U.S. Department
of Transportation
**Federal Aviation
Administration**

800 Independence Ave., S.W.
Washington, D.C. 20591

April 8, 2015

Exemption No. 11299
Regulatory Docket No. FAA−2014−1008

Mr. Charles Burnham
Special Projects Coordinator
Sevee & Maher Engineers, Inc.
4 Blanchard Road P.O. Box 85A
Cumberland Center, ME 04021

Dear Mr. Burnham:

This letter is to inform you that we have granted your request for exemption. It transmits our decision, explains its basis, and gives you the conditions and limitations of the exemption, including the date it ends.

The Basis for Our Decision

By letter dated November 19, 2014[1], you petitioned the Federal Aviation Administration (FAA) on behalf of Sevee & Maher Engineers, Inc. (hereinafter petitioner or operator) for an exemption. The exemption would allow the petitioner to operate an unmanned aircraft system (UAS) to conduct topographic surveys.

See Appendix A for the petition submitted to the FAA describing the proposed operations and the regulations that the petitioner seeks an exemption.

The FAA has determined that good cause exists for not publishing a summary of the petition in the Federal Register because the requested exemption would not set a precedent, and any delay in acting on this petition would be detrimental to the petitioner.

[1] On February 27, 2015, the petitioner responded to the FAA's Request for Information.

Airworthiness Certification

The UAS proposed by the petitioner is an Atlantic RC Aircraft LC 047.

The petitioner requested relief from 14 CFR part 21, C*ertification procedures for products and parts, Subpart H—Airworthiness Certificates*. In accordance with the statutory criteria provided in Section 333 of Public Law 112−95 in reference to 49 U.S.C. § 44704, and in consideration of the size, weight, speed, and limited operating area associated with the aircraft and its operation, the Secretary of Transportation has determined that this aircraft meets the conditions of Section 333. Therefore, the FAA finds that the requested relief from 14 CFR part 21, and any associated noise certification and testing requirements of part 36, is not necessary.

The Basis for Our Decision

You have requested to use a UAS for aerial data collection. The FAA has issued grants of exemption in circumstances similar in all material respects to those presented in your petition. In Grants of Exemption Nos. 11062 to Astraeus Aerial (*see* Docket No. FAA−2014−0352), 11109 to Clayco, Inc. (*see* Docket No. FAA−2014−0507), 11112 to VDOS Global, LLC (*see* Docket No. FAA−2014−0382), and 11213 to Aeryon Labs, Inc. (*see* Docket No. FAA−2014−0642), the FAA found that the enhanced safety achieved using an unmanned aircraft (UA) with the specifications described by the petitioner and carrying no passengers or crew, rather than a manned aircraft of significantly greater proportions, carrying crew in addition to flammable fuel, gives the FAA good cause to find that the UAS operation enabled by this exemption is in the public interest.

Having reviewed your reasons for requesting an exemption, I find that—

- They are similar in all material respects to relief previously requested in Grant of Exemption Nos. 11062, 11109, 11112, and 11213;
- The reasons stated by the FAA for granting Exemption Nos. 11062, 11109, 11112, and 11213 also apply to the situation you present; and
- A grant of exemption is in the public interest.

Our Decision

In consideration of the foregoing, I find that a grant of exemption is in the public interest. Therefore, pursuant to the authority contained in 49 U.S.C. 106(f), 40113, and 44701, delegated to me by the Administrator, Sevee & Maher Engineers, Inc. is granted an exemption from 14 CFR §§ 61.23(a) and (c), 61.101(e)(4) and (5), 61.113(a), 61.315(a), 91.7(a), 91.119(c), 91.121, 91.151(a)(1), 91.405(a), 91.407(a)(1), 91.409(a)(1) and (2), and 91.417(a) and (b), to the extent necessary to allow the petitioner to operate a UAS to perform aerial data collection. This exemption is subject to the conditions and limitations listed below.

Conditions and Limitations

In this grant of exemption, Sevee & Maher Engineers, Inc. is hereafter referred to as the operator.

Failure to comply with any of the conditions and limitations of this grant of exemption will be grounds for the immediate suspension or rescission of this exemption.

1. Operations authorized by this grant of exemption are limited to the Atlantic RC Aircraft LC 047when weighing less than 55 pounds including payload. Proposed operations of any other aircraft will require a new petition or a petition to amend this exemption.

2. Operations for the purpose of closed-set motion picture and television filming are not permitted.

3. The UA may not be operated at a speed exceeding 87 knots (100 miles per hour). The exemption holder may use either groundspeed or calibrated airspeed to determine compliance with the 87 knot speed restriction. In no case will the UA be operated at airspeeds greater than the maximum UA operating airspeed recommended by the aircraft manufacturer.

4. The UA must be operated at an altitude of no more than 400 feet above ground level (AGL). Altitude must be reported in feet AGL.

5. The UA must be operated within visual line of sight (VLOS) of the PIC at all times. This requires the PIC to be able to use human vision unaided by any device other than corrective lenses, as specified on the PIC's FAA-issued airman medical certificate or U.S. driver's license.

6. All operations must utilize a visual observer (VO). The UA must be operated within the visual line of sight (VLOS) of the PIC and VO at all times. The VO may be used to satisfy the VLOS requirement as long as the PIC always maintains VLOS capability. The VO and PIC must be able to communicate verbally at all times; electronic messaging or texting is not permitted during flight operations. The PIC must be designated before the flight and cannot transfer his or her designation for the duration of the flight. The PIC must ensure that the VO can perform the duties required of the VO.

7. This exemption and all documents needed to operate the UAS and conduct its operations in accordance with the conditions and limitations stated in this grant of exemption, are hereinafter referred to as the operating documents. The operating documents must be accessible during UAS operations and made available to the Administrator upon request. If a discrepancy exists between the conditions and

limitations in this exemption and the procedures outlined in the operating documents, the conditions and limitations herein take precedence and must be followed. Otherwise, the operator must follow the procedures as outlined in its operating documents. The operator may update or revise its operating documents. It is the operator's responsibility to track such revisions and present updated and revised documents to the Administrator or any law enforcement official upon request. The operator must also present updated and revised documents if it petitions for extension or amendment to this grant of exemption. If the operator determines that any update or revision would affect the basis upon which the FAA granted this exemption, then the operator must petition for an amendment to its grant of exemption. The FAA's UAS Integration Office (AFS-80) may be contacted if questions arise regarding updates or revisions to the operating documents.

8. Any UAS that has undergone maintenance or alterations that affect the UAS operation or flight characteristics, e.g. replacement of a flight critical component, must undergo a functional test flight prior to conducting further operations under this exemption. Functional test flights may only be conducted by a PIC with a VO and must remain at least 500 feet from other people. The functional test flight must be conducted in such a manner so as to not pose an undue hazard to persons and property.

9. The operator is responsible for maintaining and inspecting the UAS to ensure that it is in a condition for safe operation.

10. Prior to each flight, the PIC must conduct a pre-flight inspection and determine the UAS is in a condition for safe flight. The pre-flight inspection must account for all potential discrepancies, e.g. inoperable components, items, or equipment. If the inspection reveals a condition that affects the safe operation of the UAS, the aircraft is prohibited from operating until the necessary maintenance has been performed and the UAS is found to be in a condition for safe flight.

11. The operator must follow the UAS manufacturer's maintenance, overhaul, replacement, inspection, and life limit requirements for the aircraft and aircraft components.

12. Each UAS operated under this exemption must comply with all manufacturer safety bulletins.

13. Under this grant of exemption, a PIC must hold either an airline transport, commercial, private, recreational, or sport pilot certificate. The PIC must also hold a current FAA airman medical certificate or a valid U.S. driver's license issued by a state, the District of Columbia, Puerto Rico, a territory, a possession, or the Federal government. The PIC must also meet the flight review requirements specified in 14 CFR § 61.56 in an aircraft in which the PIC is rated on his or her pilot certificate.

14. The operator may not permit any PIC to operate unless the PIC demonstrates the ability to safely operate the UAS in a manner consistent with how the UAS will be operated under this exemption, including evasive and emergency maneuvers and maintaining appropriate distances from persons, vessels, vehicles and structures. PIC qualification flight hours and currency must be logged in a manner consistent with 14 CFR § 61.51(b). Flights for the purposes of training the operator's PICs and VOs (training, proficiency, and experience-building) and determining the PIC's ability to safely operate the UAS in a manner consistent with how the UAS will be operated under this exemption are permitted under the terms of this exemption. However, training operations may only be conducted during dedicated training sessions. During training, proficiency, and experience-building flights, all persons not essential for flight operations are considered nonparticipants, and the PIC must operate the UA with appropriate distance from nonparticipants in accordance with 14 CFR § 91.119.

15. UAS operations may not be conducted during night, as defined in 14 CFR § 1.1. All operations must be conducted under visual meteorological conditions (VMC). Flights under special visual flight rules (SVFR) are not authorized.

16. The UA may not operate within 5 nautical miles of an airport reference point (ARP) as denoted in the current FAA Airport/Facility Directory (AFD) or for airports not denoted with an ARP, the center of the airport symbol as denoted on the current FAA-published aeronautical chart, unless a letter of agreement with that airport's management is obtained or otherwise permitted by a COA issued to the exemption holder. The letter of agreement with the airport management must be made available to the Administrator or any law enforcement official upon request.

17. The UA may not be operated less than 500 feet below or less than 2,000 feet horizontally from a cloud or when visibility is less than 3 statute miles from the PIC.

18. If the UAS loses communications or loses its GPS signal, the UA must return to a pre-determined location within the private or controlled-access property.

19. The PIC must abort the flight in the event of unpredicted obstacles or emergencies.

20. The PIC is prohibited from beginning a flight unless (considering wind and forecast weather conditions) there is enough available power for the UA to conduct the intended operation and to operate after that for at least five minutes or with the reserve power recommended by the manufacturer if greater.

21. Air Traffic Organization (ATO) Certificate of Waiver or Authorization (COA). All operations shall be conducted in accordance with an ATO-issued COA. The exemption holder may apply for a new or amended COA if it intends to conduct operations that cannot be conducted under the terms of the attached COA.

22. All aircraft operated in accordance with this exemption must be identified by serial number, registered in accordance with 14 CFR part 47, and have identification (N-Number) markings in accordance with 14 CFR part 45, Subpart C. Markings must be as large as practicable.

23. Documents used by the operator to ensure the safe operation and flight of the UAS and any documents required under 14 CFR §§ 91.9 and 91.203 must be available to the PIC at the Ground Control Station of the UAS any time the aircraft is operating. These documents must be made available to the Administrator or any law enforcement official upon request.

24. The UA must remain clear and give way to all manned aviation operations and activities at all times.

25. The UAS may not be operated by the PIC from any moving device or vehicle.

26. All Flight operations must be conducted at least 500 feet from all nonparticipating persons, vessels, vehicles, and structures unless:
    a. Barriers or structures are present that sufficiently protect nonparticipating persons from the UA and/or debris in the event of an accident. The operator must ensure that nonparticipating persons remain under such protection. If a situation arises where nonparticipating persons leave such protection and are within 500 feet of the UA, flight operations must cease immediately in a manner ensuring the safety of nonparticipating persons; and
    b. The owner/controller of any vessels, vehicles or structures has granted permission for operating closer to those objects and the PIC has made a safety assessment of the risk of operating closer to those objects and determined that it does not present an undue hazard.

    The PIC, VO, operator trainees or essential persons are not considered nonparticipating persons under this exemption.

27. All operations shall be conducted over private or controlled-access property with permission from the property owner/controller or authorized representative. Permission from property owner/controller or authorized representative will be obtained for each flight to be conducted.

28. Any incident, accident, or flight operation that transgresses the lateral or vertical boundaries of the operational area as defined by the applicable COA must be reported to the FAA's UAS Integration Office (AFS-80) within 24 hours. Accidents must be reported to the National Transportation Safety Board (NTSB) per instructions contained on the NTSB Web site: www.ntsb.gov.

If this exemption permits operations for the purpose of closed-set motion picture and television filming and production, the following additional conditions and limitations apply.

29. The operator must have a motion picture and television operations manual (MPTOM) as documented in this grant of exemption.

30. At least 3 days before aerial filming, the operator of the UAS affected by this exemption must submit a written Plan of Activities to the local Flight Standards District Office (FSDO) with jurisdiction over the area of proposed filming. The 3-day notification may be waived with the concurrence of the FSDO. The plan of activities must include at least the following:
    a. Dates and times for all flights;
    b. Name and phone number of the operator for the UAS aerial filming conducted under this grant of exemption;
    c. Name and phone number of the person responsible for the on-scene operation of the UAS;
    d. Make, model, and serial or N-Number of UAS to be used;
    e. Name and certificate number of UAS PICs involved in the aerial filming;
    f. A statement that the operator has obtained permission from property owners and/or local officials to conduct the filming production event; the list of those who gave permission must be made available to the inspector upon request;
    g. Signature of exemption holder or representative; and
    h. A description of the flight activity, including maps or diagrams of any area, city, town, county, and/or state over which filming will be conducted and the altitudes essential to accomplish the operation.

31. Flight operations may be conducted closer than 500 feet from participating persons consenting to be involved and necessary for the filming production, as specified in the exemption holder's MPTOM.

Unless otherwise specified in this grant of exemption, the UAS, the UAS PIC, and the UAS operations must comply with all applicable parts of 14 CFR including, but not limited to, parts 45, 47, 61, and 91.

This exemption terminates on April 30, 2017, unless sooner superseded or rescinded.

Sincerely,

/s/
John Barbagallo
Acting Deputy Director, Flight Standards Service

SME
Sevee & Maher Engineers, Inc.

ENVIRONMENTAL • CIVIL • GEOTECHNICAL • WATER • COMPLIANCE

November 19, 2014

Docket Operations, M-30
U.S. Department of Transportation (DOT)
1200 New Jersey Avenue, SE.
Room W12-140, West Building Ground Floor
Washington, DC 20590-0001

Dear Administrator,

Sevee & Maher Engineers, Inc. (SME) is an engineering company located in Cumberland Center, Maine. We specialize in civil, environmental, geotechnical, water, and compliance. A large portion of our work depends on topographic information. Current topographic surveys are performed by small planes using aerial photogrammetry, which is costly and can have lead times up to several months. Using a small-unmanned aircraft system (sUAS) SME would be able to quickly and affordably provide our clients with the topography of their properties. By granting this request, flights consisting of small manned aircrafts would be replaced by sUAS, resulting in less air traffic. It is also worth noting that the sUAS is powered by batteries, and would have minimal impact on the environment compared to the planes currently used for aerial surveys.

The sites that SME wants to map consist of solid waste and industrial landfills, dams, quarries and gravel pits, and other large open areas. Most landfills are in remote areas, and operations pose no threat to public safety. Operations are typically up to 13 minutes and follow a predetermined path to provide the photos necessary for photogeometric analysis. Each operation ends in the proximity of where it began. A constant elevation (approximately 300 feet above ground level) is maintained. One site may require several operations. The sUAS will travel no faster than 10 meters per second (mps) and will never operate out of line of sight.

Granting this request will do nothing more than allow SME to do what thousands of hobbyists and manufacturers of model aircraft do every day, and we will abide by much stronger safety measures than currently required for these groups by FAA policies and regulations. In this petition for exemption, we seek to engage in essentially the same type of sUAS operation that the FAA would permit us to currently but for the fact that SME is not a hobbyist or manufacturer of a model aircraft.

Z:\SME\Administration\DRONE\20141119_Drone_Petition.doc

4 Blanchard Road, PO Box 85A, Cumberland Center, Maine 04021 • Phone 207.829.5016 • Fax 207.829.5692 • www.smemaine.com

Information Supporting this Petition as Specified in 14 C.F.R. §11.81

(a) Name and mailing address and other contact information including our telephone number and e-mail address

Sevee & Maher Engineers, Inc.
4 Blanchard Rd, P.O. Box 85A, Cumberland Center, ME 04021
Telephone: 207.829.5016
Email: ceb@smemaine.com

(b) The specific section or sections of 14 CFR from which we are seeking an exemption

- 14 C.F.R. § 21.191(a)
- 14 C.F.R. § 45.23(b)
- 14 C.F.R. § 61.113(a) and (b)
- 14 C.F.R. § 91.7(a)
- 14 C.F.R. § 91.9(b)(2)
- 14 C.F.R. § 91.103
- 14 C.F.R. § 91.109
- 14 C.F.R. § 91.119
- 14 C.F.R. § 91.121
- 14 C.F.R. § 91.151(a)
- 14 C.F.R. § 91.203(a) and (b
- 14 C.F.R. § 91.405(a)
- 14 C.F.R. § 91.407(a)(1)
- 14 C.F.R. § 91.409(a)(2)
- 14 C.F.R. § and 91.417(a) and (b)

(c) The extent of relief we are seeking, and the reason we are seeking the relief

We seek an exemption from several interrelated provisions of 14 C.F.R. Parts 21, 45 and 91 to the extent necessary to engage in commercial operations of sUAS on our clients' property. We have detailed, below, a set of safeguards that will apply to our sUAS operations as well as a copy of the Aircraft Flight Manual. Our operations will not "create a hazard to users of the national airspace system or the public or pose a threat to national security" and are thus consistent with the congressional mandate in Section 333 of the FAA Modernization and Reform Act of 2012, which gives FAA a mechanism to allow certain UAS to operate safely in the national airspace system.

(d) The reasons why granting our request would be in the public interest that is, how it would benefit the public as a whole

As described above, the sUAS will provide timely and affordable topographic survey. The current use of planes to perform aerial surveys has more significant impact on the environment (carbon footprint) and air traffic.

(e) The reasons why granting the exemption would not adversely affect safety, or how the exemption would provide a level of safety at least equal to that provided by the rule from which we are seeking the exemption

Unmanned Aircraft System

The UAS proposed is a proprietary design, conceived and constructed by Atlantic RC Aircraft, and referred to as the LC 047. This aircraft has four rotors and four motors in a quadcopter configuration (X4). Given the size, weight, speed, and limited operating area associated with the aircraft to be utilized, an exemption from 14 CFR part 21, Subpart H (Airworthiness Certificates), subject to certain conditions and limitations, is warranted and meets the requirements for an equivalent level of safety under 14 CFR part 11 and Section 333 of the FAA Modernization and Reform Act of 2012 (PL 112-95). A UAS operated without an airworthiness certificate in the restricted environment and under the conditions and limitations proposed by the petitioner will be at least as safe, or safer, than a conventional aircraft (fixed wing or rotorcraft) operating with an airworthiness certificate issued under 14 CFR part 21, Subpart H and not subject to the proposed conditions and limitations.

The unmanned aircraft (UA) to be operated under this request is less than 55 lbs. fully loaded, flies at a speed of no more than 10 meters per second, carries neither a pilot nor passenger, carries no explosive materials or flammable liquid fuels, and operates exclusively within a secured area. In addition, there are integrated safety features into the design of the UAS, as described in the petitioner's Aircraft Flight Manual, to ensure the safety of persons and property within and surrounding the limited operating area. In the event the UAS loses communications or its GPS signal, the UA will have the capability to return to a pre-determined location. It will also have the capability to abort a flight in the event of unpredicted obstacles or emergencies.

Even though its UAS will have no airworthiness certificate, an exemption may be needed from 14 CFR § 45.23 as the UA will have no entrance to the cabin, cockpit, or pilot station on which the word "experimental" can be placed. Given the size of the UA, the petitioner notes that the two-inch lettering will be impossible. The petitioner asserts that an equivalent level of safety will be provided by having the UA marked with the word "experimental" on the fuselage in compliance with 14 CFR § 45.29(f), in a

location where the pilot, observer, and others working with the UA will see the identification.

The maintenance requirements in the pertinent sections of 14 CFR part 91 are only applicable to aircraft with an airworthiness certificate in accordance with part 43. The UAS does not have specific maintenance instructions; therefore, there is a documented preflight and postflight maintenance process for the UAS. Any manufacturers' recommended instructions and procedures will be followed when those procedures exist for certain components of the UAS.

Pilot In Command (PIC)

Since the UA will not carry a pilot or passengers on board, the proposed operations will not adversely affect safety by requiring the PIC operating the aircraft to have no[ghc1] pilot license. Since there are no standards for either private or commercial UAS pilot certificates, knowledge of airspace regulations and dexterity in the control and operation of the UAS acquired from actual operation of the aircraft will be the most important factors in establishing an equivalent level of safety. Furthermore, given the restricted and controlled airspace within which operations will take place, the key factors needed by the PIC are knowledge of the airspace within which the operation will take place and how that airspace fits into the National Airspace System (NAS). It cannot be assumed that a commercial pilot, approved to operate a helicopter or fixed wing aircraft, has the skill or ability to safely operate an unmanned aerial vehicle, operating at 400 feet AGL or lower, within strictly controlled pre-approved airspace. Additionally, the aircraft will be operated within a secure environment, which no one will be allowed to enter unless they are part of the operation, have been fully briefed of the risks prior to operation of the UAS, and have consented to the risks associated with being in the operating area. Should there be a mishap, the UA being flown pose significantly less of a threat than the helicopters and fixed wing aircraft now being employed because they are a fraction of the size, carry no flammable fuel, and do not carry crew or passengers. This is in stark contrast to conventional aircraft that are flown to the site, carry flammable fuel, carry passengers and crew, and operate in a much larger area.

UAS Operating Parameters

All flights will be operated within visual line of sight (VLOS) of a pilot and/or observer, and that the UA flights will be limited to a maximum altitude of 400 feet AGL. An operator will ensure that only consenting personnel will be allowed within 100 feet of the UA operation. An equivalent level of safety can be achieved given the size, weight, and speed of the UAS, as well as the location where it is operated. The UAS will be operated within a safe operating perimeter, the boundaries of which will be determined by SME personnel and only participating and consenting personnel will be allowed

within this perimeter. Compared to flight operations with aircraft or rotorcraft weighing far more than its maximum 55 lb., and the lack of flammable fuel, any risk associated with the UAS operations is far less than those with conventional aircrafts.

With respect to preflight actions, an exemption from 14 CFR § 91.103 may be needed, because it will not have approved rotorcraft flight manuals. An equivalent level of safety will be achieved by the PIC and one additional operator taking all preflight actions as set forth in their Aircraft Flight Manual, including reviewing weather, flight battery requirements, landing and takeoff distances, and aircraft performance data before initiation of flight. Additionally, a briefing will be conducted prior to each day regarding planned UAS operations. With respect to the fuel requirements, the battery life of the UAS allows for a 15-minute flight maximum. Which makes meeting the 30 minute reserve requirements in 14 CFR § 91.151 not possible for the sUAS. An equivalent level of safety can be achieved by limiting flights to 15 minutes or 15% of battery power, whichever occurs first.

An exemption from 14 CFR § 91.121 will be needed, as the UAS will have a GPS altitude read out instead of a barometric altimeter. An equivalent level of safety will be achieved, as outlined in the Aircraft Flight Manual. Specifically, the altitude information will be provided to the UAS PIC via a digitally encoded telemetric data feed. Prior to each flight, a zero altitude initiation point will be established and confirmed for accuracy by the PIC.

Public Interest

The petitioner states that, given the small size of the UA involved and the restricted sterile environment within which it will operate, and due to the size of the UA and the restricted areas in which the UAS will operate, approval of the application presents no national security issue. Given the clear direction in Section 333, the strong equivalent level of safety surrounding the proposed operations, and the significant public benefit, including enhanced safety, reduction in environmental impacts, and including reduced emissions associated with allowing UAS for survey operations, granting the requested exemptions is in the public interest.

The attached Aircraft Flight Manual (Appendix A) includes specifics on the equipment being used.

(f) A summary that can publish in the Federal Register, stating:

Petitioner: Sevee & Maher Engineers, Inc.

Rules from which you seek the exemption:

- 14 C.F.R. § 21.191(a)
- 14 C.F.R. § 45.23(b)
- 14 C.F.R. § 61.113(a) and (b)
- 14 C.F.R. § 91.7(a)
- 14 C.F.R. § 91.9(b)(2)
- 14 C.F.R. § 91.103
- 14 C.F.R. § 91.109
- 14 C.F.R. § 91.119
- 14 C.F.R. § 91.121
- 14 C.F.R. § 91.151(a)
- 14 C.F.R. § 91.203(a) and (b
- 14 C.F.R. § 91.405(a)
- 14 C.F.R. § 91.407(a)(1)
- 14 C.F.R. § 91.409(a)(2)
- 14 C.F.R. § and 91.417(a) and (b)

Description of Relief Sought: Petitioner seeks relief from the requirements of the sections listed above to conduct private, commercial small unmanned aircraft systems (sUAS) operations on privately owned property subject to operating procedures that meet or exceed those that FAA requires for similar operations.

(g) Any additional information, views or arguments available to support our request

Please see the introduction to this exemption request.

Please do not hesitate to contact Guy Cote (President of SME) or me by phone at 207.829.5016 or via email at ceb@smemaine.com if you have any questions or comments.

Sincerely,

SEVEE & MAHER ENGINEERS, INC.

Charles Burnham
Special Projects Coordinator

cc: Guy Cote Jr., P.E., President

APPENDIX A

AIRCRAFT FLIGHT MANUAL

WooKong-M Quick Start Guide

V 1.12

January 2, 2014 Revision

For Firmware Version V5.26

& PC Assistant Software V2.04

&WM Assistant V1.4.25

Please strictly follow these steps to mount and connect the autopilot system on your multi-rotor, as well as to install the Assistant Software on your computer or Mobile Device.

Thank you for purchasing this DJI product. Please regularly visit the WooKong-M web page at **www.dji.com**. This page is updated regularly. Any technical updates and manual corrections will be available on this web page. Due to unforeseen changes or product upgrades, the information contained in this manual is subject to change without notice.

This manual is only for basic assembly and configuration; you can obtain more details and advanced instructions when using the assistant software. To assure you have the latest information, please visit our website and download the latest manual and current software version.

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Trademark

DJI and WooKong-M are registered trademarks of DJI Innovations. Names of product, brand, etc., appearing in this manual are trademarks or registered trademarks of their respective owner companies. This product and manual are copyrighted by DJI Innovations with all rights reserved. No part of this product or manual shall be reproduced in any form without the prior written consent or authorization of DJI Innovations. No patent liability is assumed with respect to the use of the product or information contained herein.

Disclaimer & Warning

Please read this disclaimer carefully before using the product. By using this product, you hereby agree to this disclaimer and signify that you have read them fully.

THIS PRODUCT IS NOT SUITABLE FOR PEOPLE UNDER THE AGE OF 18.

WooKong-M is an autopilot system designed for serious multi-rotor enthusiasts providing excellent self-leveling and altitude holding, which completely takes the stress out of flying RC multi-rotors for both professional and hobby applications. Despite the product having a built-in autopilot system and our efforts in making the operation of the controller as safe as possible when the main power battery is connected, we strongly recommend users to remove all propellers when calibrating and setting parameters. Make sure all connections are good, and keep children and animals away during firmware upgrade, system calibration and parameter setup. DJI Innovations accepts no liability for damage(s) or injuries incurred directly or indirectly from the use of this product in the following conditions:

1. Damage(s) or injuries incurred when users are drunk, taking drugs, drug anesthesia, dizziness, fatigue, nausea and any other conditions no matter physically or mentally that could impair your ability.
2. Damage(s) or injuries caused by subjective intentional operations.
3. Any mental damage compensation caused by accident.
4. Failure to follow the guidance of the manual to assemble or operate.
5. Malfunctions caused by refit or replacement with non-DJI accessories and parts.
6. Damage(s) or injuries caused by using third party products or fake DJI products.
7. Damage(s) or injuries caused by mis-operation or subjective mis-judgment.
8. Damage(s) or injuries caused by mechanical failures due to erosion, aging.
9. Damage(s) or injuries caused by continued flying after low voltage protection alarm is triggered.
10. Damage(s) or injuries caused by knowingly flying the aircraft in abnormal condition (such as water, oil, soil, sand and other unknown material ingress into the aircraft or the assembly is not completed, the main components have obvious faults, obvious defect or missing accessories).
11. Damage(s) or injuries caused by flying in the following situations such as the aircraft in magnetic interference area, radio interference area, government regulated no-fly zones or the pilot is in backlight, blocked, fuzzy sight, and poor eyesight is not suitable for operating and other conditions not suitable for operating.
12. Damage(s) or injuries caused by using in bad weather, such as a rainy day or windy (more than moderate breeze), snow, hail, lightning, tornadoes, hurricanes etc.
13. Damage(s) or injuries caused when the aircraft is in the following situations: collision, fire, explosion, floods, tsunamis, subsidence, ice trapped, avalanche, debris flow, landslide, earthquake, etc.
14. Damage(s) or injuries caused by infringement such as any data, audio or video material recorded by the use of aircraft.
15. Damage(s) or injuries caused by the misuse of the battery, protection circuit, RC model and battery chargers.
16. Other losses that are not covered by the scope of DJI Innovations liability.

Certifications

This product is approved with quality standards such as CE, FCC and RoHS.

Symbol Instruction

 Forbidden(Important)  Cautions  Tip  Reference

Assembly &Configuration

Step 1 Assembly

Install the autopilot system and receiver to the aircraft, and connect them according to the following diagram.

Refer to the Port Description for more details.

GPS/COMPASS

- GPS/Compass is sensitive to magnetic interference, should be far away from any electronic devices.
- You should use epoxy resin AB glue to assemble the GPS bracket first as the figure showed in previous page.
- Mount the bracket on the center plate of craft first, then fix the GPS on the plate of the bracket (by 3M glue provided). The GPS is sensitive to vibration interference, so position the bracket at least 10 cm from any rotor.

⚠ The DJI logo marked on the GPS should face the sky, with the orientation arrow pointing directly forward. The GPS/Compass is packaged with a special indication line for mounting for the first time.

⚠ If you are uncertain whether materials near the GPS/Compass module are magnetic or not, you can use a compass or magnet to check it. If you use your own mounting rod, make sure it is NOT magnetic!

PMU & Battery

- There is no requirement for PMU mounting.
- Use our PMU Connecter (red line depicts in figure) to connect battery, PMU and ESCs.
- You can choose 2S-6S LiPo battery.

⊘ For safety reason, please disconnect ESCs and battery connecter during the firmware upgrade and configuration procedure.

⚠ Sufficient air flow over the PMU is highly recommended.

LED Indicator

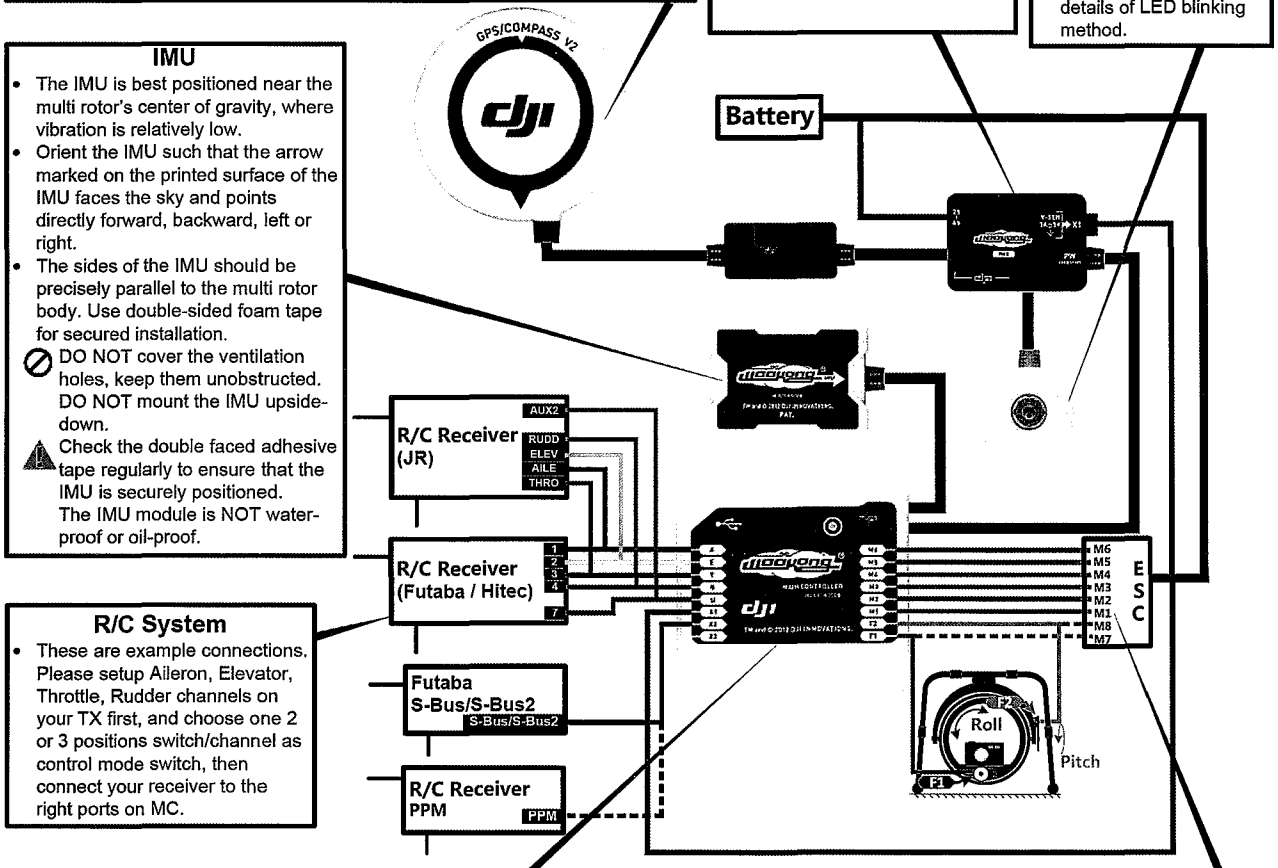
- Place The LED indicator at an appropriate location of craft body far away from the GPS. Do not mount it on other electronic devices.
- Make sure You can see the light during the flight.
- You can connect LED to the CAN-Bus port on GPS connection wire.
- Please refer to the "LED Description" in the Appendix to know the details of LED blinking method.

IMU

- The IMU is best positioned near the multi rotor's center of gravity, where vibration is relatively low.
- Orient the IMU such that the arrow marked on the printed surface of the IMU faces the sky and points directly forward, backward, left or right.
- The sides of the IMU should be precisely parallel to the multi rotor body. Use double-sided foam tape for secured installation.

⊘ DO NOT cover the ventilation holes, keep them unobstructed. DO NOT mount the IMU upside-down.

⚠ Check the double faced adhesive tape regularly to ensure that the IMU is securely positioned. The IMU module is NOT water-proof or oil-proof.



R/C System

- These are example connections. Please setup Aileron, Elevator, Throttle, Rudder channels on your TX first, and choose one 2 or 3 positions switch/channel as control mode switch, then connect your receiver to the right ports on MC.

Main Controller

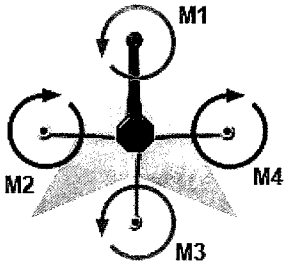
- There is no orientation requirement for the Main Controller. Choose a mounting location where as shorter ESC extension wires are needed as possible. Please make sure all ports are accessible when installing the MC so as to facilitate wiring and software configuration.
- In three-pin ports, pins near the nicks are signal pins.

- After choosing a location to mount the MC, it is recommended that you DO NOT mount the MC until all wirings and software configurations are completed.

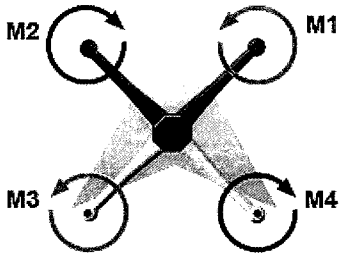
ESC & Motor

- Please make sure you are using the ESCs and motors recommended by the manufacturer of your multi rotor first. We recommend you use DJI motors and ESCs. WKM output is 400Hz refresh frequency.
- Connect all ESCs to MC by the motor numbering method introduced in ***Multi-Rotors Supported*** .
- If you use 3rd party ESCs, please make sure the ESCs travel midpoint is at 1520us. DO NOT use 700us travel midpoint ESC, as it may lead aircraft to fly away or cause injury and damage. After connect ESCs, calibrate ESCs one by one through the receiver directly before connect them to your MC, Make sure program all of them into Governor off, Break off and Normal Start up to get best experience.
- If you use 3rd party ESCs, please cut the red wire (power wire) of your ESCs , as the power from V-SEN on PMU is suitable to most of receivers and other electronic devices.
- If you use extra BEC, please use a servo cable without power wire to connect V-SEN to X1. (Not recommend)

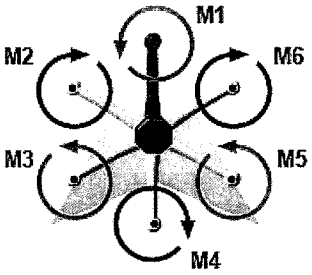
Multi-Rotors Supported



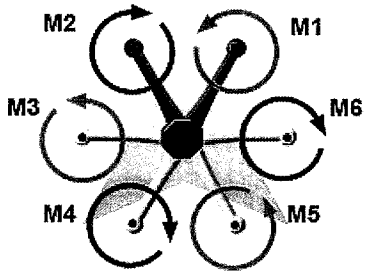
Quad-rotor I



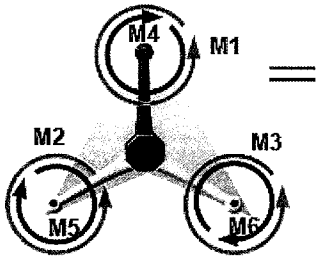
Quad-rotor X



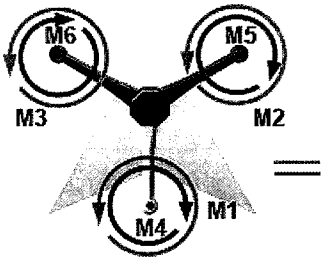
Hexa-rotor I



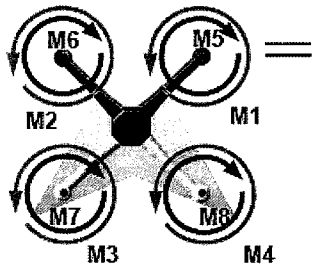
Hexa-rotor V



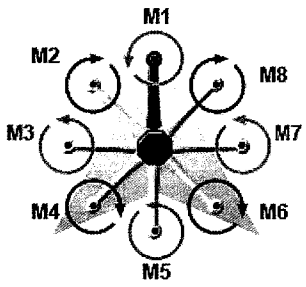
Hexa-rotor IY



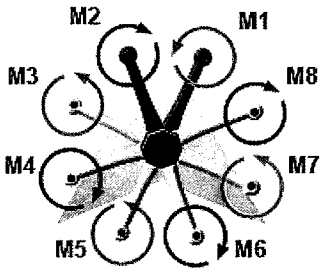
Hexa-rotor Y



Octo-rotor X



Octo-rotor I



Octo-rotor V

	• To coaxial propellers: Blue propeller is at Top; Red propeller is at Bottom. Otherwise all propellers are at top.
	• Please select the Mixer type in the assistant software according to your aircraft.

Step2 Software and Driver Installation on a PC

1. Please download the drive installer and the assistant software from DJI website.
2. Connect the autopilot system and the PC via a USB cable, and power on the autopilot system.
3. Run the driver installer, and follow the instructions strictly to finish installation.
4. Run the assistant software installer, and follow the instructions strictly to finish installation.

Step3 Configuration by Assistant Software on a PC

1. Power on the PC. Make sure your computer is connected to the Internet for the first time you use.
2. Switch on the transmitter first, and then power on the autopilot system. Connect the autopilot system to the PC with a Micro-USB cable. DO NOT break the connection until setup is finished.
3. Run the Assistant Software.
4. Observe the indicators on the left bottom of the software. (connection indicator and communication indicator) If the connection indicator is communication indicator is blinking, that the software is ready, please go to next step.
5. Select the "Info" option. Check the software and the firmware version.
6. Select the "Basic" option. Please follow step-by-step for your first-time-configuration. Basic configuration is necessary, including Mixer Type, Mounting, RC, and Gain settings.
7. You can click the "Advanced" option for more parameter settings. Advanced setting is optional. There are settings of Motor, FailSafe, Intelligent Orientation Control (IOC), Gimbal, Low-Voltage Alert, and Flight Limits. Read the instruction in the assistant software to obtain more details.
8. Select the "Viewer" option and check all parameters.

- You may be required to fill register information for your first-time-usage.
- If the communication indicator is , please double check the connections.
- Basic configuration is necessary before you go to the "Basic Flying Test".

- If the software and the firmware upgrade are available, please upgrade the assistant software and the firmware by referring to the Appendix.
- This step is required to use together with the assistant software to obtain more details.

Recommended Settings for the users with F450/F550/S800/Z15.

	Configuration Information					Basic				Attitude	
	Motor	ESC	Propeller	Battery	Weight	Pitch	Roll	Yaw	Vertical	Pitch	Roll
F450	DJI-2212	DJI-30A	DJI-8 Inch	3S-2200	890 g	150	150	100	105	150	150
F550	DJI-2212	DJI-30A	DJI-8 Inch	4S-3300	1530 g	170	170	150	140	170	170
S800	DJI-4114	DJI-40A	DJI-15Inch	6S-15000	4770 g	200	200	195	175	190	190
S800+Z15	DJI-4114	DJI-40A	DJI-15Inch	6S-10000	6100 g	240	240	200	200	220	220
S800 EVO	DJI-4114 PRO	DJI-40A	DJI-15 Inch	6S-15000	6700 g	130	130	150	150	180	180

*S800 with damping kit can use the same values as S800 EVO.

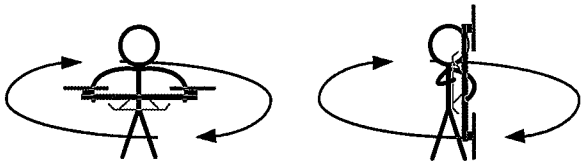
Step4 Compass Calibration

Without GPS module, please skip this step. If you use with GPS module, follow step-by-step for calibration.

- DO NOT calibrate your compass where there is strong magnetic interference, such as magnetite, car park, and steel reinforcement under the ground.
- DO NOT carry ferromagnetic materials with you during calibration, such as keys or cell phones.
- Compass module CANNOT work in the polar circle.

Calibration Procedures

1. Quickly switch the control mode switch from ***GPS Mode*** to ***Manual Mode*** and back to ***GPS Mode*** for 6 to 10 times. The LED indicator will turn on solid BLUE.
2. Rotate your Multi-rotor around the horizontal axis (about 360°) until the LED changes to solid GREEN, and then go to the next step.
3. Hold your Multi-rotor vertically and rotate it (its nose MUST be downward) around the vertical axis (about 360°) until the LED turns off, meaning the calibration is finished.



4. The LED indicator will show whether the calibration is successful or not.
   - If the LED keeps WHITE for 3 seconds, meaning the calibration is successful, and then calibration mode will exit automatically.
   - If the LED keeps flashing quickly RED, the calibration has failed. Switch the control mode switch one time to cancel the calibration, and then re-start from step 1.

1. You don't need to rotate your multi-rotor on a precise horizontal or vertical surface, but keep at least 45° difference between horizontal and vertical calibration.
2. If you keep having calibration failure, it might suggest that there is very strong magnetic interference around the GPS & Compass module, please avoid flying in this area.
3. When to do re-calibration.
   - The flight field is changed.
   - The multi-rotor mechanical setup has changed, including the following situations:
     a) If the GPS & Compass module is re-positioned.
     b) Electronic devices added, removed or re-positioned (Main Controller, servos, batteries, etc).
     c) When the mechanical structure of the multi-rotor is changed.
   - If the flight direction appears shifting (meaning the multi-rotor doesn't "fly straight").
   - The LED indicator often indicates abnormality blinking when the multi-rotor spins. But it is normal for this to happen only occasionally.
   - LED blinks yellow and green ( ) continually, indicating that the compass data is abnormal.

Basic Flying Test

Step1 About the Control Mode Switch

The autopilot system can work in Manual Mode and ATTI. Mode without a GPS module. After connecting to the GPS module, GPS Mode is available. Follow the bellow steps to enter the different control modes.

1. Use a 3-position switch on the transmitter as mode control switch.
2. Make sure to take off the aircraft in ATTI. Mode in every flight.
3. Hover the Aircraft. Release all joysticks and then flip the control mode switch to the GPS Mode or Manual Mode (NOT RECOMMENDED).

Step2 Start & Stop Motor

Star Motor : Pushing throttle stick before takeoff will not start motors. You have to execute any one of following four Combination Stick Commands (CSC) to start motors

Stop Motor :The default setting of stop motor is Immediately. For the immediately mode, in any control mode, once motors start and throttle stick is over 10%, motors will stop immediately when throttle stick is back under 10% again. In this case, if you push the throttle stick over 10% within 5s after motors stop, motors will re-start, CSC is not needed. If you don't push throttle stick after motors start within 3s, motors will stop automatically.

Please refer to the instructions of A1 and A2 in the Advanced Functions section, to learn more about the Control Mode and Stop Motor details.

Setp3 Checking List before Flying

- Make sure you have assembled your multi-rotor correctly.
- Make sure you have done the configuration procedure correctly.
- Make sure all connections are in good condition.
- Make sure batteries are fully charged for your transmitter, autopilot system and all devices.
- Any of the following mistakes will lead to a dangerous accident, double check all these items: Rotation direction of motor is opposite / Propeller installation mistake / Main controller installation mistake / Wrong connection between the main controller and ESC.
- Always switch on the transmitter first, then power on multi-rotor! (Power off multi-rotor first, then switch off the transmitter after landing!)
- Make sure the GPS signal is good, only one Red LED blinking or without Red LED blinking. Otherwise multi-rotor will drift without stick commands.

- When system is powered on, you MUST NOT move your multi-rotor or sticks on transmitter until the system initialization is finished (about 5 second).
- Please AVOID using the autopilot system in areas of urban area with crowded buildings, tunnels and under bridges, where GPS signal will be blocked most likely.

- In ATTI Mode, throttle stick center position is for 0m/s along the vertical direction. You should keep the position of throttle stick higher than 10% from cut-throttle during the flight!
- Please do the fly test and gain tuning with ATTI. Mode in the open air without heavy wind!
- Refer to the indication in the software: Basic->Gain for more details.

Step4 Flying Procedures

1. If in GPS Mode, place the aircraft in an open space without buildings or trees. Take off the aircraft after 6 or more GPS satellites are found (RED LED blinks once or no blinking). If in Manual Mode or ATTI. Mode, you can skip this step.
2. Place the aircraft three meters away from you and others (especially child), to avoid accidental injury.
3. Start-up
   - ✓ Switch on the transmitter, and then power on autopilot system! You MUST NOT move your multi-rotor or sticks on transmitter until the system initialization is finished (about 5 second).
   - ✓ Push both sticks of transmitter to the left bottom or right bottom to start the motors.
   - ✓ Release the yaw, roll and pitch sticks and keep them at the neutral position, avoiding the aircraft to tilt to one side. At the same time raise the throttle stick from the bottom quickly. The motors will stop if you do not push the throttle stick from the bottom within 3s and you will need to execute the start-up procedure again. When the aircraft is on the point of leaving the ground, continue to push the throttle stick upwards to take off from the ground, pay attention not to push the stick excessively.
   - ✓ Pay attention to the aircraft movement at any time when flying, and use the sticks to adjust the aircraft's position. Keep the yaw, roll, pitch and throttle sticks at the neutral position to hover the aircraft at the desired height.
4. Lower the aircraft slowly. Pull the throttle stick to the bottom and then push the sticks to the left bottom or right bottom to stop the motors after landing. (Also, with throttle stick under 10%, and after landing 3s the motors will stop automatically)
5. Power off the autopilot system, and then switch off the transmitter after landing.

- DO NOT fly near to any ferromagnetic substances, to avoid strong magnetic interference with the GPS. Otherwise, it may cause the aircraft to FailSafe, crack or even fly away.
- If abnormal compass data occurs during flying, LED will blink Yellow and Green alternatively (🟡🟢). If in ATTI and Manual Mode, it is free from influence. In any other control mode, the autopilot system will enter into ATTI. Mode automatically; once the compass data goes back to normal, the autopilot system will regain the original control mode.

- If the LED flashes quickly YELLOW then this indicates battery voltage is low, land ASAP.
- It is recommended to land the aircraft slowly, to prevent the aircraft from damage.
- If the transmitter indicates low-battery alarm, please land ASAP. In this condition the transmitter may cause the aircraft to go out of control or even crash.
- The LED will blink White to indicate huge cumulative yaw errors caused by spinning the craft continuously. In this case, you can stop or slow down the spinning, and continue flying after the White blinking has stopped, so as to have better flight performance.

- If Low-Voltage Alarm is set, the aircraft will act according to the configuration of the Assistant Software once Low-Voltage Alarm is triggered.
- If Fail-Safe function is set, the aircraft will act according to the configuration of the Assistant Software once Fail-Safe is triggered.

- Refer to the LED Indicator Description in the Appendix.

Advanced Functions

A1 Control Mode Knowledge

Please read the Control Mode Knowledge clearly before usage, to know how to control the aircraft.

Different control modes will give you different flight performances. Please make sure you understand the features and differences of the three control modes.

<table>
<tr><th></th><th>GPS Mode
(With GPS Module)</th><th>ATTI. Mode</th><th>Manual Mode</th></tr>
<tr><td>Rudder Angular Velocity</td><td colspan="3">Maximum rudder angular velocity is 150°/s</td></tr>
<tr><td>Command Linearity</td><td colspan="3">YES</td></tr>
<tr><td>Command Stick Meaning</td><td colspan="2">Multi attitude control; Stick center position for 0° attitude, its endpoint is 35°.</td><td>Max-angular velocity is 150°/s. No attitude angle limitation and vertical velocity locking.</td></tr>
<tr><td>Altitude Lock</td><td colspan="2">Maintain the altitude best above 1 meter from ground.</td><td>NO</td></tr>
<tr><td>Stick Released</td><td>Lock position if GPS signal is adequate.</td><td>Only attitude stabilizing.</td><td>NOT Recommend</td></tr>
<tr><td>GPS Lost</td><td>When GPS signal has been lost for 3s, system enters ATTI. Mode automatically.</td><td>Only performing attitude stabilizing without position lock.</td><td>---</td></tr>
<tr><td rowspan="2">Safety</td><td colspan="2">Attitude & speed mixture control ensures stability</td><td rowspan="2">Depends on experience.</td></tr>
<tr><td>Enhanced Fail-Safe</td><td>Auto Level Fail-Safe</td></tr>
<tr><td>Applications</td><td>AP work</td><td>Sports flying.</td><td>---</td></tr>
</table>

A2 Start & Stop Motor Knowledge

Both Immediately Mode and Intelligent Mode are available in the Assistant Software: Advanced->Motor->Stop Type.

If necessary, please select the Intelligent Mode in the Assistant Software.

By using the Intelligent Mode, different control mode has different way of stopping motors.

- In Manual Mode, only executing CSC can stop motors.
- In ATTI. Mode or GPS Mode, any one of following four cases will stop motors:
  - **a)** You don't push throttle stick after motors start within three seconds;
  - **b)** Executing CSC;
  - **c)** Throttle stick under 10%, and after landing 3 seconds.
  - **d)** The slope angle of multi-rotor is over 70°, and throttle stick under 10%.

For Intelligent Mode

- In ATTI. / GPS Mode, it has landing judgment, which will stop motors.
- Start motors in ATTI. / GPS Mode, you have to execute CSC and then push throttle stick over 10% in 3 seconds, otherwise motors will stop after 3 seconds.
- During normal flight, only pull throttle stick under 10% will not stop motors in any control mode.
- For safety reason, when the slope angle of multi-rotor is over 70° during the flight in ATTI. / GPS Mode (may be caused by collision, motor and ESC error or propeller broken down), and throttle stick is under 10%, motors will stop automatically.

For Both Intelligent Mode & Immediately Mode

- If you choose the Immediately Mode, you SHOULD NOT pull throttle stick under 10% during flight, because it will stop motors. If you do it accidentally, you should push the throttle stick over 10% in 5s to re-start motors
- When transmitter commands are valid under any control modes, the motors will start or stop immediately when you execute CSC. It has nothing to do with the current throttle stick position. Please DO NOT executes CSC during flight without a good reason.

- If you choose Intelligent, throttle stick under 10% will trigger landing judgment in any control mode. In this judgment, pitch, roll and yaw controls are denied except throttle, but multi-rotor will still auto level.
- In any control mode, DO NOT pull throttle stick under 10% during normal flight without any reason.

- The two cut off types will only work correctly if the transmitter calibration is correct.
- In failed-safe, CSC is denied by the main controller, motors will hold their state.

A3 Intelligent Orientation Control (IOC) Flight (with GPS module)

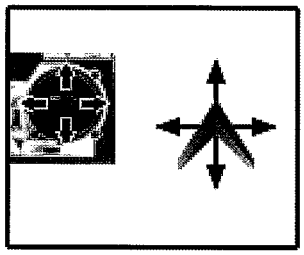
Definition of Forward Direction: Multi -rotor will fly along this direction when you push the elevator stick.

Graphic Description: ➡ Forward direction

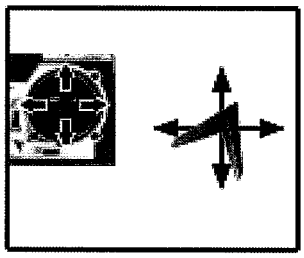
Step 1 Before You Start

Usually, the forward direction of a flying multi-rotor is the same as the nose direction. By using IOC, wherever the nose points, the forward direction has nothing to do with nose direction. The red and blue arrows on the transmitter are corresponding to pitch and roll operations in the following diagram.

- In course lock flying, the forward direction is the same as a recorded nose direction.
- All the following requirements are met: the autopilot system is in ATTI. Mode or GPS Mode.

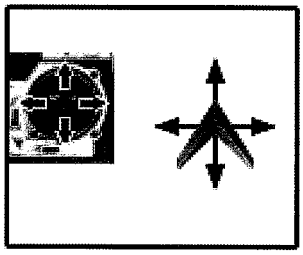


Normal flying

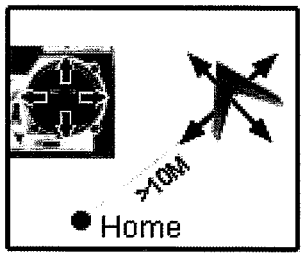


Course Lock Flying

- In home lock flying, the forward direction is the same as the direction from home point to multi-rotor.
- All the following requirements are met: 6 or more GPS satellites are found, in GPS Mode, and the aircraft is further than 10m away from the home point.

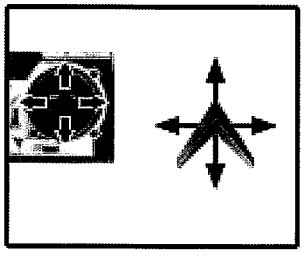


Normal flying

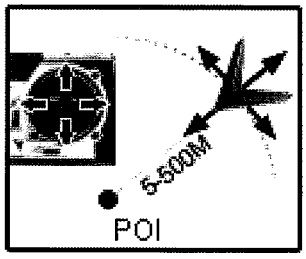


Home Lock Flying

- In POI (**POI, Point Of Interest**) flying, the roll channel controls the multi rotor circular flight speed around a fixed point, the pitch channel is used for controlling the diameter around the fixed point, the throttle is used to control the height around the fixed point.
- All the following requirements are met: 6 or more GPS satellites are found, in GPS Mode, and the aircraft is further than 5m (and less than 500m) away from the Point of Interest.



Normal flying



POI Flying

Step2 IOC Switch Setting

Refer to the assistant software; click the "Advanced" to find the "IOC".

Before using the IOC function, you have to choose a 3-position switch on your transmitter as the IOC switch, which is also used for recording the orientation, home position or point of interest in corresponding modes. There are three IOC control mode options, and you should select one in the assistant software.

Switch / Options	Positon-1 	Positon-2 	Positon-3 
Control 1	OFF	Course Lock	Home Lock
Control 2	OFF	Course Lock	POI
Control 3	OFF	POI	Home Lock

The above table is for example. The function of the switch position may be reversed since the normal/reversed setting of the switch channel. Toggle the switch and observe the slider position of channel X2 on the assistant software screen, the corresponding area should turn blue.

Step3 Method of Forward Direction, Home Point & POI Recording

If you use the IOC function, **please be aware of the Forward Direction of Course Lock Flying, the home point of Home Lock Flying, and the Point of Interest of the POI Flying.** There are two ways to record the forward direction and the home point: Manually and Automatically. You may choose any one record method.

If the IOC switch is set as the above table; you can do the manual recording according to the following table.

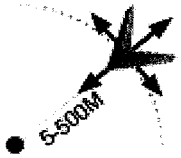
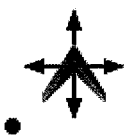
	Manually
Course Lock	Control 1 : Toggle the switch from Positon-1 to Positon-2, and back to Positon-1 quickly 3 to 5 times. Control 2 : The same as above.
Home Lock	Before takeoff and after 6 or more GPS satellites have been found. Control 1 : Toggle the switch from Positon-2 to Positon-3, and back to Positon-2 quickly 3 to 5 times Control 3 : The same as above.
POI	Before takeoff and after 6 or more GPS satellites have been found. Control 2 :Toggle the switch from Positon-2 to Positon-3, and back to Positon-2 quickly 3 to 5 times. Control 3 : Toggle the switch from Positon-1 to Positon-2, and back to Positon-1 quickly 3 to 5 times.
	Automatically
Course Lock	30 seconds after you power on the autopilot system.
Home Lock	Before takeoff, the current position of the aircraft will be saved as home point when you push the throttle stick for the first time after 6 or more GPS satellites have been found.
POI	None

- LED will blink GREEN quickly if Forward Direction recording is successful.
- LED will blink PURPLE quickly if Home Point recording is successful.
- LED will blink CYAN quickly if POI recording is successful.
- After Home Point is recorded successfully, LED will blink continually under below conditions. None of these conditions is omitted.
  1. GPS signal is well, the satellites number MC searched is more than 6.
  2. Distance between aircraft and the recorded home point is less than 8m.
  3. Current control mode is not Manual mode.
- DO NOT toggle the switch between Positon-1 to Positon-3, since it may change the recording of the Positon-2.

Step4 IOC Flying Test

Then you can do **Course Lock, Home Lock, and POI flying test**

Carry out an IOC flight by the following procedure. The Control Mode LED will blink GREEN to indicate the IOC mode only when the main controller is really to fly in Course Lock, Home Lock modes or POI.

During the same flight	STEP1: Record	STEP2: ON	STEP3: OFF	STEP4: ON again
Course Lock				
Switch Setting	Record the forward direction	Set Control Mode switch at GPS or ATTI. position, Toggle IOC switch from OFF to Course Lock position	Toggle IOC switch to OFF position	Toggle IOC switch from OFF to Course Lock position
Home Lock				
Switch Setting	Record the home point	Set Control Mode switch at GPS position, Toggle IOC switch from OFF to Home Lock position	Toggle IOC switch to OFF position	Toggle IOC switch from OFF to Home Lock position
POI				
Switch Setting	Record the POI	Set Control Mode switch at GPS position, Toggle IOC switch from OFF	Toggle IOC switch to OFF position	Toggle IOC switch from OFF to POI position

		to POI position		

→ Aircraft moving direction when pull pitch stick → Aircraft moving direction when pull roll stick

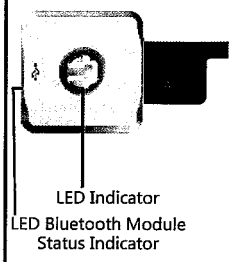
●Home point ➤ Aircraft (the arrow is pointing to the direction of the aircraft nose)

IOC FLYING NOTES !!!

	When Multi-rotor is flying by home lock far away from you and the home point, please DO NOT toggle the IOC switch many times quickly so as to avoid the change of home point without your attention.
	• Home lock flying requires that 6 or more GPS satellites are found and the aircraft is further than 10m away from the home point. • In POI flying, avoid using POI in areas where the GPS signal might be lost or the transmitter /receiver signal might be lost (such as built up urban areas), to make sure 6 or more GPS satellites are found. And the multi-rotor is required to fly further than 5m (and less than 500m) away from the Point of Interest. • Continuously spinning will cause a yaw error. In this case, you can stop or slow down the spinning, so as to have better flight performance. • If the IOC flying requirement is not satisfied, the autopilot system will quit IOC control mode. Please be aware of the LED indicator, to know the current control mode of the autopilot system.
	• Before you do the home lock flight, you have to fly the aircraft out of the 10m range around home point, and then flip the IOC switch to Home Lock position to fly in home lock when all the requirements are met. If you have already toggled the IOC switch to Home Lock position when the aircraft is still in 10m range around home point, and this is the first time you are going to fly in home lock during the current flight, then if all the requirements are met, the main controller will change into home lock automatically when Multi-rotor flies out the 10m range around home point.. • When you are flying in home lock mode, if the aircraft is back into the 10m range around home point, or you switch into ATTI. Mode, or the GPS signal becomes weak, the autopilot system will fly in course lock by the current forward direction automatically. But this forward direction is NOT the recorded forward direction. If you open the course lock now, it will fly in course lock still by the earlier recorded forward direction. • We suggest that you should know clearly that, by which lock method you are going to fly, and the locked forward direction or home point, before you switch on IOC mode during the flight.
	• Refer to the LED Description in the Appendix for more details.

WM Assistant for Mobile Device

Step1 Assemble the LED Bluetooth Module



The LED Bluetooth Module is necessary if you are using the WM Assistant. This module is only for the iOS Device, not for android equipment. Its Operating Temperature range is from -5°C to +60°C. Please refer to the Assembly & Configuration -> Step1 Assembly to attach the module.

This module has a USB interface for configuration and firmware upgrades when connecting to PC. The "LED Indicator" tells the status of autopilot system, and the "LED Bluetooth Module Status Indicator" tells whether the LED Bluetooth Module is working or not. The built-in Bluetooth is for wireless communication between the autopilot system and mobile equipment, with a maximum communication distance of 50m.

Step2 WM Assistant Installation

Please search the WM Assistant from the App Store by your iOS device, download and install it.

Step3 Parameter Configuration Procedures

1. Prepare an iOS Device that supports Bluetooth 4.0, and turn on the Bluetooth.
2. Switch on the transmitter first, power on the autopilot system. The LED Indicator blinks (●●● .....) when self-check. After that, check the LED Bluetooth Module Status Indicator, if it is solid red on, then the LED Bluetooth Module is working normally.
3. Run the WM Assistant. The LED Indicator blinks Purple and Yellow alternately (●◉) when the WM Assistant is connected to the autopilot system. Make sure your iOS device is connected to the Internet for the first time you use, to register account. And also you can login with the PC assistant account.
4. Run the WM Assistant. Set up the name and password for autopilot system according to the App start.
5. Observe the indicators ●● on the left bottom of the software. (● connection indicator and ● communication indicator) On the WM Assistant, if the communication indicator is●, please double check the connections and driver installation; otherwise if the indicator is blinking◉, go to next step.
6. Select the "Basic" option. Please follow step-by-step for your first-time-configuration. Basic configuration is necessary. Click the icon ⓘ to get the configuration details.
7. You can click the "Advanced" option for more parameter settings. Advanced setting is optional. There are Motor, Enhanced Fail-Safe, Intelligent Orientation Control (IOC), Gimbal, Low-voltage Alarm, Flight Limits, etc.
8. Select Viewer and check all parameters.
9. Select "More" to obtain more details. Including: (Parameter)Import-Export, Restore Factory Settings, Account, Main Controller List, Information(including Hardware ID, IMU, Loader, Firmware, SN and Functions Activation Status), Rate WM Assistant, Feedback, About(Help Document, Disclaimer)

If the LED Bluetooth Module Status Indicator does not be solid red on, then the LED Bluetooth Module works abnormally. There are following situations:

(1) The main controller firmware version is not matched, please upgrade the main controller.

(2) There is something wrong with the connection between the LED Bluetooth module and main controller, please check the connection.

(3) The LED Bluetooth module is damaged, please contact your dealer.

iOS Device List

iPhone 4s, iPhone 5, iPod touch 5, iPad mini, iPad 3, iPad 4

Refer to the WM Assistant for more details.

The gain value displayed on Mobile Device and PC may be a little different, that is OK for use.

Step4 Flying Test Procedures

1. Get the aircraft ready, run the WM Assistant and make sure it is connected with the main controller. (The indicators on the WM Assistant are)
2. Start the motors.
3. The "View" page shows the relative parameters real-time when flying.
4. Go to the "Basic" and click into the "Gain" page to set the values of all gains real-time during flying.
5. Go to the "Advanced" and click into the "Gimbal" page to configure the gimbal real-time during flying.
6. Finish the flying and land your aircraft.

Only the parameter referred above can be changed during flying. Others can be configured after landing.

Forgot Main Controller Password

When connecting to the WooKong M flight control system to the WM Assistant using a mobile device for the first time, users will be asked to set a name and password for the WooKong M main controller. If the password is forgotten, users can connect the flight control system to Assistant software on a PC and click "Reset Bluetooth Info" in the Tools page to reset username and password. Once complete, set a new username and password as before.

How to Activate More Functions

In the Future you might be asked to fill in the new S/N in the future if you brought new function upgrades. Fill-in the S/N and then click Write button. If you filled in an invalid S/N over 30 times, your MC will be locked and you have to contact our customer support.

Appendix

Firmware & Assistant Software Upgrade

Please follow the procedure for software and firmware upgrade; otherwise the autopilot system might not work properly. For SAFETY REASONS, DO NOT use power battery during firmware upgrade.

1. Make sure your computer is connected to the Internet.
2. Please close all the other applications during the firmware upgrade, including anti-virus software and firewall.
3. Make sure the power supply is securely connected. DO NOT un-plug the power supply until firmware upgrade has finished.
4. Connect autopilot system to PC with USB cable, DO NOT break connection until firmware upgrade is finished.
5. Run Software and wait for connection.
6. Select Info→Software and Firmware.
7. DJI server will check your current software and firmware version, and get the latest software and firmware prepared for the unit.
8. If there is a software version more up-to-date than your current version, you will be able to click to download the new version. Please re-install the assistant software follow the prompts
9. If there is a firmware version more up-to-date than your current version, you will be able to click to update them.
10. Wait until Assistant software shows "finished".
11. Click OK and power cycle the unit after at least 5 seconds. Your unit is now up-to-date.

- After firmware upgrade, please re-configure the system using Assistant software.
- If the firmware upgrade failed, the autopilot system will enter waiting for firmware upgrade status automatically, please try again with the above procedures.

Port Description

Please remember the function of each port, which may help you to use the autopilot system efficiently.

Main Controller

A	For roll control (left/right)		
E	For pitch control (front/back)		
T	For throttle control	Or to gimbal roll servo	
R	For rudder control	Or to gimbal pitch servo	
U	For Control Mode Switch		
X1	For voltage monitor (Connect with PMU V-SEN port)		
X2	For D-Bus (S-Bus/S-Bus2 compatible)	Or for gain tuning	Or for IOC switch
X3	For gimbal pitch control	Or for gain tuning	Or for switch go-home
M6	To #6 rotor		
M5	To #5 rotor		
M4	To #4 rotor		
M3	To #3 rotor		
M2	To #2 rotor		
M1	To #1 rotor		
F2	To gimbal pitch servo	Or to #8 rotor	
F1	To gimbal roll servo	Or to #7 rotor	
	Micro-B USB port: PC connection for configuration and firmware upgrades.		
	CAN-Bus port: MC uses CAN-Bus to power and communicate with other WKM modules.		

(In three-pin ports, pins near the nicks are signal pins.)

Power Management Unit

V-SEN For monitoring battery voltage and supplying power to receiver and other electronic devices.

(Connect with MC X1 port)

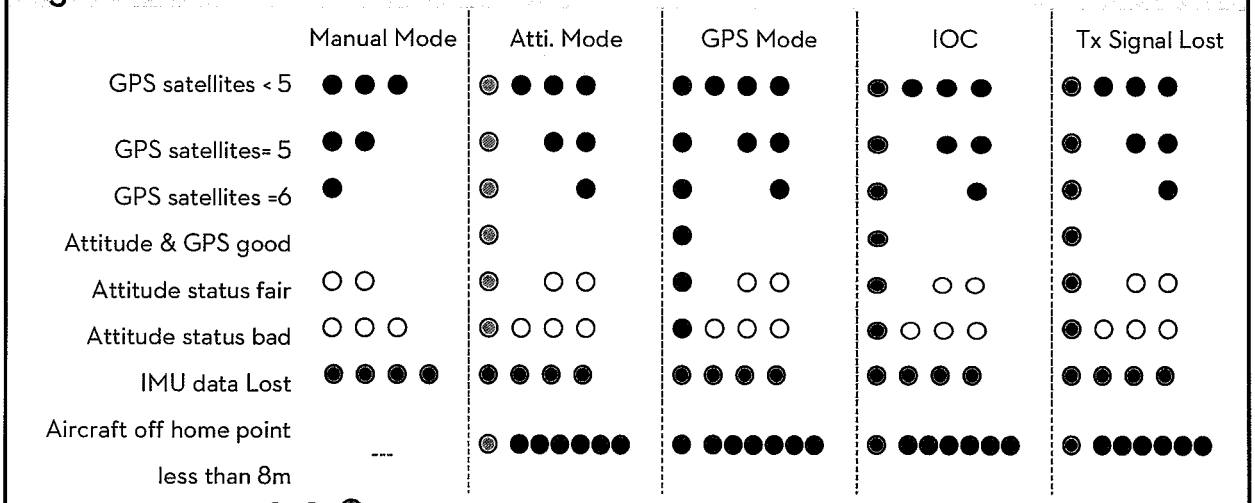
- Orange wire (signal wire) output: 0V ~ + 3.3V
- Red wire (power wire) output: 3A@5V

PW For supplying power to WKM system.

- Output: Max 2A@6V

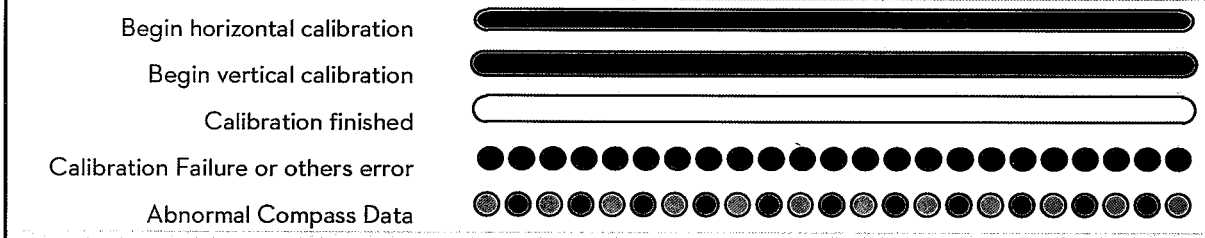
LED Description

Flight States

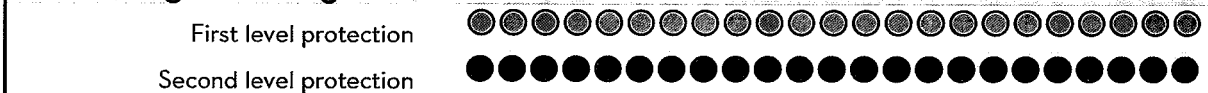


Flashing indications of , , are: **Single flash**, all the transmitter sticks are at center position, multi rotor hovering; **Double flash**, transmitter stick(s) not at center position, speed command is not zero.

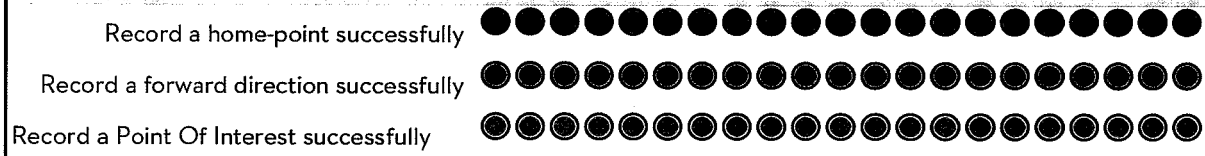
Compass Calibration and Abnormal Data Indicator



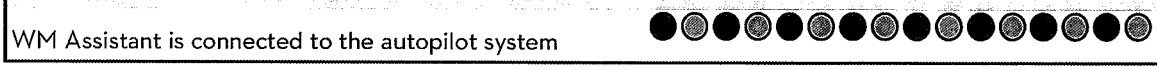
Low Voltage Warning



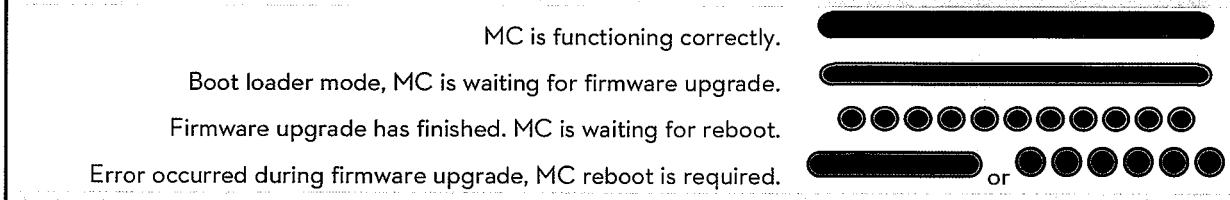
Recording



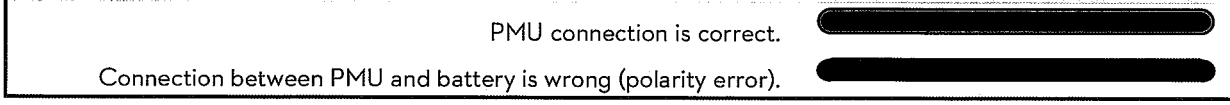
WM Assistant Connection Indicator



Main Controller LED



PMU LED



Specifications

General

Built-In Functions	●	Three Modes Autopilot	●	S-Bus/S-Bus2 Receiver Supported
	●	PPM Receiver Supported	●	Intelligent Orientation Control
	●	2-axle Gimbal Support	●	Multi Output Frequency Supported
	●	Enhanced Fail Safe	●	Low Voltage Protection

Peripheral

Supported Multi-rotor	● Quad-rotor: I4, X4; ● Hexa-rotor: I6, V6, Y6, IY6; ● Octo-rotor: X8, I8, V8.
Supported ESC output	400Hz refresh frequency.
Recommended Transmitter	Only PCM or 2.4GHz with minimum 7 channels and fail-safe function available on all channels.
Recommended Battery	2S ~ 6S LiPo
Assistant Software System Requirement	Windows XP SP3 / 7 /8

Electrical & Mechanical

Power Consumption	MAX 5W (0.9A@5V, 0.7A@5.8V, 0.5A@7.4V, 0.4A@8V)
Operating Temperature	-5°C to +60°C
Total Weight	<= 118g (overall)
Dimensions	● MC: 51.2mm x 38.0mm x 15.3mm ● IMU: 41.4mm x 31.1mm x 27.8mm ● GPS & Compass: 50mm (diameter) x 9mm ● LED Indicator: 25mm x 25mm x 7mm ● PMU: 39.5mm×27.5mm×9.7mm

Flight Performance (can be effected by mechanical performance and payloads)

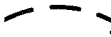
Hovering Accuracy (GPS Mode)	● Vertical: 0.5m ● Horizontal: 2m
Maximum Wind Resistance	<8m/s (17.9mph / 28.8km/h)
Max Yaw Angular Velocity	150deg/s
Max Tilt Angle	35°
Ascent / Descent	6m/s

FAQ

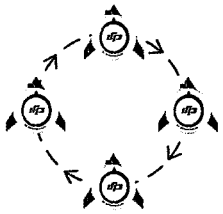
Fix the TBE (Toilet Bowl Effect) Problem

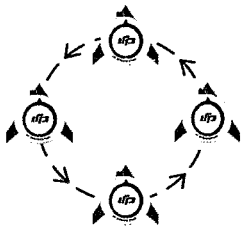
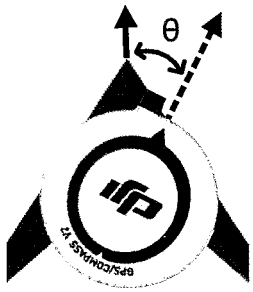
When flying in GPS Mode and the compass calibration has been done correctly, should you find the aircraft rotating (Toilet bowl effect), or drifting when hovering. Please check the GPS module mounting orientation and then re-do the compass calibration. Carry out the following procedure to re-mount the GPS module.

In the following diagram (view from the top), the aircraft can appear to be rotating in both clockwise and counter-clockwise direction, please re-mount the GPS module correspondingly.

 is the rotating direction of aircraft,  is the nose direction of aircraft,

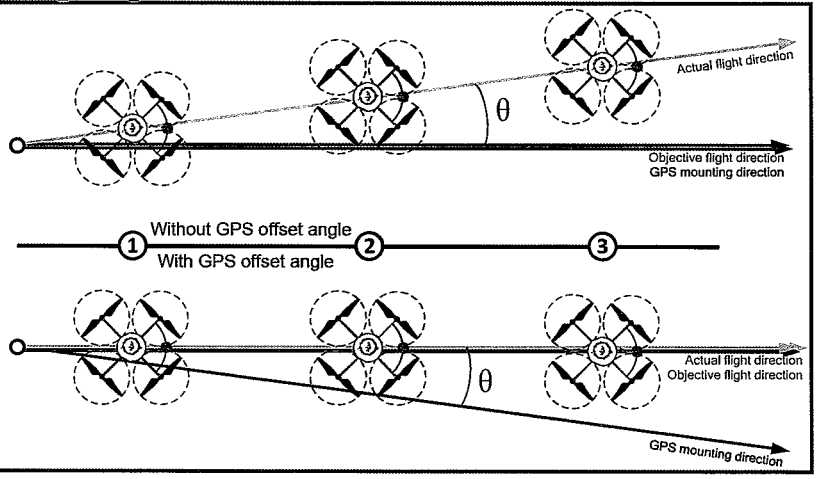
 is the arrow direction on the GPS module, θ is the offset angle for GPS re-mounting(about 10~30°)

Clockwise rotating	GPS re-mounting
	

Counter Clockwise rotating	GPS re-mounting
	

Reinstall the GPS in an Offsetting Angle

Should you find the multi-rotor does not track straight in forward flight, you might try re-mounting GPS in an offsetting angle as showed in right figure. Θ in the figure is the offsetting angle.



Attitude Controllable When One Motor Output is Failed

For Hexa-rotor, including Hexa-rotor I, Hexa-rotor V, Hexa-rotor IY and Hexa-rotor Y, aircraft is attitude controllable when one motor output is failed.

The WKM can still control the attitude of the Hexa-rotor for a safe landing when one motor output of the Hexa-rotor has failed, for example, one motor is stopped or one propeller is broken, etc.

The control mode of WKM should be in Atti. Mode or GPS Mode. The aircraft will rotate, due to an imbalance of torque; however, it can still be controlled by the Transmitter.

Select Course lock or home lock mode for flying the aircraft into a safe area to land when the aircraft is far away or the attitude can't be recognized. Even when the multi rotor is rotating, using Course lock or home lock mode will allow you to move the multi rotor in the corresponding Transmitter stick direction.

Flight Restriction in Specified Area Description

Flight Functions are restricted within the radius of 15Km from Tiananmen Square in Beijing, China.

In the restricted area, with GPS/Compass Module and GPS signal is good, you cannot take off the aircraft in any Control Mode.

In the restricted area, with GPS/Compass Module and GPS signal is bad, you can take off the aircraft, once the GPS signal becomes good, you can only control the aircraft to land. Manual Mode is free form restriction.

Fly into the restricted area, you can only control the aircraft to land. Manual Mode is free form restriction.

Abnormal Cases in Motor Test

Below are abnormal cases and solutions for Motor Test in the Assistant software

(1) Tested motor does not rotate, there are two situations:

a) Connection issues: please check the connections first, such as whether MC and motors are power on, whether connection between MC and ESC is well, whether three cables of ESC are correctly connected to motor. If connections are well, then check whether motors or ESC are breakdown.

b) Please increase the Motor Idle Speed in the Advanced page of Assistant software.

(2) Tested motor rotates in wrong direction: please swap over any two wire connections of the motor.

(3) Rotating motor is not the tested motor (e.g. M2 motor rotates when click button"M1"): please ensure the cable of ESC is correct connected to the right port of MC.

Solution for LED yellow and green blinking

LED blinks yellow and green () alternatively means compass errors or interferences:

(1) Long time  : in this case compass calibration is required.

(2) Temporary : e.g. LED blinks several times when the aircraft flying over some district and then no blinks; or take an calibrated aircraft from outside to inside of house, the may appear inside. In these cases the compass is ok and has no influences to flight. Compass calibration is not required.

When compass data become abnormal (LED blinks yellow and green ) during flying, for safety reasons, the autopilot system will auto change the control mode. However in ATTI. and Manual Mode is free from influence. In any other control mode, the autopilot system will enter into ATTI. Mode automatically (the mode shown on status bar will be "Atti." if you connect the autopilot to the assistant software). Once the compass data go back to normal, the autopilot system will regain the original control mode.

Solutions for failed gain value adjustment in the Assistant software

If you fail to adjust the gain value in the Assistant software, please check the follow items to solve the problem.

(1) Make sure the MC has connected and communicated with the Assistant software successfully.

(2)Make sure the Receiver has connected to the MC successfully.

(3)Make sure you have selected the correct Receiver type in the Assistant software, and then you can try to adjust the gain value again.

CE Statement

Due to the used enclosure material, the devices shall only be connected to a USB.

Interface of version 2.0 or higher. The connection to so called power USB is prohibited.

Hereby, SZ DJI TECHNOLOGY CO. LTD declares that this device is in compliance with the essential requirements and other relevant provisions of Directive 1999/5/EC.

CE 0700

FCC Statement：

This equipment complies with FCC RF radiation exposure limits set forth for an uncontrolled environment.

This device complies with part 15 of the FCC rules. Operation is subject to the following two conditions: (1) this device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

NOTE: The manufacturer is not responsible for any radio or TV interference caused by unauthorized modifications or changes to this equipment. Such modifications or changes could void the user's authority to operate the equipment.

NOTE: This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
-Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
-Consult the dealer or an experienced radio/TV technician for help.

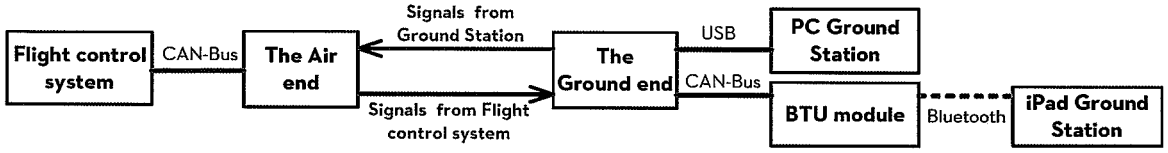
2.4G Bluetooth Datalink & iPad Ground Station User Guide V1.10

Thank you for purchasing DJI products. Please strictly follow this user guide to mount and connect the 2.4G Bluetooth Datalink, install the Assistant Software on your computer, as well as the App on your mobile device.

Note : The map of Mainland China download from Mainland China IP addresses has differences with the actual geographic environments. If users download the map of Mainland China from foreign IP addresses, which will be more accurate.

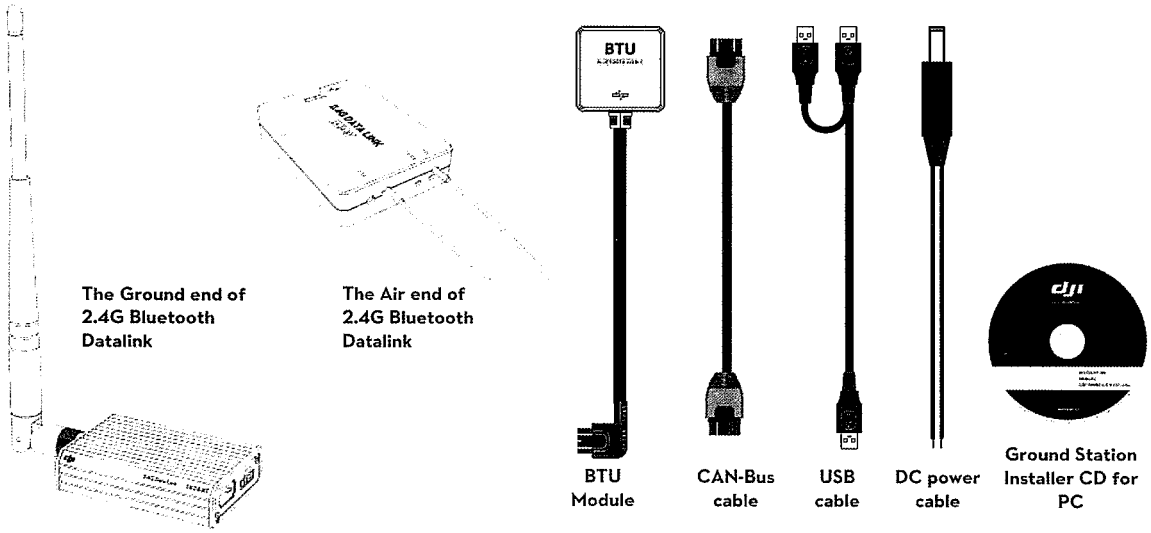
2.4G Bluetooth Datalink

The 2.4G Bluetooth Datalink consists of the Air end and the Ground end, which provides reliable and stable remote wireless transmissions for Ground Station based applications. The signal flow is as shown below.



Flight control systems that support the 2.4G Bluetooth Datalink
ACE ONE(Firmware V4.02 or above), WKM(Firmware V5.24 or above), NAZA-M, NAZA-M V2(Firmware V4.00 or above), A2(Firmware V2.0 or above)
Important: To make your Phantom 2 compatible with the 2.4G Bluetooth Datalink, please update the firmware of Phantom 2 and BTU module to the latest version.

1.1 In the box



Important : the firmware of BTU should be upgraded to version 1.0.1.2 or above to use with the 2.4G Bluetooth Datalink.

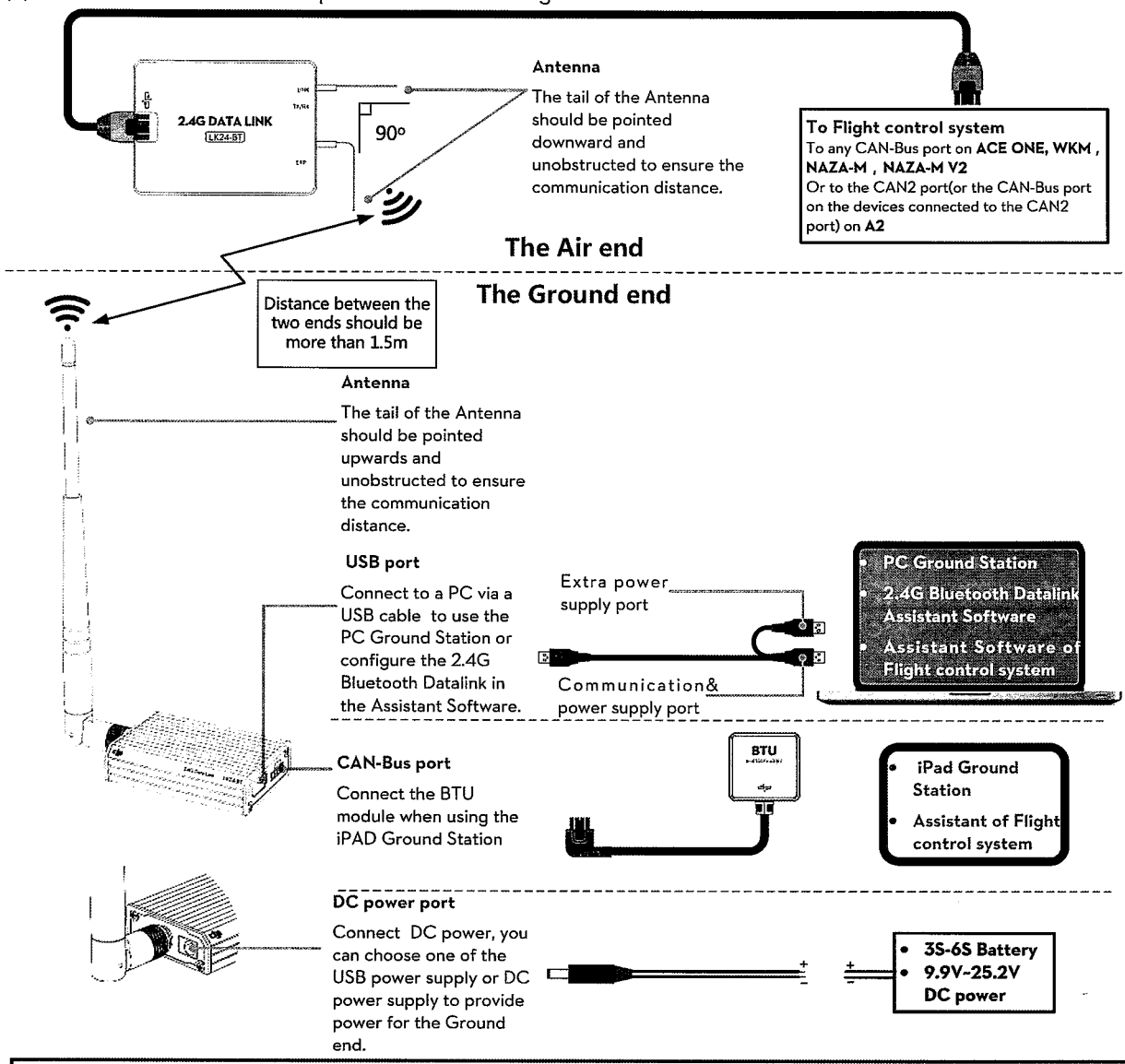
1.2 User supplied

To use the 2.4G Bluetooth Datalink and Ground Station, please prepare the Flight control system, the aircraft, batteries, PC or iPad etc.

1.3 Connections and use

(1) Please assemble the antenna of the Ground end first.

(2) For connections and use please refer to the diagram below.



Notes :

(1) You can configure the Flight control system using the Assistant software on a PC or iOS mobile Device wirelessly over the link of the 2.4G Bluetooth Datalink, however you cannot upgrade the firmware of the Flight control system using this communication route.

(2) When connecting a BTU module or a LED Bluetooth unit to the Flight control system to configure in the Assistant on mobile devices, as well as connecting a BTU module to the Ground end to use the iPad Ground station, the two Bluetooth communication links will not interfere with each other.

(3) If the Air end is changed to connect to a new Main controller, you should power cycle the Ground end.

(4) Make sure the LED indicator of BTU module is green after power on, for specific usage details please refer to the BTU Manual.

(5) For usage of the PC Ground Station please refer to the latest Ground Station User Manual.

Important :

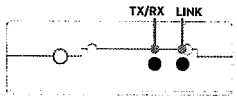
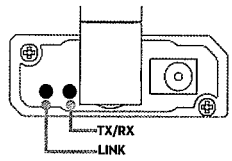
(1) If there are obstacles between the ground and air ends then the radio signal of the 2.4G Bluetooth Datalink will be weak; please make sure the antennas are always visibly unobstructed during the flight. Human body, trees, buildings or hills will disconnect the link between the Air end and the Ground end.

(2) Make sure the antenna of the Air end is pointing down, and the antenna of the Ground end is pointing upwards; it's better to put the Ground end at a high place to get further transmission distance.

(3) When using the ACE ONE Flight control system with the 2.4G Bluetooth Datalink, the Ground Station will connect to the Main controller 15s after power on.

1.4 LED Indicator descriptions

The LED Indicators of the 2.4G Bluetooth Datalink will work after power on, the descriptions are shown below.

	LED	TX/RX		LINK	
The Air end		●Green blinks	Sending	●Solid Green	The Air end links with the Ground end successfully
		●Red blinks	Receiving	●Solid Red	The Air end delinks with the Ground end
		●Yellow blinks	Searching the Main controller		
The Ground end		●Green blinks	Sending	●Solid Green	The Air end links with the Ground end successfully
		●Red blinks	Receiving	●Solid Red	The Air end delinks with the Ground end
		●Yellow blinks	Power voltage of the Ground end is less than 9.9V		

Notes :

(1) LED Indicators on both ends will blink when powering on, then the TX/RX indicator of the Air end will blink when searching the Main controller.

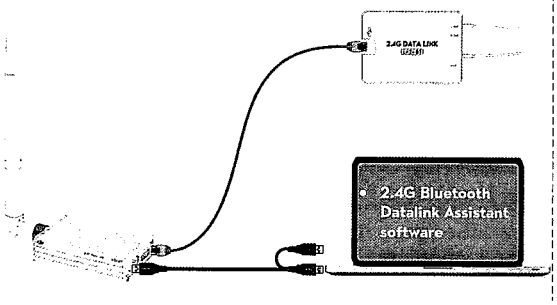
(2) The LED Indicators of LINK on both ends should be solid green to indicate that the two ends have linked successfully.

(3) It's recommended to check the power voltage of the Ground end regularly when using batteries for power supply, in order to avoid over-discharging.

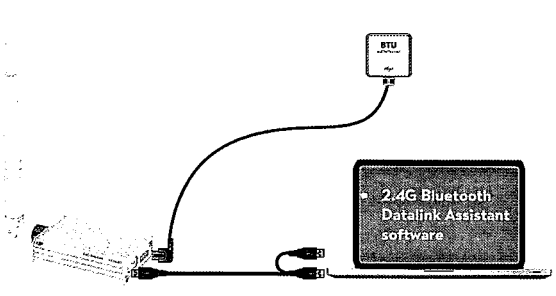
1.5 Upgrade

Use the 2.4G Bluetooth Datalink Assistant software to upgrade the 2.4G Bluetooth Datalink and BTU module. Please refer to the diagram below to connect when upgrading.

To upgrade the Air end and the Ground end



To upgrade the Ground end and BTU module



Important : POWER CYCLE the Flight control system and 2.4G Bluetooth Datalink after upgrade.

iPad Ground Station App

The iPad Ground Station is designed for remote flight control in applications of surveillance, aerial photography, etc., it should be used with the 2.4G Bluetooth Datalink to achieve auto flight after the setting of the routes. The application with easy usable design offers great portability and simple operation, which will provide users with an extraordinary flight experiences.

1.1 Introduction

Functions		
Map information display	Joystick mode	One key Take off/ Go Home
Flight display in real time	Single waypoint	Auto Landing
Flight simulator	Waypoints	Customized Waypoints
4 kinds of Route Template	Customized Route Template	Low voltage alert
Voice guidance function		

Flight control systems that support the iPad Ground Station
WKM(Firmware V5.24 or above), NAZA-M, NAZA-M V2(Firmware V4.00 or above) , A2(Firmware V2.0 or above).
Important: Phantom 2 supports iPad Ground Station V1.4.58. To use the iPad Ground Station with the Phantom 2, please update the main controller firmware to V2.00 or above, update the central board firmware to V1.0.1.24 or above while the BTU firmware should be updated to V1.0.1.3 or above.

iOS Devices that support the iPad Ground Station
iPad3 , iPad4 , iPad mini , iPad mini with Retina display , iPad Air (iOS 6.1 or above)

1.2 First Time Use

First time use		Tips and Notes
1. Open your iPad and search "DJI" in the App Store to download and install the Ground Station(GS) App.		
2. Open the Bluetooth function of your iPad.		There will have popups if you forget to enable the Bluetooth
3. Connect the 2.4G Bluetooth Datalink and BTU module to the Flight control system, power on.		Please refer to the Datalink part to connect
4. Run the GS App, create an account through the Internet and login.		PC account is available to login.
5. The GS will search your Main controller and named with "NEW" , you will be asked to set a new name and a password for the Main controller.		LED in GS indicates ● ● after the GS is connected with the Main controller
6. Please read the tips text carefully after login. Open the FisrtUse function to make use of the help text.		FisrtUse function can be opened and closed in "More " ••• →"Settings " ⚙
7. Enable the Flight Simulator and try out the follow functions:		(1) Flight Simulator can be opened and closed in "More " ••• →"Settings " ⚙ (2) When using the GS the Flight control system will enter into GPS control mode and the aquired satellites shoule be more than 6. (3) In GPS control mode the GS control priorto the Transmitter, Users can toggle
Joystick	Use the sticks on the screen to control the aircraft	
Single waypoint	Edit a single waypoint and go	
Waypoints	Use the templates to set routes, batch the waypoints and upload the routes, then confirm and go	
Location	Use to locate the aircraft or the iPad	
Auto Landing	The aircraft will land slowly	

One key Go Home	Default Home point is the one recorded by the aircraft automatically after recording conditions are satisfied	the control mode switch to other mode and back to the GPS mode quickly to get the control by Transmitter.
8. Disable the Flight Simulator and power cycle the Flight control system to start real flights. Click on Joystick and you can use One key Take off to take off your aircraft		(1) Please view the map of fight fields via Internet in the GS before outdoors flights, then the maps can be used off-line. (2) Please use the GS for real flights after you are familiar with its use and functions, Refer to all help text in the App.

1.3 Using Tips

1. **Customized Route Template**

   In Waypoints mode, users can set a route and click  to save it as a template. Users can view all the customized route templates in the template menu, slip from right to left on a template and you can choose to detele it.

2. **Capturing waypoints**

   In Waypoints mode, click  to capture the aircraft attitude (including longitude, latitude, height and nose pointing direction) properties to build a new waypoint during flight. This function is always available when the UAV is hovering or flying.

1.4 Flight Limit of Special Areas

All UAV operators should abide by all regulations from such organizations at ICAO (International Civil Aviation Organization) and per country airspace regulations. For safety reasons, key areas have been restricted, such as:

a) Within the radius of 15Km from Tiananmen Square in Beijing, China.
b) Within the radius of 8Km from the airport.

Users will not be able to build waypoints or Home points in designated special areas and the waypoint routines go through these special areas are invalid, and the UAV will fail to cruise to those areas.

All the special areas have been restricted are specified on the DJI official website and please refer to Special Areas List (http://www.dji.com/fly-safe/category-gs) to obtain details.

Appendix

3.1 2.4G Bluetooth specifications(Deliveries passed FCC)

Performance		
RF Data Rate	1536kbps	
Indoor/Urban Range	≤350m	
Outdoor/RF Line-of-Sight Range	≤2km	
Transmit Power	≤125mW	
Receiver Sensitivity (1%PER)	-94dBm	
Power Consumption	The Ground end: ≤2.3W	The Air end: ≤1.8W
Features		
Frequency Band	2.4G(2400MHz ~2483MHz)	
Serial Data Rate	115200 bps	
Antenna Options	SMA	
Operating Temperature	-10°C ~+60°C	
Size (No Antenna)	The Ground end: 73mmx47.8mmx17.1mm The Air end: 49.8mmx36.4mmx11.4mm	
Weight (with Antenna)	The Ground end: 93g	The Air end: 32g
Power supply		
Supply Voltage	The Ground end: 9.9V-25.2V	The Air end: 6V
Current (Transmitting signal)	0.18A@12.5V	
Current (Receiving signal)	0.30A@6V	
Regulatory Approvals		
FCC (USA)	Yes	

3.2 2.4G Bluetooth specifications(Deliveries passed CE)

Performance		
RF Data Rate	1536kbps	
Indoor/Urban Range	≤200m	
Outdoor/RF Line-of-Sight Range	≤1.1km	
EIRP (Equivalent Isotropic Radiated Power)	≤100mW	
Receiver Sensitivity (1%PER)	-94dBm	
Power Consumption	The Ground end: ≤1.3W	The Air end: ≤0.9W
Features		
Frequency Band	2.4G(2400MHz ~2483MHz)	
Serial Data Rate	115200 bps	
Antenna Options	SMA	
Operating Temperature	-10°C ~+60°C	
Size (No Antenna)	The Ground end: 73mmx47.8mmx17.1mm	

	The Air end: 49.8mmx36.4mmx11.4mm	
Weight (with Antenna)	The Ground end: 93g	The Air end: 32g
Power supply		
Supply Voltage	The Ground end: 9.9V-25.2V	The Air end: 6V
Current (Transmitting signal)	0.10A@12.5V	
Current (Receiving signal)	0.15A@6V	
Regulatory Approvals		
CE (European)	Yes	

3.3 FAQ

2.4G Bluetooth Datalink Failure

The Ground Station fails to connect with the Main controller, please check the following items

- The distance between the two ends of the 2.4G Bluetooth Datalink should be more than 1.5m.
- Make sure the Ground end is connected correctly and the LED indicator of BTU is green.

If above are ok please power cycle, while this problem continues after powering cycle, there may be hardware problems such as the Antenna is broken, please contact your authorized dealer.

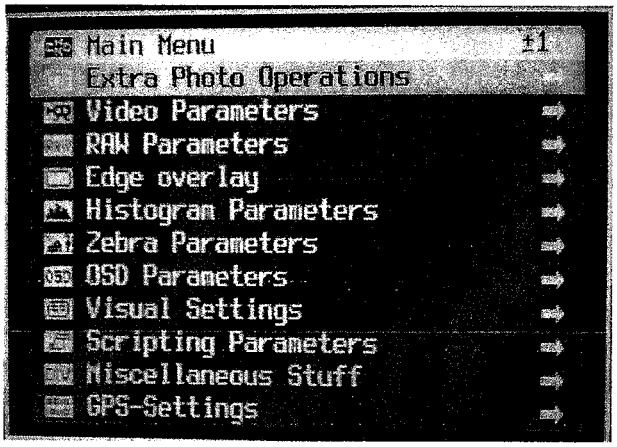
Land Cruiser Camera Checklist

	Ensure all batteries are charged
	Check SD Cards for available space
	Power on the Camera to allow GPS lock
	Attach Camera to Gimbal before powering on the Land Cruiser
	Initiate interval shooting just before take-off (tap the review button on the Canon Camera and press the shutter button on the top right)
	When mission complete, use shutter button to stop interval shooting
	After the Land Cruiser is powered off, remove camera from Gimbal
	Use a USB cable or remove SD Card to get the images
	Place into a folder and use GeoSetter or ImageJ as desired
	If you need to delete the pictures from the SD card you must "unlock" then delete, just remember to "relock" the SD card for your next use

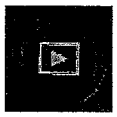
The Canon SX260 HS cameras included with your Land Cruiser system is not a stock camera, this makes it very simple to use, but different than your typical point and shoot camera. On the modified NDVI camera, do not adjust the white balancing, it has been set for optimal usage.

NEVER FORMAT THE MEMORY CARD

If you use your own memory card, the camera will not be able to do the interval shooting required to scout a field.

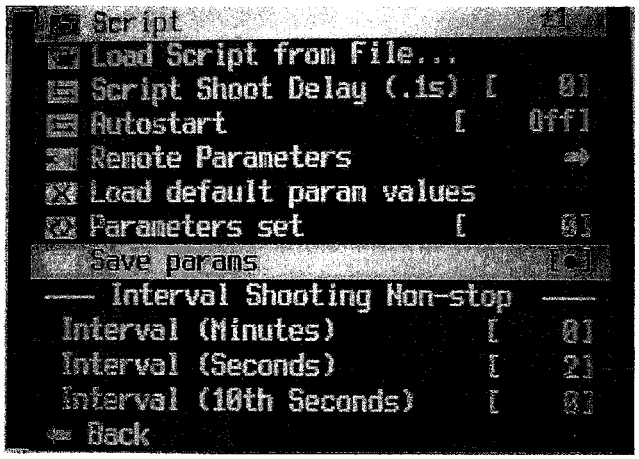


Simple steps to use

- Charge the battery
- Power on, wait until the GPS gets a lock
- Tap the "review" button to bring up the shooting menu 
- Press the shutter button to begin interval shooting
- To end the shooting, press the shutter button again

Now you have pictures of the field, the next step is unusual compared to your normal camera. Because of the custom software, the memory card is in the "locked" position. to remove the pictures, simply unlock the SD card, remove your pictures, THEN RELOCK THE SD CARD for the next use.

To alter the interval shooting

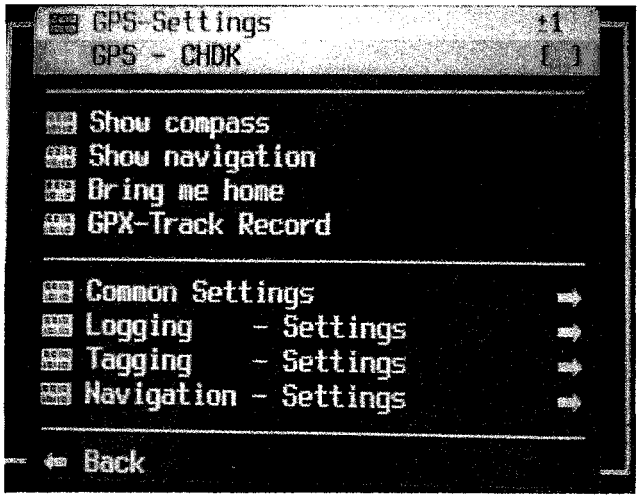


Scroll to the (seconds) and change as needed, 3 seconds will work for almost all operations

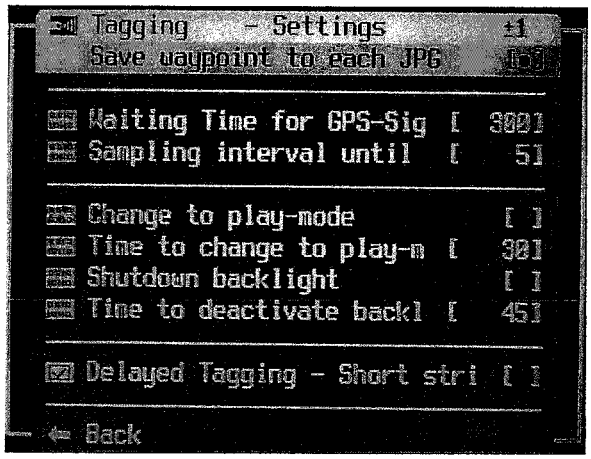
Check your GPS Settings

GPS must also be enabled in the stock Canon Camera Menu

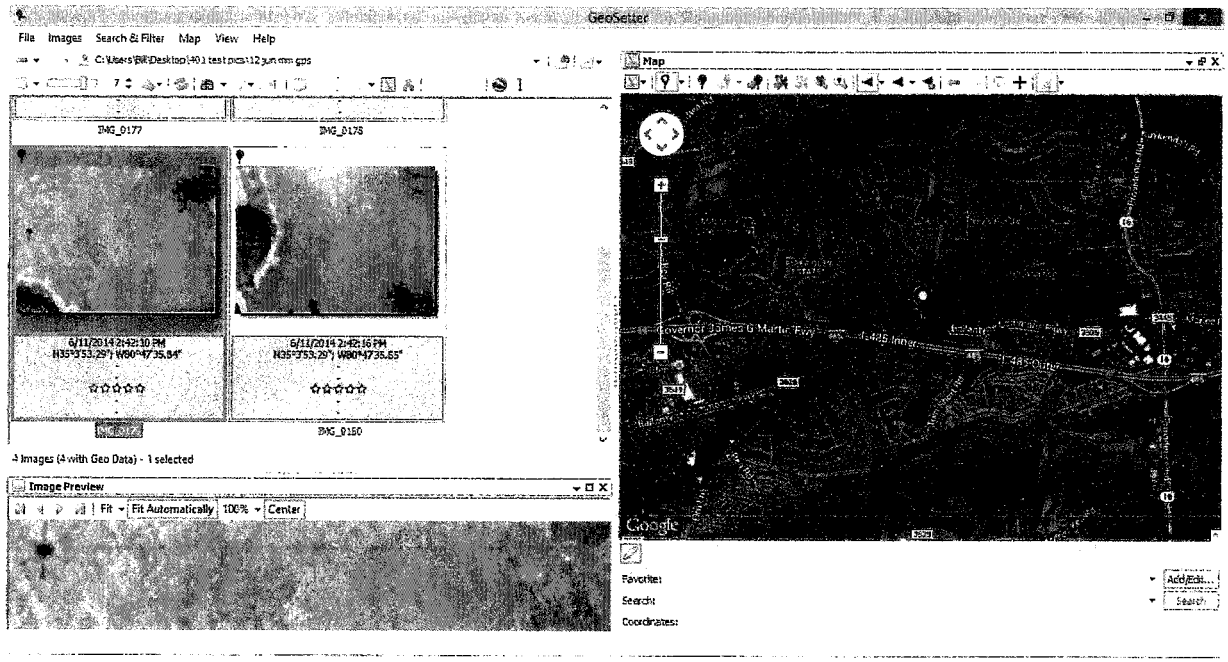
Navigate to the GPS submenu, then "Tagging – Settings"

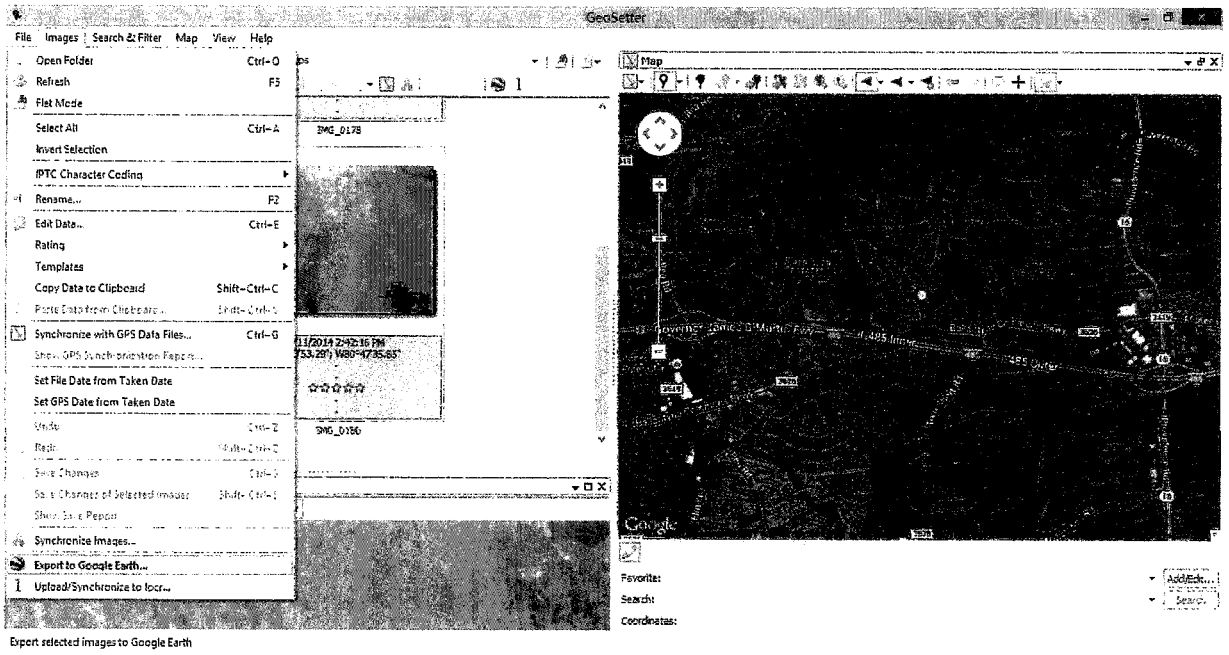


Make sure the option to "save waypoint to each JPG" is selected

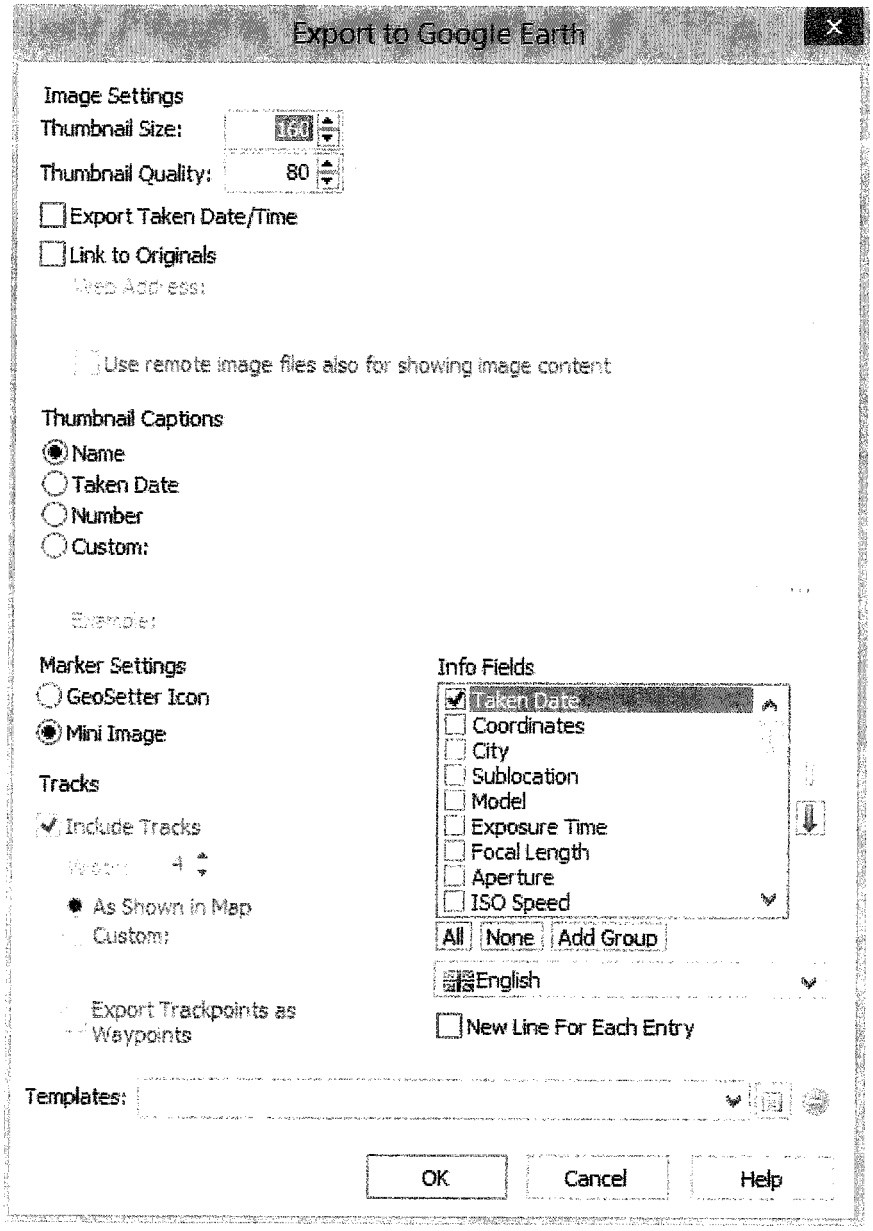

Tagging - Settings ±1
Save waypoint to each JPG [ ]
Waiting Time for GPS-Sig [300]
Sampling interval until [5]
Change to play-mode [ ]
Time to change to play-m [30]
Shutdown backlight [ ]
Time to deactivate backl [45]
Delayed Tagging - Short stri [ ]
Back

GeoSetter is an open source program that can be used to show images on a map and export a file for use in Google Earth.





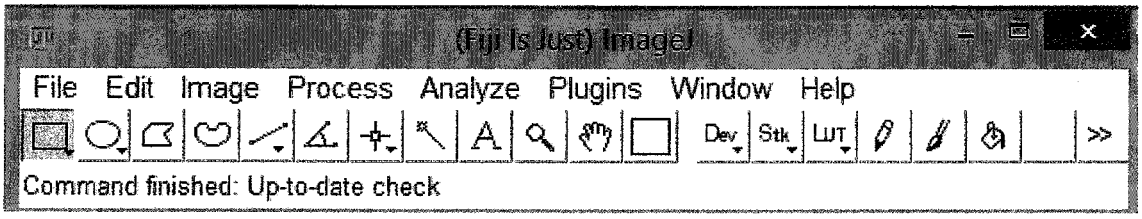
Select, export to Google Earth



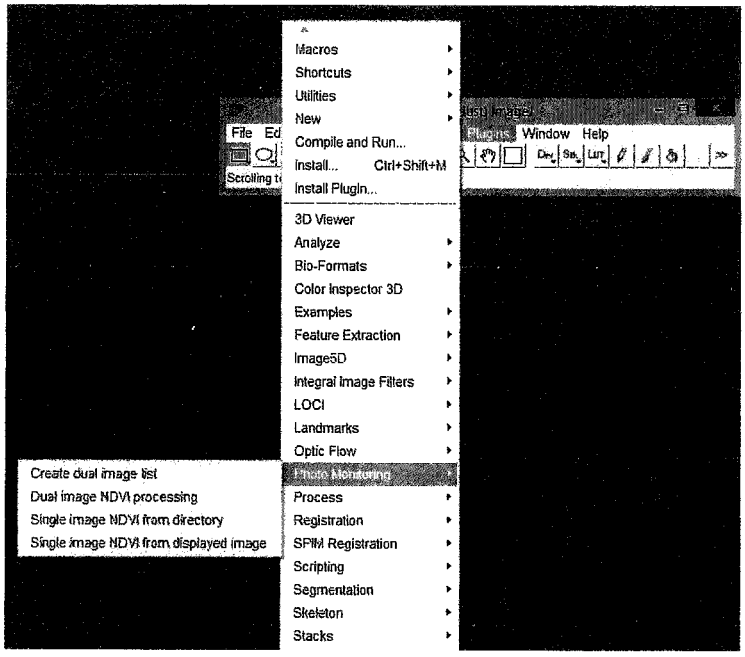
You then designate a thumbnail size and click "OK", depending on the number of images is how long it will take

Save your file where you want it and then you can load it into Google Earth on a laptop or email to a iPad/iPhone/Android device with Google Earth

ImageJ is a open source program that provides a simple way to accomplish NDVI processing from a single image

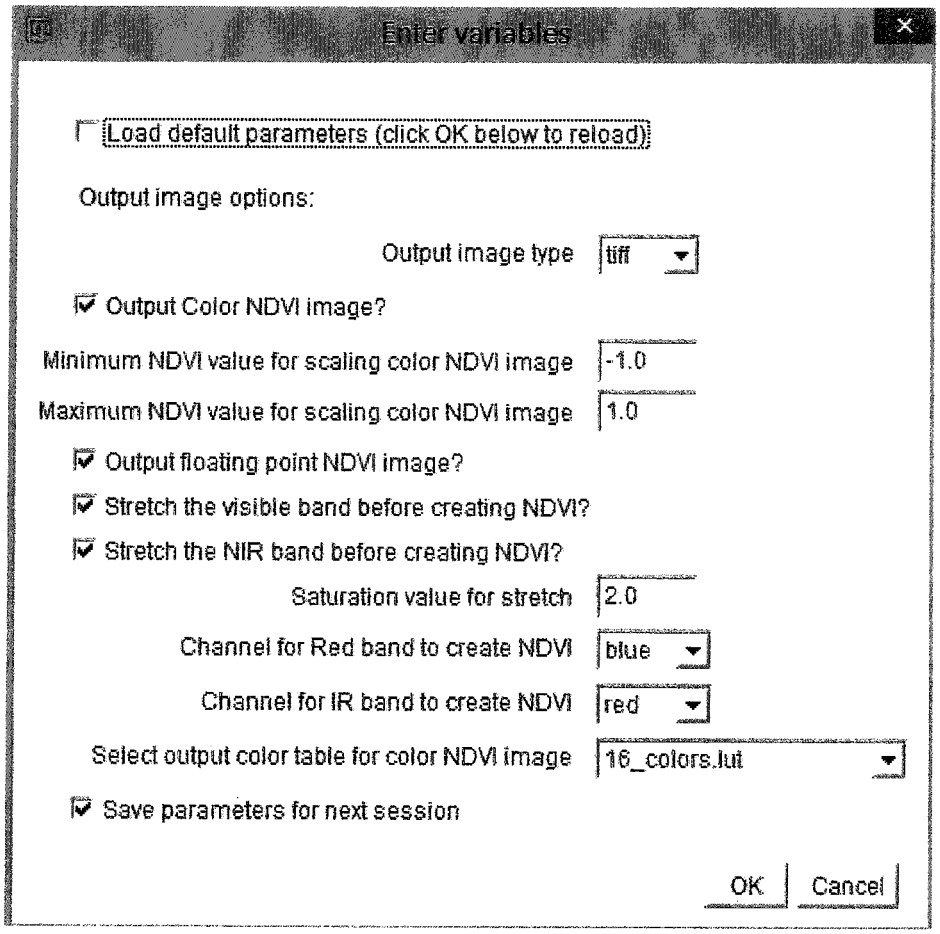


Open up ImageJ and Select "Plugins"



Then select "Photo Monitoring" and "Single image NDVI from directory"

This action will take every image in the folder and create a NDVI image



Choose your settings.

At this point you select your "input" and "output" directories (recommend 2 different folders)

Ground Station Wireless Data-link User Manual

V 2.5

www.dji-innovations.com

Disclaimer

Thank you for purchasing product(s) in DJI. Please strictly follow these steps to install all the software and hardware products, and make sure your Ground Station and Wireless Data-link work perfectly. Please use the wireless data-link in accordance with the provisions of the local radio control. Dajiang Innovation Technology Co. Ltd. assumes no liability for damage(s) or injured incurred directly or indirectly from the use of this product.

Profile

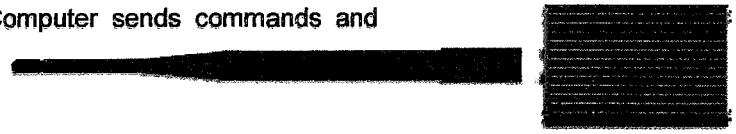
Thank you for purchasing DJI product. Please read this instruction thoroughly for proper operation of your new DJI Ground Station and Wireless Data-link. Full featured DJI Ground Station enables 3-D Map Way Points Editing, Flight Path Planning, Real-time Flight State Feedback and Auto Takeoff and Landing. This product is specially designed for the purpose of aircraft operation, BVR (Beyond Visual Range) flying in applications such as surveillance, aerial photography, etc. Working with DJI autopilot system, DJI Ground Station not only ensures stable performance and safety of the aircraft, easy operation for the pilot, but also allows the aircraft to fly along the flight path set before or modified during the flight mission in the Ground Station software autonomously. This manual covers both Single Waypoint and Ground Station products. Read this manual according to your product package. E.g., if you have WKM Single Waypoint, then you do not need to read section 4.4. Please refer to DJI autopilot manual for semi-auto takeoff and landing.

Production	ACE				WKM		
Product packages	View Mode	Joystick /Keyboard Mode	Single Waypoint	Ground Station	Single Waypoint	5 Waypoints	Ground Station
3D MapDisplay	●	●	●	●	●	●	●
Real-time Flight Monitoring	●	●	●	●	●	●	●
Flight Simulation		●	●	●	●	●	●
One Key Takeoff (WKM)					●	●	●
Joystick / Keyboard Mode		●	●	●	●	●	●
One Key Go Home			●	●	●	●	●
Click Go Mode			●	●	●	●	●
Waypoints Editing				●		●	●
				200 Waypoints		5 Waypoints	50 Waypoints
Automatic Takeoff & Landing				●		●	●
F Channel Controller				●		●	●
General Purpose Servo Action				●		●	●
						●	
Six Route Templates				●		No photogrammetry Tool	●
Photogrammetry Tool				●			●

In Box

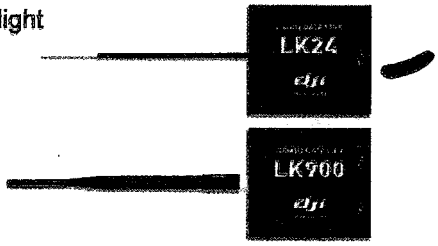
Wireless Data-link Ground End ×1

It connects to your computer. Computer sends commands and receives flight data through it.



Wireless Data-link Air End 900MHz ×1 or 2.4GHz ×1

It connects to DJI autopilot system. Autopilot system sends flight data and receives commands from computer by it.



Ground Station Install CD×1

It contains Ground Station and all required software installation files.

USB Cable ×1

For connection between wireless data-link ground end and computer.

4-Pin Cable ×1

For connection between wireless data-link air end and autopilot system.

Warranty Card ×1

It recommends the necessary conditions for using this system and related safety issues. Please fill out the customer & information card and return to DJI to register your product warranty.

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Matters Need Attention

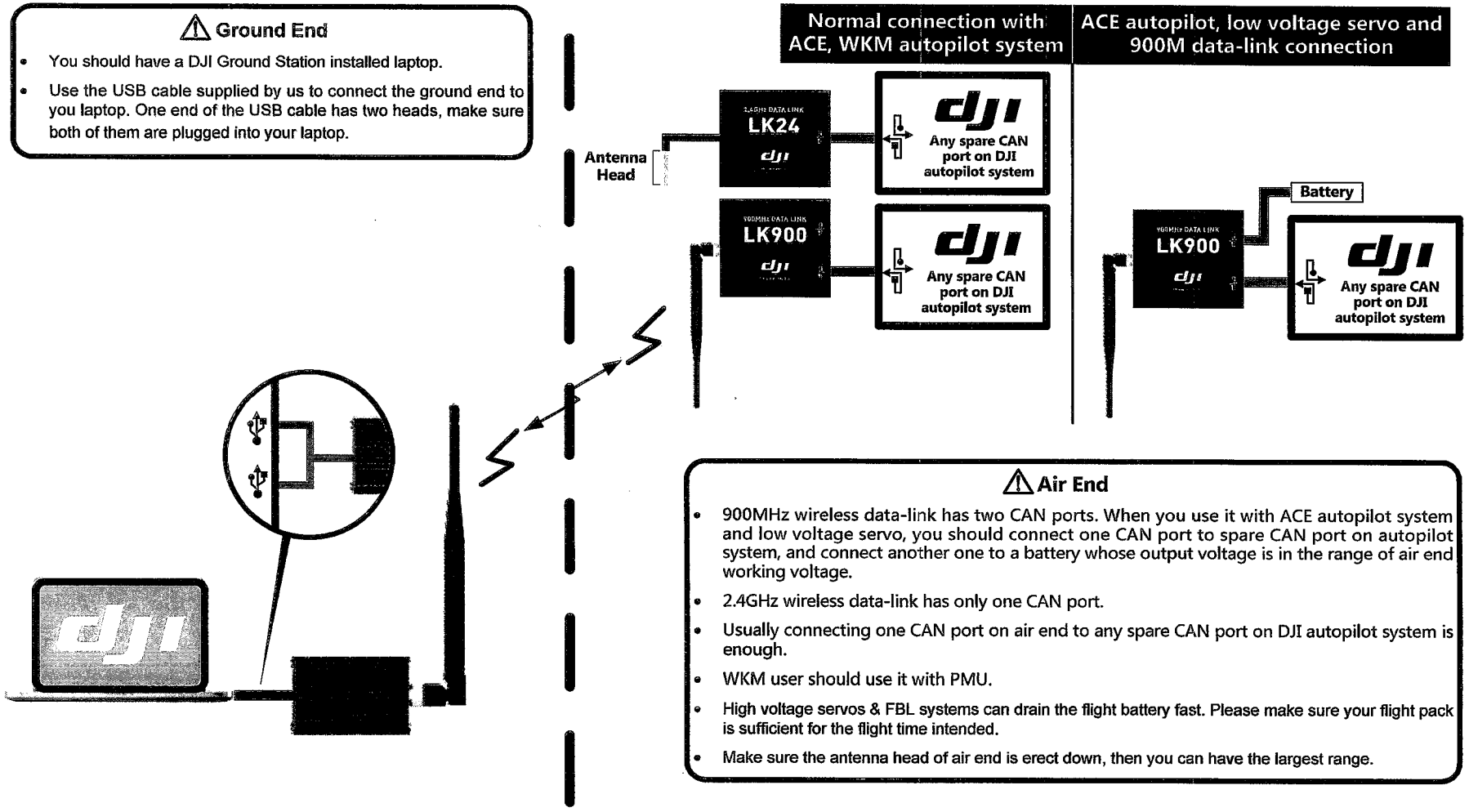
1. The ability of penetrating of radio signal from 2.4GHz wireless data-link is weak; please make sure the antenna of it is always visible to the ground end during the flight. Human body, trees, buildings or hills will stop the communication between air end and ground end.
2. You'd better put the ground end at high place. This can guarantee a good communication range.
3. Make sure the antenna head of air end is erect down, and the antenna head of ground end is erect up. Make sure there is no obstacle between antennas; otherwise the communication range will be reduced.
4. Ground end Link-Alarm red light on is distance alarm, red light off is safe. When it is on, you'd better return your aircraft.
5. When ground end Link-Alarm green light is off, this indicates the communication between ground end and air end is off, whatever the state of red light.
6. Make sure the driver is installed correctly.
7. Please choose the right com port.
8. Check out the power supply of wireless data-links before use.
9. Please close the DJI assistant software before open the ground station. Otherwise there will be port conflict.
10. Make sure the distance between 2.4GHz ground end and air end is over 1.5m; the distance between 900MHz ground end and air end is over 5m.
11. Use the right cable for connection.
12. High voltage servos & FBL systems can drain the flight battery fast. Please make sure your flight pack is sufficient for the flight time intended.
13. About control modes (Manual, Atti., GPS Atti., GPS Cruise), please refer to *ACE Control Modes* in ACE *Waypoint User Manual* and *WKM Control Modes* in *WKM User Manual*.
14. Autopilot Mode (auto mode) means: GPS Atti. or GPS Cruise Mode in ACE; GPS Atti. Mode in WKM.

If you have any problem you cannot solve during installation and usage, please contact our customer service.

Connection

⚠ Ground End

- You should have a DJI Ground Station installed laptop.
- Use the USB cable supplied by us to connect the ground end to you laptop. One end of the USB cable has two heads, make sure both of them are plugged into your laptop.



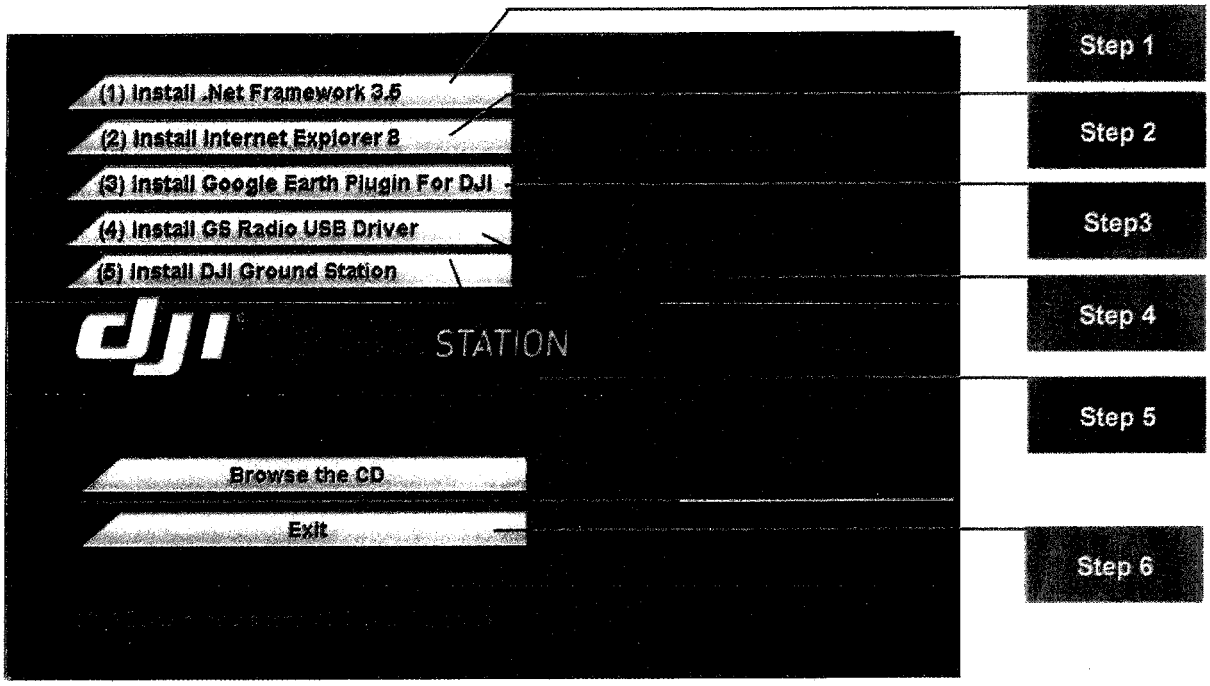
⚠ Air End

- 900MHz wireless data-link has two CAN ports. When you use it with ACE autopilot system and low voltage servo, you should connect one CAN port to spare CAN port on autopilot system, and connect another one to a battery whose output voltage is in the range of air end working voltage.
- 2.4GHz wireless data-link has only one CAN port.
- Usually connecting one CAN port on air end to any spare CAN port on DJI autopilot system is enough.
- WKM user should use it with PMU.
- High voltage servos & FBL systems can drain the flight battery fast. Please make sure your flight pack is sufficient for the flight time intended.
- Make sure the antenna head of air end is erect down, then you can have the largest range.

Ground Station Software

Install Software

- Operating system requirement: Windows XP(Needs to install sp2 patch), Vista, 7 (32-bits, 64-bits, basic version needs to install sp3 patch);
- Adobe® Reader® is required for user manual reading;
- Please follow the following install procedure strictly to install all required software.



Insert the CD to CD-ROM, auto-run window will appear.

STEP1: Check if .Net Framework 3.5 has been installed. If not, click Install .Net Framework 3.5 to install. If yes, go to step 2.

STEP2: Check if Internet Explorer 8has been installed. If not, click Install Internet Explorer 8 to install. If yes, go to step 3.

STEP3: Click Install Google Earth Plugin For DJI to install Google Earth.

STEP4: Click Install GS Radio USB Driver to install driver.

STEP5: Click Install DJI Ground Station to install GS.

STEP6: Click Exit to finish installation.

Start Software

Start Window

(1)Start the Application of GS

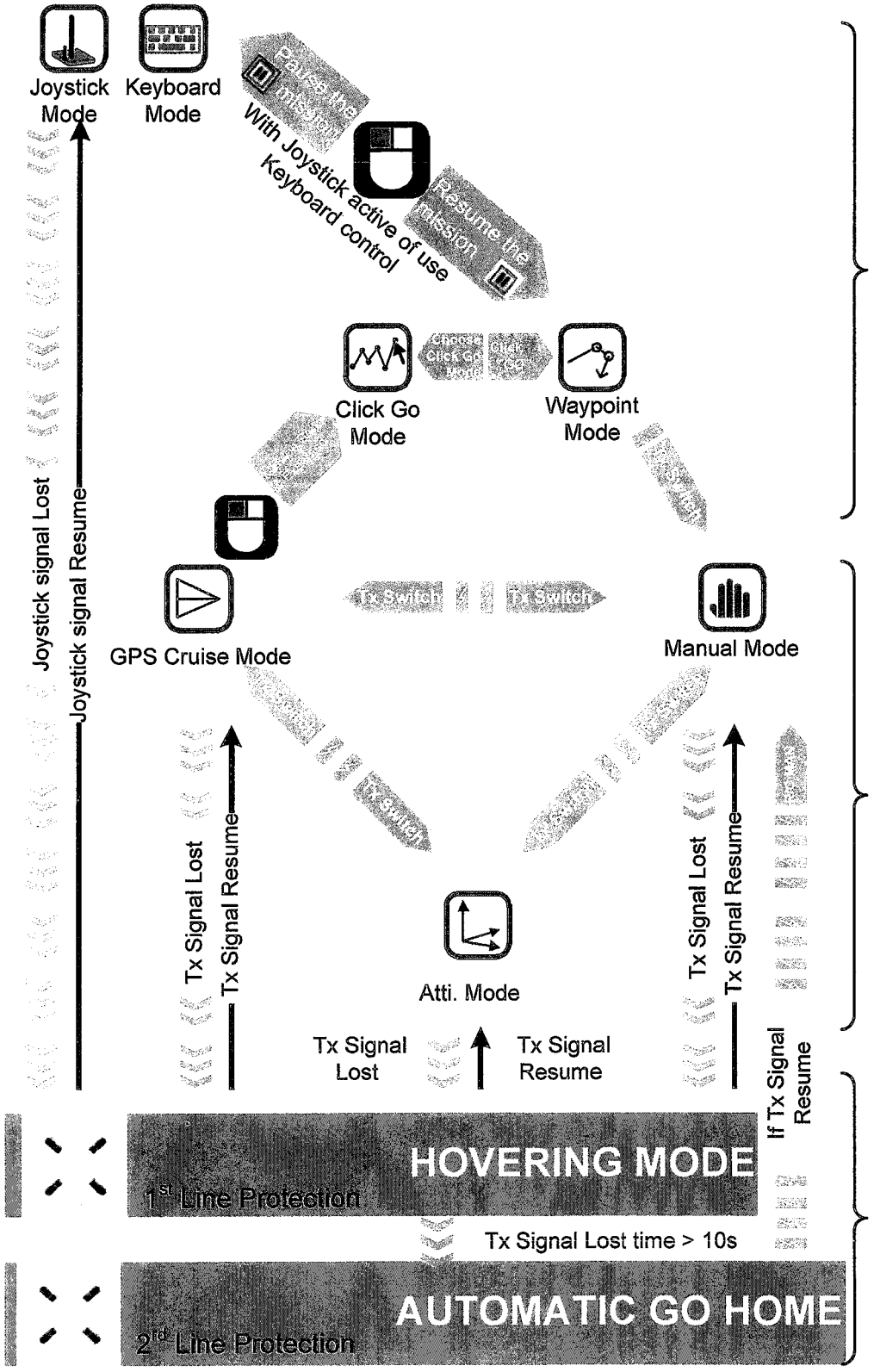
- Network Detection, if the Network connection fails, it will go offline mode automatically.
- You also can go into offline mode by clicking the OFFLINE MODE button.

(2)Connect to Main Controller

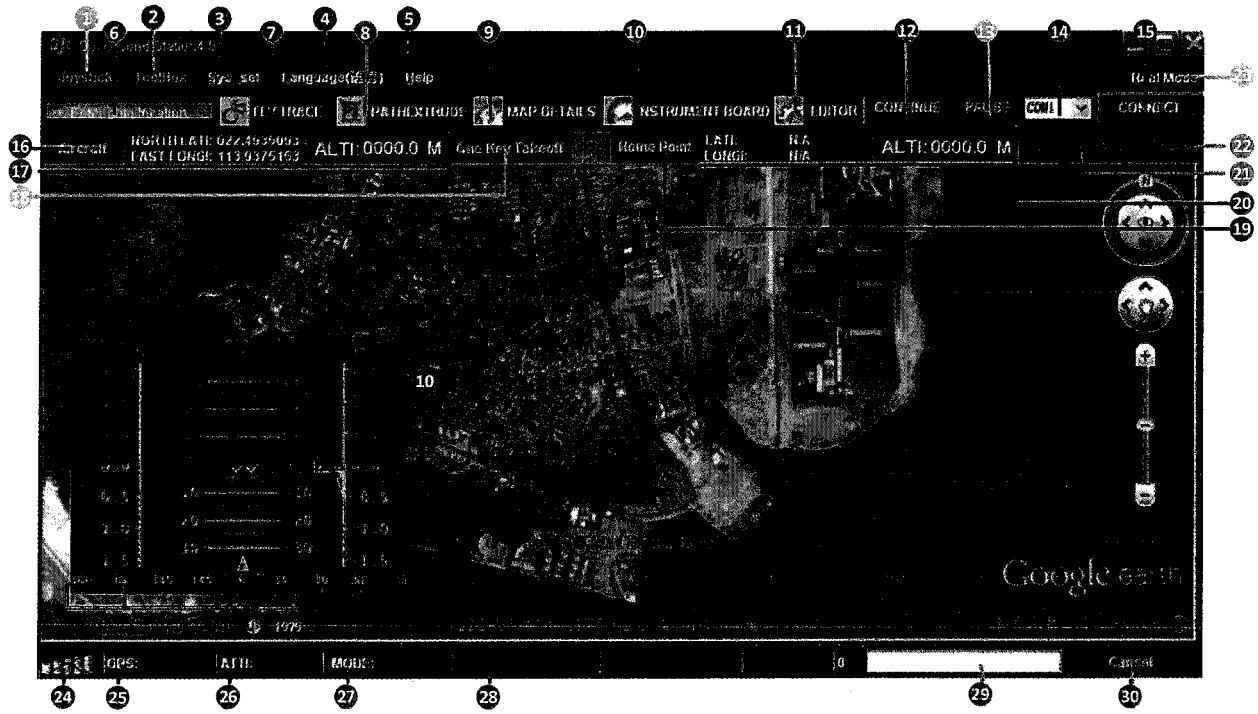
- Click Connect button on the upper right corner to connect to DJI autopilot main controller.
- If errors are showed, it means there may be some problem on connection, please check.

Application

Control Mode Switch



GUI



GUI Instruction

1. Joystick:
   - ➔ Stick: Choose your input equipment.
   - ➔ Choose Calibration: Joystick calibration.
   - ➔ Channel Mapping: Joystick channel mapping.
2. ToolBox:
   - ➔ Click Go Mode: A real-time single waypoint function.
   - ➔ F_ChannelController: Customize F channels function of Main Controller.
   - ➔ Relative Coordinates Editor: Add a new waypoint relative to current waypoint.
   - ➔ Route Template: Route library.
   - ➔ Action Config: General purpose servo action configuration.
   - ➔ Photogrammetry Tool: Photogrammetry toolbox.
3. Sys_set→Options:
   - ➔ Basic Setting:
     - Sound: Turn on or off the sound.
     - Instrument Board Style: Choose different style of the Instrument Board.
     - Action Setting: Action number display interval.

- Pause Mode Control Interval: Frequency of data packages sent to MC.
- Target Line: Line between aircraft and current target.

➔ Data Link Setting:

- The waypoint number of one package.
- Upload one package.
- Retry one package timeout.

Sys_set→Altitude offset: Set up the altitude offset.

- Height: Height mode.
- Elevation: Elevation mode.

Sys_set→Data Record Folder: Include both Log and Mission Folders, for saving log files and flight route files.

4. Language(语言): Click to change language, English or Chinese.
   ➔ 中文.
   ➔ English.
5. Help:
   ➔ Check for Update: Update software here.
   ➔ About: Check your DJI Ground Station version here.
6. Enter location: Go to the location of your input.
7. Fly Trace: Click to show the trace of aircraft.
8. PathExtrude: Click if you want to see flight Path Extrude during mission editing.
9. Map Details: Click to see map details.
10. Instrument Board: Click if you want to display instrument board.
11. Editor: Click if you want to display mission editor.
12. Continue: If you switch into autopilot mode from waypoint mode, click Pause then click Continue, the aircraft will continue the remaining (Unfinished) mission.
13. Pause: Mission pause.
14. Serial port selection.
15. Connect: Click to connect to main controller.
16. Aircraft: Click to find aircraft location.
17. Real-time coordinates of aircraft, you can copy the data.
18. One Key Takeoff: Click to take off the aircraft.
19. Home Point: Find your home location.
20. Real-time coordinates of home location, you can copy the data.
21. Set Home Point: Change your home point.
22. Go Home: Click to go home.
23. To show Real mode or Simulation mode.

24. Signal strength: Shows the connection state between controller and ground station.
25. GPS: Real-time GPS signal quality.
26. ATTI: Real-time attitude quality.
27. MODE: Real-time control mode.
28. Other state parameters: The autopilot system decides.
    - ➔ **WKM**:
      - MotorVoltage: Battery voltage.
    - ➔ **ACE**:
      - ServoVoltage: Servo output voltage.
      - Pitch%: Real-time pitch percentage.
      - Throttle%: Real-time throttle percentage.
29. Download and upload progress bar.
30. Cancel: Cancel button.

1 View Mode

1.1 View Mode Procedures

STEP1: Check Signal Strength: shows no communication between GS and MC, please check *Troubleshooting* in *Appendix*. is constructed, can go to next step.

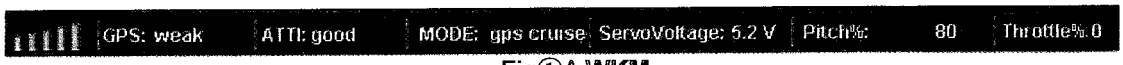
STEP2: Aircraft: When GPS signal is good enough, click Aircraft will show LATI, LONGI and ALTI of aircraft, then the aircraft logo will be showed on the map; if the aircraft logo can't be found, please double click Aircraft.

STEP3: AltitudeOffSet: Click AltitudeOffSet from Sys_set, you can just use the value recommended, and click OK. Read the paragraph below to get more details.

STEP4: Switch Height or Elevation Mode: Height mode shows relative height, and the 0 meter is the aircraft height when you choose Height mode, above 0 is positive and below 0 is negative. Elevation mode shows height above sea level, figure is showed in Fig②

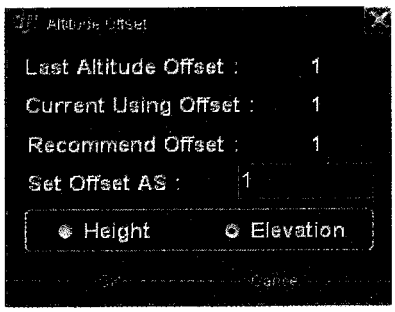
STEP5: Home Point: Home point can be found only when GPS signal is good enough. If WKM, Home Point is 20 meters above the aircraft position where user pushes the throttle stick first time; while ACE is 30 meters.

STEP6: View Fly Trace, Instrument Board and State Information: For displaying flight track and aircraft state. Contents are decided by autopilot system. Fig①A will be displayed if you are using WKM; Fig①B will be displayed if you are using ACE. Instrument Board is showed in Fig③.

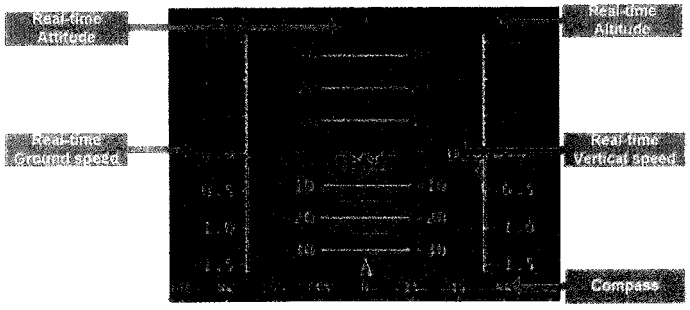


Fig①A **WKM**

Fig①B **ACE**



Fig②



Fig③

1.2 System Setting

System Setting includes Options Setting, Altitude Offset Setting and Data Record Folder.

(1)Options

Tips:

Click DEFAULT to retrieve default parameters.

The Options setting includes both Basic Setting and Data Link Setting.

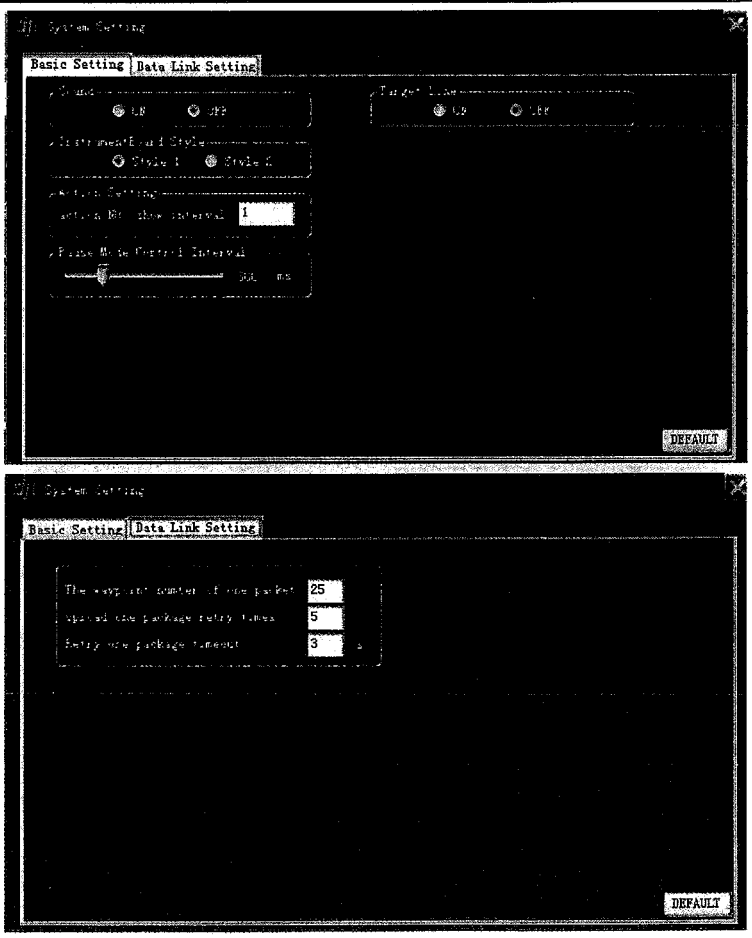
Basic Setting

- Sound: If switch on, there will be alarm sound when the radio signal is bad.
- Instrument Board Style: Choose different instrument board style.
- Action Setting: Set action number display mode. For example, 3 means that a mark will be displayed every three action intervals.
- Pause Mode Control Interval: Time interval of sending commands to the MC when use joystick or keyboard in pause mode, the smaller interval, the more fine control.
- Target Line: Display a line between aircraft and current target when switch on.

Data Link Setting

Setting parameters for the communication between MC and GS. Usually just keep DEFAULT parameters.

- The waypoint number of one package
- Upload one package retry times
- Retry one package timeout



(2)Altitude Offset Setting

- GIS database (Google Earth™) is not precise, while Flight Path Mountain and other obstacle/building collision checking feature performed based on this database, which is not real-time or up-to-date. Google Earth™ plug-in is only for the purpose as a general landscape browser, for quick way points positioning without much safety guarantee.
- Pressure sensor is used for altitude sensing, leading the result varies according to weather. Therefore, you might have different altitude values on the same location at different times. However, its relative height may be far from precise than absolute altitude information in GIS.
- Due to above problems, the following method for relative flight height calculation would be most reliable.

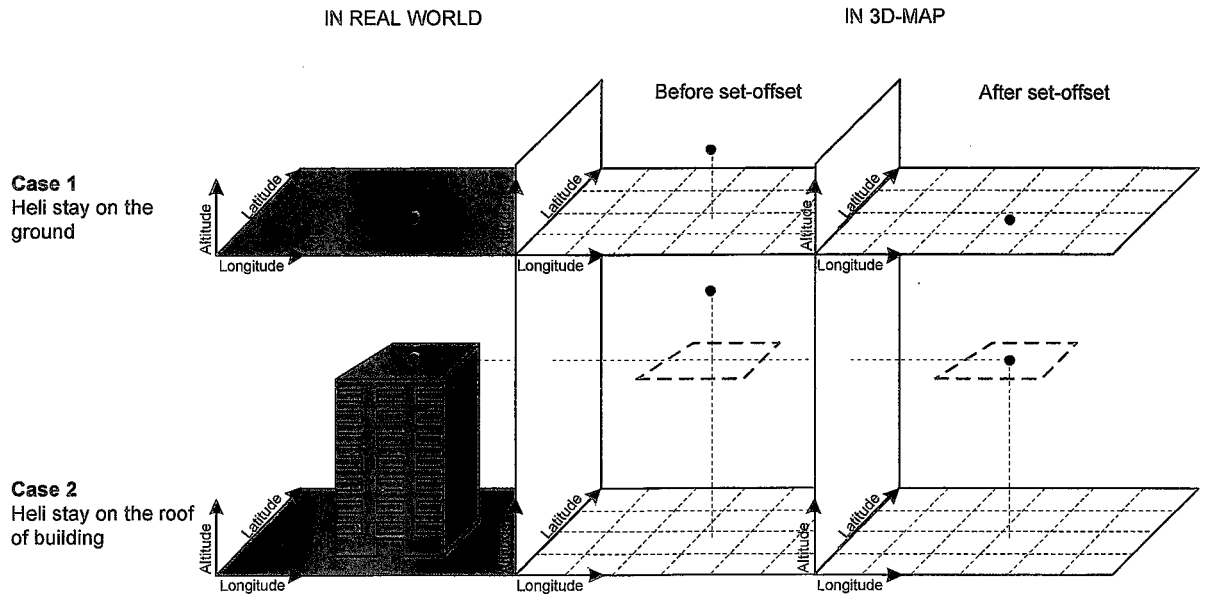
  1) Record the aircraft altitude before take-off, as L_{Gound}

  2) Way point altitude = Relative Flight Height + L_{Gound}

  Please keep in mind that this method is the most reliable way for flight path collision precaution.
- The Altitude Offset value given is only for the purpose to avoid visual confusion, such as Case 1 in fig.① shown below. The aircraft represented by the red point was located on the ground in real world but floating in the sky within 3D-Map. You have to give a negative offset value to reduce the aircraft altitude for visual effect only. The calculate altitude offset function will give you a suggestion for offset setting but not guaranteed to be correct. Because if the aircraft is landed on the roof of the building as in Case 2 in figure shown below, and the building information will not appear in GIS database, which means you cannot use the same method as in Case 1. You should calculate this offset value with a known or estimated building height.

Tips:

We highly RECOMMEND you to consider the relative flight height discussed during flight mission editing.



(3)Data Record Folder

- Log Folder: Ground Station data recording function which is for recording all data transmitted and received by radio module. You can open the log files in this folder by notepad. You can send the log files to DJI customer service for analysis if you have any usage problems.
- Mission Folder: Auto saves each flight route. You can open these files by Editor.

2 Joystick/Keyboard Mode

Joystick/Keyboard mode is the 2nd permission for users, and Fly Simulation, One Key Takeoff and Joystick/ Keyboard functions can be operated.

2.1 Simulator

Pre-Flight Simulation aims to help you getting familiar with the Ground Station software. A successful flight under simulation mode does not guarantee your aircraft to work successfully in real world, since it is only a virtual environment based on the assumption that your aircraft is working under perfect condition with infinity power supply, favorable weather, and also that the GIS & GPS are providing 100% correct and precise information. The aircraft physical model in simulator might not perform the same flight characteristic as your real aircraft.

Notices:

ENSURE the following requirements whenever during/before Simulation Mode:

1) You MUST NOT take off your aircraft.
2) You MUST NOT turn on your aircraft engine/motor.
3) You CAN disconnect the power supply for electric motor, or disconnect the throttle control servo motor for fuel engine. Otherwise, incorrect operation could result in serious personal injuries.

Please follow the steps strictly for Simulation Mode use:

STEP1 Connect the whole main control system completely, including IMU、GPS, etc.

STEP2 Hold Ctrl then Right click, you will see simulate, and the aircraft logo will be at the current mouse position.

STEP3 Click simulate, you will see a "Warning" window.

STEP4 Click Yes to turn on Simulate Mode. Now GS is in Simulate Mode!!!

Notices:

- We HIGHLY RECOMMEND Simulation Mode for practicing purpose for flight mission edit, try to get familiar with all the operations of your Ground Station as much as you can.
- The simulation model requires a complete main control system connection, and you can reference to *Assembly* in DJI autopilot system user manual.

2.2 One Key Takeoff

Notices:

One key takeoff is a function especially for WKM, that can be used only in autopilot mode and when GPS signal is good.

Messages may be showed as follows:

Successful takeoff message
"The aircraft is auto Takeoff!"
Error messages
"Auto Takeoff failure, GPS is not ready!"
"The aircraft is Takeoffing!"
"Auto Takeoff failure, the aircraft is already flying!"
"Auto Takeoff failure, please switch to auto mode!"

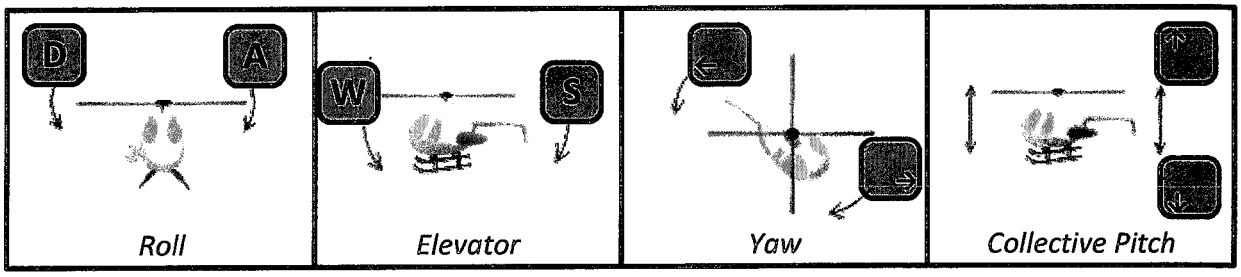
2.3 Joystick and Keyboard Mode

Please ensure GPS signal is good enough, the aircraft is already flying in air, and the control mode is autopilot mode; then click Pause, choose joystick or keyboard mode, Fig.① shows that keyboard is chosen, and then you can use keyboard control the aircraft.

Fig①

Keyboard Mode

Use keys W, S, A, D, ↑, ↓ and ←, →to control the aircraft. A, D for Roll, W、 S for Pitch, ←, →for Rudder and ↑, ↓for Throttle. For example, use helicopter to be aircraft model, shown as Fig.②.



Fig②

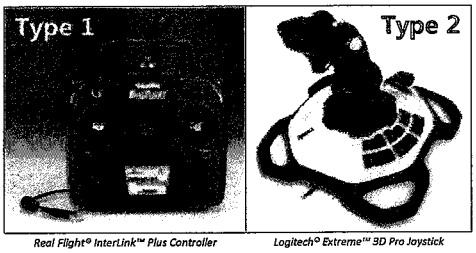
Joystick Mode

➔ Requirement

Joystick control based on a third party hardware controller, you can choose your preferred device based on the two types of joystick indicated below (Fig③).

Type 1: Traditional R/C style flight simulation controller; or your R/C Tx with a third party simulator link.

Type 2: Linear single stick 3D controller.



Fig③

➔ Technology Requirements

- At least 4 linear control channels are necessary; otherwise the joystick function will not work properly.
- Use USB connection.

➔ Connection

Joystick→Choose Joystick

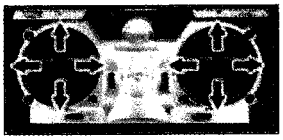
Refer to the user manual of the specific controller / Joystick you choose, and ensure the USB cable is properly connected.

Notices:

Please ENSURE the Joystick is properly connected physically, do not disconnect the joystick connection when Joystick Mode is activated.

➔ Calibration

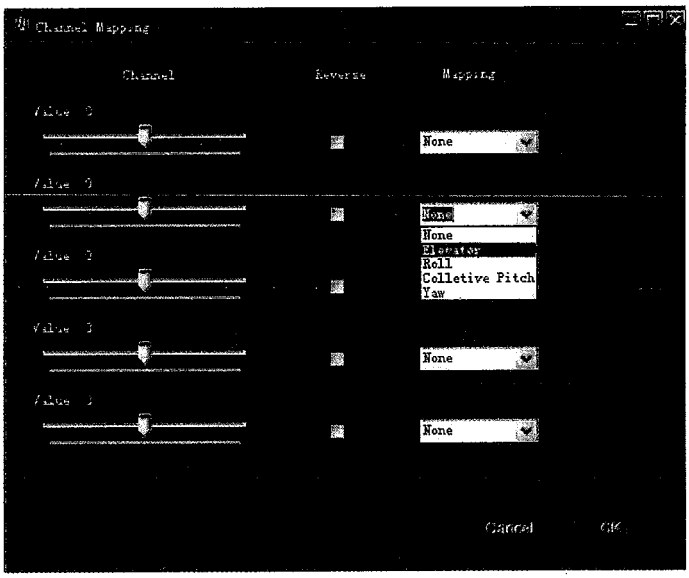
Joystick→Calibration

Steps	Joystick (Type1)	Type1	Type2
Step 1		Place all trim levers (for physical fine turning) in their neutral, or centered position. Click Next.	For Type 2 controller, might not have these physical fine turning levers. Click Next.
Step 2		Center all the sticks. Click Next to continue.	Center all stick including throttle stick. Click Next to continue.
Step 3		Move all sticks through their motion range completely several times. When completed, click Finish.	Move the sticks through their 3D motion range completely several times, including pitch. When completed, click Finish.

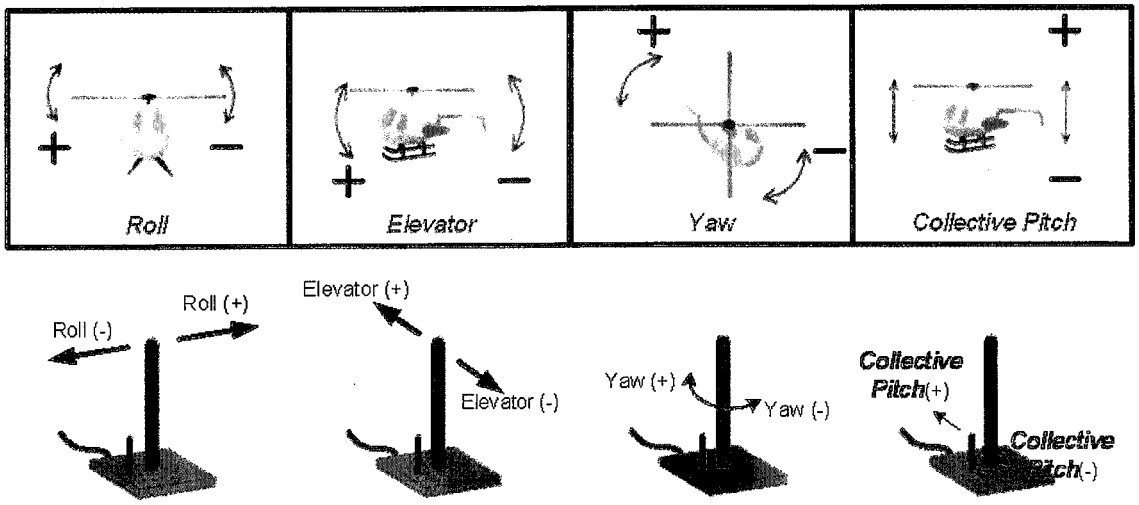
➔ Channel Mapping

Joystick→Channel Mapping

- Each control channel can be reversed, and mapped to one of the control functions listed in corresponding drop down boxes.(Fig①)
- These control function are 'Roll', 'Elevator', 'Yaw'&'Collective Pitch', they represent the cyclic and rudder control of your aircraft. use helicopter for example, shown in the figures below(Fig②). Where the '+' represents positive channel value, '-' represents negative channel value.
- Push your joystick, and the channel value feedback will tell whether it matches with suggested joystick control direction or your own settings, and then make your adjustments. For Type 1 controller, please refer to the controller's manual.



Fig①



Fig②

3 Click Go Mode

Click Go Mode is a real-time single waypoint flight mode. Under this mode, you can send a waypoint to your aircraft immediately.

STEP1: Please ensure GPS signal is good enough, the aircraft is already flying in air, and the control mode is Autopilot Mode (ACE is GPS Atti. or GPS Cruise Mode, WKM is GPS Atti. Mode).

STEP2: Click ToolBox→Click Go Mode to open the window as the figure shows.

STEP3: Click Enter Click Go Mode. Now the aircraft will go into hovering station.

STEP4: Input the waypoint Altitude and aircraft Speed.

STEP5: Hold the Space key on the keyboard, move the mouse in the 3D map, left click to set the waypoint. Then the aircraft will fly toward this waypoint immediately. You can also set a new waypoint during the flight.

STEP6: Click Exit Click Go Mode, the aircraft will hover again.

STEP7: Click CONTINUE button to continue the previous flight.

Notices:

- The aircraft will go into hovering station while the MC isn't receive a heartbeat package from the GS in 5 seconds;
- The aircraft will go into auto go home while the MC isn't receive a heartbeat package from the GS in a minute.

Tips:

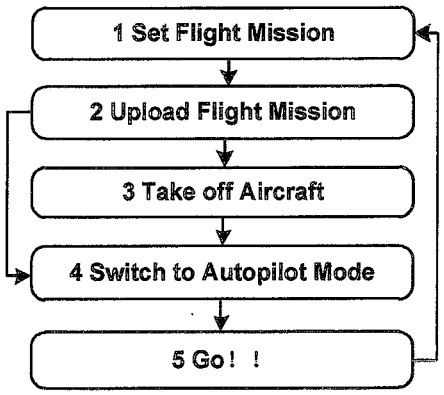
When in the Click Go Mode, all Tx control sticks are disabled. To regain control using the Tx, flip the mode switch to Manual mode, and then to other control modes (ACE: Atti, GPS Atti, or GPS Cruise mode; WKM: Atti, GPS Atti).

4 Waypoint(Single Waypoint User Skip This)

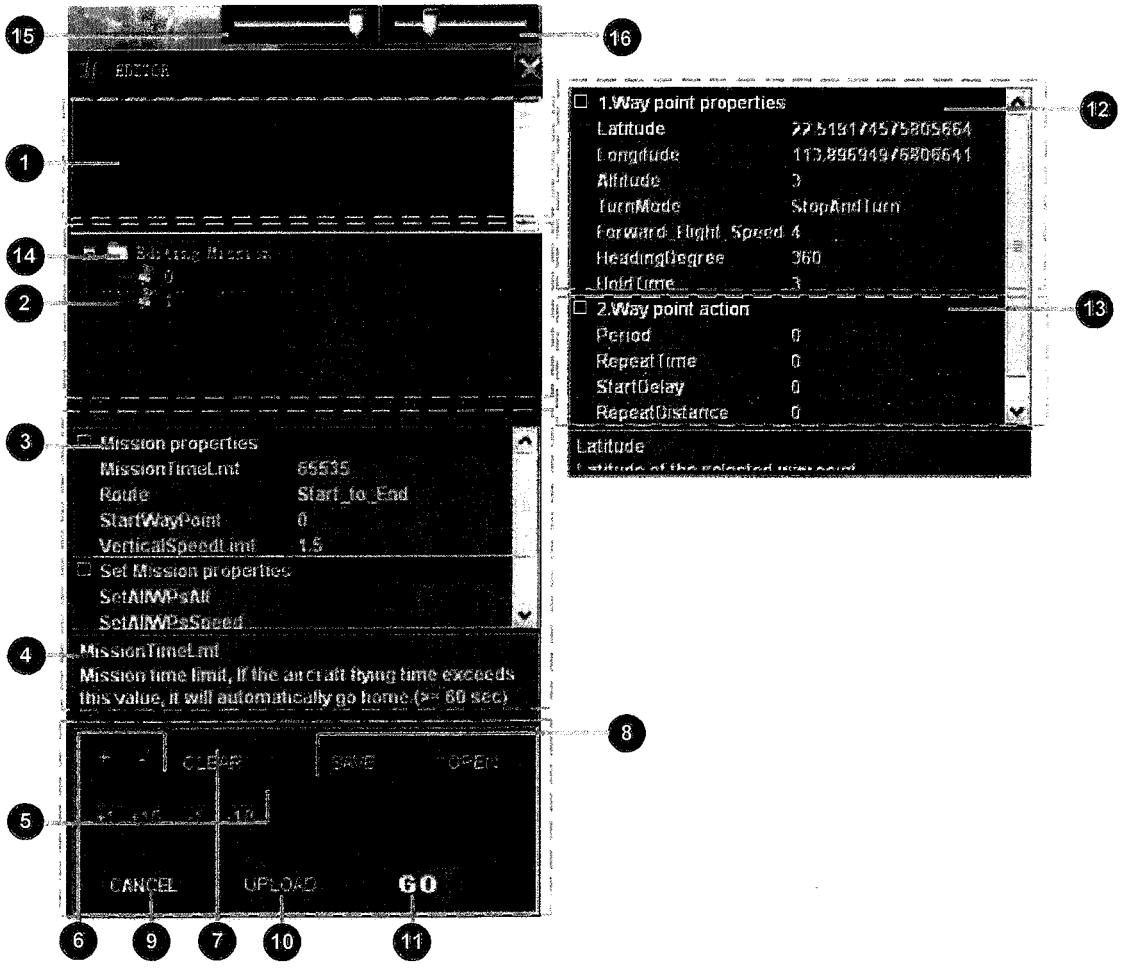
Waypoint package includes Waypoint Mode, Auto Takeoffing/Landing, F Channel Controller, General Purpose Servo Action, 6 Pre-Programmed Route Templates and Photogrammetry Tool.

4.1 Waypoint Mode

See the flow chart to get the information about Waypoint mode operation.



Mission Editor



Instructions

1) LOG to print info. Such as: upload success, upload failed...

2) Waypoint list: You can click icon + before Editing Mission to show all waypoints in the table.

3) You will see Mission properties if **14)** selected.

➔ Mission properties

- MissionTimeLmt: If the flight-time exceeds the value (>=60sec), it will go home automatically.
- Route: The mission execution mode selection: includes both modes of Start_to_End and Continuous.
- StartWayPoint: Define the first way point that the aircraft goes to after clicking GO. Select the proper way point index number listed.
- VerticalSpeedLimit: Vertical speed for up or down direction, unit is m/s.

➔ Set Mission properties

- SetAllWPsAlt: Set altitude of all waypoints.
- SetAllWPsSpeed: Set speed of all waypoints.
- SetAllWPsTurnMode: Set turn mode of all waypoints: StopAndTurn, Bank_turn , Adaptive_Bank_Turn and None.
- SetAllAction: Setup the parameters of a set of repeat actions.

4) Description of selected item.

5) Altitude change 10m or 1m per click.

6) Add new way point by click+, and then left click on the map. Or left click on the map with Ctrl. Click- to delete the selected points.

7) Clear: Click the Clear button to delete running mission or editing mission on the map.

8) Save and Open the mission.

9) Cancel all edited waypoints.

10) Upload the mission to Main Controller.

11) Click Go to execute assigned mission, including Auto Take off as assigned.

12) Show Waypoint properties. Any item in Editing Mission selected is writeable; Assigned Mission is read only.

➔ Latitude & Longitude: Units are in degree.

➔ Altitude: Unit is in meters.

➔ TurnMode: Set the turn mode individually.

➔ Forward_Flight_Speed: Velocity from previous point to current point is limited to <= 25 m/s.

➔ HeadingDegree: Heading degree facing this way point, unit in degree.

➔ HoldTime: The time to stay at this waypoint, unit in second.

13) Waypoint Action properties

➔ Period: (Unit: second) Setting the time period of the action.

➔ RepeatTime: Setting the repeat time of the action assigned.

➔ StartDelay: (Unit: second) Setting when to activate assigned servo actions if the flight arrives this way point.

➔ RepeatDistance: (Unit: meter.)Setting the repeat action in distance.

15) Set the editor box transparent.

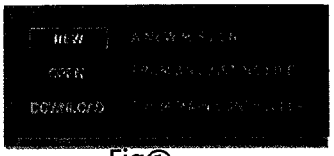
16) Set the editor box size.

(I) Flight Mission Setting

STEP1: Click to open the mission editor, see fig.①.

STEP2: Click New to edit a new mission.

STEP3: Add waypoints.



Fig①

➔ Add waypoints

There are two ways on adding waypoints. A maximum of 200 waypoints can be added in the ACE waypoint mode, and a maximum of 50 waypoints can be added in the WKM waypoint mode. If selected, the waypoint will change to be green, see fig.②.

Fig②

(1)Add Point by Point

STEP1: Click +, or press Ctrl.

STEP2: Left click on the 3D-Map where the locations you want to add a way point.

Tips:

Repeat above procedure if you wish to add more new waypoints. The initial waypoint index will be 0, incremented by 1 each new way point is added. If you want to insert a point before another point, you can move the mouse over the point then press Ctrl with Left click.

(2)Using Relative Coordinates Editor

After the first waypoint, you can use Toolbox ->Relative Coordinates Editor to add new points.

STEP1: Select one waypoint, then press Shift+P you will see the input window shown as fig.③.

STEP2: Use Tab to switch between these two input frames.

STEP3: Input the relative coordinates: Angle is the relative angle to the north of current waypoint; Distance is the relative distance to the current waypoint.

STEP4: Press Enter, then you will see a new waypoint after the current waypoint.

Fig③

➔ Delete Way Points

STEP1: Select waypoint either in map or in Editing Mission Menu, and the selected waypoint is in green;

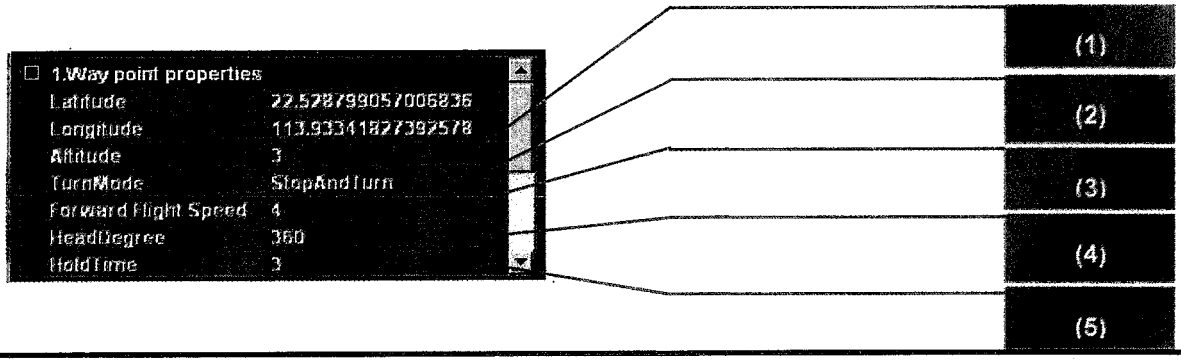
STEP2: Click - or press delete to delete all the waypoints added.

Tips:

Repeat above procedure to delete more. Click CANCLE to delete all the way points added.

➔ Waypoint Properties Editing

Select the way point in 3D-Map or in the Editing Mission Menu. See figure as following, Altitude, TurnMode, Forward Flight Speed, HeadDegree and HoldTime can be set, then press Enter to confirm.



(1) Altitude

The altitude (unit m), if pointed to height mode, means relative height; otherwise altitude mode means the waypoint altitude.

- Edit the altitude of each waypoint by clicking the [redacted].
- Type in the precise altitude in the box.

(2) TurnMode

There are three different turn modes for the aircraft at each waypoint: StopAndTurn, Bank_Turn and Adaptive_Bank_Turn. The default turn mode in the system is StopAndTurn. Change it according to the following steps.

The Hold Time in waypoint property is deactivated if Bank_Turn or Adaptive_Bank_Turn is chosen.

- Make a selection from the drop down box after TurnMode for mission execution mode.

(3) Forward Flight Speed

This Speed is the air speed of aircraft flying to specific way point editing. (Unit in m/s).

In Waypoint Mode, the default speed is 4m/s, and the maximum speed allowed is 25m/s.

- Type in the precise Forward Flight Speed in the box.

(4) HeadDegree

When the aircraft arrives at a given point where to head towards a certain direction, you can use this value. (Unit in degree).

- Input the degree value in the item.
- Right click waypoint and hold on, then move wheel or press ↑, ↓ to change head degree.

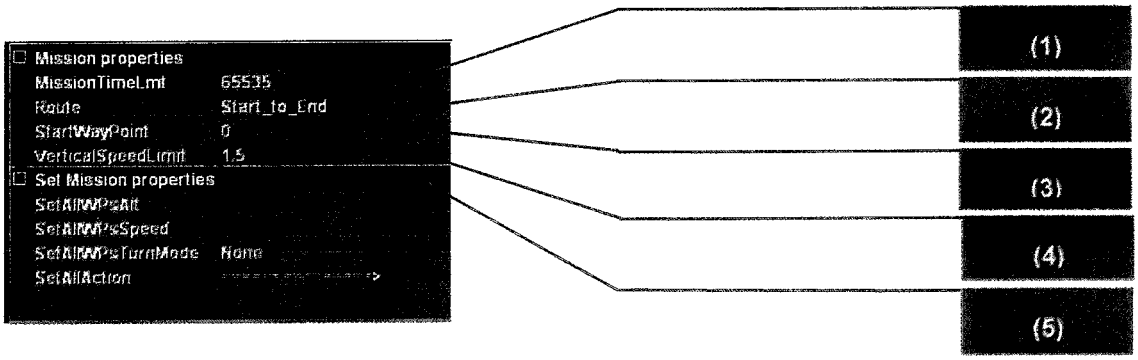
(5) HoldTime

Sets the time to stay in a particular waypoint, not for Bank_turn, only for StopAndTurn (In second).

- Type in the time to stay in a waypoint after the TimeHold in the box.

➔ Mission Properties Editing

Click Editing Mission and the Mission properties figure shown as following. Please set MissionTimeLmt, Route selection, StartWayPoint, erticalSpeedLimit and Set Mission properties, and press Enter to confirm.



(1) MissionTimeLmt

If the aircraft's flying time exceeds the value, it will go home automatically. (Default value is 65535sec. Min value is 60sec, Max value is 65535sec.)

- Type in precise time in the box after MissionTimeLmt.

(2) Route

Selection route modes: Start_to_End or Continuous. Start_to_End: execute once from start point to end point; Continuous: repeat from start point to end point. (Default setting is Start_to_End.)

- Make a selection from the drop down box after Route for mission execution mode.

(3) StartWayPoint

Setting for start waypoint from the existing waypoint indexes. (Default start waypoint is 0.)

- Make a selection from the drop down box after StartWayPoint from the existing way point indexes.

(4) VerticalSpeedLimitSetting

This Speed limit is the absolute velocity of aircraft in vertical direction, up or down (Unit in m/s). The default vertical speed limit is 1.5m/s and the maximum speed allowed is 5.0m/s.

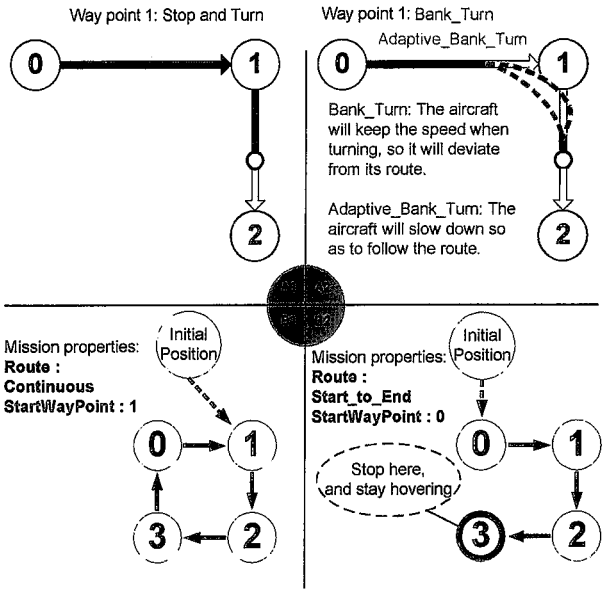
- Type in the precise speed in the box after VerticalSpeedLimit.

(5) Set Mission properties

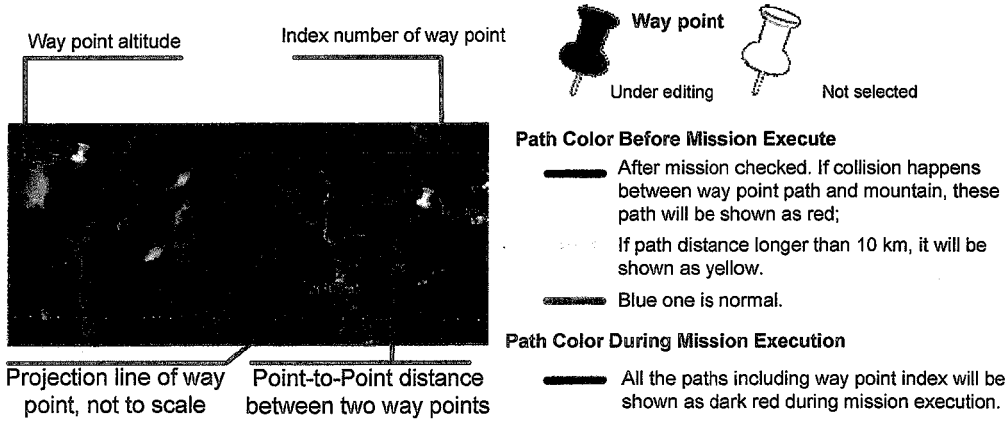
- SetAllWPsAlt
- SetAllWPsSpeed
- SetAllWPsTurnMode
- SetAllAction

The properties setting above, once set, then all the destinations will change and be the same; if a single waypoint's properties are set individually, then the corresponding waypoint properties will change.

- **Examples for Way Point turning mode:** Shown as figure A1/A2 as following.
- **Examples for Mission/Way Point properties setting**: B1/B2 Selection for the state of Route, and StartWayPoint.



- **Examples for path of way point:**



→ Mission Save & Load

Mission Save

STEP1: Click SAVE to save mission edited.

STEP2: Choose a name with extension '.awm'. For Example: DJI_Mission_20100101.awm.

Mission Load

STEP1: Click OPEN to load mission saved; choose mission file with extension '.awm'.

Notices:

The Altitude offset value will not be saved in mission file. Please set it every time!!!

(II) Upload Flight Mission

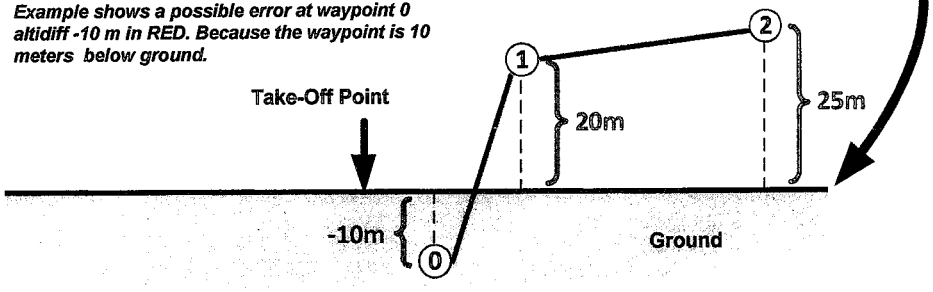
Final Check & Mission Transmitting: Click UPLOAD on the upper bottom of the mission Editor to send flight mission to DJI autopilot main controller. Here a mission review table as following example will appear for mission final check. Press OK. The mission is ready to be executed after synchronized successfully.

Example of "Mission Review" table under 3 waypoints mission

Waypoint	Latitude	Longtitude	Altitude	Speed	Turn Mode	Altidiff	Action Module
0	xxxxx	xxxxx	xxxxx	4	StopAndTurn	-10	NULL
1	xxxxx	xxxxx	xxxxx	6	StopAndTurn	20	In meter
2	xxxxx	xxxxx	xxxxx	15	StopAndTurn	25	In second

Number **[Altidiff]** is the current relative height from waypoint(s) to aircraft.
Number **[Take Off Point]** is the relative height from waypoint(s) to take-off location.

Example shows a possible error at waypoint 0 altidiff -10 m in RED. Because the waypoint is 10 meters below ground.



Tips:

After synchronization, if mission is re-edited, you should re-do the synchronization.

(III) Take off Aircraft

After finishing all the above steps, take off the aircraft in one of three takeoff modes. If you want to use Auto Takeoff and Landing function, please skip the step III and go to Step IV directly. You can take off your aircraft in Manual Mode, please hover it at a suitable height.

(IV) Switch to Autopilot Mode

Switch to any autopilot mode on your TX. Ground station is able to control the aircraft only after switching to autopilot mode!

Notices:

Making sure sufficient GSP satellite signal is acquired.

Tips:

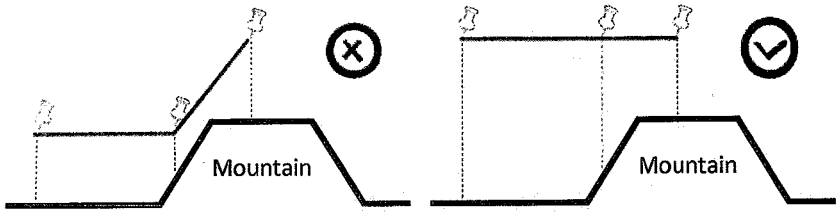
Refer to *DJI Autopilot System User Manual* for Manual, Atti., GPS Atti., GPS Cruise switching of your autopilot system, and also the *Manual* of your R/C Transmitter (Tx).

(V) GO!!

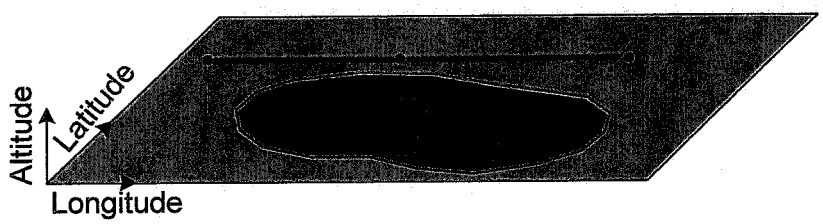
Click Go in the mission Editor, and the aircraft will fly automatically according to the path set in the flight mission.

Tips:

- Using EDIT to re-edit the mission, while a mission is in process. Please click EDIT in mission Editor to do so. Then the mission editor will return to the state explained in previous section Flight Mission Setting
- Using PAUSE to pause the mission, while a mission is in process. Please click PAUSE, and the aircraft will slow down and stay hovering. Click CONTINUE and the aircraft will resume the un-finished mission.



When you set the waypoints for the aircraft to climb a mountain, please make sure that you leave enough distance between the aircraft and the mountain, in order to avoid collision caused by aircraft air speed.



Please note that when you set a waypoint above water such as lake/sea/river, the default altitude the map shows will be at the bottom of the water body. Please be careful in setting altitude over water.

4.2 Auto Takeoff and Landing

Please read this carefully in order to work properly. It is imperative that you understand the procedures outlined before executing auto takeoff and landing functions.

Tips:

ACE users need to obtain Semi Auto Takeoff and Landing permission. **WKM** has this function built-in.

Auto Takeoff

Only after assigning or editing all waypoints, the mission is ready to take off.

STEP1: Place transmitter throttle stick to the lowest position. Otherwise, a tip The aircraft is on the ground, but the throttle is not in the lowest position, please do not switch to manual mode! will be shown.

STEP2: Flip the flight mode switch to either GPS-Cruise or GPS-Atti mode.

STEP3: Press Go command on the Editor, the aircraft main rotor will begin to spool up.

Notices:

Aircraft is ascending to waypoint altitude, please place throttle to mid-stick! This warning will go away after you place the throttle stick at mid-point, a safety feature in case you accidently bump the mode switch to Manual mode or GPS Atti mode.

Auto Landing

After mission completing or the aircraft returning home, and the aircraft hovers within visual contact. Use Ground Station keyboard for auto landing (Press pause button then select keyboard control). Auto Landing button will be available. Use W/S (Pitch), A/D (Roll), ↑/↓ (Throttle) and ←/→ (Rudder) to navigate to decent landing zone, or allowing Ground Station automatically provided a landing zone is clear of any obstacles, in order to decent the aircraft.

Use one of the methods bellow to land the aircraft.

(1) Click Auto landing, aircraft will auto land then stop engine by itself. In the latter situation, to terminate auto landing, please press ↑ or ↓, or deselect the keyboard control button → .

(2) Use ↓ to land the aircraft. After landing, keep holding ↓ until engine stops.

Notices:

Please press pause button and select keyboard mode, before auto landing operation.

4.3 F Channel Controller

Use Ground Station to customize the MC's F channel control, so that you can control the external payloads such as camera and gimbal.

STEP1: Click ToolBox→F_ChannelControl, he setup window shows as the follow figure.

STEP2: Click the small box beside channel name to choose the channels will be used.

STEP3: Click the button with letter, then press key shown and you need to choose a new control key on the keyboard.

STEP4: Setup the channel measuring range in the number boxes.

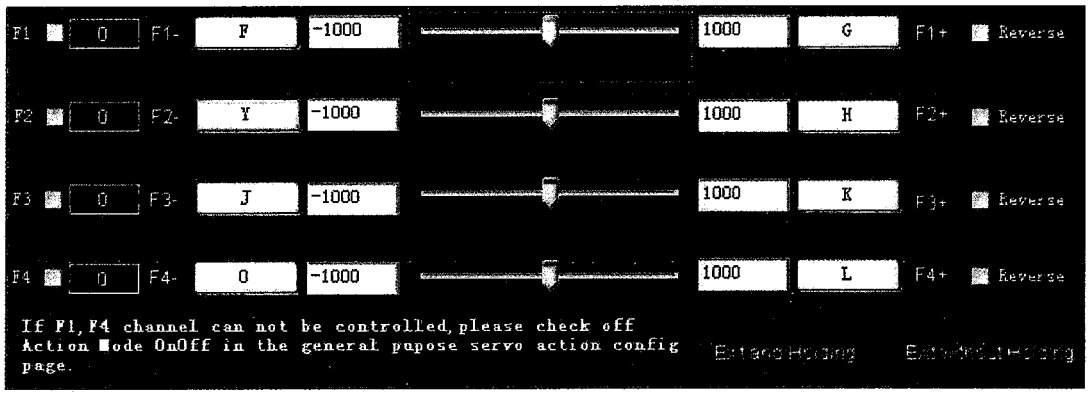
STEP5: Usually, the slide left endpoint represents the minimum value. However you can tick the Reverse box to reverse the measuring range.

STEP6: Click Exit and Holding to exit and keep the range value; Click Exit without Holding to exit and forget the range value.

Tips:

ACE supports F1, F2, F3 and F4;

WKM supports F1 and F2 only。



4.4 General Purpose Servo Action (GP-Servo Action)

GP-Servo Action is supported by one of the servo output channels in the transmitter, which will work as an interface between DJI autopilot system and external devices. This feature allows DJI autopilot to operate your external devices automatically during basic aircraft waypoint mission.

GP-Servo Action Setting

STEP1: Click ToolBox→GP Servo Action Config to open the General Purpose Servo Action Config windows;

STEP2: Click the box Action Mode OnOff to enable the GP-Servo Action function;

STEP3: For ACE, the GP-Servo uses the output channel F4 in the MC; for WKM, the GP-Servo uses the output channel F1 in the MC.

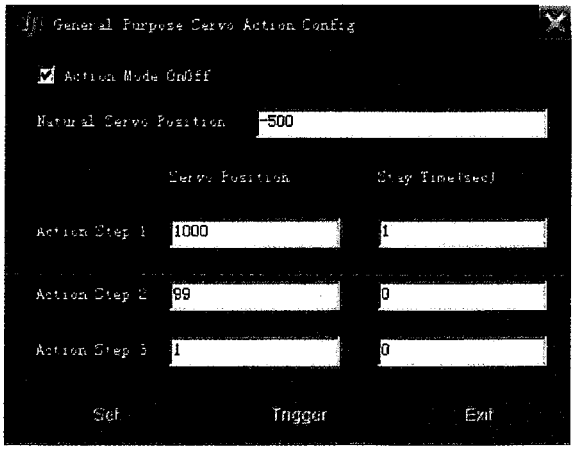
Notices:

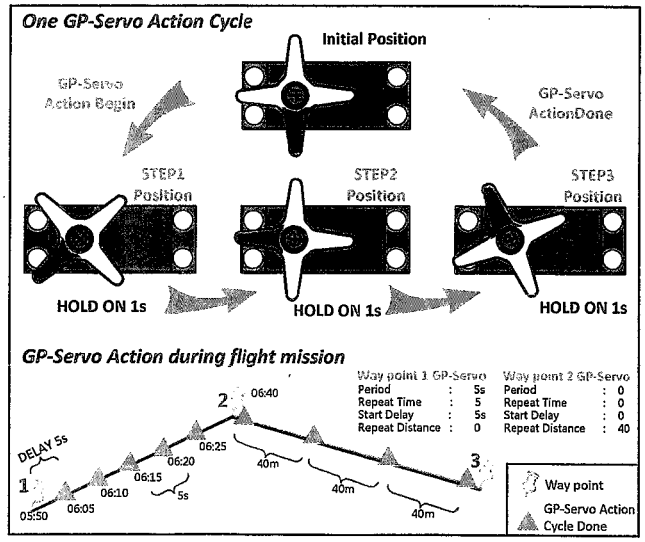
The servo position value is from -1000 to 1000; the Stay Time is in second.

The software aims to let you program four different servo positions, use servo for example.

- Initial servo position and three specific servo working positions.
- Timing of each servo transition in one GP-Servo Action cycle.
- The repeat time of a GP-Servo Action assignment on a particular assigned way point.
- Time gap between each GP-Servo Action assignments.

Please assign a default position for servo in natural status, and others 3 positions as well as the time to stay in such positions for servo to work as assigned. After all settings (click Set to save the settings), then click Trigger you review the GP-Servo Action, as we explained in *One GP-Servo Action Cycle*.





Way point Action Editing

Find and set the waypoint action properties according to the following procedures:

STEP1: Click, the Mission Status will show Editing Mission label upon the Mission Editor.

STEP2: Edit flight mission.

STEP3: Select the waypoint either in 3D-Map or in the EditingMission menu, and get Waypoint action, shown as Fig..

STEP4: Give the proper parameters explained in Editor: Period, RepeatTime, StartDelay, and RepeatDistance. Set RepeatTime and RepeatDistance zero to disable the GP-Servo Action.

Tips:

Use SetAllActioninMission properties to setup the sequence interval. For example: 0 means action property is applied to no waypoint; 1 means action property is applied to every waypoint; 2 means action property is applied to every two waypoints; 3 means action property is applied to every three waypoints, etc.

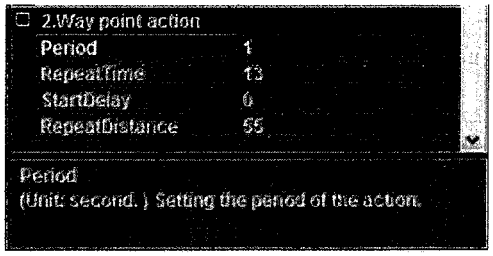


Fig. ①

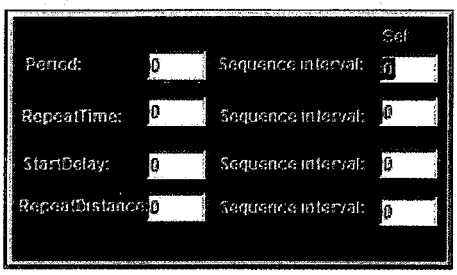


Fig. ②

4.5 Six Pre-Programmed Route Templates

Use one of the six Route templates to generate points automatically.

STEP1: Open the Template Form Toolbox→Route Template, shown as Fig.①.

STEP2: Click Add Area button to add an area, shown as Fig.②.

STEP3: Choose the waypoint icon of the chosen area, and drag it to change the area size.

STEP4: Left click mouse to rotate the area, rotation 30° per click; click  to adjust the area rotation angle and rotation 0.1° per click, as Fig. ③ shown.

STEP5: Click one Template to generate waypoint(s), for example, choose Scan, as Fig. ④ shown.

STEP6: Click Import to Edit List to do template edit, for example, choose Scan, as Fig. ④ shown.

Tips:

- You can exchange and redo STEP3 and STEP4, until get an area needed.
- Dragging the waypoint icon also can move the area, and the chosen icon shows green.
- More than one area can be added; operation will effect on every chosen area, if more than one area is chosen.
- Left click mouse to choose or not choose an area, green area is chosen, and red is not.
- You need to choose the area if you want to delete it by click Delete Area.
- Click Scan button once or twice, the route waypoints will be assigned vertically or horizontally
- Mouse on Param shows parameter meaning, row numbers for Scan and points for others.
- You can set sea level at Alti, and ensure that the altitude is higher than the aircraft altitude.
- Edit waypoints after clicking Import to Edit List button
- 5 Waypoints station will not enable Scan mode.

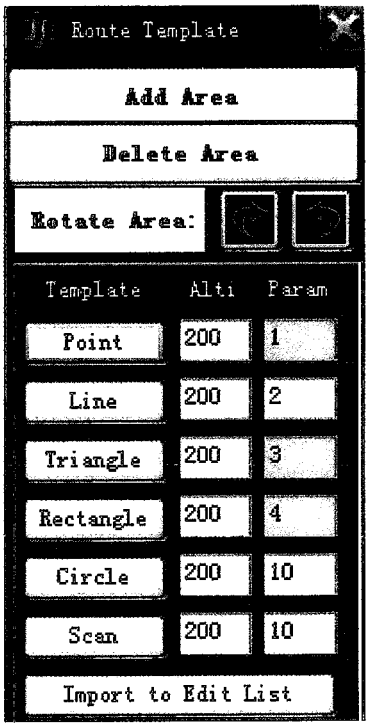


Fig.①

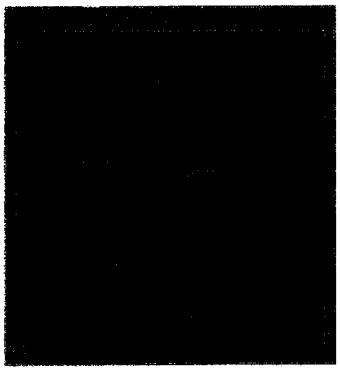


Fig.②

Fig.③

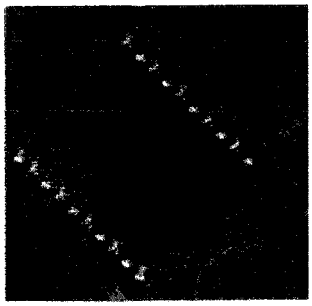


Fig.④

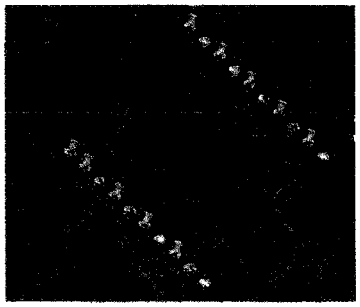


Fig.⑤

4.6 Photogrammetry Tool

Photogrammetry tool is for creating the professional maps by aerial photography easily. In order to do that, you need to setup the servo action and mission path correctly as follows.

Tips:

This tool is actually a functions combination. It simplifies the parameters setup procedure for the aerial photography.

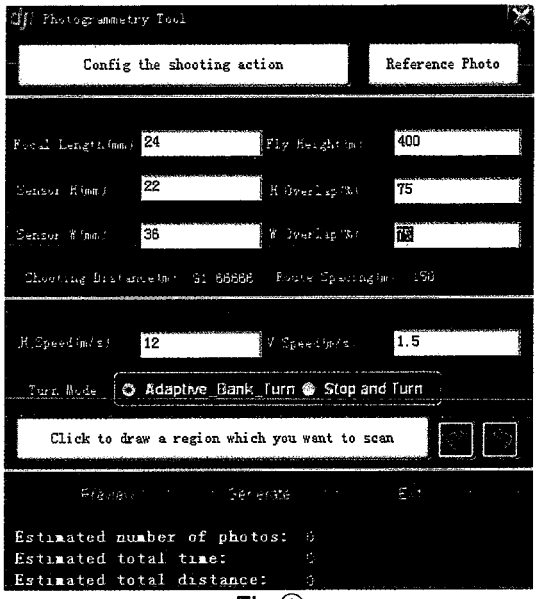


Fig.①

Fig.②

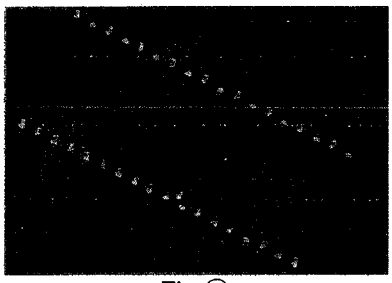


Fig.③

STEP1: Click ToolBox→Photogrammetry Tool to open the setting window, shown as Fig.①.

STEP2: Click Config the shooting action to setup the servo action for the camera shooting action, reference to section 4.4.

STEP3: Click Reference Photo to see if the camera is working as you want.

STEP4: Fill in the right Focal Length, Sensor Height, and Sensor Width according to the camera.

STEP5: Fill in the Fly Height, H Overlap and W Overlap as you like. H Overlap and W Overlap represent the overlap percentage across the sensor height and width.

STEP6: Fill in the flight horizontal and vertical speed in H Speed and V Speed separately.

STEP7: Choose turn mode between Adaptive_Bank_Turn and Stop and Turn.

STEP8: Click Click to draw a region which you want to scan to choose an area, reference to section 4.5 to change the area.

STEP9: Click Preview to preview the mission plan, shown as Fig.②.

STEP10: If everything is OK, click Generate to generate all waypoints. Now you will have a flight mission generated automatically in the Editor, shown as Fig. ③.

Tips:

You can edit any waypoint in the Editor after generate all waypoints.

Appendix

List of Ground Station Shortcut Keys

Operation	Function
View Mode	
Left Key+ 	Up/Down/Left/Right to move the map
↑, ↓, ←, →	Up/Down/Left/Right to move the map
Left Key+ 	Up/Down/Left/Right to rotate the map
Ctrl+Mouse Roll Up, Ctrl+Mouse Roll Down	Left/Right to rotate the map
Shift+Mouse Roll Up, Shift+Mouse Roll Down	Up/Down to rotate the map
Double click Left Key or Mouse Roll Up	Zoon In the Map
Double click Right Key or Mouse Roll Down	Zoon Out the Map
Joystick/Keyboard Mode	
Ctrl+ Right Key	Start Simulator
Keyboard Mode	
D, A	Roll
W, S	Pitch
↑, ↓	Throttle
←, →	Rudder
Keyboard Mode	
Blank+ Left Key	Set the Target Waypoint
Waypoint	
Ctrl+ Left Key	Add New Waypoint
Left click waypoint then Mouse Roll Up or Mouse Roll Down	Head Degree Setting
Left click waypoint then ↑ or ↓	Head Degree Setting
Left click waypoint then then Shift+P	Open the Relative Coordinates Editor

Troubleshooting

Ground Station Launching Failure

➔ Map loading failure and abort.

Solution:

Choose "run as administrator" when you right click the Ground Station icon in Windows 7.

➔ In English version Windows XP, if customer cannot open the program and the following error is reported: system. Format exception.

Solution:

Start→Control Panel→Date, Time, Language and Regional Settings→Regional and Language Options→Regional Options (change to English), senior (change non-Unicode program language into English).

➔ The earth map is not shown up when you launch the Ground Station.

Solution:

Try again or use Offline Mode.

➔ If the Connect button is gray and can't be clicked after launch the Ground Station.

Solution:

Please take the following steps to uninstall the Google Earth plugin, Start→All Program→Google Earth→Uninstall Google Earth Plug-in, and then use the installation CD to re-install the Google Earth plugin for DJI.

➔ Communication failure after click the Connect button.

Solution:

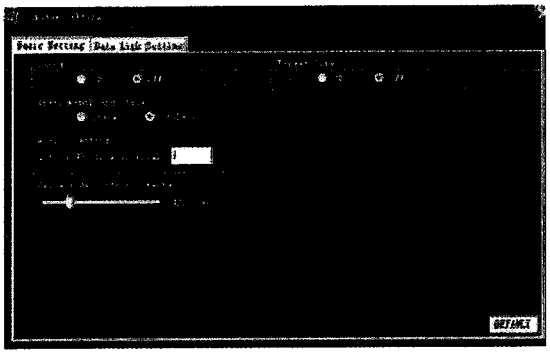
- Please choose the right COM port, and make sure that the driver is installed correctly.
- Make sure the transmitter and the receiver of the station are powered on.
- Make sure the transmitter and the receiver are matched; do not change the setup of switches on the radio station.
- Close the Assistant Software to avoid the port confliction.

Instrument Board Failure

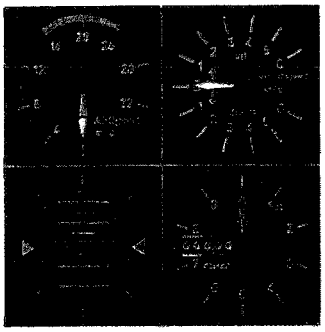
➔ The Ground Station launching failure when you click to open the instrument board; the reason is that your computer can't support the OpenGL.

Solution:

You may choose the Style2 (shown in Fig.①, ②) in System Setting→Options before you open the instrument board.



Fig①



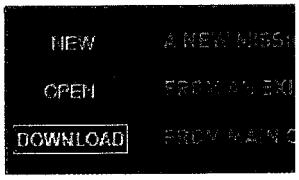
Fig②

Ground Station Software Crash

➔ Ground Station Software Crash will not affect the aircraft under mission execution. The aircraft will keep going on the flight mission edited even the Ground Station Software crash. The Ground Station Software can be launched again, but loss of the following information will happen: Altitude Offset value, Aircraft tracks and Way points.

Solution:

Click on the DOWNLOAD button, to retrieve the previously set way points from the DJI Autopilot main controller.



Launch Flight Failure

➔ Aircraft doesn't execute mission after click on GO.

Solution:

- If aircraft is in the air, please ensure it is in Autopilot Mode, and there is no need to set center position.
- If aircraft is on the ground and does not takeoff, please use Assistant Software to setup the center position and the throttle servo working range.
- If Auto Takeoff fails, you may take off the aircraft and then land manually in autopilot mode, then wait until throttle cut off automatically; or reboot the autopilot system to initialize the controller.

Action Usage Faults

➔ If there is no output change on F4 channel when click on the Trigger in the Action Setting window after connect to main controller.

Solution:

- Please ensure the receiver has been connected.

- Please ensure it is under the Autopilot Mode or Waypoint Mode.
- The action will not be valid unless the value of hold time is more than one second.

When Wireless Data-Link Doesn't Work

➔ If your Ground Station cannot be connected with the main controller, please check the following issues.

Solution:

- Make sure radio driver have been installed.
- If the Antenna is broken, the communication distance cannot be guaranteed.
- Two Wireless Data-Link Terminals had been placed too close. The valid communication distance between 2.4GHz wireless data-links should be longer than 1.5 meters; the valid communication distance between 900MHz wireless data-links should be longer than 5 meters.

Data-link LED Introduction

	Function	Introduction
Ground End		
LINK-ALARM	Distance Alarm	Light on indicates distance warning.
LINK-ALARM	Network Light	Light on indicates communication is on with air end.
DATA-POWER	Power Light	Light on indicates working well.
DATA-POWER	Data Light	Light flash indicates data transmit and receive.
Air End		
Link	Data Light	Light on indicates communication is on.
Power	Power Light	Light on indicates working well.
TX	Transmit Light	Light on indicates data transmit.
RX	Receive Light	Light on indicates data receive.

Wireless Data-link Specification

	2.4GHz	900MHz
Performance		
RF Data Rate	700kbps	100kbps
Indoor/Urban Range	≤500m	≤1Km
Outdoor/RF Line-of-Sight Range	≤3km	≤10Km
Transmit Power	130mW	1000mW
Receiver Sensitivity (1%PER)	-95dBm	-110dBm
Power Consumption	Ground end: 460mW Air end: 460mW	Ground end: 1600mW Air end: 1500mW
Features		
Frequency Band	2.4GHz(2400MHz ~2483MHz)	900MHz(902MHz ~928MHz)
Serial Data Rate	115200 bps	115200 bps
Antenna Options	SMA	SMA
Operating Temperature	-40°C ~+85°C	-40°C ~+85°C
Operating Humidity	0~95%	0~95%
Size (No Antenna)	Ground end: 70x48x17mm Air end: 51x37x10mm	Ground end: 78x47.8x17mm Air end: 73x42x10mm
Weight (Has Antenna)	Ground end: 55g Air end: 20g	Ground end: 100g Air end: 60g
Power Requirement		
Supply Voltage	4.5V~12V	4.5V~12V
Transmit Current	220mA	1300mA
Receive Current	62mA	100mA
Regulatory Approvals		
FCC (USA)	Yes	Yes
IC (Canada)	Yes	Yes

APPENDIX B

PRE-FLIGHT SETUP

SME
Sevee & Maher Engineers, Inc.

Drone Pre-Flight Setup (DRAFT)

Unpack and Assemble

- ☐ Take out upper layer of box and set aside
- ☐ Install Dampening rubber + screws
- ☐ Install Landing Gear
- ☐ Fold out arms + blades (do not tighten blades)
- ☐ Install Gimbal/Gyro Battery
- ☐ Check Battery voltage + set other batteries to charge
- ☐ Install Main Battery (do not connect yet)
- ☐ Install compass
- ☐ Check Balance
- ☐ Connect both wireless receivers (one to the AV and one to the Laptop)

Pre-flight

- ☐ Turn radio controller on before Drone
- ☐ Turn on Drone(connect Gyro battery and main battery)
- ☐ Let it sit for a moment and completely boot up
  - Red light will stop blinking once its synced with satellites
- ☐ To connect drone to controller rock the attitude switch back and forth 10 times until drone led blinks blue in confirmation
- ☐ Calibrate compass
  - Once around pointing out – light turns green
  - Once around nose down – light turns white
- ☐ Connect to Hotspot if possible
- ☐ Launch GroundStation software
- ☐ Load or create flight plan
- ☐ Select correct COM port and connect to the drone
- ☐ Check GPS(ON),ATTI(GOOD), and MODE(GPS ATTI)status
- ☐ Verify Battery Voltage
- ☐ Set Radio to GPS Cruise/Attitude mode
- ☐ Power cycle radio + drone before upload
- ☐ Upload flight plan – double check plan then make sure upload is successful
- ☐ Once ready press "GO" to initiate flight mission
- ☐ When Drone begins flight move throttle to half speed
- ☐ When arriving at last point "Pause" click the keyboard image – then click "Auto-land"

Notes:

Batteries

- Do not charge while unattended
- Look for swelling or dents
- Charge Every 3 months if not in use
- Let battery cool down after flight before charging
- Change on balance mode if cells out of alignment