Trinity Matrix/Elite Gyro Set-up Instructions

Overview

Dedicated Trinity Apps

1) Switch Setting
2) Base Settings
3) Throttle Curve
4) Collective Curve
5) Governor
6) Flight Tuning
7) Pro Tuning

Apps used for AUXILIARY channels and general transmitter operations (6, 7, 12~16 ; settings are not saved in Trinity)

System:

1) Channel Settings – Used to assign the auxiliary channels
2) XBUS Settings – Used for wireless JR servo programming
3) Type Select – Model Type selection
4) Model Select – Use to switch between Model memory for airplanes, gliders, non-Trinity equipped helicopters, multiple Trinity models can be made if different switch/assignments are desired for different helicopters
5) Failsafe – Set the failsafe operation
6) Warning – Set the warning types
7) Bind and Range – Bind new receivers and Trinity/Range check operation
8) Analog Position – Used to set toggles based on stick and other motions
9) Stick Alert – Used to assign sounds to particular stick positions
10) Trim System – Used to assign dials and sliders to fine tune collective curves, throttle curves, throttle idle, and any trim adjustments Auxiliary operations
11) Trainer – Used for buddy box flight training
12) TX Settings – Volumes, TX Battery Monitoring, Brightness, etc.
13) Hardware Setting – Used to calibrate sticks and set switch types
14) Telemetry Log – Telemetry Log viewing

Function:

1) Reverse Switch – Used for reversing non Trinity auxiliary channels
2) Subtrim - Used for setting neutral trims for non Trinity auxiliary channels
3) Travel Adjust - Used for setting current output range for non Trinity auxiliary channels
4) Limit Adjust - Used for setting the maximum output range for non Trinity auxiliary channels

5) **Output Curve - Used for creating unique stick and channel output curves for special situations or operations of non Trinity auxiliary channels**
6) **Monitor – Used to view the channel outputs and commands**
7) **Servo Speed - Used for setting output slew rate (speed) for non Trinity auxiliary channels**
8) **Program Mix – Used to mix two commands together**
9) **Timer – Used for setting the Timer options**

Widget:

Widgets are used to add telemetry and home screen navigation and operation.

Others:

Standard Android Apps that can be used included in the Operating System such as music player, Android Settings, third party APK, calculator, and clock settings.

<u>Instructions On How to Set a Parameter</u>

In all transmitter menus for Trinity, a short tap will bring up the parameter adjustment selection or slider. When selecting an option, only a tap is needed. When adjusting the value on a slider, lifting your finger off the slider will set the new value that the slider currently sits on. Horizontal sliders can be scrolled using the +/- buttons for fine adjustment. Vertical sliders can be adjusted by direct value keypad input by double tapping the value in the slider window. Clicking "Done" or "OK" to the prompt or adjustment window will close the window, display the new setting selection or value, and in the Base App return the swashplate and tail rotor control to the user if the parameter was an automated position parameter.

<u>Displaying Instructions on the Transmitter</u>

Each button contains its own instructions and how-to. A Long press on each Trinity gyro parameter will display the button and parameter's function. Tuning related values will display the default setting as well.

<u>Entering/Exiting and Navigating within an App</u>

To enter any of the transmitter's applications, a short tap on the icon will open the application. Any Apps requiring information from Trinity will also load the most current settings at the start of the application. To exit an app and directly go back to the home screen, press the top left button on the transmitter's face.

Within the applications swiping right or left will advance or go back in the page order. The current page is displayed in the upper right-hand corner. If an App has additional features which require a new list of pages to display, pressing the left middle button on the face of the transmitter will display the list of options.

To exit any of the option or adjustment windows use the bottom left button on the face of the transmitter to return to the previous menu. Additional presses on the lower right button

in an active App will sequentially close any adjustment/option windows until the App is closed all the way back to the home screen.

Model Type

When creating a new model memory to use with Trinity Gyros, select the model type "Helicopter Trinity". It is not necessary to make a new model memory for each Trinity equipped helicopter that uses the same switch assignments. Multiple Trinity's can be bound to the same Trinity model memory and all gyro based parameters (Base Settings, Flight Tuning, Flight ProTuning, Governor, Throttle Curves, and Pitch Curves) will update each time the apps are opened. For multiple switch preference profiles (Ex – different Switch position preferences for a scale helicopter vs. a 3D helicopter) it is possible to make multiple Trinity model type memories with varying switch assignment profiles. JR uses a receiver to model memory based binding matching system in which each Trinity will only link to the model memory in which it was bound to.

Safety Features

*****When powering on a Trinity, Trinity will power on, link, and finish sensor calibration, however it will hold the throttle at the 0% position and hold neutral control commands, not responding to stick commands, bank changes, etc. until Throttle Hold 1 or 2 is active. This prevents accidental spool up if the Trinity is powered on with the Motor On switch active.**

*****When entering and exiting the Base Settings App Throttle Hold 1 or 2 must be active to enter and change the base setup. This is to prevent accidental spooling or reversal of critical commands while the motor is on or the helicopter is flying.**

LED Status

Trinity has 4 LED status that show the mode that Trinity currently is in.
Fast Green Flashing: Loading new Software
Blue Blinking: The Blue LED flashes 1, 2, 3, 4, or 5 times based on what bank Trinity is activated.
Red Solid: Base Setup Mode. The gyro is not flyable in this mode; the throttle is fixed at the Off (0) position.
Orange Flash: In Base Setup Mode the light will flash when the sensor is sending RPM data. To test a magnetic sensor while mounted in the helicopter you can pass the rotating part the magnet is mounted in over the sensor. If the sensor is close enough to the magnet for safe reading the light will show, if the light does not show the sensor needs to be moved closer to the magnet.

XBUS Setting - Bus Type/Channel Assignments

While the default settings are correct for Trinity, the parameters are adjustable in certain situations in the XBUS Setting App and Channel Setting App.

XBUS Setting App - Bus Type:

Description: Trinity with the built in receiver and sub receiver option require MODE A Bus Type.

Channel Setting App:

Description: The channels for Trinity are preset in the correct order, and input. If a unique setup is required such as a flipped throttle or rudder control command orientation, it is possible to unlock the channel by tapping CH# which is red and follow the prompts to unlock the channel. This will allow adjustment to the channel freely. ***Use extreme caution when unlocking a channel that is dedicated to Trinity as all associated functions are preset which match the Trinity's fixed mapping.

Options:

Channel assignments preset in Trinity Model Type

1 – THROTTLE
2 – AILERON (roll axis)
3 – ELEVATOR (pitch axis)
4 – RUDDER (yaw axis)
5 – PITCH (collective pitch)
8 – BANK (1, 2, 3, 4, 5)
9 – THROTTLE HOLD (Thr Hold 1, Thr Hold 2)

Banks

Trinity uses 5 flight mode banks which can be used as 5 independent flight styles, tuning variations, throttle curves/RPMs, and pitch curves. Flight Tuning, Flight ProTuning, Governor, Collective Curve, and Throttle Curve all have a button on the top right of the screen which allows for displaying and changing each bank without requiring to be in the bank switch position. The button is on all pages of the above apps as "Bank (#)". This button displays the current bank being viewed, tapping Bank (#) displays the selection for which bank is to be displayed and adjustable.

Switch Setting

Switch Setting App (Function Menu) is used to assign the 5 banks, Motor On, and 2 Throttle Hold Positions to switches, buttons, or dials on the transmitter. Only 1 Bank, Motor On, and only Throttle Hold 1 is required to be set. The 4 additional banks and second Throttle Hold are optional for creating multiple tuning profiles or a second Throttle Hold position which can be used with a different throttle hold value. *Throttle Hold 1 can be assigned as an autorotation bailout during the governor setup in the Base Settings App.

Switch Selection

To select a switch position for each flight mode, tap the switch icon and an image of the transmitter with all of the optional switches will appear. Tapping the side of the transmitter image will enlarge the image allowing a choice from the optional switches. Tapping a switch, button or dial, will open a window with that devices position options. Tapping the position will enable or disable the position for that flight mode. Multiple positions can be selected per switch, button, or dial.

Switch Logic

Setting the Logic is useful for running multiple switches which can operate the same flight mode, as redundant switches, or dial for safeties or on/off toggles for flight modes.

ON = The flight mode (Bank/THR Hold) will be set permanently ON regardless of switch assignment.
OFF = The flight mode (Bank/THR Hold) will be set permanently OFF regardless of switch assignment.
OR = Multiple switches, buttons, dials, can be used to set the flight mode to the ON position independently.
AND = Multiple switches, buttons, dials, can be set so that only when in the selected positions simultaneously will the flight mode turn to the ON position.

Analogue Position

Analogue Position is used if an Analogue Switch Position was created in the Analogue Position App (System menu). It is possible to assign various stick positions or combinations to toggle as a switch position. Each Flight Mode can be set to an analogue position. This could be very useful for unique setups which may require different flight modes based off various stick positions. *For details on how to setup an Analogue Position in the App, refer to the standard Elite and Matrix App instructions.

Operation Type

Operation type is used to set the enabled switch position as a constant ON/OFF based on physical position or as a trigger to turn the flight mode on when the position is reached and will remain on regardless of being moved to another position until the set physical position is reached again, in which it will be turned off.

Normal = The position of the switch, button, or dial must physically remain constant for the flight mode to be active.
Trigger = The flight mode is activated when the set position is reached and will remain on regardless of position until the set position is reached again.

Setting the Bank Priority

The Bank priority can be adjusted so that certain banks always have priority over other Banks. By tapping the priority number, if confirmed, it will move the Bank to a higher priority (the far left is highest priority). To cancel moving the Bank after tapping the number, tapping outside the confirmation box will leave the priority unchanged.

Base Settings Application

Start New Set-up

Description: To reset the gyro to the factory defaults and begin a completely new setup confirm the Reset. *NOTE: THIS COMPELTELY RESETS THE GYRO TO FACTORY SETTINGS, NO EXISITING SET-UP WILL BE STORED.

Edit Current Set-up

Description: Begin editing the current helicopter setup which is currently stored in the gyro. Trinity must be in Throttle Hold 1 or Throttle Hold 2 for the setup to be editable. Throttle Hold 1 or Throttle Hold 2 must be on to exit Base Settings setup app as well.

Page 1

Gyro Orientation

Description: Select the orientation in which the gyro is mounted in the helicopter. The nose of the helicopter is pointing forward and the rotor head is pointing upward. If the antenna coming out of the gyro case is pointing towards the nose, choose forward. If the antenna is pointing towards the tail rotor, choose backward. If the antenna is pointing towards the rotor head, choose up. If the antenna is pointing towards the landing skids, choose down. If the antenna is pointing to the left, choose left. If the antenna is pointing right, choose right. If the label on the gyro is facing upward toward the rotor head, choose label up. If the label is facing towards the landing gear choose down. If the label is facing out of the left side of the helicopter, choose left. If the label is facing out of the right side of the helicopter, choose right.

Options:

Antenna Forward/Label Up
Antenna Backward/Label Up
Antenna Forward/Label Down
Antenna Backward/Label Down
Antenna Forward/Label Left
Antenna Backward/Label Left
Antenna Forward/Label Right
Antenna Backward/Label Right
Antenna Up/Label Right
Antenna Down/Label Right
Antenna Up/Label Left

Antenna Down/Label Left
Antenna Left/Label Up
Antenna Left/Label Down
Antenna Right/Label Up
Antenna Right/Label Down

Page 2

Cyclic Servo Type

Description: Select the servo neutral pulse width and command frequency for the cyclic servos. Refer to the servo manufacturer's specs for choosing which neutral pulse (us) and frequency (hz) to select.

Options:

1500us/50hz
1500us/285hz
760us/570hz

Tail Rotor Servo Type

Description: Select the servo neutral pulse width and command frequency for the tail rotor servo. Refer to the servo manufacturer's specs for choosing which neutral pulse (us) and frequency (hz) to select.

Options:

1500us/50hz (ESC)
1500us/285hz
760us/570hz

Throttle Servo Type

Description: Select the servo neutral pulse width and command frequency for the throttle servo/ESC control. Refer to the servo/ESC manufacturer's specs for choosing which neutral pulse (us) and frequency (hz) to select.

Options:

1500us/50hz (ESC)
1500us/285hz
760us/570hz

Page 3

Swash Plate Type

Description: Select the cyclic/collective mixing type used for the helicopter's swashplate control. The swashplate can be oriented with the #3 servo in the front or back for 120 deg

and 140 (135) deg options. Be sure to plug the servos into the Trinity servo ports in a CLOCKWISE order so that the roll combination servos are #1/2 and the single servo is always #3. If the swashplate requires no electronic mixing, ROLL (Aileron) is #1, PITCH (Elevator) is #2, and COLLECTIVE PITCH is #3.

Options:

90 Single servo
120deg 3 servo CCPM
140deg servo CCPM

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Cyclic Servo Combo

Description: Select the 3 servo's normal/reverse combination so that the servos are moving in the correct cyclic roll and pitch (elevator) movement to match the controller stick command. The collective pitch direction is not set in this step. The servo reverse order is 1:2:3.

Options:

NNN
RNN
RRN
RRR
NRN
NRR
NNR
RNR

Tail Rotor Servo Direction

Description: Select the direction in which the tail rotor's pitch motion operates in the correct direction relative to the stick command.

Options:

Direction 1
Direction 2

Collective Direction

Description: Select the direction in which the collective pitch motion operates in the correct direction relative to the stick command. Note that if "NO MIXING" swashplate type is used, Collective Direction will automatically not display as the Cyclic Servo Combo 3rd letter will set the direction for Collective.

Options:

Direction 1

Direction 2

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Servo Neutral [Servo 1;2;3;Tail Rotor]
Description: Adjust the slider to independently adjust the neutral servo offset for servo [1;2;3;Tail Rotor].

Options:
+/- 0.4 on a -1~1 scale

Level the Swashplate in Combination [Roll/Pitch]
Description: Adjust the slider to tilt the swashplate [Roll/Pitch] angle until the swashplate is level. Use a leveling tool to ensure that the swashplate is as perpendicular to the main shaft as possible.

Options:
+/- 0.5 on a -1~1 scale

Set the Collective Pitch to 0
Description: Adjust the slider to raise or lower the swashplate until the blades are set to 0 deg.

Options:
+/- 0.5 on a -1~1 scale

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Collective Range Maximum [Positive; Negative]
Description: Adjust the slider to move the collective pitch output to the maximum angle [positive; negative] desired.

Options:
5~75%

Collective Pitch Maximum [Positive; Negative] Angle
Description: Enter the collective pitch angle measurement that was used for adjusting Max [Pos; Neg] Collective Output.

Options:
0~ +/-20

Cyclic Maximum [Right Roll]

Description: Adjust the slider until the maximum amount of cyclic can be deflected without binding when rotating the rotor head at high and low collective pitch.

Options:

5-70

Cyclic Pitch Maximum Angle

Description: Enter the maximum cyclic pitch angle for all 4 cyclic directions.

Options:

0~ +/-20

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Tail Rotor Limit Adjustment [Left; Right]

Description: Adjust the [left; right] tail rotor deflection limit to full travel without binding. It is suggested to remove the tail rotor linkage so that there is no chance of binding on the default values.

Options:

10~100

Set the Tail Rotor Pitch Angle to 0 Deg

Description: Adjust the slider so that the tail rotor pitch angle is set to 0 degrees.

Options:

-100~100

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Governor Type

***Remove the main and tail rotor blades and be sure that no injury or damage can occur from accidental spool up.

Description: Select the type of governor based on the type of power system. If not using the Trinity's governor, such as an internal to the ESC governor, select INHIBIT. For internal

combustion engines (nitro, gas, turbine, etc.) choose Internal Combustion. For electric helicopters with an ESC that supports external governors, select Electric.

Options:

If **Inhibit** is selected, the governor settings will be removed from the Base Settings screens, however, still select the type of RPM sensor installed to display live RPM telemetry and utilize the flight control's adaptive algorithms based on RPM data, change the throttle output direction, set endpoints, pole count for electric motors, and a Throttle Pass Through for setting ESCs which require a throttle range to be learned. Electric Power Setup options will display in the inhibited, if using an IC engine with the governor inhibited, ignore the options for Electric Power Setup. *****NOTE – If using RPM Telemetry this automatically enables the flight control adaptive algorithm. Even if the governor is inhibited the governor RPM per bank needs to be set as a reference for the flight control.**

If **Electric** is selected, the parameters needed to control an ESC using the Trinity Governor will appear. An electric using Trinity's governor can be setup with a magnetic hall sensor or an ESC's RPM pulse output. Electric GOV also allows for a Throttle Pass Through for setting the ESCs which require a throttle range to be calibrated.

If **Internal Combustion** is selected, the parameters needed to control an IC engine will appear. **General Magnetic Hall Sensor** is also set automatically.

Sensor Type

Description: Select the type of governor sensor that will be used. Trinity's RPM input is full servo rail voltage, be sure to check that the compatible voltage of the RPM sensor can take the servo rail voltage. If not, JR Propo offers a 3.3v in line regulator and a proprietary magnetic hall sensor that is pre-regulated. The ROT port on the Trinity can accept full servo rail voltage to be used as a power port.

Options:

ESC RPM Output is used for square wave type ESC (and some other ECU type rotation sensors) RPM signal. This is usually built into ESCs and is a single signal wire or included in a backup BEC power line. External Phase Sensors for non-equipped ESCs can be used as well.

General Magnetic Hall Sensor is used for most sensors on the market where a magnet is placed in one of the drive train parts and pickup is mounted to frame. ***To check that the sensor is reading well enough while in the Base settings app, anytime the magnet is sensed, an orange light will show on the

Trinity. If the sensor light is continually on be sure to check the sensor for compatibility or damage.

Governor ON/OFF per Bank

Description: It is possible to turn the governor off and on per flight bank. Select ON or OFF by tapping ON or OFF on the adjustment window. The dot will follow the current active setting. When the governor is turned OFF in a bank, the throttle will follow that bank's throttle curves. Banks with the governor set to ON will govern the rotor RPM that is set per bank in the Governor APP. The Governor turns on and off at a certain throttle percentage set by the parameter "Governor Throttle % Trigger Point". As long as the throttle curve in that bank is above the throttle %, the governor will take over throttle control. Under the throttle % set, the throttle stick has direct control. The governor also has an auto spool up mode (ramp speeds are set in the Governor App) in which the governor when on slews to the target RPM. It is possible to simply use a flat line throttle curve (1 point) and allow the governor to always spool to the target RPM outside of throttle hold using a flat line throttle curve set above the % trigger point; this is particularly useful on electrics. For IC engines it might be useful to have a bank where the throttle curve is a linear line passing the % trigger point starting from the idle position; in which case once the throttle % is surpassed by the stick control the governor will take over and slew to the target RPM. Throttle Trims are set in the Throttle Curve App and Throttle Hold values are set in the Governor App.

Governor Throttle % Trigger Point

Description: This value is the throttle % in which the governor takes over controlling the throttle to reach and hold the set RPM (set in the Governor App). Below the throttle % set the stick controls the throttle curve directly. Once the % is reached by the throttle curve stick input, the governor slews to the target RPM; the trigger % does not need set to match the set governor RPM, it will automatically spool to the target RPM.

Options:

15~75

Default:

25

Autorotation Bailout THR Hold 1

Description: Throttle Hold 1 can be activated as an autorotation bailout which can be set to spool at a much faster rate than the normal slow spool up. The bailout rate is adjusted in the governor app. If the throttle % reduces past the Governor Throttle % Trigger Point the slow spool is turned off, as well as if Throttle Hold 2 is activated the spool is reset to slow spool. The bailout speed is used if throttle hold 1 is activated and is kept in throttle hold 1, upon deactivating throttle hold 1 and back to a throttle position higher than the % trigger, it will spool at the bailout rate. ***It is highly suggested to set Throttle Hold 1 to a 2 position switch or a 3 position switch with the motor on position, using 2 positions for motor on or 2 positions set for Throttle Hold 1 to prevent accidentally deactivating the bailout activating

Throttle Hold 2; subsequently, setting Throttle Hold 2 to a separate switch to prevent deactivation of the bailout in emergency situations.

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Throttle Reverse

Description: Reverses the throttle output. The throttle in Base Settings (Red LED active) is always in the LOW throttle position for referencing which direction. The reversing motion is done as a slow slewing motion in each direction, however it is still best to remove the throttle linkage on IC engines to prevent binding at the extremes until the limits are set.

Options:

Normal ; Reverse

Throttle Limits

Description: Tapping the HIGH and LOW adjustment buttons will automatically move the throttle to the high and low endpoints. Adjust the value until the motor is completely off for electrics or at the closed throttle position for IC engine. Adjust the high value until the motor is at 100% or fully open throttle.

Options:

0~100(-100)

Motor Pole Count

Description: Set the number of poles for the electric motor installed in the helicopter. This will be an even number (only possible to choose even values on the adjustment) specified by the motor manufacturer specs. This is used even if the governor is inhibited for RPM controlled flight control algorithms as well as for RPM Telemetry.

Options:

2~54

Throttle Limits ON/OFF Throttle Pass Through for ESC Limits

Description: Throttle Pass Through for calibrating ESC endpoints that require full throttle boot up *** USE WITH CAUTION!! **Tapping the Pass Through button will activate the throttle stick as a direct throttle control and become highlighted in yellow, as long as the box is highlighted yellow the direct stick control is active, tapping the button again will deselect the pass through and return to a blue box line with fixed 0% throttle position.**

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Heli Type

Description: Select the type of helicopter flying style and chassis of the helicopter. This selection changes the background flight tuning to fit the generalized behaviors of the various types of flying and helicopters.

Options:

3D/Sport is selected for traditional helicopters and flight styles using common 3D/sport rotor blades.

F3C is selected when using traditional F3C style rotor blades which tend to be significantly more stable. F3C mode changes Trinity's behavior to better suit F3C type blades and chassis with full bodies as well.

Scale is selected when a more scale like response and flight behavior is desired. In scale mode, the gyro is not as aggressive to reach rates as in 3D or F3C mode. Helicopter size in scale mode also exaggerates a less aggressive behavior for helicopters nearing 1m rotor length.

Main Motor Gear Ratio

Description: Enter the main rotor gear ratio which is the ratio from the turning item that the sensor is reading to the main rotor. Ex - If the sensor is reading the motor/engine rpm, enter the total gear ratio from engine to main rotor. If the sensor is reading magnets in the main gear, the ratio would then be 1:1.

Options:

1.00~25.00:1

Tail Rotor Gear Ratio

Description: Enter the tail rotor ratio relative to the main rotor.

Options:

1.00~10.00:1

Cyclic Servo Speed

Description: Set the servo speed (0.xx deg/60) to the manufacturer specs for 0-60 degree speed at the voltage powering the servo rail. This value is used in the control algorithm and electronic mixing CCPM calculations, if the spec is not accurate, it is possible to adjust it to find the optimum value while in the base app by centering the collective stick and rocking the elevator (pitch axis) back and forth looking at the swashplate control ball. The control ball should stay still during the rocking swashplate motion. If the swashplate ball is rising and falling during this motion, move the speed value up or down slightly until the ball stays still on the main shaft; that is the value that should be used. ***In "No Mixing" servo mode only enter the manufacturer's servo spec for the power voltage; the above test is not applicable to optimize the speed spec.

Options:

0.01~0.25

Rotor Blade Length Main

Description: Enter the length of main rotor blades being used on the helicopter. It is possible to enter the exact length of the blades to the millimeter. The main purpose of this parameter is to know what size class the helicopter falls under and scale background parameters based on varying rotor blade length behaviors. For example, adjusting the flight tuning parameters with 710mm rotor blades, later changing to 690mm blades, after changing the rotor blade length, the gyro will scale the previous flight tuning parameters so that re-tuning the essential parameters is not required. This is particularly useful when using similar rotor blade designs with different lengths. If changing rotor blades of the same length, but different designs, it may still be required to adjust the essential flight tuning parameters depending on the design differences between the blades. It is useful to update the blade length parameter when increasing or decreasing the rotor disk by 10mm.

Options:

200~1000mm

Rotor Blade Length Tail

Description: Enter the length of the tail rotor blades. It is possible to enter the exact length of the tail rotor blades to the millimeter. This parameter is used in the pirouette performance of the control algorithm and it is useful to update the tail rotor blade length when making tail blade length changes of 5mm or more.

Options:

40~170mm

Rotor Direction

Description: Select the direction that the main rotor turns looking from the top of the rotor disk.

Options:

CW = Clock Wise

CCW = Counter Clock Wise

<u>Collective Linearization [¾ ; ½; ¼; - ¾; - ½; - ¼] (Optional)</u>
Description: Adjust the slider so that the rotor blades measure the degree of collective pitch that is displayed (xx.xx) for each parameter. Using the linearization function is an optional feature that is not required; however, linearizing the output curve helps reduce the effects that can be felt in flight due to varying control geometry between helicopter designs. It also helps when trying to make two identically setup helicopters fly as similarly as possible. This is an internally stored/calculated value and the pitch curve will still display -100~100 regardless of the adjustments made to the linearization curves.

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<u>Cyclic Maximums [Right Roll; Left Roll; Back Pitch; Forward Pitch]</u>
Description: Adjust the slider until the maximum mechanical [Right Roll; Left Roll; Back Pitch; Forward Pitch] is deflected without binding. Make sure that for each opposite direction of cyclic (per axis) the rotor head is rotated 180 degrees to avoid mechanical geometry dissymmetry. All directions of cyclic right roll, left roll, back pitch, forward pitch should be adjusted to deflect to the same maximum pitch angle. If not interested in independently matching the outputs for all directions, simply measure and set 1 direction to the desired cyclic pitch maximum and copy the value to the other directions. However, using the available independent deflection adjustment can help flight behavior repeatability. *NOTE: If the rotor head swashplate:grip ratio is 1:1, there is no need to rotate the rotor head 180 degrees).

Options:
5~70

<u>Return to Level</u>
Description: Tapping this button moves the Cyclic and Yaw controls to neutral (0 collective and level swashplate) position allowing a pitch gauge to be calibrated to 0.

Options:
Blue = Off
Yellow = Active

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<u>Cyclic Linearization [Right/Left/Back /Forward; ¾ ; ½; ¼] (Optional)</u>
Description: Adjust the slider so that the rotor blades measure the degree of cyclic pitch that is displayed (xx.xx) for each parameter. Using the linearization function is an optional feature that is not required. However, linearizing the output curve can help improve predictability for the gyro's response even with varying control geometry between helicopter designs. It also helps when trying to make two identically setup helicopters fly as similarly as possible.

Options:

0~100

Governor Application

The Governor App contains the adjustment features for Throttle Hold and Governor RPM and tuning. The parameters which are independently set per bank are noted (Bank 1~5).

<u>Governor RPM (Bank 1~5)</u>

Description: Set the RPM for banks which the governor is turned on (ON/OFF toggled in Base App). After the throttle command passes the set Throttle % Trigger Point the governor will continue to increase or decrease the throttle to reach the target RPM at the Governor Spool Up Speed or Governor RPM Transition/Bailout Speed bailout. If the target RPM cannot reach 90% of the desired RPM it will continue to slew up to 100% power to try to reach the target RPM or reduce to down to the Governor Minimum Throttle Reduction Limit to try to reach target RPM.

Options:

500~3500 RPM

<u>Throttle Hold #1 %</u>

Description: Throttle Hold #1 sets the throttle to a fixed percent when activated by the assigned switch position in Switch Selection. This can be used to hold an IC engine at idle, electric motor/esc to 0 power, etc. for autorotation. Throttle Hold #1 can also be set to follow the Governor RPM Transition/Bailout Speed when Trinity Governor is ON and enabling Autorotation Bailout to ON in the Base Settings App.

Options:

0~35

<u>Throttle Hold #2 %</u>

Description: Throttle Hold #2 sets a secondary fixed throttle percent when activated by the assigned switch position in Switch Selection. This can be used in many ways such as a redundant safety for ESCs, a slow start reset for Trinity Governor and internal to the ESC's bailout modes and throttle cuts for IC engines. Throttle Hold #2 always follows the Governor Spool Up Speed when Trinity Governor is ON.

Options:

0~35

<u>Governor Spool Up Speed</u>

Description: Governor Spool Up Speed controls the slew rate in which the governor continually increases or decreases throttle to reach within 90% of the governor's target RPM. This automatic spool rate starts after the throttle is increased past the Governor Throttle %

Trigger Point. It is possible to set a flat line throttle curve so that going from throttle hold to above the Throttle % Trigger Point is instantaneous and the RPM slowly spools directly from the Throttle Hold position or an idling IC engine. This Spool Up Speed is the common speed used for all spool ups. Increasing the value speeds up the spool, decreasing slows the spool. The speed is a direct rate, not a time so that if the RPM difference from the target is large, it does not aggressively try to achieve it, but rather always increases at the same spool rate no matter the starting RPM.

Options:

0~100
Default: 50%

Governor RPM Transition/Bailout Speed

Description: Governor RPM Transition/Bailout Speed controls the rate at which the RPM changes to the new target when there is a difference of RPM between the banks. This value also controls the bailout spool speed if Autorotation Bailout is enabled in Base Settings and controls the slew rate in which the governor continually increases or decreases throttle to reach within 90% of the governor's target RPM for autorotation bailouts. For bailout to remain activated at the bailout speed when Throttle Hold #1 is exited the Throttle % must be above the Throttle % Trigger Point. If the throttle is below the Throttle % Trigger Point the spool will return to the Governor Spool Up Speed.

Options:

0~100
Default: 50%

Governor Gain Adjustment (Bank 1~5)

Description: Governor Gain Adjustment is used to change the governor's reactivity to load and unloading. If the governor behaves sluggish and tends to vary RPM with only slight loading or unloading, increase the governor gain. If the governor tends to overshoot the target rapidly or oscillate around the target, lower the governor gain.

Options:

25~100
Default: 50%

Governor Minimum Throttle Reduction Limit

Description: Once the Governor is active this limit controls how low the throttle can be reduced to prevent over speeding. Different types of IC engines specifically have different power curves; this parameter is useful to raise when an engine struggles to recover after a large throttle reduction (overspeed) or an engine tends to overspeed when unloading even when the governor gain is correct in all other situations. This value has no effect on the governor ON/OFF Trigger % and can be set independently (higher/lower) than the Governor Throttle % Trigger Point.

Options:

5~100
Default: 40%

Governor Holding Acceleration Adjustment

Description: When the governor is active this parameter controls how abruptly and how much smoothing is applied to the throttle while trying to hold RPM. A lower value makes the governor behavior aggressive and without hardly any smoothing, a high value will soften how aggressively it tries to hold RPM to stay within the power systems limits. Power systems with a lot of torque can overpower the ability of the tail rotor to hold it still during fast loading and unloading, in turn this parameter can be adjusted to also smooth out the governor to tail rotor interaction. A very high value could make the power system feel less powerful, and a very low value will utilize all the power the power system has to offer.

Options:

0~50%
Default: 1 for IC; 25 for Electric

Flight Tuning Application

Flight Tuning is split between two pages; Page 1 is cyclic tuning, Page 2 is tail rotor tuning. All Flight Tuning parameters are adjustable per bank.

Page 1

Cyclic Rotational Speed (Grouped ROLL (Aileron)/PITCH (Elevator)

Description: Cyclic Rotational Speed is defined in degrees per second and the rate at which the cyclic will rotate at full cyclic stick input. This value is highly adjustable based off the pilot's personal preference, but is limited by the possible rotation rate that the blades can deliver with the amount of blade angle that the rotor head/chassis allow for. The gyro will use all its available deflection to hold the rate, however, if a rate is set higher than what the helicopter can deliver, it will not be achieved. Setting the rate too high the helicopter may feel unpredictable and inconsistent. If holding the cyclic stick steady at full deflection and the roll or flip rate tends to vary, the mechanical limit is likely not enough or the blades are to too stable to hold the set rate. It is best to find what rate (deg/sec) produces consistent results and always set the rotational rate at 5% below or under that value so that the cyclic will maintain the desired rate in all conditions (wind, altitude, etc). The grouped parameter effects right/left/backward/forward cyclic control simultaneously.

Options:

25~575 Degrees per second

Default: 300

Cyclic Control Exponential (Grouped ROLL (Aileron)/PITCH (Elevator)

Description: Adding Exponential adds an exponential curve to the cyclic control input from neutral to full deflection. Increasing the value as a positive (+) will soften the cyclic control around neutral cyclic stick, decreasing the value and negative (-) values will make the cyclic control more sensitive around neutral. The grouped parameter effects right/left/backward/forward cyclic control simultaneously.

Options:

-75~75
Default: 25

Flight Response

Description: Flight Response alters the way the helicopter behaves when the cyclic stick is moving quickly. When making fast cyclic inputs a value of 50% will generate a flight response that tries to match every cyclic motion of the helicopter 1:1 with the cyclic stick motion in a very direct rate of command. For certain flying styles or personal preference some flyers prefer the cyclic to ramp up to the Cyclic Rotational Speed (useful for big and fast flying) while others prefer an accelerated response that temporarily boosts the rate to the Cyclic Rotational Speed (useful for box style/smack 3D flying). Similar to the Cyclic Rotational Speed if the blades and rotor head cyclic pitch angles do not allow the cyclic command to be reached as fast as the stick moves or is being boosted using all available cyclic blade angle, it will not feel consistent and increasing the parameter will have no effect. Adjusting Flight Response has no effect on the gyro's control of the helicopter, only the cyclic stick command feel.

Options:

0~100
Default: 50

Rotor Head Sensitivity (Rotor Head Gain)

Description: Rotor head sensitivity works as a scaler for tuning the cyclic control for varying blade and chassis variables. Increase the Rotor Head Sensitivity if the helicopter is not holding its flight path when moving the collective or while using one axis's control if the other axis does not hold angle/flight path. Reduce the Rotor Head Sensitivity if the helicopter tends to bounce or nod on the pitch axis from wind gusts or shows signs of nodding in fast forward flight or after fast cyclic commands.

Options:

0~100
Default: 50

Tail Rotor Rotational Speed

Description: Tail Rotor Rotational Speed is defined in degrees per second and the rate at which the tail rotor will rotate at full yaw (rudder) stick input. This value is highly adjustable based off the pilot's personal preference, but is limited by the possible rotation rate that the tail rotor can deliver with a given tail blade length, tail ratio, or blade angle that the tail rotor/chassis allow for. The gyro will use all its available deflection to hold the rate, however, if a rate is set higher than what the helicopter can deliver, it will not be achieved. Setting the rate too high the tail rotor may feel unpredictable and inconsistent in pirouette rate. If holding the yaw (rudder) stick steady at full deflection and the rotational rate tends to vary or whip, the mechanical limit is likely not enough or the blades are to too small to hold the set rate. It is best to find what rate (deg/sec) produces consistent results and always set the rotational rate at 5% below or under that value so that the tail rotor will maintain the desired rate in all conditions (wind, altitude, etc).

Options:

10~1000 Degrees per second
Default: 600

Tail Rotor Control Exponential

Description: Adding Exponential adds an exponential curve to the tail rotor control input from neutral to full deflection. Increasing the value as a positive (+) will soften the tail rotor control around neutral yaw (rudder) stick, decreasing the value and negative (-) values will make the tail rotor control more sensitive around neutral.

Options:

-75~75
Default: 35

Tail Rotor Flight Response

Description: Flight Response alters the way the tail rotor behaves when the yaw (rudder) stick is moving quickly. When making fast tail rotor inputs a value of 50% will generate a flight response that tries to match every tail rotor motion of the helicopter 1:1 with the yaw (rudder) stick motion in a very direct rate of command. For certain flying styles or personal preference some flyers prefer the tail rotor to ramp up to the Tail Rotor Rotational Speed while others prefer an accelerated response that temporarily boosts the rate to the Tail Rotor Rotational Speed. Similar to the Tail Rotor Rotational Speed if the tail rotor does not allow the yaw (rudder) command to be reached as fast as the stick moves, or is being boosted using all available tail rotor blade angle, it will not feel consistent and increasing the parameter will have no effect. Adjusting Tail Rotor Flight Response has no effect on the gyro's control of the tail rotor, only the yaw (rudder) stick command feel.

Options:

0~100
Default: 50

Tail Rotor Sensitivity (Tail Gain)

Description: Tail Rotor Sensitivity works as a scaler for tuning the yaw (rudder) control for varying blade and chassis variables. Increase the Tail Rotor Sensitivity if the tail rotor is not holding its angle during flight or rotating at a consistent rate within its pirouette rotational speed limit. Reduce the Tail Rotor Sensitivity if the tail rotor tends to shudder in the wind or when flying fast.

Options:

0~100
Default: 50

Flight ProTuning Application

Flight ProTuning allows the ability to separate the roll and pitch axis control rates/control directions, the ability to fine tune the roll and pitch control ratio, collective to yaw compensation, and swashplate phasing. All Flight ProTuning parameters are adjustable per bank. While named "Pro" these parameters are in no way dangerous to adjust or experiment with, rather, they are designed for detailed tuning that can be used to optimize the flight control behavior for various setups, flying styles, and personal preferences.

Page 1

Rate Separation

Description: Rate Separation allows for each axis's maximum rate to be independently adjusted, as well as per direction. The value is a % of the degrees per second set in Flight Tuning for each axis. Ex – If the grouped Cyclic Rotational Rate in Flight Tuning is set to 300 degrees per second, reducing the Roll Left rate to 50% will yield a 150 degree per second rate for left roll only, right roll, forward and backward pitch will remain at 300 degrees per second. If Tail Rotor Rotational Rate in Flight Tuning is set to 600 degrees per second, and the Right Yaw Rate is set 25%, left rate will remain at 600 dps while right rate will be reduced to 150 dps. No value is required to the be same on roll, pitch, or yaw and can be freely adjusted with no adverse effects to flight performance.

Options:

0~100%
Default: 100%

Exponential Separation

Description: Expo Separation allows for each axis's exponential curve to be independently adjusted, as well as per input direction. The value directly sets that axis and direction's expo curve. If Cyclic Control Exponential (Grouped ROLL (Aileron)/PITCH (Elevator) and Tail Rotor Control Exponential are adjusted, the values in Expo Separation will be reset to the same value set in the Flight Tuning App again. The behavior of the Expo curve is exactly the same as in the grouped Expo in Flight Tuning with added adjustability. No value is required to the be same on roll, pitch, or yaw and can be freely adjusted with no adverse effects to flight performance.

Options:

-75~75

Default: Matches EXPO grouped settings in Flight Tuning

Page 2

Cyclic Balance

Description: Cyclic Balance allows fine tuning to achieve a balanced response and behavior of the pitch axis (elevator) and roll axis (aileron). Every helicopter may have a difference roll vs pitch moment of inertia ratio depending on design or equipment choice. The pitch axis is used as the master. First tune the pitch axis to desired behavior using the Flight Tuning adjustment parameters. If the roll response feels sluggish or loose compared to the pitch axis, increase the Cyclic Balance value until the roll behavior matches the pitch behavior. If the roll axis shows signs of oscillation or is overly responsive to disturbances or control inputs compared to the pitch axis, lower the Cyclic Balance.

Options:

0~100

Default: 50

Collective to Yaw Compensation

Description: Collective to Yaw Compensation adds yaw in the direction to compensate for aggressive motor/engine torque changes related to collective to reduce the effects of tail kicking during aggressive collective and power surges. Ideally, this parameter is not used and it is advised to adjust the governor gain first to eliminate yaw kicks from aggressive power increases. However, in some unique situations (very high torque power system, slow tail rotor servos, less powerful tail rotor, or very low RPM setups). Collective to Yaw Compensation can be used to hide these tail rotor kick kicks when moving the collective loading the power system quickly.

Options:

0~100

Default: 0

Swashplate Phasing

Description: Swashplate Phasing is used to electronically advance (CW (+) or CCW (-) rotor disks) the swash plate phasing to produce a more true roll and pitch control response with certain rotor head and rotor blade setups. This adjustment is used in very small amounts for flight tuning to correct for corkscrewing in rolls and flips.

Options:

-90~90
Default: 0

Throttle Curve Application

Trinity's throttle curves are saved in the Trinity and will update when the Throttle Curve app is opened. Throttle curves are adjustable with point amount selection up to 9 independent points with 5 and 9 point options using an automatic spline function. 1 point is used for a fixed throttle percent (for ESC governors and or IC engine backup throttle curves). 3 point is linear point to point. Each bank the curve values and number of points can be changed independently.

Bank Selection

Tap the bank button to change the bank which is displayed, and for the ability to adjust the settings. It is possible to view all banks without activating the bank.

Number of Points on the Curve

It is possible to choose 1, 3, 5, or 9 points per curve, per bank. Use the middle side button to bring up the submenu and point selection window. Select the point quantity, and the curve will automatically interpolate the current curve values to fit the number of points selected.

Adjusting Curve Points

To adjust a throttle curve point, tap the point and an adjustment window will appear. The points are adjustable to 0.1; the window includes + and – adjustment buttons to make fine adjustments easier.

Throttle Curve Trim Offset

For adjusting curve offsets while flying, it is possible to assign the curve or RPM to a dial, trim button, or slider. This is done in the "TRIM SYSTEM" app. In the top right, select the trim adjustment to "HOV.THROTTLE". Select the adjustment dial, trim button, or slider using the INPUT option.

If a trim button is selected STEP is used to adjust the sensitivity of the shift to the curve per click. If a dial or slider is selected an adjust RATE (control span) is displayed for the adjustment sensitivity.

Use SWITCH SELECT to set what switch positions the trim is active. When "OFF" the trim will return to neutral position. When "ON" it will follow the current trim adjustment.

REVERSE is used to flip the direction of the adjustment dial, slider, trim button.

If a dial or slider is used it is possible to shift the motion of the dial or slider to operate in both directions from neutral (+/- 100), only in a single direction + or -, or a V curve action where neutral is 0, at the extremes are both the same sign + or -. OFFSET is used to adjust the neutral position of the dialer or slider.

IC Engine Idle Trim

To set an adjustable idle trim for IC engines enter the TRIM SYSTEM App and choose Throttle. Use INPUT to select a trim button, dial, or slider for the trim.

If a trim button is selected STEP is used to adjust the sensitivity of the trim per click. If a dial or slider is selected an adjust RATE (control span) is displayed for the adjustment sensitivity. Use SWITCH SELECT to set what switch positions the trim is active. When "OFF" the trim will return to neutral position. When "ON" it will follow the current trim adjustment.

REVERSE is used to flip the direction of the adjustment dial, slider, trim button.

If a dial or slider is used it is possible to shift the motion of the dial or slider to operate in both directions from neutral (+/- 100), only in a single direction + or -, or a V curve action where neutral is 0, at the extremes are both the same sign + or -.

OFFSET is used to adjust the neutral position of the dialer or slider.

Select the type of throttle trim using TYPE. IDLE adjusts only the idle or low throttle stick position. NORM shifts the entire throttle output. It is advised to use IDLE with governors (Trinity or external) so that your throttle curves are not affected in flying range.

Pitch (Collective) Curve Application

Trinity's Collective (pitch) curves are saved in the Trinity and will update when the Collective Curve app is opened. Collective curves are adjustable with point amount selection up to 9 independent points with 5 and 9 point options using an automatic spline function. 3 point is linear point to point. Each bank the curve values and number of points can be changed independently.

Bank Selection

Tap the bank button to change the bank which is displayed, and for the ability to adjust the settings. It is possible to view all banks without activating the bank.

Number of Points on the Curve

It is possible to choose 3, 5, or 9 points per curve, per bank. Use the middle side button to bring up the submenu and point selection window. Select the point quantity, and the curve will automatically interpolate the current curve values to fit the number of points selected.

Adjusting Curve Points

To adjust a collective curve point, tap the point and an adjustment window will appear. The points are adjustable to 0.1; the window includes + and – adjustment buttons to make fine adjustments easier.

Pitch Curve Trim Offset

For adjusting curve offset while flying, it is possible to assign the curve to a dial, trim button, or slider. This is done in the "TRIM SYSTEM" app. In the top right, select the trim adjustment to "HOV.PITCH". Select the adjustment dial, trim button, or slider using the INPUT option.

If a trim button is selected STEP is used to adjust the sensitivity of the shift to the curve per click. If a dial or slider is selected an adjust RATE (control span) is displayed for the adjustment sensitivity.

Use SWITCH SELECT to set what switch positions the trim is active. When "OFF" the trim will return to neutral position. When "ON" it will follow the current trim adjustment.

REVERSE is used to flip the direction of the adjustment dial, slider, trim button.

If a dial or slider is used it is possible to shift the motion of the dial or slider to operate in both directions from neutral (+/- 100), only in a single direction + or -, or a V curve action where neutral is 0, at the extremes are both the same sign + or -.

OFFSET is used to adjust the neutral position of the dialer or slider.

High Pitch Trim Settings

High Pitch Trim is used to adjust the range of the collective in flight relative to the total maximum set in the collective curve. It equally adjusts the high and low collective ranges so

that the slope of the curve is more shallow or steeper. The adjustment cannot add throw past +/-100% on the collective curve. This is extremely useful for reducing collective or increasing collective on the fly when different collective amounts are desired.

Use INPUT DEVICE to select an adjustment dial or slider for High Pitch Trim.

HIGH PITCH TRIM RATE adjusts how effective the full range of the slider or dial changes the range of the curve.

Use SWITCH SELECT to choose the ON and OFF switch positions when High Pitch Trim is active.

Delay Settings

Use DELAY TIME to adjust how quickly the collective curves change from bank to bank if there is a difference between the curves. 0 is nearly an instant change between two collective curves, while 100 will be a very slow change between the curve differences. This function is mainly intended for if the collective control is still, if the collective stick is being moved, if the command outruns the delay, the pilot's command will over run the delay function in case of emergencies for fast collective curve changes.