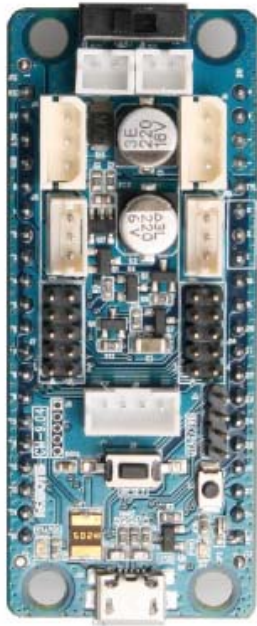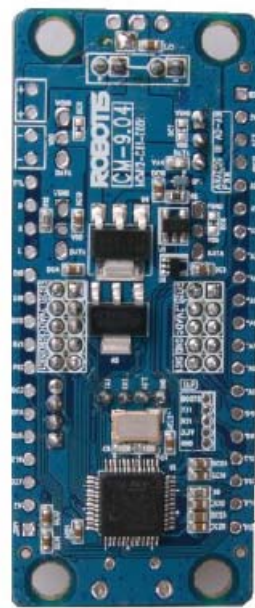# 1. OpenCM9.04 Hardware

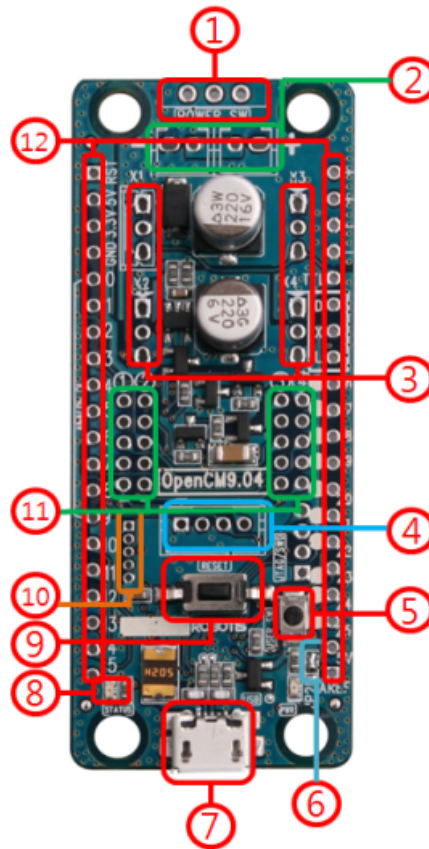① Illustration of OpenCM9.04

[TOP]   [BOTTOM]

② Parts label

1. Power Switch: battery connection (power input).

2. Battery socket: sockets to connect Li-Ion Battery(ies). *[Note: each battery provides 3.7V; batteries in both pins provide 7.4V]*

3. DYNAMIXEL TTL BUS: ports for TTL-based Dynamixels. Connected dynamixels can be daisy-chained.

4. USART PIN: connect 4-pin devices such as the BT-110, BT-210, ZIG-110, LN-101 for UART communications (note: the LN-101 firmware only allows communications with the PC).

5. User Switch: user-programmable switch; OpenCM9.04 recovery-mode

6. Analog Reference Selection Jumper : change to 5V for analog signals.

7. Micro-B USB: Connect the OpenCM9.04 for communications, downloads, and 5V input power supply. Any type-B micro USB cable for Android phone is useful.

8. Status LED: Test LED for OpenCM9.04's programming. The LED blinks with a high/low signal to pin D16.

9. Reset switch: resets the CPU.

10. JTAG/SWD 4 PIN: Via JTAG/SWD terminal implement other programs such as IAR, Keil. The OpenCM9.04 has a total of 128Kbytes of memory, downloads and stores the bootloader's binary starting at 0x08000000. (Bootloader: 0x08000000 to 0x08002FFF. User programming space: 0x08003000 to 0x08020000).

11. Extenal Sensor PIN: pins for Robotis' sensors.

12. 2.54 mm GPIO Header: Interface external devices to the OpenCM9.04's STM32F103CB CPU.

③ Product package

A Type Board Only

package		quantity
controller	OpenCM9.04	1
manual	User Guide	1

B type

package		quantity
controller	OpenCM9.04	1
PIN Header	1x20 Pin Header	2
BOX Header	1x20 BOX Header	2
USB cable	Micro B Cable	1
manual	User Guide	1

④ Product specifications

	OpenCM9.04
CPU	STM32F103CB (ARM Cortex-M3)
Op Voltage	5V~16V(USB 5V, DXL 12V, XL-Series 7.4V)
I/O	GPIO 26
Timer	8 (16bit)
Analog In(ADC)	10 (12bit)
Flash	128 Kbytes
SRAM	20 Kbytes
Clock	72Mhz(9 X 8 Mhz)
USB	1 (2.0 FullSpeed) Micro B type
CAN	1
USART	3
SPI	2
I2C(TWI)	2
Debug	JTAG & SWD
Extenal SenSor	4
3 Pin TTL	4(XL combo 3 PIN)
SW Tool	ROBOTIS OpenCM
SIZE	27mm X 66.5 mm

⑤ Power

    A. Connect to USB power

For programming simply connect the OpenCM9.04 via USB. The LED blinks I/O control under 5V becomes available.
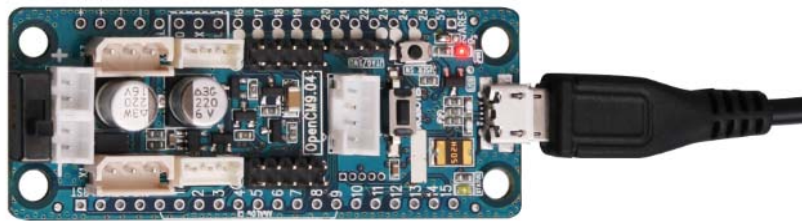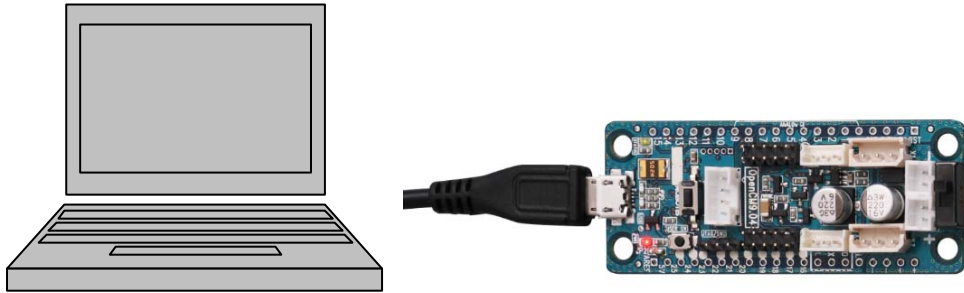

    B. Connect to battery power

To control Dynamixel(s) connect the proper battery product. Afterwards the board runs the pre-downloaded mode.
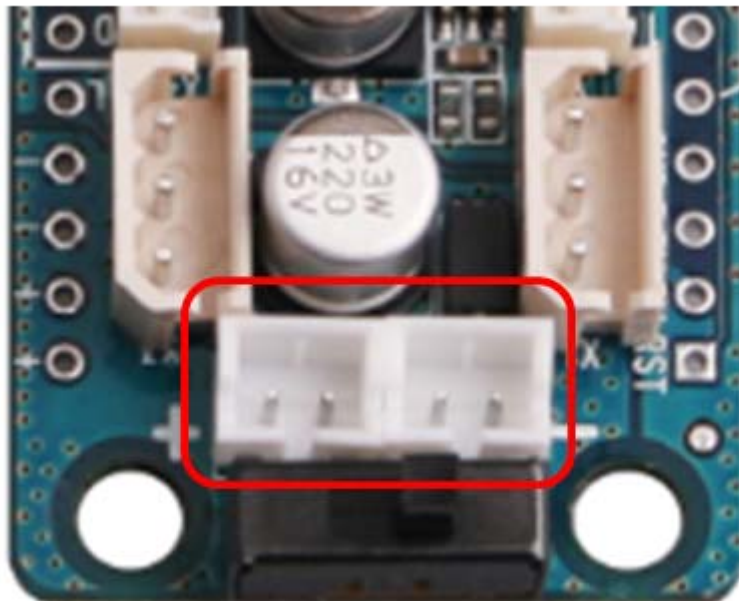
⑥ How-to-operate

A. The OpenCM9.04 executes the user code (0x08003000) when powered under battery or USB.

B. Connect to the PC via USB, write the program in the integrated development environment (IDE), compile and download the program.

<connect the OpenCM9.04 to PC>


```
/*
Blink2

Turns on the built-in(Status) LED on for 0.1 second, then off for 0.1 second
repeatedly using toggleLED() which is function only for built-in LED.

Ported to OpenCM Series from the Arduino example 27 May 2011
By ROBOTIS,.LTD.
*/

void setup() {
  // Set up the built-in LED pin as an output:
  pinMode(BOARD_LED_PIN, OUTPUT);
}

void loop() {
  toggleLED();  //toggle digital value based on current value.
```
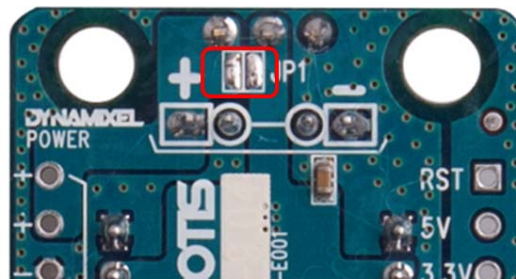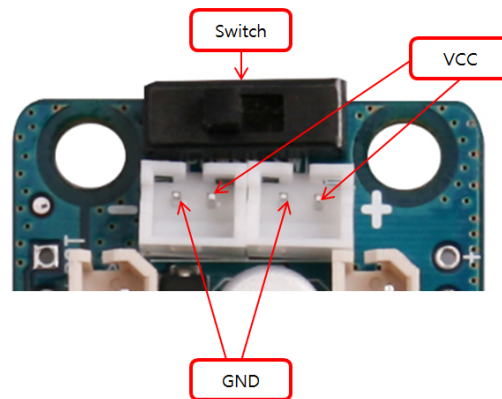
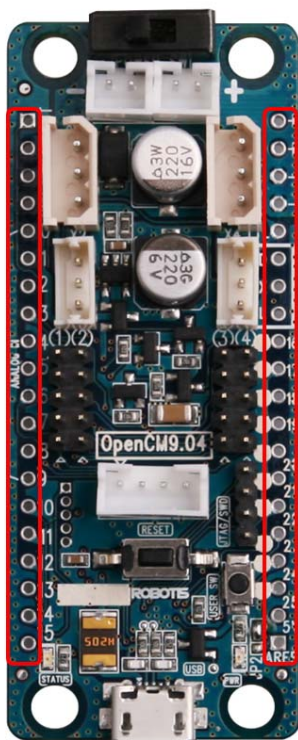<OpenCM9.04 IDE ROBOTIS OpenCM>

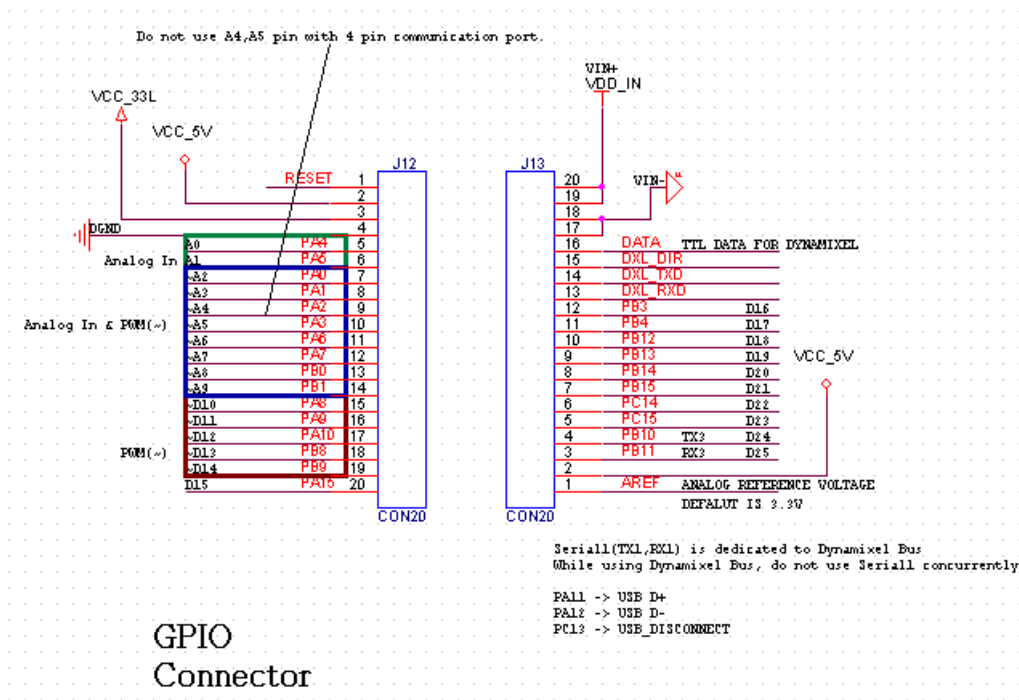## ⑦ Pin information

A. Power and switch

.

For switch use de-solder JP1

B. Refer to the OpenCM9.04's schematic for GPIO header pins to interface to the STM32F103CB CPU
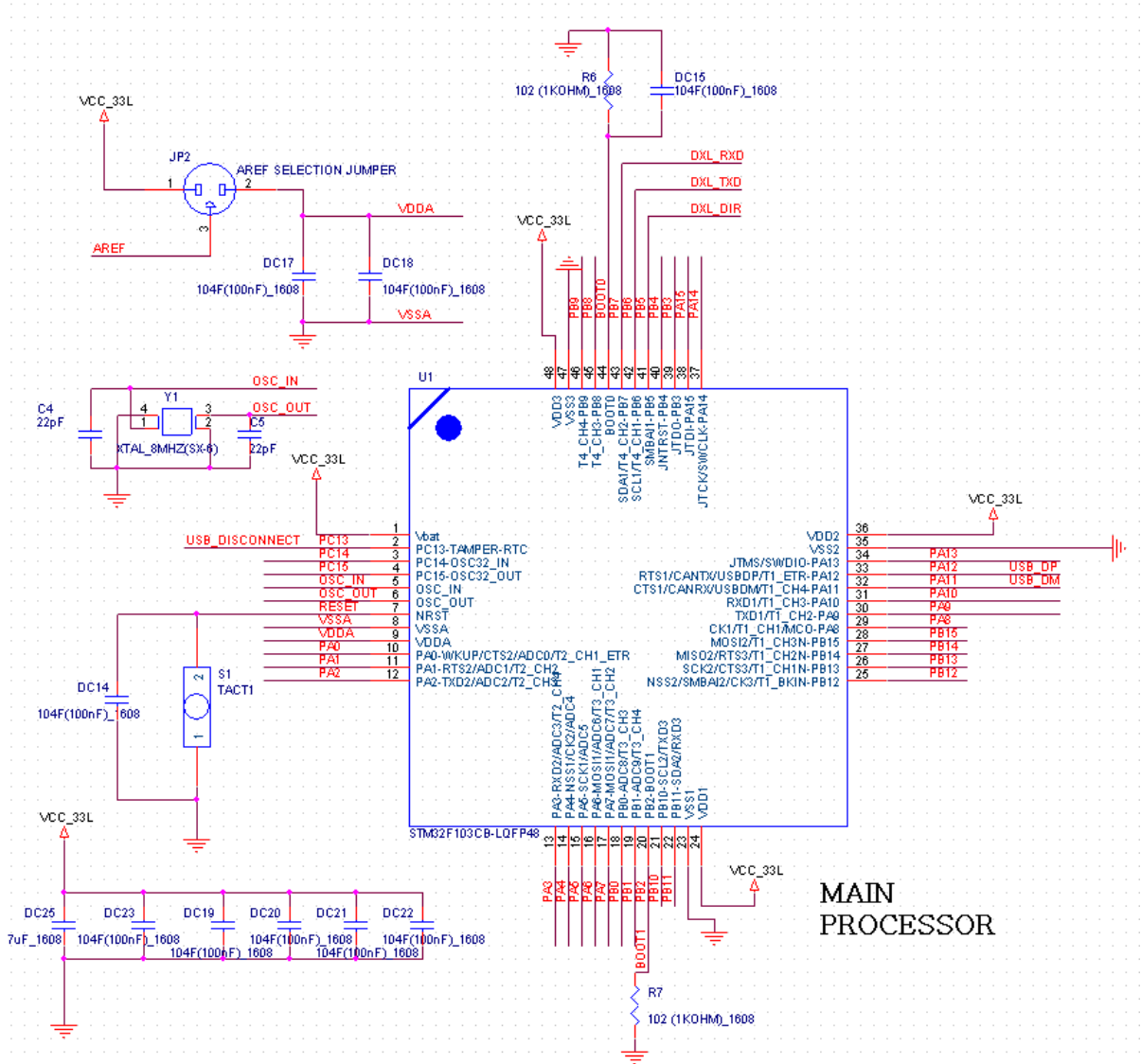
[OpenCM9.04 GPIO]

[OpenCM9.04 GPIO schematic]

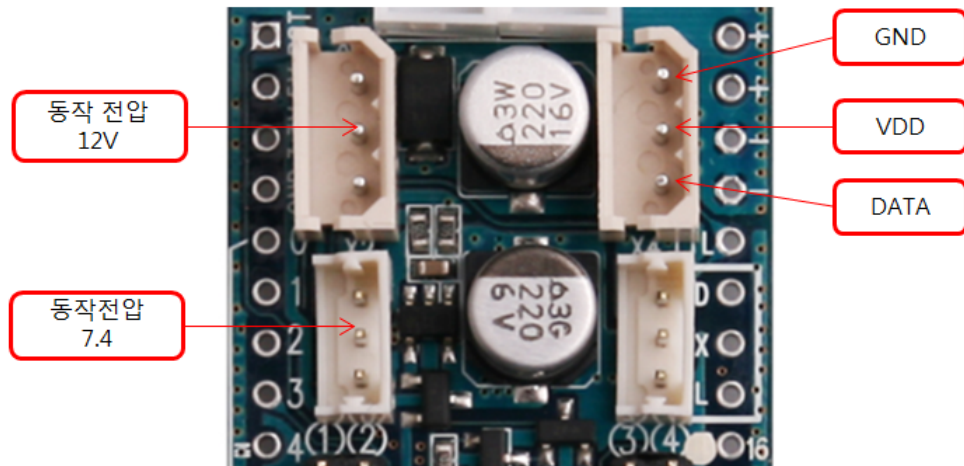For reference VDD is 12V; Dynamixel-related portions (pins PB5, PB6,

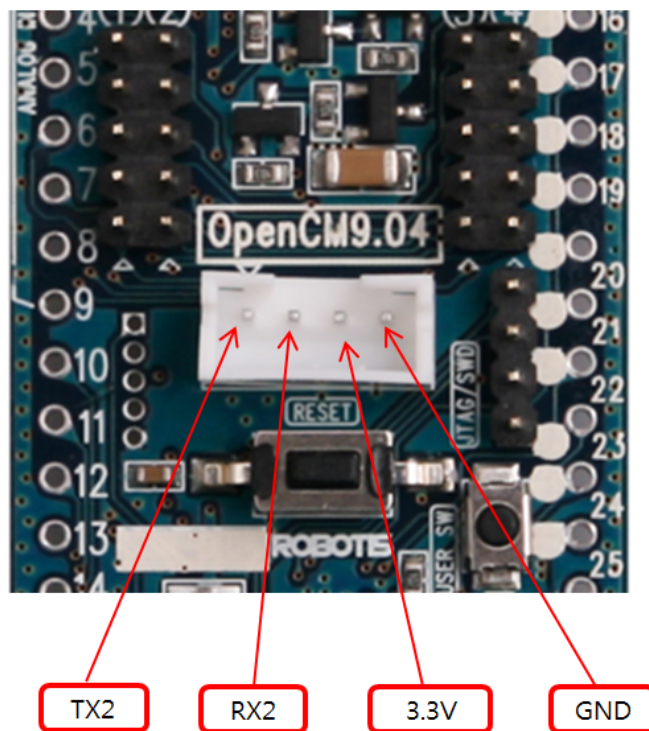PB7) have been wired separately so they are not available for use

.

< STM32F103CB(LQFP48 Package) CPU connection schematic>

C. DYNAMIXEL   TTL BUS

동작 전압
12V

동작전압
7.4

GND

VDD

DATA

D. 4-pin communication devices

TX2

RX2

3.3V

GND

The same labels shown on the reverse side.

⑧ Schematic and PCB Gerber file (Schematic & Gerber Design)

The OpenCM9.04 resources (both hardware and software) are 100% open. Resources can be obtained via gitHub with the link below.
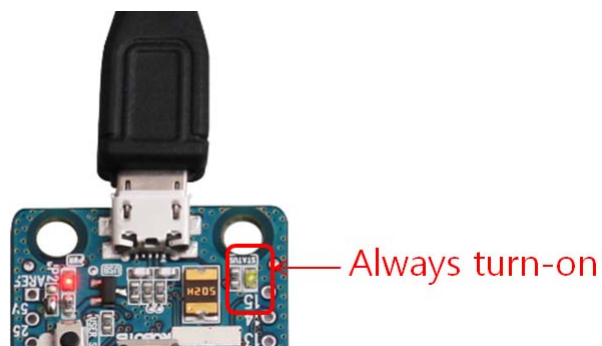
https://github.com/robotis-pandora/ROBOTIS-OpenCM.git

⑨ Emergency recovery mode

A. Whether the OpenCM9.04 USB drivers are not initialized nor device detected press the switch and connection will reestablish.
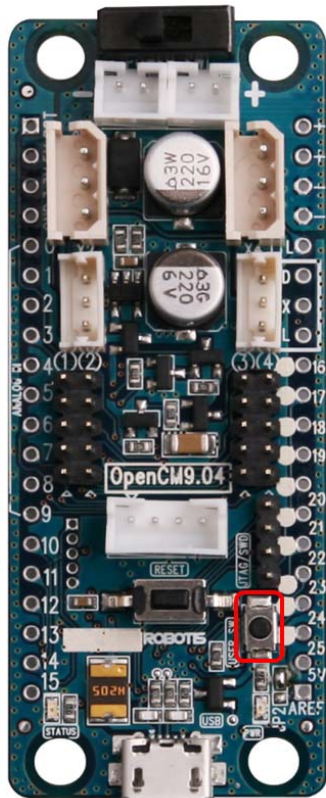
B. When connected via USB check the STATUS LED.

C. Go to File -> examples -> Digital -> Blink example; download it and

press the button (any other example OK).