

# FROM THE SKIES... TO THE CLOUD



Exemption Request Section 333 of the FAA Reform Act and Part 11 of the Federal Aviation Regulations from 14 CFR 45.23(b); 14 CFR Part 21; CFR 61.113 (a) & (b); 91.7 (a); 91.9 (b) (2); 91.103 (b); 91.109.119; 91.121; 91.151 (a); 91.203 (a) & (b); 91.405 (a); 91.407



January 8, 2015  
U.S. Department of Transportation  
Docket Operations  
West Building Ground Floor, Room  
w12-140  
1200 New Jersey Ave. SE  
Washington, DC 20590

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Re: Exemption Request Section 333 of the FAA Reform Act and Part 11 of the Federal Aviation Regulations from 14 CFR 45.23(b); 14 CFR Part 21; CFR 61.113 (a) & (b); 91.7 (a); 91.9 (b) (2); 91.103 (b); 91.109.119; 91.121; 91.151 (a); 91.203 (a) & (b); 91.405 (a); 91.407

## INTRODUCTION

Pursuant to Section 333 of the FAA Modernizations and Reform Act of 2012 and 14 CFR Part 11, ArrowData, LLC, operator of Small Unmanned Aircraft Systems (“sUASs”) equipped to conduct aerial photography for KLAS-TV for the purpose of electronic news gathering in Las Vegas, NV, hereby applies for an exemption from the listed Federal Aviation Regulations (“FARs”) to allow commercial operation of sUASs under the conditions outlined here or modified by the FAA.

In the detailed explanation to follow, the series of exemptions being requested would allow operation of the commercially procured, off-the-shelf Cinestar 8 Okto XL, an eight engine and blade, light weight, relatively slow (<50 knots) unmanned rotary aircraft (or like platform) in and around the city of Las Vegas during active news, traffic and weather events using very controlled conditions and operational procedures to provide robust safety buffers both vertically and horizontally to ensure personnel and property safety. These flights would only fly within 150 feet of the control vehicle with a dismounted pilot and safety team using an auto-pilot system that would control speed, vectoring and hovering. At no time would the vehicle fly directly over locally assembled crowds or over any ongoing fires or crime scenes. The launch and recovery point would be cordoned off by the safety team in coordination with law enforcement and/or first response units. Approval of this exemption would help to prove the safe concept of UAS activity while conducting electronic news gather (ENG) during active news, weather or traffic events in a major metropolitan environment with safety controls to provide proactive risk management that is technically within the National Airspace System, but realistically segregated well below any other air traffic and well clear of the McCarran Class B airspace (beneath the lateral confines). ArrowData, LLC is a partner with Bowhead Business and Technology Solutions who is currently is providing contract support as the PMO to one of the six FAA approved commercial UAS test ranges operated by the Nevada Institute for Autonomous Systems (NIAS). The composition of this team is unparalleled in the unmanned aviation industry, uniquely qualified to leverage the collective capabilities of UAS operations, FAA approved range testing and Analytical Risk Management. This exemption application will be accompanied with an Operations Plan, Maintenance Plan, and Risk Assessment that will depict all contingencies.

The following is contact information for the applicant:

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*ArrowData is a subsidiary within the UIC Government Services Division  
of the Ukpeaġvik Iñupiat Corporation, an Alaska Native Corporation.*

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**EXEMPTIONS** (Regulations from which the exemption is requested)

- 14 CFR Part 21, Subpart H– Airworthiness Certificates
- 14 CFR 45.23 (b), ,
  - Aircraft Marking
  - Certification and Registration
- 14 CFR 61.113 (a) & (b)
  - Pilot in Command
- 14 CFR 91.7 (a)
  - Civil aircraft airworthiness
- 14 CFR 91.9 (b) (2)
  - Document/Flight Manuals
- 14 CFR 91.103 (b)
  - Preflight action
- 14 CFR 109
  - Flight instruction
- 14 CFR 91.113
  - Right-of-way rules
- 14 CFR 91.119
  - Minimum safe altitude
- 14 CFR 91.121
  - Altimeter setting
- 14 CFR 91.131 (a) (1) (c) (2) (d) (1)
  - Operations in Class B airspace
- 14 CFR 91.145 (b)
  - Management of aircraft operations in the vicinity of aerial demonstrations and major sporting events.
- 14 CFR 91.151
  - Fuel requirements for VFR flight
- 14 CFR 91.203 (a) & (b)
  - Civil Aircraft: Certifications required
- 14 CFR 91.405 (a); 407 (a) (1); 409 (a); 417 (a) & (b)
  - Maintenance and maintenance inspections

- 14 CFR 407
  - Operation after Maintenance, preventive maintenance, rebuilding and inspections
- 14 CFR 409
  - Inspections
- 14 CFR 417
  - Maintenance records
- NOTAM 9/5151
  - Flying Around Sporting Events

## **AIRCRAFT OPERATIONS AND EQUIVALENT LEVEL OF SAFETY**

Section 333 refers to exemptions for sUASs for commercial operations. Those operations could include a vast array of events such as electronic news gathering (ENG). Much like the movie industry, aerial news and traffic/weather information gathering is both useful and entertaining to the general public. The quick deployment and less restrictive weather constraints will create a safer environment, while delivering a superior and timelier product to the general public, providing near real time information for traffic, severe weather and crime scene avoidance considerations.

The sUAS aircraft to be employed by ArrowData, LLC has a number of safety features that make it ideal for use in this environment. The state of the art Cinestar 8 Okto XL with dual 21,000 mAh, 22.2 volt battery technology and the ability to fly with two engines inoperable. It is well under 55 pounds with a top speed of approximately 50 knots. Additionally, there is redundancy in the power system to the data link, motherboard, and wireless communications within the sUAS team operating the system. The mobile vehicle to be used with the UAS is already fitted with redundant power sources for satellite and camera operations and would be available to the UAS safety team as well. The aircraft would be employed utilizing Line-of Sight (LOS) operations not to exceed 150 and launched from a sterile area created upon arrival at the news event by the safety team in coordination with local law enforcement and first responders. Any vertical obstructions would be noted upon arrival and the pilot and safety team would ensure operations remained well clear of those obstructions. The pilot would launch the aircraft and navigate to an acceptably safe hover point at which time a waypoint would be designated and the auto-pilot would be engaged in an auto-hover mode while filming commences. A loss of communication “return to base” fail-safe system is integrated as well. The battery life is approximately 45 minutes with a planned flight time of not more than 25 minutes. ArrowData, LLC will file a FAA Form 7711-1 or any such form deemed appropriate with the local Flight Standards District Office. Additionally, an Operations Plan would be submitted on a mutually agreed periodical basis to the FSDO.

All sUAS pilots being employed by ArrowData, LLC for this mission will have a FAA Commercial Pilot Certificate with Instrument Rating and a second class FAA medical certificate with additional experience in unmanned aircraft operations. Pilots will be required to have a minimum of 200 hours of manned flight time and 500 hours of unmanned flight time. The team composition will consist of a minimum of one pilot, one camera operator and one safety observer during all mobile news events, giving



redundancy to the human element as well. Pilots will be well trained in areas of both normal and abnormal operations equipped with checklists and operations and maintenance manuals to be able to contend with any scenario. After extensive range testing and pilot training, the sUAS team will perform “dry-runs” to simulate and practice actual news events and situations. Additionally, a simulation evaluation will be completed by using the Monte Carlo modeling program. This program simulates 10,000 flights and provides a failure expectation value. To help prepare for actual flight and news gathering with a UAS, the team would deploy with the mobile news team and observe conditions and scenarios where future operations might take place. This would give the team a feel for the “cadence” of an active news event to allow them to be able to plan timing and coordination issues. Unlike other uses for sUASs, these flights would be mostly shorter in length, obviating the need for a backup pilot. The designated safety observer would help to provide greater situational awareness for the team in order maintain alertness and vigil at all times. A radio frequency spectrum assessment will be conducted before the first operational mission. Additionally, an environmental assessment will be performed to measure such parameters as noise and hazardous material concerns.

#### **14 CFR Part 21, Subpart H– Airworthiness Certificates 14 CFR 91.203 (a) (1)**

Subpart H (Airworthiness Certificates) defines the requirements for airworthiness certificate issuance IAW FAR 91.203 (a) (1). Existing law (49 USC 44701 (f)), Part 11 and Section 333 allow the FAA to exempt aircraft from the requirements of an airworthiness certificate upon consideration of the size, weight, speed, operational capability and proximity to airports and populated areas of the identified sUAS. Unlike a manned helicopter, the sUAS being employed is lightweight, has no flammable fuel or other lubricants, operates at very slow speeds and stays well below any conflicting air traffic thereby providing, an equivalent level of safety when compared to currently employed manned aircraft.

The proposed sUAS to be employed is under 55 lbs. when outfitted with all equipment and batteries. There are no flammable liquids or other hazardous materials that would propose a danger to the public or event participants. Accordingly, no threat to national security exists due to the inability of carriage of any external stores or ordnance and the exhaustive vetting of team personnel, most of whom possess a current or recent DoD/government security clearance. All activities will be closely monitored by a team of aviation professionals and using a system with redundancies in all areas.

#### **14 CFR 45.23 (b) Display of Marks; general**

CFR 45.23 states:

When marks include only the Roman capital letter “N” and the registration number is displayed on limited, restricted or light-sport category aircraft or experimental or provisionally certificated aircraft, the operator must also display on that aircraft near each entrance to the cabin,

cockpit, or pilot station, in letters not less than 2 inches nor more than 6 inches high, the words “limited,” “restricted,” “light-sport,” “experimental,” or “provisional,” as applicable.

An exemption to this section is needed due to the lack of a cabin, cockpit or pilot station where any reference to the term “Experimental” could be affixed. Accordingly, the wording will be placed on the fuselage. This equivalent level of safety will allow the team to clearly see “Experimental.” Previous precedence exists within Exemptions 10700, 10167, and 10167A.

### **CFR 61.113 (a) & (b) Private Pilot Privileges and Limitations: Pilot in Command**

CFR 61.113 (a) & (b) states:

**(a)** Except as provided in paragraphs (b) through (h) of this section, no person who holds a private pilot certificate may act as pilot in command of an aircraft that is carrying passengers or property for compensation or hire; nor may that person, for compensation or hire, act as pilot in command of an aircraft.

**(b)** A private pilot may, for compensation or hire, act as pilot in command of an aircraft in connection with any business or employment if:

**(1)** The flight is only incidental to that business or employment; and

**(2)** The aircraft does not carry passengers or property for compensation or hire.

To reach an equivalent level of safety, the self-imposed experience and training requirements would more than offset any risk introduced by using private pilots to fly an unmanned aircraft in very restricted and controlled areas.

### **CFR 91.7 (a) Civil aircraft worthiness**

CFR 91.7 (a) states:

No person may operate a civil aircraft unless it is in an airworthy condition.

Assuming no airworthiness certificate will be required due to relief from Subpart H, no regulatory standard exists for determining airworthiness. The equivalent level of safety will be achieved through the employment of flight manual and maintenance manual procedures, pilot training and analytical risk management for each event.

### **CFR 91.9 (b) (2) Civil Aircraft Flight Manual in the Aircraft**

CFR 91.9 (b) (2) states:

No person may operate a U.S.-registered civil aircraft—

For which an Airplane or Rotorcraft Flight Manual is not required by § [21.5](#) of this chapter, unless there is available in the aircraft a current approved Airplane or Rotorcraft Flight Manual, approved manual material, markings, and placards, or any combination thereof.

Given the size of the sUAS being utilized in this endeavor, there is no room onboard for an aircraft flight manual.

The equivalent level of safety will be achieved by keeping the flight manual with the pilot/team on the ground with easy access. Previous precedence is resident in Exemptions 8607, 8737, f8738, 9299, 9299A, 9565, 9565B, 10167, 10167A, 10602, f32827, and 10700.

### **CFR 91.103 (b) Preflight action**

CFR 91.103 (b) states:

Each pilot in command shall, before beginning a flight, become familiar with all available information concerning that flight. This information must include—

**(b)** For any flight, runway lengths at airports of intended use, and the following takeoff and landing distance information:

**(1)** For civil aircraft for which an approved Airplane or Rotorcraft Flight Manual containing takeoff and landing distance data is required, the takeoff and landing distance data contained therein; and

**(2)** For civil aircraft other than those specified in paragraph (b)(1) of this section, other reliable information appropriate to the aircraft, relating to aircraft performance under expected values of airport elevation and runway slope, aircraft gross weight, and wind and temperature.

This regulation dictates that a pilot conduct preflight activities. Without an FAA approved flight manual, relief is required from this regulation. Extensive pre-flight planning will provide an equivalent level of safety by using the operations plan, aircraft flight manual, maintenance manual and available weather and NOTAM information.

### **CFR 91.109 Flight instruction**

CFR 91.109 states:

No person may operate a civil aircraft (except a manned free balloon) that is being used for flight instruction unless that aircraft has fully functioning dual controls.

sUASs clearly have no onboard flight controls. An equivalent level of safety will be accomplished by conducting pilot training via the control system that communicates with the aircraft from the ground. ArrowData, LLC intends to conduct this training on the Nevada test site under controlled conditions.

#### **CFR 91.113 Right-of-way rules: Except water operations.**

CFR 91.113 deals with the many scenarios whereby different types of aircraft in different states must give way to other aircraft.

Because the sUAS PIC does not have “see and avoid” capability, the petitioner requests relief from this regulation. All operations will be within LOS of the pilot and well below any airspace where other flight activity is taking place.

#### **CFR 91.119 (d) (1) Minimum safe altitudes; general**

CFR 91.119 states:

**(d) Helicopters, powered parachutes, and weight-shift-control aircraft.** If the operation is conducted without hazard to persons or property on the surface—

**(1)** A helicopter may be operated at less than the minimums prescribed in paragraph (b) or (c) of this section, provided each person operating the helicopter complies with any routes or altitudes specifically prescribed for helicopters by the FAA.

Recognizing that this relief is unprecedented, the petitioner asks that the FAA recognize the inherent capability of the ArrowData, LLC/BBTS/NIAS team. With a proven leader in risk management (ArrowData, LLC) and a leading FAA test site (NIAS/Nevada), we feel that an acceptable level of safety can be achieved. Extensive range testing and additional on-site testing in a benign environment would be conducted in real or near-real time conditions. The current altitude and/or horizontal restrictions on rotorcraft assumes a much heavier manned aircraft loaded with fuel and possible external stores. The light-weight sUAS being proposed for use in this activity along with its precise guidance and redundant systems create an entirely different paradigm that should be considered by regulatory bodies.

The activities being proposed by this petitioner are in a very controlled and open area. The flights would be confined to the immediate area of the mobile control center (MCC). Given these considerations, ArrowData, LLC proposes allowing flights to operate no more than 150 feet from the MCC and well clear of the Class B airspace and attendant manned air traffic.

## CFR 91.121 Altimeter settings

CFR 91.121 states:

Each person operating an aircraft shall maintain the cruising altitude or flight level of that aircraft, as the case may be, by reference to an altimeter that is set, when operating—

Below 18,000 feet MSL, to—

The current reported altimeter setting of a station along the route and within 100 nautical miles of the aircraft;

The sUAS aircraft intended for this activity will not be equipped with a barometric altimeter. Instead it will incorporate radio altimetry via the onboard GPS. An equivalent level of safety will be achieved through use of the operations and maintenance manuals governing altitude control. A preflight calibration of launch site altitude will be accomplished.

## CFR 91.131 (a) (1) (c) (2) & (d) (1) Operations in Class B airspace

CFR 91.131 states:

**(a) Operating rules.** No person may operate an aircraft within a Class B airspace area except in compliance with § [91.129](#) and the following rules:

**(1)** The operator must receive an ATC clearance from the ATC facility having jurisdiction for that area before operating an aircraft in that area.

**(c) Communications and navigation equipment requirements.** Unless otherwise authorized by ATC, no person may operate an aircraft within a Class B airspace area unless that aircraft is equipped with—

**(2) For all operations.** An operable two-way radio capable of communications with ATC on appropriate frequencies for that Class B airspace area.

**(d) Other equipment requirements.** No person may operate an aircraft in a Class B airspace area unless the aircraft is equipped with—

**(1)** The applicable operating transponder and automatic altitude reporting equipment specified in § [91.215 \(a\)](#), except as provided in § [91.215 \(e\)](#), and

Much of the city of Las Vegas lies within the limits of the Class B airspace. Because the planned sUAS to be employed lacks an onboard transponder or two way communication capability, relief from

this regulation is required. An equivalent level of safety will be achieved by limiting the operating ceiling of the sUAS to altitudes well below any conflicting manned aircraft traffic (no higher than 150 feet). This assures de-confliction with all other traffic and specifically traffic within the Class B airspace.

Additionally, the sUAS will remain clear of the McCarran Class B airspace at all times. ArrowData, LLC will periodically report to the FSDO on operations and risk management issues.

**CFR 91.145 (b) Management of aircraft operations in the vicinity of aerial demonstrations and major sporting events.**

CFR 91.145 states:

In deciding whether a temporary flight restriction is necessary for an aerial demonstration or major sporting event not listed in paragraph (a) of this section, the FAA considers the following factors:

- (1) Area where the event will be held.
- (2) Effect flight restrictions will have on known aircraft operations.
- (3) Any existing ATC airspace traffic management restrictions.
- (4) Estimated duration of the event.
- (5) Degree of public interest.
- (6) Number of spectators.
- (7) Provisions for spectator safety.
- (8) Number and types of participating aircraft.
- (9) Use of mixed high and low performance aircraft.
- (10) Impact on non-participating aircraft.
- (11) Weather minimums.
- (12) Emergency procedures that will be in effect.

If KLAS intends to use the sUAS to cover sporting events from the outside of the activity, coordination will be completed by contacting the FSDO prior to the event to ascertain the presence of any other unmanned activities. Flight activity will be conducted using the same operations plan as with any other ENG activity with particular attention to the avoidance of overflight of large concentrations of people. All of the concerns in the above twelve subparagraphs have been or will be addressed in other portions of this exemption application. However, specific relief from this regulation is still necessary to ensure compliance with FARs.



**CFR 91.151 (b) Fuel requirements for flight in VFR conditions.**

CFR 91.151(b) states:

No person may begin a flight in a rotorcraft under VFR conditions unless (considering wind and forecast weather conditions) there is enough fuel to fly to the first point of intended landing and, assuming normal cruising speed, to fly after that for at least 20 minutes.

The batteries that power the Cinestar 8 Okto XL have a mission life of approximately 45 minutes. To meet the 20 minute reserve requirement, the airborne mission would be limited to approximately 25 minutes. Given the limitation of the proposed flight area during any ENG, a more liberal flight time is a reasonable request. The aircraft would never be further than 150 feet from the recovery area, literally representing seconds to land. In no case would the aircraft be operated with less than 25% battery life remaining.

No night time operations are currently planned.

**CFR 91.203 (a) & (b) Civil Aircraft: Certifications required**

CFR 91.203 (a) & (b) states:

**(a)** Except as provided in § [91.715](#), no person may operate a civil aircraft unless it has within it the following:

**(1)** An appropriate and current airworthiness certificate. Each U.S. airworthiness certificate used to comply with this subparagraph (except a special flight permit, a copy of the applicable operations specifications issued under § [21.197\(c\)](#) of this chapter, appropriate sections of the air carrier manual required by parts [121](#) and [135 of this chapter](#) containing that portion of the operations specifications issued under § [21.197\(c\)](#), or an authorization under § [91.611](#)) must have on it the registration number assigned to the aircraft under part [47 of this chapter](#). However, the airworthiness certificate need not have on it an assigned special identification number before 10 days after that number is first affixed to the aircraft. A revised airworthiness certificate having on it an assigned special identification number, that has been affixed to an aircraft, may only be obtained upon application to an FAA Flight Standards district office.

**(2)** An effective U.S. registration certificate issued to its owner or, for operation within the United States, the second copy of the Aircraft Registration Application as provided for in § [47.31\(c\)](#), or a registration certification issued under the laws of a foreign country.

**(b)** No person may operate a civil aircraft unless the airworthiness certificate required by paragraph (a) of this section or a special flight authorization issued under § [91.715](#) is displayed at the cabin or cockpit entrance so that it is legible to passengers or crew.

The sUAS to be employed has no cockpit or pilot and therefore has no ability to carry onboard any certification or registration documentation.

The equivalent level of safety will be achieved by keeping these documents with the pilot/team on the ground at the event. Previous precedence is resident in Exemptions 9565, 9665, 9789, 9789A, 9797, 9797A, 9816A and 10700.

#### **CFR 91.405 (a); 407 (a) (1) (2); 409 (a) (2); & 417 (a) & (b) Maintenance**

These CFRs state:

Each owner or operator of an aircraft—

**(a)** Shall have that aircraft inspected as prescribed in subpart E of this part and shall between required inspections, except as provided in paragraph (c) of this section, have discrepancies repaired as prescribed in part [43 of this chapter](#);

Operation after maintenance, preventive maintenance, rebuilding, or alteration.

**(a)** No person may operate any aircraft that has undergone maintenance, preventive maintenance, rebuilding, or alteration unless—

**(1)** It has been approved for return to service by a person authorized under § [43.7](#) of this chapter; and

**(2)** The maintenance record entry required by § [43.9](#) or § [43.11](#), as applicable, of this chapter has been made.

Except as provided in paragraph (c) of this section, no person may operate an aircraft unless, within the preceding 12 calendar months, it has had—

**(2)** An inspection for the issuance of an airworthiness certificate in accordance with part [21 of this chapter](#).

operator shall keep the following records for the periods specified in paragraph (b) of this section:

**(1)** Records of the maintenance, preventive maintenance, and alteration and records of the 100-hour, annual, progressive, and other required or approved inspections, as appropriate, for each aircraft (including the airframe) and each engine, propeller, rotor, and appliance of an aircraft. The records must include—

**(i)** A description (or reference to data acceptable to the Administrator) of the work performed; and

**(ii)** The date of completion of the work performed; and

**(iii)** The signature, and certificate number of the person approving the aircraft for return to service.

(2) Records containing the following information:

- (i) The total time in service of the airframe, each engine, each propeller, and each rotor.
  - (ii) The current status of life-limited parts of each airframe, engine, propeller, rotor, and appliance.
  - (iii) The time since last overhaul of all items installed on the aircraft which are required to be overhauled on a specified time basis.
  - (iv) The current inspection status of the aircraft, including the time since the last inspection required by the inspection program under which the aircraft and its appliances are maintained.
  - (v) The current status of applicable airworthiness directives (AD) and safety directives including, for each, the method of compliance, the AD or safety directive number and revision date. If the AD or safety directive involves recurring action, the time and date when the next action is required.
  - (vi) Copies of the forms prescribed by § [43.9\(d\)](#) of this chapter for each major alteration to the airframe and currently installed engines, rotors, propellers, and appliances.
- (b) The owner or operator shall retain the following records for the periods prescribed:
- (1) The records specified in paragraph (a) (1) of this section shall be retained until the work is repeated or superseded by other work or for 1 year after the work is performed.
  - (2) The records specified in paragraph (a) (2) of this section shall be retained and transferred with the aircraft at the time the aircraft is sold.
  - (3) A list of defects furnished to a registered owner or operator under § [43.11](#) of this chapter shall be retained until the defects are repaired and the aircraft is approved for return to service.

These FARs only concern aircraft with an airworthiness certificate and therefore would not apply in this situation. All maintenance and inspections will be conducted IAW the maintenance manual and operations manual. The ability for an almost immediate safe recovery and landing if a malfunction occurs and the eight engine configuration with the ability to fly with loss of thrust on 2 engines provides a comfortable operating envelope and ensures an equivalent level of safety.

**The reasons why granting ArrowData, LLC's request would be in the public interest; that is, how it would benefit the public as a whole:**

Granting the exemption to ArrowData, LLC would allow the public to safely view breaking news from a dynamic and unprecedented aerial perspective. ArrowData, LLC has created a unique way to view news events that benefits the general public socially and economically. ArrowData, LLC sets the industry standard in using purpose built Small Unmanned Aircraft Systems (sUAS) with multiple redundant features that enhance safety. ArrowData, LLC builds and engineers its Cinestar 8 Okto XL platform with dual electronic motherboards and flight control systems, dual high-capacity batteries rated at 21,000 mAh each, and the ability to maintain controlled flight with the loss of 2 engines.

**The reasons why granting the exemption would not adversely affect safety:**

ArrowData, LLC is leading the sUAS industry by using a safe and beneficial business model. ArrowData, LLC is a partner with Bowhead Business and Technology Solutions, LLC (BBTS). BBTS currently provides contract support as the Program Management Office (PMO) contractor to one of the six FAA approved commercial UAS test ranges operated by the Nevada Institute for Autonomous Systems (NIAS). The composition of this team is unparalleled in the unmanned aviation industry, uniquely qualified to leverage the collective capabilities of UAS operations, FAA approved range testing and Analytical Risk Management.

In addition, enhanced safety is achieved by using an unmanned aircraft that does not carry passengers or crew and does not carry flammable fuel.

**IAW 14 CFR Part 11.81, the following summary is provided for publication in the Federal Register, should it be deemed necessary:**

Applicant seeks relief from the following rules:

14 CFR Part 21, Subpart H– Airworthiness Certificates, 14 CFR 45.23 (b), 14 CFR 61.113, (a) & (b), 14 CFR 91.7 (a), 14 CFR 91.9 (b) (2), 14 CFR 91.103 (b), 14 CFR 109, 14 CFR 91.119, 14 CFR 91.113, 14 CFR 91.121, 14 CFR 91.131 (a) (1) (c) (2) (d) (1), 14 CFR 91.145 (b), 14 CFR 91.151, 14 CFR 91.203 (a) & (b), 14 CFR 91.405 (a); 407 (a) (1); 409 (a); 417 (a) & (b), 14 CFR 407, 14 CFR 409, 14 CFR 417, NOTAM 9/5151

The unparalleled operational and testing capabilities created by the partnership between ArrowData, LLC, Bowhead Business and Technology Solutions (Program Management Office contractor for NIAS), and the Nevada Institute for Autonomous Systems (the Nevada test range) will enable the Federal Aviation Administration to allow for the introduction of sUASs into environments not previously allowed with an acceptable level of safety. This is an opportunity to use highly dependable, multi-redundant unmanned aircraft in a major metropolitan area, but to do so with stringent controls, pervasive risk management and detailed mitigation strategies to ensure that the public is not at any time exposed to unsafe conditions. Extensive range testing, “dry-run” testing under benign conditions and simulated emergencies will demonstrate that this activity can be accomplished without hazard to the general public. Additionally, a simulation evaluation will be completed by using the Monte Carlo modeling program. This program simulates 10,000 flights and provides a failure expectation value. The rotorcraft being proposed for this operation has redundancy in every conceivable area: thrust, communications, and electrical power for both the aircraft itself and the supporting system. Eight engines powered by two separate 21,000 mAh batteries and a data link system with “fly home” capability ensure that at no time will the aircraft not be able to land safely should that need arise. Pre-plotted waypoints using Geographic Instrument System coordinates and auto-pilot “fly to” commands provide extremely precise navigation. A Safety Management System will be employed and will address such issues as environmental impact (noise and hazardous material) and coordination with local Emergency Services/Incident Management personnel to include:

- Fire fighting
- Medical response
- Incident investigation

These capabilities, in total, provide a level of safety that should be satisfactory to the FAA and general public.

In view of the beneficial advantages to public safety, we respectfully submit our Section 333 exemption request.

Sincerely,

Michael S. Bradshaw  
President  
ArrowData, LLC  
777 N. Rainbow Blvd, Suite 380  
Las Vegas, NV 89107

## **FLIGHT OPERATIONS ARROWDATA & KLAS ABC CHANNEL 8**

### **Flight Operations Introduction**

The designated On-Scene Lead (OSL) is the event pilot-in-command and is responsible for the safe employment of the Electronic News Gathering Unmanned Aerial System (ENGUAS) that is assigned to the operation. He/she will be responsible for all operations utilizing the ENGUAS to include establishing a safe operating zone, coordination with local law enforcement/first responders, de-confliction with other airborne assets, both manned and unmanned and any other contingencies that might present themselves. In addition to the lead, at a minimum, there will be a camera operator and safety observer. The initial composition of this team beyond this minimum will be determined by KLAS, but independently overseen by the ArrowData management team. Specifically the Director of Operations of ArrowData will perform this oversight function. He will also serve as the Chief Pilot until indigenous KLAS personnel have accrued enough experience to safely transition. Currently, this position is held by:

William H. Wilson  
Director of Operations, ArrowData, LLC  
777 N Rainbow BLVD, Las Vegas NV 89104  
702-816-5095

### **Flight Operations Functional Areas**

#### **Chief Pilot**

The CP is responsible to the FAA for all operations and ensuring those operations are conducted using the procedures outlined here and all other documents included and submitted for this 333 exemption. All flights and procedures for ground operations of installed engines and/or propeller(s), engaging of rotors, and movement of UAS aircraft conducted by the contractor are subject to final approval by the CP. The team shall prepare and maintain specific written procedures, separate and distinct from industrial or quality procedures that describe generic aircraft flight and ground operations at all ENG events. If ArrowData references existing company procedures, operating instructions, etc., in these procedures, the referenced document(s) must be readily available for review and become part of the FAA 333 exemption approval process.

#### **Aviation Risk Management**

As per Federal Aviation Administration (FAA) Orders 8900 and 8130, all UAS operations will adhere to the Safety Management System (SMS) process as required in manned aircraft operations. Personnel will use Safety Risk Management (SRM) principles outlined in the current editions of FAA Advisory Circular (AC) 120-92-Safety Management Systems for Aviation Service Providers and FAA Order 8040.4A-Safety Risk Management Policy. These FAA policies maintain or improve the safety of the National Airspace



System (NAS) by identifying safety risks, hazards, and mitigations associated with proposed UAS operations. All flight operations conducted by ArrowData on behalf of KLAS fall under the purview of the FAA and the Flight Operations CP will implement and manage the SRM program in concert with FAA risk management policy. Aviation Risk Management will also make initial and subsequent safety risk and maturity determinations to ensure compliance by all team members at all associated ENG events.

## Airspace

KLAS will use all means available to notify NAS (National Airspace System) partners (FAA, law enforcement, first responders, other airspace users, etc.) that there is a potential ENG event and that subsequent employment of an ENG UAS will be imminent. All technology available (radios, telephonic, email, social media) will be considered to ensure any potential airspace users in close proximity to the ongoing event are aware that there will be an unmanned KLAS airborne asset in the area. Upon arrival on the launch sight, the OSL and safety observer will quickly ascertain the operating environment and follow up prior coordination with any other aforementioned stakeholders prior to initial launch of the ENG UAS. Other risk factors such as weather, onlookers, immediate obstructions to flight (trees, power lines, construction equipment, etc.) will be identified and mitigated. The maximum line of sight distance from the controlling pilot to the ENG UAS is 150 feet. The OSL will determine what geographical and/or electronic metrics can be employed to help determine the maximum line-of-sight distance restriction. This can be ascertained by using assets such as laser range finders, known physical distances and heights such as the length of the city block or height of utility poles. Once there is a determination that a safe launch can be made and the ENG UAS is airborne, the OSL will closely monitor the time of flight, flight track, changing local conditions (weather, airspace saturation, crowd size and disposition, etc.) and continually assess any possible need to modify or discontinue operations in the interest of safety. Early and accurate planning of the on-site requirements to accommodate the air and ground footprint is critical to both planning and execution. All team members will be an integral part of the Airspace Management processes and must be well versed in flight, ground, and ENG UAS operations. The OSL and his team will conduct a flight readiness and operational risk management review via checklists enroute to every event.

## Pilots, Camera Operators and Safety observers

Chief Pilot, OSLs, Camera Operators and Safety observers and attached reporters are to provide a superior level of cooperation with all stakeholders on the scene, always conscious of safety first. If at any time, a determination is made that the safest action is to discontinue flight operations due to a safety issue, the OSL will not hesitate to recall the ENG UAS and re-evaluate the on-scene conditions. The KLAS Team will work directly with other on-scene stakeholders and the FAA local offices to ensure all FAA, procedures, regulations, and paper work are in full compliance. Additionally, our Team will provide services well beyond regulatory compliance as we seek to provide a “concierge” level” of safety to meet safety objectives in all phases of any project/event. All team members will be well versed in basic project management skill sets and familiar with UAS/Aviation industry to support ENG for all events. The

designated pilot will, at a minimum, be a rated FAA Commercial Pilot with no less than 200 manned flight hours and an additional 500 UAS hours.

## KLAS SPECIFIC PROCEDURES

### KLAS Operating Procedures Overview for Electronic News Gathering

The KLAS Team, led by the CP shall prepare and maintain specific written Procedures, separate and distinct from industrial or quality procedures that describe aircraft flight and ground operations ENG events supported. If KLAS references existing company procedures, operating instructions, etc., in these procedures, the referenced document(s) shall be made readily available for review and become part of the FAA 333 exemption approval process. The Procedures shall:

1. Provide specific guidance describing activities and requirements for all ENG UAS flight activities. All provisions pertaining to safety, and flight and ground operations applicable to all aircraft for each specific event will be clearly defined.
2. Describe in detail how the team ensures that individuals perform only duties they are qualified and authorized to perform.
3. Provide an overview of proposed operations plan including, but not limited to:
  - a. Aircraft system to be Utilized
  - b. Scope of flight operations
  - c. Communications support requirements
  - d. Emergency procedures – requirements (Aircraft Rescue and Fire Fighting, Traffic control, etc.)
  - e. Launch/Recovery requirements and procedures
  - f. Lost communications and lost link procedures
  - g. Generic on-scene safety outline, including safety observer and pre-post flight brief with all applicable staff, production personnel and flight crew. Applicant should provide any recent FAA monthly status reports including any “off-nominal” events. Copies of PIC and visual observers’ training hours/records may be requested at any time.
4. Provide Operational Requirements such as ownership information; aircraft description (performance specifications and speed, altitude, arrival and take off, movement and camera operations); program purpose for which the aircraft will be used; anticipated hours, time of ground tests/flights and days for use; and areas over which the flights are to be conducted and address of base operation.
5. Provide a narrative (i.e. – Flight Plan and parameters for operation) summarizing overall experience as well as describing equipment and the various specific modes of operation, including routes and altitudes to be flown. Narrative will also include details for exit criteria. Flight Plan must also include Lost Link procedures and other emergency procedures.

## Risk Assessment

During the initial standup of ENGUAS activity pre-planning, the CP's staff and UAS flight crew identify and assess possible hazards consistent with FAA Safety Risk Management process. Based on this pre-planning the team will create a concise, yet exhaustive Risk Management worksheet/checklist that is adaptable and scalable for all potential ENG events. The team will complete Risk Management worksheets/checklists either enroute to the scene or after arrival on the scene before each event. These tools will be made available to any FAA representative having a "need" for review. All Risk Assessments will be reviewed by event personnel leadership and approved for operation by the CP.

## Changes

All proposed changes shall be submitted to the CP in writing. Approved changes shall be incorporated into all copies of the Procedures. Changes are not in effect until the CP approves them.

## Crewmember Approval

All crewmembers must be approved as a requisite step for indemnification under the ArrowData Risks Clause. The CP shall ensure that the appropriate numbers of crewmembers are authorized and that programs include sufficient flying time for currency in accordance with the Mission Assurance Risk Assessment. The CP shall not approve any crewmember until the procedures have been approved and that crew member has demonstrated a complete and thorough understanding.

## Ground Operations

Ground Operations are aircraft operations without intent for flight. Specific operations include, but are not limited to:

1. Aircraft maintenance
2. Overhaul Modification Repair Ground Test
3. Subsystem warm-up/checkout
4. Spectrum De-confliction Ground Test
5. Engine run or other operation of installed engines and propeller(s) or rotor(s), as appropriate
6. Preflight/post flight
7. Operation of associated aerospace ground support equipment
8. Aircraft Rescue and Firefighting (ARFF) operations and Training
9. Operation of any Ground Test Vehicle (GTV)

The CP shall not approve any ground operations until the procedures have been approved.

## Flight Approval

The CP shall not approve any flight until the procedures have been approved. CP approval is required for all flights using the ArrowData designation and authorities. Flight approvals are requested using real

time email/telephone requests to the CP. In the dynamic world of news gathering, this will often be completed while enroute to the news event. Any verbal or email approval will suffice for this requirement. This allows the CP to evaluate the effects of all the factors (such as aircraft condition, weather, aircrew life stressors, etc.) which influence flight effectiveness and safety. CPs shall not authorize operations that are outside the scope of the exemption requirements. Approval of operations not allowed by this exemption could create serious liability issues.

## Multiple Flight Approvals

Highly repetitive flights and events (such as flight instruction or a repeated flight training involving the same aircrew, mission, and flight profile or exact same event) may be authorized. OSLs should know the general profile and objectives for each event as well as the currency and qualifications of the flight/ground crews involved for the duration of the approval period.

## Assumptions and Restrictions for all ENG Events

- All flights are to utilize the Cinestar 8 airframe, Controlled by the Graupner/SJ HOTT MZ-24, with the MikroKopter Okto Combi Redundant ESC; the flight manuals with the specifics are attached. A couple points of record are:
  - a. Cinestar 8 airframe has been the industry standard for years with its roots attached to the movie industry
  - b. Graupner/SJ is the controller of choice and is extremely programmable (Two of these are utilized so the pilot always has a backup controller)
  - c. The Okto Combi Redundant ESC by MikroKopter is truly a redundant capability for dual failures. In other words, if one ESC fails the Cinestar 8 flies without interruption. (Any failure will cause an immediate return to the Launch/Recovery location and the asset landed)
  - d. The Cinestar 8 can maintain flight with up to two motors failed. (As long as the two motors aren't next to each other) A failure of any motor will cause an immediate return to the Launch and Recovery location for an immediate landing.
  - e. The Cinestar 8 will be flown with two batteries in parallel. Thus, complete power redundancy. If one battery fails, an immediate return to the Launch and Recovery location for a safe landing will be initiated. The Graupner/SJ monitors real time both batteries.
  - f. The Cinestar 8 will never be flown past 75% of total battery duration as an additional safety procedure.
- **ALL PROCEDURES HAVE BEEN DEVELOPED TO NEVER INTENTIONALLY OVERFLY THE GENERAL PUBLIC**

- a. The specific procedures are developed to utilize the Cinestar 8 in multiple “anchored” locations utilizing the “look angle” and “Camera’s zoom” to develop one of a kind Full Motion Video
  - b. The Cinestar 8 will primarily be flown with Altitude Hold Mode after arriving at the optimum view position for the event. Manual operation is available but would constitute a return to the Launch/Recovery location for flight termination if done as a result of loss of any autonomous mode of operation. (That said, 50% of all pilot training is in manual mode to ensure the utmost safe ability to handle all contingencies)
- A safety observer will be utilized to ensure at all times Cinestar 8 operating points remain clear of all personnel
  - Pilot Operators, Camera Operators and the safety observer will be on headset and in constant real time communication at all times when the Cinestar 8 is airborne or about to be airborne.
  - The Cinestar 8 will launch and Recovery in the Vertical
  - Elevation will be based upon safety first, winds, camera requirements, sun and light requirements, to never exceed 150 feet.
  - The Cinestar 8’s Lost Link altitude will always be set above all obstacles and always be able to handle the winds at that altitude.
  - The Cinestar 8 will always return to its Launch and Recovery location prior to reaching 75% of battery duration.
  - Cinestar 8 KLAS CP will maintain constant contact with other team members at all times.
  - An initial spectrum scan will be made for a typical ENG event prior to the maiden launch.
  - At all times the OSLs chief role while the Cinestar 8 is airborne will be to monitor the sUAS position and hover point to ensure separation from large concentrations of spectators and any other hazards. All safety observers and pilots will ensure they maintain LOS visibility with the Cinestar 8 at all times.

## Assumptions and Restrictions for all ENG Emergency Events

- During emergency operations all team members will focus exclusively on the safe recovery of the Cinestar 8. Upon emergency flight termination, no additional Cinestar 8’s will be launched until a complete understanding of what caused the malfunction is determined.
- All event law enforcement and First Responders will be briefed on the basic CONOPS of the Cinestar 8 and what they can do to support KLAS CP in the event of an emergency.
- When possible all Emergencies will be terminated at the Launch and Recovery location.

## Event Cinestar 8 CONOPS

1. Once the Pilot has completed all ground ops he’ll check in with the CP who will provide an “all clear for launch”.
2. The Pilot will then verify good communications with his team, Camera Operator first, (Camera operator’s “all clear for launch” means his ground checks are complete, he has verified camera operation and zoom functionality), then the safety observer. At this point

- the pilot will launch the Cinestar 8 from the Launch and Recovery location vertically and announce the initial operating altitude and launch time to the crew. Upon reaching altitude, the Pilot will announce the initial hover point.
3. The safety observer should verify the time and that the initial operating area is clear. If at any point the safety observer realize the area isn't clear, he/she should announce this fact and make a recommendation to the pilot of a known clear area. The preferred method is to return to the last known clear point for the pilot. For example: "pilot, SAFETY OBSERVER , initial hover point isn't clear, recommend displacing xxx feet left/right." The pilot will announce his understanding and state his intentions. For example: "Copy SAFETY OBSERVER, I'll hold at xxx, and Camera Operator please plan to capture event from that area. The Camera Operator will acknowledge the Pilots instructions as he was the last crew member directed. For example, "Camera Operator (CO) confirms xxx area for initial broadcast. Then the SAFETY OBSERVER will confirm the pilots last instructions. "SAFETY OBSERVER copies xxx for initial broadcast.
  4. The team will continue to capture the news in this manner throughout the event.
  5. There are several mandatory calls from all team members and SAFETY OBSERVER will be responsible to initiate these safety checks. They are:
    - a. Every 5 minutes from launch time a battery check until recovery
    - b. Every 5 minutes from launch time a position accuracy check
    - c. Every 5 minutes from launch time an altitude validation check
      - i. For example: at 1605L the SAFETY OBSERVER will say: "Pilot, SAFETY OBSERVER safety check"
      - ii. At this point all crew members will verify that the position and altitude appears reasonable with what has been directed and additionally the pilot will verify the remaining battery duration. Then, all crew members will acknowledge with the pilot being first as he was the last directed crew position. For example: "Crew, Pilot, good safety check with battery remaining 76%" Then, "CO, good safety check" then "SAFETY OBSERVER good safety check
  6. All crew members will acknowledge and verify critical information during the ENG event via professional Crew Resource Management (CRM). When the CP (or designated representative), who is in constant contact with the production team, passes information, the team will acknowledge and offer any concise updates or suggestions. For example: the CP will relay anytime the team is showing live coverage. For example: "Pilot, CP, you're live," then, "pilot, copies" then "CO copies" Then "SAFETY OBSERVER copies."



# Cinestar 8 Maintenance

## Required Tools

<u>JST crimping Tool</u>	<u>Threadlocker (Purple)</u>
<u>Wire Stripper</u>	<u>Dremel</u>
<u>2.5mm Driver</u>	<u>Electric Hand Drill</u>
<u>2.0mm Screwdriver</u>	<u>Can of Compressed Air</u>
<u>5.5mm Socket Driver</u>	
<u>Soldering Iron</u>	
<u>Heat Gun</u>	
<u>Multimeter</u>	

## Useful Digital Links

[CineStar Build Manual Download \(V.5\)](#)  
[CineStar Electronics Assembly](#)  
[CineStar Electronics Assembly Part II](#)  
[Mikrokopter Software](#)

## Main Body

### Components:

1x - Top plate	5x - Press nuts
1x - Bottom plate	9x - 12mm standoffs
3x - Landing gear with 4.4mm holes	4x - 50mm standoffs
3x - Landing gear with 3mm holes	82x - Clamps
1x - Battery mount plate	8x - 500mm carbon fiber booms
1x - Camera mount plate	8x - 500mm carbon fiber booms
8x - Motor mount plates	49x - SH M3x40mm screws
2x - GPS/Navi mount	41x - SH M3x35mm screws
4x - Vibration isolator - top retainer plate	9x - BH M3x10mm screws
4x - Vibration isolator - bottom retainer plate	9x - BH M3x8mm screws
4x - Vibration isolator - top spacer plate	72x - BH M3x6mm screws
4x - Vibration isolator - bottom spacer plate	25x - Blue o-rings

The frame of the Cinestar 8 is composed of high strength carbon fiber. Before and after each flight inspect the frame to insure no cracks or fractures are forming. Pay special attention to stress areas of the frame such the connecting joints between the engine booms and the center frame. If cracks or fractures are found replace damaged part immediately.



The Cinestar 8 uses Tiger MN4012 Heavy Lift Motors. Before and after each flight inspect the motors to ensure they are functioning properly. Rotate the motors by hand feeling for any obstructions or particles that may cause friction or grinding inside the motor. Also, listen for any abnormal sounds such as clicking or grinding. After use in dusty environments use canned compressed air to blow out any debris or dust that may have accumulated during flight.

The Tiger MN4012 HLM uses EZO bearings. These bearings should be replaced on a regular basis to ensure no flight performance issues. Replace each bearing when they have had 60 hours of flight time. The image below shows where the bearing is located.

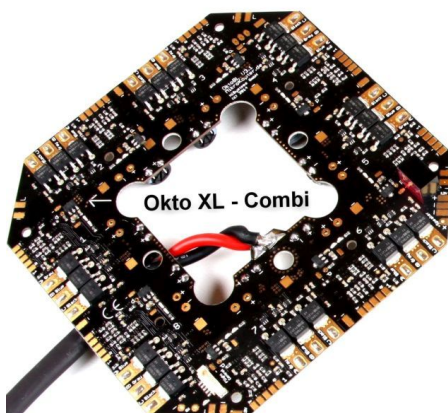


## Props

The Cinestar 8 is using Tiger 15x5 Carbon Fiber Propellers. 4 Clockwise props and 4 Counter Clockwise props that make up a total of 8 props. Before and after each flight inspect all props to ensure there are no cracks, fractures, or deep pitting. If there is light or moderate pitting or chipping you can use sandpaper to work them out. If the damage is too severe replace entire prop.

## Electronics

### ESC Board



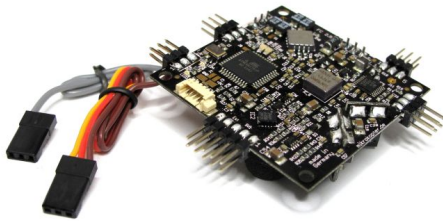
### Specs

- Voltage : 10 to 30V -> 3 -7S Lipo
- 6 -layer PCB for optimal heat dissipation . 70u copper layers make the entire circuit board to the heat sink
- Current: up to 30A (per unit) and 120A (Total) - with appropriate cooling
- Current limiting and temperature limiting
- Active freewheeling -> less power loss
- Integrated 12V voltage regulator for external LED-Supply

- Switchable LED output -> LEDs can flash in case of undervoltage
- Adjustable motor timing in several steps of 13-28° - compatible with the most common BL motors
- Adjustable switching frequency ( 10kHz - 20kHz )
- PPM to 500 Hz with simultaneous I2C - bus operation for telemetry and data logging
- Integrated 12V stabilization for LED lighting and other 12V appliances
- Switchable outputs for lighting -> ZB The blinking lights at low voltage
- Software adjustable direction of rotation
- Adjustable current and temperature limits
- Adjustable start-PWM
- Silent Start: test tone at startup can be disabled
- 11-bit resolution (2048 steps )
- two LEDs (OK and Error )
- all BLCs are already addressed (address 1-8)
- current measurement up to 75A per controller
- extra pcb for serial connection and receiver, Molex cable to connect a 2nd FlightCtrl for redundancy

Cinestar 8 is running the Okto XL V3 ESC board. The board should be kept clean and free of moisture. If board becomes dirty use a soft toothbrush with a little bit of alcohol to gently scrub down the board. Let dry completely before powering on system. Check for any burned components or capacitors. If any are found replace board immediately.

## Flight Control Board



### Specs

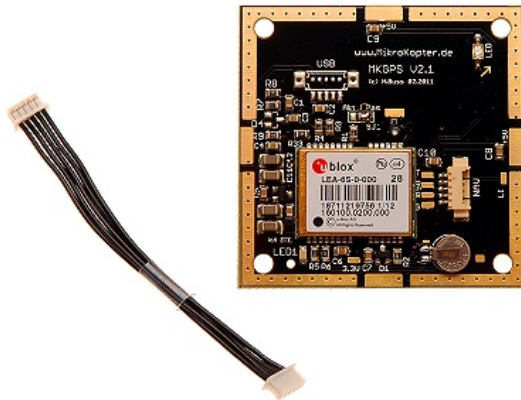
- Useable up to 5,000 meters
- Supply voltage up to a max of 6S voltage
- LEDs on the switching outputs
- Additional protection resistors at the servo outputs
- High-quality gyroscope (MEMS technology) from analog devices
- 5 servo outputs
- 1 pressure sensor (up to about 5000m NN)
- Molex connector for easier connection to the distribution boards
- Easy use of Jeti or HoTT telemetry
- Servo and lighting can be connected via pin header
- 4-layer PCB design
- Max of 6s supply

The Cinestar 8 uses the Flight-CTRL V2.5 ME. It is located at the center of the ESC board. Check to make sure all connecting points are not bent or loose. Make sure solder points have

not broken. If flight controller has become dirty use a toothbrush with soft bristles and alcohol to clean away any dust buildup. Let component dry completely before powering on system. If any components are found burnt or damaged replace board immediately.

## GPS

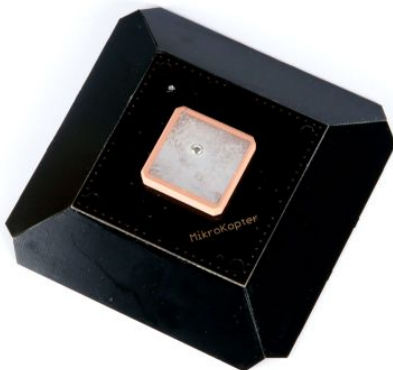
Cinestar 8 uses an MKGPS receiver with u-blox LEA6S GPS module and a passive antenna.



### Specs

- Module can also be operated with an active GPS antenna.
- 1x board (SMD-preassembled)
- 1x passive GPS antenna
- 1x cable with connector (5pin)
- NaviCtrl or MK3Mag not included in delivery

The GPS board is covered by the GPS shield as shown below:



The GPS board and shield should be inspected regularly to insure no damage has occurred. If the board and shield have become dirty from dust and grime use a soft toothbrush and alcohol to clean component. Wait until components are completely dry before turning on system.

## Batteries

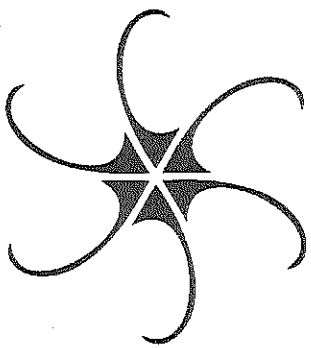
- Capacity: 21,000 mAh 6S1P
- Voltage: 22.2V (6S)
- Size: 9" x 4" x 2" (L\*W\*H)
- Weight: 5.15 lbs
- Discharge rate: 30C/630A continuous; 1260A burst
- Charge rate: 5C charging acceptable
- Plug: EC5 female
- Balancer Plug: XH 8cm lead

21,000mAh  
6S 30C LiPo



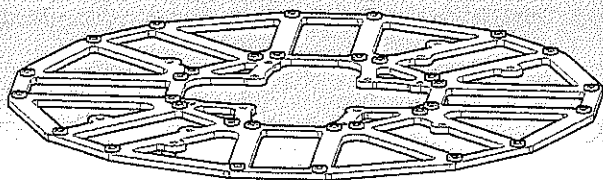
Inspect batteries before each flight. Ensure they have been fully charged and there is no bulging. If bulging occurs replace battery immediately. If battery is not in use for more than a week discharge to 60% for storage.



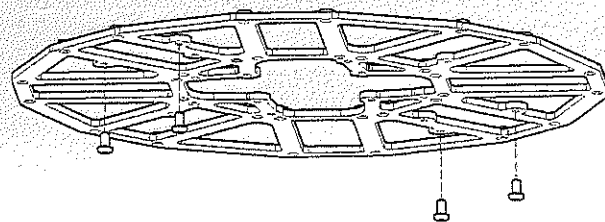


CINESTAR

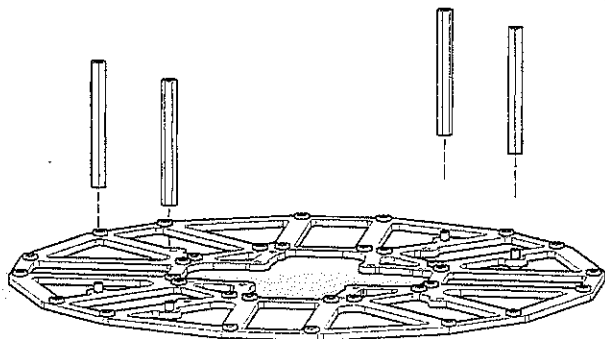
[www.freelysystems.com](http://www.freelysystems.com)



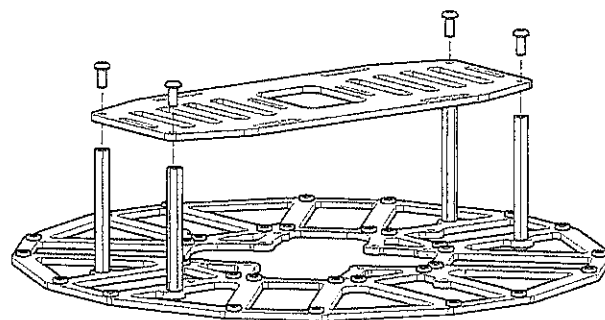
**BP7.1** Now we need to install the battery tray. Note that only the top frame is shown for ease of explanation.



**BP7.2** Insert four (4) M3x6 BHCS into the holes in the top frame plate as shown in the drawing. Note that the current view shows the bottom side of the top frame plate.

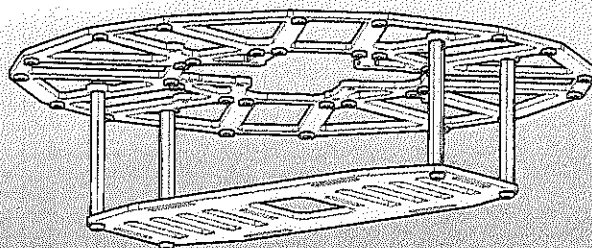


**BP7.3** Thread the four (4) 50mm aluminum standoffs onto the M3x6 BHCS.



**BP7.4** Thread four (4) M3x6 BHCS through the battery tray and into the 50mm aluminum standoffs.

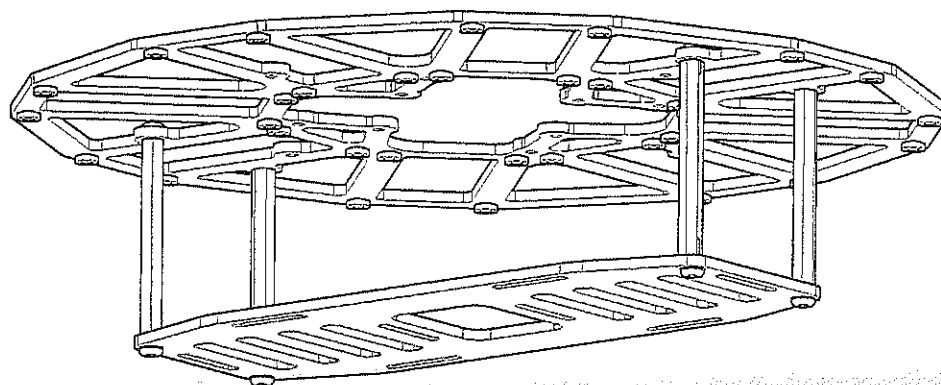
**BP7.5** Assembled battery plate.



# BATTERY PLATE

BP7.1 - BP7.5

7



GPS6.5 Nylon standoffs installed.

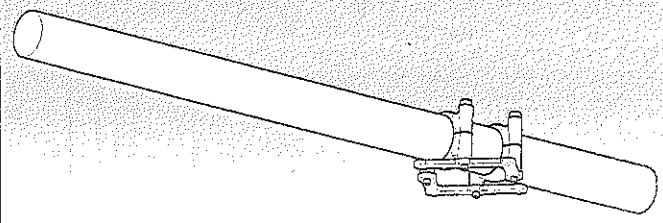
GPS6.6 GPS board and NAVI board installed.

GPS6.7 Completed GPS/NAVI assembly.



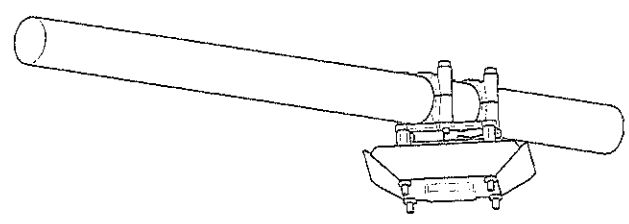
3

GPS6.3 GPS/NAVI mount plates installed.



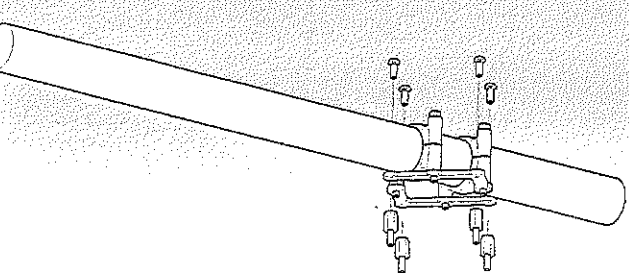
1

GPS6.1 If you choose to run the MK GPS with the GPS shield, it will not fit in the stock mounting location. For this reason, we have included an accessory mount for the GPS that allows for it to be mounted on a boom. Additionally, you can mount the NAVI board on this accessory mount to distance the sensitive compass from potential interference.



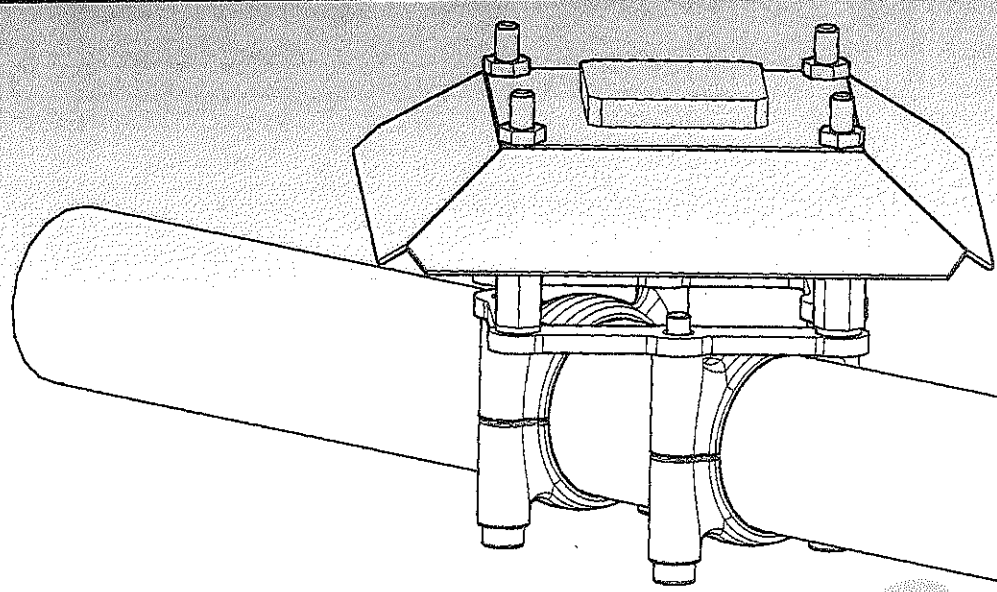
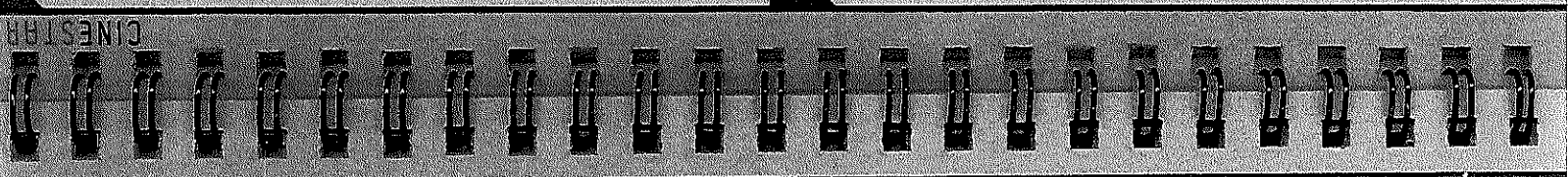
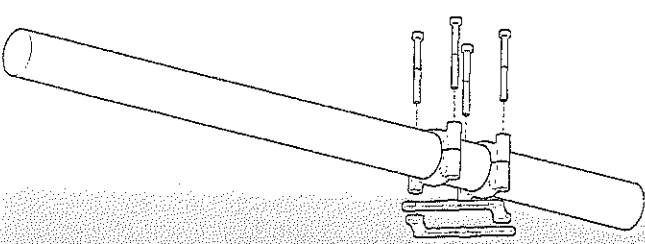
4

GPS6.4 Attach four (4) nylon standoffs using M3x6 BHCS.



2

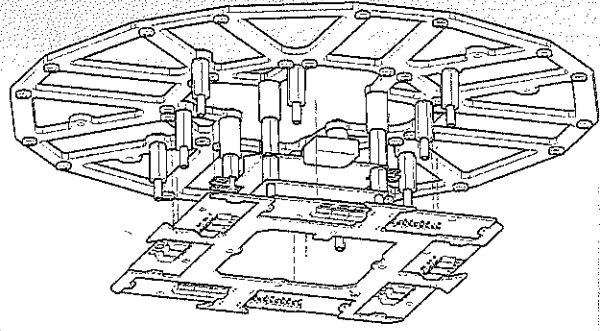
GPS6.2 Install four (4) M3x35 screws through the four (4) clamp halves into the press nuts in the GPS/NAVI mount plates.



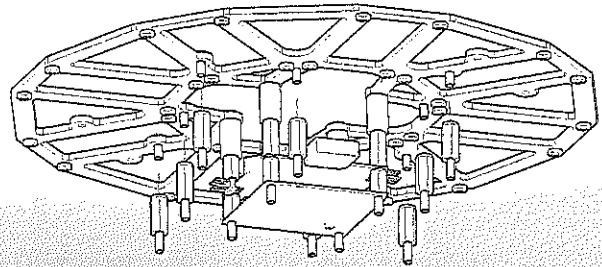
6

GPS  
GPS6.1 - GPS6.7

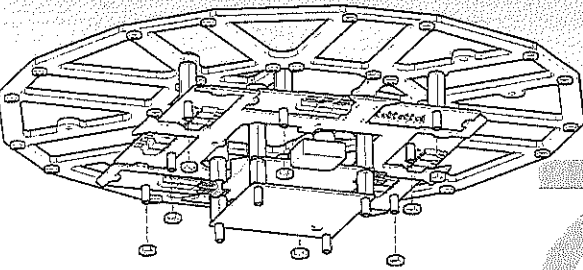
**MKE5.11** Now place the Mk distribution ring onto the nylon standoffs being careful not to strip the threads.



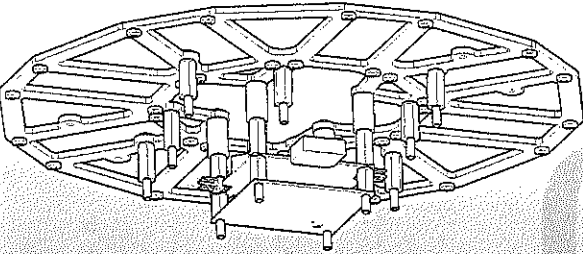
**MKE5.9** Thread the 15mm nylon standoffs onto the M3x6 BHCS. Be careful not to strip the nylon threads.



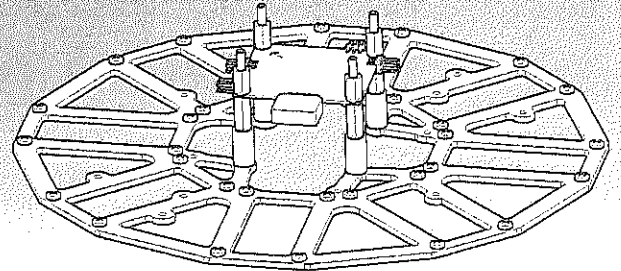
**MKE5.12** Install the nylon nuts to retain the distribution ring.



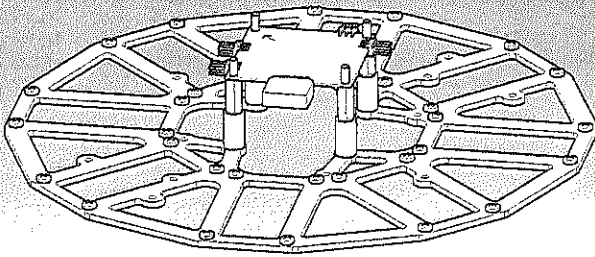
**MKE5.10** Nylon standoffs installed.



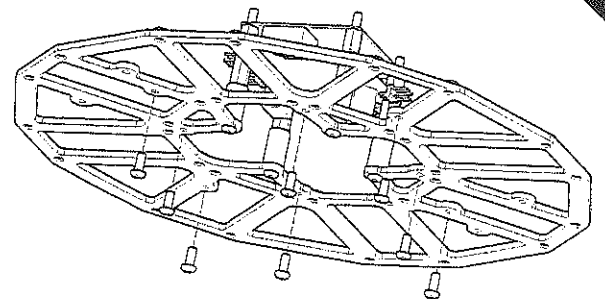
**MKE5.6** Install the four (4) nylon standoffs onto the existing studs of the flight control vibration isolation mounts.



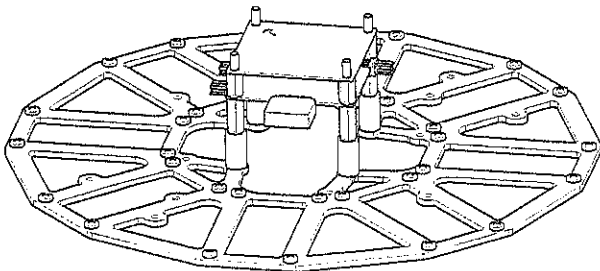
**MKE5.5** Mount the flight control board onto the vibration isolation mounts being careful to observe proper orientation. The flight control board has a small arrow that should be aligned as shown in the drawing.



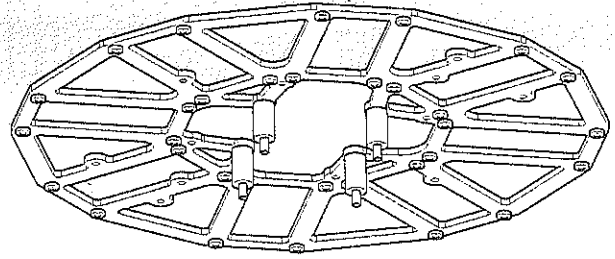
**MKE5.8** Now we will install the distribution ring. Once again, for the ease of viewing, only the top frame plate is shown. Insert eight (8) M3x6 BHCS into the holes shown.



**MKE5.7** Install the Navi-Ctrl board being careful again to observe proper orientation and carefully tighten the 3mm nylon nuts to secure the board.

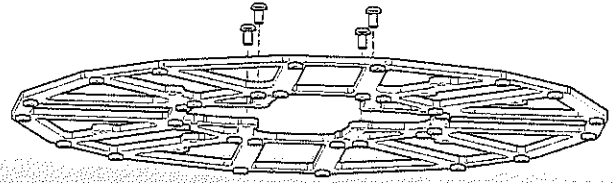


**MKE5.3** Thread the MK flight control vibration isolation mounts onto the M3x6 BHCS.



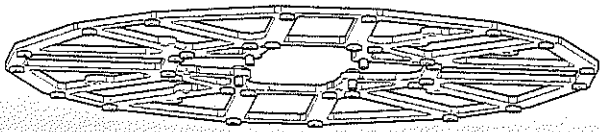
3

**MKE5.1** Install four (4) M3x6 BHCS to hold the flight control board vibration isolators. Note only the top frame plate is shown for ease of illustration.

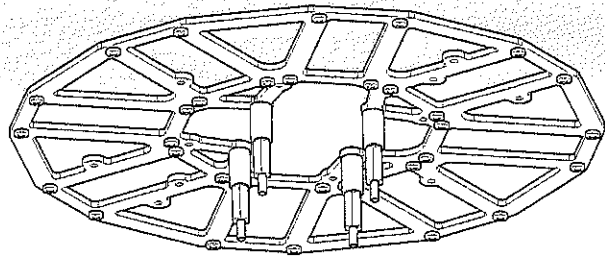


1

**MKE5.2** View of four (4) M3x6 BHCS installed.

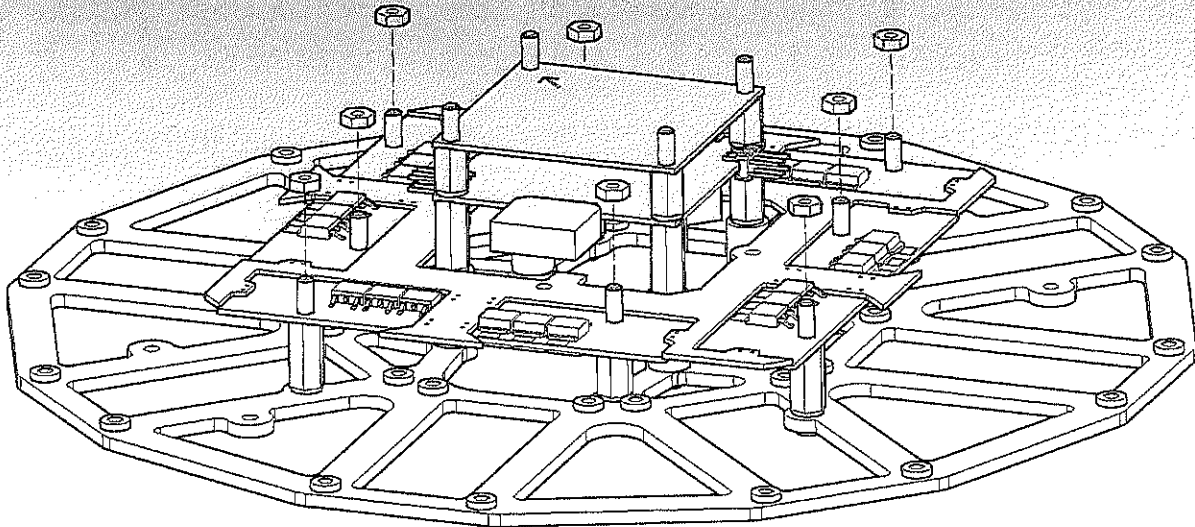


2



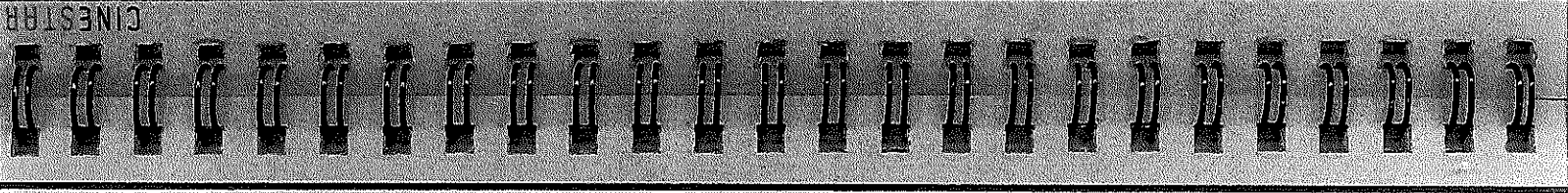
4

**MKE5.4** Thread the four (4) 15mm nylon standoffs onto the rubber vibration isolator mounts. This will give the flight control board adequate spacing from the distribution board.



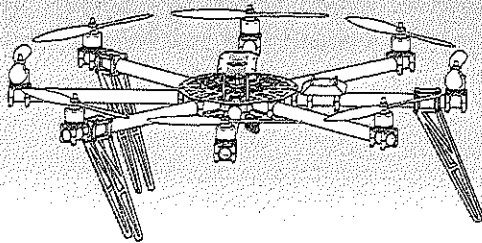
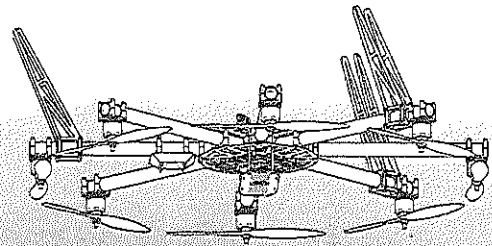
5

**MK ELECTRONICS**  
MKE5.1 - MKE5.12



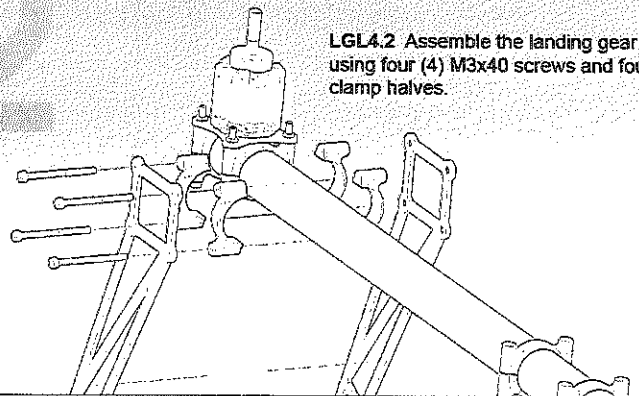
CINESTAR

**LGL4.5** Complete installation of the remaining two (2) landing gear legs.

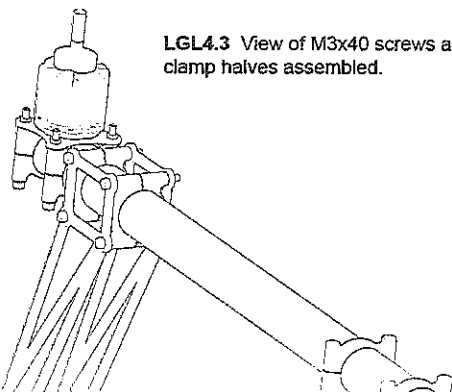


**LGL4.1** Now the landing gear needs to be installed. The CineStar team usually runs the rear leg pointed outward and the front two (2) legs pointing inward. The CineStar team sets the landing gear up this way, so that there is the visual cue of the rear leg facing outward while flying. You can also mount the front legs facing outward for maximum stability on takeoff and landing.

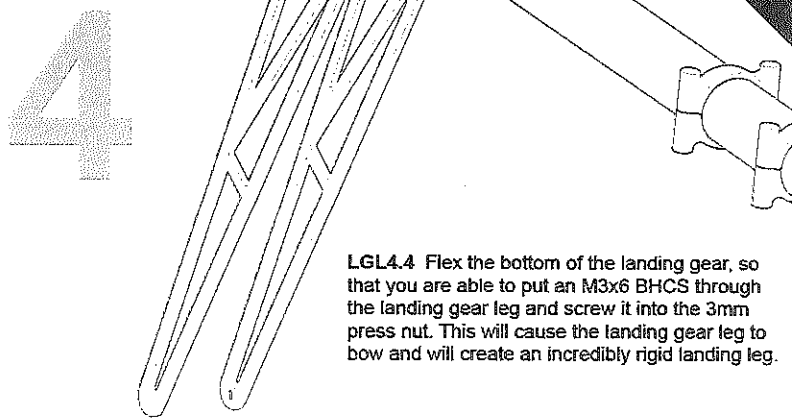
**LGL4.2** Assemble the landing gear leg using four (4) M3x40 screws and four (4) clamp halves.



**LGL4.3** View of M3x40 screws and clamp halves assembled.



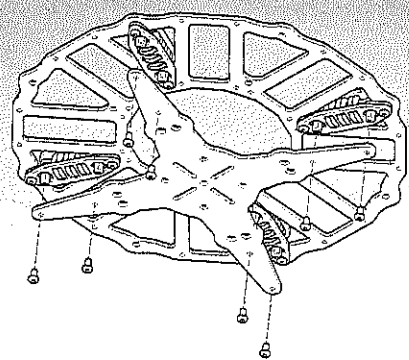
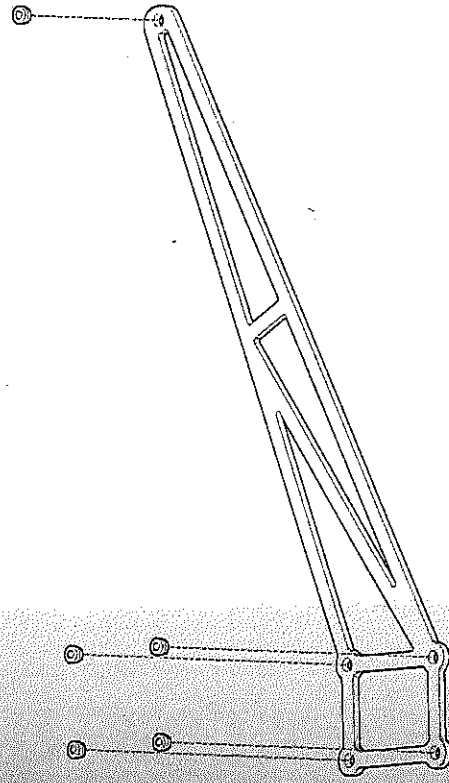
**LGL4.4** Flex the bottom of the landing gear, so that you are able to put an M3x6 BHCS through the landing gear leg and screw it into the 3mm press nut. This will cause the landing gear leg to bow and will create an incredibly rigid landing leg.





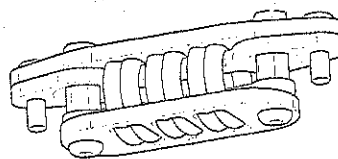
# LANDING GEAR LEGS

LGL4.1 - LGL4.5



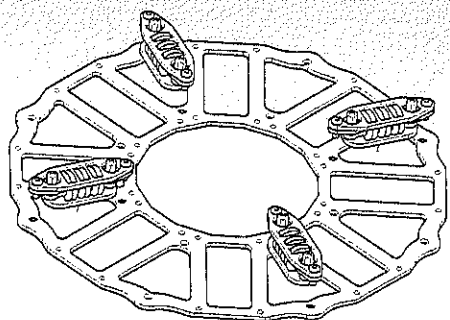
ISO3.13 Attach the camera mount plate to the aluminum standoffs in the vibration isolators using the eight (8) M3x6 BHCS.

1



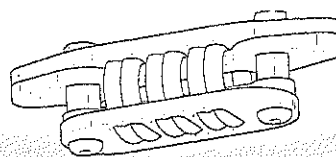
ISO3.11 M3x10 BHCS installed.

12



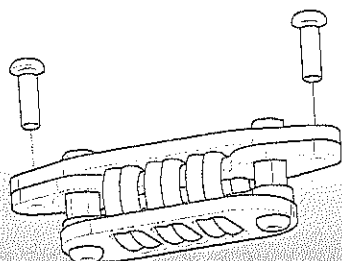
ISO3.12 Attach the four (4) completed isolators to the bottom side of the bottom frame plate by threading the M3x10 BHCS into the press nuts.

9



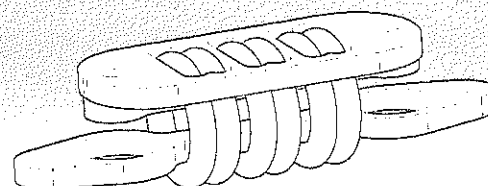
ISO3.9 Install the bottom isolator plate.

10



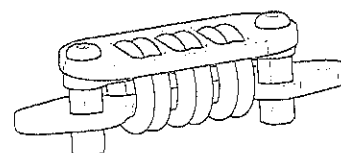
ISO3.10 Insert the M3x10 BHCS. Please note that the screws used here are M3x10 BHCS and the screws used earlier in the isolator are M3x8 BHCS.

CINSTR



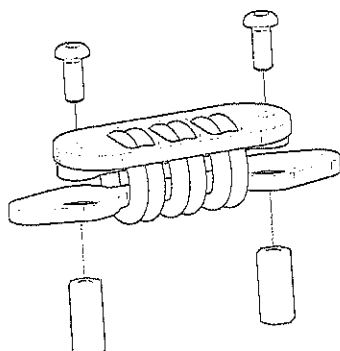
ISO3.6 Top isolator plate installed.

8

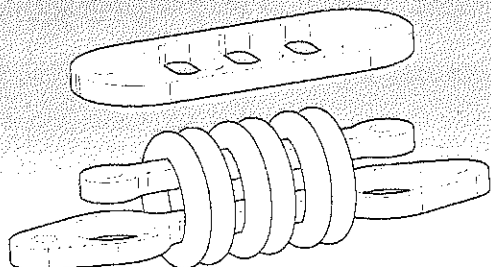
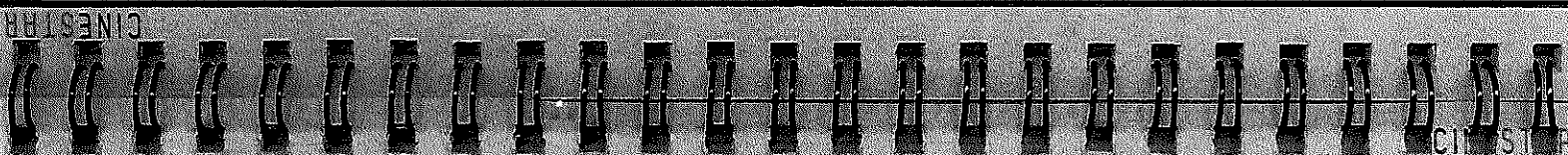


ISO3.8 12mm aluminum standoffs installed.

7

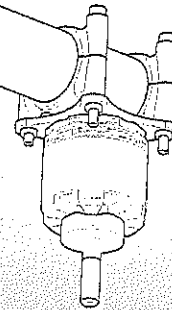


ISO3.7 Install the 12mm aluminum standoffs using M3x8 BHCS.

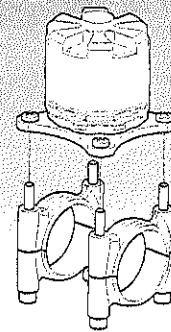
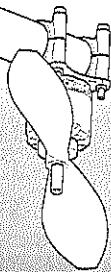


ISO3.5 Place the top isolator plate on top of the O-rings. You will need to align pairs of O-rings into the three (3) slots.

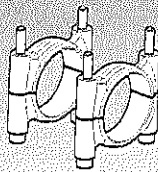
B2.9 Insert the boom into the clamps. It will take a little finessing to get the boom through the clamps, as the parts are designed to fit fairly tight. Please make sure the end of the boom is flush with the end of the clamp. Tighten the M3x35 screws to secure the boom.



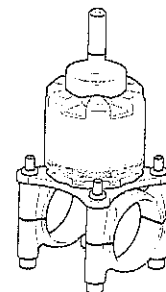
B2.10 Repeat these steps until you have all eight (8) booms fully built.



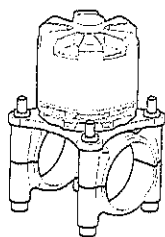
B2.6 Thread the four (4) M3x35 screws into the motor mount plate. Once again, only thread the screws until they are flush with the press nuts, as we will need the slack in the clamps to make the boom installation easier.



B2.5 Clamps mounted onto the M3x35 screws.



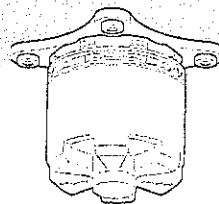
B2.8 Install the included prop adapter onto the Quadcopter motor.



B2.7 Motor and motor mount plate installed.

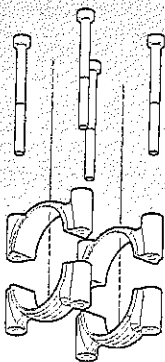
3

B2.3 Motor mounted to the motor mount plate.  
Please observe the orientation of the press nuts.



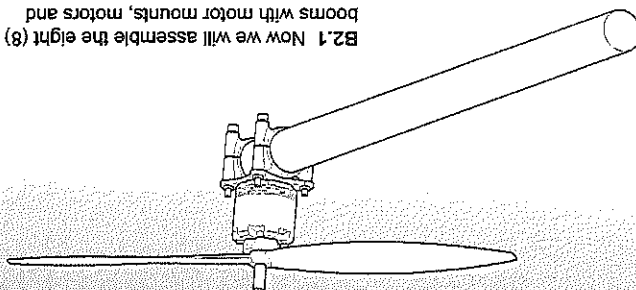
4

B2.4 Fit the four (4) clamp halves onto the four M3x35 screws.



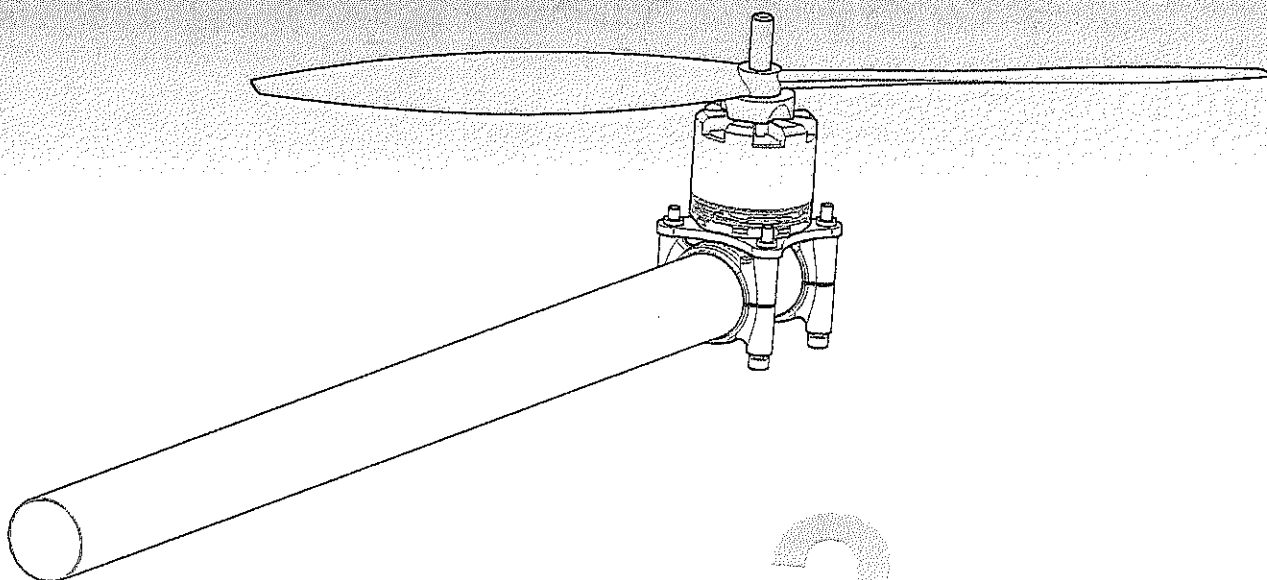
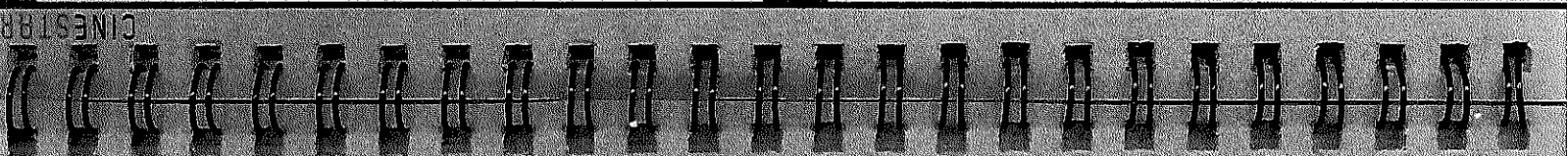
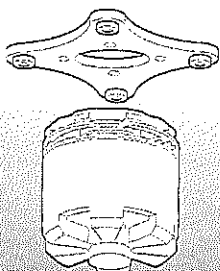
1

B2.1 Now we will assemble the eight (8) booms with motor mounts, motors and props.



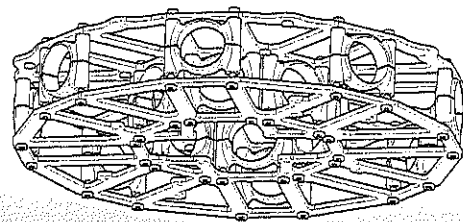
2

B2.2 Install motors onto the motor mount plate using M3x6 button head cap screws ("BHCS") making sure to use purple Loctite.

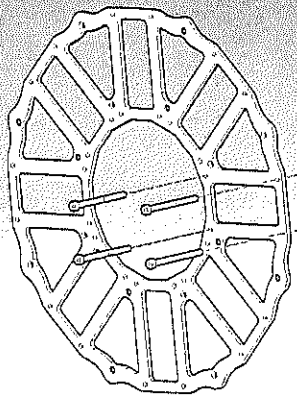


**BOOM**  
B2.1 - B2.10

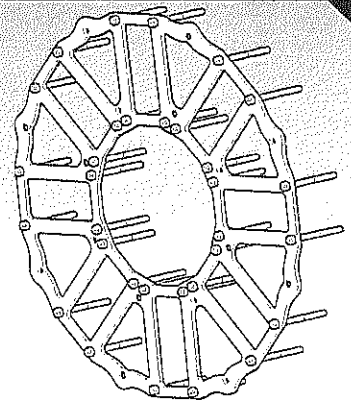
MF1.5 Assembled main frame.



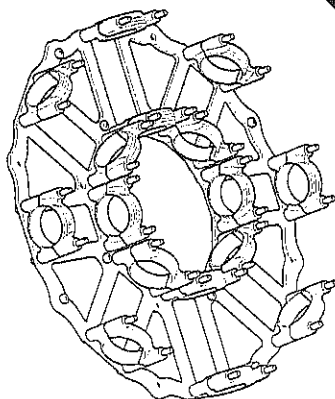
**MF1.1** Install thirty-two (32) M3x40mm screws through the bottom frame plate. Note that the press nuts are on the backside of the bottom frame plate in the current view.



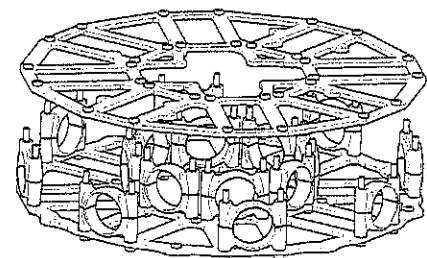
**MF1.2** All thirty-two (32) M3x40mm screws installed.



**MF1.3** Install thirty-two (32) clamp halves onto the M3x40 screws.

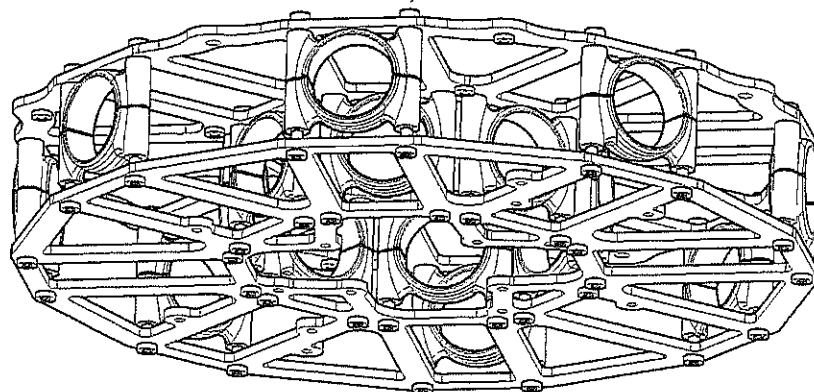


**MF1.4** Thread the thirty-two (32) M3x40mm screws into the top plate just far enough so they are flush with the edge of the press nuts. Do not fully tighten, as we will need the clamps loose in order to insert the booms.





MF1.1 - MF1.5  
MAIN FRAME



## TECHNICAL FOREWORD

Below are a few tips from the designers to aid in assembly, flight and maintenance of the CineStar 8. The CineStar 8 is designed to be a professional heavy lift multi-rotor helicopter. As such, it is very important to take your time and assemble with care.

Here are a few important tips in assembling the CineStar 8:

- ⇒ Always use threadlocker on any screw going into either aluminum or steel. This will ensure that the screws will not come loose even under the vibrations encountered in flight. We recommend using "Loctite 222MS Low Strength Purple Threadlocker," as it is intended for the small screw sizes found on the CineStar 8. It is important to use this product or a similar strength screw retainer adhesive, as stronger variations, such as Green or Red Loctite, are too strong for the small screw sizes used on the CineStar 8 and may make disassembly for repair/service impossible.
- ⇒ Be careful working with the carbon fiber booms and frame. We try to make sure that the edges on the carbon fiber are smooth and safe, but carbon can still have sharp edges which can cut your fingers and/or chafe delicate electronic wires. Any time a wire has to make a bend around the carbon fiber booms or frame, we recommend using some kind of protective sleeve (e.g., shrink tubing, nylon braid, etc.), so that the vibrations from the motors will not cause the wire to chafe on the edge of the carbon fiber. Carbon fiber is also conductive, so it is very important to make sure that all flight components are appropriately insulated.
- ⇒ Always remove the props when you are making a change to the configuration of the CineStar 8. We always recommend first testing the CineStar 8 with the props removed to make sure that the motors are spinning in the correct direction and that the motor assignment is correct with respect to your flight control board. If you have either of these wrong, the CineStar 8 will be uncontrollable.

Always install your selected flight control system in accordance with the manufacturer's instructions.

## SAFETY WARNING AND DISCLAIMER

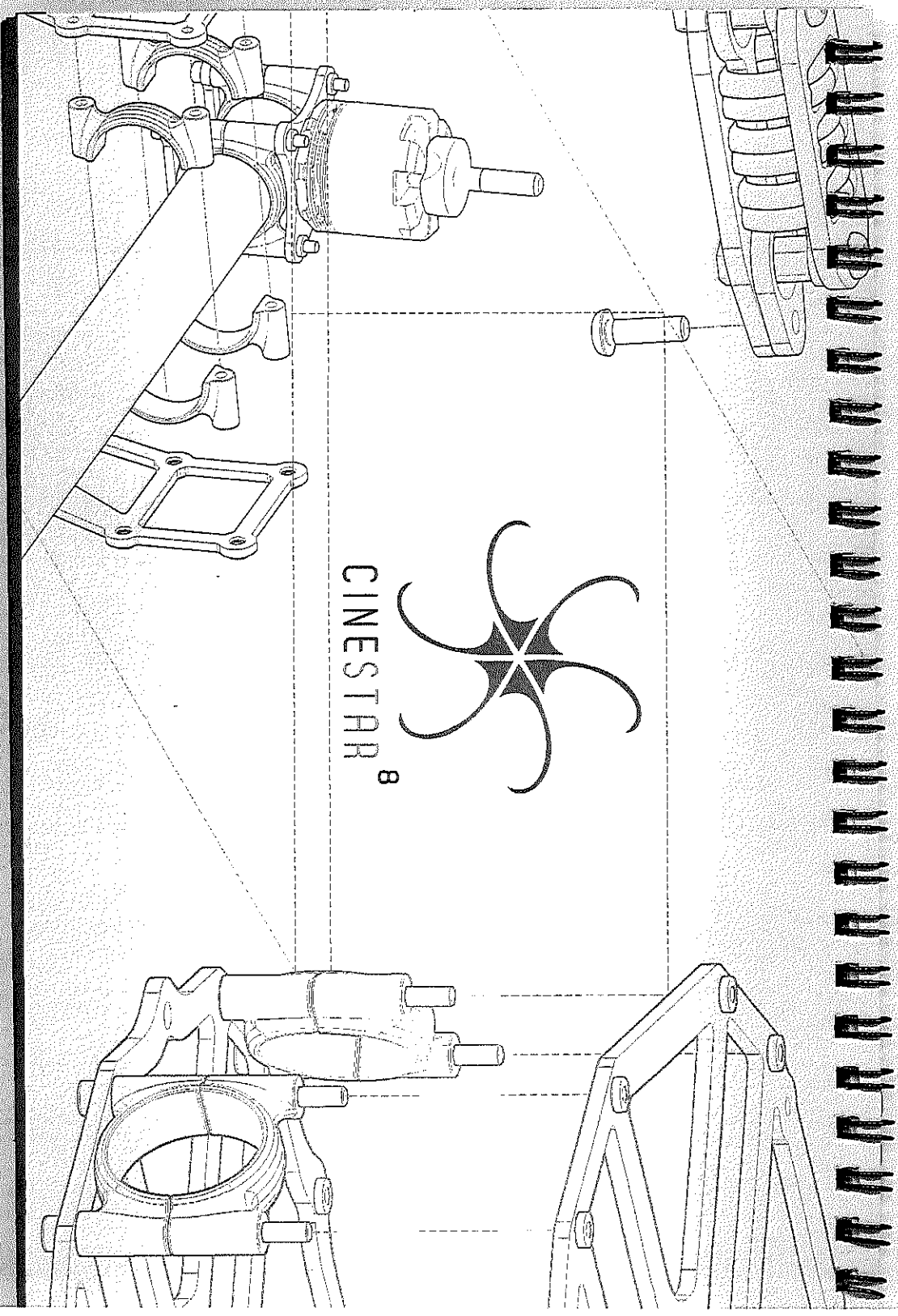
Thank you for purchasing the CineStar 8 by FreeFly Systems. The CineStar 8 is not a toy and should be operated with extreme care, as improper operation can cause serious personal injury and damage to property. The CineStar 8 should not be flown over or around people, power lines or other aircraft. It is important to always check the CineStar 8 and its components prior to operation. Always maintain a safe distance from the CineStar 8 when in use. Never attempt to touch the CineStar 8 when the propellers are moving. As with any multi-rotor helicopter, the CineStar 8 is a complex and technical machine. Novice pilots should invest sufficient time on a flight simulator and seek training from an experienced pilot prior to operation. A flight simulator is no substitute for training with an experienced pilot, particularly when it comes to learning how to safely operate the CineStar 8. Novice pilots should never fly without the supervision of an experienced pilot.

Always remove the props when you are making a change to the configuration of the CineStar 8. Always test the CineStar 8 with the props removed to make sure that the motors are spinning in the correct direction and that the motor assignment is correct with respect to your flight control board. If you have either of these wrong, the CineStar 8 will be uncontrollable and dangerous.

FreeFly Systems disclaims all warranties, whether express or implied, including but not limited to the implied warranties of merchantability and fitness for a particular purpose. FreeFly Systems does not assume any liability, whether direct or indirect, from the use of the CineStar 8. FreeFly Systems shall not be liable for any direct, indirect, special, incidental, punitive, contingent or consequential damages to persons or property caused by the CineStar 8. In no event shall FreeFly Systems be liable for personal injury up to and including death.

It is your responsibility to perform a full system check of the CineStar 8 prior to flight. It is your responsibility to learn how to safely operate the CineStar 8 and to adhere to all applicable rules and regulations. Fly at your own risk.





CINESTAR<sup>8</sup>

# Graupner/SJ

# HOTT

HOPPING.TELEMETRY.TRANSMISSION

No. S1006

## mz-24

# HOTT

HOPPING.TELEMETRY.TRANSMISSION

### OPERATING INSTRUCTION

Prior to use, please read this manual thoroughly.

Keep this manual in a convenient place for quick and easy reference.

[www.Graupner-SJ.com](http://www.Graupner-SJ.com)



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9-3. ELEV >> FLAP .....	93~94P
9-4. FLAP >> ELEV .....	94~95P
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11. Airbrake (Airplane) .....	97~99P
12. Butterfly (Gilder) .....	99~100P

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3. Etc.set .....	102P
4. Display .....	103P
5. Stick Cali .....	104P
6. MP3 .....	105P
• FIRMWARE UPDATE .....	105P
• SAFETY APPROVAL .....	106~107P

## • BEFORE USE

Thank you for purchasing mz-24 HoTT 2.4GHz Radio System. This system is extremely versatile and may be used by beginners and pros alike. In order for you to make the best use of your system and to fly safely, please read this manual carefully. If you have any difficulties while using your system, please consult the manual, our online Frequently Asked Questions (on the web pages referenced below), your hobby dealer, or the SJ Service Center.

Due to unforeseen changes in production procedures, the information contained in this manual is subject to change without notice.

## • INTRODUCTION

Graupner/SJ mz-24 HoTT radio system is used to airplane, helicopter and glider and should be a perfect choice for anyone who needs a high quality radio. This HoTT radio system gives user real-time information on various useful data such as user model's RPM, voltage, temperature, user programmable warning, and so on which are directly obtained from telemetric speed controllers equipped with this HoTT system without having to install separate sensor devices. Of course, all of those telemetric data can be also transmitted from separate sensor devices.

**⚠ WARNING :** Read the ENTIRE instruction manual to become familiar with the features of the product before operating. Failure to operate the product correctly can result in damage to the product, personal property and cause serious injury.

## • SUPPORT AND SERVICE

### • Customer support

Please feel free to ask any question by e-mail or phone. We've been trying to deal with your question. We are open from nine to six, Monday to Friday in Korea. We may respond to your question by e-mail as soon as possible when we are close.

### • Internet sales site

Please feel free to contact "www.openhobby.com" to get all information on product features, specifications, running events and the newest product line up..

### • A/S regulation

Only when the product is faulty after normal operation within the warranty period, we will repair the product for free based on our regulations. The repair is paid for by the consumer when the damage is due to use in improper ways or beyond the warranty period..

### • Warranty regulation

Refer the WARRANTY Card in a Package

## • OPENHOBBY A/S CENTER

8F, 202 Dong, Chunui Techno-Park II, 18, 198 street, Bucheon-ro, Wonmi-Gu, Bucheon-Shi, Gyeonggi-Do KOREA 420-857  
Phone: 82-32-623-0706 FAX: 82-32-623-0720  
Customer Service E-mail: service@openhobby.com

## 1. BOX CONTENTS

- |                     |                           |                        |                              |
|---------------------|---------------------------|------------------------|------------------------------|
| • mz-24 Transmitter | • Transmitter charger     | • USB PC interface set | • Micro SD Card              |
| • GR-24 receiver    | • Warranty Card           | • SD Card adapter      | • USB adapter wire           |
| • Manual            | • 1x 4000mAh LiPo Battery | • SD Card case         | • Transmitter strap          |
|                     |                           | • USB Cable            | • USB interface adapter wire |

## 2. FLYING SAFETY

This is a sophisticated hobby product and NOT a toy. It must be operated with caution and common sense and requires some basic mechanical ability. Failure to operate this product in a safe and responsible manner could result in injury or damage to the product or other property. This product is not intended for use by children without direct adult supervision. Do not attempt disassembly, use with incompatible components or augment product in any way without the approval of Graupner/SJ. This manual contains instructions for safety, operation and maintenance. It is essential to read and follow all the instructions and warnings in the manual, prior to assembly, setup or use, in order to operate correctly and avoid damage or serious injury.

1. Do not fly your model near spectators, parking areas or any other area that could result in injury to people or damage of property.
2. The radio system is affected by signal environment and the electronic jamming signals can cause disorientation and loss of control of your aircraft.
3. Since models are hazardous when operated and maintained incorrectly, install and operate a radio control system correctly and always pilot a model so the model is kept under control in all conditions
4. Ensure that all channels are working in the proper manner.
5. Do not fly during adverse weather conditions. Poor visibility can cause disorientation and loss of control of your aircraft. Strong winds can cause similar problems
6. When working with a model, always power on the transmitter first and power off the transmitter last.
7. After a model is bound to a transmitter and the model is set up in the transmitter, always bind the model to the transmitter again to establish failsafe settings.
8. When working with a model, always power on the transmitter first and power off the transmitter last.
9. Ensure all batteries are full charged before flying.
10. Only to use the recommended adapter when charging the battery of the transmitter and receiver
11. The transmitter shouldn't be switched off at any time during flight
12. Perform a range check of the transmitter and the model before flying the model
13. Make sure all control surfaces correctly respond to transmitter controls before flying.
14. Perform the programming setup of the transmitter after removing a power battery from a model or stopping an engine of a model.
15. Don't move or touch the transmitter antenna during flight

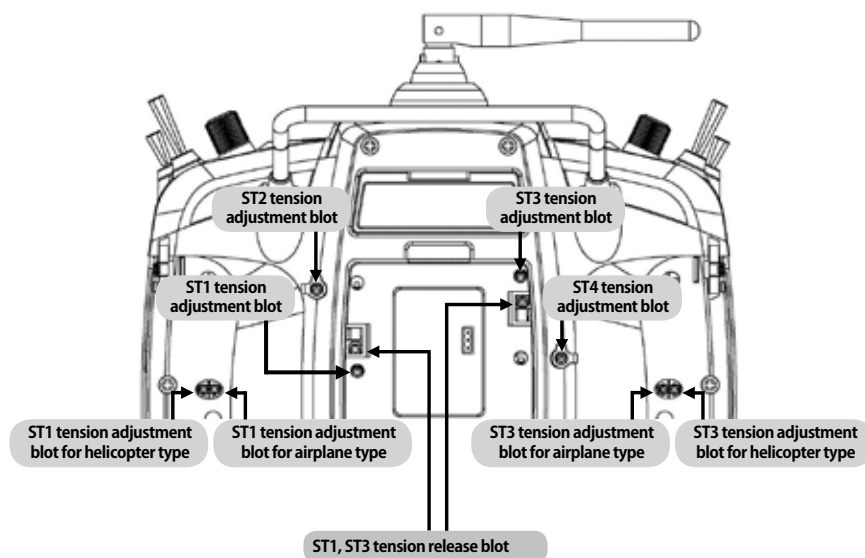
## 3. FEATURES

1. HoTT (Hopping Telemetry Transmission)  
The use of up to 75 hopping channels provides advanced reliable operation while keeping from any external interference.
2. This HoTT radio system gives user real-time information on various useful data such as user model's RPM, voltage, temperature, user programmable warning, and so on.
3. All telemetry data are directly obtained from telemetric speed controllers equipped with this HoTT system without having to install separate sensor devices.
4. Future-proof update capability using data interface of USB or Data pin.
5. Advanced HoTT wireless trainer system makes Teacher and Pupil system more enjoyable and gives user convenience for the teaching/learning.
6. Simple, ultra-fast binding of transmitter and receiver.

#### 4. SPECIFICATION

	Transmitter mz-24	Receiver GR-24
Frequency band	2.4~2.4835GHz	2.4~2.4835GHz
Modulation	FHSS	FHSS
Output power	100mW	-
Current drain	approx 125mA	approx 70mA
Operating voltage	3.4V~6V	3.6V~8.4V

#### 5. STICK TENSION ADJUSTMENT



You may release the stick tension with ST1 or ST3 tension release bolts. Turn the bolts clockwise then the stick tension is released

- Mode 1: ST1 tension release bolt is used
- Mode 2: ST3 tension release bolt is used

The other can be adjusted for your purpose

#### 6. TRANSMITTER CONTROL IDENTIFICATION





## 7. BINDING

1. You must bind the receiver to the transmitter before the receiver will operate. Binding teaches the receiver the specific code of the transmitter so that it will only connect to it's corresponding transmitter. If you turn on transmitter's power before binding, the warning message appears on transmitter LCD page, which announce transmitter is not bound. Touch SET icon on warning pop up to access to Tx ctl (BIND)

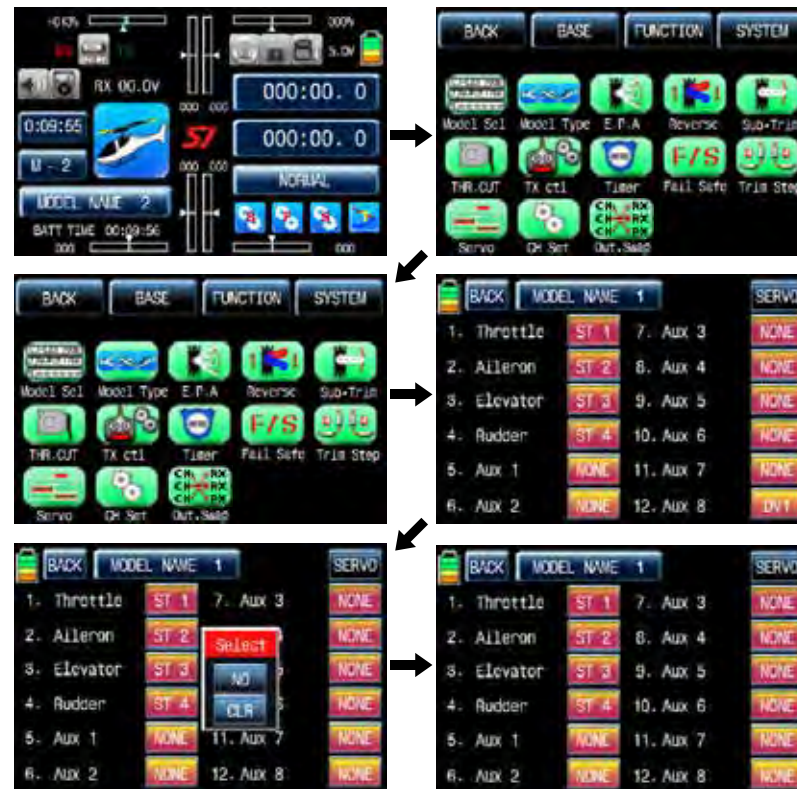


2. After accessing to Tx ctl(BIND), Turn on receiver's power and touch Bind button on receiver for over 3 sec to enter binding mode. Touch OFF icon in the cross line of BIND ON/OFF and RX1 then OFFs in the cross line of BIND ON/OFF and RX1, RF ON/OFF and RX1 are changed to ONs indicating the system has been connected. If the binding process has failed, repeat the whole procedure.



### ⚠ CAUTION

We strongly recommend to unlock the throttle limit function when you control Helicopter. Throttle limit function restrict the travel amount of throttle with DV1 volume and this function is set by default. Touch "BASE" icon at the main page to call "BASE" page and touch "CH set" icon to call "CH set" setup page. Touch DV1 in channel 12 to call "Select" message popup and touch CLR in popup then DV1 is switched to NONE. Now, throttle limit function is unlocked.



## 8. TRANSMITTER PROGRAMMING SETUP

### BASE MENU

Turn on transmitter's power and touch B icon on the main page to access to BASE menu.



## BASE MENU (Helicopter, Airplane, Gilder)

### 1. Model select

It is used to add or select model.

Touch Model Sel icon in base menu to access Model sel menu



#### 1-1. SET

Touch the desired MODEL NAME icon then it is activated in blue. Touch SET icon, Pop up message "Please Wait !!" appears. About 1 sec later, the desired MODEL NAME is selected and MODEL NAME at top is also changed.



#### 1-2. NEW

This function is use to create the new model or exchange the current model to others. There is 2 methods of Manual setting and Wizard setting. You may program the basic function sequentially in Manual setting. Here is the example for airplane

Touch the desired MODEL NAME icon and touch NEW icon on the right then the pop up message

"Select" appears. Touch MAN to start Manual setting. The first function of Manual setting is MODEL NAME. Tap model name in blank of New Model Name using keypad on the right. Touch EN icon on the right bottom and touch MAN icon on the left top then the model is named and stored and then the next function, model type, is accessed.

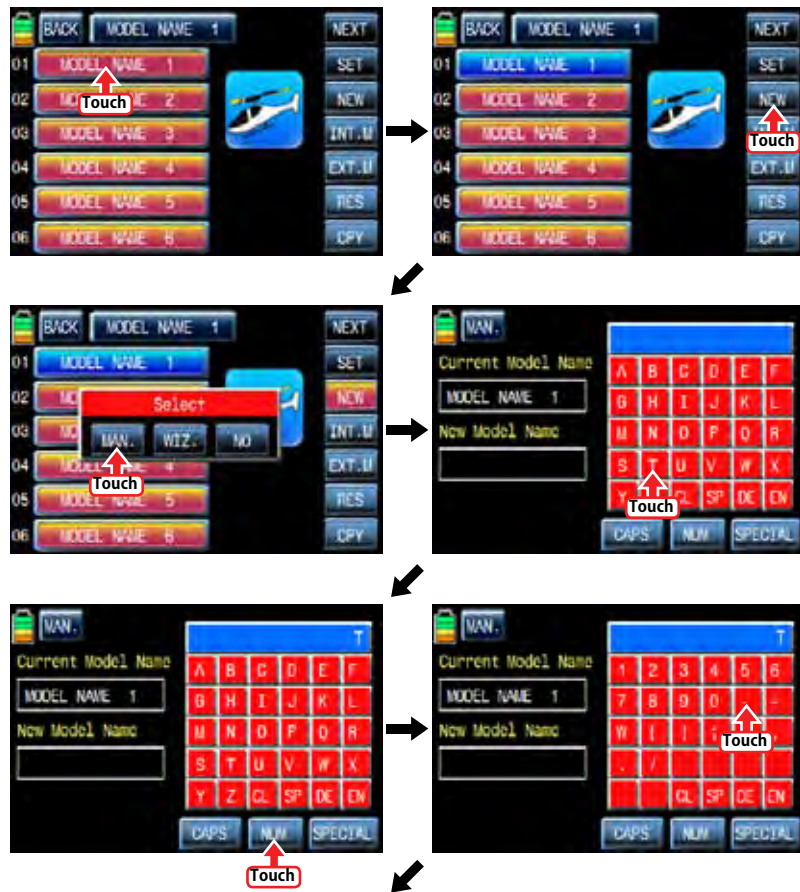
- Alphabet keyboard explanation.

- CL(Clear):it is used to erase every letter you typed at a time.
- SP(SPACE):it is used to make a space between words
- DE(DELETE):it is used to erase a letter you typed
- EN(ENTER):it is used to save every letter you typed.
- CAPS:it is used for capital letters or small letters
- NUM:it is used for numbers.
- SPECIAL:it is used for special character.





In accordance with model type that you selected, swash type function or wing type function is accessed. Below picture shows the example for wing type in airplane. Select the desired wing type, tail type and power type in turn. If all procedures have been done correctly, all types that you selected appear on the page. Touch ENT icon on the right bottom after checking the selected types, Manual setting is completed and returned to base menu



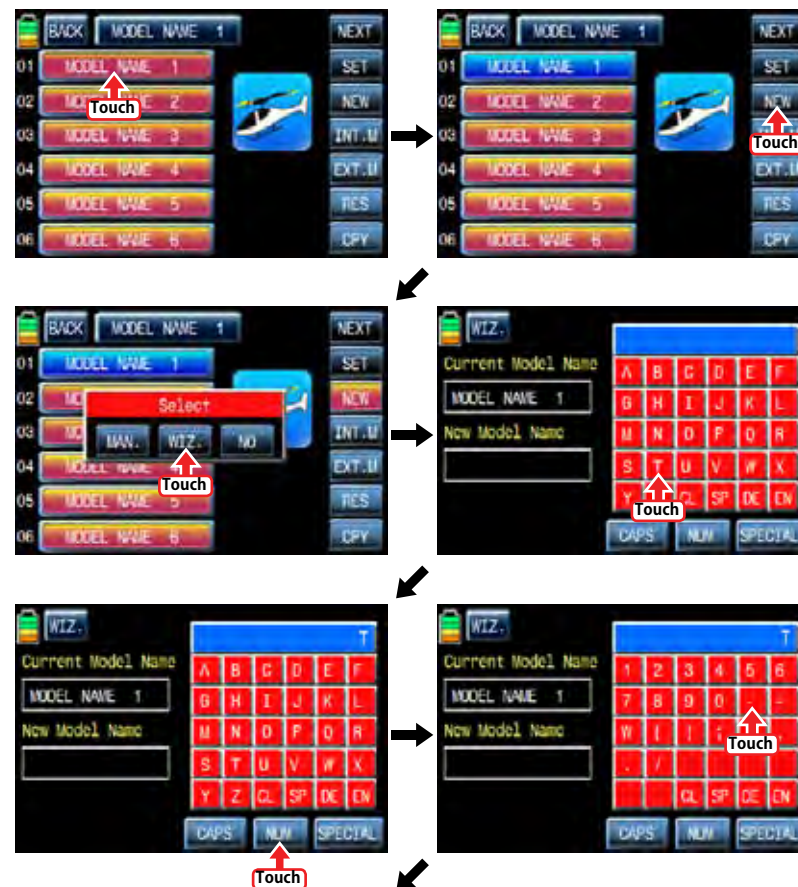


“Wizard setup” is used to set the basic function of a model and the essential function of flight one by one. Please refer to the example of helicopter type as below.

Touch the icon of desired model you want to program Wizard setup in the model list and touch “NEW” icon then the “Select” message is popped up. If you touch “WIZ” icon, WIZARD function is ready to set. The first function of wizard setting is MODEL NAME. Tap model name in blank of New Model Name using keypad on the right. Touch EN icon on the right bottom and touch WIZ icon on the left top then the model is named and stored and then the next function, model type, is accessed.

- Alphabet keyboard explanation.
- CL(Clear):it is used to erase every letter you typed at a time.
- SP(SPACE):it is used to make a space between words
- DE(DELETE):it is used to erase a letter you typed
- EN(ENTER):it is used to save every letter you typed.
- CAPS:it is used for capital letters or small letters
- NUM:it is used for numbers.
- SPECIAL:it is used for special character.

In accordance with model type that you selected, swash type function or wing type function is accessed. Below picture shows the example for swash type in helicopter. Select the desired swash type, power type and set reverse function, EPA function, D/R EXP function, Pit CRV function, Thr.CRV function, GYRO function, Thr.HOLD function, FAILSAFE function in turn. When you touch WIZ icon after completing to program each function, the next step is accessed in turn. When you touch WIZ after FAILSAFE function is programmed finally, “Model type”, “Swash type”, and “Power type” that you selected appear on the page. Touch ENT icon on the right bottom after checking the selected types, Manual setting is completed and returned to base menu



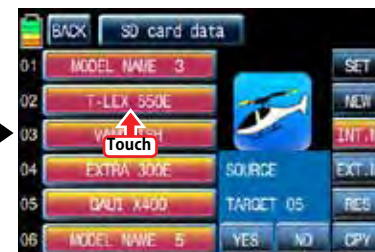
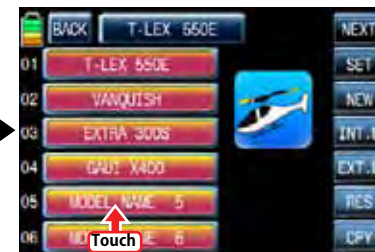
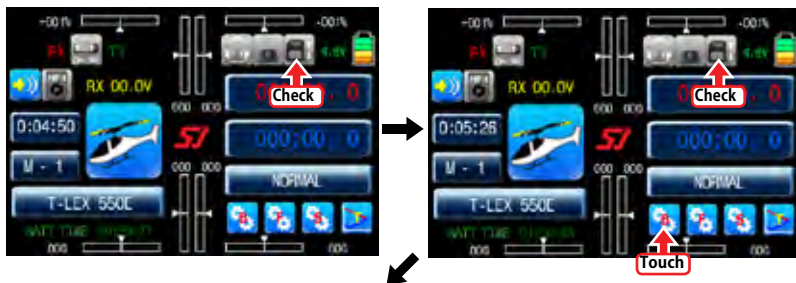






### 1-3. INT.M (Internal Model)

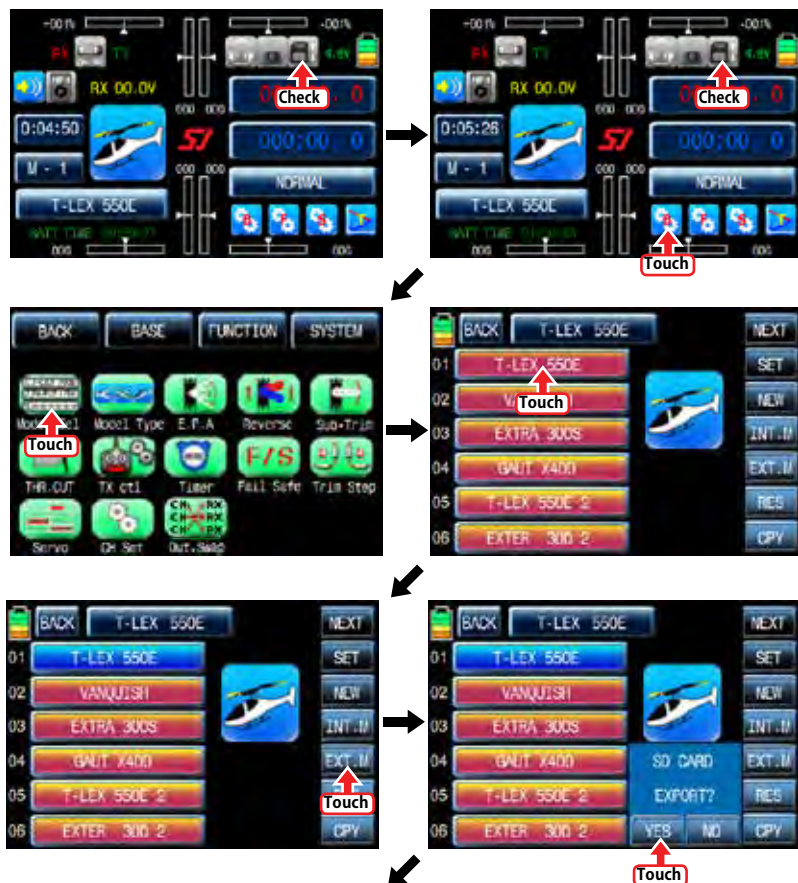
It is used to copy the model memory in SD Card into the model list of transmitter. To make use of INT.M function, you need SD Card that has the programmed model file. If you put SD Card into SD Card slot on the back of transmitter, "SD Card" icon is lighted in the transmitter main page. When the icon is lighted, touch the base setup icon to call the base setup page. In the page, touch "Model Select" icon to call the "Model Sel" setup page and touch the copy destination then it is activated in blue. Touch "INT.M" icon then the model list in SD Card appears and then select the source model to copy. The popup message indicating the destination and source appears. Touch YES, if they are correct, then "Please wait" message is displayed and a few seconds later, the model data in SD Card is copied to the model list in transmitter.





#### 1-4. EXT.M (External Model)

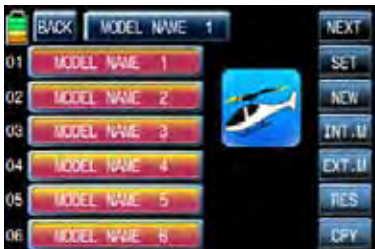
This function is used to copy the model in transmitter into SD Card. In order to use EXT.M function, you need to plug SD Card into SD Card slot on the back of transmitter. When it is plugged into the slot, "SD Card" icon is lightened in the transmitter main page. Touch Base setup icon to call the base setup page. In the page, touch "Model Select" icon to call the "Model Select" setup page and touch the source model to copy in transmitter then it is activated in blue. Touch "EXT.M" icon then the popup message "SD Card EXPORT?" appears. Touch YES then "Please wait" message is displayed and a few seconds later, the model data in transmitter is copied to SD Card now



#### 1-5. RES(RESET)

It allows you to remove the selected models in model list. Refer to the example of Model 01 as shown below. At first, you need to select the desired model that you want to remove then the model icon is activated in blue. "Please wait" message is popped up when you touch "YES" icon. All the data of the corresponding model is removed within a few second.





## 1-6. CPY(Model Copy)

The Copy function is used to copy the programmed values of a model into the other model. Touch the source model to copy, it is activated in blue. Now touch "CPY" icon on the right bottom and touch the copy destination then it is activated in blue as well. The popup message indicating the destination and source appear. Touch YES, if they are correct, then "Please wait" message is displayed and a few seconds later, the source data is copied to the copy destination transmitter.



## 2. Model type

It is used to reset the model type. Please note that all the value, excepting for model name, is reset when "Model type" is reset. Touch "Model type" icon on base menu page to call the model type setup page, the preset "model type", "swash type" and "power type" is displayed. The below example tells you how to change from the heli type to air type. If you touch M/TYPE icon, you may select airplane from preset Helicopter at M/TYPE page again. In accordance with the selected model type, "Swash type" or "Wing type" appear. Since the airplane type is selected, the wing type is shown in the example below. Select the desired wing type, tail type and power type in turn. If all procedures have been done correctly, all types that you selected appear on the page. Touch ENT icon on the right bottom after checking the selected types, Manual setting is completed and returned to base menu





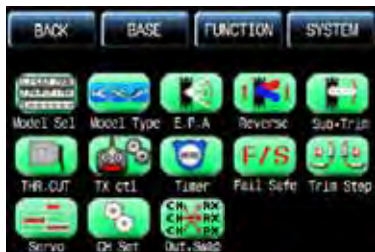


### 3. E.P.A

E.P.A is used to adjust Servo operation angle and limitation for each channel. Touch "E.P.A" icon on the base menu page to call E.P.A setup page. "Limit" and "travel" can be set individually. When you touch each icon, it is activated in blue and you may adjust the values with "INC" and "DEC" buttons. Touch NEXT icon on the right to go and set more channels' E.P.A. after setting each channel's E.P.A, touch "SERVO" icon to call "SERVO VIEW" page. By moving each channel's stick, you may check E.P.A value in the graph. When "BACK" icon in the "SERVO VIEW" page is touched, you may return to the base menu page.







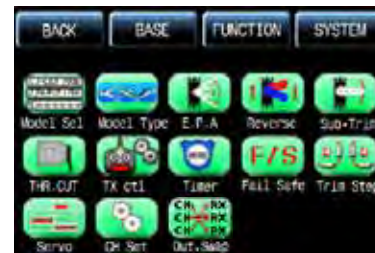
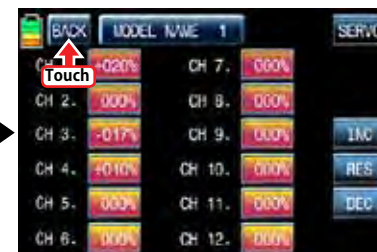
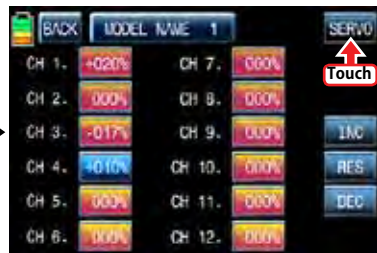
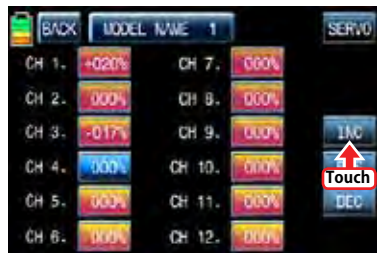
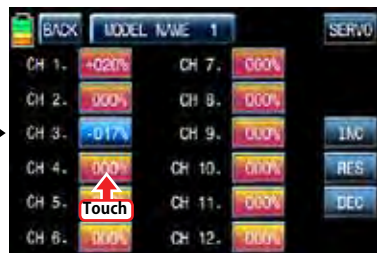
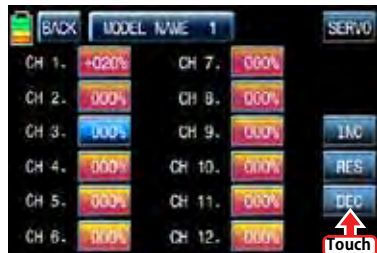
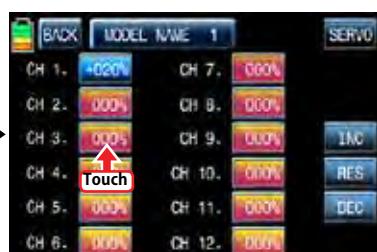
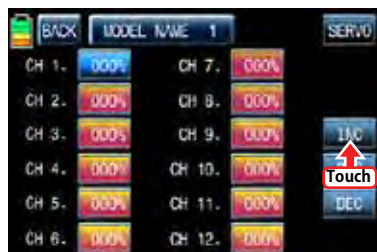
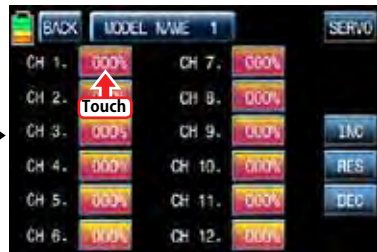
#### 4. Reverse

It is used to reverse the operation of an individual servo. Touch the "Reverse" icon in the base menu page to call the Reverse setup page. In "Reverse" page, you are able to reverse the operation of a servo. When you touch the "NOR" icon, "NOR" is changed to REV" and the operation of an individual servo is reversed. Touch "Servo" icon on the left top to call the "Servo View" page after setting "Reverse" function. When each channel's stick is controlled, "Reverse" setting status can be seen in a graph. Now, touch "Back" icon in the servo view page to call the reverse setup page. When Reverse function setting is completed, touch "Back" icon on the top left page to call the Base menu page.



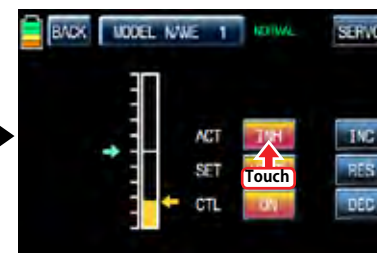
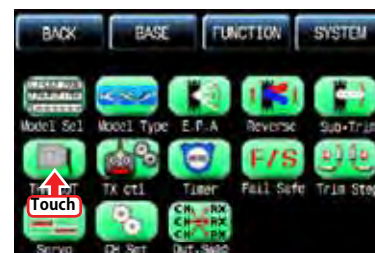
#### 5. Sub-Trim

It is used to set the servo neutral position, and may be used to make fine adjustments to control surface without hooking linkages and pushrods up. When Sub-Trim function is used, make sure that the servo trims are set to their center position. Touch "Sub-Trim" icon in the base menu to call the "Sub-Trim" setup page. In the base menu, touch "000%" icon then it is activated in blue. "Sub-Trim" values can be adjusted with the "INC", "DEC" icons. When the setting for "Sub-Trim" is completed, touch "Servo" icon to call "Servo View" page in which you may check "Sub-Trim" value in a graph. Touch "Back" icon to call "Sub-Trim" setup page and touch "Back" icon again to call "Base" menu page after setting "Sub-Trim" for every channel.

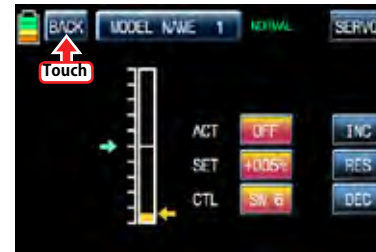
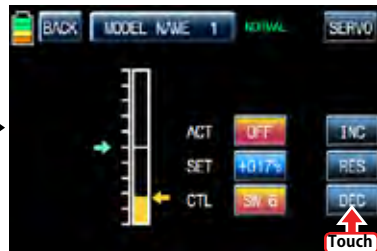
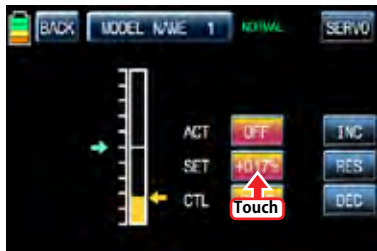
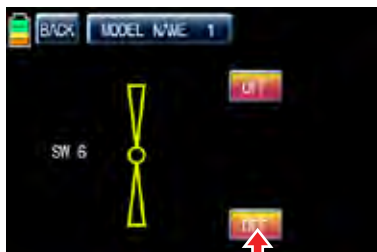


## 6. THR.CUT

This function is used to stop the operation of engine. THR.CUT function works from below one-third position of the full movement range of throttle stick. Touch "THR.CUT" icon in the base menu page to call the "THR.CUT" setup page. When touching "INH" icon in "ACT" line, you may change the value to "OFF". When touching "On" icon in "CTL", the message "Select" is popped up. Now, move the switch with your choice then this switch is set to on/off switch for "THR.CUT" and the switch setup page appears. You may change ON/OFF by touching icons. When the switch is moved to the direction of ON, the function is operated. After the switch setup is completed, touch "BACK" icon on the left top to return "THR.CUT" setup page then set the value in "SET" line. Touch "017%" icon to activate it in blue and touch "INC" and "DEC" icons to decide the throttle position when "THR.CUT" is on. Now the servo of throttle channel is operated to the corresponding position. Touch "Back" icon to return the base menu page.







## 7. TX ctl

It consists of the multiple functions for a transmitter. It includes "BIND ON/OFF", "TX OUT SET", "RF ON/OFF", "RF TYPE", "RANG TEST", and "DSC OUTPUT" functions. Touch "TX ctl" icon to call the "TX ctl" setup page.



## - BIND ON/OFF

It is used to bind a transmitter to a receiver. In "TX ctl" setup page, turn on a receiver and press "Setup" icon of a receiver for over 3 seconds until a receiver is entered the binding mode. If you touch "Off" icon in "BIND ON/OFF" of "RX1" then the transmitter is bound to a receiver in a few seconds and "OFF" of "RX1" is changed to the product name of the bound receiver. "RF ON/OFF" is set to "ON" as well. Rx2 can be bound as the same as explained above.



## - TX OUT SET

It is used to edit the receiver's "out-channel" connected to each channel of transmitter as you want. For example, when "2 Elevator" function is used, the "CH3" and "CH8" out pins of receiver are used in the traditional channel setup, however, if the receiver's CH4 pin is set for the transmitter's CH3 using "TX OUT SET" function, the CH4 and CH3 pin are operated for the "2 ELEVATOR" function. To make use of this function, a receiver should be bound first. When you bind the receiver to RX1 and RX2 and then touch "Set" icon in "TX OUT SET" to call "TX OUT SET" setup page. "TX OUT SET" page is differently shown according to the number of receiver's channel which is bound to a transmitter. Basically, the order of transmitter's channel is set as the same as the order of receiver's out-pin. Touch the desired channel number to activate in blue and change it to the channel that you want to match with "INC" and "DEC" button and then touch "STO" icon to transmit the setup data to the receiver. The other channels are set as the same as explained above.

NOTE: Since "TX OUT SET" function is set the receiver by transmitter, you should touch the "STO" icon to transmit the setup data to the receiver and to save the data on a receiver for operation.



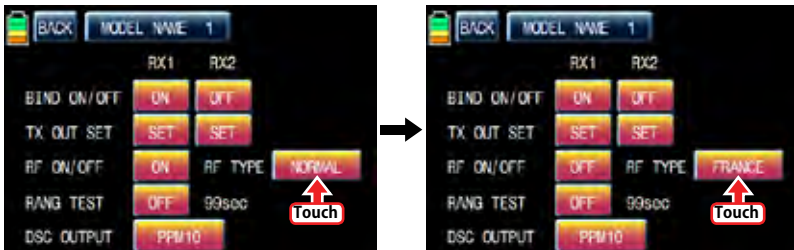
## - RF ON/OFF

It is used to turn on or off transmitter's "RF" function. If you are not flying a model but programming transmitter only, you are able to save the battery of the transmitter by setting RF to turn off. Under "OFF" status, transmitter is disconnected with the receiver. Touch "ON" icon in "RF ON/OFF" to change to "OFF"



## - RF TYPE

mz-12 offers 2 RF types, NORMAL and FRANCE, to comply with country regulation. "NORMAL" type is usually used in most countries, but you need France RF setting to comply with France regulations in FANCE. France RF setting should only be turned on when operating your transmitter in France outdoors. "NORMAL" type can be changed into "FRANCE" type by touching "NORMAL" icon. If the "FRANCE" icon is touched again, it can be changed into "NORMAL" icon.



#### - DSC OUTPUT

It is used to set the number of channel when Trainer function is used with DSC jack. If 5 channels are used, PPM5 is recommended to use. To use more than 5 channels, choose the appropriate PPM for each condition. PPM10, PPM16, PPM18, PPM24 are selectable. Whenever you touch the value icon in DSC OUTPUT, You can select "PPM10", "PPM16", "PPM18", and "PPM 24" in turn. Default value is "PPM 10".

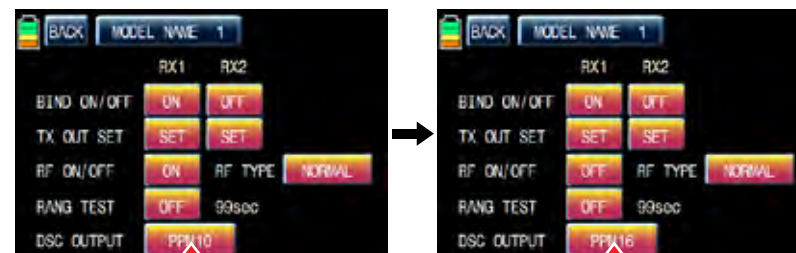


#### - RANGE TEST

"Range Test" function reduces the power output. This allows for a range test to confirm the RF link is operating correctly. Perform a range check at the beginning of each flying session to confirm system operation.

If the servo connected to receiver is operated normally within 50m or 70m of the distance from the receiver, you may fly a model, if not, you need do range test again. If it doesn't operate normally even after the test, please send mz-12 for repair.

Touch "OFF" icon in "RANGE TEST" to change to "ON", transmitter beeps indicating "Range test" setup begins. This function is available for 99sec. you may touch "ON" icon if you want to stop the function.





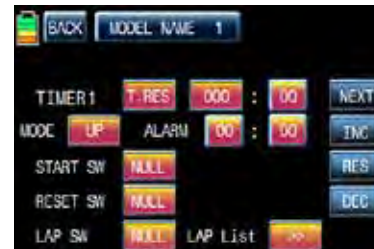


## 8. TIMER

Timer function may be set for any desired time ,i.e. model time, date, time, etc. Two independent timers, TIMER1 and TIMER2, are provided for each model. Touch "Timer" icon in base menu page to call the timer setup page.



In the "Timer" setup page, set "TIMER 1" first. The timer in the first line is used when to save the flight data on SD card. Bind transmitter and receiver and Insert SD card into SD card slot in the rear of transmitter. Touch the value in minute or second to operate or stop timer. The flight data starts to be saved on SD card when timer starts to operate and stop to save when timer stop to operate. Touch "T.RES" icon to reset timer. Since the timer in TIMER 1 is operated with ALARM timer at a time, you need to operated ALARM timer to use it



To set the model time, touch "MODE" icon and then select "UP" or "DOWN". The default value is UP. Timer may be set count-down or count-up operation with your choice. Count-up timer continues counting from zero to the setup time and Count-down timer keeps counting from the setup time to zero.

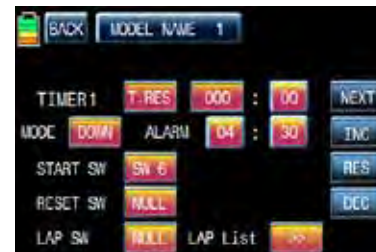


After "MODE" setup, you need to set "ALARM". The alarm sounds from the last 20 seconds in the setup time. It has the 2 seconds intervals for the first 10 seconds and has the 1 second interval for the next 10 seconds.



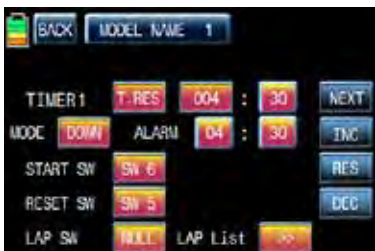


After "ALARM" setup, you may set "START SW". Touch "NULL" icon in "START SW" to call "Select" message popup. Now, move the switch with your choice then this switch is set on/off switch for "START SW" and the switch direction setup page appears. You may change ON/OFF by touching icons. When the switch is moved to the direction of on, the function is operated. Touch "Back" icon to return TIMER setup page

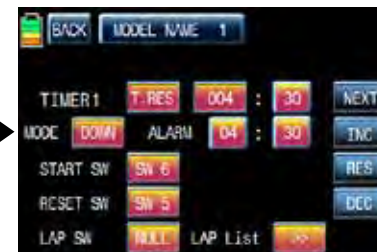
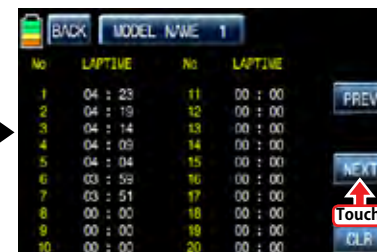
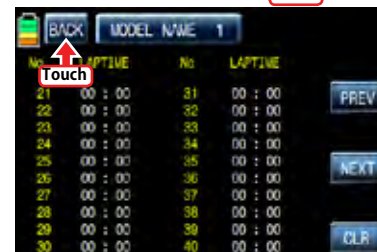


When START SW setup is completed, you may set RESET SW function. Touch the "NULL" icon in "RESET SW" to call "select" message popup. Now, move the switch with your choice then this switch is set to on/ off switch for "RESET SW" and the switch direction setup page appears. You may change ON/OFF by touching icons. When the switch is moved to the direction of ON, the function is operated. Touch "Back" icon to return TIMER setup page

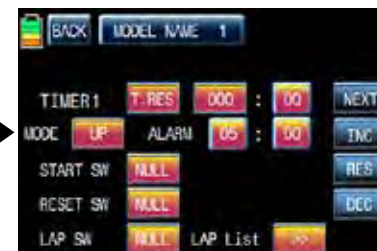
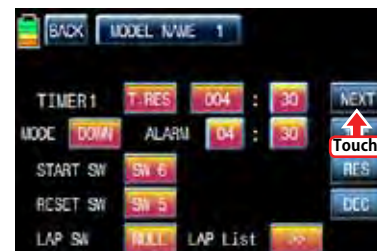




After RESET SW is set, you may set "LAP SW" function. Touch "NULL" icon in "LAP SW" to call "select" message popup. Now, move the switch with your choice then this switch is set on/ off switch for "LAP SW" and the switch direction setup page appears. You may change ON/OFF by touching icons. When the switch is moved to the direction of ON, the function is operated. Whenever the LAP SWITCH is on, Lap time is saved into LAP list. Touch "BACK" icon on the left top to call Timer setup page. In order for you to check the LAP list, Touch ">>" icon in LAP List to call LAP list page. Up to 100 ea of Lap time can be saved and only 20ea is displayed in the page. For the next LAP list, touch "NEXT" icon. If touching "CLR" icon on the right top, LAP list is deleted. Touch "BACK" icon to call Timer setup page.



Touch "NEXT" icon on the right in Timer 1 setup page, you may call Timer 2 setup page. You are able to set Timer 2 as the same as explained above. Timer 2 don't have the function of the flight data saving so it can calculate the time only.





After Timer 2 setup, touch “NEXT” icon on the right. You may call the page of the date/ time setup. Touch “SET” icon to activate it in blue and touch the desired value to activate in blue. With “INC” and “DEC” buttons, you may adjust the values for the date and time as the picture shown below. BATT TIME and MODEL TIME can be reset by touching the corresponding B.RES and M.RES icons.





## 9. FAILSAFE

When you bind your transmitter, you are programming the receiver with failsafe defaults. If connection is lost between the transmitter and receiver, the receiver immediately operates in those preprogrammed default positions.

The default value is "Hold" and you may select "Hold" or "F/S" for up to six channels.

**CAUTION:** Fail safe function should be operated when the transmitter and receiver are switched on.

**Hold:** If you lose connection between the transmitter and the receiver, the preset channels hold the last given command.

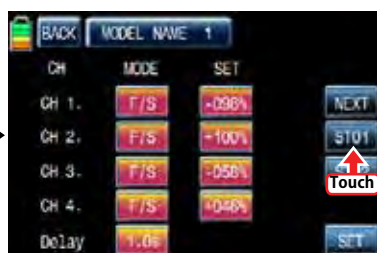
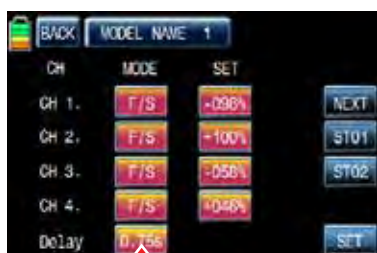
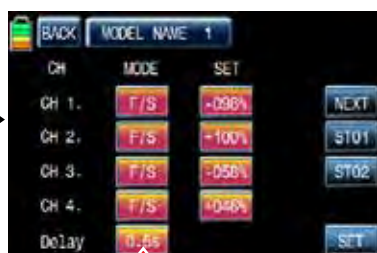
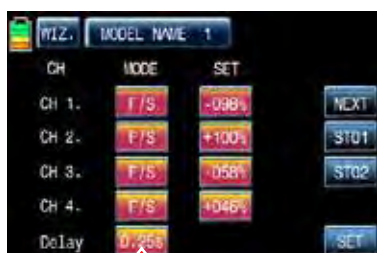
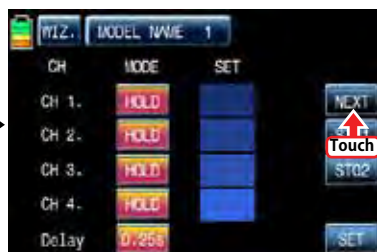
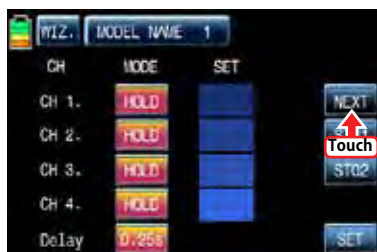
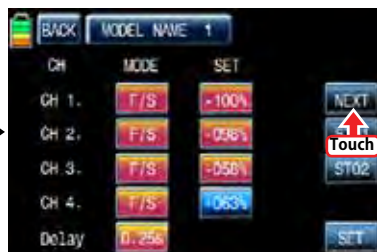
**F/S:** If the signal is lost, the preset channels are driven to their failsafe preset position.

In the base page, touch "Fail Safe" icon to call "Fail Safe" setup page. All channels' default values excepting for throttle channel are set in "Hold". Touch "Hold" icon in the channel to set to "F/S" and then touch the "SET" value to activate in blue. After that, move transmitter stick to the desired position and touch "Set" icon in the right bottom then the position of transmitter stick is displayed in percentage. Every channel can be set in the same and when touching NEXT icon in the right, you may call the next setup page.

You may set "Delay" function after all channels setup, 0.25s is set by default, and may select any of 3 types ( 0.5s, 0.75s, 1.0s ) by touching the delay mode icon. After "Delay" setup, be sure to touch "STO1" and "STO2" icons in the right to transmit Failsafe setup data to a receiver. Now failsafe setup is completed.





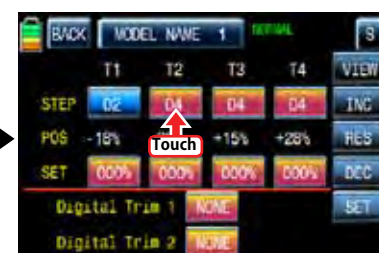
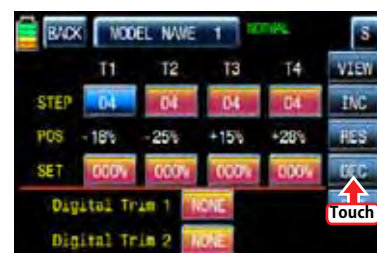
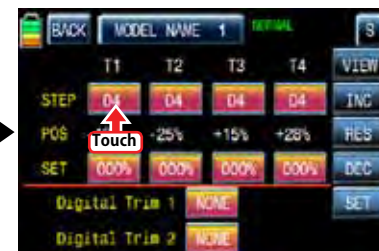
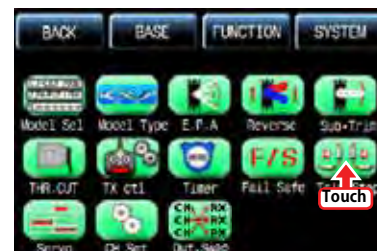


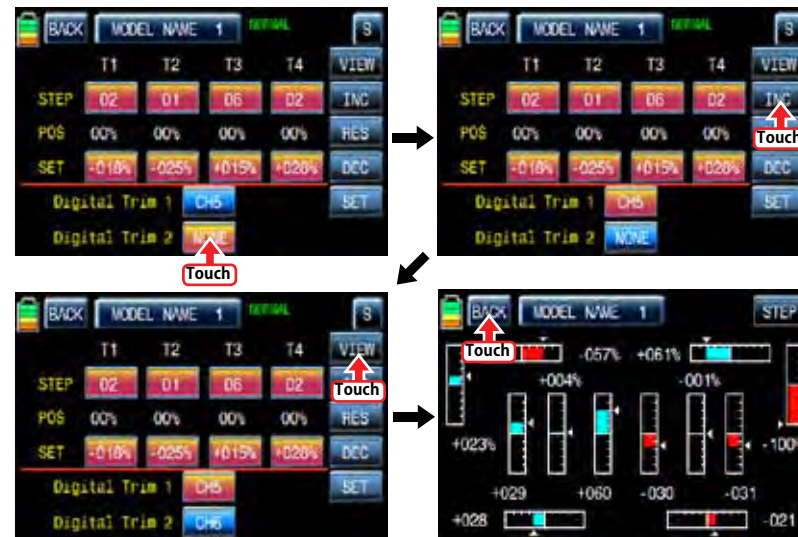
## 10. TRIM STEP

It allows you to check all function values of "Digital trim step", "DT1", "DT2", "Digital volume", and "Side slide". Touch "Trim Step" icon in base menu page to call Trim Step setup page. The step value indicates the amount that the trim is moved in the range, 100, when operating trim key one time. "4" is set by default and it means that the trim is moved as much as "4" by operating trim key one time.

Touch and activate the values in STEP line and adjust the values with "INC" and "DEC" buttons. The programmed trim values are displayed in "POS" line and can be saved on transmitter. If you save the programmed trim, the value is reset to the natural, 00%, and it can be verified in "POS" line as well. Touch and activate the values, 000%, in SET line and touch "SET" icon in the right bottom then the value in POS line is switched to 000%, the programmed trim value is saved in SET line.

After Trim STEP and SET setup, you may adjust the function value of "Digital trim 1" and "Digital trim 2". Their default value is set as "None". Touch any of options for "DT1" and "DT2" to activate in blue. You may adjust the function value with "INC" and "DEC" buttons. Touch "View" icon in the right to call the next page that you can see all setup data such as Trim position, DT1, DT2, Digital volume and Side slide. Touch "BACK" icon to return the previous page.



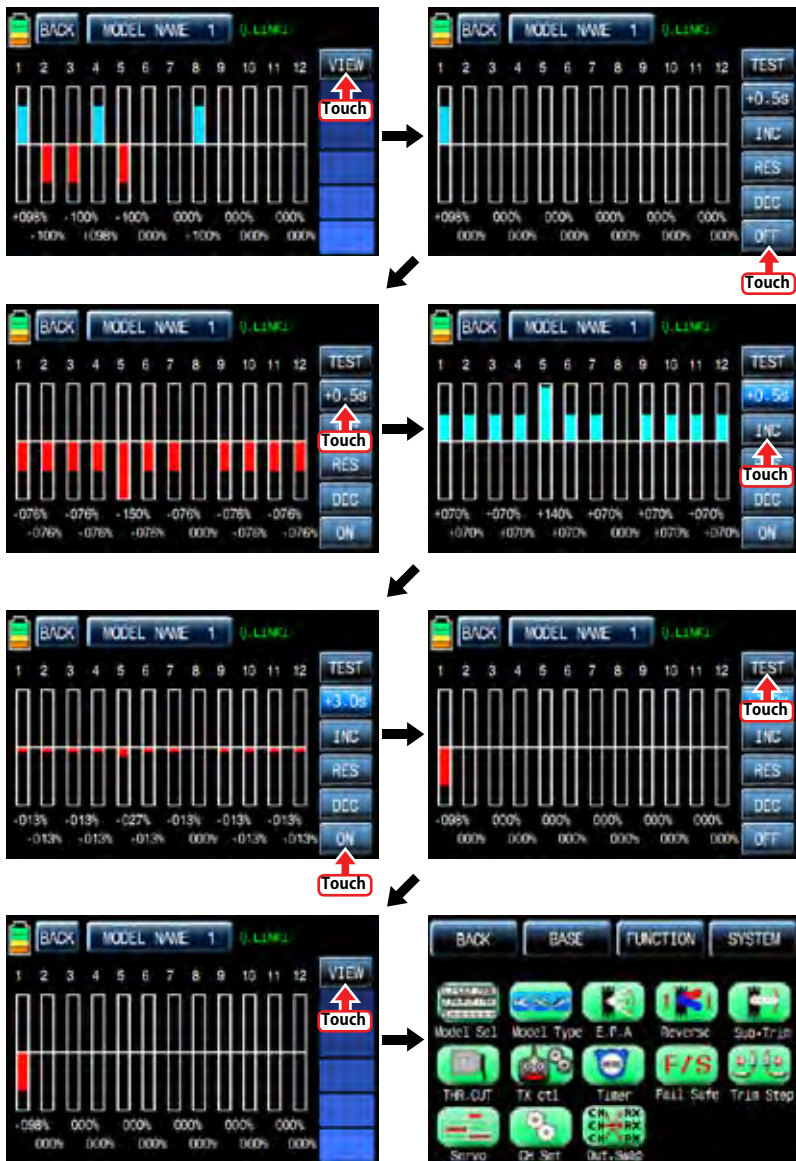


## 11. SERVO

It is used to test a servo and check the servo movement in a graph. You are able to test the servo movement from 0.5sec to 5 sec with your choice. Touch "Servo" icon in the base page to call the servo setup page. In the servo setup page, the servo movement of every 12 channels is displayed in graph and figure when transmitter is operated. Touch "View" icon in the right bottom to call "Test" function page. Touch "Off" icon in the right bottom then "Off" is changed to "On" and then "Test" function is activated. During the operation of "Test" function, touch "0.5s" icon to activate in blue. With INC and DEC buttons, you may select from 0.5s to 5sec of operation speed. Touch "ON" icon to change to "OFF" then "Test" function is terminated. When "TEST" icon is touched, you may return VIEW function page.



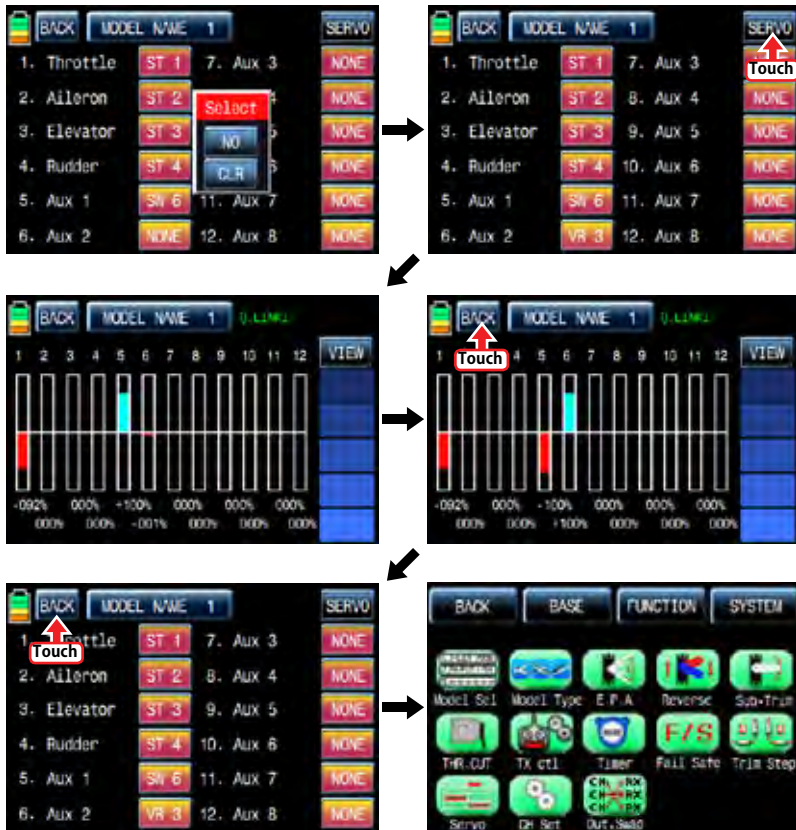




## 12. CH Set

It is used to set the channel of a transmitter. The basic setup of the transmitter's channel is set differently depending on 3 different types ("model type", "wing type", and "swash type") and mz-12 offers AUX channel to set the switch, volume, and side lever for your purpose. Touch "CH set" icon on base menu page to call to "CH set" setup page. In "Ch Set" setup page, the basic functions of the transmitter which is connected individually to every channel are displayed. AUX channels are displayed as NONE when they are not connected to a servo. To connect AUX channel to a servo, touch "NONE" icon to call the "select" message popup and move the switch, volume or side lever with your choice then the selected switch, volume or side lever is set to AUX channel and the connected servo is controlled. Touch "SERVO" icon on the right to call the "SERVO VIEW" page, you may check the operating status of servo connected AUX channel in this page. Touch "BACK" icon to return the previous page.

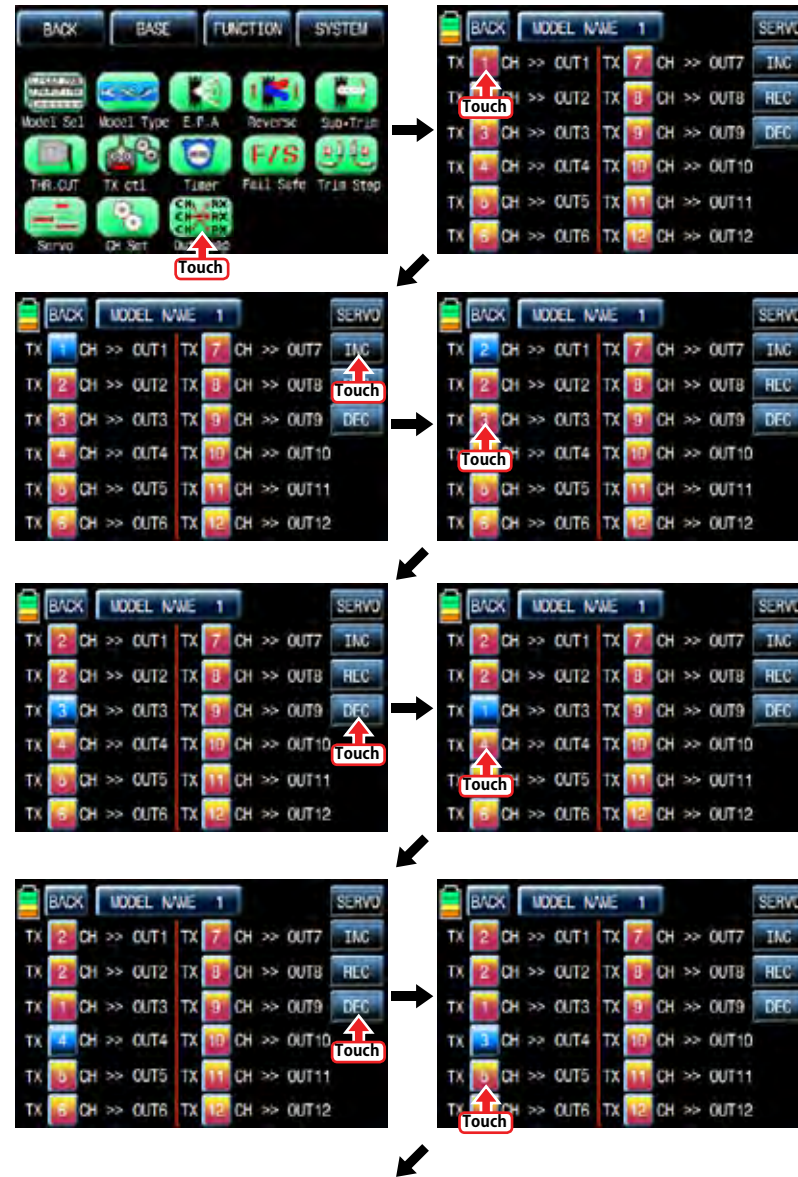




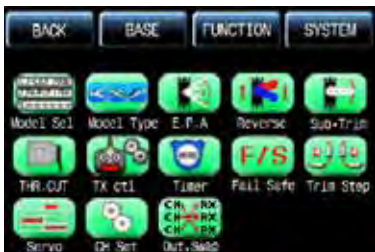
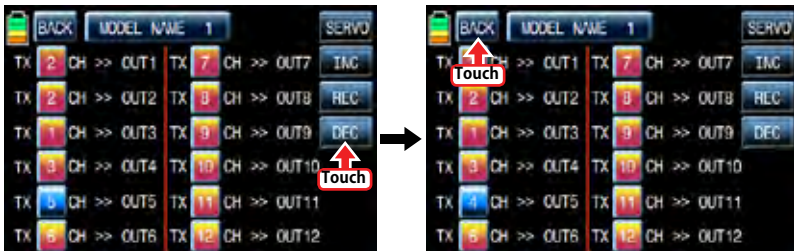
### 13. Out Swap

This function is used to edit the channel connection between transmitter and receiver. (It is similar to TX OUT SET function in TX ctl, but Out Swap function is operated without transmitting the setup data to a receiver unlike TX OUT SER function. Even if receiver channels are more than transmitter channels, you are able to set receiver channel in "TX OUT SET" function, but "Out Swap" function allows you to edit only twelve channels connected to the transmitter.)

In base menu page, touch "Out.Swap" icon to call "Out. Swap" setup page. The channel order of transmitter is set as the same as the order of receiver. Touch the channel number to activate in blue and decide the desired channel number with "INC" and "DEC" button. Every channel is set in the same way. After setup, touch "BACK" icon to return to the base menu page.





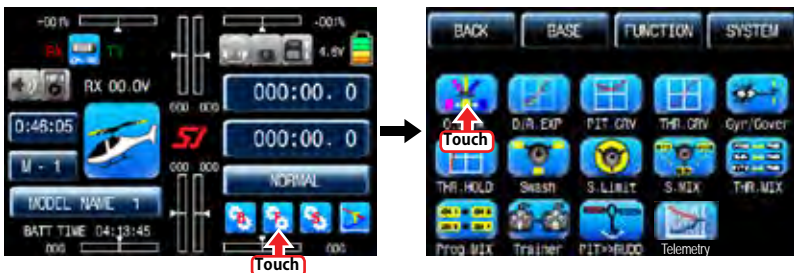


## FUNCTION MENU (Helicopter)

### 1. Q.LINK

This function is used to set Q.LINK and assign the corresponding switch to cope with the unexpected trouble situation. Since the adjusted value is activated by moving the switch and you can cope with the crisis with just one switch. It makes you operating the flight much easier. Q.LINK for helicopter type consists of 6 types. (NORMAL, HOLD, IDEL UP1, IDEL UP2, IDEL UP3, Q. link5 ) Normal type is set as a default value.

In the transmitter main page, touch "Function" icon to call the Function page and touch "Q.LINK" icon to call Q.LINK setup page. Q.LINK list is displayed. "1.NORMAL" is the default value and it cannot be changed.

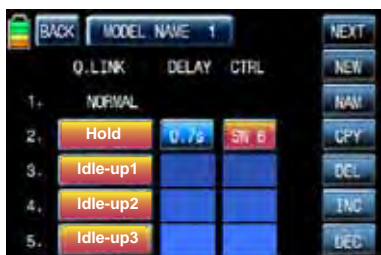


### 1-1 NEW

This function is used when you wish to create new Q.LINK. If you may want to set for new Q.LINK, touch the value in "Q.LINK" line to activate it in blue and touch "NEW" icon in the right to call "CTRL" and "DELAY" options. In "CTRL" setup, touch "NULL" icon to call "Select" message popup and move the switch or stick with your choice then the switch or stick is set to Q.LINK switch. To set "DELAY" function, touch "0.0s" icon to activate in blue and set the delay time with "INC" and "DEC" buttons. DELAY indicates the time till Q.LINK start to work after Q.LINK is switched on







## 1-2 NAM

It is used when to revise the name of "Q.LINK". Touch the target value in "Q.LINK" to activate in blue. Now touch "NAM" icon to call NAM setup page. In the page, enter the desired name using the keypad. After that, touch "EN" icon then the revised name is displayed in "New Q.LINK Name". Now, touch "BACK" icon on the left top left to call "Q.LINK" setup page and the revised name is stored at the corresponding Q.LINK.



## 1-3 CPY

CPY function is used to copy the preset Q.LINK setup data into another Q.LINK. Touch the desired entry in "Q.LINK" line to activate in blue. Touch "CPY" icon to call "COPY" message popup. Touch the entry in TARGET then all entry in TARGET are displayed in turn. Now, select the desired Q.LINK entry and touch "YES" icon then the preset data is saved into the selected Q.LINK entry and return to Q.LINK setup page.





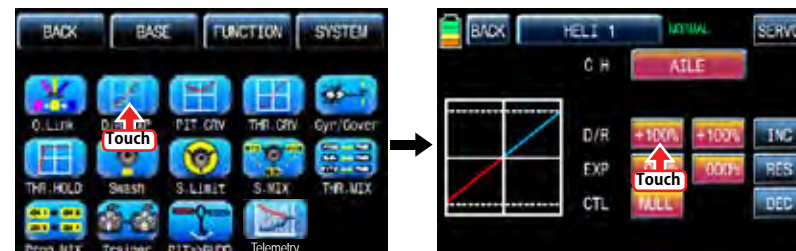
#### 1-4 Del

It is used to delete the unused Q.LINK. Touch the entry in Q.LINK line that you want to delete to activate in blue and touch "DEL" icon. Now, the selected Q.LINK entry is deleted in Q.LINK list. If you touch "NEXT" icon, you may call the next page



#### 2. D/R, EXP

D/R function is used to adjust the operation range of servos that is connected to all channels including aileron, elevator and rudder channels. You can assign them to numerous switches and sticks EXP function is used to set D/R function to aileron, elevator and rudder channels and adjust the sensitivity of neutral position of every channel. Positive Exponential reduces the control sensitivity of neutral position for more precise control and negative exponential increase the control sensitivity of neutral position D/R, EXP function can be operated with the assigned switch or connected to Q.LINK for purpose In the function page, touch "D/R, EXP" icon to call D/R, EXP setup page. Touch D/R or EXP icon to activate in blue and perform D/R or EXP programming setup with "INC" and "DEC".



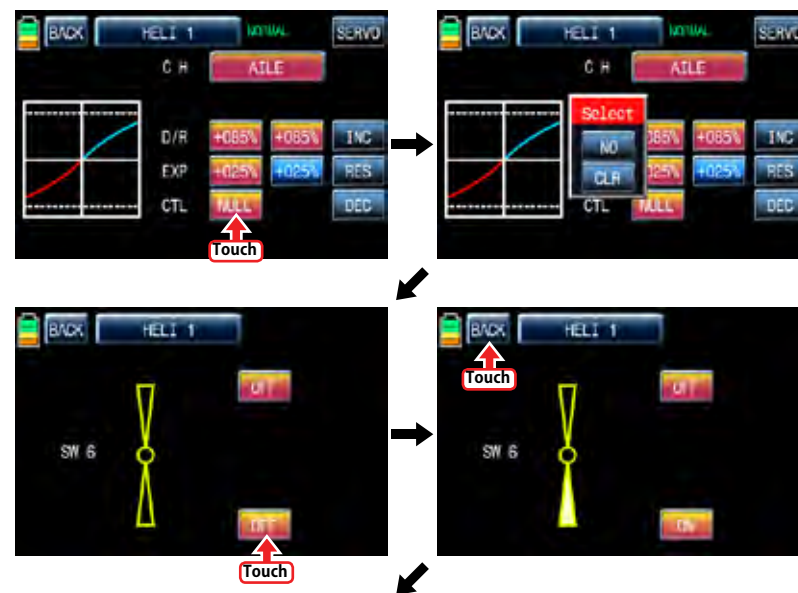


After "D/R", "EXP" setup, perform CTL setup. It is used to assign the switch to D/R, EXP function Touch "NULL" icon in CTL line to call "Select" message popup and move the switch that you want to use then that switch is set on/ off to switch and the switch direction setup page appears. You may select ON or OFF by touching icons. When the switch is moved to the direction of ON, the function is operated. Touch "Back" icon to return D/R, EXP setup page.

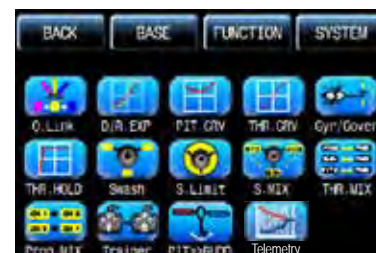
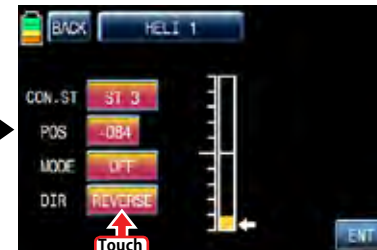
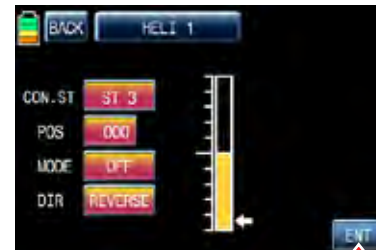
When D/R, EXP switch is off, D/R, EXP is returned to the default setup.

If you want to use stick instead of switch for "D/R", "EXP" function, Touch SW6 line to call "Select" message popup and move the stick with your choice then that stick is selected as on/ off stick and the stick direction setup page appears. In the direction setup page, move the stick to the "ON" position that you can comfortably reach, when the stick reach this position, D/R, EXP function is off. Touch "ENT" icon on the right bottom then the designated position is marked with the red or blue bar in the graph and the value of set position is displayed in POS. If you touch REVERSE in "DIR" line, all setup is reversed.

To set "ON" or "OFF" at the both end of stick operation range, touch "SINGLE" icon to change to "DUAL" then D/R, EXP function is on or off at the both end of stick operation range. You may set ELEV and RUDD channel in the same way. We recommend to set 5~12 channels to Q.LINK since they don't have on/off setup in D/R, EXP. When the setting is completed, touch "BACK" icon to return the function page.





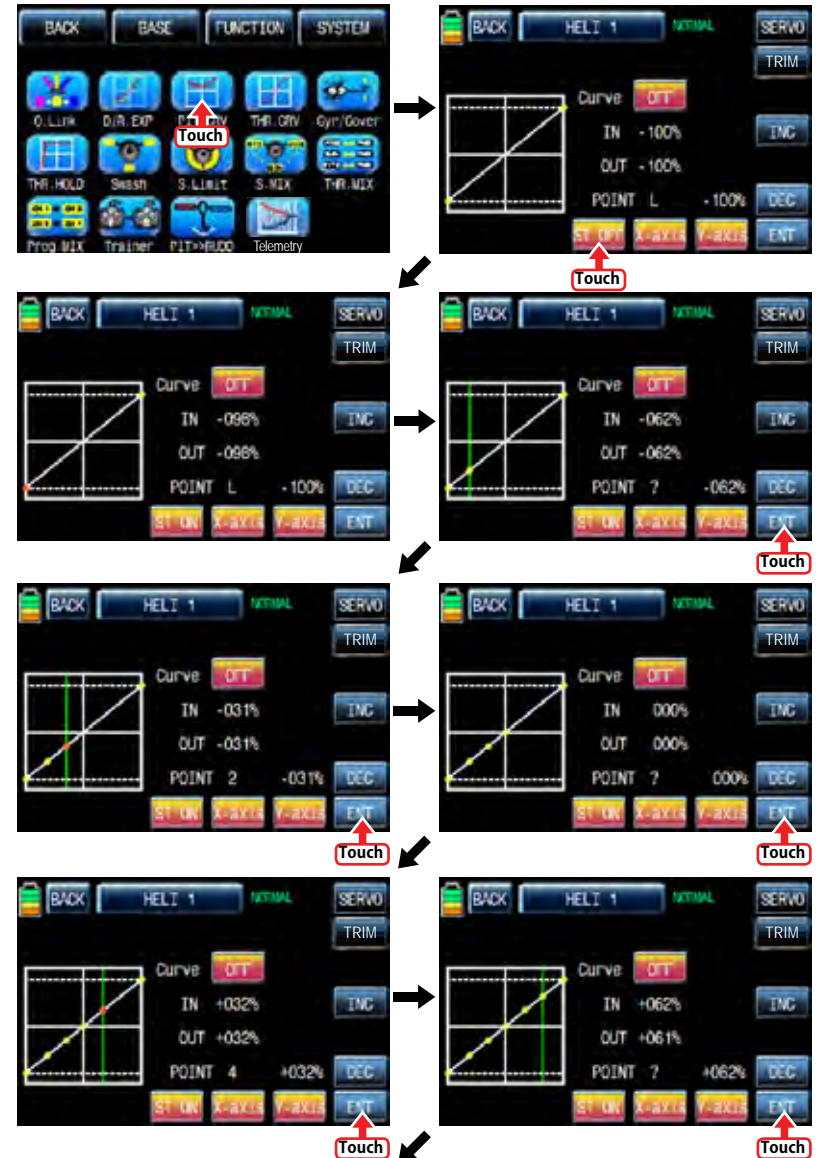


### 3. PIT.CRV

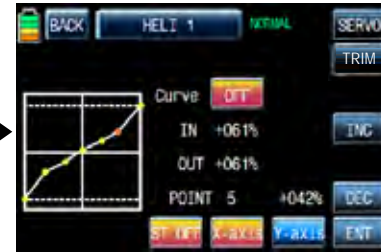
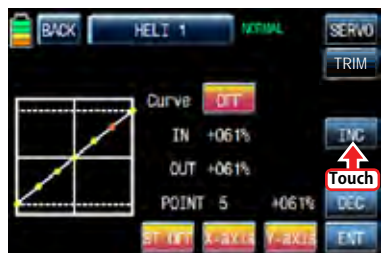
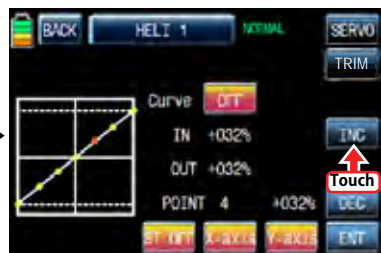
This function adjusts the pitch operation curve in relation to the movement of the throttle stick for each condition. Since pitch curve is closely related with Q.LINK setup, Q.LINK setup should precede PIT.CRV setup. Call Q.LINK setup page and check Q.LINK setup is completed correctly and touch "BACK" icon to return FUNCTION page. (Refer to the manual on Q.LINK setup)



In FUNCTION page, touch "PIT.CRV" icon to call PIT.CRV setup page. You need to mark the point on graph first and then adjust the operation curve with "DEC", "INC", X-axis and Y-axis buttons. Touch "ST OFF" to change to "ST ON" then the throttle position line appears on graph. Move throttle stick and place the line at the desired position between point "L" and "H" then touch "ENT" icon on the bottom right. Now the new point is marked in graph. You can mark five points between point "L" and "H" in the same way. Touch ST ON to change to "ST OFF" and complete the point setup. Now touch "DEC" or "INC" button to select point and touch X-axis or Y-axis to activate and then touch DEC" or "INC" button to adjust the operation curve. Turn on the preset Q.LINK switch then you may adjust the operation curve of every Q.LINK as well.



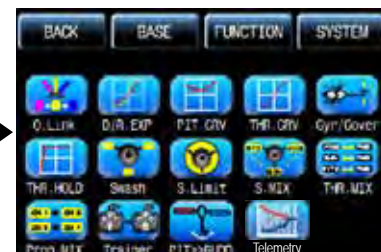
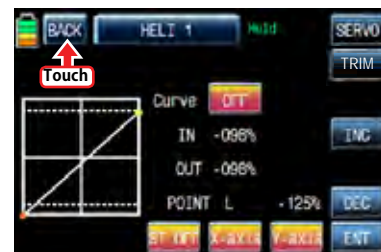




Q.LINK (idel-up2)



Q.LINK (Hold)



If you touch OFF icon in Curve line, it is changed to ON and the operation curve is smoother. To set the pitch, throttle curve trim, touch "TRIM" icon in the top right to call the pitch, throttle curve trim setup page.

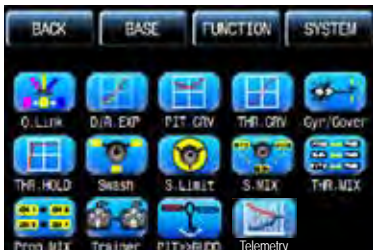


You may designate throttle curve key with DV1, DV2, DV3, DV4, SL1 and SL2 to set the section curve for the hovering in normal Q.Link and IDLE 1, IDLE 2 Q.Link.

Touch "NONE" icon in CTL line to call "Select" message popup then move the switch that you want to use then that switch is designated to the pitch, throttle curve trim switch. After CTL setup, touch and activate "NONE" icon in MIXER line to select the pitch curve or the throttle curve. Touch and activate "L" icon in POINT line to select the point number with INC and DEC buttons. Now, if you move the designated switch, the selected point follows the switch's movement. After POINT setup, touch and activate the value, "1", in Q.LINK line to set Q.LINK number then the pitch, throttle curve trim is activated within the setup Q.LINK. Touch "BACK" icon to return to FUNCTION page.







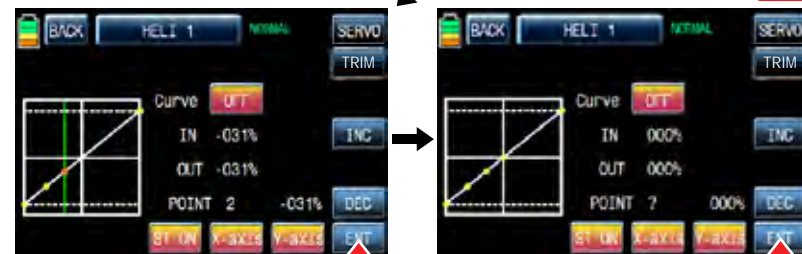
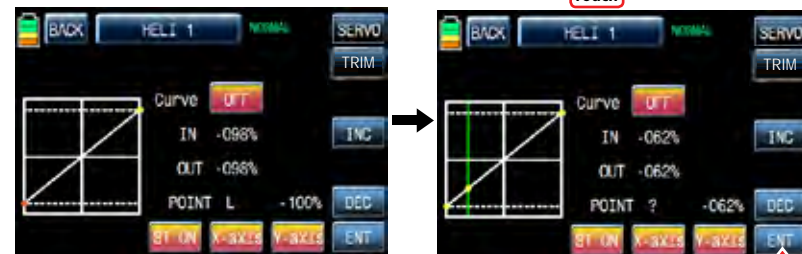
#### 4. THR.CRV

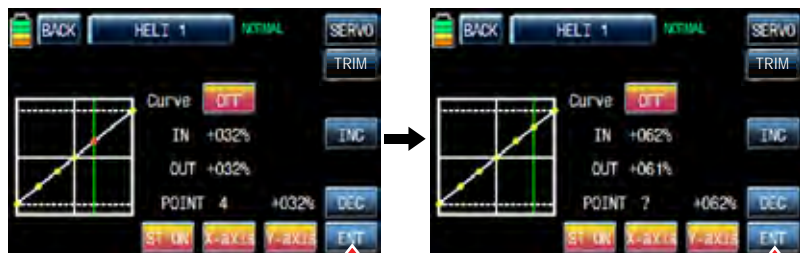
This function adjusts the throttle operation curve in relation to the movement of the throttle stick for each condition. Since the throttle curve is closely related with Q.LINK setup, Q.LINK setup should precede THR.CRV setup.

Call Q.LINK setup page and check Q.LINK setup is completed correctly and touch "BACK" icon to return FUNCTION page. (Refer to the manual on Q.LINK setup)



In FUNCTION page, touch "THR.CRV" icon to call THR.CRV setup page. You need to mark the point on graph first and then adjust the operation curve with "DEC", "INC", X-axis and Y-axis buttons. Touch "ST OFF" to switch to "ST ON" then the throttle position line appears on graph. Move throttle stick and place the line at the desired position between point "L" and "H" then touch "ENT" icon on the bottom right. Now the new point is marked in graph. You can mark five points between point "L" and "H" in the same way. Touch "ST ON" to switch to "ST OFF" and complete the point setup. Now touch "DEC" or "INC" button to select point and touch X-axis or Y-axis to activate and then touch DEC" or "INC" button to adjust the operation curve. Turn on the preset Q.LINK switch then you may adjust the operation curve of every Q.LINK as well.





Touch



Touch



Touch



Touch



Touch



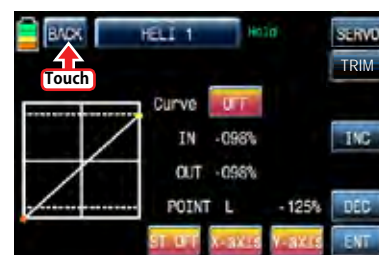
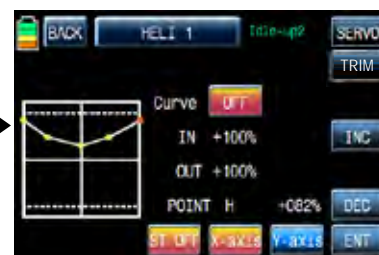
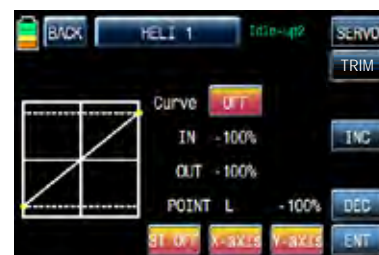
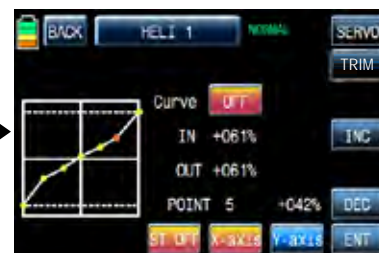
Touch



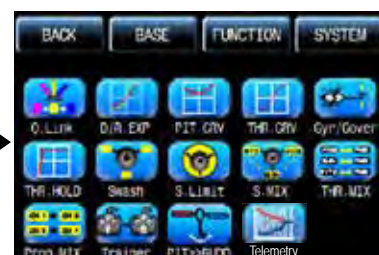
Touch



Touch

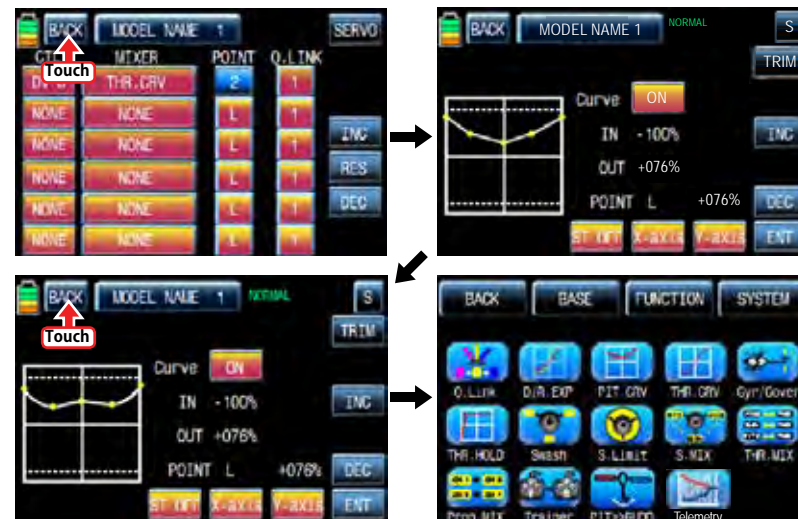
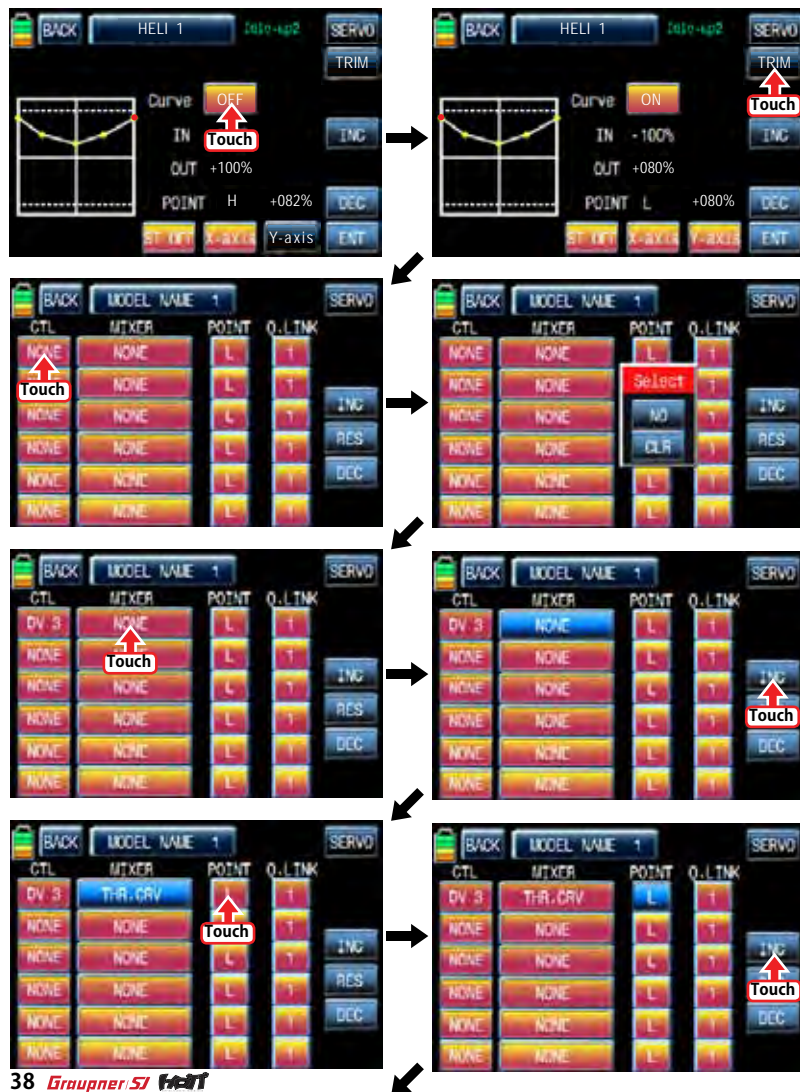


Touch





If you touch OFF icon in Curve line, it is changed to ON and the operation curve is smoother. You may set the pitch, throttle curve trim by touching "TRIM" icon in the top right. The setup method is explained at PIT.CRV



## 5. Gyr/Gover

This function is utilized to adjust the mixing of Gyro" and "Governor" for each condition. Since Gyr/Gover is closely related with Q.LINK setup, Q.LINK setup should precede Gyr/Gover setup.

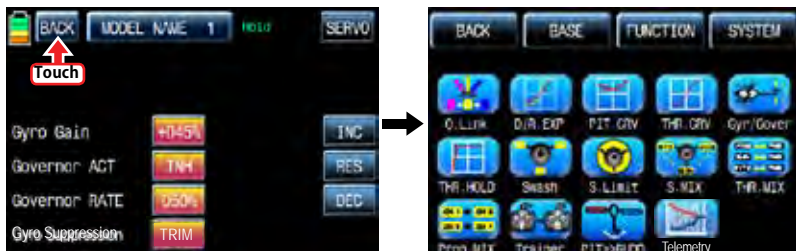


Gyro Gain, Governor, Governor RATE, Gyro Suppression are available in this function

- Gyro Gain is used to adjust the sensitivity of gyro. "00%" is basically set and heading lock gyro is operated at over 40% of sensitivity. You may adjust sensitivity for each condition of Q.LINK.
- Governor ACT is used to select "INH" or "ON" for Governor function. The default value is "INH" and it should be set to "ON" to use Governor ACT by touching "INH" icon.
- Governor RATE is used to set the rate of Governor Function. You may adjust Governor "RATE" for each condition of Q.LINK.

Touch "Gyr / Gover" icon to call the Gyr / Gover setup page. Touch the value in Gyro Gain to activate in blue then adjust the value with "INC" and "DEC" buttons. Touch "INH" icon in Governor ACT to switch it ON and then touch the value in Governor RATE to activate in blue. Adjust the function value with "INC" and "DEC" buttons. We recommend you to adjust Governor RATE for each condition of rotor RPM while a helicopter is hovering. Gyro Suppression function is used to offset Rudder by adjusting the value of Piezo gyro, it is not used when to use Head lock gyro Touch "BACK" icon on the left top to return FUNCTION page.





## 6. THR.HOLD

This function is for powering down an engine or motor using a designated switch. Throttle hold has higher authority than any other flight mode. When you activate THR.HOLD, the throttle channel is driven to its programmed value. It is usually used to turn off an engine or hold in idle position when helicopter's auto rotation flight

In function page, touch "THR.HOLD" icon to call "THR.HOLD" setup page. Touch "INT" icon in ACT line to switch it on and touch "NULL" icon in CTL line to call "Select" message popup. Move the switch with your choice then that switch is designated as on/ off switch and the switch direction setup page appears. You may select ON or OFF by touching icons. When the switch is moved to the direction of ON, the function is operated. Touch "BACK" icon to return to "THR.HOLD" setup page again. Touch the default value, 17%, to activate in blue and adjust it with "INC" and "DEC" buttons. The red arrow indicates the value for each value. When "THR.HOLD" function is on, the green arrow is positioned in the setup value. After setup, touch "BACK" icon to return FUNCTION page.

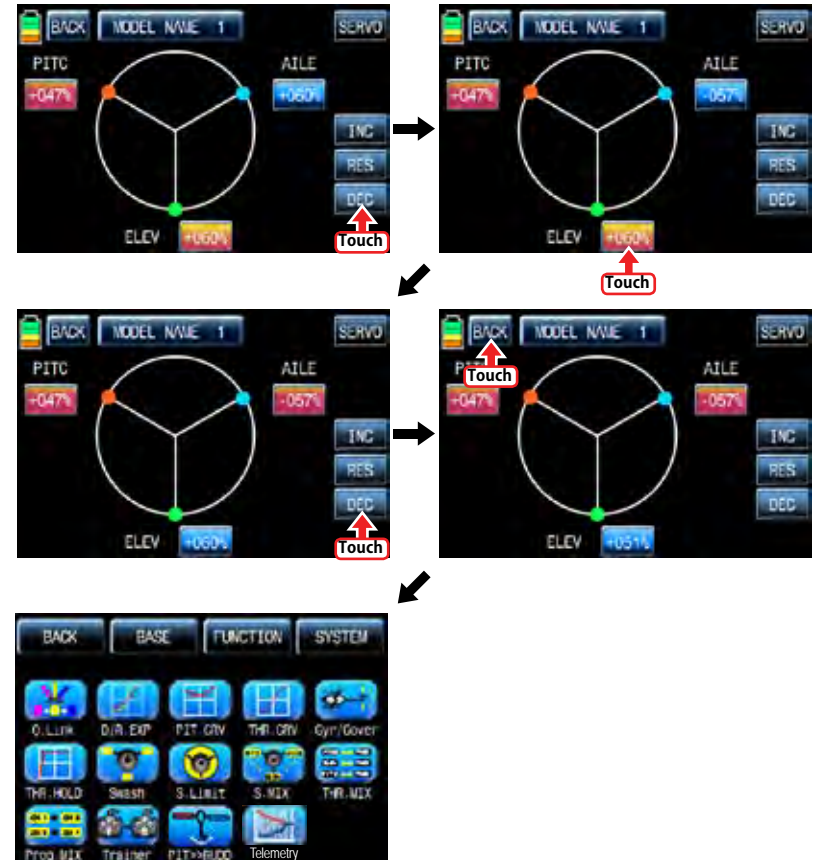
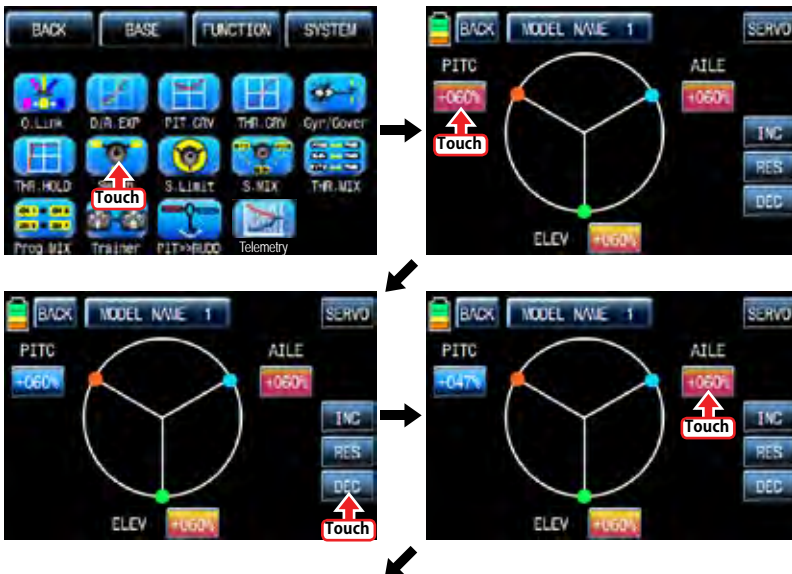






## 7. SWASH

The swash function supports adjustment of the travel amount and direction of the aileron, elevator and pitch in Helicopter mode. Bind a helicopter to a receiver and set the travel amount and direction of the swash channels desirably Touch "SWASH" icon to call "SWASH" setup page. When touching the values in PITC, AILE and ELEV, they are activated in blue. You may adjust the values with INC and DEC buttons. The default value is 60%. If the minus value is programmed, the travel direction of the swash channel is reversed. You may watch the servo operation by touching "SERVO" icon in the right top. Touch "BACK" icon to return to the function page.





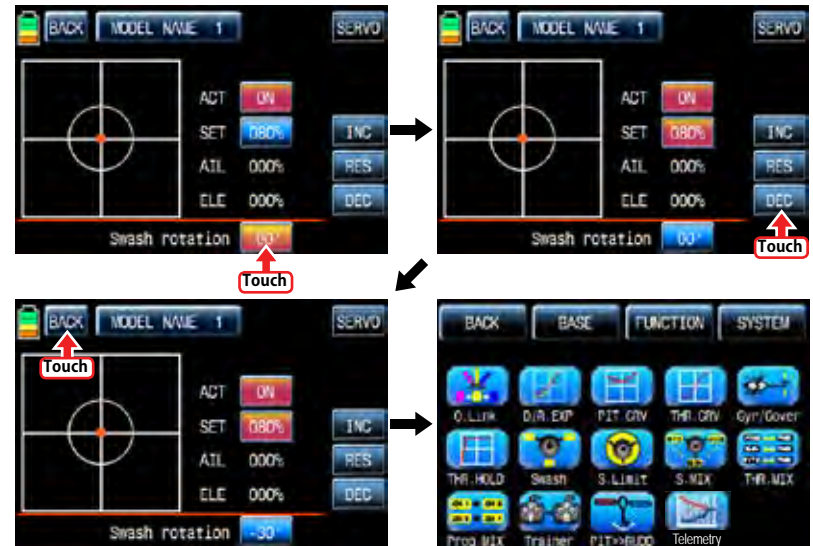
## 8. S.Limt (Swash Limit)

It is used to have the channels of PITCH, AILE and ELEV operated for the circle movement of the stick and the channels of PITCH, AILE and EL have the travel limits according to the circle setup size. Servo EPA should be set over 100%, if the circle size is over 100%

The Swash rotation function in the bottom is used to make the swash that mz-12 doesn't support available by rotating the swash angle

In the Function page, touch "S.Limit" icon to call "S.Limit" setup page. Touch "INH" icon in "ACT" line to switch to "ON" then the default value, 100% sized circle appears.

Now, touch "100%" icon in SET line to activate in blue. Adjust the circle size with "INC" and "DEC" buttons. Touch "00" icon in "Swash rotation" in the bottom to activate in blue then the swash angle is set with "INC" and "DEC" buttons. Touch "BACK" icon to return to "FUNCTION" page.



## 9. S.MIX (Swash mixing)

S.MIX typically corrects swash plate timing issues by mixing AILE>>ELEV, ELEV>>AILE, PITC>>AILE, PITC>>ELEV.

This function can be adjusted for each condition of Q.LINK.

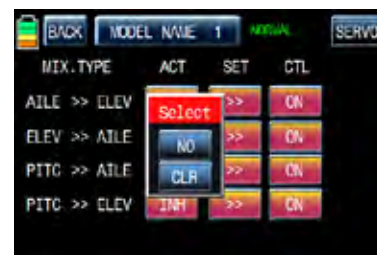
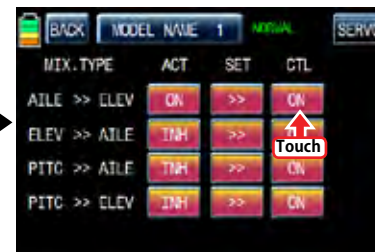
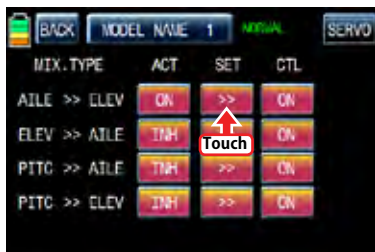
AILE>>ELEV: It is used when a helicopter tends to be UP or DOWN while controlling aileron.

ELEV>>AILE: It is used when a helicopter tends to bank to left or right while controlling elevator.

PITC >>AILE: It is used when a helicopter tends to bank to left or right while controlling pitch.

PITC >>ELEV: It is used when a helicopter tends to be UP or DOWN while controlling pitch.

In function page, touch "S.MIX" icon to call S.MIX setup page. Touch "INH" icon in ACT line to switch to "ON" and touch >> icon to call the mixing setup page. Touch and activate the values in LEFT and RIGHT line and adjust the mixing value with "INC" and "DEC" buttons. The programmed values are indicated in the left graph. The soft or rough movement can be adjusted by touching the values in EXP line, (+) value will make it smoothly and (-) value will make it roughly. You may watch the servo operation by touching "SERVO" icon in the right top. Touch "BACK" icon to return to S.MIX setup page. Now, you need to set CTL function. Touch "On" icon to call "Select" message popup then move the switch with your choice then that switch is designated as on/ off switch and then the switch direction setup page appears. You may select ON or OFF by touching icons. When the switch is moved to the direction of ON, the function is operated. Touch "BACK" icon to return to S.MIX setup page and confirm the setup data. Touch "BACK" icon to return to FUNCTION page





## 10. THR.MIX

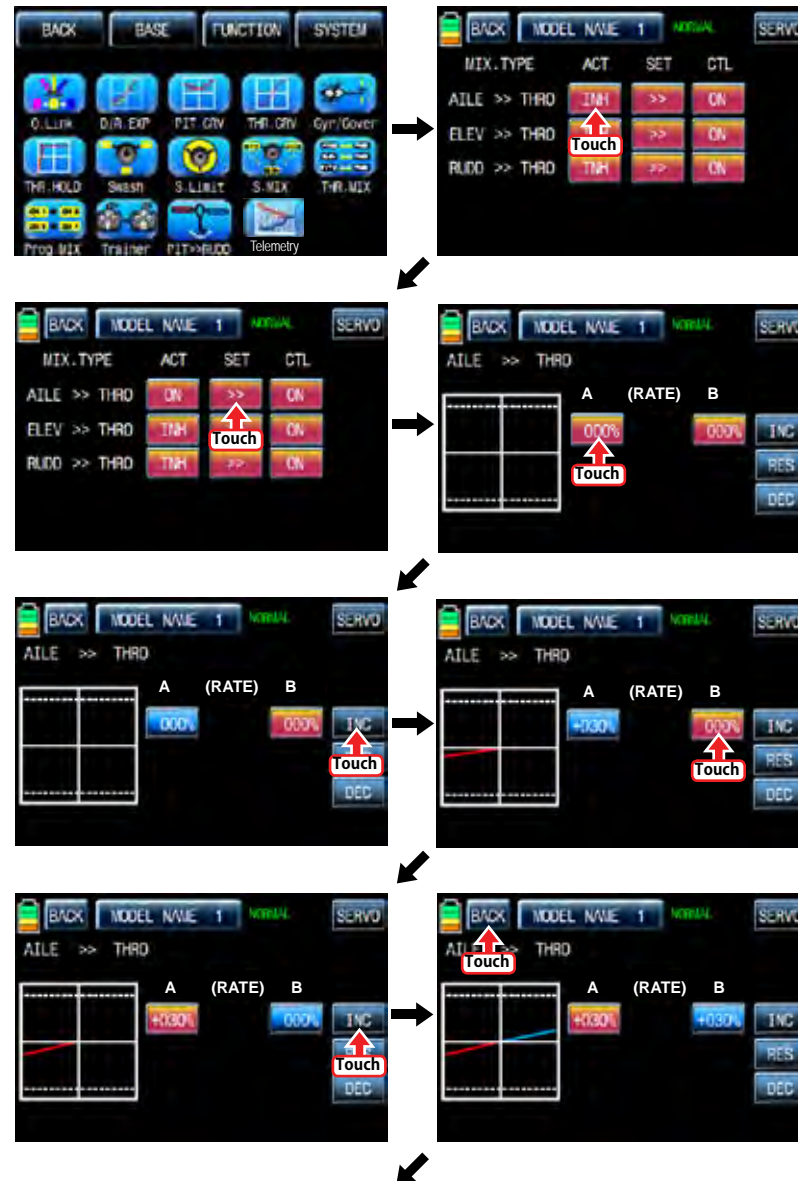
THR.MIX function prevents RPM decay when PITCH, AILE and ELEV inputs are given. This mix advances the throttle position with mix control to maintain RPM. This function can be adjusted for each condition of Q.LINK and three types is available (AILE>>THRO, ELEV>>THRO, RUDD>>THRO)

AILE>>THRO: It can prevent RPM decay and maintain flight altitude of a helicopter while controlling aileron.

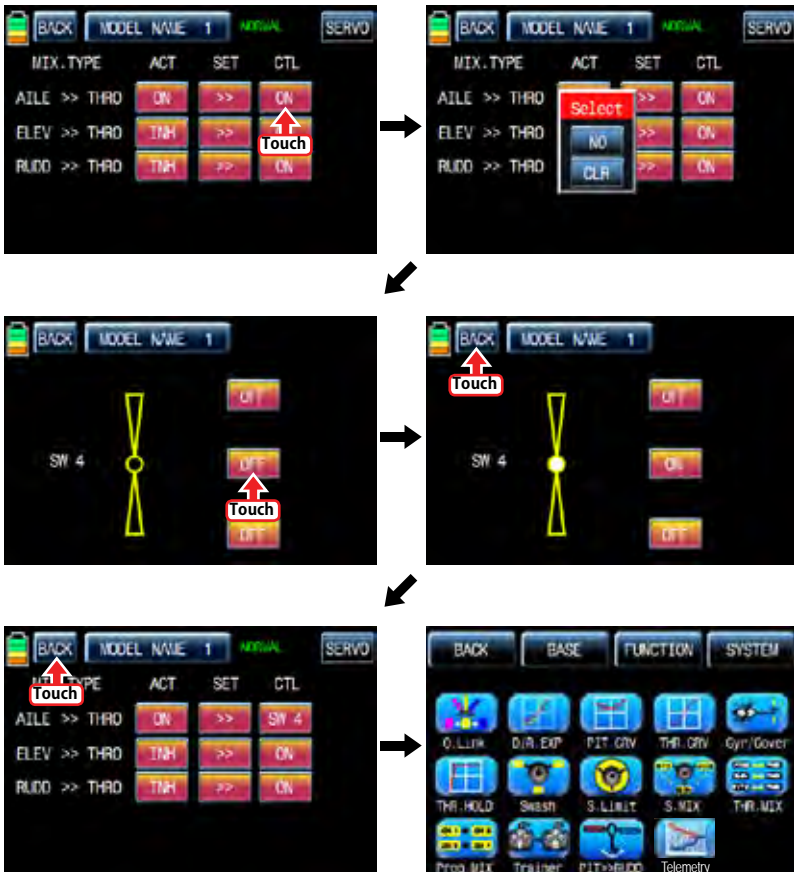
ELEV>>THRO: It can prevent RPM decay and maintain flight altitude of a helicopter while controlling elevator.

RUDD>>THRO: It can prevent RPM decay and maintain flight altitude of a helicopter when the rudder pitch is changed by controlling rudder

In FUNCTION page, touch "THR.MIX" icon to call THR.MIX setup page. Touch "INH" icon in ACT line to switch to "ON" and touch >> icon to call the mixing setup page. Touch and activate the values in LEFT and RIGHT line and adjust the mixing value with "INC" and "DEC" buttons. The programmed values are indicated in the left graph. You may watch the servo operation by touching "SERVO" icon in the right top. Touch "BACK" icon to return to THR.MIX setup page. Now, you need to set CTL function. Touch "On" icon to call "Select" message popup then move the switch with your choice then that switch is designated as on/ off switch and then the switch direction setup page appears. You may select ON or OFF by touching icons. When the switch is moved to the direction of ON, the function is operated. Touch "BACK" icon to return to THR.MIX setup page then confirm the setup data. Touch "BACK" icon to return to FUNCTION page







## 11. Prog.MIX

Prog.MIX function is used to mix the different channels for diverse purpose. We recommend you to use the same "On" switch with the one of Q.LINK. You may set the different program mix function for each Q.LINK condition.

8 MIXs are available. The mixing method introduced here is divided into 2 type, liner mixing type and curve mixing type. 1~6 MIXs are liner mixing type and 7~9 MIX is curve mixing type. The curve mixing method is the same with the pitch, throttle curve setup as explained above

### 11-1. Liner mixing type

In FUNCTION page, touch "Prog.MIX" icon to call the prog.mix page. Touch "INH" icon in ACT line to switch to "ON" and touch "NONE" in MST line to call the mixing channel setup page. Touch and activate "NONE" icon and select the desired channel for the master by touching. Now, touch and activate the left "NONE" icon, it is for Slave channel, and select the desired channel for the slave by touching. Touch "BACK" icon to return to Prog.MIX setup page. Touch >> icon in SET line to call the program mixing setup page. Now, you need to set CTL function.

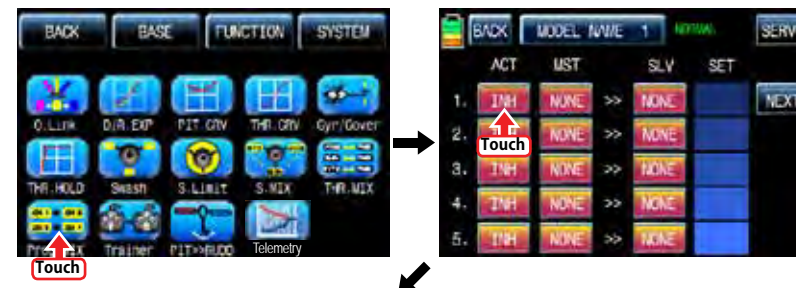
- CTL setup with a switch

Touch "NULL" icon in CTL line to call "Select" message popup then move the switch with your choice then that switch is designated as on/ off switch and then the switch direction setup page appears. You may select ON or OFF by touching icons. When the switch is moved to the direction of ON, the function is operated. Touch "BACK" icon to return to Prog.MIX setup page.

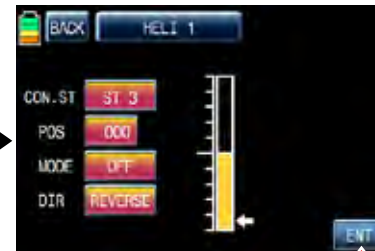
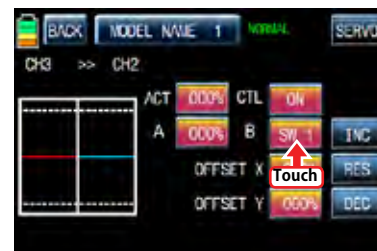
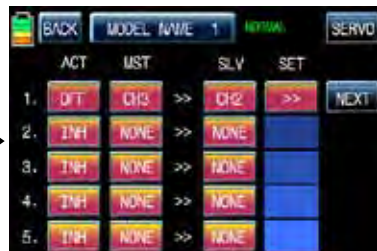
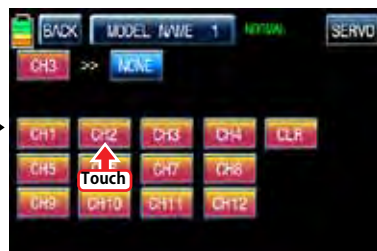
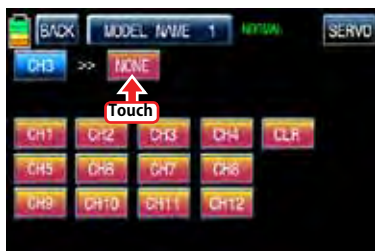
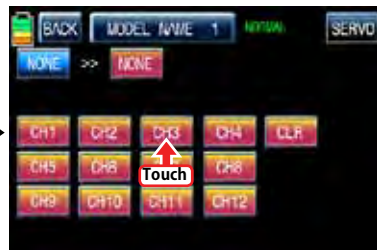
- CTL setup with a stick

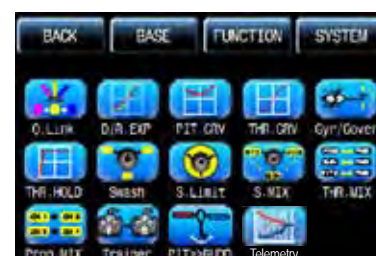
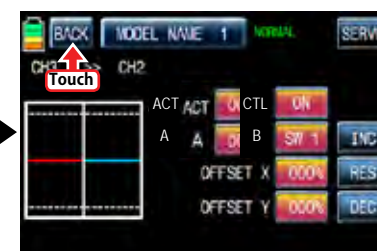
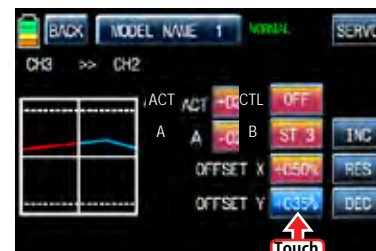
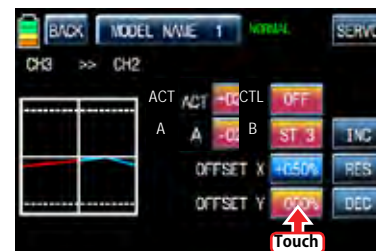
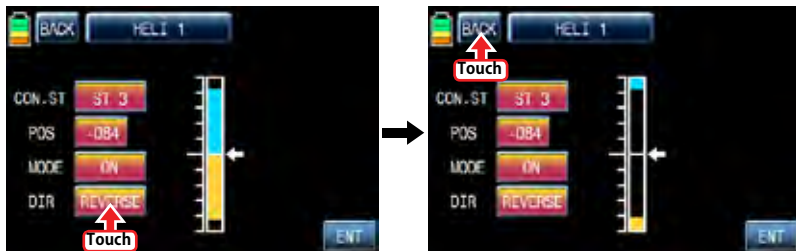
Touch "SW6" icon in CTL line to call "Select" message popup then move the stick with your choice then that stick is designated as on/ off stick and then the stick direction setup page appears. Move the stick to the position that you can comfortably reach, when the stick reach this position, Prog.MIX function is off. Touch "ENT" icon on the right bottom then the designated position is marked with the red or blue bar in the graph and the value of set position is displayed in POS. If you touch REVERSE in "DIR" line, all setup is reversed. To set "ON" or "OFF" at the both end of stick operation range, touch "SINGLE" icon to switch to "DUAL" then Prog.MIX function is on or off at the both end of stick operation range. Touch "BACK" icon to return to the program mixing setup page.

After CTL setup, you need to set the program mix operation value. Since the throttle channel is designated to the master channel, the operation value is displayed in A and B. Touch and activate the values in blue to adjust the value with "DEC" and "INC" buttons, the setup value is displayed in graph. OFFSET X/Y can be set in the same method and the setup value is displayed as well.









## 11-2. Curve mixing type

In the prog.mix page, touch "NEXT" icon to call the next page and touch "INH" icon in the cross line of NO7 and ACT to switch to "ON". Touch "NONE" in MST line to access the channel selection page and touch and activate "NONE" icon to select the desired channel of MST and SLV. Touch "BACK" icon to return to the prog.mix page. Touch ">>" icon to call the program mixing setup page. Now, you need to set CTL function.

- CTL setup with a switch

Touch "ON" icon in CTL line to call "Select" message popup then move the switch with your choice then that switch is designated as on/ off switch and then the switch direction setup page appears. You may select ON or OFF by touching icons. When the switch is moved to the direction of ON, the function is operated. Touch "BACK" icon to return to the program mixing setup page.

- CTL setup with a stick

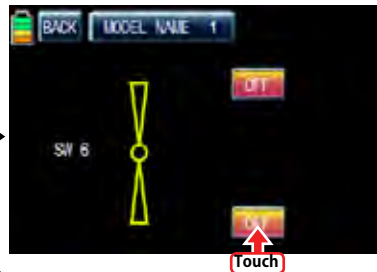
Hoping that you would refer the explanation as explained above

Here, you need to set the operation value, "L" and "H" points are set by default and you need to mark 5 points between "L" and "H" on graph first and then adjust the operation curve with "DEC", "INC", X-axis and Y-axis buttons. Touch "ST OFF" icon to switch to "ST ON" then the blue line appears on graph. Move the designated switch or stick to place the line at the desired position then touch "ENT" icon on the bottom right. Now the new point is marked in graph. You may set five points in your favorable position.

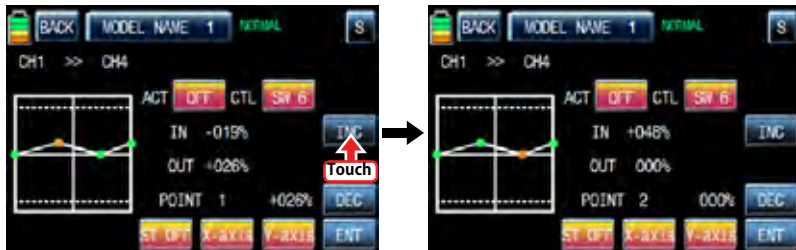
Touch "PITT >> RUDD" icon in the function page to call PIT >> RUDD setup page. You need to mark the point on graph first and then adjust the operation curve with "DEC", "INC", X-axis and Y-axis buttons. Touch "ST OFF" icon to switch to "ST ON" then the pitch position line appears on graph. Move throttle stick and place the line at the desired position between point "L" and "H" then touch "ENT" icon on the bottom right. Now the new point is marked in graph. Touch ST ON" to switch to "ST OFF" and complete the point setup. Now touch "DEC" or "INC" button to select point and touch X-axis or Y-axis to activate and then touch DEC" or "INC" button to adjust the operation curve.











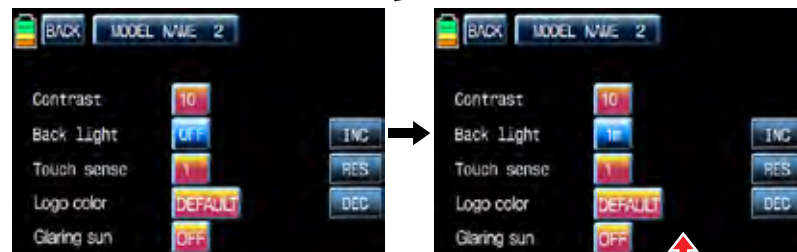
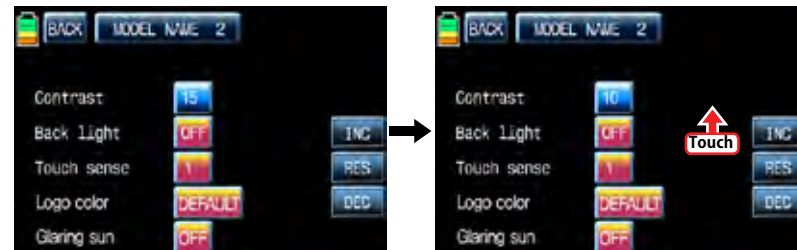
## 12. Trainer (Helicopter, Airplane, Gilder)

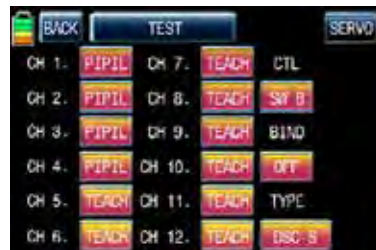
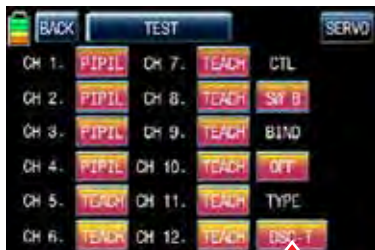
mz-12 features a programmable trainer function. Two transmitters must be connected by Wireless or an optional DSC code. This function makes it possible for the instructor to choose which functions and channels are to be used for instruction.

In FUNCTION page, touch "Trainer" icon to call the trainer setup page. The default value, TEACH, is set in all channels which means that this transmitter is Teacher transmitter. If touching TEACH icon, it is switched to PUPIL.

Assigned the desired channel to Pupil transmitter by touching "TEACH" icon to switch to PUPIL and touch "NULL" icon in CTL line to call "Select" message popup. Move the switch with your choice then that switch is designated as on/ off switch, but we recommend to use S8 as the trainer switch. When the switch direction setup page appears, you may select ON or OFF by touching icons. When the switch is moved to the direction of ON, the function is operated. Now, you need to bind teacher transmitter and pupil transmitter. Turn on pupil's transmitter and receiver and touch "OFF" icon in BIND line to switch to ON then this transmitter is bound to pupil transmitter. Pupil transmitter can control the channels only if the trainer switch is on. You may select trainer type by touch the value in TYPE line.

- RF : Teacher and pupil transmitters are connected by wireless
- DSC T & S : When teacher and pupil transmitters are connected by optional DSC code, teacher transmitter should be set to DSC T and pupil transmitter should be set to DSC S





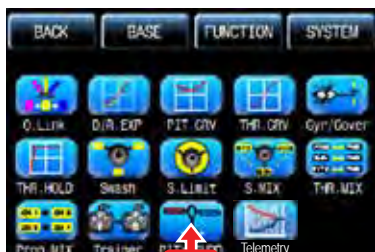
### 13. PIT >> RUDD

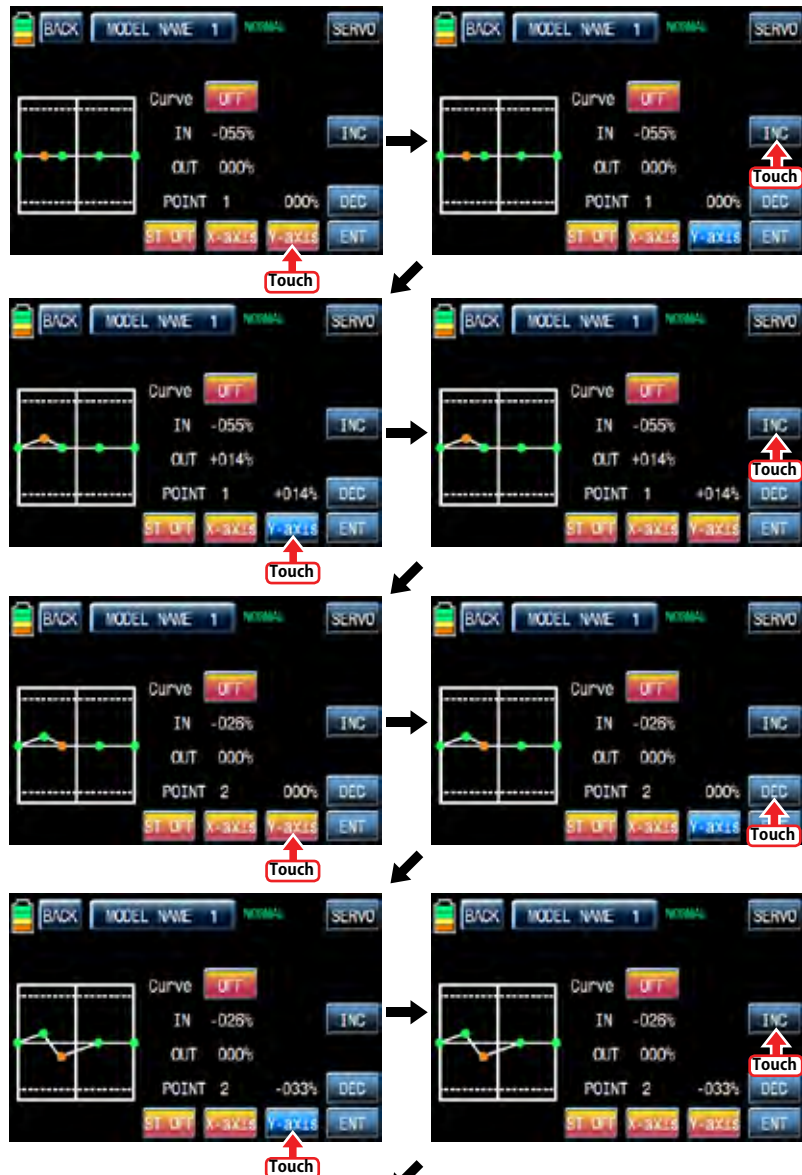
This function is used to correct the unintended movement of rudder during the flight of a helicopter. It is not necessary when you make use of heading lock gyro

Touch "PITT >> RUDD" icon in the function page to call PIT >> RUDD setup page. You need to mark the point on graph first and then adjust the operation curve with "DEC", "INC", X-axis and Y-axis buttons. Touch "ST OFF" icon to switch to "ST ON" then the pitch position line appears on graph. Move throttle stick and place the line at the desired position between point "L" and "H" then touch "ENT" icon on the bottom right. Now the new point is marked in graph.

By moving the pitch bar with the throttle stick, you should fix the bar in the desired position between L and H point. Now, touch the "ENT" icon on the bottom right side and then the new point will appear. You may set five points in your favorable position.

You need to mark the point on graph first and then adjust the operation curve with "DEC", "INC", X-axis and Y-axis buttons. Touch "ST OFF" to change to "ST ON" then the throttle position line appears on graph. Move throttle stick and place the line at the desired position between point "L" and "H" then touch "ENT" icon on the bottom right. Now the new point is marked in graph. You can mark five points between point "L" and "H" in the same way. Touch ST ON to switch to "ST OFF" and complete the point setup. Now touch "DEC" or "INC" button to select point and touch X-axis or Y-axis to activate and then touch DEC" or "INC" button to adjust the operation curve. Turn on the preset Q.LINK switch then you may adjust the operation curve of every Q.LINK as well.





#### 14. Telemetry

It is used to perform the programming setup and check HoTT telemetry functions. Touch "Telemetry" icon to call the Telemetry page. You may program 5 types of "RX SELECT", "SETTING & DATA VIEW" "SENSOR SELECT", "RF STATUS VIEW", and "VOCIE TRIGGER".

##### 14-1. RX SELECT

It is used to select a receiver that would transmit the telemetry data to mz-12 when 2 receivers are bound to mz-12. All of the telemetry sensors should be connected to the selected receiver. RX1" is set in RX SELECT line as a default and "RX1" and "RX2" can be switch by touching.





## 14-2. SETTING & DATA VIEW

It is used to program or check telemetry data of a receiver and telemetry sensors. Only if transmitter and receiver are bound, SETTING & DATA VIEW function is activated. Touch ">>" icon in the telemetry setup page to call "RX DATA VIEW" setup page

### - RX DATA VIEW

You may check telemetry data of a receiver in this page. Touch "ENT" icon to access to the next function, "RX SERVO" page.



### - RX SERVO

The servo functions, "REVERSE", "CENTER", "TRIM", "LIMIT-", "LIMIT+", and "PERIOD", can be programmed throughout receiver when servo is connected to each channel of receiver.

In "RX DATA VIEW" page, touch "ENT" icon to call RX SERVO page. You may move the cursor ">" to other category with INC button and select the category that you want to program. After deciding the desired category, touch "SET" icon to activate in red and adjust the value with INC and DEC buttons.

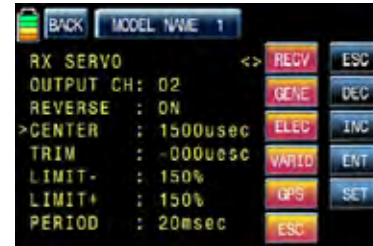


### • OUTPUT CH

The receiver's out channel is programmed in OUTPUT CH line. Touch "SET" icon to activate the value in red and select the desired channel with INC and DEC buttons. Touch "SET" icon again to deactivate the value and touch INC button to move the cursor to "Reverse".







## • REVERSE

It is used to reverse the operation of an individual servo. Touch "SET" icon to activate "OFF" in red and touch INC and DEC buttons to switch to "ON". Touch "SET" icon again to deactivate the value and touch INC buttons to move the cursor to "CENTER".

## • CENTER

It is used to set the "center position" of servo.

Touch "SET" icon to activate the value in red. Move and hold the throttle stick to the desired position for the servo center and touch "SET" icon then that position is assigned to the servo center and the relevant value is displayed. Touch INC button to move the cursor to "Reverse"



## • TRIM

It is used to set the servo's "Trim position".

Touch "SET" icon then the values of CENTER and TRIM are activated in red. Adjust TRIM values with INC and DEC buttons and touch "SET" icon again to deactivate the value. Touch INC button to move the cursor to "LIMIT -"

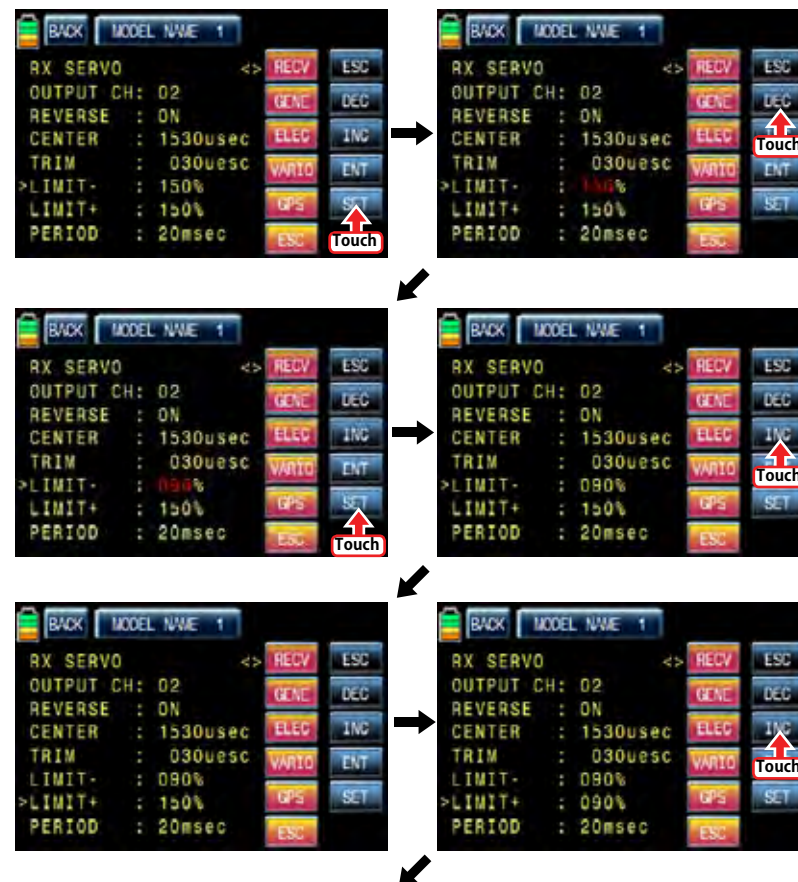
NOTICE: When TRIM value is adjusted, the default value of CENTER, 1500usec, is automatically set and the trim setup value is added to 1500usec.



## • LIMIT -, +

The function supports the adjustment of servo's maximum travel amount for +, - direction.

Even the default value is 150%, the travel amount is limited to 100% that is programmed at SERVO EPA of transmitter so 100%~150% range cannot be programmed and under 100% range can be only programmed at "LIMIT-". Only if SERVO EPA of transmitter is set to "150%", you can set below 150% at LIMIT- value. Touch "SET" icon to activate the value in red and adjust the value with INC and DEC buttons. Touch "SET" icon again to deactivate the value and touch INC button to move the cursor to "PERIOD".

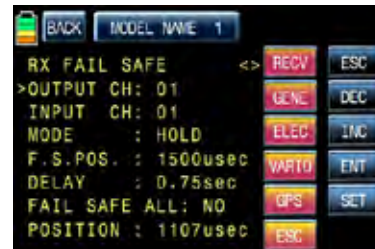




#### • PERIOD

It is used to set the speed of receiver's output signal.

Touch "SET" icon to activate the default value, 20msec, in red and set the value to 10msec with INC and DEC buttons. Touch "SET" icon again to deactivate the value and touch ENT button to call "RX FAIL SAFE" setup page



#### - RX FAIL SAFE

#### • OUTPUT CH/ INPUT CH

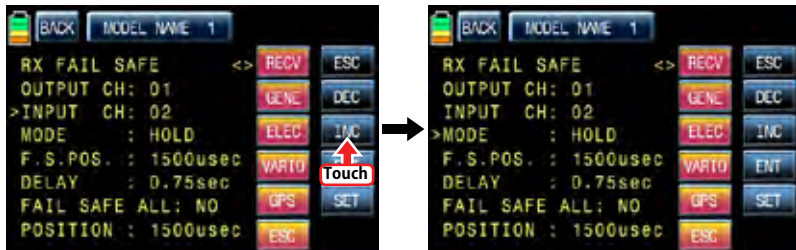
You may edit and adjust transmitter channel which is connected with a receiver using "OUTPUT CH" and "INPUT CH". Receiver CH1, 2, 3, 4, 5, 6 are connected to the same channels of transmitter as the default and you may edit the channel connection of receiver and transmitter. Since OUTPUT CH is changed if INPUT CH would be changed, we recommend that you would change INPUT CH.

Touch INC button to move the cursor to "INPUT CH" and touch "SET" icon to activate the value in red then select the channel to be connected to "OUTPUT CH" with INC and DEC buttons.

Touch "SET" icon again to deactivate the value. Touch INC button to move the cursor to "MODE"



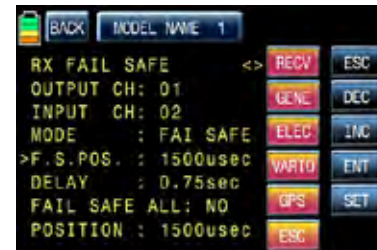




#### • MODE

It is used to select the failsafe type. "HOLD" is basically set in all the channels.

Touch "SET" icon to activate the value in red then you may select HOLD or OFF or FAIL SAFE with INC and DEC buttons. After selecting one of HOLD, OFF and FAIL SAFE, touch "SET" icon again to deactivate the value. Touch INC button to move the cursor to "F.S.POS"

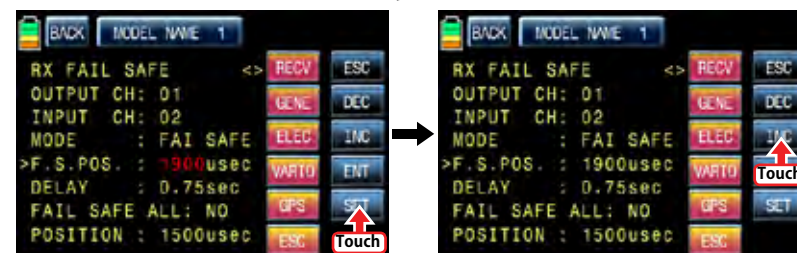
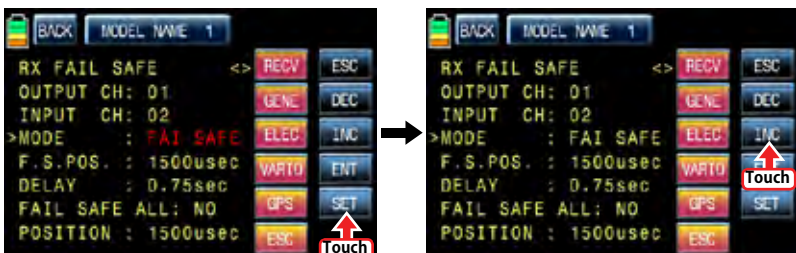
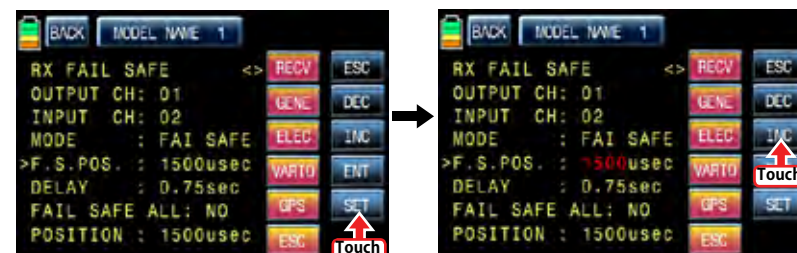
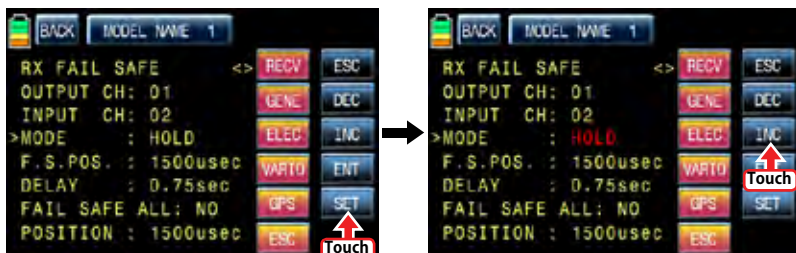


#### • F.S.POS

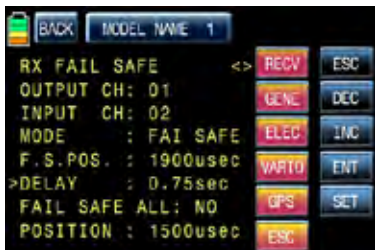
It is used to decide the servo's position when FAIL SAFE function is activated.

Touch "SET" icon to activate the value in red and adjust the value with INC and DEC buttons.

Touch "SET" icon again to deactivate the value. Touch INC button to move the cursor to "DELAY"





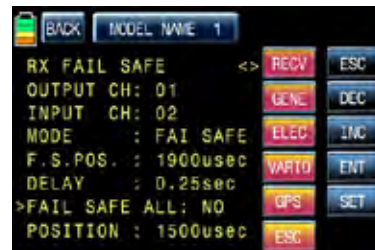


#### • DELAY

It is used to set the time delay. The failsafe will delay for the setup time.

Touch "SET" icon to activate the value in red and adjust the value with INC and DEC buttons.

Touch "SET" icon again to deactivate the value. Touch INC button to move the cursor to "FAIL SAFE ALL"



#### • FAIL SAFE ALL

This function allows that all failsafe position for every channel can be set at a time without the use of F.S.POS function. Notice that MODE of all channels should be set to FAIL SAFE.

Touch "SET" icon to activate the value, NO, in red and move and hold the throttle stick to the desired position for FAIL SAFE operation position. Touch "SET" icon then that position is assigned to FAIL SAFE operation position and the relevant value is displayed in F.S.POS line. The servo that is connected to receiver is operated to the set position of FAIL SAFE when transmitter is turned off Touch INC button to move the cursor to "POSITION"

#### • POSITION

You may check the operation range of transmitter's stick which is connected with "INPUT CH". Touch "ENT" icon on the right to access to the next page, "RX FREE MIXER".



## - RX FREE MIXER

This function is used to correct the unintended movement of airplane during the flight by mixing master channel and slave channel.

### • MIXER

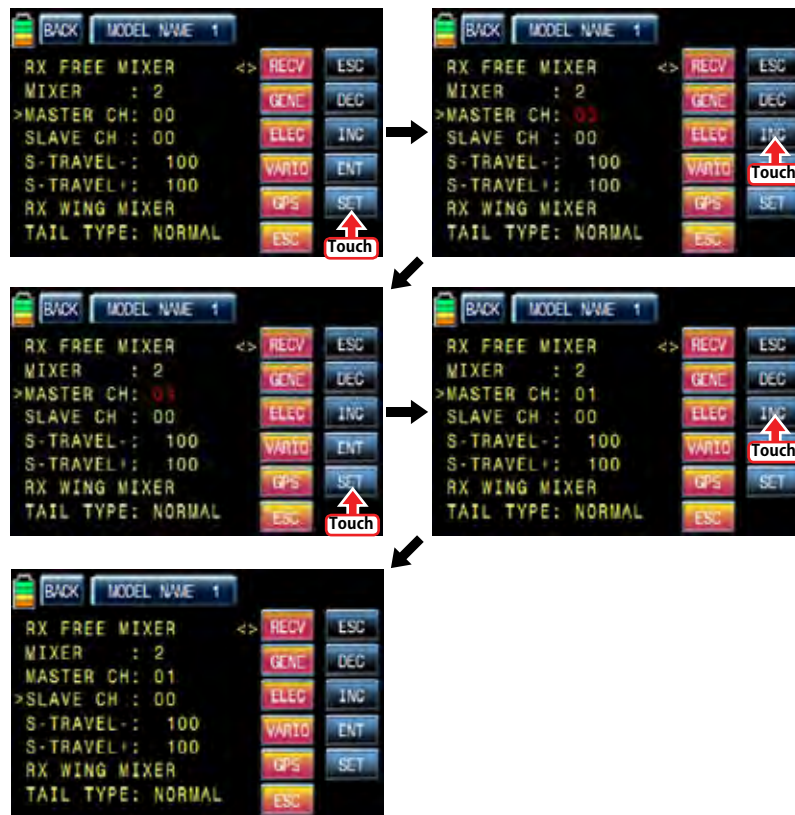
You may decide MIXER number that you want to set. Touch "SET" icon to activate the value in red and select MIXER number with INC and DEC buttons. Touch "SET" icon again to deactivate the value. Touch INC button to move the cursor to "MASTER CH"



### • MASTER CH

You may set the master channel of FREE MIXER.

Touch "SET" icon to activate the value in red and select the master channel number with INC and DEC buttons. Touch "SET" icon again to deactivate the value. Touch INC button to move the cursor to "SLAVE CH"



### • SLAVE CH

You may set the slave channel of FREE MIXER.

Touch "SET" icon to activate the value in red and select the slave channel number with INC and DEC buttons. Touch "SET" icon again to deactivate the value. Touch INC button to move the cursor to "S-TRAVEL"





# • "S-TRAVEL -, +"

It is used to set the mix operation range of SLAVE CH.

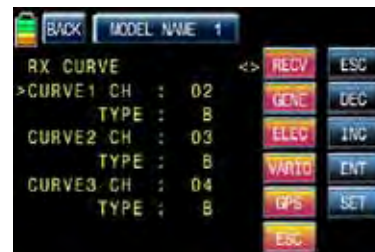
Touch "SET" icon to activate the value in red and select the slave channel number with INC and DEC buttons. Touch "SET" icon again to deactivate the value. If you operate the master channel, the slave channel is operated within the setup range at the same time. Touch INC button to move the cursor to "TAIL TYPE"



#### • TAIL TYPE

You may select the appropriate tale type for the airplane that you use

Touch "SET" icon to activate the value in red and select the appropriate tale type with INC and DEC buttons. Touch "SET" icon again to deactivate the value. Touch "ENT" icon on the right to access to the next page, "RX CURVE",



#### - RX CURVE

It is used to set the curve of CH2, CH3, and CH4 and 3 types of A, B, and C are selectable.

- > A type : Sensitive operating
- > B type : Normal operating
- > C type : smooth operating

The default, B type is set and it is very similar with "EXP" function of transmitter. You may transfer the cursor, >, with INC and DEC buttons and can select the desired category. Touch "SET" icon to activate the value in red and select the channel and type with INC and DEC buttons. Touch "SET" icon again to deactivate the value. If you operate the master channel, the slave channel is operated within the setup range at the same time. Touch "ENT" icon on the right to access to the next page, "RX SERVO TEST",







#### - RX SERVO TEST

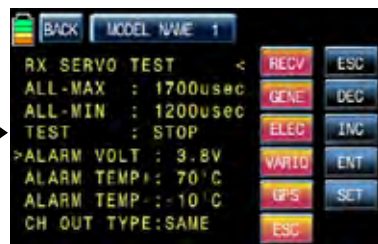
This function allows servo operation to be tested and program the receiver's power voltage, the alarm for the maximum/minimum temperature of receiver and the channel out type of receiver.

#### • ALL-MAX/ ALL-MIN/ TEST

The travel amount for servo test is decided for the setup value of ALL-MAX and ALL-MIN  
Touch "SET" icon to activate the value of ALL-MAX and ALL-MIN in red and adjust the value with INC and DEC buttons. Touch "SET" icon again to deactivate the value. Transfer the cursor to TEST line and touch "SET" icon to activate the value, STOP, in red. Now, switch to START with INC and DEC buttons and touch "SET" icon again to deactivate the value then all servos connected to receiver are slowly operated within the setup. If you set to STOP by touching "SET" and "INC/DEC" icons, all servos stop operating. Touch INC button to move the cursor to "TAIL TYPE"

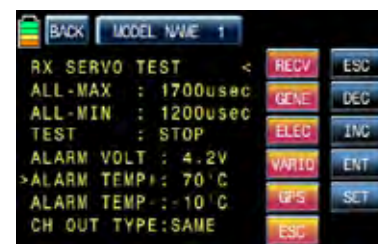
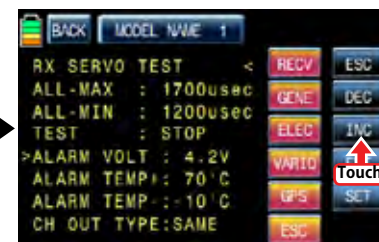
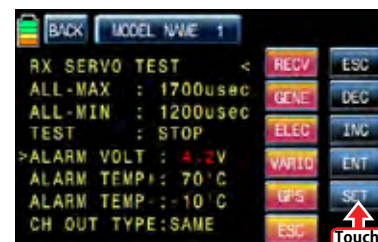
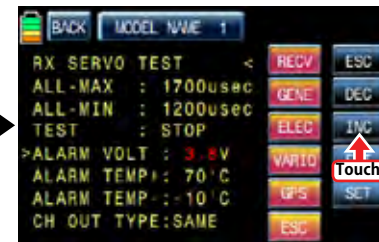
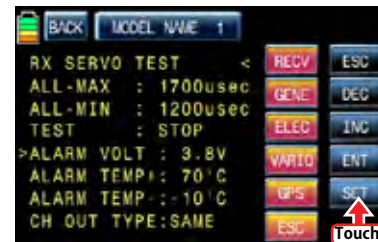
Touch "SET" icon again to deactivate the value. If you operate the master channel, the slave channel is operated within the setup range at the same time. Touch INC button to move the cursor to "ALARM VOLT",





## • ALARM VOLT

It is the low voltage alarm setup for receiver power battery. Transmitter sounds an alarm throughout telemetry technology when the battery of receiver reaches the low voltage limit. Touch "SET" icon to activate the value in red and adjust the value with INC and DEC buttons. Touch "SET" icon again to deactivate the value. Touch INC button to move the cursor to "ALARM TEMP+"

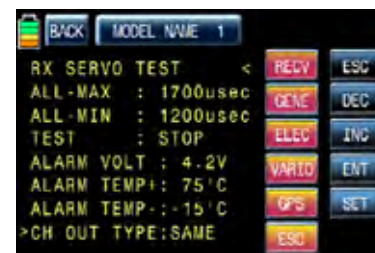
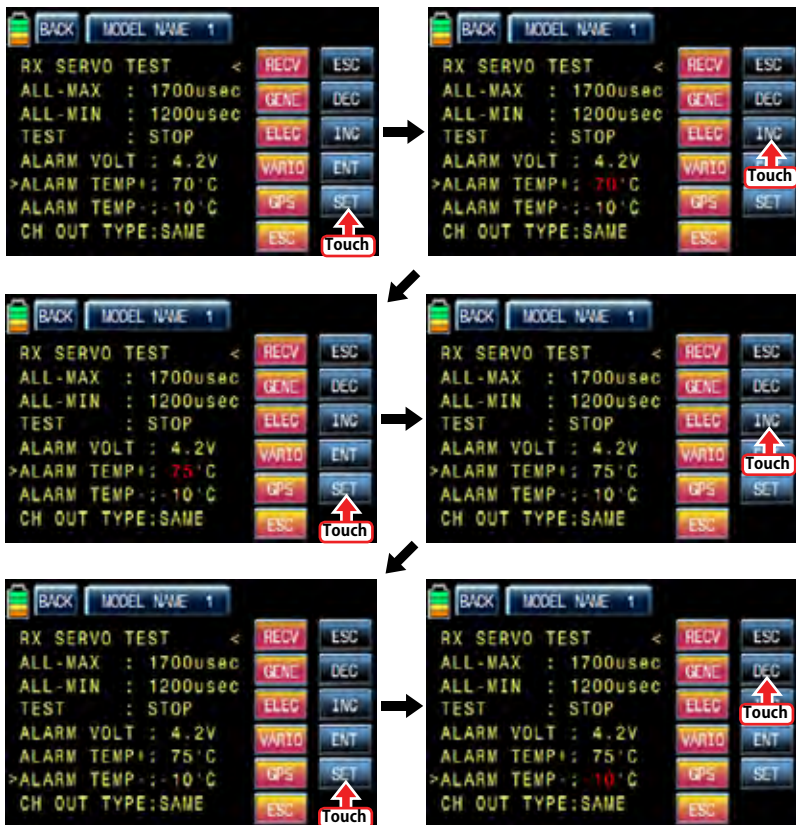




## • ALARM TEMP +/-

It is the alarm setup for the maximum/minimum temperature of receiver. Transmitter sounds an alarm throughout telemetry technology when the temperature of receiver reaches the temperature limits.

Touch "SET" icon to activate the value in red and adjust the value with INC and DEC buttons. Touch "SET" icon again to deactivate the value. Touch INC button to move the cursor to "CH OUT TYPE"



## - CH OUT TYPE

It is used to set the type of receiver's signal output and it consists of ONCE, SAME, SUMO 12, SUMI, and SUMD HD12.

- > ONCE : This type is applied to the analog servo. "20msec" is automatically set to PERIOD in RX SERVO setup
- > SAME : This type is usually applied to the digital servo. You need to "10 ~ 20msec" to PERIOD. In case that the analog servo is connected, you need to set "20msec" to PERIOD.
- > SUMI : The receiver set to SUMI take the output signal from the receiver set to SUMO and outputs the signal.
- > SUMO : Only the selected channel outputs the signal of all channels of receiver. In case that 1 receiver is set to SUMO and the other receiver is set to SUMI and then they are connected in ex code, the receiver set to SUMI take the output signal from the receiver set to SUMO and it is operated at the same time. The final channel of receiver is the output channel of SUMO, but you may change to the desired channel.
- > SUMD HD : The digital output signal of all channels in receiver is outputted from the selected channel. It is used to the product that needs the receiver digital signal such as Power box and Flybarless system. The factory default for SUMD HD output channel is the last channel of receiver, but you may change it

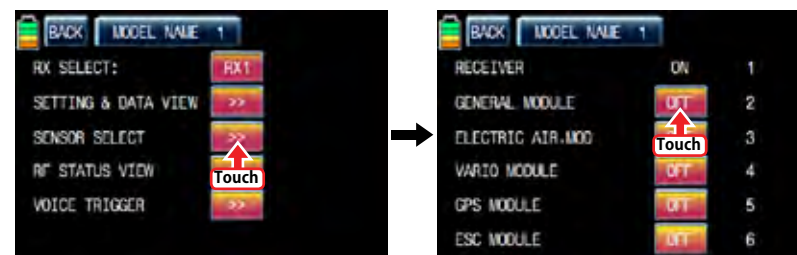


Touch "SET" icon to activate the value in red and select the desired type with INC and DEC buttons. Touch "SET" icon again to deactivate the value. Touch INC button to move the cursor to "CH OUT TYPE" In order to set for CH OUT TYPE, touch "INC" icon to move the cursor to CH OUT TYPE and then touch the "SET" icon. Now, "SAME" in CH OUT TYPE is activated in a red. When it is activated, touch the INC or DEC icons to select the desirable receiver type and then touch the "SET" icon to remove the cursor. The set type of receiver is activated. When you select SUMO 8 and SUMD HD8 and try to select the different output channel, touch "SET" icon to activate the channel number in red then select the desired channel with INC and DEC buttons. Touch "SET" icon again to deactivate the value. Now, the selected channel outputs PPM signal.



#### 14-3. SENSOR SELECT

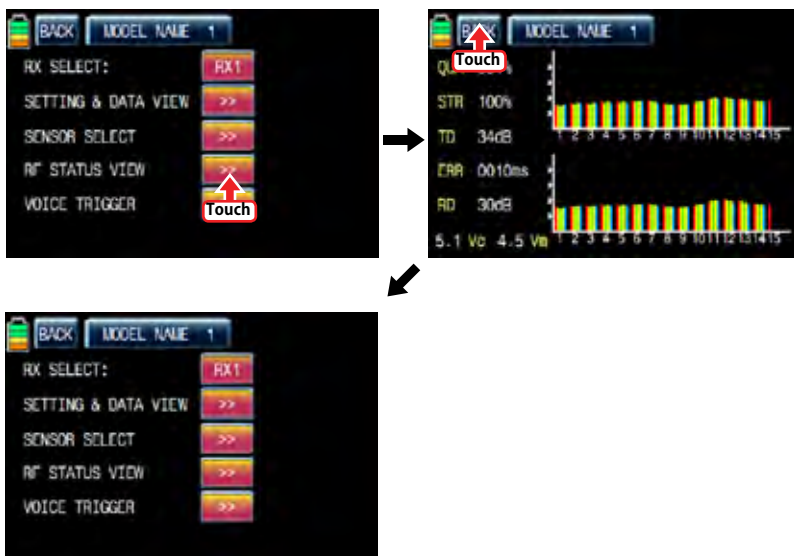
This function is used to program telemetry sensor that is connected to HoTT receiver. You should select the sensor first to use and program the function such as voice function, warning and the telemetry data information. Touch ">>" icon in SENSOR SELECT line then RECEIVER, GENERAL MODULE, ELECTRIC AIR, MOD, VARIO MODULE, GPS, and ESC are displayed. RECEIVER is set to ON, the others are set to OFF by default. To select the sensor, touch "OFF" icon to switch to "ON" then voice function, warning and the telemetry data information are available. After the sensor selection is completed, touch "BACK" icon to return to the previous page.





#### 14-4. RF STATUS VIEW

It shows RF status between transmitter and receiver throughout telemetry function  
Touch ">>" icon in RF STATUS VIEW line then the indication to show the RF connection status is displayed by graph.



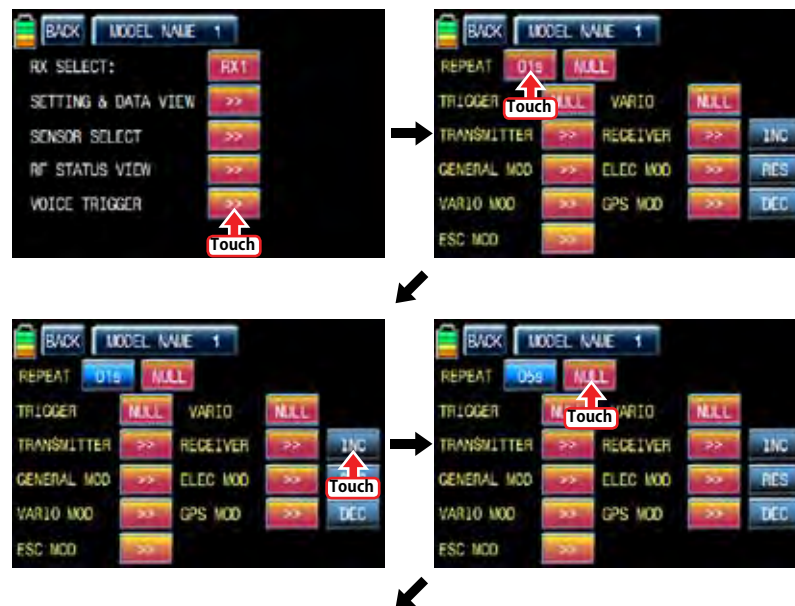
#### 14-5. VOCIE TRIGGER

It is used to program the sensors related with voice function. REPEAT, TRIG, VARIO, TRANSMITTER, RECEIVER are available by default and the optional sensors could be attached. If the optional sensor is connected, it is need to add the optional sensor at SENSOR SELECT mode then new category in VOICE TRIGGER is created. The useable sensors are GENERAL MODULE, ELECTRIC AIR MODULE, VARIO MODULE, GPS, AIR ESC  
Touch ">>" icon in VOICE TRIGGER line to call "VOICE TRIGGER" setup page.

#### - REPEAT

You may set the time and select the switch. If the switch is on, one of voice functions is repeated for the setup time.

Touch the value, "01s", in blue and adjust the repeat time with INC and DEC buttons. Touch "NULL" icon to call the "Select" message popup. Move the switch or volume with your choice then that switch or volume is designated as on/ off key and then the key direction setup page appears. You may select ON or OFF by touching icons. When the key is moved to the direction of ON, the function is operated. Touch "BACK" icon to return to "VOICE TRIGGER" setup page.



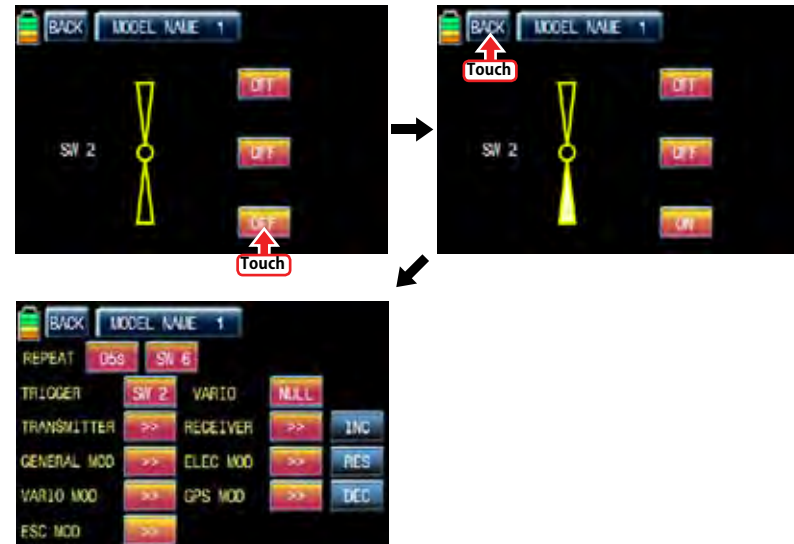


#### - TRIG

You may designate the switch for the voice functions of transmitter, receiver and sensor. The next voice function is came in turn whenever the switch is on/off

To set TRIGGER, touch "NULL" icon to call the "Select" message popup. Move the switch or volume with your choice then that switch or volume is designated as on/ off key and then the key direction setup page appears. You may select ON or OFF by touching icons. When the key is moved to the direction of ON, the function is operated. Touch "BACK" icon to return to "VOICE TRIGGER" setup page.

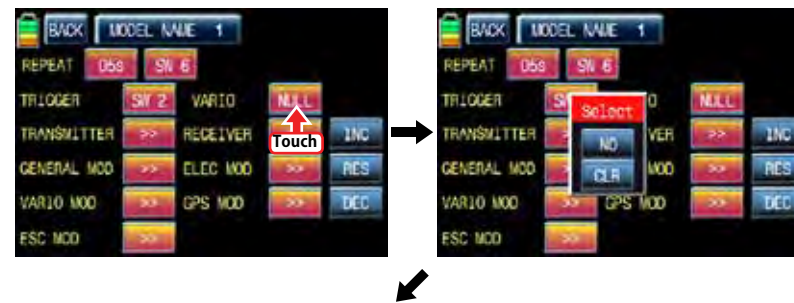
If the switch that has spring such as S2 is designated as TRIG switch, On/Off operation is easier and convenient



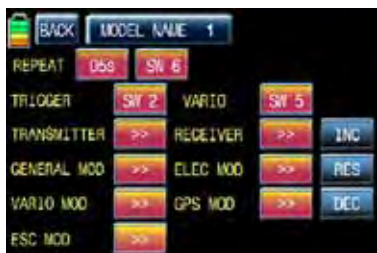
#### - VARIO

It is used to set "on/off" switch for the voice function of Vario module.

To set VARIO, touch "NULL" icon to call the "Select" message popup. Move the switch or volume with your choice then that switch or volume is designated as on/ off key and then the key direction setup page appears. You may select ON or OFF by touching icons. When the key is moved to the direction of ON, the function is operated. Touch "BACK" icon to return to "VOICE TRIGGER" setup page.







#### - TRANSMITTER

송신기의 텔레메트리VOICE기능 TX VOLT, MODEL TIME, BATT TIME, TIMER 1, TIMER 2, CURRENT TIME 6가지 VOICE기능의 사용을 편집하는 기능입니다. TRANSMITTER기능을 설정하려면 TRANSMITTER기능의 >>를 터치하면TRANSMITTER 설정화면으로 이동합니다. TRANSMITTER기능으로 이동하면 TX VOLT, MODEL TIME, BATT TIME, TIMER 1, TIMER 2, CURRENT TIME 6가지 TRANSMITTER VOICE기능이 기본으로 빨간색으로 체크되어 있습니다. 사용하고 싶지 않은 기능을 터치하면 빨간색 체크가 흰색으로 해제되고 TRANSMITTER VOICE기능에서 편집 됩니다. TRANSMITTER기능설정이 끝나면 좌측상단의 BACK를 터치하면 VOICE TRIGGER기능 설정화면으로 이동합니다.



#### - RECEIVER

수신기의 텔레메트리VOICE기능 TEMP, STRENGTH, RX VOLT, LOW VOLT 4가지 VOICE기능의 사용을 편집하는 기능입니다. RECIVER기능을 설정하려면 RECIVER기능의 >>를 터치하면 RECIVER 설정화면으로 이동합니다. RECIVER기능으로 이동하면 TEMP, STRENGTH, RX VOLT, LOW VOLT 4가지 RECIVER VOICE기능이 기본으로 빨간색으로 체크되어 있습니다. 사용하고 싶지 않은 기능을 터치하면 빨간색 체크가 흰색으로 해제되고 RECIVER VOICE기능에서 편집 됩니다. RECIVER기능설정이 끝나면 좌측상단의 BACK를 터치하면 VOICE TRIGGER기능 설정화면으로 이동합니다.



## - GENERAL MOD

GENERAL MOD의 텔레메트리 VOICE기능 CELL1, CELL2, CELL3, CELL4, CELL5, CELL6, S1-VOLT, S2-VOLT, S1-TEMP, S2-TEMP, RPM, ALT, CURRENT, POWER, CAP 15가지 GENERAL MOD VOICE기능의 사용을 편집하는 기능입니다.

GENERAL MOD기능을 설정하려면 GENERAL MOD기능의 >>를 터치하면 GENERAL MOD 설정화면으로 이동합니다. GENERAL MOD 기능으로 이동하면 CELL1, CELL2, CELL3, CELL4, CELL5, CELL6, S1-VOLT, S2-VOLT, S1-TEMP, S2-TEMP, RPM, ALT, CURRENT, POWER, CAP 15가지 GENERAL MOD VOICE기능이 기본으로 빨간색으로 체크되어 있습니다. 사용하고 싶지 않은 기능을 터치하면 빨간색 체크가 흰색으로 해제되고 GENERAL MOD VOICE기능에서 편집 됩니다. GENERAL MOD기능설정이 끝나면 좌측상단의 BACK를 터치하면 VOICE TRIGGER기능 설정화면으로 이동합니다.



## - ELEC MOD

ELECTRIC MODUL의 텔레메트리 VOICE기능 C1L, C2L, C3L, C4L, C5L, C6L, C7L, C1H, C2H, C3H, C4H, C5H, C6H, C7H, BV1, BV2, BT1, BT2, ALT, CUR, POW, CAP 22가지 ELEC MOD VOICE기능의 사용을 편집하는 기능입니다.

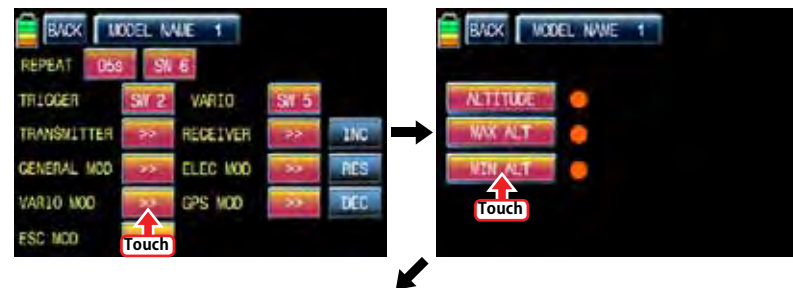
ELEC MOD기능을 설정하려면 ELEC MOD기능의 >>를 터치하면 ELEC MOD 설정화면으로 이동합니다. ELEC MOD 기능으로 이동하면 C1L, C2L, C3L, C4L, C5L, C6L, C7L, C1H, C2H, C3H, C4H, C5H, C6H, C7H, BV1, BV2, BT1, BT2, ALT, CUR, POW, CAP 22가지 ELEC MOD VOICE기능이 기본으로 빨간색으로 체크되어 있습니다. 사용하고 싶지 않은 기능을 터치하면 빨간색 체크가 흰색으로 해제되고 ELEC MOD VOICE기능에서 편집 됩니다. ELEC MOD기능설정이 끝나면 좌측상단의 BACK를 터치하면 VOICE TRIGGER기능 설정화면으로 이동합니다.

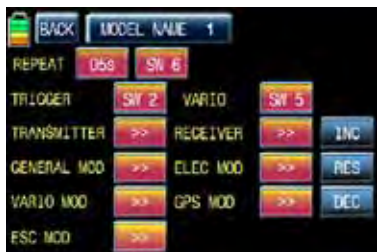


## - VARIO MOD

VARIO MODUL의 텔레메트리 VOICE기능의 ALTITUD, MAX ALT, MIN ALT 3가지 VARIO MOD VOICE기능의 사용을 편집하는 기능입니다.

VARIO MOD기능을 설정하려면 VARIO MOD기능의 >>를 터치하면 VARIO MOD 설정화면으로 이동합니다. VARIO MOD 기능으로 이동하면 ALTITUD, MAX ALT, MIN ALT 3가지 VARIO MOD VOICE기능이 기본으로 빨간색으로 체크되어 있습니다. 사용하고 싶지 않은 기능을 터치하면 빨간색 체크가 흰색으로 해제되고 VARIO MOD VOICE기능에서 편집 됩니다. VARIO MOD기능설정이 끝나면 좌측상단의 BACK를 터치하면 VOICE TRIGGER기능 설정화면으로 이동합니다.





#### - TRANSMITTER

송신기의 텔레메트리VOICE기능 TX VOLT, MODEL TIME, BATT TIME, TIMER 1, TIMER 2, CURRENT TIME 6가지 VOICE기능의 사용을 편집하는 기능입니다. TRANSMITTER기능을 설정하려면 TRANSMITTER기능의 >>를 터치하면TRANSMITTER 설정화면으로 이동합니다. TRANSMITTER기능으로 이동하면 TX VOLT, MODEL TIME, BATT TIME, TIMER 1, TIMER 2, CURRENT TIME 6가지 TRANSMITTER VOICE기능이 기본으로 빨간색으로 체크되어 있습니다. 사용하고 싶지 않은 기능을 터치하면 빨간색 체크가 흰색으로 해제되고 TRANSMITTER VOICE기능에서 편집 됩니다. TRANSMITTER기능설정이 끝나면 좌측상단의 BACK를 터치하면 VOICE TRIGGER기능 설정화면으로 이동합니다.



#### - RECEIVER

수신기의 텔레메트리VOICE기능 TEMP, STRENGTH, RX VOLT, LOW VOLT 4가지 VOICE기능의 사용을 편집하는 기능입니다. RECIVER기능을 설정하려면 RECIVER기능의 >>를 터치하면 RECIVER 설정화면으로 이동합니다. RECIVER기능으로 이동하면 TEMP, STRENGTH, RX VOLT, LOW VOLT 4가지 RECIVER VOICE기능이 기본으로 빨간색으로 체크되어 있습니다. 사용하고 싶지 않은 기능을 터치하면 빨간색 체크가 흰색으로 해제되고 RECIVER VOICE기능에서 편집 됩니다. RECIVER기능설정이 끝나면 좌측상단의 BACK를 터치하면 VOICE TRIGGER기능 설정화면으로 이동합니다.





## - GENERAL MOD

GENERAL MOD의 텔레메트리 VOICE기능 CELL1, CELL2, CELL3, CELL4, CELL5, CELL6, S1-VOLT, S2-VOLT, S1-TEMP, S2-TEMP, RPM, ALT, CURRENT, POWER, CAP 15가지 GENERAL MOD VOICE기능의 사용을 편집하는 기능입니다.

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## - ELEC MOD

ELECTRIC MODUL의 텔레메트리 VOICE기능 C1L, C2L, C3L, C4L, C5L, C6L, C7L, C1H, C2H, C3H, C4H, C5H, C6H, C7H, BV1, BV2, BT1, BT2, ALT, CUR, POW, CAP 22가지 ELEC MOD VOICE기능의 사용을 편집하는 기능입니다.

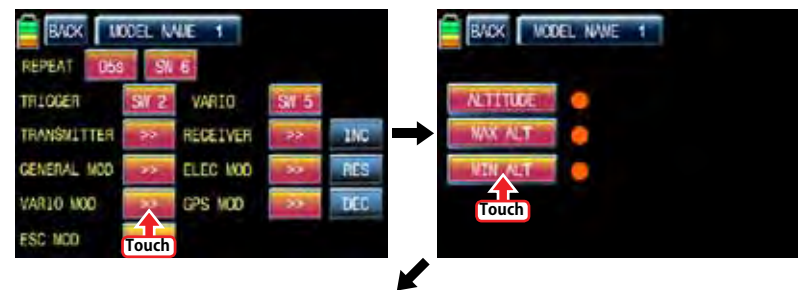
ELEC MOD기능을 설정하려면 ELEC MOD기능의 >>를 터치하면 ELEC MOD 설정화면으로 이동합니다. ELEC MOD 기능으로 이동하면 C1L, C2L, C3L, C4L, C5L, C6L, C7L, C1H, C2H, C3H, C4H, C5H, C6H, C7H, BV1, BV2, BT1, BT2, ALT, CUR, POW, CAP 22가지 ELEC MOD VOICE기능이 기본으로 빨간색으로 체크되어 있습니다. 사용하고 싶지 않은 기능을 터치하면 빨간색 체크가 흰색으로 해제되고 ELEC MOD VOICE기능에서 편집됩니다. ELEC MOD기능설정이 끝나면 좌측상단의 BACK를 터치하면 VOICE TRIGGER기능 설정화면으로 이동합니다.



## - VARIO MOD

VARIO MODUL의 텔레메트리 VOICE기능의 ALTITUD, MAX ALT, MIN ALT 3가지 VARIO MOD VOICE기능의 사용을 편집하는 기능입니다.

VARIO MOD기능을 설정하려면 VARIO MOD기능의 >>를 터치하면 VARIO MOD 설정화면으로 이동합니다. VARIO MOD 기능으로 이동하면 ALTITUD, MAX ALT, MIN ALT 3가지 VARIO MOD VOICE기능이 기본으로 빨간색으로 체크되어 있습니다. 사용하고 싶지 않은 기능을 터치하면 빨간색 체크가 흰색으로 해제되고 VARIO MOD VOICE기능에서 편집됩니다. VARIO MOD기능설정이 끝나면 좌측상단의 BACK를 터치하면 VOICE TRIGGER기능 설정화면으로 이동합니다.





## - GPS MOD

You may decide the voice functions of GPS MOD to use or not to use. 4 voice functions, SPEED, DISTANCE, ALTITUDE, and DIRECTION, are available.

Touch ">>" icon to call the GPS MOD setup page. All the functions are marked with red dot by default in the page. Touch the function icon that you don't want to use then the red dot is switched to white dot. The functions marked with white dot are edited out from the voice functions. Touch "BACK" icon to return to VOICE TRIGGER setup page.



## - ESC MOD

You may decide the voice functions of ESC MOD to use or not to use. 4 voice functions, RPM, CURRENT, POWER-V, and CAPACITY, are available.

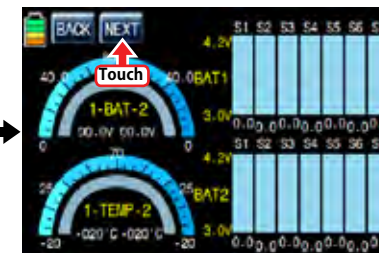
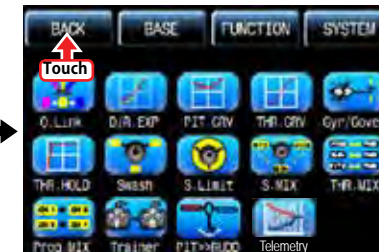
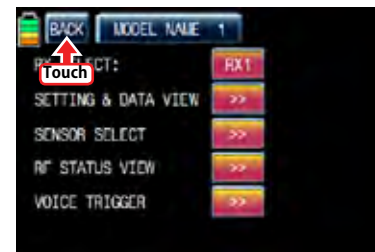
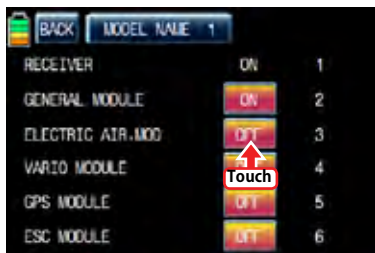
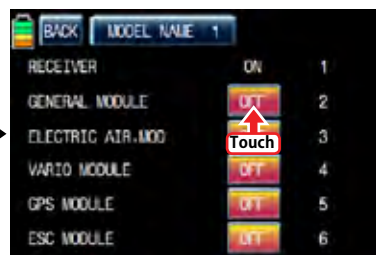
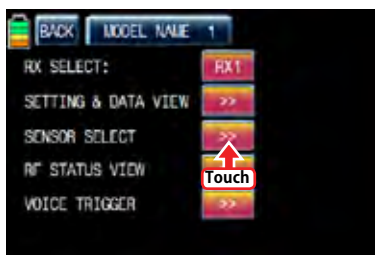
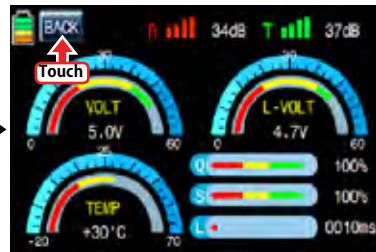
Touch ">>" icon to call the ESC MOD setup page. All the functions are marked with red dot by default in the page. Touch the function icon that you don't want to use then the red dot is switched to white dot. The functions marked with white dot are edited out from the voice functions. Touch "BACK" icon to return to VOICE TRIGGER setup page.



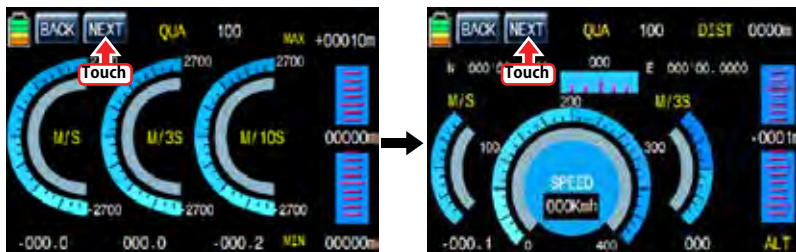
## 14-6. DISPLAY SETUP FOR TELEMETRY SENSOR

All telemetry indication of the sensors are displayed at the receiver telemetry page. Connect option sensors to receiver and access to the sensor select setup page by course of page transfer. Touch "OFF" icon of the connected sensors to switch to "ON" at the sensor select setup page. After that, return to the receiver telemetry page. You may check all telemetry indication here and access to the next page by touching "NEXT" icon on the top left



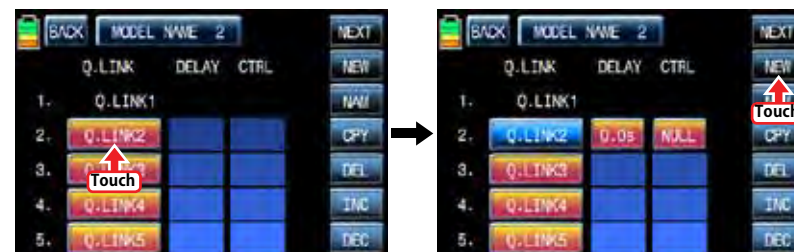






## 1-1 NEW

This function is used when you wish to create new Q.LINK. If you may want to set for new Q.LINK, touch the value in "Q.LINK" line to activate it in blue and touch "NEW" icon in the right to call "CTRL" and "DELAY" options. In "CTRL" setup, touch "NULL" icon to call "Select" message popup and move the switch or stick with your choice then the switch or stick is set to Q.LINK switch or stick. To set "DELAY" function, touch "0.0s" icon to activate in blue and set the delay time with "INC" and "DEC" buttons. DELAY indicates the time till Q.LINK start to work after Q.LINK is switched on

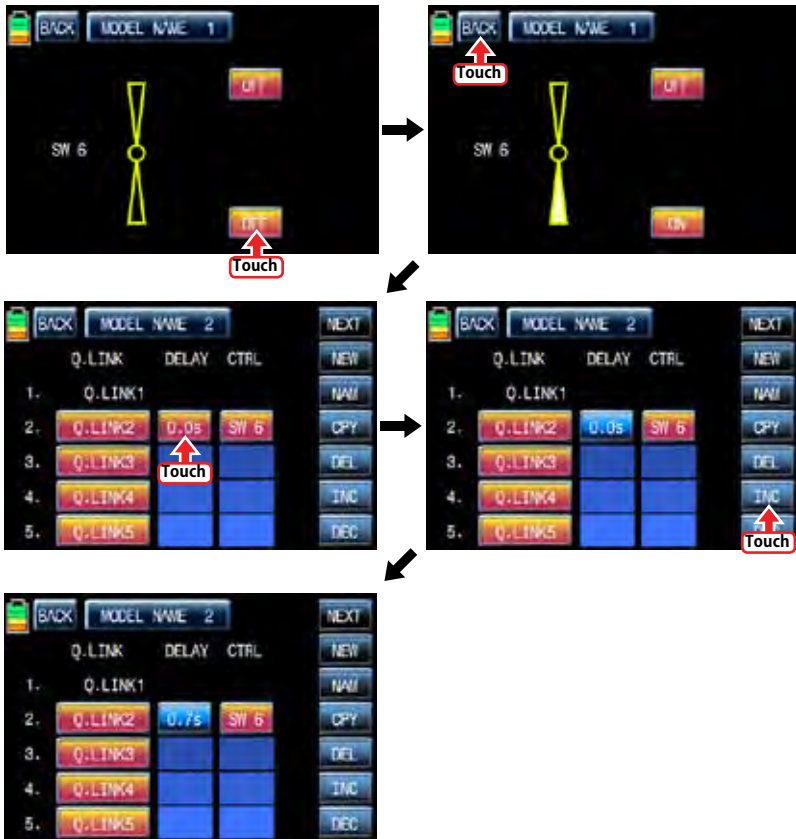


## FUNCTION MENU (Airplane, Gilder)

### 1. Q.LINK

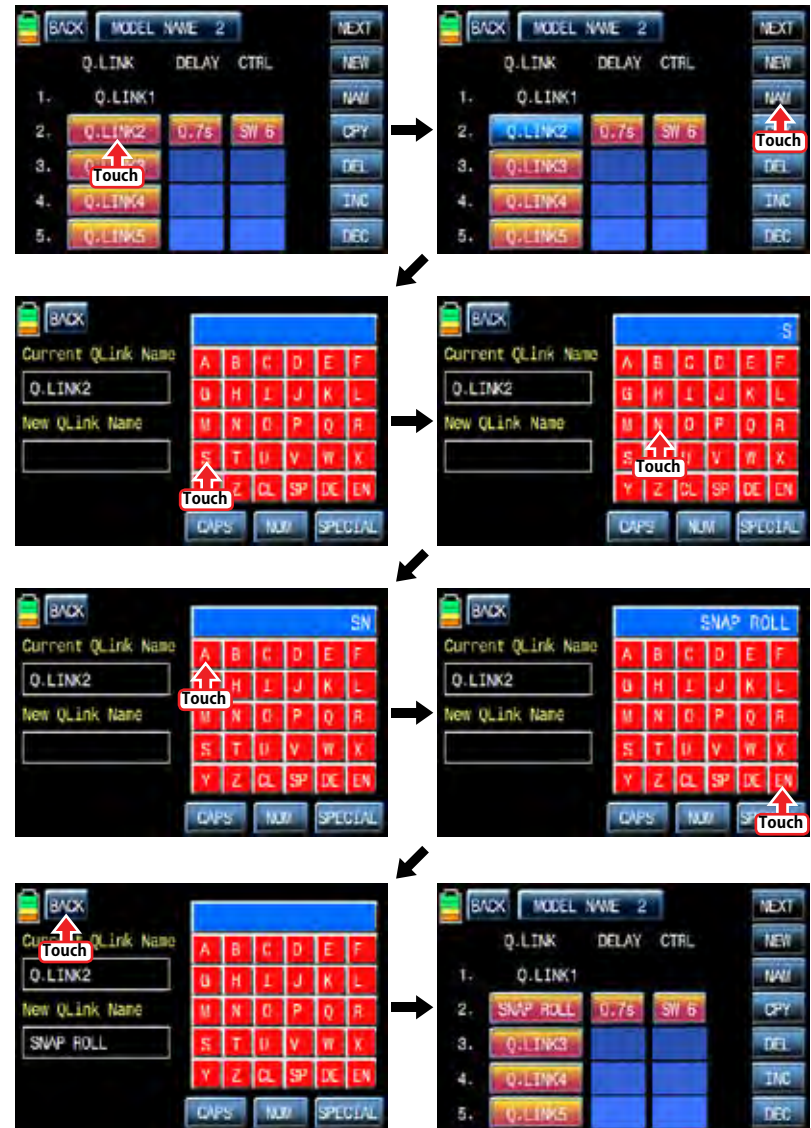
This function is used to set Q.LINK and assign the corresponding switch to cope with the unexpected trouble situation. Since the adjusted value is activated by moving the switch and you can cope with the crisis with just one switch. It makes you operating the flight much easier. Q.LINK for airplane type consists of 8 types. (NORMAL, IDLE UP1, IDLE UP2, IDLE UP3, HOLD, Q.LINK6, Q.LINK7, Q.LINK8) Normal type is set as a default value.

In the transmitter main page, touch "Function" icon to call the Function page and touch "Q.LINK" icon to call Q.LINK setup page. Q.LINK list is displayed. "1.NORMAL" is the default value and it cannot be changed.



## 1-2 NAM

It is used when to revise the name of "Q.LINK". Touch the target value in "Q.LINK" to activate in blue. Now touch "NAM" icon to call NAM setup page. In the page, enter the desired name using the keypad. After that, touch "EN" icon then the revised name is displayed in "New Q.LINK Name". Now, touch "BACK" icon on the left top left to call "Q.LINK" setup page and the revised name is stored at the corresponding Q.LINK.



### 1-3 CPY

CPY function is used to copy the preset Q.LINK setup data into another Q.LINK. Touch the desired entry in "Q.LINK" line to activate in blue. Touch "CPY" icon to call "COPY" message popup. Touch the entry in TARGET then all entry in TARGET are displayed in turn. Now, select the desired Q.LINK entry and touch "YES" icon then the preset data is saved into the selected Q.LINK entry and return to Q.LINK setup page.



### 1-4 DEL

It is used to delete the unused Q.LINK. Touch the entry in Q.LINK line that you want to delete to activate in blue and touch "DEL" icon. Now, the selected Q.LINK entry is deleted in Q.LINK list



### 1-5 NEXT

If you touch "NEXT" icon, you may call the next page



### 2. D/R, EXP

D/R function is used to adjust Servo travel amount that is connected to all channels including aileron, elevator and rudder channels. You can assign them to numerous switches and sticks. EXP function is used to set D/R function to aileron, elevator and rudder channels and adjust the sensitivity of natural position of every channel. Positive Exponential reduces the control sensitivity of neutral position for more precise control and negative exponential increase the control sensitivity of neutral position. D/R, EXP function can be operated with the assigned switch or connected to Q.LINK for purpose. In the function page, touch "D/R, EXP" icon to call D/R, EXP setup page. Touch D/R or EXP icon to activate in blue and perform D/R or EXP programming setup with "INC" and "DEC".



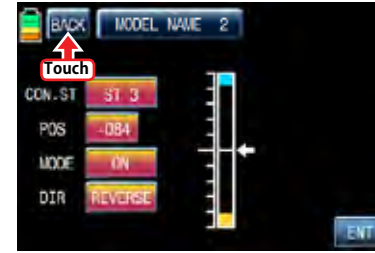
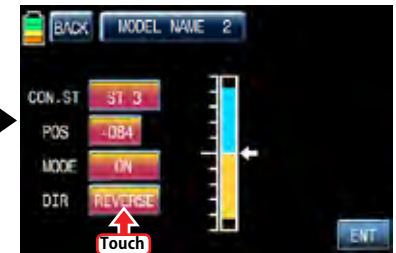
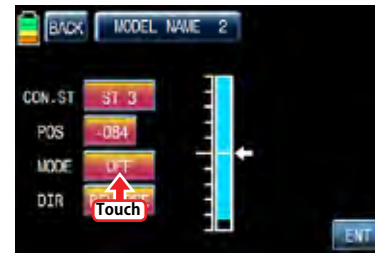
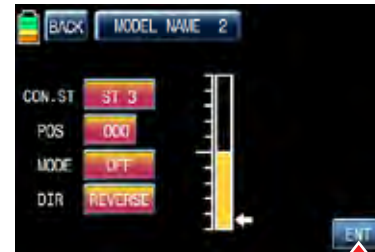
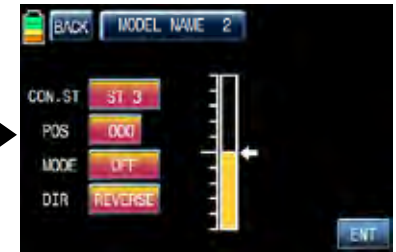
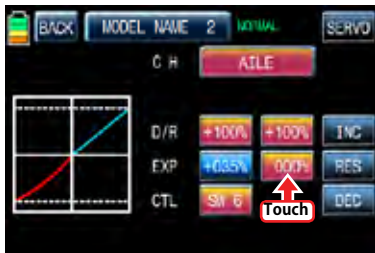
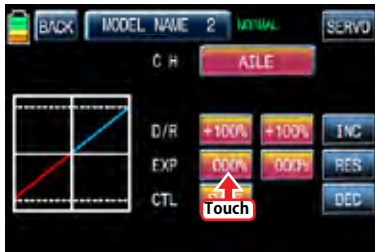
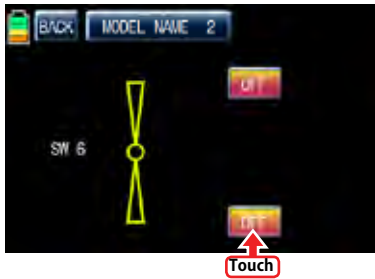


After "D/R", "EXP" setup, perform CTL setup. It is used to assign a switch to D/R, EXP function Touch "NULL" icon in CTL line to call "Select" message popup and move the switch that you want to use then that switch is set on/ off to switch and the switch direction setup page appears. You may select ON or OFF by touching icons. When the switch is moved to the direction of ON, the function is operated. Touch "Back" icon to return D/R, EXP setup page. When D/R, EXP switch is off, D/R, EX is returned to the default setup.

If you want to use stick instead of switch for "D/R", "EXP" function, Touch SW6 in CTL line to call "Select" message popup and move the stick with your choice then that stick is selected as on/ off stick and the stick direction setup page appears. In the direction setup page, move the stick to the position that you can comfortably reach, when the stick reach this position, D/R, EXP function is off. Touch "ENT" icon on the right bottom then the designated position is marked with the red or blue bar in the graph and the value of set position is displayed in POS. If you touch REVERSE in "DIR" line, all setup is reversed.

To set "ON" or "OFF" at the both end of stick operation range, touch "SINGLE" icon to change to "DUAL" then D/R, EXP function is on or off at the both end of stick operation range. You may set ELEV and RUDD channel in the same way. We recommend to set 5~12 channels to Q.LINK since they don't have on/off setup in D/R, EXP. When the setting is completed, touch "BACK" icon to return the function page.







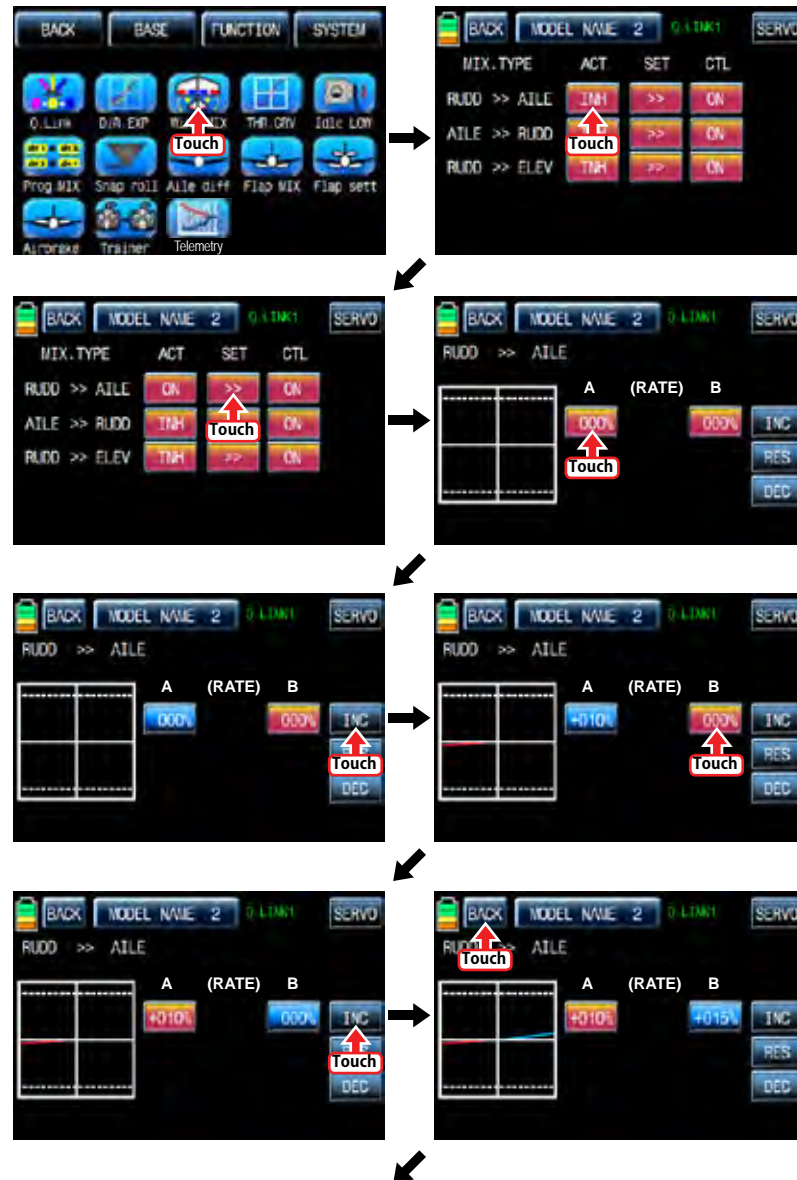
### 3. Wing MIX

Wing MIX consists of various mixing functions which are essential to fly. There are three types mix, RUDD>>AILE", "AILE>>RUDD", and "RUDD>>ELEV"

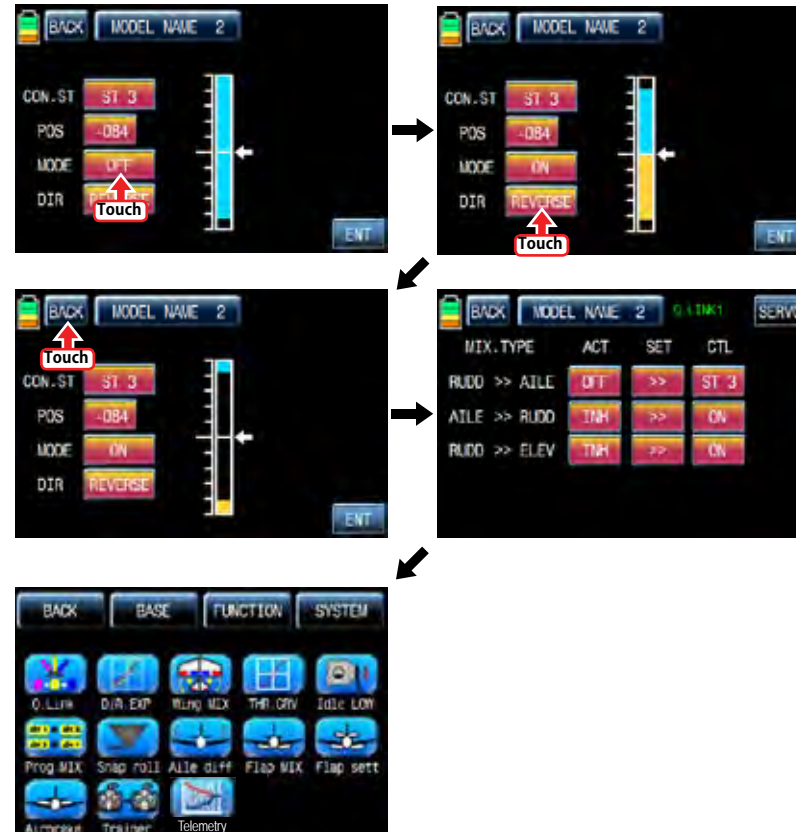
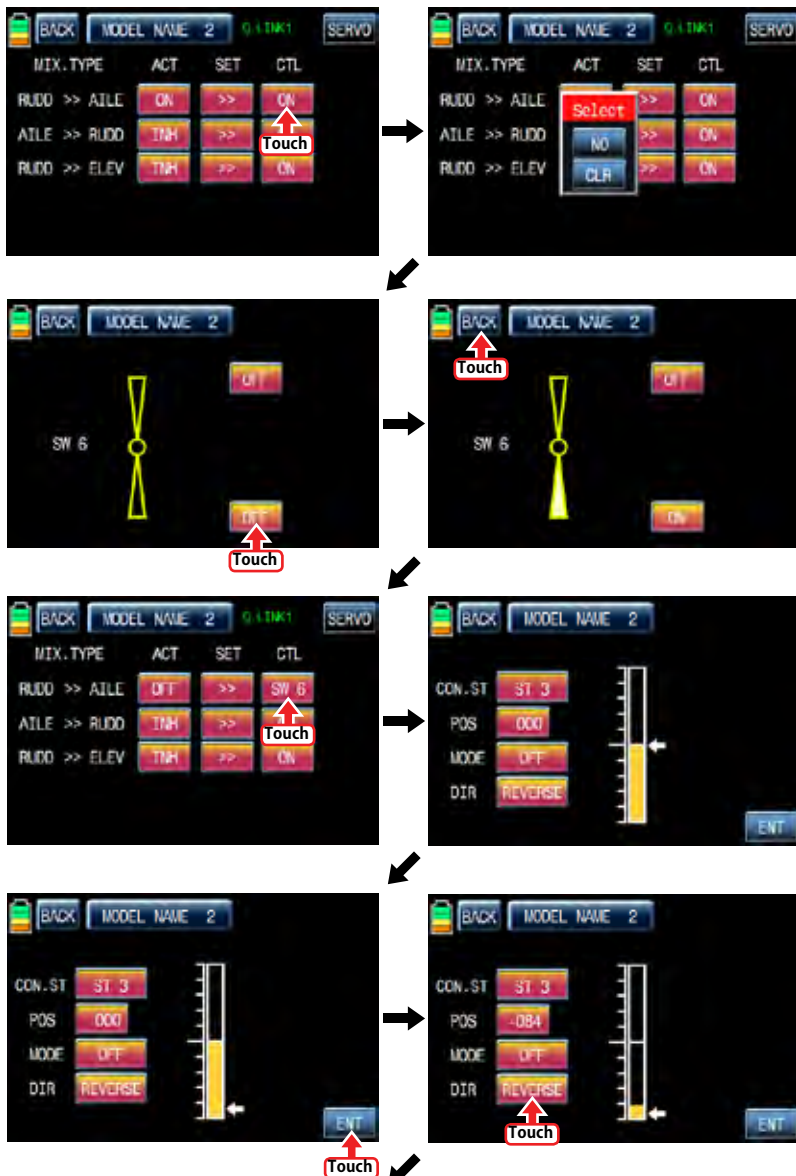
In FUNCTION page, touch "Wing MIX" icon to call "Wing MIX" setup page. Touch "INH" icon in "ACT" line to switch to ON and touch ">>" icon in "SET" line to call "SET" page. In "SET" page, you may adjust the travel amount of slave channel for the master channel operation. Touch and activate the values in LEFT and RIGHT line and adjust the mixing value with "INC" and "DEC" buttons. The programmed values are indicated in the left graph. Touch "BACK" icon to return to "Wing MIX" setup page. Now, you need to set CTL function. Touch "On" icon to call "Select" message popup then move the switch with your choice then that switch is designated as on/ off switch and then the switch direction setup page appears. You may select ON or OFF by touching icons. When the switch is moved to the direction of ON, the function is operated. Touch "BACK" icon to return to "Wing MIX" setup page.

If you want to use stick instead of switch for "Wing MIX" function, Touch SW6 in CTL line to call "Select" message popup and move the stick with your choice then that stick is selected as on/ off stick and the stick direction setup page appears. In the direction setup page, move the stick to the position that you can comfortably reach, when the stick reach this position, "Wing MIX" function is off. Touch "ENT" icon on the right bottom then the designated position is marked with the red or blue bar in the graph and the value of set position is displayed in POS. If you touch REVERSE in "DIR" line, all setup is reversed.

To set "ON" or "OFF" at the both end of stick operation range, touch "SINGLE" icon to change to "DUAL" then Wing MIX function is on or off at the both end of stick operation range. When the setting is completed, touch "BACK" icon to return to the wing mix setup page and to the function page.





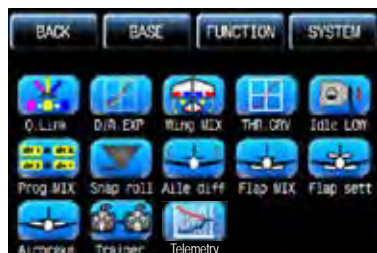
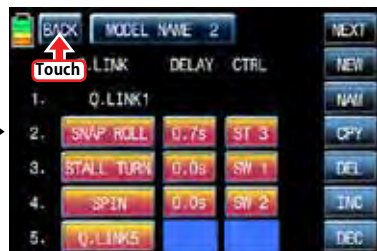
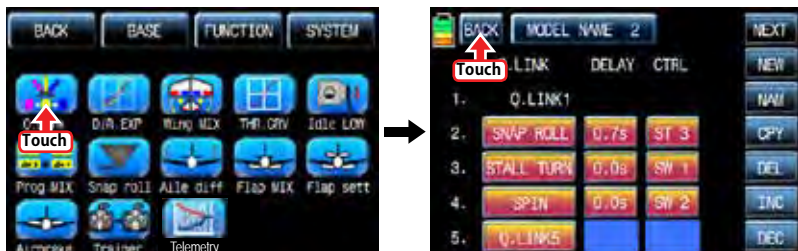


#### 4. THR,CRV

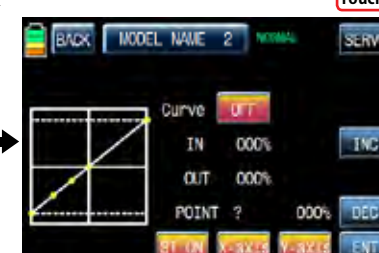
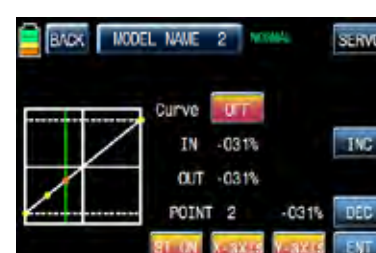
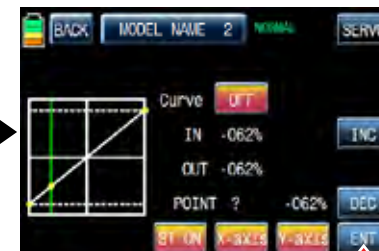
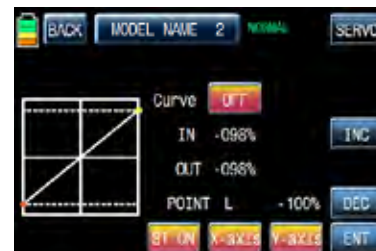
This function adjusts the throttle operation curve in relation to the movement of the throttle stick for each condition

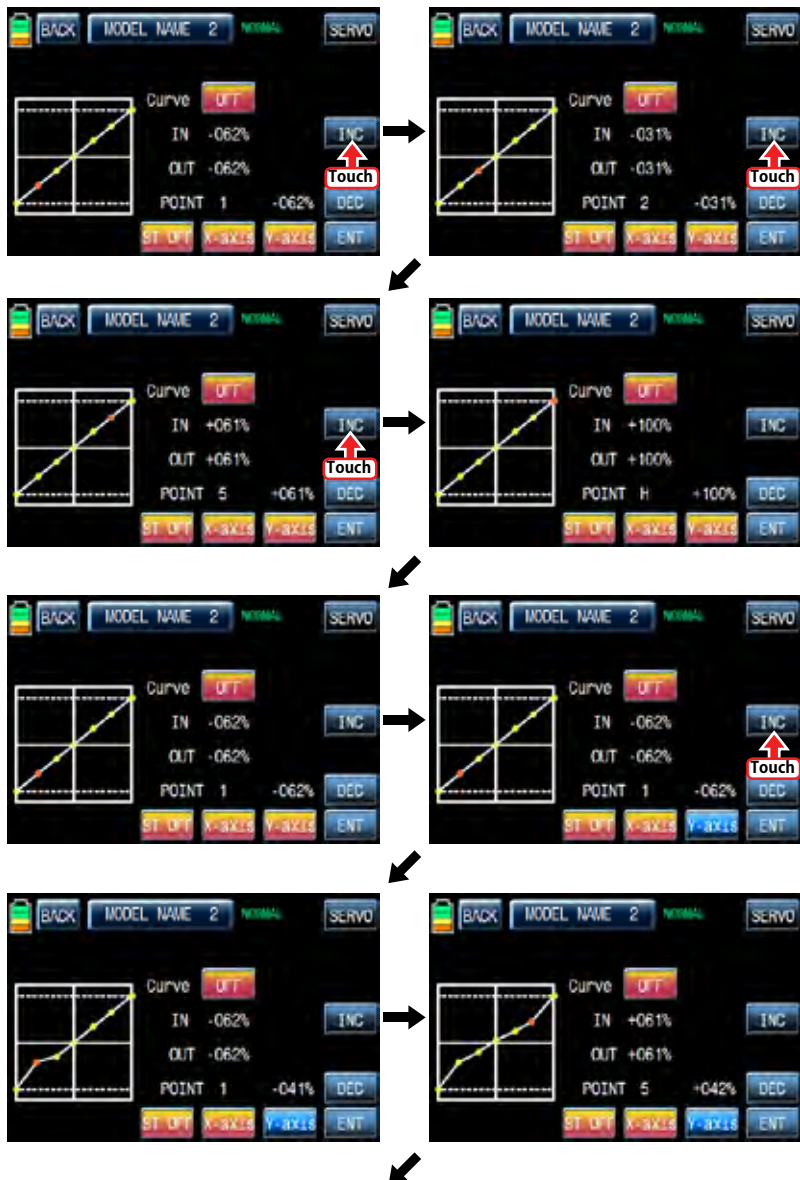
Since the throttle curve is closely related with Q.LINK setup, Q.LINK setup should precede THR.CRV setup.

Call Q.LINK setup page and check Q.LINK setup is completed correctly and touch "BACK" icon to return FUNCTION page. (Refer to the manual on Q.LINK setup)



In FUNCTIONPN page, touch "THR.CRV" icon to call THR.CRV setup page. You need to mark the point on graph first and then adjust the operation curve with "DEC", "INC", X-axis and Y-axis buttons. Touch "ST OFF" to switch to "ST ON" then the throttle position line appears on graph. Move throttle stick and place the line at the desired position between point "L" and "H" then touch "ENT" icon on the bottom right. Now the new point is marked in graph. You can mark five points between point "L" and "H" in the same way. Touch ST ON" to switch to "ST OFF" and complete the point setup. Now touch "DEC" or "INC" button to select point and touch X-axis or Y-axis to activate and then touch DEC" or "INC" button to adjust the operation curve. Turn on the preset Q.LINK switch then you may adjust the operation curve for every Q.LINK as well. When the setting is completed, touch "BACK" icon to return to the function page.



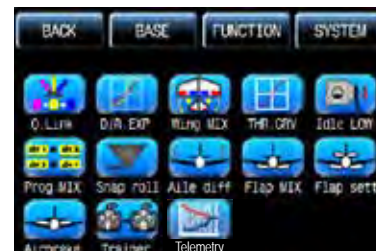
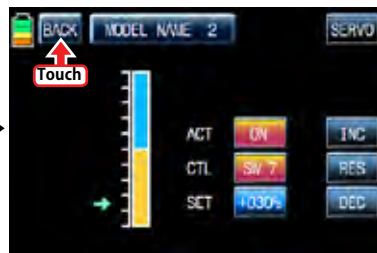
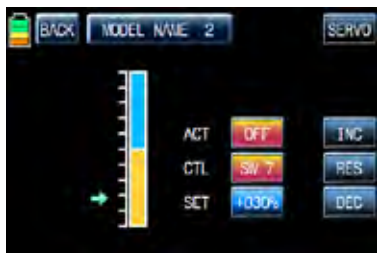
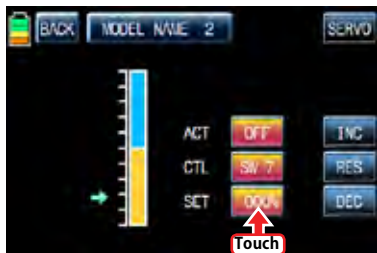


## 5. Idle LOW

It is used to lower the idle speed of the engine temporarily when airplane lands  
 In FUNCTION page, touch "Idle LOW" icon to call "Idle LOW" setup page and touch and switch "INH" in ACT line to "ON" then Idle LOW function is activated. Touch "ON" in CTL line to call "Select" message popup then move the switch with your choice then that switch is designated as on/ off switch and then the switch direction setup page appears. You may select ON or OFF by touching icons. When the switch is moved to the direction of ON, the function is operated. Touch "BACK" icon to return to Idle LOW setup page. Now, you need to set the operation value of Idle LOW. Touch and activate the value in SET line and set the desired value with INC and DEC buttons. Touch "BACK" icon to return to FUNCTION page  
 NOTICE: After setup Idle LOW, make sure to check the arrow direction of throttle channel







## 6. Prog.MIX

Prog.MIX function is used to mix the different channels for diverse purpose. We recommend you to use the same "On" switch with the one of Q.LINK. You may set the different program mix function for each Q.LINK condition.

8 MIXs are available. The mixing method introduced here is divided into 2 type, liner mixing type and curve mixing type. 1~5 MIXs are liner mixing type and 6~8 MIX is curve mixing type.

### 6-1. Liner mixing type

In FUNCTION page, touch "Prog.MIX" icon to call the prog.mix page. Touch "INH" icon in ACT line to switch to "ON" and touch "NONE" in MST line to call the mixing channel setup page. Touch and activate "NONE" icon and select the desired channel for the master by touching. Now, touch and activate the left "NONE" icon, it is for Slave channel, and select the desired channel for the slave by touching. Touch "BACK" icon to return to Prog.MIX setup page. Touch >> icon in SET line to call the program mixing setup page. Now, you need to set CTL function.

#### - CTL setup with a switch

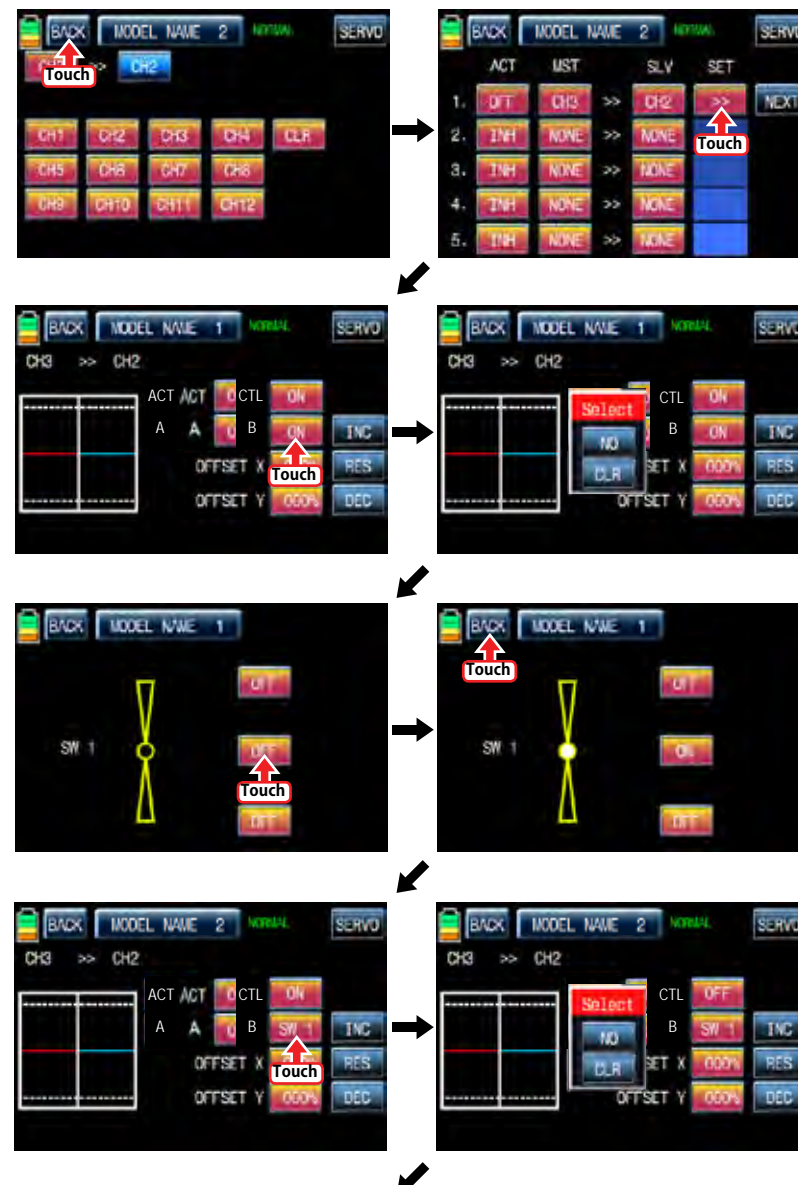
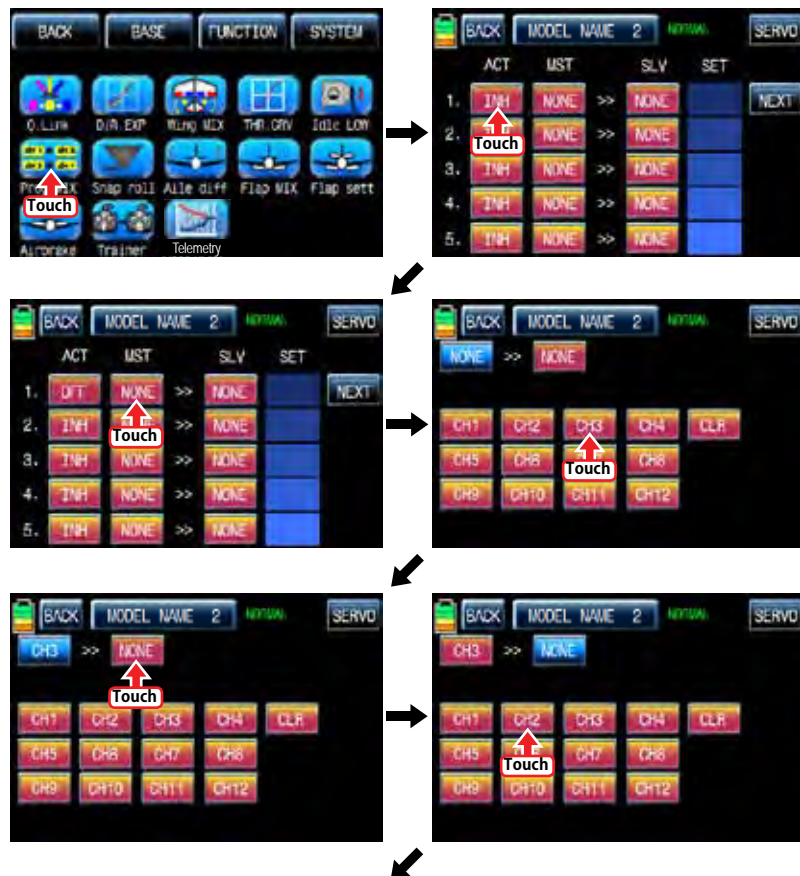
Touch "NULL" icon in CTL line to call "Select" message popup then move the switch with your choice then that switch is designated as on/ off switch and then the switch direction setup page appears. You may select ON or OFF by touching icons. When the switch is moved to the direction of ON, the function is operated. Touch "BACK" icon to return to Prog.MIX setup page.

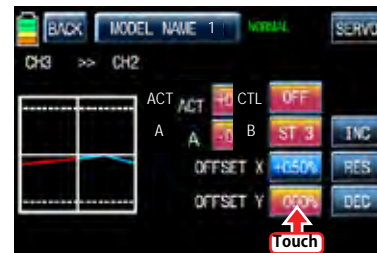
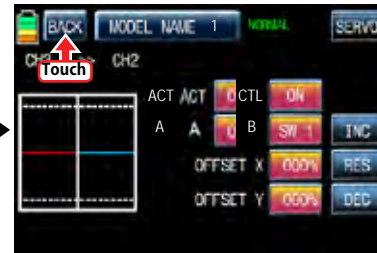
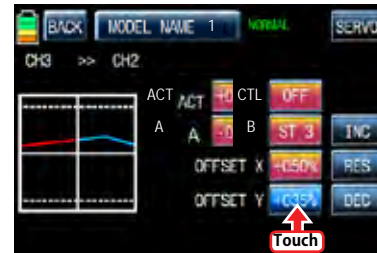
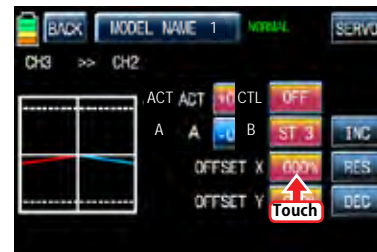
#### - CTL setup with a stick

Touch "SW6" icon in CTL line to call "Select" message popup then move the stick with your choice then that stick is designated as on/ off stick and then the stick direction setup page appears. Move the stick to the position that you can comfortably reach, when the stick reach this position, Prog.MIX function is off.

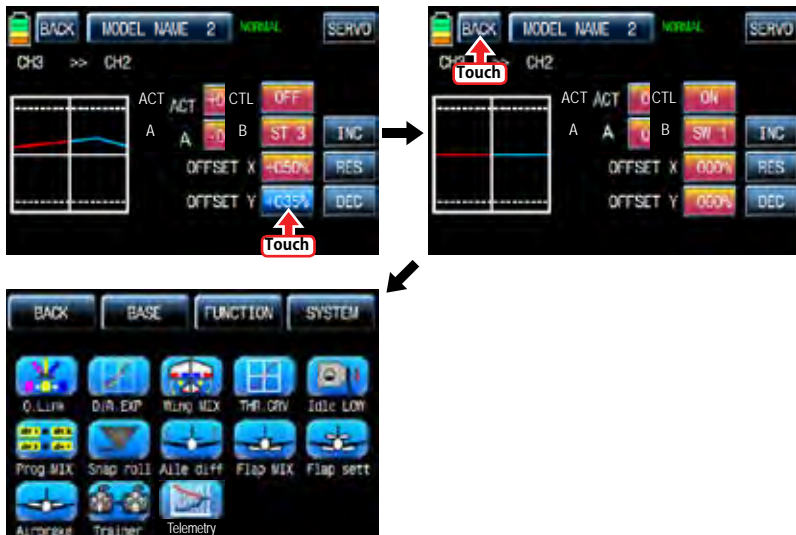
Touch "ENT" icon on the right bottom then the designated position is marked with the red or blue bar in the graph and the value of set position is displayed in POS. If you touch REVERSE in "DIR" line, all setup is reversed. To set "ON" or "OFF" at the both end of stick operation range, touch "SINGLE" icon to switch to "DUAL" then Prog.MIX function is on or off at the both end of stick operation range. Touch "BACK" icon to return to the program mixing setup page.

After CTL setup, you need to adjust the program mix operation value. Since the throttle channel is designated to the master channel, the operation value is displayed in A and B. Touch and activate the values in blue to adjust the value with "DEC" and "INC" buttons, the setup value is displayed in graph. OFFSET X/Y can be set the same method and the setup value is displayed as well.









## 6-2. Curve mixing type

In the prog.mix page, touch "NEXT" icon to call the next page and touch "INH" icon in the cross line of NO7 and ACT to switch to "ON". Touch "NONE" in MST line to access the channel selection page and touch and activate "NONE" icon to select the desired channel of MST and SLV. Touch "BACK" icon to return to the prog.mix page. Touch ">>" icon to call the program mixing setup page. Now, you need to set CTL function.

### - CTL setup with a switch

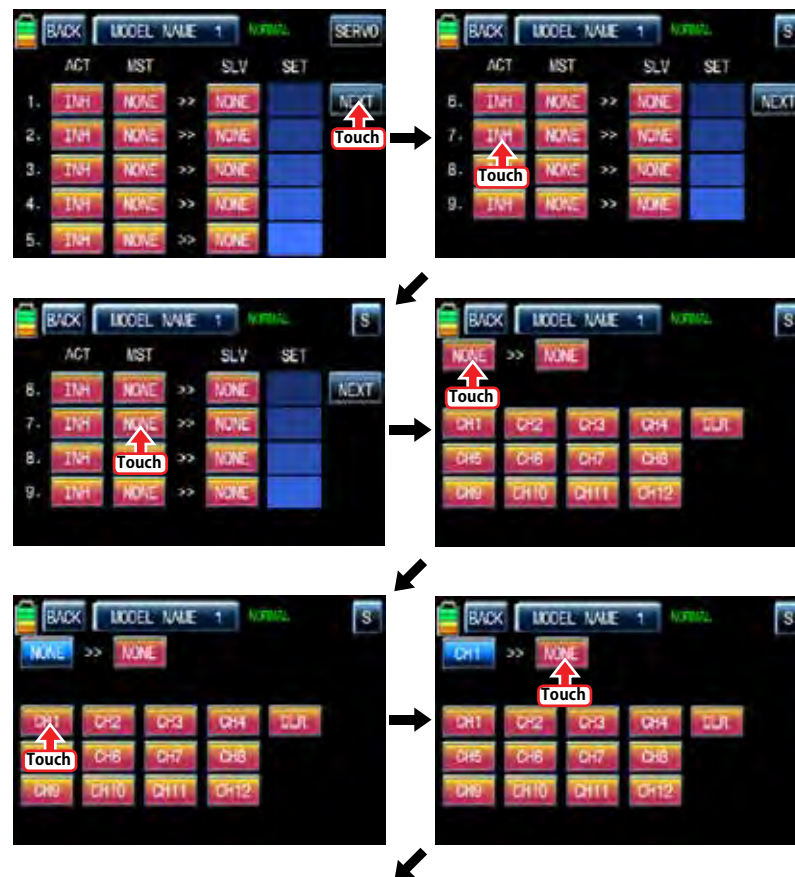
Touch "ON" icon in CTL line to call "Select" message popup then move the switch with your choice then that switch is designated as on/ off switch and then the switch direction setup page appears. You may select ON or OFF by touching icons. When the switch is moved to the direction of ON, the function is operated. Touch "BACK" icon to return to the program mixing setup page.

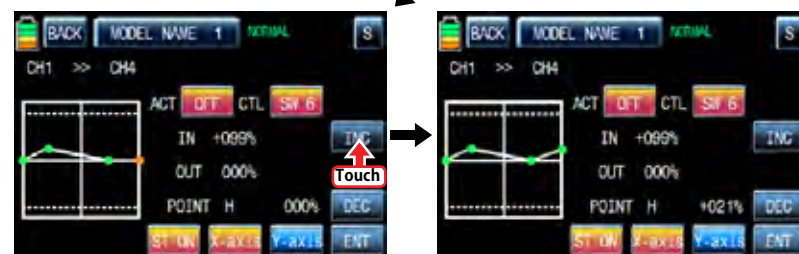
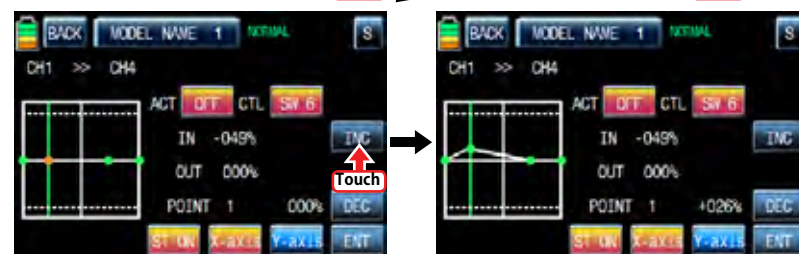
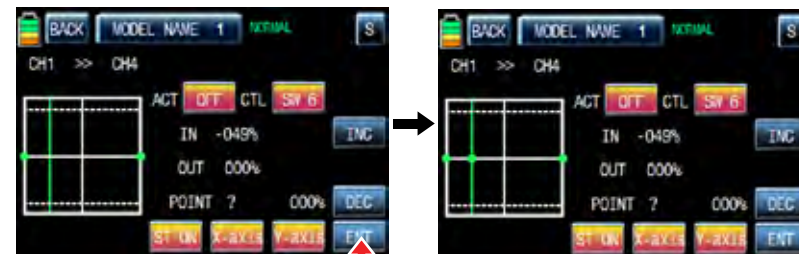
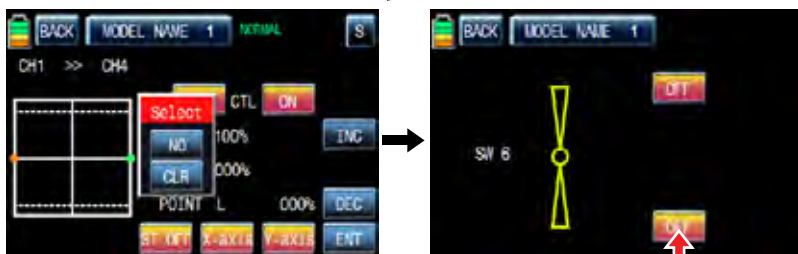
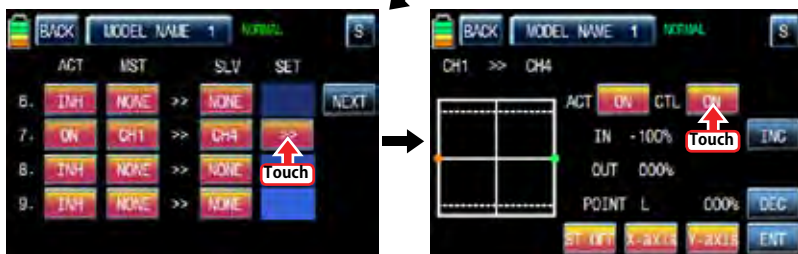
### - CTL setup with a stick

Hoping that you would refer the explanation as explained above

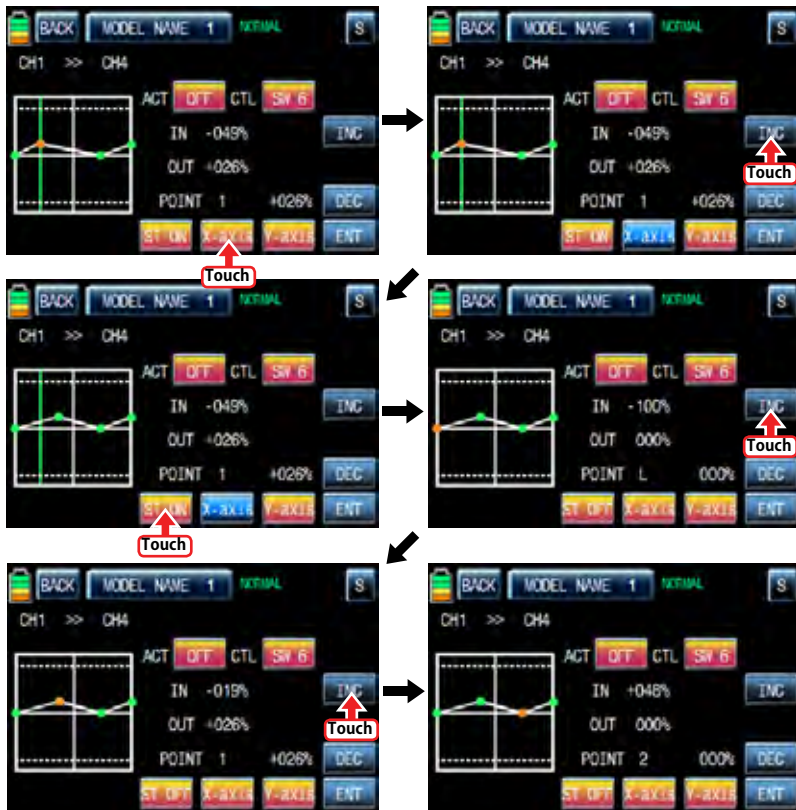
Here, you need to set the operation value, "L" and "H" points are set by default and you need to mark 5 points between "L" and "H" on graph first and then adjust the operation curve with "DEC", "INC", X-axis and Y-axis buttons. Touch "ST OFF" icon to switch to "ST ON" then the blue line appears on graph. Move the designated switch or stick to place the line at the desired position then touch "ENT" icon on the bottom right. Now the new point is marked in graph. You may set five points in your favorable position.

Touch "PITT >> RUDD" icon in the function page to call PIT >> RUDD setup page. You need to mark the point on graph first and then adjust the operation curve with "DEC", "INC", X-axis and Y-axis buttons. Touch "ST OFF" icon to switch to "ST ON" then the pitch position line appears on graph. Move throttle stick and place the line at the desired position between point "L" and "H" then touch "ENT" icon on the bottom right. Now the new point is marked in graph. Touch ST ON" to switch to "ST OFF" and complete the point setup. Now touch "DEC" or "INC" button to select point and touch X-axis or Y-axis to activate and then touch DEC" or "INC" button to adjust the operation curve.









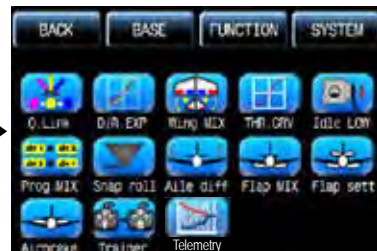
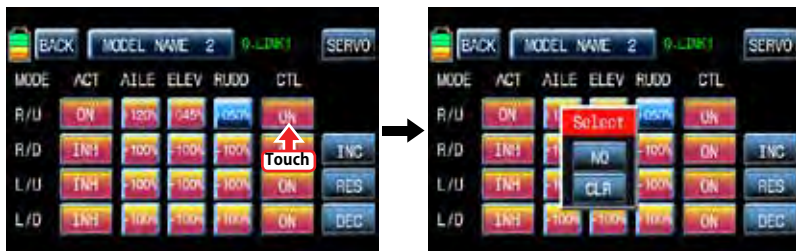
## 7. Snap roll

It is used to select the switch and adjust the value of AILE, ELEV, RUDD channels for the snap roll function. Four snap roll directions can be set for your convenience.

In function page, touch "Snap roll" icon to call the snap roll setup page. Touch "INH" icon in ACT line to switch to ON. Touch and activate the value in AILE, ELEV and RUDD line to adjust the values with "INC" and "DEC" buttons. Touch "NULL" icon in CTL line to call "Select" message popup then move the switch with your choice then that switch is designated as on/off switch and then the switch direction setup page appears. You may select ON or OFF by touching icons. When the switch is moved to the direction of ON, the function is operated. Touch "BACK" icon to return to Snap roll setup page and to FUNCTION page



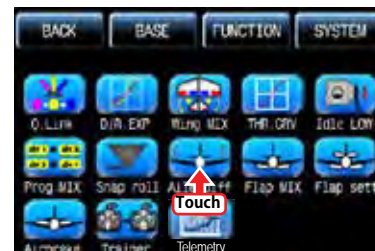


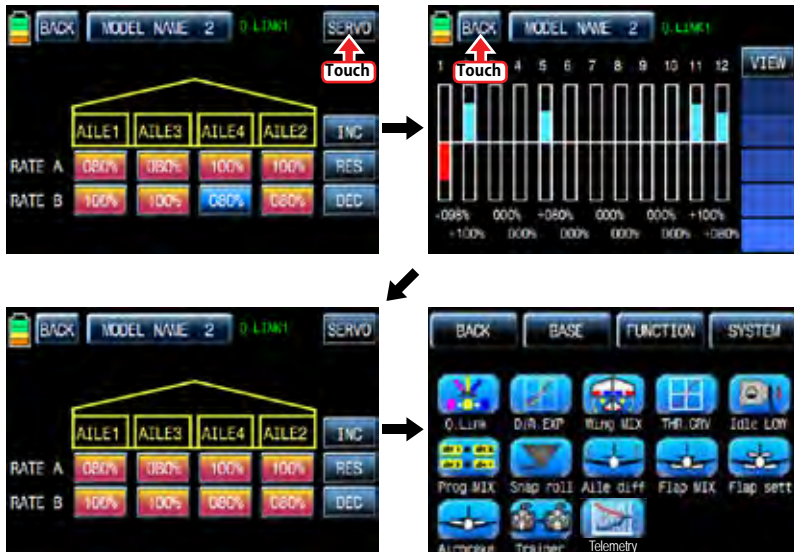


## 8. Aile diff

This function decreases the amount an aileron moves down without affecting the amount the other aileron moves up. This can decrease adverse yaw (right or left movement of the aircraft nose) tendencies during roll maneuvers.

Touch "Aile diff" icon to call "Aile diff" setup page. The setup options are different for each wing type. In "Aile diff" setup page, touch and activate the values in "RATE A" and "RATE B" lines to adjust them with INC and DEC buttons. We recommend setting accurately over the flight. Now, touch "Servo" icon on the left top to call SERVO VIEW page. In this page, you may check the value for the aileron stick movement in a graph. Touch "BACK" icon to return to the aile diff setup page and the function page.



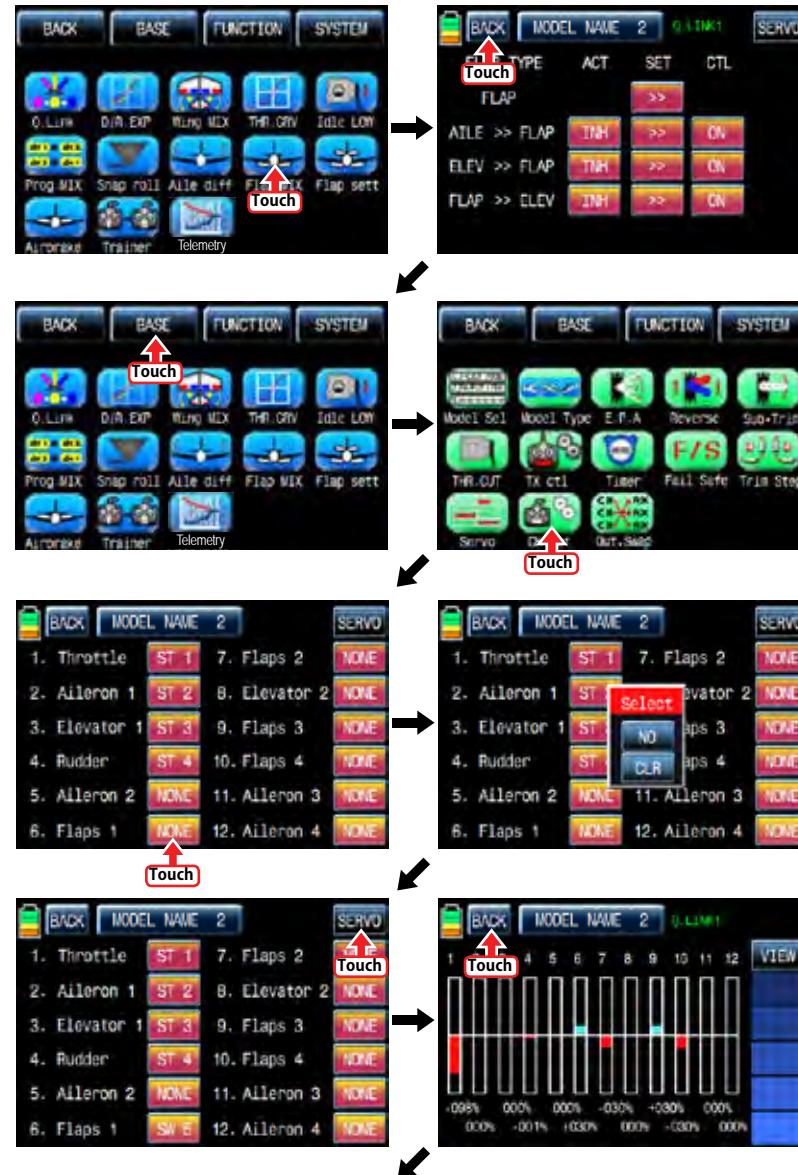


## 9. Flap MIX

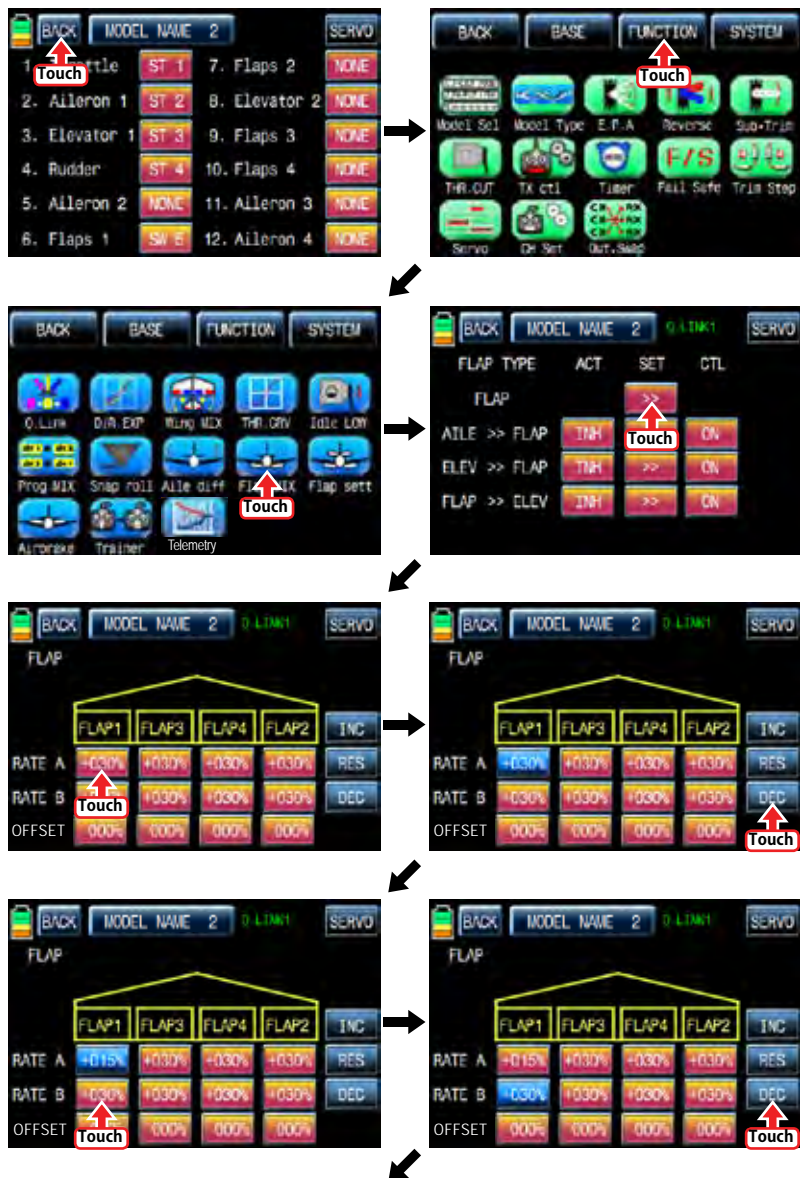
It consists of 4 mixing types, "FLAP", "AILE>>FLAP", "ELEV>>FLAP", and "FLAP>>ELEV".

### 9-1. FLAP

This function is used to adjust the flap angle to increase or decrease airplane lift. To setup the flap function, you need to designate on/off control key such as switch, stick and volume. When you move the control key, the flap function is operated. Touch "CH SET" in BASE page to call "CH SET" setup page. Touch "NONE" icon in FLAP 1 line to pop up "Select" message. Move the control key with your choice then that control key is designated as on/ off key. Now, touch "SERVO" icon in the right top to call the servo view page. The default value, 30%, for the travel amount of servo is displayed in the graph and this function value can be adjusted. To adjust the function value, touch "Flap MIX" icon in the function page to call Flap Mix page and touch ">>" icon in SET line to call the flap setup page. Touch and activate the function value to adjust with INC and DEC buttons. Now, touch "SERVO" icon again to call the servo view page then you may check the setup value in this page. After setup, touch "BACK" icon to return to Flap MIX page.



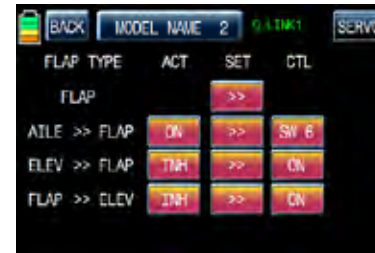
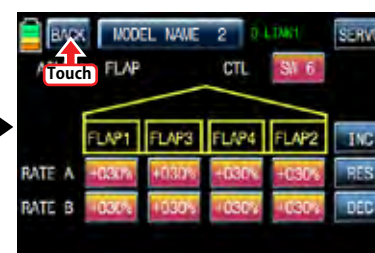
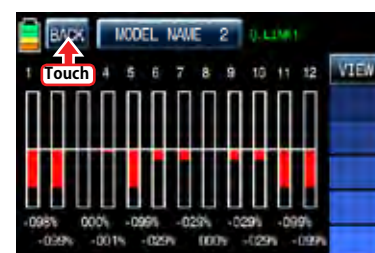
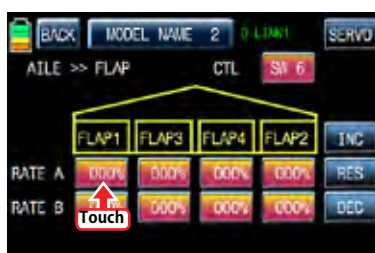
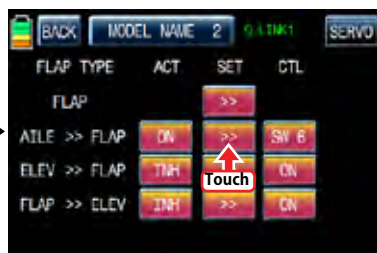
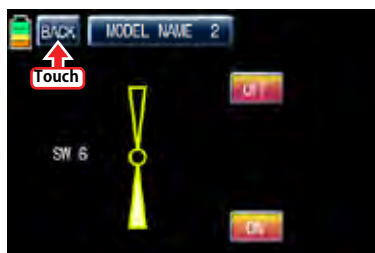
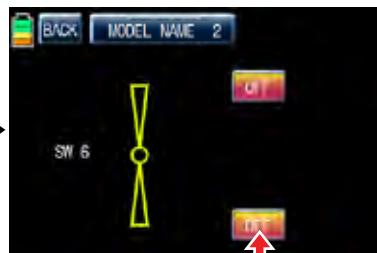




## 9-2. AILE >> FLAP

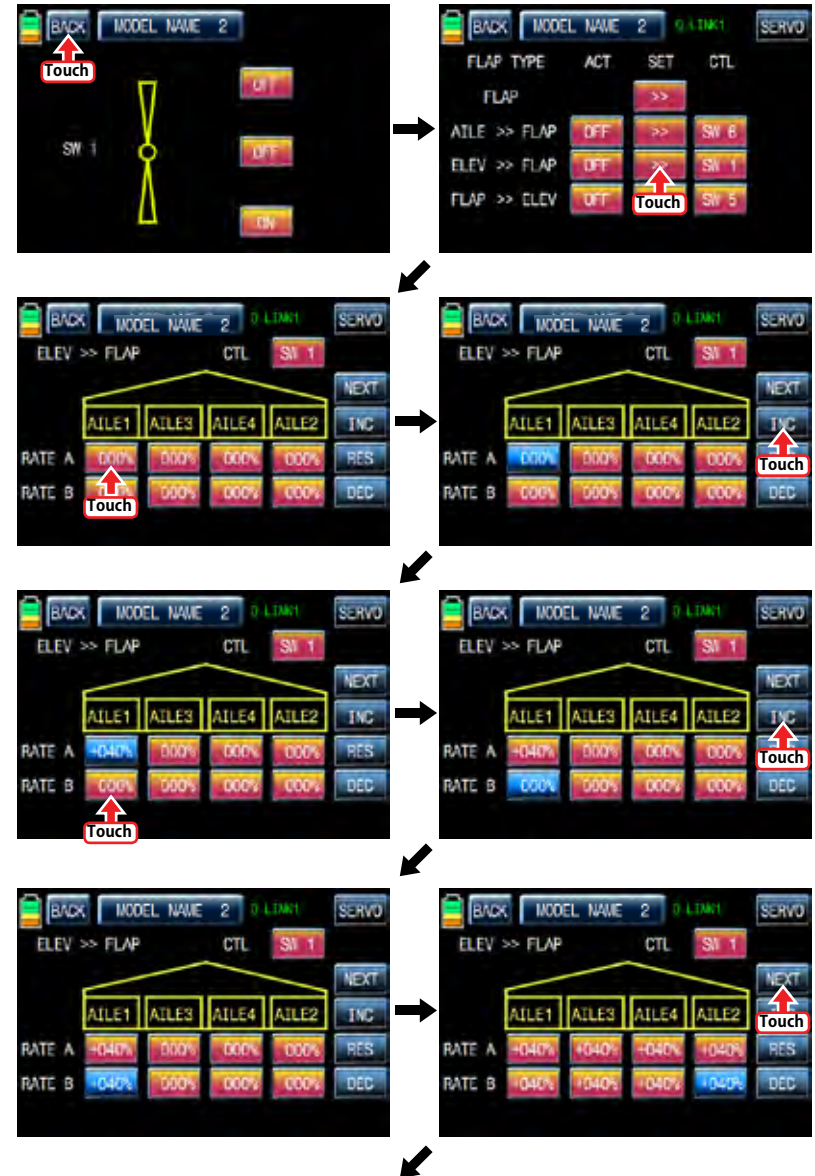
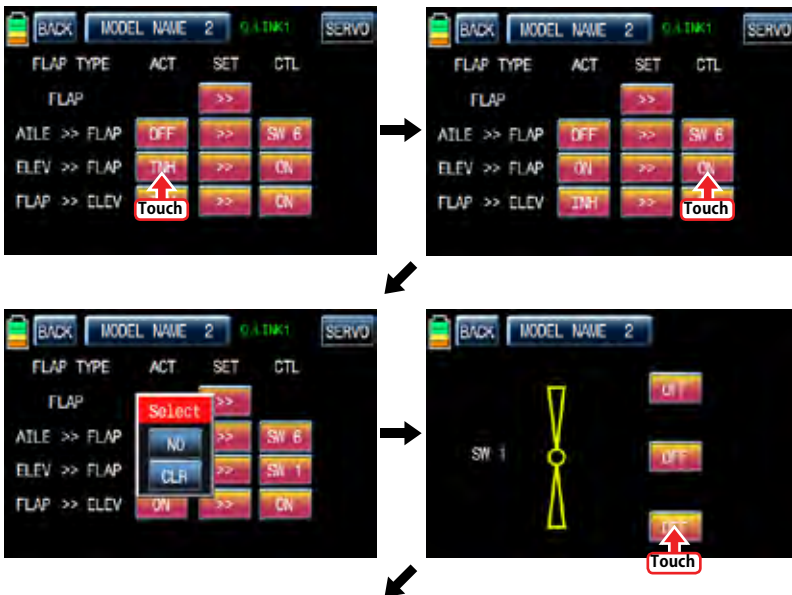
This mixing allows the entire trailing edge of the wing (aileron and flap) to operate as ailerons. When active, as aileron is applied the flaps also move so that the airplane rolls faster. In FLAP MIX page, touch "INH" icon in ACT line to switch to "ON" then AILE >>FLAP function is activated. Touch "ON" in CTL line to call the "Select" message popup and move the switch or stick or volume with your choice then that switch or stick or volume is designated as on/ off key and then the key direction setup page appears. You may select ON or OFF by touching icons. When the key is moved to the direction of ON, the function is operated. Touch "BACK" icon to return to FLAP MIX page. Touch ">>" icon in "SET" and "AILE >> FLAP" cross line to call "AILE >> FLAP" setup page. Touch and activate the values in blue and adjust them with INC and DEC buttons. When the setup is completed, touch SERVO icon on the top right to call SERVO page. You may check the setup value for "AILE >> FLAP".





### 9-3. ELEV >> FLAP

This mixing creates more lift of airplane, allowing a tighter turn. The entire trailing edge of the wing (aileron and flap) operates as flaps when elevator is applied. Touch INH icon in ACT line to switch to "ON" then ELEV >> FLAP is activated. Touch "ON" in CTL line to call the "Select" message popup and move the switch or stick or volume with your choice then that switch or stick or volume is designated as on/ off key and then the key direction setup page appears. You may select ON or OFF by touching icons. When the key is moved to the direction of ON, the function is operated. Touch "BACK" icon to return to FLAP MIX page. Touch ">>" icon in "SET" and "ELEV >> FLAP" cross line to call "ELEV >> FLAP" setup page. You may call "AILE" and "FLAP" setup page with NEXT button in the top right. Touch and activate the values in blue and adjust them with INC and DEC buttons. When the setup is completed, touch SERVO icon on the top right to call SERVO page. You may check the setup value for "ELEV >> FLAP".

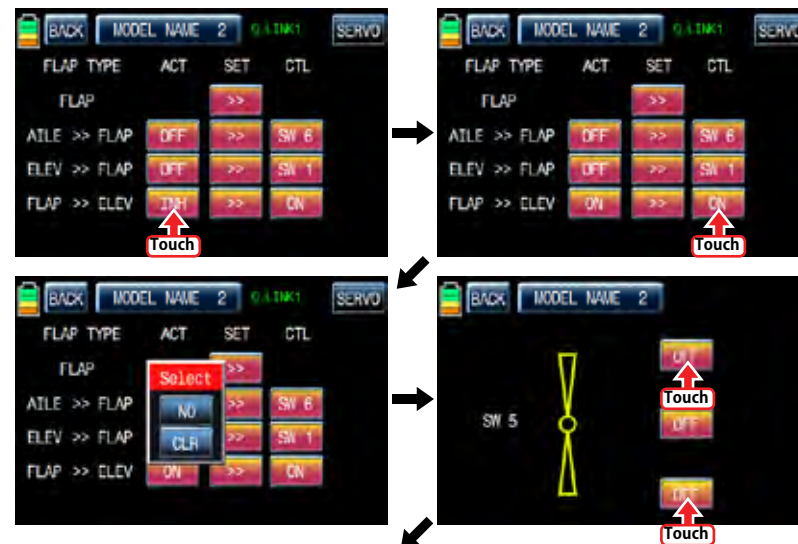




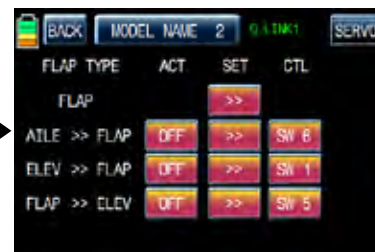
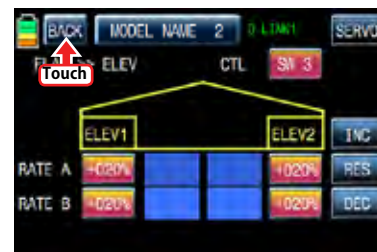
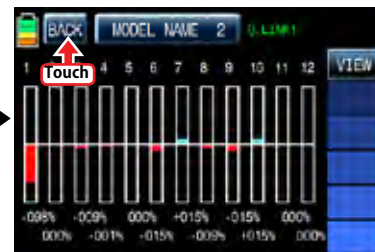
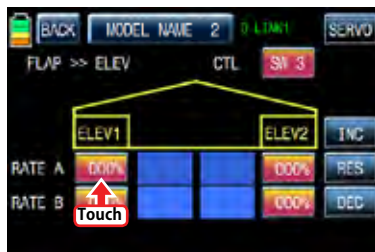
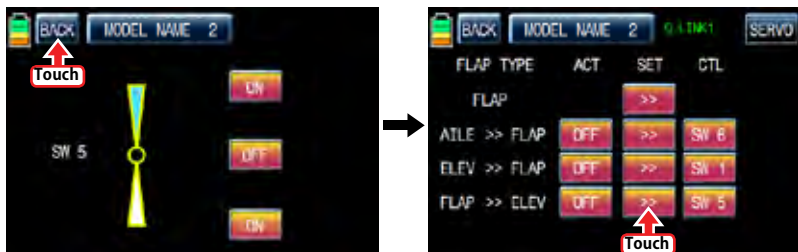


#### 9-4. FLAP >> ELEV

This mixing prevents the change of the nose of airplane that occurs when FLAP is applied by operating elevator in FLAP MIX page, touch "INH" icon in ACT line to switch to "ON" then FLAP >> ELEV function is activated. Touch "ON" in CTL line to call the "Select" message pop-up and move the switch or stick or volume with your choice then that switch or stick or volume is designated as on/ off key and then the key direction setup page appears. You may select ON or OFF by touching icons. When the key is moved to the direction of ON, the function is operated. Touch "BACK" icon to return to FLAP MIX page. Touch ">>" icon in "SET" and "FLAP >> ELEV" cross line to call "FLAP >> ELEV" setup page. Touch and activate the values in blue and adjust them with INC and DEC buttons. When the setup is completed, touch SERVO icon on the top right to call SERVO page. You may check the setup value for "FLAP >> ELEV". The preset set "FLAP" and the set "FLAP >> ELEV" are activated at the same time when SW5 which was set in "FLAP >> ELEV" is set to "ON".





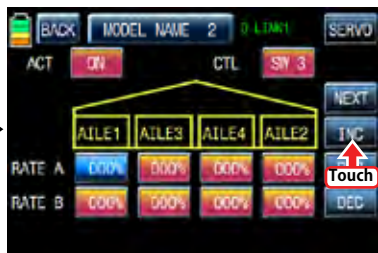


Flap mix Functions can be adjusted for each Q.LINK condition.

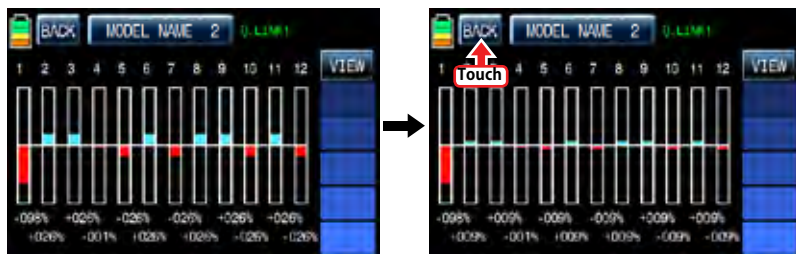
## 10. Flap sett (Airplane, Gilder)

This mixing allows that the aileron, flap and elevator setups are applied at the same time by operating a switch.

Touch "Flap sett" icon to access to the "Flap sett" setup page. The first page is AILE setup and you may access to FLAP and ELEV setup page by touching "NEXT" icon in the top right. Touch "INH" icon in ACT line to switch to "ON" and touch "ON" in CTL line to call the "Select" message popup. Move the switch or stick or volume with your choice then that switch or stick or volume is designated as on/ off key and then the key direction setup page appears. You may select ON or OFF by touching icons. When the key is moved to the direction of ON, the function is operated. Touch "BACK" icon to the previous page then touch and activate the values in blue and adjust them with "INC" and "DEC" buttons. After performing the programming setup of AILE and FLAP and ELEV in turn, touch SERVO icon on the top right to call SERVO page. You may check the setup value for Flap sett. When Tx and Ctl are set to DV1, DV2, DV3, DV4, SL1, and SL2 in advance, the setup values are applied by operating "DV" or "SL" while flying





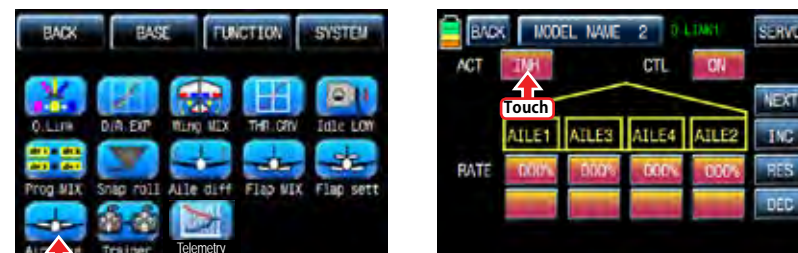


## 11. Airbrake (Airplane)

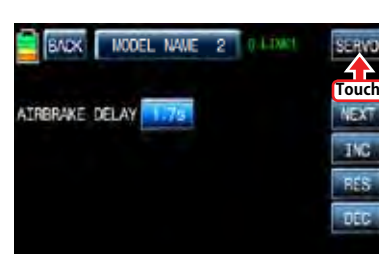
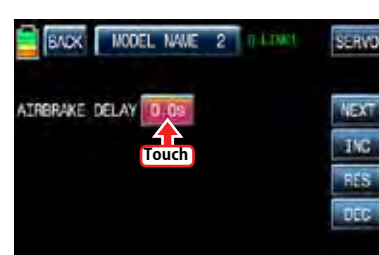
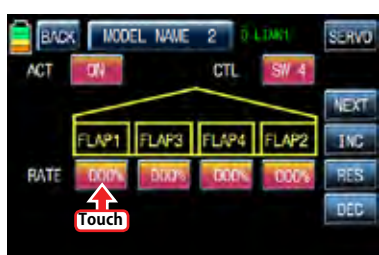
This mixing is used when the airplane is need to land or descent vertically. Airbrake can be set by AILE, FLAP and ELEV.

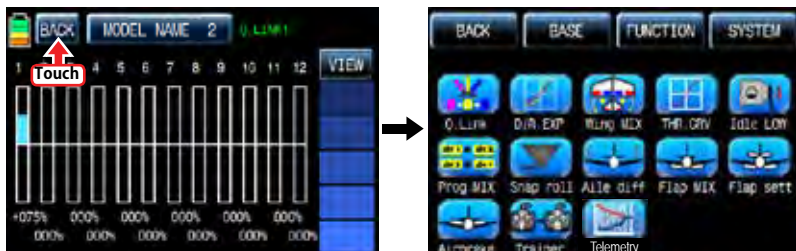
Touch "Airbrake" icon in the function setup page to call the airbrake setup page. The first page is AILE setup and you may access to FLAP, ELEV and AIRBRAKE DELAY setup page by

touching "NEXT" icon in the top right. Touch "INH" icon in ACT line to switch to "ON" and touch "ON" in CTL line to call the "Select" message popup. Move the switch or stick or volume with your choice then that switch or stick or volume is designated as on/ off key and then the key direction setup page appears. You may select ON or OFF by touching icons. When the key is moved to the direction of ON, the function is operated. Touch "BACK" icon to the previous page then touch and activate the values in blue and adjust them with "INC" and "DEC" buttons. After the programming setup of FLAP, ELEV and AIRBRAKE DELAY in turn, touch SERVO icon on the top right to call SERVO page. You may check the setup value for Airbrake.







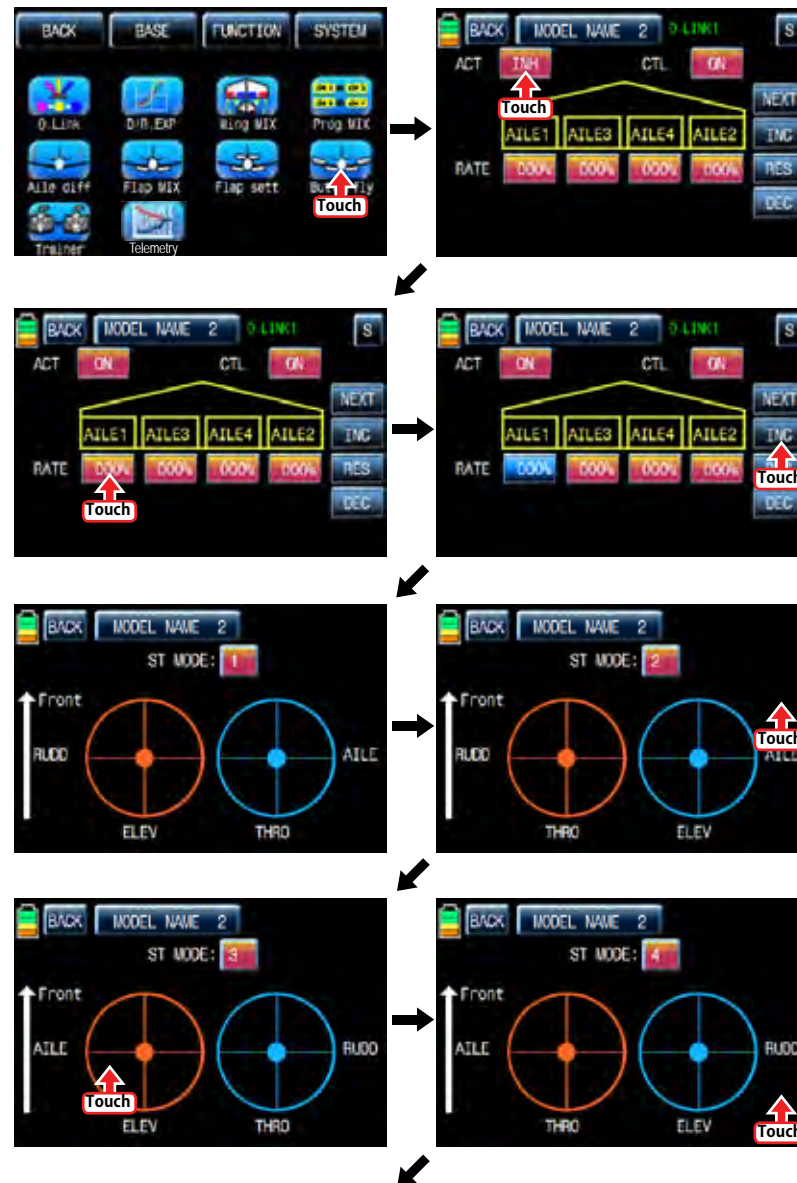


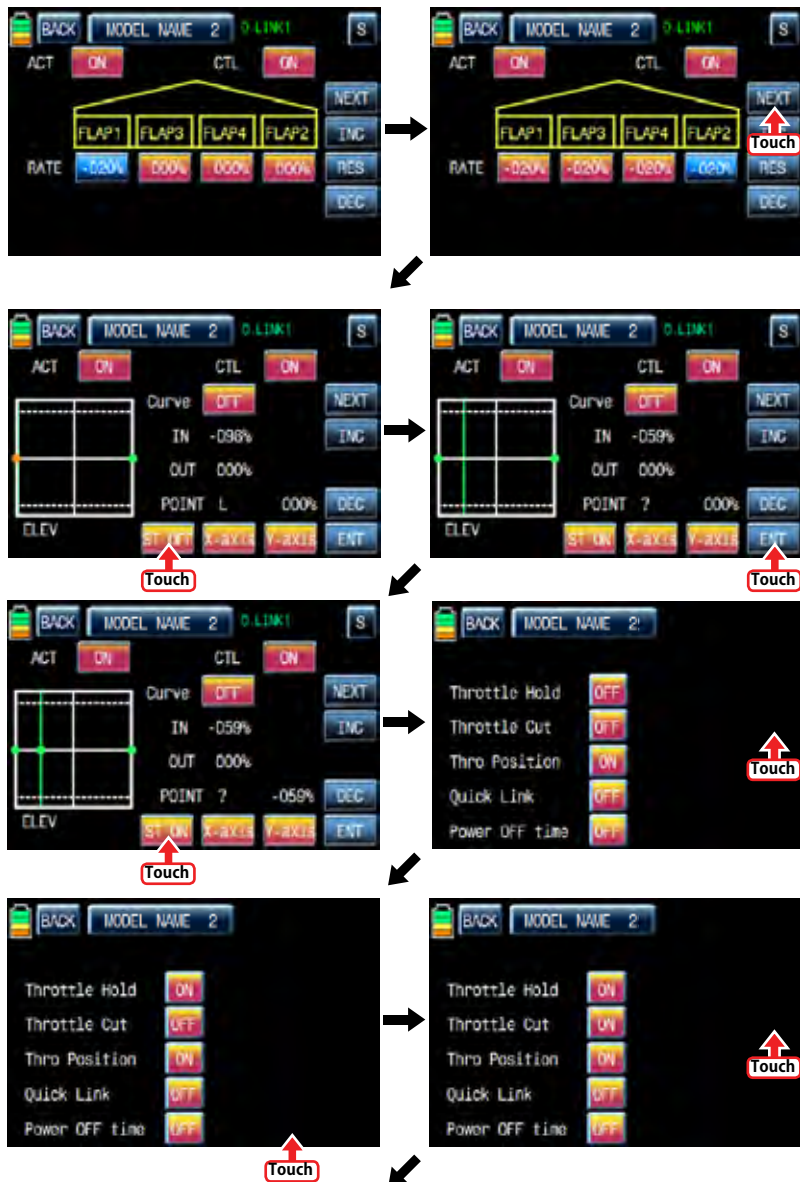
## 12. Butterfly (Glider)

It is used in glider type only. This function allows powerful brake operation by simultaneously raising the left and right ailerons and lowering the flaps. Butterfly produces an extremely efficient landing configuration by flying at a slower speed.

CAUTION: We recommend that you do several tests on high altitude to make the best use of this function.

For the setup of butterfly function, touch "Butterfly" icon to access to the Butterfly setup page. Touch "INH" icon to switch to "ON" to call the "Select" message popup and move the switch or stick or volume with your choice then that switch or stick or volume is designated as on/ off key and then the key direction setup page appears. You may select ON or OFF by touching icons. When the key is moved to the direction of ON, the function is operated. Touch "BACK" icon to return to the Butterfly setup page. The setup pages of AILE, FLAP, ELEV and BUTTERFLY OFF appear by touching "NEXT" button. AILE, FLAP values are activated in blue by touching and adjusted with INC and DEC buttons. ELEV can be set with curve in the graph. You need to mark the point on graph first and then adjust the operation curve with "DEC", "INC", X-axis and Y-axis buttons. Touch "ST OFF" to change to "ST ON" then the throttle position line appears on graph. Move throttle stick and place the line at the desired position between point "L" and "H" then touch "ENT" icon on the bottom right. Now the new point is marked in graph. You can mark five points between point "L" and "H" in the same way. Touch ST ON" to change to "ST OFF" and complete the point setup. Now touch "DEC" or "INC" button to select point and touch X-axis or Y-axis to activate and then touch DEC" or "INC" button to adjust the operation curve. If you touch OFF icon in Curve line, it is changed to ON and the operation curve is smoother. Now touch "NEXT" icon to call "BUTTERFLY OFF" setup page. This function is used to set whether it is switched off. Move and hold the throttle stick to the desired position for the function off and touch the value then the stick position is decided and the assigned value is displayed. The butterfly function is operated under the assigned value and it is not operated over the assigned value. When the setting for butterfly is completed, touch "S" icon on the top right to access to Servo page. In Servo page, you may check the setup value of AILE, FLAP, and ELEV.



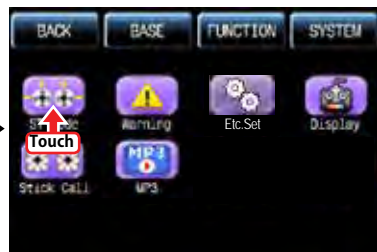


## SYSTEM (Helicopter, Airplane, Gilder)

### 1. ST mode

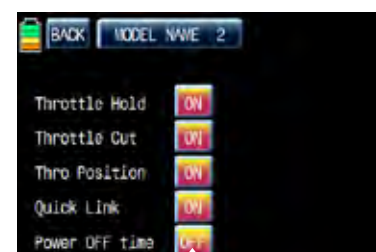
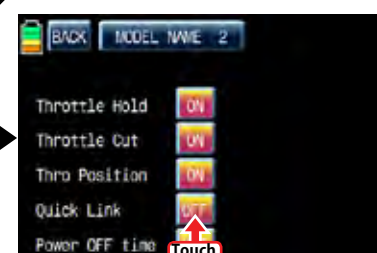
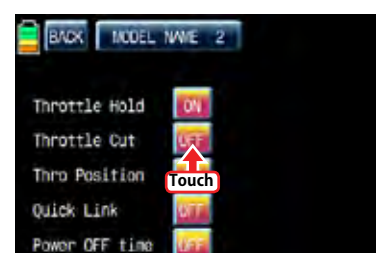
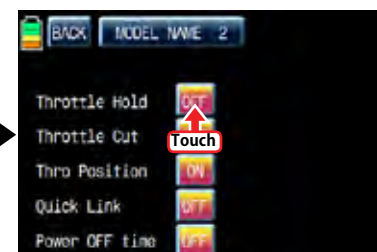
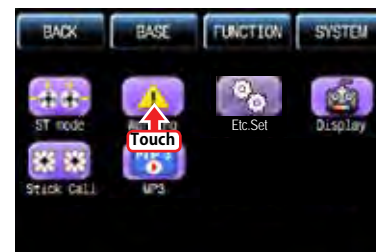
The Stick model can be selected from 1 to 4. "Mode 1" is widely used in ASIA and Mode 2 is widely used in North America and Europe and also mode 3, 4 are available to use. In the initial page, touch "SYSTEM" icon to call SYSTEM setup page and touch "ST mode" icon to call ST mode setup page. In ST mode setup page, ST mode is selectable from "1" to "4" whenever "ST mode number" is touched and the indications are displayed for each ST mode. When the stick setup is completed, touch "BACK" icon to call the SYSTEM menu page





## 2. Warning

The Warnings function programs an alarm to sound to be made if specific switches or stick positions are in an unsafe position when the transmitter is powered on. You can program 5 warnings such as "Throttle Hold", "Throttle Cut", "Thro Position", "Quick Link", and "Power Off time". "On" is basically set in only "Thro Position" and "Off" is basically set in the others. Touch "ON/OFF" icons to switch to "OFF/ON". After the setup is completed, touch "BACK" icon on the top left to return to "SYSTEM" menu page.





### 3. Etc. set

It is used to select the battery type and set battery warning voltage, Power on melody and Speaker volume. Touch "Etc. set" icon to call Etc. set page and touch and activate the value in blue. After that, choose the desired battery type, warning time, Power on Melody and Speaker volume with INC and DEC icons. If the setup is completed, touch "BACK" icon to return to the System menu page.



4. Display

It is used to adjust TFT LCD's contrast, back light off time, the sensitivity of Touch sense, Logo color and Glaring sun. Touch "Display" icon in the system menu page to access to the display setup page. In this page, touch and activate the value in blue and set the relevant value to each category with the INC and DEC icons. After the setup is completed, touch "BACK" icon to return to the System menu page.

NOTICE: In Glaring sun category, we recommend to switch the value to "ON". It enables the more clear display in the sun





## 5. Stick Cali

It is used to calibrate the stick's neutral position

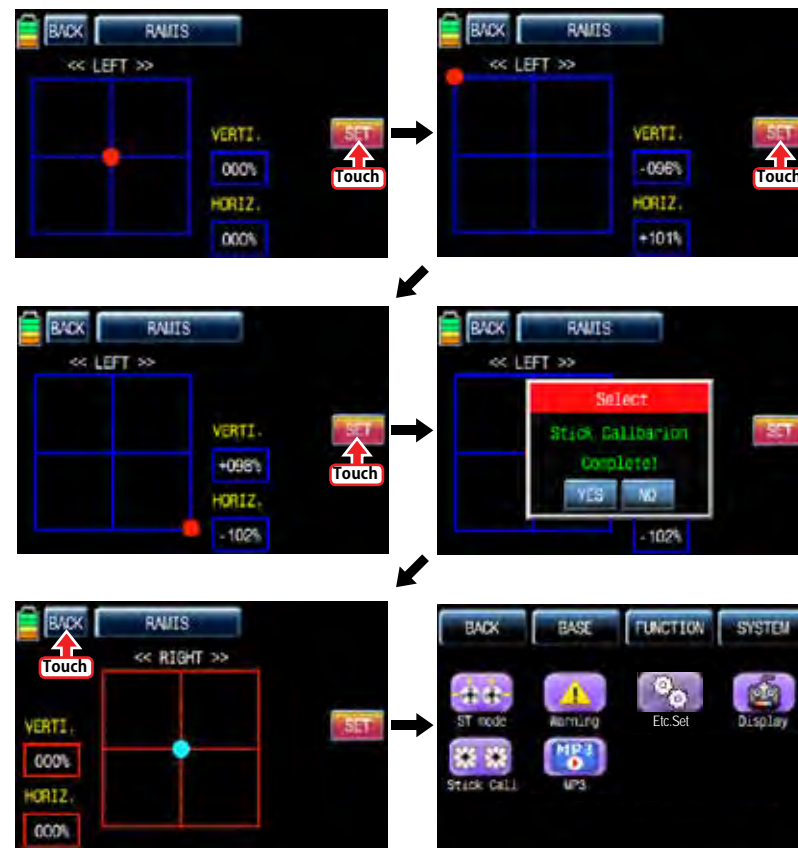
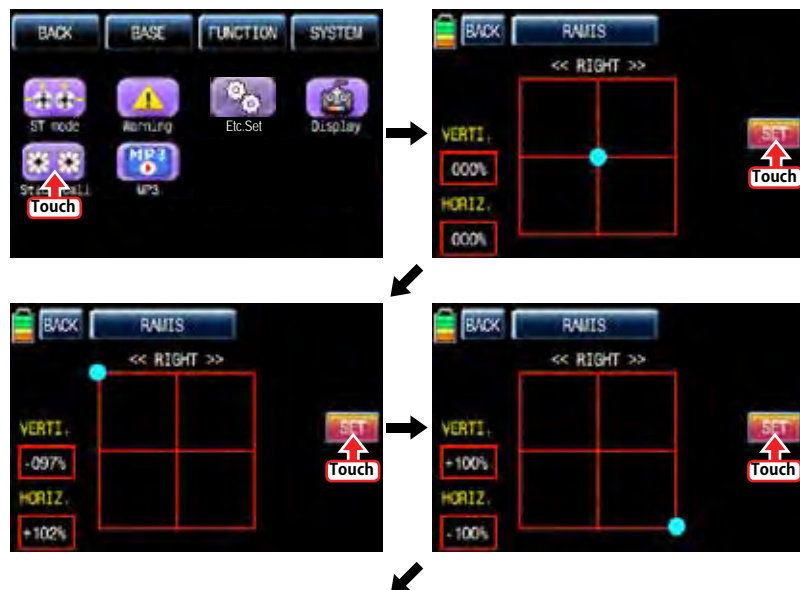
Touch "Stick Cali" icon in the system menu page to call "Stick Cali" page. The right stick and the left stick of transmitter are calibrated in turn and the stick position is indicated on VERTI, HORIZ with percentage

- Center: When the dot is centered on the graph, move and hold the stick at the desired neutral position and touch "SET" icon then the stick's neutral position is saved.

- Full down, Full left: When the dot is at the corner of the top left on the graph, move and hold the stick at the desired end position of the top left and touch "SET" icon then the stick's Full down/Full left position is saved.

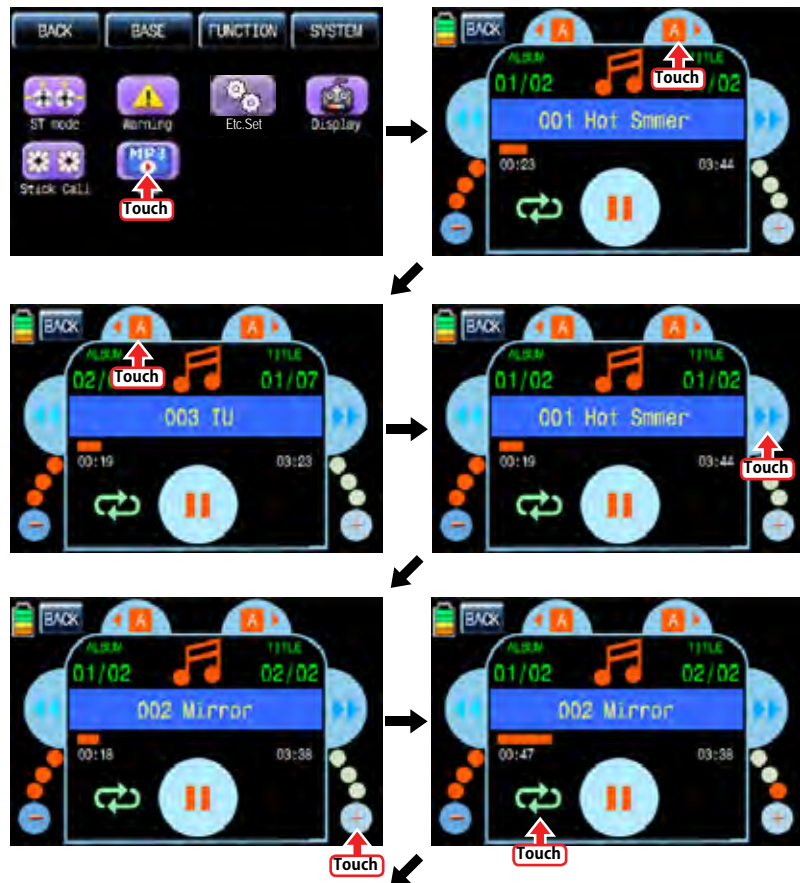
- Full up, Full right: When the dot is at the corner of the bottom right on the graph, move and hold the stick at the desired end position of the bottom right and touch "SET" icon then the stick's Full up/Full right position is saved.

After Full up and Full right setup, "Stick Calibration complete!" message is popped up. Now, touch "Yes" icon to complete the Stick Calibration setup. Touch the "Back" icon to return to SYSTEM menu page.



## 6. MP3

You may listen to the music by storing music files on SD card. You can enjoy music while flying or practicing. To make use of MP3 function, touch "MP3" icon to call the MP3 setup page. You may select folder with "<A, A>" icons and select the song with "<<, >>" icons. Also you can control a volume with "-" and "+" icons. You may repeat the music (all song, one song selectable) and stop the repeat with a repeat icon and play or pause the music with the start and pause icon. When "BACK" icon is touched, you may return to "SYSTEM" menu page.



### • FIRMWARE UPDATE

For more information on the latest firmware and the related software, please refer to the download menu on our website [www.openhobby.com](http://www.openhobby.com), [www.graupner-sj.com](http://www.graupner-sj.com)

NOTICE: The optional USB adapter is needed to update.

## • SAFETY APPROVAL

### Declaration of Conformity

(in accordance with ISO/IEC 17050-1)



- Product(s): Graupner/SJ mz-24 Transmitter

Item Number(s):

Equipment class: 2

The objects of declaration described above are in conformity with the requirements of the specifications listed below, following the provisions of the European R&TTE directive 1999/5/EC:

**EN 62479:2010**

**EN 60950-1:2006/A11:2009/A1:2010/A12:2011**

**EN 301 489-1 V1.9.2**

**EN 301-489-17 V2.2.1**

**EN 300 328 V1.7.1**

### • FCC Information

- Graupner /SJ mz-24 Transmitter

**Contains FCC ID: SNL-36204410**

**FCC 47 CFR PART 15C**

**FCC 47 CFR PART 15B**



### • FCC Statement

1. 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.
  - (2) This device must accept any interference received, including interference that may cause undesired operation.
2. Changes or modifications not expressly approved by the party responsible for compliance 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.

### • FCC radiation exposure statement

This equipment complies with FCC radiation exposure limits set forth for an uncontrolled environment. This equipment should be installed and operated with minimum distance of 20 cm between the radiator and your body.

### • KC Information

- Graupner /SJ mz-24 Transmitter



- KCC인증번호: KCC-CRM-sjr-16005200, KCC-CRM-sjr-36204410

- 방송통신위원회고시 제2013-01호 “무선설비규칙”

- 방송통신위원회고시 제2012-102호 “신고하지 아니하고 개설했을 수 있는 무선기기”

**KN 301 489-1:2009**

**KN 301 489-17:2009**

**KN 61000-4-2:2008**

**KN 61000-4-3:2011**



- **Caution**

- This equipment's aerial must be at least 20 cm from any person when the system is in use. We therefore do not recommend using the equipment at a closer range than 20cm.
- Ensure that no other transmitter is closer than 20cm from your equipment, in order to avoid adverse effects on the system's electrical characteristics and radiation pattern.
- The radio control system should not be operated until the Country setting has been set correctly at the transmitter. This is essential in order to fulfill the requirements of various directives - FCC, ETSI, CE, KC and etc. Please refer to the instructions for your particular transmitter and receiver for details of this procedure.
- Check all working systems and carry out at least one full range check on the ground before every flight, in order to show up any errors in the system and the models programming.
- Never make any changes to the programming of the transmitter or receiver whilst operating a model.

- **ENVIRONNEMENTAL PROTECTION NOTES**

This product must not be disposed of with other waste. Instead, it is the user's responsibility to their waste equipment by handing it over to a designated collection point for the recycling of waste electrical and electronic equipment. The separate collection and recycling of your waste equipment at the time of disposal will help to conserve natural resources and ensure that it is recycled in a manner that protects human health and the environment. For more information about where you can drop off your waste equipment for recycling, please contact your local city office, your household waste disposal service or where you purchased the produce



# Graupner/SJ

# HoTT

HOPPING. TELEMETRY. TRANSMISSION



## mz-24 HoTT

Optimized 12CH Digital Proportional System

mz-24 radio provides you with various advanced features which can lead you to the high level flight for both airplane and helicopter. Advanced data log system in mz-24 radio will lead you to very easy and stable operation during flight with the incredible control of Graupner/SJ 2.4GHz HoTT technology. mz-24 should be a perfect choice for anyone who needs a high quality radio!

### ► Hopping System

Remarkable interference rejection thanks to optimised frequency hopping broad channel sequence.

### ► 3.5" True Color LCD

User friendly true color wide LCD screen with full touch function shows everything that user needs to monitor.

### ► Teacher and Pupils System

Advanced HoTT wired/wireless trainer system makes Teacher and Pupils system more enjoyable and gives user convenience for the teaching/learning.

### ► Voice announcement System

Smart voice announcement system allows user to hear various data such as timers, telemetry data, and warnings in real time.

### ► Fast Data Interface

The standard Micro SD Memory card is used for data interface. User can share model setup, expand model memory and stay up to date with the latest Graupner/SJ Firmware.

[www.OPENHOBBY.COM](http://www.openhobby.com)

2.4  
GHz



MP3

3.5"  
TFT

No. S1006