  - Manufacturer
    Name: Renesas Electronics Corporation
    Address: 5-20-1, Josuihon-cho, Kodaira-shi, Tokyo 187-8588, Japan
  - Person responsible for placing on the market
    Name: Renesas Electronics Europe GmbH
    Address: Arcadiastrasse 10, 40472 Dusseldorf, Germany
  - Trademark and Type name
    Trademark: Renesas
    Product name: GCPX3 PLC evaluation board J70D1
    Model name: RTK0EE0003D01001BJ **

Environmental Compliance and Certifications:
- Waste Electrical and Electronic Equipment (WEEE) Directive 2012/19/EU

United States regulatory notices on electromagnetic compatibility

FCC Certifications (United States Only):
This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) this device may not causeharmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

** Note)
About representation of the model name
A model name of the kit including accessories is "RTK0EE0003D01002BJ". (It is displayed on a box.)
A model name of the main board is "RTK0EE0003D01001BJ". (It is displayed on the main board.)

Important

Before using this product, be sure to read this document carefully.

This Product:
"This product" in this document collectively refers to the following product manufactured by Renesas Electronics Corporation. "This product" herein encompasses neither the customer's user system nor the host machine.
(a) GCPX3 Evaluation Kit equipped with PLC modem LSI R9A06G037（RTK0EE0003D01002BJ）

Purpose of use of this product:
This product is a solution kit which adopts Renesas Electronics Corporation PLC modem LSI R9A06G037.
Be sure to use this product correctly according to said purpose of use. Please avoid using this product other than for its intended purpose of use.

For those who use this product:
This product can only be used by those who have carefully read the document and know how to use it.
Use of this product requires basic knowledge of electric circuits, logical circuits, and MCUs.
When using this product:
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(8) The all operation of the USB device connected to this product is not guaranteed.
(9) All of the application note and sample program provided about this product are reference data, and they do not guarantee the operation. Please use as technical reference data for software development.

When disposing of this product:
Penalties may be applicable for incorrect disposal of this waste, in accordance with your national legislation.

Usage restrictions:
This product has been developed as evaluation system for PLC modem LSI R9A06G037.
Therefore, do not use it as an embedded device in other equipment. Also, do not use it to develop systems or equipment for use in the following fields.
(1) Transportation and vehicular
(2) Medical (equipment that has an involvement in human life)
(3) Aerospace
(4) Nuclear power control
(5) Undersea repeaters
If you are considering the use of this product for one of the above purposes, please be sure to consult your local distributor.

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This product is provided "as is" and no repair, analysis, etc. are supported.

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In this document, 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.
 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.
In addition to the three above, the following are also used as appropriate.	
△ means WARNING or CAUTION	
Example:	 CAUTION AGAINST AN ELECTRIC SHOCK
⃠ means PROHBITION	
Example:	 DISASSEMBLY PROHIBITED
● means A FORCIBLE ACTION	
Example:	 UNPLUG THE POWER CABLE FROM THE RECEPTACLE

⚠ WARNING

Warnings for AC Power Supply:

- Do not touch the plug of the AC power cable when your hands are wet. This may cause electric shock.
- If other equipment is connected to the same branch circuit, care should be taken not to overload the circuit.

- If you smell a strange odor, hear an unusual sound, or see smoke coming from this product, then disconnect power immediately by unplugging both the AC/DC Adapter and the AC power cables for PLC signal 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.

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.

- CAUTION: High Voltage (Risk of Electric Shock)
- This is the evaluation kit for powerline communications. All work in powerline communications must be done with extreme care. Caution must be exercised when using power supplies or power related equipment.
- Use this board with expert technical supervision.
- There is high voltage (100V-230 V AC) power on this board.
- There is no protection against high voltage accidental human contact.
- Accidental human contact with high voltage is dangerous.
- The capacitors on this board can be energized even after disconnecting this board from the main power supply. Be careful to not touch any parts on this board immediately after you disconnect the main power supply.
- Do not touch the high voltage area during live operation for debugging, probing, or any other purpose.
- Renesas Electronics bears no responsibility for any consequences that may result from the improper or hazardous use of this board.

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 40°C. Care should be taken that this temperature is not exceeded.

⚠ CAUTION

Cautions for AC Power Supply:

- Use a power cord and AC adapter that are appropriate for that country's safety standards.
- Use of an inappropriate power cord or AC adapter may cause generation of heat, fire, or electric shock.

Cautions to Be Taken for Handling This Product:

- Use caution when handling the product. Be careful not to apply a mechanical shock.
- Do not touch the connector pins of this product and the target MCU connector pins directly. Static electricity may damage the internal circuits.
- When attaching and removing the cable, hold the plug of the cable and do not touch the cable. Do not pull this product by the communications interface cable or the flexible cable. And, excessive flexing or force may break conductors.

Caution to Be Taken for System Malfunctions:

- If this product malfunctions because of interference like external noise, do the following to remedy the trouble.

(1) Exit this product debugger, and shut OFF this product and the user system.
(2) After a lapse of 10 seconds, turn ON the power of this product and the user system again, then launch this product debugger.

Caution to Be Taken for Disposal:

- Penalties may be applicable for incorrect disposal of this waste, in accordance with your national legislation.

How to Use This Manual

1. Purpose and Target Readers

This manual is designed to provide the user with an understanding of the hardware functions and electrical characteristics of the evaluation board. In addition, a description of the functions of the evaluation tool is provided.

It is intended for users designing applications and systems based on the board.

Particular attention should be paid to the precautionary notes when using the manual. These notes occur within the body of the text, at the end of each section, and in the Usage Notes section.

The revision history summarizes the locations of revisions and additions. It does not list all revisions. Refer to the text of the manual for details.

2. List of Abbreviations and Acronyms

Abbreviation	Full Form
AFE	Analog Front End
ARIB	Association of Radio Industries and Broadcast
FCC	Federal Communications Commission
GND	Ground Potential
MAC	Media Access Control Layer
MCU	Micro Controller Unit
OCD	On Chip Debugger
OFDM	Orthogonal Frequency Division Multiplexing
PLC	Power Line Communication
PHY	Physical Layer
SAP	Service Access Point
S/W	Software
FW	firmware

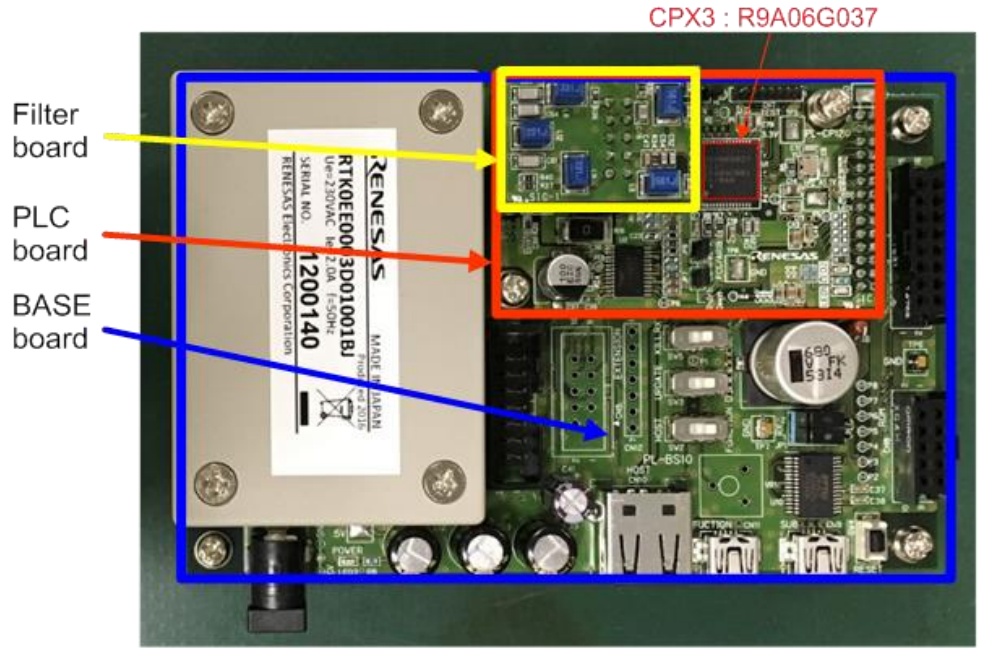
Table of Contents

1. Outline

The GCPX3 Evaluation Kit J70D1 is a tool to evaluate the hardware and the software of Renesas' PLC modem LSI R9A06G037(CPX3). This kit supports CENELEC-A, FCC and ARIB frequency bands.
This chapter introduces the configuration and setup for the GCPX3 Evaluation Kit J70D1.

1.1 Hardware Configuration

The GCPX3 Evaluation Kit J70D1 has a circuit configuration which includes the PLC modem device, the control MCU and the AFE required for power line communication.
The evaluation board is composed of the following three boards. The main board is composed of 1) and 2).
1) PLC board: **PLC modem device (CPX3:R9A06G037)** and **AFE device (NJM45001)** } the main board
2) BASE board: Power circuitry and control MCU (RX631)
3) Filter board: Receive filter for CENELEC-A, FCC and ARIB frequency bands



Notes: 1) 2) and 3) boards are one unit. (Please do not use each board separately.)

Figure 1-1: GCPX3 Evaluation Kit J70D1 configuration

Table 1-1: Hardware specifications

Product	GCPX3 Evaluation Kit J70D1	
Model number	RTK0EE0003D01002BJ	
PLC modem device	CPX3 R9A06G037 (Renesas Electronics)	
Control MCU	RX631 (R5F5631EDDFP)	
AFE device	NJM45001 (NJRC) (DRV amp + RCV amp + RX step ATT)	
PLC specification	Carrier frequency : CENELEC-A:35kHz-90kHz, FCC:150kHz-490kHz, ARIB: 150kHz-450kHz Input voltage for Power line : AC100-230V	
DC power supply voltage	5.0V/3.0A	
Interface	AC inlet	PLC line Connector(CN3) : Connects the power cable
	DC Jack	Power Connector(CN4) : Connects the AC adapter
	USB serial	USB Connector(CN9) : Connects the USB cable to control the Simple MAC
	On-chip debug connector for RX631	OCD Connector(CN6) : Connects the E1 emulator for RX631
	GPIO connector for CPX3	GPIO Connector(CN7) : For monitoring of CPX3 signals
	Serial ROM Connector	Serial ROM Connector(CN8) for a Serial ROM board
	USB interface for RX631	HOST USB (CN10) for RX631 FUNCTION USB (CN11) for RX631
Accessories	The following contents are bundled with this product. ● Main Board (PLC board + BASE board) ---------- 1pcs ● Filter board (A-type) (It is attached to the Main board.) ---------- 1pcs ● Filter board (F-type) ---------- 1pcs ● Filter board (G-type) ---------- 1pcs ● S-ROM board ---------- 1pcs ● USB cable ---------- 1pcs ● Precautions for use ---------- 1pcs ● SJ/T 11364 Table of Hazardous Substance(China RoHS) ---------- 1pcs	
Board Dimensions	120×76×44 mm	

Note)
About representation of the model name
A model name of the kit including accessories is "RTK0EE0003D01002BJ". (It is displayed on a box.)
A model name of the main board is "RTK0EE0003D01001BJ". (It is displayed on the main board.)

1.2 Software Configuration

Figure 1-2 shows the PLC evaluation software (PHY evaluation tool : SimpleMAC) configuration of RX631 and the PLC Modem device (CPX3 : R9A06G037).
The SimpleMAC program runs on the RX631. Thus, the user can control the PLC modem device from the PC using SimpleMAC GUI.

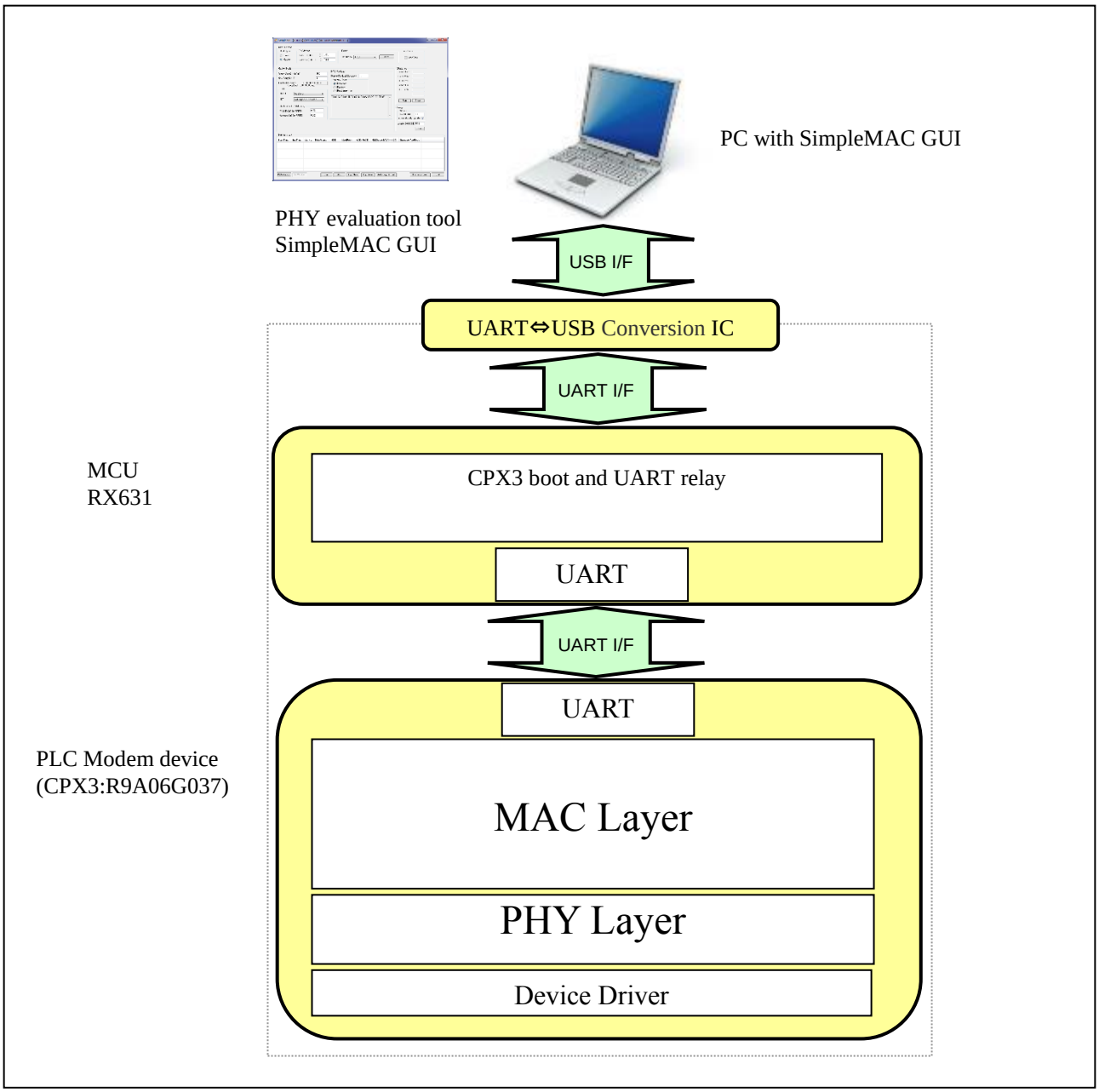


Figure 1-2: Software Configuration

1.3 Details of GCPX3 Evaluation Kit J70D1

Figure 1-3 shows the details of the evaluation board and other components. Figure 1-4 shows the block diagram of this evaluation board.

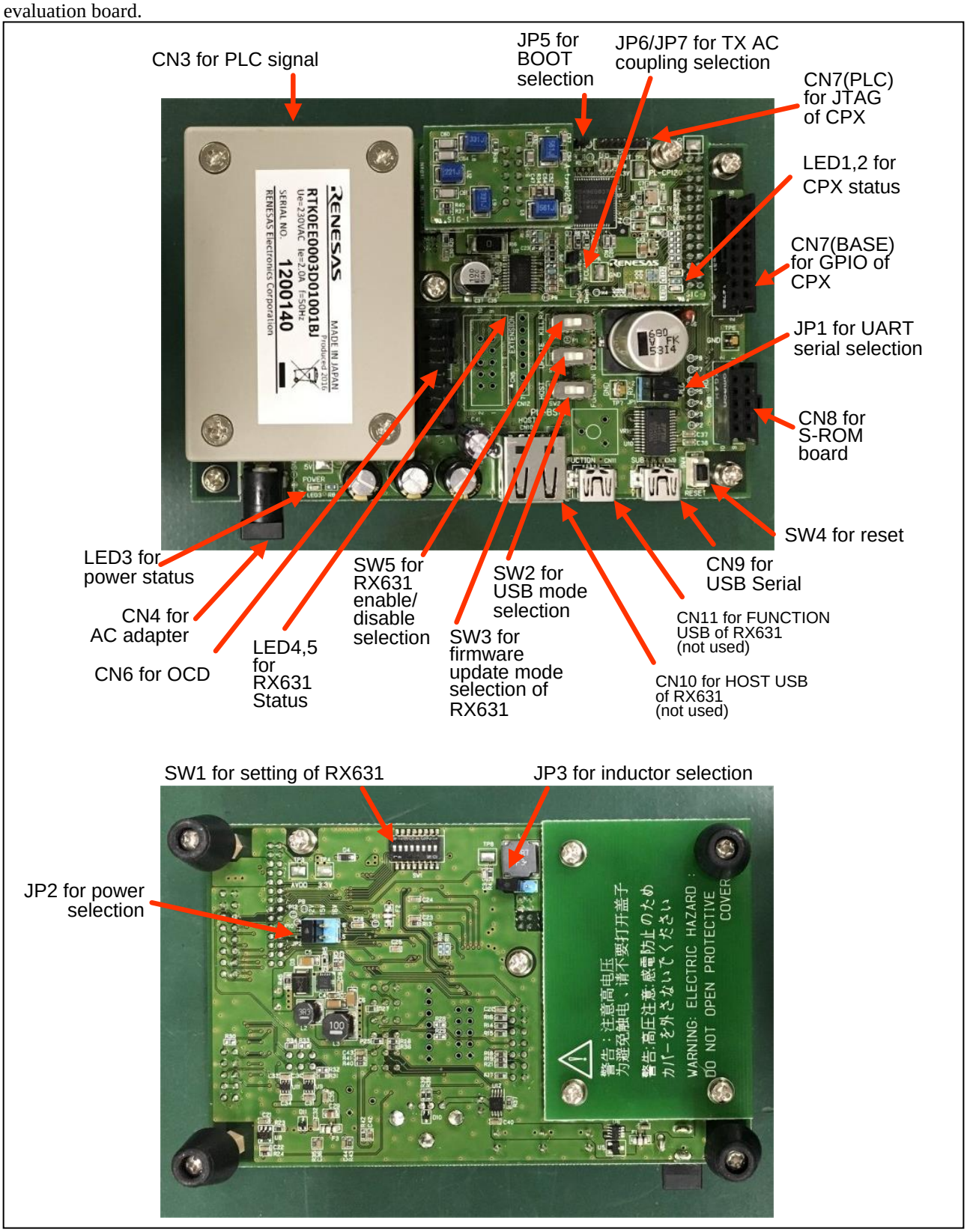


Figure 1-3: Details of GCPX3 Evaluation Kit J70D1

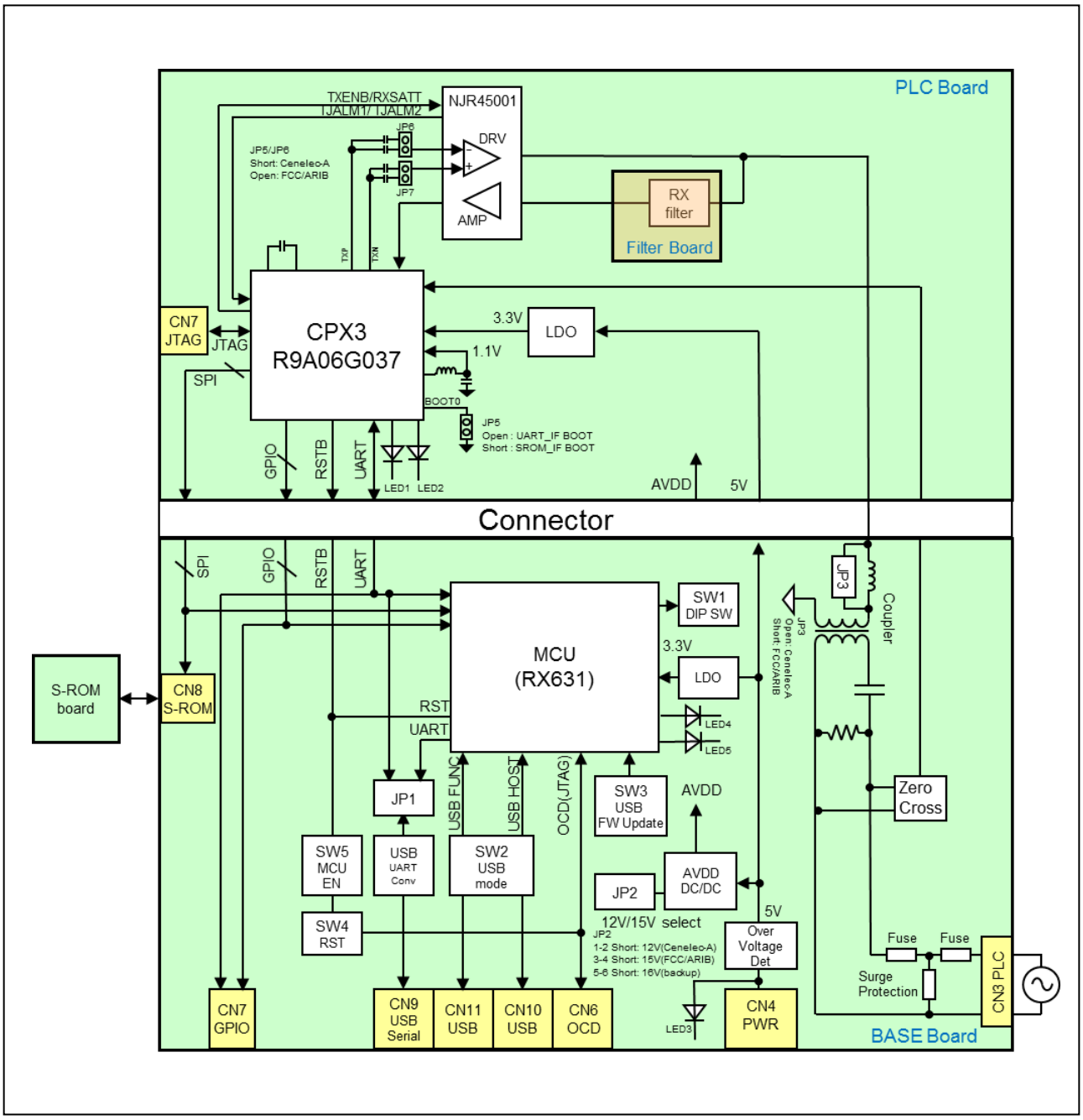


Figure 1-4: Block Diagram

The board is 4-layered (FR4). Figure 1-5 shows the PLC and Filter board Dimensions. Figure 1-6 shows the BASE board. Dimensions are shown in mm.

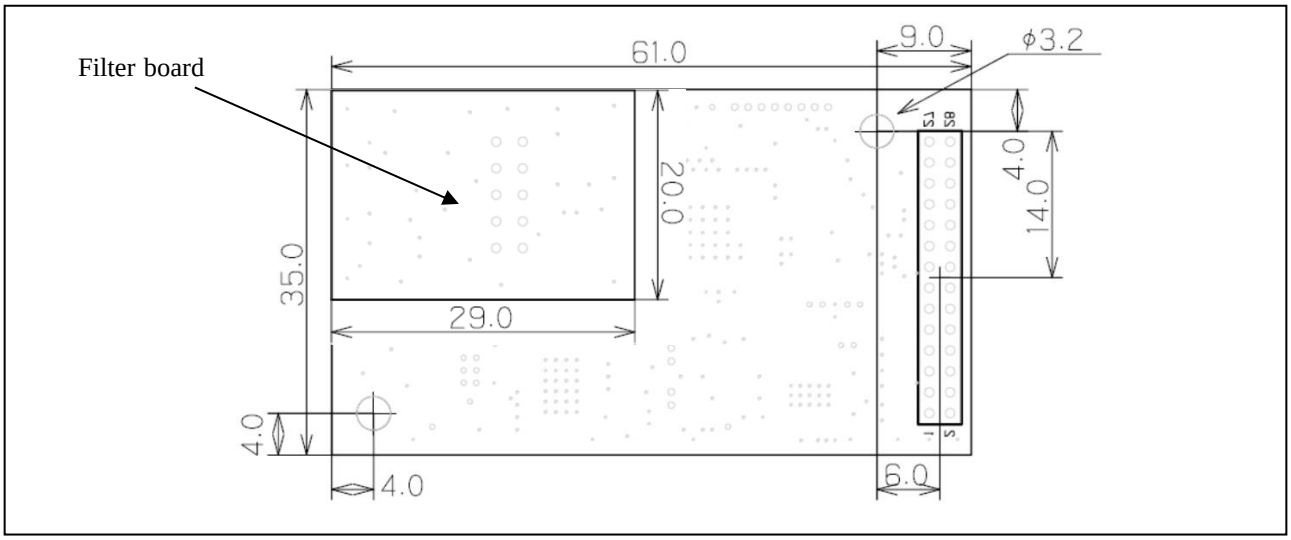


Figure 1-5: PLC and Filter board Dimensions

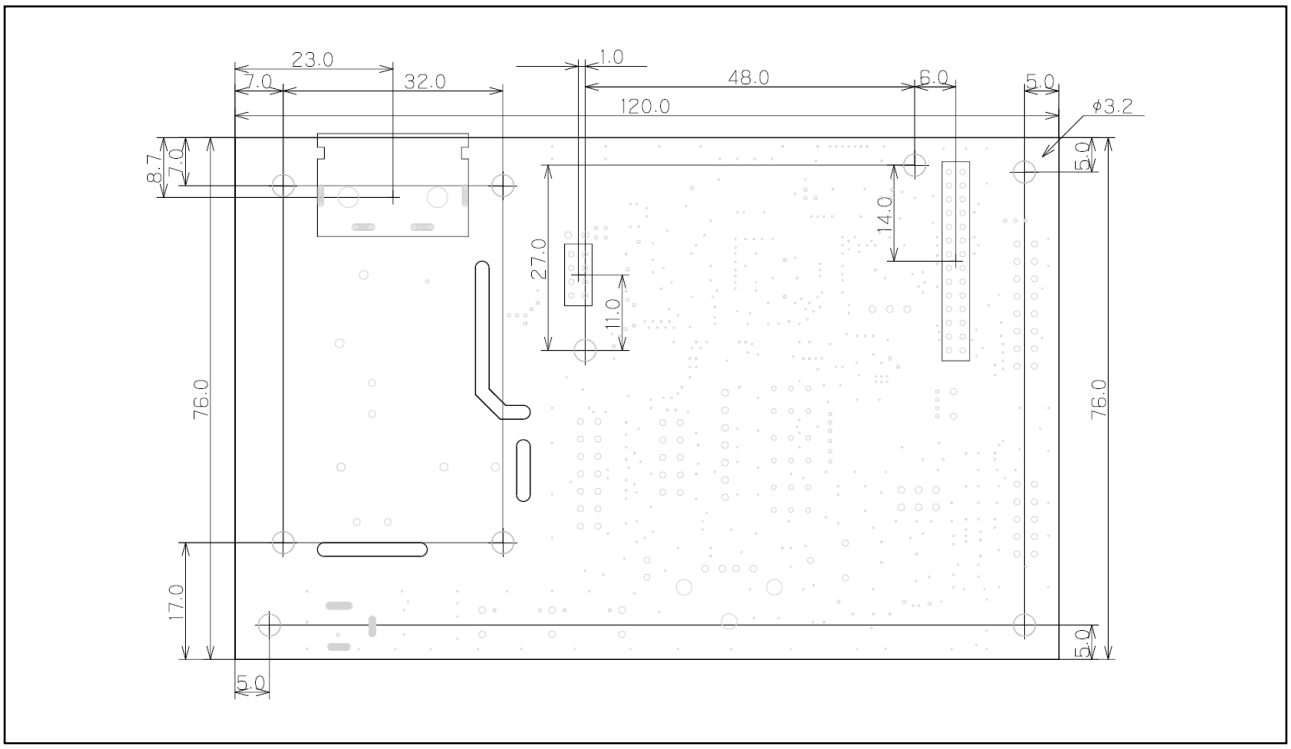


Figure 1-6: BASE board Dimensions

1.4 Required Items

Hardware items required for a basic setup consisting of two transceivers are listed below. When using with additional devices, it is required to use with the corresponding items for each device.

Hardware:

- Two this products
- Two power cables for this products
- A PC with a minimum of two USB ports
- USB cables to connect this products with the PC
- An E1 debugger (incl. cables)
- Two power supplies (5V / 3A)

Software:

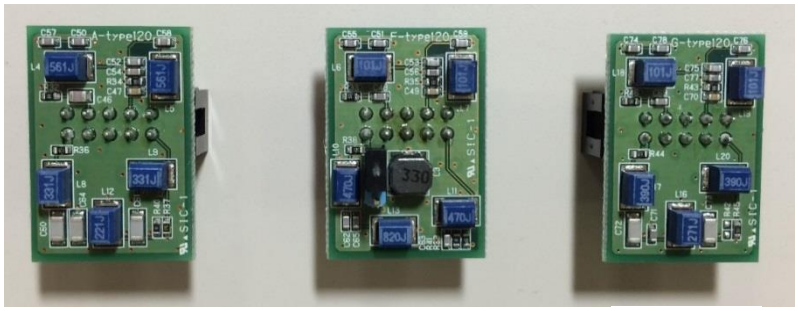
- Installation of *Renesas Flash Programmer (Refer to our website below)*
  https://www.renesas.com/en-us/products/software-tools/tools/programmer/renesas-flash-programmer-programming-gui.html

- Installation of a serial terminal program

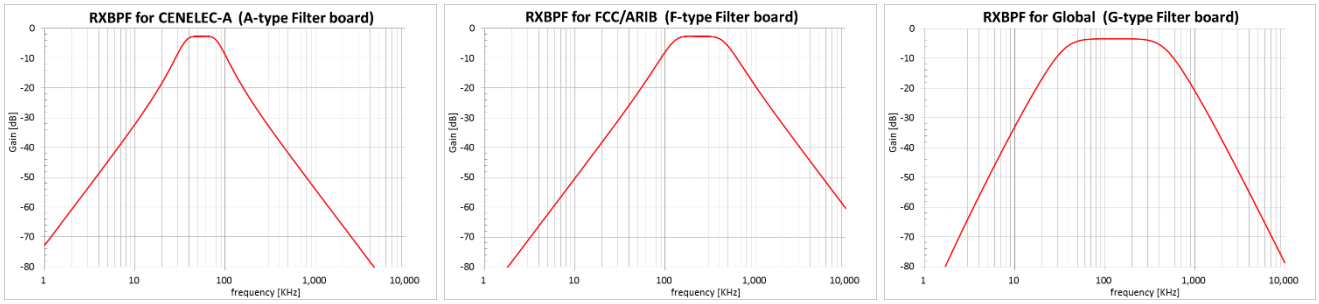
1.5 Hardware Setup

The GCPX3 Evaluation Kit J70D1 consists of a PLC board, a BASE board and a filter board for RXBPF (Receiver Band Pass Filter) that allows out-of-the-box evaluation of different PLC technologies. The filter board specifications are:

- A-type RX band pass filter board for the CENELEC-A band plan
- F-type RX band pass filter board for the FCC / ARIB band plan
- G-type RX band pass filter board for 35kHz – 500kHz (Global) band plan



A-type F-type G-type



A-type RXBPF F-type RXBPF G-type RXBPF (35 kHz–500 kHz)

Figure 1-7: RX band pass filter (Filter board)

Tx-LPF is built into the CPX3. This filter is setup as a mode, which corresponds to each band by FW automatically. Filter characteristics are as follows.

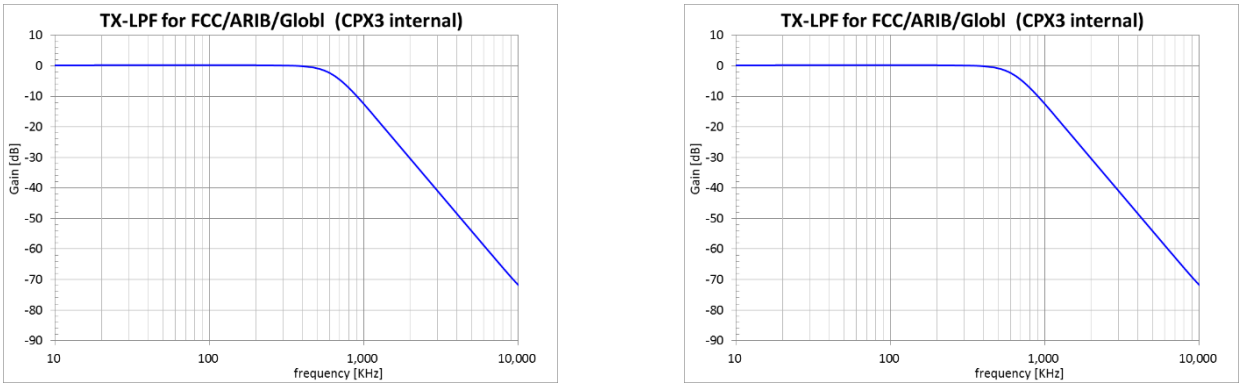


Figure 1-8: TX-LPF (CPX3 internal)

Please set the initial settings of each band of GCPX3 Evaluation Kit J70D1 as follows.

Table 1-2: The initial settings of each band

Parts	CENELEC-A	FCC	ARIB	Global (35-500kHz)
RXBPF Filter board	A-type(35-90kHz)	F-type(150-500kHz)	F-type(150-500kHz)	G-type(35-500kHz)
TX-LPF (CPX3 internal)	fc=150kHz***	fc=600kHz***	fc=600kHz***	fc=600kHz***
JP1	RX (1-3,2-4) side	RX (1-3,2-4) side	RX (1-3,2-4) side	RX (1-3,2-4) side
JP2	15V (3-4) side	15V (3-4) side	12V (1-2) side	15V (3-4) side
JP3	open	short	short	short
JP4 on F-type filter	-	open	short	-
JP5	UART boot : open Serial ROM boot : short	UART boot : open Serial ROM boot : short	UART boot : open Serial ROM boot : short	UART boot : open Serial ROM boot : short
JP6	short	open	open	short
JP7	short	open	open	short
SW1	all OFF	all OFF	all OFF	all OFF
SW2	Function side	Function side	Function side	Function side
SW3	Default side	Default side	Default side	Default side
SW5	USE RX side	USE RX side	USE RX side	USE RX side

*** fc: Cut off frequency

The evaluation boards should be connected by following the instructions shown in Figure 1-7 (Follow the same instructions for each board when connecting with several boards):

- Connect the evaluation board to the host PC with USB cable (Connect PC USB port to CN9 of evaluation board).
- Connect the power supply to the power connector (CN4) of the evaluation board.
- Check if LED3 of the evaluation board is flashing.
- Connect the boards (CN3) to the power line using the power cables. Note that the boards should be used either in mains, artificial mains or clean-line setups as the power cables are for communication use only. Power is supplied by the external power supply.
- Check that LED5 of the boards is blinking. Please press SW4 for RESET if it is not blinking.
- Start the GUI of Simple MAC on the host PC. After that, please refer to SimpleMAC User's Manual.

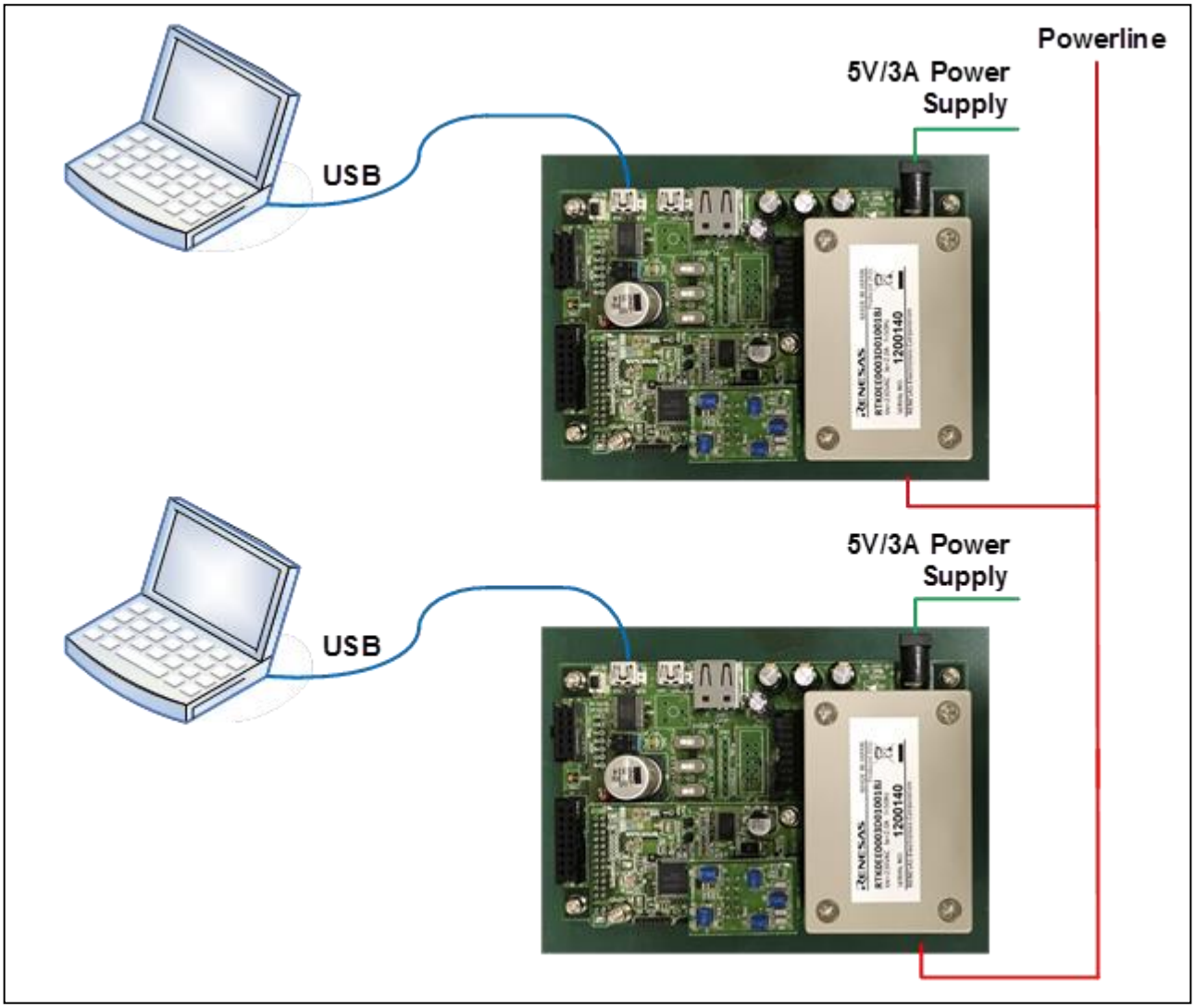


Figure 1-9: PLC Evaluation Setup

2. Interface specification

Table 2-1 shows the list of board interfaces.

Table 2-1: The List of Board Interfaces

Item	Content
LED	PLC modem indicator (LED1,2) Power-on indicator (LED3) General-purpose 2-bit MCU (LED4,5)
DIP SW	General-purpose 8-bit MCU SW (SW1)
Reset SW	System Reset (SW4)
Slide SW	MCU USB mode selection SW (SW2) MCU firmware update mode selection SW (SW3) MCU Enable/Disable SW (SW5)
Jumper	UART selection (JP1) Power supply voltage setting (JP2)
AC inlet	Power line connector (CN3)
DC Jack	Power connector (CN1)
USB connector	USB serial connector (CN9) HOST USB connector (CN10) FUNCTION USB connector (CN11)
On-chip debug connector for RX631 MCU	OCD connector (CN6) Connect the E1 emulator for RX631 MCU
GPIO connector for CPX3	GPIO connector (CN7) For monitoring the signal from CPX3.
Serial ROM Connector	Serial ROM Connector(CN8) for a Serial ROM board

2.1 LED Configuration (LED1, LED2, LED3, LED4, LED5)

The boards are equipped with a number of LEDs that provide information about the evaluation board's status. The LEDs are configured as follows.

- CPX3 LEDs: Two LEDs indicate the status of the PLC modem device
  - LED1: Packet reception running.
  - LED2: Packet transmission running.
- RX LEDs: Two LEDs indicate the status of the RX631 MCU
  - LED4: Completed CPX3 firmware download.
  - LED5: (not included in this product)
- Power LED (LED3): If this LED is on, the board is properly connected to the power supply.

2.2 Power Line Connector (CN3)

CN3 is a connector for the power line communication.
The power line communication is executed via CN3. CN3 is not used as a power supply.
Connector: CCT2302-0771F (SMK)
Adaptation cable: IEC60320-1 Standard Sheet C7

2.3 Power Connector (CN4)

CN4 is a connector for the power supply unit (5V/3.0A).
Connector: HEC0470-01-630 (Hoshiden)
Adaptation DC plug: Outer diameter φ5.5mm, Inner diameter φ2.1mm, center positive

2.4 OCD connector (CN6)

CN6 is an OCD connector to connect the E1 emulator with RX631MCU.

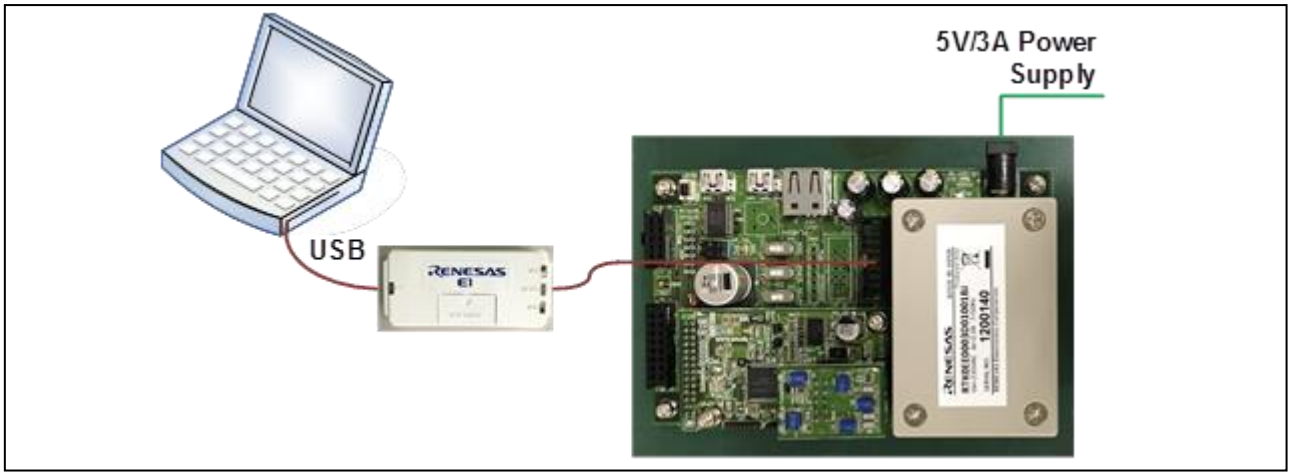


Figure 2-1: Connecting the E1 emulator

When using development tools via the E1 emulator, set the operational status to "TARGET VOLTAGE". Table 2-2 shows the pin assignment of CN6.

Table 2-2: OCD connector (CN6)

Pin No.	Pin Name	Function
1	TCK	RX631-TCK
2	GND	GND
3	TRST	RX631-TRST
4	EMLE	RX631-EMLE
5	TDO	RX631-TDO
6	RFU	Open (NC)
7	MD	RX631-MD
8	VDD	3.3V
9	TMS	RX631-TMS
10	UB	RX631-PC7
11	TDI	RX631-TDI
12	GND	GND
13	RES#	RX631-RES#
14	GND	GND

- Setting when using firmware updates
  To rewrite the program of the MCU using the flash programming tool from the E1 emulator, please use the setting shown in Table 2-3 and follow the tool manual.

Table 2-3: Setting when using firmware user updates

SW	Setting	Function
SW3	Setting to any mode	Setting from the E1 emulator
SW5	USE RX	Setting of RX631 operating mode

2.5 GPIO Connector (CN7)

CN7 is a connector used to monitor the signals of the CPX3.
Table 2-4 shows the pin assignment of the GPIO connector.

Table 2-4: GPIO Connector (CN7)

PIN No.	Pin Name	Function
1	RXD_IN	Connected CPX3-UART0_RX
2	TXD_OUT	Connected CPX3-UART0_TX
3	GPIO9	Connected CPX3-GPIO9
4	GPIO7	Connected CPX3-GPIO7
5	GPIO8	Connected CPX3-GPIO8
6	GPIO15	Connected CPX3-GPIO15
7	GPIO4	Connected CPX3-GPIO4
8	GPIO3	Connected CPX3-GPIO3
9	GPIO6	Connected CPX3-GPIO6
10	GPIO5	Connected CPX3-GPIO5
11	RESETB	Connected CPX3-RESETB
12	GPIO14	Connected CPX3-GPIO14
13	3.3V	3.3V output
14	GND	GND
15	GND	GND
16	5V	5V output

Connector: XG4H-1631(Omron)

2.6 JTAG connector (CN7 of PLC board)

JTAG connector (CN7 of PLC board) is used to connect the JTAG terminal of CPX3.
Table 2-5: JTAG connector (CN7 of PLC board) shows the pin assignment of the GPIO connector.

Table 2-5: JTAG connector (CN7 of PLC board)

PIN No.	Pin Name	Function
1	VDD	Connected CPX3-UART0_RX
2	TCK	Connected CPX3-UART0_TX
3	GND	Connected CPX3-GPIO9
4	TMS	Connected CPX3-GPIO7
5	TDO	Connected CPX3-GPIO8
6	TDI	Connected CPX3-GPIO15
7	TRST	Connected CPX3-GPIO4
8	TICE	Connected CPX3-GPIO3

Connector: PSS-710103-08 (Hirosugi)

2.7 Connecter for a Serial ROM board (CN8)

CN8 is a connector for a Serial ROM board.
When using a Serial ROM board, please set JP5 to 1-2.
Table 2-6 shows the pin assignment of the Serial ROM connector.

Table 2-6: Serial ROM Connector (CN8)

PIN No.	Pin Name	Function
1	SROM_CSB	Connected CPX3-GPIO4 / N25Q032-SB(CSB)
2	SROM_MISO	Connected CPX3- GPIO6 / N25Q032-DQ1(SO)
3	3.3V	Connected 3.3V / N25Q032-WB/Vpp
4	GND	Connected GND / N25Q032-VSS
5	SROM_MOSI	Connected CPX3-GPIO3 / N25Q032-DQ0(SI)
6	SROM_CLK	Connected CPX3-GPIO5 / N25Q032-C(SCK)
7	3.3V	Connected 3.3V / N25Q032-HOLDB
8	3.3V	Connected 3.3V / N25Q032-VCC
9	N.C.	
10	N.C.	

Connector: XG4H-1031(Omron)

Figure 2-2: Serial ROM board

2.8 USB connectors (CN9, CN10, CN11) & Jumper for USB serial setting (JP1)

The boards are equipped with three USB connectors (see Figure 1-3):

- USB Serial (CN9) and Jumper for USB (JP1): Provides serial communication access to the RX631 or CPX3 via FTDI virtual serial port (this connector is used to connect this board to a host PC).
  USB Serial is connected to RX631 or CPX3. Use the USB serial of RX631 for normal operation.
  For USB-to-Serial devices, refer to the web site: http://www.ftdichip.com/Drivers/VCP.htm

Table 2-7: Jumper (JP1)

USB serial setting	Jumper setting	Function
USB serial of RX631 (Setting at as shipped)	1-3 short & 2-4short	Connecting RX631
USB serial of CPX3	3-5 short & 4-6short	Connecting CPX3

- HOST USB (CN10), FUNCTION USB (CN11): The HOST USB and FUNCTION USB are used to communicate with to the RX631. (These are unused in SimpleMAC FW which has been written to this product.)
  When operating RX631 with the HOST USB and FUNCTION USB, set SW2 and SW3 settings in reference to the Table below. In addition, it is impossible to use CN10 and CN11 at the same time.

Table 2-8: Setting of SW2, SW3

	HOST USB Setting	FUNCTION USB Setting
SW2	HOST1	FUNCTION2
SW3	DEFAULT	DEFAULT

2.9 Jumper for AVDD Power Supply Voltage Selection (JP2)

JP2 is a jumper to switch AVDD power supply voltage.
Refer to the Table 2-9 for settings.

Table 2-9: Jumper (JP2)

AVDD Voltage setting	Jumper setting	Content
12V	1-2 Short	Please use for ARIB.
15V(default)	3-4 Short	Please use for CENELEC-A, FCC, Global (35kHz-500kHz).
16V	5-6 Short	For backup

2.10 Jumper for Inductor Selection (JP3)

JP3 is a jumper to switch the inductor according to the output. The output power of CENELEC-A band increases about 2-3dB by using this inductor when the load impedance is low. On the other hand, the output power of FCC band considerably decreases by using it when the load impedance is low. Refer to Table 2-10 for settings.

Table 2-10: Jumper (JP3)

Inductor setting	Jumper setting	Content
Use the inductor	Open	Please use for CENELEC-A, and do not use for FCC, ARIB, Global (35kHz-500kHz).
Not use the inductor	Short	Please use for FCC, ARIB, Global (35kHz-500kHz).

2.11 Jumper for CPX3 BOOT selection (JP5)

JP5 is a jumper to select CPX3 boot interface. Refer to the Table 2-11 for settings.

Table 2-11: Jumper (JP5)

Setting	Jumper setting	Content
OPEN(default)	1-2 Open	UART interface BOOT
SHORT	1-2 Short	Serial ROM interface BOOT

2.12 Jumper for AC coupling selection of TX (JP6/JP7)

JP6/JP7 are jumpers to select the AC coupling capacitors of TX (the input of DRV amp). Refer to the Table 2-12 for settings.

Table 2-12: Jumper (JP6/JP7)

AC coupling setting	Jumper setting	Content
OPEN	1-2 Open	For FCC / ARIB band
SHORT	1-2 Short	For CENELEC-A / Global (35kHz-500kHz) band

2.13 General purpose DIP SW for RX631 (SW1)

SW1 is a DIP SW to set the applications of RX631. **Table 2-13** shows the pin assignment of SW1.
When the SW is "on", the signal level at RX631 becomes LOW. When the SW is "off", the signal level at RX631 becomes HIGH.
(This evaluation board does not include a pull-up resistor on. Please enable the on-chip pull-up function of RX631.)

Table 2-13: General purpose DIP SW (SW1)

SW No.	Connection
SW1-1	Connected to RX631-PE0
SW1-2	Connected to RX631-PE1
SW1-3	Connected to RX631-PE2
SW1-4	Connected to RX631-PE3
SW1-5	Connected to RX631-PE4
SW1-6	Connected to RX631-PE5
SW1-7	Connected to RX631-PE6
SW1-8	Connected to RX631-PE7

2.14 SW for USB mode selection of RX631 MCU (SW2)

SW2 is a switch to set the USB mode (HOST USB or FUNCTION USB) of the RX631 MCU.
When using USB device on RX631 MCU, select the correct USB.
Table 2-14 shows the setting of SW2.

Table 2-14: SW2 for USB mode selection of RX631 MCU

SW2 setting	Function
FUNCTION mode	VBUS detection of FUNCTION mode, and the pull-up control of D + line
HOST mode	VBUS supply control, and over-current detection of VBUS

2.15 SW for firmware update mode of RX631 MCU (SW3)

SW3 is a switch to select the rewrite mode of RX631MCU when using a flash programming tool connected to the USB (using CN11). Select the default setting for normal operation.

Table 2-15: SW for firmware update mode of MCU (SW3)

SW3 setting	Function
DEFAULT mode	MCU(RX631) normal operation mode
UPDATE mode	MCU(RX631) USB boot mode

2.16 RESET SW (SW4)

SW4 is a push switch to RESET the system.
Press the switch (SW4), if you need to initialize both CPX3 and RX631MCU.

2.17 RX631 MCU Enable/Disable SW (SW5)

SW5 is a switch to Enable/Disable the control of the CPX3 by the RX631 MCU.
CPX3 can be connected to another MCU on this board by disabling RX631MCU,
Table 2-16 shows the settings of SW5. Use the default settings for normal operation.

Table 2-16: MCU Disable SW (SW5)

MCU control	SW5 setting	function
Operation state (default)	USE RX	RX631 in operating state. CPX3 reset controlled by RX631.
Reset state	KILL RX	RX631 in the reset state. CPX3 reset controlled by SW4.

2.18 Control MCU

The evaluation board is equipped with the RX631 (R5F5631EDDFP) for a control MCU. The connections are shown in **Table 2-17** and **Table 2-18**.

- Unused pin settings: Since the signals connected to PLC LSI have pin settings on the PLC board, set the ports to "Input" when not using the RX631. Set other signal pins with on-chip pull-up resistor of MCU.

Table 2-17: RX631 connections Table (1/2)

PIN No.	PIN Name of RX631		Connection	Notes (Recommended settings when not in use)
1	VREFH	-	3.3V	-
2	EMLE	-	CN6-4	-
3	VREFL	-	GND	-
4	PJ3	I	-	Pull up the on-chip resistance when not in use
5	VCL	-	Stabilizing capacitor (0.1uF)	-
6	VBATT	-	3.3V	-
7	MD/FINED		CN6-7	-
8	XCIN		32.768KHz Xtal OSC	-
9	XCOUT		32.768KHz Xtal OSC	-
10	RES#		CN6-13***	-
11	XTAL/P37		12MHz Xtal OSC	-
12	VSS	-	GND	-
13	EXTAL/P36	-	12MHz Xtal OSC	-
14	VCC	-	3.3V	-
15	P35	I	3.3V	Set as Input port when not in use
16	TRST#/P34	I	CN6-3	Set as Input port when not in use
17	P33	I	-	Pull up the on-chip resistance when not in use
18	P32	I	-	Pull up the on-chip resistance when not in use
19	TMS/P31	I	CN6-9	Set as Input port when not in use
20	TDI/P30	I	CN6-11	Set as Input port when not in use
21	TCK/FINECP27	I	CN6-1	Set as Input port when not in use
22	TDO/P26	I	CN6-5	Set as Input port when not in use
23	P25/USB0_DPRPD	I	For pulling down CN10-3	Pull up the on-chip resistance when not in use
24	P24	O	LED5	Pull up the on-chip resistance when not in use
25	P23	O	LED4	Pull up the on-chip resistance when not in use
26	P22/USB0_DRPD	I	For pulling down CN10-2	Pull up the on-chip resistance when not in use
27	P21/RXD0	I	FT232RL-TXD	Pull up the on-chip resistance when not in use
28	P20/TXD0	I	FT232RL-RXD	Pull up the on-chip resistance when not in use
29	P17	I	-	Set as Input port when not in use
30	P16/USB_VBUS/USB_VBUSEN	I/O	SW2-2	Pull up the on-chip resistance when not in use
31	P15	I	-	Pull up the on-chip resistance when not in use
32	P14/USB_DPUPE/USB_OVRCURA	I/O	SW2-5	Pull up the on-chip resistance when not in use
33	P13	I	-	Set as Input port when not in use
34	P12	I	-	Set as Input port when not in use
35	VCC_USB	-	3.3V	-
36	USB0_DM	I/O	CN10-2,CN11-2	-
37	USB0_DP	I/O	CN10-3,CN11-3	-
38	VSS_USB	-	GND	-
39	P55	I	-	Pull up the on-chip resistance when not in use
40	P54	I	-	Pull up the on-chip resistance when not in use
41	BCLK/P53	I	-	Pull up the on-chip resistance when not in use
42	P52	I	-	Pull up the on-chip resistance when not in use
43	P51	I	-	Pull up the on-chip resistance when not in use
44	P50	I/O	CPX3-GPIO15	Set as Input port when not in use
45	PC7	I	CN6-10	Set as Input port when not in use
46	PC6	I/O	CN1-4	Set as Input port when not in use
47	PC5	I/O	CN1-3	Set as Input port when not in use
48	PC4	I/O	CN1-6	Pull up the on-chip resistance when not in use
49	PC3	I/O	CN5-10	Pull up the on-chip resistance when not in use
50	PC2	I/O	CN5-9	Pull up the on-chip resistance when not in use

***SW5 USE RX setting

Table 2-18: RX631 connections Table (2/2)

PIN No.	PIN Name of RX631		Connection	Notes (Recommended settings when not in use)
51	PC1/SCK5	I/O	CN5-8	Pull up the on-chip resistance when not in use
52	PC0	O	CPX3-RESETB***	Set high-level output when not in use
53	PB7	O	CPX3-UART0_RX	Set as Input port when not in use
54	PB6	I/O	CPX3-UART0_TX	Set as Input port when not in use
55	PB5	I	-	Pull up the on-chip resistance when not in use
56	PB4	I	-	Pull up the on-chip resistance when not in use
57	PB3	I	-	Pull up the on-chip resistance when not in use
58	PB2	I/O	CPX3- GPIO7	Pull up the on-chip resistance when not in use
59	PB1	I/O	CPX3- GPIO9	Pull up the on-chip resistance when not in use
60	VCC	-	3.3V	-
61	PB0	I/O	CPX3- GPIO8	Pull up the on-chip resistance when not in use
62	VSS	-	GND	-
63	PA7	I/O	SROM_MISO	Set as Input port when not in use
64	PA6	I/O	SROM_MOSI	Set as Input port when not in use
65	PA5	O	S_SROM_CLK	Set as Input port when not in use
66	PA4	I/O	SROM_CSB	Set as Input port when not in use
67	PA3	I/O	CPX3-GPIO14	Pull up the on-chip resistance when not in use
68	PA2	I	-	Pull up the on-chip resistance when not in use
69	PA1	I	-	Pull up the on-chip resistance when not in use
70	PA0	I	-	Pull up the on-chip resistance when not in use
71	PE7	I	DIPSW1-8	Pull up the on-chip resistance when not in use
72	PE6	I	DIPSW1-7	Pull up the on-chip resistance when not in use
73	PE5	I	DIPSW1-6	Pull up the on-chip resistance when not in use
74	PE4	I	DIPSW1-5	Pull up the on-chip resistance when not in use
75	PE3	I	DIPSW1-4	Pull up the on-chip resistance when not in use
76	PE2	I	DIPSW1-3	Pull up the on-chip resistance when not in use
77	PE1	I	DIPSW1-2	Pull up the on-chip resistance when not in use
78	PE0	I	DIPSW1-1	Pull up the on-chip resistance when not in use
79	PD7	I	-	Pull up the on-chip resistance when not in use
80	PD6	I	CN1-7	Pull up the on-chip resistance when not in use
81	PD5	I/O	CPX3-GPIO2	Pull up the on-chip resistance when not in use
82	PD4	I	-	Pull up the on-chip resistance when not in use
83	PD3/IRQ3	I/O	CN5-7	Pull up the on-chip resistance when not in use
84	PD2	I/O	CPX3-GPIO11	Pull up the on-chip resistance when not in use
85	PD1	I/O	CPX3-GPIO10	Pull up the on-chip resistance when not in use
86	PD0	I/O	CPX3-GPIO13	Pull up the on-chip resistance when not in use
87	P47	I	-	Pull up the on-chip resistance when not in use
88	P46	I	-	Pull up the on-chip resistance when not in use
89	P45	I	-	Pull up the on-chip resistance when not in use
90	P44	I	-	Pull up the on-chip resistance when not in use
91	P43	I	-	Pull up the on-chip resistance when not in use
92	P42	I	-	Pull up the on-chip resistance when not in use
93	P41	I	CN5-6	Pull up the on-chip resistance when not in use
94	VREFL0	-	GND	-
95	P40	I	CN5-5	Pull up the on-chip resistance when not in use
96	VREFH0	-	3.3V	-
97	AVCC0	-	3.3V	-
98	P07	I	-	Pull up the on-chip resistance when not in use
99	AVSS0	-	GND	
100	P05	I	-	Pull up the on-chip resistance when not in use

***SW5 USE RX setting

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		Page	Summary
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