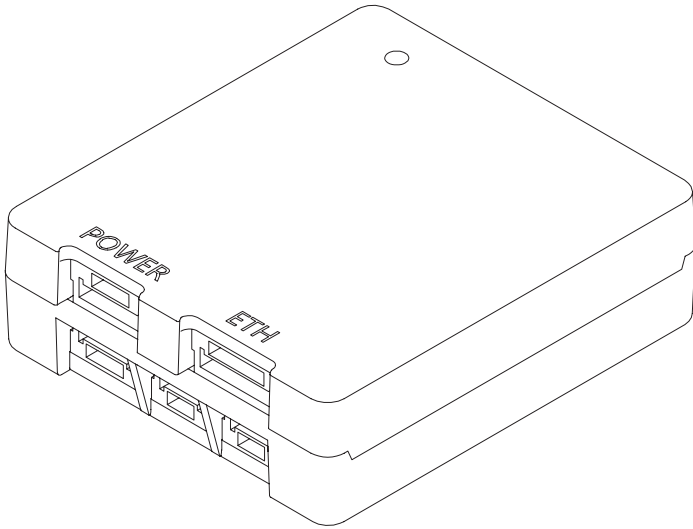# GCU
User Manual

Using this Manual – Legend

⚠ Important   🔑 Tips   ❓ Explanation

Revision History

Date	Document Version
2023.06.19	V1.0

Date	Document Version
2023.10.16	V1.1

1.   Introduction – Overview: Refine diagram of GCU ports. [P3]
2.   Configuring & Updating Firmware:
  2.1 Modify default IP address of GCU (192.168.1.121 → 192.168.144.121) and default IP address of camera (192.168.1.108 → 192.168.144.108). [P4]
  2.2 Add tip of conferring network authority while first running GCU_ Config.[P4]
  2.3 Configuring the GCU – S.BUS Setting: Modify explanation of follow mode.[P6]
3.   Appendix 2 Dimensions: Add requirement of GCU cooling.[P9]
4.   Add Appendix 4: MAVLink Communication Process.[P12]

Catalog

Introduction

Synopsis

The GCU supports Z-serial and D-serial gimbals. With the GCU and the Dragonfly software, user can watch the image from the camera and control the gimbal real-timely on a computer.

The GCU has a tiny size and multiple extend ports. It supports Network, UART and S.BUS control. The GCU support both private protocol and MAVlink protocol.

Overview
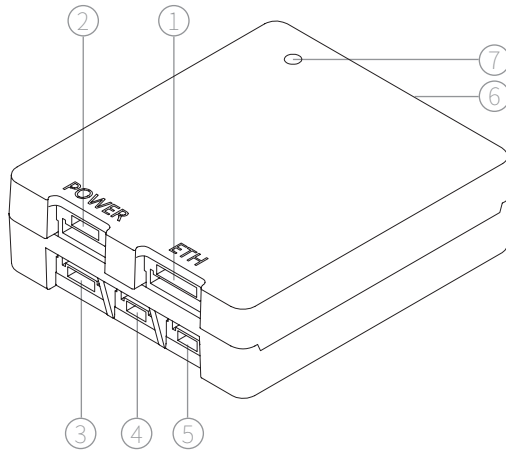
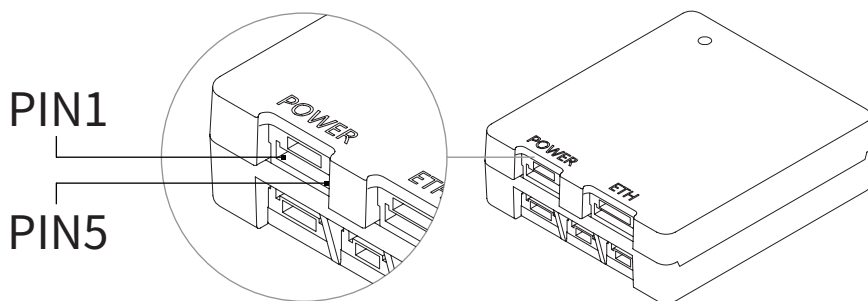1.ETH Port   2.POWER Port

3.UART2 Port   4.UART Port

5.S.BUS Port   6.Pod Control Port

7.Status LED

Status LED Description

Blue flashing	Working normally
Solid blue	Carrier's GNSS not positioning
Solid purple	No Carrier's GNSS data
Red flashing	Error

Port Definition

PIN1

PIN5

Port	Pin	Definition	Description
POWER	1	GND	Operating Voltage: 14~52V DC
	2	GND	
	3	NC	
	4	Vin	
	5	Vin	
ETH	1	5V	GCU configuring; Private protocol control; HD image Output
	2	GND	
	3	T+	
	4	T-	
	5	R+	
	6	R-	
S.BUS	1	GND	Support S.BUS1 standard such as FASST and SFHSS and S.BUS2 standard such as FASSTest
	2	5V	
	3	S.BUS	
UART	1	GND	GCU configuring; Private protocol control
	2	UART_Rx	
	3	UART_Tx	
UART2	1	UART2_Tx	MAVlink protocol control
	2	GND	
	3	5V	
	4	UART2_Rx	

The total output power of 5V on the GCU is 1.5W. Do not supply power to any equipment over 1.5W through the GCU. Otherwise may cause the device working unproperly.

Configuring & Updating Firmware

⚠ Ensure the gimbal and the GCU have both been updated to the latest firmware before use. Otherwise, usage may be affected.

⚠ Ensure the diver of the config module is installed on the computer before configuring or updating the firmware.

⚠ Before configuring, the computer should be set to a static IP address, which is in the same network segment with the GCU and the camera (without IP address conflicts). The default IP address of the GCU and the camera are 192.168.144.121 and 192.168.144.108.

⚠ Do not power off the device while updating the firmware. Restart the device once firmware update is complete.

⚠ For Windows10 or higher version operating system, network authority needs to be conferred while first running the GCU_Config software.

Configuring the GCU

1. Connect the computer and ETH port of the GCU with the network conversion module, or connect the computer and UART port of the GCU with the config module.
2. Connect the gimbal and the GCU with the gimbal control cable. Power on the device. Run the GCU_Config software and choose UDP port or the COM port corresponding to the config module. Click"Start Config", the, software will display current configuration of the GCU.
3. Configure the GCU in the software.

🔍 The new parameter filled in textbox will not be saved until clicking "Enter"on the keyboard. It is unnecessary to click "Enter" after editing other settings.

1.Network setting

- GCU IP / Gateway IP / Subnet mask / Remote IP
  Configure the network parameters of the GCU. Ensure the parameters will not cause network linkage abnormal.

- Camera IP
  Fill in the IP address of current camera, Video stream addresses will be generated automatically by the GCU. It will not change the IP address of the camera.

2.Gimbal Data

Display the altitude data of the gimbal

3.Carrier Data

Display the INS positing statue, altitude angle and northward / eastward / upward accuracy of the carrier.

4.S.BUS Setting

Set S.BUS channels corresponding to gimbal functions and their renversements. The pitch and yaw are liner channel, and others are switch channels.

For switch channels, pulse width entering [1000μs , 1300μs] triggers lower function once; entering [1300μs , 1700μs] triggers middle function once; entering [1700μs , 2000μs] triggers higher function once. Pulse width varying in the same interval does not repeat the trigger.

- Mode

  Follow: Head follow mode. Yaw angle and pitch angle are controllable. Heading of the gimbal rotates with the carrier and pitch of the gimbal keeps current attitude while no rotating command is received.

  Lock: Head lock mode. Yaw angle and pitch angle of the gimbal are controllable and keep current angle while no rotating command is received.

  MAVlink: The gimbal can be controlled by MAVlink protocol. Other S.BUS channels controlling is unavailable in the mode.

  Ortho: Orthoview mode. In this mode, the gimbal rotates to vertical downward. The yaw angle follows the carrier and is uncontrollable. Otherwise the yaw angle remains unchanged and is controllable.

  Gaze: Gaze mode. Gimbal constantly aims current position in the center of the view. To gimbals equipped with laser ranger finder, turning on ranging before entering gaze mode will improve the accuracy of locking. The gaze mode is available only when the gimbal receiving valid GNSS data.

  Neutral: Gimbal returns its neutral position

- Track

  The gimbal will automatically keep tracking the target in the center of the screen.

- Pitch / Yaw

  Control value corresponds the angular velocity of pitch / yaw of the gimbal.

- Zoom

  The zoom rate constantly varies while the channel value is in Tele / Wide interval, until the channel value enters stop interval or the camera is at max / min zoom rate.

- Pic & Rec

  The Pic command triggers camera shoot one photo. The Rec command starts or stops recording. It is able to shoot photos while recording without ending record. The pictures and the video are saved in the MicroSD card of the gimbal.

- Video Switch

    Palette: To gimbals equipped with thermal camera, this command switches options of palette.

    Pic-in-pic: To gimbals equipped with multiple cameras, this command switches different view of the cameras.

- IRCUT

    Turn on IRCUT, the camera will switch to night scene to achieve a better image quality in low-light environment.

- Lamp

    To gimbals equipped with laser lighting module, choose this function to turn on laser lighting and IRCUT at the same time.

⚠ Several models of gimbal equipped with laser lighting module, which is a Class 3B invisible laser. DO NOT exposure eyes to the beam within 12 meters or observe the beam by any optical instrument. DO NOT place any inflammable within 20 centimeters in front of the lighting module.

- Ranging

    To gimbals equipped with laser range finder, this command turns on / off ranging. The gimbal is able to calculate out the longitude, latitude and elevation of the target while receiving valid carrier INS data.

5.Reset

    Click to reset all the parameters of the GCU.

6.Calibration

    Click to calibrate the gimbal. Please keep the gimbal static while calibrating.

🔍 After calibration, it is normal that the yaw shaft of the gimbal drifts about 15 degrees per hour when not receiving valid carrier INS data. To make sure the gimbal attitude corrects, it is necessary to transmit valid carrier INS data, usually the GNSS should be positioning.

Updating Firmware

1. Connect the computer and UART port of the GCU with the config module. Power on the devices.
2. Run FreeFlightIAP software. Choose the COM port corresponding to the config module.
3. Click "browse", choose the firmware file, click "download" and wait for the updating complete.
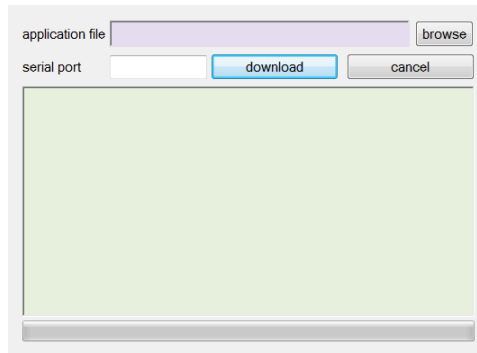
Appendix 1 Specifications

General	
Product Name	GCU
Dimensions	45.4 x 40 x 13.5mm
Weight	18.6g
Operating Voltage	14 ~ 53 VDC
Power	1.8W
Environment	
Operating Temperature	-20°C～ 60°C
Storage Temperature	-20°C～ 60°C
Storage Humidity	≤ 85%RH（Non-condensing）

Appendix 2 Dimensions
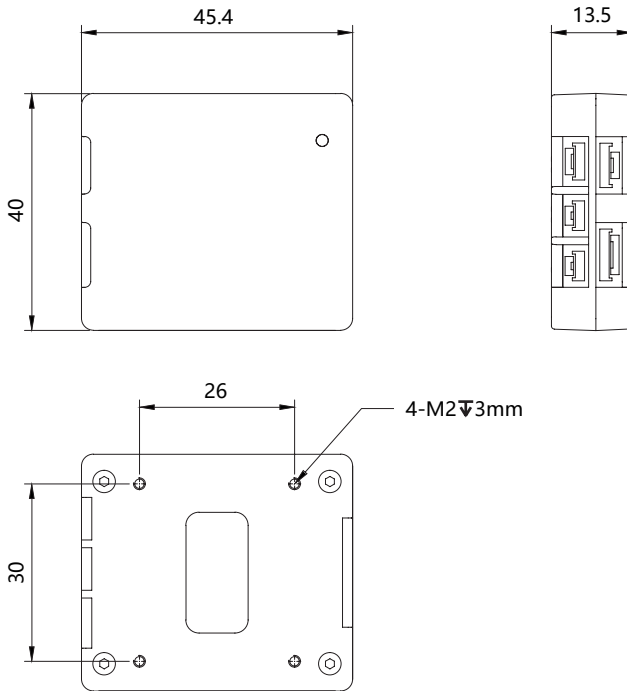
⚠ Use screws of proper length to fix the GCU. Too short screws short may cause the fixation unsecure, and too long screws may damage the device.

⚠ The GCU heats while operating. Please ensure the device good cooling.

Appendix 3 MAVLink Configuration

ArduPilot

SERIAL1	
SERIAL1_BAUD	115
SERIAL1_OPTIONS	1024
SERIAL1_PROTOCOL	2
SR1	
SR1_ADSB	0 Hz
SR1_EXIT_STAT	0 Hz
SR1_EXTRA1	0 Hz
SR1_EXTRA2	0 Hz
SR1_EXTRA3	0 Hz
SR1_PARAMS	0 Hz
SR1_POSITION	0 Hz
SR1_RAW_CTRL	0 Hz
SR1_RAW_SENS	0 Hz
SR1_RC_CHAN	0 Hz
MNT1	
MNT1_TYPE	4 (Gremsy) / 6 (SToRM32 Mavlink)
RC1	
RC1_OPTOPN	213 (MOUNT1_PITCH)
RC2	
RC2_OPTOPN	214 (MOUNT1_YAW)
RC3	
RC3_OPTOPN	163 (MOUNT1_LOCK)
CAM	
CAM_TRIGG_TYPE	3 (Mount)

🔍 The MNT1_TYPE is recommended as 6. The MNT1_ROLL_MAX, MNT1_ROLL_MIN, MNT1_PITCH_MAX, MNT1_PITCH_MIN, MNT1_YAW_MAX and MNT1_YAW_MIN will be configured automatically depend on data from the GCU. The angle limit should be set manual while the MNT1_TYPE is 4.

🔍 The RC1~RC3 are just examples, which can be defined according to actual situation.

PX4

MAVLink	
MAV_1_CONFIG	TELEM2
MAV_1_MODE	Custom / Gimbal
MAV_1_RATE	115200 B/s
Serial	
SER_TEL2_BAUD	115200 8N1
Mount	
MNT_MAIN_PITCH	AUX1
MNT_MAIN_YAW	AUX2
MNT_MODE_IN	Auto (RC and Mavlink Gimbal)
MNT_MODE_OUT	MAVLink gimbal protocol v2
Camera Setup	
Trigger mode	Distance based, on command (Survey mode)
Trigger interface	MAVLink (forward via MAV_CMD_IMAGE_START_CAPTURE)

🔍 The MAV_1_MODE is recommended as Custom.

🔍 The AUX1 and AUX2 are just examples, which can be defined according to actual situation. It should be configured in RC Map for further application.

🔍 The trigger mode is just an example, which can be modified according to actual situation.

Appendix 4 MAVlink Communication Process

After receiving HeartBeat from the flight controller, and identifying SYSID and COMPID of the flight controller, GCU will operate as below:

1. GCU actively sends package *MAVLINK_MSG_ID_HEARTBEAT 0* at a frequency of 2Hz.

2. GCU requests following packages in turn at a frequency of 1Hz. The flight controller fills these parameters into package *MAVLINK_MSG_ID_COMMAND_LONG 76* until the request completing.：

   MAVLINK_MSG_ID_EKF_STATUS_REPORT 193 (No this package for PX4);

   MAVLINK_MSG_ID_GLOBAL_POSITION_INT 33;

   MAVLINK_MSG_ID_SCALED_IMU 26;

   MAVLINK_MSG_ID_SYSTEM_TIME 2;

   MAVLINK_MSG_ID_RC_CHANNELS 65;

   MAVLINK_MSG_ID_CAMERA_TRIGGER 112 (No this package for APM);

   MAVLINK_MSG_ID_AUTOPILOT_STATE_FOR_GIMBAL_DEVICE 286;

   MAVLINK_MSG_ID_GIMBAL_DEVICE_SET_ATTITUDE 284 (No this package for APM);

3. GCU actively sends package *MAVLINK_MSG_ID_GIMBAL_DEVICE_ATTITUDE_STATUS 285* at a frequency of 100 Hz while the packages above being received and the gimbal being operational.

4. Generally, the flight controller will request package *MAVLINK_MSG_ID_GIMBAL_DEVICE_INFORMATION 283*, which GCU does not send actively.