Servo Driver HAT

User Manual

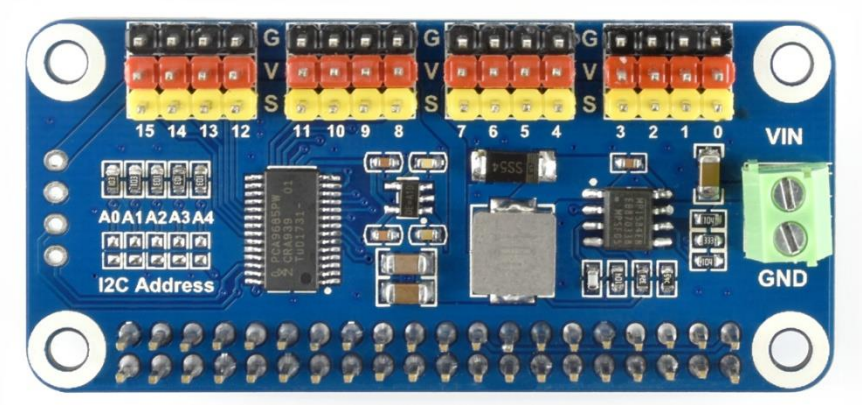
OVERVIEW

This Servo Driver board is an PWM/servo expansion board for Raspberry Pi. Use PCA9685 chip, expands up to 16 channels and support 12-bits resolution for each channel. Using I2C interface. This board also integrates 5V regulator, up to 3A output current, can be powered from battery through VIN terminal. It could be used to for Robot applications.

FEATURES

- Power supply: 6V~12V (VIN terminal)
- Servo voltage: 5V
- Logic voltage: 3.3V
- Driver: PCA9685
- Control interface: I2C
- Dimension: 65mm x 36mm
- Mounting hole size: 3.0mm

HARDWARE



You can connect battery to the green socket VIN on the left for power supply, for VIM, voltage range 6V~12V. 5V regulator on board could output 3A (MAX) current. You can also connect 5V power supply to the POWER interface on the right, and it could power micro:bit via 3.3V regulator.

A0~A4 can be used to set devices address of I2C, supports multiple Servo Driver HAT connected at the same time.

GPIOs on top are interfaces of servo. Black pins are connected to GND (mostly connect to brown wire of servo). Red pins are VCC pin connected to 5V. Yellow GPIOs are signal wires of PWM, channel 0~15 supports 16 servos connected at the same time.

【Note】

1. If you only connect 5V power supply to USB interface, servo cannot be driven.
2. You should connect higher power supply for higher-power servo.
3. Make sure servo are connected properly, otherwise they will not move.

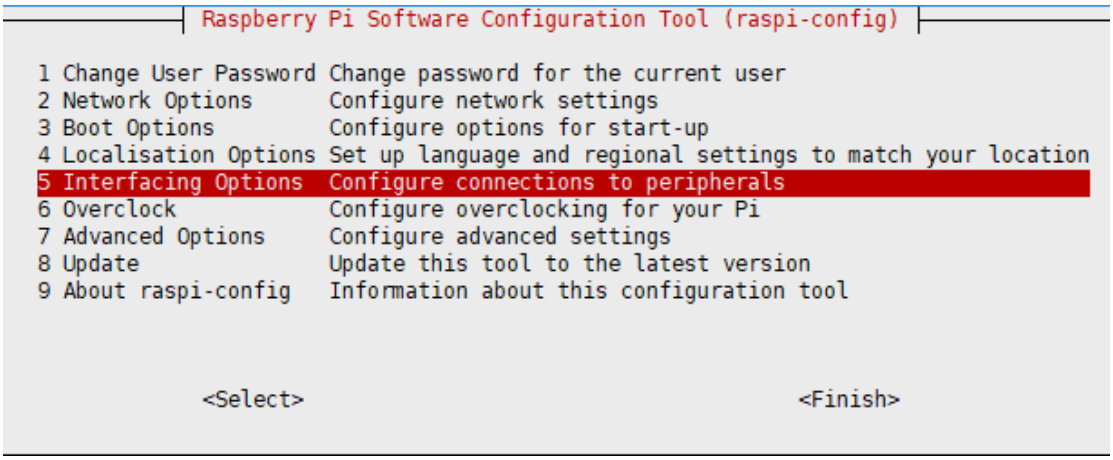
HOW TO USE

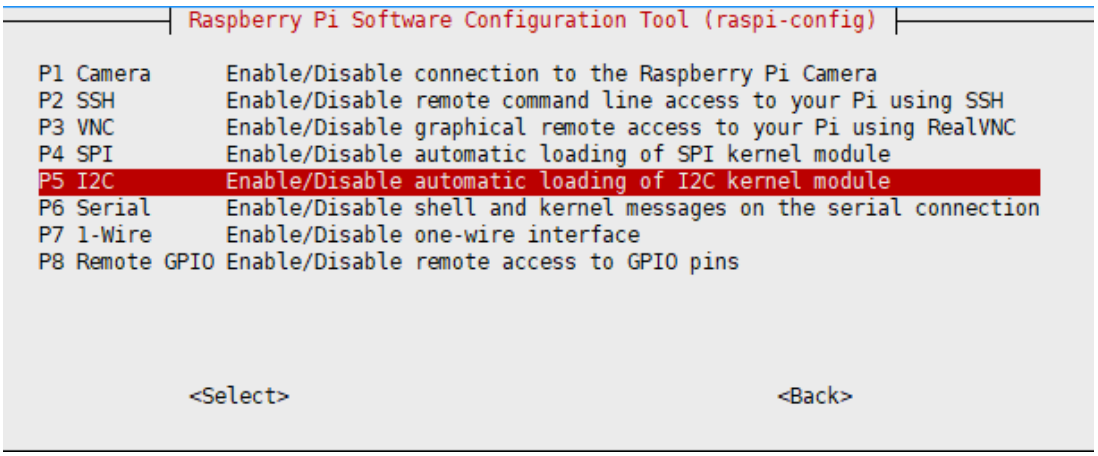
ENABLE I2C

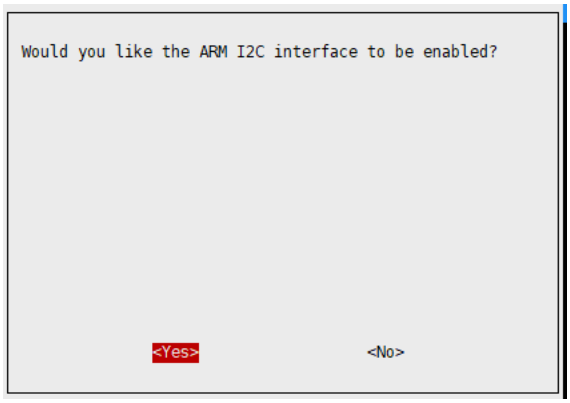
1. Run this command on terminal to begin setting.

   sudo raspi-config

2. Choose Interfacing Options ->I2C -> yes







If errors occurs after running demo code:

1) Edit modules file:

   sudo nano /etc/modules

2) Add these two statements to file opened and save:

   i2c-dev

   i2c-bcm2708

RUNNING CODE

We provide both python2 and python3 demo code for this HAT, to test PCA9685, WIFI remote control and Bluetooth remote control.

To test WiFi and Bluetooth demo code, you should first install APP to your phone, which only support Android.

Download demo code from our Wiki, then extract and copy it to Raspberry Pi.

PCA9685 LIBRARIES TESTING

Running PCA9685 demo code with commands:

```
cd Servo_Driver_HAT/python
sudo python PCA9685.py
```

Expected Result: Connect servo to channel 0, servo keeps rotating from 0 degree to 180 degree then turning to 0 again.

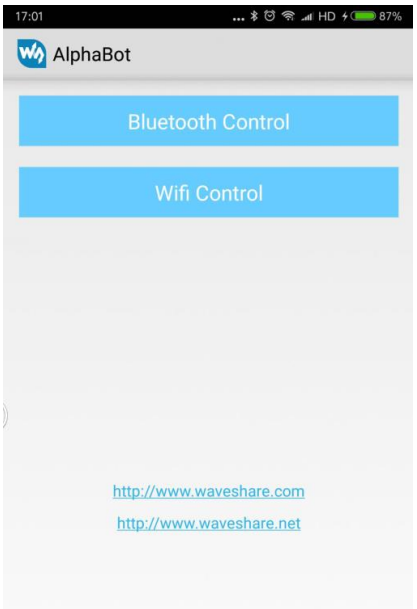
WIFI REMOTE CONTRLLING

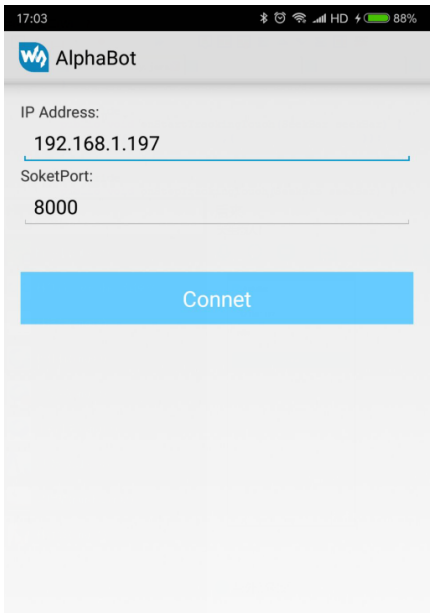
Running the demo code:

```
cd Servo_Driver_HAT/python/Wifi-Control
sudo python main.py
```

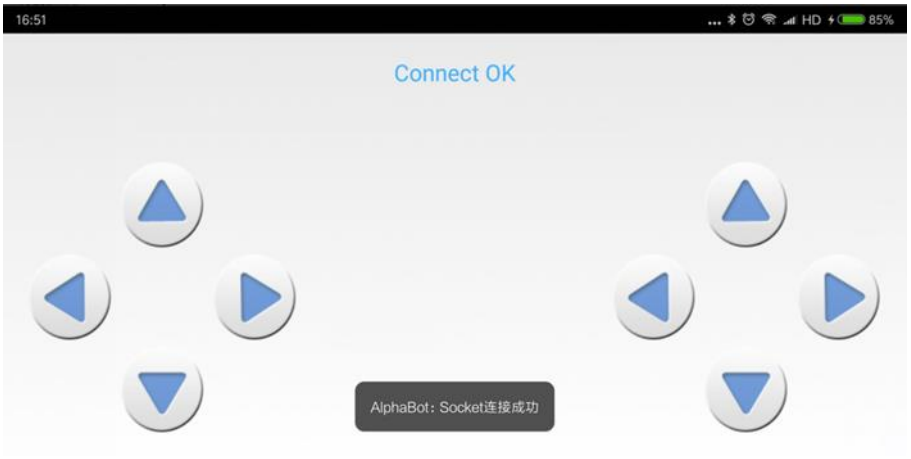
Expected result: Sender (Phone or PC) and receiver (Raspberry Pi) should be connected to the same LAN. This demo code uses TCP protocol for data transmitting. After running demo code, IP address of Raspberry Pi and the socket port 8000 will be printed.

Open the APP on your phone, choose WiFi Control, input ip address of Raspberry Pi and SoketPort, click Connect:





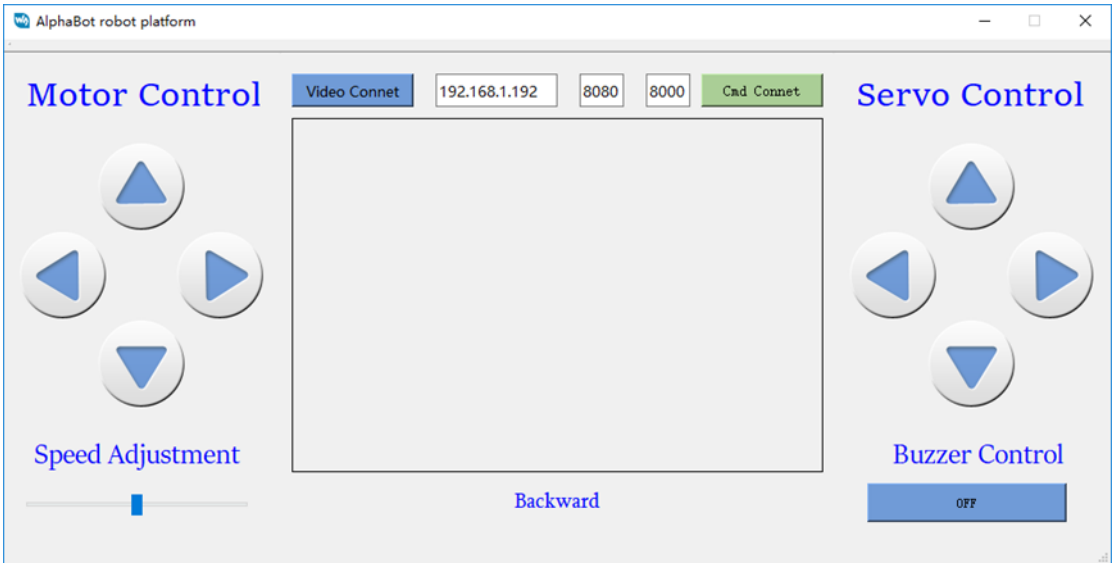
After connecting, it will enter the control page, click buttons could control servos from channel 0 to channel 4




```
pi@raspberrypi:~/Servo_Driver_HAT/python/Wifi-Control $ sudo python main.py
start
192.168.1.192

server is running....
('got connection from ', ('192.168.1.184', 59089))
Forward
Stop
Backward
Stop
```

You can also use the software (QT) on PC as below:



BLUETOOTH REMOTE CONTROLLING

1. Update and install tools for Bluetooth communication

   sudo apt-get update

   sudo apt-get upgrade -y

   sudo apt-get dist-upgrade -y

   sudo apt-get install pi-bluetooth bluez bluez-firmware blueman

2. Add user pi to group bluetooth

   sudo usermod -G bluetooth -a pi

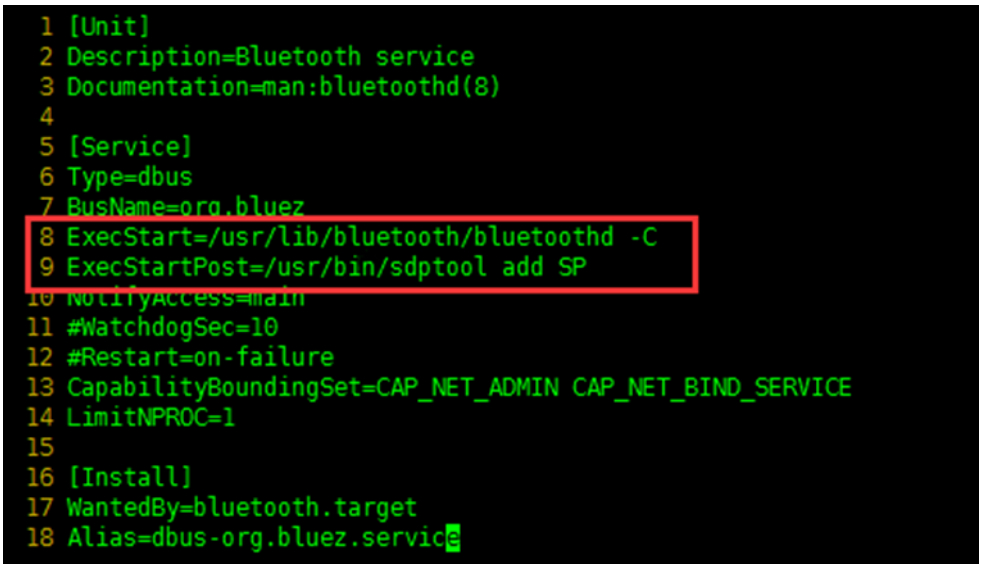
3. Restart Raspberry Pi

   sudo reboot

4. Enable/add SPP, enable Bluetooth devices

   sudo vi /etc/systemd/system/dbus-org.bluez.service

   modify the statements as below:



5. Restart Raspberry Pi, check Bluetooth services y hciconfig command:

```
pi@raspberrypi:~ $ sudo hciconfig
hci0:   Type: BR/EDR  Bus: UART
        BD Address: B8:27:EB:2D:00:87  ACL MTU: 1021:8  SCO MTU: 64:1
        UP RUNNING
        RX bytes:717 acl:0 sco:0 events:42 errors:0
        TX bytes:1532 acl:0 sco:0 commands:42 errors:0
```

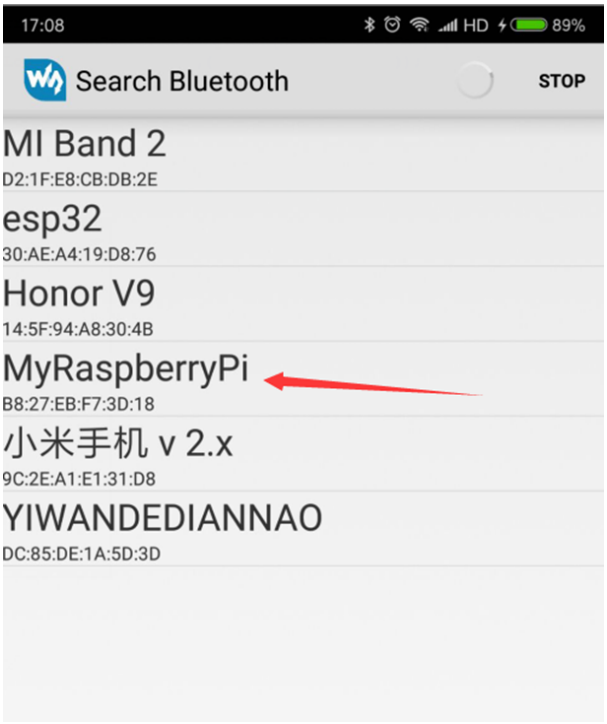
6. If hci0 device is recognized, Bluetooth is working normally, otherwise Raspberry Pi doesn’ t Bluetooth and you need to check the steps above.

7. Running demo code:

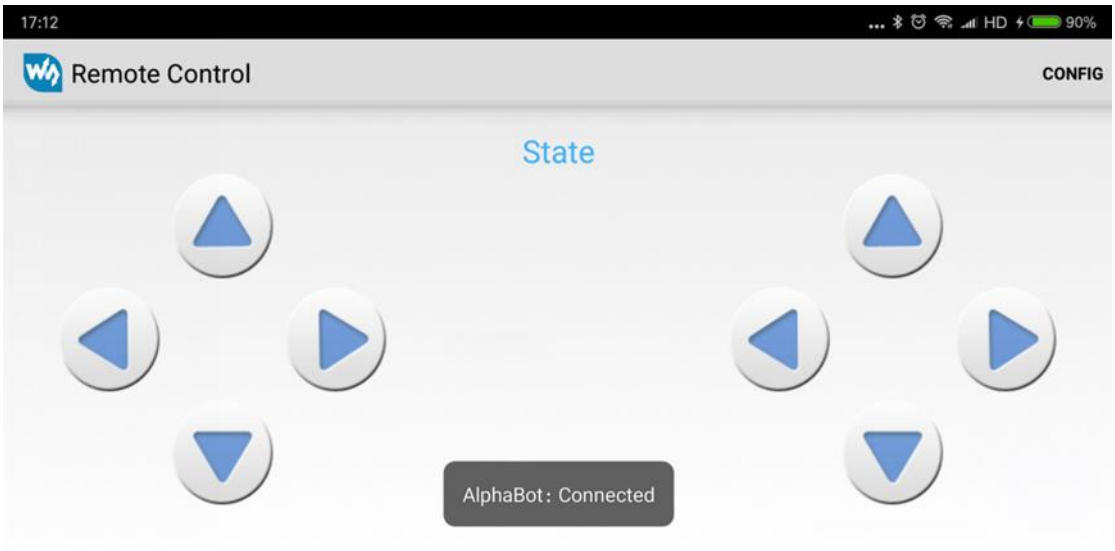
   cd Servo_Driver_HAT/python/Bluetooth-Control

   sudo ./Bluetooth.sh

Expected result: After running demo code, it will prompt waiting for Bluetooth connecting. Open APP on your phone, click scanning, and connect Raspberry Pi device.



After connecting, it will enter control page, you can clock buttons to control servos now.




```
pi@raspberrypi:~/Servo_Driver_HAT/python/Bluetooth-Control $ sudo ./bluetooth.sh
[NEW] Controller B8:27:EB:F7:3D:18 raspberrypi [default]
[NEW] Device 94:87:E0:DA:12:1D 小米手机
[bluetooth]# discoverable on
[DEL] Controller B8:27:EB:F7:3D:18 raspberrypi [default]
[bluetooth]#
(bluetoothctl:32748): GLib-CRITICAL **: Source ID 23 was not found when attempting to remove it
Waiting for connection on channel 1
Connection from 94:87:E0:DA:12:1D to /dev/rfcomm0
Press CTRL-C for hangup
serial test start ...
Forward
Stop
Backward
Stop
```

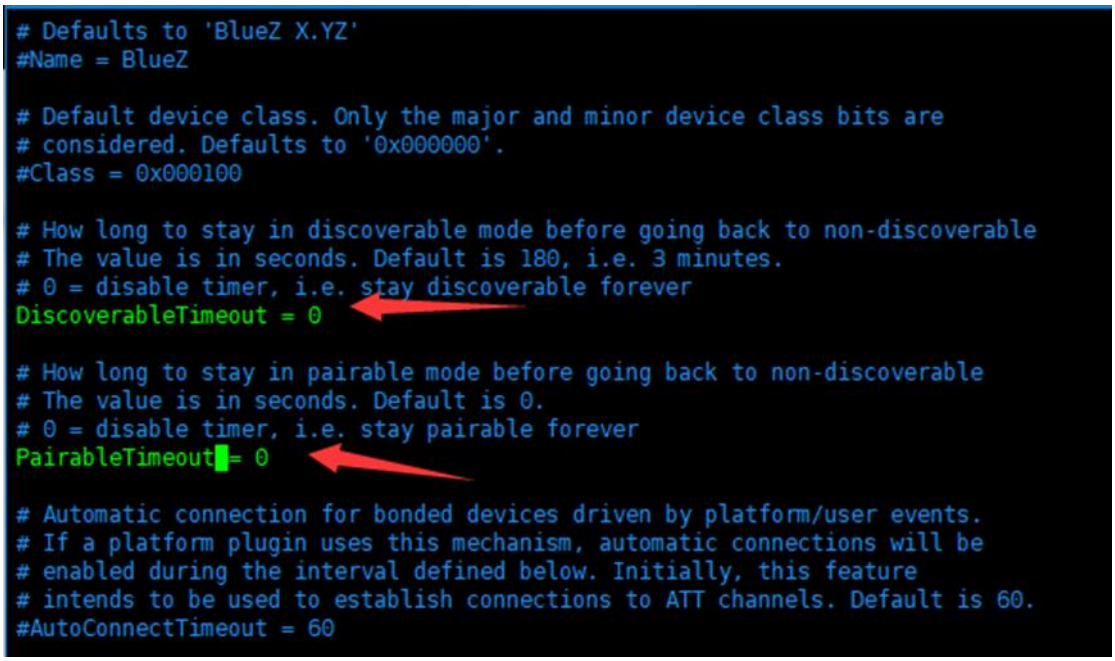
【Note】

- If commands received are wrong, you can config the command of buttons for press and release states.

- Raspberry Pi could only be scanned for 180s by default. If you want to letRaspberry Pi could be scanned and paired all the time, you should change setting as below:

sudo vi /etc/bluetooth/main.conf

uncomment statements as image:



The demo code is compatible with python3, you can just change the command python to python3.

For more details about Raspberry Pi WIFI and Bluetooth Controlling, please refer to Alphabot2:

https://www.waveshare.com/wiki/AlphaBot2

PCA9685 LIBRARIES

There are some functions included in driver library PCA9685.py, you can used them when you write your own application code.

INITIALIZE NEW OBJECT

You can create a new object for every HAT

pwm = PWM(0x40)

pwm is the object we created, PWM(0x40) is creating. by default, the I2C device address of the module is 0x40. If you have changed the I2C address, you could use other address to create new object.

SET PWM FREQUENCY

setPWMFreq(self,freq)

Used to set PWM frequency. This value defines the time of every pulse, that is cycle.

Parameters:

- **freq:** numbers (Hz), in range: 40~1000.

If you use PWM to control servo, the frequency should be 5Hz as below:

Example:

pwm.setPWMFreq(50)

SET PWM PLUSE WIDTH

setPWM(self,channel,on,off)

This function is used to set PWM pulse in certain channel, set its high level being (on) and finish (off) time.

Parameter:

- **channel:** PWM channel (0~15)
- **on:** When the signal change from Low to High (0~4095)
- **off:** When the signal changed from High to Low (0~4095)

Example:

The example is set channel 15 begin to output High level at 0 and finish at 1024. That is the High level (0-1024) duty rate is 25%, and Low level (1024-4095) duty rate is 57%, cycle is (1/freq).

pwm.setPWM(15 ,0 ,1024)

SET SERVO PULSE

setServoPulse (self,channel, pulse)

This function is used to set the pulse of servo.

【Note】Before this function, you should set PWM frequency to 50Hz first, otherwise servo works improperly.

Parameters:

- **channel:** PWM channel (0-`5)
- **pulse:** pulse width outputted, unit is us （500~2500）

Examples

This example will output 1500us PWM signal to channel 0. That is rotate the servo 90 degree.

pwm. setServoPulse (0,1500)

The relationship between pulse and degree are:

500 ------- 0 °

1000 ------- 45 °

1500 ------- 90 °

2000 ------- 135 °

2500 ------- 180 °