User's Manual

Adaptor Board with R-IN32M3 module

YCONNECT-IT-I-RJ4501

User's Manual
(Reference Material)

R-IN32M3 Module (RY9012A0)

Renesas Electronics
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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.

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 R-IN32M3 Module. It is intended for users designing application systems incorporating the MCU. A basic knowledge of electric circuits, logical circuits, and MCUs is necessary in order to use this manual.

> 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.

The following documents apply to the R-IN32M3 Module. Make sure to refer to the latest versions of these documents. Last four digits of document number (described as ****) indicate version information of each document. The newest versions of the documents listed may be obtained from the Renesas Electronics Web site.

Document Type	Description	Document Title	Document No.
Data Sheet	Hardware overview and electrical characteristics	R-IN32M3 Module Datasheet	R19DS0109ED****
User's manual for Hardware	Hardware specifications (pin assignments, peripheral function specifications, electrical characteristics, timing charts) and operation description	R-IN32M3 Module User's Manual: Hardware	R19UH0122ED****
User's manual for Software	Description of API	R-IN32M3 Module User's Manual: Software	R17US0002ED****
Quick Start Guide	Information on application examples Sample program for Host MCU.	R-IN32M3 Module Application Note: Quick Start Guide	R12QS0042ED****
Sample Package	Package of sample software, documents and tool.	R-IN32M3 Module Sample Package	r18an0052xx**** r18an0064xx****
Renesas Technical Update	Product specifications, updates on documents, etc.	Available from Renesas Electronics Web site.	

2. Notation for Numbers and Symbols

Note:
Explanation of a point marked “Note” in the text.

Caution:
Item deserving extra attention.

Remark:
Supplementary explanation to the text

3. List of Abbreviations and Acronyms

Abbreviation	Full Form
Hi-Z	High Impedance
SPI	Serial Peripheral Interface
SW	Switch
DC	Distributed Clock
MCU	Micro Controller Unit

Table of Contents

1. Overview

This document describes the hardware specifications, circuit configuration, and easy connection of an adapter board with R-IN32M3 Module (YCONNECT-IT-I-RJ4501).

Subsequently, this document describes YCONNECT-IT-I-RJ4501 as this board.

1.1 Introduction

The adapter board with R-IN32M3 Module (YCONNECT-IT-I-RJ4501) is an evaluation board equipped with an R-IN32M3 module. By connecting to a variety of MCU evaluation boards with Arduino™ or Pmod™ interfaces, you can evaluate communications and develop applications for industrial Ethernet PROFINET, EtherNet/IP™, and EtherCAT®

Figure 1-1 shows a connection diagram between the adapter board and various MCU evaluation boards. Sample software of each host MCU for quick evaluation of industrial Ethernet is ready.

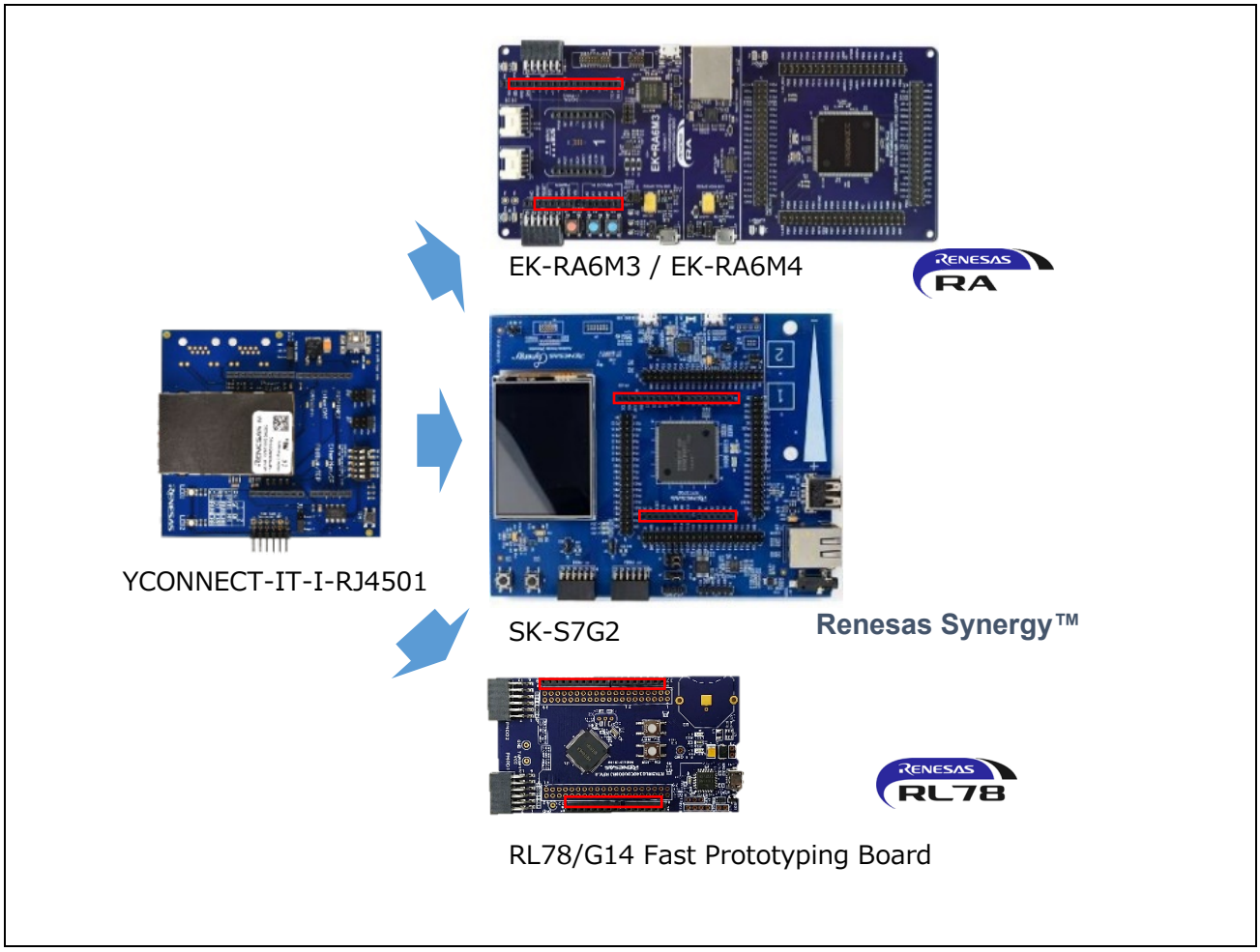


Figure 1-1 Connection to MCU Evaluation Board

1.2 Package Contents

The package consists of the following items.

Table 1-1 The package contents

Item	Qty.
Adapter board with R-IN32M3 Module (YCONNECT-IT-I-RJ4501)	1
USB Cable Type A to mini B	1
Bridge wire	red 1, yellow 1
Connection extenders	4
CE Compliance document	1
China RoHS compliance document	1
Product content list	1

Figure 1-2 YCONNECT-IT-I-RJ4501

1.3 Operating Environment

A MCU evaluation board equipped with Arduino or Pmod interface for connecting to this board is required to evaluate R-IN32M3 module with this board.

This document is confirmed in the following environment.

- Synergy SK-S7G2 Starter Kit [rev.3.3 or later]
- PC
  - OS：Windows® 10
  - RAM：8GB or more
  - LAN port
  - USB 2.0 interface

2. Hardware Configuration

2.1 Board Specification

Table 2-1 Board Spec

Item	Description
Input supply voltage	3.3V (supply from Arduino or Pmod interface) or 5V (supply from USB Mini-B)
Operating temperature	0 ~ 45 ℃
Board dimensions	85mm x 85mm

2.2 Board Appearance

The appearance diagram of this board is shown in Figure 2-1, and the main components and external interfaces are shown in Table 2-2.

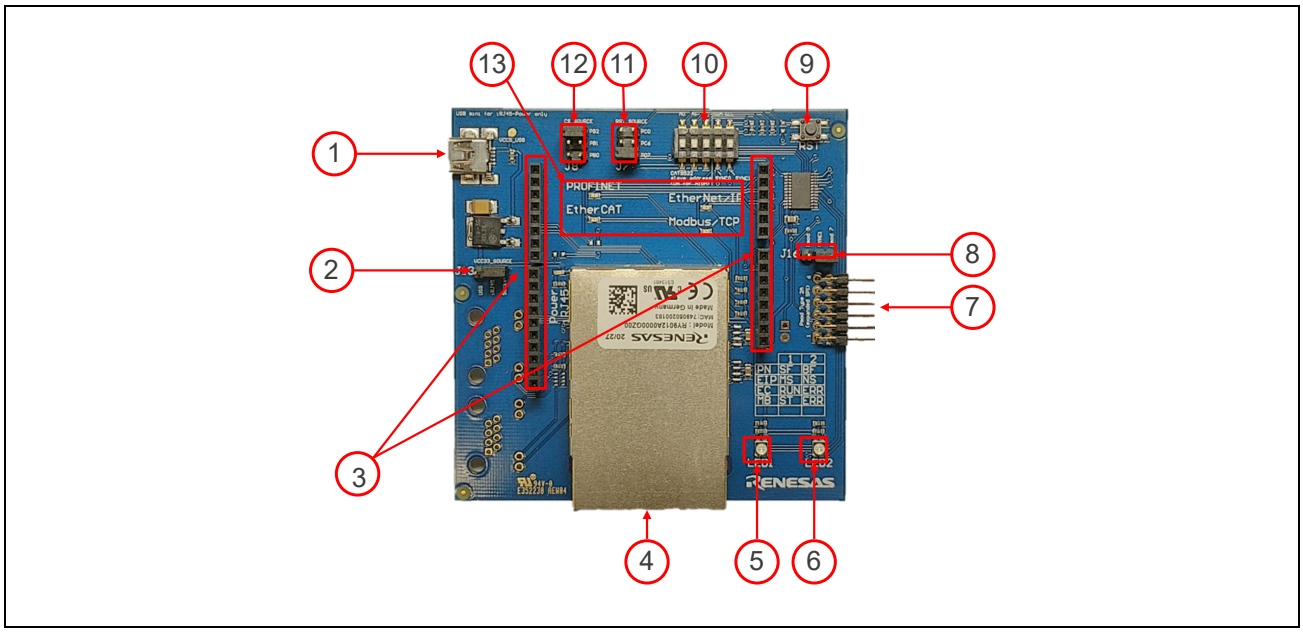


Figure 2-1 Appearance diagram

Table 2-2 External interface

No.	Component Description	No.	Component Description
1	mini-USB	8	J16 : Sync1 select jumper (not used)
2	J13 : Power input select jumper	9	RST: Reset switch (SW1)
3	Arduino Interface	10	S1 : DIPSW (all off : fixed)
4	RJ-45 Port (R-IN32M3 Module)	11	J7 : Reset select jumper
5	LED1 : Protocol status LED (G/R)	12	J8 : CS select jumper
6	LED2 : Protocol status LED (G/R)	13	Protocol LED
7	Pmod interface		

2.3 External Interface

This chapter describes the main external interfaces.

2.3.1 RJ-45 (R-IN32M3 Module)

The R-IN32M3 Module on this board has two RJ-45 Ethernet ports and two LEDs per port. (Figure2-2)

For more information about the R-IN32M3 Module, see R-IN32M3 Module User's Manual Hardware (R19UH0122ED****).

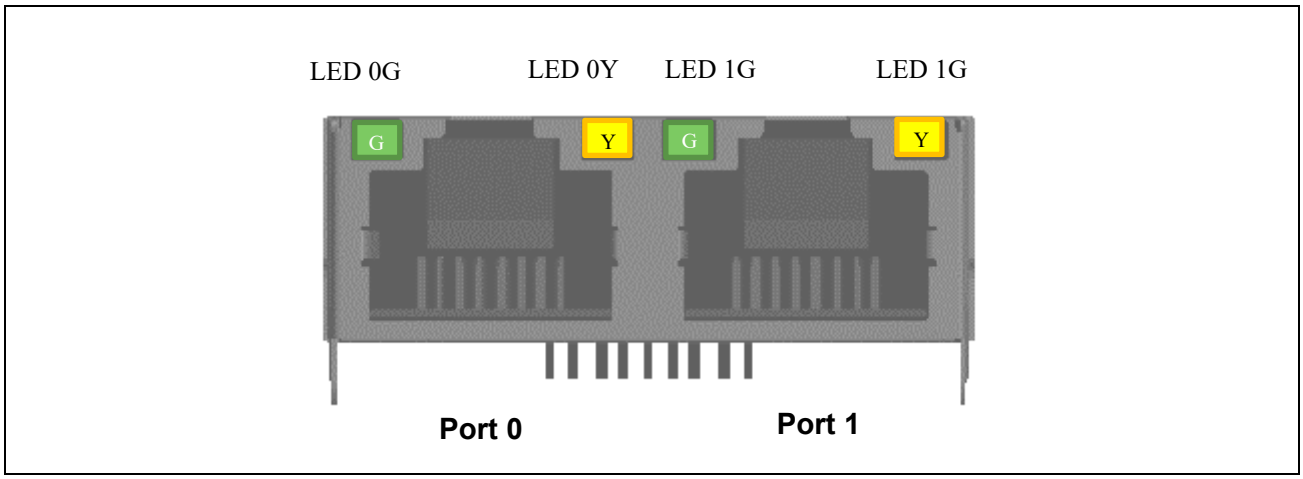


Figure2-2 RJ-45 ports

Table2-3 LED Feature

Port	LED	Signal	Description
0	0G	Network Link	Green LED for connected link on port 0
	0Y	Network Activity	Yellow LED for communication activity on port 0
1	1G	Network Link	Green LED for connected link on port 1
	1Y	Network Activity	Yellow LED for communication activity on port 1

2.3.2 Arduino™

This board can be connected with host MCU via Arduino UNO R3 compatible interface. J13 setting defines whether the power source from Arduino interface (VCC33_socket) is supplied to this board.

Note) When Synergy SK-S7G2 board is connected via Arduino interface, connect two jumper wirings externally to Arduino interface to use DC(distribute clock) sync mode in EtherCAT. See Table2-4 and Chapter 2.5 for details.

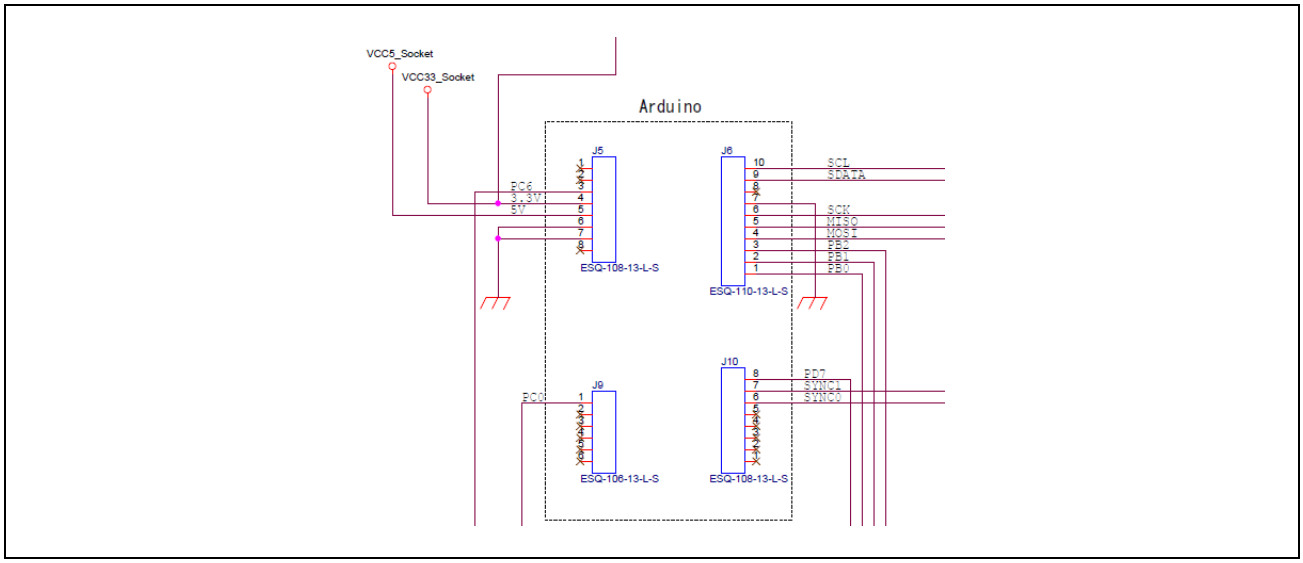


Figure 2-3 Arduino

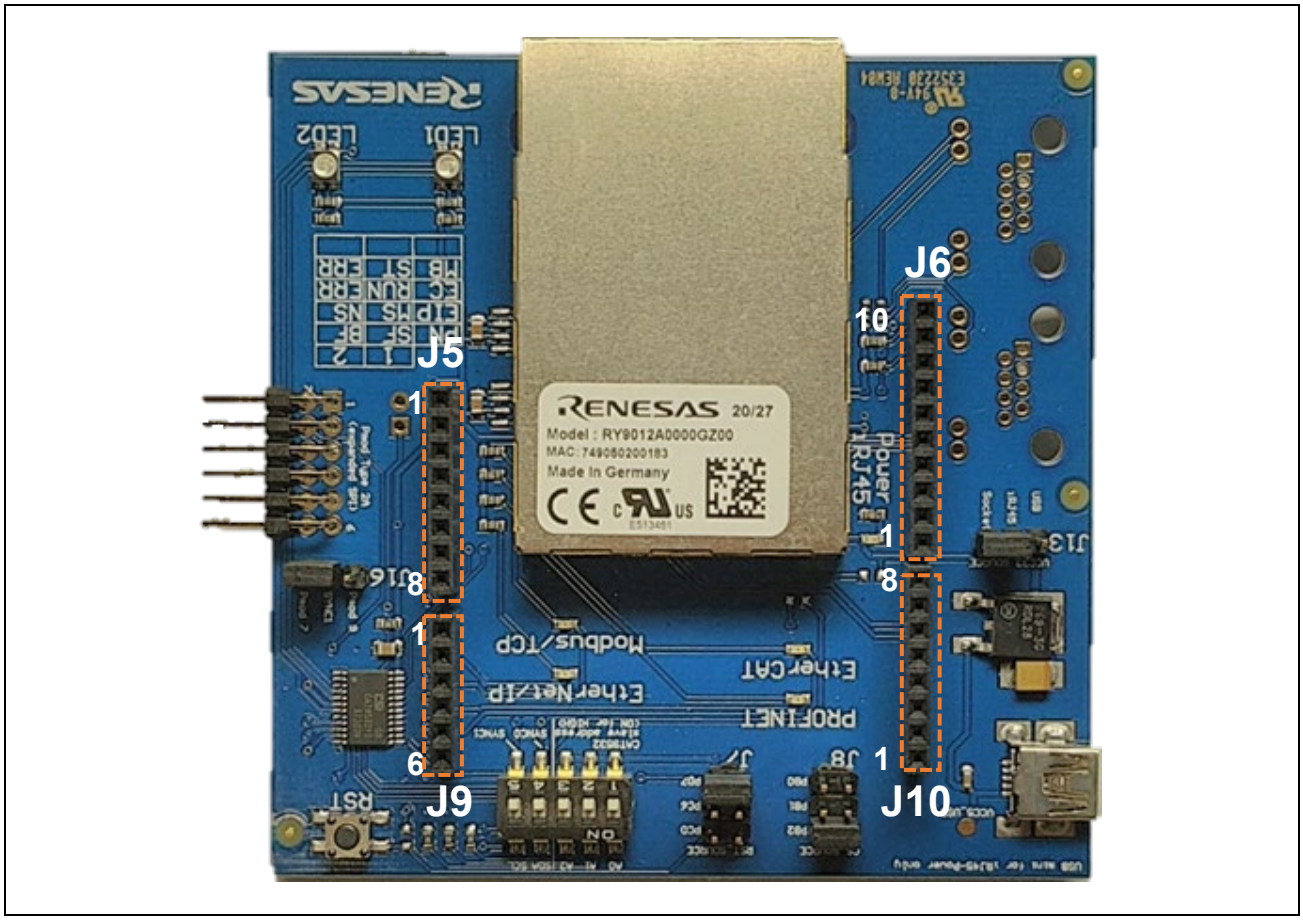


Figure 2-4 Appearance of Arduino interface

Table2-4 Arduino Connector

Connector		Arduino Compatible		YCONNECT-IT-I-RJ4501	Note
J5	1	NC		NC	
	2	IOREF		NC	
	3	RESET		PC6 (J7-3)	no use (*1)
	4	3.3V		3.3V	
	5	5V		5V	no use
	6	GND		GND	
	7	GND		GND	
	8	VIN		NC	
J9	1	A0		PC0 (J7-1)	no use (*1)
	2	A1		NC	
	3	A2		NC	
	4	A3		NC	
	5	A4		NC	
	6	A5		NC	
J10	1	D0	RXD	NC	(*2)
	2	D1	XD	NC	(*2)
	3	D2	INT0	NC	CATSYNC0
	4	D3	INIT1	NC	CATSYNC1
	5	D4		NC	
	6	D5		SYNC0	Connect with J10-3pin externally
	7	D6		SYNC1	Connect with J10-4pin externally
	8	D7		PD7 (J7-5)	RESET (*1)
J6	1	D8		PB0 (J8-2)	no use (*1)
	2	D9		PB1 (J8-4)	no use (*1)
	3	D10	SPI_SS	PB2 (J8-6)	SPI_CS (*1)
	4	D11	SPI_MOSI	MOSI	SPI
	5	D12	SPI_MISO	MISO	SPI
	6	D13	SPI_SCK	SCK	SPI
	7	GND		GND	
	8	AREF		NC	no use
	9	I2C_SDA		SDATA	I2C for LED driver
	10	I2C_SCL		SCL	I2C for LED driver

(*1) in case of default jumper configuration

(*2) depending on the board. (SK-S7G2 : no use, EK-RA6M4:UART log, EK-RA6M3:UART log)

2.3.3 PMOD™

This board also enables for R-IN32M3 Module to connect host MCU via Pmod™ interface. In this case, 3.3V is supplied to this board from Pmod interface.

Note) The sample software of host MCU for Synergy SK-S7G2, EK-RA6M4 and EK-RA6M3 does not support the Pmod connection.

Also, when Synergy SK-S7G2 board is connected via Pmod interface, there are some hardware restrictions. (DC sync mode of EtherCAT cannot be used because the SYNC signal cannot be connected. LED cannot be controlled because I2C interface cannot be connected.)

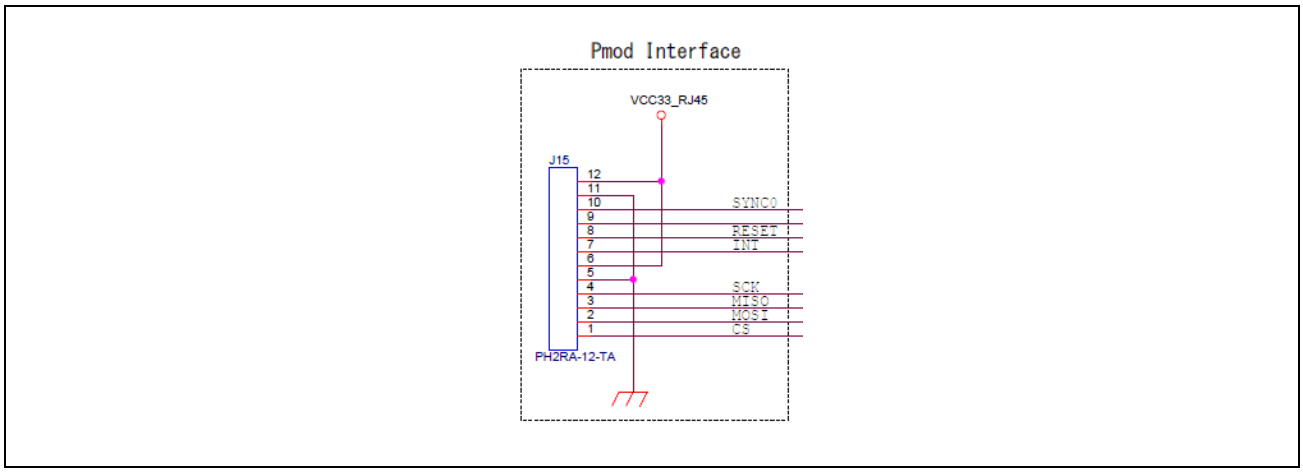


Figure 2-5 Pmod

Table2-5 Pmod Connector

Connector		Pmod Type 2A	YCONNECT-IT-I-RJ4501
J15	1	CS	/SS
	2	MOSI	MOSI
	3	MISO	MISO
	4	SCK	SCK
	5	GND	GND
	6	VCC	VCC33_RJ45
	7	GPIO	(J16-1) INT
	8	GPIO	/RESET
	9	GPIO	(J16-3)
	10	GPIO	/SYNC0
	11	GND	GND
	12	VCC	VCC33_RJ45

2.3.4 LED

LED1 (green/red) and LED2 (green/red) on this board are status LEDs defined by each industrial protocol standard. LED3 to 6 also indicate which industrial protocol is running (LED6 is not supported). They are controlled with LED driver IC.

For more information about the required specification of status LEDs for the R-IN32M3 Module, see the R-IN32M3 Module User's Manual Hardware (R19UH0122ED****).

Note) The sample software for SK-S7G2 controls the LED driver on this board with the I2C bus via Arduino interface. It does not support LED control via Pmod interface.

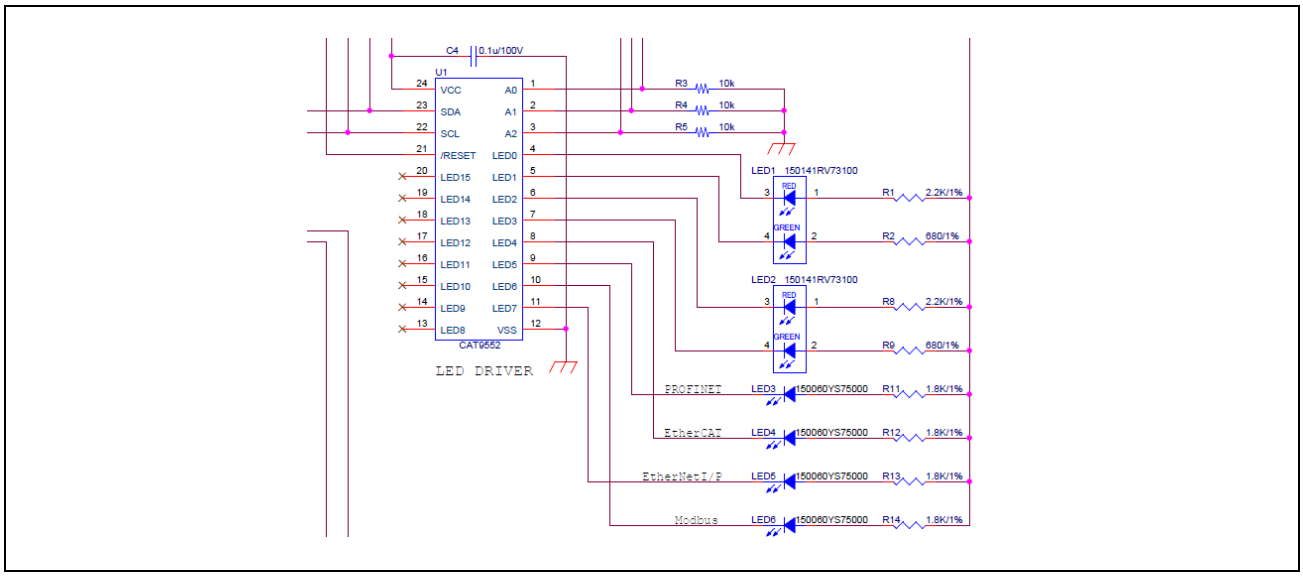


Figure 2-6 LED

Table 2-6 Protocol Status LED

Mode		LED2		LED1	
		Description	Color	Description	Color
1	PROFINET	SF	*Red*	BF	*Red*
		Connection	*Green*	DCP Indicator	*Green (Blink)*
2	EtherNet/IP	MS	*Green/ Red*	NS	*Green/ Red*
3	EtherCAT	RUN	*Green*	ERR	*Red*

SF: system failure, BF: bus failure, MS: module status indicator, NS: network status indicator,
DCP: Discovery and Configuration Protocol

2.3.5 Jamper Pin Settings

The jumper pin settings of this board are explained.

The sample software for SK-S7G2 is provided with the recommended settings below.

2.3.5.1 J13

Select the 3.3V power source to supply to the R-IN32M3 Module.

Table 2-7 J13

J13 setting	Description	Recommended settings
1-2 (Silk description "USB")	The USB connector (J18) supplies 3.3V power to the R-IN32M3 Module. Caution) Do not select this when connecting to Pmod.	
2-3 (Silk description "Socket")	The Arduino connector (J5_4pin) supplies 3.3V power to the R-IN32M3 Module	✔

2.3.5.2 J7

Select the reset signal terminal when connecting the Arduino connector.

Table 2-8 J7

J7 setting	Description	Recommended settings
PC0	PC0 (J9_1pin) as reset terminal	
PC6	PC6 (J5_3pin) as reset terminal	
PD7	PC7 (J10_8pin) as reset terminal	✔

2.3.5.3 J8

Select the CS signal terminal when connecting the Arduino connector.

Table 2-9 J8

J8 setting	Description	Recommended settings
PB2	PB2 (J6_3pin) as CS terminal	✔
PB1	PB1 (J6_2pin) as CS terminal	
PB0	PB0 (J6_1pin) as CS terminal	

2.3.5.4 J16

Select SYNC1 signal connection. (no use)

Table 2-10 J16

J16 setting	Description	Initial settings
1-2 (Silk description "Pmod 7")	Connect SYNC1 with J15-7pin	✔
2-3 (Silk description "Pmod 9")	Connect SYNC1 with J15-9pin	

2.3.6 USB

Mini-USB terminal for supplying power to this board.

This is enabled when shorting the 1-2 pin in J13. Do not be used when connecting to Pmod.

2.3.7 RST

RST (SW1) is a reset switch of the R-IN32M3 Module. The reset terminal (/RESET) is pulled up in the R-IN32M3 Module. See R-IN32M3 Module User's Manual Hardware (R19UH0122ED****) Chapter 5.2.3 for recommended reset circuit for R-IN32M3 Module.

Note) Since the reset switch SW1 is connected with /RESET signal directly on this board, /RESET signal is controlled by Hi-Z or Low with the sample software for the host MCU.

2.3.8 DIPSW

DIPSW (S1) is unused.

Set it as a fixed all SW OFF.

2.4 R-IN32M3 Module

The R-IN32M3 Module has a 9-pin interface for application, and it has functions as a power supply, SPI slave interface, reset signal, and EtherCAT DC synchronous signal.
They are connected to the Arduino and Pmod connectors on this board, respectively.

Table 2-11 R-IN32M3 Module pin

pin	Signal	I/O	Description
1	V_{CC}	—	3.3V ±0.15V DC power supply
2	GND	—	Ground
3	/SS	I	Slave select: Active low to enable the slave device
4	RESET#	I	Reset of the whole R-IN32M3 Module: Active low
5	MISO	O	Master in slave out. Data from slave to master
6	MOSI	I	Master out slave in. Data from master to slave
7	SCLK	I	Serial clock: The master provides the clock to shift the data.
8	SYNC0	O	EtherCAT sync signal for distributed clocks
9	SYNC1	O	EtherCAT sync signal for distributed clocks

Note) Pin 8 and pin 9 are EtherCAT sync signals for distributed clocks are only used for EtherCAT protocol.

2.5 EtherCAT Support

Limitations and supplementary matters for EtherCAT support of this board are shown below.

- **For DC mode**

  To use DC sync mode in EtherCAT, SYNC0 and SYNC1 signals need to be assigned to the interrupt port of the host MCU.

  In combination with Synergy SK-S7G2, short 3pin and 6pin, also 4pin and 7pin of J10, respectively. (Figure 2-7)

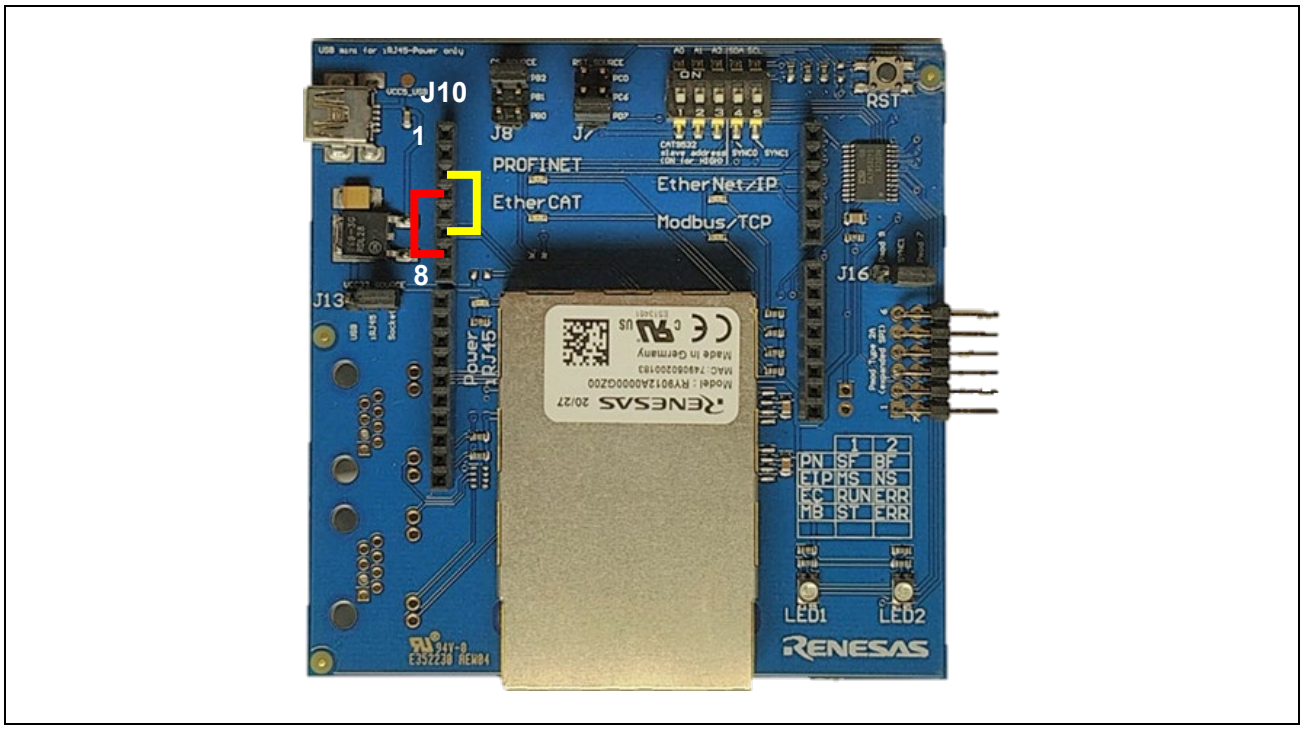


Figure 2-7 Jumper connection for EtherCAT

- **For the conformance test**

  In order to comply with the standards of EtherCAT slave equipment with this board, the following changes are required. This board have passed it with the following additional works.

  - Add device ID configuration switch.
  - Add indication as "IN" and "OUT" around EtherCAT port, respectively.

3. Board Connection

Figure 3-1 shows Arduino interface connection with SK-S7G2, as an example of host MCU connection.

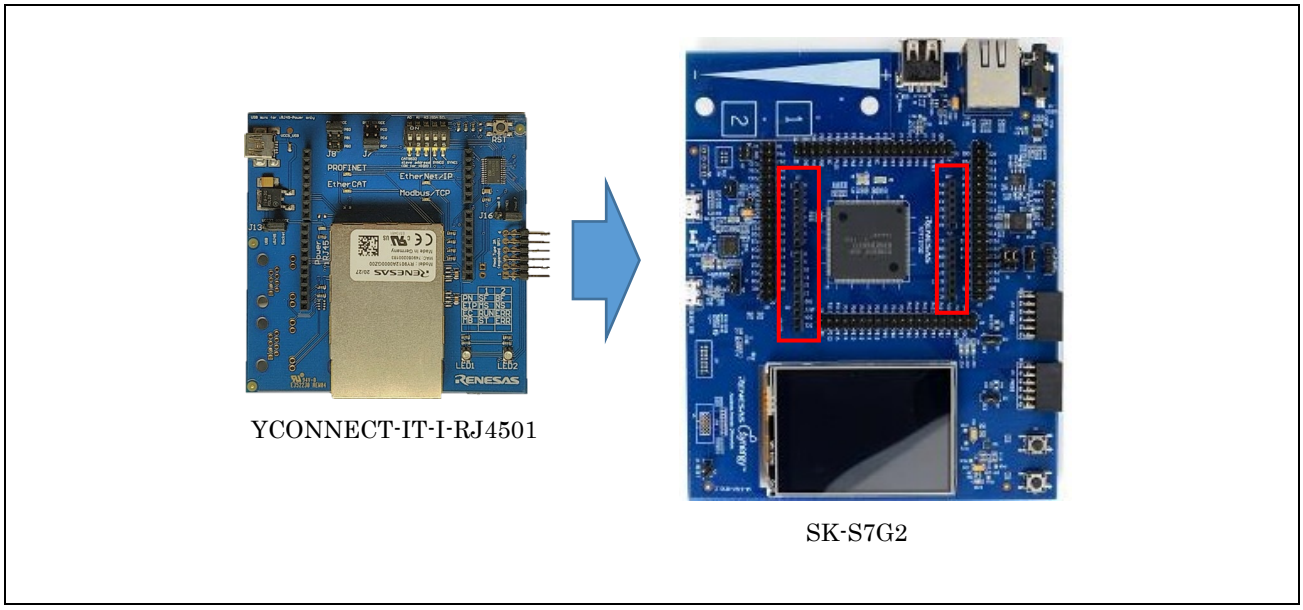


Figure 3-1 Arduino Connection

The power is also supplied from the USB connector of the SK-S7G2 board to this board.

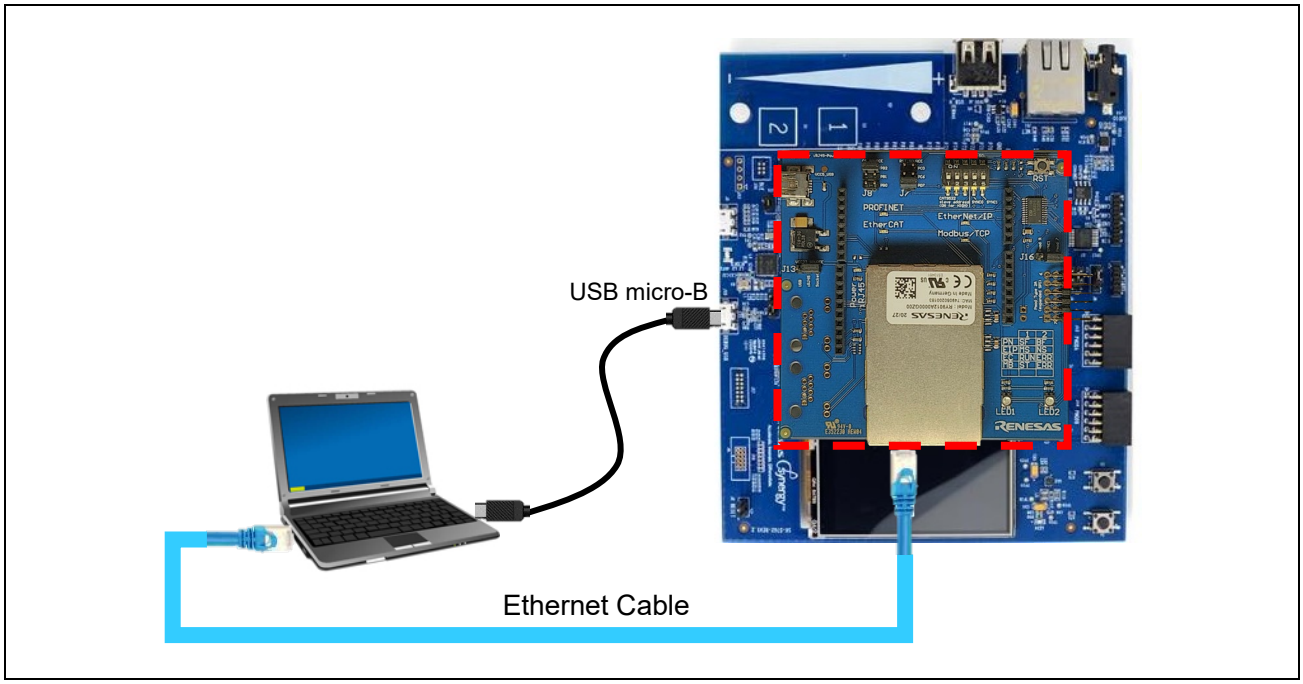
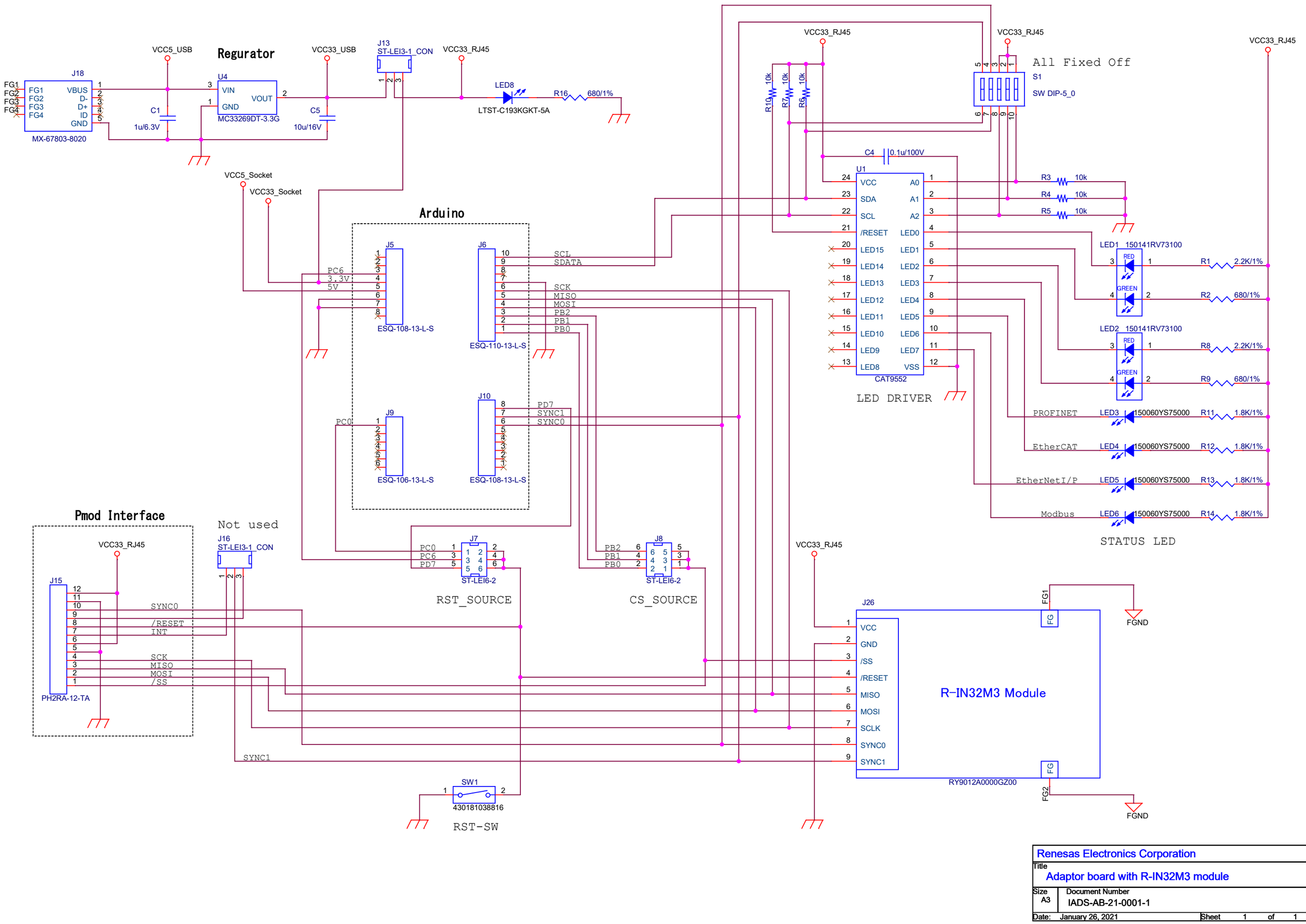


Figure 3-2 Evaluation environment

4. Appendix

A reference schematic of YCONNECT-IT-I-RJ4501 is posted.



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Rev.	Date	Page	Description
1.00	Feb 5, 2021		First edition issued
1.01	May 31, 2021	12	Added Table2-4 and Figure 2-4
		13	Updated section 2.3.3
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