

MS600 V2 MultiSpectral Camera User Manual (v1.0)



Content

1. Overview..... 1

2. Use steps.....2

 2.1 Connection..... 2

 2.1.1 Insert Micro SD card..... 2

 2.1.2 Connect DLS module connection.....3

 2.1.3 Power Connection..... 3

 2.2 Use of cameras..... 4

 2.2.1 Power on equipment..... 4

 2.2.2 Power Off..... 4

 2.2.3 LED status..... 4

3. Camera configuration and preview display..... 5

 3.1 Establish WiFi connections..... 5

 3.2 Monitoring page..... 6

 3.3 Settings page..... 7

 3.3.1 Timing Trigger Mode..... 8

 3.3.2 Overlap Trigger Mode..... 9

 3.3.3 The Relationship between Head Overlap and High Ratio Constraints of Aircraft Speed..... 10

 3.3.4 External Trigger Mode..... 10

 3.3.5 Cascade trigger..... 11

 3.3.6 Manual exposure..... 11

 3.3.7 Advanced settings..... 11

 3.4 Preview page..... 15

 3.4.1 Preview function..... 15

 3.4.2 Trigger during preview..... 16

 3.4.3 Automatic gray board shooting function..... 17

 3.4.4 Manual exposure adjustment..... 18

 3.5 Planning page..... 19

 3.6 File storage..... 21

4. Data acquisition recommendation.....21

5. Firmware upgrade.....22

6. Installation and interface definition..... 23

6.1 Mechanical interface.....	23
6.2 Electrical interface.....	24
6.2.1 Host interface.....	24
6.2.2 DLS interface.....	25
7. Parameter Description.....	26
Ending page.....	29

Disclaimer

Our company aims to provide high quality products, create value for customers, and maintain a serious and responsible attitude towards customers. In order to facilitate customers' understanding of our company and our better operation, our company carries out quality assurance and disclaimer on this:

1. We guarantee to provide customers with fully qualified products, if the product does have quality problems, after verification by our company, we are responsible for it.

2. Customer should operate the instrument according to the requirements of the product specification, our company will not be responsible for the problems caused by the improper operation of the customer.

3. Our company is not responsible for product performance degradation or damage caused in the transportation or storage process,

4. Our company is not responsible for the damage caused by man-made, natural disaster or irresistible factor;

5. We will not be responsible for any problems other than those caused by product quality, and will not accept complaints from customers for non-quality reasons.

6. Electronic products and electromagnetic storage media have data loss in rare cases. Please be responsible for confirming the status of the equipment before use, and back up data in time after use. Our company does not bear any direct or indirect loss caused by data loss.

Hereby declare!

Identification Note



Note: Improper operation may result in improper use of the equipment, but it will not damage the equipment.



Warning: Improper operation may result in improper use of the equipment, and may cause damage to the equipment.



A description of the item, see the description will help to understand the content.

1. Overview

MS600 series camera is a light, compact and professional multi-spectral camera available for drones, which includes 3 Version: MS600 V2, MS600 V2 Advanced and MS600 Pro.

MS600 series camera has 6 multi-spectral sensors with 1.2Megapixels to recognize six specific bands of light including blue, green, red, dual red-edge, near infrared and capture invisible images to meet the needs of different industries such as crop condition monitoring, resource investigation, water quality monitoring, river ecology, hazard assessment and target recognition etc. (*17 optional Wavelength Bands, contact us to customize).

Besides the multi-spectral camera, MS600 includes one downwelling light sensor(DLS) which enables measurement of ambient light during flight for more accurate data in varying light conditions; The DLS also has a built-in GPS module to measure camera position and attitude during the flight and record it in the image metadata for post-processing, so there is no need to connect to a third-party GPS module by default.



camera



Micro SD



DLS



USB-WIFI

2. Use steps



MS600 V2



MS600 Pro



1x DLS



1x packing cases



1x Gray Board



1x Camera COMM Cable



1x DLS Cable



1x USB-WiFi



1x 64GB TF Card



4x M3 Screw



1x Power Cable



1x Trigger Cable

2.1 Connection

The cables needed to connect the camera including camera COMM cable, DLS cable, power cable, trigger cascade cable (if you do not use external trigger function, you may not connect this line).

2.1.1 Insert Micro SD card

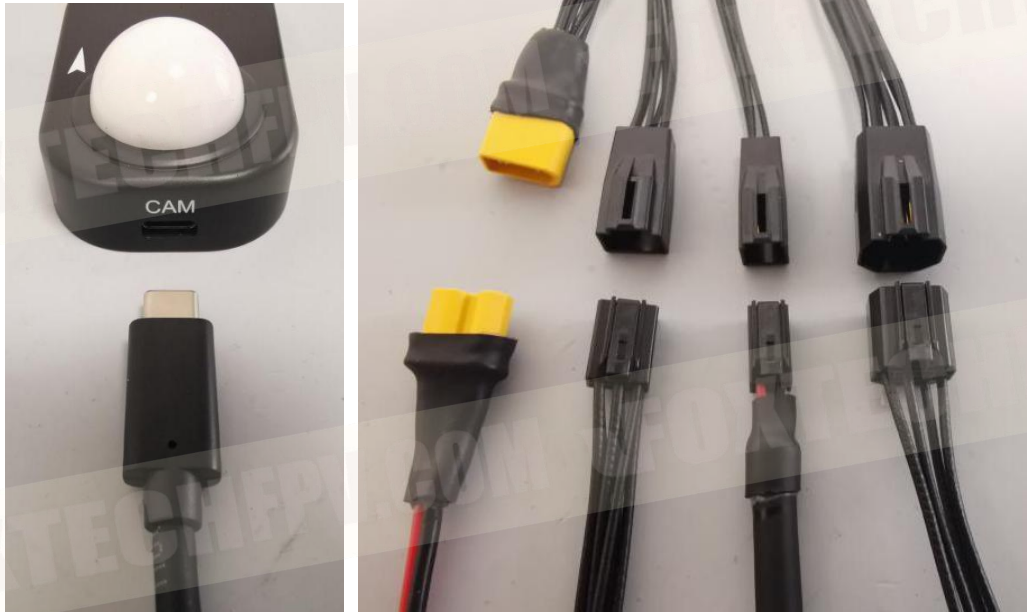
Ensure that the Micro SD card is inserted as shown below.



Attention

- 1) Micro SD card capacity not exceeding Max. 128 GB;
- 2) Micro SD card file format :exFAT/FAT32;
- 3) Micro SD card write speed not less than 60 MB/s;

2.1.2 DLS module Connection



The Type-C interface of the DLS cable is first inserted into the CAM port of the DLS module, and the other end is connected with the camera COMM cable. For details, please refer to DLS 6.2.2 interface section.

DLS measuring the ambient light of the same wavelength as the six channels of the camera and the position, attitude information of the whole machine, the collected results are recorded in the metadata of the captured image.



Warning

Please complete the DLS module connection before powering on the camera, if not it may cause damage to the DLS module.

2.1.3 Power Cable Connection



Insert the camera COMM cable into the camera, as shown.



Warning

The camera supply voltage is 6 V~30 V, Considering that the power supply cable has a certain voltage drop, it is recommended that the minimum voltage should not be less than 7V, and the maximum voltage should not be higher than 30V, and ensure that the polarity is correct. Failure to follow this rule will permanently cause damage to the camera and DLS module, and is not covered by warranty. Please refer to the “6.2 Electrical Interface section” for wire order definition.

2.2 Use of camera

2.2.1 Power on equipment

When the external power is connected, the camera is powered on.

When the camera is powered on, the camera status light and the DLS status light are white and always on. After the initialization is completed, it starts to flash according to the working state.


Please refer to the relevant information of “2.2.3 LED status” section for specific status definition.

2.2.2 Power Off Equipment

Turn off the external power directly after the work is completed, the camera will be powered off.

2.2.3 LED status

LED display status corresponds to the different working status and fault information of the camera, which can be used as a judgment before flight, as shown in the following table:

 Status display		
Color	Flashing frequency	Meaning
Red	10Hz	System temperature is too high
Red	2Hz	GPS not connected or GPS no signal
Red	1Hz	DLS not connected
Red	0.5 Hz	SD card not inserted / SD card full capacity
Red	Always bright	Software upgrade failed
Yellow	1Hz	GPS signal quality poor
Yellow	0.5 Hz	SD card capacity is insufficient
Blue	10Hz	SD card clearance
Blue	2Hz	Software upgrade
Green	10Hz	Write SD card
Green	1Hz	Normal
Green	Always bright	Upgrade success
White	Always bright	Camera Initialization or Camera Firmware anomaly

 **Warning**

Make sure the power is off before removing the SD card. Failure to follow this action will result in errors and loss of files while the SD card is still writing, and may never be restored.

3. Camera configuration and preview display

Make sure that the camera has been plugged into the USB-WiFi module that comes with the camera, and then you can connect to the camera through any device with WiFi function, and configure the camera and preview the image through the device's browser.

3.1 Establish WiFi connections

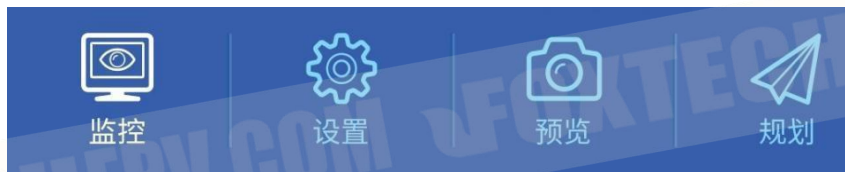
The steps to connect the device by WiFi are as follow:

- 1) Connect and turn on the camera, wait for initialization to complete as required;
- 2) Search WiFi, select hot spots named "MS600V2-XXXXXXXXXXXX (X stand for camera SN)" and connect;
- 3) Enter password: yusense2020, if the connection is not smooth, please try again;
- 4) After connecting, open any browser input "192.168.18.1" to access the camera WEB configuration page;
- 5) First enter the welcome page, you can choose Chinese and English display, click the "click enter" button to enter the camera page.



USB-WiFi wireless card does not support hot plugging, and it needs to be reconfigured.

WEB configuration page includes four items:



3.2 Monitoring page

This page provides the main status of the camera system, including:

- 1) Storage status: Micro SD card total capacity, residual capacity, working state information;
- 2) DLS status: DLS connection status, working status;
- 3) GPS status: current searching star number and signal quality;
- 4) Coordinate position: longitude and latitude;
- 5) Height: altitude and surface relative height;
- 6) Time: UTC time, when the GPS has no signal or signal quality is poor, the starting time displayed has no practical reference significance;
- 7) Temperature: camera internal temperature;
- 8) Capture status: shows the current effective automatic capture mode, mainly for pre-flight reference judgment;
- 9) Image storage format: 16 bit TIFF, JPG;
- 10) Working band: displays the opening status of the current channel.



3.3 Settings page

This page is used to configure the automatic capture mode of the camera, including timing trigger, overlap rate trigger, external trigger and so on.



Attention

After setting the automatic capture mode, the capture status and related parameters on the home page can be confirmed. The mode setting will be automatically saved as the default setting, and it will be remained after the camera restarting.



3.3.1 Timing Trigger Mode

- 1) Auto capture mode drop-down menu select "timing trigger";
- 2) Set timing trigger interval;
- 3) Set timing trigger enable height;
- 4) Save confirmation after setting up;
- 5) Start triggering.



Attention

After the timing trigger mode is set, the camera will start to trigger the photo after the aircraft takes off to the expected relative height, in order to avoid the large amount of redundant image data before the flight mission is performed.



3.3.2 Overlap Trigger Mode

- 1) Select "overlap rate trigger" in automatic capture mode drop-down menu ;
- 2) Enter the target flight altitude;
- 3) Enter the target flight velocity value;
- 4) Sets the course overlap rate of the two triggered images in drop-down menu ;
- 5) Save confirmation after setting;
- 6) Start triggering.



Attention

According to the pre-flight situation, the user can modify the default value of the flight speed to avoid the actual work in the overlap rate trigger mode, which exceeds the limit of the camera's fastest capture rate. Once exceeded, the user can use the method of increasing flight altitude, or reducing flight speed, or reducing overlap rate.

**Warning**

The altitude in overlap rate mode must be consistent with the altitude of the UAV when it executes the route, referring to the altitude relative to the UAV takeoff point, not altitude above sea level.

In order to avoid the camera triggering to generate redundant image data during the drone's ascent or descending process, the camera will stop triggering when it is lower than the "set flight altitude (meters) minus 50 meters" condition. Please pay attention to the flight settings in the WEB. The altitude matches the actual flying altitude, otherwise the camera may not take pictures.

3.3.3 The relationship between the course overlap and the speed-to-height ratio of the aircraft

The minimum shooting interval of MS600 V2 multispectral camera is 1 second, the shooting interval is less than this value, the phenomenon of missed shooting will occur. In order to avoid this situation, we can refer to the following table.

Flight altitude (m)	heading overlap (%)		Maximum speed (m/s)		Ground resolution (cm/pixel)	view angle (m²)
	80	70	3.2	4.8		
40	80	70	3.2	4.8	2.88	37×28
80	80	70	6.4	9.6	5.77	74×55
120	80	70	9.6	14.4	8.65	110×83
160	80	70	12.8	19.2	11.54	148×111
200	80	70	16	24	14.42	185×138
300	80	70	24	36	21.63	277×208
500	80	70	40	60	36.06	426×346



Attention

The speed in the above table refers to the speed relative to the ground, and the flight altitude refers to the altitude of the UAV, generally relative to the altitude of the take-off point.

3.3.4 External Trigger Mode

- 1) Before the external trigger mode is used, ensure that the effective trigger signal is properly connected to the camera;
- 2) Select "external trigger" in Auto capture mode drop-down menu;
- 3) The drop-down menu includes three trigger settings, as follow:

Settings	Note
Rising edge	The camera is photographed according to the rising edge of the pulse
Falling edge	The camera is photographed according to the falling edge of the pulse
PWM	The camera will trigger when it switches from less than the threshold to greater than the threshold.



- 1) PWM trigger mode also needs to set threshold time T , range $0 < T < 20\text{ms}$, PWM signal frequency range: 50 Hz-400Hz;
- 2) Confirm and save;
- 3) The external trigger function of the camera can be checked by setting the external trigger source.

3.3.5 Cascade trigger

Cascade trigger is mainly used for synchronous shooting of 2 or more multispectral cameras. The camera is divided into two parts, master camera and slave cameras, The PWM_OUT pin of the main camera is connected to the PWM_IN pin of the slave camera, See 6.2.1 camera interface for details; The main camera sets the shooting mode according to the normal process, slave cameras set to external trigger mode (signal type: PWM, temporal threshold: 1.5 ms). After the setting is completed, the flight mission will be executed. The master camera will trigger all the slave cameras to take pictures synchronously when shooting. The event interval between the master and slave cameras is less than 1ms.

3.3.6 Manual exposure

Check the manual exposure option in each trigger mode, you can adjust the exposure time and gain corresponding to each channel uniformly or independently on the preview page. See 3.4.3 for details.

3.3.7 Advanced settings

The advanced settings menu includes image storage format, channel

strobe, SD card formatting, DLS information, calibration function, recovery of factory settings and other functions.



➤ Image Storage Format

In advanced settings, you can set the camera storage format to 16 bit TIFF or JPG, the latter format can greatly reduce image volume, but will lead to image lossy compression.



➤ Working Band Customization

In the advanced settings, you can also select some channels to save the data, no need to save all the data of 6 channels. If you switch to the preview page thereafter, the preview button will only refresh the image of the selected channel.



➤ SD card formatting

When the Micro SD card capacity is not sufficient or full, it can be directly formatted through this function.

processing

Completion status



**Warning**

Perform SD card formatting, will clear all content in the Micro SD, which can not be restored.

➤ DLS information

Click on the 'DLS Information' option to see the DLS serial number and software version number.

< DLS信息

DLS版本号: V1.0.7

DLS序列号: CA220205003

➤ Calibration function

It is recommended to perform geomagnetic calibration after installing the multispectral camera on the drone. When calibrating, please make sure that there is no metal and strong magnetic interference around.

The geomagnetic calibration steps are as follow:

- 1) Enter the calibration function interface, click the "start" button for geomagnetic calibration;
- 2) First, perform the horizontal calibration. Slowly rotate the drone in one direction at least 720° horizontally. While rotating, keep the red dot in the calibration interface within the blue range.
- 3) When all 8 parts of the outermost white circle turn blue, the horizontal calibration is completed and enters vertical calibration mode.
- 4) In vertical calibration mode, slowly rotates the drone in one direction at least 720° vertically according to the instructions in the interface, while rotating, keep the red dot in the calibration interface within the green range.
- 5) When all 8 parts of the outermost white circle turn blue, the magnetometer calibration is complete.



保持无人机水平的同时，缓慢旋转无人机至少720度



开始



保持无人机垂直的同时，缓慢旋转无人机至少720度



取消

**Attention**

The third party compass should be used to check after calibration. It can be confirmed by comparing the angle in the "Flight Direction" column on the homepage. The corresponding true north direction should not exceed $\pm 10^\circ$. If the error exceeds this value, it is recommended to recalibrate.

During geomagnetic calibration, poweroff are prohibited.

➤ Factory Reset

Click on the recovery factory settings button, restart the camera, automatic capture mode, image storage format, channel strobe can be restored to the factory default state, the data in Micro SD card is not affected.



**3.4 Preview page**

The preview page provides an image refreshed in approximately real-time. This page mainly assists the gray board calibration work before flight, and can also judge the current imaging angle and effect of the camera.

The relationship between the image of the preview page and the corresponding channel on the camera is shown below:

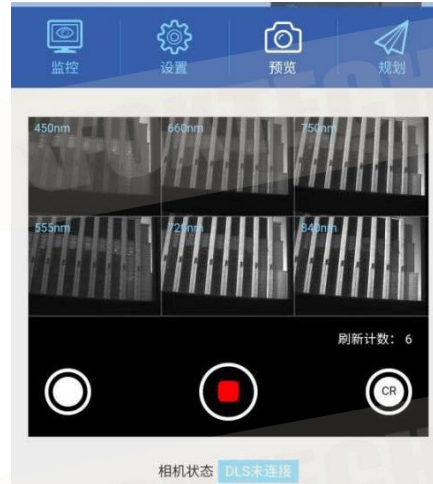


3.4.1 Preview function

When you switch to this page, the preview enable button defaults to , and when you click start, it will turn to , you will see an approximate real-time image (about 2 frames per second) of the corresponding band in the preview area, and the refresh count in the lower right corner will be updated continuously.



Preview Closed



Preview opens






Attention

When there is no memory card or memory card is full, it can not be previewed;

After setting any automatic capture mode, switch the preview page and turn on the preview enable button, automatically pause the automatic capture mode set before, exit the preview mode, automatically restore the automatic capture mode set before.

3.4.2 Trigger in preview process

In the preview process can trigger the photo, trigger the photo button is equivalent to the mechanical shutter button, when the photo is not taken, the icon is , in photo taking status, the icon darkens to , when finished, the icon recover to  and prompted 'photo taking successful'.







Attention

Take pictures in the preview interface can be realized only when the preview mode is opened.

3.4.3 Automatic Gray Board shooting function

The automatic gray board shooting function is added to prevent the overexposure problem of the gray board in extreme situations. It can automatically adjust the light and complete the gray board shooting.

In the preview process, click the  button to start entering the automatic gray board shooting mode, and pop up the "open automatic gray board shooting function" prompt, a black and white frame appears on the image of each channel in the preview interface, indicating that it is in automatic gray board shooting mode;

click the  icon again to close the automatic gray board shooting mode, at the same time, the box on each channel image of the preview interface disappears, as shown in the figure below.

In the process of automatic gray board shooting, adjust the position of the camera so that the gray board and the two-dimensional



code are all in the field of vision of each channel. Wait for a

period of time, when it prompts "Gray board automatic shooting succeeded", it means that the gray board was taken successfully and exited the automatic gray board shooting mode; when the "Gray board automatic shooting failed" was prompted, it indicated that the gray board was not successfully shot and exited the automatic gray board shooting mode. Need to restart the gray board shooting work.



Attention

1. Need to use the factory standard gray board, automatic gray board shooting need to identify the two-dimensional code on the gray box.

2. It is necessary to use the automatic gray board shooting function in the case of sufficient external light, and it is recommended to use the manual method to shoot the gray board under cloudy conditions.

3. For the advanced version camera, if you use the reflectance photo return function, you must first carry out automatic gray board shooting.

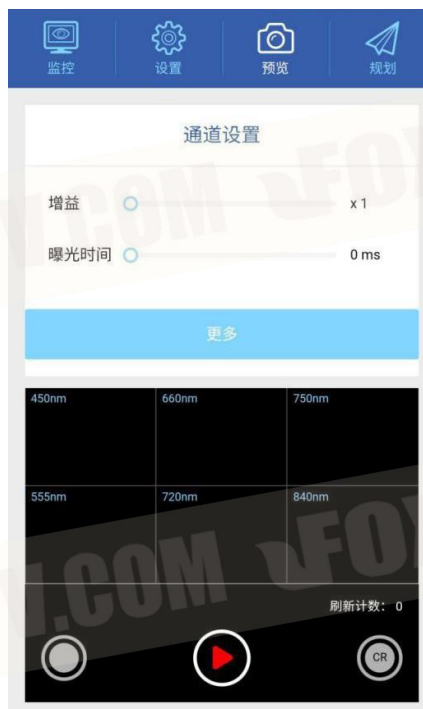
3.4.4 Manual exposure adjustment

Automatic capture mode drop-down selection off, while enabling manual exposure settings and save, switching to the preview page will see the corresponding manual adjustment of exposure time and gain options, Adjust exposure time and gain value after opening preview button will see brightness change of 6 channel images.

Select to close Automatic capture mode, and at the same time enable manual exposure settings and save, switch to the preview page, you will see the corresponding manual adjustment of the exposure time and gain options, turn on the preview button and adjust the exposure time and gain values, then you will see the brightness change of the 6 channel image.

The gain is divided into $\times 1, \times 2, \times 4, \times 8$, exposure time range $0 \sim 8$ ms.

In drop-down channel settings menu the exposure time and gain for



each channel can be set as shown below:

< 通道设置

ch1

增益 x 1

曝光时间 0 ms

ch2

增益 x 1

曝光时间 0 ms

ch3

增益 x 1

曝光时间 0 ms

ch4

增益 x 1

曝光时间 0 ms



Attention

After setting and saving the automatic capture mode, the system sets the exposure function to automatic exposure, and the manual exposure automatically fails.

Manual exposure settings need to be reconfigured after camera restart.

3.5 Planning page

This page provides simple mission planning and evaluation functions. The pre-flight estimator is used as a calculator tool to evaluate the mission, input the mission parameters, and press the "calculate" key to display the calculation results.



任务参数输入		
飞行高度	120	m
飞行速度	6	m/s
飞行面积	10000	m ²
航向重叠率	80	%
旁向重叠率	70	%
图像存储格式	tif16	

相机状态 DLS未连接

The estimated flight time, image width, capture times and storage capacity can be obtained.

计算结果	
照片高度	72.0 m
照片宽度	96.0 m
拍摄距离间隔	21.6 m
拍摄时间间隔	3.6 s
飞行时间	66.7 s
拍摄次数	18
拍摄照片张数	108 张
需要的存储容量	0.2 GB



Attention

The evaluation results of the pre-flight estimator are for reference only. Please judge according to the actual situation and experience.

3.6 File storage

After each camera is powered on, a new folder " MS600_SET_XXX " is automatically created in the storage card when the photo is triggered for the first time, the image is stored in the folder, when the folder is not deleted, the folder name serial number will be increased in turn.

By default, each trigger will create 6 photo files in the folder, and the photo files will be stored as "MS600_XXXX XXXnm ", each folder can store 1000 groups of files, When the number of shots exceeds 1000, a new folder will be created to store the images, and the file number will continue from the previous folder.

MS600_0001_450nm.tif	TIF 文件	2,405 KB
MS600_0001_555nm.tif	TIF 文件	2,405 KB
MS600_0001_660nm.tif	TIF 文件	2,405 KB
MS600_0001_720nm.tif	TIF 文件	2,405 KB
MS600_0001_750nm.tif	TIF 文件	2,405 KB
MS600_0001_840nm.tif	TIF 文件	2,405 KB
MS600_0002_450nm.tif	TIF 文件	2,405 KB
MS600_0002_555nm.tif	TIF 文件	2,405 KB
MS600_0002_660nm.tif	TIF 文件	2,405 KB
MS600_0002_720nm.tif	TIF 文件	2,405 KB
MS600_0002_750nm.tif	TIF 文件	2,405 KB
MS600_0002_840nm.tif	TIF 文件	2,405 KB
MS600_0003_450nm.tif	TIF 文件	2,405 KB
MS600_0003_555nm.tif	TIF 文件	2,405 KB
MS600_0003_660nm.tif	TIF 文件	2,405 KB
MS600_0003_720nm.tif	TIF 文件	2,405 KB
MS600_0003_750nm.tif	TIF 文件	2,405 KB
MS600_0003_840nm.tif	TIF 文件	2,405 KB

When selecting TIFF storage format, the photo is saved to 16 bit TIFF format, each file is about 2.35 MB size, containing 1280 pixel information, metadata exists in each file in EXIF 、XMP format; when selecting JPG storage format, the photo is saved to JPG format. Each file size does not exceed 300 metadata in EXIF 、XMP format.

4. Data acquisition recommendation

For the purpose of using MS600V2 multispectral camera to collect

multispectral image data more effectively and accurately, when planning route and trigger shooting, the following suggestions can be referred to:

- 1) Make sure the arrow direction of the DLS module is consistent with the flight direction;
- 2) Make sure the camera lens is clean before flight;
- 3) Ensure that the GPS module receives signal with good quality

- 4) The course and side overlap rate is not less than 75%;
- 5) At least one route is beyond the edge of the planned flight area to ensure that the edge data is valid;
- 6) If accurate reflectivity data are required, gray board calibration should be carried out immediately before and after each flight.
- 7) It is suggested that data collection should be carried out under sunny weather conditions, and for better data results, data collection should be carried out within 2.5 hours before and after local noon time;
- 8) In the multispectral image data acquisition operation including the water area scene, we should avoid the flare phenomenon caused by the sun's direct projection of the water(as shown in the figure). In this case, it is suggested that the flight acquisition should be carried out after the solar high angle is slightly reduced, or the route planning should avoid the water area as far as possible;
- 9) In order to obtain the height information of crops, it is suggested to plan the flight route in the direction perpendicular to the crop planting ridge;
- 10) If the planned flight area is large and requires multiple sorties, it is recommended to ensure that there is at least one overlapping section of the route for the two flights;
- 11) It is recommended to avoid the use in scenes with a large number of dynamic targets.





Attention

During the calibration process of the gray board, need to use the camera button on the WiFi preview page. When taking pictures, the gray board should occupy at least half of the camera's field of view, which can be judged by previewing the page.

5. Firmware upgrade

Continue to pay attention to our website, we will launch firmware upgrade information about MS600 series multispectral camera at any time. You can also obtain firmware upgrade information through the distributor.

The steps of the upgrade process are as follow:

- 1) Ensure that the DLS is properly connected with the camera;
- 2) Copy the upgrade package file (. bin format) to the card root directory;
- 3) Power off the camera, insert memory card;
- 4) Power-on Camera, start automatic upgrade;
- 5) During the upgrade process, the camera status light flashes blue;
- 6) After the upgrade is successful, the camera status light becomes green; if the upgrade fails, the status light becomes red, repeat step 4) until the upgrade is successful, if you can not upgrade successfully many times, please contact us for technical support;
- 7) After the upgrade is complete, restart the camera and view the firmware version number on the WEB page to confirm that the upgrade is successful.



Attention

It is strictly prohibited to put 2 or more different versions of the upgrade package in the same memory card;
After the firmware upgrade, when re-using the mobile terminal WEB page to configure the device, it is recommended to clear the browser cache.

6. Installation and interface definition

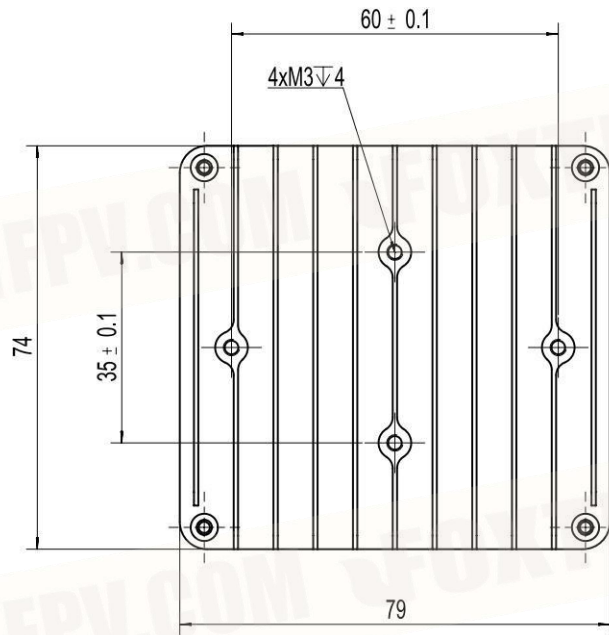
6.1 Mechanical interface

There are 4 M3 screw holes at the bottom of the MS600V2 main frame for installation.

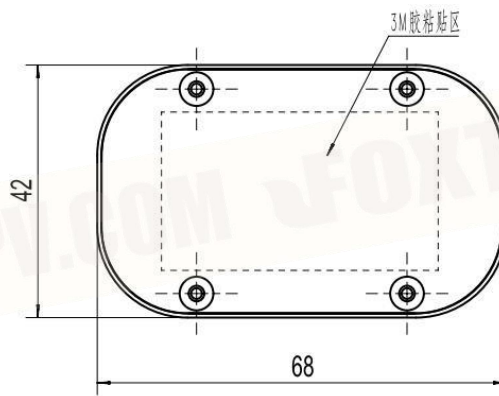


Attention

Ensure that all surfaces of the camera have air convection, which is very necessary for heat dissipation. The camera's mounting surface should not completely covered or isolated when installed on the UAV.



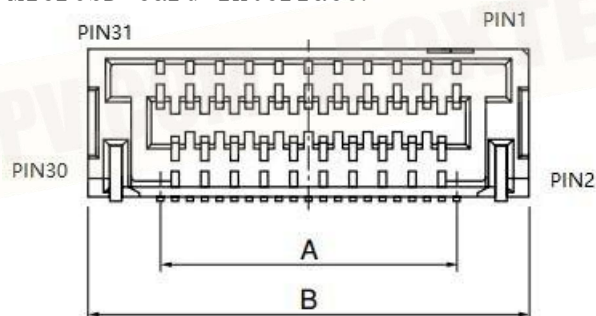
DLS module size as shown in the figure, can be fixed by 3M glue.



6.2 Electrical interface

6.2.1 Camera interface

MS600V2 camera has an external connector interface, including power supply, external trigger, DLS power supply and communication, serial port, network port and other functions; 1 USB 2.0 interface for USB-WiFi module; 1 MicroSD card interface.



Connector Name: External Connector			
Node	Definition	Note	Description
PIN1	GND	Signal ground	
PIN2	NET_TRXN3	Net port	Brown (not connected)
PIN3	NET_TRXP3		Brown white (not connected)
PIN4	NET_TRXN2		Blue (not connected)
PIN5	NET_TRXP2		Blue and white (not connected)
PIN6	NET_TRXN1		Green
PIN7	NET_TRXP1		Green white
PIN8	NET_TRXN0		Orange
PIN9	NET_TRXP0		Orange white
PIN10	GND	Signal ground	
PIN11	GND	Signal ground	
PIN12	5V	DLS External Power supply	Maximum current ≤500 mA
PIN13	5V		
PIN14	UART2_RXD	DLS	

PIN15	UART2_TXD		
PIN16	UART1_RXD	API serial port TTL	
PIN17	UART1_TXD		
PIN18	GND	Signal ground	
PIN19	NC	Reservations	
PIN20	NC		
PIN21	PWM_IN	PWM	Standard voltage: 3.3 VDC; Input voltage range :0.0 VDC-5.0VDC; PWM signal frequency range :50 Hz-400Hz
PIN22	PWM_OUT		Standard voltage: 3.3VDC; Input voltage range: 0.0VDC-5.0VDC;
PIN23	GND	Signal ground	
PIN24	PWR_GND	External power supply (black)	Camera input voltage 7VDC-30VDC ; average 6W, peak 9W (excluding external DLS Module)
PIN25	PWR_GND		
PIN26	PWR_GND		
PIN27	PWR_GND		
PIN28	PWR_IN	External power supply (red)	Mean 7W, peak 10W (including external DLS Module)
PIN29	PWR_IN		
PIN30	PWR_IN		
PIN31	PWR_IN		
Type specifications			
Connector Type		SHLVP-31V-S-1	

Fit connector plug	SM31B-SHLVS-G-TB Recommendation AWG28 Wire
--------------------	--

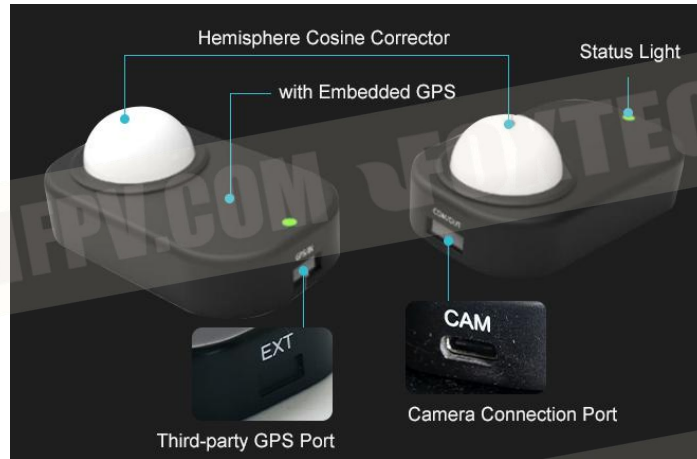
**Attention**

If the GND of trigger signal is different from the power supply GND, must not to connect GND only at the camera.

6.2.2 DLS interface

The MS600V2 DLS has two external connector interfaces: camera connection, third party GPS connection interface; DLS with built-in GPS module, by default do not need to connect to third-party GPS module.

When a third-party GPS module is used, the GPS module that meets the NMEA-0183 protocol needs to be plugged in EXT interface, the DLS will automatically switch to use the third-party GPS module; recommended to use UBLOX M8N GPS module Pixhack version.



Connector Name: CAM (Camera Connection Interface)				
A face	Definition	B face	Definition	Description
A1	GND	B1	GND	Signal/power ground
A2	NC	B2	NC	
A3	NC	B3	NC	
A4	VCC	B4	VCC	DLS supply ,5 V
A5	RXD	B5	RXD	3.3 V Level UART
A6	NC	B6	NC	
A7	NC	B7	NC	
A8	TXD	B8	TXD	3.3 V Level UART
A9	VCC	B9	VCC	DLS power supply ,5 V
A10	NC	B10	NC	
A11	NC	B11	NC	
A12	GND	B12	GND	Signal/power ground
Type specification				
Connector Type	Type-C			
Adapted connector Plug	Type-C			

Connector name: EXT (third party GPS connection interface)		
Node	Signal	Description
1	5VDC	Output to GPS power supply ,≤500 mA
2	GPS_TX	3.3 V UART
3	GPS_RX	3.3 V UART
4	NC	NC
5	NC	NC
6	GND	Signal/power ground
Type specifications		
Connector Type	SM06B-GHS-TB	
Fit connector plug	GHR-6V-S Recommendation AWG28 Wire	

7. Parameter Description

Basic parameters table

Parameters	MS6000 V2	MS600 Pro
Sensor	1/3 inch CMOS; 1.2 megapixels; global shutter	
Field of view	49.6°HFOV; 38°VFOV; Aperture:f/2.2	
Quantitative level	12bit	
Typical Image Width	110m*83m@h=120m(~400ft)	
Ground spatial Distance(GSD)	8.65cm@h=120m(~400ft)	
Available Wavelength Bands for Selection	400nm~900nm(select 6 from 17: 410nm, 450nm, 490nm, 530nm, 555nm, 570nm, 610nm, 650nm, 660nm, 680nm, 720nm(NBP/LWP), 750nm, 780nm, 800nm, 840nm, 900nm)	
Data Calibration	High-precision spectral calibration, radiation calibration, geometric correction; standard DLS	
Image Format	16 bit TIFF, JPEG	16 bit TIFF
Capture Rate	≥ 1s	
Positioning Module	GPS positioning accuracy CEP 2.5m 9-axis IMU	
Storage	Micro SD card, default 64G, maximum support 128G	Micro SD card, default 64G, maximum support 128G, UHS3
Interface	Serial, 10/100/1000 Ethernet、PWM	DJI-X Port
Date Transmission Link	No	Support
Image transmission Link	No	Support
Operating Temperature	-10 °C ~ + 50 °C (ambient with airflow ≥1m/G4s)	
Operating humidity range	≤85% (non-condensing)	
Storage temperature range	-30°C ~+70°C	
Triggering Options	Timing trigger, Overlap rate trigger, External trigger(relay single)	
Voltage	6V DC~30V DC	
Power consumption	7W average; 10W peak	
Dimensions	79mmx74mmx52mm	129mmx157x148mm
Weight	275g	655g
Environmental adaptability	Sapphire protection window, scratch resistance, abrasion resistance, good durability	
Processing Software	Yusense Map image processing software, compatible with mainstream software such as Pix4D, data support access to cloud platform	
Controlling Software	WEB interface accessible by any WIFI device, supports Chinese and English	Yusense-Fly GCS App; DJI Pilot
Certification	CE、FCC、RoHS	

17 optional band configurations, as shown in the table below.

Band Configuration

Tiff band name	Central wavelength	Bandwidth (FWHM)
Blue (blue)	410nm	35 nm
Blue (blue)	<u>450 nm *</u>	35 nm
Green (green)	490nm	25 nm
Green (green)	530nm	25 nm
Green (green)	<u>*555nm</u>	25 nm
Yellow (yellow)	570nm	32.5 nm
Orange (orange)	610nm	30 nm
Red (red)	650 nm	27 nm
Red (red)	<u>660nm *</u>	22.5 nm
Red (red)	680nm	25 nm
red edge (red edge)	<u>720 nm(narrow band)*</u>	10nm
red edge (red edge)	720 nm(Qualcomm)	40 nm
red edge (red edge LP)	<u>750 nm *</u>	10nm
Near-infrared (near infrared)	780 nm	13.5 nm
Near-infrared (near infrared)	800 nm	35 nm
Near-infrared (near infrared)	<u>nm *840</u>	30 nm
Near-infrared (near infrared)	900 nm	35 nm

* Represents the default band for the came