

TACTIC™

2.4GHz 6-CHANNEL COMPUTER RADIO INSTRUCTION MANUAL

Tactic's TTX650 computer transmitter uses the advanced 2.4GHz spread spectrum SLT "Secure Link Technology" protocol for solid, interference-free control of R/C models. Ball-bearing gimbals, a wireless trainer system, 20 model memories, and advanced programming options are just a few of the benefits which can be used on models of all sizes. Tactic 2.4GHz transmitters are compatible only with Tactic brand receivers and those utilizing the SLT protocol.



For safe operation and best results, it's strongly recommended to read this manual in its entirety before use! Also read and understand the instructions included with the model. Damage resulting from misuse or modification will void your warranty.

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** large glamour picture with callouts
neck strap eyelet
power switch
antenna
LED power indicator

LCD
pushbuttons
carrying handle
each toggle switch
charge jack (left side, bottom)
firmware upgrade jack (left side, just above charge jack)
trim levers

SLT TECHNOLOGY, Tx-R, AND COMPATIBLE RECEIVERS

Tactic's custom SLT technology ensures that transmitters emit a strong, clear, frequency-hopping 2.4GHz signal, and that your compatible receiver accepts no signal except *yours*. Binding Tactic brand receivers is as simple as pushing a button, which creates a locked-in, interference free *link*. The TTX650 radio can store up to 20 models in memory, making it perfect to control a full fleet of models with the super-affordable Tactic brand 2.4GHz receivers. The TTX650 is also compatible with non-Tactic brand receivers which use the *SLT protocol, for the ultimate in convenience and flexibility.

* Make sure optional receivers have the *genuine SLT protocol* before use with the TTX650.

The TTX650 is also compatible with all transmitter-ready aircraft bearing the "Tx-R" logo. Such aircraft include receivers having the SLT protocol.

RECEIVER INSTALLATION

Always mount the optional receiver, servos, switch harness, battery, electronic speed control, etc. as explained in the manual included with such equipment and/or the model. Keep the Rx and its antenna(s) as far away from the engine/motor, servos, and ESC and other electronic items as much as possible. It may also be a good idea to mount the Rx inside certain models using Velcro[®], and wrap it in foam rubber to prevent damage from strong vibrations or crash damage (except in extremely warm environments). It's best to have as few items surrounding the receiver's antenna tips as possible inside the model, to allow for the most obstruction-free signal path to the transmitter. Exposing the receiver's antenna tip outside the model is recommended if possible. For receivers with two antennas, position the antennas at 90 degree angles with the tips resting at least 5 inches apart. If possible, allow one antenna to point vertically above the receiver itself.

TTX650 POWER SYSTEM

INPUT POWER: Four 1.5V "AA" alkaline cells (included) or 1.2V "AA" NiCd or NiMH cells supply power to the TTX650. Do not mix cell types, or old and new cells, etc. Slide open the battery door to find the four "AA" cell battery holder. Insert all cells with the proper polarity as shown inside the battery holder. Carefully tuck the wires and battery holder inside the battery compartment so not to damage them when closing the battery door.

Alternatively, an assembled 4.8V NiCd or NiMH "AA" flat pack can be installed. Remove the alkaline cell holder from the battery compartment and carefully observe the polarity of the wires before disconnecting the plug from the Tx. Install the NiCd or NiMH battery by first inserting its connector into the jack in the battery compartment. Make sure to observe proper polarity.

Battery voltage is shown on the LCD's home screen for easy monitoring. A "LOW BATTERY" warning will show when battery power drops to the voltage value shown in the BATTERY ALARM screen as described on page xx.



WARNING! Never operate an R/C model with weak Tx batteries! Reduced operational range and/or possible loss of control of the aircraft could result. Replace weak alkaline batteries, or re-charge NiCd or NiMH batteries, before attempting a flight!

A "Tx Batt." timer in the TIMER menu described on page xx can track the total amount of time the transmitter has been operational.

See the ACCESSORIES section on page xx for optional batteries and chargers available at local hobby retailers.

CHARGE JACK AND CHARGING RECHARGEABLE BATTERIES: The charge jack should *only* be used for recharging optional NiCd or NiMH batteries (charger not included). Do not try to recharge alkaline batteries. Charge adapters for Futaba brand transmitters are compatible, with the center pin being positive polarity. The Tx power switch must be in the OFF position to recharge batteries. Do not charge batteries at greater than 1 amp. Cycling of the Tx batteries can be accomplished through this jack. Misuse, improper charging, or over-charging of rechargeable cells can result in damage to the cells that could include cell rupture, explosion, or fire!!



TTX650 CHARGE JACK



WARNING! Do not accidentally short circuit the terminals inside the charge jack, as this can cause permanent damage to the radio's charge circuitry and battery and void the warranty.

POWER LED: The blue LED illuminates when the power switch is turned on and ample voltage is supplied by the battery. This LED will flash if battery voltage drops to the voltage set in the BATTERY ALARM setting described on page xx.

FLIGHT CONTROLS

Channels 1 - 4 are fully proportional. Channels 5 and 6 can be controlled by a non-proportional switch. However, if a proportional channel (1-4) is mixed to channel 5 or 6 these channels can exhibit proportional control.

Aircraft control is accomplished through various electro-mechanical devices which are manipulated by the *pilot*, such as the control sticks and toggle switches. In addition, the Tx can automatically manipulate the pilot's control inputs *electronically* to alter the control signals before they are delivered to the receiver (e.g. mixing two channels, applying differential reduction to a channel, etc.). Some electronic functions can be turned on/off by the pilot during flight such as a timer. Other functions can only be altered while the model is on the ground, such as changing travel limits or reversing for a particular channel.

GIMBAL STICKS: Ball-bearing construction allows both sticks to provide the ultimate in smooth, precise control. Stick *length* can be adjusted for optimum feel and control. Each stick consists of a base and a tip. To adjust, hold the base tightly, then loosen the tip by turning it counter-clockwise. Adjust the stick tip to the desired length. Tighten the stick by holding the tip in place and turning the base counter-clockwise until it's tight against the tip.

STICK TENSION AND THROTTLE RACHET: Each control stick can be adjusted for softer or stiffer movement tension. A ratchet is also included for the throttle stick which can be adjusted for feel depending on personal preference. Adjustment of either feature requires removal of the rear of the Tx case as explained in the CASE SEPARATION AND ASSEMBLY section below.

CASE SEPARATION AND ASSEMBLY



WARNING! Failure to follow these instructions for separating and re-assembling the Tx case can result in permanent damage to the transmitter, and void the warranty. Contact Hobby Services if you do not feel comfortable that you can safely and accurately perform these steps.

ALWAYS disconnect and remove the batteries from the battery compartment FIRST. Failure to do so can result in permanent damage to the Tx.

Remove the six screws from the back of the Tx case. Carefully pull the case rear away from the case front and note exactly how all wires are routed inside the case.

After adjustments are made as described in other sections of this manual, close the case by first carefully tucking all cables back inside as when the case was opened. Align the case rear back onto the case front, making sure that no wires are pinched between the case parts. Press the case halves together. Insert the screws back into their positions and carefully tighten them *until snug* - making sure not to cross the threads or over-tighten the screws. Re-connect the battery holder's connector to the socket inside the Tx. Insert the battery into the compartment, and carefully tuck the wires inside the cavity so they do not become pinched when the door is closed. Close the battery door.

Stick tension: Silver screws on the back of each gimbal are used to adjust the stick tension, as shown in this picture. Turn the screw clockwise to make stick tension more firm. Turn the screw counter-clockwise to make stick tension more light.

Throttle ratchet: A silver ratchet bar is mounted across the throttle gimbal. For airplane use, a more firm ratchet feel might be desired for the throttle. In this case, turn the adjustment screw clockwise. For helicopter use, less of a ratchet feel might be desired. Turn this adjustment screw counter-clockwise to achieve the desired feel.

DIGITAL STICK TRIMS: The trim controls for the four main channels are digital. Holding the trim lever will cause the servo output to move repeatedly. Trim positions are visible on the LCD's home screen, and stored into that respective memory. Changing the model memory will also cause trim settings to change accordingly.

For aircraft with glow engines, the precise position of the trim lever is helpful when determining the engine's preferred idle point. The throttle trim lever is not active when the main throttle stick is above 50% full throttle.

The amount of servo movement for each increment of a digital trim can be adjusted as desired, as explained in the TRIM SETTING section on page xx.

TOGGLE SWITCHES: Each switch can be assigned to control one of a variety of functions as desired and described throughout this manual. See page xx for the location of all switches, which are also marked on the Tx by letter. The factory default switch assignments are as follows:

Switch	Type	Default Function – Airplane	Default Function - Helicopters
A	2-position	CH2 elevator dual-rate	timer control
B	2-position	CH5 landing gear	gyro gain
C	3-position	CH6 flaps	(no setting)
D	2-position	CH1 aileron dual-rate	aileron, elevator, and rudder dual-rates (all)
E	3-position	CH4 rudder dual-rate	normal / idle-up control
F	2-position, momentary	trainer	throttle cut

H 2-position throttle cut throttle hold

ANTENNA: The strongest signals are emitted at a 45 degree angle from the sides of the antenna. Rotate and fold the antenna so that it's not pointing directly towards the model during flight. Do not grab the antenna during operation as it may affect radio signal quality.

HOME SCREEN

The factory default screen and menus will be for airplanes. See the next section for navigating and changing menus for model type and other functions.

MENUS

The TTX650 has three types of menus.

The SYSTEM SETUP menu allows for setting basic operational functions for the radio itself.

Selecting and managing the model memories, configuring the radio for the structure of the airplane or helicopter, etc. is done in the MODEL SETUP menu. Most functions apply for both airplanes and helicopters. Select functions are available for airplanes only or helicopters only.

Setting various radio functions to control the model is done in the SETTINGS menu. Some settings apply for both airplanes and helicopters. Select settings are available for airplanes only or helicopters only.

LCD, PROGRAMMING CONTROLS, MENU NAVIGATION

The LCD contrast is adjustable for optimum viewing. Six pushbuttons navigate the menus and settings. Single button pushes will result in a single incremental adjustment on-screen. Holding a button for a short time will result in slow scrolling of adjustments; continued holding will result in fast adjustments.

Left side buttons:

SERVO Press any time to see the servo position screen shown below. Indicators for certain channels will change depending on model type, wing type, etc. Moving any Tx control will graphically be shown on this screen. When setting / adjusting mixes to determine if the mix is as desired, set the mix and then view this screen. Move all controls to determine if the mix moves each respective channel as needed.

CLEAR Quickly resets certain values and settings back to factory defaults.

ESC Jumps back to the previous screen, and removes certain pop-up messages from the screen.

Right side buttons: adjustment of values on-screen.

↑ + Moves the cursor up, and for increasing highlighted values/settings.

↓ - Moves the cursor down, and for decreasing highlighted values/settings.

ENTER To select or de-select a setting, or enter a screen.

SYSTEM SETUP

Fundamental settings for the transmitter itself are located in this menu. With the power switch in the OFF position, press and hold ENTER, turn the power switch ON and wait for the SYSTEM SETUP screen to show. Move the cursor and press ENTER to select any setting. Press ↑ + and ↓ - to change settings. Press ENTER to confirm the setting.

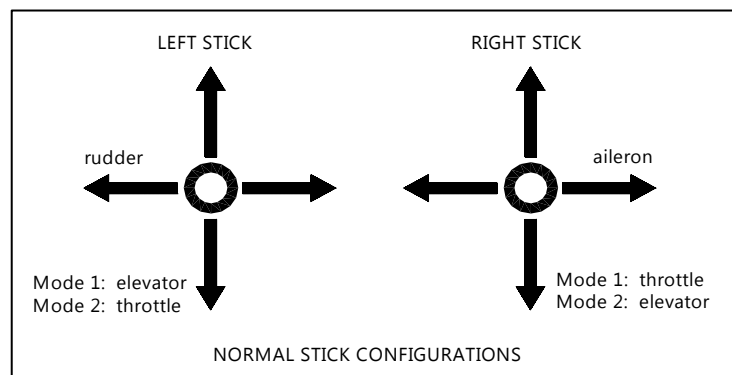
USER NAME: Enter your name to identify the radio. The cursor will be under the first character to enter. Press ↑ + and ↓ - to find the desired character, then ENTER to confirm. The cursor will automatically move to the next

cursor. Pressing ← or → can move the cursor freely. Repeat as necessary for up to 8 characters. Pressing CLEAR will move the cursor back one space and erase the character in that space. Press ESC when finished.

STICK MODE: The TTX650 is factory set to Mode 2 configuration, but can be changed to Mode 1 (elevator on left, throttle on right). To change modes in the programming, move the cursor to the STICK MODE line, highlight and press ENTER, then press ↑+ or ↓-. Press ENTER to confirm.

In addition to programming changes, stick mode changes require reversal of the throttle ratchet and elevator arm/spring. Refer to the CASE SEPARATION AND ASSEMBLY section on

page xx for opening and safely re-assembling the case after the mechanical adjustments are made. **Failure to do this properly can cause permanent damage to the radio and void the warranty.**



Throttle ratchet: The long metal bar resting across the throttle gimbal must be moved to the other gimbal. Carefully remove the screws at each end of the bar. Re-locate the bar to the other gimbal and install across the ratcheted surface of the gimbal as shown. Re-install both screws. Carefully install the screw at top until snug – **do not over-tighten!** The screw at bottom should be tightened until the vertical movement of this stick has the desired amount of resistance.

Elevator arm and spring: The black plastic arm and spring must be re-located from the elevator gimbal to the opposite gimbal. Using a pair of needle nose pliers or hemostats, carefully grip the end of the spring which is looped over the end of the black plastic arm and gently lift it off the arm. Then slide the spring towards the center of the gimbal to remove it from the gimbal. Set the spring aside.

Raise the plastic arm to a vertical position. Slide the arm towards the center of the gimbal to remove it from its mounting pin.

Rotate the arm 180 degrees to mount it to the opposite gimbal as shown. While in the vertical position, slide the arm over the mounting pin on the opposite gimbal. Lay the arm down across the gimbal.

Gripping one loop on the end of the spring, carefully lower the opposite loop of the spring into the gimbal to slide it over the appropriate mounting pin. With the spring holding onto the pin inside the gimbal, carefully stretch the spring and hook the loop over the end of the plastic arm. Confirm the arm and spring are mounted properly by moving this stick and ensuring all movement is smooth but with resistance from the spring.

Close the transmitter as explained in the CASE SEPARATION AND ASSEMBLY section.

CONTRAST: Adjust the LCD's contrast level for optimum viewing.

BEEP VOLUME: Adjust the loudness of the radio's beeper as desired. This volume setting affects all tones that are emitted from the radio including **trim adjustments, alarms**, programming changes, etc.

BATTERY ALARM: An alarm will sound and the display will show "LOW BATTERY" when the Tx battery's voltage drops to the level shown in this setting. Do NOT set this value too low, as the radio could lose power very rapidly as the battery nears full discharge and cause a loss of control of the model. **Land the model immediately once this alarm has sounded!**

Battery Alarm			
Battery type	Default	Recommended	Minimum
Nickel-Cadmium (NiCd) or Nickel-Metal Hydride (NiMH)	4.40V	4.40V	4.00V
Alkaline	4.00V	4.00V	3.60V

Once all functions in this menu are set, press ESC to return to the home screen.

MODEL SETUP MENU – AIRPLANES

From the home screen, press and hold ENTER for 2 seconds to find the MODEL SETUP menu which is for setting of fundamental operating parameters as shown here.

MODEL SELECT: Memories are available to store parameters for up to 20 different models. This screen is for selecting the memory to be active. Move the cursor to find the desired memory to make active, and press ENTER. The radio will automatically return to the home screen.

Changing the model memory is not possible if the Tx battery voltage is too low. See the INPUT POWER section on page xx. It's a good idea to keep a record of all settings in each memory as a backup in case parameters in a particular memory are accidentally changed, etc.

MODEL MANAGEMENT: Shows basic information regarding the model setup in the memory number shown at top in brackets. Move the cursor up or down to select / change the function to adjust, and press ENTER to enter the function screen.

Type: Press ↑+ to select the model type as airplane or helicopter. Press ENTER to confirm.

Name: Move the cursor to this line and press ENTER. The method for setting the model name is the same as for entering the USER NAME as described on page xx. The maximum number of characters is six. Press ESC when finished.

Copy: To copy all parameters from one model memory to another, place the cursor over "Copy" and press ENTER. The "COPY FROM" page will show. Highlight the memory to copy FROM and press ENTER. Now the "COPY TO" page will show.

Place the cursor over the memory number to copy TO, and press ENTER. The confirmation screen will show.

To NOT proceed with the copy function as shown on-screen, highlight "NO" and press ENTER to cancel and return to the main MODEL MANAGEMENT screen.

Otherwise, press ↓- to highlight "YES" and press ENTER. All settings that previously existed in the receiving memory will be permanently erased. The display will return to the main MODEL MANAGEMENT screen. Return to the MODEL SELECT screen to confirm the copy function was successful by looking at the memory that was copied "to".

Reset: To change the parameters of any single memory *except model type and model name* use this reset function. Enter this screen, move the cursor over the memory to reset and press ENTER. Select "NO" to cancel or "YES" to proceed with the reset, and press ENTER. The display will then return to the home screen.

Erase: Use the erase function to completely clear *all settings* (including model type and name) in any single memory to factory default settings. The method for selecting, cancelling, and approving this function is the same as for reset.

WING TYPE: This is for setting the type of tail and wing configuration for the model. Depending on the mixes used and setup of the aircraft, it might be necessary to change the aileron, elevator, or rudder reversing settings to achieve the proper throw directions for the model.

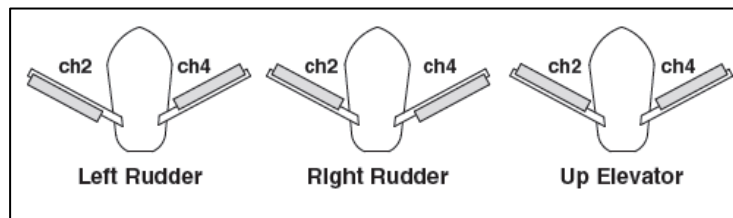
"Normal" is the factory default setting for the "TAIL" type. Move the cursor over "Normal", press ENTER then ↑+ or ↓- to select from V-Tail, Delta (elevon), and 2 Elevator options. Press ENTER to confirm the selection. The charts below can aid in determining the preferred tail and flap setting for the model.

Normal: One servo each is used for aileron(s), elevator(s), and rudder.

AIRPLANE NORMAL TAIL				
	1AIL	1AIL/1FLAP	2AIL	2AIL/1FLAP
CH1	AIL	AIL	AIL	AIL
CH2	ELEV	ELEV	ELEV	ELEV
CH3	THRO	THRO	THRO	THRO
CH4	RUDD	RUDD	RUDD	RUDD
CH5	AUX1	FLAP	AUX1	FLAP
CH6	AUX2	AUX2	AIL2	AIL2

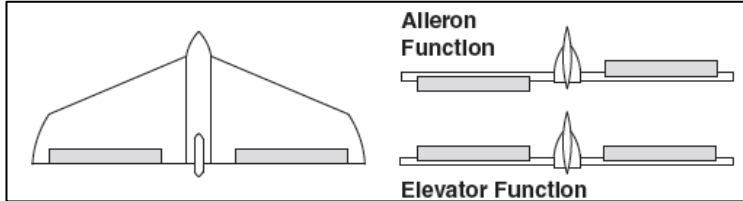
V-tail: Elevator and rudder channels are mixed. Two servos are used in the tail – one for each control surface, with connections as shown in the graphic below. V-tail mixing controls the airplane's "pitch" and "yaw" axis at the same time. If the elevator and rudder functions appear reversed at the control surfaces, it may be necessary to swap the channel 2 and channel 4 servo plug positions in the Rx. The travel limits for each servo can be adjusted independently.

AIRPLANE V-TAIL				
	1AIL	1AIL/1FLAP	2AIL	2AIL/1FLAP
CH1	AIL	AIL	AIL	AIL
CH2	V-TAIL1	V-TAIL1	V-TAIL1	V-TAIL1
CH3	THRO	THRO	THRO	THRO
CH4	V-TAIL2	V-TAIL2	V-TAIL2	V-TAIL2
CH5	AUX1	FLAP	AUX1	FLAP
CH6	AUX2	AUX2	AIL2	AIL2



Delta wing (elevon): Elevator and aileron channels are mixed, useful for aircraft such as flying wings and other models not having a tail. Elevon mixing controls the airplane's "pitch" and "roll" axis at the same time. One servo is used for each control surface. Travel limits for each servo can be adjusted separately. If the elevator and aileron functions appear reversed at the control surfaces, it may be necessary to swap the channel 2 and channel 3 servo

plug positions at the Rx for the delta wing mix. If the delta wing option is selected, and the "FLAP" option below is set to 2AI1FL, the elevator channel will mix 100% to the aileron channel.



	AIRPLANE	DELTA WING
	2AIL	2AIL/1FLAP
CH1	ELEVON1	ELEVON1
CH2	ELEVON2	ELEVON2
CH3	THRO	THRO
CH4	RUDD	RUDD
CH5	AUX1	FLAP
CH6	AUX2	AUX1

2-Elevators: Elevator channel 2 and channel 6 are mixed for aircraft which have two separate servos moving separate elevator surfaces. Both elevators move independently, and are independently adjustable for travel limits, etc.

	AIRPLANE	2 ELEVATORS	
	1AIL	1AIL/1FLAP	2AIL
CH1	AIL	AIL	AIL
CH2	ELEV	ELEV	ELEV
CH3	THRO	THRO	THRO
CH4	RUDD	RUDD	RUDD
CH5	AUX1	FLAP	AIL2
CH6	ELEV2	ELEV2	ELEV2

The "FLAP" setting allows for configuration of the ailerons and/or flaps of the airplane. Move the cursor over "1AI" to select from the following options:

1AI: Use this "1 aileron" setting for normal wing types having one aileron on each wing, where one servo controls the movements of both servos simultaneously.

1AI1FL: This "1 aileron + 1 flap" setting is for wings having one servo that controls the ailerons on both wings, and another servo that controls the flaps on both wings (both servos moving in the same direction). Connect the aileron servo to Rx channel 1, and the flap servo to channel 6.

2AI: This "2 ailerons" setting is for airplanes having one aileron servo for each wing. Connect one aileron servo to Rx channel 1, and the other to channel 6. This setting allows each aileron servo to function independently of the other.

2AI1FL: This "2 ailerons + 1 flap" setting is for airplanes having two separate aileron servos, requiring one servo to control each aileron, and also one servo that will control flaps for both wings simultaneously.

To achieve a flaperon mix, use the 2AI1FL setting and the air brake mixer (see page xx) to get flap and aileron control from the aileron stick. Set the amount of deflection for the aileron and flap servos individually. Select a switch to control the flaps. One aileron servo should be connected to Rx channel 1, and aileron servo two connected to Rx channel 6. Connect the flap servo to Rx channel 5.

CHANNEL ASSIGNMENTS: This function allows regular transmitter channels to be re-assigned to different channels before being sent to the receiver. This can be useful for models having unusual configurations.

Some small electric flight models use only elevator, throttle, and rudder channels (not aileron). Here, it's often preferred that the rudder be controlled with the opposite stick (right stick for Mode 2 configurations). Such channel re-assignment can be done in this screen.

Determine which Tx channel on the left should be mapped to the desired output channel on the right. With the cursor on the "OUTPUT" channel number on the right, move the cursor up or down to change the channel number as shown on the left. Press ENTER then ↑+ or ↓- to find the output channel as desired. Press ENTER when finished.

WARNINGS: Two warnings can show to alert of certain conditions in the radio, which can be inhibited if desired in this screen. Select the warning to be activated or inhibited as desired and adjust. When set to active "ACT", the warnings are as follows:

THRO POS: Throttle stick is over 50% full throttle. Move the stick below 50% full throttle to clear the warning.

THRO CUT: This alert rises when the throttle cut function is set, and the throttle cut switch is turned on. Turn the throttle cut switch to off to clear the warning.

TRAINER: The process of binding transmitters for training purposes is explained on page xx. When in training mode with the TTX650 being used by the teacher, this radio can allow the teacher to transfer control of all *or only certain* channels to the student if desired.

Enter this screen. Press ↑+ or ↓- to select a channel to set. Press ENTER to toggle the setting. Repeat with other channels as desired. Setting a channel to SLV means the student will have control of that channel when the teacher pulls the trainer switch on the master radio. Those channels which are set to MST will be controlled by the teacher at all times.

The teacher can select which switch will control the training function at the CTRL line at bottom. The control positions for the trainer switch can also be selected as described on page xx (for the Control function). Press ESC to confirm settings and return to the MODEL SETUP menu.

TRIM SETTING: The number of degrees a servo will rotate with each increment of digital trim deflection can be adjusted, from very small up to large steps. Enter this screen, select the channel trim to adjust ranging from "1" for the smallest steps to "20" for the largest steps.

SETTINGS MENU – AIRPLANES

This menu is for setting servo control functions for airplane use.

SERVO SET: Enter this function to adjust any channel's reversing, sub-trim, or travel limit setting. The "Reverse" screen will show first. To move to the "Sub Trim" or "Travel" screen, place the cursor over "Reverse", press ENTER and then ↑+ to find the desired screen.

Reverse: Sets the rotational direction for a channel's output relative to the movement of the control stick. Move the cursor to the channel to adjust. Set to "NOR" normal or "REV" reverse. Adjust all reversing settings *before* making any other settings or adjustments in the programming.

Sub-trim: *Finely* adjusts a channel's center position. Be aware that extreme adjustments of sub-trim could possibly result in servo binding if the servo's output arm moves too far in the model. This is available for all channels.

Travel limits: Sets the maximum travel limits for each channel. Limits can be set for *each side* of center. If two channels are mixed, adjusting the travel limits of *each individual channel* may be necessary to adjust the travel limits for the entire mix. Move the cursor to the channel to adjust. Deflect the control stick for that channel to one side and notice the cursor on-screen will move accordingly. Set the percent for that direction of travel as needed. Move the stick to the opposite direction and repeat. Repeat for all channels as needed.

DUAL-RATES, EXPONENTIAL: For setting dual-rates and/or exponential travel for the aileron, elevator, and rudder channels. Dual-rates allows a channel's maximum travel limits to be switched between two limits. Exponential changes the *rate* at which a servo rotates per degree of control stick deflection. The rate of servo movement is non-linear in relation to the movement of the stick. The higher the exponential percentage, the more the servo will rotate as the stick is moved away from center position.

To select the desired channel to adjust, press ENTER, then ↑+ or ↓- . Press ENTER when finished.

Assign a switch to change the dual-rate / exponential setting by moving the cursor to the CTRL line, and press ENTER. Select the switch that will control this function as explained on page xx. Press ESC when finished.

Different dual rate and exponential settings can be set for each position of the switch. Highlight the dual-rate percentage and move the assigned switch to the position that will allow for the furthest servo travel. Adjust this percentage to the widest travel distance as needed for this channel. Note that the slope of the diagonal line in the graph changes as the percent is adjusted. Deflect the control switch to the opposite position, and adjust the percentage to the lowest travel distance needed. The diagonal line on-screen will now show the slope for the low dual-rate setting. A low rate can allow for better control of the model while on the ground, at low altitudes, or while performing certain maneuvers. A high rate can allow for optimum control of the aircraft in mid-flight.

To set an exponential value, move the cursor to the EXPO line and repeat the steps explained above to set a different value for each position of the control switch. This function can be handy for optimum control of the model - especially around center-stick position, and when performing stunts or aerobatic maneuvers.

Moving the control stick for the channel shown on-screen will change the position of the vertical line in the graph. The point where the vertical line intersects the diagonal line is shown at the bottom-left on the screen. The "x" (horizontal) coordinate is on the left, and "y" (vertical) coordinate is on the right.

Repeat the above steps for each the aileron, elevator, and rudder channels as desired.

CH5 AND CH6 SET: Enter this screen to set the functions of channels 5 and 6. At the INPUT line select CH5 or CH6. Then follow the steps below.

Control: Choose which switch will control the selected channel. Switches are identified by letters A through H, as printed on the transmitter next to each switch.

On-screen the switches will be identified as "SWA" for switch A, "SWH" for switch H, and so on. All are 2-position switches except switches "E" and "C" which have 3-positions. Deflect the switch which will ultimately control this function.

The display will show a graphic representing the switch, and the different control positions of the switch as shown here (0, 1, and 2). The default position for "0" will always be in the down direction. The control positions of the switch can be assigned to fit personal preference. To use the default settings, simply press ESC to confirm. To change the control locations of the switch to be high "H", medium "M", or low "L" position, press ↑+ or ↓- to move the cursor to the position to be changed. Press ENTER to highlight the function at this position. Then press ↑+ or ↓- to change the control function. Repeat as necessary for all switch positions. Press ESC when finished.

To remove the switch that has been set in the Control function, press ENTER to highlight the switch selection and press CLEAR.

Other functions in this radio allow for assigning a switch to a specific function. Refer back to this section as needed.

Offset: Move the cursor to this function. Press ENTER, then ↑+ or ↓- to find the percent to offset the center position of the channel shown on this screen.

Travel: For adjusting the maximum travel limits for a selected channel. Deflect the switch to one position and adjust the maximum travel limit for this switch position, and then repeat for the opposite switch position. Highlight either and press CLEAR to change back to the default setting. Press ENTER when finished.

While the output channel is being operated normally, any movement of the input channel will be mixed to- *and also affect* the movement of the output channel.

THROTTLE CURVE: The throttle's output is normally linear in relation to movement of the throttle stick. A non-linear relation between the two – or curve - can allow for optimum power control in certain models or for specific types of flying styles.

Make sure the model's full throttle position can be achieved when the throttle stick is at maximum deflection. The throttle trim must be able to minimize throttle control completely when the throttle is at minimum.

Enter this function. Up to six points can be placed on the throttle curve, as designated next to "Point" on the graph. Points L (low) and H (high) are each limited to a fixed range on the curve. Points 1, 2, 3, and 4 can be set if desired with respect to the position of the throttle stick.

As the throttle stick is advanced note the point where the vertical line (throttle position) intersects the diagonal line (curve). The coordinates of this point are shown at the bottom. The "x" (horizontal) coordinate is on the left, and the "y" (vertical) coordinate on the right.

To set points on the curve, start at the minimum throttle position which will be noted as point "L". A point for "L" is not marked on the graph, but is the left-most end of the curve line. The vertical position of this point can be adjusted by moving the cursor to the RATE percentage, press ENTER then ↑+ or ↓- as desired. Press ENTER when finished.

To set point 1 on the graph, advance the throttle stick until * shows next to "Point". Find the desired throttle stick position and press ENTER. A + symbol will be placed on the curve to mark this point.

Pressing ↑+ or ↓- will adjust the vertical position of curve at this exact point. Adjust as desired.

Repeat these steps to set points 2, 3, and 4 on the graph as desired. A point for "H" is not marked on the graph, but is the right-most end of the curve line. The vertical position of this point can be adjusted by moving the cursor to the RATE percentage, press ENTER then ↑+ or ↓- buttons. Press ENTER when finished.

To clear any point on the graph, place the cursor on the RATE percent, move the throttle stick until the graph's vertical line intersects the point, press ENTER and then CLEAR.

A switch can be assigned to toggle between the linear curve (for starting the engine, etc.) and the user-defined curve (for forward flight, stunts, etc.). Select the switch on the CTRL line.

The exponential control of the user-defined throttle curve (but not the linear curve) can be active or inhibited. This will soften or make the transition of the throttle curve more smooth. Move the cursor next to the EXPO line and toggle between "ACT" and "INH". Press ENTER when finished.

THROTTLE CUT: Allows the throttle channel's output to be quickly moved to a user-defined position by flipping a switch. This is to reduce engine / motor power for safety reasons. Default setting is -100% (idle).

When setting up the model mechanically, make sure the carburetor is at full-open when the throttle stick is at full position. Use the trim to adjust the engine idle position. Move the throttle stick to idle position and turn the assigned throttle hold switch on and off repeatedly while changing the offset value until the servo stops moving.

Select a switch to control the throttle cut function on the CTRL line. Press ESC.

Move the cursor next to TRIG but do not press ENTER. Move the throttle stick to the desired position that will trigger the throttle channel to move to the cutoff position. The graph will move accordingly as will the percent shown on the THRO line at bottom. Press ENTER. The arrow on the left will now move and mark this selected trigger position.

Move the cursor to the CUT percentage, press ENTER and adjust this cutoff value by pressing ↑+ and ↓- to the desired position for the throttle channel's output to move to when the throttle cut function is activated. This position will be marked by the arrow on the right. Press ENTER to confirm this mark.

When the throttle cut switch is in the ON position and the throttle stick is positioned *above* the trigger mark, reducing the throttle stick to the trigger mark will automatically drop the throttle channel to the throttle cutoff mark. The throttle channel will remain in this position. To regain full control of the throttle channel, move the control switch to the OFF position.

NOTE: The method for setting the various following mixer screens is the same for each mixer. Refer to the instructions for the DIFFERENTIAL mixer screen for adjustment of all other mixer screens. Any difference in any one mixer screen will be noted accordingly. Normal wing mixing is the factory default setting. Depending on the mixes used and setup of the aircraft, it might be necessary to change the setting of the aileron, elevator, or rudder reversing settings to achieve the proper throw directions for the model.

AILERON DIFFERENTIAL: Only available when 2AI and 2AI1FL wing types are selected, to help offset unwanted yaw which can occur when ailerons are moved. One servo must be connected to each aileron for this mix. Instead of equal linear movement between both ailerons, a differential percentage can be assigned so that the deflection

of one aileron is at a lower or higher rate than the opposite aileron. Certain applications may require a reduction in the aileron differential rate when an airbrake is applied. This feature is useful for glider and/or sailplane applications which use other settings to achieve "butterfly" or "crow" functionality.

Enter the DIFFERENTIAL function. There are two ways to control the mix. One is to make the mix be active at all times. Another is to control the mix with an otherwise unused switch.

To make AILE DIFFERENTIAL active at all times do NOT assign a switch at the CTRL line. Press ENTER to highlight the differential rate percent and press ↑+ or ↓- to find the desired value. Press ENTER when finished.

To control the mix with a switch, move the cursor to the CTRL line and press ENTER. Deflect the switch that will control the mix. The screen will show the functional assignments for each position of the switch as described previously. Press ESC to confirm the switch selection. The display will now show the different switch positions (SP.0, SP.1, SP.2). A different rate can be set for each switch position.

Deflect the switch to one position, and note the cursor on-screen will move automatically to the rate for that position. Adjust that rate as desired. Deflect the switch to the remaining positions and repeat. To remove a switch which might have been assigned previously, highlight the switch selection in the CTRL line and press CLEAR.

Press ESC once all mixing values are set to return to the FUNCTION menu screen.

AILERON FLAP ADJUST: This function is for setting the maximum deflection angle of the aileron and/or flap servos for takeoff and landing purposes, which can be controlled by a switch. This is only available for 2AI and 2AIL1FL wing types. Ailerons-only can be set if the selected wing type is 2 ailerons (2AI). Aileron and flap selections will show if the selected wing type is 2 ailerons + 1 flap.

AIL FLAP ADJUST					
Tail type	Mixing	1 Ail	1 Ail, 1 Flap	2 Ail	2 Ail, 1 Flap
Normal	Ail			X	X
	Flap				X
Delta	Ail				
	Flap				X

Enter the AIL FLAP ADJUST function. Determine set the percentage(s) as needed.

AILERON MIXER: The aileron channel can be mixed to the rudder channel, which can be useful with certain wing/airplane types.

AILERON > RUDDER					
Tail type	Mixing	1 Ail	1 Ail, 1 Flap	2 Ail	2 Ail, 1 Flap
Normal	Ail > Rudd	X	X	X	X
Delta	Ail > Rudd			X	X

To make this AILE → RUDD mix active at all times do NOT assign a switch at the CTRL line. Adjust the mixture percentage and press ENTER.

On/off control of this mix can be assigned to a switch. Set the mix rates as desired for each switch position. Press ESC when finished.

ELEVATOR MIXER: Not available for the 1AI wing type selection. The elevator channel can be mixed to the ailerons or flaps depending on the wing type.

ELEVATOR MIXER					
Tail type	Mixing	1 Ail	1 Ail, 1 Flap	2 Ail	2 Ail, 1 Flap
Normal	Elev > Ail			X	X
	Elev > Flap		X		X
Delta	Elev > Ail				X
	Elev > Flap				X

The method for making adjustments in this screen is the same as described above. In the WING TYPE menu, if the FLAP selection is set to 2AI1FL and the TAIL selection is set to Delta, the elevator-to-aileron mixture will automatically be fixed to 100%.

If the 1AI1FL wing type is selected the elevator can be mixed to the flaps. The mix can be active at all times, or turned on/off with a selected switch.

If the 2AI wing type is selected, the elevator can be mixed to ailerons. Set the mix as needed. A control switch for the mix can be selected if desired, or the mix can always be active by selecting a percentage but not selecting a switch.

If the 2AI1FL wing type is selected the elevator can be mixed to the ailerons and/or flaps. The mix can always be active by not selecting a control switch. Otherwise, select a control switch as explained earlier.

FLAP MIXER: Not available for 1AI or 2AI wing types. Different setup options are available depending on the selected wing type, where the flaps can be mixed to the aileron, elevator, or back to the flaps.

FLAP MIXER					
Tail type	Mixing	1 Ail	1 Ail, 1 Flap	2 Ail	2 Ail, 1 Flap
Normal	Flap > Ail				X
	Flap > Ele		X		X
	Flap > Flap				X
Delta	Flap > Ail				
	Flap > Ele				X
	Flap > Flap				X

1AI1FL: Highlight the FLAP → ELEV mix percent and adjust as desired. Press ENTER when finished. Assigning a switch can allow on/off control of the mix. Set a mix percentage for each position of the switch (SP.0, SP.1, SP.2).

2AI1FL: If this wing type was set, the flap channel can be mixed with the aileron or elevator. Set the mix percent for each channel to be mixed, for all switch positions that control the mix. Do NOT assign a switch at the CTRL line to make the mix active at all times. Press ENTER when done.

AIR BRAKE SET: This function is available at all times when the model type is set to airplane.

AIR BRAKE SET				
	1 Ail	1 Ail, 1 Flap	2 Ail	2 Ail, 1 Flap
Elev	X	X	X	X
Ail			X	X
Flap		X		X

When mixing brake to elevator the model's elevator will deflect when the air brake is applied.

When mixing brake to flaps, the flaps will deflect downward when air brake is applied. When mixing brake to aileron, the ailerons will deflect together when air brake is applied.

When the 1AI wing type is selected the brake can be mixed to the elevator channel. Adjust the mix percentage as needed. Select a switch to turn the mix on/off.

When the 1AI1FL wing type is selected the brake can be mixed to elevator and/or flaps. Adjust each mix percentage as needed. Select a switch to turn the mix on/off.

When the 2AI wing type is selected the brake can be mixed to elevator and/or aileron. Adjust each mix percentage as needed. Select a switch to turn the mix on/off.

When the 2AIL1FL wing type is selected the brake can be mixed with each the elevator, aileron, or flaps. Adjust each mix percentage as needed. Select a switch to turn the mix on/off..

PROGRAMMABLE MIXER: Up to four programmable mixes can be set, with one channel being mixed to any one or more channels. Control characteristics from the "input" channel will be passed to the "output" channel(s), such as travel limits, exponential, etc. The output channel will still be able to function independently as if it were not mixed with another channel, but once an adjustment is made to the input channel a resulting change will be seen on the output channel as well. The mix level can be adjusted by percent. A switch can be assigned to turn this mix on/off.

Enter the mixer screen. Move the cursor to select which mix to set and press ENTER.

The top line will show the mix number, with the cursor over the input channel, and the output channel to the right. Press ENTER and ↑+ or ↓- to highlight and set the input channel.

The rate of the input channel to mix with the output channel can be adjusted for each the right and left side of the input channel's center position. With the cursor next to RATE L, set the desired mix percentage. Repeat for RATE R. Note the curve on the display's graph will adjust according to the percentages entered.

The amount of the input channel to be mixed can be offset by setting a percentage next to "OFFSET".

Assign a switch to control the mix in the CTRL line as explained earlier. Repeat the above procedures for each of the four mixes that are to be configured.

RF OUTPUT: The Rf output signal can be turned on or off. If changing any programming parameters in the radio it's recommended to turn the Rf off so not to unnecessarily clutter the flying space with radio signals. Leave the Rf output signal ON anytime the model is being controlled.

Enter this screen to perform a range check on the radio system, as fully explained on page xx.

TIMER: A timer is shown on the home screen, which can be configured in the TIMER menu. The timer can be set to count up or down, and can be controlled by a user assigned switch. In addition, the timer can be controlled by the throttle stick if desired.

To count UP as a stopwatch, leave the timer set to 00:00. To configure the timer to count DOWN, set a time other than 00:00 with a maximum possible start time of 99:59. When used as a countdown timer, a set of tones will sound at 00:10 and every second thereafter to warn that the timer is nearing the end. After reaching 00:00, the timer will automatically begin counting up to help track how much longer the model was operational after the timer ended.

A switch can be selected on the right side of the screen to turn the timer on / off. Place the box on-screen over this setting and deflect the switch that will control the timer. In operation, the timer will be stopped when the switch is in one position. Moving the switch to the opposite position will cause the timer to count. To reset the timer, move the switch to the stop position and press the CLEAR button.

The timer can also be started and stopped by the throttle stick. Move the throttle stick to the minimum throttle position. Place the box on-screen over this setting and press ENTER. When "Chose the control switch" displays, move the throttle stick up from minimum throttle.

The "START/STOP" screen should show. Moving the stick up or down will show changes to the "THROTTLE" position value. The "START/STOP" value shows the trip point where starting and stopping the timer will occur. Move the stick to the position where the timer's trip point and press ENTER. The position value for START/STOP should now match that for THROTTLE.

Press ESC to return the timer setting screen. The throttle stick's START/STOP position for the timer should show below the timer settings.

For example, if a throttle stick START/STOP value of +45% is selected, anytime the throttle stick is below this value the timer will be stopped. Anytime the throttle stick is above this value the timer will count. To reset the counter, move the throttle stick below this value and press the CLEAR button.

The "Tx Batt." timer at the bottom of the TIMER setting screen accumulates the total amount of time the radio has been operational. This time can only be reset by moving the cursor over "Tx Batt" and pressing the CLEAR button.

MODEL SETUP MENU – HELICOPTERS

This menu is for setting servo control functions for when helicopter is the selected model type. Use of all functions in this menu are the same as described on pages xx - xx except that a SWASH TYPE function screen is included for helicopters instead of a WING TYPE function.

All channels for helicopters are assigned as shown in the chart.

HELICOPTERS	
CH1	AIL
CH2	ELEV
CH3	THRO
CH4	RUDD
CH5	GYRO
CH6	PITCH

SWASH TYPE: Enter this screen to select the type of swash plate in the helicopter. Setting this properly allows for proper mixing of all controls for the main rotor. Four options are available, with some offering cyclic and collective pitch mixes (CCPM) for optimum simplicity and performance. It may be necessary to reverse the direction of a control when using a CCPM mix to achieve the proper functionality.

1 Servo: Tilting of the swash plate is accomplished with one servo for control of the elevator axis and one servo for the aileron axis. Another servo directly controls collective pitch. Selecting this swash type means that no swash plate mixers are required or used.

2Sv(180): For CCPM with two servos (aileron and elevator) connected to the swash plate 180 degrees apart. Control of the pitch-axis happens as a result of a mechanical de-coupling rocker. Through this pre-set mix, throttle (pitch) stick movement causes both servos to move the plate up and down. Aileron stick movement causes both servos to tilt the plate side-to-side.

3Sv(120): For CCPM with three servos connected to the symmetrical swash plate at 120° angles from each other. One pitch servo, one elevation servo, and one aileron servo are connected to the swash plate.

3Sv(140): "3-servo (140°)" for CCPM with three servos connected to the swash plate. The connections are similar to the 3Sv(120) but with slightly different geometry (two servos are connected at 140° angles forward from the rear of the swash plate).

SETTINGS MENU – HELICOPTERS

Functions for helicopters support models with various fixed mixes, programmable mix options, and swash types.

Setting of the **SERVO SET, DUAL-RATES, EXPONENTIAL, RF OUTPUT,** and **TIMER** functions is the same as described for airplanes on pages xx - xx. However, if using a helicopter which has CCPM mixing, read the SWASH TYPE section on the previous page before adjusting the reversing and travel limits settings.

THROTTLE CUT: Allows the throttle channel's output to be quickly moved to a user-defined position by flipping a switch. This is to reduce engine / motor power for safety reasons and/or auto-rotations. Default setting is - 100% (idle).

When setting up the model mechanically, make sure the carburetor is at full-open when the throttle stick is at full position. Use the trim to adjust the engine idle position. Move the throttle stick to idle position and turn the assigned throttle hold switch on and off repeatedly while changing the offset value until the servo stops moving.

Select a switch to control the throttle cut function on the CTRL line. Press ESC.

Move the cursor next to TRIG but do not press ENTER. Move the throttle stick to the desired position that will trigger the throttle channel to move to the cutoff position. The graph will move accordingly as will the percent shown on the THRO line at bottom. Press ENTER. The arrow on the left will now move and mark this selected trigger position.

Move the cursor to the CUT percentage, press ENTER and adjust this cutoff value by pressing ↑+ and ↓- to the desired position for the throttle channel's output to move to when the throttle cut function is activated. This position will be marked by the arrow on the right. Press ENTER to confirm this mark.

When the throttle cut switch is in the ON position and the throttle stick is positioned *above* the trigger mark, reducing the throttle stick to the trigger mark will automatically drop the throttle channel to the throttle cutoff mark. The throttle channel will remain in this position. To regain full control of the throttle channel, move the control switch to the OFF position.

THROTTLE HOLD: Throttle hold allows full use of collective pitch while setting the throttle at a user pre-determined position. this function is often used for autorotation. The pilot can then release the hold and regain full control of the throttle as needed.

The "Control" line is for setting the ability to turn this function ON/OFF with a switch. Selecting "INH" inhibits this function from operating.

To select a switch to turn throttle hold on or off during flight, set the Control field to ON. With the cursor next to CTRL, deflect the switch that will control throttle hold. In one position the control will be ON. Moving the switch to the opposition will turn the control OFF.

Move the cursor next to "Position" and set a percent of full throttle that the throttle channel will deflect to automatically when the control switch is moved to the ON position.

THROTTLE CURVE: The throttle's output is normally linear in relation to movement of the throttle stick. A non-linear relation between the movement of the throttle stick and the throttle in the model can allow for optimum control of power to the model (which is also linked to the control of the pitch of the main rotor blades). These non-linear control curves can be customized for the particular model.

The idle-up function is used to optimize the throttle position for all flight envelopes including aerobatic flight. By default the TTX650 assigns switch E as the idle-up control switch. This switch incorporates one "normal" and two "up" functions within the three positions of the switch.

Position 1 = normal: Used for startup, take-off, landing, and typical flight profiles.

Position 2 = idle-up 1: Used for aerobatic flight

Position 3 = idle-up 2: Typically used as a secondary setup for aerobatic flight.

Make sure all mechanical linkages are connected exactly as specified in the helicopter's instruction manual. Make sure the model's full throttle position can be achieved when the throttle stick is at maximum deflection. The throttle trim must be able to minimize throttle control completely when the throttle limiter is at idle position.

ENTER this function. Up to six points can be placed on the throttle curve, as designated next to "Point" on the graph. Points L (low) and H (high) are each limited to a fixed range on the curve. Points 1, 2, 3, and 4 can be set if desired with respect to the position of the throttle stick.

As the throttle stick is advanced note the point where the vertical line (throttle position) intersects the diagonal line (curve). The coordinates of this point are shown at the bottom. The "x" (horizontal) coordinate is on the left, and the "y" (vertical) coordinate on the right.

To set points on the curve, start at the minimum throttle position which will be noted as point "L". A point for "L" is not marked on the graph, but is the left-most end of the curve line. The vertical position of this point can be adjusted by moving the cursor to the RATE percentage, pressing ENTER and then ↑+ or ↓- as desired. Press ENTER when finished.

To set point 1 on the graph, advance the throttle stick until * shows next to "Point". Find the desired throttle stick position and press ENTER. A + symbol will be placed on the curve to mark this point.

Pressing ↑+ or ↓- will adjust the vertical position of curve at this exact point. Adjust as desired.

Repeat these steps to set points 2, 3, and 4 on the graph as desired. A point for "H" is not marked on the graph, but is the right-most end of the curve line. The vertical position of this point can be adjusted by moving the cursor to the RATE percentage, pressing ENTER and then ↑+ or ↓- buttons. Press ENTER when finished.

To clear any point on the graph, place the cursor on the RATE percent, move the throttle stick until the graph's vertical line intersects the point, press ENTER and then CLEAR.

A switch can be assigned to toggle between the linear curve (for starting the engine, etc.) and the user-defined curve (for forward flight, stunts, etc.). Select the switch on the CTRL line. The switch set for flight phase control can also control the throttle curve.

The exponential control of the user-defined throttle curve (but not the linear curve) can be active or inhibited. This will soften or make the transition of the throttle curve smoother. Move the cursor next to the EXPO line and toggle between "ACT" and "INH". Press ENTER when finished.

PITCH CURVE: The method for setting the pitch curve is the same as for the throttle curve as explained above, by moving the throttle stick and using the same controls.

GYRO MIXING: This function is for setting and switching the sensitivity of an optional gyro. Enter this screen.

To make the gyro mixing active at all times do NOT assign a switch at the CTRL line. Press ENTER to highlight the normal mixing rate, and press ↑+ or ↓- to find the desired value. Press ENTER when finished.

To control the mix with a switch, move the cursor to the CTRL line and press ENTER. Deflect the desired switch to control the mix. The screen will show the functional assignments for each position of the switch (see page xx for details). Press ESC to confirm the switch selection.

The display will now show the different switch positions (SP.0, SP.1, SP.2). A different gyro mixing rate can be set for each switch position. Deflect the switch to one position and note the cursor on-screen will automatically move to the percentage for that position. Adjust the rate as desired and press ENTER when finished. Deflect the switch to the remaining positions and repeat.

To clear a switch was set to control the mix or hold, highlight the switch and press CLEAR.

SWASH MIXING: This mix is not available when using the "1 Servo" swash setting. This function adjusts the mixture rate of the pitch, aileron, and elevator channels for the swash plate. Move the cursor to the value to adjust, and change as necessary.

THROTTLE MIXING: When a helicopter's aileron, elevator, and tail controls are moved, the movement of the swash plate can affect the RPM of the engine/motor. This throttle mix can offset that effect.

To mix the aileron, elevator, and/or rudder channels to the throttle channel and leave the mix active at all times, do not set a control switch on the CTRL line like shown above left. Move the cursor to select which channel to mix to the throttle channel, press ENTER and then ↑+ or ↓- to adjust the value.

A switch can be assigned at the CTRL line to change between different mixture rates. Once a switch is selected, move the switch to each position, then use ↑+ or ↓- to move the cursor to the individual percentages and adjust as desired.

If mixing the rudder channel to the throttle, set the mix value as a positive value such as "+17%" if the main rotor turns *clockwise* if looking down on the rotor from above. If the main rotor turns *counter-clockwise*, set the mix value as a negative value such as "-29%".

To reset any mix value or clear a switch selection, move the cursor to the value, press ENTER, and then press CLEAR.

RUDDER MIXING: This function is helpful if using a gyro that does not have the heading-hold function. Much like throttle mixing, the aileron and/or elevator channels can be mixed to the rudder channel. If the helicopter's main rotor turns clockwise when looking down on the rotor from above, set a positive mix value such as "+35%". If the main rotor turns counter-clockwise, set a negative mix value such as "-41%".

Setting of the rudder mix uses the same method as the throttle mix as explained above.

SWASH RING: Depending on how certain mixes are set and mechanical linkages are connected to the swash plate, it's possible that the mechanical connections can accidentally be damaged or dislodged if they are forced to try and move past their own limitations. By adjusting the maximum amount of travel the aileron and elevator

channels can move the controls away from center, this SWASH RING function can help prevent damage from occurring to controls inside the model. At the default 150% setting the controls are not limited, and effectively turns this function off.

Once inside this function, press ENTER to highlight the "Rate" value. Press ↑+ or ↓- to find the desired maximum rate. The circle graphic represents the maximum movement rate. Moving the aileron and/or elevator stick to their limits will cause the actual position of these controls to show at the bottom of the screen.

PROGRAMMABLE MIXER: Setting of programmable mixes for helicopters is identical to that for airplanes, as described on page xx.

BIND THE RECEIVER TO THE TRANSMITTER

Binding the TTX650 to the Tactic receiver ensures sole communication between the two, and prevents other transmitters from being able to control the receiver.

1. Turn on the Tx.
2. Apply power to the Rx.
3. If the Rx LED flashes once and then stays on, the Rx is already bound to the Tx and you can skip to the next section. Otherwise, insert a small diameter screwdriver through the hole marked "BIND" and press the pushbutton until the Rx LED glows red and then turns off after about one second.
4. Release the "BIND" button.
5. If the binding is successful, the Rx LED will flash once and then remain ON.
6. Test for proper Tx/Rx functionality before use. If the radio doesn't appear to have become properly bound, repeat steps 1–6 above.

FAILSAFE FUNCTION

The failsafe function is not controlled by the TTX650 transmitter itself, but rather by the Tactic receiver. Tactic's stand-alone 2.4GHz receivers have a failsafe feature which engages in the event that the signal from the Tx somehow becomes interrupted. In such case, channels 1, 2, 4, 5, and 6 (all but throttle) will hold their last received position.

Throttle channel 3 can move to a pre-set position. The factory default failsafe position for channel 3 is to move to 0% throttle. The throttle's failsafe position can be manually set to any other position if desired, as follows:

1. **IMPORTANT:** make sure the servo reverse settings for all servos are in the correct position for the application.
2. Apply power to the Tx and Rx.
 - 3a. If using an ESC: do NOT arm the ESC, or attempt to adjust the throttle's failsafe position if the ESC is armed.
NOTE: If you're using an ESC which has a signal loss feature, its pre-set failsafe position will be irrelevant as the receiver's failsafe function will cease the throttle operation if the signal is lost.
 - 3b. If using a combustion engine: do NOT attempt to adjust the throttle's failsafe position while the engine is operating.
4. Move the Tx throttle stick to the desired throttle failsafe position.

5. Press and hold the receiver's "Bind" button. The Rx's LED should blink twice. Release the Bind button, and the LED should stay on continuously. The Tx and Rx should now be linked, with the throttle failsafe in the new position as set above.

WIRELESS TRAINER

Two Tactic brand transmitters with trainer capabilities can communicate with each other by wireless means for teaching a student how to fly (no trainer jack - no cable required!). The TTX650 can be configured for wireless trainer function with any other Tactic brand transmitter, but is not compatible with wireless trainer systems in other brand transmitters. Once linked for training, make sure both transmitters are kept within 15 feet of each other at all times.



IMPORTANT! Before flying the model in training situations it's very important to make sure all channel reverse settings and trim adjustments on the teacher and student transmitters match! Otherwise, the model could suddenly veer in an unwanted manner when the teacher's trainer switch is activated.

Proper matching of the student and teacher's Tx settings should ensure that no unexpected movements occur when the trainer switch is pressed. This is especially true of the throttle control!

Teacher's radio: TTX650 Student's radio: Tactic TTX404 or TTX600

1. Bind the teacher's TTX650 to the Rx inside the model, and then remove power from the Rx.
2. In the TTX650 TRAINER screen described on page xx select which channels to NOT be transferred to the student while training, and **select a switch to control the trainer function.**
3. Turn the teacher's Tx off.
4. Pull the TTX650 trainer switch and *hold it in this position* while turning the power switch on. The "searching" message should show on-screen.
5. Move the student's transmitter to within 3 feet of the teacher's transmitter and turn on the TTX404/600 power switch.
6. The TTX650's "searching" screen should disappear. The teacher can release the trainer switch. If the TTX650 doesn't identify the signal from the student's radio a "NO SIGNAL" message will show.
7. Once linked, move the throttle stick on both transmitters to minimum. Turn the Rx power on and make sure only those channels selected for transfer to the student are transferred when the TTX650 trainer switch is deflected. Ensure the teacher can regain control of all channels when the trainer switch is released.
8. Perform a complete range check before flight.
9. When the training session has ended, with the model safely landed and power removed from the model simply turn the power switch for both transmitters to the OFF position. This will terminate the wireless link between both transmitters.

Teacher's radio: Tactic TTX404/600 Student's radio: Tactic TTX650

1. Bind the teacher's TTX404/600 to the Rx. Remove power from the model, and then turn the teacher's Tx off.

2. Pull the TTX404/600 trainer switch and *hold it in this position* and turn the power switch on.
3. Move the student's transmitter to within 3 feet of the teacher's transmitter, turn the power switch on and set the RF OUTPUT to ON.
4. The TTX404/600 LED should flash three times and then stay on to indicate the bind was complete. Release the trainer switch.
5. Once linked, move the throttle stick on both transmitters to minimum. Turn the Rx power on and make sure only those channels selected for transfer to the student are transferred when the TTX650 trainer switch is deflected. Ensure the teacher can regain control of all channels when the trainer switch is released.
6. Perform a complete range check before flight.
7. When the training session has ended, with the model safely landed and power removed from the model simply turn the power switch for both transmitters to the OFF position. This will terminate the wireless link between both transmitters.

Teacher and student's radio: TTX650

1. Bind the teacher's radio to the Rx.
2. In the teacher's TRAINER screen described on page xx select which channels to NOT be transferred to the student while training, and **select a switch to control the training function**. Then turn the teacher's Tx off.
3. Move the student's transmitter to within 3 feet of the teacher's transmitter.
4. Pull the teacher's trainer switch and turn the power switch on. The "searching" screen should show.
5. Turn the student's radio on, and set the RF OUTPUT to ON.
6. The TTX650's "searching" screen should disappear. The teacher can release the TTX650 trainer switch. If the TTX650 doesn't identify the signal from the student's radio a "NO SIGNAL" message will show.
7. Once linked, move the throttle stick on both transmitters to minimum. Turn the Rx power on and make sure only those channels selected for transfer to the student are transferred when the TTX650 trainer switch is deflected. Ensure the teacher can regain control of all channels when the trainer switch is released.
8. Perform a complete range check before flight.
9. When the training session has ended, with the model safely landed and power removed from the model simply turn the power switch for both transmitters to the OFF position. This will terminate the wireless link between both transmitters.

RANGE TEST: Before each flight make sure to check the operating range of the Tx / Rx set. The TTX650 includes a function that automatically reduces its output power to prevent having to walk a long distance to check the range.

1. Make sure the Tx throttle stick is at minimum position.
2. Enter the "RF OUTPUT" screen in the FUNCTION menu, as described on page xx. Leave the "RF ON/OFF" selection ON.
3. Move the cursor over "99sec". This time determines how long before the radio's output power automatically returns to full power.
4. Place the Rx/model on the ground and apply power to the Rx/model.
5. Hold the Tx as it will be held during flight and press ENTER. The range test timer on-screen will start to count down. Tones will sound to identify that this function is active.
6. Move the Tx xx feet away from the model and confirm all controls are transferred smoothly at all times.

The counter will reset once the timer has expired, and reset to 99 seconds. The radio will return to full output power at this time. Pressing ENTER any time during countdown will stop the timer.

FIRMWARE UPDATES

A 3-pin socket above the charge jack on the left side of the radio is used for updating the TTX650's operating firmware. An optional Tactic TTX650 USB Firmware Interface (part number TACJ2651) is required. The software and suitable driver required for the download are free and found at <http://tacticrc.com/tacj2650.html>.



IMPORTANT: Make sure the Tx battery shows good voltage prior to attempting a download. Use new alkalines, or fully recharge NiCd or NiMH batteries prior to starting the download. Once the software is loaded on the computer, the new firmware can be uploaded to the Tx.

Refer to all instructions included with TTX650 USB Firmware Interface for upgrading the firmware in the TTX650 radio.

WARNING INDICATIONS

The following indications will sound and/or show if any of the following occur:

LOW BATTERY: Battery voltage is at or below the BATT ALARM setting. Cannot change memories at this time. Replace or re-charge batteries.

RF ON / OFF?: Turn the radio's Rf signal on or off.

THRO POS.: The throttle stick is >50% full deflection at start-up. Move the throttle stick to minimum.

THRO CUT: The throttle cut function has been set and the switch is on.

NO SIGNAL: While in training mode, if the signal between the teacher and student transmitters becomes unlinked.

AUTO SHUTDOWN: If no transmitter stick or control is moved after 10 minutes have elapsed, this warning screen will show and the Tx will proceed to shut itself down to prevent unwanted drainage of the batteries. If the

transmitter's Rf section is turned ON, the Tx will automatically shut down 120 seconds after this message shows. If the Rf section is turned OFF, the Tx will shut down 60 seconds after this message shows.

SYSTEM CHECK AND OPERATION



WARNING! Always make sure that power is applied to the transmitter BEFORE applying power to the receiver and servos, and the Tx throttle stick is at minimum (idle) position. Failure to do so could result in the model becoming uncontrollable and cause a safety hazard. During all pre-flight preparations, do not stand the Tx upright on the ground. Carefully lay the Tx on its back on the ground to prevent it from falling over and possibly dislodging the throttle stick which would create a safety hazard. Make sure all devices are properly mounted inside the model, and all wiring connections are solid to prevent them from easily becoming dislodged during normal flight. It's best to check the system with the propeller removed from the aircraft.

1. Once all connections are made, check the general operation of the radio and all other components before attempting a flight.
2. Move the Tx throttle stick to the minimum (idle) position.
3. Turn on the Tx, and then the Rx.
4. Make sure all controls are operating in the proper direction. If any servo is turning in the wrong direction, change the reverse setting for that channel.
5. With both sticks at center position, move the trim levers for the aileron, elevator, and rudder channels so each respective control surface is perfectly aligned with the main surface. For example: when the aileron trim lever is at center, it's best that the trailing edge of the aileron is aligned with the trailing edge of the wing itself (not above or below the wing's trailing edge).
6. Make sure that movements of the throttle stick result in an equal adjustment of the throttle in the model. Depending on whether the model is electric or glow powered:
 - a. Electric: confirm that when the throttle stick is at maximum position the electronic speed control gives the appropriate indications (LED and/or audible indicators) for full forward flight. And, when the throttle stick is at minimum position the electronic speed control gives the appropriate indications for "off" or no motor rotation.
 - b. Glow: confirm that when the throttle stick is at maximum position the mechanical linkage to the engine allows the engine to be at full throttle. And, when the throttle stick is at minimum position and the throttle trim lever is moved to minimum position, the engine stops completely.
7. Perform a range check as explained on page xx.
8. Anytime power is to be removed from the radio system, it's important to shut down power in the aircraft **first**. Otherwise, the aircraft could become out of control and cause a safety hazard! Move the throttle stick and throttle trim to minimum position to stop the glow engine or shut down the ESC. Once the propeller has stopped rotating, shut off the ON/OFF power switch in the model, and disconnect the power battery from the ESC in electric airplanes. Then turn off the power switch in the Tx.

FLYING THE AIRCRAFT

1. Once all setup procedures have been confirmed, and power has been removed from the model and transmitter, prepare the model for flight.



IMPORTANT: Be very careful to stay clear from moving propellers and blades!!

2. Make sure the glow engine fuel tank has an adequate amount of fuel, or power batteries for electric models are fully charged.

3. Move the Tx throttle stick to the minimum position, and then turn on the Tx power switch. Turn on the power switch in the model or connect the flight battery.

4. During the first flight, it might be necessary to re-trim the main channels to allow the model to sustain smooth, even flight. If further adjustments are required on the ground, make sure to turn off the engine or ESC/motor beforehand.

5. When the flight is completed, remove power from the system as described before. Shut down power to the electronic speed control or glow engine first, then the receiver, and finally the transmitter.

IMPORTANT WARNINGS AND PRECAUTIONS



* **NEVER** allow water or moisture to make contact with the electronic components inside the transmitter, receiver, servos, switch harness, etc.! This could lead to failure or improper functionality of components and poor control of aircraft which could pose a safety hazard.

* **NEVER** operate R/C model aircraft near power lines, radio or cell phone towers, roads or automobiles, buildings, or pedestrians. Be very careful in locations where many R/C aircraft are being used simultaneously.

* **NEVER** operate R/C equipment if you are physically impaired as it could pose a safety hazard to yourself or others in the area.

* **NEVER** allow small children to operate/control model R/C equipment without the supervision of an adult.

* **NEVER** allow the transmitter's throttle stick to accidentally be moved away from the "off" or minimum position while the model's engine/motor is moving.

* **ALWAYS** range check the radio system before use.

* **ALWAYS** make sure that all transmitter stick movements operate all servos properly in the model. Check the proper operation of control surfaces before and after starting the engine/motor.

* **ALWAYS** make sure the transmitter antenna is unfolded entirely so that it's pointing upright to ensure max. range and control of the aircraft.

* Do not store your radio equipment in extremely hot or cold locations, in direct sunlight, or in locations with high humidity. Store R/C equipment in cool and dry locations.

* Do not allow chemicals to come in contact with any parts of the radio system. Substances such as glow fuel, gasoline, CA glue, etc. could permanently damage plastic parts of the radio system.

* If rechargeable batteries were installed in the transmitter, remove the batteries before placing the radio in long-term storage.

TTX650 SPECIFICATIONS

Model types: airplane and helicopter

Channels: 6

Frequencies: 2.403 – 2.480GHz

Protocol: Tactic SLT

Modulation: FHSS spread spectrum

Input power: 3.40 - 7.00V DC, four 1.5V alkaline or 1.2V NiCd/NiMH "AA" single cells
jack included for connecting optional 4.8V NiCd or NiMH pack

Current consumption: approx. 100-120mA

Low voltage alarm: 3.20 - 5.60V adjustable

Memories:	20, with copy function
Stick modes:	two
Trims:	digital for aileron, elevator, throttle, rudder
Switch assignments:	user selectable
Display:	128 x 64 graphing LCD, with adjustable contrast
Channel controls:	reversing, end points, sub-trims, dual-rates, exponential
Failsafe:	all channels, user-selectable
Timers:	count-up stopwatch, count-down, flight timer
Charge jack:	Futaba® compatible
Trainer system:	wireless, Tactic SLT compatible

TROUBLESHOOTING

RANGE IS SHORT: Interference – check Rx installation and servo connections. Low Tx or Rx battery – replace the batteries or recharge if applicable. Transmitter antenna not unfolded properly. Rx may need to be located to a different position in the model for better reception. Crash damage – send the radio to Hobby Services for repair.

RUN TIME IS SHORT: Low Tx or Rx batteries – replace or recharge the batteries. Obstructed servo linkages causing excess battery drain – free the linkages / pushrods.

Tx POWER SWITCH ON BUT SERVOS DO NOT FUNCTION: Tx or Rx batteries are low – replace or recharge the batteries. Tx RF output is set to "OFF" – change to "ON". Rx switch is in the off position – turn on the ESC or switch harness. Switch harness or ESC is connected incorrectly – check all connections and the ESC instruction manual. Rx is not linked to the Tx properly – perform binding process again. Check Tx or Rx battery polarity.

INTERFERENCE OR SERVOS GLITCHING: Out of range – operate the model more closely to the transmitter. Outside radio interference from other electronic devices in the area - check your local R/C club regarding local operation. Rx/antennas located too closely to engine, motor, or servos or other moving mechanical parts which might be creating unwanted electrical noise – relocate the Rx inside the model or relocate the ESC. Align both Rx antennas at 90 degree angles from each other if possible/applicable.

CONTROL SURFACE MOVES IN THE WRONG DIRECTION: Reverse the control direction of the channel in the radio's programming.

ONLY ONE SERVO GLITCHES: Servo is bad – replace the servo or send to Hobby Services for repair.

FAILSAFE NOT WORKING CORRECTLY: Receiver is not properly linked to the transmitter – bind the Rx to the Tx and re-try. Check the channels which are programmed for transferring from Tx to Rx in the transmitter's programming. Contact Hobby Services for further details.

WIRELESS TRAINING FUNCTION NOT BINDING: Check to see that another Tactic 2.4GHz system is not on in your area. The teacher's and student's transmitters were not powered in the proper sequence or are positioned too far from each other. Carefully follow the instructions on page xx for proper binding and operation for training.

RECHARGEABLE BATTERIES WON'T ACCEPT CHARGE THROUGH THE TRANSMITTER: Check the charger for proper setup and operation. Make sure the charge plug is inserted fully into the charge jack. Make sure the transmitter's power switch is in the OFF position. Make sure the cells are inserted inside the battery compartment in the proper direction.

Contact Hobby Services for other problems.

SAFETY GUIDE

The Academy of Model Aeronautics (AMA) has established a Membership Manual which includes a description of the AMA's function and mission, insurance benefits, the Model Aircraft Safety Code, membership renewal information, and more. Model flying **MUST** be done in accordance within AMA guidelines in order for AMA liability protection to apply. See the website listed below, or contact the AMA for further details:

<http://www.modelaircraft.org/files/Memanual.PDF>

Academy of Model Aeronautics

5161 East Memorial Drive

Muncie, Indiana 47302
(765) 287-1256 – Business
(765) 289-4248 – Fax
(800) 435-9262 – Membership Services
<http://www.modelaircraft.org>

Practice good safety precautions at all times when flying model aircraft. The AMA can assist in locating authorized local flying clubs and fields.

The Tactic TTX650 transmitter is intended for use with radio control model hobby airplanes and helicopters. Use with non-hobby related products for non-hobby related activities is not recommended or encouraged. Any alterations or modifications to any parts of this product are not recommended. Tactic is not responsible for unauthorized repairs or modifications. All unauthorized repairs will void the warranty.

ACCESSORIES

TACL0624	Tactic TR624 6-Channel 2.4GHz Receiver
TACM2001	Tactic Switch Harness with Charge Plug, Futaba J Plugs
TACM2100	Tactic Adjustable Neck Strap
HCAM6301	HydriMax™ Ultra 4.8V 750mAh Flat Rx AAA NiMH Battery
HCAM6321	HydriMax™ Ultra 4.8V 2000mah Flat Rx AA NiMH Battery
FUGP7300	Fuji® AA Alkaline Batteries (4)
SANP1100	Sanyo® N-700AAC 1.2V AA NiCd Cell

See www.tacticrc.com for a full list of radio parts and accessories.

FCC STATEMENT

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.

FCC RF Radiated Exposure Statement: This transmitter must not be co-location or operating in conjunction with any other antenna or transmitter. The equipment complies with FCC RF radiation exposure limits set forth for an uncontrolled environment. This equipment should be installed and operated with a minimum distance of 20 centimeters between the radiator and your body.

NOTE: THE MANUFACTURER IS NOT RESPONSIBLE FOR ANY RADIO OR TV INTERFERENCE CAUSED BY UNAUTHORIZED MODIFICATIONS TO THIS EQUIPMENT. SUCH MODIFICATIONS COULD VOID THE USER'S AUTHORITY TO OPERATE THE EQUIPMENT.

FCC ID: IYFTTX650

1-YEAR LIMITED WARRANTY - *U.S.A. and Canada Only

Tactic warrants this product to be free from defects in materials and workmanship for a period of one (1) year from the date of purchase. During that period, Tactic will, at its option, repair or replace without service charge any product deemed defective due to those causes. You will be required to provide proof of purchase (invoice or receipt). This warranty does not cover damage caused by abuse, misuse, alteration or accident. If there is damage stemming from these causes within the stated warranty period, Tactic will, at its option, repair or replace it for a

service charge not greater than 50% of its then current retail list price. Be sure to include your daytime telephone number in case we need to contact you about your repair. This warranty gives you specific rights. You may have other rights, which vary from state to state.

For service on your Tactic product, send it postpaid and insured to:

HOBBY SERVICES

3002 N. Apollo Dr., Suite 1

Champaign, IL 61822

Tel: (217) 398-0007 (9:00am - 5:00pm CST, M-F)

E-mail: hobbyservices@hobbico.com

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TACJ2650MNL

Made in China

FCC ID IYFTTX650

- * This product is suitable only for people of 14 years and older. This is not a toy!
- * **WARNING: CHOKING HAZARD** - May contain small parts. Keep away from children under 3 years. Please retain packaging for future reference.
- * No part of this manual may be reproduced in any form without prior permission.
- * The contents of this manual are subject to change without prior notice.
- * Tactic is not responsible for the use of this product.

TACJ2650 v1.0