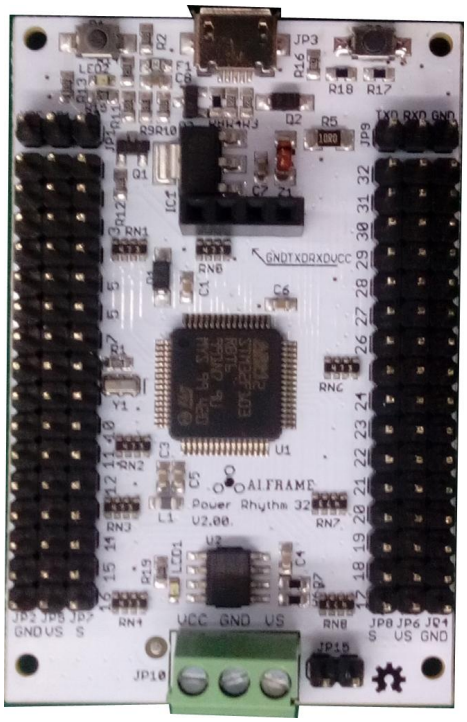
Power Rhythm 32 Guide V1.0



Cautions!/警告

- Read this quick start guide completely before wiring and applying power to the board! Errors in wiring can damage the Power Rhythm 32 board, STM32 or EEPROM Chip, and any attached servos or peripherals.
  在使用本控制器之前请仔细阅读此说明书。错误的操作将会对控制器造成无法挽回的伤害
- Never reverse the power coming in to the board. Make sure the black wire goes to (-) GND, and the red wire goes to (+) VCC, or VS. Never connect peripherals when the board is powered on.
  禁止反接电源正负极，确保负极连接板上的 GND 引脚，正极连接 VCC 或 VS 引脚，禁止在控制器通电时连接其他外设
- The on-board regulator can provide 250mA total. This includes the micro controller chip, the on-board LEDs, and any attached peripherals. Drawing too much current can cause the regulator to overheat.
  板载的电源只提供约 250mA 的电流，过多电流将会导致电源过热。

Power Rhythm 32

The Power Rhythm 32 is a servo controller allows you to control up to 32 servos by sending serial commands from a micro controller or PC via TTL serial or USB

connection.Since the Power Rhythm 32 is powered by a STM32 chip and base on an Arduino compatible board Maple Rev 3, the firmware is open-source, so the Power Rhythm 32 is also a development platform which can be customized for specific applications including systems that require servos, DC motors, stepper motors and lighting control.

Power Rhythm 32 是一个 USB 和串口舵机控制器，可以同时控制 32 个舵机

Maple quick start guide:/Maple 开发平台入门：

http://leaflabs.com/docs/hardware/maple.html

What is a Servo?

Before we illustrate how to use the servo controller we need to explain what a servo is, and define the control methodology.

Pulse-proportional servos are designed for use in radio-controlled (R/C) cars, boats and planes. They provide precise control for steering, throttle, rudder, etc. using a signal that is easy to transmit and receive. The signal consists of positive going pulses ranging from 0.9 to 2.1mS (milliseconds) long, repeated 50 times a second (every 20mS). The servo positions its output shaft in proportion to the width of the pulse, as shown below.

In radio-control applications, a servo needs no more than a 90° range of motion, since it is usually driving a crank mechanism that can't move more than 90°. So when you send pulses within the manufacturer-specified range of 0.9 to 2.1mS, you get around 90° range of motion.

Most servos have more than 90° of mechanical range. In fact, most servos can move up to 180° of rotation. However, some servos can be damaged when commanded past their mechanical limitations. The Power Rhythm 32 lets you use this extra range. A position value of 500

corresponds to 0.50mS pulse, and a position value of 2500 corresponds to a 2.50mS pulse. A one unit change in position value produces a 1uS (microsecond) change in pulse width. The positioning resolution is 0.09°/unit (180°/2000). From here on, the term pulse width and position are the same.

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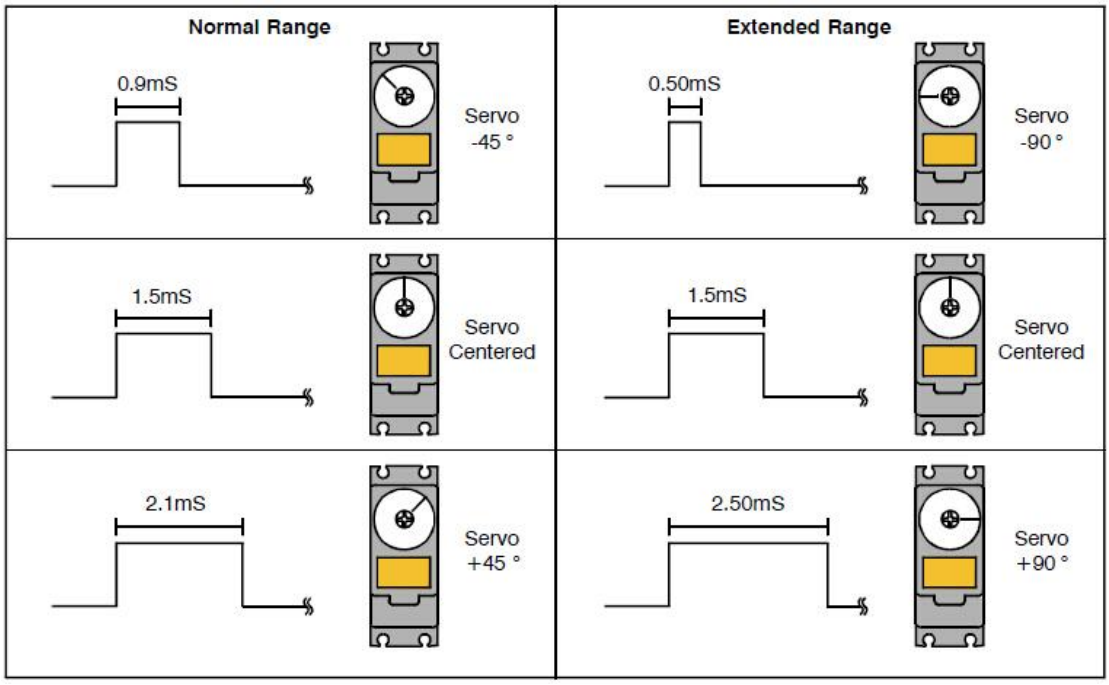


Remember that some servos may not be able to move the entire 180° range. Use care when testing servos. Move to the extreme left or right slowly, looking for a point when additional positioning values no longer result in additional servo output shaft movement. When this value is found, put it as a limit in your program to prevent damaging the servo. Generally, micro servos are not able to move the entire 180° range.

Feathers:/产品参数

- STM32 based hardware/基于 STM32 单片机
- Program via USB interface with PC/通过 USB 编程
- Separate screw-terminal power supply for servos and chips/独立的舵机电源和芯片电源供电
- Servo speed controlled and acceleration controlled/具有舵机调速和加速度控制功能
- Compatible with Arduino coding/兼容 Arduino
- The accuracy of PWM signal is 1 uS/信号精度 1uS
- Support all kinds of PWM servos/支持所有 PWM 舵机
- Open-source firmware and hardware
- Support offline mode/具有脱机模式
- 512K EEPROM flash for offline command data saving/板载 512Kflash

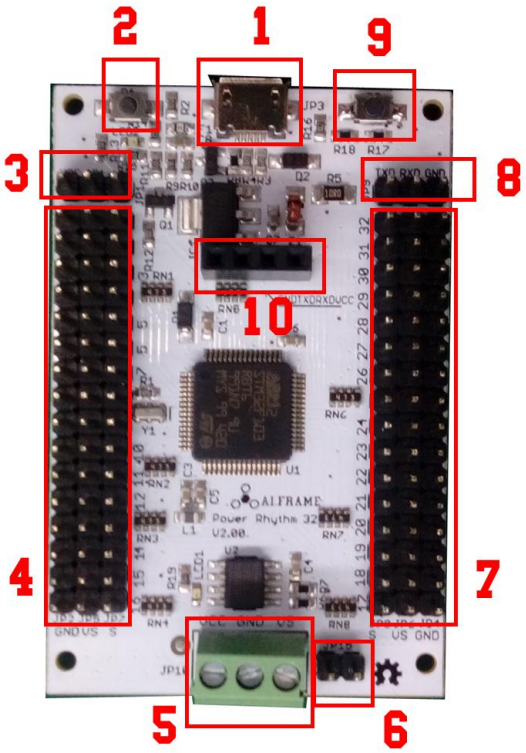
Application:

- Fun-house prop control
- Animated art control
- Robotics

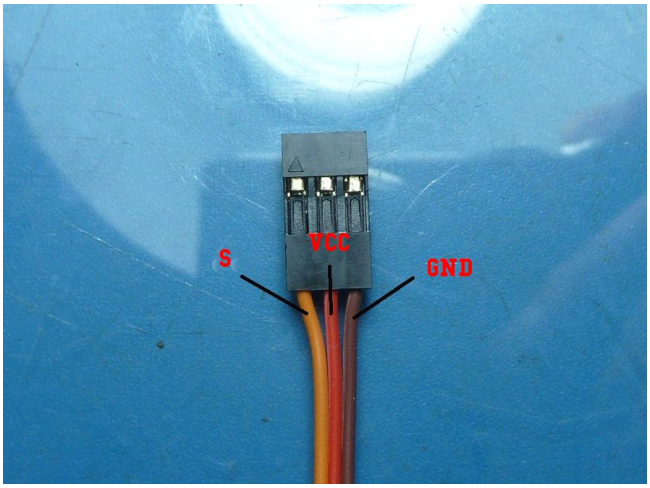
Specifications：

- Power requirements: 5 - 12 VDC @ ~60 mA for logic VCC, 4.8 – 7.5 VDC for servos VS (do not exceed your servos' input voltage rating)/电压: 5 - 12 VDC @ ~60 mA 到 VCC, 4.8 – 7.5 VDC f 到舵机供电端 VS (不要超过舵机的最大使用电压)
- Communication: Asynchronous Serial @ 115200 bps (TTL or USB) /波特率默认 115200
- Operating temperature: 32 to 158 °F (0 to 70 °C)/使用温度 0 到 70 摄氏度
- Dimensions: 2.40 x 1.60 x 0.45 in (61.0 x 40.6 x 11.5 mm)大小：61.0 x 40.6 x 11.5 mm

Overview:/预览



1. Micro USB port/USB 接口
2. Reset button P1/复位按键
3. Analog input AD0, AD1, and 3.3V DC output VCC/模拟信号输入和电源输出
4. Servo signals output 1 - 16. A servo has three wires: (-), (+), and signal, (-) to row GND, (+) to row VS, and signal to row S. The color of signal wire usually is orange or white./舵机接口 1 - 16



5. Power supply for chips (VCC) and servos (VS)/芯片电源和舵机电源
6. JP15: connect these two pins will connect VCC to VS/舵机电源和芯片电源短接排针
7. Servo signals output 17 - 32.A servo has three wires: -, +, and signal, - to row GND, + to row VS, and signal to S. The color of signal wire usually is orange or white./舵机接口 17 - 32
8. UART port/串口
9. Button P2/按键 P2
10. Bluetooth module port/蓝牙接口

Install The Drivers:/安装驱动

- Download the ZIP file for 32-bits Windows/下载驱动软件 (http://static.leaflabs.com/pub/leaflabs/maple-ide/maple-ide-0.0.12-windowsxp32.zip)
- Extract all the files in the ZIP file to a suitable location on your system (like your Desktop folder). /解压下载的 ZIP 文件
- First, install DFU drivers (for uploading code to your Power Rhythm 32) using the following steps.首先安装 DFU 驱动，用于更新固件程序，只适用 32 位系统
  1.Plug your Power Rhythm 32 into the USB port./用 USB 线连接电脑和控制板
  2.Hit the reset button P1 on your Power Rhythm 32 (it's the small button at the top left, labeled P1). Notice that it blinks quickly 6 times, then blinks slowly a few more times.单击复位按键，红灯闪烁表示正常
  3.Hit reset again, and this time push and hold the other button during the 6 fast blinks (the button is on the top right; it is labeled P2). You can release it once the slow blinks start.再次单击复位按键，松开的同时按下 P2 按键，等待 2 秒左右，看到红灯慢闪时可以松开
  4.Your Power Rhythm 32 is now in perpetual bootloader mode. This should give you a chance to install the DFU drivers.现在的控制板进入了更新固件模式，可以安装 DFU 驱动
  5.Windows should now prompt you for some drivers. In the top level directory of the Maple IDE, point Windows to drivers/mapleDrv/dfu/. 驱动文件在解压文件内的 drivers/mapleDrv/dfu/路径内，使用设备管理器的手动安装找了这个路径进行安装程

序，具体参考百度：
http://jingyan.baidu.com/article/3f16e003c24c162590c10376.html

- Next, install serial drivers (for communicating with your Power Rhythm 32 using serial over USB)./接下来安装串口驱动
  1.Reset your Power Rhythm 32 and allow it to exit the bootloader (wait for the slow blinking to stop). The Power Rhythm 32 will next start running whatever program was uploaded to it last. (New Maples will start running the test program we upload to them before shipping them to you)./按下复位键然后松开
  2.Once Power Rhythm 32 is running some user code, Windows should prompt you for more drivers. Point windows to driver/mapleDrv/serial. You can now run the Servo_Rhythm_Controller.exe for 32-bits Windows./使用与安装 DFU 驱动一样的方法安装串口驱动，驱动路径为 driver/mapleDrv/serial

Command Formatting:/通信指令

- Servo Movement:舵机动作
  #<ch>P<pw>... #<ch>P<pw>T<time>!
  # = Command start flag/命令开头
  <ch> = Channel number in decimal, 1 - 32./舵机序号：1-32
  <pw> = Pulse width in microseconds, 500 - 2500./信号宽度 500-2500 微秒
  <time> = Time in mS for the entire move, affects all channels, 65535 max./动作时间
  ! = Command end flag./命令结尾
  It returns an “N”, when this command finishes.每次运行完返回”N”
  Servo Move Example: "#5P1600T1000!"/单个舵机控制
  The example will move servo 5 to position 1600. It will take 1 second to complete the move regardless of how far the servo has to travel to reach the destination.
  Multi Servo Move Example: "#5P1600#10P750T2500!"/多个舵机控制
  The example will move servo 5 to position 1600 and servo 10 to position 750. It will take 2.5 seconds to complete the move, even if one servo has farther to travel than another. The servos will both start and stop moving at the same time. This is a very powerful command. By commanding all of the legs in a walking robot with the Group Move it is easy to synchronize complex gaits. The same synchronized motion can benefit the control of a robotic arm as well.
- Read Analog Inputs:/读取模拟信号
  AD<ch>!
  <ch> = Channel number in decimal, 0 - 1./模拟信号的输入端 0 或 1
  Analog read example: “AD1!”
  Read the value on the pin AD1 as analog, it returns the decimal value from 0 to 4095, A return value of 0 represents 0vdc. A return value of 4095 represents +3.3vdc
- Offline Command Group:/脱机动作组命令
  EN<ch>!
  <ch> = Channel number in decimal, 0 - 48./脱机的动作组序号：1-48

If <ch> is not 0, Run the offline servo move command saved in the flash, otherwise disable the offline servo group move command. It returns an “W”, when the Power Rhythm 32 gets this command./“EN0!”表示停止运行脱机信号，“EN4!”表示循环运行脱机动作组 4

Offline Group Move Example: ”EN1!”

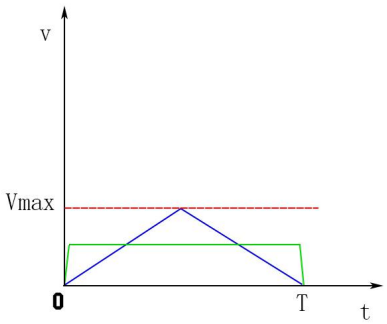
Circle to run the offline servo move command in the group 1. One group can contain up to 20 servo group move commands.

- Circle All Offline Command Group: ”GO!”

  This command will circle to run all the command in the flash, start with group 1. It returns an “W”, when this command finishes./“GO!”按顺序循环所有动作组

- Read The Number of Offline Command Group:”READ!”/“READ!”读取所有脱机动作组总数量

  It returns the number of the offline command group.



- Check The Version Of Firmware: ”V!”/“V!”读取固件版本

  It returns the version of the Power Rhythm 32.

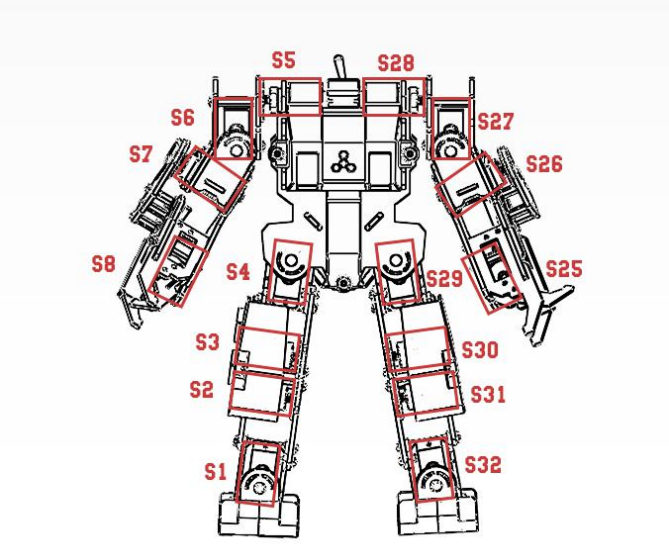
- Change The Acceleration Mode SM<ch>!

  “SM0!”: Without acceleration control, Speed change probably like the green line in the figure.

  “SM1!”:Speed changing according to Trapezoidal_curve. Speed change probably like the blue line in the figure. This can decrease the shaking when a servo coma to a stop.

Connection For Robots:/机器人的舵机连接顺序

- Apollo:/AIF-44-0



- Rex:/AIF-50-0

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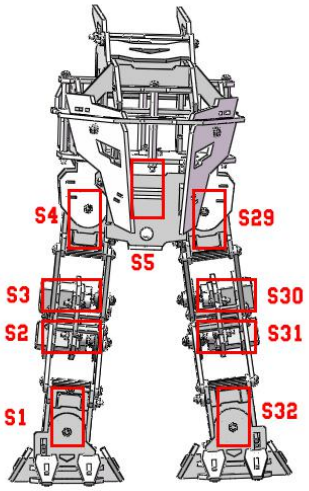

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