Introduction

The P4M-440G is a module type of PHPoC product. Since PHPoC function is provided in module form, it is possible to implement the board suitable for user application.

P4M-440G provides various interfaces, including 10/100M Ethernet, UART, SPI, I2C, digital input/output, and more, making it possible to produce a wide range of products tailored to user requirements.

※ Notice: P4M-440G is a programmable module, but this feature is initially disabled. Please refer to the instructions of Activating PHPoC Engine before use.

Features

- Modular PHPoC
- Provides self-development PHPoC Interpreter
- Provides simple development environment via USB
- Provides 10/100Mbit Ethernet
- Provides 10 digital I/O ports
- Provides 2 UART ports
- Provides I2C and SPI interfaces
- Embeds 32.768KHz crystal for RTC
- Provides self-developed TCP/IP stacks
- Provides a Web Server
- Support Websocket, Telnet, SSH, SSL
- Provides the various libraries such as Email, DNS, MySQL and so on
- Provides PHPoC Debugger - a development tool for Windows

H/W Specification

Power	Input	DC 3.3V (±0.16V)
	Current Consumption	Typical - about 95mA
Dimension		26mm x 26mm x 9mm
Weight		about 4g
Interface	UART	2 X UART Ports(UART0 ~ 1), Baudrate: 1,200 bps ~ 230,400 bps
	Network	10/100Mbps Ethernet
	USB	USB Device - for PC
	Digital I/O	maximum 10 ports
	SPI	NSS, SCK, MISO, MOSI
	I2C	SCL, SDA
Temperature	Storage /Operating	-40℃ ~ 85℃
Environment		RoHS Compliant

Dimension
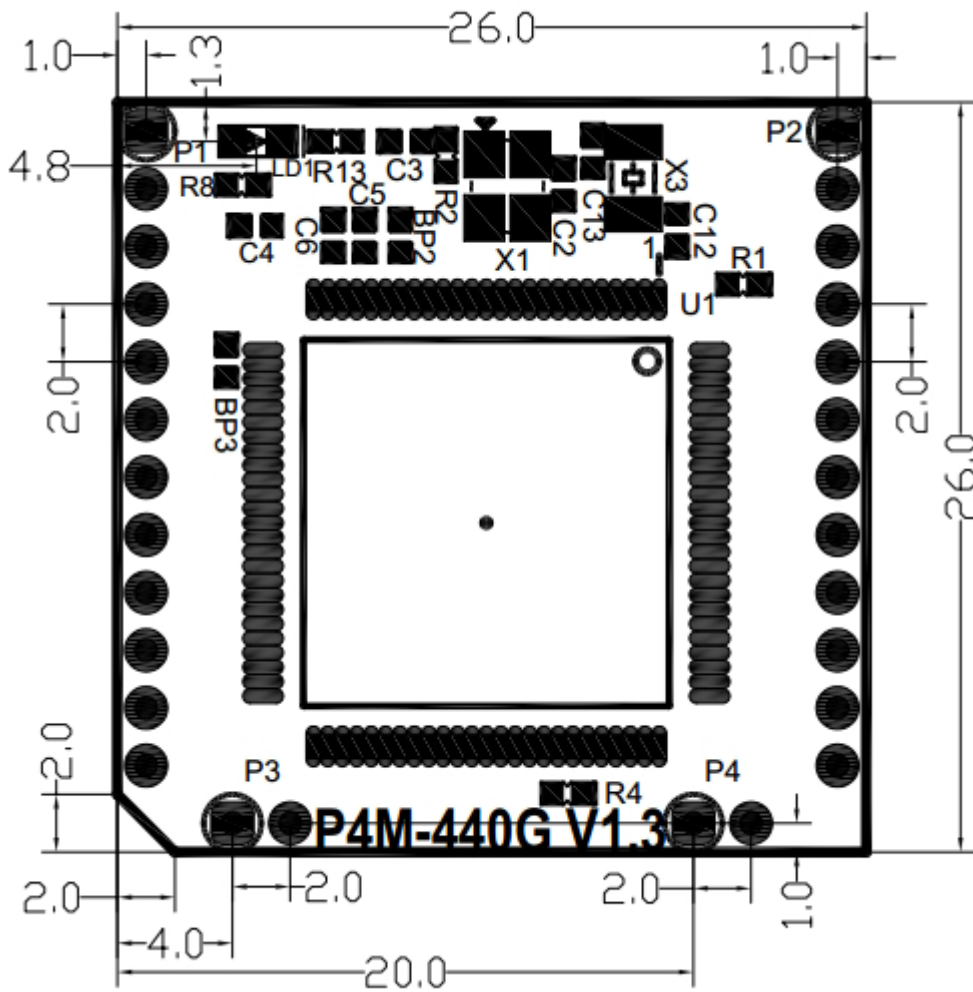
※ Dimensions(unit : mm) may vary according to a method of measurement.

Layout
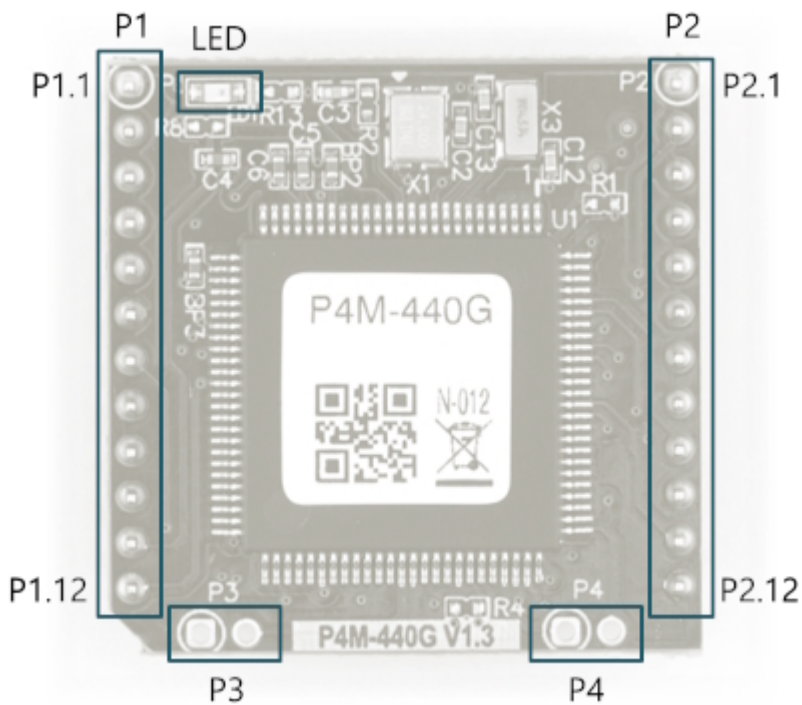
P4M-440G interfaces with two 12 x 1 pin headers (P1 ~ P2). The pin spacing is 2mm.

P1

Pin#	Name	I/O	Description
P1.1	GND	-	Ground
P1.2	TPTX+	In/Out	Ethernet Transmit +
P1.3	TPTX-	In/Out	Ethernet Transmit -
P1.4	TPRX+	In/Out	Ethernet Receive +
P1.5	TPRX-	In/Out	Ethernet Receive -
P1.6	GND	-	Ground
P1.7	VBUS	In	USB Device VBUS
P1.8	USB_D_D-	In/Out	USB Device Data -
P1.9	USB_D_D+	In/Out	USB Device Data +
P1.10	VBAT	In	Battery Input
P1.11	RST#	In	Reset Input (Active LOW)
P1.12	ISP#	In	ISP Input (Active LOW)

P2

Pin#	Name	I/O	Description
P2.1	+3.3V	-	+3.3V Power Input
P2.2	NSS(0.0)	In/Out	UIO 0.0 / SPI NSS
P2.3	SCK(0.1)	In/Out	UIO 0.1 / SPI SCK
P2.4	MISO(0.2)	In/Out	UIO 0.2 / SPI MISO
P2.5	MOSI(0.3)	In/Out	UIO 0.3 / SPI MOSI
P2.6	U0TX(0.4)	In/Out	UIO 0.4 / UART0 TX
P2.7	U0RX(0.5)	In/Out	UIO 0.5 / UART0 RX
P2.8	SCL(0.6)	In/Out	UIO 0.6 / I2C SCL

Pin#	Name	I/O	Description
P2.9	SDA(0.7)	In/Out	UIO 0.7 / I2C SDA
P2.10	U1TX(0.10)	In/Out	UIO 0.10 / UART1 TX
P2.11	U1RX(0.11)	In/Out	UIO 0.11 / UART1 RX
P2.12	GND	-	Ground

LED

There is an STS LED located at the top-left corner of the module. This LED blinks at a 1-second interval and operates in two different patterns depending on the product's status.

Status	LED Pattern
During code execution	ON duration = OFF duration
Otherwise	ON duartion << OFF duration

P3, P4

P3 and P4 are only for the manufacture.

Interface

System

Pin	Description
+3.3V	Input the power supply of 3.3V DC to this pin. Make sure the DC voltage is in the range of 3.15V ~ 3.45V. It is recommended to use a power supply capable of supplying more than 500mA current while stable output of DC 3.3V for the stable operation of the module.
GND	Connect the ground of your main system to this pin. It is recommended that the ground is as wide as possible to shorten the path of return signal.
RESET#	This pin is used to restart the system. If you enter a LOW pulse of 1 millisecond (1ms) or more to this pin, the system will restart. Since this pin is LOW Active, normally it should keep it high state(It is internally pulled up with a 10K ohm resistor.)
ISP#	ISP# is the pin used to put the product into ISP mode. ISP mode is a necessary mode for system maintenance such as Escaping infinite reset state. Since this pin is LOW Active, normally it should keep it high state(It is internally pulled up with a 10K ohm resistor.)
VBAT	Connect the battery to VBAT so that the built-in RTC time information and back up SRAM contents are not erased when power is not applied. Connect this pin to +3.3V if you do not use any battery. The allowable voltage is DC 1.65V to DC 3.6V.

Ethernet

Pin#	Name	I/O	Description
P1.3	TPTX+	In/Out	Ethernet Transmit +
P1.4	TPTX-	In/Out	Ethernet Transmit -
P1.5	TPRX+	In/Out	Ethernet Receive +
P1.6	TPRX-	In/Out	Ethernet Receive -

P4M-440G provides 10/100Base-TX Ethernet Interface. Note that RJ45 connector is required to use Ethernet. Refer to a circuit diagram of the Application Circuit Diagram for the connection.

USB Device

Pin#	Name	I/O	Description
P1.7	VBUS	In	USB Device VBUS
P1.8	USB_D_D-	In/Out	USB Device Data -
P1.9	USB_D_D+	In/Out	USB Device Data +

This port must be interfaced for product development and configuration. After connecting this port and connecting the product with PC via a USB cable, you can access the product using the development tool (PHPoC Debugger). Either type B USB connector, mini USB or micro USB connector can be used for this port.

※ Note: The VBUS pin cannot be used for supplying power to P4M-440G.

Digital I/O

Pin#	Name	I/O	Description
P2.2	NSS(0.0)	In/Out	UIO 0.0 / SPI NSS

Pin#	Name	I/O	Description
P2.3	SCK(0.1)	In/Out	UIO 0.1 / SPI SCK
P2.4	MISO(0.2)	In/Out	UIO 0.2 / SPI MISO
P2.5	MOSI(0.3)	In/Out	UIO 0.3 / SPI MOSI
P2.6	U0TX(0.4)	In/Out	UIO 0.4 / UART0 TX
P2.7	U0RX(0.5)	In/Out	UIO 0.5 / UART0 RX
P2.8	SCL(0.6)	In/Out	UIO 0.6 / I2C SCL
P2.9	SDA(0.7)	In/Out	UIO 0.7 / I2C SDA
P2.10	U1TX(0.10)	In/Out	UIO 0.10 / UART1 TX
P2.11	U1RX(0.11)	In/Out	UIO 0.11 / UART1 RX

UART, SPI and I2C ports can be set or used to digital I/O pins. These ports are mapped to UIO 0. Digital I/O ports can also be operated as output ports of ST(Software Timer).

- Electrical Characteristics of Digital I/O

Parameter	Description	Min.[V]	Max.[V]	Current[mA]
V_{IH}	HIGH level input	2.31	-	-
V_{IL}	LOW level input	-	0.99	-
V_{OL}	LOW level output	-	0.2	+8
V_{OH}	HIGH level output	3.1	-	+8

※ Note: Each UIO port is 3.6V(5.5V) tolerant in input mode and the maximum driving current is 25mA in output mode.

UART

Pin#	Name	I/O	Description
P2.6	U0TX(0.4)	In/Out	UIO 0.4 / UART0 TX
P2.7	U0RX(0.5)	In/Out	UIO 0.5 / UART0 RX
P2.10	U1TX(0.10)	In/Out	UIO 0.10 / UART1 TX
P2.11	U1RX(0.11)	In/Out	UIO 0.11 / UART1 RX

There are two UART ports and each of them has RX and TX.

SPI

Pin#	Name	I/O	Description
P3.1	NSS(0.0)	In/Out	UIO 0.0 / SPI NSS
P3.2	SCK(0.1)	In/Out	UIO 0.1 / SPI SCK
P3.3	MISO(0.2)	In/Out	UIO 0.2 / SPI MISO
P3.4	MOSI(0.3)	In/Out	UIO 0.3 / SPI MOSI

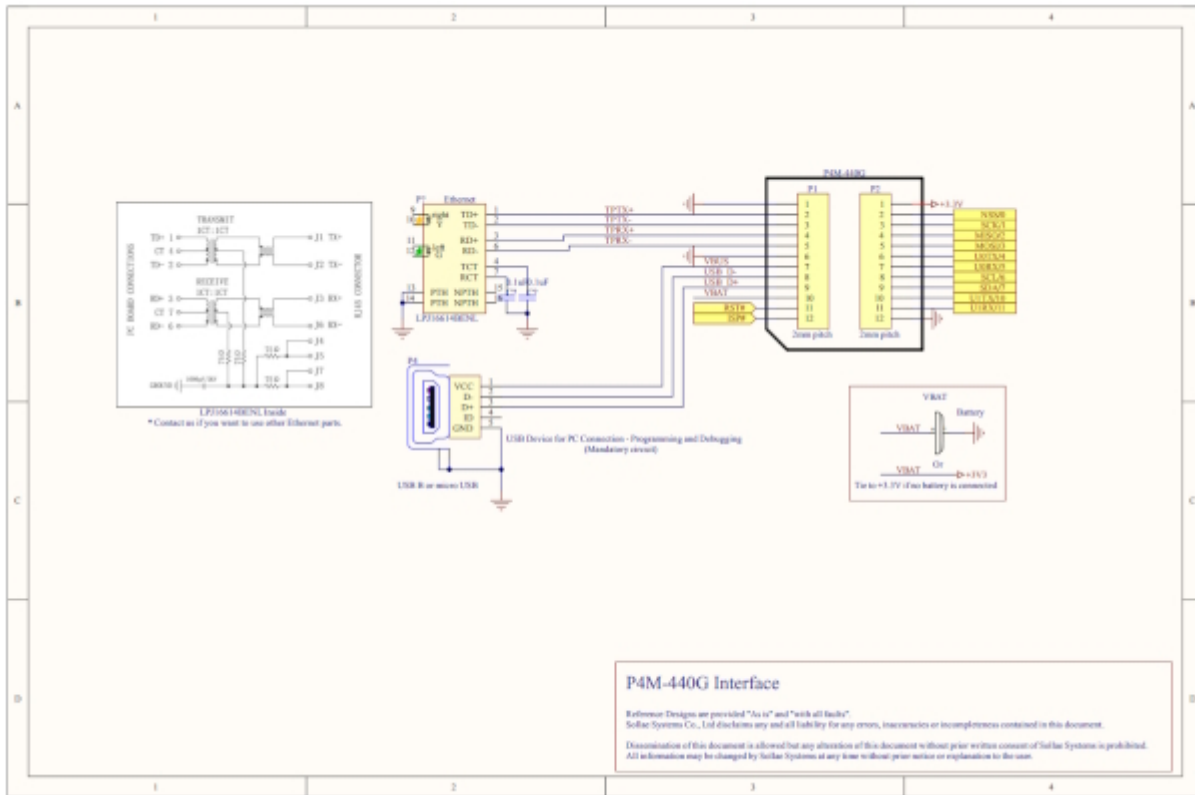There is SPI port which has NSS, SCK, MISO and MOSI.

I2C

Pin#	Name	I/O	Description
P3.7	SCL(0.6)	In/Out	UIO 0.6 / I2C SCL
P3.8	SDA(0.7)	In/Out	UIO 0.7 / I2C SDA

There is I2C port which has SCL and SDA.

Application Circuit Diagram

This is an application circuit diagram for interfaces of P4M-440G.

Software (IDE)

PHPoC Debugger

PHPoC Debugger is a software used for developing and setting PHPoC products. You need to install this program on your PC for using PHPoC.

- PHPoC Debugger Download Page
- PHPoC Debugger Manual

Functions and Features of PHPoC Debugger

- Upload files from local PC to PHPoC
- Download files in PHPoC to local PC
- Edit files stored in PHPoC
- Debug PHPoC scripts
- Monitor resources of PHPoC
- Configure parameters PHPoC
- Upgrade Firmware of PHPoC
- Support MS Windows O/S

Connecting

USB Connection

1. Connect the USB device port of P4M-440G to PC via a USB cable.

2. Run the PHPoC Debugger.

3. Select connected COM PORT and press connect ( ) button.

4. If USB is successfully connected, connect button will be inactivated and disconnect button ( ) will be activated.

Remote Connection

The remote connection is provided. Please refer to the PHPoC Debugger manual page for details.

Reset

Settings Reset

Settings Reset makes all the settings of your PHPoC products to factory default. A certificate in PHPoC is also deleted.

- Settings Reset Procedure

Step	Action	Product State	STS LED
1	Input LOW signal to ISP# shortly (less than 1 second)	Button setup mode	On
2	Input LOW signal again over 5 seconds	Preparing initialization	Blink very rapidly
3	Check if the STS LED is turned OFF	Initialization ready	Off
4	Release the LOW input right after the STS is OFF.(※ If you don't release the button within 2 seconds, the state goes back to the step 2)	Progressing initialization	On
5	Rebooting automatically	Initial state	Off

Factory Reset

Factory Reset makes all the settings including saved password of your PHPoC products to factory default. Furthermore, all files stored in flash memory are deleted as well as certificate. Because of this, you have to back up your files before doing Factory Reset.

- Factory Reset Procedure

Web Interface

PHPoC itself has a webserver to provide a web interface. Webserver is independent of PHPoC main script. TCP 80 is used for web server and you can use the interface via web browsers.

How to use web interface

To use the web interface, "index.php" file should be in the file system of P4M-440G. Connect to this page by entering device IP address after connecting it to network.
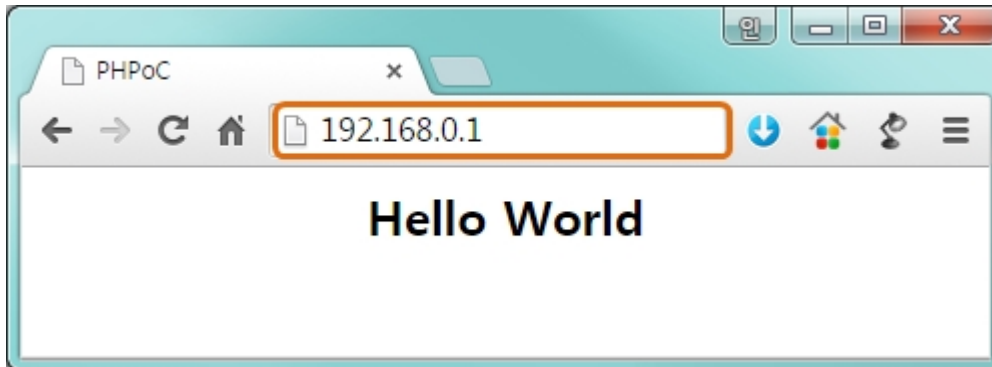
If the name of file is not "index.php", just specify the name of file after the IP address with slash mark.
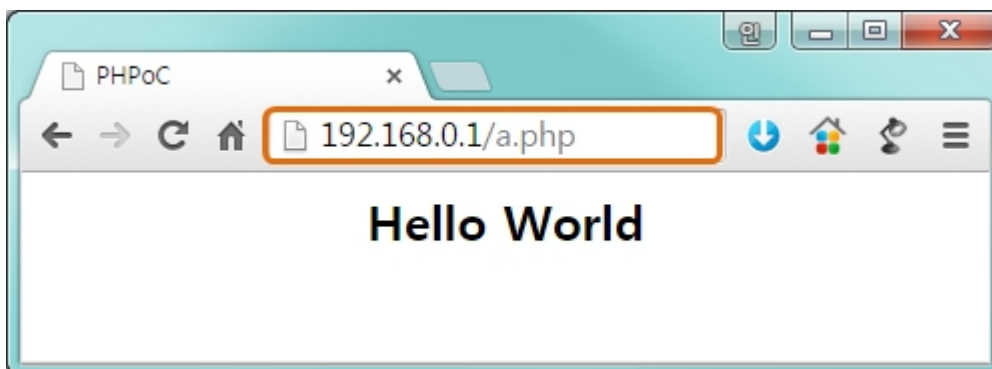
Practical Use of Web Interface

When PHPoC operates as a web server, it executes PHP code embedded in web pages. Therefore, users can insert code for interacting with various interfaces and data within the web page. WebSocket, in particular, allows for real-time exchange of such data.

Setting Passwords

If you set a password for the product, you must enter the password when connecting the product via USB or network.

Please refer to the PHPoC Debugger manual page for details.

Escaping Infinite Reset

PHPoC basically runs scripts when it boots up. Therefore, it is possible that a P4M-440G cannot be escaped from infinite reboot when script contains system command such as "reboot". Refer to the Following to solve this problem since it needs to stop the running script.

1. Entering ISP mode

   Make P4M-440G to enter ISP mode by supplying power while inputting LOW to ISP# pin. In the ISP mode, you can access to PHPoC by PHPoC Debugger without running a script.

2. Connect to PHPoC

   Connect a PC to PHPoC via a USB cable and connect to the port via PHPoC Debugger. A message window related with ISP mode will be popped up.

3. Reboot PHPoC

   Reboot PHPoC by using "Reboot a product" menu in PHPoC Debugger. After rebooting, PHPoC stops running script even it is not in the ISP mode.

4. Correct source code

   Correct the source code to prevent infinite reboot state.

Device Information

Device	Channel	Path	Note
UART	2	/mmap/uart0~1	-
NET	1	/mmap/net0	Ethernet
TCP	5	/mmap/tcp0~4	-
UDP	5	/mmap/udp0~4	-
Digital I/O	1	/mmap/uio0	10 Pins (uio0.0 ~ 0.7, 0.10, 0.11)
ST	8	/mmap/st0~7	-
SPI	1	/mmap/spi0	-
I2C	1	/mmap/i2c0	-
RTC	1	/mmap/rtc0	-
UM	4	/mmap/um0~3	-
NM	1	/mmap/nm0	-

※ Refer to the PHPoC Device Programming Guide for p40 for detailed information about using devices.
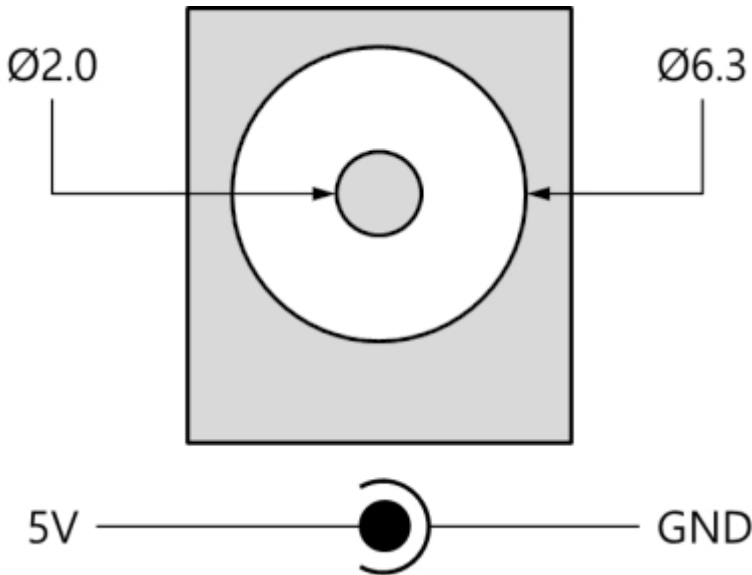
Evaluation Board

This evaluation board is only can be used with P4M-440G.
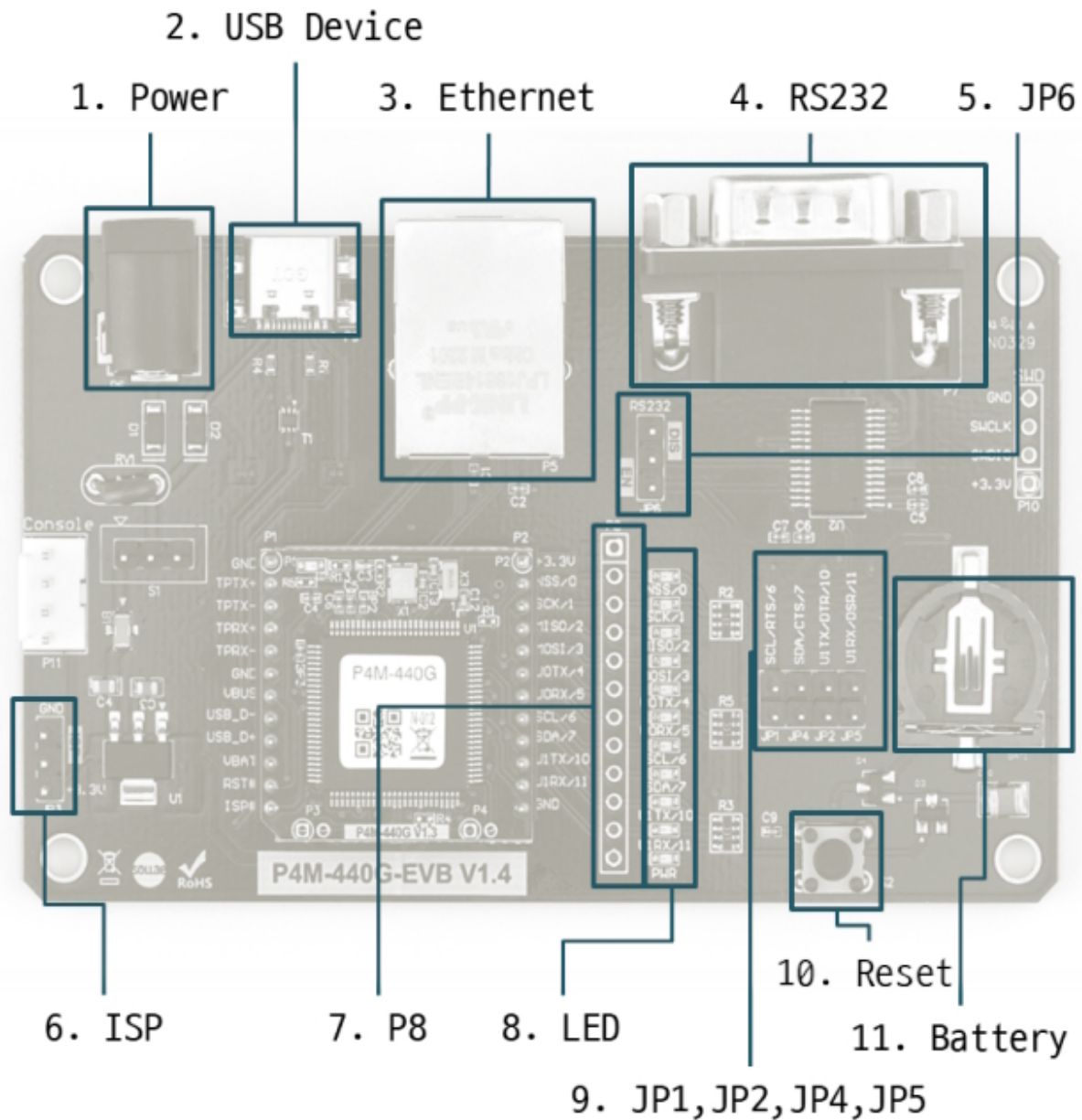
1. Power

This is the power input port that supplies power to the board. The input voltage is DC 5V, and the port specifications are as follows:

Ø2.0

Ø6.3

5V ———————●—————— GND

## 2. USB Device Port for connection with PC

The USB device port is to connect with PC. You can access to P4M-440G via the development tool(PHPoC Debugger) by connecting USB cable to this port. You can supply DC 5V power through this port.

3. Ethernet

This port provides 10/100Base-TX Ethernet interface of P4M-440G. This port is equipped with an RJ45 connector and is mapped to the NET0 device for programming purposes.

```
#1 : Tx + (Out)
#2 : Tx - (Out)
#3 : Rx + (In)
#6 : Rx - (In)
```

#8 ··· #1

4. RS232

① ② ③ ④ ⑤
⑥ ⑦ ⑧ ⑨
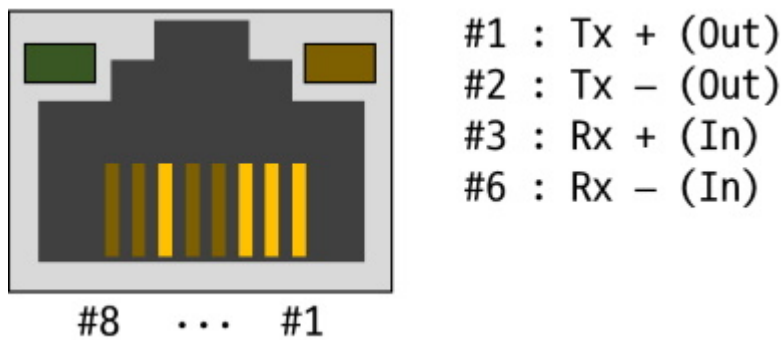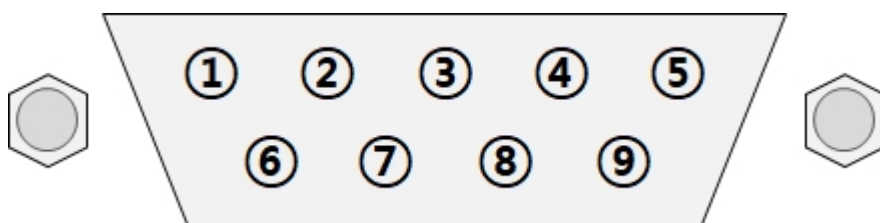
This port uses a D-SUB 9-pin male connector and is mapped to the UART0 device for programming purposes. The pin specifications are as follows:

Pin	Name	Description	Level	I/O	Wiring
2	RXD	Receive Data	RS232	In	Required

Pin	Name	Description	Level	I/O	Wiring
3	TXD	Transmit Data	RS232	Out	Required
4	DTR	Data Terminal Ready	RS232	Out	Optional
5	GND	Ground	Ground	-	Required
6	DSR	Data Set Ready	RS232	In	Optional
7	RTS	Request To Send	RS232	Out	Optional
8	CTS	Clear To Send	RS232	In	Optional

5. JP6
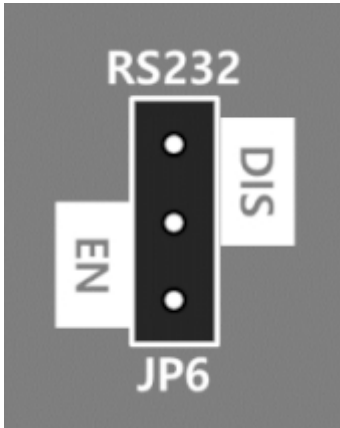
JP6 enables or disables the RS232 port on the board. Connecting the jumper to the "EN" side activates it, while connecting it to the "DIS" side or leaving it unconnected deactivates it.

6. ISP Jumper

You connect +3.3V or GND to the ISP# pin of the P4M-440G using this jumper.

7. P8

P8 is connected 1:1 with all the pins on the module's P2.

Pin	Name	I/O	Description
P8.1	+3.3V	-	+3.3V Power Input
P8.2	NSS(0.0)	In/Out	UIO 0.0 / SPI NSS
P8.3	SCK(0.1)	In/Out	UIO 0.1 / SPI SCK
P8.4	MISO(0.2)	In/Out	UIO 0.2 / SPI MISO
P8.5	MOSI(0.3)	In/Out	UIO 0.3 / SPI MOSI
P8.6	U0TX(0.4)	In/Out	UIO 0.4 / UART0 TX
P8.7	U0RX(0.5)	In/Out	UIO 0.5 / UART0 RX
P8.8	SCL(0.6)	In/Out	UIO 0.6 / I2C SCL
P8.9	SDA(0.7)	In/Out	UIO 0.7 / I2C SDA
P8.10	U1TX(0.10)	In/Out	UIO 0.10 / UART1 TX
P8.11	U1RX(0.11)	In/Out	UIO 0.11 / UART1 RX
P8.12	GND	-	Ground

8. LED

LED	Color	Description
NSS/0	Green	ON when UIO 0.0 is LOW
SCK/1	Green	ON when UIO 0.1 is LOW
MISO/2	Green	ON when UIO 0.2 is LOW
MOSI/3	Green	ON when UIO 0.3 is LOW

LED	Color	Description
U0TX/4	Green	ON when UIO 0.4 is LOW
U0RX/5	Green	ON when UIO 0.5 is LOW
SCL/6	Green	ON when UIO 0.6 is LOW
SDA/7	Green	ON when UIO 0.7 is LOW
U1TX/10	Green	ON when UIO 0.10 is LOW
U1RX/11	Green	ON when UIO 0.11 is LOW
PWR	Red	ON when the power is supplied

9. JP1, JP2, JP4, JP5
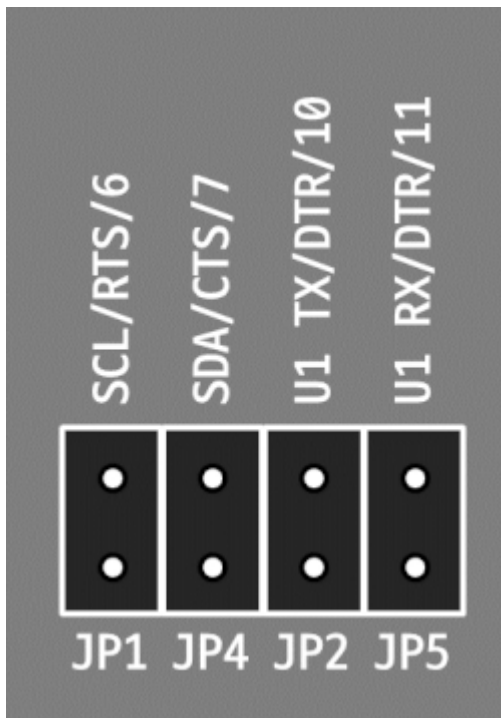
These jumpers are used to connect each control signal (RTS, CTS, DTR, DSR) of RS232 to the RS232 port.

Name	Description
JP1	Jumper Connection: Connect P2.8 (SCL, 0.6) pin to RS232 port 7.
JP4	Jumper Connection: Connect P2.9 (SDA, 0.7) pin to RS232 port 8.
JP2	Jumper Connection: Connect P2.10 (U1TX, 0.10) pin to RS232 port 4.
JP5	Jumper Connection: Connect P2.11 (U1RX, 0.11) pin to RS232 port 6.

10. Reset Button

If this button is pressed, LOW signal is connected to the RESET# pin.

11. Battery Socket

This is a battery socket for the RTC. Please use a CR1225 or CR1220 battery.