



PHANTOM 4 RTK

VISIONARY INTELLIGENCE.
ELEVATED ACCURACY.



PHANTOM 4 RTK KEY FEATURES

DJI has rethought its drone technology from the ground-up, revolutionizing its systems to achieve a new standard for drone accuracy – resulting in the creation of the Phantom 4 RTK.

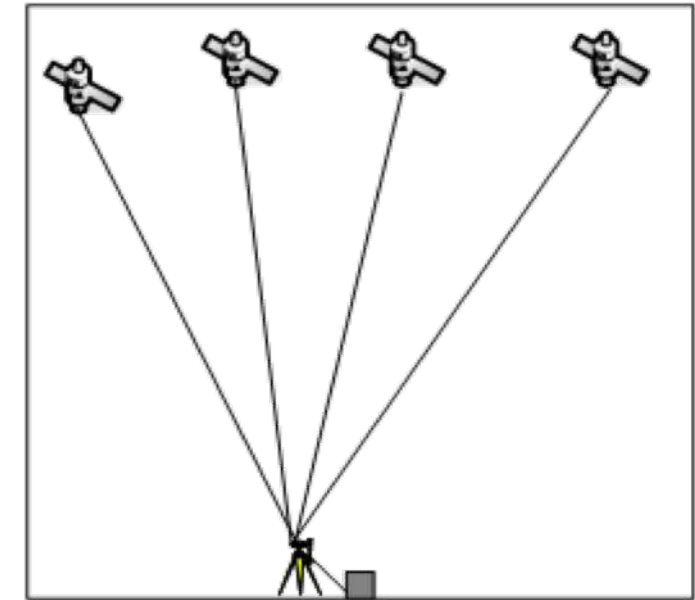
The system was designed by looking at the requirements from the drone mapping and surveying market and building exactly what they wished for – a compact drone solution with a high-resolution camera and the ability to capture centimeter-accurate RTK data.

- Supports RTK and PPK
- Centimeter-Level Positioning System
- OcuSync
- Precise Imaging System
- TimeSync
- D-RTK 2 Mobile Station Compatibility
- NTRIP Compatibility
- Mobile SDK Supported

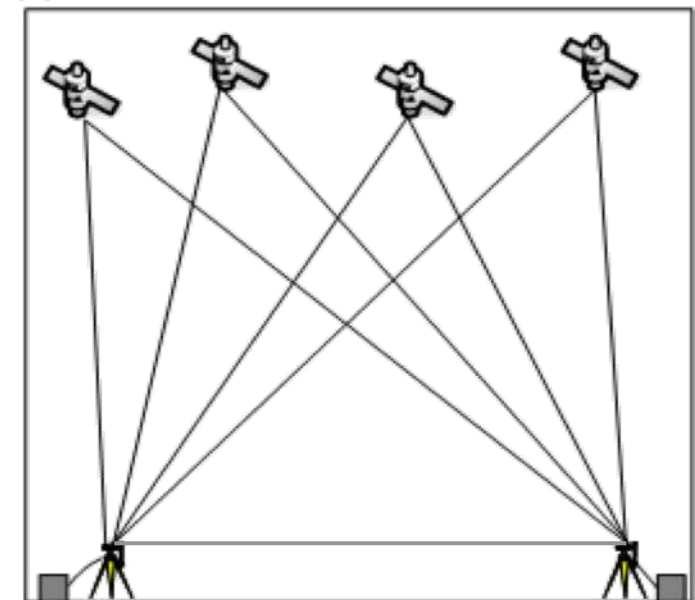


TERMINOLOGIES

- GNSS - Global Navigation Satellite System
- RTK - Real-Time Kinematic
- PPK - Post-Process Kinematic
- GCP - Ground Control Point for aircraft positioning reference.
- Ground Station - Provides RTK/PPK centimeter-level positioning accuracy data for position correction.
- RTCM - Data format provided by the ground station, currently supports RTCM 3.0, 3.1, 3.2 MSM4 and 3.2 MSM5.



GNSS Single Point Positioning



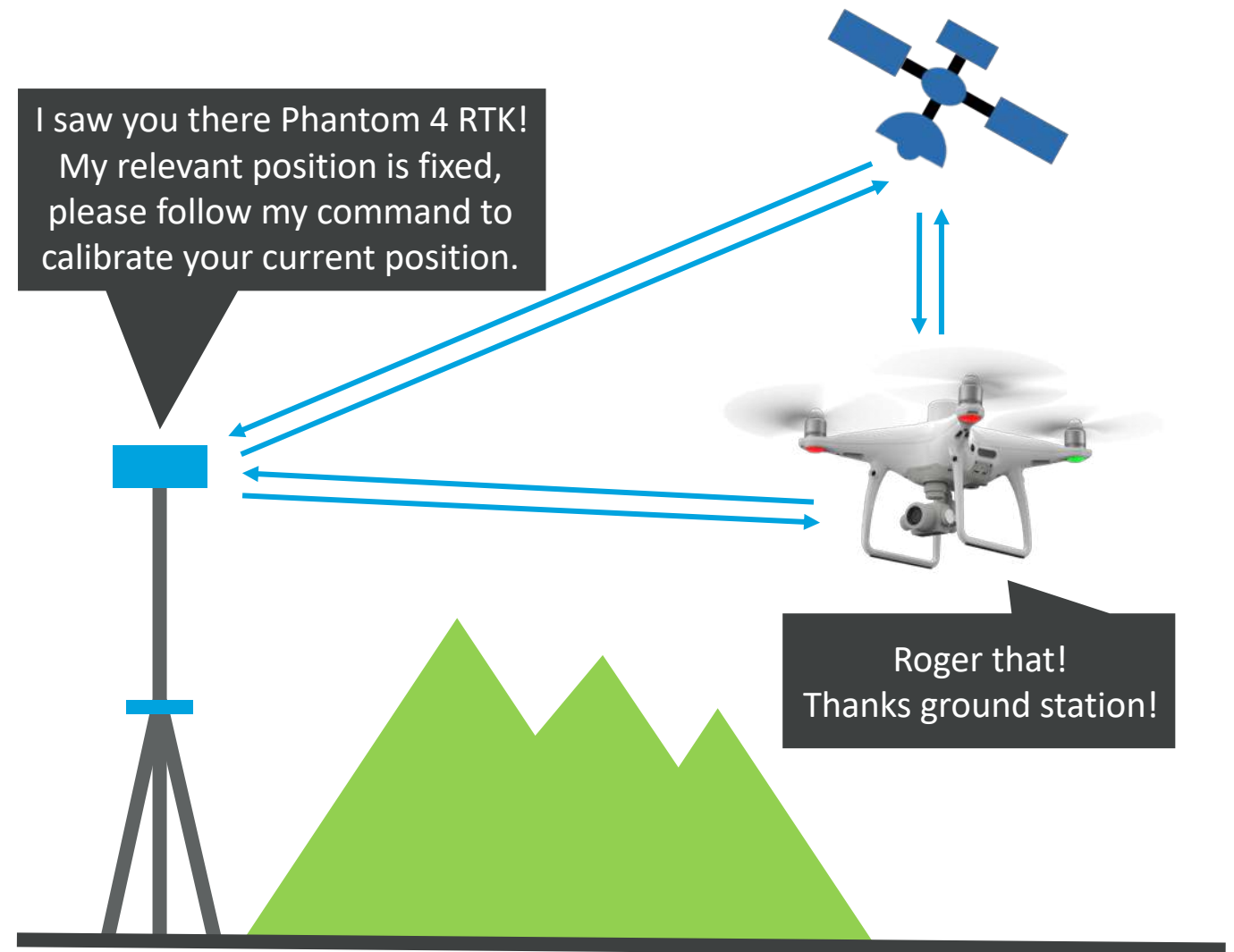
GNSS Real Time Kinematic

REAL TIME KINEMATIC BASICS

Real-Time Kinematic or RTK is an advanced satellite positioning system utilizing ground station as secondary position reference to delivering highly precise centimeter-level accuracy data.

Combine and contrast position data captured from virtual or physical base station, the Phantom 4 RTK's camera would geotag the centimeter-level precision data into the image.

Radial and tangential lens distortions were measured for every Phantom 4 RTK's camera to have its unique distortion parameters and write these distortion parameters into the image for post-process calibration.



TOP PHANTOM 4 RTK FEATURES

- CENTIMETER-LEVEL POSITIONING SYSTEM
- OCUSYNC
- PRECISE IMAGING SYSTEM
- TIMESYNC
- REMOTE CONTROLLER
- COMPATIBILITY
- INTEGRATED MAPPING SOLUTION

PHANTOM 4 RTK KEY FEATURES

	Phantom 4 RTK
Maximum Flight Time	Approx. 30 minutes
Total Weight (With propellers and battery)	3 lbs (1.39 kg)
Video Transmission System	OcuSync
Maximum Transmission Range	4.3 miles (7 km)
Horizontal RTK Positioning Accuracy	0.4 inch (1 cm) + 1 ppm
Vertical RTK Positioning Accuracy	0.4 inch (1.5 cm) + 1 ppm
Absolute Horizontal Accuracy in Photogrammetric mode	1.97 inch (5 cm)*
Remote Controller with Built-in Display and 4G Compatibility	Supported
Built-in RTK with Centimeter-accuracy Positioning	Supported



*When flying in sunny conditions, wind speeds below 13.12 ft/s (4 m/s), 328.08 ft (100 m) height and 1.08 in (2.74 cm) GSD, front overlap rate of 80%, side overlap rate of 70%.

CENTIMETER-LEVEL POSITIONING SYSTEM

- The integrated RTK module provides accurate positioning data even with no GCPs.
- The Phantom 4 RTK stores the satellite observation data for PPK (Post-Process Kinematic) position post-process.
- Compatible with the D-RTK 2 Mobile Station, NTRIP (Network Transport of RTCMv3 via Internet Protocol) and third-party RTK stations (Only PPK is available when the ground station is without the NTRIP service).



INTEGRATED RTK MODULE

A new RTK module is integrated directly into the Phantom 4 RTK, providing real-time, centimeter-level positioning data for improved absolute accuracy on image metadata.

Sitting just beneath the RTK receiver is a redundant GNSS module, installed to maintain flight stability in signal-poor regions such as dense cities.

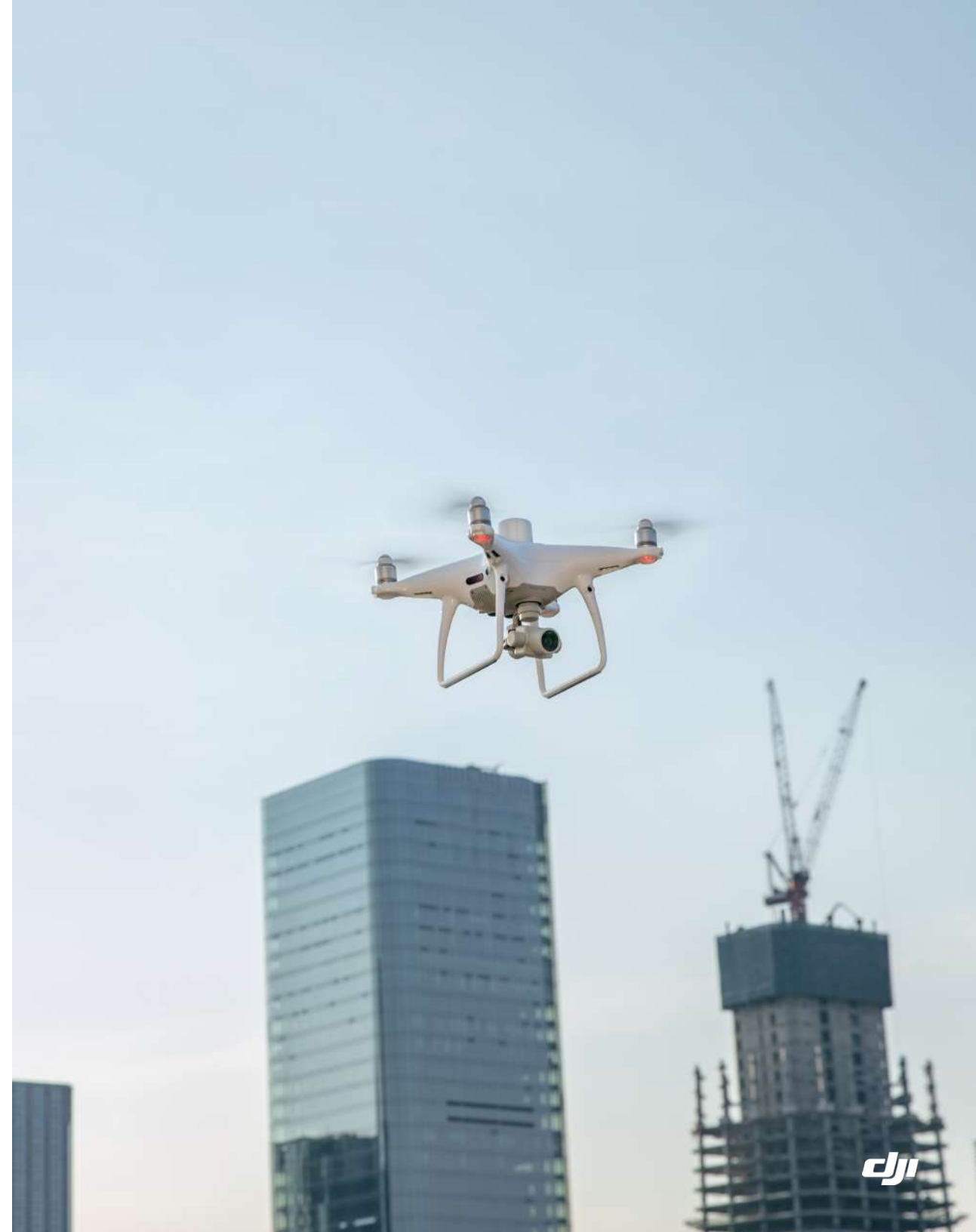
Combining both GNSS and RTK modules, the Phantom 4 RTK can optimize flight safety while ensuring the most precise data is captured for complex surveying, mapping, and inspection workflows.



OCUSYNC

Enjoy stable and reliable HD live video transmission at distances of up to 4.3 miles*, the Phantom 4 RTK is great for mapping large scale sites.

*Unobstructed, free of interference, when FCC compliant. Maximum flight range specification is a proxy for radio link strength and resilience. Always fly your drone within visual line of sight unless otherwise permitted.



PRECISE IMAGING SYSTEM

- 1-inch CMOS sensor, 20M effective pixels, 2.7 cm GSD (Ground Sample Distance) at 100 m flight altitude.
- Radial and tangential lens distortions were measured for post-processing image calibration.
- The camera is synchronized with the RTK module, delivers millisecond-level imaging deviation.
- Phantom 4 RTK's camera would capture and store the phase compensation data for the post-processing position calibration
- The mechanical shutter on Phantom 4 RTK's camera eliminates rolling shutter distortions which can occur when flying at high speed, allows high-precision shots to be captured without the wobble distortion.



TIMESYNC

To take full advantage of the Phantom 4 RTK's positioning modules, the new TimeSync system was created to align the flight controller, camera and RTK module continually.

Additionally, TimeSync ensures each photo uses the most accurate metadata and fixes the positioning data to the center of the CMOS - optimizing the results from photogrammetric methods and letting the image achieve centimeter-level positioning data.

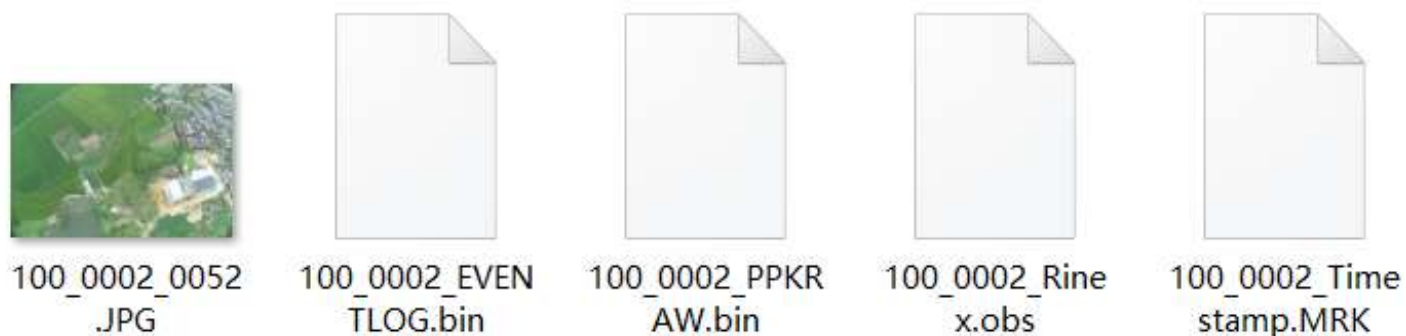


POST-PROCESS KINEMATIC FILES

While using the Photogrammetry or the Waypoint Flight planning method, following files would all be generated automatically in the “survey” folder.*

- “PPKRAW.bin” (satellite observation and ephemeris data in RTCM3.2 MSM5 format)
- “EVENTLOG.bin” (Exposure time log file in binary)
- “Rindex.obs”(Rindex observation data file)
- “Timestamp.MRK” (Exposure time log file in ASCII format)

*The “survey” folder and corresponding files would not be generated under manual flight mode.



POST-PROCESS KINEMATIC FILES

The data format of the file “Timestamp.MRK” is shown as follows:

First Column: Correspond photo number

Second Column: The exposure time of the GPS seconds of the week (UTC Time)

Third Column: The exposure time of the GPS week (UTC Time)

Fourth Column: Phase compensation value between the north antenna to the center of the CMOS sensor. (Unit: millimeter)

Fifth Column: Phase compensation value between the east antenna to the center of the CMOS sensor. (Unit: millimeter)

Sixth Column: Phase compensation value between the up and down directional (downward as positive) antenna to the center of the CMOS sensor. (Unit: millimeter)



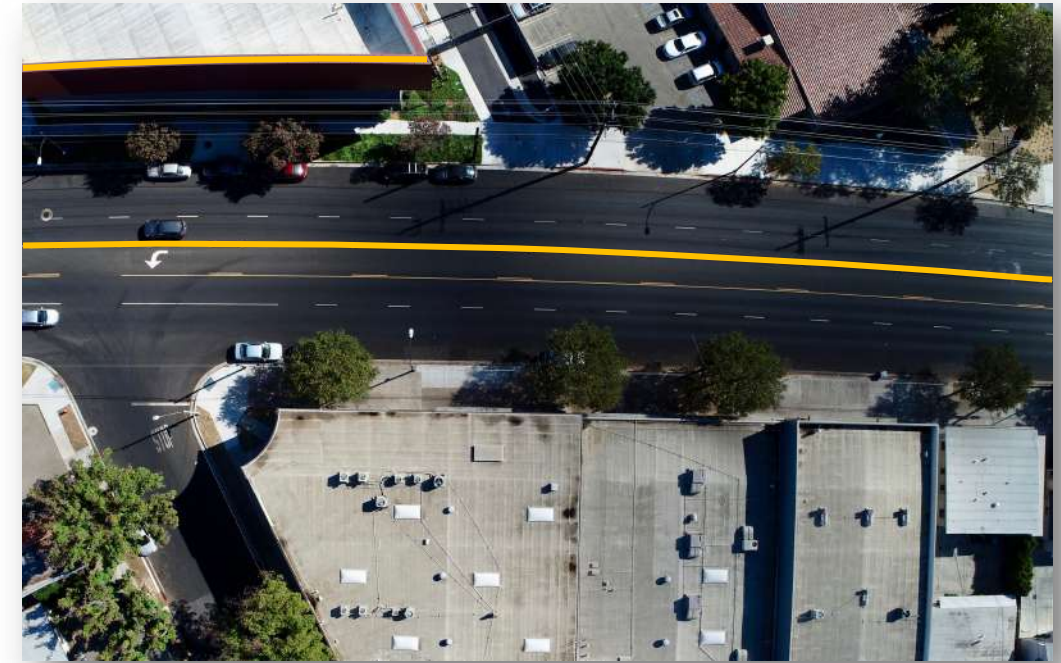
3	460573.248764	[2020]	-18,N	23,E	192,V
4	460575.827768	[2020]	-11,N	20,E	193,V
5	460578.439206	[2020]	-18,N	20,E	193,V
6	460581.024708	[2020]	-19,N	20,E	192,V
7	460583.624467	[2020]	-18,N	19,E	193,V
8	460586.241808	[2020]	-27,N	21,E	192,V
9	460588.831281	[2020]	-19,N	18,E	192,V
10	460591.430969	[2020]	-29,N	20,E	191,V
11	460594.024330	[2020]	-82,N	61,E	165,V
12	460596.645565	[2020]	-26,N	15,E	192,V
13	460599.213752	[2020]	-48,N	-71,E	174,V
14	460601.838875	[2020]	-33,N	21,E	189,V
15	460604.415534	[2020]	-14,N	15,E	193,V
16	460607.029618	[2020]	-19,N	15,E	193,V
17	460609.637551	[2020]	-18,N	16,E	193,V
18	460612.231297	[2020]	-16,N	13,E	194,V
19	460614.841318	[2020]	-19,N	13,E	193,V
20	460617.432591	[2020]	-2,N	0,E	195,V
21	460620.030560	[2020]	-16,N	4,E	194,V
22	460622.645079	[2020]	-23,N	12,E	192,V
23	460625.236552	[2020]	25,N	-8,E	192,V
24	460627.815597	[2020]	13,N	23,E	192,V
25	460630.447396	[2020]	-29,N	10,E	192,V
26	460633.030326	[2020]	-20,N	16,E	193,V
27	460635.644476	[2020]	-14,N	21,E	193,V
28	460638.223222	[2020]	-24,N	8,E	193,V
29	460640.829357	[2020]	-24,N	9,E	192,V
30	460643.441769	[2020]	-57,N	-14,E	185,V

DISTORTION CORRECTION

Enable distortion correction would calibrate the optical distortion caused by the camera lens, real-time calibrated images would be captured and stored in Micro-SD card.

Disable the distortion correction would have Phantom 4 RTK's camera capture the unedited image with fisheye effect. The lens distortion parameters were all pre-measured. These parameters would all be saved in "DewarpData" under the XMP field for every image taken.

You can also input these parameters manually to calibrate the image distortion with third-party software. (The location of the principal point should first meet the third-party software's requirement to proceed. Match the imager origin point of the distortion parameter given by XMP with the principal point.) Distortion calibration using post-processing software would have better accuracy compared to the built-in distortion correction feature in the GS RTK app.



Distortion Correction: Disabled



Distortion Correction: Enabled

DISTORTION CORRECTION

Access Instruction:

Open the “.jpg” format image as text file, search the keyword “DewarpData” under the XMP field. Format of the text would be like:
drone-dji: DewarpData =" 2018-03-13;3663.4800000000..."

Numbers in sequence correspond to:

“calibrate_date;fx,fy,cx,cy,k1,k2,p1,p2,k3”

“fx,fy” is the focal length in pixel

“cx,cy” is the optical center expressed in pixel coordinate (Origin point as the center of the imager)

For more information, please refer to the following website:

https://docs.opencv.org/3.4.1/d4/d94/tutorial_camera_calibration.html

*It is recommended to turn off “Distortion Correction” in the camera settings for more accurate post-process distortion calibration.

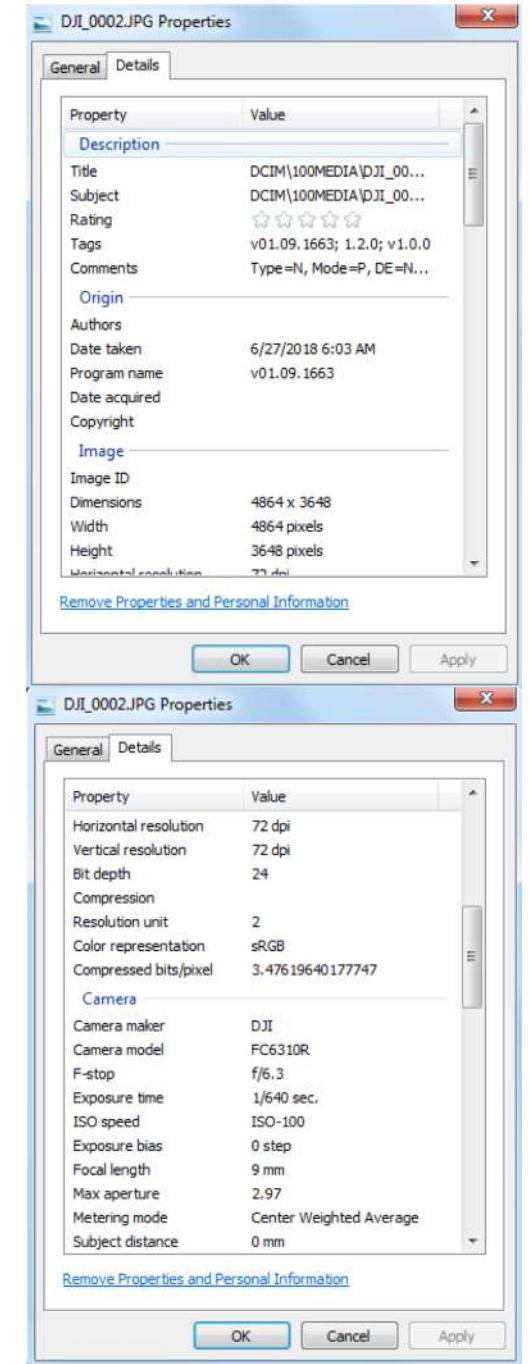


IMAGE EXIF DATA

Exif contains all metadata of the image, to access image Exif data:

Windows: Right click on the image – select “Properties” – “Details” tag

macOS: Open the image with the default Apple Preview software – “Tools” tag – select “Show Inspector”



XMP DATA

Telemetry data contained in the XMP file:

Open the “.jpg” format image as text file, search for the keyword “XMP”.

drone-dji:AbsoluteAltitude="+126.00" Absolute Altitude
drone-dji:RelativeAltitude="+99.89" Relative Altitude
drone-dji:GpsLatitude="22.78797799" GPS Latitude
drone-dji:GpsLongitude="114.89875118" GPS Longitude
drone-dji:GimbalRollDegree="+0.00" Gimbal Roll Degree
drone-dji:GimbalYawDegree="-111.90" Gimbal Yaw Degree
drone-dji:GimbalPitchDegree="-60.00" Gimbal Pitch Degree
drone-dji:FlightRollDegree="-2.60" Aircraft Roll Degree
drone-dji:FlightYawDegree="-112.40" Aircraft Yaw Degree
drone-dji:FlightPitchDegree="+15.00" Aircraft Pitch Degree

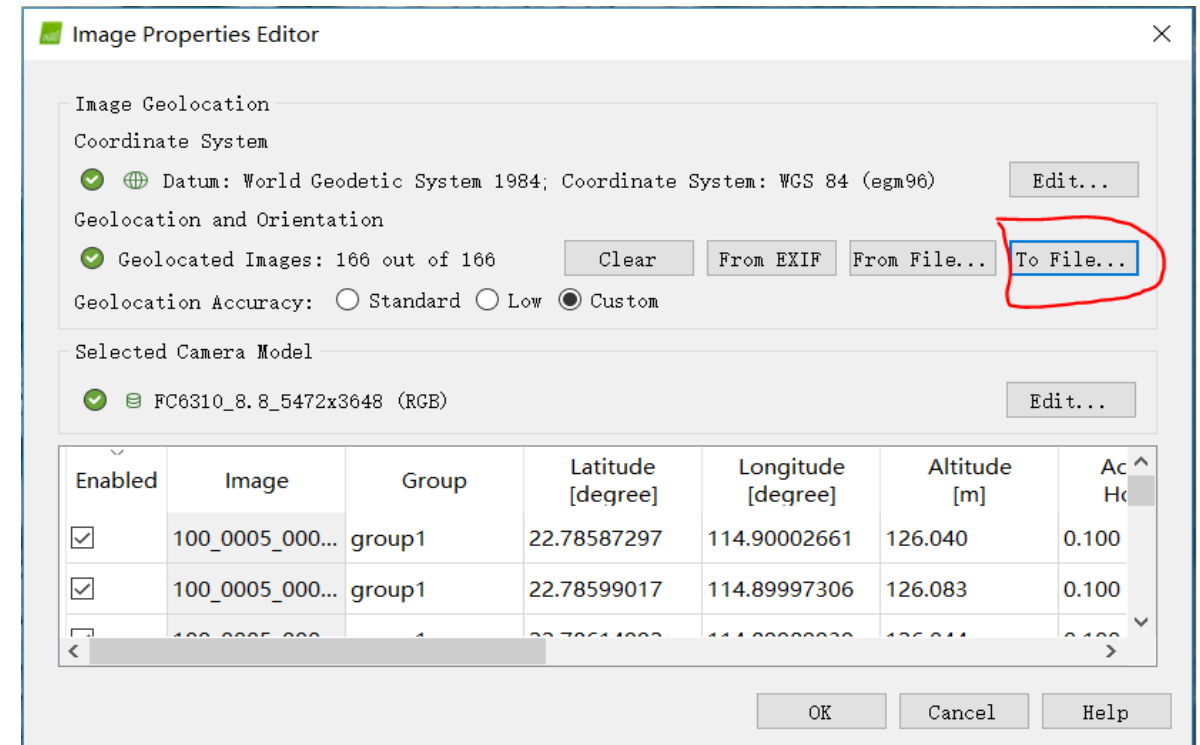
drone-dji:FlightXSpeed="-1.10" X Directional Speed
drone-dji:FlightYSpeed="-3.10" Y Directional Speed
drone-dji:FlightZSpeed="+0.00" Z Directional Speed
drone-dji:RtkFlag="50" RTK Positioning (16 as point positioning ,
34 as float solution and 50 as fixed solution)
drone-dji:RtkStdLon="0.01019" RTK Standard Deviation along
the Longitude
drone-dji:RtkStdLat="0.01035" RTK Standard Deviation along
the Latitude
drone-dji:RtkStdHgt="0.02611" RTK Standard Deviation along
the Altitude
drone-dji:DewarpFlag="0" Distortion Correction
enabled/disabled

POS DATA

To extract the pos data:

Currently, the pos data is written in the XMP and the Exif fields. You would need to use third-party software to extract the pos data.

The Phantom 4 RTK provides the same coordinate system as the CORS datum, the WGS 84 geodetic coordinate system is also required. The pos information would be needed for marking map into different coordinate frames. Convert measured parameters with the method of Helmert transformation, and then convert the Phantom 4 RTK's original coordinates for the desired coordinate frame. (DJI does not provide the parameter conversion or coordinate conversion tool. Be aware of the coordinate transformation is a complex and error-prone process, so please double check all the parameters and settings before conversion process) Import all converted coordinates as the pos datum, begin the processing process.



REMOTE CONTROLLER

- Built-in with a 5.5", 1000 cd/m² high-brightness LCD display
- Interchangeable battery and antennas design
- Phantom 4 RTK's remote controller has a built-in secondary battery to ensure the system would continuously operate while hot swapping external batteries
- Built-in DJI GS RTK app
- Latest OcuSync transmission system, transmission range up to 4.3 miles (unobstructed, free of interference)
- The remote controller's Multi-Aircraft Control Mode can be used to coordinate the operation of up to five aircraft at the same time, enabling pilots to work efficiently
- Supports 4G, Wi-Fi, and OcuSync connectivity



D-RTK 2 HIGH-ACCURACY MOBILE STATION

- Supports four satellite navigation systems: GPS, GLONASS, BeiDou, and Galileo
- Supports both OcuSync and 4G connectivity
- Supported for multiple DJI aircraft models
- Still Detection: The RTK station should always maintain still during the operation. However, if the station has been moved or tilted accidentally, its Still Detection feature would automatically detect its changed stationary state and report the captured data as unreliable result.



USAGE

With a new RTK system, rethought internals resulting in TimeSync and a turnkey flight application, the Phantom 4 RTK was built around requirements from the surveying community. With the ability to connect the positioning system to the D-RTK 2 Mobile Station, NTRIP (Network Transport of RTCM via Internet Protocol) with Wi-Fi or 4G connection*, or store the satellite observation data to be used for PPK, the Phantom 4 RTK fits various workflows for professional solutions.

- Surveyors
- Civil Engineers
- Drone Service Providers
- Construction Site Managers
- BIM/VDC Managers

*4G only in regions of Europe.



IN THE BOX

- Phantom 4 RTK Aircraft × 1
- Remote Controller with Built-in Screen × 1
- Propeller (Pairs) × 4
- Intelligent Flight Battery × 2
- Intelligent Flight Battery Charging Hub × 1
- Power Adapter × 1
- AC Power Cable × 1
- Intelligent Battery × 1
- Intelligent Battery Charging Hub × 1
- Micro-USB Cable × 1
- Male-to-Male USB Cable × 1
- 16 GB Micro-SD Card × 1
- Carrying Case × 1



GS RTK APP

The new DJI GS RTK app allows pilots to intelligently control their Phantom 4 RTK and preplan the upcoming flights, with two planning methods - Photogrammetry and Waypoint Flight - alongside a more traditional flight mode.

- No need to download the app on a separate device, the GS RTK app is preinstalled in every Phantom 4 RTK's remote controller.
- Highly implemented with the Phantom 4 RTK, provides a highly efficient and accurate solution for orthographic mapping applications.



GS RTK APP

- Records geolocation, aircraft position and camera settings in aerial shots. Image metadata is compatible with third-party mapping software.
- The route trajectory can be accurately repeated in the mobile app to improve inspection efficiency and safety.
- GS RTK app is optimized for mapping usage, supports KMZ/KML file import to automatically generate a flight mission according to the geometry field, helping users to conduct mapping with accuracy and ease.
- Supports Shutter Priority Mode
- Supports High Velocity Wind Warnings



GS RTK APP

RTK SETTINGS

RTK Data Sources:

- NetRTK: Use supported Network RTK service
- RTK Base Station: Use the DJI D-RTK Mobile Station for RTK service
- Custom Network RTK: User would need to request a RTCMv3 format supported NTRIP account from the local Network RTK/CORS operating agency to connect the Phantom 4 RTK to the local RTK network.

Supports RTCM 3.0 and RTCM 3.1, RTCM 3.2 MSM4 and MSM5 data format.



GS RTK APP PLANNING METHODS

Photogrammetry Planning

- Automatically generate flight path, supports both orthographic and tilt modes
- Supports manual planning mode
- Supports KML/KMZ file import
- Supports interrupted flight resume
- Supports in-app camera settings and shutter priority

Waypoint Flight Planning

- Record aircraft's precise geolocation and altitude of passed waypoints for mission planning and flight path duplication.
- Maximum up to 99 Waypoints



GS RTK APP

MORE FEATURES

- High-Wind Velocity Warnings:
A warning message would pop up when wind speed exceeds 13.4 mph (6 m/s), when the speed exceeds over 20 mph (9 m/s), the warning message would appear on the status bar.
- Firmware Update:
You can use the remote controller to update aircraft firmware. Use the Micro-USB cable and USB Type-C OTG adapter to connect the Phantom 4 RTK and use GS RTK app to download and update firmware for the remote controller and the aircraft.
- Optimized Virtual Fence:
Now supports custom polygonal boundaries.
- Supports Auto Focus Continuous (AF-C) under manual mode.



SOFTWARE SUPPORT

Phantom 4 RTK operates with the GS RTK app, Assistant 2 for Phantom as well as third-party customized SDK software.

Software

DJI GS RTK app

DJI Assistant 2
for Phantom

Supported Platforms

Built-in to the
Phantom 4 RTK Remote Controller

macOS, Windows



PHANTOM 4 RTK

MAPPING SOLUTIONS

MAPPING SOLUTIONS



Solution 1: Connect the Phantom 4 RTK to the local NetRTK service with a NTRIP account.



Solution 2: Connect the Phantom 4 RTK with the D-RTK 2 Mobile Station.



Solution 3: Connect the Phantom 4 RTK to a third-party RTK database with a NTRIP account via 4G or Wi-Fi network.



Solution 4: Have the Phantom 4 RTK natively store all satellite observation data for image post-process in PPK (Post-Process Kinematic) software, then compare data results with the offline data captured by the D-RTK 2 mobile station / third-party base station.

PHANTOM 4 RTK MAPPING SOLUTIONS

Solution 1: Connect the aircraft to NetRTK with the NTRIP account.

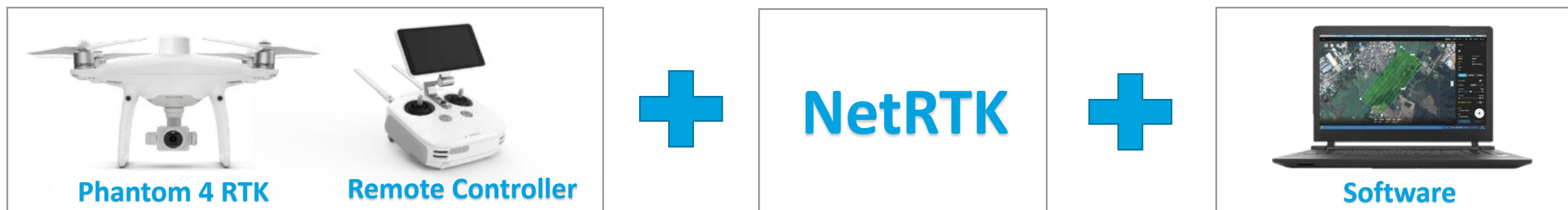
Pros:

- Easy operation with out ground station
- High-resolution image output with centimeter-level RTK precision

Cons:

- RTK/CORS account needed
- Required 4G or Wi-Fi connectivity*

*(Wi-Fi connection with NetRTK currently is only available in China and US)



PHANTOM 4 RTK MAPPING SOLUTIONS

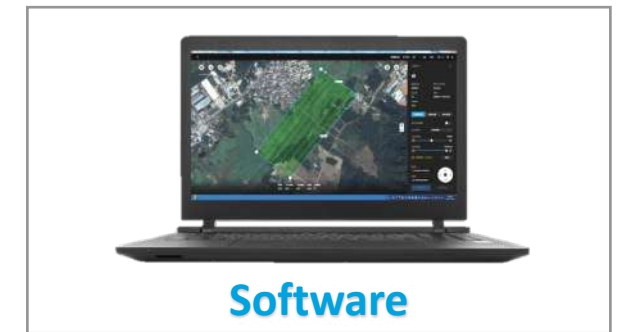
Solution 2: Connect the Phantom 4 RTK with the DJI D-RTK 2 Mobile Station.

Pros:

- Operable without 4G or Wi-Fi connectivity
- High-resolution image output with centimeter-level RTK positioning accuracy

Cons:

- Requires an additional setup process for the D-RTK 2 Mobile Station, operational range limits within 3.1 miles (5 km)



PHANTOM 4 RTK MAPPING SOLUTIONS

Solution 3: Connect the Phantom 4 RTK to a third-party RTK database with a NTRIP account via 4G LTE or Wi-Fi network.

Pros:

- High-resolution image output with reliable centimeter-level positioning accuracy

Cons:

- NTRIP account needed
- Required 4G or Wi-Fi connectivity
- Need to mark the absolute position of the third-party base station, range up to 18.6 miles (30 km)
- A custom server is needed for RTK station



PHANTOM 4 RTK MAPPING SOLUTIONS

Solution 4: Have the Phantom 4 RTK natively store all satellite observation data for image post-process in PPK (Post-Process Kinematic) software, then compare data results with the offline data captured by the D-RTK 2 mobile station / third-party base station.

Pros:

- High-resolution image output with reliable positioning accuracy
- Does not required direct connection between the Phantom 4 RTK and the base station in operation
- Consist data and more flexible

Cons:

- Complex workflow, PPK process required



PHANTOM 4 RTK

ACCURACY

TEST REPORT

PHANTOM 4 RTK ACCURACY TEST REPORT

Test Environment:

Firmware Version: V01.04.0330

GCP(Ground Control Points): 0

Check Points: 9

Coordinate System: WGS 84

CORS	Flight Hight (m)	GSD Resolution (cm/pixel)	Vertical / Horizontal Overlapping Rate (%)	Flight Duration	Test Area (km²)
Qianxun Network CORS	100	2.74	80 / 70	15m 21s	0.26
Tianjin Local CORS	100	2.74	80 / 70	19m 41s	0.40

PHANTOM 4 RTK ACCURACY TEST REPORT

Test Dataset One :

- Qianxun Network CORS
- RTCM 3.2 Source Node
- WGS 84 Coordinate

Phantom 4 RTK Accuracy Comparison with Experimental Measurements (Unit: m)										
Mark #	expX	expY	expH	domX	domY	demH	ΔX	ΔY	ΔXY	ΔH
XK1	~97.489	~06.585	-06.393	~97.461	~06.603	-06.270	-0.03	0.02	0.03	-0.12
XK2	~67.308	~66.983	-06.148	~67.283	~66.978	-06.064	-0.02	-0.01	0.03	-0.08
XK3	~56.253	~79.850	-05.283	~56.212	~79.851	-05.184	-0.04	0.00	0.04	-0.10
XK5	~78.437	~37.245	-04.640	~78.448	~37.210	-04.510	0.01	-0.03	0.04	-0.13
XK6	~90.364	~45.215	-05.782	~90.372	~45.165	-05.694	0.01	-0.05	0.05	-0.09
XK7	~30.192	~57.551	-05.967	~30.218	~57.552	-05.845	0.03	0.00	0.03	-0.12
XK8	~22.379	~34.919	-06.390	~22.398	~34.930	-06.257	0.02	0.01	0.02	-0.13
XK9	~08.232	~81.966	-05.582	~08.251	~81.993	-05.461	0.02	0.03	0.03	-0.12
Average XY-Plane Error: 0.03 m , Average Height Error: 0.11 m										

PHANTOM 4 RTK ACCURACY TEST REPORT

Test Dataset Two :

- Tianjin Local CORS
- RTCM 3.1 Source Node
- WGS 84 Coordinate

Phantom 4 RTK Accuracy Comparison with Experimental Measurements (Unit: m)										
Mark #	expX	expY	expH	domX	domY	demH	ΔX	ΔY	ΔXY	ΔH
XK1	~97.521	~06.456	-6.282	~97.509	~06.474	-6.327	-0.01	0.02	0.02	0.05
XK2	~67.346	~66.865	-6.029	~67.316	~66.840	-6.120	-0.03	-0.02	0.04	0.09
XK3	~56.288	~79.743	-5.143	~56.254	~79.726	-5.234	-0.03	-0.02	0.04	0.09
XK5	~78.476	~37.129	-4.527	~78.495	~37.075	-4.534	0.02	-0.05	0.06	0.01
XK6	~90.382	~45.096	-5.626	~90.405	~45.048	-5.700	0.02	-0.05	0.05	0.07
XK7	~30.216	~57.433	-5.813	~30.218	~57.386	-5.851	0.00	-0.05	0.05	0.04
XK8	~22.415	~34.796	-6.257	~22.432	~34.774	-6.271	0.02	-0.02	0.03	0.01
XK9	~08.262	~81.819	-5.447	~08.273	~81.821	-5.510	0.01	0.00	0.01	0.06
Average XY-Plane Error: 0.04 m , Average Height Error: 0.06 m										

PHANTOM 4 RTK

FAQ

FAQ

Q: What's the benefit of having a mechanical shutter?

A: The mechanical shutter eliminates rolling shutter distortion, which can occur when capturing images of fast-moving subjects with an electronic shutter.

Q: What are some main differences between the Phantom 4 RTK and the rest of Phantom 4 Series?

A: Compare to the Phantom 4 Pro V2.0, the Phantom 4 RTK has a build-in RTK module for high precision mapping usage. Both the camera and aircraft of the Phantom 4 RTK are fully optimized for enterprise applications. The GS RTK app is built-in to the new remote controller and its detachable antenna and battery design increases the overall efficiency.

Q: How long does it take to fully charge a Phantom 4 RTK's battery?

A: About 90 minutes.



FAQ

Q: Would existing Phantom 4 Series ND filters work with the Phantom 4 RTK?

A: Yes, they are compatible with the Phantom 4 RTK.

Q: Can I connect an iOS device or Android device to the Phantom 4 RTK and use the GO 4 app to control with its remote controller?

A: No, Phantom 4 RTK does not support DJI GO 4 app. But it would support the MSDK soon.

Q: Which propellers does the Phantom 4 RTK support?

A: The Phantom 4 RTK supports both standard DJI Quick Release propellers and the new DJI 9450S Low-Noise propellers.



NEED MORE INFO?
VISIT DJI.COM