User's Manual

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BCPX3 Evaluation Kit J80D1
RTK0EE0007D01001BJ

User's Manual

RENESAS
PLC Modem LSI R9A06G037

Renesas Electronics
www.renesas.com

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(Rev.3.0-1 November 2016)

General Precautions in the Handling of MPU/MCU Products

The following usage notes are applicable to all MPU/MCU products from Renesas. For detailed usage notes on the products covered by this manual, please refer to the relevant sections of the manual.

1. Handling of Unused Pins
   Handle unused pins in accord 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 unused pin in the open-circuit state, extra electromagnetic noise is induced near 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 one with a different part number, confirm that the change will not lead to problems.
   — The characteristics of MPU/MCU in the same group but having different part numbers may differ because of the differences in internal memory capacity and layout pattern. When changing to products of different part numbers, implement a system-evaluation test for each of the products.

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

CE Certifications:

Directive 2014/30/EU (EMC) : EN 55032:2012, EN 55024:2010
Directive 2011/65/EU (RoHS) : EN 50581:2012

Information for traceability

- Authorized 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: DC PLC BOARD
  Model name: RTK0EE0007D03001BJ **

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 cause harmful 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 "RTK0EE0007D01001BJ". (It is displayed on a box.)
A model name of the PLC board is "RTK0EE0007D03001BJ". (It is displayed on the 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) BCPX3 Evaluation Kit J80D1equipped with PLC modem LSI R9A06G037(RTK0EE0007D01001BJ)

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:
(1) This product is a development-support unit for use in your program development and evaluation stages. When a program you have finished developing is to be incorporated in a mass-produced product, the judgment as to whether it can be put to practical use is entirely your own responsibility, and should be based on evaluation of the device on which it is installed and other experiments.
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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.

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

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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.
In addition to the three above, the following are also used as appropriate.	
⚠ means PROHBITION	
Example: 	CAUTION AGAINST AN ELECTRIC SHOCK
⊘	
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.

- 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.
- There is high voltage (100V-230 V AC) power on this board. Do not touch the high voltage area during live operation for debugging, probing, or any other.
- 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

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.
- Do not touch this product immediately after a lightning strike.

⚠ 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.

Caution to Be Taken for Disposal：

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

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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. 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
SW	Switch
S/W	Software
FW	Firmware
UART	Universal Asynchronous Receiver/Transmitter
PWM	Pulse Width Modulation
PA	Power Amp

Table of Contents

1. Product Overview

The BCPX3 Evaluation Kit J80D1 is a tool to evaluate DC power line communication (hereinafter referred to as DC PLC) for system evaluation and software development with Renesas PLC modem LSI R9A06G037(CPX3).

This chapter explains the board configuration and the usage of this product.

1.1 Board Configuration

The BCPX3 Evaluation Kit J80D1 has a total circuit configuration with items required for DC power line communication including the analogue front-end, control MCU, and CPX3. Figure 1-1 show the board configurations of this product.

This product consists of 4 board types as listed below. Communication can be done by PLC board alone. When using Audio board, it consists of 1), 2), and 3) as shown below. Power filter board is used to connect PLC board to DC power line.

"RTK0EE0007D01001BJ" (described in the external package) is a type name of this evaluation kit including attachments. Type names for each board are follows; "RTK0EE0007D03001BJ" for the PLC board, "RTK0EE0007C04001BJ" for the RX651 MCU board, "RTK0EE0007B06001BJ" for the Audio board and "RTK0EE0007Z07001BJ" for the Power filter board.

1) PLC board：PLC modem LSI (CPX3:R9A06G037) and AFE device (ISL15110)
2) RX651 MCU board：Control MCU board (RX651)
3) Audio board：Board for Audio input/output (TI：TLV320AIC3120RHB)
4) Power filter board：Filter to remove PLC signals into the impedance upper and DC power supply source.

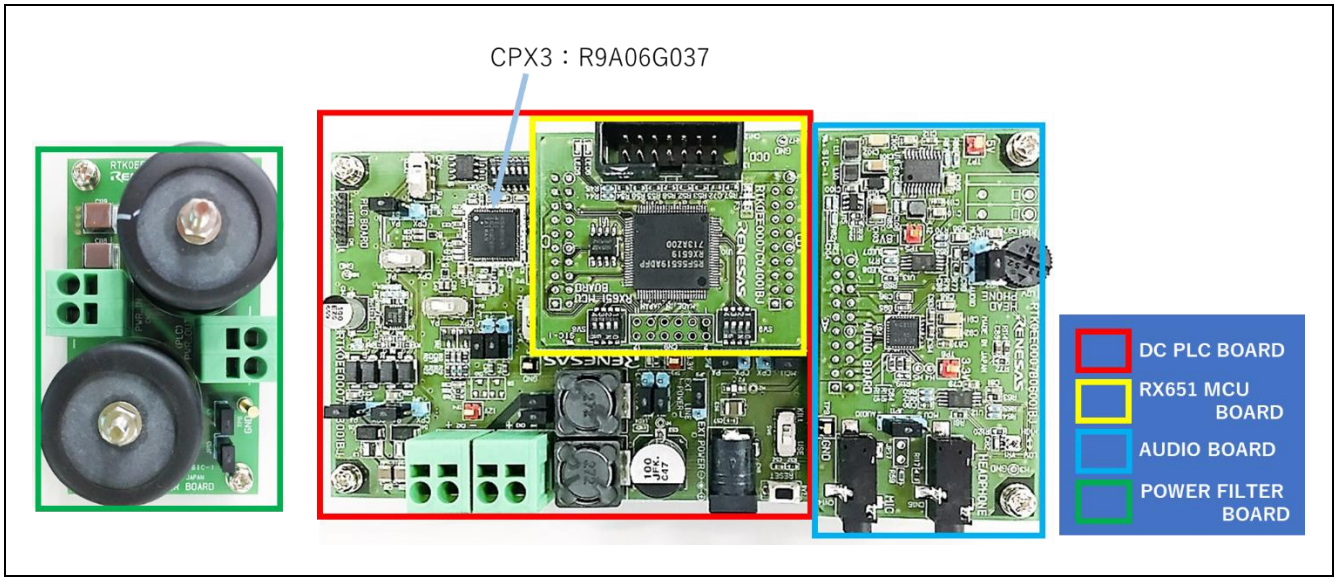

Figure 1-1 Configuration of PLC board, RX651 MCU board, Audio board and Power filter board

Table 1-1 The List of product specifications

Product	BCPX3 Evaluation Kit J80D1
Model number	RTK0EE0007D01001BJ
PLC modem device	CPX3 (R9A06G037: Renesas)
Control MCU	RX651 (R5F56519ADFP: Renesas)
AFE device	ISL15110 (Intersil) : Power Amp(hereinafter referred to as PA) + RCV amp, RX Step ATT : discrete
PLC specification	Supported frequencies: 35kHz - 490kHz Support 1：35.9375kHz - 90.625kHz Support 2：98.4375kHz - 121.875kHz Support 3：154.6875kHz - 403.125kHz Support 4：154.6875kHz - 487.5kHz Supported power line voltage: 16 to 48VDC
Power supply	Line feeding: feed power from the power source to the communication line (DC power line) (DC16 to 48V, 0.5A or more recommended) Not including the Audio board current. (*1) External feeding: feed power from the external AC adaptor (DC16 to 48V, 1A or more recommended) (*2)
Product contents	(1) PLC board×1 (2) RX651 MCU board×1 (3) Audio board ×1 (4) Power filter board ×1 (5) USB cable ×1 (6) Precaution for use (English) ×1 (7) Precaution for use (Japanese) ×1 (8) SJ/T 11364 table of hazardous substance (China RoHS) ×1
Board dimensions	(1):105×70×27 mm, (1)+(2)+(3): 135×70×32 mm, (4): 40×70×35 mm

(*1) When the current of the Audio board is supplied from supply Line, the communication distance becomes shorter. Therefore, it is not recommended. The voltage drops due to the impedance of the cable increases.

(*2) The AC adaptor needs to be prepared by the user, as it is not included in the kit.

(*3) Cautions in AUDIO board use: When AUDIO board is working, and the connection of AUDIO board and PLC board comes off, RX651 MCU board and PLC board may be broken. Please use it at a stable place so that AUDIO board does not come off from PLC board.

Table 1-2 Communication performance example

Drive system	CPX3 direct drive	CPX3+PA drive
The number of connected boards	64 boards (*4) (*5) (*6)	128 boards (*4) (*5) (*6)
Communication range	800m (*4) (*5) (*6)	1.6km (*4) (*5) (*6)
Power line feeding voltage (input voltage)	DC16 to 48V	
Polarity of transmission path (expected 2 cores)	Non-polarity / Polarity	
Transmission path specification	Expected the cable equivalent to AWG12 to AWG18 Note that the communication range and number of connected boards may change depending on line specifications	
Transmission path topology	Line topology (*5), Star topology (*6)	
Frequencies	Refer to Table 1-1	
Transmission rate	Max. 200kbps	
Transmission output level (Total power within the frequency band)	≧99dBuVrms	≧119dBuVrms
Input impedance	≧1.5kΩ	≧1kΩ
Board power supply voltage 1	-	12V
Board power supply voltage 2	3.3V	3.3V
Consumption current (at reception/transmission)	≦20mA (converted to DC24V)	≦27mA (converted to DC24V)

(*4) When using the cable equivalent to AWG12(w/o shield, 2 cores/2.0mmΦ/impedance :5Ω/km)

(*5) (*6) Look at the next page

(*5) Connection example of Line topology

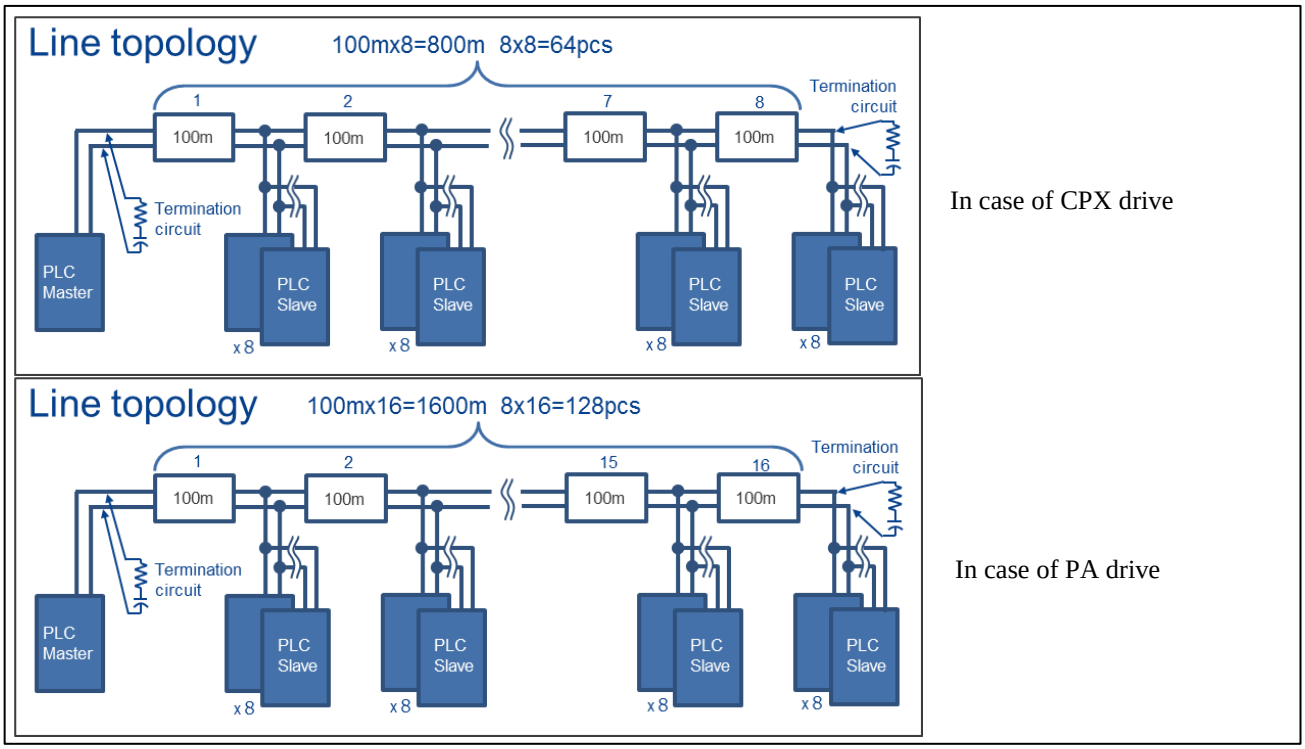

Figure 1-2 Connection example of Line topology

(*6) Connection example of Star topology

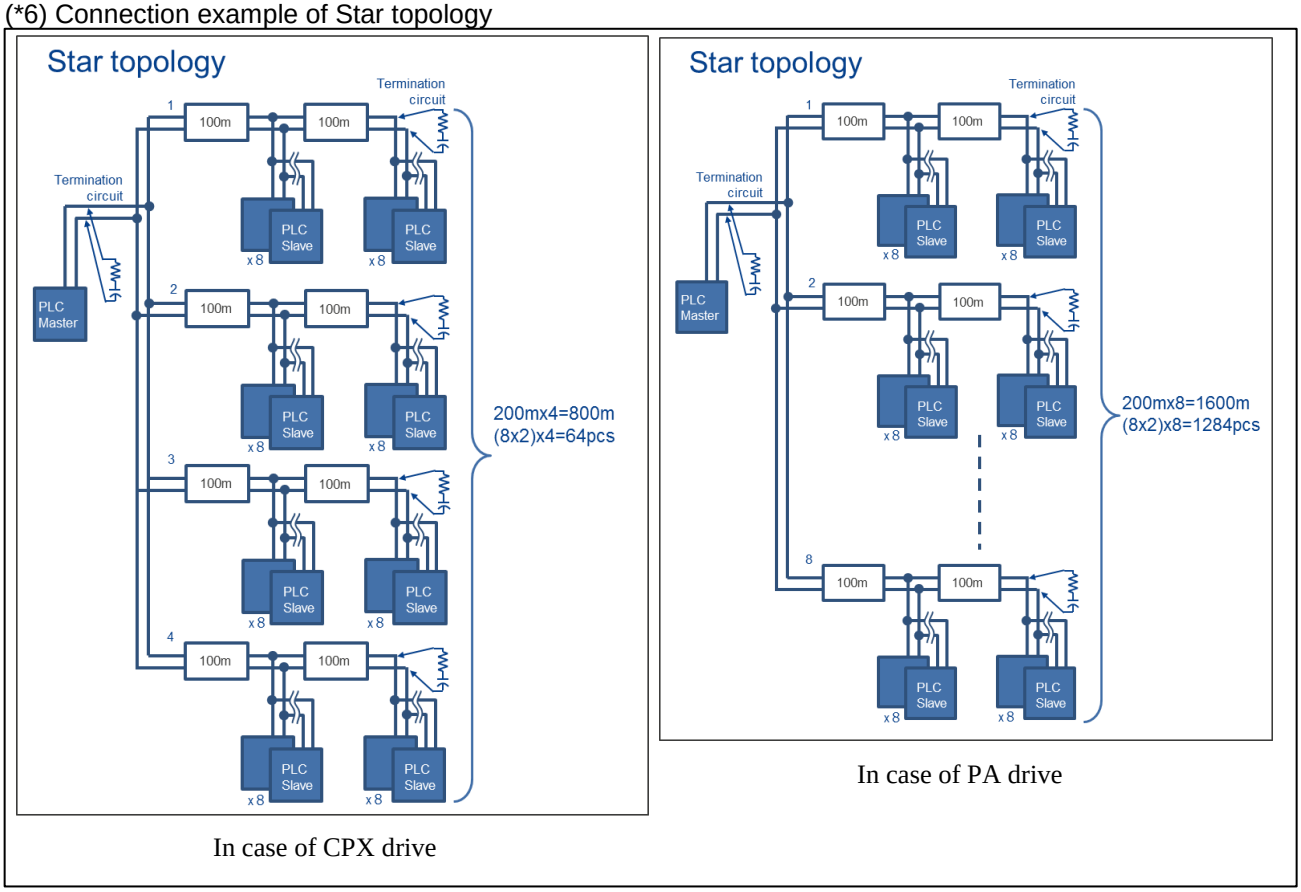

Figure 1-3 Connection example of Star topology

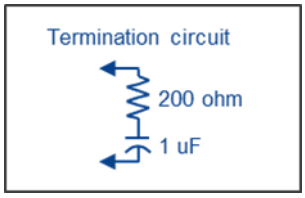

Figure 1-4 Termination circuit example

- The communication range and number of connected boards (Table 1-2) were confirmed under (*4) (*5) (*6) conditions.
- When the connection method is different, it may be different from the above result.
- It is recommended to add the termination circuit to transmission and receiving end to suppress influence of the reflection of the cable. An example of termination circuit insertion is shown in Figure 1-2 and Figure 1-3.
- The termination circuit of Figure 1-4 is an example using (*4). The capacitance (1uF) of the circuit is inserted for DC cut.
- The value of the terminating resistor varies depending on the cable. Therefore, please decide according to the cable to be used.

1.2 PLC evaluation software configuration

Figure 1-5 shows PLC evaluation software configuration(PHY evaluation tool： SimpleMAC)configuration of CPX3 (PLC modem LSI R9A06G037) .

The SROM on the PLC board is programmed with the FW supporting SimpleMAC, which enables the user to control CPX3 with the PC using SimpleMAC GUI.

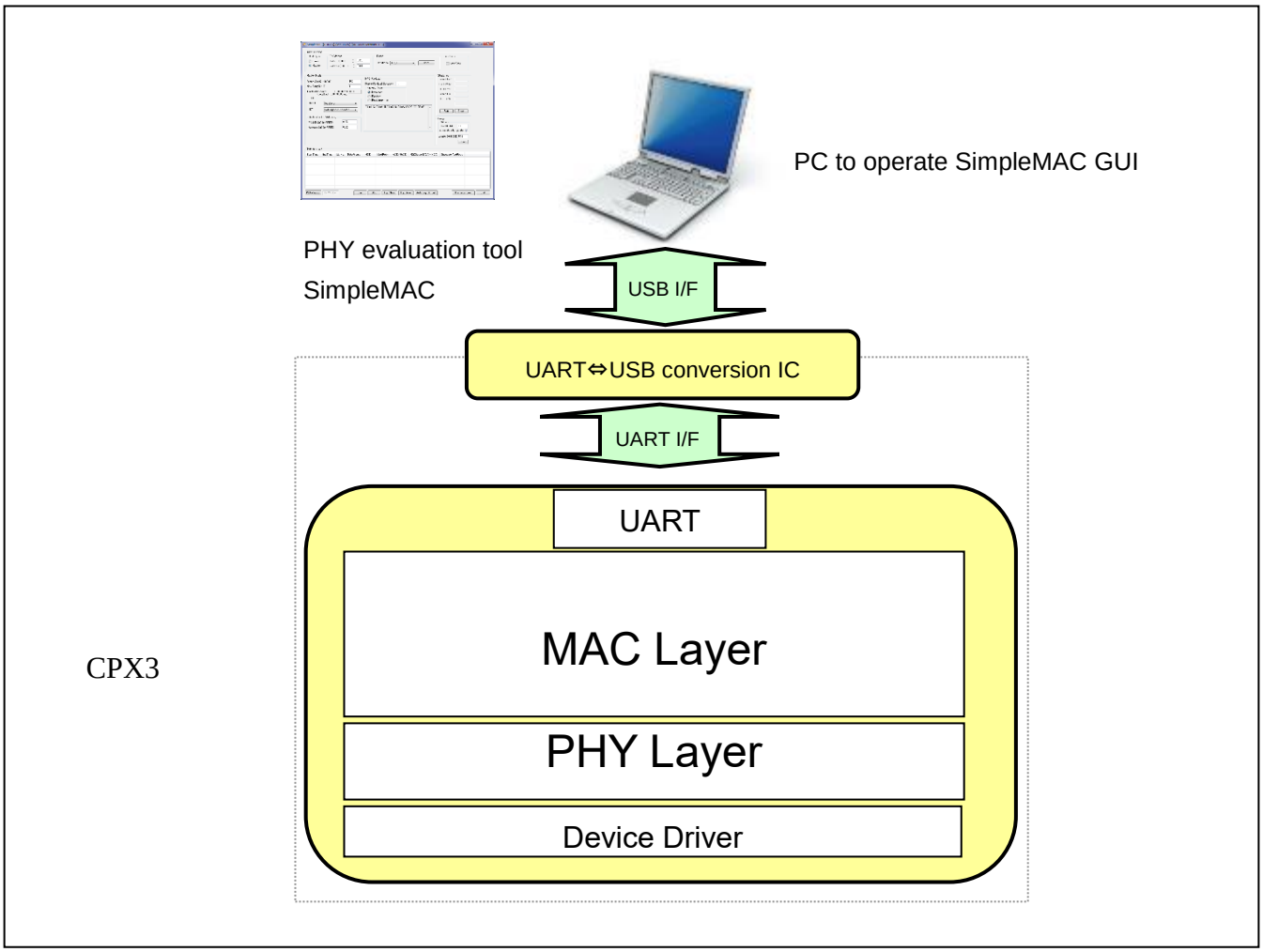

Figure 1-5 PLC evaluation software configuration

1.3 Descriptions on Main Body Parts

Figure 1-6 shows the block diagram of this product. Details for each connector, JP, SW and VR are shown in Figure 1-8, Figure 1-9, Figure 1-10, and Figure 1-11.

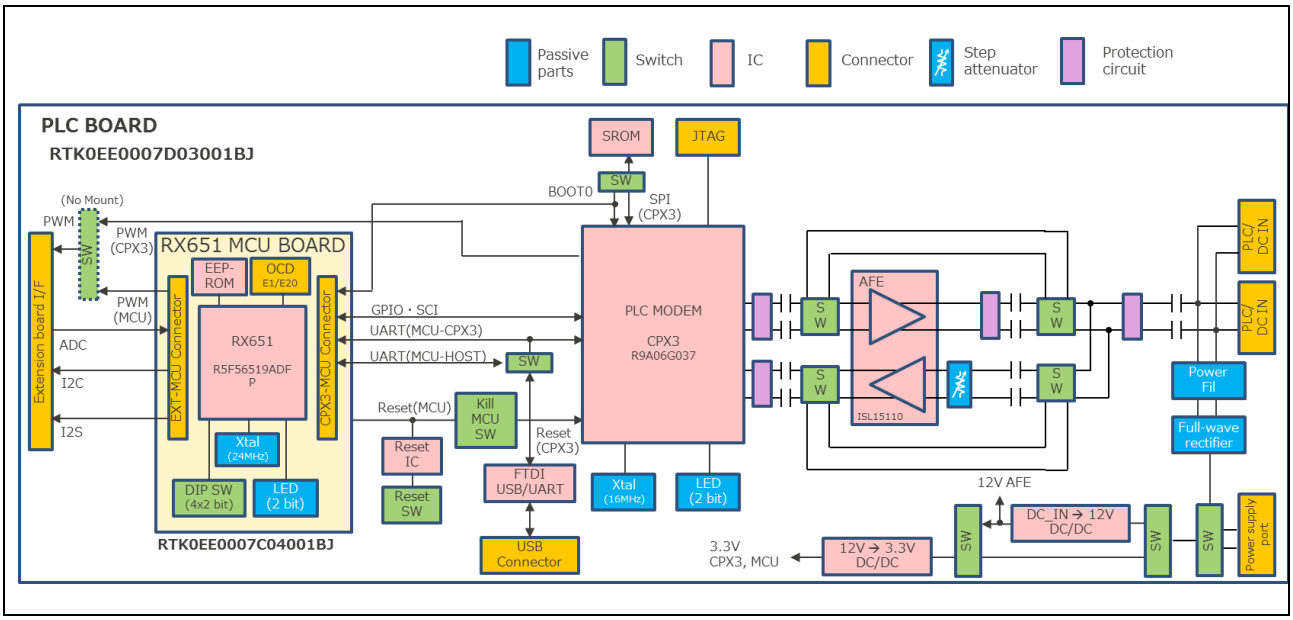

Figure 1-6 PLC board, RX651 MCU board Function block diagram

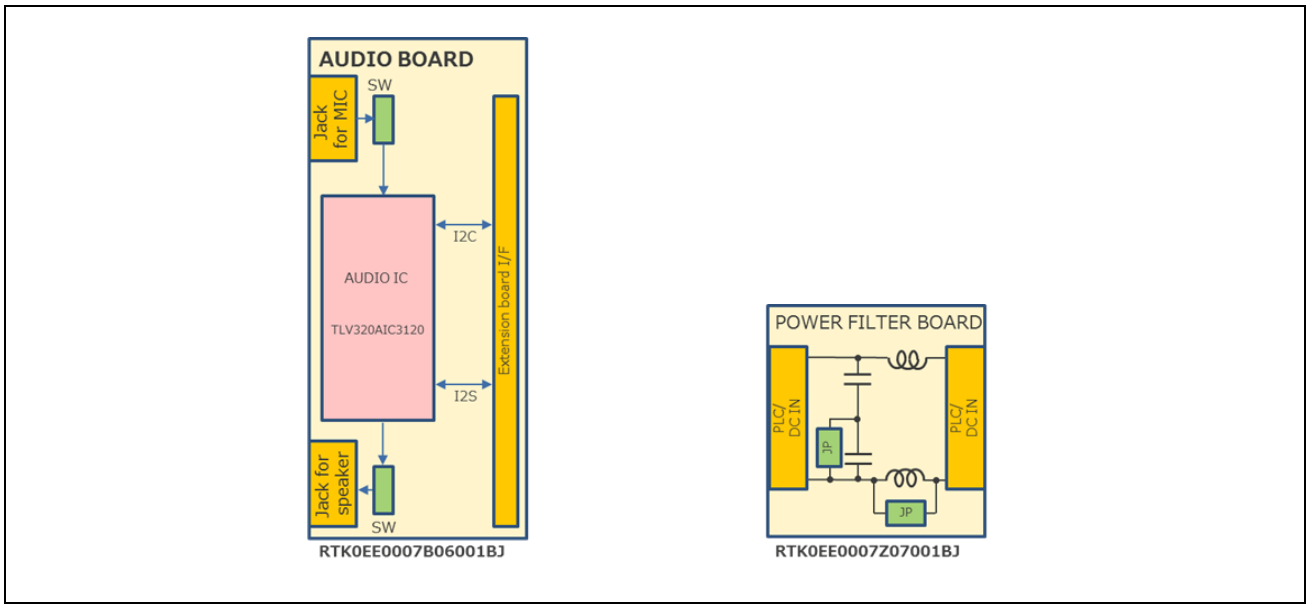

Figure 1-7 Audio board, Power Filter Board Function block diagram

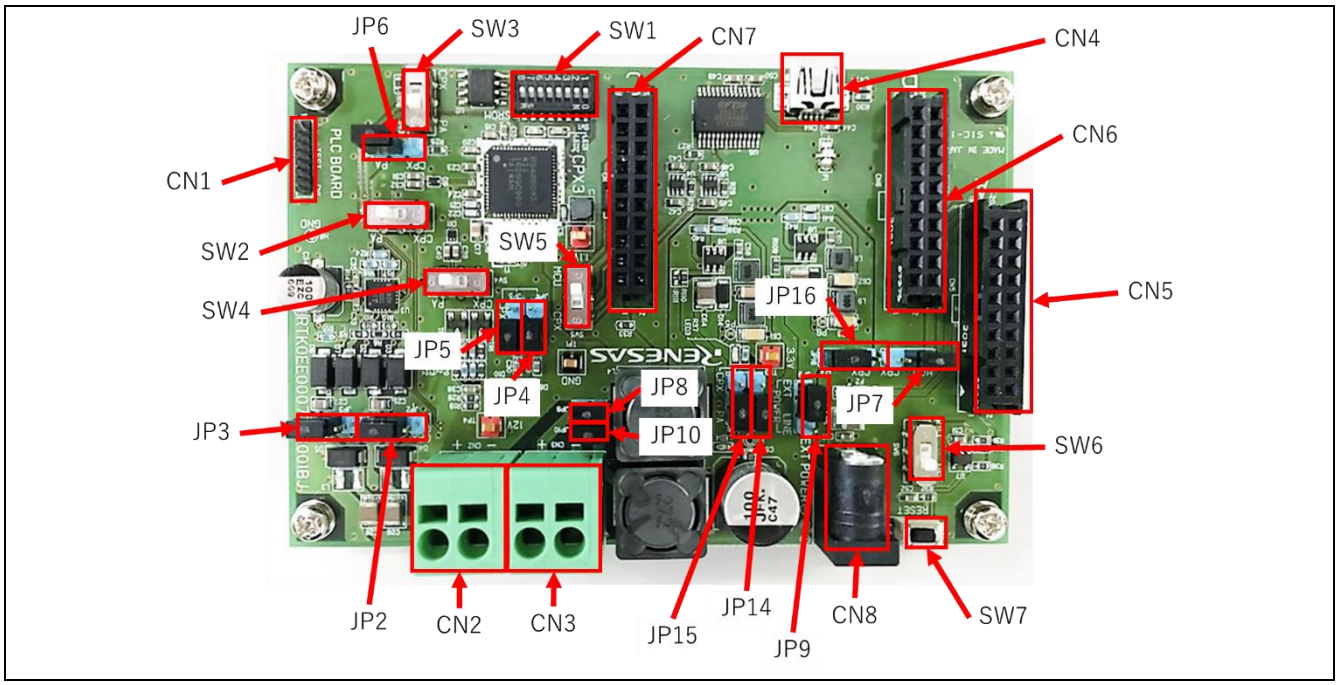

Figure 1-8 PLC board connector, JP, and SW

Table 1-3 PLC board connector, JP, and SW applications

Connector/JP/SW	Applications
SW2, SW3, SW4, JP2, JP3, JP4, JP5, JP6, JP14, JP15, JP16	JP and SW for switching drive system
SW1	SW for selecting boot setting(No.4) / SROM connection (No.1-3,5-8)
SW5	SW for selecting UART-USB connection
SW6	SW for enabling/disabling MCU
SW7	Reset SW
JP7	Not implemented
JP8, JP10	JP for connecting voltage generation parts for line feeding
JP9	JP for switching power supply. Line(CN2,3) or External(CN8)
CN1	JTAG connector for CPX3
CN2, CN3	Connector for DC PLC communication and power line supply
CN4	USB connector
CN5	Extension terminal connector (Audio board connection)
CN6, CN7	MCU board connector
CN8	External power supply connector

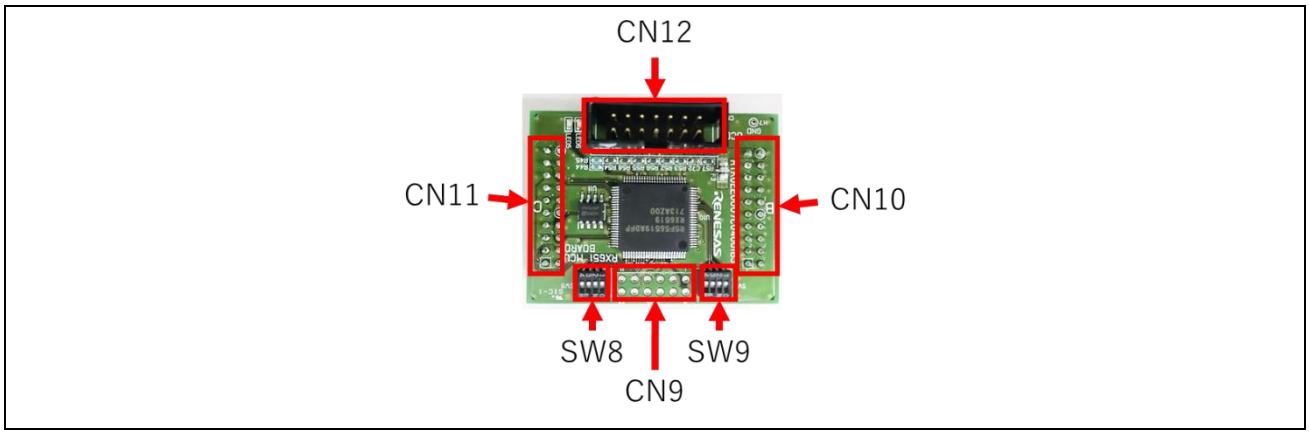

Figure 1-9 RX651 MCU board connector and SW

Table 1-4 RX651 MCU board, connector and SW applications

Connector/SW	Applications
SW8, SW9	General-purpose DIP SW for RX651
CN9	Extension terminal connector (not implemented)
CN10, CN11	PLC board connector
CN12	OCD connector

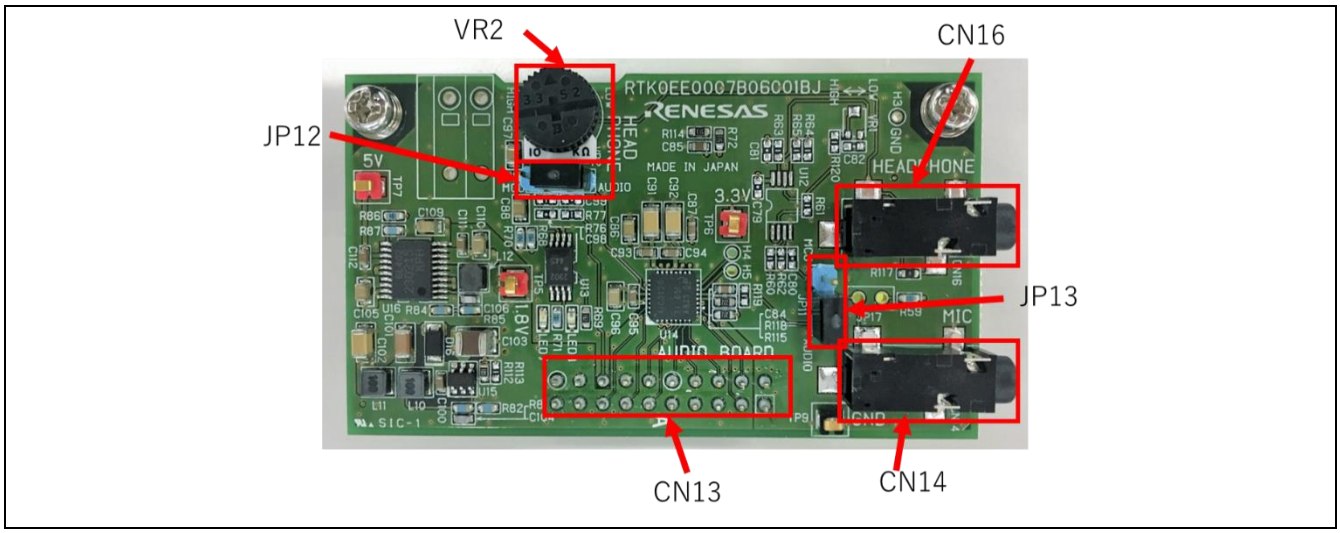

Figure 1-10 Audio board connector, JP and VR

Table 1-5 Audio board connector, JP, and VR applications

Connector/JP/VR	Applications
JP12	Fixed to Audio IC output
JP13	Fixed to Audio IC input
CN13	PLC board connector
CN14	Connector for microphone input
CN1	Connector for headphone output
VR2	Volume for adjusting Audio output level

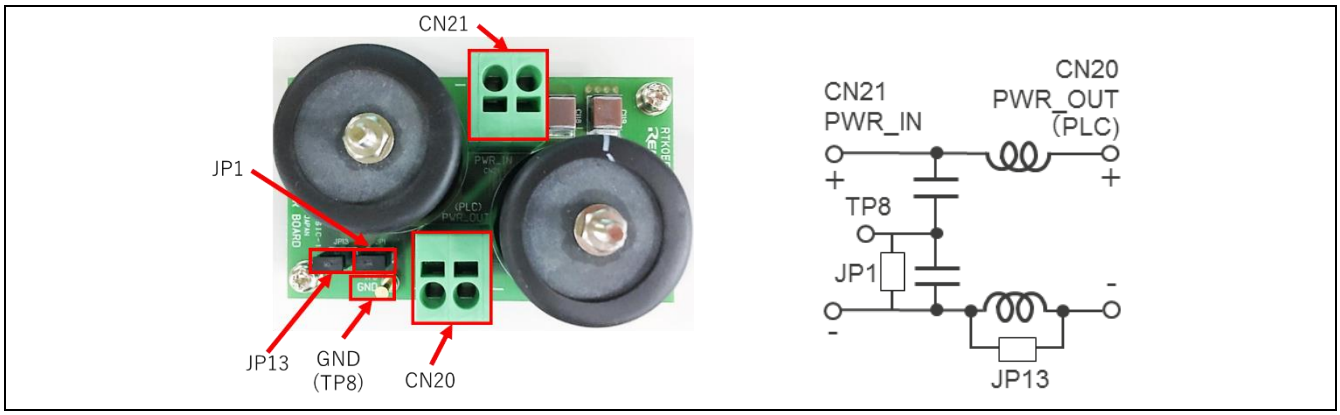

Figure 1-11 Power filter board connector, JP and TP

Table 1-6 Power filter board connector, JP, and TR applications

Connector/JP	Application
JP1	Select whether to insert or not insert a condenser for the power supply filter on the power supply line (-)
JP13	Select whether to insert or not insert an inductor for the power supply filter on the power supply line (-)
CN20	Power supply connector for PLC communication
CN21	Connector to the power supply source
GND pin：TP8	GND pin When feeding DC voltage both (+) and (-) sides of the power supply line, do not fail to connect the GND pin TP8 to the GND of the power source supply.

1.4 Required Items for Evaluation DC PLC Communication

The following table shows the required items for evaluating DC PLC communication with the basic configuration using 2 of the evaluation kit. Prepare additional parts when adding more kits. See Chapter 2 for how to connect.

Table 1-7 HW to be prepared

Product name	Communication line power supply	External power supply
PLC board (attached)	×2	×2
Power filter board (attached)	×1	×1 (*2)
PC (PC w/ 2 or more USB ports)	×1	×1
USB cable (attached)	×2	×2
AC adaptor (16 to 48V/1A or more recommended)	(*1)	×2
Power supply for communication line (16 to 48V/0.5A or more recommended) (*4)	×1	×1 (*2)
RX651 MCU board (attached)	×2 (*1)(*3)	×2 (*1)(*3)
Audio board (attached)	×2 (*1)	×2 (*1)
E1 debugger (w/ cable)	×1 (*3)	×1 (*3)

(*1) Required when using Audio board

(*2) Required when feeding the board with an external power supply and applying DC voltage on the communication line. (Figure 2-4, Figure 2-7)

(*3) Required when using RX651MCU board

(*4) The power supply for communication line does not include the current consumption of the Audio board.

Table 1-8 Software to be prepared

Product name	Notes
Renesas flash programmer	Download from the Renesas website.
Simple MAC GUI	Download from the Renesas website.
Virtual serial port driver	Refer to Chapter 3.1.9

2. Usage

This chapter explains how to set of SW and JP and use each board.

2.1 How to set SW and JP

Table 2-1 shows the setting at the time of the shipment of SW and JP of each board.

Table 2-1 How to set SW and JP of each board

How to set SW and JP				Setting at the time of the shipment (Unused RX651 MCU board and Audio board)	Using RX651 MCU board and Audio board
Mode selection	alternatives	Board name	Name of SW or JP		
Driving System	PA driving or CPX driving	PLC board	SW2, SW3, SW4, JP2, JP3, JP4, JP5, JP6, JP14, JP15, JP16	PA driving	PA driving or CPX driving
BOOT setting	SROM(U2) or UART(MCU)	PLC board	SW1	BOOT:SROM(U2) = all ON	BOOT：UART = all OFF
MCU use / unused	MCU USE or MCU KILL (unused)	PLC board	SW6	MCU:KILL (unused)	MCU:USE
Connection of USB－UART	CPX or MCU	PLC board	SW5	CPX	MCU
Feeding system	Line feeding or External feeding (AC adaptor)	PLC board	JP9	Line feeding	Refer to Table 2-2
DC voltage feeding to DC power line	Single (+)side:DC voltage feeding, (-)side:GND or Differential (+)/(-) side:DC voltage feeding	Power Filter board	JP1,JP13	Single: SHORT	Refer to Table 3-17

Note 1 Please use JP8/JP10(PLC board) by setting of SHORT mode fixation because these JPs are for evaluations.

Note 2 Please use JP11/JP10(Audio board) by setting of AUDIO side fixation because MCU side function is the non-deployment.

Note 3 SW8/9(RX651 MCU board) are set in all OFF because these are undefined at the time of the board shipment. In the case of use SW8/9, please define them.

2.2 DC PLC Communication Usage

2.2.1 DC Power Supply Setting

Table 2-2 shows how to supply DC power to the PLC board and JP9 settings available for each condition. Figure 2-2 shows the power supply configuration from the communication line, Figure 2-3 shows power supply configuration from the AC adaptor, and Figure 2-4 shows the power supply configuration from the communication line and AC adaptor.

Table 2-2 JP9 setting for power supply

Condition		JP9 setting
1	PLC board (+ RX651 MCU board) DC power supply from communication line	LINE (short：1 - 2) Feeding from CN2 or CN3
2	PLC board (+ RX651 MCU board) DC power supply from AC adaptor (1)	EXT (short：2 - 3) Feeding from CN8 and not superimposing DC to the communication line
3	PLC board (+ RX651 MCU board) DC power supply from AC adaptor (2)	EXT (short：2 - 3) Feeding from CN8 and superimposing DC to the communication line
4	PLC board + RX651 MCU board + Audio board DC power supply from communication line and AC adaptor (1)	LINE (short：1 - 2) Feeding the PLC board/RX651 MCU board from the communication line, and the Audio board from the AC adaptor
5	PLC board + RX651 MCU board + Audio board DC power supply from communication line and AC adaptor (2)	EXT (short：2 - 3) Feeding the PLC board/RX651 MCU board/Audio board from the AC adaptor, and not superimposing DC to the communication line
6	PLC board + RX651 MCU board + Audio board DC power supply from communication line and AC adaptor (3)	EXT (short：2 - 3) Feeding the PLC board/RX651 MCU board/Audio board from the AC adaptor, and superimposing DC to the communication line

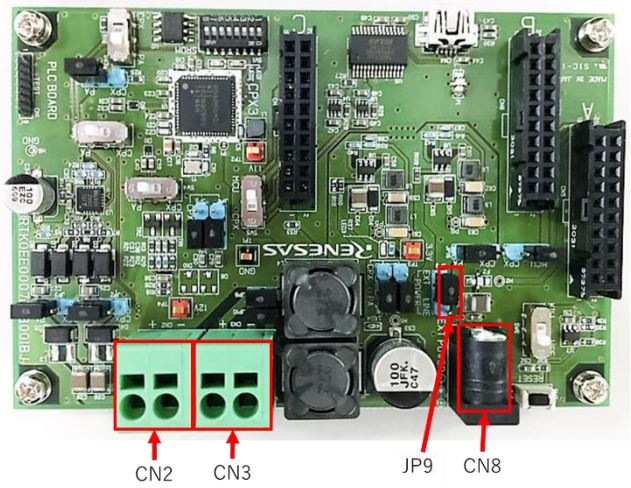

Figure 2-1 Board power supply setting parts

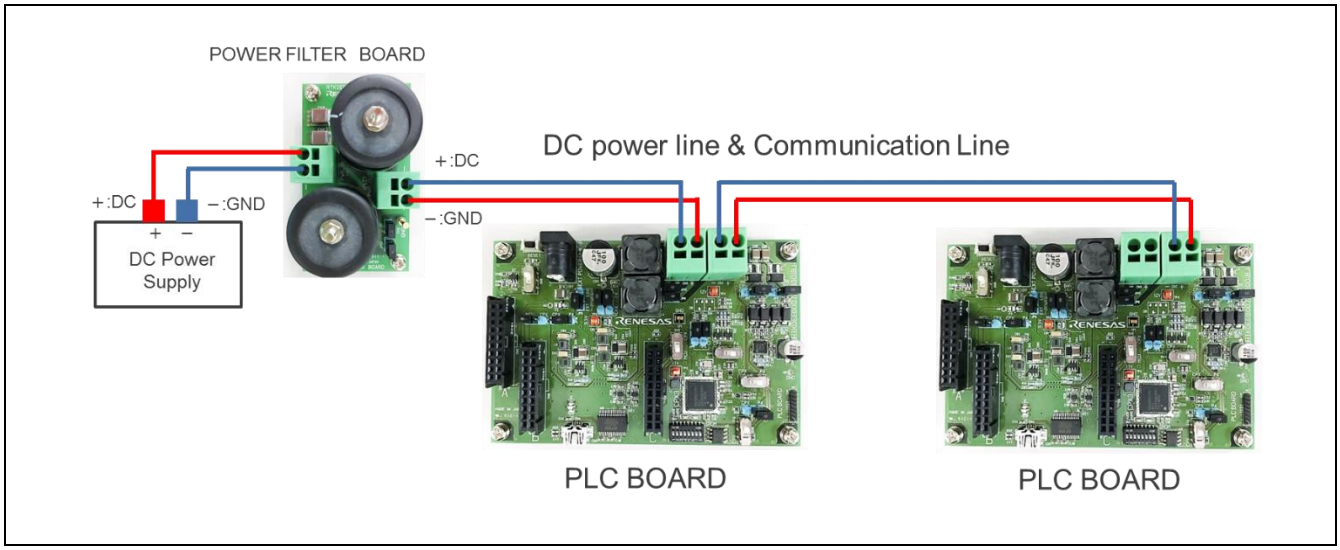

Figure 2-2 Condition 1: PC board connection example of DC power supply from the communication line

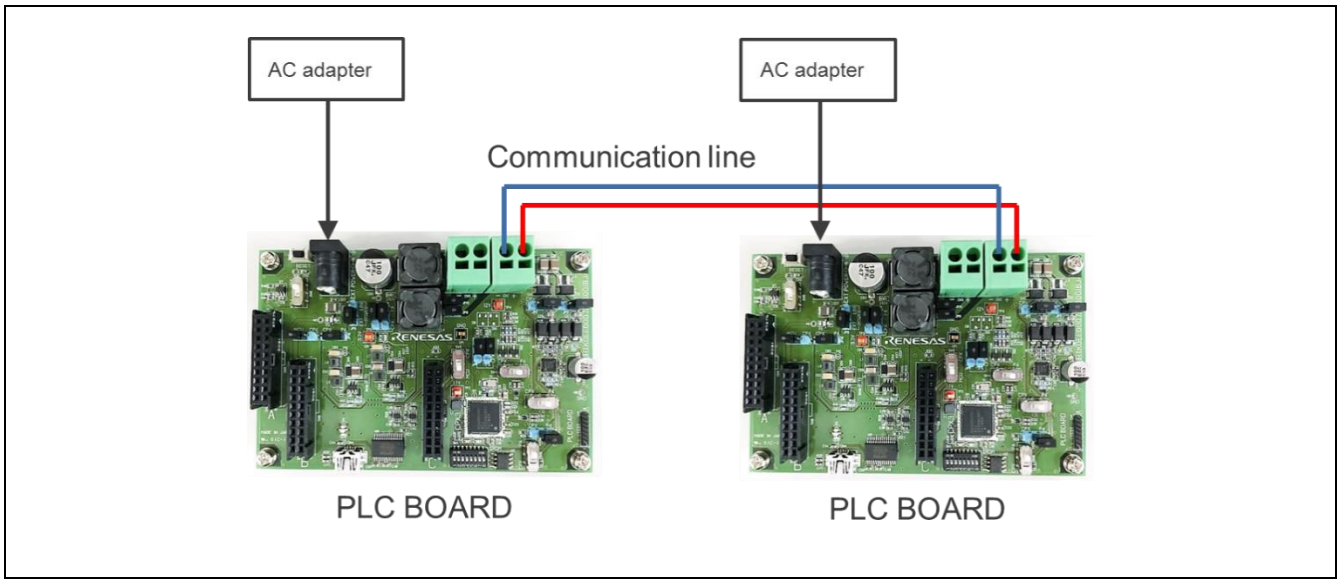

Figure 2-3 Condition 2: PC board connection example of DC power supply from the AC adaptor (1)

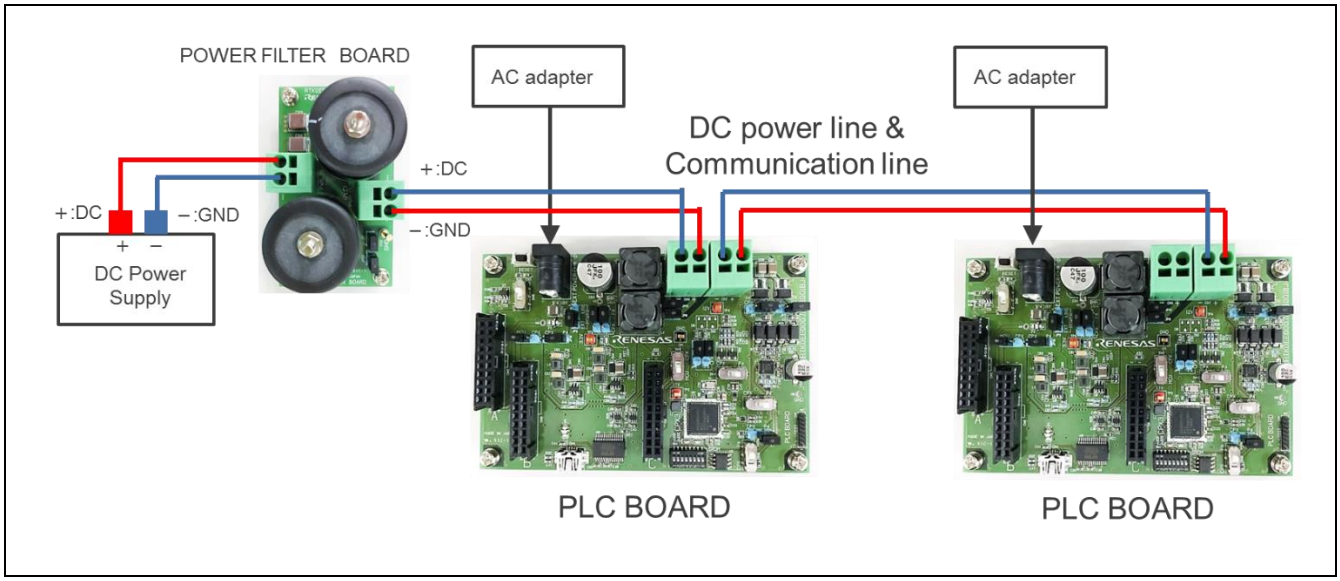

Figure 2-4 Condition 3: PC board connection example of DC power supply from the AC adaptor (2)

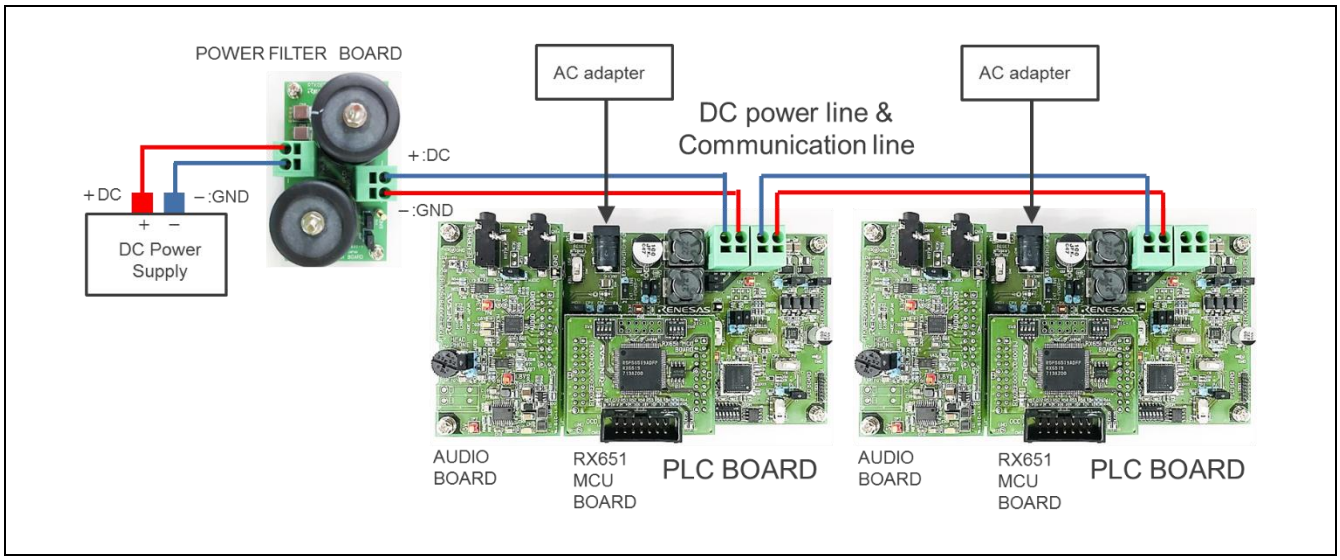

Figure 2-5 Condition 4: PLC board + RX651 MCU board + Audio board

Connection example of DC power supply from the communication line and AC adaptor (1)

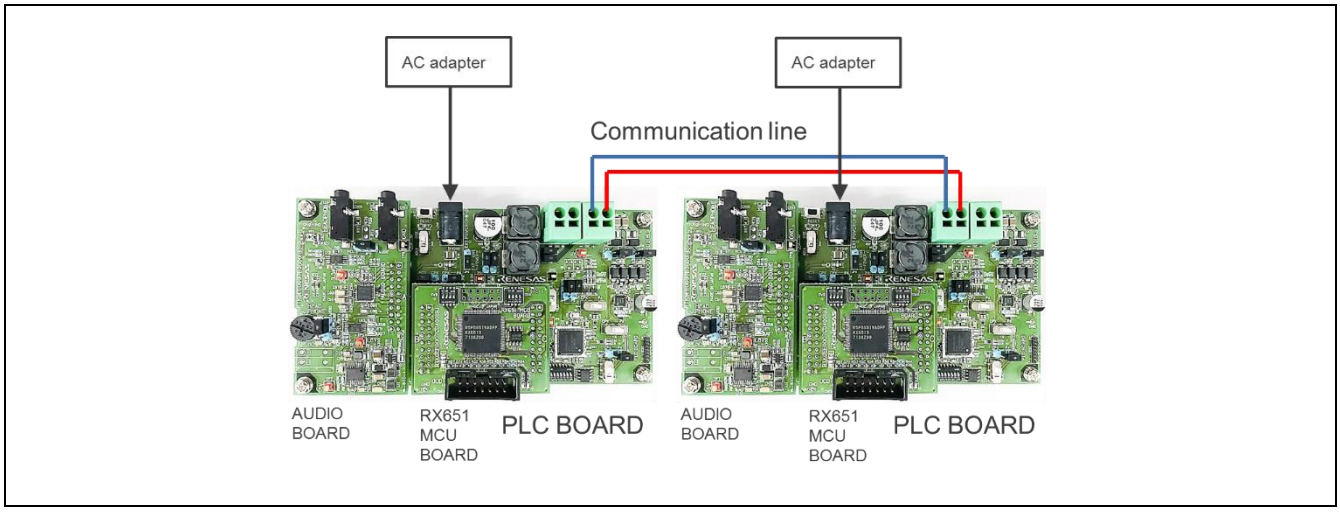

Figure 2-6 Condition 5 : PLC board + RX651 MCU board + Audio board

Connection example of DC power supply from the communication line and AC adaptor (2)

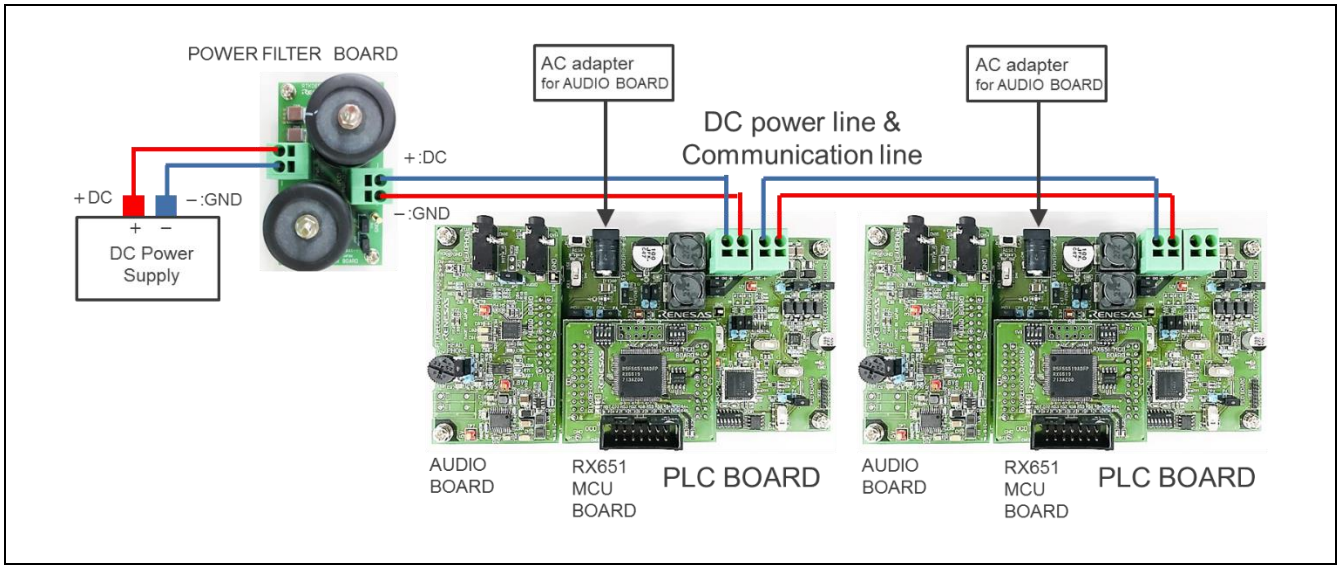

Figure 2-7 Condition 6 : PLC board + RX651 MCU board + Audio board

Connection example of DC power supply from the communication line and AC adaptor (3)

2.2.2 How to Select Drive System

The PLC board has two transmission output types; CPX3 direct drive (hereinafter referred to as CPX drive) and CPX3+PA drive (hereinafter referred to as PA drive). The PA is used for evaluation with many kits or longer communication range, with the output level 20dB larger than the CPX drive. Figure 2-8 shows the setting parts for selecting the drive system and Table 2-3 shows the setting condition.

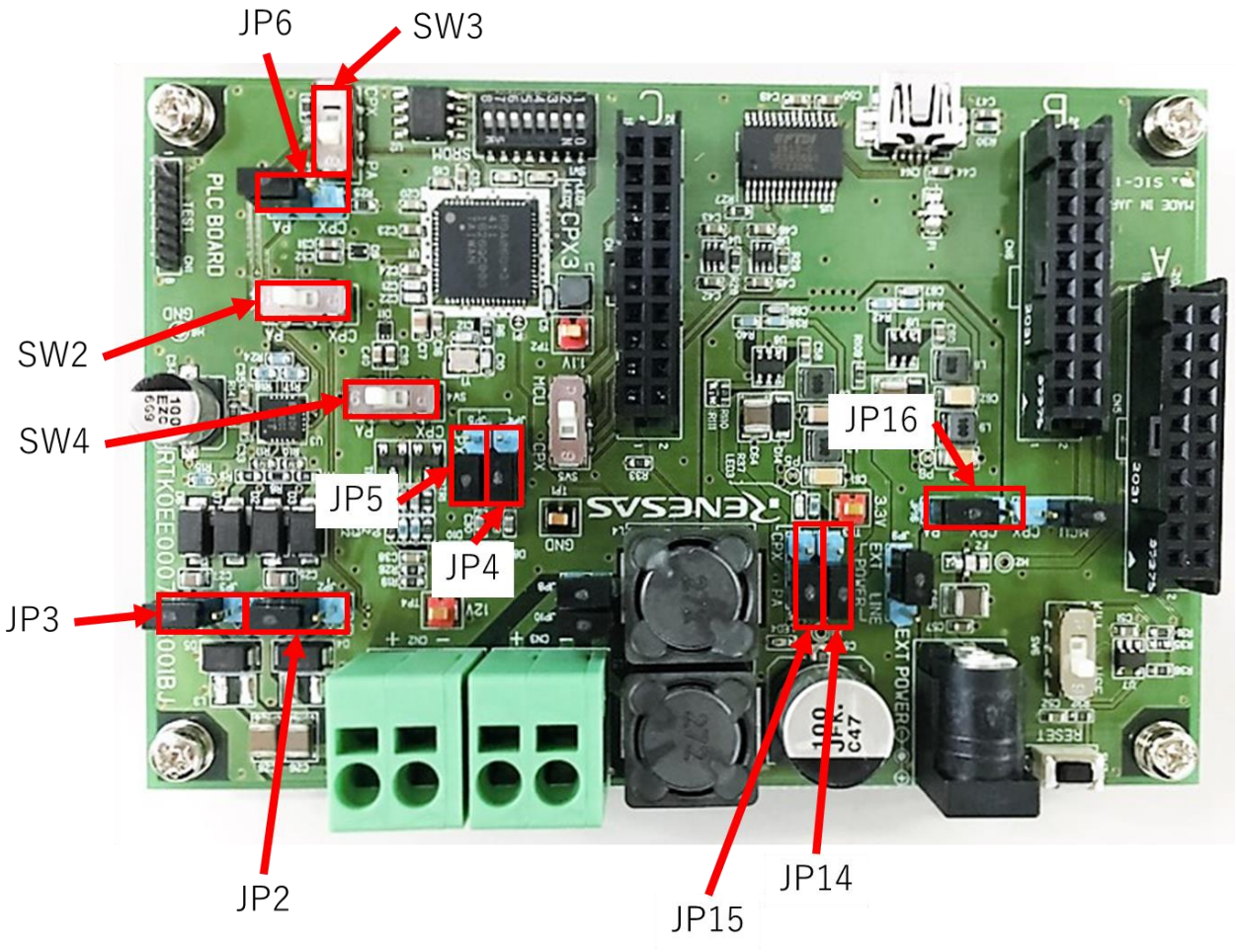

Figure 2-8 Setting parts for selecting drive system

Table 2-3 Drive system setting condition

Target connector/JP/SW	Setting Condition
SW2	PA：CPX3 output→PA→transmission output CPX：CPX3 output→transmission output
SW3	PA：Connect the TXENB/RXSATT signal to ISL15110 CPX：Specify TXENB=High / RXSATT=Low
SW4	PA：Reception input →RCV Amp→CPX3 input CPX：Reception input →CPX3 input
JP2, JP3	PA：Select CPX3 output CPX：Select PA output
JP4, JP5	PA：Reception input →RCV-Amp→Select CPX3 CPX：Reception input → Select CPX3
JP6	PA：Enable RCV amp CPX: Disable RCV amp
JP14, JP15, JP16	PA：Supply voltage →12V generation→3.3V generation CPX：Supply voltage →3.3V generation

2.2.3 DC PLC Communication Using SimpleMAC Function

Follow the instruction below for the evaluation environment setting.

1) Connect the USB cable to the USB port of the PC and the USB port(CN9) of the PLC board
2) Refer to Chapter 2.1.1 and feed the PLC board with the DC power supply. Make sure to connect the DC power supply and the PLC board correctly.
3) Turn on the DC power supply.
4) Confirm that LED1 on the PLC board lights up within 2 seconds after power supply
   If the LED had not lightened up, check the SROM SW state. Or press the Reset SW and see if it will recover.
5) For the communication method after starting-up SimpleMAC GUI on the PC, refer to SimpleMAC User's Manual. Also, refer to "Audio Solution User's Manual "for DC PLC communication with the Audio solution using the Audio board.

In addition, when you perform DC PLC communication using AUDIO board, please refer to Renesas PLC Voice Communicator Quick Start Guide.

2.3 Audio board Usage

2.3.1 Power Supply Setting

When using the Audio board, make sure to supply power from the AC adaptor. For power supply setting, refer to Chapter 2.1.1

2.3.2 How to Switch Audio I/O Destination

Set JP11/JP12 to the Audio side when using the Audio board. If it is set to the MCU side (1-2short), the Audio I/O cannot be performed properly. Figure 2-9 shows the setting parts, and Table 2-4 shows JP setting.

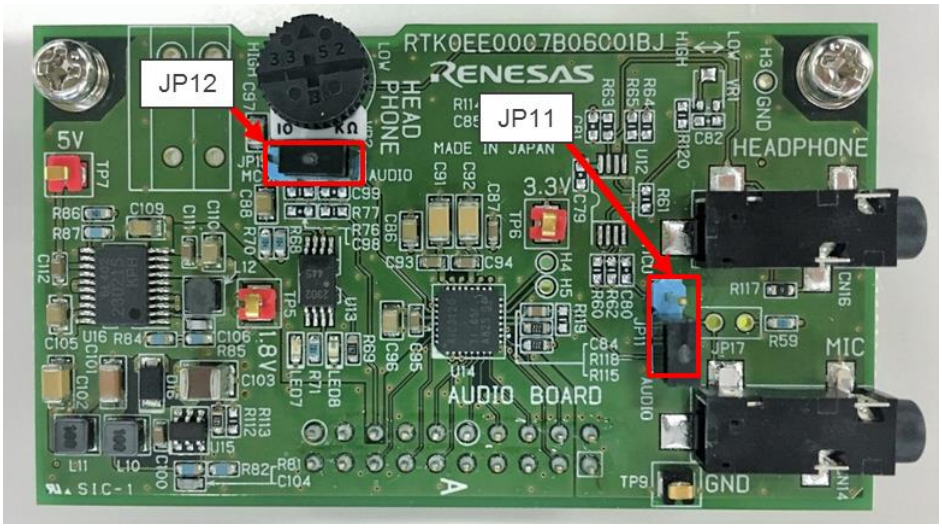

Figure 2-9 Audio board setting parts

Table 2-4 JP11, JP12 setting

Input	Setting
JP11	Microphone input on the Audio side (2-3short)
JP12	Audio output on the Audio side (2-3short)

2.3.3 Microphone Input Setting

Connect a microphone to CN14. This board is expected to be used with a dynamic microphone input. When using a condenser microphone, implement and short circuit JP17 before use.

2.3.4 Audio Output Setting

This board is expected to be used with the external Audio amp attached to the Audio output(CN16). Do not connect CN16 directly to a speaker. When the Audio output volume is too loud or too small, adjust it by turning the VR2 to the HIGH/LOW side to increase/decrease the volume.

3. Interface Specifications

This chapter explains the interface specifications of this product.

3.1 PLC Board

This chapter explains interface specifications for the PLC board.

3.1.1 LED (LED1, LED2, LED3, LED4)

The PLC board has the following LED modes to indicate the state.

- LED for PLC modem LSI signal：2 LEDs to indicate the PLC modem LSI state
  - LED1：Lights on during packet reception
  - LED2：Lights on during packet transmission
- LED on the power supply side：2 LEDs to indicate the power supply state
  - LED3：Lights on when feeding 3.3V power supply
  - LED4：Lights on when feeding 12V power supply

3.1.2 PLC Connector(CN2/CN3)

The PLC connector(CN2/CN3) is used to connect the communication power line and supply power to the board. This product uses XW4C-02E1-V1 (Omron) for the connector.

3.1.3 Power Supply Connector(CN8)

The power supply connector(CN8) is used for the external power supply, and connects the AC adaptor. It is also used when feeding from the PLC connector (communication line) with the Audio board. The connector used for this product is HEC0470-01-630 (Hosiden). The fit AC adaptor is outside diameterφ5.5mm, inside diameterφ2.1mm, center +, and output voltage 16V to 48V. 0.5A and more of output current is recommended when not using the Audio board, or 1A and more of output current when using the Audio board. In addition, the AC adaptor needs to be prepared by the user, as it is not included in the kit.

3.1.4 Power Supply Switching Jumper(JP9)

The power supply switching jumper (JP9) is used to select a power supply method.
Select either the PLC connector(CN2/CN3) or the power supply connector (CN8) for power supply.
Refer to Table 3-1 for the settings.

Table 3-1 Power supply switching jumper setting

Power supply method	Jumper setting	Description
PLC connector	1-2 short	Feed from the PLC connector (communication line)
Power supply connector	2-3 short	Feed from the power supply connector (external power supply)

3.1.5 Jumper/Switch for Selecting Drive System

Figure 3-1 shows parts used for switching drive system. You can change the drive system by selecting parts in a red square (□). The JP and SW should be set on the PA side for Power amp driving method, or set them on the CPX side for CPX3 direct drive.

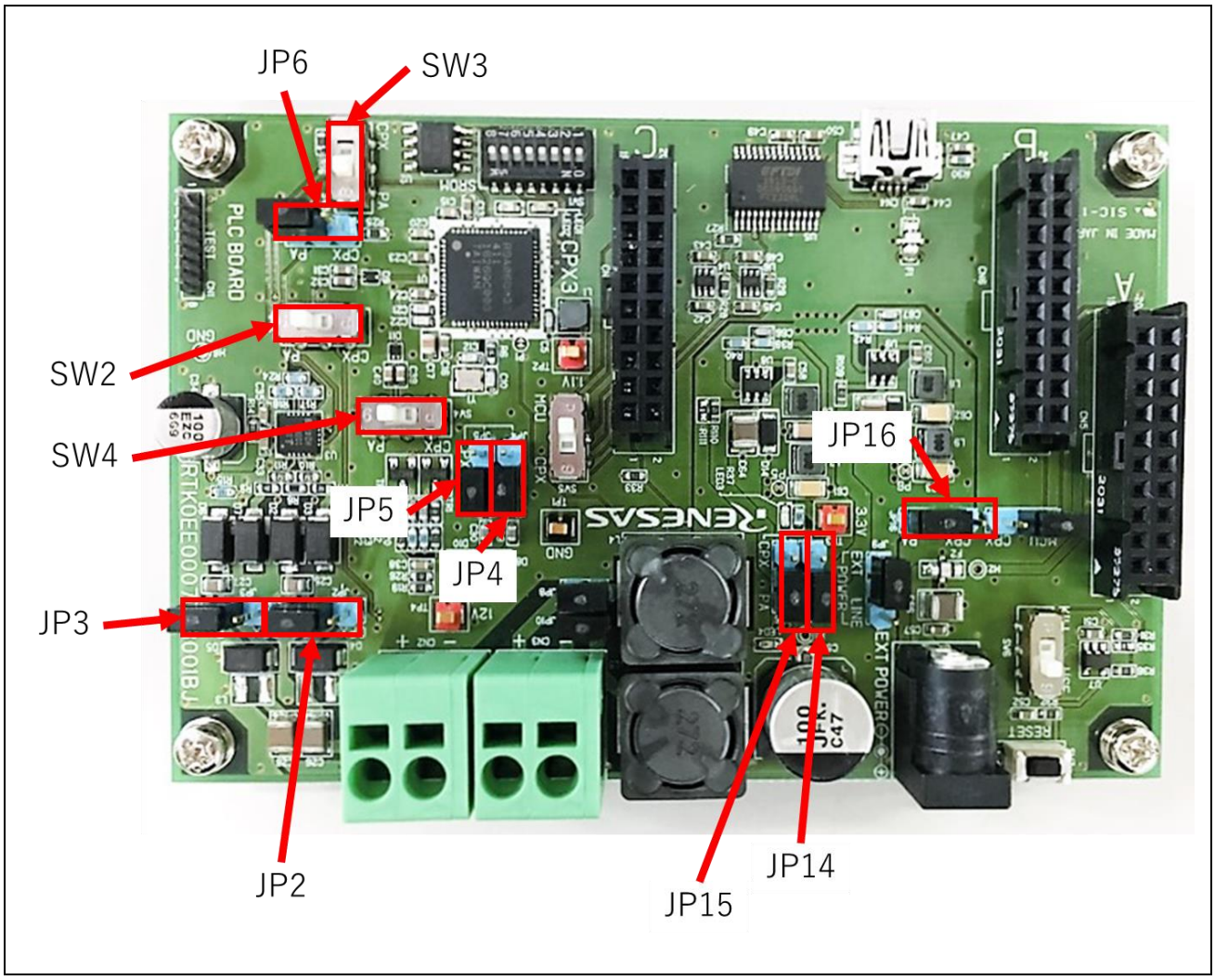

Figure 3-1 Parts used for switching drive system

3.1.6 Reset Switch(SW7)

The Reset Switch (SW7) is a button used for resetting the system. Press this switch (SW7) to initialize CPX3 and MCU(RX651).

3.1.7 Switch for Enabling/Disabling MCU(RX651) (SW6)

SW6 is a switch to enable/disable the CPX3 control of the RX651 MCU.
Table 3-2 shows the SW6 settings. Use the default setting for SimpleMAC.

Table 3-2 SW6 setting for enabling/disabling MCU (RX651)

MCU control	SW6 setting	Function
Reset state (Default setting)	KILL	MCU(RX651) in the reset statue CPX3 reset controlled by SW7
Operation state	USE	MCU(RX651) in the operation state CPX3 reset controlled by MCU (RX651)

3.1.8 DIP Switch for Boot Setting and SROM Connection (SW1)

The 4th SW of SW1 is used to switch UART/SROM boot. The 1st to 3rd and 5th to 8th of SW1 is connected to SROM. The SROM is used for SPOM boot of the CPX3. The SW1 is programmed with the SimpleMAC F/W by default and set to the SROM boot setting. When using UART boot, set all the DIP SW(SW1) to the OFF side. Table 3-3 shows the SW patterns.

Table 3-3 CPX3 boot setting

Boot mode	Setting
UART (connected to SROM terminal)	Turn OFF all the SWs.
UART (connected to SROM terminal)	Turn OFF the 4th, and turn ON all the other SWs. Use this setting for SROM programming via UART.
SROM	Turn ON all the SWs.

3.1.9 USB Connector(CN4) and Serial Communication Changeover Switch(SW5)

The evaluation boards are equipped with the USB connector (CN4), which enables serial communication with the MCU(RX651) or CPX3 via the FTDI virtual serial port (this connector is used to connect the board to a host PC). The connection destination can be selected by the serial communication switch(SW6).Table 3-4 shows the SW5 setting.

Connect to the MCU(RX651) or CPX3 with a USB cable. Select the USB serial port when using SimpleMAC.

For device driver available for USB-to-Serial, refer to the FTDI website;

Table 3-4 Serial communication changeover SW (SW5) setting

USB serial setting	Setting	Function
Connected to CPX3 serial port (default setting)	CPX	Connected to CPX
Connected to MCU(RX651) USB serial port	MCU	Connected to MCU(RX651)

3.1.10 MCU Board Connector

Table 3-5 and **Table 3-6** show the pin assignments of the MCU board.

Table 3-5 CN6 connector

PIN No.	Pin name	Function
1	GND	Connected to GND
2	AN000	Connected to CN5-2
3	SDA	Connected to CN5-3
4	SCL	Connected to CN5-4
5	GND	Connected to GND
6	MCLK	Connected to CN5-6
7	GND	Connected to GND
8	BCLK	Connected to CN5-8
9	GND	Connected to GND
10	WCLK	Connected to CN5-10
11	SDIN	Connected to CN5-11
12	SDOUT	Connected to CN5-12
13	GPIO	Connected to CN5-13
14	GND	Connected to GND
15	RST	Connected to CN5-15 and a pull-down register
16	PWM	Connected to JP7-1
17	RESOUT	Connected to CN17-10 and SW6-2
18	GND	Connected to GND
19	3.3V	3.3V power for MCU board power supply
20	3.3V	3.3V power for MCU board power supply

Table 3-6 CN7 connector

PIN No.	Pin name	Function
1	CPX3RESB	Connected to SW6 to 4 and a pull-down register
2	BOOT0	Connected to CPX3 - BOOT0 and SW1-13
3	UART0_RX	Connected to CPX3 - GPIO0 and SW5-1
4	UART0_TX	Connected to CPX3 - GPIO1 and SW5-4
5	GPIO2	Connected to CPX3 – GPIO2
6	GPIO3	Connected to CPX3 – GPIO3
7	GND	Connected to GND
8	GPIO4	Connected to CPX3 – GPIO4
9	GPIO5	Connected to CPX3 – GPIO5
10	GPIO6	Connected to CPX3 – GPIO6
11	GND	Connected to GND
12	GPIO7	Connected to CPX3 – GPIO7
13	GPIO8	Connected to CPX3 – GPIO8
14	GPIO9	Connected to CPX3 – GPIO9
15	GPIO12	Connected to CPX3 – GPIO12
16	RXD_MCU	Connected to SW5-3
17	TXD_MCU	Connected to SW5-6
18	GND	Connected to GND
19	3.3V	3.3V power for MCU board power supply
20	3.3V	3.3V power for MCU board power supply

3.1.11 Audio board Connector

Table 3-7 shows pin assignments of the Audio board.

Table 3-7 CN5 connector

PIN No.	Pin name	Function
1	GND	Connected to GND
2	AN000	Connected to CN6 - AN000
3	SDA	Connected to CN6 – SDA
4	SCL	Connected to CN6 – SCL
5	GND	Connected to GND
6	MCLK	Connected to CN6 – MCLK
7	GND	Connected to GND
8	BCLK	Connected to CN6 - BCLK
9	GND	Connected to GND
10	WCLK	Connected to CN6 - WCLK
11	SDIN	Connected to CN6 - SDIN
12	SDOUT	Connected to CN6 - SDOUT
13	GPIO	Connected to CN6 - GPIO
14	GND	Connected to GND
15	RST	Connected to CN6 – RST and a pull-down register
16	PWM	Connected to JP7- 2
17	RESETOUT	Connected to reset circuit
18	GND	Connected to GND
19	3.3VMAIN	Connected to PLC board 3.3V power supply
20	ADPIN	Connected to EXT power (external power)

3.2 RX651 MCU board

This chapter explains interface specifications for the RX651 MCU board.

3.2.1 General-purpose DIP SW for MCU (RX651) (SW8, SW9)

SW1 is a DIP switch to select the RX651 application. When it is ON, the RX651 signal level is LOW, or HIGH when it is OFF.

(Enable the RX651 on-chip pull-up function, as no pull-up resistance is mounted on the evaluation board)

3.2.2 EEPROM(M24C64)

EEPROM(M24C64-WMN6P) is required when developing RX651MCU application. EEPROM is connected to RX651MCU I2C and GPIO. Also, EEPROM terminal E0, E1 and E2 are connected to VCC. Refer to the M24C64-WMN6P datasheet for EEPROM usage in detail.

3.2.3 OCD connector(CN12)

The OCD connector(CN12) is used to connect the E1 emulator and the MCU(RX651) mounted on the RX651 MCU board. When connecting the development tool via the E1 emulator, set the target power supply to the user-specified setting, and feed the PLC board from the line or the external power supply. **Figure 3-2** shows the connection configuration with the E1 emulator, and **Table 3-8** shows the OCD connector (CN12) terminal information.

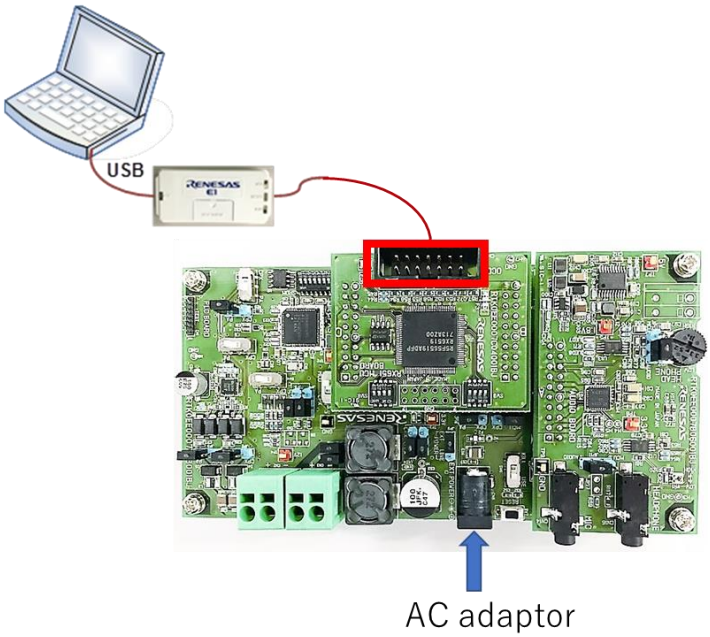

Figure 3-2 E1emulator - RX651 MCU board connection configuration

Table 3-8 OCD connector(CN12)

PIN No.	Pin name	Function
1	TCK	RX651-TCK
2	GND	GND
3	TRST	RX651-TRST
4	EMLE	RX651-EMLE
5	TDO	RX651-TDO
6	RFU	Open (not connected)
7	MD	RX651-MD
8	VDD	3.3V
9	TMS	RX651-TMS
10	UB	RX651-PC7
11	TDI	RX651-TDI
12	GND	GND
13	RES#	RX651-RES#
14	GND	GND

3.2.4 LED (LED5 / LED6)

LED5 and LED6 are LED use for RX651MCU application development.

3.2.5 Control MCU(RX651)

The RX651 MCU board is equipped with RX651 for PLC control. The following tables show the control MCU terminal connection information. For unused pin settings, set the ports to “Input” since the signals connected to CPX3 have the pin assignments on the CPX3. Also, use the MCU on-chip pull-up function to set other signal terminals.

Table 3-9 RX651 MCU connection table 1/2

PIN No.	Pin name of RX651		Connection	Notes (recommended setting when not in use)
1	AVCC1	-	3.3V	-
2	EMLE	-	CN11-4	-
3	AVSS1	-	GND	-
4	PJ3	I	-	Pull-up the on-chip resistor when not in use
5	VCL	-	Stabilized capacitor (0.22uF)	-
6	VBATT	-	3.3V	-
7	MD/FINED		CN11-7	-
8	XCIN		Pull-up resistance	-
9	XCOUT		-	-
10	RES#		CN12-13 and CN10-17	-
11	XTAL/P37		24MHz crystal resonator	-
12	VSS	-	GND	-
13	EXTAL/P36	-	24MHz crystal resonator	-
14	VCC	-	3.3V	-
15	P35/NMI	I	Pull-up resistance	Select the input port when not in use
16	TRST#/P34	I	CN12-3	Select the input port when not in use
17	P33	I	CN11-14	Pull-up the on-chip resistor when not in use
18	P32	I	CN11-13	Pull-up the on-chip resistor when not in use
19	TMS/P31	I	CN12-9	Select the input port when not in use
20	TDI/P30	I	CN12-11	Select the input port when not in use
21	TCK/FINECP27	I	CN12-1	Select the input port when not in use
22	TDO/P26	I	CN12-5	Select the input port when not in use
23	P25	I	CN10-15	Pull-up the on-chip resistor when not in use
24	P24	O	LED6	Pull-up the on-chip resistor when not in use
25	P23	O	LED5	Pull-up the on-chip resistor when not in use
26	P22	I	CN10-13	Pull-up the on-chip resistor when not in use
27	P21/RXD0	I	CN11-16	Pull-up the on-chip resistor when not in use
28	P20/TXD0	O	CN11-17	Pull-up the on-chip resistor when not in use
29	P17/SDA2	I/O	CN10-3	Select the input port when not in use
30	P16/SCL2	O	CN10-4	Pull-up the on-chip resistor when not in use
31	P15	I	-	Pull-up the on-chip resistor when not in use
32	P14	O	EEPROM-WC	Pull-up the on-chip resistor when not in use
33	P13/SDA0	I/O	EEPROM-SDA	Select the input port when not in use
34	P12/SCL0	O	EEPROM-SCL	Select the input port when not in use
35	VCC_USB	-	3.3V	-
36	USB0_DM	I/O	-	-
37	USB0_DP	I/O	-	-
38	VSS_USB	-	GND	-
39	P55	I	-	Pull-up the on-chip resistor when not in use
40	P54	I	-	Pull-up the on-chip resistor when not in use
41	P53	I	CN11-10	Pull-up the on-chip resistor when not in use
42	P52	I	CN11-8	Pull-up the on-chip resistor when not in use
43	P51	I	CN11-9	Pull-up the on-chip resistor when not in use
44	P50	I/O	CN11-6	Select the input port when not in use
45	PC7/UB	I	CN12-10	Select the input port when not in use
46	PC6	I/O	CN11-12	Select the input port when not in use
47	PC5	I/O	CN11-2	Select the input port when not in use
48	PC4	I/O	CN9-4	Pull-up the on-chip resistor when not in use
49	PC3	I/O	CN9-6	Pull-up the on-chip resistor when not in use
50	PC2	I/O	CN9-5	Pull-up the on-chip resistor when not in use

Table 3-10 RX651 MCU connection table 2/2

PIN No.	Pin name of RX651		Connection	Notes (recommended setting when not in use)
51	PC1	I/O	CN9-3	Pull-up the on-chip resistor when not in use
52	PC0	O	CN11-1	Select HIGH for output when not in use
53	PB7	O	CN11-3	Select the input port when not in use
54	PB6/	I/O	CN11-4	Select the input port when not in use
55	PB5	I	CN11-5-	Pull-up the on-chip resistor when not in use
56	PB4	I	CN11-15	Pull-up the on-chip resistor when not in use
57	PB3	I	SW8-4	Pull-up the on-chip resistor when not in use
58	PB2	I/O	SW8-3	Pull-up the on-chip resistor when not in use
59	PB1	I/O	SW8-2	Pull-up the on-chip resistor when not in use
60	VCC	-	3.3V	-
61	PB0	I/O	SW8-1	Pull-up the on-chip resistor when not in use
62	VSS	-	GND	-
63	PA7	I/O	CN9-8	Select the input port when not in use
64	PA6	I/O	CN9-9	Select the input port when not in use
65	PA5	O	CN9-10	Select the input port when not in use
66	PA4	I/O	CN9-7	Select the input port when not in use
67	PA3	I/O	CN9-2	Pull-up the on-chip resistor when not in use
68	PA2	I	RX651-82	Pull-up the on-chip resistor when not in use
69	PA1	O	CN10-16	Pull-up the on-chip resistor when not in use
70	PA0	I	CN9-1	Pull-up the on-chip resistor when not in use
71	PE7	I	CN10-6	Pull-up the on-chip resistor when not in use
72	PE6	I	-	Pull-up the on-chip resistor when not in use
73	PE5	I	-	Pull-up the on-chip resistor when not in use
74	PE4	I	CN10-8, RX651-83	Pull-up the on-chip resistor when not in use
75	PE3	I	-	Pull-up the on-chip resistor when not in use
76	PE2	I	CN10-10	Pull-up the on-chip resistor when not in use
77	PE1	I	-	Pull-up the on-chip resistor when not in use
78	PE0	I	-	Pull-up the on-chip resistor when not in use
79	PD7	I	-	Pull-up the on-chip resistor when not in use
80	PD6	I	-	Pull-up the on-chip resistor when not in use
81	PD5	I/O	-	Pull-up the on-chip resistor when not in use
82	PD4	I	RX651-68	Pull-up the on-chip resistor when not in use
83	PD3/IRQ3	I/O	CN10-8, RX651-74	Pull-up the on-chip resistor when not in use
84	PD2	I/O	CN10-11	Pull-up the on-chip resistor when not in use
85	PD1	I/O	CN10-12	Pull-up the on-chip resistor when not in use
86	PD0	I/O	CN10-2	Pull-up the on-chip resistor when not in use
87	P47	I	-	Pull-up the on-chip resistor when not in use
88	P46	I	-	Pull-up the on-chip resistor when not in use
89	P45	I	-	Pull-up the on-chip resistor when not in use
90	P44	I	-	Pull-up the on-chip resistor when not in use
91	P43	I	SW9-4	Pull-up the on-chip resistor when not in use
92	P42	I	SW9-3	Pull-up the on-chip resistor when not in use
93	P41	I	SW9-2	Pull-up the on-chip resistor when not in use
94	VREFL0	-	GND	-
95	P40	I	SW9-1	Pull-up the on-chip resistor when not in use
96	VREFH0	-	3.3V	-
97	AVCC0	-	3.3V	-
98	P07	I	-	Pull-up the on-chip resistor when not in use
99	AVSS0	-	GND	
100	P05	I	-	Pull-up the on-chip resistor when not in use

3.2.6 PLC board connector (CN10 / CN11)

Table 3-11 and **Table 3-12** show pin assignments of the RX651 MCU board and the PLC board.

Table 3-11 CN10 connector

PIN No.	Pin name	Function
1	GND	Connected to GND
2	AN000	Connected to RX651 - PD0/AN108
3	SDA	Connected to RX651 - P17/SDA2
4	SCL	Connected to RX651 - P16/SCL2
5	GND	Connected to GND
6	MCLK	Connected to RX651 - PE7/MTIOC6A
7	GND	Connected to GND
8	BCLK	Connected to RX651 - PE4/MTIOC1A
9	GND	Connected to GND
10	WCLK	Connected to RX651 - PE2/MTIOC4A
11	SDIN	Connected to RX651 - PD2/MISOC
12	SDOUT	Connected to RX651 - PD1/MOSIC
13	GPIO	Connected to RX651 - P22
14	GND	Connected to GND
15	RST	Connected to RX651 - P25
16	PWM	Connected to RX651 - PA1/MTIOC0B
17	RESOUT	Connected to RX651 - RES#
18	GND	Connected to GND
19	3.3V	3.3V power supply into MCU board
20	3.3V	3.3V power supply into MCU board

Table 3-12 CN11 connector

PIN No.	Pin name	Function
1	CPX3RESB	Connected to RX651 – PC0
2	BOOT0	Connected to RX651 - PC5
3	UART0_RX	Connected to RX651 - PB7/TXD9/TXD11
4	UART0_TX	Connected to RX651 - PB6/RXD9/RXD11
5	GPIO2	Connected to RX651 - PB5/SCK11
6	GPIO3	Connected to RX651 - P50/TXD2
7	GND	Connected to GND
8	GPIO4	Connected to RX651 - P52/RXD2
9	GPIO5	Connected to RX651 - P51/SCK2
10	GPIO6	Connected to RX651 - BCLK/P53
11	GND	Connected to GND
12	GPIO7	Connected to RX651 - PC6
13	GPIO8	Connected to RX651 - P32/TXD6
14	GPIO9	Connected to RX651 - P33/RXD6
15	GPIO12	Connected to RX651 - PB4
16	RXD_MCU	Connected to RX651 - P21/RXD0
17	TXD_MCU	Connected to RX651 - P20/TXD0
18	GND	Connected to GND
19	3.3V	3.3V power supply into MCU board
20	3.3V	3.3V power supply into MCU board

3.2.7 Expansion Terminal(CN9)

Table 3-13 shows the expansion terminal connection.

Table 3-13 CN9 connector

PIN No.	Pin name	Function
1	PA0_MCU	GPIO
2	PA3_MCU	GPIO
3	PORT_MCU	GPIO
4	S_SCK_MCU	SCI5-SCK
5	SI_MCU	SCI5-RXD
6	SO_MCU	SCI5-TXD
7	SROM_CSB_MCU	RSPI0-SSLA0
8	SROM_MISO_MCU	RSPI0-MISO
9	SROM_MOSI_MCU	RSPI0-MOSI
10	S_SROM_CLK_MCU	RSPI0-CLK
11	3.3VX	3.3V
12	GND_RX	GND

3.3 Audio board

This chapter explains interface specifications for the Audio board.

3.3.1 LED (LED7 / LED8)

The LED (LED7 / LED8) is an indicator LED used for checking the Audio output level. The LED7(Green) lights up for the output voltage more than 2.0V, and the LED8 (Red) lights up for more than 2.6V.

3.3.2 Microphone Input(CN14)

The microphone input (CN14) is a connector used for microphone connection, designed for a dynamic microphone. When using a condenser microphone, implement and short circuit JP17.

3.3.3 Audio Output (CN16)

The Audio output (CN16) is a connector used for outputting Audio signals. This product is designed to be used with an external Audio amp connection, so do not connect a speaker directly into the output terminal. Note that this product does not contain LPF (Low Pass Filter), and it may fail to cut noises on the high frequency side depending on customer applications. In that case, prepare the external LPF.

3.3.4 Output Level Adjustment Volume(VR2)

The output level adjustment volume(VR2) is a volume used for adjusting the Audio level. Turn it to the HIGH/LOW side to increase/decrease the output level.

3.3.5 Audio Output Switching Jumper (JP12)

The Audio output switching jumper (JP12) can only be set to the Audio IC output(JP12：2-3short). No Audio signal will be released when it is set to JP12：1-2short setting. **Table 3-14** shows the setting.

Table 3-14 Audio output changeover setting

Output source		Setting	Function
Audio IC		JP12：2-3short	Select Audio IC output
Invalid setting		JP12：1-2short	None

3.3.6 Microphone Input Switching Jumper (JP11)

The microphone input switching jumper (JP11) can only be set to the Audio IC input(JP11：2-3short). No microphone signal will be released when it is set to JP11：1-2 short. **Table 3-15** shows the setting.

Table 3-15 Microphone input changeover

Input destination	Setting	Function
Audio IC	JP11：2-3short	Select Audio IC input
Invalid setting	JP11：1-2 short	None

3.3.7 Jumper for Condenser Microphone(JP17)

Implement and short circuit the JP for condenser microphone(JP17) only when using a condenser microphone.

3.3.8 PLC Board Connector(CN13)

Table 3-16 shows the pin assignments of the Audio board and the PLC board.

Table 3-16 CN13 connector

PIN No.	Pin name	Function
1	GND	Connected to GND
2	AN000	Connected to Microphone input
3	SDA	Connected to AUDIO IC - SDA
4	SCL	Connected to AUDIO IC - SCL
5	GND	Connected to GND
6	MCLK	Connected to AUDIO IC - MCLK
7	GND	Connected to GND
8	BCLK	Connected to AUDIO IC - BCLK
9	GND	Connected to GND
10	WCLK	Connected to AUDIO IC - WCLK
11	SDIN	Connected to AUDIO IC - DIN
12	SDOUT	Connected to AUDIO IC - DOUT
13	GPIO	Connected to AUDIO IC - GPIO
14	GND	Connected to GND
15	RST	Connected to AUDIO IC - RESET
16	PWM	Connected to Audio output
17	RESETOUT	Connected to Audio board power ON reset signal
18	GND	Connected to GND
19	3.3VMAIN	PLC board 3.3V power supply
20	ADPIN	Connected to

3.4 Power filter board

This chapter explains interface specifications for the Power filter board.

3.4.1 Power Supply Connector (CN21: Silk Display PWR_IN)

Connect the power supply connector (CN21) on the power supply side.

3.4.2 Communication Line Connector (CN20: Silk Display PWR_OUT(PLC))

Connect the communication connector (CN20) on the communication line (DC PLC evaluation kit connection)

3.4.3 Power Supply Mode Setting Jumper (JP1/JP13)

The power supply mode setting jumper (JP1/JP13) is used to select the power supply filter mode. The JP1 is used to select whether to insert or not insert a power supply filter on the power supply line (-). The JP131 is used to select whether to insert or not insert an inductor on the power supply line (-). Table 3-17 shows how to select the settings.

3.4.4 GND Pin TP(TP8)

When feeding DC voltage to both (+) and (-) sides of the power supply line, make sure to connect the GND Pin TP8 to the GND of the power source.

Table 3-17 JP Setting for power supply

Output source	Setting	Function
DC voltage connected to the power supply line (+), GND connected to the power supply line (-)	JP1：Short JP13：Short TP8：Open	Insert a power supply filter on the power supply line side (+) only
DC voltage 1 connected to on the power supply line (+), and DC voltage 2 connected to power supply line (-)	JP1：Open JP13：Open TP8：Connected to GND	Insert a power supply filter on power supply line (+) and (-) sides.

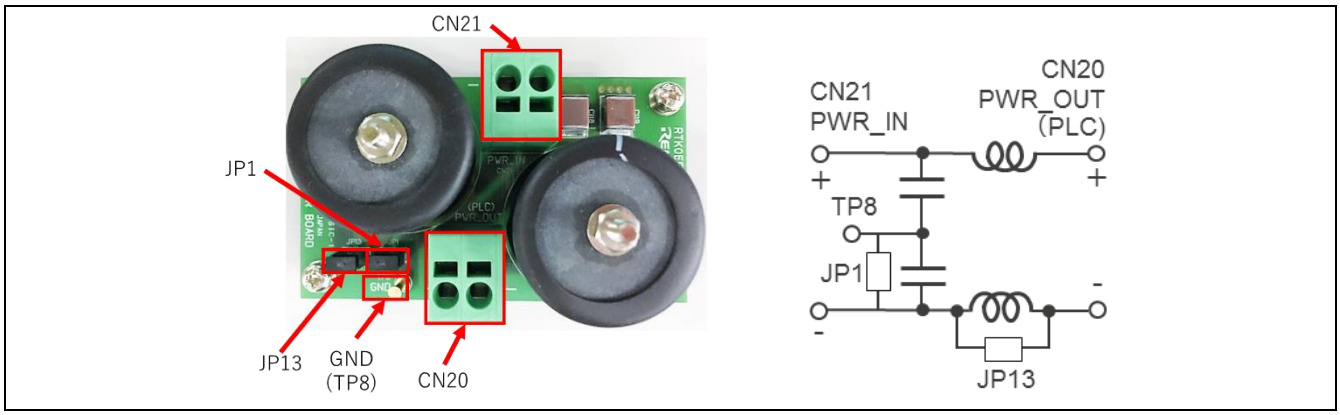

Figure 3-3 Connector, JP and TP for Power filter board

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