



# TANDEM CHOPPERS

## FEATURING THE TECH MODEL PRODUCTS “TWINN REXX”

**Words:** *Chuck Bassani*

For me, tandem helicopters have always had that extra “wow” factor. When the opportunity to take on a tandem project presented itself, nothing was going to get in my way. Along with this excitement, however, came the realization that this wasn’t going to be just another build; there was a learning curve ahead.

Unlike conventional tail rotor equipped helicopters, tandem choppers use two main rotors to provide lift, pitch, roll, and yaw control. Complex control mixing between the front and rear rotors, as well as inputs from multiple on-board sensors, becomes necessary. This is beyond the mixing capability of the transmitter. Fortunately, there are products on the market that handle this task, and for this project the Tech MP TH-2 GP Tandem Helicopter Controller was the obvious choice.

## THE TECH MP 'TWINN REXX' KIT

Assembly of the base Twinn REXX kit is rather conventional. The front and rear frame assemblies are constructed from pairs of router cut G-10 fiberglass frame sides separated by aluminum spacers and plastic bearing blocks. These frame assemblies are then mated to a square aluminum spar, thus forming the classic tandem skeleton. Miter gears transfer power from the motor driven front rotor shaft to the rear rotor shaft via a 5mm hollow stainless steel driveshaft sup-

ported by four bearings. The landing gear is formed from aluminum tubing and plastic strut mounts. All of this rests on four sets of double wheel 'foam tired' bogies.

The parts fit and finish is nothing short of excellent. High performance bearings and stainless steel hardware is used throughout the kit. Overall, it's a very well thought out design and a true joy to build.

## THE ROTOR HEADS

Once the base kit is assembled, you need to procure a rather extensive list of components to complete the build (see sidebar). The obvious parts are the two main rotor heads. The Twinn REXX uses stock Align TRex 450 CCPM rotor heads. Those who have built a TRex 450 will be very

familiar with assembling the rear rotor head. However, the front rotor spins counter-clockwise, so that one needs to be assembled as a 'mirror image' of the rear rotor head.

Building a 'mirror image' rotor head is accomplished as follows:

- ♦ The blade grips are flipped.
- ♦ The flybar seesaw mounts upside down.
- ♦ The flybar cage is assembled with the short side of the control bars reversed.
- ♦ The washout base is installed upside down.
- ♦ The mixing and washout arms are mounted inside out.

**KIT:** The completed kit. Prior to assembly, I painted the frame parts with zinc chromate paint for that 'realistic' look.

**B**

**REAR ROTOR HEAD:** Standard TRex 450 eCCPM metal rotor heads are used.

**C**

**F**

**G**

**A**

**I**



# THE TECH MP TH-2 GP TANDEM CONTROLLER

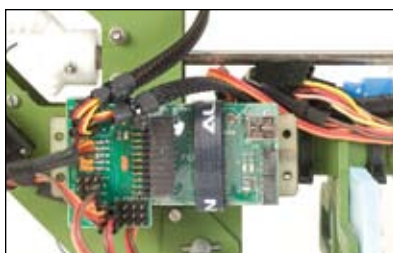
A few issues back, I did an in-depth review of the Tech MPTH-2 GP Tandem Controller. In case you missed that, here is a quick review of what it does:

The controller (or mixer) is the brain that performs all the magic. It has two major functions:

- 1) Receives control input from the transmitter and performs all the mixing necessary to actuate the collective and cyclic pitch movement of both rotors.
- 2) Processes input from the two gyros to stabilize the helicopter around its yaw and pitch axis.



Collective, aileron, and rudder mixing are essentially a one-to-one ratio. That is, equal amounts of control are fed to the front and rear swash plates. For collective changes, both swash plates rise to increase pitch and descend to decrease pitch. Aileron input causes both swash plates to tilt to the left with left stick inputs and vice versa with right stick inputs. Rudder input causes the swash plates to tilt in opposite directions. With right rudder stick input, the front swash plate tilts right and the rear



swash plate tilts left. Again, vice versa with left rudder stick input.

With respect to the pitch axis, the controller not only tilts the swash plates for fore / aft control, but also feeds in some collective pitch as well. This is referred to as 'Differential Collective Pitch' (or DCP). For example, when the elevator stick is moved forward—both swash plates tilt forward. Additionally, the front swash plate is lowered and the rear swash plate is raised, thus resulting in less lift in the front and more lift in the rear. The result is very effective pitch response.

Two gyros are used to stabilize yaw and pitch. The controller also factors in input from the DCP gyro to provide yaw compensation. This is a proactive rather than reactive control input that is used to compensate for the yaw induced during differential collective conditions.

## ADDITIONAL STUFF

In addition to the Twinn REXX base kit, the following components are required to complete the build:

- |                                   |               |
|-----------------------------------|---------------|
| A) Tandem Rotor Controller        | D) (6) Servos |
| B) (2) TRex 450 CCPM Rotor Heads  | E) (2) Gyros  |
| C) (2) Sets of 325mm Rotor Blades | F) BEC        |
|                                   | G) ESC        |
|                                   | H) Motor      |
|                                   | I) TX / RX    |



B

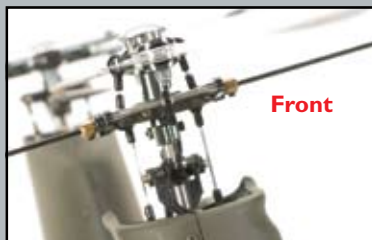
**FRONT ROTOR HEAD:** Notice the front rotor head is a mirror image of the rear rotor head due to its counter-clockwise rotation.



H

D

E

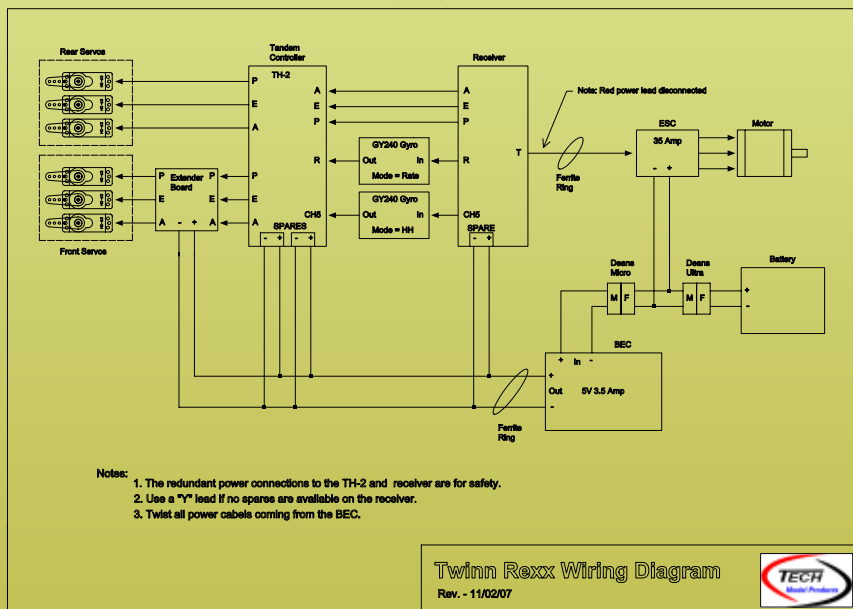


Front

NOTE – If the body kit is going to be used, there is a flybar limiter option that prevents the flybar from hitting the body's rear molded rotor tower.



Rear



## WIRING IT ALL UP

As you can imagine, the wiring is somewhat involved. Having the ability and tools to make some custom length servo extensions will come in handy. The support page for the Twinn Rexx on Tech Model Products web-site hosts some very nice diagrams that show exactly how all the components are wired.

Due to the higher than average power requirements of all the on-board components, a separate BEC or voltage regulator is recommended. This will supply power to the receiver, six servos, two gyros, and the TH-2 GP controller. The ESC receives its power directly from the battery and only requires a signal pulse from the receiver. If your ESC has a built-in BEC, make sure that you remove the power wire connection between it and the receiver.

Wiring the Twinn Rexx as per the instructions will require a minimum of seven channels (if remote gyro gain is desired). As an alternative, you can use a Y-connector and feed the receiver's elevator output into both the TH-2 GP's Elevator input as well as the DCP gyro input. Doing this will free up a receiver channel and allow you to fly the Twinn Rexx with a six channel system while still retaining the ability to control gyro gain remotely. If you do choose to go this route, you'll have to reduce the TH-2 GP's DCP recommend input gain. The goal here is to have about 5mm of DCP deflection over the full elevator control range. I used a Spektrum DX7 radio with an AR6000 6-channel receiver, so I set up my Twinn Rexx as per these alternate wiring recommendations.

## ON TO THE BODY

The body kit is a sport scale CH-47 Chinook and is basically two clear plastic vacuum formed half shells that get joined along the center. Careful trimming here is absolutely necessary for a good seam. I chose to glue a one inch flange along the inside seam of one half and let it overlap the opposite side by

about one-half inch. The two halves were then secured together with #2 button head sheet metal screws. This was a rather tedious task.

I also decided to add a hatch in the bottom just below where the battery sits in order to have access to it without removing the body. The hatch was cut out and hinged with standard model airplane control surface hinges. It's held closed by small rare earth magnets.

The body attaches to the frame with button head machine screws at four points. Frame standoffs are provided for these attachment points. There are also two plywood formers that attach to the main spar. These provide mounting surfaces for foam supports that form a friction fit to the bottom of the body to further secure it and keep it aligned. To top it off, I also purchased a vacuum formed engine kit from Jim Ryan. That really steps up the "scale factor". Tech Model Products is now selling this kit directly. The engines were attached with alignment pins and rare earth magnets.

## COMPONENTS & PRICES

TMP Twinn Rexx Base Kit:	\$275.00
TMP Twinn Rexx CH-47 Body Kit:	\$69.99
Twinn Rexx CH-47 Engines Kit:	\$9.99
TMP TH-2 GP Controller:	\$149.99
TMP TH-2 Extender Board:	\$8.99
TMP TH-2 Mounting Plate:	\$5.99
TMP USB Cable:	\$4.99
Align T-Rex 450 Metal Rotor Head:	(2 @ \$145.99)
	\$291.98
Align 325mm Carbon Fiber Main Rotor Blades:	(2 @ \$36.49)
	\$72.98
Hitec HS-65HB Servos:	(6 @ \$24.99)
	\$149.94
E-Flite G90 Gyro:	(2 @ \$84.99)
	\$169.98
Castle Creations BEC:	\$21.99
Castle Creations Phoenix 45 Brushless ESC:	\$101.99
JustGoFly 500T Brushless Motor:	\$59.99
Spektrum DX7 w/AR6000 receiver:	\$299.99

## LINKS

Tech Model Products:	<a href="http://www.tech-mp.com">www.tech-mp.com</a>
Align:	<a href="http://www.alignrcusa.com">www.alignrcusa.com</a>
Hitec:	<a href="http://www.hiteccrd.com">www.hiteccrd.com</a>
Spektrum:	<a href="http://www.spektrum.com">www.spektrum.com</a>
Castle Creations:	<a href="http://www.castlecreations.com">www.castlecreations.com</a>
JustGoFly:	<a href="http://www.justgofly.com">www.justgofly.com</a>
E-Flite:	<a href="http://www.e-flite.com">www.e-flite.com</a>
Thunder Power RC:	<a href="http://www.thunderpowerrc.com">www.thunderpowerrc.com</a>
Eagle Tree Systems:	<a href="http://www.eagletreesystems.com">www.eagletreesystems.com</a>
Callie Graphics:	<a href="http://www.callie-graphics.com">www.callie-graphics.com</a>





## PAINTING FINISHING

Once the body was mounted, the model was passed off to my buddy Ed Sowles for painting and finishing. Here is his account of that effort:

The body was washed with warm water and some Dawn dishwashing detergent. It was then prepared with fine sand paper and Scotch-Brite pads. I did have to use some auto body filler up front to get a smooth seam around the nose area. The final preparation prior to painting was to rewash it and leave it to air dry.

I decided to prime the body before painting. This adds a little extra weight, but lends to a much better paint adhesion. The window and nose areas were sprayed with gloss black Krylon Fusion and left to dry. Window templates were cut from self adhesive vinyl shelving paper and put in place over the gloss black. The entire body was then sprayed with flat olive drab Krylon Camouflage with Fusion technology.

Finally, some marker drawn panel lines, pin striping, and custom decals from Callie Graphics finished it off.



The finished chopper. Not too shabby for a sport scale project.

## CONCLUSION

This project is by no means inexpensive, but seeing this machine fly is a sight to behold. Even the sound the two rotors make while beating against each other is awesome, and might I add very realistic. The realization of all the on-board subsystems working in harmony has a rewarding feeling all its own. Believe me, my words cannot do this experience the justice it deserves. *RCH*

## FLYING

The first thing that needed to be done was to get the headspeed just right. This took some experimenting. Long story short, with the help of the Eagle Tree Systems eLogger V3 I settled on a JustGoFly 500T motor, 12T pinion, and a Thunder Power RC 4S 2200 mAh eXtreme V2 pack. This gave me my desired headspeed of around 1800 RPM. With this configuration, the motor doesn't even break a sweat.

Flying this puppy is extremely gratifying. Unlike conventional helis, this model seems to just happily float around in a hover with no tendency to tip over. Scale like lift offs come naturally, with the nose wheels leaving the ground first. Very precise taxiing is possible by working the elevator and collective to lift up the front wheels and steering with the rudder.

In a hover, the rudder response takes a little getting used to. Once you begin to pirouette, it just wants to keep going. Opposite rudder input is required to stop it.

Forward flight also takes a little getting used to. Tandems experience what is called 'Front Rotor Vortex Interference' (or FRVI). This is where the rear rotor flies into the front rotor's downwash, resulting in the tail dropping. The DCP gyro helps to reduce this effect quite a bit but not totally. You learn to compensate with piloting. Coordinated turns are a must as the heli just doesn't want to turn on rudder alone.

All that being said, it doesn't take long to get used to flying this heli. Once you do it's actually quite fun to fly, and very scale-like I must say.

## BUT WAIT - THERES MORE

On the horizon, Joe Orlando (Mr. Tech Model Products) has informed me that he is currently working on a three-bladed rotor head for the Twinn Rexx. This will be a fully articulated metal head with O-ring damping on the feathering shafts. No additional electronics will be required for this upgrade, as the TH-2 GP controller is fully capable of working with this head.



The Twinn Rexx where it looks best; in flight.