Precautions

Before using the product, you shall agree the conditions below.

The Functional Safety Reference Board for industries (RTK0EF0058D02001BJ) is to be used to have consideration of conforming to functional safety and evaluation of initial performance for industrial equipment by RX72N MCU of Renesas. The board is not for embedding or including to product machines. Please do not use for other than the original purpose.

The specifications and information of the board are not to guarantee acquisition of functional safety certification. This board includes added redundant functions or non-compliant components with functional safety such as jumpers, to have previous consideration and evaluation of functional safety.

Power-supplies are not included to the product. Please prepare your own.

CE mark of the board is of EMC directive [2014/30/EU] and applied standards are [EN 55032: 2012/AC:2013] and [EN 55035: 2017]. The cable(s) that connect to the connector must be shorter than three meters to conform the standards.
The board is a product of (class A [EN 55032: 2012/AC:2013]). If it is used in a residential district, radio wave interference such as radio frequency noise may occur. The responsibility is required that using the product properly and safely with the provisions under the law of the country and region you live in.

Unlike general equipment, a casing for protection of product safety is not included since the board is developed for engineering. When using the board, be prepared with measures for electrostatic and so on, and do not touch the connectors nor devices with a bare hand. The users must be limited to those who have an intimate knowledge of the risks of operating equipment.

Renesas Electronics Corporation assumes no liability for any result of using the product.

The information in this document is as of time of the issue, and may subject to change without notice.

Contents

1. Introduction

1.1 Packaged Items

Ensure that all the items are packaged as shown in Figure 1.1.1. In case any of the items is missed, please contact the distributer you purchased from.

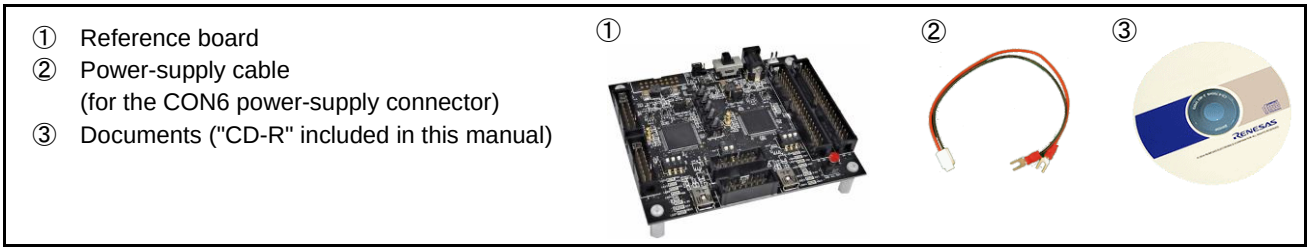

Figure 1.1.1 Packaged Items

1.2 Power-supplies

Power-supplies are not included to the product. Please prepare your own. Note that although filters for the power-supply lines are equipped on the board, noise of power-supply source may propagate to the MCU power-supply part. Figure 1.2.1 shows the specifications of the power-supply connectors and a switch.

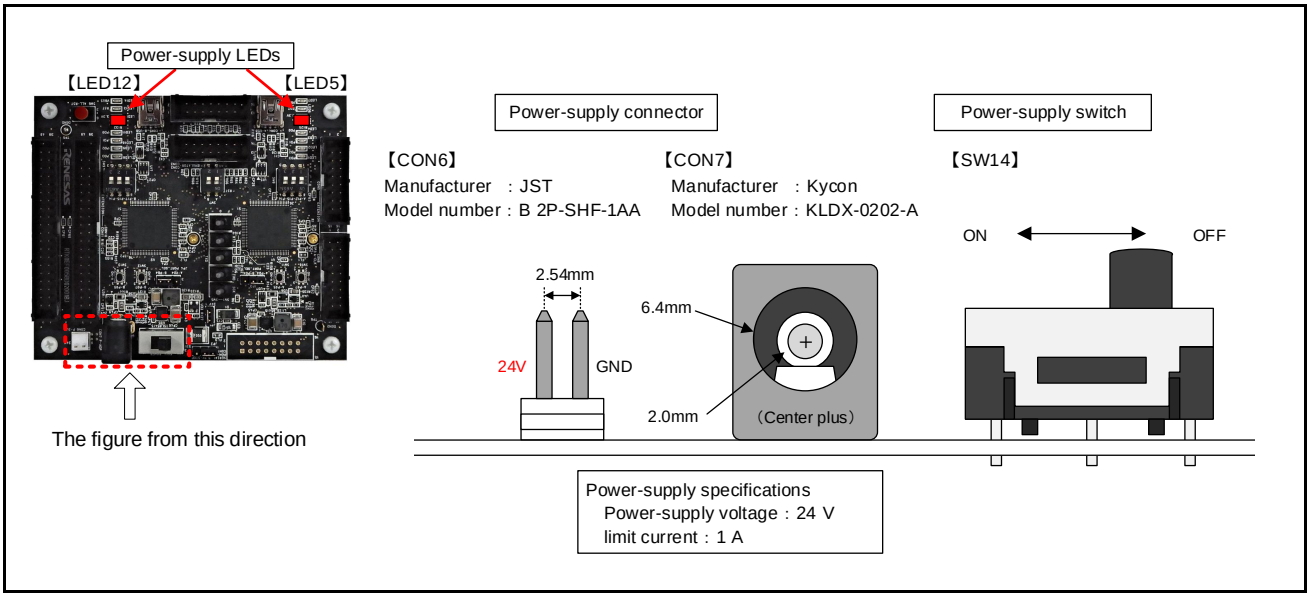

Figure 1.2.1 Power-supply Connectors and Switch

[Power-supply Procedure]

- Set the power-supply switch (SW14) to OFF.
- Turn on power to the power-supply connector (CON6 or CON7). *1
- Set the power-supply switch (SW14) to ON.
- Ensure that the power-supply LEDs (LED5 and LED12) light up. *2

*1 : Connect only one of CON6 and CON7 to avoid short circuit of the power-supply.

*2 : If either of the power-supply LEDs does not light up, immediately turn off the power-supply.

2. Reference Board Overview

The Functional Safety Reference Board for industries (RTK0EF0058D02001BJ) is to be used to have consideration of conforming to functional safety and evaluation of initial performance for industrial equipment by RX72N MCU of Renesas. Connecting system compatible extension boards to the board enables easy configuration and evaluation of functional safety system.

2.1 Features

The features of the board are as follows:

- Two units of the RX72N MCUs (100-pin LQFP) from Renesas for functional safety control, which realize the structure of HFT (Hardware Fault Tolerance) = 1.
- ICE (E2 emulator Lite of Renesas) connectors for connection are mounted to respond software development.
- LEDs for status display are mounted (power-supply LED, reset LED, and general LED for software control).
- All the power-supplies are generated by 24V power-supply source on the assumption for industrial equipment.
- The connectors are mounted to connect general network communication boards.
- The connectors are mounted to connect extended boards applicable to target systems such as remote IO, and motor systems.

2.2 Appearance

Figure 2.2.1 shows the appearance of the board.

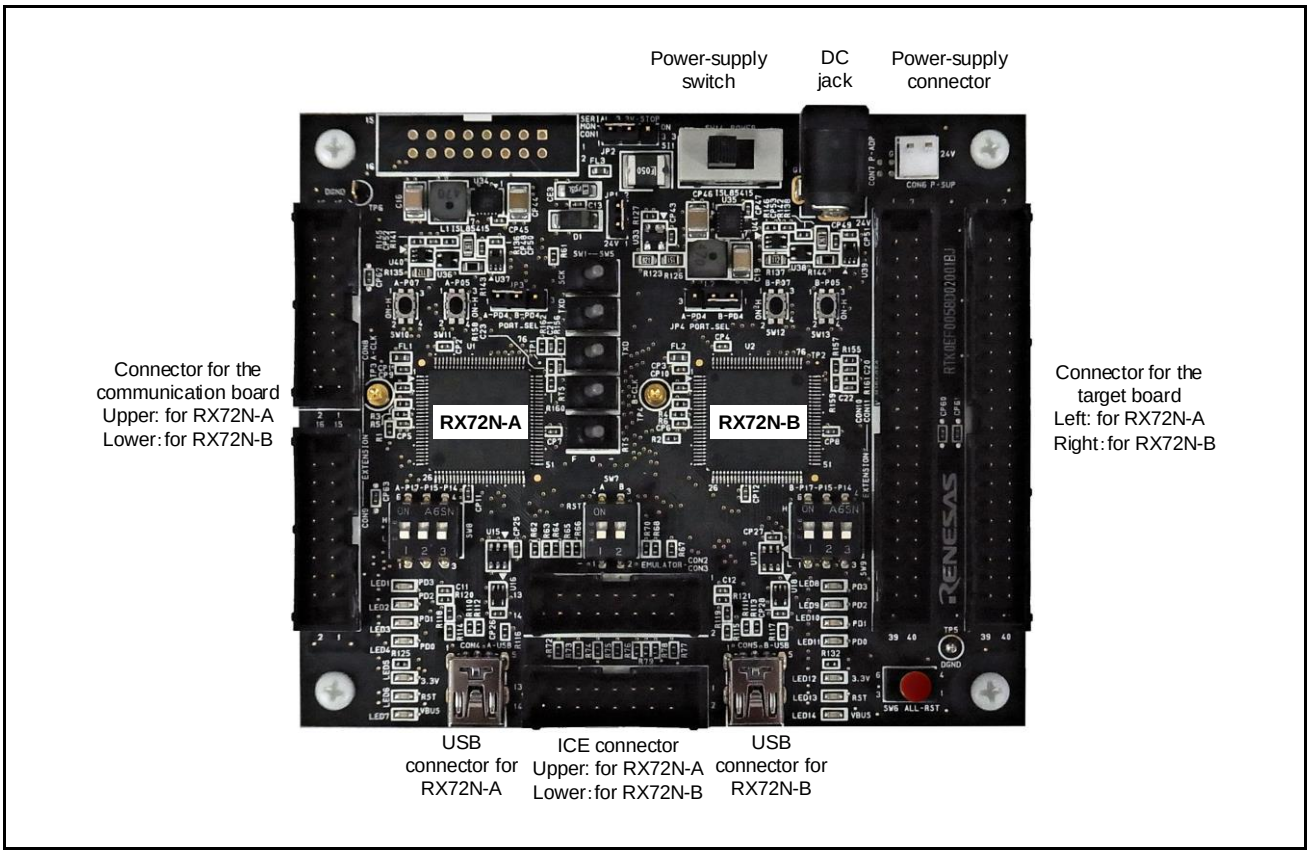

Figure 2.2.1 Appearance of Functional Safety Reference Board (upper surface of C)

2.3 Example Component of Use

Figure 2.3.1 shows an example use of the board as a single unit.

- Each of the two RX72N MCUs has an ICE connector.
- "Independent reset" and "common reset" are possible for the two RX72N MCUs by the reset switches on the board.
- It is incapable of turning on and off of the power-supply of two RX72N MCUs separately. If you want to turn off one of the two, use independent reset to set it in continuous reset state.

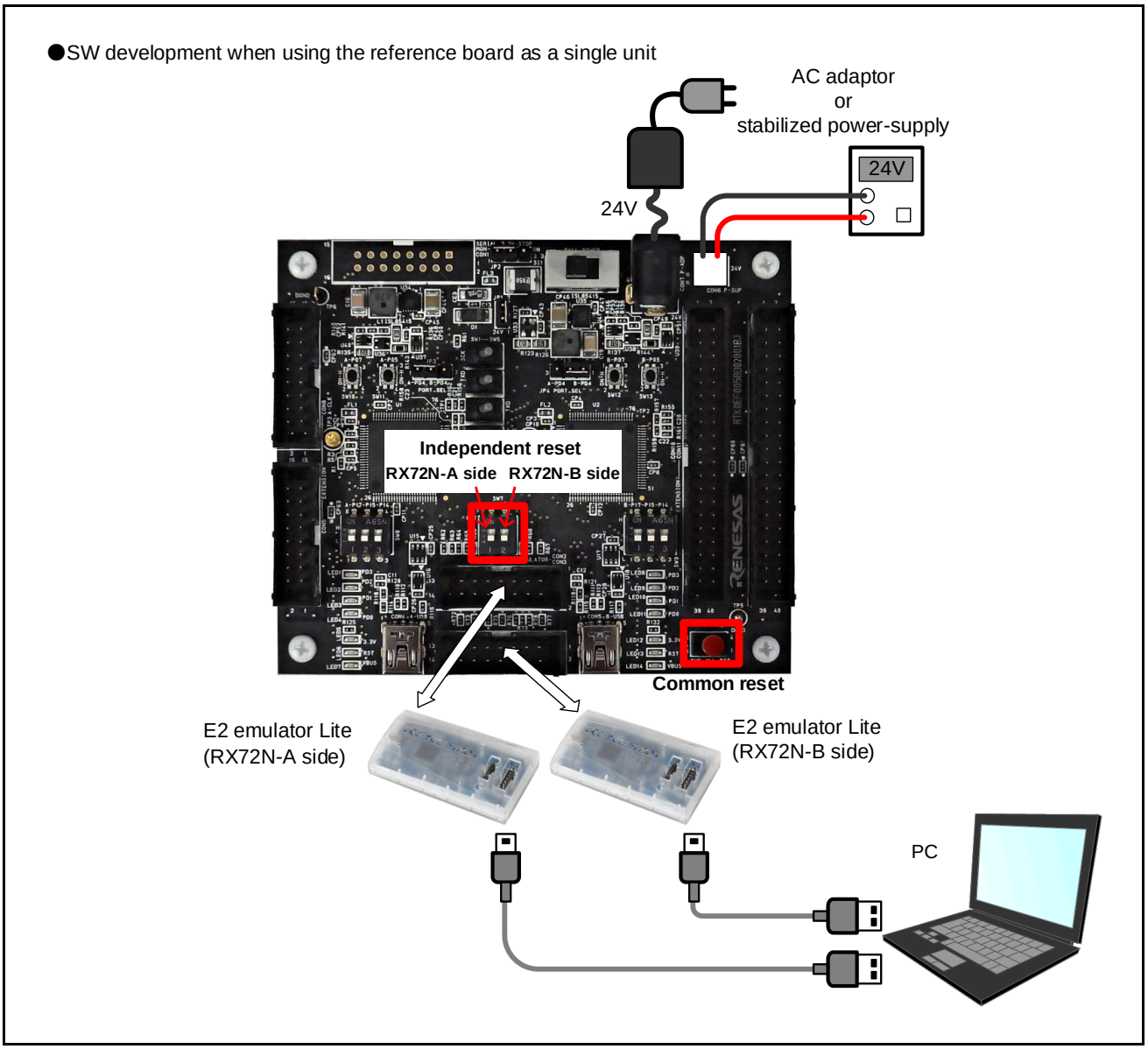

Figure 2.3.1 Example Use 1 of Functional Safety Reference Board (single unit use)

Figure 2.3.2 shows an example component conforming to safety network.

Pins of serial communication, external interruption, general port, for each RX72N MCU, power-supply and ground are allocated to the connectors for the communication board. Connect necessary signal(s) for communication with the network communication board.

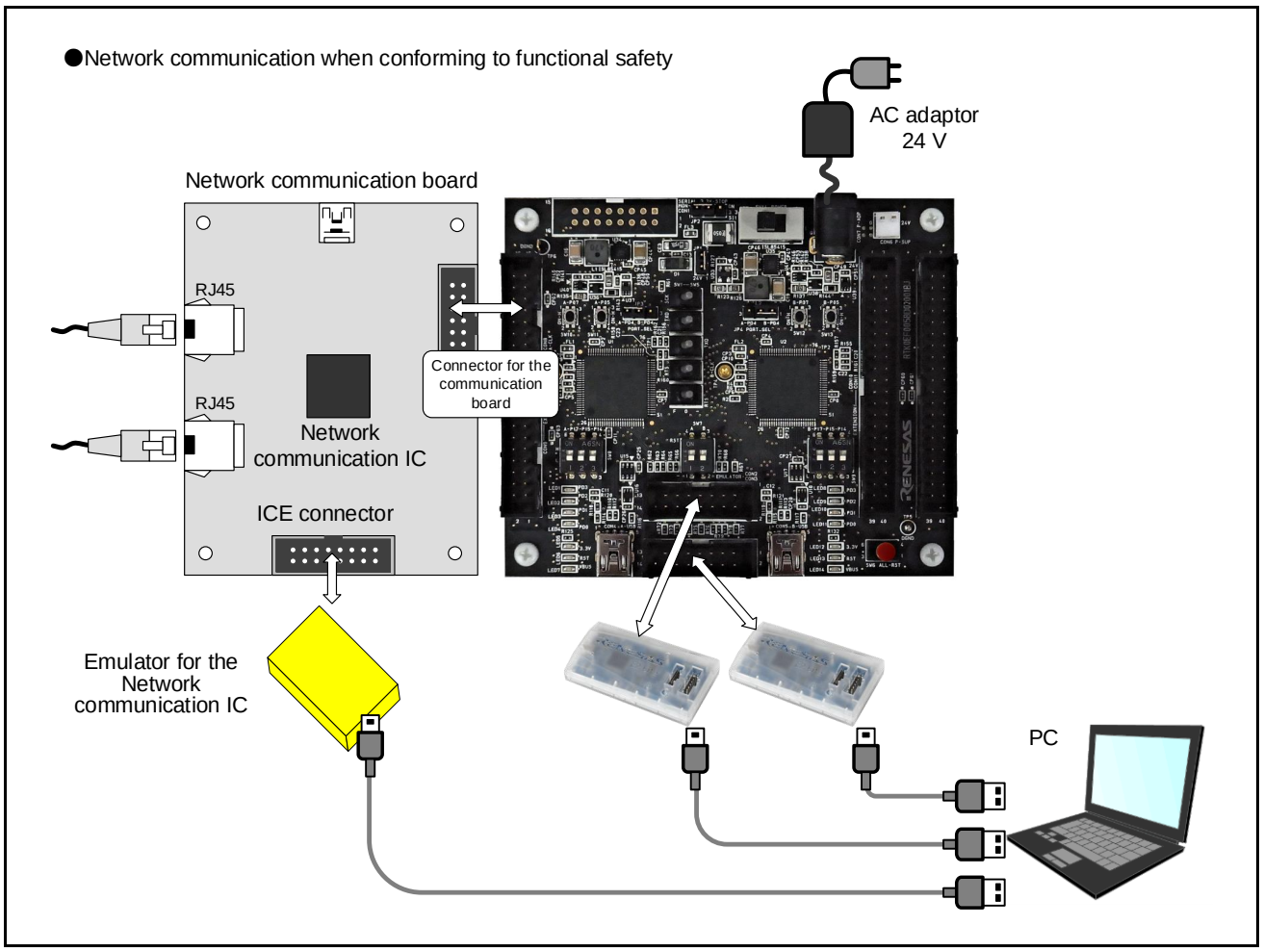

Figure 2.3.2 Example Use 2 of Functional Safety Reference Board (conforming to safety network)

Figure 2.3.3 shows an example component conforming to safety drive.

Pins of serial communication, external interruption, and general port of each RX72N MCU, timer pins for external pulse monitoring, power-supply and ground pins are allocated to connectors for the target board. Connect necessary signal(s) for communication and control of the target board.

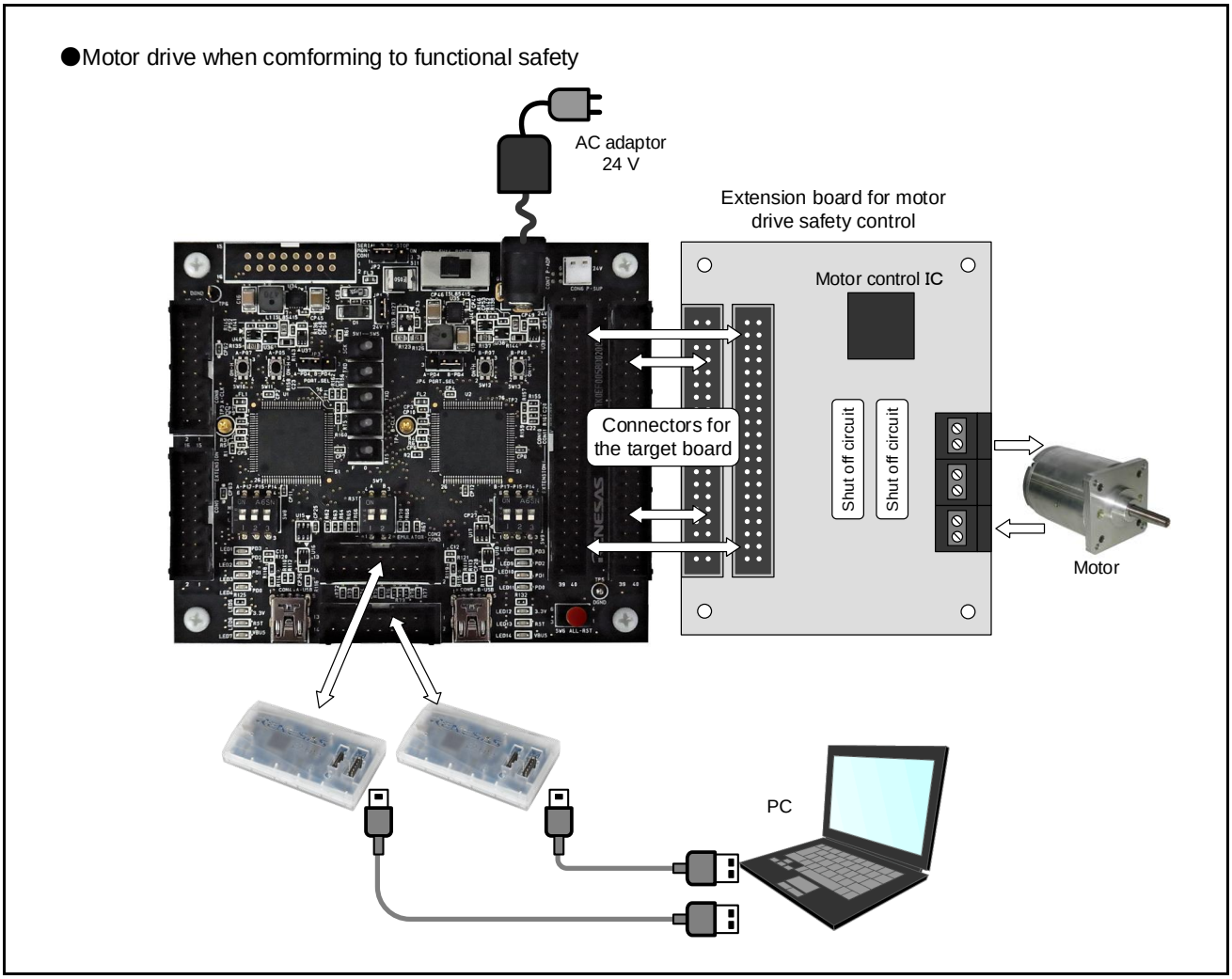

Figure 2.3.3 Example Use 3 of Functional Safety Reference Board (conforming to safety drive)

2.4 Reference Board Specifications

Table 2.4.1 to Table 2.4.3 list the specifications of the board.

Table 2.4.1 Specifications of Functional Safety Reference Board (1 of 3)

Function	Description
MCU	[RX72N] of Renesas are two mounted ●Mounted model name : R5F572NNDDFP (cryptographic module not included) ●Maximum operating frequency of CPU : 240 MHz (using internal oscillator) ●LFQFP package of 100 pins (14×14 mm) ●Mounted memory capacity : Internal flash ROM 4 M bytes Internal RAM 1 M bytes E2 data flash 32 K bytes

Table 2.4.2 Specifications of Functional Safety Reference Board (2 of 3)

Function	Description
Power-supply and use environment	Power-supply voltage: typ 24 V (recommended voltage range 22 V to 26 V) Power-supply current: max 1.0 A Supply method: selecting from DC jack or power-supply connector
	● Two source systems of 3.3 V power-supply for MCUs and peripheral circuits are generated from the board power-supply 24 V. ● It is possible to automatically shut off the power-supply for MCUs when the board power-supply source voltage declines less than 21 V.
	Operating temperature: 0-50℃
Power-supply for MCU and peripheral circuit	Standard voltage: typ 3.3 V
	● Two source systems of 3.3 V power-supply for RX72N MCUs and peripheral circuits are generated on the regulator [ISL85415] of Renesas. ● It is possible to check 3.3 V power-supply voltage value by the external power-supply monitoring IC and AD converter of RX72N MCU. The circuit is mounted to modify the judgement voltage value of external power-supply monitoring IC.
External memory (EEPROM)	[BR24T128FVJ-W] of ROHM is connected to each RX72N MCU
	●Capacity: 128 K bits ●TSSOP-B8J package of 8 pins (3.0×4.9 mm)
USB connector	The mini B type connectors are mounted to communicate with PCs by using the internal USB module of each RX72N MCU.
Emulator connection *1	The connectors are mounted to connect E2 emulator Lite of Renesas. The communication method is JTAG connection.
Connector for communication board	16-pin connectors are connected to the pins of serials, port and external interruption of each RX72N MCU. The connection to a network communication board is assumed.
Connector for target board	40-pin connectors are connected to the pins of serials, port and external interruption of each RX72N MCU. The connection to drive control board is assumed.
Switch	Six types of switches are mounted as follows : ● Power-supply ON and OFF : Turns on and off of the power-supply from the DC jack and power-supply connector. ● Common reset : Resets the two RX72N MCUs at the same time. ● Independent reset : Resets the single RX72N MCU retaining the reset status. ● General (push type) : Connects to the pin of the RX72N MCU generic port (external interruption). ● General (slide type) : Connects to the pin of the RX72N MCU generic port (external interruption). ● Evaluation of signal fixing : Tests the communication pins between RX72N MCUs.

*1 : This board does not support Renesas Flash Programmer(programming tool the on-chip flash memory of Renesas microcontrollers).

Table 2.4.3 Specifications of Functional Safety Reference Board (3 of 3)

Function	Description
LED	Five types of LEDs are mounted as follows : ● (Red) 3.3 V power-supply : Lights up when 3.3 V power-supply for RX72N MCU is turned on. ● (Red) USB-VBUS : Lights up when 5 V power-supply for USB-VBUS pin is turned on. ● (Yellow) reset : Lights up when reset signal is effective for the RX72N MCU. ● (Green) general [3] : Lights up by port control of RX72N MCU. ● (Orange) general [1] : Lights up by port control of RX72N MCU.
Jumper	Three types of jumpers are mounted as follows : ● Measurement of 24 V power-supply current : For connection with current measurement equipment of 24V power-supply. ● 3.3 V auto-off function selecting : Selects effective or non-effective of the turning off function of 3.3 V output when 24 V power-supply voltage declines. ● Test port selecting : Selects switching port number for judgement voltage value of external power-supply monitoring IC.
Others	● Test pins for the supply of external clock are mounted on each of the two RX72N MCUs. ● The connector is prepared for monitoring connection pins between RX72N MCUs.

3. Revision History

Revision history	Functional Safety Reference Board Product Overview

Rev.	Date	Revision content	
		Page	point
1.00	Nov. 10, 2020	–	First edition issued

The WEEE (Waste Electrical and Electronic Equipment) regulations put responsibilities on producers for the collection and recycling or disposal of electrical and electronic waste. Return of WEEE under these regulations is applicable in the European Union only. This equipment (including all accessories) is not intended for household use. After use the equipment cannot be disposed of as household waste, and the WEEE must be treated, recycled and disposed of in an environmentally sound manner.

Renesas Electronics Europe GmbH can take back end of life equipment, register for this service at ‘http://www.renesas.eu/weee‘.

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

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

1. Precaution against Electrostatic Discharge (ESD)
   A strong electrical field, when exposed to a CMOS device, can cause destruction of the gate oxide and ultimately degrade the device operation. Steps must be taken to stop the generation of static electricity as much as possible, and quickly dissipate it when it occurs. Environmental control must be adequate. When it is dry, a humidifier should be used. This is recommended to avoid using insulators that can easily build up static electricity. Semiconductor devices must be stored and transported in an anti-static container, static shielding bag or conductive material. All test and measurement tools including work benches and floors must be grounded. The operator must also be grounded using a wrist strap. Semiconductor devices must not be touched with bare hands. Similar precautions must be taken for printed circuit boards with mounted semiconductor devices.
2. Processing at power-on
   The state of the product is undefined at the time when power is supplied. The states of internal circuits in the LSI are indeterminate and the states of register settings and pins are undefined at the time when power is supplied. In a finished product where the reset signal is applied to the external reset pin, the states of pins are not guaranteed from the time when power is supplied until the reset process is completed. In a similar way, the states of pins in a product that is reset by an on-chip power-on reset function are not guaranteed from the time when power is supplied until the power reaches the level at which resetting is specified.
3. Input of signal during power-off state
   Do not input signals or an I/O pull-up power supply while the device is powered off. The current injection that results from input of such a signal or I/O pull-up power supply may cause malfunction and the abnormal current that passes in the device at this time may cause degradation of internal elements. Follow the guideline for input signal during power-off state as described in your product documentation.
4. Handling of unused pins
   Handle unused pins in accordance with the directions given under handling of unused pins in the manual. The input pins of CMOS products are generally in the high-impedance state. In operation with an unused pin in the open-circuit state, extra electromagnetic noise is induced in the vicinity of the LSI, an associated shoot-through current flows internally, and malfunctions occur due to the false recognition of the pin state as an input signal become possible.
5. Clock signals
   After applying a reset, only release the reset line after the operating clock signal becomes stable. When switching the clock signal during program execution, wait until the target clock signal is stabilized. When the clock signal is generated with an external resonator or from an external oscillator during a reset, ensure that the reset line is only released after full stabilization of the clock signal. Additionally, when switching to a clock signal produced with an external resonator or by an external oscillator while program execution is in progress, wait until the target clock signal is stable.
6. Voltage application waveform at input pin
   Waveform distortion due to input noise or a reflected wave may cause malfunction. If the input of the CMOS device stays in the area between V_{IL} (Max.) and V_{IH} (Min.) due to noise, for example, the device may malfunction. Take care to prevent chattering noise from entering the device when the input level is fixed, and also in the transition period when the input level passes through the area between V_{IL} (Max.) and V_{IH} (Min.).
7. Prohibition of access to reserved addresses
   Access to reserved addresses is prohibited. The reserved addresses are provided for possible future expansion of functions. Do not access these addresses as the correct operation of the LSI is not guaranteed.
8. Differences between products
   Before changing from one product to another, for example to a product with a different part number, confirm that the change will not lead to problems. The characteristics of a microprocessing unit or microcontroller unit products in the same group but having a different part number might differ in terms of 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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