

# HEQ飞控使用指南

## HEQ Flight Control User Guide

### Basic Parameters

#### 基本参数

1. 飞控尺寸55\*39mm

Flight control size: 55\*39mm

2. 重量: 15g

Weight: 15g

3. 主控: Stm32F765I1K6

Main control: Stm32F765I1K6

4. IMU独立减震(3颗冗余)

IMU independent shock absorption (3 redundant)

5. 主控: STM32F765

Main control: STM32F765

6. 接口: PWM\*8, IIC\*2, uart\*4, CAN\*1, sbus-in\*1

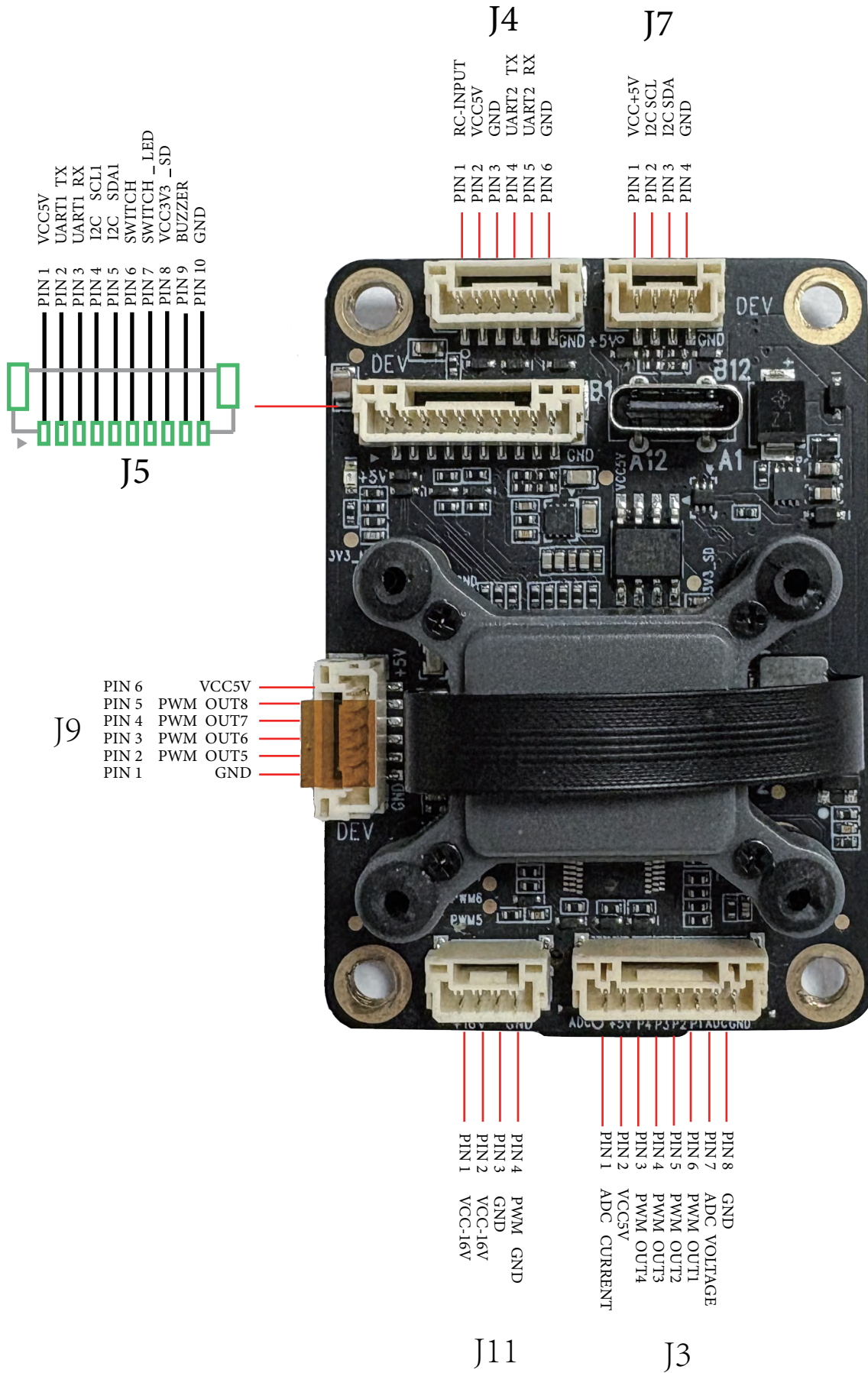
Interface: PWM\*8, IIC\*2, uart\*4, CAN\*1, sbus-in\*1

7. 电源: 16.8V输入 5V输入\输出

Power supply: 16.8V input, 5V input\output

# Interface Definition

## 接口定义



J8

- PIN 1 VCC5V
- PIN 2 M7 SWDIO
- PIN 3 M7 SWCLK
- PIN 4 UART7 TX
- PIN 5 UART7 RX
- PIN 6 GND

J13

- PIN 1 VCC+5V
- PIN 2 CANL\_H
- PIN 3 CANL\_L
- PIN 4 GND

J10

- PIN 1 VCC+5V
- PIN 2 UART3 TX
- PIN 3 UART3 RX
- PIN 4 GND

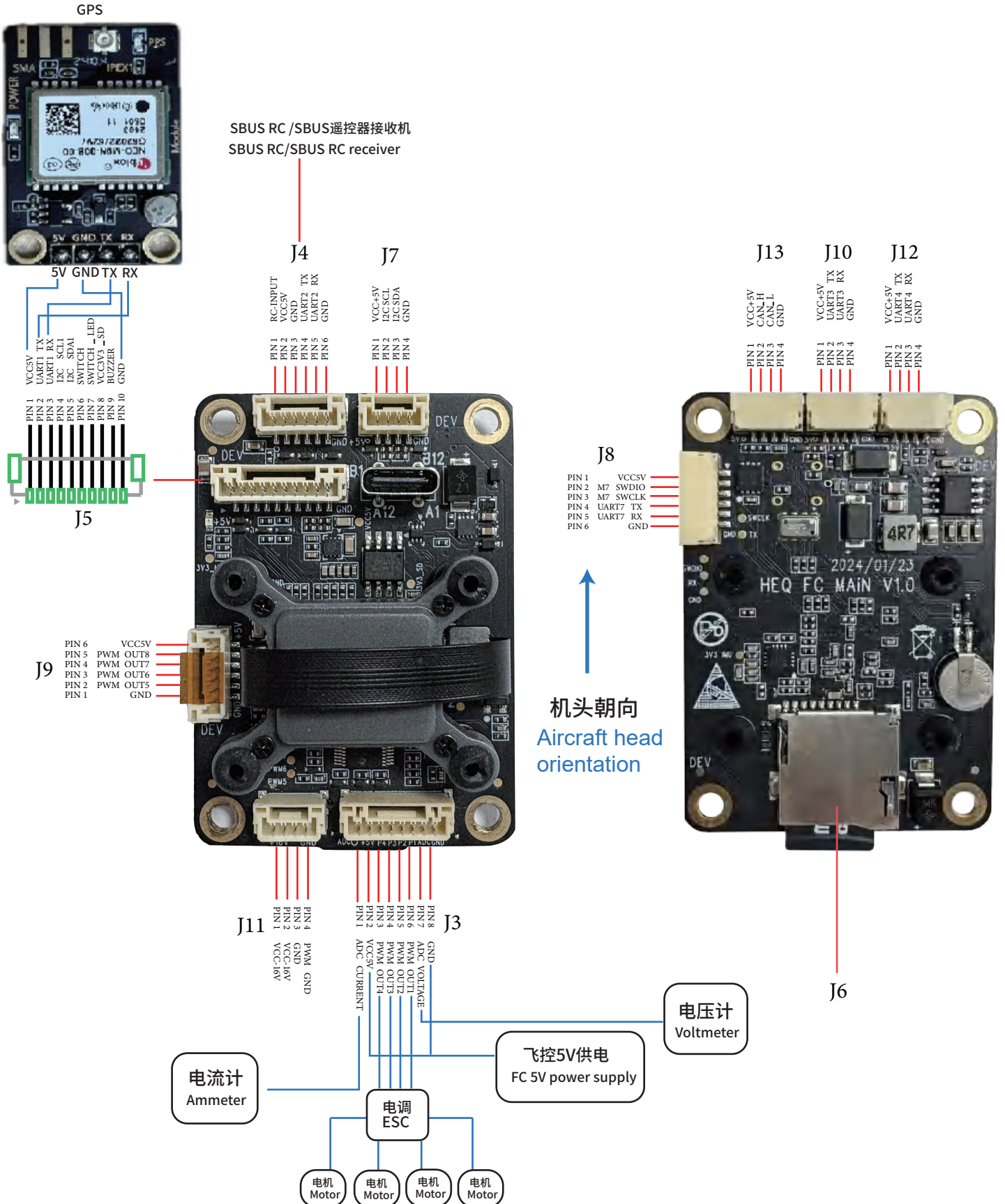
J12

- PIN 1 VCC+5V
- PIN 2 UART4 TX
- PIN 3 UART4 RX
- PIN 4 GND



# Wiring Reference (Conventional Quadrotor)

## 接线参考 (常规四旋翼)



| 连接器名称<br>Connector Name | 功能 Function   |   |   |
|-------------------------|---|---|---|
|                         | PX4固件<br>PX4 Firmware   | HEQ垂起固件<br>HEQ VTOL Firmware                                      | APM固件<br>APM Firmware   |
| J3                      | 连接电源模块；电源输入和电压、电流检测；PWM输出，可用于控制电机<br>Connect power module; power input and voltage, current detection; PWM output, can be used to control the motor |   |   |
| J4                      | SBUS/Telegram 1   | Serial 1 (Sbus 不可以) (Sbus No)                                     |   |
| J5                      | 全球定位系统GPS GPS   |   |   |
| J6                      | 插入SD卡进行日志存储 Insert SD card for log storage  |   |   |
| J7                      | I2C接口<br>I2C Interface  | I2C接口 (空速计)<br>I2C interface (airspeed meter)                     | I2C接口<br>I2C Interface  |
| J8                      | BUG调试口，读取调试信息<br>BUG debugging port, read debugging information   |   | Uart7 RX 为sbus输入<br>Uart7 RX is sbus input                                |
| J9                      | 预留PWM Reserved PWM  |   |   |
| J10                     | 电台口 (Telegram 2) (需要设置)<br>Radio port (Telegram 2) (need to be set)   | 电台口 (Serial2) (默认开启)<br>Radio port (Serial2) (enabled by default) |   |
| J11                     | 16.8V连接电源，可不接 16.8V power supply connection, optional   |   |   |
| J12                     | 电台口 (Telegram 4/serial 4)<br>(需要设置)<br>Radio port (Telegram 4/serial 4)<br>(need to be set)   | 不可用<br>Unavailable  | 电台口 (Serial 4)<br>(默认开启)<br>Radio port (Serial 4)<br>(enabled by default) |
| J13                     | 连接CAN GPS等UAVCAN设备 (HEQ垂起固件不可用)<br>Connect to UAVCAN devices such as CAN GPS (not available for HEQ VTOL firmware)                                  |   |   |

# PX4 Firmware Flashing Guide

## PX4固件烧录指南

从QGC官网下载最新地面站,选择您使用的平台对应的软件下载,后续固件刷写以Windows为例:

Download the latest ground station from the QGC official website, select the software download corresponding to the platform you are using, and the subsequent firmware flashing takes Windows as an example

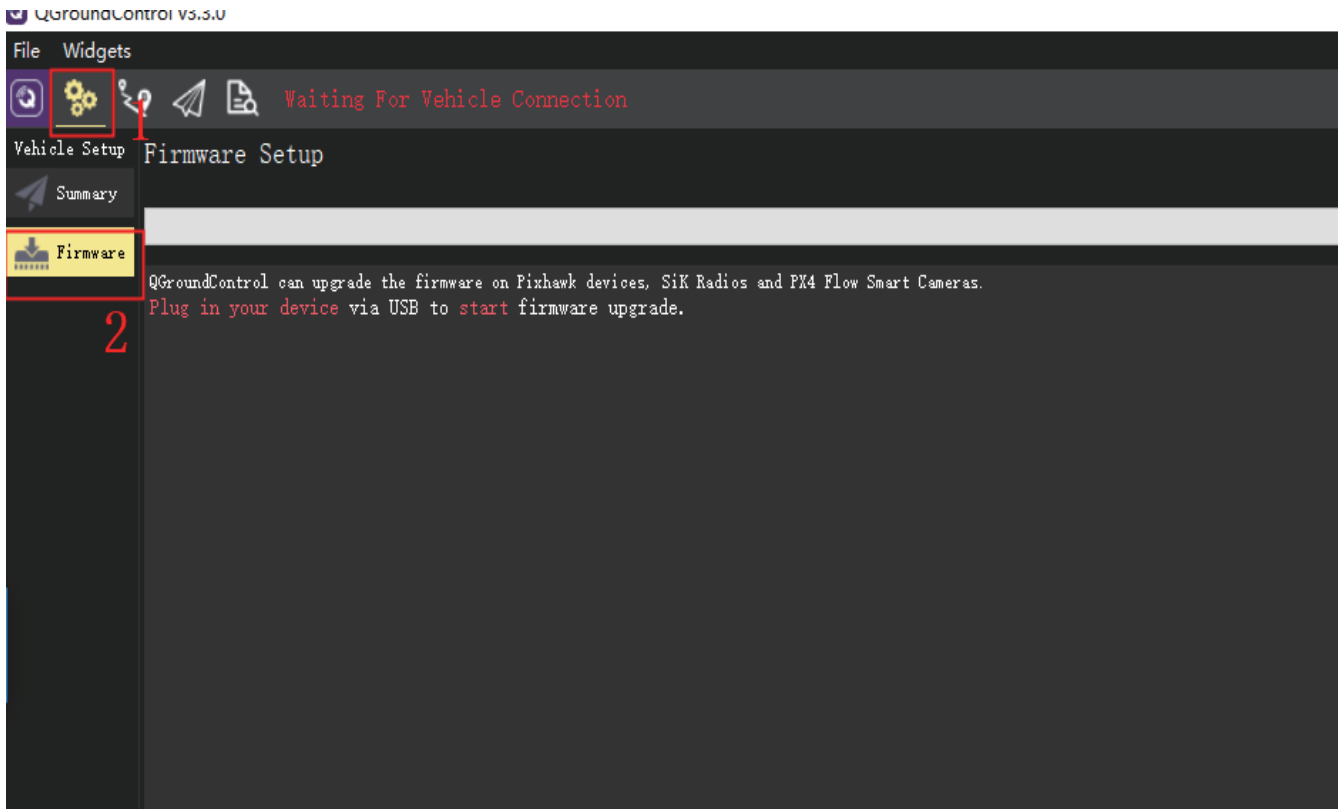
[https://docs.qgroundcontrol.com/master/en/qgc-user-guide/getting\\_started/download\\_and\\_install.html#windows](https://docs.qgroundcontrol.com/master/en/qgc-user-guide/getting_started/download_and_install.html#windows)

## 在线烧写固件

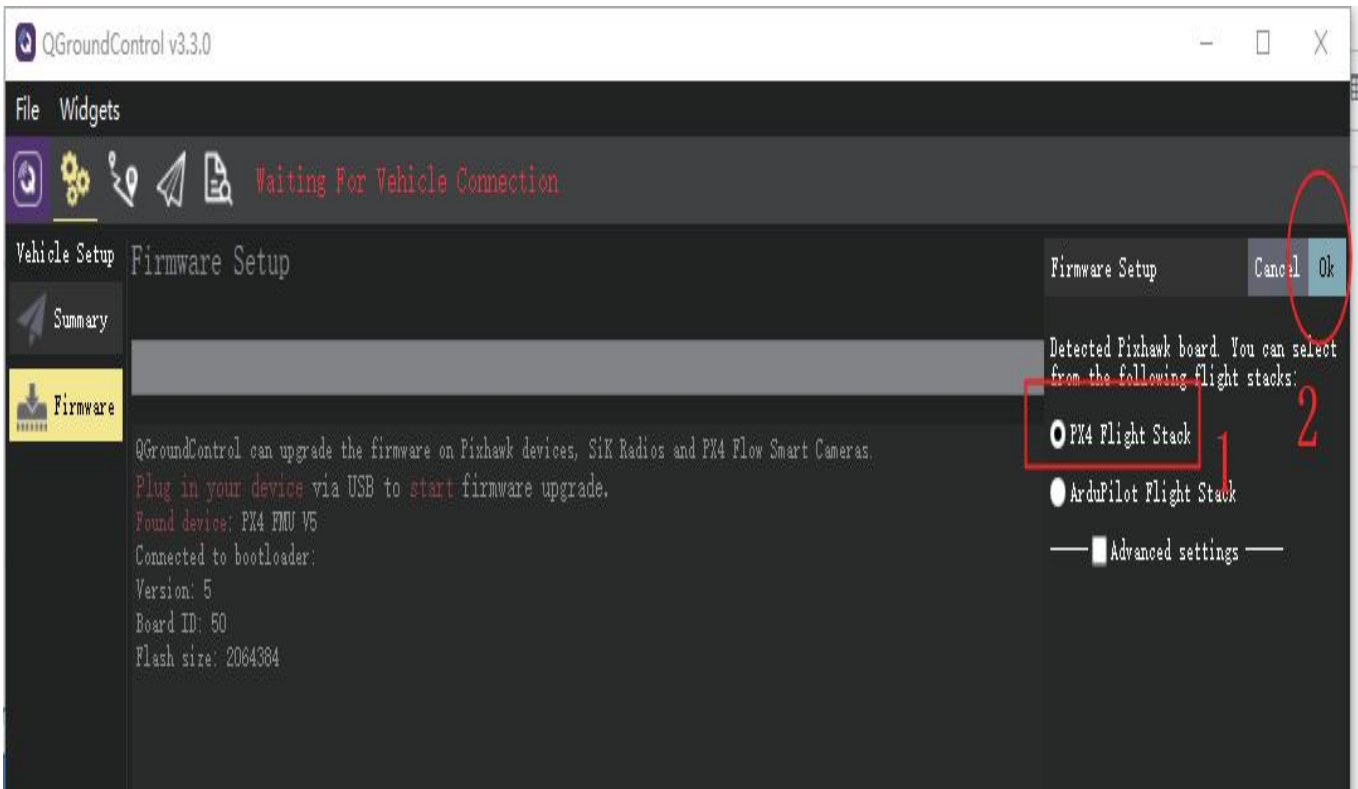
### Online firmware burning

将飞控连接到电脑,打开QGroundControl地面站,点击设置图标>点击固件。

Connect the FC to your computer, open QGroundControl, click the Settings icon > click "Firmware".



通过USB线将飞控连接到电脑,地面站右侧会弹出以下窗口“需要选择PX4 Flight Stack”OK。  
Connect the FC to the computer via a USB cable, and the following window will pop up on the right side of the ground station, need to select: "PX4 Flight Stack", then click "OK".



## 写入本地固件

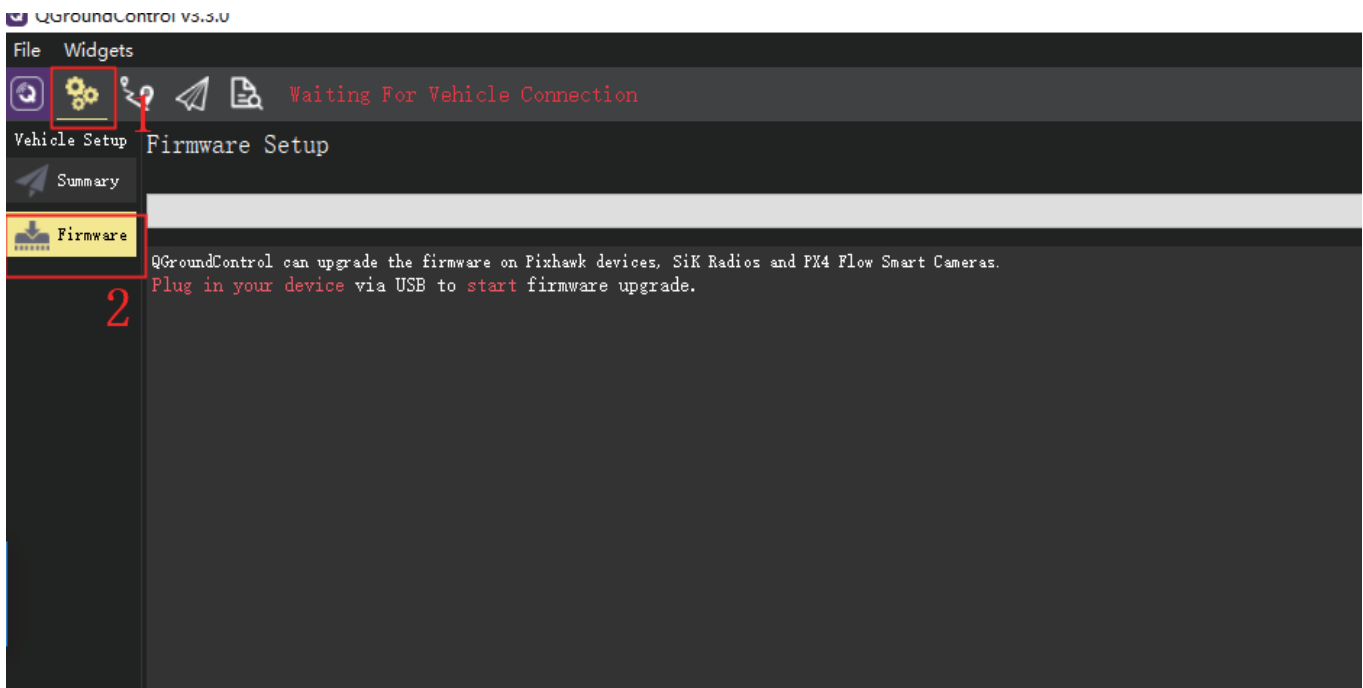
### Write local firmware

将PX4本地固件下载到本地。

Download the PX4 local firmware to the local computer.

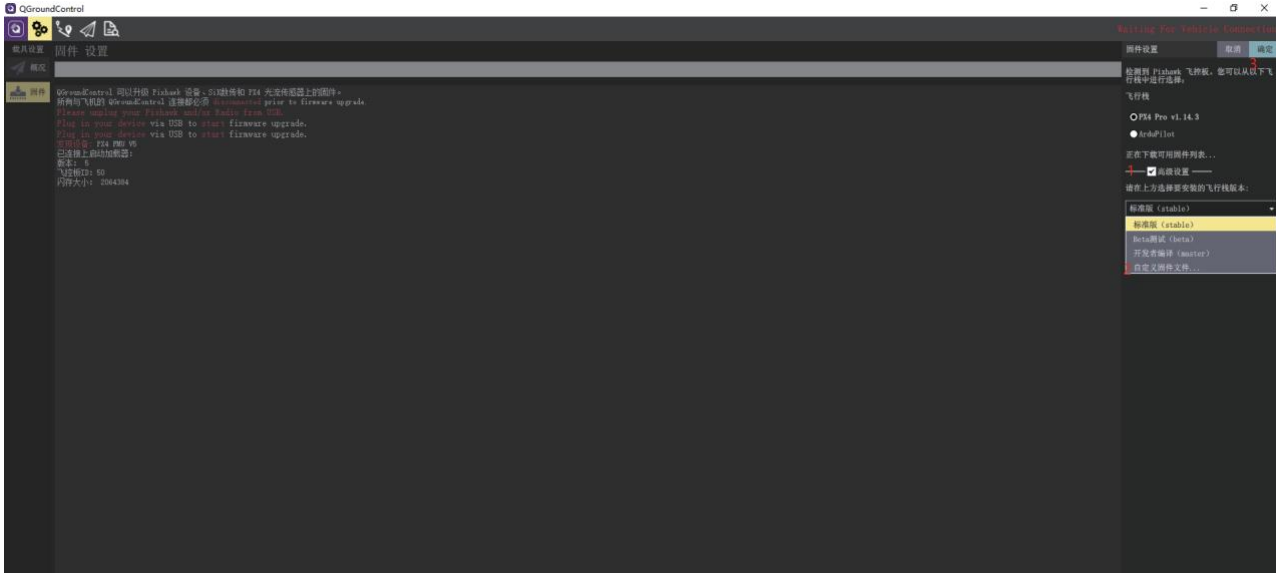
打开地面站>单击设置图标>然后单击固件。

Open the ground station > click the "settings" icon > then click "firmware".



•通过USB线将飞控连接到电脑,地面站右侧会弹出以下窗口“需要选择高级设置”>自定义固件文件>查找本地的固件,点确定。

Connect the FC to the computer via a USB cable. The following window will pop up on the right side of the ground station. You need to select "Advanced Settings" → "Custom Firmware File" → "Search for Local Firmware" and click "OK"



# PX4 Firmware Parameter flashing

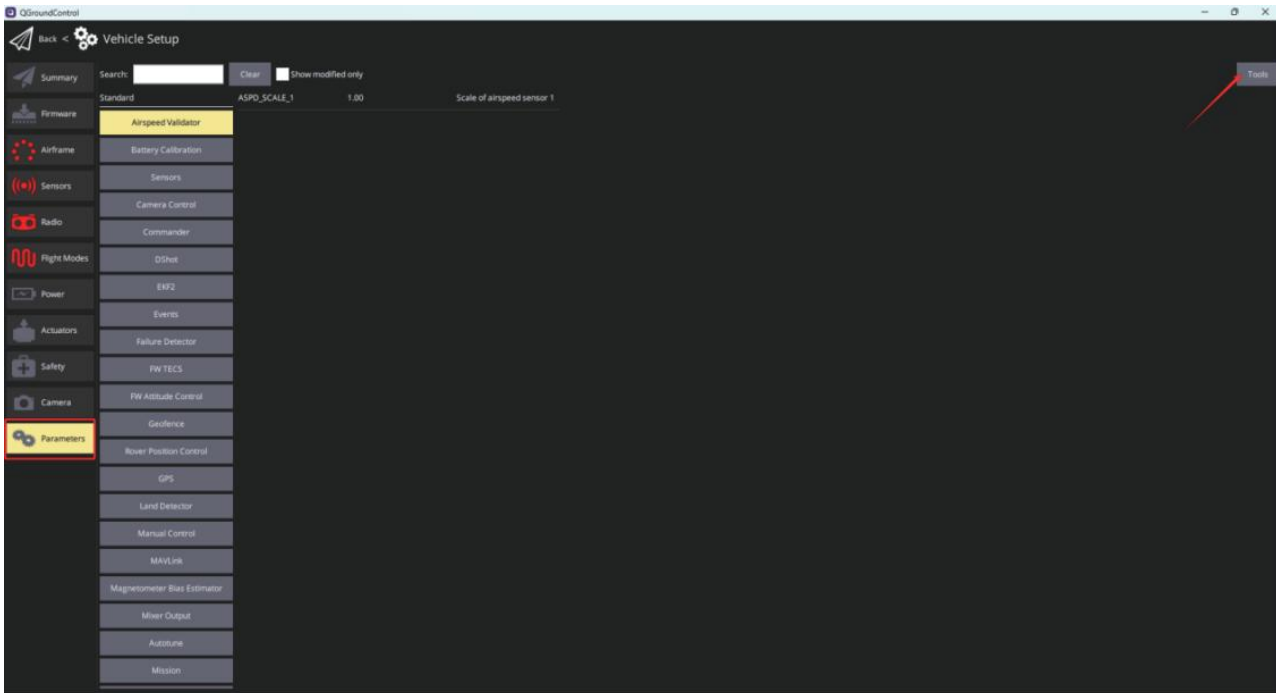
## PX4固件的参数刷写

将PX4本地的参数下载到本地。

Download the local parameters of PX4 to the local computer.

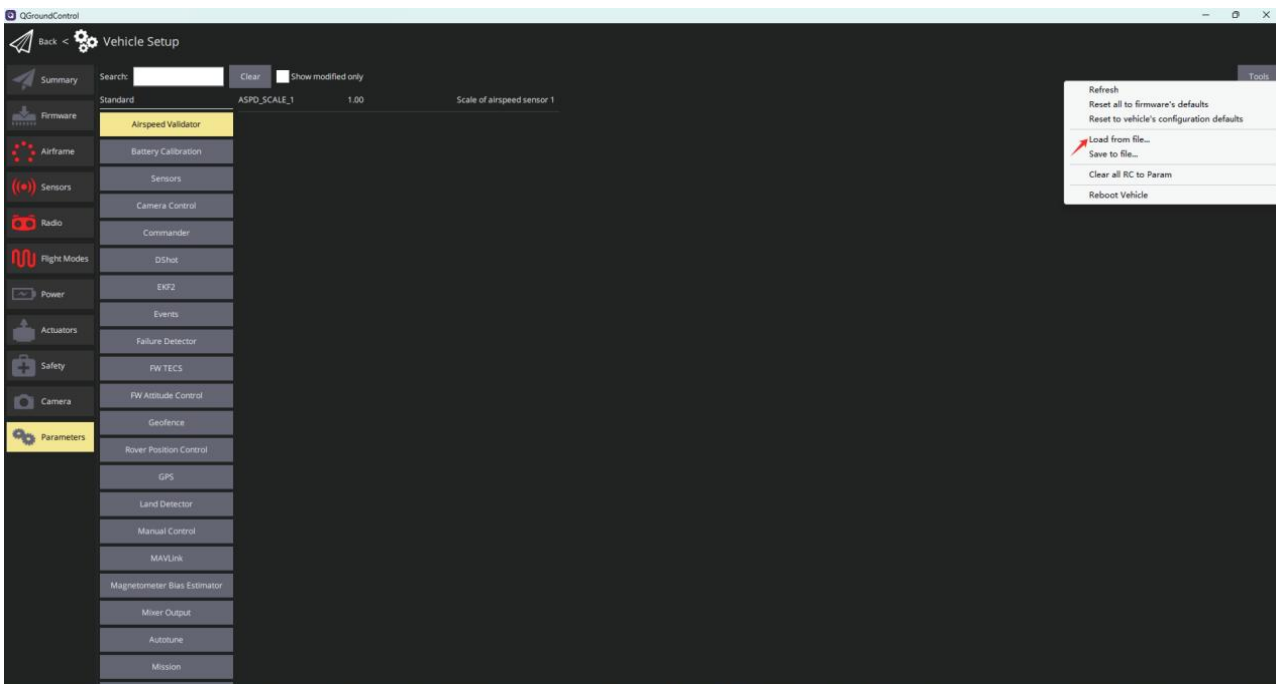
点击Parameters栏目,点击右上角Tool

Click the "Parameters" column and click "Tool" in the upper right corner.

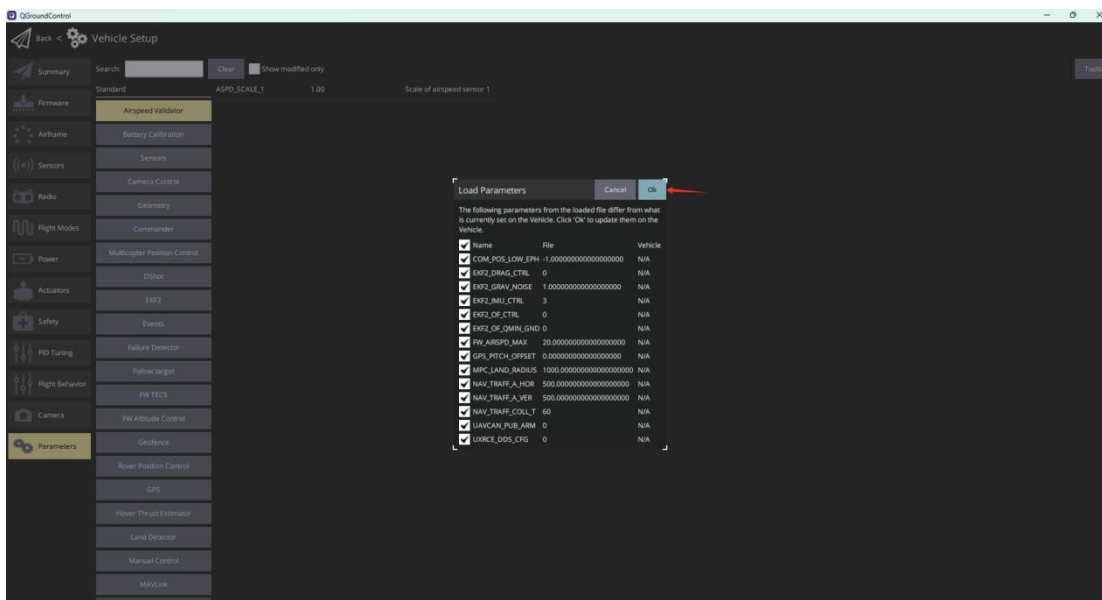
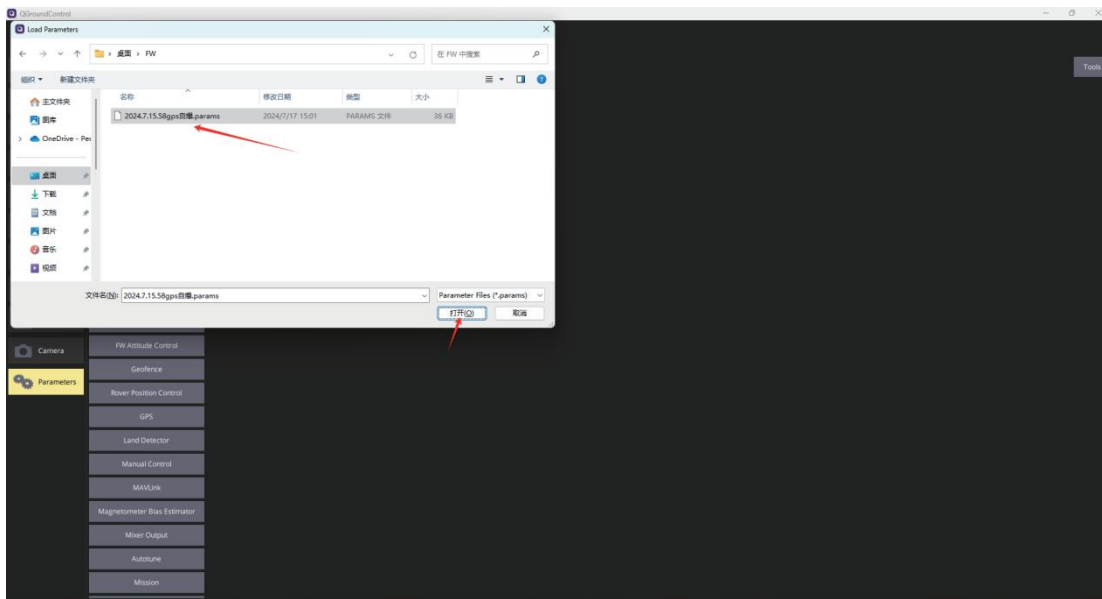


点击Load From file

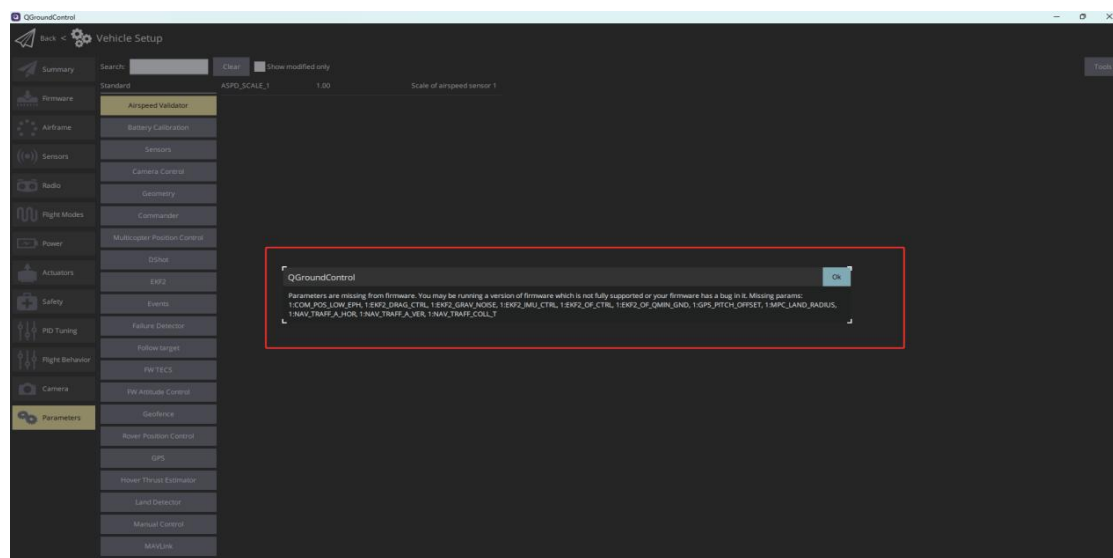
Click "Load From file"



## 选择参数文件 Select parameter file



忽略出现的弹窗提示,全部点击OK,所有弹窗消失后,重启飞控参数生效。  
Ignore the pop-up prompts that appear and click "OK" for all. After all pop-up windows disappear, restart, and the flight control parameters will take effect.



# APM Firmware Guide

## APM固件指南

从APM官网下载最新地面站,选择您使用的平台对应的软件下载,后续固件刷写以Windows为例

Download the latest ground station from the APM official website, select the software download corresponding to the platform you are using, and the subsequent firmware flashing takes Windows as an example

<https://ardupilot.org/planner/docs/mission-planner-overview.html>

### 写入本地固件

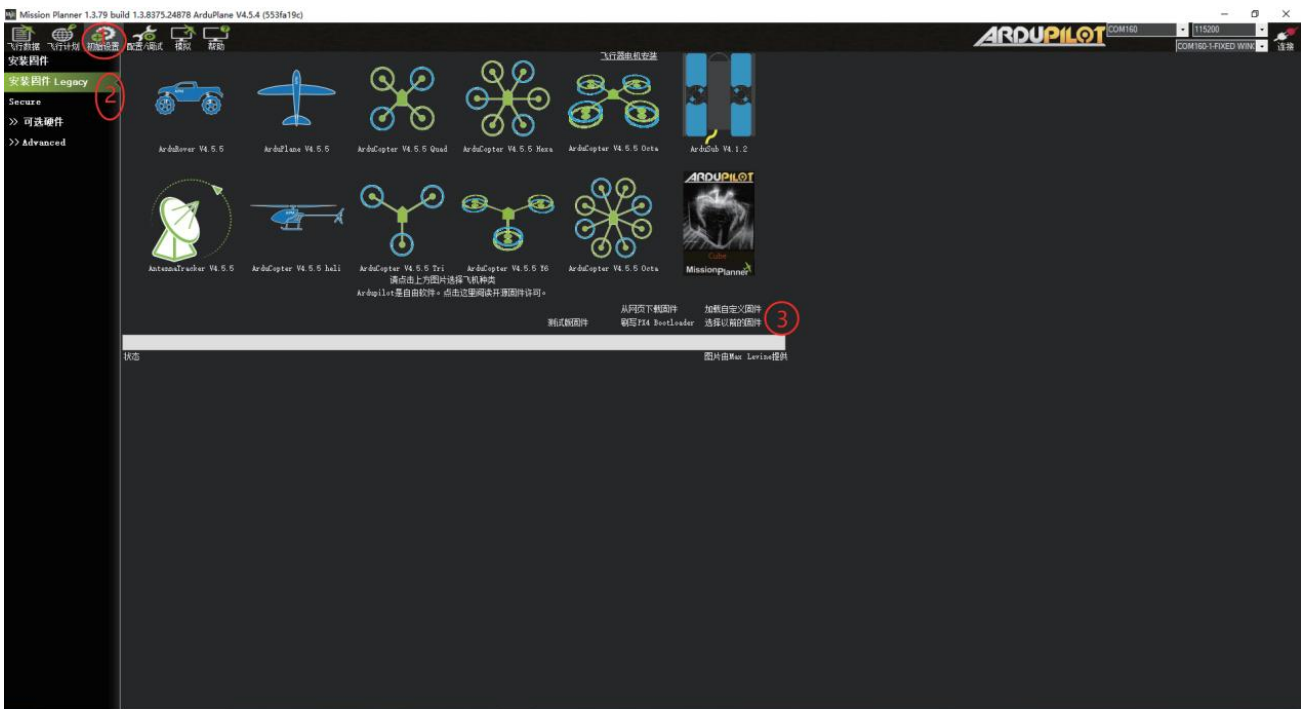
#### Write Local Firmware

将APM本地固件下载到本地。

Download the APM local firmware to your local computer.

通过USB线将飞控连接到电脑>打开Mission Planner地面站>单击初始设置图标>然后单击安装固件Legacy>选择自定义固件(需要使用HEQ编译的固件,当前版本为4.5.4)。

Connect the FC to your computer via USB cable > Open the "Mission Planner" ground station > Click the "Initial Settings" icon > Then click "Install Firmware Legacy" > Select "Custom Firmware".(Requires firmware compiled with HEQ, current version is 4.5.4).



# 注意: APM固件的SBUS输出

## Note: APM firmware SBUS output

接线图概述的J8序号, 将uart 7 RX接入SBUS信号线即可。

According to the J8 serial number outlined in the wiring diagram, connect uart 7 RX to the SBUS signal line.

打开Mission Planner地面站>单击配置/调试>全部参数表>将SERIAL6\_OPTIONS改为3, SERIAL6\_PROTOCOL改为23即可。

Open Mission Planner ground station > click "Configuration/Debug" > All Parameters > change SERIAL6\_OPTIONS to 3, and SERIAL6\_PROTOCOL to 23.

The screenshot shows the 'All Parameters' table in Mission Planner. The table has columns for '命令' (Command), '值' (Value), '单位' (Unit), '选项' (Options), and '描述' (Description). Two red arrows point to the 'SERIAL6\_OPTIONS' and 'SERIAL6\_PROTOCOL' rows.

| 命令                | 值      | 单位                   | 选项   | 描述   |
|-------------------|--------|----------------------|--|--|
| SERIAL6_BAUD      | 57     |                      | 1:None 2:2400 4:4800 9:9600 19:19200 38:38400 57:57600 111:111100 115:115200 230:230400 255:255000 460:460800 500:500000 921:921000 1500:1500000 2000:2000000  | The baud rate used for Serial6. Most stm32-based boards can support rates of up to 1500. If you setup a rate you cannot support and then can't connect to your board you should load a firmware from a different vehicle type. That will reset all your parameters to defaults.  |
| SERIAL6_OPTIONS   | 0      |                      | -1:None 1:MAVLink 2:MAVLink2 3:Fsky 4:Fsky Sport 5:GPS 7:Arducopter Serial 8:Gimbal 9:RangeFinder 10:FSky SPIv2 15:Passthrough 16:OpenTX 11:Lidar360 13:Beacon 14:Voice servo out 15:SBUS servo out 16:ESCC Telemetry 17:Devo Telemetry 18:ControlFlow 19:RoboteServo 20:MMA7455 21:WiredVibe 22:3LCAN 23:RCIN 24:FFI Serial 25:3DM 26:RunCam 27:Hot Telen 28:Coasting 29:Coasting VTX 30:Generator 31:Winch 32:MSP 33:DU FPV 34:HiSpeed 35:ADSB 36:ARMS 37:SmartAudio 38:FE Telemetry 39:Torpedos 40:AIS 41:CoDroneC 42:DisplayPort 43:MAVLink High Latency 44:IRC Tramp 45:DDoS XRC 46:IMU.DAT 48:PPP  | Control over UART options. The InvertRX option controls invert of the receive pin. The InvertTX option controls invert of the transmit pin. The HalfDuplex option controls half-duplex (bimane) mode, where both transmit and receive is done on the transmit wire. The Swap option allows the RX and TX pins to be swapped on STM32F7-based boards. |
| SERIAL6_PROTOCOL  | -1     |                      | -1:None 1:MAVLink 2:MAVLink2 3:Fsky 4:Fsky Sport 5:GPS 7:Arducopter Serial 8:Gimbal 9:RangeFinder 10:FSky SPIv2 15:Passthrough 16:OpenTX 11:Lidar360 13:Beacon 14:Voice servo out 15:SBUS servo out 16:ESCC Telemetry 17:Devo Telemetry 18:ControlFlow 19:RoboteServo 20:MMA7455 21:WiredVibe 22:3LCAN 23:RCIN 24:FFI Serial 25:3DM 26:RunCam 27:Hot Telen 28:Coasting 29:Coasting VTX 30:Generator 31:Winch 32:MSP 33:DU FPV 34:HiSpeed 35:ADSB 36:ARMS 37:SmartAudio 38:FE Telemetry 39:Torpedos 40:AIS 41:CoDroneC 42:DisplayPort 43:MAVLink High Latency 44:IRC Tramp 45:DDoS XRC 46:IMU.DAT 48:PPP  | Control what protocol Serial6 port should be used for. Note that the Fsky options require external converter hardware. See the wiki for details.   |
| SERIAL7_BAUD      | 115200 |                      | 1:1200 2:2400 4:4800 9:9600 19:19200 38:38400 57:57600 111:111100 115:115200 230:230400 255:255000 460:460800 500:500000 921:921000 1500:1500000 2000:2000000  | The baud rate used for Serial7. Most stm32-based boards can support rates of up to 1500. If you setup a rate you cannot support and then can't connect to your board you should load a firmware from a different vehicle type. That will reset all your parameters to defaults.  |
| SERIAL7_OPTIONS   | 0      |                      | -1:None 1:MAVLink 2:MAVLink2 3:Fsky 4:Fsky Sport 5:GPS 7:Arducopter Serial 8:Gimbal 9:RangeFinder 10:FSky SPIv2 15:Passthrough 16:OpenTX 11:Lidar360 13:Beacon 14:Voice servo out 15:SBUS servo out 16:ESCC Telemetry 17:Devo Telemetry 18:ControlFlow 19:RoboteServo 20:MMA7455 21:WiredVibe 22:3LCAN 23:RCIN 24:FFI Serial 25:3DM 26:RunCam 27:Hot Telen 28:Coasting 29:Coasting VTX 30:Generator 31:Winch 32:MSP 33:DU FPV 34:HiSpeed 35:ADSB 36:ARMS 37:SmartAudio 38:FE Telemetry 39:Torpedos 40:AIS 41:CoDroneC 42:DisplayPort 43:MAVLink High Latency 44:IRC Tramp 45:DDoS XRC 46:IMU.DAT 48:PPP  | Control over UART options. The InvertRX option controls invert of the receive pin. The InvertTX option controls invert of the transmit pin. The HalfDuplex option controls half-duplex (bimane) mode, where both transmit and receive is done on the transmit wire. The Swap option allows the RX and TX pins to be swapped on STM32F7-based boards. |
| SERIAL7_PROTOCOL  | 2      |                      | -1:None 1:MAVLink 2:MAVLink2 3:Fsky 4:Fsky Sport 5:GPS 7:Arducopter Serial 8:Gimbal 9:RangeFinder 10:FSky SPIv2 15:Passthrough 16:OpenTX 11:Lidar360 13:Beacon 14:Voice servo out 15:SBUS servo out 16:ESCC Telemetry 17:Devo Telemetry 18:ControlFlow 19:RoboteServo 20:MMA7455 21:WiredVibe 22:3LCAN 23:RCIN 24:FFI Serial 25:3DM 26:RunCam 27:Hot Telen 28:Coasting 29:Coasting VTX 30:Generator 31:Winch 32:MSP 33:DU FPV 34:HiSpeed 35:ADSB 36:ARMS 37:SmartAudio 38:FE Telemetry 39:Torpedos 40:AIS 41:CoDroneC 42:DisplayPort 43:MAVLink High Latency 44:IRC Tramp 45:DDoS XRC 46:IMU.DAT 48:PPP  | Control what protocol Serial7 port should be used for. Note that the Fsky options require external converter hardware. See the wiki for details.   |
| SERVO_32_ENABLE   | 0      | 0:Disabled 1:Enabled |  | This allows for up to 32 outputs, enabling parameters for outputs above 16   |
| SERVO_AUTO_TRIM   | 0      | 0:Disable 1:Enable   |  | This enables automatic servo trim in flight. Servos will be trimmed in stabilized flight modes when the aircraft is close to level. Changes to servo trim will be saved every 10 seconds and will persist between flights. The automatic trim won't go more than 20% away from a centered trim.  |
| SERVO_BLH_RFMASK  | 0      | 0:Disabled 1:Enabled |  | Mask of channels which are dynamically reversible. This is used to configure ESCs in 3D mode, allowing for the motor to spin in either direction. Do not use for channels selected with SERVO_BLH_RFMASK.  |
| SERVO_BLH_AUTO    | 0      | 0:Disabled 1:Enabled |  | If set to 1 this enables BLH pass-thru support for all multiplex motors  |
| SERVO_BLH_DEBUG   | 0      | 0:Disabled 1:Enabled |  | When set to 1 this enables verbose debugging output over MAVLink when the blh protocol is active. This can be used to diagnose failures.   |
| SERVO_BLH_MASK    | 0      |                      |  | Enable of BLH pass-thru servo protocol support to specific channels. This mask is in addition to motors enabled using SERVO_BLH_AUTO (if any)  |
| SERVO_BLH_OPTIONS | 0      |                      | 0:None 1:OneShot 2:OneShot125 3:400us 4:400us 5:400us 6:400us 7:400us 8:400us 9:400us 10:400us 11:400us 12:400us 13:400us 14:400us 15:400us 16:400us 17:400us 18:400us 19:400us 20:400us 21:400us 22:400us 23:400us 24:400us 25:400us 26:400us 27:400us 28:400us 29:400us 30:400us 31:400us 32:400us 33:400us 34:400us 35:400us 36:400us 37:400us 38:400us 39:400us 40:400us 41:400us 42:400us 43:400us 44:400us 45:400us 46:400us 47:400us 48:400us 49:400us 50:400us 51:400us 52:400us 53:400us 54:400us 55:400us 56:400us 57:400us 58:400us 59:400us 60:400us 61:400us 62:400us 63:400us 64:400us 65:400us 66:400us 67:400us 68:400us 69:400us 70:400us 71:400us 72:400us 73:400us 74:400us 75:400us 76:400us 77:400us 78:400us 79:400us 80:400us 81:400us 82:400us 83:400us 84:400us 85:400us 86:400us 87:400us 88:400us 89:400us 90:400us 91:400us 92:400us 93:400us 94:400us 95:400us 96:400us 97:400us 98:400us 99:400us 100:400us 101:400us 102:400us 103:400us 104:400us 105:400us 106:400us 107:400us 108:400us 109:400us 110:400us 111:400us 112:400us 113:400us 114:400us 115:400us 116:400us 117:400us 118:400us 119:400us 120:400us 121:400us 122:400us 123:400us 124:400us 125:400us 126:400us 127:400us 128:400us 129:400us 130:400us 131:400us 132:400us 133:400us 134:400us 135:400us 136:400us 137:400us 138:400us 139:400us 140:400us 141:400us 142:400us 143:400us 144:400us 145:400us 146:400us 147:400us 148:400us 149:400us 150:400us 151:400us 152:400us 153:400us 154:400us 155:400us 156:400us 157:400us 158:400us 159:400us 160:400us 161:400us 162:400us 163:400us 164:400us 165:400us 166:400us 167:400us 168:400us 169:400us 170:400us 171:400us 172:400us 173:400us 174:400us 175:400us 176:400us 177:400us 178:400us 179:400us 180:400us 181:400us 182:400us 183:400us 184:400us 185:400us 186:400us 187:400us 188:400us 189:400us 190:400us 191:400us 192:400us 193:400us 194:400us 195:400us 196:400us 197:400us 198:400us 199:400us 200:400us 201:400us 202:400us 203:400us 204:400us 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